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(54) **INSERTION AND REMOVAL TOOL FOR A HEARING AID**

(57) A tool for inserting and removing a deep-in-canal hearing aid into/from a canal is disclosed. The tool comprises a base, a coupling and a stop. The coupling is fixed to one longitudinal end portion of the base and is configured to be coupled to the deep-in-canal hearing aid. The stop is attached to the base, and is movable in the longitudinal direction of the base. The stop is configured to be fixed to the base.

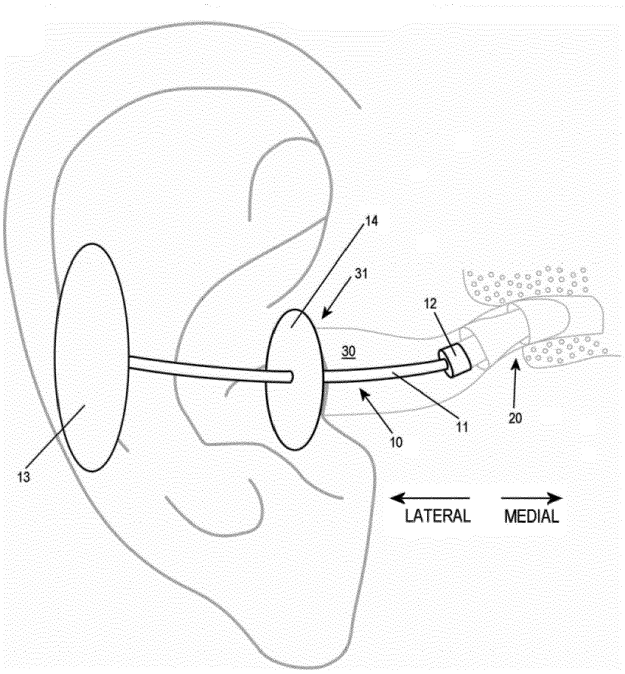

Fig. 1

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Description

FIELD

[0001] The present disclosure relates to a tool for inserting and removing a hearing aid, to a hearing device and to a kit. More particularly, the disclosure relates to a tool for inserting and removing a deep-in-canal hearing aid into/from an external acoustic meatus ((external) ear canal) of a user and/or a canal of a storage device, to a hearing device comprising the tool and the hearing aid, and to a kit comprising the tool, the hearing aid and a storage device.

BACKGROUND

[0002] Hearing instruments inserted deeply in the ear canal (deep-in-canal hearing aids) in order to obtain invisibility are difficult to handle. In some cases, the device is only to be handled by a hearing care professional. If it is made possible for the end user (user) to fully control the insertion and removal of the hearing aid, new possibilities occur and a larger user segment is addressed. The hearing instrument may, for instance, be removed when swimming or at night, when a battery charge or change is needed in case of rechargeable hearing aids or for cleaning the hearing aid. In short, in this case the handling would become more convenient for the user and the user would become less dependent on assistance by others.

[0003] Deep-in-canal hearing aids are often meant to obtain a so called bony-seal, where the hearing aid obtains a tight sealing to the ear canal wall in the innermost part of the external ear canal (the bony part of the ear canal) where the skin is very thin and the canal opening is surrounded by osseous tissue (bone tissue) instead of cartilaginous tissue.

[0004] However, obtaining this desired insertion position is difficult for many potential hearing aid users. On the one hand, the hearing aid shall not be inserted too deep into the ear canal, since the hearing aid could abut the tympanic membrane (eardrum), thus causing pain or an uncomfortable feeling to the user, or could even damage the eardrum. Hence, maintaining a safe distance of approximately 3mm from the eardrum is desirable. On the other hand, the hearing aid shall not be inserted too shallow into the ear canal, since this placement of the hearing aid would result in an incorrect acoustic amplification and a risk of occlusion problems for the user. The desired or proper insertion position differs amongst the users, since each ear canal is formed individually.

[0005] Another issue relates to inserting the hearing aid into a storage case (storage device), which is configured to charge the hearing aid battery. In case of wireless charging, it may be desirable that the hearing aid is placed in a predetermined position in the storage device, i.e., is inserted not too deep and not too shallow in the canal of the storage device. Only if the hearing aid is positioned appropriately, the power transmitting coil in the charger of the storage device is capable to deliver the necessary electromagnetic field as efficiently as possible to the hearing aid reception coil or antenna making use of the well defined position and/or orientation of the hearing aid inside the storage device.

[0006] Therefore, there is a need to provide a solution that allows for inserting a hearing aid into a canal such that the hearing aid is reliably and safely placed at a desired or predetermined position in a longitudinal direction of each canal.

SUMMARY

[0007] According to an aspect, a tool for inserting and removing a deep-in-canal hearing aid into/from a canal is provided. The hearing aid comprises a base, a coupling and a stop. The coupling is fixed to one longitudinal end portion of the base and is configured to be coupled to the deep-in-canal hearing aid. The stop is attached to the base, and is movable in the longitudinal direction of the base. The stop is configured to be fixed to the base.

[0008] This allows for simply adjusting the distance between the coupling to which the hearing aid is coupled and the stop, which prevents further insertion of the tool, i.e., for simply adjusting the insertion depth. Accordingly, the hearing aid can be inserted into the canal such that the hearing aid is reliably and safely placed at a desired or predetermined position in a longitudinal direction of each canal.

[0009] According to another aspect, a hearing device is provided. The hearing device comprises the tool according to any of the aspects presented herein, and the deep-in-canal hearing aid.

[0010] In other words, the hearing device is a system of at least the tool and the hearing aid.

[0011] According to yet another aspect, a kit is provided. The kit comprises the hearing device according to any of the aspects presented herein, and a storage device. The storage device has the canal configured to accommodate the deep-in-canal hearing aid.

[0012] This allows using the tool for both placing the hearing aid into the ear canal of the user and into the canal of the storage device while ensuring that in both cases a desired position/ insertion depth is obtained.

[0013] Preferably, a tool according to any of the aspects presented herein is provided, wherein the stop is configured to abut the inner or the outer periphery of an opening of the canal.

[0014] This allows for simply stopping the insertion operation at the desired position/ depth of the hearing aid in the canal.

[0015] Preferably, a tool according to any of the aspects presented herein is provided, wherein the stop is fixable to the base by a screw, preferably by a setscrew.

[0016] This allows for removably fixing the stop to the base. When using this configuration, the insertion depth can be adjusted to the dimension of the individual ear

canal and can be prevented from being (unintentionally) changed again. In the case that a readjustment becomes necessary, the adjusted insertion depth can be easily changed by loosening the screw. By this, the tool becomes reusable. The setscrew allows for keeping the dimensions of the tool small and for avoiding protruding parts of the tool coming into contact with the ear canal walls, thus injuring the ear canal or causing an uncomfortable feeling.

[0017] Preferably, a tool according to any of the aspects presented herein is provided, wherein the stop is fixable to the base by shrinking.

[0018] This allows for easily and durably fixing the stop to the base once the insertion depth has been adjusted.

[0019] Preferably, a tool according to any of the aspects presented herein is provided, wherein the stop is fixable to the base by adhesive bonding.

[0020] This allows for even more reliably fixing the stop to the base once the insertion depth has been adjusted.

[0021] Preferably, a tool according to any of the aspects presented herein is provided, wherein the stop is disc-shaped.

[0022] This allows for easily providing a stop having a simple structure. If the disc shape is chosen sufficiently large, the stop will work despite the size variations of the ear canals or the ear canal openings.

[0023] Preferably, a tool according to any of the aspects presented herein is provided, wherein the stop is configured to taper toward the coupling.

[0024] This allows for easily providing a stop having a simple structure. If the tapered shape of the stop is chosen sufficiently small on the side, which is directed toward the coupling (the side, which is first inserted into the canal, or the medial side), and sufficiently large on the opposite side, which is directed away from the coupling (the side, which is inserted into the canal last, or the lateral side), the stop will work despite the size variations of the ear canals. Further, since there is no abrupt abutment of the stop to the ear canal walls, which taper as well, and also due to the deformability of the skin in the bony part of the ear canal, there is a small degree of play in the longitudinal direction when the stop abuts the ear canal walls. This allows fine adjustment of the placement of the hearing aid/ of the insertion depth, which can be controlled by the increasing resistance accompanying the further insertion of the hearing aid and which is limited by the pain tolerance of the user. When using a deformable material for the stop, the fine adjustment capability of the tool can be increased even more.

[0025] Preferably, a tool according to any of the aspects presented herein is provided, wherein the base has an elongated tubular form.

[0026] This allows for further facilitating the insertion and removal operation of the haring aid, because the tool can adapt to the shape of the ear canal of the user.

[0027] Preferably, a tool according to any of the aspects presented herein is provided, wherein the base has an elongated form and is flexible, and is thus configured to adapt to the contour of the canal.

[0028] This allows for even further facilitating the insertion and removal operation of the haring aid, because the tool can even better adapt to the shape of the ear canal of the user.

[0029] Preferably, a tool according to any of the aspects presented herein is provided, wherein the coupling is a magnetic coupling and/or a mechanical coupling.

[0030] The magnetic coupling allows for simply coupling the tool and the hearing aid without the necessity of bringing the coupling of the tool exactly in position relative to the corresponding coupling of the hearing aid. In other words, it is sufficient to bring the coupling of the tool only roughly in the vicinity of the coupling of the hearing aid so that the magnetic attractive force between the couplings ensures the proper connection. This allows for easily handling the tool, particularly for users having only limited psychomotor skills. Further, the magnetic coupling is less likely to mechanically damage other objects, e.g., when being worn in the same bag or pocket of the user. The mechanical coupling allows for firmly coupling the tool without any interference. Further, the mechanical coupling provides a constant functionality over time. Moreover, it generally allows for exerting a higher tensile force in case of the removal operation. Additionally, a mechanical coupling does not impair other magnetic devices, such as magnetic strips of cards, e.g., when being worn in the same bag or pocket of the user. The mechanical coupling is particularly suitable for rotating the hearing aid, particularly, if stops, such as protrusions and recesses, are additionally provided or simply by abutment of parts of the two couplings.

[0031] Preferably, a tool according to any of the aspects presented herein is provided, wherein the coupling comprises a hook and an eye or a bayonet joint or a biased snap-fit element.

[0032] This allows for easily providing a mechanical coupling having a small and simple structure and being easily operable by the user, while allowing for the same effects as described above in conjunction with the mechanical couplings.

[0033] Preferably, a tool according to any of the aspects presented herein is provided, wherein the tool comprises a handle. The handle is fixed to the other longitudinal end portion of the base, and is configured to be held by a user. The stop is attached to the base between the coupling and the handle in the longitudinal direction of the base.

[0034] This allows for easily handling the tool, particularly for users having only limited psychomotor skills.

[0035] Preferably, a kit according to any of the aspects presented herein is provided, wherein the kit comprises a charging unit. The charging unit is configured to charge a battery of the deep-in-canal hearing aid, preferably by wireless charging.

[0036] This allows for using the storage device for both protecting the hearing aid and the tool from the environment and charging the battery of the hearing aid at the

same time. Particularly when using wireless charging, the user does not have to connect the charging unit and the hearing aid, which is cumbersome or even impossible for persons having limited psychomotor skills. The storage unit can be configured such that the power transmitting coil of the charging unit can be placed and be (removably) fixed in the storage device in accordance with the insertion depth obtained by the tool, and particularly by the stop, when inserting the hearing aid into the storage device. This allows for delivering the necessary electromagnetic field as efficiently as possible to the hearing aid reception coil or antenna making use of the well defined position and/or orientation of the hearing aid inside the storage device.

[0037] Even though the disclosure particularly relates to deep-in-canal hearing aids, it is also applicable to Completely-in-Canal (CIC) hearing aids.

BRIEF DESCRIPTION OF DRAWINGS

[0038] 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:

Figure 1 illustrates a hearing device comprising a tool and a hearing aid according to an embodiment of the disclosure, wherein the tool is used to insert the hearing aid into an ear canal of a user or is used to remove the hearing aid from the ear canal of the user;

Figure 2A illustrates a tool according to an embodiment of the disclosure;

Figure 2B illustrates a tool according to an embodiment of the disclosure, in which the stop is arranged further toward the medial side of the tool than in Figure 2A; and

Figure 2C illustrates a tool according to an embodiment of the disclosure, in which the stop is arranged even further toward the medial side of the tool than in Figure 2B.

DETAILED DESCRIPTION

[0039] 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.

[0040] 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.

[0041] The hearing aid is adapted to be worn in any known way. This may include In-the-Canal (ITC)/ Completely-in-Canal (CIC) type hearing aids.

[0042] 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.

[0043] 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.

[0044] The disclosure relates to a mechanical tool for easy insertion and removal of a deeply inserted in-the-canal hearing aid and obtaining the correct position of the aid in the ear canal.

[0045] The miniaturized hearing aid shall be removable by means of a magnetic/mechanical system, where one or more magnets are used to guide the mechanical parts and the parts are locked together by means of a mechanical hook system. Alternatively the mechanical hook system works without any magnetic support. The current disclosure deals with obtaining the correct insertion position/ depth in the individual ear canal.

[0046] Now referring to Figure 1, which illustrates a hearing device comprising a tool 10 and a hearing aid 20 according to an embodiment of the disclosure, wherein

the tool 10 is used to insert the hearing aid 20 into an ear canal 30 of a user or is used to remove the hearing aid 20 from the ear canal 30 of the user.

[0047] In particular, Figure 1 shows the hearing device consisting of the tool 10 and the hearing aid 20. The tool 10 comprises a base 11, a coupling 12, a handle 13 and a stop 14. The coupling 12, the stop 14 and the handle 13 are provided at the base 11 in this order from the medial end to the lateral end of the tool 10.

[0048] The tool 10 (base 11) is of fixed overall length. In other words, the distance from the handle 13 to the coupling 12 is fixed.

[0049] In the presented embodiment, the coupling 12 is provided at the medial tip end of the base 11, i.e., at one longitudinal end portion 11a of the base. This allows for a better coupling to the hearing aid 20. The coupling 12 is permanently fixed to the base 11.

[0050] In the present embodiment, the stop 14 and the handle 13 are disc-shaped. This provides for a large cross-sectional area while keeping both elements simple and saving material costs. The large cross-sectional area of the stop 14 provides for a save abutment. The large cross-sectional area of the handle 13 provides for a batter grip.

[0051] The handle 13 is provided at the tip end of the lateral end of the base 11, i.e., at the other longitudinal end portion of the base 11. This allows for a better handling of the tool 10 and for utilizing the whole length of the base 11 for moving the stop 14 in the lateral and medial direction in order to adjust the insertion depth of the hearing aid 20. The handle 13 is permanently fixed to the base 11.

[0052] The insertion depth of the hearing aid 20 is adjusted, preferably by a hearing care professional, before using the hearing aid 20 for the first time. To adjust the insertion depth, the hearing aid 20 is carefully inserted into the ear canal 30 until it reaches the predetermined position. At this time, the stop 14 is movable along the base 11. Before inserting the hearing aid 20, the stop 14 can be moved far toward the medial side of the base 11, so that it quickly abuts the pinna and then slides on the base 11, when the base 11 is inserted further into the ear canal 30.

[0053] After reaching the predetermined position/ depth, the stop 14 is directly fixed to the base 11, while the tool 10 and the hearing aid 20 are still inserted in the ear canal 30. Alternatively, the tool 10 and the hearing aid 20 can be carefully removed from the ear canal 30, while temporarily fixing/ holding the stop 14 so that it does not slide along the base 11. The stop 14 is then fixed to the base 11, while the tool 10 and the hearing aid 20 are removed from the ear canal 30.

[0054] In short, the tool 10 includes the stop 14, which is adjusted in position according to the individual ear canal 30 dimensions. This adjustment is preferably done by the hearing care professional as part of the initial fitting, and as a result, the stop 14 is fixed in the correct position either by a screw, by glue, by heating or by other means.

[0055] The fixing can be done by any suitable means, such as by bonding using an adhesive, by screwing it to the base 11 or by shrinking. The shrinking can be done by heating the stop 14 or by placing the stop 14 on a sleeve (not shown), which is inserted into the central hole of the stop 14 and around the base 11. After being heated, the stop 14 or the sleeve shrink and provide a force fit (frictional connection) with the base 11.

[0056] Once the stop 14 is fixed to the base 11, the user can safely insert the hearing aid 20 into the ear canal 30 without the risk of damaging the eardrum.

[0057] For inserting the hearing aid 20 into the ear canal 30 or for removing the hearing aid 20 from the ear canal 30, the coupling 12 is coupled to (connected to, engaged with) a (not shown) coupling of the hearing aid 20. Then, the hearing aid 20 is inserted until the stop 14 abuts the outer periphery of an opening 31 of the ear canal 30, i.e., abuts a part of the pinna. Alternatively (depending on the size of the disc-shaped stop 14 or if the stop 14 has a different shape, such as a conical shape), the stop 14 can abut the inner periphery of the opening 31 of the ear canal 30. Subsequently, the tool 10 is decoupled (disconnected, disengaged) from the coupling of the hearing aid 20 and is removed from the ear canal 30.

[0058] Figure 2A illustrates a tool 10 according to an embodiment of the disclosure. The stop 14 is arranged more on the lateral side than on the medial side of the base 11. This adjustment of the stop 14 results from a relatively large length of the ear canal 20 of a user. In other words, with this arrangement, the hearing aid 20 can be inserted relatively deep into the ear canal 20.

[0059] Figure 2B illustrates a tool 10 according to an embodiment of the disclosure in which the stop 14 is arranged further toward the medial side of the tool 10 than in the tool 10 shown in Figure 2A. The stop 14 is arranged approximately in the center of the base 11 in the longitudinal direction of the base 11. This adjustment of the stop 14 results from a smaller length of the ear canal 20 of a user than the length according to which the tool 10 of Figure 2A has been adjusted. In other words, with this arrangement, the hearing aid 20 cannot be inserted as deep into the ear canal 20 as with the tool 12 shown in Figure 2A.

[0060] Figure 2C illustrates a tool 10 according to an embodiment of the disclosure in which the stop 14 is arranged even further toward the medial side of the tool 10 than in the tool 10 shown in Figure 2B. The stop 14 is arranged more on the medial side than on the lateral side of the base 11. This adjustment of the stop 14 results from a relatively short length of the ear canal 20 of a user. In other words, with this arrangement, the hearing aid 20 cannot be inserted as deep into the ear canal 20 as with the tool 12 shown in Figure 2B.

[0061] In short, Figures 2A to 2C show the tool 10, where the stop 14 is shown in three different positions, Figure 2C representing the shortest ear canal 30 length.

[0062] According to a further embodiment of the disclosure, the tool 10 can be used for inserting the hearing aid 20 into a storage device (not shown). The storage device has a canal (opening), which corresponds to the ear canal 30 of the user.

[0063] Preferably, the storage device and the canal thereof have one or only a few standard sizes. The length of the storage device substantially corresponds to the length of the tool 10 (the base 11). The width of the storage device substantially corresponds to the width of the tool 10 (the dimensions of the handle 13 or the stop 14) and the hearing aid 20. The height of the storage device substantially corresponds to the height of the tool 10 (the dimensions of the handle 13 or the stop 14).

[0064] In this storage device, a charging unit is provided movably in the longitudinal direction of the storage device. The dimensions of the storage device then increase accordingly. The location of the storage device can be adjusted to the insertion depth of the tool 10. In particular, the hearing aid 20 is inserted into the canal by means of the tool 10, until the stop 14 abuts (a part of) the storage device. If the storage device has a openable cover, the predetermined position in the storage device can be easily recognized. Then, the charging unit is moved in the vicinity of the predetermined position and is fixed within the storage device. Thus, the battery of the hearing aid can be recharged efficiently.

[0065] This structure of the storage device is particularly desirable in the case that the charging unit is a wireless charging unit. However, a wired charging unit may also utilize this structure, e.g., if a delicate (sensitive) plug-and-socket-connection is used to which only small forces should be applied. In this case, the stop 14 provides for limiting the compressive force on the connection during insertion, thus protecting the connection from being damaged.

[0066] 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.

[0067] 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 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 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.

[0068] 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.

[0069] 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.

[0070] Accordingly, the scope should be judged in terms of the claims that follow.

Claims

1. Tool (10) for inserting and removing a deep-in-canal hearing aid (20) into/from a canal (30), comprising
   a base (11),
   a coupling (12) being fixed to one longitudinal end portion (11a) of the base (11) and being configured to be coupled to the deep-in-canal hearing aid (20), and
   a stop (14) being attached to the base (11), and being movable in the longitudinal direction of the base (11), wherein
   the stop (14) is configured to be fixed to the base (11).

2. Tool (10) according to claim 1, wherein
   the stop (14) is configured to abut the inner or the outer periphery of an opening (31) of the canal (30).

3. Tool (10) according to any of the preceding claims, wherein
   the stop (14) is fixable to the base (11) by a screw, preferably by a setscrew.

4. Tool (10) according to any of the preceding claims, wherein
   the stop (14) is fixable to the base (11) by shrinking.

5. Tool (10) according to any of the preceding claims, wherein

the stop (14) is fixable to the base (11) by adhesive bonding.

6. Tool (10) according to any of the preceding claims, wherein
the stop (14) is disc-shaped.

7. Tool (10) according to any of the preceding claims, wherein
the stop (14) is configured to taper toward the coupling (12).

8. Tool (10) according to any of the preceding claims, wherein
the base (11) has an elongated tubular form.

9. Tool (10) according to any of the preceding claims, wherein
the base (11) has an elongated form and is flexible, and is thus configured to adapt to the contour of the canal (30).

10. Tool (10) according to any of the preceding claims, wherein
the coupling (12) is a magnetic and/or mechanical coupling.

11. Tool (10) according to any of the preceding claims, wherein
the coupling (12) comprises a hook and an eye or a bayonet joint or a biased snap-fit element.

12. Tool (10) according to any of the preceding claims, comprising
a handle (13), being fixed to the other longitudinal end portion (11b) of the base (11), and being configured to be held by a user, wherein
the stop (10) is attached to the base (11) between the coupling (12) and the handle (13) in the longitudinal direction of the base (11).

13. Hearing device, comprising
the tool (10) according to any of the preceding claims, and
the deep-in-canal hearing aid (20).

14. Kit, comprising
the hearing device according to claim 13, and
a storage device having the canal (30) configured to accommodate the deep-in-canal hearing aid (20).

15. Kit according to claim 14, comprising
a charging unit configured to charge a battery of the deep-in-canal hearing aid (20), preferably by wireless charging.

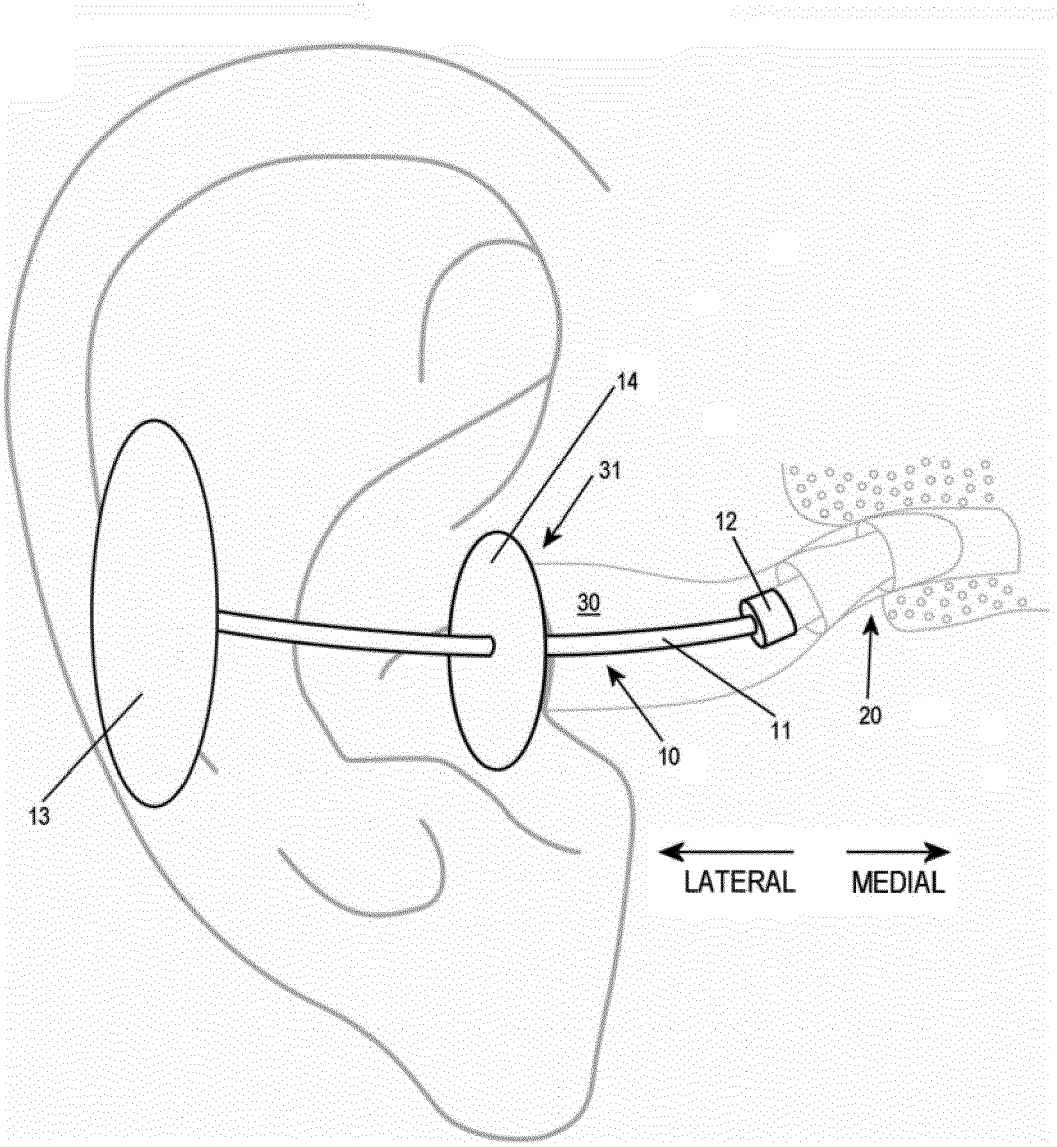

Fig. 1

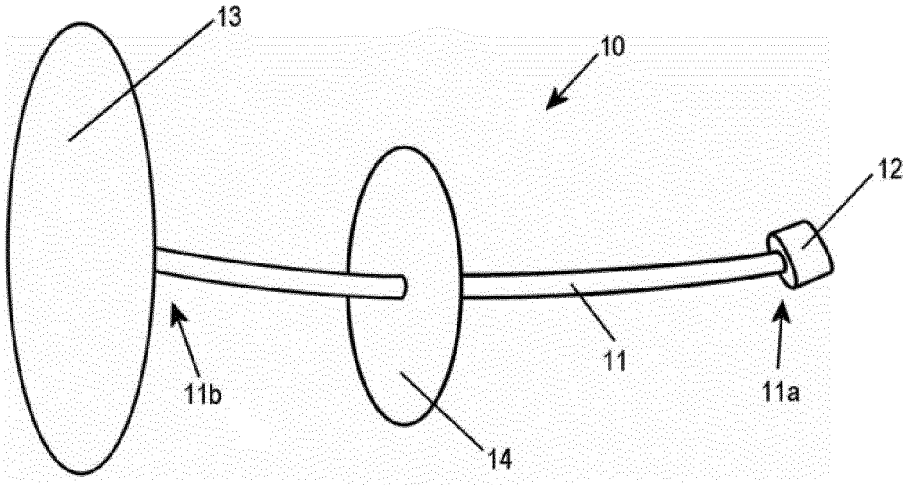

Fig. 2A

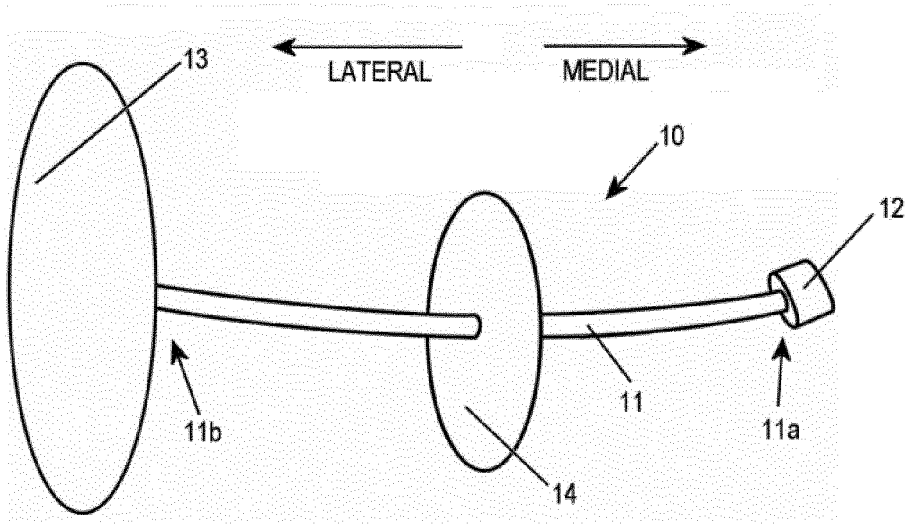

Fig. 2B

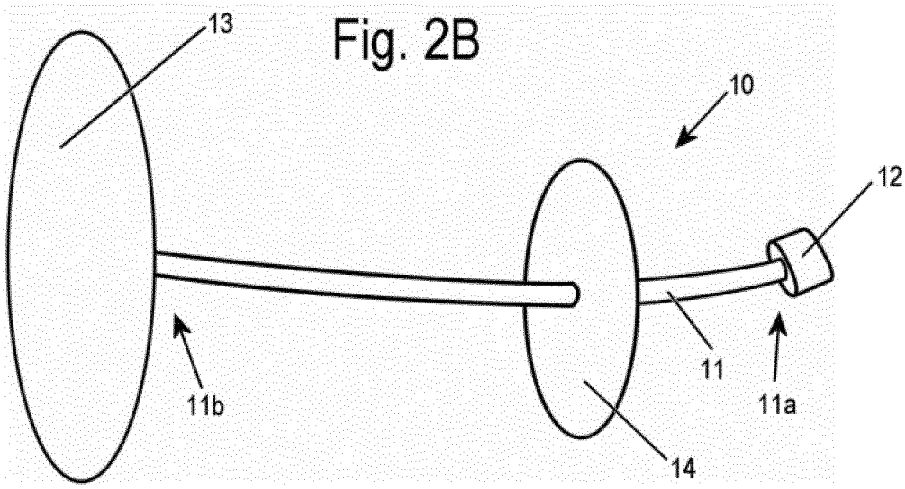

Fig. 2C

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 18 20 5988

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	WO 2013/126749 A1 (ARIA INNOVATIONS INC [US]) 29 August 2013 (2013-08-29) * abstract * * paragraph [0042] - paragraph [0057] * * figures 1-3 *	1-13 14,15	INV. H04R25/00
X Y	US 2011/188692 A1 (NAUMANN FRANK [DE] ET AL) 4 August 2011 (2011-08-04) * abstract * * paragraph [0018] * * paragraph [0023] * * paragraph [0039] - paragraph [0040] * * paragraph [0050] * * figures 2,3,6,7 *	1-13 14,15	
X Y	EP 2 040 488 A2 (SIEMENS MEDICAL INSTR PTE LTD [SG]) 25 March 2009 (2009-03-25) * abstract * * paragraph [0016] * * figures 2,5 *	1,13 14,15	
Y	US 2014/254844 A1 (SHENNIB ADNAN [US] ET AL) 11 September 2014 (2014-09-11) * paragraph [0037] * * figure 9 *	14,15	TECHNICAL FIELDS SEARCHED (IPC) H04R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	26 April 2019	Fülöp, István

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