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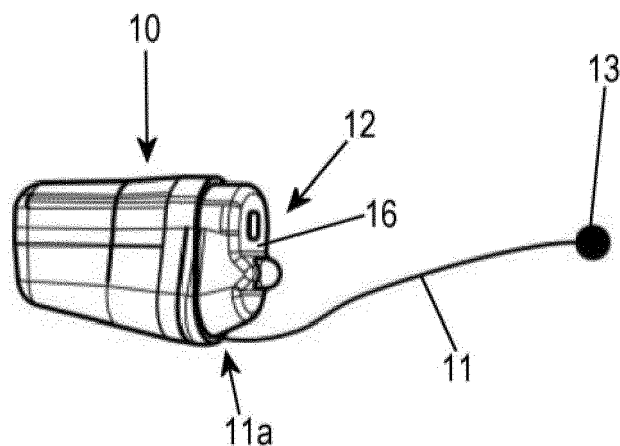
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(54) **HEARING AID FOR DEEP-IN-CANAL INSERTION**

(57) A hearing aid for deep-in-canal insertion is disclosed. The hearing aid comprises a pull member, an attachment portion, and an interface. The pull member is configured to be fixed to the hearing aid with one end portion and to remove the hearing aid from the canal

when being pulled. The interface is configured to be fixed to the pull member. The interface is configured to be detachably attachable to the attachment portion by a first magnetic force.

FIG. 1A



Description

FIELD

[0001] The present disclosure relates to a hearing aid, a tool and a hearing device. More particularly, the disclosure relates to a hearing aid for deep-in-canal insertion, to a tool for inserting and removing a deep-in-canal hearing aid into/from a canal, and to a hearing device comprising the hearing aid and the tool.

BACKGROUND

[0002] On today's Completely-in-Canal (CIC) type hearing aids a pull out string is glued to the faceplate. The pull out string is used to remove the hearing aid from the ear canal. Even though the pull out string is of transparent material, the string is visible since sticking out of the ear. The industry strives to make a truly invisible hearing aid, which for one reason cannot be obtained because of the visibility of the pull out string.

[0003] Therefore, there is a need to provide a solution that addresses the above-mentioned problem.

SUMMARY

[0004] According to an aspect, a hearing aid for deep-in-canal insertion is provided. The hearing aid comprises a pull member, an attachment portion, and an interface. The pull member is configured to be fixed to the hearing aid with one end portion and to remove the hearing aid from the canal when being pulled. The interface is configured to be fixed to the pull member. The interface is configured to be detachably attachable to the attachment portion by a first magnetic force.

[0005] This allows for hiding the pull member in the ear canal by attaching, in addition to one end portion of the pull member, another part of the pull member via the interface to the hearing aid. Therefore, the length of the portion of the pull member, which is spaced apart from the hearing aid, is shortened, and thus is less visible or even completely invisible from outside the ear canal. Preferably, the interface is fixed to or near the other end portion of the pull member, which is an end portion being opposite to the one end portion in the longitudinal direction of the pull member.

[0006] According to another aspect, a tool for inserting and removing a deep-in-canal hearing aid into/from a canal is provided. The tool comprises a magnetic coupling being configured to exert on the hearing aid a second magnetic force and a third magnetic force. The third magnetic force is larger than the second magnetic force.

[0007] This allows for easily inserting the hearing aid according to any of the aspects presented herein into the ear canal. This also allows for easily removing the hearing aid according to any of the aspects presented herein from the ear canal.

[0008] According to yet another aspect, a hearing de-

vice is provided. The hearing device comprises a hearing aid according to any of the aspects presented herein, and a tool according to any of the aspects presented herein. The hearing device is configured such that the first magnetic force is set larger than the second magnetic force and smaller than the third magnetic force.

[0009] In other words, the hearing device is a system of at least the hearing aid and the tool. This allows for easily inserting and removing the hearing aid into/ from the ear canal.

[0010] Preferably, a hearing aid according to any of the aspects presented herein is provided, wherein at least a part of the interface and the attachment portion is a magnet. Alternatively, at least a part of one of the interface and the attachment portion is a magnet and at least a part of the other one comprises a magnetizable material.

[0011] This allows for providing an attachment portion and an interface, which is attachable to the attachment portion, having a simple structure and a reliable functionality.

[0012] Preferably, a hearing aid according to any of the aspects presented herein is provided, wherein the interface is spherical and the attachment portion comprises a ring magnet.

[0013] This allows for providing an attachment portion and an interface, which is attachable to the attachment portion, having a simple structure and a reliable functionality. This particularly allows for a reliable sit of the magnetic or magnetizable spherical interface in the ring shaped magnet of the attachment portion. Alternatively, the ring magnet can also be replaced by a magnetizable ring, if the interface is composed of or comprises a magnet. The combination of a sphere and the ring allows for ensuring a predetermined sit/ position of the interface at the attachment portion.

[0014] Preferably, a hearing aid according to any of the aspects presented herein is provided, wherein the pull member comprises nylon or aramid. More preferably, the pull member is composed of nylon or aramid.

[0015] This allows for easily providing a pull member having the required strength and flexibility. This further allows for providing a pull member being easy available and cheap.

[0016] Preferably, a hearing aid according to any of the aspects presented herein is provided, wherein the pull member is a cord and comprises a shape memory material. More preferably, the pull member is composed of the shape memory material. More preferably, the shape memory material is a polymer. The pull member is configured to be curled when the interface is attached to the attachment portion.

[0017] This allows for arranging the pull member entirely or at least a larger part of the pull member in close vicinity to the attachment portion. In other words, the pull member is effectively prevented from extending toward the opening of the ear canal, thus being invisible from outside the ear canal.

[0018] Preferably, a hearing aid according to any of the aspects presented herein is provided, wherein the hearing aid comprises a hole. The hole is configured to accommodate the pull member when the interface is attached to the attachment portion.

[0019] This allows for accommodating the pull member entirely in the hearing aid. In other words, the pull member is effectively prevented from extending toward the opening of the ear canal, thus being invisible from outside the ear canal.

[0020] Preferably, a hearing aid according to any of the aspects presented herein is provided, wherein the hearing aid comprises a faceplate at a distal end. At least a part of the faceplate comprises the attachment portion. The interface is attachable to the center of the faceplate.

[0021] This allows for providing a hearing aid having a simple structure and a reliable functionality. This further allows for ensuring a predetermined sit/ position of the interface at the faceplate.

[0022] Preferably, a hearing aid according to any of the aspects presented herein is provided, wherein the hearing aid comprises a disposable first module and a reusable second module. The pull member is fixed to the first module.

[0023] This allows for regularly replacing the pull member, thus ensuring functionality of the pull member. On the one hand, the pull member has a small cross-section and thus a limited (tensile) strength. On the other hand, relative large forces might be necessary to remove the hearing aid from the ear canal. Thus, replacing the pull member before fatigue occurs in the pull member contributes to maintaining the functionality of the pull member and the hearing aid.

[0024] Preferably, a hearing aid according to any of the aspects presented herein is provided, wherein the hearing aid comprises a damper element at the attachment portion. Additionally or alternatively, the hearing aid comprises a GMR switch.

[0025] This allows for damping or eliminating the sound, which occurs when the magnets of the attachment portion and the interface meet. The GMR (giant magnetoresistance) switch in the hearing aid can shut off the hearing aid when the magnet force is detected. By shutting down the hearing aid (or put it in sleep mode) the sound will not be amplified. By adding the damper element, which is preferably a damping silicone, at the attachment portion, the sound is dampened when the magnets meet. Alternatively or additionally, the damper element can be provided at the pull member.

[0026] Preferably, a tool according to any of the aspects presented herein is provided, wherein the coupling comprises two magnets having different magnetic forces or two differently magnetizable materials. The magnets or materials are spaced apart from each other in the longitudinal direction of the tool.

[0027] This allows for easily providing a simply structured tool being configured to exert two magnetic forces having different magnitudes for inserting and removing

the hearing aid into the ear canal.

[0028] Preferably, a tool according to any of the aspects presented herein is provided, wherein the coupling comprises one magnet or magnetizable material being configured to be displaced along the longitudinal direction of the tool.

[0029] This allows for easily providing a simply structured tool being configured to exert two magnetic forces having different magnitudes for inserting and removing the hearing aid into the ear canal. This further allows for using only one magnet for generating the two forces. It further allows for providing adjustable magnetic forces.

[0030] Preferably, a tool according to any of the aspects presented herein is provided, wherein the coupling comprises an electromagnet.

[0031] This allows for easily providing a tool being configured to exert two magnetic forces having different magnitudes for inserting and removing the hearing aid into the ear canal. This further allows for using only one magnet for generating the two forces. It further allows for providing adjustable magnetic forces.

[0032] Preferably, a tool according to any of the aspects presented herein is provided, wherein the tool comprises a damper element at one longitudinal end part of the tool.

[0033] This allows for damping or eliminating the sound, which occurs when the magnets of the attachment portion/ the interface and the tool meet. By adding the damper element, which is preferably a damping silicone, at the tool front, the sound is dampened when the magnets meet.

BRIEF DESCRIPTION OF DRAWINGS

[0034] 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:

Figures 1A to 1C illustrate a hearing aid according to an embodiment of the disclosure, wherein the attachment operation of the interface to the attachment portion and the curling up of the pull member is depicted, and wherein Figure 1A shows a detached state of the interface from the attachment portion and a substantially fully extended state of the pull member, Figure 1B shows an attached state of the interface to the attachment portion and a state of the pull member, in which the pull member extends by a

length corresponding to approximately half the length of the fully extended state without being curled up, and Figure 1C shows the attached state of the interface and a curled-up state of the pull member, in which the pull member substantially does not extend in the longitudinal direction of the ear canal; Figure 2 illustrates an attached state of the interface to the attachment portion according to an embodiment of the disclosure;

Figures 3A and 3B illustrate a structure for accommodating the pull member and a hearing device according to an embodiment of the disclosure as a schematic sectional view, wherein

Figure 3A shows an almost fully retracted state, in which the pull member is almost completely accommodated in a recess and the interface is not yet attached to the attachment portion, and Figure 3B shows an almost fully extended state, in which a stop almost abuts a limiting portion of the recess and the pull member almost fully extends into the ear canal due to a magnetic force exerted from a tool;

Figures 4A and 4B illustrate a tool and a hearing device according to an embodiment of the disclosure as mixture of a schematic sectional view and a side view, wherein Figure 4A illustrates the tool and Figure 4B illustrates the hearing device comprising the tool and the hearing aid;

Figure 5 illustrates a tool according to an embodiment of the disclosure as a schematic sectional view; Figure 6 illustrates a tool according to an embodiment of the disclosure as mixture of a schematic sectional view and a side view; and

Figure 7 illustrates a tool according to an embodiment of the disclosure as a schematic sectional view.

DETAILED DESCRIPTION

[0035] The detailed description set forth below in connection with the appended drawings is intended as a description of various configurations. The detailed description includes specific details for the purpose of providing a thorough understanding of various concepts. However, it will be apparent to those skilled in the art that these concepts may be practiced without these specific details.

[0036] A hearing device according to the disclosure includes a hearing aid and a tool for inserting the hearing aid into a canal and for removing the hearing aid from the canal. A hearing device may include a hearing aid that is adapted to improve or augment the hearing capability of a user 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. Such audible signals may be provided in the form of an acoustic signal radiated into the user's outer ear.

[0037] The hearing aid is adapted to be worn in any known way. This may include In-the-Canal (ITC)/ Com-

pletely-in-Canal (CIC) type hearing aids. It preferably includes deep-in-canal hearing aids.

[0038] 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.

[0039] The input unit may include multiple input microphones, e.g. for providing direction-dependent audio signal processing. Such 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 speaker/loudspeaker/ receiver for providing an air-borne acoustic signal.

[0040] The disclosure relates to a hidden pull string operated by use of magnets in combination with a removal and insertion tool for deep-in-canal hearing aids.

[0041] The overall idea is to have a magnet or a magnetizable material at the end of the pull string, which can attach to the hearing aid faceplate on a magnetic plate or an additional magnet, or a magnetizable material. This way the pull string becomes short and invisible when in the ear canal. When the hearing aid shall be removed, a tool comprising a magnet is inserted into the ear. The magnet force is so that the magnet/ magnetizable material on the pull string will jump from the hearing aid to the tool. Then the tool is led out of the ear canal with the pull string following the tool magnet because of the adherence between the two magnets. When the pull string is outside the ear canal and the pull string is stretched out, the tool will separate from the pull out string magnet/ magnetizable material and the pull string is now outside the ear and can be used as a conventional pull string.

[0042] The pull string (wire)/ pull member is fixated to the hearing aid. The pull out string is able to withstand the pull force required to pull out the hearing aid from the ear canal. The pull string can be a thin nylon wire like a fishing line. The fishing line can have a diameter in the range from approximately 0.2mm to approximately 1mm. Also aramide fibers (Kevlar) can be used. The string can be attached to an exchangeable part in order to limit the lifecycle usage of the part and thereby the wear. For example, in truly invisible hearing aids, the dome and battery is exchanged every three weeks. The intention is to

fixate the pull string in the dome/battery/earpiece spare part. The other benefit by doing so is that the string can be curled up to be even more hidden. The string is curled up in production. If the string is curled up, the material chosen for the string will have to be a material which is not set. As an example, nylon thread can set and bend back to their curled shape. The material choice could be Kevlar fibers instead.

[0043] At the end of the pull string an element (interface) is placed. The element is a magnet, if the attachment portion of the hearing aid is a magnetic material. If attachment portion is a magnet, the pull string element can be either a magnet or a magnetic element. The size of the element at the pull out string is large enough to make a finger pinch. The diameter of the element is around 1mm. The element can have many shapes.

[0044] Instead of the loop of the pull string being outside the hearing aid or curled up, the string element can be inside the hearing aid as shown below. The pull string then runs within a cavity/ opening and is pulled out when the tool magnet approaches.

[0045] In order for the concept to work an element attached on the hearing aid is needed. This element can be either magnetic or be a magnet. The element is preferably placed on the back of the hearing aid and more preferably placed in the center. This in order to be sure that a big magnet can get in contact with the pull string magnet.

[0046] Since the hearing aid is invisible because it is placed very deep in the ear canal, it requires an insertion/removal tool. Therefore an insertion and removal tool is combined in the same (one) tool.

[0047] The concept of the tool is to have a big magnet for removal of the hearing aid. The big magnet is able to pull the pull string magnet loose from the hearing aid as described earlier. The big magnet is as big as possible to get a large force. The ear canal size sets the limit of the magnet size. The magnet can have a diameter of approximately 5mm and a length of approximately 10mm.

[0048] For insertion, a small magnet is used to guide the hearing aid into a cavity (opening, recess) of the tool and to hold the hearing aid in place. Having the recess allows for rotating the tool and thereby the hearing aid to orient the hearing aid correctly in the ear canal. The small magnet has a force, which is too low to separate the pull string magnet from the hearing aid. In other words, when the hearing aid is in place in the ear canal, the tool separates from the hearing aid with the interface maintaining attached to the attachment portion of the hearing aid.

[0049] Another concept of the tool is to have a magnet, which can be moved back and forward, for example, by a slider. When inserting the hearing aid, the tool magnet is moved forward and connected to the hearing aid magnet. This position is also the position which is used to remove the hearing aid. In order to release the hearing aid (to avoid that the pull string or the entire hearing aid follows the tool), the magnet is pulled backwards. This

means that the magnet force acting on the interface of the pull string/ the hearing aid is minimized. Thus, the tool can be removed while the pull string/ the hearing aid keeps the location/ position in the ear canal.

[0050] Since the pull string is hidden in the ear canal it can be easier recognizable by the user, if having a colour (preferably a striking colour) instead of being transparent. The more colourful string can make it easier to locate it when other people are helping or by the use of a mirror. This feature is of particular interest for people with visual impairment.

[0051] Now referring to Figures 1A to 1C, which illustrate a hearing aid 10 according to an embodiment of the disclosure as an perspective view. The attachment operation of the interface 13 to the attachment portion 12, which can be constituted by a faceplate 16 of the hearing aid 10, and the curling up of the pull member 11 is depicted. In the present embodiment, the attachment portion 12 has a seat being a recess, in which the interface 13 can rotate, as indicated in Figures 1A to 1C, thus facilitating the curling up of the pull member 11. In particular, the fixedly attached end portion 10a and the interface 13, which is detachably attached to the faceplate 16, cause the pull member 11 to form a loop. This per se ensures that the pull member 11 is hardly visible or even completely invisible from outside the ear canal. To retract the pull member 11 even further into the ear canal, a material can be chosen, which causes the curling up of the pull member 11, as described above.

[0052] Figure 1A shows a detached state of the interface 13 from the attachment portion 12. It further shows the pull member 11 in a state, in which it is almost fully extended from the hearing aid 10 into the ear canal.

[0053] Figure 1B shows an attached state of the interface 13 to the attachment portion 12. It further shows a state of the pull member 11, in which the length, by which the pull member 11 extends into the ear canal, corresponds to approximately half the length as depicted in Figure 1A, i.e., to half the length in the fully extended state of the pull member 11. In the state presented by Figure 1B the pull member 11 is not curled up.

[0054] Figure 1C shows the attached state of the interface 13. In the state depicted by Figure 1C, the pull member 11 is curled up. In this state, the pull member 11 substantially does not extend in the longitudinal direction of the ear canal. In other words, the extension length into the ear canal of the pull member 11 in this state is negligible.

[0055] Figure 2 shows one exemplary embodiment of the seat of the interface 13 at the attachment portion 12. The magnetic or magnetizable ring 14 allows rotation of the spherical interface 13 of the pull member 11 as indicated in Figure 2, thus contributing to making the hearing aid 10 invisible when in use.

[0056] Figures 3A and 3B show another embodiment of the hearing aid 10. In this embodiment, the hearing aid has a hole or recess 15, which accommodates the pull member 11, when the interface 13 is attached to the

attachment portion 12. At the end portion 11a of the pull member 11, a stop 17 is fixed, which prevents that the pull member 11 is completely detached from the hearing aid 10. In other words, the stop 17 fixes the pull member to the hearing aid 10 by abutting a limiting portion of the recess 15/the hearing aid 10.

[0057] Figure 3A shows an almost fully retracted state of the pull member 11. In this state, the pull member 11 is almost completely retracted into a recess 15 and housed therein. The interface 13 is not yet attached to the attachment portion 12. In the fully retracted state, the pull member 11 is completely accommodated in the recess 12 and the interface 13 is attached to the attachment portion 12.

[0058] Figure 3B additionally shows the system of the hearing aid 10 and the tool 20, i.e., shows the hearing device. It is depicted in Figure 3B, how the magnet 22 of the tool, which is stronger than the magnetic force generated between the interface 13 and the attachment portion 12, attracts the interface 13, thus pulling the pull member 11 out of the hearing device 10. This is done for removing the hearing aid 10 from the ear canal. The magnet 22 constitutes part of the magnetic coupling 21 of the tool 20.

[0059] Figure 3B presents an almost fully extended state of the pull member 11. In this state, the stop 17 almost abuts a limiting portion of the recess 15/the hearing aid 10. The pull member 11 almost fully extends into the ear canal due to a magnetic force exerted from the tool 20.

[0060] In the fully extended state, the stop 17 abuts the limiting portion and the pull member 11 completely extends inside the ear canal and outside the hearing aid 10.

[0061] Figures 4A and 4B show one embodiment of the tool 20. The magnetic coupling 21 of the tool 20 comprises a stronger magnet 22 and a weaker magnet 23. Further, the tool 20 has a structure 27 allowing for accommodating the hearing aid 10, as shown in Figure 4B. When the hearing aid 10 is placed in the structure 27, the interface 13 of the hearing aid 10 is arranged in a recess 26 of the tool 20. The structure 27 allows for stably holding the hearing aid 10 and for rotating the hearing aid 10 in the ear canal during the insertion operation.

[0062] The larger magnet 22 is used during the removal operation of the hearing aid 10 from the ear canal. By means of the magnet 22, the pull member 11 can be drawn out of the ear canal. Then, the pull member 11 can be used as known in the art.

[0063] It is noted that the relationship between the magnetic forces is as follows. The magnetic force, which acts between the smaller magnet 23 of the tool 20 and the magnet/magnetizable material of the attachment portion 12 and/or the interface 13 (second magnetic force) is weak. The magnetic force between the magnet/magnetizable material of the attachment portion 12 and the magnet/magnetizable material of the interface 13 (first force) is set to be larger than the second magnetic force.

The magnetic force, which acts between the larger magnet 22 of the tool 20 and the magnet/magnetizable material of the attachment portion 12 and/or the interface 13 (third magnetic force) is stronger than the first magnetic force or the second magnetic force.

[0064] Figure 5 shows another embodiment of the tool 20. In this embodiment, an electromagnet 24 is used instead of conventional magnets. Figure 5 shows the coil and the core of the magnet as well as the battery 28 and the button switch 29. Depending on the intensity of the current, the magnetic force can be adjusted. Thus, the electromagnet 24 is capable of generating the second and the third magnetic force.

[0065] Figure 6 shows still another embodiment of the tool 20, in which only one conventional magnet is used. The magnet can be moved in the longitudinal direction of the tool 20, as indicated by the arrows in the figure. The user moves the magnet by operating the slider. When the magnet approaches the hearing aid, the magnetic force becomes stronger. When the magnet is moved away from the hearing aid 10, the magnetic force becomes weaker. Thus, the single movable conventional magnet is capable of generating the second and the third magnetic force.

[0066] Figure 7 shows still another embodiment of the tool 20, in which one magnet 22, 23 is schematically depicted, which represents the coupling 21 of the tool 20. The tool 20 has a damper element 25 at (at least) one end portion in the longitudinal direction of the tool 20, which contributes to avoiding or minimizing a disturbing sound, which the user hears, when the tool 20 and the hearing aid 10 meet (abut each other), as described above.

[0067] In the embodiments described above, the interface is detachably attachable to a magnetic or magnetizable material of the attachment portion. However, a hearing aid is also feasible, in which the magnetic or magnetizable attachment portion can be dispensed with. In this case, the interface is not attached to the hearing aid housing. In such embodiment, the pull member is made shorter than in the above-described embodiments, and is made from a material, which does not allow the pull member to move easily.

[0068] It is intended that the structural features of the devices described above, either in the detailed description and/or in the claims, may be combined with steps of a method, when appropriately substituted by a corresponding process.

[0069] As used, the singular forms "a," "an," and "the" are intended to include the plural forms as well (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 there-

of. 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 elements 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.

[0070] 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.

[0071] The claims are not intended to be limited to the aspects shown herein, but is 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.

[0072] Accordingly, the scope should be judged in terms of the claims that follow.

Claims

1. Hearing aid (10) for deep-in-canal insertion, comprising
a pull member (11) being configured to be fixed to the hearing aid (10) with one end portion (11a) and to remove the hearing aid (10) from the canal when being pulled,
an attachment portion (12),
an interface (13) being configured to be fixed to the pull member (11), wherein the interface (13) is configured to be detachably attachable to the attachment portion (12) by a first magnetic force.
2. Hearing aid (10) according to claim 1, wherein at least a part of the interface (13) and the attachment portion (12) is a magnet or at least a part of one of the interface (13) and the attachment portion (12) is a magnet and at least a part of the other one comprises a magnetizable material.
3. Hearing aid (10) according to any of the preceding
- claims, wherein the interface (13) is spherical and the attachment portion (12) comprises a ring magnet (14).
4. Hearing aid (10) according to any of the preceding claims, wherein the pull member (11) comprises nylon or aramid and is preferably composed of nylon or aramid.
5. Hearing aid (10) according to any of the preceding claims, wherein the pull member (11) is a cord and comprises or is composed of a shape memory material, preferably a polymer, and the pull member (11) is configured to be curled when the interface (13) is attached to the attachment portion (12).
6. Hearing aid (10) according to any of the preceding claims, comprising a hole (15) being configured to accommodate the pull member (11) when the interface (13) is attached to the attachment portion (12).
7. Hearing aid (10) according to any of the preceding claims, comprising a faceplate (16) at a distal end, wherein at least a part of the faceplate (16) comprises the attachment portion (12), and the interface (13) is attachable to the center of the faceplate (16).
8. Hearing aid (10) according to any of the preceding claims, comprising a disposable first module and a reusable second module, wherein the pull member (11) is fixed to the first module.
9. Hearing aid (10) according to any of the preceding claims, comprising a damper element at the attachment portion (12), and/or a GMR switch.
10. Tool (20) for inserting and removing a deep-in-canal hearing aid (10) into/from a canal, comprising a magnetic coupling (21) being configured to exert on the hearing aid (10) a second magnetic force and a third magnetic force being larger than the second magnetic force.
11. Tool (20) according to claim 10, wherein the coupling (21) comprises two magnets (22, 23) having different magnetic forces or two differently magnetizable materials, wherein the magnets (22, 23) or materials are spaced apart from each other in the longitudinal direction of the tool (20).
12. Tool (20) according to claim 10 or 11, wherein

the coupling (21) comprises one magnet or magnetizable material being configured to be displaced along the longitudinal direction of the tool (20).

13. Tool (20) according to any of the claims 10 to 12, 5
wherein
the coupling (21) comprises an electromagnet (24).
14. Tool (20) according to any of the claims 10 to 13, 10
comprising
a damper element (25) at one longitudinal end part
of the tool (20).
15. Hearing device, comprising
a hearing aid (10) according to any of the claims 1 15
to 9, and
a tool (20) according to any of the claims 10 to 14,
wherein
the hearing device is configured such that the first
magnetic force is set larger than the second mag- 20
netic force and smaller than the third magnetic force.

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FIG. 1A

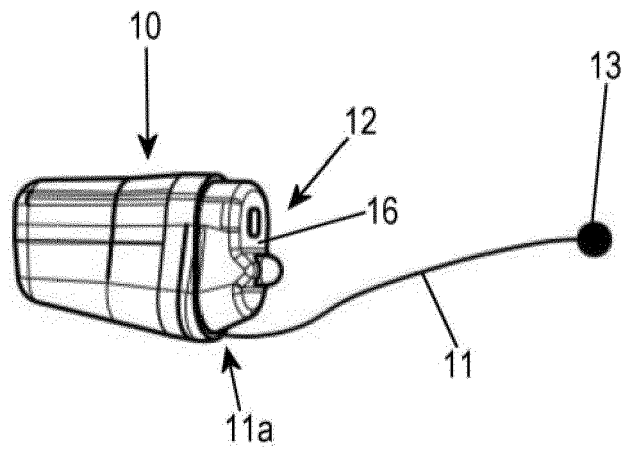


FIG. 1B

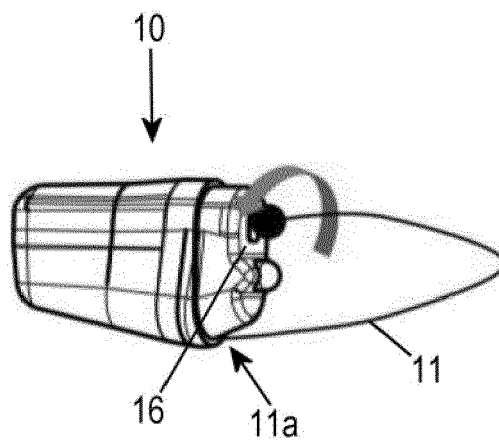


FIG. 1C

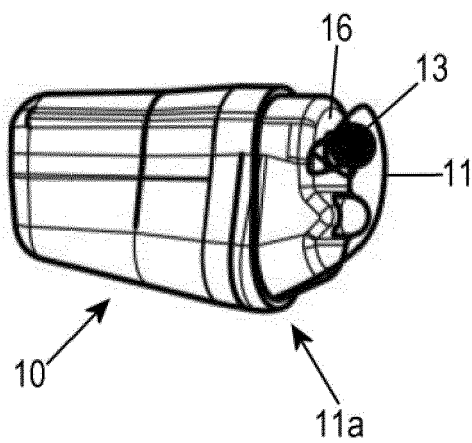


FIG. 2

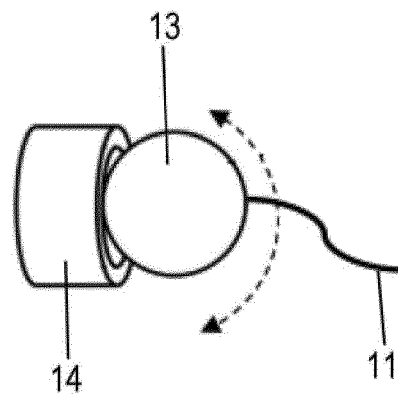


FIG. 3A

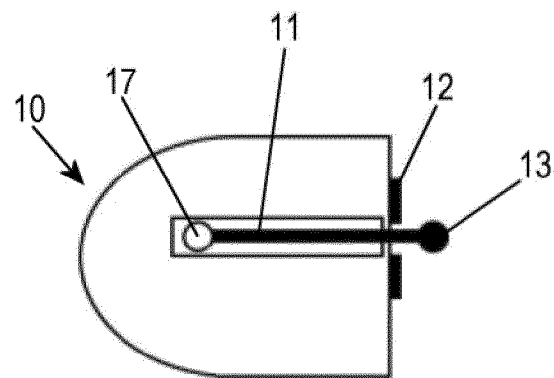


FIG. 3B

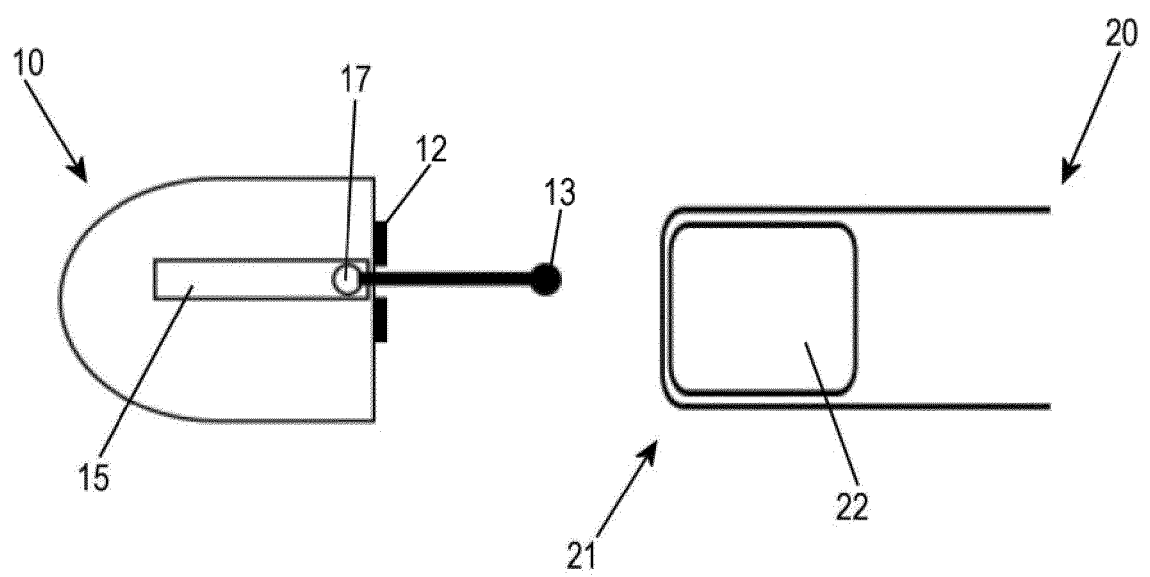


FIG. 4A

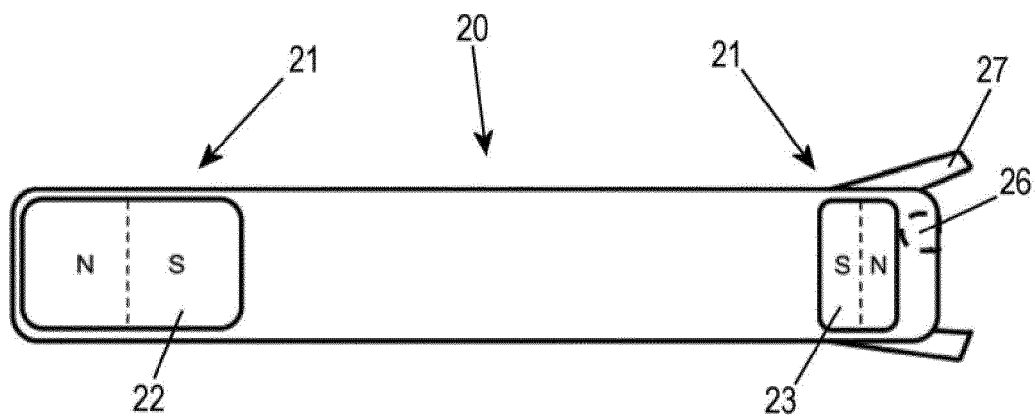


FIG. 4B

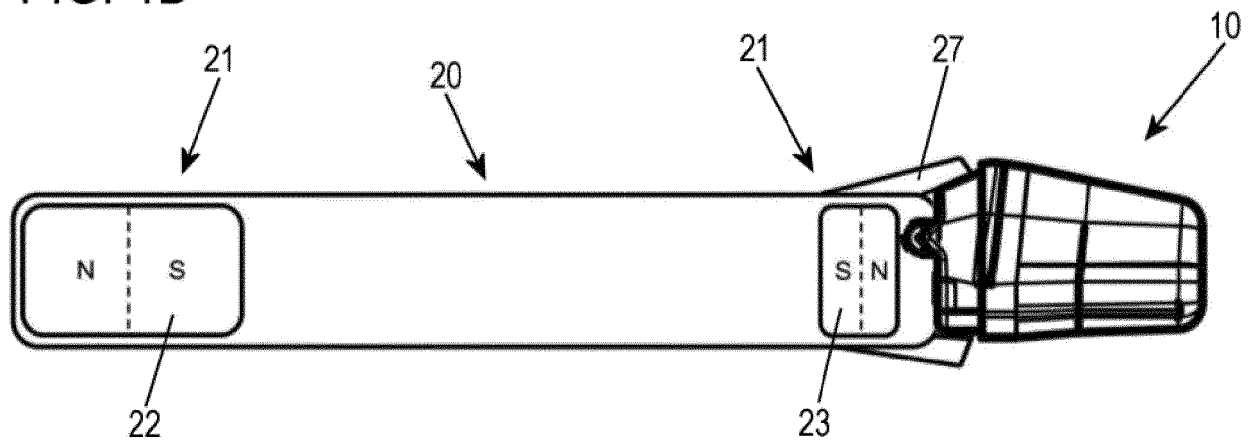


FIG. 5

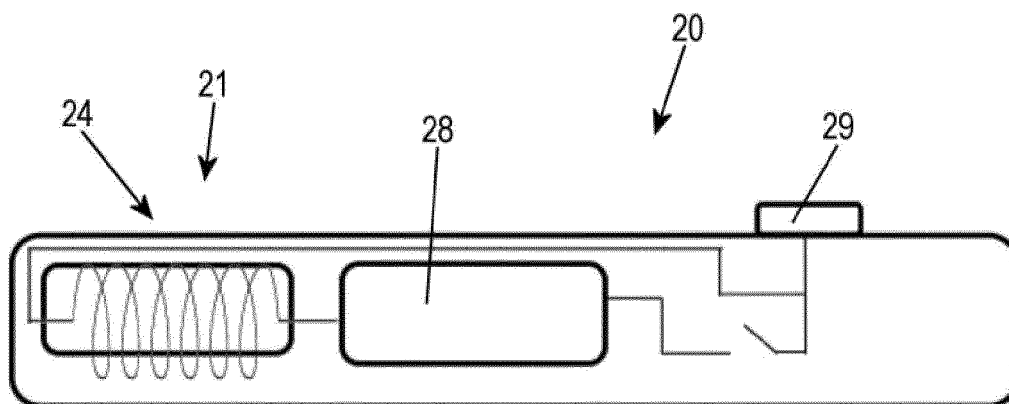


FIG. 6

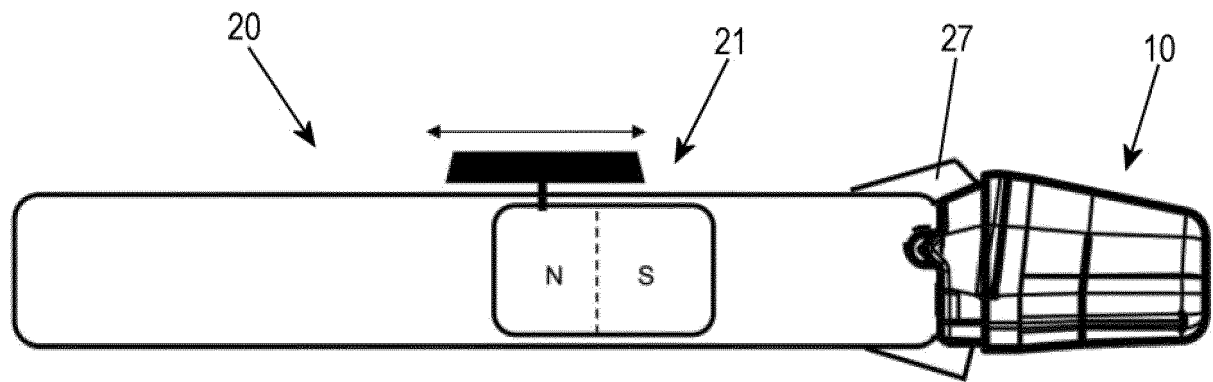
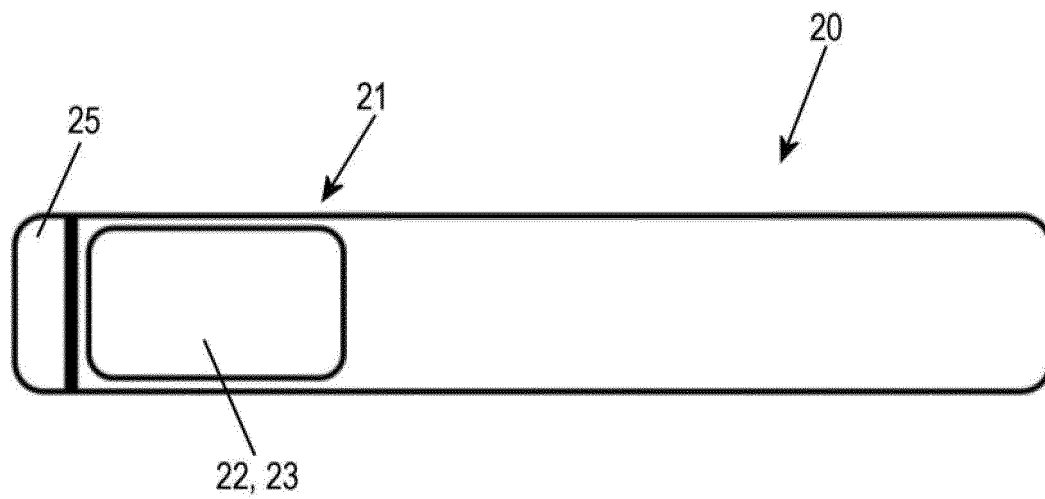


FIG. 7





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