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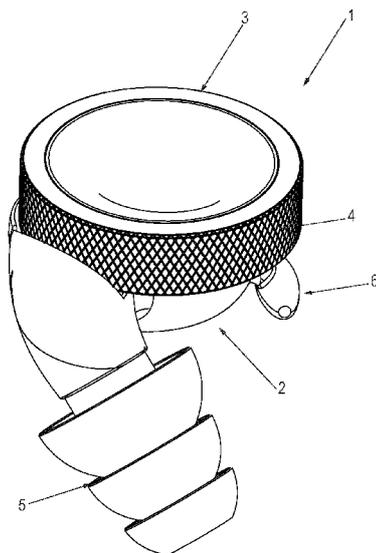


Fig. 1

(57) Abstract: The present invention relates to an adjustable hearing protection device for arranging in and/or on the ear, the hearing protection device comprising: - a housing with an acoustic entrance opening, - an insertion part for inserting into an auditory canal of the ear extending from the housing with an acoustic exit opening oriented toward the interior of the auditory canal, - adjusting means for adjusting the hearing protection device to one of at least two acoustic adjustment positions, wherein - each acoustic adjustment position sets one of a number of acoustic couplings between the entrance opening and the exit opening.



**ADJUSTABLE HEARING PROTECTION DEVICE**

The present invention relates to an adjustable hearing protection device for arranging in and/or on the ear for the purpose of providing a number of distinct settings for the measure of protection of the ear.

The use of earplugs to protect hearing is known. Many types of protection by means of earplugs have been developed. Simple forms of protection provided a certain measure of damping of ambient sound by blocking the auditory canal of the ear. Such a blockage also distorts the sound, whereby the origin of the sound is less readily discernible by the user.

This is however a drawback when listening to music or voices since high quality is usually desired when listening to music or voices even when these are reproduced loudly. Earplugs have therefore been developed in which a partially continuous air channel is realized by means of filters in that the filter comprises a diaphragm with a small opening. Hereby realized on the one hand is a high degree of damping and on the other that the sound is transmitted with certain quality.

The present inventor has established that such an operating principle also has a drawback. Such an earplug is not able to modify the damping to changing conditions. When the user moves from a space with a very high sound level to a space with a very low sound level while wearing an earplug with a high damping, and thereby a greater protection, the user cannot then function properly in the space with the low sound level because the damping is too high to allow passage of the low sound level. The drawback here is that the wearer has to alternate insertion and removal of the earplug in order to adapt to the conditions.

In order to obviate such a drawback the present invention provides an adjustable hearing protection device for arranging in and/or on the ear, the hearing protection device comprising:

5           - a housing with an acoustic entrance opening,  
          - an insertion part for inserting into an auditory canal of the ear extending from the housing with an acoustic exit opening oriented toward the interior of the auditory canal,

10           - adjusting means for adjusting the hearing protection device to one of at least two acoustic adjustment positions, wherein

          - each acoustic adjustment position sets one of a number of acoustic couplings between the entrance opening  
15 and the exit opening.

A first important advantage of such a hearing protection device is that it is adaptable to conditions where a high damping is desired and conditions where a low damping is desired. An example hereof is a hearing protection  
20 device with four adjustment positions, a very high damping, a high measure of damping, a moderate damping and a position without damping. Using such a hearing protection device set to the high protection adjustment position a user can enter a space with a high sound intensity without  
25 damaging his/her hearing. By applying a suitable filter a high degree of sound quality can be realized here with a high measure of damping. When leaving the space and arriving in a space with a low sound level where the user has to focus on voices, he/she can easily modify the adjust-  
30 ment position in order to be easily able to understand the voices in a position with low damping or no damping.

In a first preferred embodiment the adjusting means in the hearing protection device comprise a revolver,

which revolver can be positioned rotatably so as to correspond to each adjustment position. It hereby becomes possible in simple manner to adjust the hearing protection device by means of a rotating turning movement of the revolver. Since the hearing protection device is situated at the ear, it can easily be reached with the hand so as to easily perform the turning movement. In alternative manner the adjusting means comprise a slide, which slide can be positioned slidably so as to correspond to each adjustment position. Depending on the preference of the user, such a movement can be performed easily for the purpose of setting the adjusting means.

According to a further preferred embodiment, each acoustic coupling is provided by a predetermined combination of at least one filter and/or at least one channel configuration. Provision is for instance made that the same filter or channel part can be applied in different acoustic couplings when they are arranged in series or in parallel in each respective acoustic coupling.

At least one of the at least one filter is preferably arrangeable here in the housing. In alternative manner at least one of the at least one filter is arrangeable in the adjusting means. In an embodiment in which one or more filters are arranged in the revolver, they provide, together with filters and/or channel parts of the housing, an acoustic coupling when they are arranged coupled acoustically in an adjustment position.

In a further preferred embodiment at least one of the acoustic couplings provides a substantially unobstructed acoustic passage for sound. A variant with a position with substantially normal hearing function is possible by applying such a preferred embodiment.

In alternative manner the hearing protection device

more preferably provides in at least one of the acoustic couplings an acoustic coupling configured to simulate or substantially simulate an acoustic coupling such as is provided by an empty auditory canal. The human auditory canal provides a determined acoustic coupling between the eardrum and the surrounding area. This acoustic coupling serves to provide a resonance for the purpose of providing an amplification of determined frequencies, particularly in the range between 2000 and 4000 Hz.

10 A hearing protection device according to the present invention disrupts this natural resonance in the auditory canal just as any blockage or partial blockage of the auditory canal would do. The present preferred embodiment obviates such a drawback by simulating this natural resonance in the hearing protection device by providing one or more resonance spaces therein. Within the context of the present description these resonance spaces can be modified experimentally to the ear, and more preferably take into account the remaining part of the auditory canal for the purpose of providing the most natural possible reproduction to the eardrum. At least one of the acoustic couplings more preferably comprises a Helmholtz resonator. A Helmholtz generator is a space for resonance with a certain volume with two openings arranged substantially opposite each other, an entrance opening and an exit opening of the chamber.

According to a further preferred embodiment, the device comprises acoustic channel parts and/or filters arranged serially and/or parallel relative to each other. Predetermined combinations of acoustic couplings are hereby arrangeable in the housing and/or adjusting means.

For the purpose of providing a desired damping effect the at least one filter provides a damping effect on

the acoustic coupling by means of a narrowest part of a channel passage with a length greater than the diameter, preferably greater than twice the diameter, more preferably greater than four times the diameter, more preferably greater than five times the diameter, more preferably greater than ten times the diameter. By means of this measure the present inventor identifies in experimental manner a relation between the length of the channel and the damping effect, whereby the inventor disassociates himself from a damping effect by means of a substantially pointed narrowing of the passage. The present inventor provides a relatively long channel with a relatively large cross-section for the purpose of providing a similar damping with a very short cut-off point with a very small diameter.

The entrance opening more preferably comprises a substantially cone-shaped or horn-shaped member for receiving a sufficient amount of sound to provide sufficient quality following damping thereof.

According to a further preferred embodiment, the adjusting means, preferably the substantially cone-shaped or horn-shaped member, in the hearing protection device comprise biasing means, such as a deformable wall part, for imparting a bias to a wall part comprising a passage opening for sound for the purpose of moving this passage opening to the position of an acoustic coupling to be selected. Because the wall part comprising a passage opening is brought under bias by biasing means, leakage of sound other than via the selected acoustic coupling can be impeded or prevented. The quality of the selected acoustic coupling is hereby enhanced.

According to a further preferred embodiment, a wall part of the adjusting means, such as comprising the pas-

sage opening, is congruent with a wall part of the housing whereby this wall part of the adjusting means provides an acoustic seal for at least one acoustic coupling other than the adjusted acoustic coupling. Leakage of sound other than via the selected acoustic coupling is hereby also  
5 impeded or prevented.

It is particularly advantageous to apply the bias in combination with the congruity of said wall parts. The congruent wall of the adjusting means is pressed here un-  
10 der bias against the congruent wall of the housing, thereby preventing in optimal manner the separation of the acoustic couplings and other leakages of sound.

In a further preferred embodiment at least one acoustic coupling more preferably comprises an elongate  
15 channel which is preferably formed as a channel through a solid body, more preferably by means of a hose through a hollow space. Such an elongate channel provides the advantage that a reliable and considerable acoustic damping is provided with good results. This is possible because  
20 sufficient space is available herefor in the housing of the hearing protection device according to the present invention and/or preferred embodiment, this in contrast to a hearing protection device with a substantially short straight channel placed axially in the auditory canal. The  
25 filters required for such protection having a short channel suitable therefor with a cross-section of substantially a tenth of a millimetre or less for a sufficient damping are therefore replaceable by the elongate channels as described in this document.

30 More preferably provided is a preferred embodiment with two acoustic adjustment positions and two acoustic couplings. These are preferably disposed in a sliding arrangement .

According to a further preferred embodiment, the hearing protection device comprises indicator means discernible by touch for discerning at least one adjustment position by feel. The acoustic coupling is hereby always provided in reliable manner by correctly reaching the associated adjustment position. This takes place in a manner which is easy for the user to discern outside the field of vision of the user.

The device more preferably comprises at least one intermediate stop position for the purpose of providing positioning of the adjusting means relative to an acoustic adjustment position. The adjusting means are hereby held in an adjustment position in advantageous manner.

According to a further preferred embodiment, a support member is oriented substantially upward for the purpose of engaging an edge of the external ear when the hearing protection device is arranged in the ear. This engagement on an edge of the external ear contributes toward a stable Seating' of the device in the ear.

The hearing protection device more preferably comprises individually, or in combination with the support member, an ear contact surface on the underside for supporting thereof by parts of the ear on the underside of the hearing protection device when it is arranged in the ear. Preferably in combination the support member and the ear contact surface on the underside provide, preferably in further combination with the insertion part, the said stable Seating' in an ear as a whole. Through the distribution of contact this placing in the ear also provides a high degree of comfort when the hearing protection device is arranged in the ear.

Tactile indication and/or the intermediate stop position is for this purpose provided in advantageous manner

by magnetic action.

The housing more preferably comprises a receiving chamber for receiving an adjustable element of the adjusting means, and wherein the adjusting means comprise the adjustable element for arrangement thereof at the receiving chamber of the housing, wherein the adjustable element comprises the entrance opening and a passage opening for coupling thereof for the purpose of forming, in co-action with the housing, an acoustic coupling associated with an acoustic adjustment position. A device is hereby provided which can be manufactured advantageously, wherein the housing and the adjustable element can be manufactured in advantageous manner by means of for instance a forming process such as injection moulding.

The device more preferably comprises a support member or positioning member for providing a supporting or positioning effect relative to the ear. The device can hereby be positioned firmly in trustworthy manner, and the user can for instance easily set the adjusting means to another setting. The adjusting means preferably comprise a control edge for operation thereof, wherein the control edge is preferably substantially annular and protrudes from the ear during use in a manner such as to be substantially engageable by two fingers.

According to a further preferred embodiment, the entrance opening is arranged in a side of the adjusting means, or control edge, remote from the head.

Further advantages, features and details of the present invention will be described in greater detail hereinbelow on the basis of one or more preferred embodiments with reference to the accompanying figures. Similar, though not necessarily identical components of different preferred embodiments are designated with the same refer-

ence numerals.

Fig. 1-6 show a number of views of a first preferred embodiment according to the present invention.

Fig. 7 shows a schematic representation of a Helmholtz generator.

Fig. 8 shows a schematic view of a further preferred embodiment comprising a Helmholtz generator.

Fig. 9 shows a graphic representation of resonance in a natural auditory canal for simulation thereof by means of a device according to the present invention.

Fig. 10 shows a graphic representation of damping effects related to a diameter and a length of a filter channel .

Fig. 11-17 show a number of views of a further preferred embodiment according to the present invention.

Fig. 18 shows a number of views of a further preferred embodiment according to the present invention.

A first preferred embodiment (Fig. 1) according to the present invention relates to an adjustable hearing protection device 1. This comprises a housing 2 with an auditory canal element 5 arranged thereon for arrangement thereof in an auditory canal during wearing of hearing protection device 1. A substantially zeppelin-shaped support element 6 is also arranged on the ear side of the housing.

The housing comprises a receiving space 9 for receiving adjusting means 3 therein. Adjusting means 3 are embodied as a rotatable cone 7 with an operating ring 4 arranged thereon. The rotatable cone 7 forms the entrance opening of the hearing protection device and comprises a passage opening 17 for passage of sound in the direction of inlet openings 11, 12, 13 of the housing.

The shortest path for the sound through the housing

runs through opening 13 via space 23 to opening 14 in the direction of the auditory canal. A slightly longer path for the sound through the housing runs through opening 12 via space 22 and subsequently via space 23 through opening 16 through wall 16' to space 23 and further. The longest path in this preferred embodiment runs through opening 11 via space 21 through opening 15 through wall 15' in the direction of space 22 and further.

Provided in openings 15, 16 are filters (not shown) for imparting additional damping. Provision is also made that placing of filters is possible in openings 11, 12, 13 and 14. The skilled person will configure the placing of these filters and the damping effect thereof within the context of the present invention and the desired acoustic couplings. Each of these filters is therefore optional within the context of the present invention.

In the housing a magnet 31 is also arranged in opening 31' for co-action with respective magnets 32 arrangeable in openings 32' of the adjusting means. A positioning of the cone with the opening 17 relative to respective openings 11, 12, 13 is hereby realizable in tactile manner. Through the action of the magnets relative to each other the adjusting means remain positioned at the adjustment position. Provision is alternatively made that the positioning is realized by means of notches and balls placed under bias.

The cone is preferably manufactured in a manner such that the connection to the housing is sound-proof.

Fig. 7 shows the operation of a Helmholtz resonator, wherein a space 41" is provided with an inlet opening 13" and an outlet opening 14". Provided in similar manner in the preferred embodiment according to Fig. 8 is a Helmholtz generator space 41 with two respective openings 13',

14' arranged opposite each other analogously with the openings of an above preferred embodiment. A Helmholtz resonator can be arranged in the device in this way.

Shown graphically in Fig. 9 is how a natural auditory canal provides frequencies to the eardrum within the range of 2000-4000 Hz with a considerably higher sound volume than lower and higher frequencies. Provision is made that such a resonance is simulated by preferred embodiments according to the present invention.

Shown in Fig. 10 is how the sound damping is realized by applying a filter with a diameter of 0.2 mm with a respective length of 0.2 mm, 0.5 mm, 1 mm, 2 mm.

The auditory canal element 5 is arrangeable on a flange 21 and can be fitted in interchangeable manner to the ear of the user.

Fig. 11 and 12 show a number of views of a further preferred embodiment according to the present invention. Also shown here is housing 2 with auditory canal element 5 for arrangement thereof in the auditory canal during wearing of hearing protection device 1.

Cone 7 is arrangeable in receiving space 9 of the housing in rotatable manner for reaching, through opening 17 of the cone, the different channels 61, 62, 63 arranged in a solid element 64 of the housing. Three acoustic couplings are defined by means of these channels 61, 62, 63. A fourth acoustic coupling provides a maximum damping and in this case does not comprise a channel.

It is important that cone 7 is formed with a lower, thicker wall part 71 with channel 17 therein, which wall part 71 is substantially rigid for connection to a wall part with the openings for the channels of the housing. A deformable wall part 72 imparts a bias in the direction of the arrow E when the wall part is pressed downward rela-

tive to wall part 71 in the direction of arrows F. Pressing elements in the natural position 73, 74 of the material are pressed downward when the cone is arranged in the housing with adjusting ring 4 arranged thereon. Pressing  
5 elements 73, 74 are hereby brought into the positions 73', 74' relative to wall part 71. The resulting biasing force provides a sustained close connection of wall part 71 to a corresponding wall part 77 of the housing.

A suitable choice of material for the cone, such as  
10 a rubber-like material such as TPE, ensures in combination with the bias that the cone is both sealing and readily rotatable. An easy rotatability is advantageous in the device when it is arranged in the ear for the purpose of user convenience and comfort, in addition to the proper separation of the acoustic couplings and preventing leakage  
15 of sound via the acoustic couplings.

The acoustic coupling which makes use of channel 61 provides the freest passage of sound and is preferably such that voice sound is reproduced as neutrally as possible.  
20 It is hereby possible to temporarily speak to people in the vicinity by selecting this acoustic coupling.

A channel 67 is suitable to serve as a Helmholtz generator for a relative amplification of sounds in the range of 2 kHz to 6 kHz, such as the speech range of frequencies.  
25

Fig. 17 shows the contact points with the ear, such as support element 6, insertion member 5 and a contact surface 78 for contact with the interior of the ear, substantially opposite support element 6. Placing of any element in the ear is hereby possible in advantageous manner.  
30 In addition to a hearing protection device, an ear part with a sound provision is likewise provided here.

The present invention has been described in the

foregoing on the basis of several preferred embodiments. Different aspects of different embodiments are deemed described in combination with each other, wherein all combinations which can be deemed by a skilled person in the  
5 field as falling within the scope of the invention on the basis of reading of this document are included. These preferred embodiments are not limitative for the scope of protection of this document. The rights sought are defined in the appended claims.

## CLAIMS

1. Adjustable hearing protection device for arranging in and/or on the ear, the hearing protection device  
5 comprising:  
- a housing with an acoustic entrance opening,  
- an insertion part for inserting into an auditory canal  
of the ear extending from the housing with an acoustic exit  
10 opening oriented toward the interior of the auditory  
canal,  
- adjusting means for adjusting the hearing protection device to one of at least two acoustic adjustment positions,  
wherein  
- each acoustic adjustment position sets one of a number  
15 of acoustic couplings between the entrance opening and the  
exit opening.

2. Hearing protection device as claimed in claim 1,  
wherein the adjusting means comprise a revolver, which re-  
20 volver can be positioned rotatably so as to correspond to  
each adjustment position.

3. Hearing protection device as claimed in claim 1  
or 2, wherein the adjusting means comprise a slide, which  
25 slide can be positioned slidably so as to correspond to  
each adjustment position.

4. Hearing protection device as claimed in one or  
more of the foregoing claims, wherein each acoustic cou-  
30 pling is provided by a predetermined combination of at  
least one filter and/or at least one channel configura-  
tion.

5. Hearing protection device as claimed in one or more of the foregoing claims, wherein at least one of the at least one filter is arrangeable in the housing.

5       6. Hearing protection device as claimed in one or more of the foregoing claims, wherein at least one of the at least one filter is arrangeable in the adjusting means.

7. Hearing protection device as claimed in one or  
10 more of the foregoing claims, wherein at least one of the acoustic couplings provides a substantially unobstructed acoustic passage for sound.

8. Hearing protection device as claimed in one or  
15 more of the foregoing claims, wherein at least one of the acoustic couplings provides an acoustic coupling configured to simulate or substantially simulate an acoustic coupling such as is provided by an empty auditory canal.

20       9. Hearing protection device as claimed in one or more of the foregoing claims, wherein at least one of the acoustic couplings comprises a Helmholtz resonator.

10. Hearing protection device as claimed in one or  
25 more of the foregoing claims, comprising acoustic channel parts and/or filters arranged serially relative to each other .

11. Hearing protection device as claimed in one or  
30 more of the foregoing claims, comprising acoustic channel parts and/or filters arranged parallel relative to each other .

12. Hearing protection device as claimed in one or more of the foregoing claims, the at least one filter providing a damping effect on the acoustic coupling by means of a narrowest part of a channel passage with a  
5 length greater than the diameter, preferably greater than twice the diameter, more preferably greater than four times the diameter, more preferably greater than five times the diameter, more preferably greater than ten times the diameter.

10

13. Hearing protection device as claimed in one or more of the foregoing claims, wherein the entrance opening comprises a substantially cone-shaped or horn-shaped member.

15

14. Hearing protection device as claimed in one or more of the foregoing claims, wherein the adjusting means, preferably the substantially cone-shaped or horn-shaped member, comprise biasing means, such as a deformable wall  
20 part, for imparting a bias to a wall part comprising a passage opening for sound for the purpose of moving this passage opening to the position of an acoustic coupling to be selected.

25

15. Hearing protection device as claimed in one or more of the foregoing claims, wherein a wall part of the adjusting means, such as comprising the passage opening, is congruent with a wall part of the housing whereby this wall part of the adjusting means provides an acoustic seal  
30 for at least one acoustic coupling other than the adjusted acoustic coupling.

16. Hearing protection device as claimed in one or

more of the foregoing claims, wherein at least one acoustic coupling comprises an elongate channel which is preferably formed as a channel through a solid body, more preferably by means of a hose through a hollow space.

5

17. Hearing protection device as claimed in claim 3, comprising two acoustic adjustment positions and two acoustic couplings.

10

18. Hearing protection device as claimed in one or more of the foregoing claims, comprising indicator means discernible by touch for discerning at least one adjustment position by feel.

15

19. Hearing protection device as claimed in one or more of the foregoing claims, comprising at least one intermediate stop position for the purpose of providing positioning of the adjusting means relative to an acoustic adjustment position.

20

20. Hearing protection device as claimed in claim 18 or 19, wherein tactile indication and/or the intermediate stop position is provided by magnetic action.

25

21. Hearing protection device as claimed in one or more of the foregoing claims, wherein the housing comprises a receiving chamber for receiving an adjustable element of the adjusting means, and wherein the adjusting means comprise the adjustable element for arrangement thereof at the receiving chamber of the housing, wherein the adjustable element comprises the entrance opening and the passage opening for coupling thereof for the purpose of forming, in co-action with the housing, an acoustic coupling asso-

30

ciated with an acoustic adjustment position,,

22. Hearing protection device as claimed in one or more of the foregoing claims, comprising a support member  
5 or positioning member for providing a supporting or positioning effect relative to the ear.

23. Hearing protection device as claimed in the foregoing claim, wherein the support member is oriented  
10 substantially upward for the purpose of engaging an edge of the external ear when the hearing protection device is arranged in the ear.

24. Hearing protection device as claimed in the two  
15 foregoing claims, comprising an ear contact surface on the underside for supporting thereof by parts of the ear on the underside of the hearing protection device when it is arranged in the ear.

20 25. Hearing protection device as claimed in one or more of the foregoing claims, wherein the adjusting means comprise a control edge for operation thereof, wherein the control edge is preferably substantially annular and is arranged outside the ear during use in a manner such as to  
25 be substantially engageable by two fingers.

26. Hearing protection device as claimed in one or more of the foregoing claims, wherein the entrance opening is arranged in a side of the adjusting means, or control  
30 edge, remote from the head.

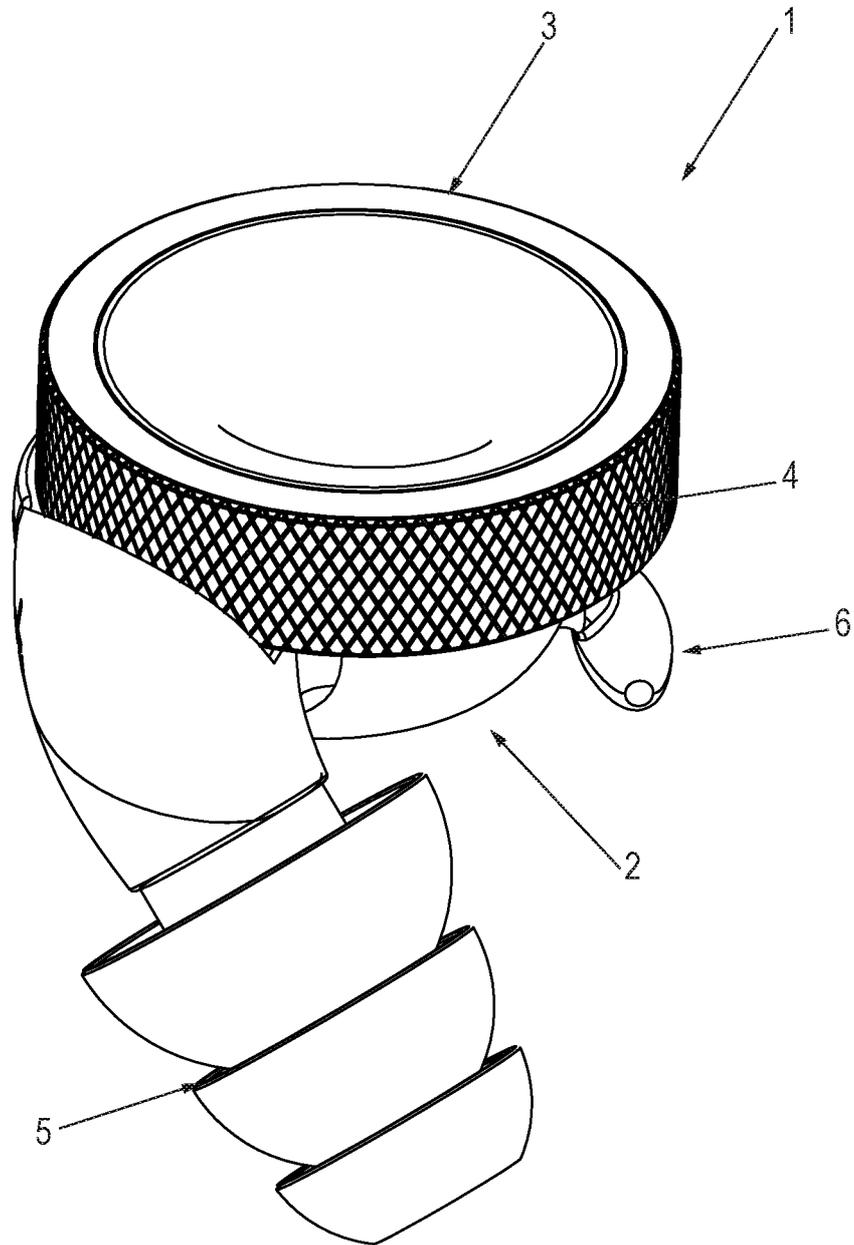


Fig. 1

2 / 15

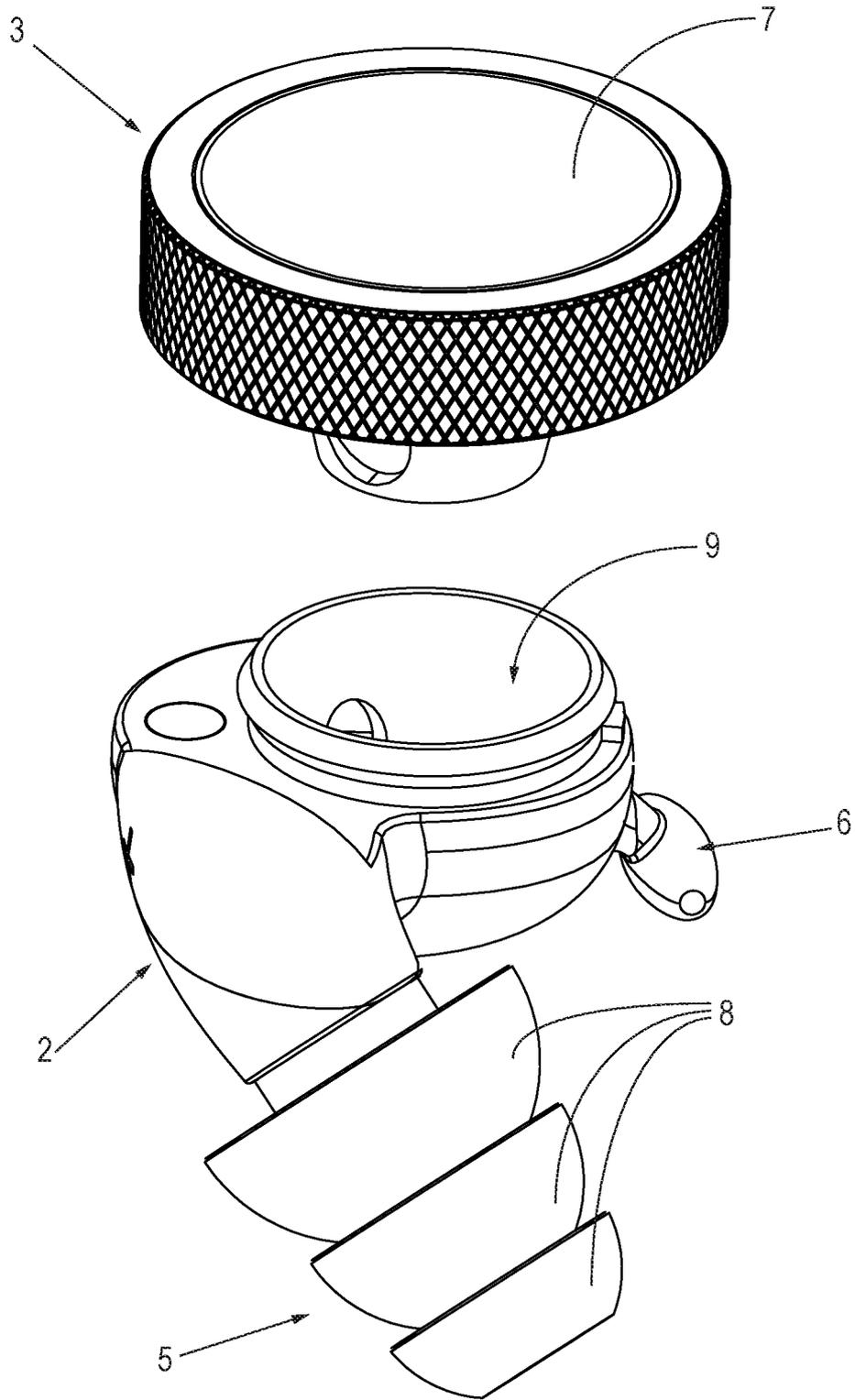


Fig. 2

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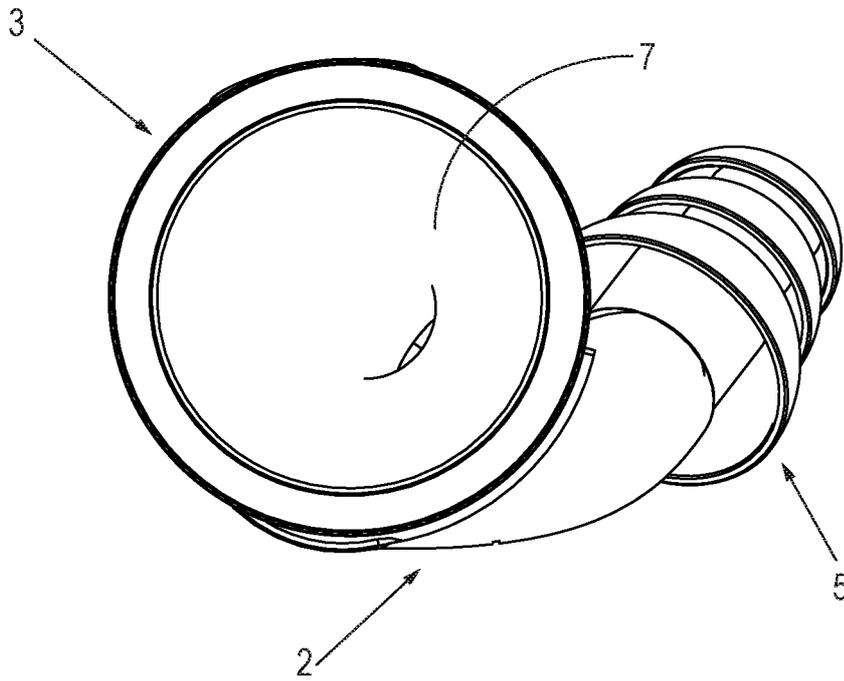


Fig. 3

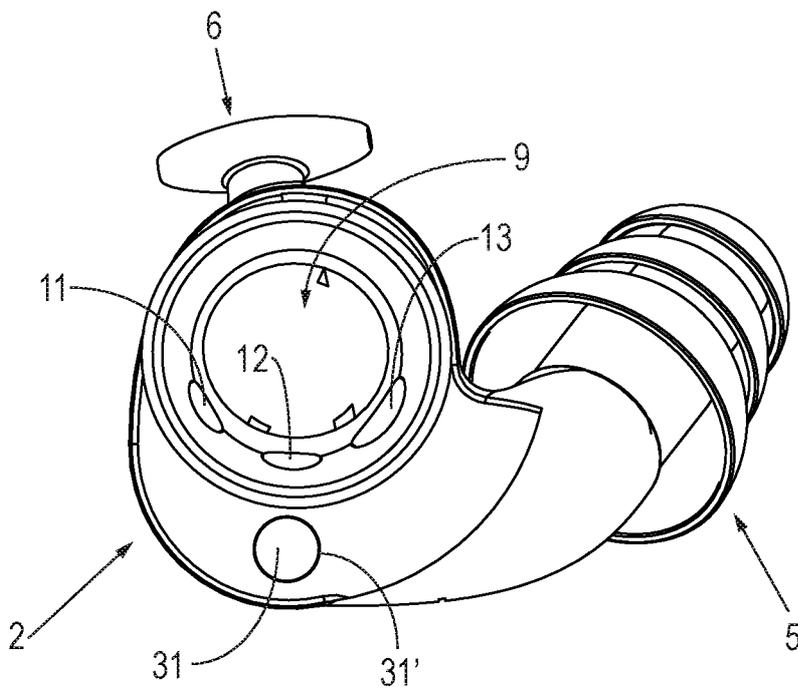


Fig. 4

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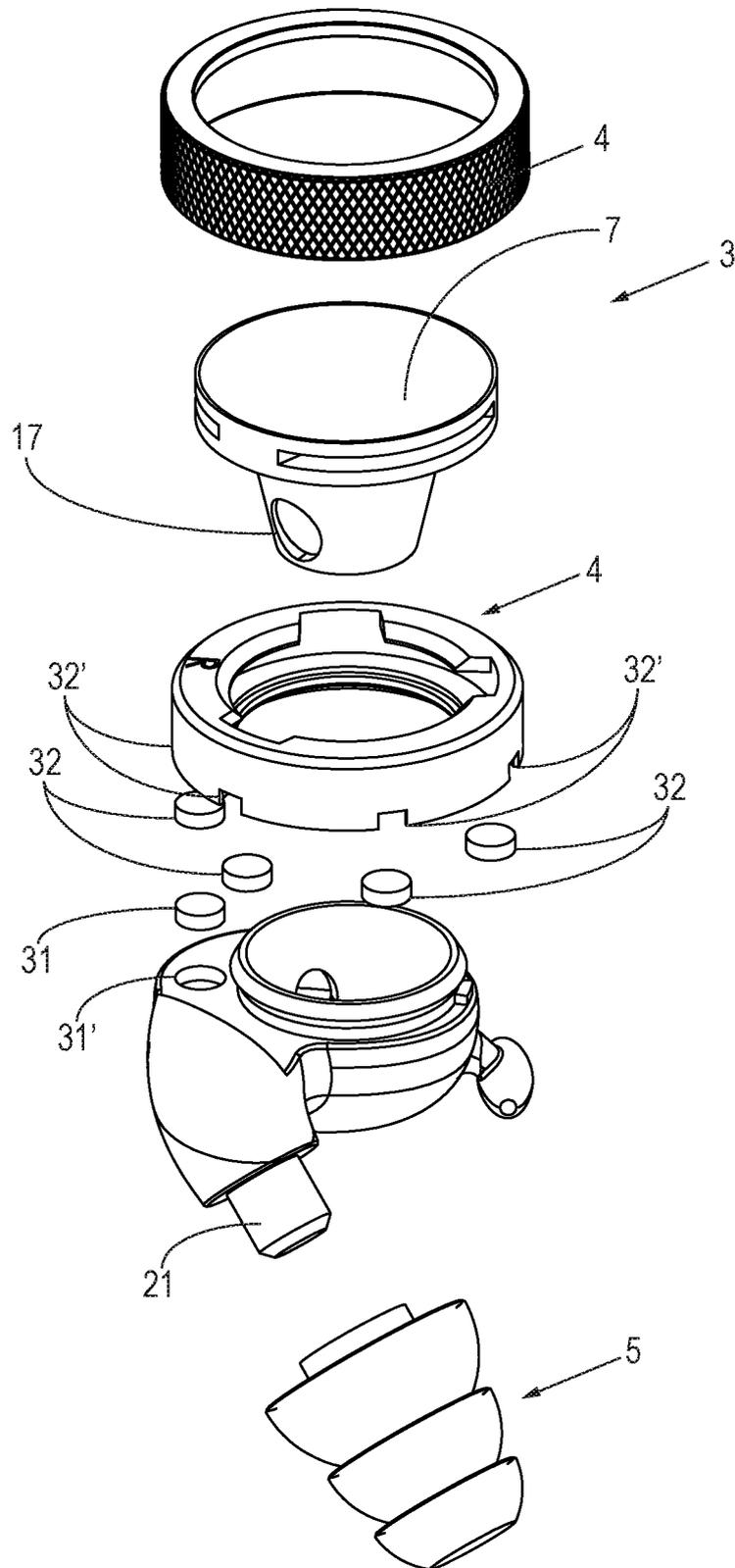


Fig. 5

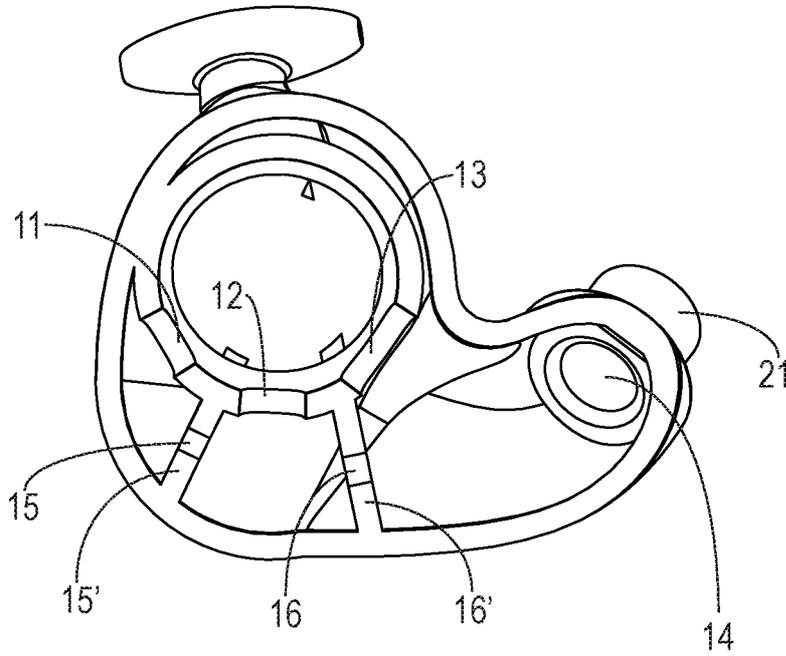


Fig. 6 B

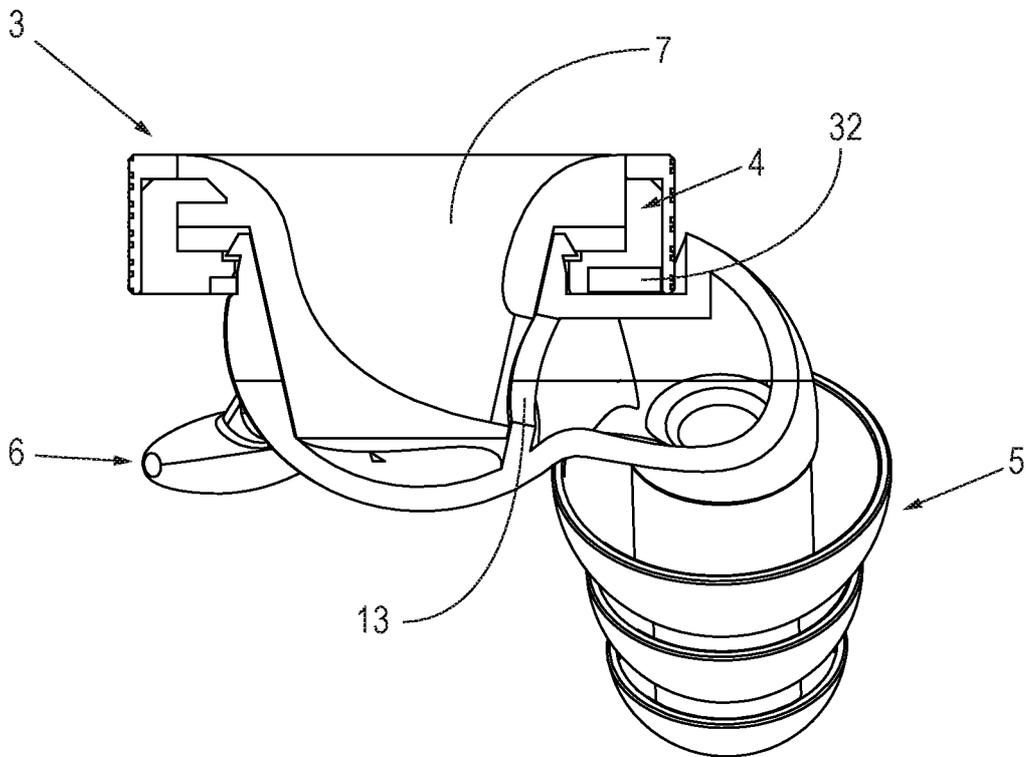


Fig. 6 A

6 / 15

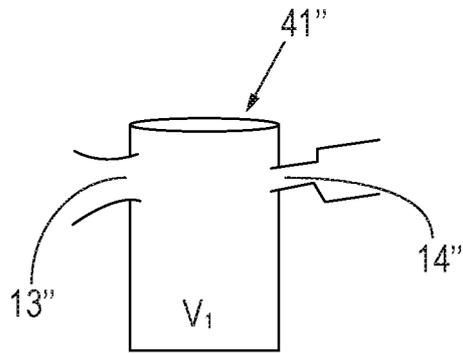


Fig. 7

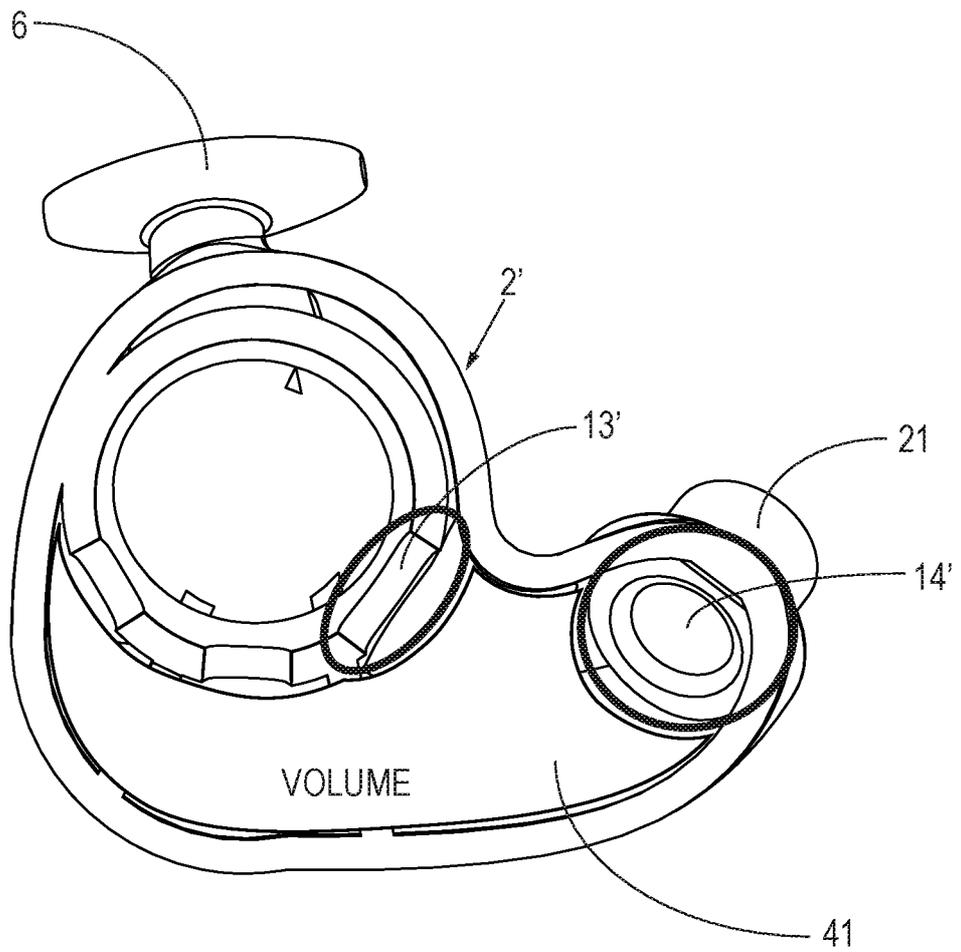


Fig. 8

7 / 15

Open oor model

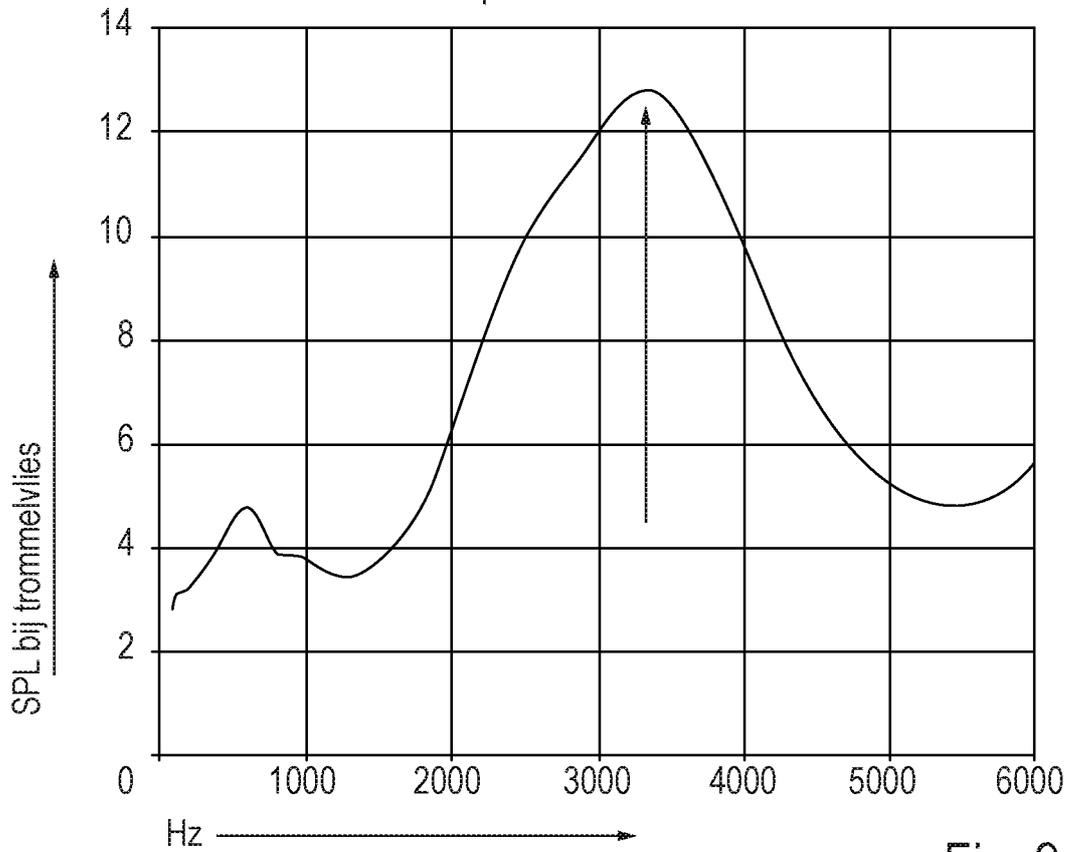


Fig. 9

Effect van filterlengte @D 0,2mm

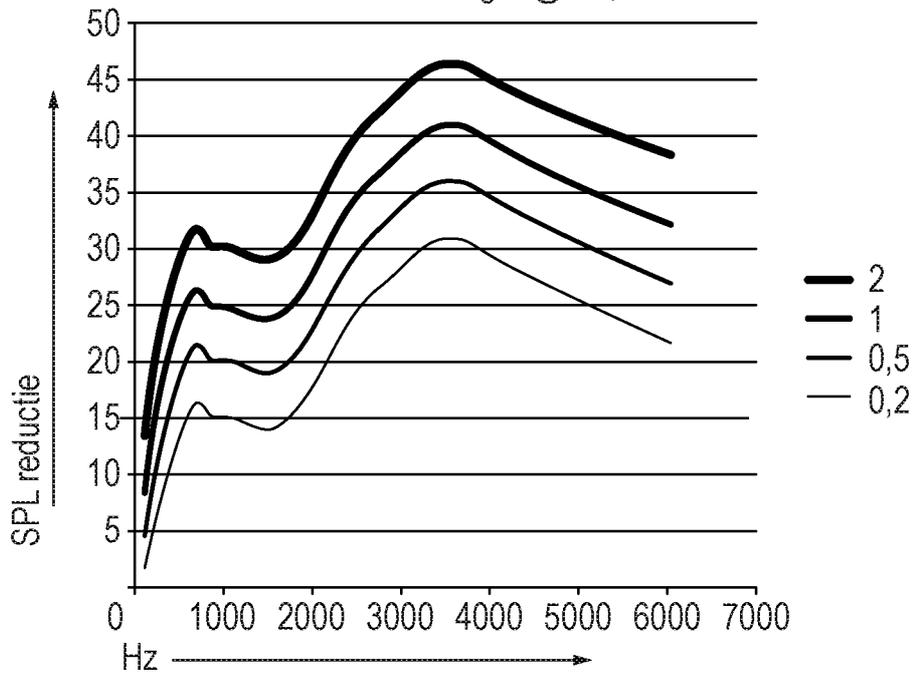


Fig. 10

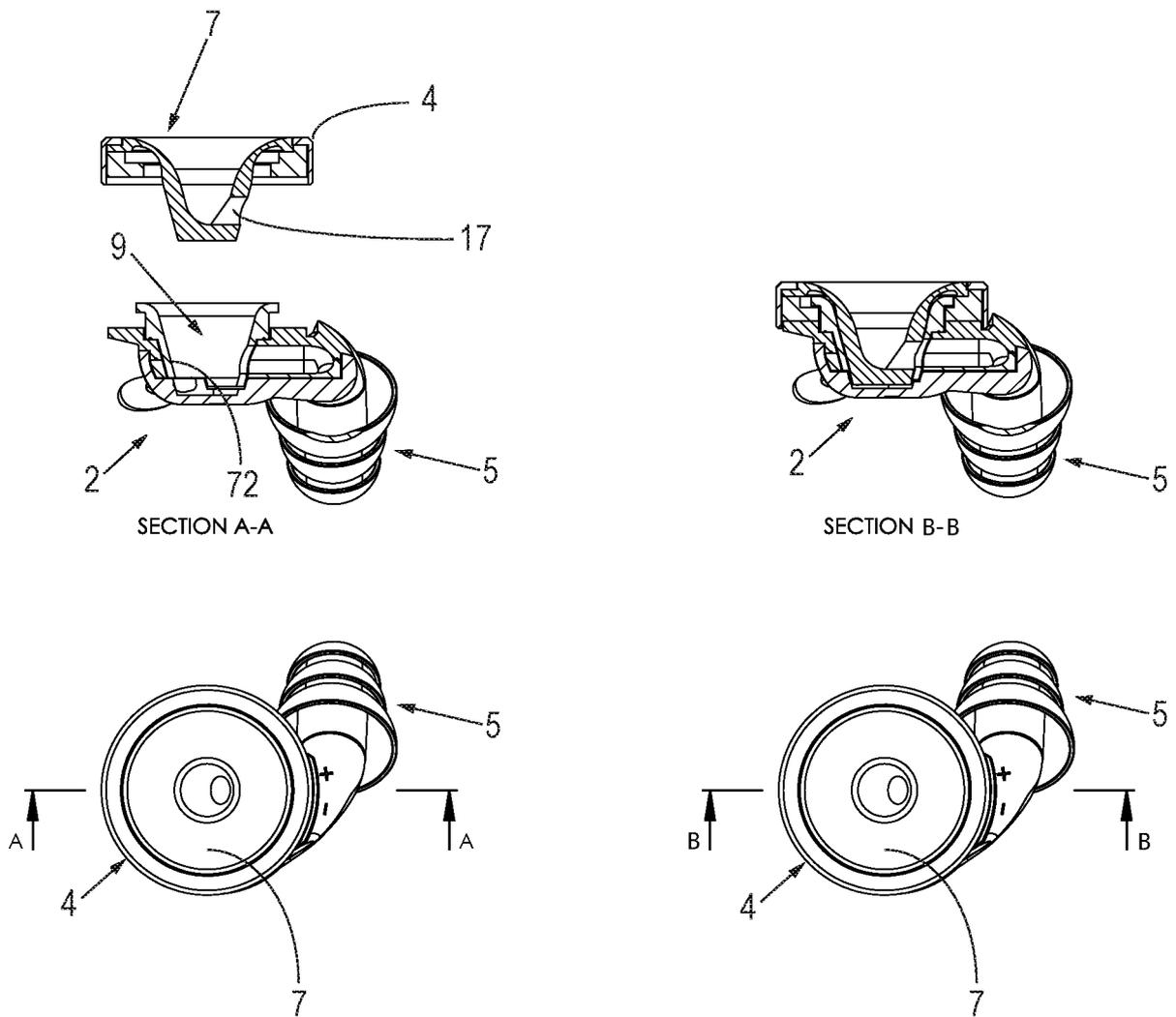


Fig. 11

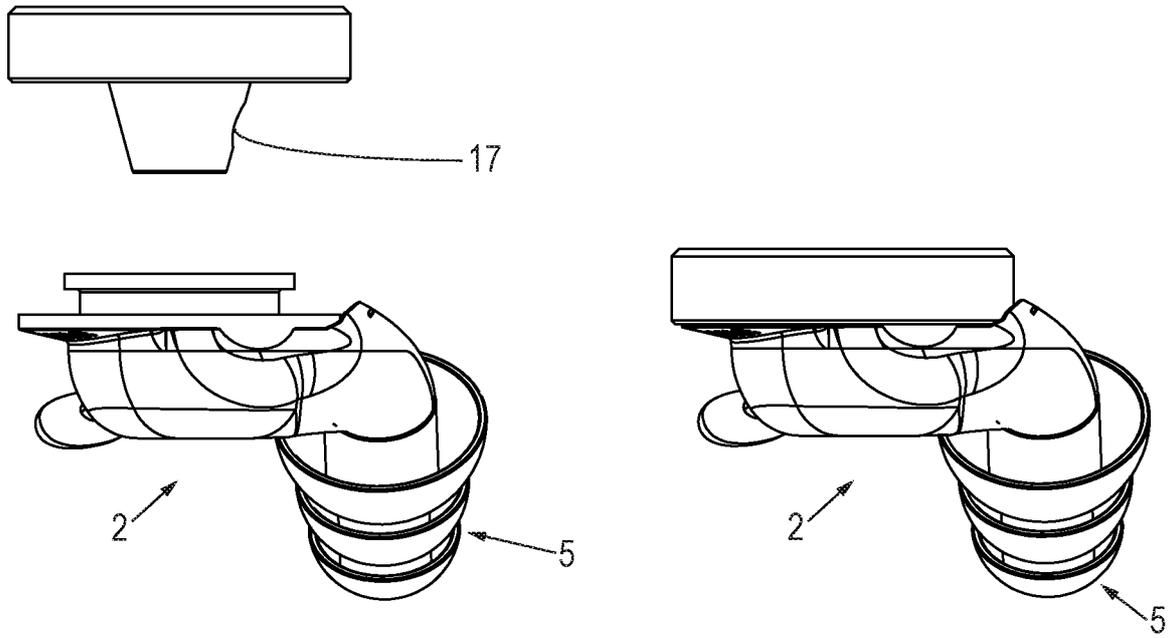


Fig. 12

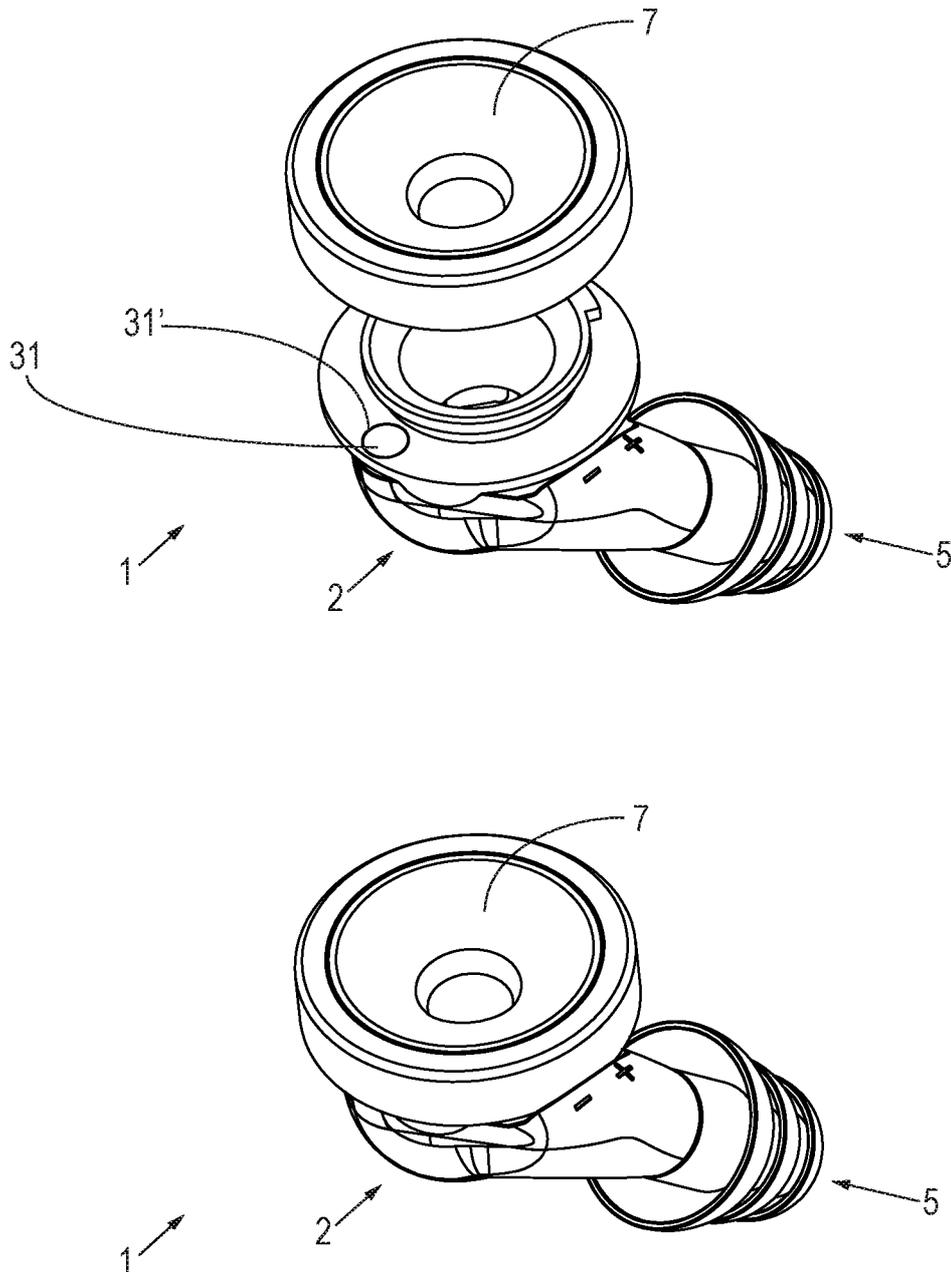


Fig. 13

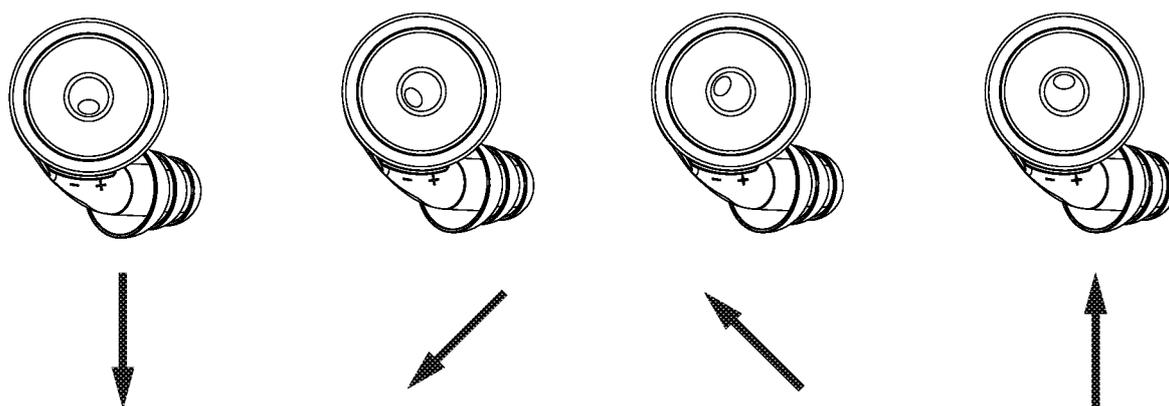


Fig. 14

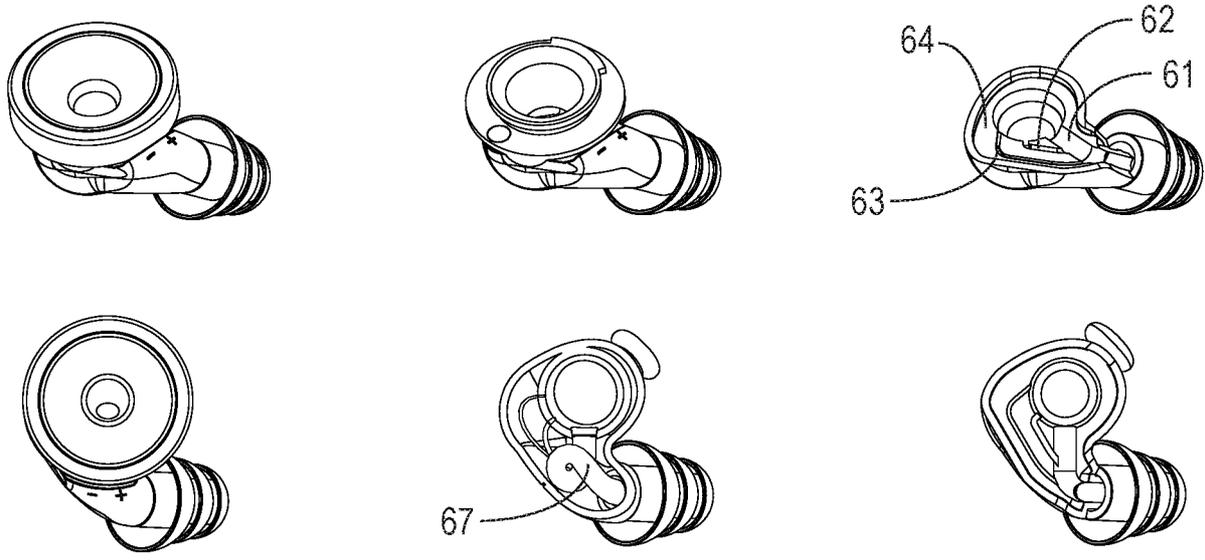


Fig. 15

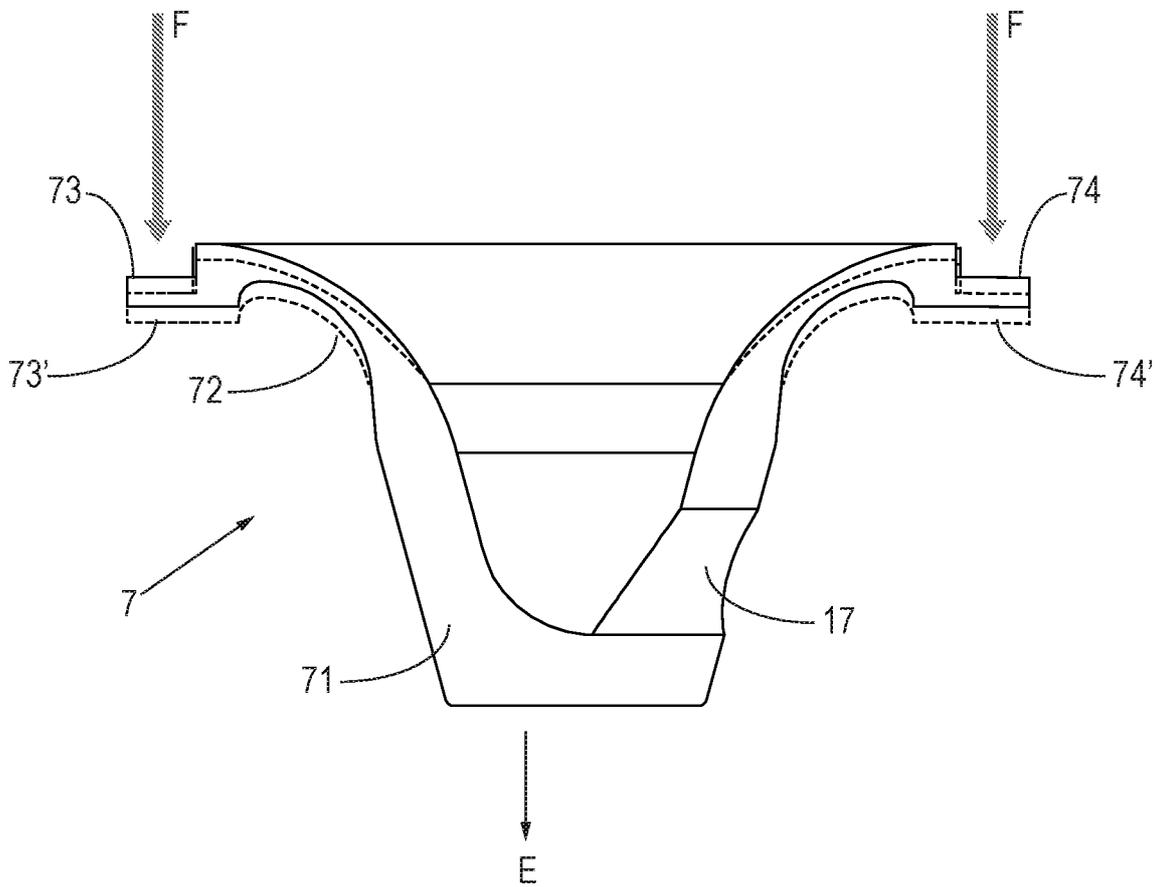


Fig. 16

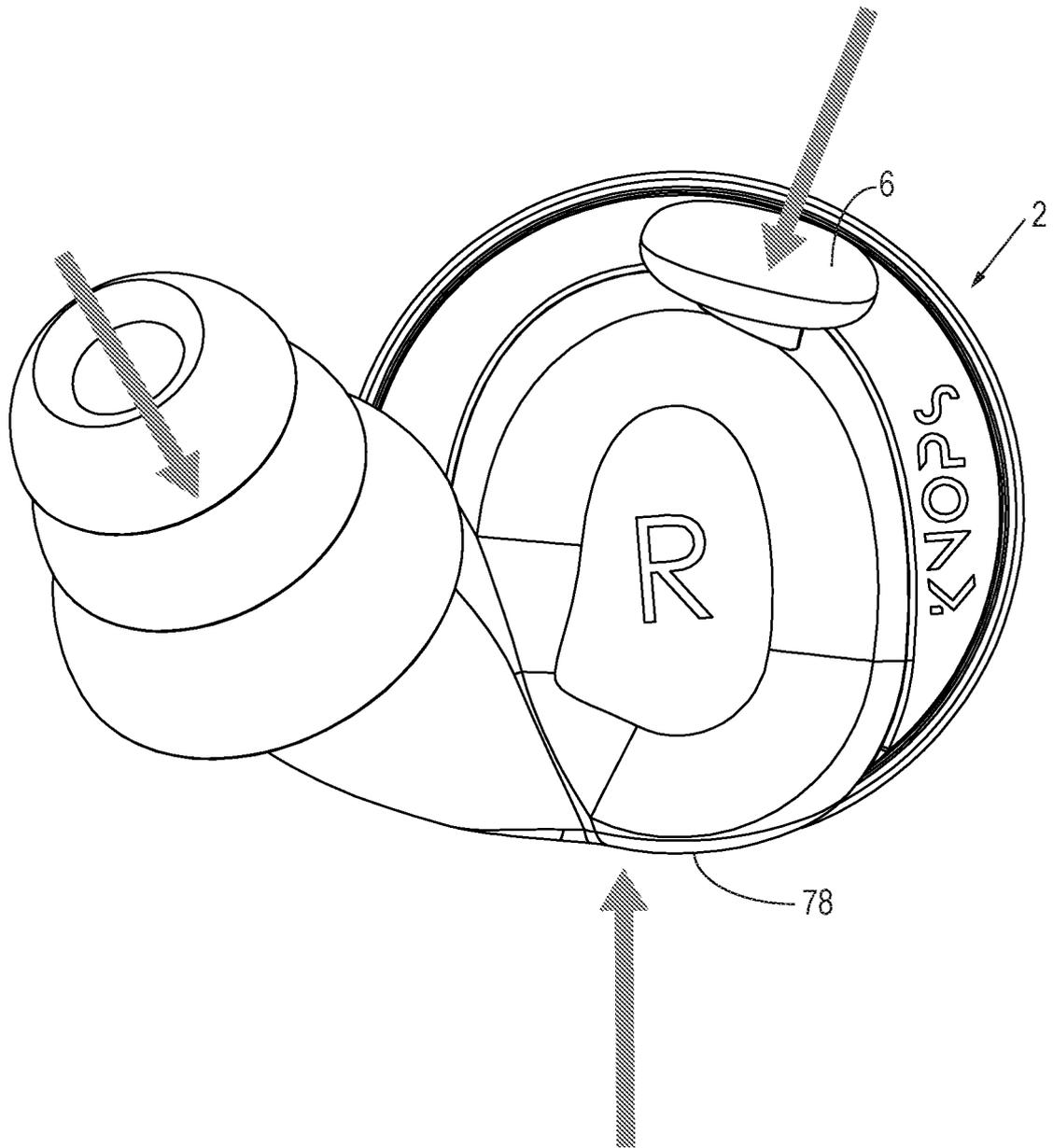


Fig. 17

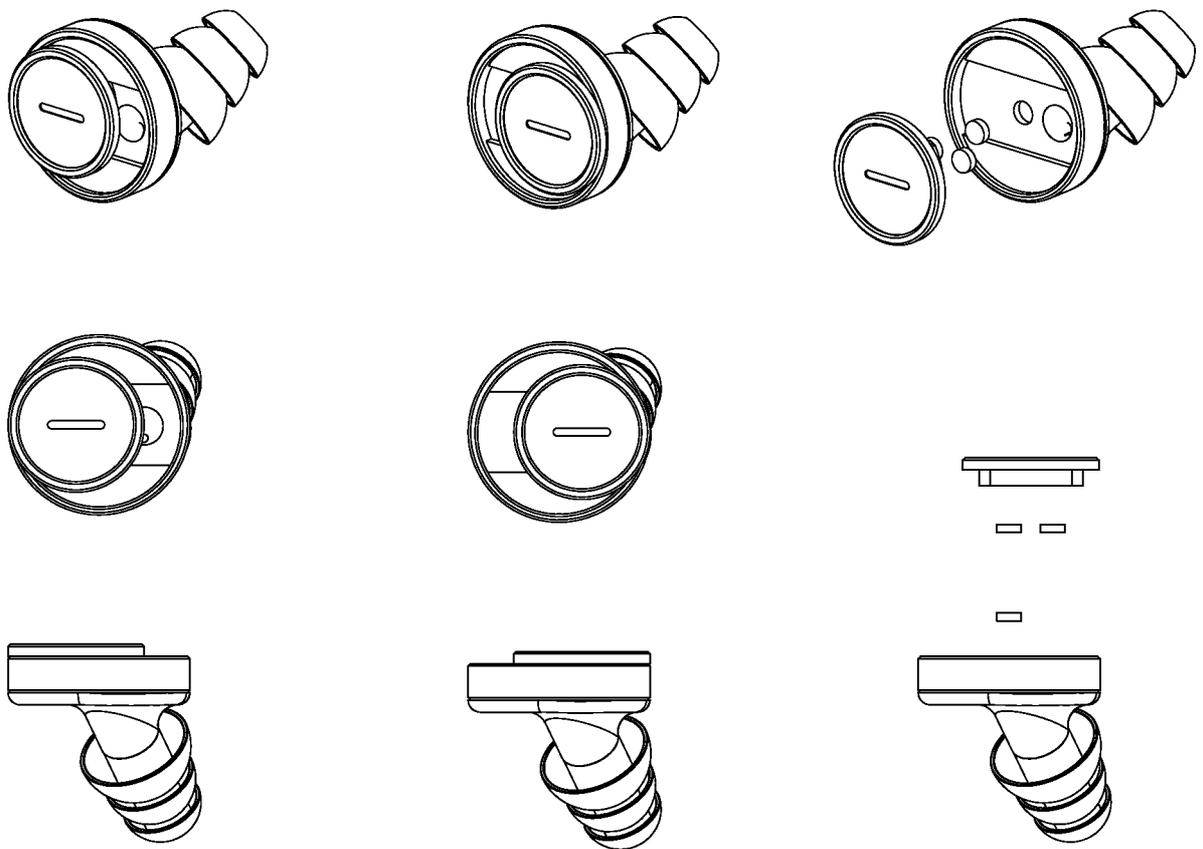


Fig. 18

**INTERNATIONAL SEARCH REPORT**

International application No  
PCT/NL2017/050675

A. CLASSIFICATION OF SUBJECT MATTER  
**INV. GIOKII/00 A61F11/08 A61F11/12**  
 ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
**G10K H04R A61F**

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
**EPO-Internal , WPI Data**

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 997 010 AI (MEZIANI MICHEL [FR] ) 25 April 2014 (2014-04-25)	1, 2, 4, 5 , 10, 13-16, 18, 19 , 21-26
Y	claims ; figures	3, 6-9 , 11 , 12 , 17 , 20
X	----- US 2012/318605 AI (BROWN THOMAS WILLIAM [US] ) 20 December 2012 (2012-12-20)	1, 2, 4, 5 , 10, 13-16, 18, 19 , 21-26
Y	paragraph [0020] - paragraph [0034] ; claims ; figures	3, 6-9 , 11 , 12 , 17 , 20
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Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search <b>16 March 2018</b>	Date of mailing of the international search report <b>26/03/2018</b>
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer <b>Serra i Verdaguer, J</b>
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## INTERNATIONAL SEARCH REPORT

International application No

PCT/NL2017/050675

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2009/086649 A1 (AWENGEN DANIEL F [CH] ) 16 July 2009 (2009-07-16)	I, 2, 4, 5, 10, 13-16, 18, 19, 21-26
Y	page 3, line 22 - page 7, line 8; figures	3, 6-9, II, 12, 17, 20
X	----- EP 0 955 025 A1 (CABOT SAFETY INTERMEDIATE CORP [US]) 10 November 1999 (1999-11-10)	I, 2, 4, 5, 10, 13-16, 18, 19, 21-26
Y	the whole document	3, 6-9, II, 12, 17, 20
X	----- US 6 082 485 A (SMITH ERIC B [US]) 4 July 2000 (2000-07-04)	I, 2, 4, 5, 10, 13-16, 18, 19, 21-26
Y	column 2 - column 3  -----	3, 6-9, II, 12, 17, 20

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Information on patent family members

International application No <b>PCT/NL2017/050675</b>
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