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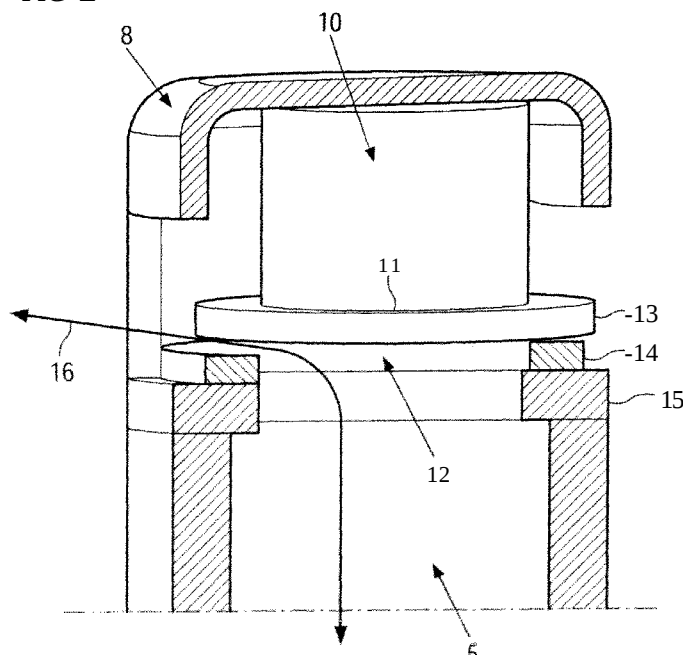
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(54) Title: A VENT CONTROLLING SYSTEM FOR A HEARING AID, THE HEARING AND A METHOD FOR CONTROLLING VENT

FIG 2



(57) Abstract: A vent controlling system for a hearing aid (1) including a surface (11) of a piece (10) adapted to be coupled to an opening (12) of a vent (5) to vary engagement of the vent (5) with an external environment by changing a geometry of the piece (10) on application of a force to the piece (10), wherein the piece (10) is adapted to be placed in a housing (8) to be worn in an ear of a user, the vent (5) is through the housing (8) adapted to allow passage of air and acoustic from an external environment to inside of the ear and the surface (11) of the piece (10) and the opening (12) of the vent (5) are substantially parallel to each other.

A VENT CONTROLLING SYSTEM FOR A HEARING AID, THE HEARING AND
A METHOD FOR CONTROLLING VENT

Description

A vent controlling system for a hearing aid, the hearing and
a method for controlling vent

The invention relates to a hearing aid. More specifically,
the invention relates to a hearing aid for controlling a vent
for varying engagement of the vent with the external
atmosphere .

While wearing a hearing aid, the hearing aid fills outer
portion of a user's ear canal and the user perceives echoing
of own voice. It is caused by bone-conducted sound vibrations
reverberating off the hearing aid filling the ear canal.
While talking or chewing, these vibrations normally escape
through an open ear canal. When the ear canal is blocked, the
vibrations are reflected back toward the eardrum and appears
like echoing of own voice.

To deal with echoing of own voice, the hearing aid are
provided with a vent which enables a pass through for air and
sound from inside the ear to an external environment. Such
vent helps to reduce echoing effect, however at the same
time; the vent also allows sound from external environment to
reach into the ear. So, the ear of the user receives similar
sounds from microphone of the hearing aid and as well as from
the external environment. Hence, the sound from the external
environment works as feedback in addition to the sound from
the micro phone and may reduce clarity of the hearing aid.

One way to improve clarity of the hearing aid is disclosed by
US Appl . No. 12/844,033, wherein a in-the-canal hearing aid
has a housing with a channel in the housing that is designed
as a through-opening for sound and air between the interior
of the ear and the environment outside the ear, the channel
is provided with a structural element for changing the size

of the through-opening at least one position. The structural element is a valve formed with electroactive material and the size of the through-opening is adjusted by application of a voltage to the valve. However, using extra material such a valve over the through-opening reduces size of the through-opening and may result in improper management of echoing effect of own voice and feedback of the sound from the external environment.

It is an object of the invention to control the vent for managing echoing effect of a user's voice and feedback of a sound from an external environment.

The object is achieved by a hearing aid of claim, a vent controlling system of claim 9 and a method for manufacturing the hearing aid of claim 15.

According to an embodiment of a hearing aid, the hearing aid includes an housing to be worn in an ear of a user, a vent through the housing adapted to allow passage of air and acoustic from an external environment to inside of the ear, and a surface of a piece adapted to be coupled to an opening of the vent to vary engagement of the vent with the external environment by changing a geometry of the piece on application of a force to the piece, wherein the surface and the opening are substantially parallel to each other. Such varying of engagement of the vent with the external environment helps managing echoing effect of a user's voice and feedback of a sound from the external environment.

According to another embodiment of the hearing aid, the piece includes electro-activated polymer and the force applied to the piece is a electromotive force. This helps to easily and automatically vary the engagement of the vent with the external environment.

According to yet another embodiment of the hearing aid, the hearing aid includes a lid secured to the surface of the piece, such that the surface of the piece adapted to be

coupled to an opening of the vent via the lid to vary engagement of the vent with the external environment by changing a geometry of the piece on application of a force to the piece. Providing the lid to the surface of the piece helps to define the engagement of the vent to the external environment .

According to one embodiment of the hearing aid, the hearing aid includes a sealing part adapted to seal the opening of the vent to disengage the vent with the external environment. Such sealing part provides extra support to completely disengage the vent from the external environment when the opening of the vent is closed using the coupling of the vent and the surface of the piece.

According to another embodiment of the hearing aid, the hearing aid includes a base coupled to the vent adapted to define the opening of the vent. Proper definition of the opening enables better functionality of the coupling of the vent and the surface of the piece.

According to an exemplary embodiment, the geometry comprises a length substantially perpendicular to a longitudinal axis of the opening and a surface area of the surface, wherein the geometry is changeable atleast by changing the length or the surface area. Providing a defined geometry helps in better functioning of the coupling of the vent and the surface of the piece.

According to another embodiment, wherein if the surface area of the piece is bigger than the surface area of the opening, than the geometry is variable by varying the surface area of the piece. In cases, when the piece is big enough to remain out of the vent, variation of the surface area enables the functioning of the coupling of the vent and the surface of the piece.

According to yet another embodiment, wherein if the surface area of the piece is lesser than the surface area of the

opening, than the geometry is variable by varying the surface area of the piece and keeping the piece substantially inside the vent. In cases, when the piece is small to remain inside of the vent, variation of the length enables the functioning of the coupling of the vent and the surface of the piece.

The above-mentioned and other features of the invention will now be addressed with reference to the drawings of a preferred embodiment of the present hearing aid device. The illustrated embodiment of the hearing aid device is intended to illustrate, but not limit the invention. The drawings contain the following figures, in which like numbers refers to like parts, throughout the description and drawings.

FIG 1 is a side view of a hearing aid device according to the state of the art.

FIG2 shows an internal view of a hearing aid according to an embodiment of the invention having a piece with a lid coupled through a sealing to a vent with a base.

FIG 3 shows a vent control system of a hearing aid with a piece coupled to a vent of the hearing aid, wherein a surface area of a surface of the piece is more than a size of an opening of the vent.

FIG 4 shows a vent control system of a hearing aid with a piece coupled to a vent of the hearing aid, wherein a surface area of a surface of the piece is less than a size of an opening of the vent.

In principle, the main components of hearing devices, such as hearing aids, are an input transducer, an amplifier and an output transducer. In general, the input transducer is a sound receiver, e.g. a microphone, and or an electromagnetic receiver, e.g. an induction coil. The output transducer is usually designed as an electroacoustic transducer, e.g. a miniaturized loudspeaker, or as an electro-mechanical

transducer, e.g. a bone conduction earpiece. The amplifier is usually integrated into a signal-processing unit. By way of a hearing device, an input signal is typically received and converted to an audio signal, is then processed in a signal-processing unit and amplified and then output.

Referring now to the figures of the drawing in detail and first, particularly, to FIG. 1 thereof, there is shown the configuration of a conventional in-the-ear (ITE) hearing aid 1. The hearing aid 1 has a housing 8 enclosing a microphone 2 as input transducer, a receiver 3 as output transducer, and also a signal-processing unit 9 with amplifier. It is also provided with a battery 4 for supplying energy and voltage, a loudspeaker control 6 and, in more recent devices, a program interface 7. The hearing aid 1 additionally has a channel (vent) 5, which forms a through-opening between the interior of the ear and the environment outside the ear.

A hearing aid 1 according to the invention, as shown in FIG 2, additionally has a piece 10 which functions like a valve for varying engagement of the vent 5 to the external environment. The engagement is variable through a coupling of a surface 11 of the piece 10 and an opening 12 of the vent 5. To strengthen the variability of the engagement of the vent 5 to the external environment, the piece 10 includes a lid 13 secured to the surface 11 of the piece 10 to define the engagement, the vent 5 includes a base 15 of the vent 5 for defining the opening 12 and a sealing part 14 is provided between the base 15 and the lid 13 to seal the engagement completely when no engagement is desired with the external environment .

The sealing part 14, the lid 13 secured to the surface 11 of the piece 10, the base 15 and the opening 12 are located in such a way that each of them are places substantially parallel to each other, for allowing a scenario of disengaging the vent 5 to the external environment completely when the lid 13 secured to the surface 11 of the piece 10 is

physically coupled to the sealing part 14 and the sealing part 14 is physically coupled to the base 15 of the vent 5.

In an alternate embodiment, the hearing aid 1 can be without any of the lid 13, the sealing part 14 and the base 15 in combination or alone. When the sealing part 14 is not present, than while completely closing the opening 12 of the vent 5, the lid 13 secured to the surface 11 of the piece 10 and the base 15 of the vent 5 tightly couples each other for disallowing air and acoustic flow inside the vent 5 from the external environment. When the sealing part 14 and the base 15 is not present, than while completely closing the opening 12 of the vent 5, the lid 13 secured to the surface 11 of the piece 10 and the opening 12 of the vent 5 tightly couples each other for disallowing air and acoustic flow inside the vent 5 from the external environment. When the sealing part 14 is not present and the lid 13 is not secured to the surface 11 of the piece 10, than while completely closing the opening 12 of the vent 5, the surface 11 of the piece 10 and the base 15 of the vent 5 tightly couples each other for disallowing air and acoustic flow inside the vent 5 from the external environment. When the base 15 is not secured to the opening 12 of the vent 5, the opening 12 is defined by a shape of starting of the vent 5 nearest to the surface 11 of the piece 10. When the lid 13 is not secured to the surface 11 of the piece 10, the definition of engagement of the vent 5 to the external environment is defined by the surface 11 of the piece 10 itself.

In embodiments when any one of the sealing part 14, the lid 13 and the base 15 are absent, than to practice the scenario of completely disengaging the vent 5 to the external environment, the remaining of the sealing part 14, the lid 13 and the base 15 are substantially parallel to each other and to the opening 12 of the vent 5 and the surface 11 of the piece 10, to allow physical coupling of the remaining of the sealing part 14, the lid 13, and the base 15 with each other and to the opening 12 of the vent 5 and the surface 11 of the piece 10.

For varying the engagement of the vent 5 to the external environment, a force is applied onto the piece 10, so that geometry of the piece 10 changes to enable the coupling of the surface 11 of the piece 10 and the opening 12 of the vent 5. The force can be mechanical, electrical or combination thereof.

The mechanical force can be applied by introducing a hydraulic mechanism coupled to the piece 10, so that when the housing 8 of the hearing aid 1 is pressed, the hydraulic mechanism will be actuated to enable the coupling of the surface 11 of the piece 10 and the opening 12 of the vent 5. The hydraulic mechanism will be actuated through a hydraulic element, such as air, water or any other fluid. While using hydraulic mechanism, the lid 13 secured to the surface 11 along with the housing 8 may be used as holding means to hold the hydraulic element.

There may be other types of mechanical forces which can be applied to the piece 10 by using an adjusting tool by a user. The adjusting tool forces the piece 10 to move in a translational motion towards or away from the vent 5 for varying the engagement of the vent 5 from the external environment.

Here, enabling the coupling means actuating the coupling of the surface 11 of the piece 10 and the opening 12 of the vent 5 to start functioning for varying the engagement of the vent 5 to the external environment.

Electrical forces are automotive forces applied to the piece 10 either directly or indirectly through the housing 8. Application of electrical forces involves application of voltage which may or may not be convertible into mechanical forces when the coupling of the surface 11 of the piece 10 and the opening 12 of the vent 5 is being enabled.

One way to apply electromotive force directly onto the piece 10 which enables the piece 10 to change its geometry by changing either a length 1 of the piece 10 or a surface area A of the surface 11 of the piece 10. Such change could be functioned by using an electro active polymer inside the piece 10 or outside the piece 10 as a part of the piece 10, or making the whole piece 10 from the electro active polymer.

For varying the engagement of the vent 5 with the external environment, when the surface area A of the surface 11 of the piece is more than or equal to a size of the opening 12 of the vent 5, a vent control system is illustrated in FIG 3. In such cases, the geometry of the piece 10 is changed by changing the length 1 of the piece 10 which is substantially perpendicular to the surface 11 of the piece 10. The surface 11 of the piece 10 is outside the vent 5. This allows to changes volume of air per unit time coming inside and going out from the vent 5. This helps to vary the engagement of the vent 5 to the external environment with respect to the air and acoustic flow into and out of the environment.

For varying the engagement of the vent 5 with the external environment, when the surface area A of the surface 11 of the piece 10 is less than a size of the opening 12 of the vent 5, a vent control system is illustrated in FIG 4. In such cases, the geometry of the piece 10 is changed by changing the surface area A of the surface 11 of the piece 10 wherein the surface 11 is substantially parallel to the opening 12 of the piece 10 and inside the vent 5 through the opening 12. This allows to changes volume of air per unit time coming inside and going out from the vent 5. This helps to vary the engagement of the vent 5 to the external environment with respect to the air and acoustic flow into and out of the environment .

Summarily, the invention focuses to manage varying of the engagement of the vent 5 to an external environment by using a mechanism to allow wider range of maximum and minimum allowance of air and acoustic flow in and out of the vent 5,

by avoiding reduction in size of the vent 5. This also helps to introduce such mechanism easily in an already existing reconstructible hearing aid 1 where a manufacturer, seller or a user of the hearing aid 1 can easily modify introduce the piece 10 whose surface 11 will be in coupling to the opening 12 of the vent 5 and then re-assemble the hearing aid 1 to be used by the user.

Patent Claims

1. A hearing aid (1) comprising:

- an housing (8) to be worn in an ear of a user,
- a vent (5) through the housing adapted to allow passage of air and acoustic from an external environment to inside of the ear, and
- a surface (11) of a piece (10) adapted to be coupled to an opening (12) of the vent (5) to vary engagement of the vent (5) with the external environment by changing a geometry of the piece (10) on application of a force to the piece (10), wherein the surface (11) and the opening (12) are substantially parallel to each other.

2. The hearing aid (1) according to the claim 1, wherein the piece (10) comprises electro-activated polymer and the force applied to the piece (10) is a electromotive force.

3. The hearing aid (1) according to any of the claims 1 or 2 comprising :

- a lid (13) secured to the surface (11) of the piece (10), wherein the surface (11) of the piece (10) adapted to be coupled to an opening (12) of the vent (5) via the lid (13) to vary engagement of the vent (5) with the external environment by electronically changing a geometry of the piece (10) on application of the force to the piece (10) .

4. The hearing aid (1) according to any of the claims from 1 to 3 comprising:

- a sealing part (14) adapted to seal the opening (12) of the vent (5) to disengage the vent (5) with the external environment .

5. The hearing aid (1) according to any of the claims 1 to 4 comprising :

- a base (15) coupled to the vent (5) adapted to define the opening (12) of the vent (5) .

6. The hearing aid (1) according to any of the claims 1 or 2, wherein the geometry comprises a length (1) substantially perpendicular to a longitudinal axis of the opening (12) and a surface area (A) of the surface (11), wherein the geometry is changeable atleast by changing the length (1) or the surface area (A) .

7. The hearing aid (1) according to claim 6, wherein if the surface area (A) of surface (11) the piece (10) is eual to or bigger than the size of the opening (12), than the geometry is variable by varying the surface area (A) of surface (11) of the piece (10).

8. The hearing aid (1) according to claim 6, wherein if the surface area (A) of the piece (10) is lesser than the size of the opening (12), than the geometry is variable by varying the surface area (A) of the surface (11) of the piece (10) and keeping the piece (10) substantially inside the vent (5) .

9. A vent controlling system for a hearing aid (1) comprising :

- a surface (11) of a piece (10) adapted to be coupled to an opening (12) of a vent (5) to vary engagement of the vent (5) with an external environment by changing a geometry of the piece (10) on application of a force to the piece (10),
Wherein the piece (10) is adapted to be placed in a housing (8) to be worn in an ear of a user, the vent (5) is through the housing (8) adapted to allow passage of air and acoustic from an external environment to inside of the ear and the surface (11) of the piece (10) and the opening (12) of the vent (5) are substantially parallel to each other.

10. The vent controlling system according to claim 9, wherein the piece (10) comprises electro-activated polymer.

11. The vent controlling system according to any of the claims 9 or 10, wherein the geometry comprises a length substantially perpendicular to a longitudinal axis of the opening (12) and a surface area (A) of the surface (11),

wherein the geometry is changeable atleast by changing the length (1) or the surface area (A) .

12. The vent controlling system according to claim 11, wherein if the surface area (A) of the piece (10) is bigger than or equal to the size of the opening (12), than the geometry is variable by varying the surface area (A) of surface (11) of the piece (10) .

13. The vent controlling system according to claim 11, wherein if the surface area (A) of the piece (10) is lesser than the size of the opening (12), than the geometry is variable by varying the surface area (A) of the surface (11) of the piece (10) and keeping the piece (10) substantially inside the vent (5) .

14. The vent controlling system according to any of the claims from 9 to 13, wherein the piece (10) comprises electro-activated polymer and the force applied to the piece (10) is a electromotive force.

15. A method for constructing a hearing aid (1) for controlling a vent (5) comprising:
- placing a piece (10) into a housing (8) having the vent (5) through it for coupling a surface of the piece (10) to an opening (12) of the vent (5) to vary engagement of the vent (5) with an external environment by changing a geometry of the piece (10) on application of a force to the piece (10), wherein the surface (11) of the piece (10) and the opening (12) of the vent (5) are substantially parallel to each other and the housing (8) is to be worn in an ear of a user.

16. The method according to claim 15 comprising:
- securing a lid (13) to the surface (11) of the piece (10), wherein the surface (11) of the piece (10) adapted to be coupled to an opening (12) of the vent (5) via the lid (13) to vary engagement of the vent (5) with the external environment by electronically changing a geometry of the piece (10) on application of a voltage to the piece (10) .

17. The method according to any of the claims 15 or 16 comprising :

- placing a sealing part (14) between the opening (12) of the vent (5) and the surface (11) of the piece (10), wherein the sealing part (14) is adapted to seal the opening (12) of the vent (5) to disengage the vent (5) with the external environment .

18. The method according to any of the claims 15 to 17 comprising :

- coupling a base (15) to the vent (5) for defining the opening (12) of the vent (5) .

FIG 1

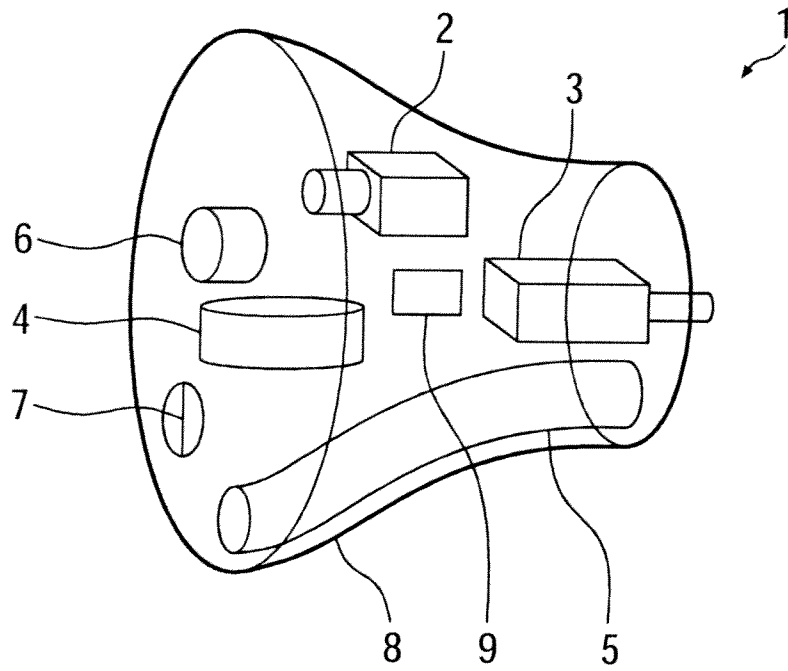


FIG 2

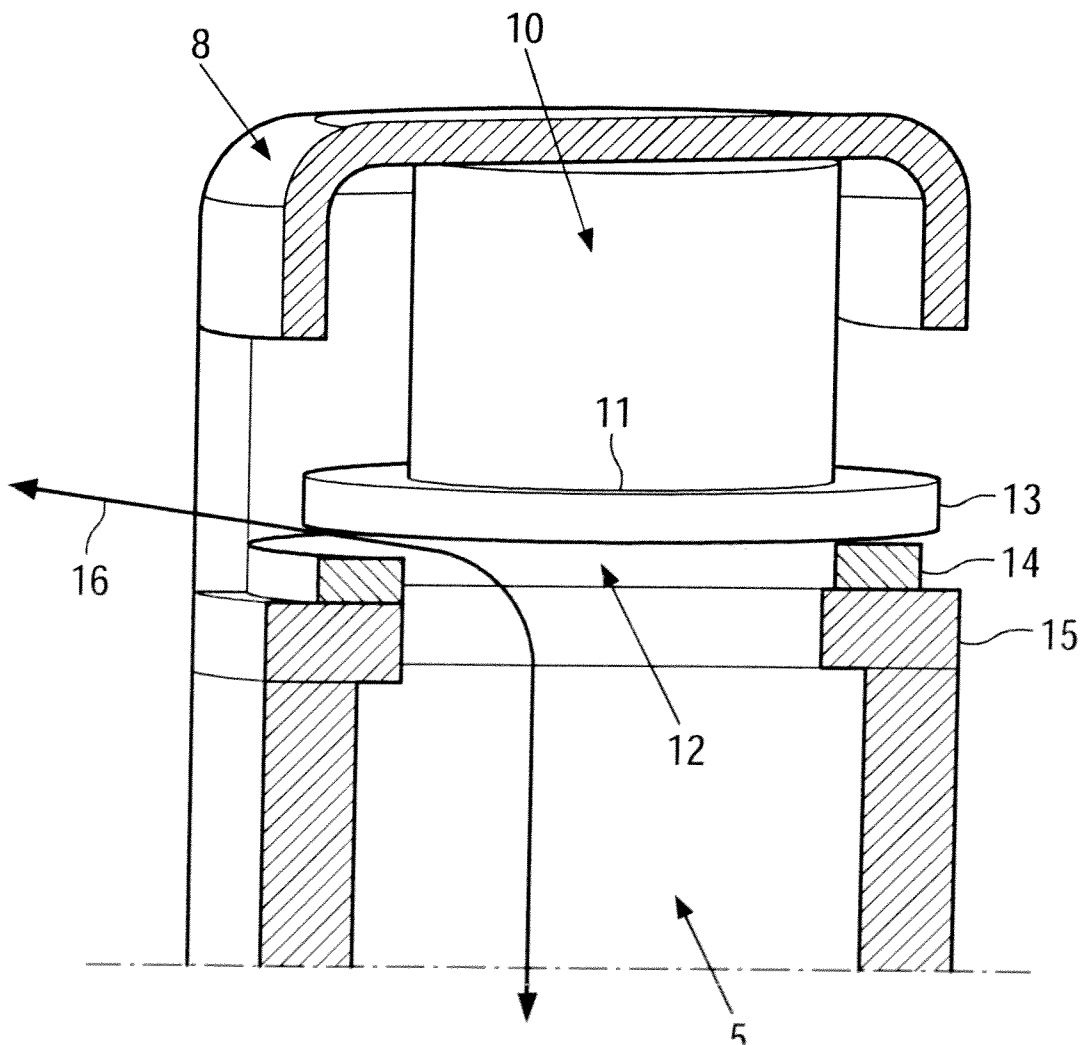


FIG 3

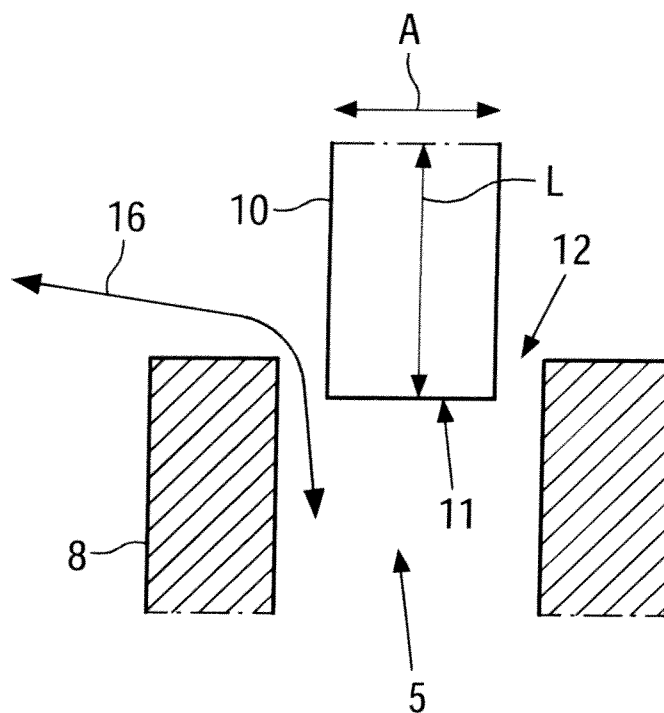
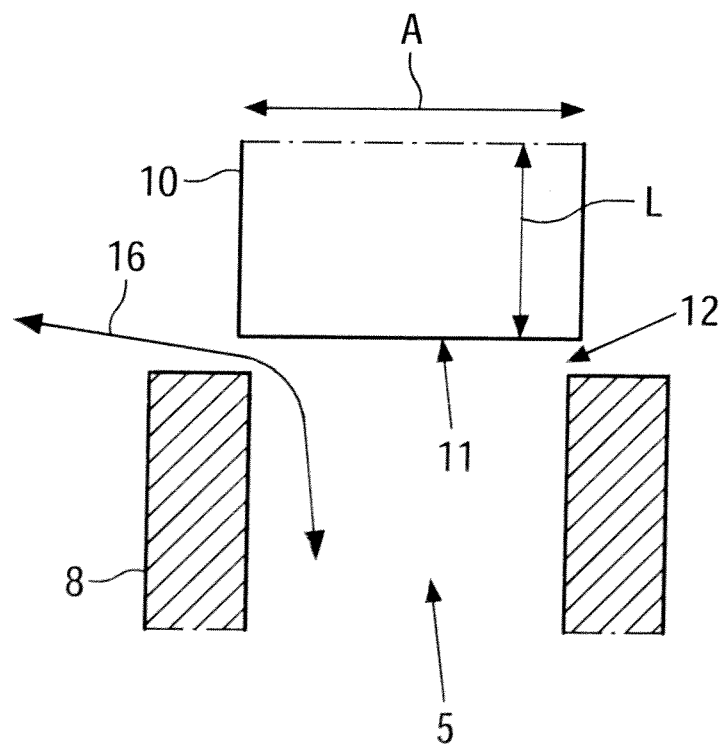


FIG 4



INTERNATIONAL SEARCH REPORT

International application No

PCT/US2011/066357

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

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04R

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

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

EPO-Internal , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	DE 10 2009 010603 A1 (SI EMENS MEDICAL INSTR PTE LTD [SG]) 12 May 2010 (2010-05-12) the whole document -----	1,2,4,6, 8-11 , 13-15
X	W0 2010/042613 A2 (KNOWLES ELECTRONICS LLC [US] ; MILLER THOMAS E [US] ; RYAN WILLIAM A [US] 15 April 2010 (2010-04-15) the whole document ----- -/- .	1,3-9 , 11-13 , 15-18



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"&" document member of the same patent family

Date of the actual completion of the international search

28 February 2013

Date of mailing of the international search report

07/03/2013

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2011/066357

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2011/066357

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