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(54) **HEARING AID WITH LIGHT INDICATOR**

(57) A hearing aid having a housing and a light source for emitting light is disclosed. The light source is arranged below a structure that comprises a transparent section and a surrounding opaque section, wherein the light source is arranged in a position that allows for transmission of light through the transparent section of the structure.

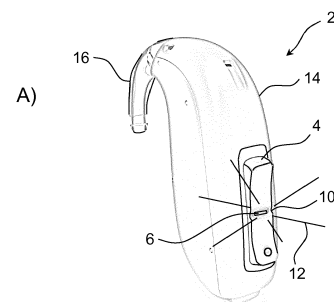


Fig. 1

Description

Field of disclosure

[0001] The present disclosure relates to a hearing aid provided with a light indicator.

Background

[0002] Hearing aids are continuously developed in order to reduce their physical size. Accordingly, attempts are made to make modern behind-the-ear hearing aids as small as possible, so they can fit almost "invisible" behind the user's ear.

[0003] One possible way to reduce the size of a hearing aid includes a reduction of the number of parts to a minimum and optimise their position inside the device. In the paediatric and geriatric segment, it is required to have a light indicator on the hearing aid in order to provide a visual feedback to the user. A light indicator is typically arranged at the back side of the hearing aid, between the microphones and a push button. In this position the light indicator will be clearly visible for the user and the people near the user, when the hearing aid is placed on the ear of the user.

[0004] A typical light indicator in a hearing aid includes a light guide part, that transmits the light illuminated from a light emitting diode (LED) on a printed circuit board (PCB) to the outside of the device for making the light indicator visible for the user. This solution is associated with several disadvantages:

[0005] A separate light guide part requires space in a crowded area inside the hearing aid. Accordingly, this solution is not suitable for achieving the object of reducing the physical size of the hearing aid.

[0006] Moreover, the small light guide part is difficult to handle in the production process. In addition, fixation of the light guide part in the top shell of the hearing aid is challenging.

[0007] Accordingly, it would be advantageous to have a more compact hearing aid having a light source.

Summary of the disclosure

[0008] Preferred embodiments of the present disclosure can be achieved by a hearing aid as described in the present disclosure. Other advantageous embodiments are defined e.g. in the dependent sub claims, explained in the following description and illustrated in the accompanying drawings.

[0009] According to an aspect of the disclosure, the hearing aid is a hearing aid having a housing and a light source for emitting light, wherein the light source is arranged below a structure that comprises a transparent section and a surrounding opaque section, wherein the light source is arranged in a position that allows for transmission of light through the transparent section of the structure.

[0010] Hereby, the hearing aid can be produced in a compact manner with a reduced number of parts.

[0011] The housing of the hearing aid may be referred to as a shell. It may have any suitable geometrical shape.

The structure below which the light source is arranged may be a plane structure, an arced structure or a combination thereof. The light source may be any suitable type of light source including a LED.

[0012] According to another aspect of the disclosure, the structure is a one-piece body.

[0013] Hereby it is possible to reduce the number of components. Moreover, a more simple manufacturing process and assembling process can be applied.

[0014] According to yet another aspect of the disclosure, the one-piece body constitutes part of the periphery of the hearing aid.

[0015] Hereby, it is possible to provide the desired light signal to the user and the people in the proximity of the user.

[0016] It may be an advantage that the light source is arranged in a short distance from the periphery of the hearing aid (e.g. integrated in the housing or shell of the hearing aid).

[0017] According to a further aspect of the disclosure, the one-piece body is a button.

[0018] Hereby, it is possible to arrange the light source in an area that is already used for the button. Accordingly, it is possible to reduce the size of the hearing aid since no separate space is needed for the light source itself.

[0019] The button may preferably be a push button.

[0020] According to another aspect of the disclosure, the light source is integrated in the button.

[0021] Hereby, it is possible to produce a hearing aid that comprises fewer (a lower number of) components than the prior art hearing aids. Consequently, it is possible to reduce the size of the hearing aid.

[0022] According to yet another aspect of the disclosure, the hearing aid comprises two switches and the light source is arranged between the two switches.

[0023] Hereby, the light source can be provided in a position, in which the light can be easily reached by the user of the hearing aid and the people surrounding the user.

[0024] According to a further aspect of the disclosure, the hearing aid comprises two tactile switches and the light source is arranged between the two tactile switches.

[0025] According to yet another aspect of the disclosure, the hearing aid comprises a button provided with two switches and the light source is arranged between the two switches.

[0026] According to another aspect of the disclosure, the hearing aid comprises a button having two tactile switches and the light source is arranged between the two tactile switches.

[0027] Thus, the light source can be integrated in a prior art press button.

[0028] According to yet another aspect of the disclosure, the one-piece body is the housing of the hearing aid.

[0029] Hereby, the light source can be integrated in the housing of the hearing aid. This solution provides large design freedom.

[0030] According to an aspect of the disclosure, the opaque section comprises a painted structure or surface.

[0031] The opaque section may be an injection moulded plastic component made in a transparent material that is painted. Accordingly, a transparent section can be provided by removing the paint in the desired area.

[0032] According to a further aspect of the disclosure, the transparent section is a painted structure that has received a surface treatment. The surface treatment may be any suitable type of surface treatment including laser treatment and mechanical surface treatments.

[0033] According to an even further aspect of the disclosure, the surface treatment is a laser treatment. Hereby, a well-defined area can be treated and a high precision can be achieved.

[0034] According to a further aspect of the disclosure, the light source is a light emitting diode (LED).

[0035] According to another aspect of the disclosure, the one-piece body is a moulded structure that is painted. The moulded structure may be moulded by means of injection moulding (e.g. an injection moulded plastic component).

[0036] According to yet another aspect of the disclosure, the hearing aid is a behind-the-ear (BTE) hearing aid.

[0037] According to a further aspect of the disclosure, the one-piece body is provided with an indentation. The indentation may be configured to converge or diverge light like an optical lens.

[0038] According to another aspect of the disclosure, the one-piece body is provided with an indentation provided in the transparent section.

[0039] According to a further aspect of the disclosure, the indentation is provided in the central portion of the button.

[0040] Hereby, it is possible to provide a light signal that is easy to see for the user and the people in the proximity of the user of the hearing aid.

[0041] According to another aspect of the disclosure, the thickness of the transparent section equals the thickness opaque section.

[0042] Hereby, it is possible to ease the production of the structure, below which the light source is arranged, in an easy manner.

[0043] According to a further aspect of the disclosure, the thickness of the transparent section is smaller than the thickness opaque section. According to another aspect of the disclosure, the thickness of the transparent section is larger than the thickness of the opaque section.

Brief description of the drawings

[0044] The aspects of the disclosure may be best understood from the following detailed description taken in conjunction with the accompanying figures. The figures

are schematic and simplified for clarity, and they just show details to improve the understanding of the claims, while other details are left out. Throughout, the same reference numerals are used for identical or corresponding parts. The individual features of each aspect may each be combined with any or all features of the other aspects. These and other aspects, features and/or technical effects will be apparent from and elucidated with reference to the illustrations described hereinafter in which:

Fig. 1 A shows a perspective view of a hearing aid according to an embodiment of the disclosure;

Fig. 1 B shows a perspective view of a hearing aid according to another embodiment of the disclosure;

Fig. 2 shows a schematic perspective view of hearing aid according to another embodiment of the disclosure;

Fig. 3 A shows a schematic side view of a hearing aid according to an embodiment of the disclosure;

Fig. 3 B shows a schematic perspective view of hearing aid according to another embodiment of the disclosure;

Fig. 4 A illustrates a close-up view of a hearing aid according to an embodiment of the disclosure;

Fig. 4 B shows a schematic perspective view of hearing aid according to an embodiment of the disclosure;

Fig. 4 C shows a schematic perspective view of hearing aid according to another embodiment of the disclosure;

Fig. 4 D shows a schematic perspective view of hearing aid according to a further embodiment of the disclosure;

Fig. 5 A shows a cross-sectional view of a structure according to an embodiment of the disclosure and

Fig. 5 B shows a cross-sectional view of another structure according to an embodiment of the disclosure.

Detailed description of the disclosure

[0045] A hearing aid is adapted to improve or augment a user's hearing capability by receiving an acoustic signal from a user's surroundings, generating a corresponding audio signal, possibly modifying the audio signal and providing the possibly modified audio signal as an audible signal to at least one of the user's ears. The "hearing aid" may further refer to a device adapted to receive an audio signal electronically, possibly modifying the audio signal and providing the possibly modified audio signal as an audible signal to at least one of the user's ears. Such audible signals may be provided in the form of an acoustic

signal radiated into the user's outer ear.

[0046] The hearing aid is adapted to be worn in any known way. This may include i) arranging a unit of the hearing aid behind the ear with a tube leading air-borne acoustic signals into the ear canal or with a receiver/ loud-speaker arranged close to or in the ear canal such as in a behind-the-ear type hearing aid, and/ or ii) arranging the hearing aid entirely or partly in the pinna and/ or in the ear canal of the user such as in an in-the-ear type hearing aid or in-the-canal/ completely-in-canal type hearing aid, or iii) arranging a unit of the hearing aid attached to a fixture implanted into the skull bone such as in bone-anchored hearing aids or cochlear implants, or iv) arranging a unit of the hearing aid as an entirely or partly implanted unit such as in bone-anchored hearing aids or cochlear implant.

[0047] In general, a hearing aid includes i) an input unit such as a microphone for receiving an acoustic signal from a user's surroundings and providing a corresponding input audio signal, and/or ii) a receiving unit for electronically receiving an input audio signal. The hearing aid further includes a signal processing unit for processing the input audio signal and an output unit for providing an audible signal to the user in dependence on the processed audio signal.

[0048] The input unit may include multiple input microphones, e.g. for providing direction-dependent audio signal processing. Such a directional microphone system is adapted to enhance a target acoustic source among a multitude of acoustic sources in the user's environment. In one aspect, the directional system is adapted to detect (such as adaptively detect) from which direction a particular part of the microphone signal originates. This may be achieved by using conventionally known methods. The signal processing unit may include an amplifier that is adapted to apply a frequency dependent gain to the input audio signal. The signal processing unit may further be adapted to provide other relevant functionality such as compression, noise reduction, etc. The output unit may include an output transducer such as a loudspeaker/receiver for providing an air-borne acoustic signal transcutaneously or percutaneously to the skull bone or a vibrator for providing a structure-borne or liquid-borne acoustic signal. In some hearing aids, the output unit may include one or more output electrodes for providing the electric signals such as in a cochlear implant.

[0049] Referring now in detail to the drawings for the purpose of illustrating preferred embodiments of the disclosure, Fig. 1A illustrates a schematic view of a hearing aid 2 according to an embodiment of the disclosure. The hearing aid 2 is a behind-the-ear (BTE) hearing aid 2 comprises a housing 14, a sound hook 16 and a button 4. The button 4 is a push button configured to be pushed down in a first configuration and in another configuration.

[0050] The hearing aid 2 comprises an indentation 10 and a light source provided below the indentation 10. The light source 6 emits light 12 indicated by lines. The light source 6 may be a LED. The push button 4 is a one-piece

body that constitutes part of the periphery of the hearing aid 2. The press button 4 may be a painted structure and the indentation 10 may have received a laser treatment for removing the paint in order to be transparent.

[0051] Fig. 1B illustrates a perspective view of a hearing aid 2 according to another embodiment of the disclosure. The hearing aid 2 comprises a housing 14, a sound hook 16 and a press button 4 configured to be pushed down in a first configuration and in another configuration. The press button 4 is a one-piece body. A light source 6 is provided below a transparent section of the housing 14. The emitted light 12 is indicated with lines.

[0052] Fig. 2 illustrates a schematic perspective view of hearing aid 2 according to another embodiment of the disclosure. The hearing aid 2 comprises a housing 14 and a press button 4 provided with an indentation 10 arranged in the central area of the button 4. The indentation 10 is semi-cylindrical and comprises a longitudinal axis Y extending perpendicular to the longitudinal axis X of the button 4.

[0053] Below the outer periphery of the button 4 a first tactile switch 8 and a second tactile switch 8' are arranged. The first tactile switch 8 is configured to be activated upon pressing the button 4 into a first configuration by pressing down the first end 28. Likewise, the second tactile switch 8' is configured to be activated upon pressing the button 4 into a second configuration by pressing down the second end 30. The light source 6 is arranged between the two switches 8, 8'. The light source 6 emits light 12 that is transmitted through the transparent indentation and absorbed by the remaining portion of the cover of the button 4.

[0054] Fig. 3A illustrates a schematic side view of a hearing aid 2 according to an embodiment of the disclosure. The hearing aid 2 comprises a light source 6 arranged below a transparent area provided in the housing 14 of the hearing aid 2.

[0055] The housing 14 may be produced in a transparent material (e.g. an injection moulded plastic material) that is painted. The paint may be removed (e.g. by laser treatment) in the area intended to allow for transmission of light 12. The hearing aid 2 comprises a press button 4.

[0056] Fig. 3B illustrates a schematic perspective view of BTE hearing aid 2 according to another embodiment of the disclosure. The hearing aid 2 comprises a housing 14, a sound hook 16 and a press button 4 provided as a one-piece body. A light source 6 is integrated in the housing. The light source 6 is provided below an oval transparent section of the housing 14 and the emitted light 12 is indicated with lines.

[0057] Fig. 4A illustrates a close-up view of the lower portion a hearing aid 2 according to an embodiment of the disclosure. The hearing aid 4 comprises a housing 14 provided with a press button 4. A light source 6 is arranged below the central portion of the cover of the button 4. The light source 6 emits light 12 that is transmitted through a transparent section of the button 4 surrounded by an opaque section. The light source is ar-

ranged in a position that allows for transmission of light 12 through the transparent section of the button 4.

[0058] Fig. 4B shows a schematic perspective view of hearing aid 2 according to an embodiment of the disclosure. The hearing aid 2 comprises a housing 14 and a sound hook 16 attached thereto. A button 4 is provided in the lower portion of the housing, whereas a light source 6 is provided below a transparent section of the housing 14. The light source 6 emits light 12 indicated with lines.

[0059] Fig. 4C illustrates a schematic perspective view of hearing aid 2 according to another embodiment of the disclosure. The hearing aid 2 comprises a housing 14 and a sound hook 16 attached to the housing 14. An earmould 18 is attached to the distal end of the sound hook 16.

[0060] A light source 6 is provided below a transparent section of the top portion of the housing 14. The light source 6 emits light 12 and functions as a light indicator. The hearing aid 2 is a BTE hearing aid 2.

[0061] Fig. 4D illustrates a schematic perspective view of hearing aid 2 according to a further embodiment of the disclosure. The hearing aid 2 comprises a housing 14 and a thin tube 22 attached to the top section of the housing 14. A micro-mould 20 is attached to the distal end of the tube 22.

[0062] A light source 6 is provided below a transparent section of the top portion of the housing 14. The light source 6 emits light 12 and functions as a light indicator. The hearing aid 2 is a receiver-in-the-ear (RITE) hearing aid 2.

[0063] Fig. 5A illustrates a schematic cross-sectional view of a structure according to an embodiment of the disclosure. The structure is a housing 14 of a hearing aid 2. The housing 14 is formed as a plane plate-shaped structure. The housing 14 comprises a transparent section 24 surrounded by an opaque section 26. The thickness D_1 of the transparent section 24 equals the thickness D_2 opaque section 26. However, in a further embodiment of the disclosure, the thickness D_1 of the transparent section is smaller than the thickness opaque section.

[0064] According to another aspect of the disclosure, the thickness of the transparent section is larger than the thickness D_2 of the opaque section.

[0065] On the other hand, in another embodiment of the disclosure, the thickness D_1 of the transparent section is larger than the thickness opaque section.

[0066] A light source 6 is provided in a distance D_3 below the housing 14. In a preferred embodiment, the light source 6 is a LED.

[0067] Fig. 5B illustrates a schematic cross-sectional view of a structure according to another embodiment of the disclosure. The structure is a button 4 of a hearing aid 2. The button 4 comprises a plane plate-shaped structure provided with a transparent section 24 surrounded by an opaque section 26. The thickness D_1 of the transparent section 24 equals the thickness D_2 opaque section 26.

[0068] A light source 6 is provided in a distance D_3 below the plane plate-shaped structure of the button 4.

[0069] According to another aspect of the disclosure, the thickness of the transparent section is larger than the thickness D_2 of the opaque section. In another embodiment of the disclosure, the thickness D_1 of the transparent section 24 is larger than the thickness opaque section 26.

[0070] When nouns are used in the singular form, they are also intended to include the corresponding plural forms (i.e. to have the meaning "at least one"), unless expressly stated otherwise. It will be further understood that the terms "includes," "comprises," "including," and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. It will also be understood that when an element is referred to as being "connected" or "coupled" to another element, it can be directly connected or coupled to the other element, but an intervening element may also be present, unless expressly stated otherwise. Furthermore, "connected" or "coupled" as used herein may include wirelessly connected or coupled. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items. The steps of any disclosed method are not limited to the exact order stated herein, unless expressly stated otherwise.

[0071] It should be appreciated that reference throughout this specification to "one embodiment" or "an embodiment" or "an aspect" or features included as "may" means that a particular feature, structure or characteristic described in connection with the embodiment is included in at least one embodiment of the disclosure. Furthermore, the particular features, structures or characteristics may be combined as suitable in one or more embodiments of the disclosure. The previous description is provided to enable any person skilled in the art to practice the various aspects described herein. Various modifications to these aspects will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other aspects.

[0072] The claims are not intended to be limited to the aspects shown herein, but are to be accorded the full scope consistent with the language of the claims, wherein reference to an element in the singular is not intended to mean "one and only one" unless specifically so stated, but rather "one or more." Unless specifically stated otherwise, the term "some" refers to one or more.

[0073] Accordingly, the scope should be judged in terms of the claims that follow.

List of reference numerals

[0074]

2 Hearing aid

4, 4'	Button
6	Light source
8, 8'	Switch (tactile switch)
10	Indentation
12	Light
14	Housing
16	Sound hook
18	Earmould
20	Micro-mould
22	Tube
24	Transparent section
26	Opaque section
28	First end
30	Second end
D ₁ , D ₂	Thickness
D ₃	Distance
X, Y	Longitudinal axis

Claims

1. A hearing aid (2) having a housing (14) and a light source (6) for emitting light (12), wherein the light source (6) is arranged below a structure (4, 14) that comprises a transparent section (24) and a surrounding opaque section (26), wherein the light source (6) is arranged in a position that allows for transmission of light (12) through the transparent section (24) of the structure (4, 14). 30
2. A hearing aid (2) according to claim 1, wherein the structure (4, 14) is a one-piece body (4, 14).
3. A hearing aid (2) according to claim 2, wherein the one-piece body (4, 14) constitutes part of the periphery of the hearing aid (2). 35
4. A hearing aid (2) according to claim 2 or claim 3, wherein the one-piece body (4, 14) is a button (4). 40
5. A hearing aid (2) according to claim 4, wherein the light source (6) is integrated in the button (4).
6. A hearing aid (2) according to claim 4 or claim 5, wherein the hearing aid (2) comprises two switches (3) and wherein the light source (6) is arranged between the two switches (3). 45
7. A hearing aid (2) according to claim 2 or claim 3, wherein the one-piece body (4, 14) is the housing (14) of the hearing aid (2). 50
8. A hearing aid (2) according to one of the preceding claims, wherein the opaque section (26) comprises a painted structure or surface. 55
9. A hearing aid (2) according to one of the preceding claims, wherein the transparent section (24) is a painted structure that has received a surface treatment.
10. A hearing aid (2) according to claim 9, wherein the surface treatment is a laser treatment. 5
11. A hearing aid (2) according to one of the preceding claims, wherein the light source (6) is a light emitting diode (LED) (6). 10
12. A hearing aid (2) according to one of the preceding claims, wherein the one-piece body (4, 14) is a moulded structure that is painted.
13. A hearing aid (2) according to one of the preceding claims, wherein the hearing aid (2) is a behind-the-ear (BTE) hearing aid (2). 15
14. A hearing aid (2) according to one of the preceding claims, wherein the one-piece body (4, 14) is provided with an indentation (10). 20
15. A hearing aid (2) according to claim 4 and claim 14, wherein the indentation (10) is provided in the central portion of the button (4). 25

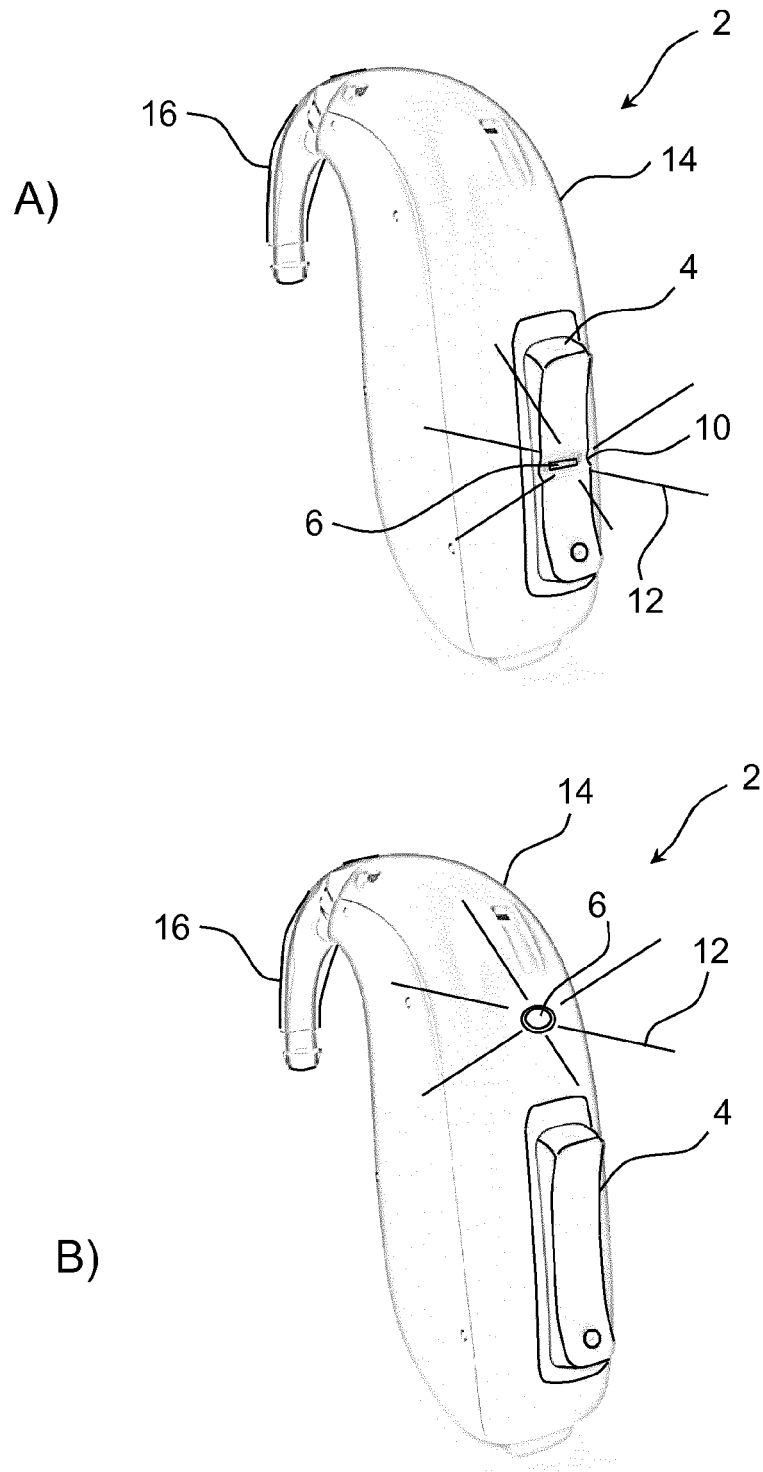


Fig. 1

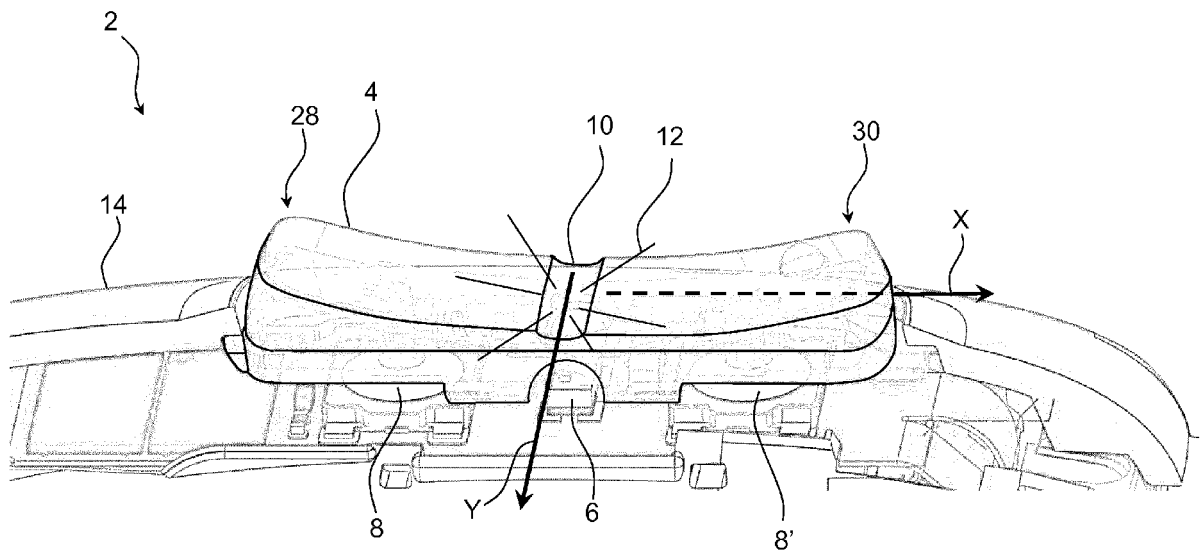


Fig. 2

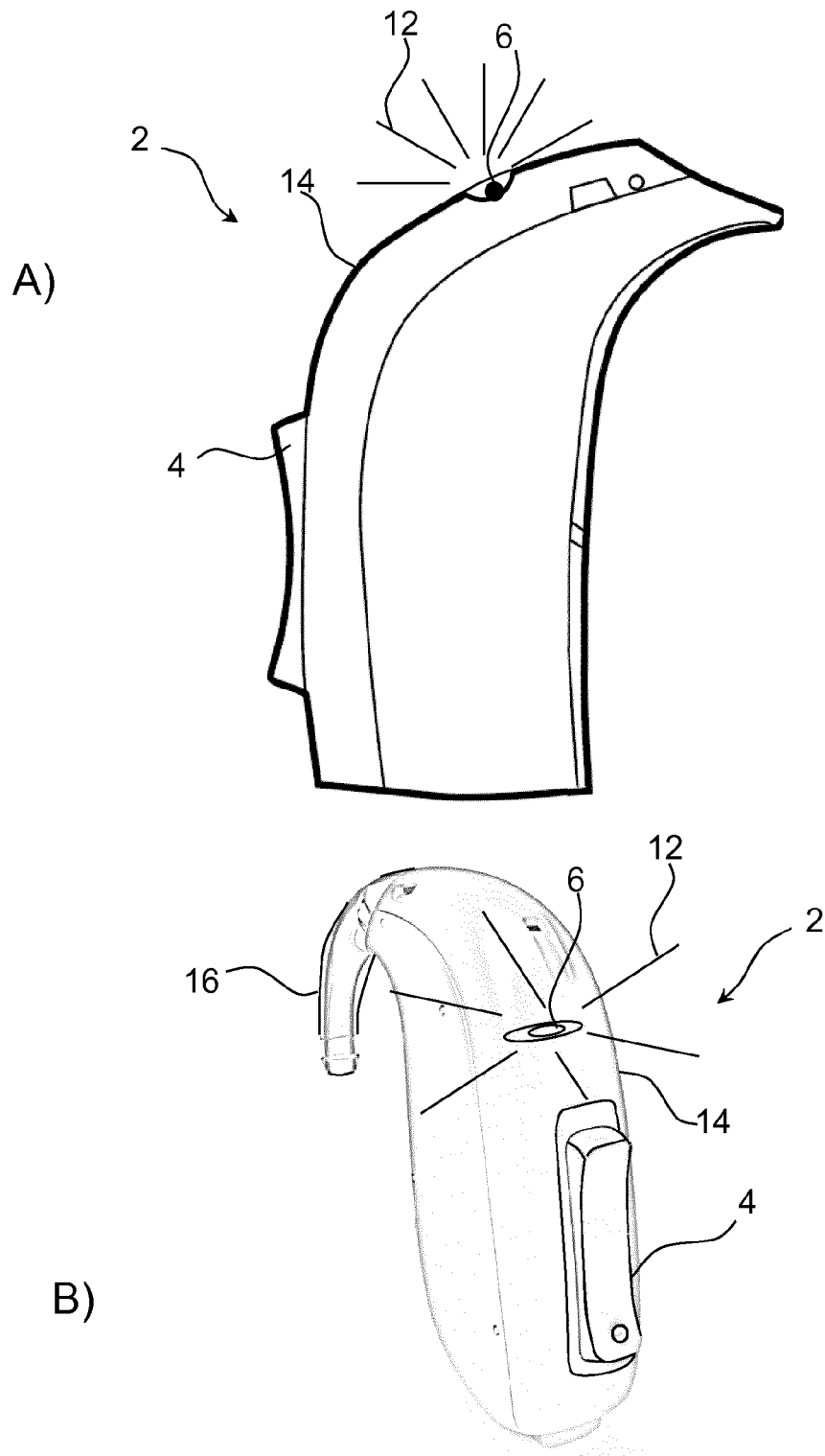


Fig. 3

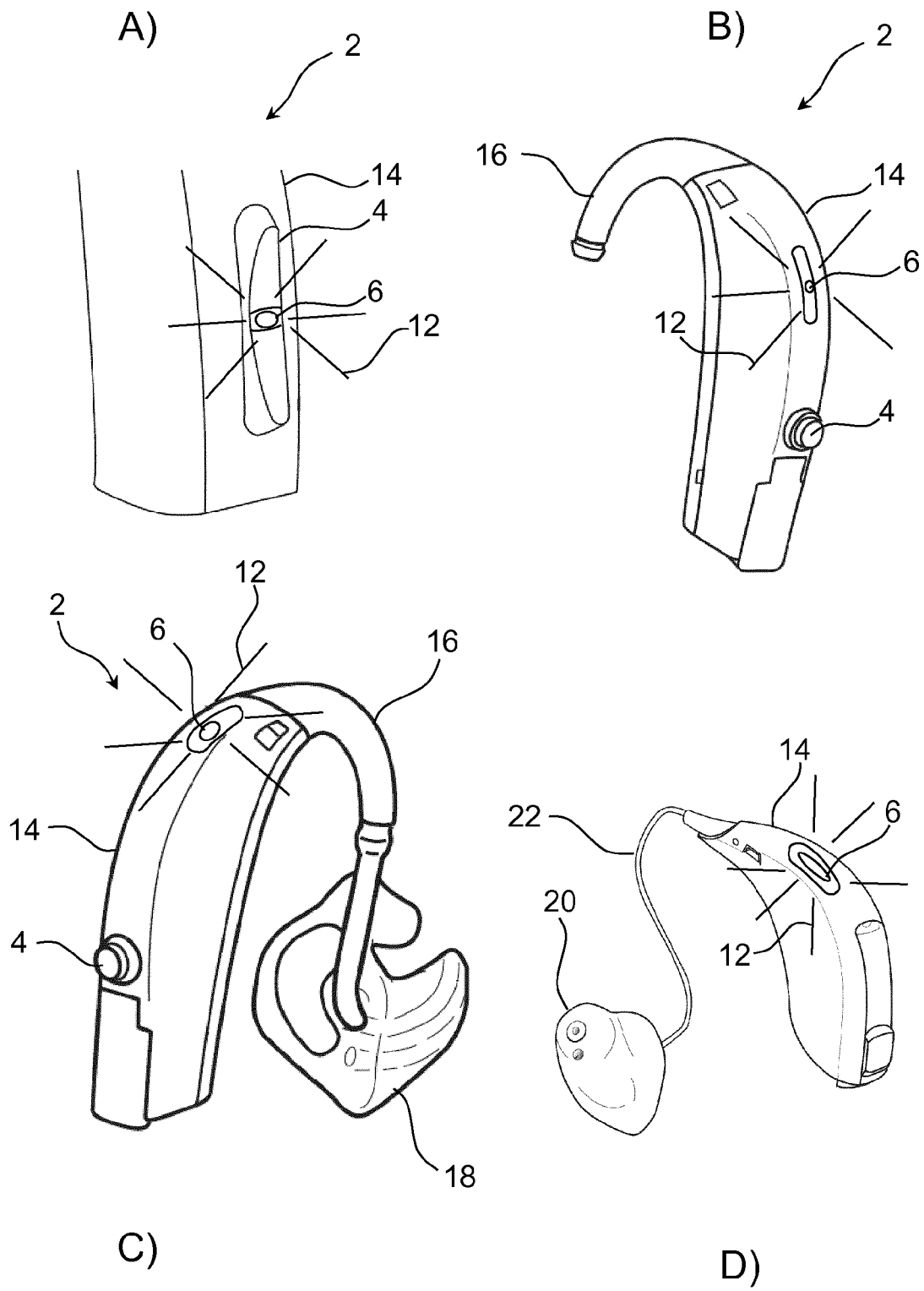


Fig. 4

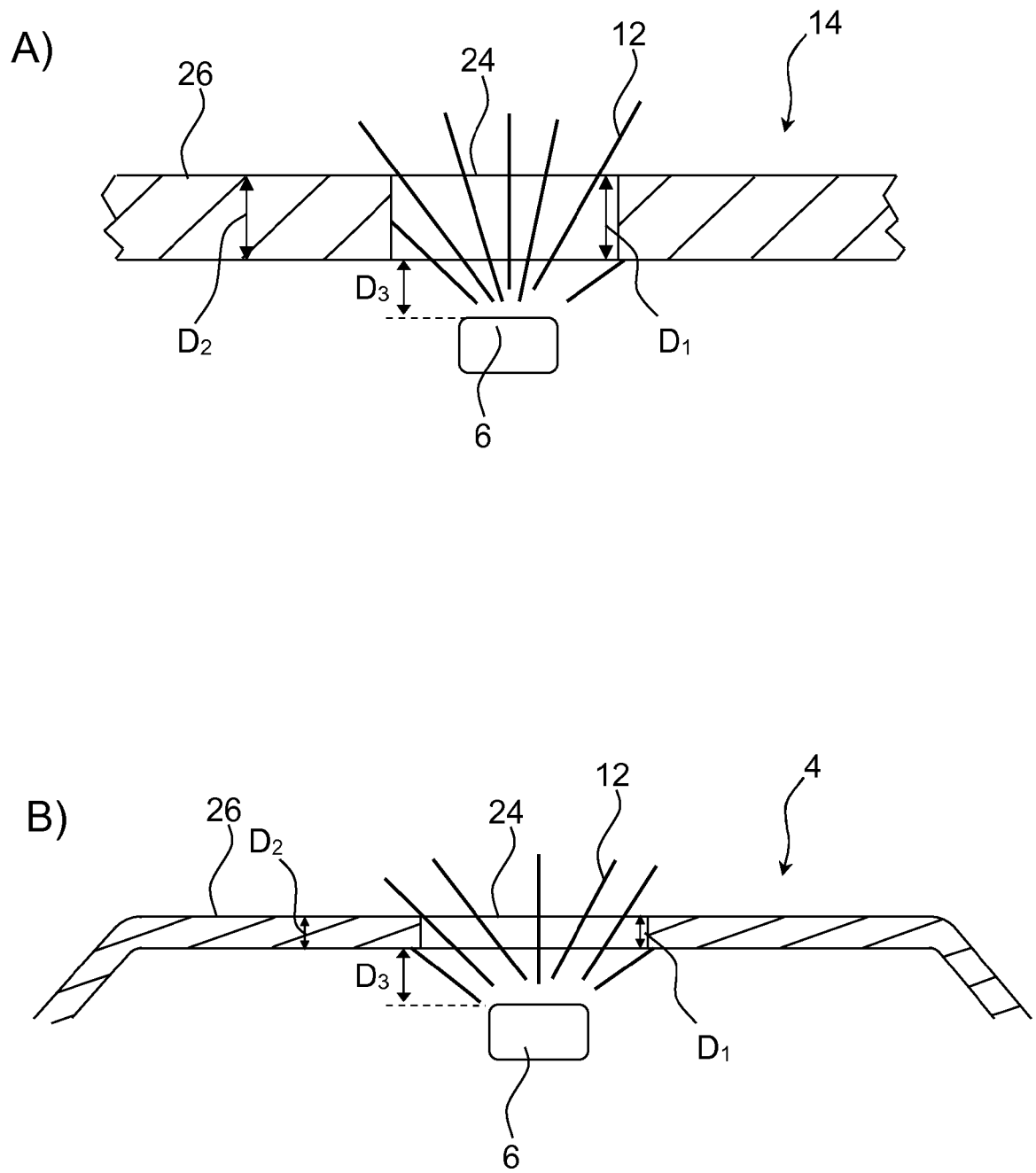


Fig. 5



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Application Number
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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