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(54) HEARING DEVICE WITH A MICROPHONE PROTECTION COVER

HÖRGERÄT MIT EINER MIKROFONSCHUTZABDECKUNG

DISPOSITIF AUDITIF DOTÉ D'UNE COUVERTURE DE PROTECTION DE MICROPHONE

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Description**TECHNICAL FIELD OF THE INVENTION**

- 5 **[0001]** The current invention relates to a hearing device according to the pre-characterising part of claim 1 and a microphone protection cover for the hearing device.

DESCRIPTION OF THE RELATED ART

- 10 **[0002]** Hearing devices are known for example from WO 2009/138524. The hearing device comprises a housing with two microphones arranged within the housing. A protection cover arranged over each microphone prevents the direct connection of the microphones to the environment. WO 2012/049046, EP2369857, US2011/0135127 and US 2009/138524 all describe hearing devices.

SUMMARY OF THE INVENTION

- 15 **[0003]** It is an object of the current invention to provide a hearing device with an improved microphone protection. This object is realised by a hearing device with the features of claim 1. Further embodiments of the hearing device as well as of a microphone protection cover are defined by features of further claims.

- 20 **[0004]** A hearing device according to the current invention comprises a housing, at least one microphone arranged within the housing, at least one microphone opening, that connects the respective microphone to the outside of the housing by means of a channel, a first microphone protection cover that is arranged within the housing between the microphone and the microphone opening, and a toggle that is arranged on the first microphone protection cover. The first microphone protection cover comprises at least one protection section adapted to cover at least a part of the
25 respective microphone and a central sealing section adapted to seal the inside of the housing in the region of the toggle. The at least one protection section and the central sealing section are formed integrally in one piece from a single material. A single material can mean one single material only or can mean a material with the same material composition everywhere. A base material with evenly distributed particles therein is also considered a single material. With such a design, less parts are required and the sealing is better.

- 30 **[0005]** In a further embodiment, the first microphone protection cover comprises at least one peripheral sealing section that surrounds the respective protection section. The peripheral sealing sections make sure that no dust, dirt or humidity can enter the inside of the housing sideways from the channel or in the region of the toggle.

- 35 **[0006]** According to another embodiment, the first microphone protection cover has a plate-shaped body whose lateral extension is several times its thickness. The thickness of the at least one protection section is smaller than the thickness of the body. The smaller thickness results in a lesser stiffness.

- [0007]** In an embodiment, the central sealing section and the at least one peripheral sealing section project beyond the plate-shaped body of the first microphone protection cover. The greater thickness results in a greater stiffness in the sealing area.

- 40 **[0008]** In a further embodiment, the at least one protection section comprises at least one hole. Having a hole reduces the dampening of a sound signal passing through the protection section. The protection section may have a diameter in the range of 1 mm to 3 mm. The hole is dimensioned as such that sound can pass easily and dust, dirt or humidity is prevented from passing, at least partially. The shape of a hole can be circular, oval, square or rectangular. The hole may form a conically expanding volume with a changing diameter.

- 45 **[0009]** In yet another embodiment, the at least one protection section comprises several holes that are arranged in an orderly manner. The holes can be arranged in a linear or circular pattern. This allows for an optimised sound transmittal through a protection section, as the sound can be directed by means of the specially arranged holes. At the sound entrance side of the protection section the diameter of the holes should be smaller than at the sound exit side. This prevents the obstruction of the holes with particles. The medium diameter of the holes may range from 0.05 mm to 0.3 mm. The thickness of the protection section with at least one hole may be of the same order of magnitude as the diameter
50 of the holes.

- [0010]** In a further embodiment, the protection section is a thin membrane. The membrane is completely closed and blocks dirt, liquids and humidity. The thin membrane allows the transmission of sound with only little acoustic dampening. Therefore, the ratio between the diameter of the membrane and its thickness should be greater than 50, preferably greater than 100. For example, a membrane of 2 mm diameter should have a thickness of less than 40 µm, preferably less than 20 µm. A substantially round form is preferred.

- 55 **[0011]** According to an embodiment, the toggle is arranged on the outward facing side of the first microphone protection cover. Like so, the user has a direct contact with the toggle that can be made from a specific material and the first microphone protection cover is sealing the inside of the housing completely in the region of the toggle. The direct contact

with the toggle allows for the selection of a toggle material that the user perceives pleasing.

[0012] In a further embodiment, the toggle is enclosed within the first microphone protection cover. The toggle can be arranged in a recess in the protection cover that has an opening facing inwards and the toggle can be inserted and removed therefrom or the toggle can be moulded together with the protection cover and the material of the cover is partially or completely covering the entire surface of the toggle. The toggle being enclosed within the first microphone protection cover, prevents the pollution of the toggle region, i.e. the accumulation of dust, dirt or humidity below the toggle.

[0013] According to another embodiment, there are two microphones and two corresponding protection sections. Two microphones that are spaced apart from each other allow a direction detection of the receiving sound. The central sealing section together with the two protection sections form an entity that covers and seals a large part of the inside of the housing, thereby improving the sealing effect and simplifying the assembly of the hearing device.

[0014] In an embodiment, the channel extends from the microphone in a first direction beyond the position of the first microphone protection cover and then extends in a second direction to a corresponding microphone opening. The angular arrangement of the two sections of the channel gives an additional protection against pollution. The angle between the first direction and the second direction is in the range of 60 to 90 degrees. The bigger the angle, the lesser it is possible for pollutions to reach the region of the microphone protection cover.

[0015] In another embodiment, the material of the first microphone protection cover is an elastic polymer, preferably silicone. Such a material is water repellent, is flexible and has good sealing properties.

[0016] In yet a further embodiment, the material is an optically absorbing material. The material itself can be optically absorbing or the base material can comprise optically absorbing components. Preferably the material or the absorbing components can absorb UV radiation. The radiation protection reduces the aging rate of the microphones.

[0017] According to an embodiment, the hearing device further comprises a second microphone protection cover, which is arranged between the microphone and the first microphone protection cover. The second cover provides an additional protection and can be of a different composition than the first cover. The second cover can comprise a woven or nonwoven fabric or any open-pore material. The second cover can comprise an adhesive area, preferably at its periphery or it can be self-adhesive.

[0018] The features of the above-mentioned embodiments of the hearing device can be used in any combination, unless they contradict each other.

[0019] A first microphone protection cover for use in a hearing device according to the invention comprises at least one protection section adapted to cover at least a part of a respective microphone, and a central sealing section adapted to seal the inside of a housing in the region of a toggle, wherein the at least one protection section and the central sealing section are formed integrally in one piece from a single material.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] Embodiments of the current invention are described in more detail in the following with reference to the figures. These are for illustrative purposes only and are not to be construed as limiting. It shows

Fig. 1 a perspective view of a hearing device with an integrated microphone protection cover according to an embodiment of the invention;

Fig. 2 a perspective view of the microphone protection cover and the toggle of figure 1;

Fig. 3 a perspective view of a further embodiment of the microphone protection cover;

Fig. 4 a side section view of the hearing device of figure 1;

Fig. 5 a partial view of figure 4;

Fig. 6 a side section view of the protection section according to an embodiment with holes; and

Fig. 7 a side section view of the protection section according to an embodiment with a closed membrane.

DETAILED DESCRIPTION OF THE INVENTION

[0021] Figure 1 shows a perspective view of a hearing device with an integrated microphone protection cover according to an embodiment of the invention. The hearing device comprising a housing 1 and a toggle 3 that is accessible and operable by a user. Two microphone openings 6 are present in the vicinity of the toggle 3.

[0022] Figure 2 shows a perspective view of the microphone protection cover 2 and the toggle 3 of figure 1. The first

microphone protection cover 2 comprises two protection sections 21, 22 adapted to cover at least a part of a respective microphone, and a central sealing section 23 adapted to seal the inside of the housing 1 in the region of the toggle 3. The two protection sections 21, 22 and the central sealing section 23 are formed integrally in one piece from a single material. Each protection section 21, 22 is surrounded by a respective peripheral sealing section 24, 25. The first microphone protection cover 2 has a plate-shaped body 20 whose lateral extension is several times its thickness. The protection section 21, 22 blocks dirt, it needs to be acoustically transparent or cause only a low dampening of the sound. The thickness of the two protection sections 21, 22 is smaller than the thickness of the body 20. The central sealing section 23 and the at least one peripheral sealing section 24, 25 project beyond the plate-shaped body 20 of the first microphone protection cover 2. The two protection sections 21, 22 each comprise at least one hole 210, 220. Depicted are protection sections 21, 22 each comprising several holes 210, 220 that are arranged in an orderly manner. The orderly manner in the shown case is a regular arrangement. The toggle 3 is arranged on the side of the first microphone protection cover 2 that faces outward in its intended use position.

[0023] Figure 3 shows a perspective view of a further embodiment of the microphone protection cover 7. The basic design of this protection cover is similar to the one from figure 1. The main difference is that the toggle 8 is enclosed within the first microphone protection cover 7. Again, the protection cover 7 comprises a disk- or plate-shaped body 70 with two protection sections 71, 72 that flank a central sealing section 73. The two protection sections each comprise a plurality of holes 710, 720 that are arranged in an orderly manner. Each protection section 71, 72 is surrounded by a peripheral sealing section 74, 75 that projects beyond the plate-shaped body 70. The toggle 8 is arranged within the central sealing section 73 of the protection cover 7.

[0024] Figure 4 shows a side section view of the hearing device of figure 1. Inside the housing 1, two microphones 4 are arranged adjacent to the toggle 3. Each microphone 4 is connected to the surrounding by means of a respective microphone opening 6.

[0025] Figure 5 shows a partial side section view of the hearing device of figure 4. The hearing device comprising a housing 1, two microphones 4 (although only one is shown in figure 4) arranged within the housing 1, two microphone openings 6 (shown is only one), each connecting the respective microphone 4 to the outside of the housing 1 by means of a respective channel 60. The first microphone protection cover 2 is arranged within the housing 1 between each microphone 4 and each corresponding microphone opening 6. The channel 60 extends from the microphone 4 in a first direction 61 beyond the position of the first microphone protection cover 2 and then extends in a second direction 62 to the microphone opening 6. The shown angle 63 between the first direction 61 and the second direction 62 is about 80 degrees. A second microphone protection cover 5 is arranged between the microphone 4 and the first microphone protection cover 2.

[0026] Figure 6 shows a side section view of the protection section 22. The one or more holes 220 in the protection section allow airflow and propagation of sound through the holes, they provide low acoustic attenuation of the sound passing through the protection section. Each hole 220 comprises an outside diameter 221 at the sound entrance side and an inside diameter 222 at the sound exit side, wherein the outside diameter 221 is smaller than the inside diameter 222. The hole 220 extends conically from the outside diameter 221 to the inside diameter 222. The thickness of the protection section 22 has about the same size as the inside diameter 222.

[0027] Figure 7 shows a side section view of the protection section 21. The protection section is designed as a thin membrane 211.

REFERENCE SIGNS LIST

1	Housing	6	Microphone opening
2	first microphone protection cover	60	Channel
		61	first direction
20	Body	62	second direction
21	Protection section	63	Angle
210	Hole	7	first microphone protection cover
211	Membrane		
22	Protection Section	70	Body
220	Hole	71	Protection section
221	outside diameter	710	Hole
222	inside diameter	72	Protection section
23	central sealing section	720	Hole
24	peripheral sealing section	73	central sealing section
25	peripheral sealing section	74	peripheral sealing section
3	Toggle	75	peripheral sealing section

(continued)

4	Microphone	8	Toggle
5	second microphone protection cover		

5

Claims

1. A hearing device comprising a housing (1), at least one microphone (4) arranged within the housing (1), at least one microphone opening (6), that connects the respective microphone (4) to the outside of the housing (1) by means of a channel (60), a first microphone protection cover (2; 7) that is arranged within the housing (1) between the microphone (4) and the microphone opening (6), and a toggle (3; 8) that is arranged on the first microphone protection cover (2; 7), **characterized in that** the first microphone protection cover (2; 7) comprises at least one protection section (21, 22) adapted to cover at least a part of the respective microphone (4), and a central sealing section (23) adapted to seal the inside of the housing (1) in the region of the toggle (3; 8), wherein the at least one protection section (21, 22) and the central sealing section (23) are formed integrally in one piece from a single material.
2. The hearing device according to claim 1, wherein the first microphone protection cover (2; 7) comprises at least one peripheral sealing section (24, 25) that surrounds the respective protection section (21, 22).
3. The hearing device according to claim 1 or 2, wherein the first microphone protection cover (2; 7) has a plate-shaped body (20) whose lateral extension is several times its thickness, wherein the thickness of the at least one protection section (21, 22) is smaller than the thickness of the body (20).
4. The hearing device according to claim 3, wherein the central sealing section (23) and the at least one peripheral sealing section (24, 25) project beyond the plate-shaped body (20) of the first microphone protection cover (2; 7).
5. The hearing device according to one of the preceding claims, wherein the at least one protection section (21; 22) comprises at least one hole (210, 220).
6. The hearing device according to claim 5, wherein the at least one protection section (21, 22) comprises several holes (210, 220) that are arranged in an orderly manner.
7. The hearing device according to one of claims 1 to 4, wherein the protection section (21, 22) comprises a closed membrane (211).
8. The hearing device according to one of claims 1 to 7, wherein the toggle (3) is arranged on the outward facing side of the first microphone protection cover (2).
9. The hearing device according to one of the preceding claims, wherein there are two microphones (4) and two corresponding protection sections (21, 22).
10. The hearing device according to one of the preceding claims, wherein the channel (60) extends from the microphone (4) in a first direction (61) beyond the position of the first microphone protection cover (2; 7) and then extends in a second direction (62) to the microphone opening (6), wherein an angle (63) between the first direction (61) and the second direction (62) is in the range of 60 to 90 degrees.
11. The hearing device according to one of the preceding claims, wherein the material is an elastic polymer, preferably silicone.
12. The hearing device according to claim 11, wherein the material is an optically absorbing material.
13. The hearing device according to one of the preceding claims, wherein the hearing device further comprises a second microphone protection cover (5), which is arranged between the microphone (4) and the first microphone protection cover (2; 7).

Patentansprüche

- 5 1. Hörgerät mit einem Gehäuse (1), mindestens einem im Gehäuse (1) angeordneten Mikrofon (4), mindestens einer Mikrofonöffnung (6), welche das jeweilige Mikrofon (4) mit der Außenseite des Gehäuses (1) mittels eines Kanals (60) verbindet, einer ersten Mikrofonenschutzabdeckung (2; 7), welche innerhalb des Gehäuses (1) zwischen dem Mikrofon (4) und der Mikrofonöffnung (6) angeordnet ist, und einem Schalter (3; 8), welcher auf der ersten Mikrofonenschutzabdeckung (2; 7) angeordnet ist, **dadurch gekennzeichnet**
 10 **dass** die erste Mikrofonenschutzabdeckung (2; 7) mindestens einen Schutzabschnitt (21, 22) umfasst, welcher ausgelegt ist, um mindestens eines Teils des jeweiligen Mikrofons (4) abzudecken, und einen zentralen Dichtungsabschnitt (23) umfasst, welcher ausgelegt ist, um das Innere des Gehäuses (1) im Bereich des Schalters (3; 8) abzudecken, wobei der mindestens eine Schutzabschnitt (21, 22) und der zentrale Dichtungsabschnitt (23) einstückig aus einem einzigen Material ausgebildet sind.
- 15 2. Hörgerät nach Anspruch 1, wobei die erste Mikrofonenschutzabdeckung (2; 7) mindestens einen peripheren Dichtungsabschnitt (24, 25) umfasst, der den jeweiligen Schutzabschnitt (21, 22) umgibt.
3. Hörgerät nach Anspruch 1 oder 2, wobei die erste Mikrofonenschutzabdeckung (2; 7) einen plattenförmigen Körper (20) aufweist, dessen seitliche Ausdehnung ein Mehrfaches seiner Dicke beträgt, wobei die Dicke des mindestens einen Schutzabschnitts (21, 22) kleiner ist als die Dicke des Körpers (20).
 20
4. Hörgerät nach Anspruch 3, wobei der zentrale Dichtungsabschnitt (23) und der mindestens eine periphere Dichtungsabschnitt (24, 25) über den plattenförmigen Körper (20) der ersten Mikrofonenschutzabdeckung (2; 7) hinausragen.
- 25 5. Hörgerät nach einem der vorhergehenden Ansprüche, wobei der mindestens eine Schutzabschnitt (21; 22) mindestens ein Loch (210, 220) umfasst.
6. Hörgerät nach Anspruch 5, wobei der mindestens eine Schutzabschnitt (21, 22) mehrere Löcher (210, 220) umfasst, die in geordneter Weise angeordnet sind.
 30
7. Hörgerät nach einem der Ansprüche 1 bis 4, wobei der Schutzabschnitt (21, 22) eine geschlossene Membran (211) umfasst.
8. Hörgerät nach einem der Ansprüche 1 bis 7, wobei der Schalter (3) an der nach aussen gerichteten Seite der ersten Mikrofonenschutzabdeckung (2) angeordnet ist.
 35
9. Hörgerät nach einem der vorhergehenden Ansprüche, wobei zwei Mikrofone (4) und zwei entsprechende Schutzabschnitte (21, 22) vorhanden sind.
- 40 10. Hörgerät nach einem der vorhergehenden Ansprüche, wobei sich der Kanal (60) vom Mikrofon (4) in einer ersten Richtung (61) über die Position der ersten Mikrofonenschutzabdeckung (2; 7) hinaus erstreckt und sich dann in einer zweiten Richtung (62) zur Mikrofonöffnung (6) erstreckt, wobei ein Winkel (63) zwischen der ersten Richtung (61) und der zweiten Richtung (62) im Bereich von 60 bis 90 Grad liegt.
- 45 11. Hörgerät nach einem der vorhergehenden Ansprüche, wobei das Material ein elastisches Polymer ist, vorzugsweise Silikon.
12. Hörgerät nach Anspruch 11, wobei das Material ein optisch absorbierendes Material ist.
- 50 13. Hörgerät nach einem der vorhergehenden Ansprüche, wobei das Hörgerät ferner eine zweite Mikrofonenschutzabdeckung (5) umfasst, die zwischen dem Mikrofon (4) und der ersten Mikrofonenschutzabdeckung (2; 7) angeordnet ist.

Revendications

- 55 1. Appareil auditif comprenant un boîtier (1), au moins un microphone (4) disposé à l'intérieur du boîtier (1), au moins une ouverture de microphone (6), qui relie le microphone respectif (4) à l'extérieur du boîtier (1) au moyen d'un canal (60), un premier couvercle de protection de microphone (2; 7) qui est disposé à l'intérieur du boîtier (1) entre

le microphone (4) et l'ouverture du microphone (6), et un bouton (3; 8) disposé sur le premier couvercle de protection de microphone (2; 7), **caractérisé en ce que**

le premier couvercle de protection de microphone (2; 7) comprend au moins une section de protection (21, 22) adaptée pour couvrir au moins une partie du microphone respectif (4), et une section d'étanchéité centrale (23) adaptée pour étancher l'intérieur du boîtier (1) dans la région du bouton (3; 8), où la au moins une section de protection (21, 22) et la section d'étanchéité centrale (23) sont formées intégralement d'une seule pièce d'un seul matériau.

2. Appareil auditif selon la revendication 1, dans lequel le premier couvercle de protection de microphone (2; 7) comprend au moins une section d'étanchéité périphérique (24, 25) qui entoure la section de protection respective (21, 22).

3. Appareil auditif selon la revendication 1 ou 2, dans lequel le premier couvercle de protection de microphone (2; 7) a un corps en forme de plaque (20) dont l'extension latérale est plusieurs fois son épaisseur, dans lequel l'épaisseur de la au moins une section de protection (21, 22) est inférieure à l'épaisseur du corps (20).

4. Appareil auditif selon la revendication 3, dans lequel la section d'étanchéité centrale (23) et la au moins une section d'étanchéité périphérique (24, 25) font saillie au-delà du corps en forme de plaque (20) du premier couvercle de protection de microphone (2; 7).

5. Appareil auditif selon l'une des revendications précédentes, dans lequel la au moins une section de protection (21; 22) comprend au moins un trou (210, 220).

6. Appareil auditif selon la revendication 5, dans lequel la au moins une section de protection (21, 22) comprend plusieurs trous (210, 220) qui sont disposés de manière ordonnée.

7. Appareil auditif selon l'une des revendications 1 à 4, dans lequel la section de protection (21, 22) comprend une membrane fermée (211).

8. Appareil auditif selon l'une des revendications 1 à 7, dans lequel le bouton (3) est disposée sur le côté tourné vers l'extérieur du premier couvercle de protection de microphone (2).

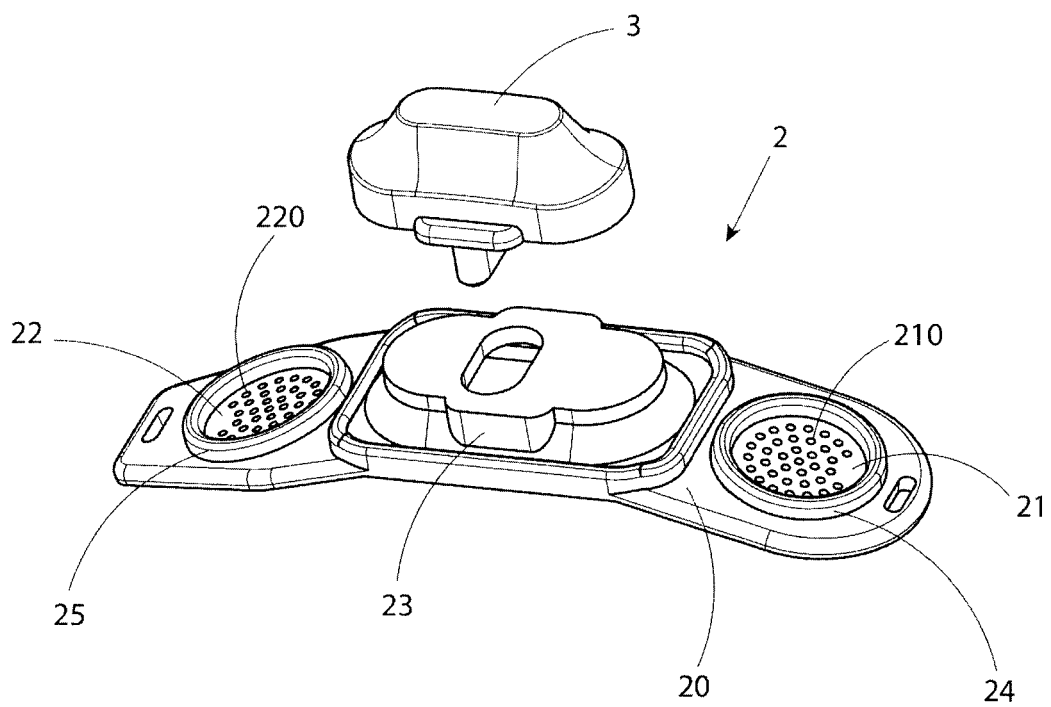
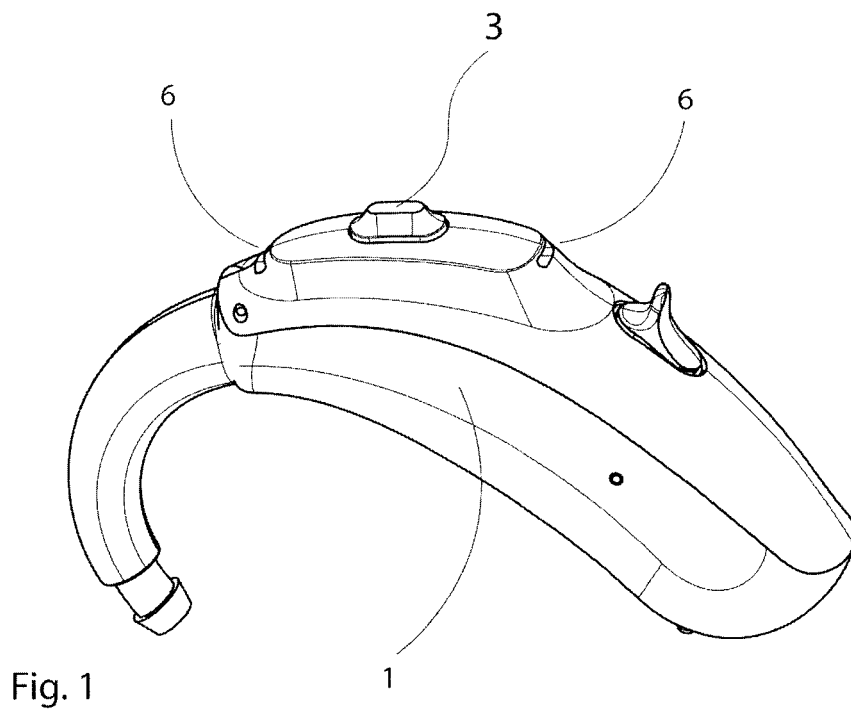
9. Appareil auditif selon l'une des revendications précédentes, dans lequel il y a deux microphones (4) et deux sections de protection correspondantes (21, 22).

10. Appareil auditif selon l'une des revendications précédentes, dans lequel le canal (60) s'étend depuis le microphone (4) dans une première direction (61) au-delà de la position du premier couvercle de protection de microphone (2; 7) et s'étend ensuite dans une deuxième direction (62) vers l'ouverture du microphone (6), où un angle (63) entre la première direction (61) et la deuxième direction (62) est dans le domaine de 60 à 90 degrés.

11. Appareil auditif selon l'une des revendications précédentes, dans lequel le matériau est un polymère élastique, de préférence du silicone.

12. Appareil auditif selon la revendication 11, dans lequel le matériau est un matériau optiquement absorbant.

13. Appareil auditif selon l'une des revendications précédentes, dans lequel l'appareil auditif comprend en outre un deuxième couvercle de protection de microphone (5), qui est disposé entre le microphone (4) et le premier couvercle de protection de microphone (2; 7).



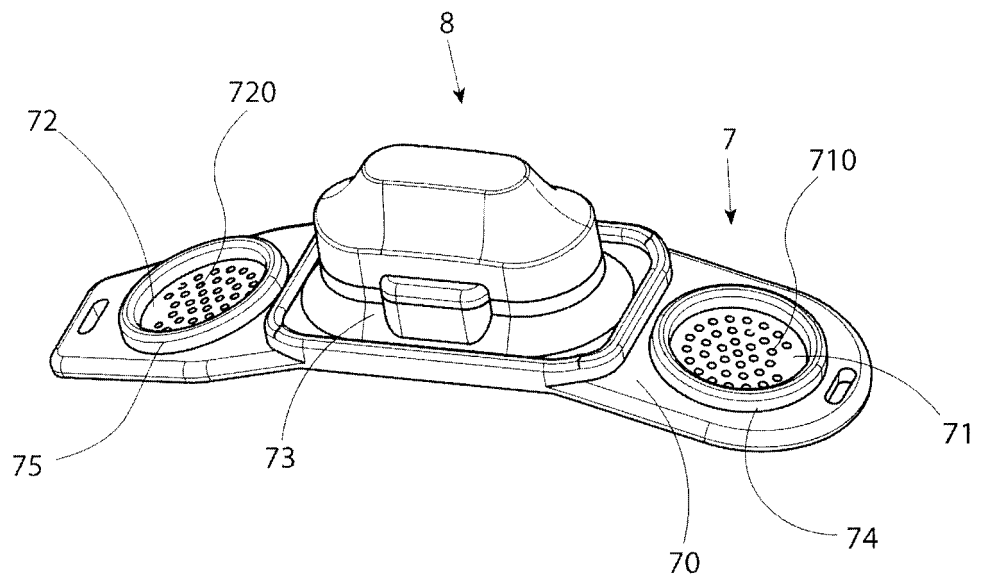


Fig. 3

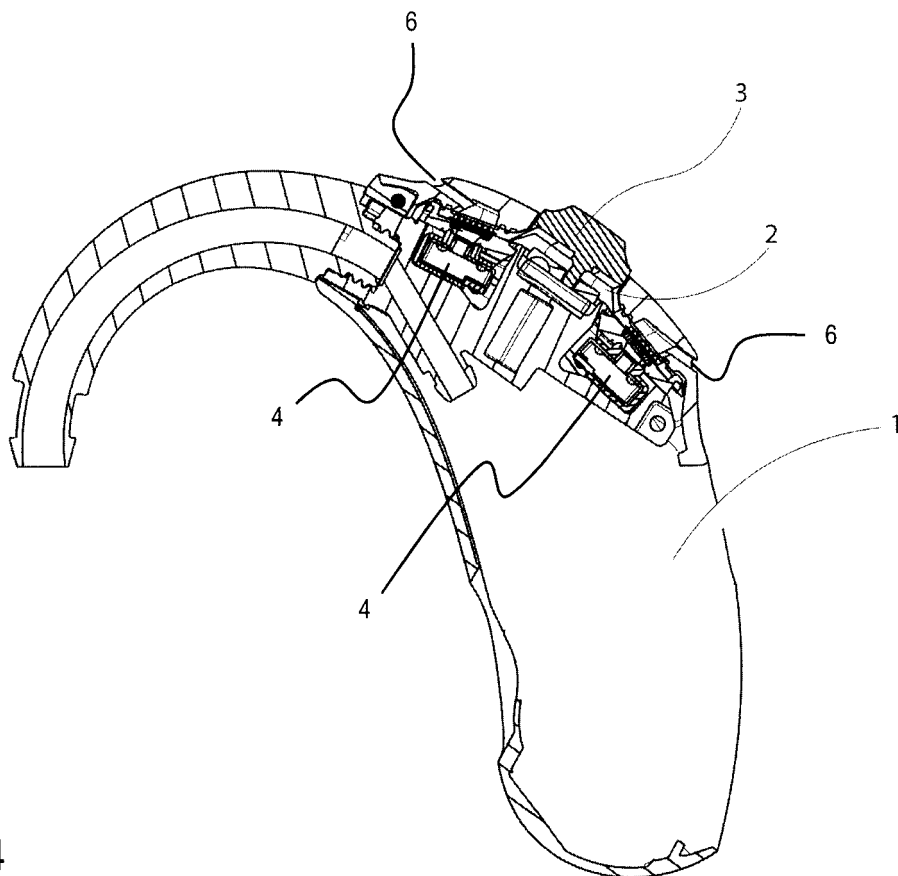


Fig. 4

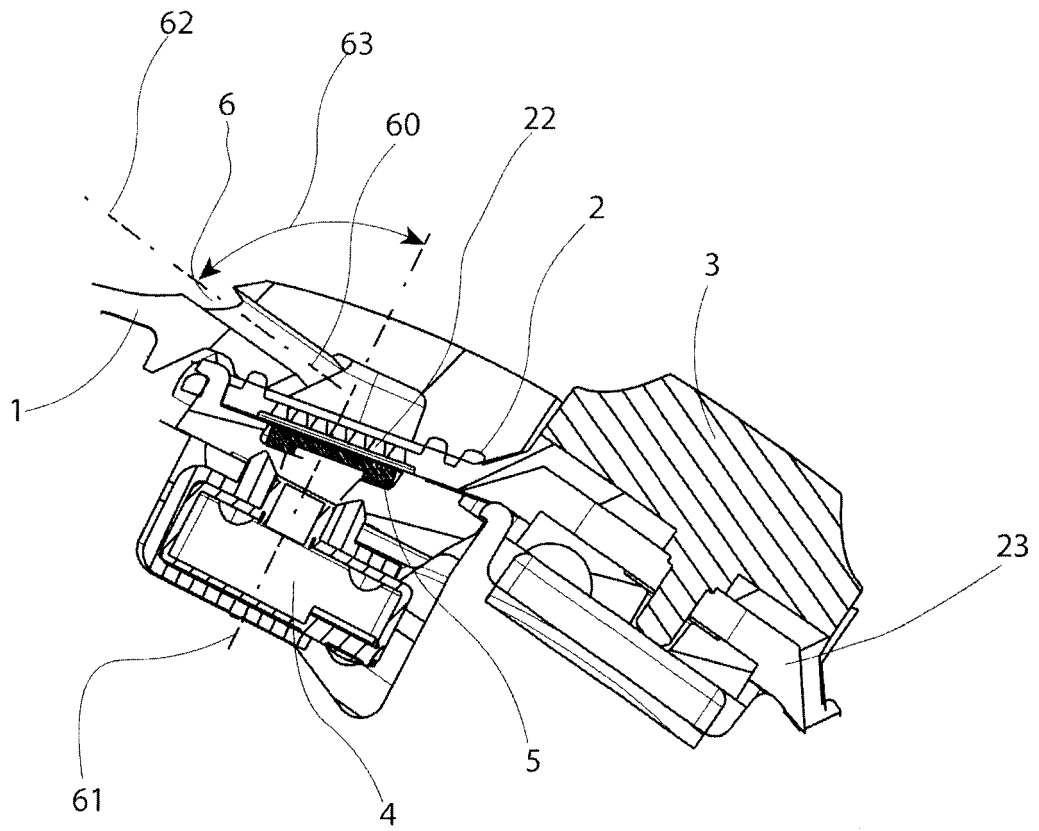


Fig. 5

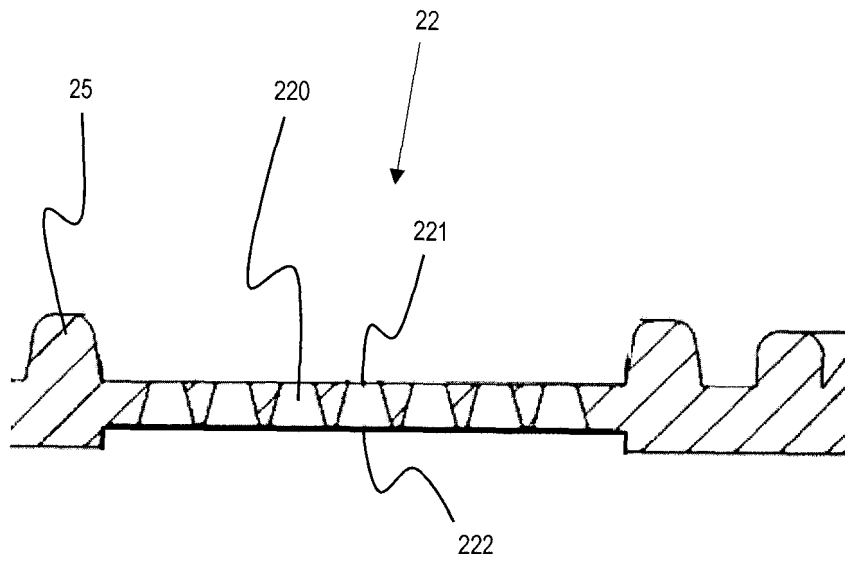


Fig. 6

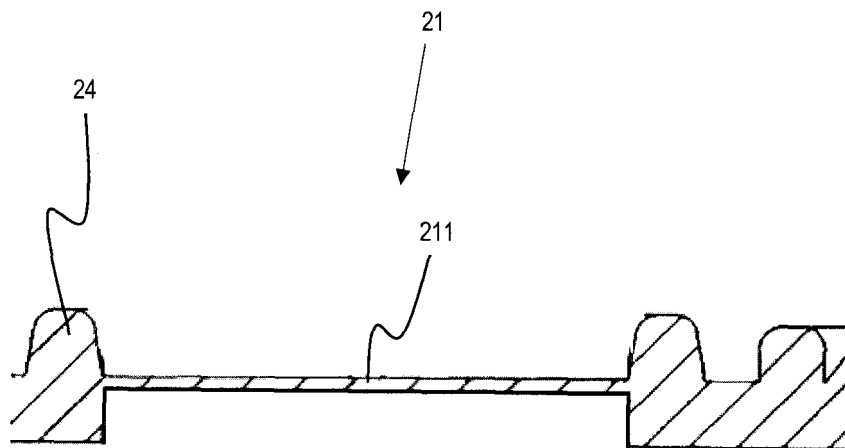


Fig. 7

REFERENCES CITED IN THE DESCRIPTION

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