

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
21 August 2008 (21.08.2008)

PCT

(10) International Publication Number
WO 2008/100197 A1

(51) International Patent Classification:

A61F 11/14 (2006.01) H04R 1/10 (2006.01)

(21) International Application Number:

PCT/SE2008/000098

(22) International Filing Date: 6 February 2008 (06.02.2008)

(25) Filing Language: Swedish

(26) Publication Language: English

(30) Priority Data:

0700371-8 14 February 2007 (14.02.2007) SE

(71) Applicant (for all designated States except US): **MSA SORDIN AB** [SE/SE]; Rorlaggarvagen 8, SE-331 53 Värnamo (SE).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **ROOS, Anders** [SE/SE]; Stenmursvagen 21, SE-331 54 Värnamo (SE).
BIRGERSSON, Joakim [SE/SE]; Upplanda 4, S-574 91

Vetlanda (SE). **DAVIDSSON, Håkan** [SE/SE]; Ågårdsgatan 4A, S-331 34, Värnamo (SE).

(74) Agent: **AWAPATENT AB**; Gjuterigatan 9, S-553 18 Jönköping (SE).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,

[Continued on next page]

(54) Title: SYSTEM FOR FORMING A HEARING PROTECTOR, EAR CUP IN SUCH A SYSTEM, AND HEARING PROTECTOR FORMED BY SUCH A SYSTEM

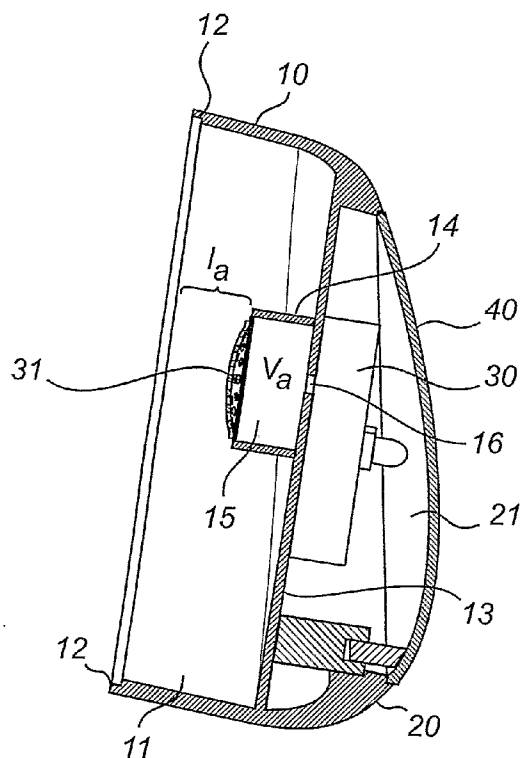


Fig. 2a

(57) Abstract: The invention concerns a system for forming hearing protectors, an ear cup of such a system and a hearing protector formed from such a system. The system comprises a number of first ear cups (5a) and a number of second ear cups (5b), the first and second ear cups having noise-reducing spaces (11) of different size, and at least one electronic unit (30) with at least one speaker (31). An inner distance (13) in the noise-reducing space from the speaker (31) in the direction away from the noise-reducing space, and a volume (V3) of a resonance space (15) in the first ear cup are adapted to the inner distance (1b) and the volume (Vb) of the resonance space (15) in the second ear cup (5b). This is done in such a manner that, when the electronic unit is mounted in each ear cup, sound emitted by the speaker (31) in each ear cup produces substantially the same sound characteristic from the first ear cup (5a) as that from the second ear cup (5b). This allows the same type of electronic unit to be used for ear cups with different degrees of noise attenuation.

WO 2008/100197 A1



FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL,
NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG,
CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report*

SYSTEM FOR FORMING A HEARING PROTECTOR, EAR CUP IN SUCH A
SYSTEM, AND HEARING PROTECTOR FORMED BY SUCH A SYSTEM.

Field of the Invention

The present invention relates to a system for forming hearing protectors, a hearing protector formed from such a system, and ear cups adapted for use in a hearing protector formed from such a system. More specifically, the invention concerns hearing protectors that in addition to a noise-reducing function also have a sound-reproducing function associated with the hearing protector to allow the emission of sound inside the hearing protector.

10 Technical Background

Hearing protectors comprise two ear cups and a device for fastening the hearing protector to the head of a wearer, such that the ear cups are positioned over the wearer's ears. Ear cups used in existing hearing protectors may function as active elements, which means that they have a passive, sound-reducing function which is combined with the function of actively reproducing sound inside the ear cup to allow the user to hear this reproduced sound.

To this end, the ear cup may be provided with an electronic unit having a speaker. The electronic unit may incorporate different functions. One type of electronic unit may, for instance, contain a radio receiver and the electronic circuitry required to reproduce the sound received by the radio receiver through the speaker. Another type of electronic unit may be designed such that it is capable of reproducing ambient sound from the vicinity of the hearing protector. In this case, the hearing protector may be provided with a microphone that is connected to the electronic unit. The electronic unit thus has a function that allows it to receive the sound from the microphone and convert it in such a manner that it is emitted by the speaker in the ear cup at a level that is suitable for the wearer. The electronic circuitry of the electronic unit may comprise, for example, circuits that dampen frequencies that are

particularly disturbing to the human ear for the benefit of the frequency range within which ordinary speech is situated. In this way, the user of an active hearing protector of this kind is able to talk to another person in a noisy environment without having to remove the hearing protector and without
5 risking any hearing damage. The electronic unit may also be designed to have both of the functions described above.

Different types of ear cups may be designed with different degrees of attenuation depending on the levels of noise in the environments in which they are to be used. If a hearing protector is intended for use in environments
10 where noise levels are high, for example in the vicinity of aircraft taking off, the ear cup must have a much higher degree of noise attenuation than if the hearing protector is to be used in less noisy environments, for example in a catering kitchen. For this reason, hearing protectors are designed to have different noise-attenuating ability, i.e. to have noise-reducing spaces of
15 different size. In general, the larger the cup the better the attenuating ability.

It is important that speakers arranged in hearing protectors do not emit sound that is too loud, so that it becomes harmful to the ear of the user. For this reason, there is an upper limit for the sound volume that can be emitted by the electronic unit through the speaker in the ear cup. This sound
20 reproduction level limit is described, for instance, in the European standard EN352. To avoid that the sound level emitted by the speaker adjacent the ear of a user exceeds this limit, and to make sure that the user has the same type of sound experience with all ear cups, it is desirable for active ear cups to emit the same sound level adjacent the ear at a certain sound volume setting,
25 independently of the type of ear cup. To achieve this in cups with different degrees of attenuation, i.e. with noise-reducing spaces of different size, different electronic circuitry must be employed today to provide the same sound-reproducing function(s) depending on the degree of attenuation of the ear cup. When manufacturing, for example, ear cups with two different
30 degrees of attenuation, two versions of the circuitry required to provide the sound-reproducing function must be developed, one for the ear cup with a higher degree of attenuation and another for the ear cup with a lower degree of attenuation. This means higher costs for each ear cup in the form of

assembly, development, adaptation of the circuitry, storage etc. than would be the case if the same circuitry could be used regardless of the degree of attenuation of the ear cup.

5 Summary of the Invention

 An object of the present invention is therefore to provide a solution that eliminates the drawback described above, i.e. that provides a similar sound experience adjacent the ear of a user with the same type of electronic circuitry and speaker regardless of the size and degree of attenuation of the
10 ear cup.

 The object is achieved by a system for forming hearing protectors, an ear cup in such a system and a hearing protector formed from such a system according to the respective independent claims.

 Embodiments of the invention appear from the dependent claims and
15 from the following description and the appended drawings.

 According to a first aspect of the invention, this object is achieved by a system for forming hearing protectors, which comprises at least one first ear cup (5a) and at least one second ear cup (5b), the first and second ear cups having noise-reducing spaces (11) of different size, and at least one
20 electronic unit (30) with at least one speaker (31),

 the ear cups (5a, 5b) being arranged to accommodate the electronic unit,

 each of the ear cups (5a, 5b) being arranged to accommodate the speaker (31) in such a manner that an inner distance (l) is obtained in the
25 noise-reducing space (11) from the speaker and in the direction of the ear of a user, when the user is wearing the ear cup,

 the ear cups (5a, 5b) further having a resonance space (15), which is arranged to function as a sounding board for sound emitted by the speaker (31), and

30 the inner distance (l_a) and the volume of the resonance space (V_a) in the first ear cup (5a) being adapted to the inner distance (l_b) and the volume of the resonance space (V_b) in the second ear cup (5b) such that, when the electronic unit (30) is mounted in each ear cup (5a, 5b), sound emitted by the

speaker (31) in each ear cup produces substantially the same sound characteristic from the first ear cup (5a) as that from the second ear cup (5b).

The noise-reducing space can be defined as a space that is limited by the inside of the ear cup and a surface that is defined by an outer,

5 circumferential edge on the ear cup, which edge is adapted to face the ear of a user.

By "inner distance" is meant the distance that sound emitted by a speaker arranged in an ear cup travels inside the noise-reducing space from the speaker, suitably the speaker diaphragm, until it leaves the noise-reducing space in the direction of the ear of a user, when the ear cup is positioned against the ear of the user. This distance is suitably defined as the distance from the speaker diaphragm to a surface that is defined by the outer, circumferential edge of the ear cup. See reference numerals l_a , l_b in Figs 2a, 3a.

15 By "resonance space" is meant the spatial cavity in the ear cup that is intended to act as a sounding board for sound emitted by speakers, i.e. the space adjacent the speaker that has a substantial impact on the emitted sound level and sound characteristic. The resonance space is primarily located behind the speaker, and is also called the rear volume of the speaker.

20 Suitable inner distances and volumes of the resonance space are determined by laboratory testing for each type of ear cup by varying the position of the speaker in each cup and by varying the volume of the resonator space until substantially the same sound characteristic is obtained for one type of cup with a noise-reducing space of a certain size as for another type of cup having a noise-reducing space of a different size, when using the same type of speaker and electronic circuitry in both cups. By employing this solution, there is no need to have different circuitry for different ear cup sizes. As a result, cups are more cost-efficient due to reduced costs for assembly, development, adaptation of circuitry, storage etc than would be the case if different circuitry would have to be used for different ear cup sizes.

30 According to one embodiment of the invention, the ear cups have a support, which is arranged in the noise-reducing space and on which support the speaker is to be mounted. This makes it possible to change the inner

distance and the volume of the resonance space, respectively, in the ear cups by altering the extension of the support in the direction in which sound emitted by a speaker arranged on the support would travel in the direction of the ear of a user, to obtain substantially the same sound characteristic in two different ear cups with noise-reducing spaces of different size.

According to another embodiment, the resonance space in each ear cup is formed by at least part of the noise-reducing space.

According to a further embodiment, the resonance space in each ear cup is designed such that it is separated from the noise-reducing space when the speaker is mounted in an ear cup. A clearly delimited resonance space is thus obtained the volume of which can be changed relatively easily to achieve the object of the invention. Furthermore, this makes it relatively easy to provide a resonance space of the same size in both the right and the left ear cup of a hearing protector, since the size of the resonance space is not dependent on the size of the noise-reducing space, which size may not be the same in the right ear cup and in the left ear cup depending on whether any elements are arranged in the noise-reducing space in the right or left ear cup.

According to yet another embodiment of the invention, the support is formed with a recess and this recess forms the resonance space in the ear cup. This allows both the inner distance and the volume of the resonance space to be changed by designing the support in different ways, which makes it easier to adjust these measures to match ear cups of different sizes, thereby to achieve the object of the invention. Moreover, the size of the resonance space will not be dependent on the size of the noise-reducing space, which gives the same advantages as those of the previous embodiment.

According to another embodiment, the support in each ear cup is arranged such that when the speaker is mounted on the support the recess is covered in a manner that separates it completely from the noise-reducing space. Because the space behind the speaker is separated from the space in front of the speaker, the risk that sound emitted by the speaker will affect the speaker itself through acoustic short-circuiting is eliminated. Furthermore, a closed space of this kind behind the speaker gives a better bass sound in the

speaker than if the resonant volume and the noise-reducing space are partly the same volume.

According to another embodiment, the inner distance (l_a) in the first ear cup is substantially the same as the inner distance (l_b) in the second ear cup and the volume (V_a) of the resonance space in the first ear cup is substantially the same as the volume (V_b) of the resonance space in the second ear cup. By the measures being the same in the two different variants of ear cups with noise-reducing spaces of different size, the sound characteristic is substantially the same adjacent the ear of a user from both ear cups when similar circuitry is used in both ear cups.

According to a further embodiment, the ear cups each have an inner cup portion, which defines the noise-reducing space and an outer cup portion, which is arranged to accommodate at least a part of the electronic unit. By dividing the cup in two in this way, it is possible to provide a noise-reducing space of the same size in both the right ear cup and the left ear cup of a hearing protector, regardless of whether the electronic unit is arranged in only one of the ear cups or, for example, split in such a manner that the electronic circuitry as such is arranged in one of the ear cups of the hearing protector and the battery of the electronic unit is arranged in the other ear cup of the hearing protector.

The invention also concerns an ear cup included in the system and a hearing protector made up of some of the parts of the system.

Brief Description of the Drawings

Figure 1 is a perspective view of a hearing protector in which the electronic circuitry, including speakers and lids, is illustrated in the form of an exploded view.

Figure 2a is a cross-sectional side view of an ear cup with a large noise-reducing space, in which the electronic circuitry, including a speaker, is mounted.

Figure 2b is a perspective view of the ear cup in Figure 2a.

Figure 2c is a front view of the inside of the ear cup in Figure 2a.

Figure 3a is a cross-sectional side view of an ear cup with a small noise-reducing space, in which the electronic circuitry, including a speaker, is mounted.

Figure 3b is a perspective view of the ear cup in Figure 3a.

5 Figure 3c is a front view of the inside of the ear cup in Figure 3a.

Figure 4 is an exploded view of part of an ear cup and a speaker.

Description of Preferred Embodiments

Figure 1 shows a hearing protector 1 which has two ear cups 5. The
10 ear cups are connected to each other by a strap 4 for mounting the hearing protector on the head of a user. The strap is fastened to the ear cups with the aid of fastening devices 3. In one alternative embodiment, instead of the strap 4 the two ear cups 5 may have another device for connecting the ear cups with each other, for example each of the cups may be provided with a holder,
15 which is provided for attachment to a helmet or the like which is to be worn on the head of a user. Each of the ear cups 5 has an inner cup portion 10 and an outer cup portion 20, which are made of, for example, rigid plastic. Mounted on the edge 12 of the inner cup portion (see for example Figure 2b) is a sealing ring 6, which is arranged to be in close contact with the head of a
20 user in the area around one ear of the user. Advantageously, the ear cups 5 have noise-reducing spaces of equal size, so that the reduction of noise is the same for the right ear and for the left ear of the user.

Figures 2a-2c show a first ear cup 5a with a large noise-reducing space 11 and Figures 3a-3c show a second ear cup 5b with a small noise-reducing space 11. Both the first and the second ear cup have the features
25 described below.

The inner cup portion 10 delimits the noise-reducing space 11. The inner cup portion 10 has an outer, circumferential edge 12, which is arranged to face the user when the user is wearing the ear cup. The outer,
30 circumferential edge 12 is designed such that it allows the arrangement of a sealing ring thereon. The outer cup portion 20 and a lid 40 define an outer space 21 intended to accommodate, inter alia, parts of an electronic unit 30. The electronic unit comprises: electronic circuitry for providing a sound-

reproducing function, for example an FM radio, and/or an mp3 player and/or electronic circuitry for reproducing ambient sound; at least one speaker and a current source. In a hearing protector, the electronic unit is either mounted in one of the ear cups or split between both ear cups, for example by the current
5 source being arranged in one ear cup and the circuitry in the other ear cup. Speakers are advantageously arranged such that there is one speaker in each ear cup.

The inner cup portion 10 and the outer cup portion 20 are separated by a partition 13, which may be made in one piece with the inner cup portion 10.
10 In the noise-reducing space 11, a support 14 which extends from the partition is arranged to accommodate a speaker 31. The support has a recess 15, which forms a resonance space for the speaker. The support 14 and the speaker 31 are designed in such manner that when the speaker is mounted on the support 14 the recess 15 is sealed by the speaker, so that the
15 resonance space formed is separated from the noise-reducing space 11. The partition 13 further has a hole 16 through which a wire (not shown) connecting the speaker 31 to the electronic circuitry 30 is passed.

According to the invention, the first ear cup 5a is formed with a large noise-reducing space 11 and the second ear cup 5b with a small noise-
20 reducing space 11, so that an inner distance l is obtained from the speaker when mounted on the support 14 to a surface defined by the circumferential edge 12. This inner distance l_a in the first cup 5a and the volume V_a of the resonance space 15 of the first cup are then adjusted to match the corresponding inner distance l_b and volume V_b of the second cup 5b, so that
25 when the same type of electronic circuitry 30 is arranged in the first cup 5a and the second cup 5b, respectively, substantially the same sound characteristic is obtained at the surface defined by the circumferential edge 12 for sound emitted by a speaker 31 mounted on the support 14. The adjustment is made by testing different distances and resonance space
30 volumes until a ratio is found which gives substantially the same sound characteristic for both ear cups.

In one embodiment, the first and the second ear cup are designed such that the inner distance l_a in the first ear cup is substantially the same as

the inner distance l_b in the second ear cup, and that volume V_a of the resonance space in the first ear cup 5a is substantially the same as the volume V_b of the resonance space 15 in the second ear cup 5b. As a result, the sound characteristic is substantially the same adjacent the ear of a user.

- 5 To achieve the same resonance space volume and, at the same time, the same inner distance in cups with noise-reducing spaces 11 of different size, the speaker must be located further away from the inside of the noise-reducing space (i.e. the surface of the partition 13) in the first cup 5a than in the second cup 5b for the speaker to be located at the same distance from the surface defined by the circumferential edge 12 in both the first and the second cup. Accordingly, the support 14 is made higher, i.e. it has a greater extension length in the first cup 5a than in the second cup 5b. In this connection, the resonance space 15 is adapted so that it has the same size in the first cup 5a as in the second cup 5b.

- 15 According to one embodiment, which is illustrated in Figures 2a and 3a, the support 14 may have the form of a cylinder which rests on the inside of the inner cup portion 10, against the partition 13, and extends towards the surface defined by the circumferential edge 12. The cylinder has an upper surface located furthest away from the partition, which face forms an bearing surface for the speaker, in that the speaker is adapted to be arranged on this bearing surface. The resonance space 15 is thus formed by the space delimited by the cylinder 14, the partition 13 and the surface defined by the bearing surface. In the embodiment where the first and the second cup have the same inner distances l and volumes of the resonance space V , the resonance space is then formed such that the cylinder 14 of the first ear cup 5a with a larger noise-reducing space 11 has a greater extension and more narrow cross-sectional area than that of the second ear cup 5b with a smaller noise-reducing space. In this way, the cups will have the same inner distances l and the same volumes of the resonance space V .

- 30 The invention also concerns a system for forming a hearing protector. The system comprises a number first ear cups 5a with a large noise-reducing space 11, a number of second ear cups 5b with a small noise-reducing space 11 and a number of electronic units 30 of the same type with at least one

speaker 31 each. To form a hearing protector from this system, two copies of the same type of ear cup, two speakers and one electronic unit are advantageously selected, which are then assembled. For example, a hearing protector for use in extremely noisy environments is, suitably made up of two
5 copies of the first ear cup with a large noise-reducing space and an electronic unit with two speakers, one for each ear cup. In the same way, a hearing protector intended for less noisy environments is suitably made up of two units of the second ear cup with a small noise-reducing space and an electronic unit with two speakers, one for each ear cup, the electronic unit,
10 including the speakers, being of the same type for both hearing protectors.

The system does not exclude forming of hearing protectors comprising a first ear cup with a large noise-reducing space and a second ear cup with a small noise-reducing space and an electronic unit with two speakers. It is also conceivable to have embodiments of hearing protectors in which only one of
15 the ear cups is equipped with speakers, and thus acts as a passive ear cup.

As well as having two different types of ear cups, the system may also have three or more types of ear cups of different size, which can be used to form hearing protectors with a large number of noise-reducing spaces of different size and, thus, with different noise-reducing abilities.

20 As described above, the same type of speaker may be used in cups with noise-reducing spaces of different size. Figure 4 shows how a speaker can be adapted for mounting on supports of different sizes. Figure 4 illustrates, in the form of an exploded view, the speaker 31, a sealing ring 32 and the support. By using an adapter device, which may be, for example, a
25 sealing ring 32, the size of the speaker 31 can be adapted. The sealing ring 32 is provided in different sizes depending on the size of the support 14, to allow mounting of the speaker on the support. Advantageously, the sealing ring is designed such that when the sealing ring 32 has received the speaker 31 and they have been positioned on the support 14, the speaker and the
30 sealing ring 32 cover the recess 15 in the support 14 regardless of the cross-sectional area of the recess 15, which results in the recess 15 that forms the resonance space being separated from the noise-reducing space. This allows

the same type of speaker to be used for different types of ear cups regardless of the size of the support.

5 In one alternative embodiment, the ear cup may be formed without a separate resonance space. In this case, the whole noise-reducing space, or at least the part of the noise-reducing space that is located behind the speaker, serves as a resonance space. In this case, the ear cup may be designed, for example, such that the speaker is mounted on a support in the form of two pins on which the speaker rests.

10 In another alternative embodiment, the cups may have a single cup portion, in which the electronic circuitry is to be mounted in the noise-reducing space.

CLAIMS

1. A system for forming hearing protectors, **characterised in** that it comprises at least one first ear cup (5a) and at least one second ear cup (5b),
5 the first and second ear cups having noise-reducing spaces (11) of different size, and at least one electronic unit (30) with at least one speaker (31),
the ear cups (5a, 5b) being arranged to accommodate the electronic unit,
each of the ear cups (5a, 5b) being arranged to accommodate the
10 speaker (31) in such a manner that an inner distance (l) is obtained in the noise-reducing space (11) from the speaker and in the direction of the ear of a user, when the user is wearing the ear cup,
the ear cups (5a, 5b) further having a resonance space (15), which is arranged to function as a sounding board for sound emitted by the speaker
15 (31), and
the inner distance (l_a) and the volume of the resonance space (V_a) of the first ear cup (5a) being adapted to the inner distance (l_b) and the volume of the resonance space (V_b) of the second ear cup (5b) such that, when the electronic unit (30) is mounted in each ear cup (5a, 5b), sound emitted by the
20 speaker (31) in each ear cup produces substantially the same sound characteristic from the first ear cup (5a) as that from the second ear cup (5b).
2. A system according to claim 1, wherein each ear cup (5a, 5b) has an outer, circumferential edge (12), which is arranged to face the ear of a
25 user, the inside of the cup and a surface defined by the outer, circumferential edge (12) defining the noise-reducing space (11),
and the inner distance (l) is a distance from the speaker to the surface defined by the outer, circumferential edge.
3. A system according to claim 1 or 2, wherein each ear cup (5a, 5b) has a support (14) which is arranged in the noise-reducing space (11), on
30 which support the speaker (31) is to be arranged.

4. A system according to any one of claims 1-3, wherein the resonance space (15) in each ear cup (5a, 5b) is formed by at least part of the noise-reducing space (11).

5 5. A system according to any one of claims 1-3, wherein the resonance space (15) in each ear cup (5a, 5b) is designed such that it is separated from the noise-reducing space (11) when the speaker (31) is mounted in an ear cup.

10 6. A system according to any one of claims 3-5, wherein the support (14) in each ear cup (5a, 5b) has a recess (15) and this recess forms the resonance space in the ear cup.

15 7. A system according to claim 6, wherein the support (14) in each ear cup (5a, 5b) is so arranged that when the speaker (31) is mounted on the support (14) the recess (15) is covered in a manner that separates it completely from the noise-reducing space (11).

20 8. A system according to any one of claims 1-7, wherein the inner distance (l_a) in the first ear cup (5a) is substantially the same as the inner distance (l_b) in the second ear cup (5b), and the volume (V_a) of the resonance space (15) in the first ear cup (5a) is substantially the same as the volume (V_b) of the resonance space (15) in the second ear cup (5b).

25 9. A system according to any one of claims 1-8, wherein at least one of the at least one first ear cup (5a) and the at least one second ear cup (5b) has an inner cup portion (10), which defines the noise-reducing space and an outer cup portion (20) which is arranged to accommodate at least a part of the electronic unit (30).

30

10. An ear cup (5) included in the system according to claims 1-9.

11. A hearing protector (1) made up of:

14

two ear cups (5a or 5b) included in the system according to claims 1-9,
which have noise-reducing spaces (11) of the same size,
an electronic unit (30) with at least one speaker (31), and
a device (4) for connecting the ear cups to one another, the device
5 being arranged to fasten the hearing protector to the head of a user.

1/4

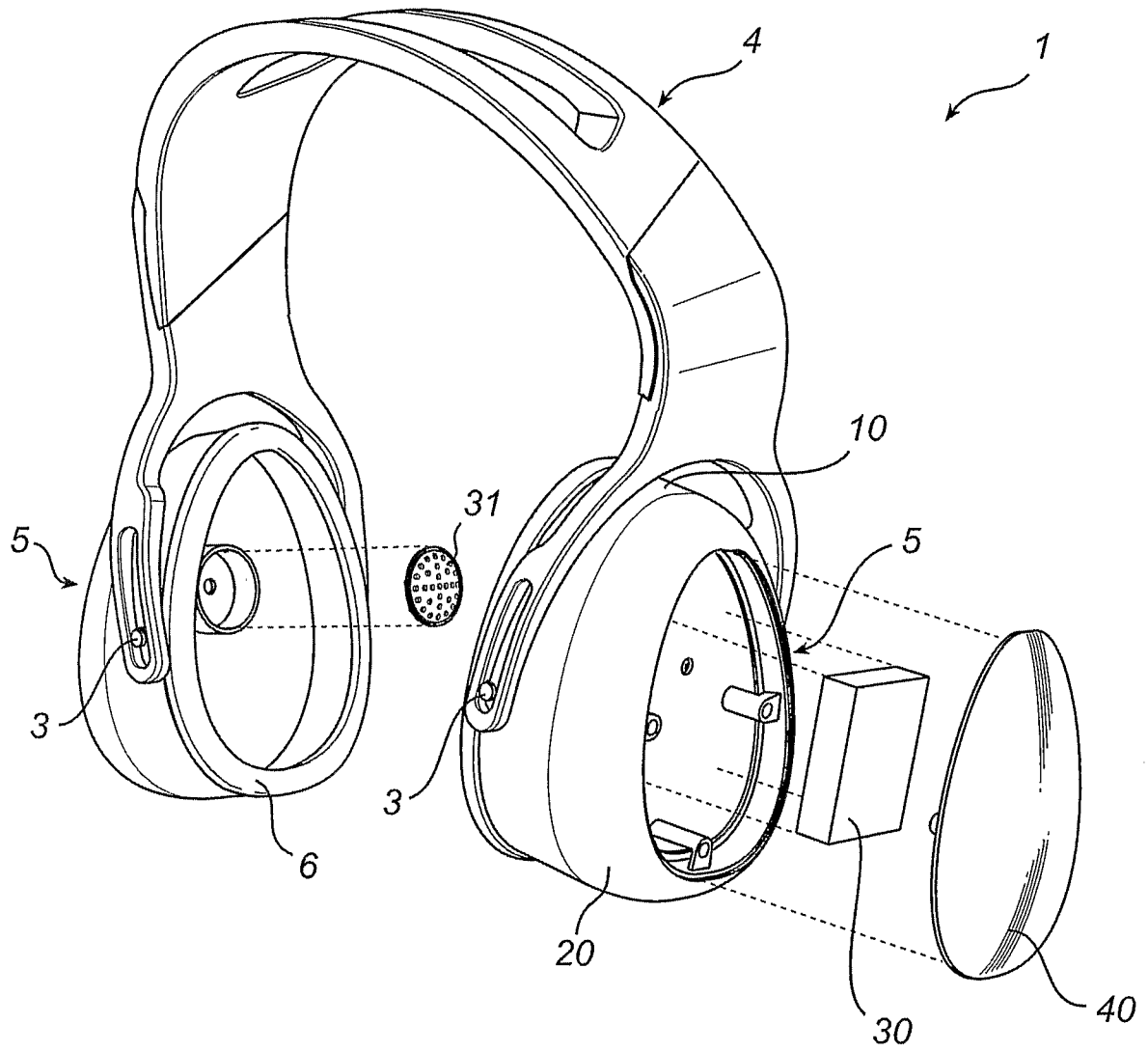


Fig. 1

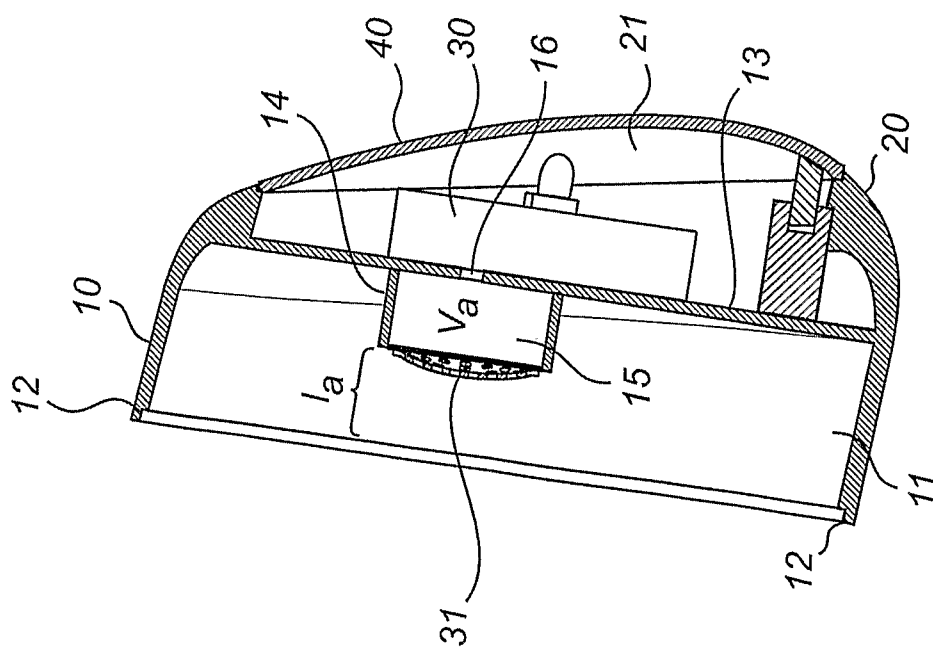


Fig. 2a

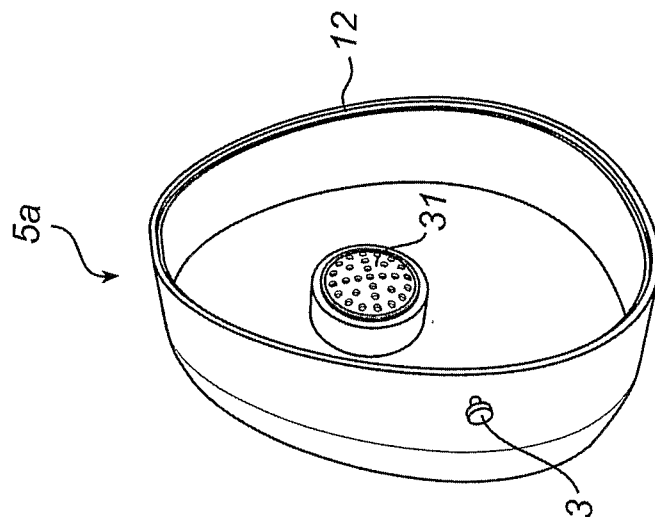


Fig. 2b

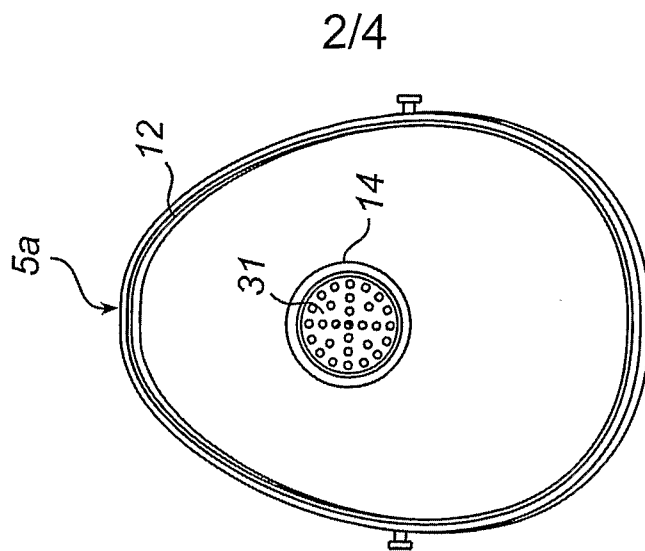


Fig. 2c

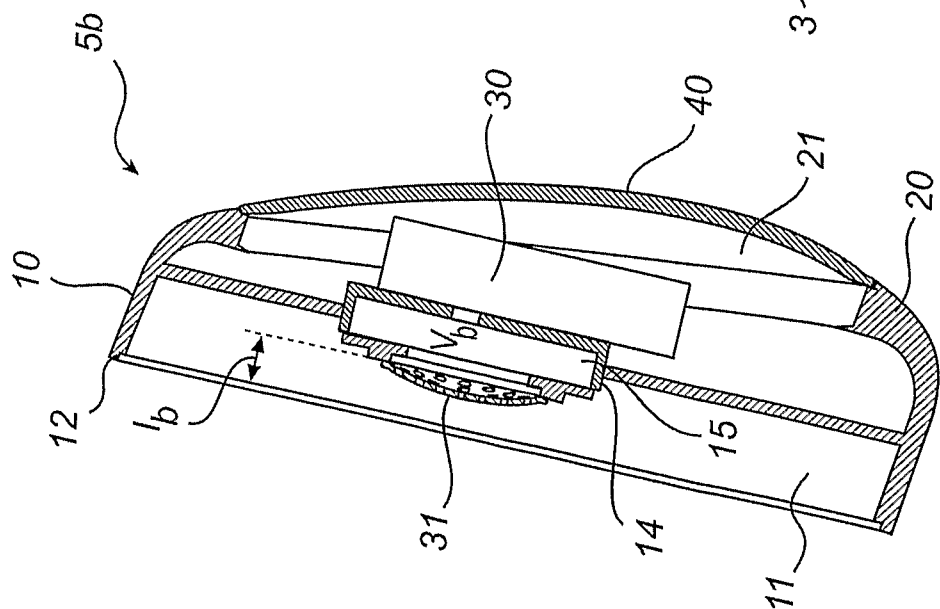


Fig. 3a

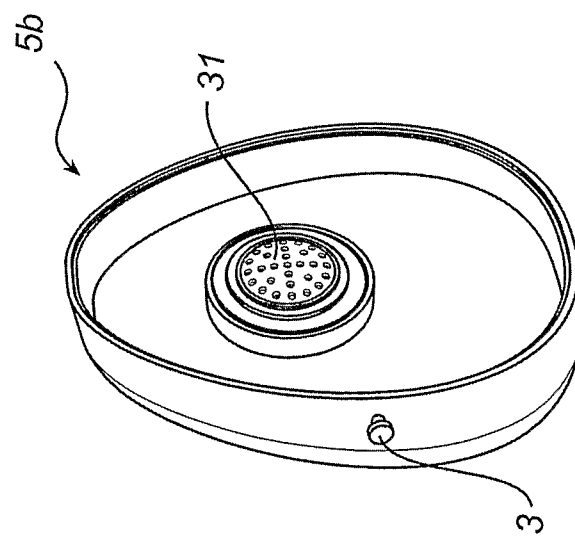


Fig. 3b

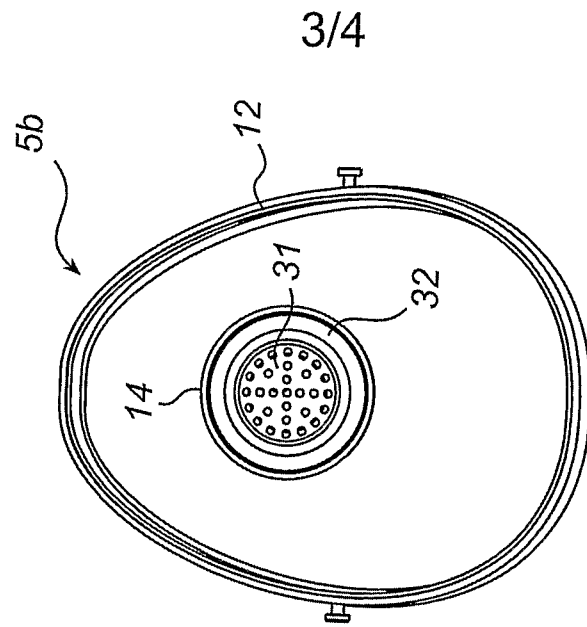


Fig. 3c

4/4

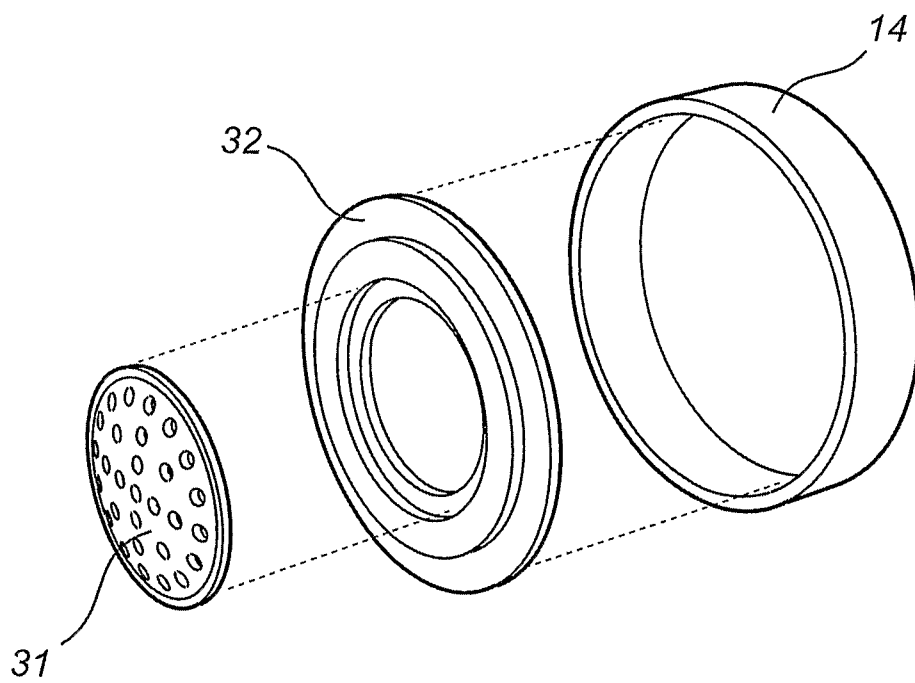


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE2008/000098

A. CLASSIFICATION OF SUBJECT MATTER		
IPC: see extra sheet According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC: A61F		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
SE,DK,FI,NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
EPO-INTERNAL, WPI DATA, PAJ		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 03019978 A2 (MM GEAR CO. LTD.), 6 March 2003 (06.03.2003), figure 1, abstract --	1-11
A	EP 0967592 A2 (NOISE CANCELLATION TECHNOLOGIES, INC.), 29 December 1999 (29.12.1999), figure 4, abstract --	1-11
A	GB 2279202 A (M.J. FOGARTY ET AL), 21 December 1994 (21.12.1994), figure 3, abstract --	1-11
A	US 5551089 A (J. WHIDDEN), 3 Sept 1996 (03.09.1996), figure 2, abstract --	1-11
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 20 May 2008		Date of mailing of the international search report 23-05-2008
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86		Authorized officer Leif Brander / MRo Telephone No. +46 8 782 25 00

International patent classification (IPC)**A61F 11/14** (2006.01)**H04R 1/10** (2006.01)**Download your patent documents at www.prv.se**

The cited patent documents can be downloaded at www.prv.se by following the links:

- In English/Searches and advisory services/Cited documents (service in English) or
- e-tjänster/anförda dokument (service in Swedish).

Use the application number as username.

The password is **GHYUOIGPVE**.

Paper copies can be ordered at a cost of 50 SEK per copy from PRV InterPat (telephone number 08-782 28 85).

Cited literature, if any, will be enclosed in paper form.

INTERNATIONAL SEARCH REPORT

International application No.

26/01/2008

PCT/SE2008/000098

WO	03019978	A2	06/03/2003	AU	2002325575 A	10/03/2003
				CN	1605223 A	06/04/2005
				EP	1419671 A	19/05/2004
				JP	2005501496 T	13/01/2005
				US	20040264727 A	30/12/2004

EP	0967592	A2	29/12/1999	SE	0967592 T3	
				AU	7355594 A	17/01/1995
				DE	69424419 D,T	04/01/2001
				DE	69434918 D,T	08/11/2007
				EP	0705472 A,B	10/04/1996
				SE	0705472 T3	
				ES	2281160 T	16/09/2007
				JP	8510565 T	05/11/1996
				US	6118878 A	12/09/2000
				US	7103188 B	05/09/2006
				WO	9500946 A	05/01/1995

GB	2279202	A	21/12/1994	GB	9311916 D	00/00/0000
				GB	9410713 D	00/00/0000

US	5551089	A	03/09/1996	GB	2296856 A,B	17/07/1996
				GB	9600376 D	00/00/0000