

July 29, 1958

H. W. AUSTIN ET AL
NOISE PROTECTIVE DEVICE

2,844,820

Filed Aug. 29, 1955

3 Sheets-Sheet 1

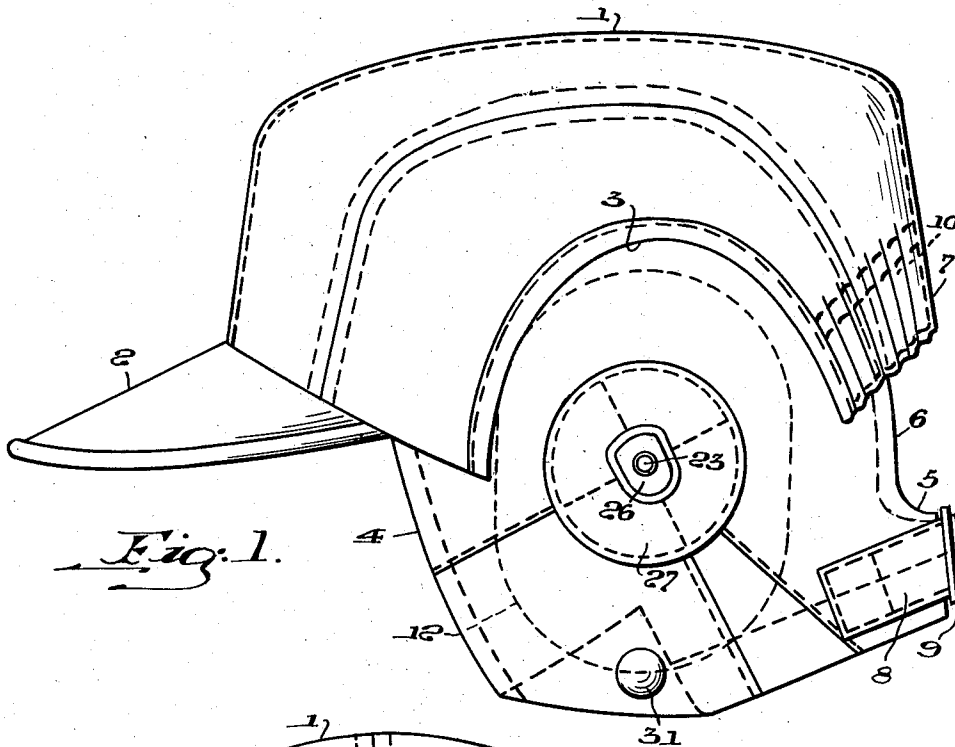


Fig. 1.

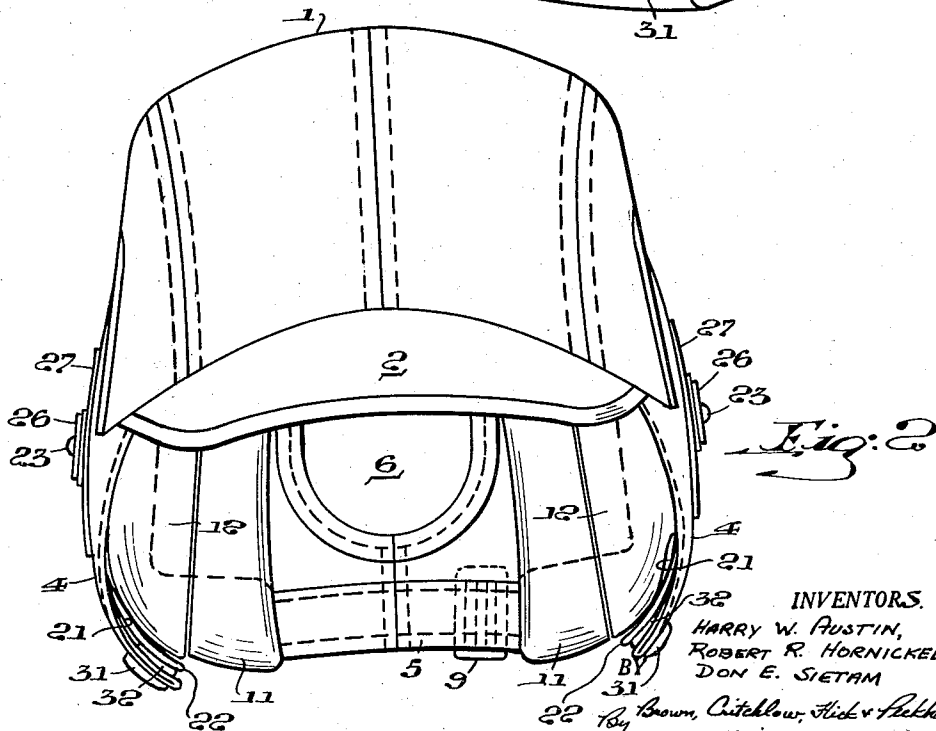


Fig. 2.

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3 Sheets-Sheet 2

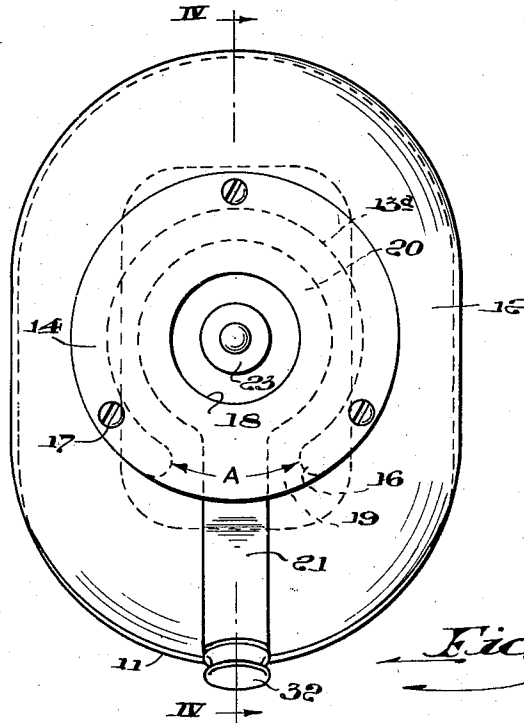


Fig. 3.

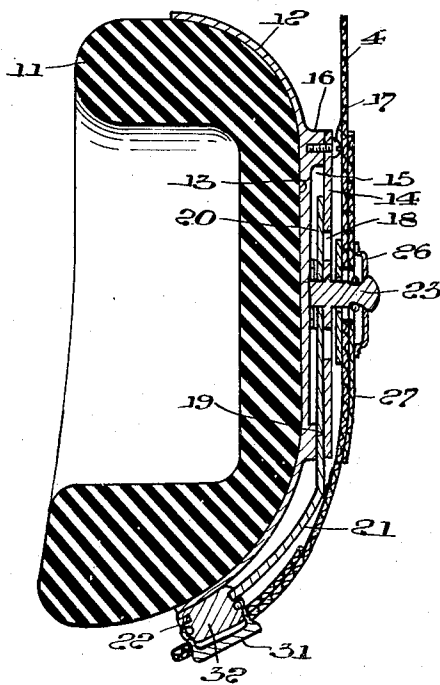


Fig. 4

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3 Sheets-Sheet 3

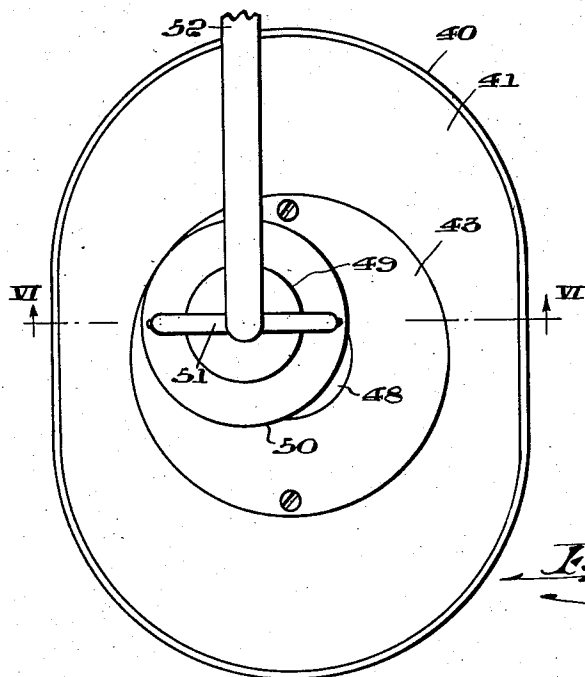


Fig. 5

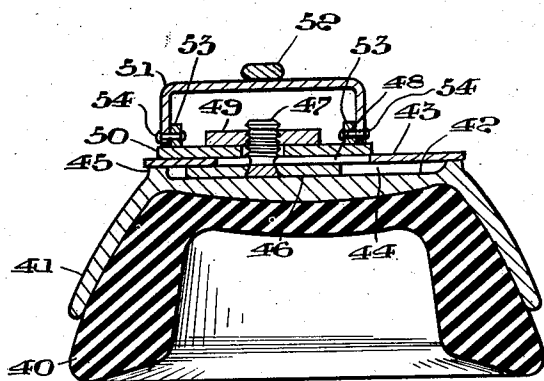


Fig. 6

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NOISE PROTECTIVE DEVICE

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Application August 29, 1955, Serial No. 531,128

13 Claims. (Cl. 2—6)

This invention relates to a head-supported, noise protective device of the type provided with ear pads of sound absorbing material, for insulating the human ear from high intensity ambient noise.

The present application is a continuation-in-part of an application similarly titled, Serial No. 456,092, filed September 15, 1954, now abandoned.

Protection of the human ear from high level noise is a problem in many fields. It is especially so for personnel subjected to the intense sounds created by the operation of jet aircraft engines, both in the air and on the ground. When in the vicinity of such engines for any considerable period, the human ear must have some protection. Additionally, in order that personnel may effectively maintain communications in such situations with the use of telephone or radio earphones, it is necessary to insulate the earphone and the ear from the ambient noise. Conventional noise protective devices of the type employing ear pads of sound absorbing material, with or without earphones associated with the ear pads, are generally deficient in providing adequate sound insulation. It has been found that such deficiency is largely due to lack of complete closure of the ear pad around the wearer's ears, particularly below the ears. This incomplete closure is frequently the result of inadequate provision for adjusting the ear pad to heads of various sizes and shapes. Such lack of adjustment also creates discomfort for the wearer. In addition, the incomplete closure around the wearer's ears is partly due to inadequate pressure of the ear pads against the wearer's head. Frequently, increased pressure is supplied by a chin strap to compress the lower portion of the pad against the neck and jaw of the wearer; but chin straps are notoriously uncomfortable, especially in hot weather, require frequent adjustment, and do not permit the quick donning and doffing of the headgear.

It is accordingly among the objects of this invention to provide a noise protective headgear having sound absorbing ear pads, in which the pads will be readily adjustable relative to a head-supported member so as to fit all sizes and shapes of heads and will be comfortable to wear for long periods of time, in which a complete and effective seal will be obtained between the wearer's head and the ear pads without the use of a chin strap, and in which the various parts can be easily disassembled and reassembled for cleaning or replacement.

Other objects will be apparent from the following description of the invention, which is illustrated in the accompanying drawings. In those drawings:

Fig. 1 is a side elevation of a complete headgear assembly incorporating this invention;

Fig. 2 is a front elevation of the headgear shown in Fig. 1;

Fig. 3 is a side elevation, somewhat enlarged, of one of the ear pads and of the adjustable means used for attaching it to the headgear;

Fig. 4 is a sectional view along line IV—IV of Fig. 3;

Fig. 5 is a side elevation of an ear pad, showing an

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alternative means for adjustably connecting it to a head-supported member;

Fig. 6 is a sectional view along the line VI—VI of Fig. 5.

In accordance with this invention, ear pads of sound absorbing material are each supported in a rigid ear cup. The base of the cup has a double wall, preferably circular, providing a shallow, circular recess or pocket between the two walls. The outer of the two walls may be removable and has a central opening, preferably circular, that is smaller than the pocket. Slidably received within the pocket, and preferably slidably engaging at least one wall of the pocket, is an adjusting member, which may be in the form of a disc having a diameter less than that of the pocket but greater than that of the opening in the outer wall, so as to be retained within the pocket when the outer wall is in place. This adjusting member is provided with fastening means extending through the opening in the outer wall for attaching the adjusting member to a head-supported member, such as the ear flap of a helmet or the yoke of a radio receiver type headband, so that the ear cup will be adjustably supported thereby.

Referring to Figs. 1 through 4, the head-supported member, or headgear, is in the form of a cap provided with the usual skull portion 1 and a visor 2. Part of the skull portion above the ears is cut away along an arc 3; and depending therefrom are ear flaps 4 of elastic material, preferably of the two-way stretch type, and large enough to completely cover the wearer's ears. In addition, the bottoms of the ear flaps have rearward extensions 5 that are joined together to form an elastic band adapted to rest against the nape of the wearer's neck, with an opening 6 for ventilation between the band and the back 7 of the cap. In case the wearer's head is unusually small, there is also provided an adjustable strap 8 and buckle 9 for assuring a snug fit at the back of his neck. The back 7 of the cap has an elastic strip 10 sewed into its gathered seam for adapting the cap to heads of various sizes.

Ear pads 11 of resilient, sound absorbing material, such as foam rubber or diisocyanate foam, are partially enclosed by and secured to rigid or semi-rigid, ear cups 12, which are in turn adjustably and detachably secured to the ear flaps 4. It will be noted that the ear cups do not fully enclose the ear pads and therefore do not contact the wearer's head. The base of each ear cup is provided with a double wall, the inner wall 13 being parallel to the outer wall 14 and spaced therefrom. Between the two walls there is accordingly a vertically extending shallow recess or pocket 15, preferably having a circular shape, as shown by the broken line 13a in Fig. 3. The double wall construction at the base of the ear cup just referred to can be conveniently formed by providing an annular ridge 16 on the inner wall 13 of the base of the cup and by making the outer wall 14 in the form of a circular cover plate detachably secured by screws 17 to the annular ridge 16. The outer wall 14 is provided with a central circular opening 18, which has a diameter less than the diameter of the circular pocket 15.

In the embodiment of the invention shown in Figs. 1—4, the pocket 15 between the two walls of the ear cup is provided with a restricted circumferential opening or slot 19 at the bottom of the pocket. This slot may be conveniently obtained by making a portion of the annular ridge 16 of lesser height than the rest of the ridge over a short arc A (see Fig. 3). Slidably received within the pocket 15 is an adjusting member 20, in the form of a disc having a diameter smaller than that of the pocket but larger than that of the opening 18 in the outer wall. This disc may be provided with an arm 21

of rigid or spring-like material that extends downward through the slot 19 at the bottom of the pocket and has its lower portion bent to conform to the curvature of the ear cup, so that its lower end 22 will bear against the bottom of the cup for detachably securing the lower edge of the ear flap 4, as hereinafter described. The retaining arm 21 may be made integral with the adjusting member 20, and the width of the slot 19 is such that either the retaining arm or the ear cup can be rotated relative to each other.

The adjusting member 20 is attached to the ear flap 4 by a suitable fastening means, such as a two-part fastener of the snap spring type shown in Fig. 4. The stud part 23 of that fastener is secured to the adjusting member 20 and extends outwardly through the circular opening 18 in the outer wall 14 to engage the other, or female, part 26 of the fastener, which is attached to the adjacent ear flap. In this area, the ear flap is preferably reinforced by a strip of flexible, but non-elastic, material 27. The opening 18 is, of course, large enough to allow the adjusting member 20 with its stud 23 to have the desired freedom of movement within the pocket 15; but the depth of the pocket (i. e., the distance between the inner wall 13 and the outer wall 14) is such that the adjusting member slidably engages the walls of the pocket and its movements are frictionally restrained thereby. Accordingly, once the position of the adjusting member within the pocket (and consequently the position of the ear cup relative to the ear flap) is manually adjusted, it tends to stay in adjustment, not only while the cap is in use, but also after it is removed from the wearer's head. The lower front portion of each ear flap, adjacent the jaw of the wearer, is stretched and kept neatly in place by a snap fastener 31 attached to the ear flap and adapted to engage a stud 32 attached to the lower end 22 of the arm 21.

Whenever it is likely that the protective headgear itself may physically contact a source of noise vibrations, such as portions of the body or frame of jet aircraft in operation, it may be desirable to provide an insulating layer or cover for the exposed external portions of the fastening means 23 and 26, such as by providing a padded flap that can be detachably mounted on the ear flap itself.

It will be apparent from the foregoing construction that the position of the ear cup and its supported ear pad relative to the head and ears of the wearer may be adjusted within wide limits. Not only is the ear cup rotatable within respect to the ear flap about the stud 23, but also it can be translated up, down or side-ways, with respect to the ear flap. It will also be apparent that, when the headgear is placed on the wearer's head, the ear pads, ear cups, and ear flaps will be forced outward (see Fig. 2), causing the elastic material of the back of the cap and of the ear flaps to be under tension. Additional tension is provided by making that portion of the ear flap between the stud 23 and the fastener 31 of such dimension that the flap must be stretched to attach the fastener 31 to the stud 32. Because of the elasticity of the ear flap material and because it will be stretched in all directions, the ear flap will exert substantially uniform pressure on all sides of the ear cup, and that pressure will be transmitted to the ear pad supported by the cup. Accordingly, the ear pads will be tightly pressed, with substantially uniform pressure around their periphery, against the sides of the wearer's ears, including the area below the ears where proper closure can otherwise be obtained only with the aid of a chin strap.

Further advantages are that none of the elements of this protective cap can fall out of place and be lost or caught in machinery; that these elements are, however, readily removable for replacement or cleaning; and that the cap may be made of light, porous textile material, providing a maximum of comfort to the wearer.

A slightly modified form of ear cup suspension is shown in Figs. 5 and 6, which is particularly applicable

to adjustably attaching the ear cups and pads to other types of head-supported members that are not provided with ear flaps. In Figs. 5 and 6, the modified suspension is shown, for purposes of illustration, as associated with a spring-type headband (only a portion of which is shown in the drawings) of the conventional type used for supporting radio receiver earphones.

Referring to Figs. 5 and 6, the ear pad 40 is supported by an ear cup 41, the base of which is provided with double walls 42 and 43, forming a pocket 44 between them. This pocket may be formed in the same way as previously described in connection with Figs. 3 and 4, except that the annular ridge 45 on the base of the ear cup is uninterrupted and the pocket is completely closed around its circumference. Slidably received within this pocket is an adjusting member 46 in the form of a simple disc. The disc may be of sufficient thickness to frictionally engage both walls of the pocket, and is provided with a threaded stud 47 extending at right angles to the disc through a central circular opening 48 in the outer wall 43. Secured to the threaded stud by a nut 49 is a yoke plate 50. This yoke plate is pivotally connected to a yoke 51, which is in turn attached to a supporting rod 52, of a conventional radio receiver headband (only part of which is shown in Figs. 5 and 6). The pivotal connection is effected by means of lugs 53 mounted on the yoke plate and pivot pins 54 extending through the lugs and the ends of the yoke, so that the ear cups can be tilted relative to the yoke for proper fitment on the wearer's head. Additional fitment is provided by the usual rotatable mounting of the rod 52 in the headband assembly. This headband is of the conventional type that fits over the wearer's head and because of its spring nature exerts an inward lateral pressure to force the ear pads against the wearer's head. It will be apparent that the ear cups and ear pads are individually adjustable with respect to the headband, so that the latter can be worn in its most comfortable position and effect complete ear closure for heads of many sizes and shapes.

It will be understood that a telephone or radio receiver earphone can be incorporated in both of the ear pads shown in Figs. 4 and 6, for improving the intelligibility of communication in areas of intense noise.

It will also be apparent that the headband support of Figs. 5 and 6 can be used with the ear cup of Figs. 3 and 4, by providing the yoke plate 50 with a female snap fastener, such as fastener 26 in Fig. 4. With such a fastener, there is a certain universal freedom of movement between the male stud portion 23 and the female portion 26 as is provided by a ball and socket joint, thereby increasing the adjustability of the ear cup relative to the head-supported member.

It will likewise be apparent that the snap fastening means 23 and 26 of the adjusting member 20 in Figs. 3 and 4 can be replaced by other types of fastening means, such as the threaded stud 47 and the engaging nut 49 of Figs. 5 and 6. In such case, the reinforcing strip 27 of the ear flap 4 (see Figs. 1 and 4) will act as a grommet or bearing surface for the nut 49. Also, the male stud 23 of Fig. 4 can be replaced by a threaded stud, such as stud 47 in Fig. 6, of proper diameter to engage the female portion 26 of the snap fastener, as well as a threaded nut.

According to the provisions of the patent statutes, we have explained the principle of our invention and have illustrated and described what we now consider to represent its best embodiment. However, we desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

We claim:

1. An adjustable ear pad support for use in a noise protective device provided with a head-supported member and ear pads, said adjustable support comprising an ear cup supporting the ear pad, the base of the ear cup having an inner and an outer wall forming a pocket there-

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between, the outer wall being provided with a restricted opening communicating with the pocket, an adjusting member slidably received within the pocket and having fastening means extending through the opening of the outer wall to secure the adjusting member to the head-supported member, whereby the ear cup may be slidably displaced relative to the adjusting member and the fastening means.

2. A device according to claim 1, in which the inner and outer walls are circular and parallel and define a shallow cylindrical pocket between them, and in which the opening in the outer wall is circular and has a diameter less than that of the pocket, and in which the adjusting member includes a disc portion having a diameter less than that of the pocket but greater than that of the opening.

3. A device according to claim 1, in which the inner wall has an annular ridge on its outer surface and the outer wall is a disc detachably secured to the annular ridge to form said pocket.

4. An adjustable ear pad support for use in a noise protective device provided with a head-supported member and ear pads, said adjustable support comprising a rigid ear cup supporting the ear pad, the base of the ear cup having an inner and outer wall forming a shallow cylindrical pocket therebetween, the outer wall being provided with a restricted opening communicating with the pocket, an adjusting member slidably received within the pocket and frictionally engaging at least one of the walls, and fastening means extending from the adjusting member through the opening of the outer wall for attaching the adjusting member to the head-supported member, whereby the ear cup may be slidably displaced relative to the adjusting member and the fastening means.

5. A device according to claim 4, in which the fastening means includes a stud mounted on the adjusting member that is adapted to engage a complementary female member mounted on the head-supported member.

6. An adjustable ear pad support for use in a noise protective headgear provided with ear flaps and ear pads, said adjustable support comprising a rigid ear cup partially enclosing and supporting the ear pad, the base of the cup having spaced inner and outer walls forming a pocket therebetween, the outer wall being provided with a restricted opening communicating with the pocket, a spacing member between the walls defining the periphery of the pocket and provided with an opening to form a slot between the walls communicating with the bottom of the pocket, an adjusting member slidably received within the pocket and having a first fastening means extending through the opening of the outer wall for attaching the adjusting member to the ear flap and having a retaining arm extending through the slot with the lower end of the arm adjacent the side of the ear cup, and a second fastening means for attaching the lower end of the arm to the ear flap at a point removed from the first fastening means, whereby the ear cup may be slidably displaced relative to the adjusting member and the first fastening means.

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7. In a noise protective headgear provided with a skull portion and sound absorbing ear pads, the combination comprising ear flaps of elastic material depending from the skull portion, a rigid ear cup partially enclosing and supporting each ear pad, the base of each cup being provided with spaced inner and outer parallel walls forming a vertically extending pocket therebetween, the outer wall having a restricted opening communicating with the pocket, a spacing member between the walls defining the periphery of the pocket and being provided with an opening between the walls to form a slot communicating with the bottom of the pocket, an adjusting member slidably received within the pocket and having a first fastening means extending through the opening of the outer wall for detachably securing the adjusting member to the ear flap and having a rigid retaining arm extending downward through the slot, with the lower end of the arm resting against a side of the ear cup and being provided with a second fastening means for securing the arm to the ear flap at a point removed from the first fastening means.

8. A combination in accordance with claim 7, in which the first fastening means includes a two part fastener having one of its parts attached to the adjusting member and the other of its parts attached to the adjacent ear flap.

9. A combination in accordance with claim 7, in which the pocket has a circular periphery, and in which the opening in the outer wall is circular, and in which the adjusting member is disc-shaped having a diameter less than the diameter of the pocket.

10. A combination in accordance with claim 7, in which the outer wall of the ear cup is an annular disc mounted in spaced parallel relation to the inner wall.

11. A combination in accordance with claim 7, in which the spacing member is an annular ridge mounted on the outer surface of the inner wall and in which the outer wall is a circular disc mounted on the annular ridge parallel to the inner wall.

12. A combination in accordance with claim 7, in which the elastic material of the ear flaps is disposed substantially symmetrically about the first fastening means and in which the lower rear portions of the ear flaps are joined together at the back of the cap to provide elastic tension forces holding the ear pads tightly against the sides of the wearer's head to effect complete closure of the ears.

13. A combination according to claim 7, in which the adjusting member frictionally engages at least one of the walls of the pocket.

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