

[54] **EAR PROTECTING DEVICE**

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[52] **U.S. Cl.**..... **2/209; 179/182 R**

[51] **Int. Cl.<sup>2</sup>**..... **A42B 1/06**

[58] **Field of Search**..... **2/209; 179/182 R**

[56] **References Cited**

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[57] **ABSTRACT**

The invention relates to an ear protecting device of

the kind comprising two shells intended to be placed over the ears to be protected and interconnected by a resilient holder means or yoke to which the shells are secured in a manner permitting adjusting their position to the individual shape of the head of the user. Each shell contains an absorber for standing sound waves and an annular soft sealing pad bearing against the head of the user around the ear. In order to give the pad required rigidity for effective absorption of the standing sound waves combined with sufficient flexibility at the edge zone bearing against the head of the bearer to avoid points of leakage, the annular pad of the invention is provided at at least one of its circumferences with a flange limiting deformation in radial direction. Such flange may be provided at the outer or the inner circumference of the pad or, if desired, at both the inner and the outer circumference. Preferably the flange is formed with an outer portion projecting towards, and producing a recess in, the pad. According to a preferred embodiment the annular pad is composed of a substantially even bottom portion of some relatively stiff material and a covering portion connected to said bottom portion and made of some relatively more flexible material, said bottom and covering portions encasing a yielding, but not easily compressible medium such as a liquid.

**4 Claims, 2 Drawing Figures**

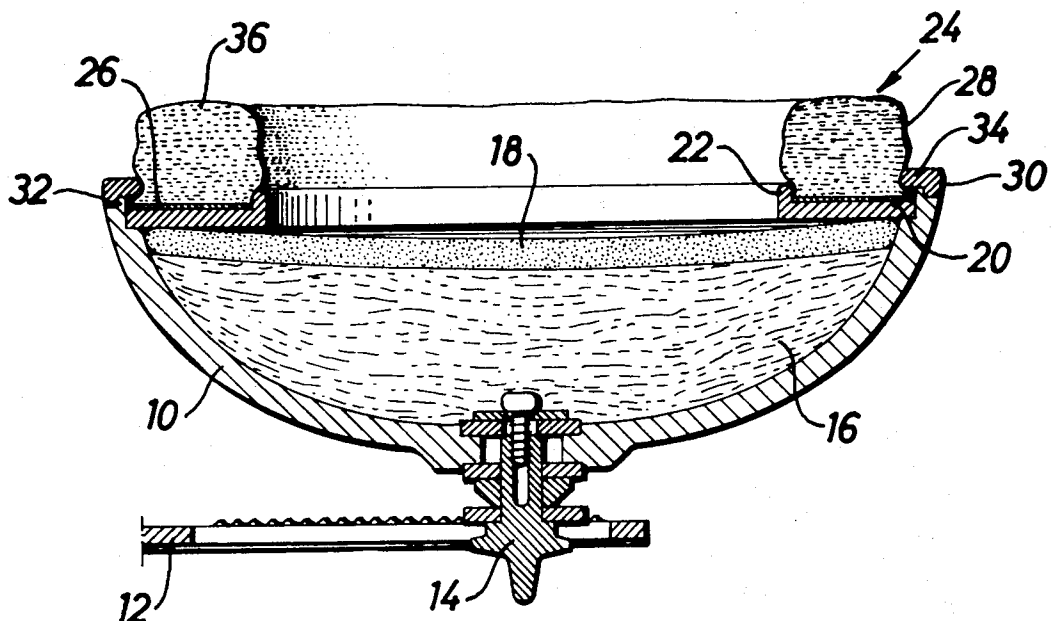


Fig.1

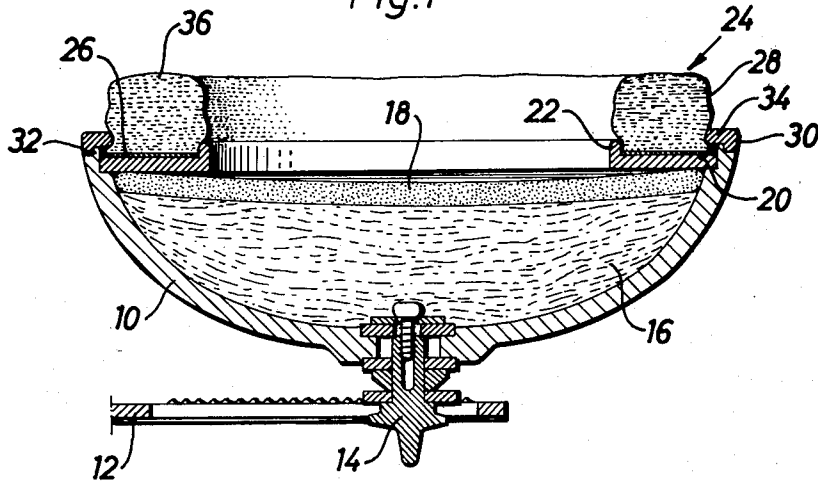
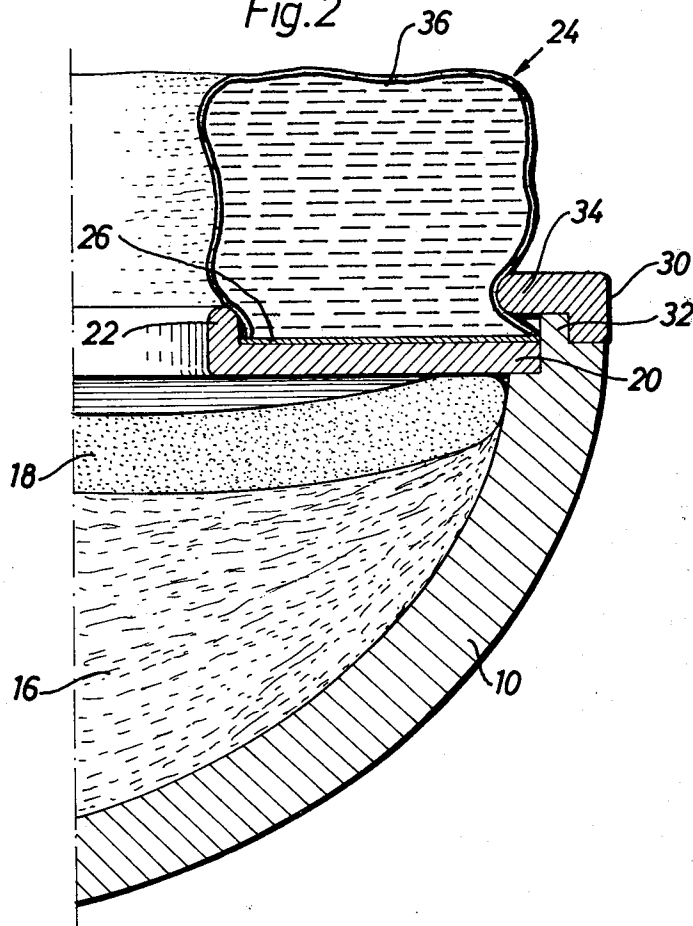


Fig.2



## EAR PROTECTING DEVICE

### FIELD OF THE INVENTION

This invention relates to an ear protection device, i.e., a device intended to protect the sense of hearing of persons working under highly noisy conditions and therefor exposed to the danger of grave reduction of their normal capacity of hearing.

More particularly this invention relates to an ear protecting device of the type which comprises two shells to be placed above one ear each of the user and interconnected by holder members, each shell having an absorber for standing sound waves and an annular soft sealing pad bearing against the head of the user about the ear. The annular pad is formable and has for this purpose a covering encasing a hollow space which may be filled with a liquid or a paste or consist of a filling of foamed plastic.

### THE PRIOR ART

The annular sealing pad is usually secured onto the shell by means of glueing or by being formed with a collar which is forced over the periphery of the shell. According to another design the elastic sealing pad is secured by glueing onto a rigid ring of plastic material which is springlocked on the shell.

### MAIN OBJECTS AND ADVANTAGES OF THE INVENTION

A sealing pad of this kind must on one hand possess great softness to afford good bearing, and thereby sealing, against various head shapes. On the other hand the pad must have great rigidity to provide efficient damping of low frequencies. The reason for the last-mentioned requirements is that for normally existing sizes of ear protecting devices the sound wave length at low frequencies in air considerably exceeds the dimensions of the shell. This results in that at low frequencies the shell as a unit is subjected to the same momentaneous pressure over its entire surface which implies that the shell oscillates as a rigid piston on the resilient element constituted by the sealing pad and to some extent by the tissue around the ear of the user which in turn implies that the pressure which is built up inside the shell i.e., is dependent of the length of stroke of the shell which in turn is determined by the rigidity of the resilient elements. Consequently, the capacity of the shell to damp low frequencies is determined by the weight and volume of the shell and the elasticity of the sealing pad. It will thus be understood that one main object of the invention is to provide an ear protecting device the sealing pad of which on one hand has great softness to avoid direct leakage between the same and the user's head and on the other hand a great "acoustic rigidity" to provide for effective damping.

### MAIN FEATURES AND ADVANTAGES OF THE INVENTION

It has now proved that both these properties can be obtained simultaneously according to one main feature of the invention by disposing at at least one of the circumferences of the annular sealing pad a flange which is devised to limit deformation in radial direction of the pad. According to an especially important embodiment the flange has an outer portion projecting towards and into the pad. The flange may be provided at the outer or the inner circumference of the pad. It is also con-

ceivable to provide both the inner and the outer circumference of the pad with a bracing flange.

When the sealing pad is exposed to pressure it will change its shape but retain its volume. In accordance with the invention, rapid deformations are hampered but slow deformations are rendered possible. Measuring tests with ear protecting devices designed on one hand according to the invention with stiffening flange and on the other hand without such a flange have given the following results:

Frequency:	200	300	400	500	Hz
Damping without stiffening flange:	14	17	20	23	dB
Damping with stiffening flange:	18	21	23	28	dB

### SHORT DESCRIPTION OF THE DRAWINGS

The invention shall hereinafter be described nearer with reference to an embodiment shown by way of example in the accompanying drawings.

FIG. 1 is a sectional view of the one shell of an ear protecting device designed according to the invention.

FIG. 2 is a partial view on an enlarged scale of the shell shown in FIG. 1.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, reference numeral 10 denotes a shell made suitable of plastic material and given oval shape. The ear protecting device comprises two such shells which by means of a resilient yoke 12 are retained in position over the two ears of the user. The yoke 12 is connected to each shell by means of a fastening device 14 which in known manner permits adjustment of the yoke relatively to the shell for adaptation to varying head shapes. Provided in the shell 10 is an absorber which has for its purpose to prevent standing sound waves to come into existence within the shell and which may consist of a layer 16 of glass-wool covered by a layer 18 of soft cellular plastic.

Secured to the outer edge of the shell is an annular oval disc 20 with a belled inner edge 22. A disc 20 serves as carrier for a pad 24 which has the shape of an oval ring and which is intended to bear against the head of the user around the ear. The interior of the pad is preferably closed and contains a yieldable but not easily compressible medium such as a liquid e.g., water mixed with glycerine. The pad may have a generally even bottom portion 26 of a relatively rigid plastic material which is united by welding with a U-shaped covering 28 of highly flexible or easily deformable material. This covering may be composed of double thin sheets of PVC. The pad 24 is easily formable to the contour of the head while its covering 20 is elastic to limited degree only.

In accordance with the invention the pad 24 has a limited liberty of motion in radial direction which in the shown embodiment is due to a flange 30 which at the outer periphery of the pad extends upwards from the edge portion 32 of the shell over a portion of the pad in its height extension transversely to the disc 20. Further the flange 30 projects with a portion 34 into the pad so that this latter has a corresponding recess straight opposite to the portion 34. The flange 30 imparts to the pad the acoustic rigidity which ensures a

substantial improvement of the sound damping capacity as analyzed above. Furthermore, the flange portion 34 permits to mount the pad on the shell without requiring to be fastened rigidly onto the same. The relatively rigid bottom disc 26 projects so much as to be located below the flange portion 34. In spite of this rigidity the pad has capacity of adapting itself in a sealing manner with its plane outer surface 36 to the shape of the head of the user or possible legs of spectacles and the like.

If desired the support 30 or 34, respectively, stiffening the pad in lateral direction may be located at the inner periphery of the pad. It is also possible to provide such supports on both sides of said pad.

While one more or less specific embodiment of the invention has been shown and described, it is to be understood that this is for purpose of illustration only, and that the invention is not to be limited thereby, but its scope is to be determined by the appended claims.

What is claimed is:

1. In a hearing protection device of the type having a shell containing a sound absorbing means and having a resilient annular sealing pad means located on the shell circumference for placement over the ear and against the head of a user the improvement in the annular sealing pad resulting in increased damping of sound

comprising restraining flange means located on the annular sealing pad, and in contact relationship with the shell, the flange means limiting the deformation of the annular sealing pad in a radial direction sufficiently to provide acoustic rigidity for damping of sound while retaining flexibility of the sealing pad edge portion opposite its base to enable leakage proof bearing against the head of the user.

2. A hearing protection device as claimed in claim 1 wherein the restraining flange means is located at both the inside and outside periphery of the sealing pad.

3. A hearing protection device as claimed in claim 1 wherein the annular sealing pad comprises an oval ring-like pad of yieldable but not easily compressible material secured to a rigid annular disc by means of a flexible U-shaped cover, the disc portion being positioned adjacent the shell circumferential edge, the flange means being secured to the shell circumferential edge, the flange means having a portion projecting into and deforming the ring-like pad and extending over the disc to removably retain the sealing pad joined to the shell.

4. A hearing protection device as claimed in claim 3 wherein the yieldable but not easily compressible material is a liquid medium.

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UNITED STATES PATENT OFFICE  
CERTIFICATE OF CORRECTION

Patent No. 3,908,200 Dated Sept. 30, 1975

Inventor(s) TORD RUNE LUNDIN

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Claim 1, line 9, change "shell" to--annular sealing pad--.

**Signed and Sealed this**

*Twenty-seventh* **Day of** *September 1977*

[SEAL]

*Attest:*

**RUTH C. MASON**  
*Attesting Officer*

**LUTRELLE F. PARKER**  
*Acting Commissioner of Patents and Trademarks*

UNITED STATES PATENT OFFICE  
CERTIFICATE OF CORRECTION

Patent No. 3,908,200 Dated September 30, 1975

Inventor(s) Tord Rune Lundin

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Claim 1, lines 7-8, change "annular sealing pad" to  
-- shell --.

Signed and Sealed this

Twenty-fourth Day of May 1977

[SEAL]

*Attest:*

**RUTH C. MASON**  
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**C. MARSHALL DANN**  
*Commissioner of Patents and Trademarks*