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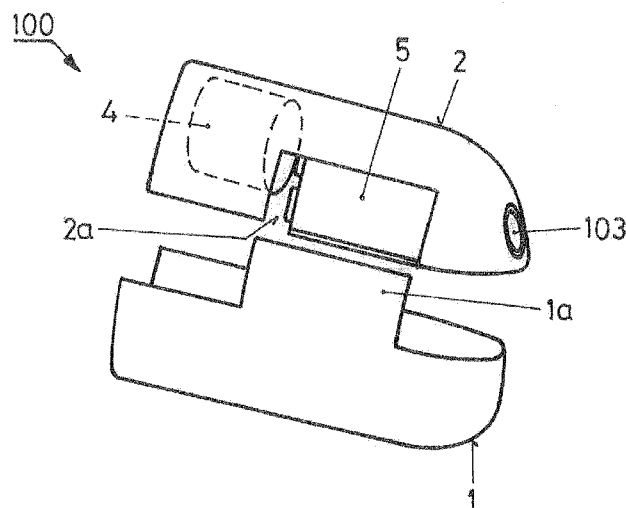


Fig. 2B

(57) Abstract: A method of manufacturing a hearing device (100), the method comprising the steps of molding a substrate for obtaining a first and a second half-shell (1, 2), creating an electrical interconnection layout (3) on an inner concave surface of at least one of the first half-shell (1) and the second half-shell (2) by using Molding Interconnect Device technology, the electrical interconnection layout (3) being adapted to receive electronic components (4, 5, 6), positioning the electronic components (4, 5, 6) within at least one of the first and the second half-shell (1, 2), electrically connecting contacts of the electronic components (4, 5, 6) with corresponding contacts of the electrical interconnection layout (3), and joining the first and the second half-shell (1, 2) for at least partly forming a housing of the hearing device (100).

**METHOD OF MANUFACTURING A HEARING DEVICE AS WELL AS A
HEARING DEVICE**

5 TECHNICAL FIELD OF THE INVENTION

The present invention is related to a method of manufacturing a hearing device as well as to a hearing device, particularly to a CIC-(Completely-In-the-Canal)
10 hearing device, more particularly to an extended wear hearing device.

BACKGROUND OF THE INVENTION

15

Extended wear hearing devices are intended to be disposed in the bony region of the ear canal, up to approximately 4mm from the tympanic membrane, and can remain there for a period of several weeks or even months without the need of
20 taking out the hearing device. In order to maximize the anatomical fit rate, i.e. the percentage of individuals in a population that can be physically fitted with the hearing device, the outer dimensions of such a hearing device must be minimal, implicating a very high degree of integration
25 and miniaturization.

In order to maximize battery life time - having a direct influence on the wearing time of the hearing device - a very low power for the electronic system has to be
30 realized. Due to very low currents (typically a few micro-

amperes) such an electronic system is highly sensitive to moisture and needs an appropriate packaging concept.

Known methods for manufacturing hearing devices comprise
5 limitations with regard to narrow specifications that must
be fulfilled. Currently manufactured hearing devices for
extended wear applications comprise electronics components
that are encapsulated with an epoxy resin using a single-
use silicone mold defining the outer dimensions of the
10 device. As the cavity of the mold is designed for minimal
wall thickness, it is difficult to make sure that all
electronic components are covered with sufficient epoxy to
act as a reliable environmental barrier.

15 Furthermore, EP-1 317 163 B1 discloses a hearing device of
the types In-The-Ear (ITE) and Behind-The-Ear (BTE). The
known hearing devices comprise four housing elements, of
which at least two have integrated conductors for
electrically connecting electronic components via spring
20 contacts. The four housing elements are detachable in order
to open the hearing device housing for exchanging the
battery, for example. Therefore, also this known hearing
device does not provide for a sufficient environmental
barrier. In addition, manufacturing constraints are less
25 demanding for ITE and BTE hearing devices than for CIC-
(Completely-In-the Canal) hearing devices, for example.

The known methods for manufacturing hearing devices, in
particular for extended wear hearing devices, do not reach
30 the requirements with regard to outer dimensions, barrier

properties, durability, biocompatibility and manufacturability.

Outer dimensions: In order to have the highest possible fit rate the outer dimensions of the hearing device must be minimal. Thus any wall thickness of an outer hull or housing is to be kept at a minimum and components must be integrated to the minimum possible size.

Barrier properties: The outer hull of the hearing device has two barrier functions: First, a very low moisture transmission rate is necessary in order to protect the electronic components from humidity and to avoid leakage currents and corrosion. Second, Ni-release from electronics components of the hearing device to the exterior of the device and the patient must be avoided.

Durability and environmental resistance: No degradation or change of structural integrity may occur during prolonged contact with sweat or cerumen during prolonged wear in the ear canal.

Biocompatibility: Skin biocompatibility with regard to ISO 10993-1 (not cytotoxic, non irritant, non sensitization) must be fulfilled.

Manufacturability: In order to fabricate a single-use hearing device at minimal cost a high degree of automation is desirable. Design, materials and processes must favor automation.

SUMMARY OF THE INVENTION

- 5 An object of the present invention is thus to provide a method for manufacturing a hearing device, in particular for extended wear, that fulfills at least one of the above-mentioned requirements.
- 10 Although the present invention primarily relates to hearing aids, it equally applies to other types of hearing devices, by which we understand communication devices, active hearing protection devices for suppressing loud noise, tinnitus treatment devices, etc. Furthermore, it should be
- 15 noted that the hearing device of the present invention can equally be applied to conventional short-term wear hearing devices although it is particularly applicable to the above-mentioned extended-wear types.
- 20 First, the present invention is directed to a method of manufacturing a hearing device. The method comprises the steps of:
- molding a substrate for obtaining a first and a second half-shell,
 - 25 - creating an electrical interconnection layout on an inner concave surface of at least one of the first half-shell and the second half-shell by using Molding Interconnect Device technology, the electrical interconnection layout being adapted to receive
 - 30 electronic components,

- 5 -

- positioning the electronic components within at least one of the first and the second half-shell,
- electrically connecting contacts of the electronic components with corresponding contacts of the electrical interconnection layout, and
- joining the first and the second half-shell for at least partly forming a housing of the hearing device.

By positioning the electronic components on the inner concave surface comprising the electrical interconnection layout of at least one of the first and the second half-shell additional volume is freed that can be used to increase a back-volume of the receiver and increase the sound output level for a given receiver current. As a consequence, less current is necessary to generate the same output sound pressure level and thus battery life is prolonged.

The use of the Molding Interconnect Device technology allows for a higher degree of automation in component assembly, as the folding and handling of a PCB-(Printed Circuit Board) is not necessary.

As the encapsulation can be omitted, the final assembly of the hearing device will be made easier and faster.

Additional alignment features on the convex outer side of the half shells can simplify the attachment of earpieces, such as acoustic seals, and thus speed up production.

The use of injection molded components for the half-shells of the hearing device can also improve the dimensional stability.

5 In an embodiment of the method according to the present invention, the electrical interconnection layout is either created on the inner concave surface of the first half-shell or on the inner concave surface of the second half-shell.

10

The manufacturing process is simplified if only one of the two half shells comprise an electrical interconnection layout.

15 In further embodiments of the method according to the present invention, the step of electrically connecting is carried out by one of the following processes:

- direct soldering by reflow soldering;
- conductive adhesive bonding;
- 20 - laser soldering.

In still further embodiments of the method according to the present invention, the step of joining the first half-shell to the second half-shell is carried out by one of the

25 following processes:

- adhesive bonding;
- laser welding;
- ultrasonic welding.

In still further embodiments of the method according to the present invention, the first and the second half-shell are made of a liquid crystal polymer such as VECTRA or ZEONEX.

- 5 The use of thermoplastic materials with very low moisture transmissibility and adsorption such as the proposed liquid crystal polymers (LCP) significantly reduce the moisture exposure to the electronic components.
- 10 Further embodiments of the method according to the present invention further comprise the steps of:
- providing a protective element, and
 - joining the protective element and at least the first and the second half-shell to complete the housing of
- 15 the hearing device.

In still further embodiments of the method according to the present invention, the electronic components are positioned in the half-shell containing the electrical interconnection

20 layout.

In still further embodiments of the method according to the present invention, the two half-shells either join in a transversal parting plane or in a coronal parting plane

25 with respect of an anatomical orientation of the parting plane.

In still further embodiments of the method according to the present invention, one half-shell comprises cut-outs while

30 the other half-shell comprises protuberances that fit into

the corresponding cut-outs to form the housing or parts thereof.

5 Therewith, a higher stability of the hearing device housing and an easier mounting of the two half shells are obtained.

In still further embodiments of the method according to the present invention, the electronic components comprise at least one electro-acoustic transducer, an amplifier unit
10 and a battery, the battery being produced by applying the Molding Interconnect Device technology.

The use of a plastic anode can and a plastic cathode allows to free additional volume that can be used to fill in more
15 active material (zinc powder/electrolyte) to increase the battery capacity.

Second, the present invention is directed to a hearing device for extended wear, the hearing device comprising:

- 20 - a first half-shell,
 - a second half-shell,
 - an electrical interconnection layout on an inner concave surface of at least one of the first half-shell and the second half-shell by using Molding
25 Interconnect Device technology, and
 - electronic components operatively connected to the electrical interconnection layout,
wherein the first half-shell joins to the second half-shell for at least partly forming a housing.

In an embodiment of the hearing device according to the present invention, the electrical interconnection layout is on the inner concave surface of the first half-shell or on the inner concave surface of the second half-shell.

5

In embodiments of the hearing device according to the present invention, the electronic components are operatively connectable by one of the following processes:

- direct soldering by reflow soldering;
- 10 - conductive adhesive bonding;
- laser soldering.

In further embodiments of the hearing device according to the present invention, the first half-shell is joined to the second half-shell by one of the following processes:

15

- adhesive bonding;
- laser welding;
- ultrasonic welding.

20 In still further embodiments of the hearing device according to the present invention, the first and the second half-shell are made of a liquid crystal polymer such as VECTRA or ZEONEX.

25 Further embodiments of the hearing device according to the present invention further comprise a protective element that joins to the first half-shell and/or to the second half-shell to complete the housing.

In still further embodiments of the hearing device according to the present invention, the two half-shells either join in a transversal parting plane or in a coronal parting plane with respect to an anatomical orientation of the parting plane.

In still further embodiments of the hearing device according to the present invention, one half-shell comprises cut-outs while the other half-shell comprises protuberances that fit into the corresponding cut-outs to form the housing or parts thereof.

In further embodiments of the hearing device according to the present invention, the electronic components comprise at least one electro-acoustic transducer, an amplifier unit and a battery, the battery being produced by applying the Molding Interconnect Device technology.

It is pointed out that any combination of the above-mentioned embodiments is possible. Only those combinations of embodiments are excluded that would result in a contradiction.

BRIEF DESCRIPTION OF THE DRAWINGS

Non-limiting exemplary embodiments of the present invention will be described with reference to following drawings.

Fig. 1 shows a hearing device for extended wear with two half-shells joined together at a transversal parting plane,

5 Fig. 2A to 2D
show subsequent process steps of the method of manufacturing the hearing device of Fig. 1,

10 Fig. 3 shows a hearing device for extended wear with two half-shells joined together at a coronal parting plane,

Fig. 4A to 4D
15 show subsequent process steps of the method of manufacturing the hearing device of Fig. 3,

Fig. 5 shows a perspective view of a first embodiment of an anode can for a battery according to the present invention,

20 Fig. 6 shows a cross sectional view of a closing element for the anode can depicted in Fig. 5,

Fig. 7 shows a perspective view of a second embodiment for an anode can for a battery according to the present invention, and

25 Fig. 8 shows a cross sectional view of a closing element for the anode can depicted in Fig. 7.

30

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 schematically shows architecture of a hearing
5 device 100 comprising two half-shells 1 and 2 joined
together in a transversal parting plane 101, which defines
a starting point for a first embodiment of a method for
manufacturing a hearing device 100 according to the present
invention. The transversal parting plane 101 is a
10 horizontal plane dividing the hearing device 100 in a lower
portion basically comprising a first half-shell 1 and an
upper portion basically comprising a second half-shell 2.
The second half-shell 2 comprises a sound outlet 103 that
is in communication with a loudspeaker (not shown in Fig.
15 1), also called receiver in the technical field of hearing
devices. On the opposite side with regard to the sound
outlet 103, a protection element 17 and an extraction loop
102 complete the hearing device 100. While the protection
element 17 prevents cerumen from obstructing a sound inlet
20 (not visible in the perspective view of Fig. 1) that is in
communication with a microphone (also not shown in Fig. 1),
the extraction loop 102 is used to extract the hearing
device 100 from the ear canal.

25 Figs. 2A, 2B, 2C and 2D show a sequence of manufacturing
steps that are used to describe a method according to the
present invention.

Fig. 2A shows the first and the second half-shell 1 and 2
30 being already formed and ready for further processing. The

first and the second half-shells 1 and 2 are made by injection molding, for example, using a ceramic or a thermoplastic material. Once the first and the second half-shells 1 and 2 have been completed, an electrical
5 interconnection layout 3 is produced on an inner concave surface of the second half shell 2 by using MID-(Molded Interconnect Device) technology.

MID is a technology to form 3D wiring patterns (i.e. the
10 electrical interconnection layout 3) on a molded structure (i.e. the second half-shell 2). Although the structure can be made of ceramic, it is most commonly made of thermoplastic materials. The wiring pattern (circuitry) is to provide the electrical connection as well as the support
15 for mechanical attachment of chips and other components (for example through soldering pads). Two different types of processes are involved in the manufacturing of an MID device:

- 20 - molding of the substrate;
- metallization of the substrate;

The molding of the substrate is most commonly done by injection molding. Other types of molding include Reaction
25 Injection Molding, Extrusion, Compression Molding, Transfer Molding and Thermoforming. There are several different ways to metalize the substrate. The two most commonly used technologies are Laser Direct Structuring (LDS) and 2K (Two Shot Component) Molding. Other types of metallization
30 include Laser Subtractive Structuring (LSS), Metal Transfer

Processes (e.g. Hot Embossing, Paper transfer, Decal Transfer) and Thick or Thin Film Deposition.

The LDS method is based on doped thermoplastics on which
5 the tracks in the circuits are activated using laser light
and subsequently metalized in a chemical bath. This
technology uses laser radiation to activate special organo-
metal substances dissolved or finely dispersed in the
plastic: the laser radiation breaks the chemical bonds
10 between metal atoms and the rest of the plastic structure
creating metal seeds (activated nuclei) which can be
subsequently metalized in a chemical bath without an
electronic current. Successive layers of copper, nickel and
gold finish can be raised in this way.

15 The 2K Molding technology uses two-shot molding techniques
to form conductive patterns on complex irregularly shaped,
multi-sided molded structures. One shot is molded out of a
(catalytic) plastic, which can be made receptive to metal
20 plating. The other shot is molded from a non-catalytic
plastic which is inert to subsequent processing steps so
that no metal will deposit on this material. Depending on
the catalytic plastic, an adhesion promotion process
utilizing chemical and/or energizing steps is used to
25 promote electro-less metal adhesion to the catalytic
material only. The plating catalyst can be compounded into
the catalyst plastic, or chemical steps can be used to
selectively catalyze this material. After the appropriate
adhesion promotion process, the catalyzed and activated
30 plastic is plated using fully additive or semi-additive

plating techniques (electro-less or electroplating), usually copper. The non-catalytic plastic remains non-receptive to the metal deposition process, thereby leaving the non-conductive pattern areas unplated. At this time, further electro-less or immersion coatings such as nickel, gold, palladium or tin may be applied if desired.

In further embodiments of the present invention, the electrical interconnection layout 3 may be produced on one or on both half-shells 1 and 2.

As depicted in Fig. 2A, the electrical interconnection layout 3 is created on the second half shell 2. Thereto, the LDS-(Laser Direct Structuring) technique is used to create the electrical interconnection layout 3 necessary for the electronic components of the hearing device. The electronic components are assembled by means of conductive adhesive bonding, laser soldering or reflow soldering onto the electrical interconnection layout 3 on the inner concave surface of the second half shell 2.

In a further embodiment of the present invention, as depicted in Fig. 2A, the second half shell 2 comprises a cut-out 2a, for example, in order to facilitate the assembly of electronic components. The first half shell 1 will then have the corresponding protuberance 1a.

In Fig. 2B, a further assembly step according to the present invention is depicted: a microphone 4 and a receiver 5 as transducers are mounted into the second half

shell 2 and connected by means of direct soldering on the conductive tracks of the second half shell 2, for example. Alternatively, the connection can be made by wires.

5 In Fig. 2C, a further assembly step according to the present invention is depicted: a battery 6 is mounted into the second half shell 2 and connected by means of direct soldering on the electrical interconnection layout 3 of the second half shell 2, for example. Alternatively, the
10 connections can be made by wires.

In Fig. 2D, a further assembly step according to the present invention is depicted: the two half shells 1 and 2 are joined including the protection element 7 and the
15 extraction loop 102 on the lateral end of the hearing device 100. The half shells 1 and 2 can be joined by means of adhesive bonding, laser welding, ultrasonic welding or similar joining techniques for thermoplastic polymers.

20 Fig. 3 schematically shows architecture of the hearing device 100 comprising two half-shells 1 and 2 joined together in a coronal parting plane 105, which defines a starting point for a second embodiment of a method for manufacturing the hearing device 100 according to the
25 present invention. The coronal parting plane 105 is a vertical plane dividing the hearing device 100 in a front portion basically comprising a first half-shell 10 and a back portion basically comprising a second half-shell 20. In contrast to the embodiment depicted in Fig. 1, the sound
30 outlet 103 is now divided by the coronal parting plane 105.

Apart from the different parting plane, the embodiment having a coronal parting plane comprises the same steps of manufacturing. These steps are illustrated in Figs. 4A, 4B, 4C and 4D, wherein the same reference signs have been used for like components having been introduced by describing Fig. 2A, 2B, 2C and 2D.

It has been shown that a liquid crystal polymer (LCP) such as VECTRA or ZEONEX is particularly advantageous for using in the manufacturing method according to the present invention, and can, at the same time, very well be used to build components by MID technology. These materials have excellent barrier properties against moisture and exhibit a very low moisture uptake. This property is crucial for packaging low power electronic components such as hearing devices.

A further advantage of the proposed method of manufacturing a hearing device is the fact that due to the good barrier properties of the shell material the inner volume of the hearing device does not need to be filled with an encapsulant in order to protect the electronic components against moisture. This allows the available free volume to be used as additional acoustic back-volume for the receiver. Increasing the back-volume of the receiver will lead to higher sound pressure output at frequencies below the resonance of the receiver. This in turn results in the advantage that the battery power consumption can be reduced and thus a longer life time of the battery is obtained. On

the other hand, the hearing device manufactured according to the present invention allows also achieving higher SPL- (Sound Pressure Level) output without additional energy consumption.

5

The two method of manufacturing a hearing device as explained in connection with Figs. 2 and 4 assume the enclosure of a pre-fabricated battery 6 made by crimping of metal half shells.

10

In a further embodiment of the present invention, the battery 6 is not a pre-fabricated battery but it is produced by applying the Molding Interconnect Device technology (MID technology). Therewith, a further
15 integration and easier manufacturing can be obtained further reducing overall manufacturing costs for hearing devices.

In the following, embodiments of a batteries produced by applying the Molding Interconnect Device technology are
20 described. A first embodiment of such a battery is depicted in Figs. 5 and 6 showing a perspective view of an anode can 20 (Fig. 5) and a cross sectional view of an cathode can (Fig. 6), wherein the LDS technology or the 2K Molding
25 technology is applied for manufacturing.

The battery of Fig. 5 and 6 comprises an anode and a cathode that are both built as MID components. A current collector 21 made of copper, for example, is integrated in
30 the thin walled anode can 20 (e.g. made of a polymer)

forming the anode. The current collector 21 (Fig. 5) leads along an inner cathode 24 (Fig. 6) at a predefined distance and is connected to the outside anode connector 23 (Fig. 5) embedded in the anode can 20. Beside the inner cathode 24, the cathode further comprises an inner cathode plate 25 and an outer cathode plate 26 that are both made of plastic, the inner cathode plate 25 and the outer cathode plate 26 being joined together by adhesive bonding, laser welding or ultrasonic welding. The inner cathode 24, the inner cathode plate 25 as well as the outer cathode plate 26 are tightly sealed against each other to prevent any leakage of electrolyte. The outer cathode plate 26 has an integrated electrical connection 27 to electrically connect the inner cathode plate 25 made of a nickel mesh with the outer cathode plate 26 by means of a through connection 28 into which a contact wire (not shown in Fig. 6) can be fixed by soldering or conductive adhesive bonding. While the metallization on the anode (i.e. the current collector 21, front connector 22 and outside anode connector 23) is made of copper, for example, the metallization of the outer cathode plate 26 and the through connection 28 are made of copper-nickel-gold, for example. An air hole 29 in the outer cathode plate 26 allows the supply of oxygen into the battery as it is needed for zinc-air batteries.

An alternative embodiment for a battery according to the present invention based on MID technology is shown in Figs. 7 and 8. For this embodiment, it is proposed to only build the cathode using MID technology. The thin walled plastic anode can 30 (Fig. 7) does not have an integrated copper

current collector but is made of a polymer that can withstand the highly alkaline environment caused by the electrolyte. The cathode is made by two plastic parts, the inner cathode 34 and the outer cathode plate 36, that are joined by adhesive bonding, laser welding or ultrasonic welding. The inner cathode 34, an inner cathode plate 35 as well as the outer cathode plate 36 are tightly sealed against each other to prevent any leakage of electrolyte. The outer cathode plate 36 has an integrated current collector 37 that electrically connects the inner cathode plate 35 made of a nickel mesh with the outer cathode plate 36 via a through connection 38 into which a contact wire (not shown in Fig. 8) can be fixed by soldering or conductive adhesive bonding. In addition - and as a difference compared to the embodiment depicted in Fig. 5 and 6 -, the inner cathode 34 is also made by applying MID technology. It contains a spike 32 made of polymer, the spike 32 comprising a metallization 33 (e.g. made of copper) that acts as a current collector once inserted into the zinc/electrolyte mixture upon closing of the battery. It further contains a further through connection 40 that is also metalized, the further through connection 40 being connected to the metalized anode 33 accessible through the outer cathode plate 36 by means of a hole 41, via which the metallization 33 on the spike 32 is contactable from the outside, e.g. by a contact wire that can be fixed by soldering or conductive adhesive bonding (not shown) in the further through connection 40. While the metallization 33 on the spike 32 is made of copper, the metallization in the outer cathode plate 36, in particular the integrated

current collector 37 and the through connection 38, can be made of copper-nickel-gold, for example. An air hole 39 in the outer cathode plate 36 allows the supply of oxygen into the battery as it is needed for any zinc/air battery.

5

The concepts for the MID-based plastic battery is, in an embodiment of the present invention, combined with the design proposals explained in connection with Figs. 2 and 4 in order to realize the most integrated design. The

10 combination of the concepts of Figs. 2 and 4, for example, have the advantage that the battery and the electronic components can be realized separately and joined at the final assembly stage.

CLAIMS:

1. A method of manufacturing a hearing device (100), the
5 method comprising the steps of:

- molding a substrate for obtaining a first and a second half-shell (1, 2; 10, 20),
- creating an electrical interconnection layout (3) on
10 an inner concave surface of at least one of the first half-shell (1; 10) and the second half-shell (2; 20) by using Molding Interconnect Device technology, the electrical interconnection layout (3) being adapted to receive electronic components (4, 5, 6),
- positioning the electronic components (4, 5, 6) within
15 at least one of the first and the second half-shell (1, 2; 10, 20),
- electrically connecting contacts of the electronic components (4, 5, 6) with corresponding contacts of the electrical interconnection layout (3), and
- 20 - joining the first and the second half-shell (1, 2; 10, 20) for at least partly forming a housing of the hearing device (100).

2. The method of claim 1, wherein the electrical
25 interconnection layout (3) is either created on the inner concave surface of the first half-shell (1; 10) or on the inner concave surface of the second half-shell (2; 20).

3. The method of claim 1 or 2, wherein the step of electrically connecting is carried out by one of the following processes:

- direct soldering by reflow soldering;
- 5 - conductive adhesive bonding;
- laser soldering.

4. The method of one of the claims 1 to 3, wherein the step of joining the first half-shell (1; 10) to the second half-shell (2; 20) is carried out by one of the following processes:

- adhesive bonding;
- laser welding;
- ultrasonic welding.

15

5. The method of one of the claims 1 to 4, wherein the first and the second half-shell (1, 2; 10, 20) are made of a liquid crystal polymer such as VECTRA or ZEONEX.

20 6. The method of one of the claims 1 to 5, further comprising the steps of:

- providing a protective element (17), and
- joining the protective element (17) and at least the first and the second half-shell (1, 2; 10, 20) to
- 25 complete the housing of the hearing device (100).

7. The method of one of the claims 2 to 6, wherein the electronic components (4, 5, 6) are positioned in the half-

shell (1, 2; 10, 20) containing the electrical interconnection layout (3).

8. The method of one of the claims 1 to 7, wherein the two half-shells (1, 2; 10, 20) either join in a transversal parting plane (101) or in a coronal parting plane (105) with respect of an anatomical orientation of the parting plane.

9. The method of one of the claims 1 to 8, wherein one half-shell (1, 2; 10, 20) comprises cut-outs (2a) while the other half-shell (1, 2; 10, 20) comprises protuberances (1a) that fit into the corresponding cut-outs (2a) to form the housing or parts thereof.

10. The method of one of the claims 1 to 9, wherein the electronic components comprise at least one electro-acoustic transducer (4, 5), an amplifier unit and a battery (6), the battery (6) being produced by applying the Molding Interconnect Device technology.

11. A hearing device for extended wear comprising:

- a first half-shell (1; 10),
- a second half-shell (2; 20),
- an electrical interconnection layout (3) on an inner concave surface of at least one of the first half-shell (1; 10) and the second half-shell (2; 20) by using Molding Interconnect Device technology, and
- electronic components (4, 5, 6) operatively connected to the electrical interconnection layout (3),

wherein the first half-shell (1; 10) joins to the second half-shell (2; 20) for at least partly forming a housing.

12. The hearing device of claim 11, wherein the electrical interconnection layout (3) is on the inner concave surface of the first half-shell (1; 10) or on the inner concave surface of the second half-shell (2; 20).

13. The hearing device of claim 11 or 12, wherein the electronic components (4, 5, 6) are operatively connectable by one of the following processes:

- direct soldering by reflow soldering;
- conductive adhesive bonding;
- laser soldering.

14. The hearing device of one of the claims 11 to 13, wherein the first half-shell (1; 10) is joined to the second half-shell (2; 20) by one of the following processes:

- adhesive bonding;
- laser welding;
- ultrasonic welding.

15. The hearing device of one of the claims 11 to 14, wherein the first and the second half-shell (1, 2; 10, 20) are made of a liquid crystal polymer such as VECTRA or ZEONEX.

16. The hearing device of one of the claims 11 to 15,
further comprising a protective element (17) that joins to
the first half-shell (1; 10) and/or to the second half-
shell (2; 20) to complete the housing.

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17. The hearing device of one of the claims 11 to 16,
wherein the two half-shells (1, 2; 10, 20) either join in a
transversal parting plane (101) or in a coronal parting
plane (105) with respect to an anatomical orientation of
the parting plane.

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18. The hearing device of one of the claims 11 to 17,
wherein one half-shell (1, 2; 10, 20) comprises cut-outs
(2a) while the other half-shell (1, 2; 10, 20) comprises
protuberances (1a) that fit into the corresponding cut-outs
(2a) to form the housing or parts thereof.

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19. The hearing device of one of the claims 11 to 18,
wherein the electronic components comprise at least one
electro-acoustic transducer (4, 5), an amplifier unit and a
battery (6), the battery (6) being produced by applying the
Molding Interconnect Device technology.

20

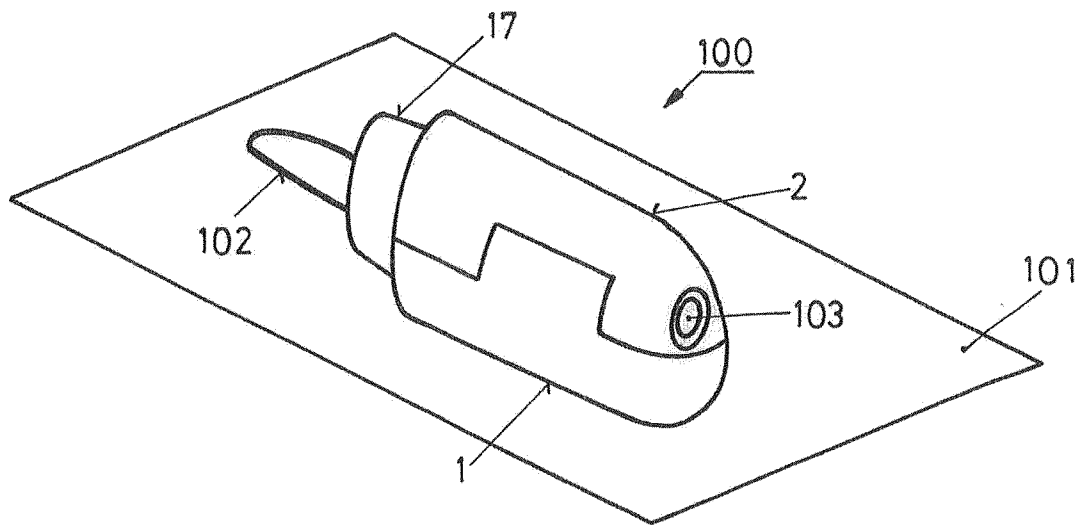


Fig. 1

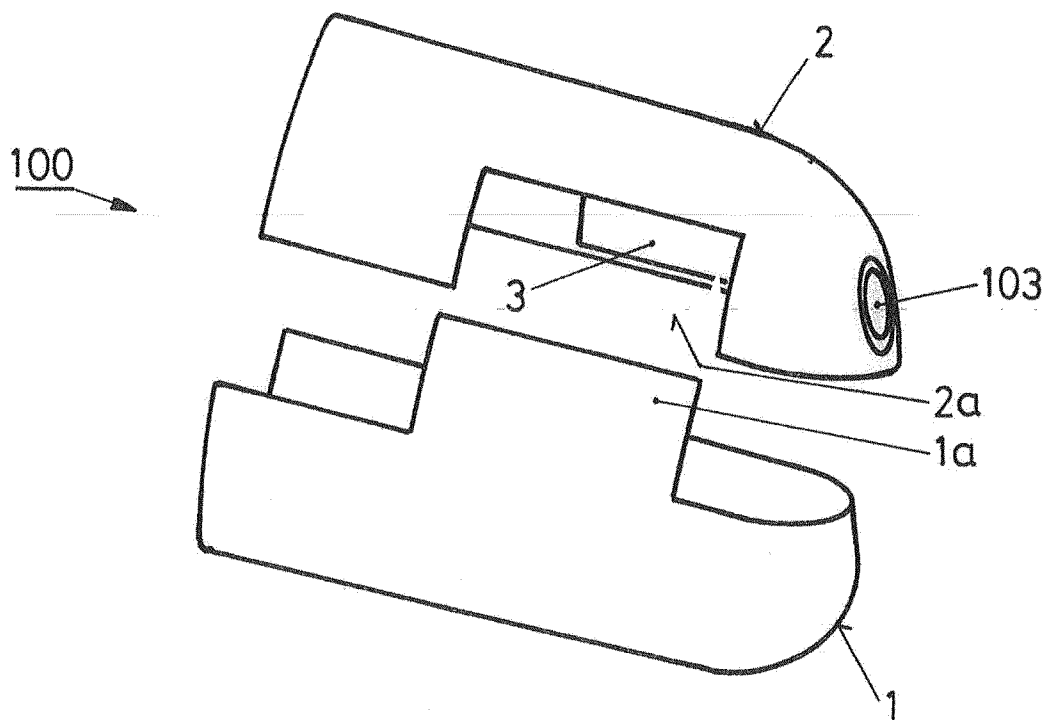


Fig. 2A

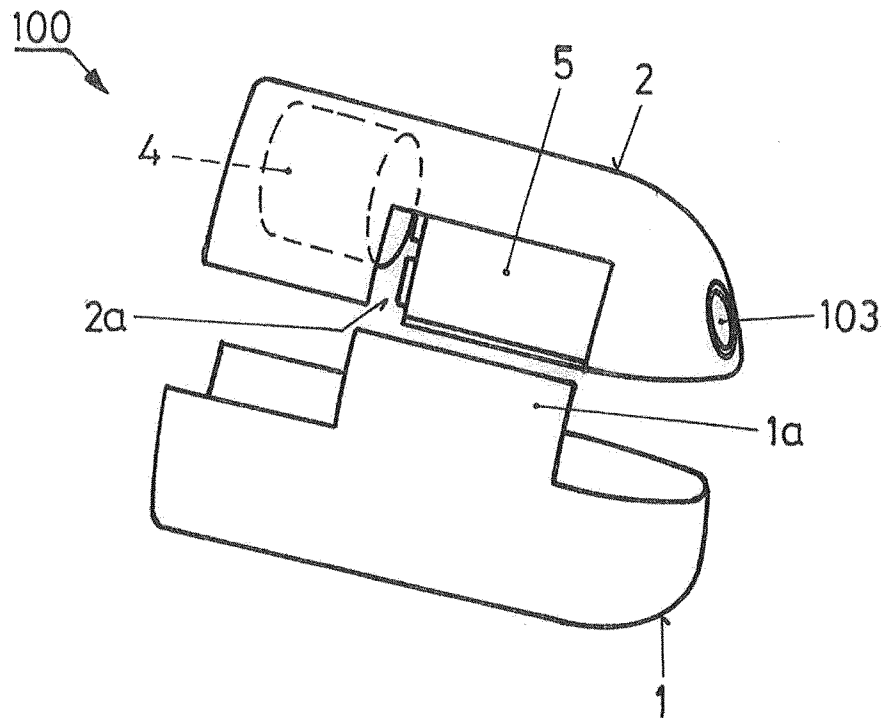


Fig. 2B

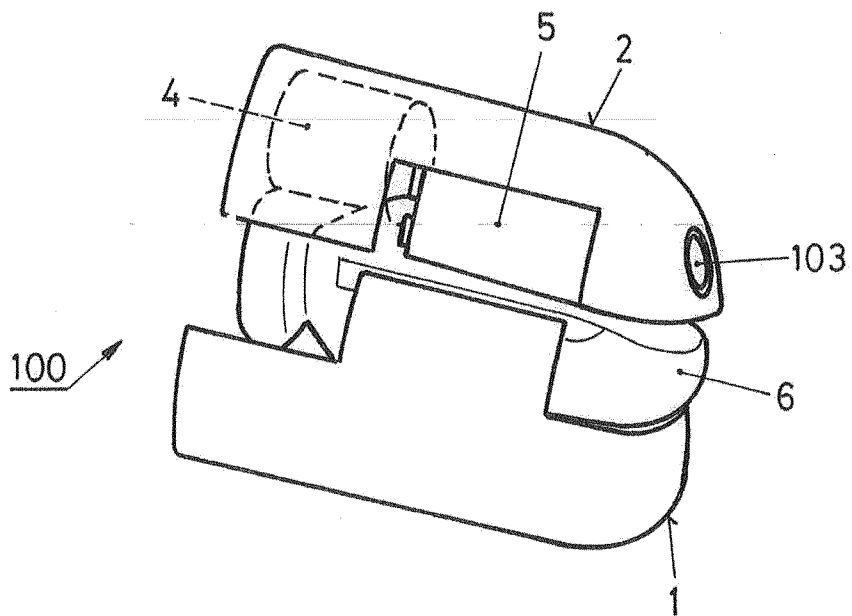


Fig. 2C

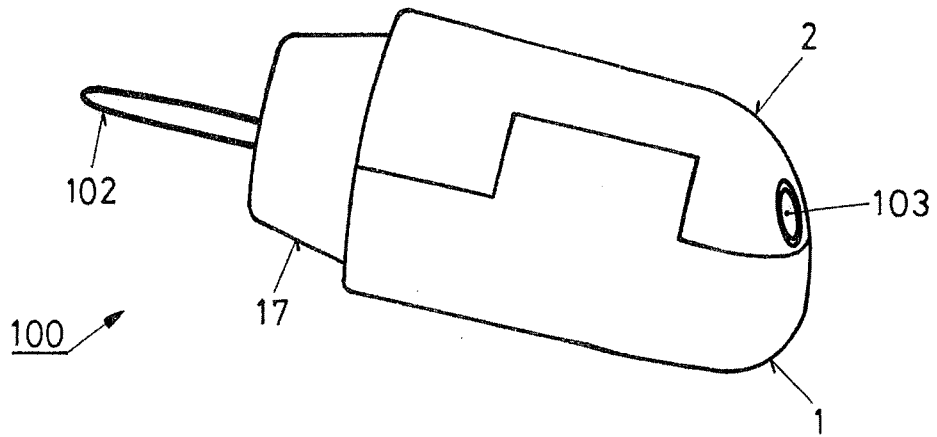


Fig. 2D

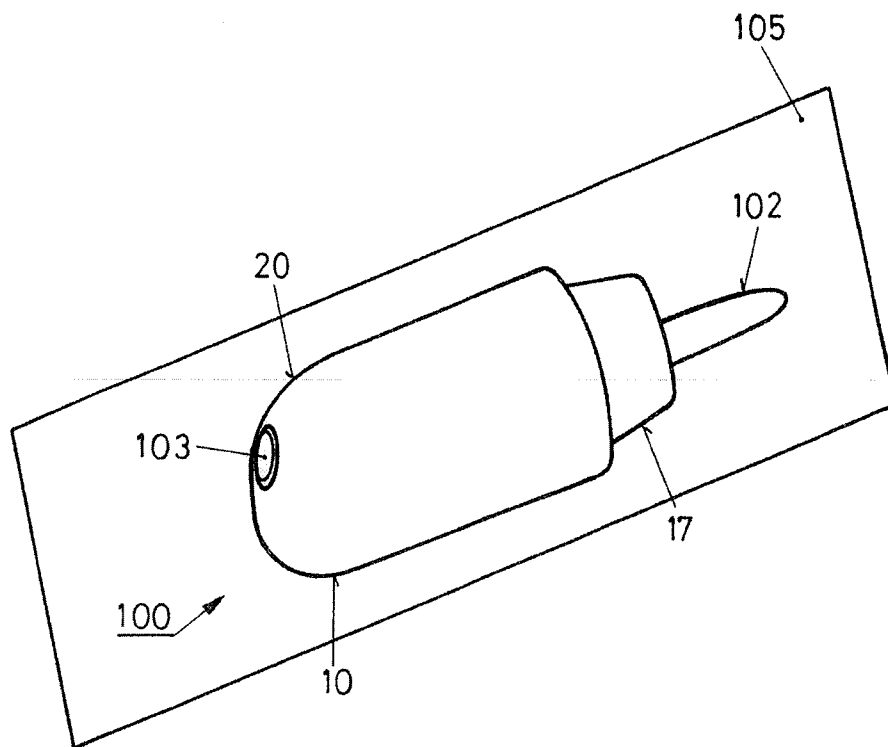


Fig. 3

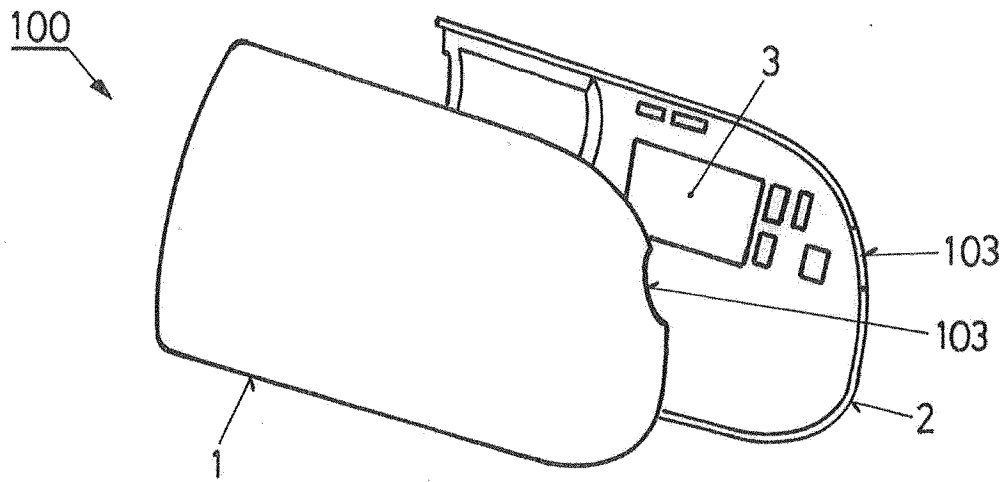


Fig. 4A

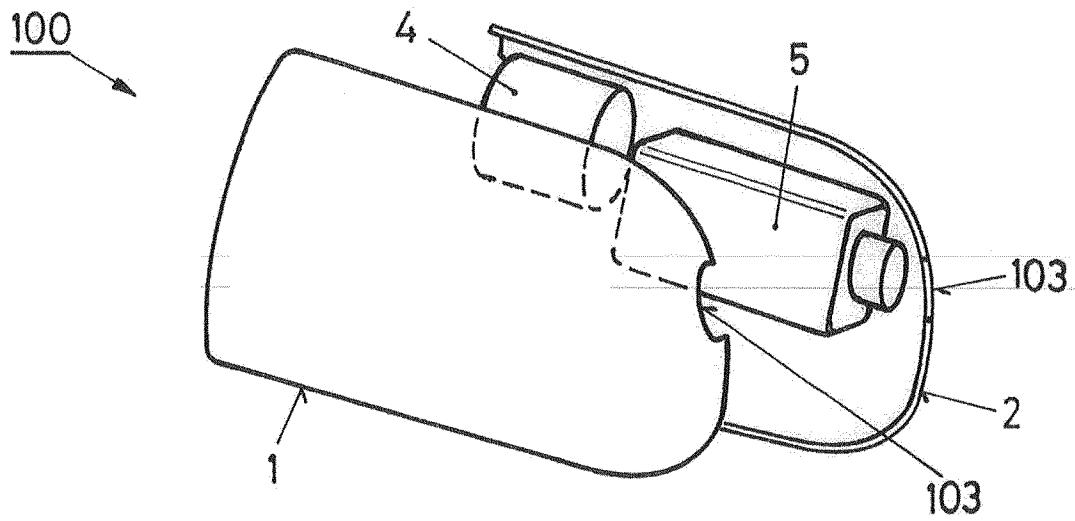


Fig. 4B

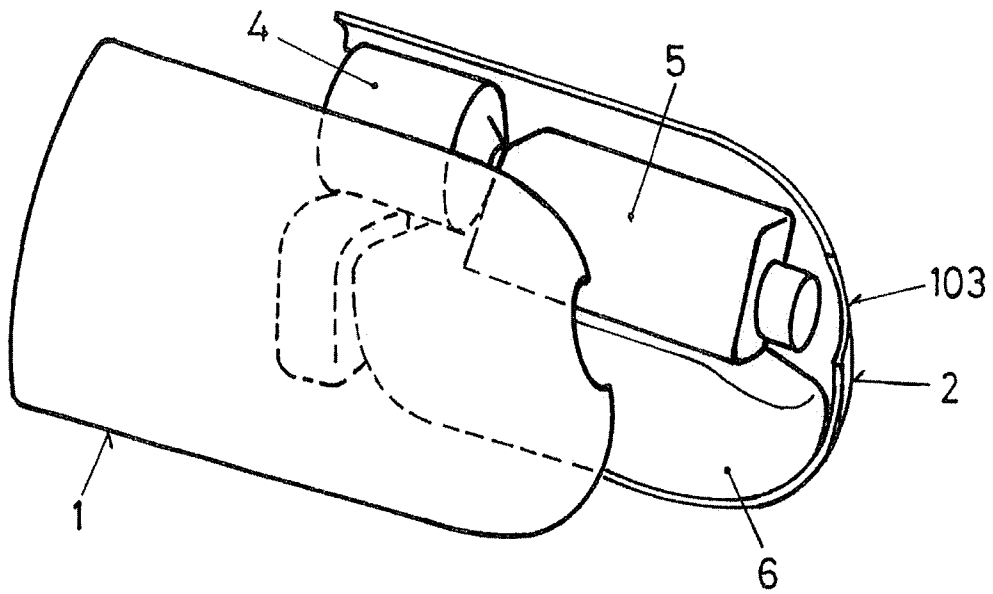


Fig. 4C

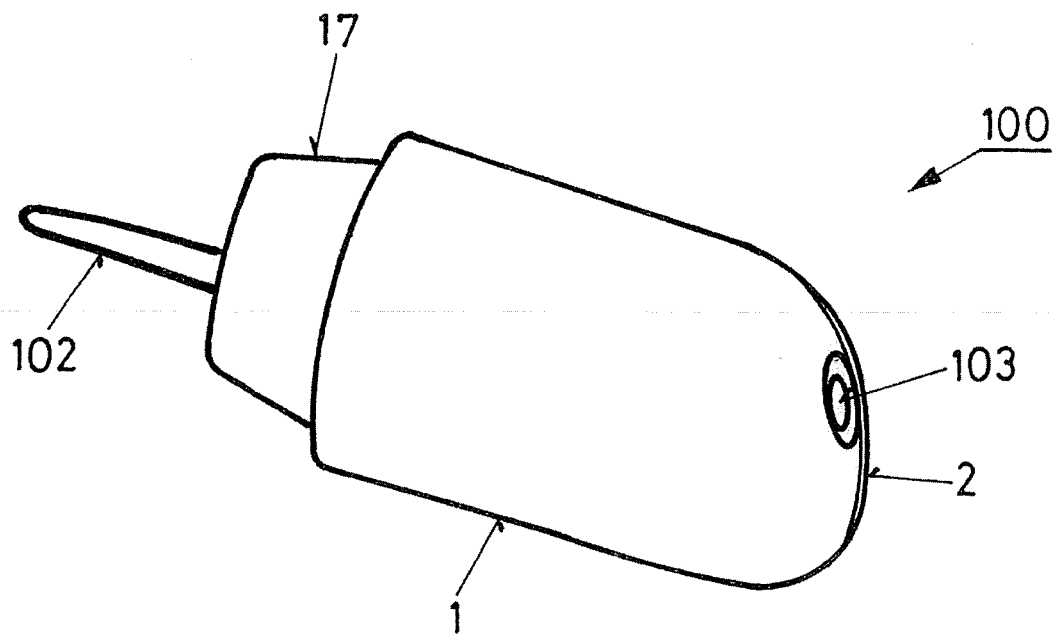


Fig. 4D

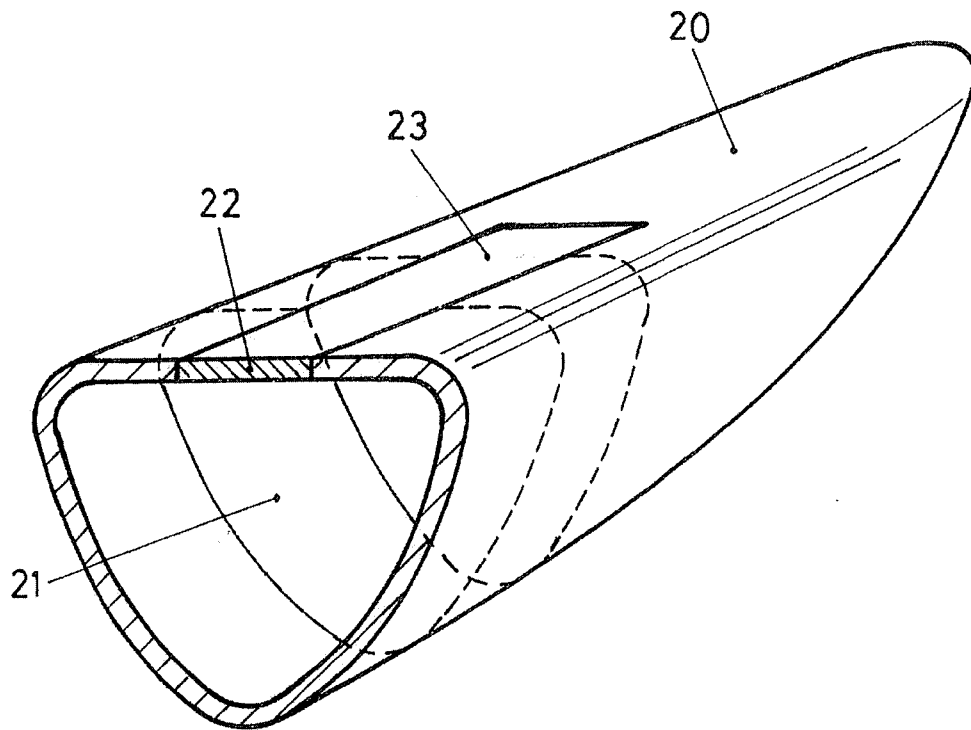


Fig. 5

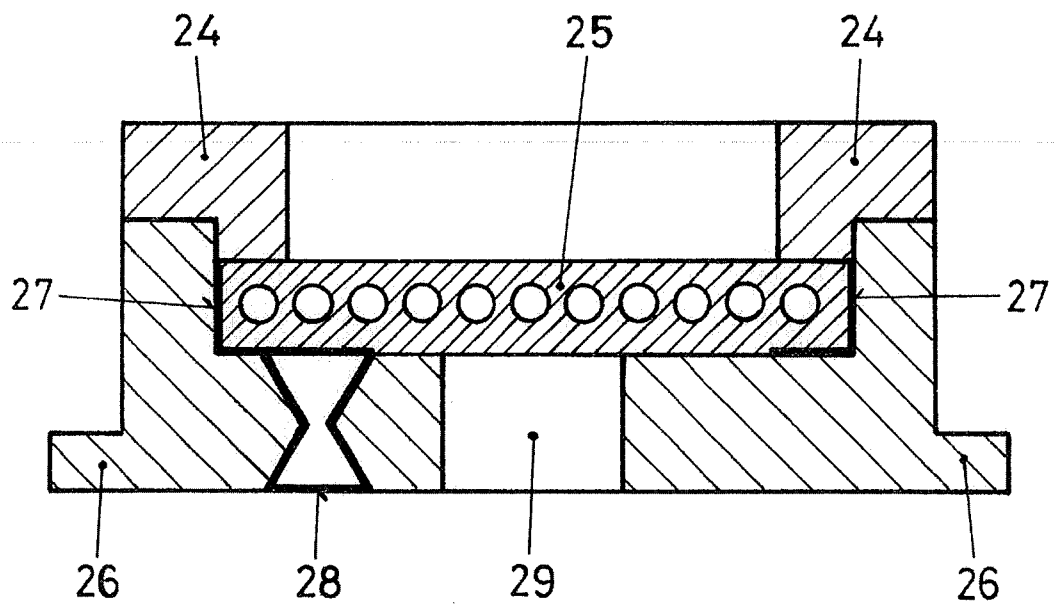


Fig. 6

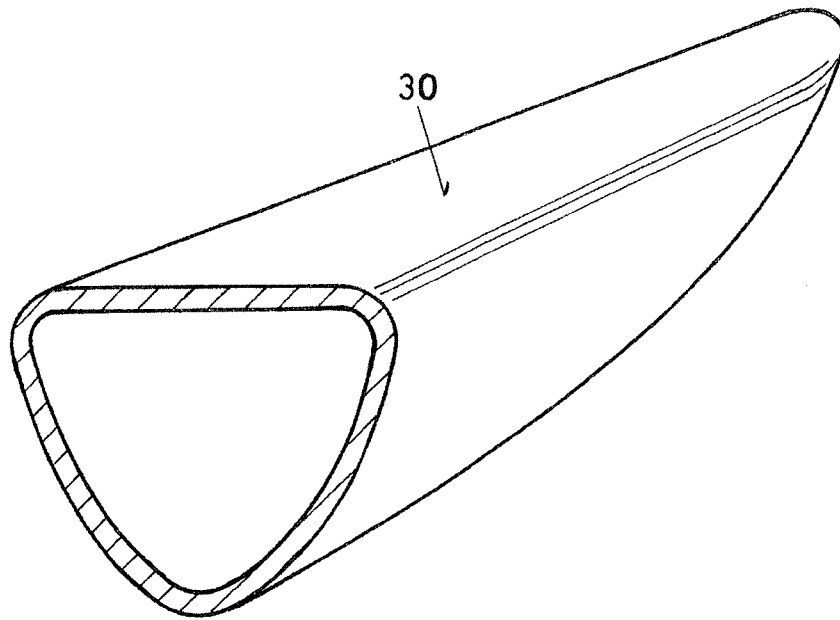


Fig. 7

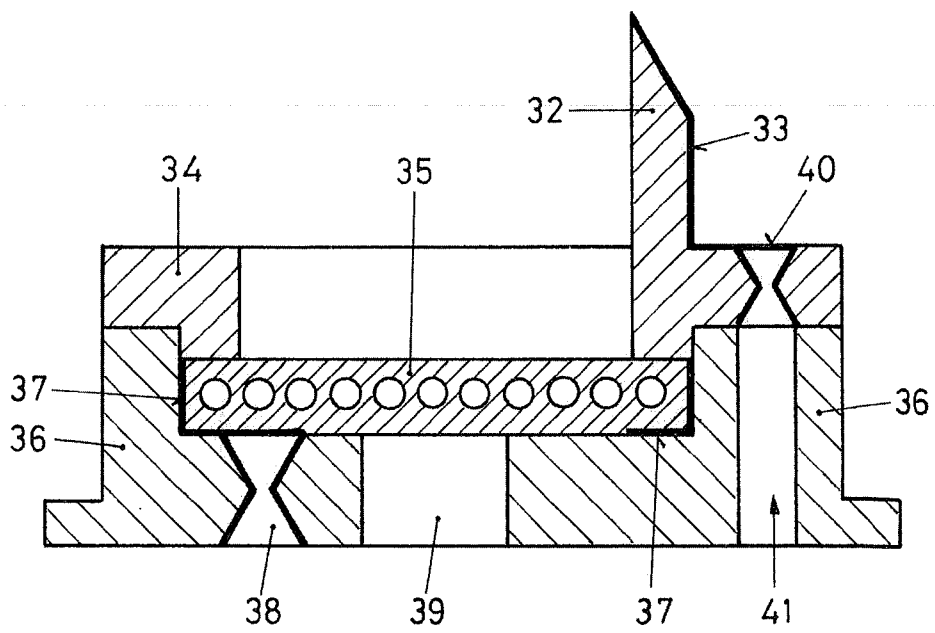


Fig. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/055577

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04R25/00
ADD.

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)
H04R H01M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	WO 2004/008802 A1 (OTICON AS [DK]; SVENDSEN KLAUS L [DK]; LUNDBERG PER [DK]) 22 January 2004 (2004-01-22) page 3, lines 22-31; figure 1 page 1, line 29 - page 2, line 3 page 2, lines 15-20 page 4, lines 30-33 -----	1-19
Y	EP 1 317 163 A2 (PHONAK AG [CH]) 4 June 2003 (2003-06-04) paragraphs [0008], [0009], [0014]; figure 1 ----- -/--	1-19



Further documents are listed in the continuation of Box C.



See patent family annex.

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search

12 December 2014

Date of mailing of the international search report

23/12/2014

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Authorized officer

Carrière, Olivier

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/055577

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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A	US 2013/328524 A1 (BARTULEC ROMAN [DE] ET AL) 12 December 2013 (2013-12-12) paragraphs [0027], [0062]; figures 17,18 -----	10,19
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