(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 376 775 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
19.09.2018 Bulletin 2018/38

(21) Application number: **16863931.8**

(22) Date of filing: **06.10.2016**

(51) Int Cl.:
H04R 1/10 *(2006.01)*

(86) International application number:
PCT/JP2016/079849

(87) International publication number:
WO 2017/081967 (18.05.2017 Gazette 2017/20)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(30) Priority: **12.11.2015 JP 2015222419**

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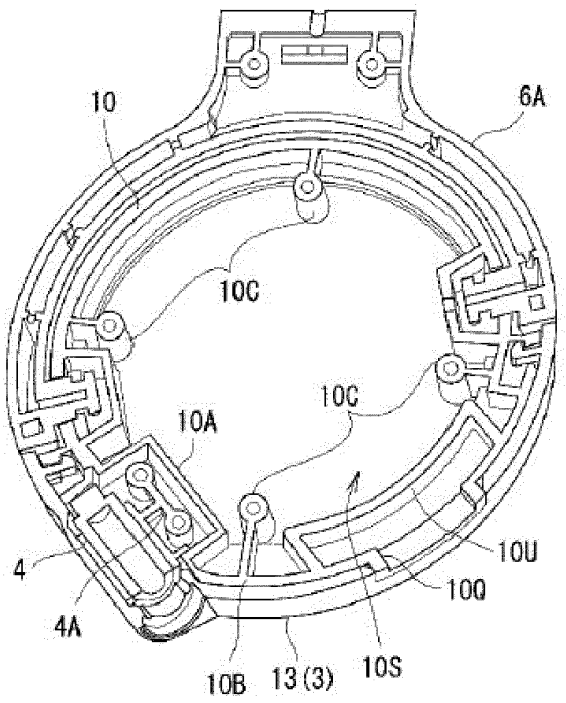
(54) HEADPHONES

(57) In a headphone of which housing is provided with a jack, the present invention prevents air from unintentionally leaking around the jack in a back chamber in the housing.

A headphone (1) includes a headphone unit (1A) having a speaker unit (2) and a housing (3) that houses the speaker unit (2), the housing (3) is provided with a jack (4) that is electrically connected to a wire of the speaker unit (2), and the housing (3) includes a wall portion (10A) that airtightly separates a back chamber (10S) placed on a side opposite to a sound emission side of the speaker unit (2) and the surrounding of the jack (4).

FIG. 3



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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a headphone.

DESCRIPTION OF THE RELATED ART

[0002] A headphone is an on-ear or over-ear electro-acoustic conversion device that forms a closed acoustic space outside the ear canal to emit sound into the acoustic space, the sound being produced by a sounding body such as a speaker unit. Various forms such as a headband model, a neckband model, and an earhook model in appearance are known. The headphone includes here a headset equipped with a microphone device.

[0003] A headphone generally includes a speaker unit, a housing that houses the speaker unit, and a pad provided to the housing in such a manner as to surround a sound emission side of the speaker unit. The sound emission side of the speaker unit indicates here a side facing the ear canal when a user wears the headphone.

[0004] As such a headphone, one having a housing provided with a jack to mate with a plug is known (JP-A-2011-507462). The jack is an interface terminal for inputting audio signals and power into the speaker unit. One end of the jack is connected to a plug on a cable to be connected to an audio playback device, an output plug of a microphone device, or the like.

SUMMARY OF THE INVENTION

[0005] As described above, the known headphone of which housing is provided with the jack has a problem that it is difficult to create an airtight structure around the jack since it is necessary to provide a circuit board and a wiring path to ensure an electrical communication between the jack and the speaker unit. Hence, there arises a problem that air leaks unintentionally in a back chamber provided on a side opposite to the sound emission side of the speaker unit in the housing; accordingly, desired acoustic properties cannot be obtained. Moreover, there arises a problem that noise (such as touch noise) transmitted from, for example, a cord to the jack is likely to transmit to the acoustic space on the sound emission side of the speaker unit through the space in the housing.

[0006] Moreover, the headphone of which housing is provided with the jack has a problem that it is difficult to reduce the size of the headphone unit since when the longitudinal direction of the jack is oriented in the thickness direction of the housing, the space in the thickness direction in the housing is increased.

[0007] In contrast, if the longitudinal direction of the jack is oriented in a direction perpendicular to the thickness direction of the housing to mount the jack in the housing, when the longitudinal direction of the jack is oriented toward the center of the housing, space to mount the jack is likely to interfere with the placement of the speaker unit that is housed in the housing. Accordingly, there arises a problem that the degree of freedom in the size and the placement of the speaker unit is reduced.

[0008] An object of the present invention is to solve these problems.

[0009] In order to achieve such an object, a headphone of the present invention includes a headphone unit having a speaker unit and a housing that houses the speaker unit, the housing is provided with a jack that is electrically connected to a wire of the speaker unit, and the housing has a wall portion that airtightly separates a back chamber placed on a side opposite to a sound emission side of the speaker unit and the surrounding of the jack. The headphone of the present invention with such a configuration can prevent air leakage around the jack in the back chamber by providing the wall portion to the housing.

[0010] Moreover, in another aspect of the headphone of the present invention, the jack is placed in a direction where a longitudinal direction thereof is tangent to an outer edge of the housing. It becomes harder for the jack of the headphone with such a configuration to interfere with the speaker unit in the housing.

[0011] Moreover, in another aspect of the headphone of the present invention, the shape of the outer edge of the housing is a circle. It is further possible to place a large size of the circular speaker unit in the circular housing of the headphone with such a configuration.

[0012] Moreover, in another aspect of the headphone of the present invention, attached on the sound emission side of the speaker unit to the housing is an ear cushion body. It is further possible to place a large size of the speaker unit in the housing of the headphone with such a configuration.

[0013] Moreover, another aspect of the headphone of the present invention includes: one of headphone units with the jack, having the wall portion in the housing; and the other headphone unit without the jack, and a housing of the other headphone unit has a dummy wall portion of the same shape as the wall portion. It is further possible for the headphone with such a configuration to match the acoustic properties of the left and right headphone units without providing a dummy jack to the other headphone unit when the jack is provided only to the one headphone unit.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

Fig. 1 is an explanatory view illustrating an external configuration of a headphone according to an embodiment of the present invention;

Fig. 2 is a perspective cross-sectional view illustrating an internal configuration of a headphone according to an embodiment of the present invention;

Fig. 3 is an explanatory view illustrating an internal structure of a housing of a headphone (one of headphone units) according to an embodiment of the present invention;

Fig. 4 is an explanatory view illustrating a support cover body structure of a headphone according to an embodiment of the present invention; and

Fig. 5 is an explanatory view illustrating an internal structure of a housing of a headphone (the other headphone unit) according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] Hereinafter, preferred embodiments of the present invention will be described with reference to the drawings. In the following description, the same reference numerals in the different drawings indicate the same portions, and their duplicate descriptions for the drawings are omitted.

[0016] As illustrated in Figs. 1 and 2, a headphone 1 according to an embodiment of the present invention includes at least one headphone unit 1A. The headphone unit 1A has a speaker unit 2, and a housing 3 that houses the speaker unit 2. The headphone unit 1A is a device worn on or over a user's ear. The headphone 1 may be configured of a single headphone unit, or may include a pair of left and right headphone units. An ear cushion pad 5 is attached to the housing 3.

[0017] The housing 3 of the headphone unit 1A is provided with a jack 4 that is electrically connected to a wire of the speaker unit 2. The jack 4 is an interface terminal for inputting audio signals and power into the speaker unit 2. A plug T1 on, for example, a cable T is detachably connected to the jack 4. An example where a headband 6 is attached to the headphone unit 1A via a hanger portion 6A is illustrated in Fig. 1. However, the headphone 1 according to the embodiment of the present invention is not particularly limited to this kind of headband shape. Moreover, the headphone 1 according to the embodiment of the present invention may have a structure where the jack 4 is placed in each of a pair of left and right headphone units and a cable is connected to each of the headphone units, or a structure where a cable is connected to the left or right headphone unit depending on the preference of the user.

[0018] Fig. 2 illustrates by example an internal structure of the headphone unit 1A. The pad 5 attached to the front side of the housing 3 is provided in a ring fashion in such a manner as to surround a space on a sound emission side of the speaker unit 2, and forms a closed acoustic space inward of the pad 5 while pressing the pad 5 against the user's ear. In the illustrated example, the pad 5 includes an ear cushion body 5A and a pad coupling portion 5B. The pad coupling portion 5B and a support cover body 11 of the housing 3 are coupled via a coupling member 5C.

[0019] The housing 3 that houses the speaker unit 2 is configured of a back chamber forming body 10, the support cover body 11, a rear exterior body 12, a side exterior body 13, and the like. The back chamber forming body 10 forms a back chamber 10S on a side opposite to the sound emission side of the speaker unit 2. In Fig. 2, the internal structure and the wire of the speaker unit 2 are omitted.

[0020] In the housing 3, the back chamber forming body 10 and the support cover body 11 that supports the speaker unit 2 are coupled, and the back chamber 10S is formed on the side opposite to the sound emission side of the speaker unit 2. In the illustrated example, an outside communicating air chamber 10T is formed, separated by a partition wall 10U, outside the back chamber 10S. The partition wall 10U is provided with an inner duct 10P. An outer wall of the back chamber forming body 10 is provided with an outer duct 10Q that causes the outside communicating air chamber 10T and the outside to communicate with each other. The back chamber 10S communicates with the outside of the headphone unit 1A via the inner duct 10P and the outer duct 10Q. The forms of their sizes, placements, and the like set the acoustic properties of the headphone unit 1A.

[0021] The support cover body 11 is provided with a sound emission portion 11A provided in front of the speaker unit 2, a pad support portion 11B to which the pad 5 is attached, a speaker unit support portion 11C that supports the speaker unit 2, and the like. The pad 5 is attached to the pad support portion 11B in such a manner as to surround the sound emission portion 11A.

[0022] As illustrated in Fig. 3, the housing 3 is provided with the jack 4 that is electrically connected to the wire of the speaker unit 2. The housing 3 includes a wall portion 10A that airtightly separates the back chamber 10S and the surrounding of the jack 4. The wall portion 10A couples the back chamber forming body 10 and the support cover body 11 to airtightly isolate the back chamber 10S and the surrounding of the jack 4. The wall portion 10A is integral with an outer edge portion 10B that surrounds the outer edge of the back chamber 10S. In the illustrated example, a connection terminal portion 4A that connects the jack 4 and the wire of the speaker unit 2 is installed outside the wall portion 10A.

[0023] Moreover, the jack 4 provided to the housing 3 is placed in a direction where the longitudinal direction of the jack 4 is tangent to the outer edge of the housing 3. In the illustrated example, the shape of the outer edge of the housing 3 is a circle, and the jack 4 is placed, orienting the longitudinal direction in the tangent direction of the circular outer edge. Moreover, the jack 4 is so designed that a plug insertion port 4B of the jack 4 is oriented obliquely downward when the user wears the headphone unit 1A. The shape of the housing 3 is not only a circle but may also be, for example, an arc. Moreover, also in a case of a housing of a square outer shape, the jack 4

may be placed in such a manner that the longitudinal direction is tangent to an outer edge of the housing.

[0024] Fig. 4 illustrates a state where the back chamber forming body 10 is covered with the support cover body 11 that supports the speaker unit 2. The back chamber forming body 10 and the support cover body 11 are coupled by a coupler such as a screw, causing a coupling portion 10C of the back chamber forming body 10 and a coupling portion 11D of the support cover body 11 to mate with each other.

[0025] In the illustrated example, the wall portion 10A is formed in such a manner as to surround the jack 4 and a jack fixing portion 4A. The jack fixing portion 4A has a function of fixing the jack 4. A coupling portion 11E for fixing the jack fixing portion 4A to the support cover body 11 is provided near an outer periphery of the support cover body 11. Although the illustration is omitted, the wire from the speaker unit 2 is connected to the jack 4 through a hole 15 formed in the support cover body 11. Moreover, the hole 15 is sealed with an adhesive or the like after wiring is carried out.

[0026] The headphone 1 including such a headphone unit 1A is provided with the wall portion 10A between the back chamber 10S and the jack 4 in the housing 3. Accordingly, it is possible to prevent air from unintentionally leaking around the jack 4 from the back chamber 10S. Consequently, the flow of air between the back chamber 10S and the outside can be restricted only to the dedicated ducts (the inner duct 10P and the outer duct 10Q), and the acoustic properties of the headphone 1 can be set to desired properties.

[0027] Moreover, the wall portion 10A is provided to enable an increase in the airtightness of the outer edge of the housing 3. Accordingly, it is possible to increase insulation for sound entering the housing 3, and prevent noise from reaching the ear through the inside of the housing 3. Especially, a headphone with a jack has a structure where a connection of a cable or the like allows touch noise caused by a touch on the cable to easily enter the headphone. However, the wall portion 10A is provided as in the embodiment of the present invention to separate the surrounding of the jack 4 and the back chamber 10S. Accordingly, it is possible to effectively reduce touch noise.

[0028] In the embodiment of the present invention, it is so designed that the connection terminal portion 4A is installed outside the wall portion 10A to enable the connection of the wire of the speaker unit 2 drawn out of the back chamber 10S to the connection terminal portion 4A. Consequently, it is possible to eliminate the risk of reducing the airtightness of the back chamber 10S with the wiring of the speaker unit 2.

[0029] Moreover, in the embodiment of the present invention, the jack 4 provided to the housing 3 is placed in the direction where the longitudinal direction is tangent to the outer edge of the housing 3. Accordingly, the surrounding space of the jack 4 including the jack 4 itself or the jack fixing portion 4A can avoid interfering with the space to house the speaker unit 2 that is housed in the housing 3. Consequently, the degree of freedom in the design of the size and the mounting position of the speaker unit 2 can be increased.

[0030] Especially, if the shape of the outer edge of the housing is a circle, when the longitudinal direction of the jack is oriented toward the center of the housing, the shape of the outer diameter is to greatly influence the space to place the circular speaker unit. As in the embodiment of the present invention, the longitudinal direction of the jack 4 is oriented in the tangent direction to the outer edge of the circular housing 3. Accordingly, space to place the speaker unit 2 can be effectively secured. Moreover, even if the shape of the outer edge of the housing is not a circle and is, for example, an arc or square, the jack 4 is placed likewise in such a manner that the longitudinal direction is tangent to the outer edge of the housing. Accordingly, a similar effect can be obtained.

[0031] Furthermore, in a case of an on-ear model that is used pressing the ear cushion body 5A directly against the auricle (an on-ear type), in other words, if the front side of the ear cushion body 5A comes into contact with the auricle of the user of the headphone, the size of the housing of the on-ear model is usually equal to or smaller than, the auricle. Accordingly, when the jack 4 having the wall portion 10A is provided, space to place the speaker unit 2 is insufficient, which leads to a reduction in the degree of freedom in design. Even in such a case, it is possible to effectively secure space to place the speaker unit 2 by orienting the longitudinal direction of the jack 4 in the tangent direction to the outer edge of the circular housing 3. It is needless to say that the shape of the housing of the on-ear model is not restricted to a circle. Naturally, even if the ear cushion body 5A has a structure that covers the user's auricle, the present invention is effective.

[0032] Next, a description is given of a case where the headphone 1 according to an embodiment of the present invention includes a pair of left and right headphone units. In this case, if each of the left and right headphone units includes the jack 4 as in the above-mentioned headphone unit 1A, the left-right symmetric headphone units 1A are provided to make the sound qualities of the left side and the right side equal.

[0033] In contrast, if the jack is provided only to one of the pair of left and right headphone units, the shapes of the back chambers in the housing are made symmetric left and right irrespective of the presence or absence of the jack. Accordingly, the sound qualities of the left side and the right side can be made equal. At this point in time, if an attempt is made to provide a dummy jack for the purpose of causing the shape of the back chamber of the headphone unit without the jack to match the shape of the back chamber of the headphone unit with the jack, there are problems that it is difficult to simulate the complicated shape of the jack by resin molding or the like, and the cost is increased. Moreover, if a jack equal to

the headphone unit on a side where the jack is provided is placed, the shapes and materials of the air chambers on the left and right sides can be made equal. However, it becomes a cause of an increase in cost.

[0034] Fig. 5 is a solution to the above-mentioned problems, and illustrates by example an internal structure of a housing in a case where, if the headphone 1 includes a pair of left and right headphone units, only one of the headphone units is provided with the jack, and the other headphone unit is not provided with the jack.

[0035] Here, if the structure of the housing 3 of the headphone unit 1A illustrated in Fig. 3 is the structure of the left or right side, an internal structure of a housing 30 of the other headphone unit 1B on the left or right side is illustrated. The housing 30 of the headphone unit 1B illustrated here is not provided with the jack. However, a dummy wall portion 31A of the same shape as the above-mentioned wall portion 10A is provided to a back chamber forming body 31 of the housing 30. Moreover, the back chamber forming body 31 is provided with an outer edge portion 31B, a coupling portion 31C, an outer duct 31Q, a partition wall 31U, and the like of the same shapes as those of the back chamber forming body 10 of the headphone unit 1A. Consequently, a back chamber 31S formed in the back chamber forming body 31 has the same shape as the back chamber 10S in the back chamber forming body 10 of the headphone unit 1A. Accordingly, the sound qualities of the left and right headphone units can be made equal without providing a dummy jack.

[0036] Up to this point the embodiments of the present invention have been described in detail with reference to the drawings. However, a specific configuration is not limited to these embodiments. The present invention also includes modifications and the like in design within the scope that does not depart from the gist of the present invention. Moreover, the above-mentioned embodiments can be combined, using their technologies to each other, unless a contradiction and a problem arise in the object, configuration, and the like.

Claims

1. A headphone comprising a headphone unit including a speaker unit and a housing that houses the speaker unit, wherein

   the housing is provided with a jack that is electrically connected to a wire of the speaker unit, and
   the housing includes a wall portion that airtightly separates a back chamber placed on a side opposite to a sound emission side of the speaker unit and the surrounding of the jack.

2. The headphone according to claim 1, wherein the jack is placed in a direction where a longitudinal direction thereof is tangent to an outer edge of the housing.

3. The headphone according to claim 2, wherein the shape of the outer edge of the housing is a circle.

4. The headphone according to any of claims 1 to 3, wherein attached on the sound emission side of the speaker unit to the housing is an ear cushion body.

5. The headphone according to any of claims 1 to 4, further comprising:

   one of headphone units with the jack, including the wall portion in the housing; and
   the other headphone unit without the jack, wherein
   a housing of the other headphone unit includes a dummy wall portion of the same shape as the wall portion.

FIG. 1

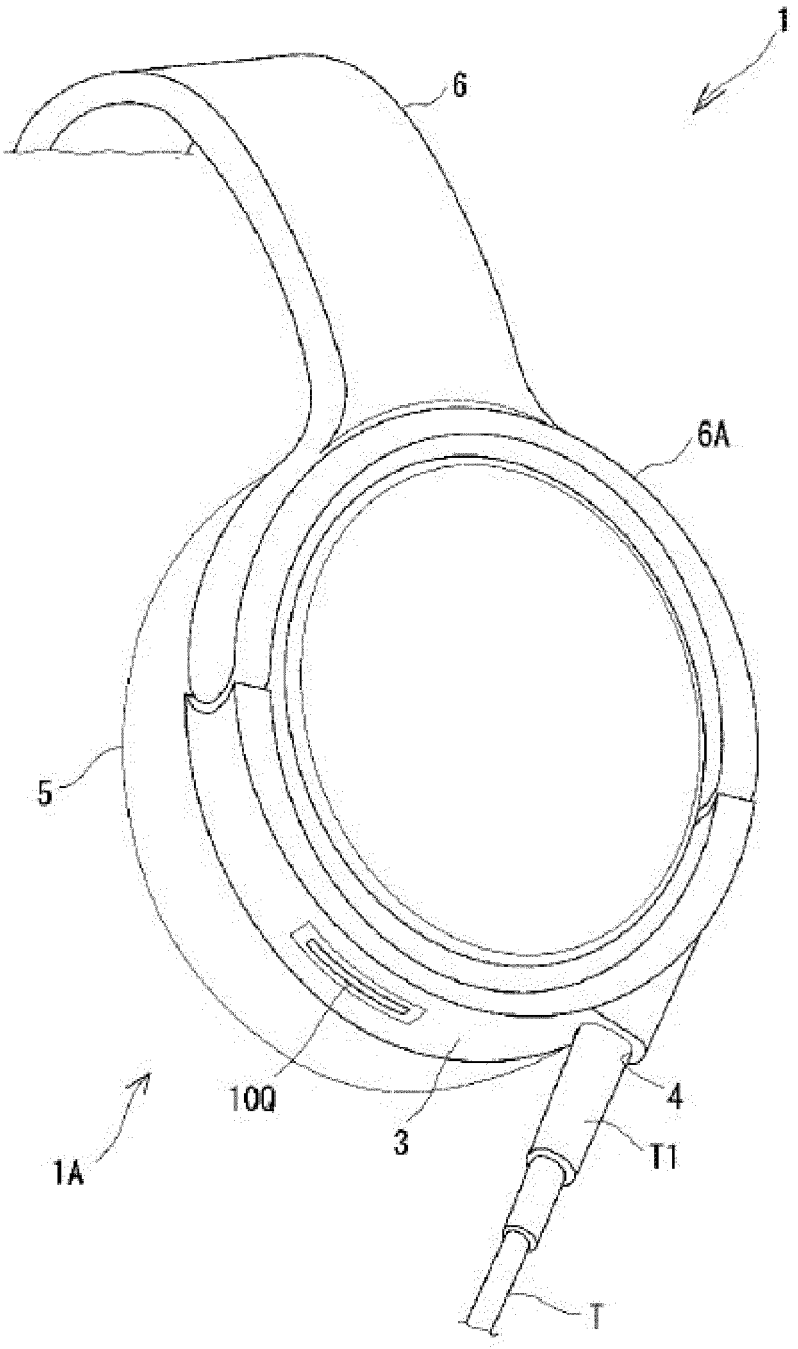


FIG. 2

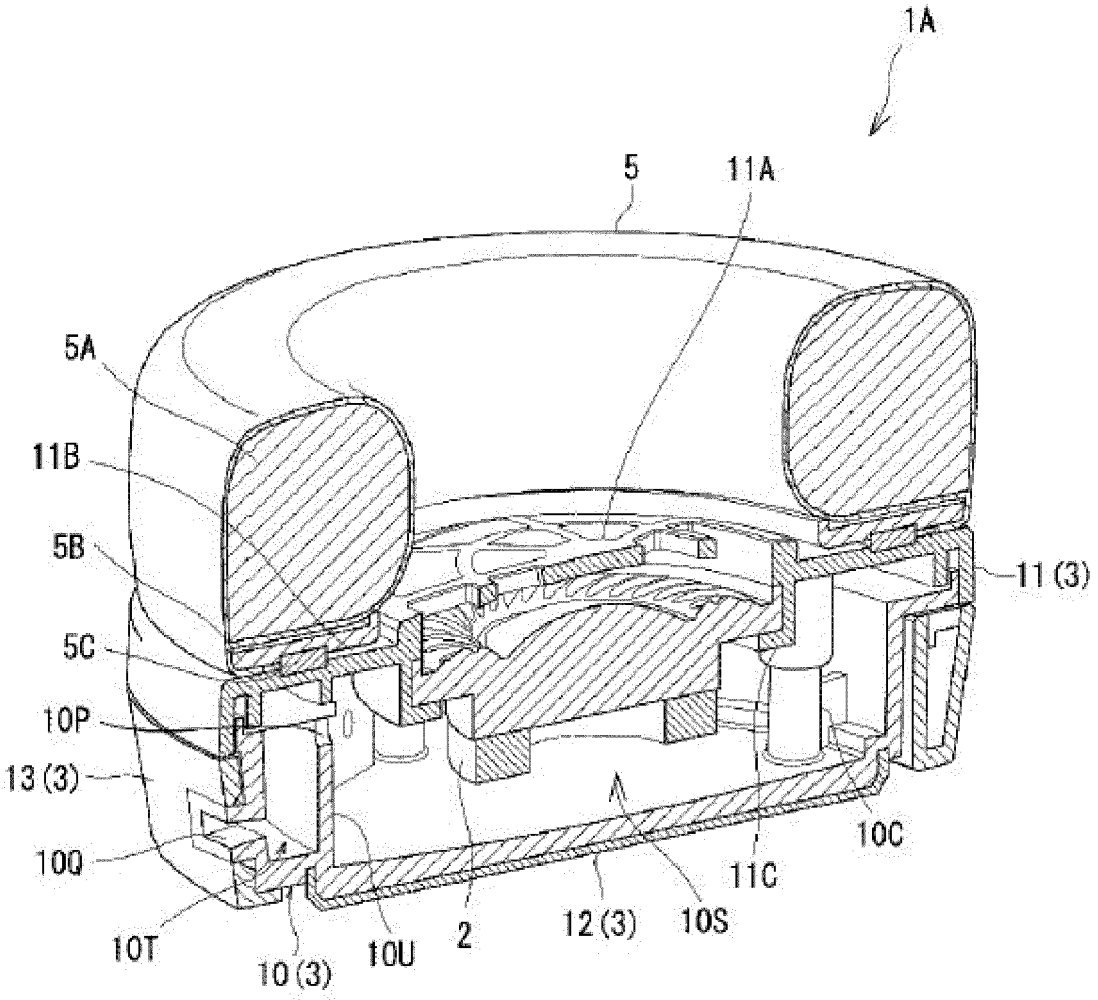


FIG. 3

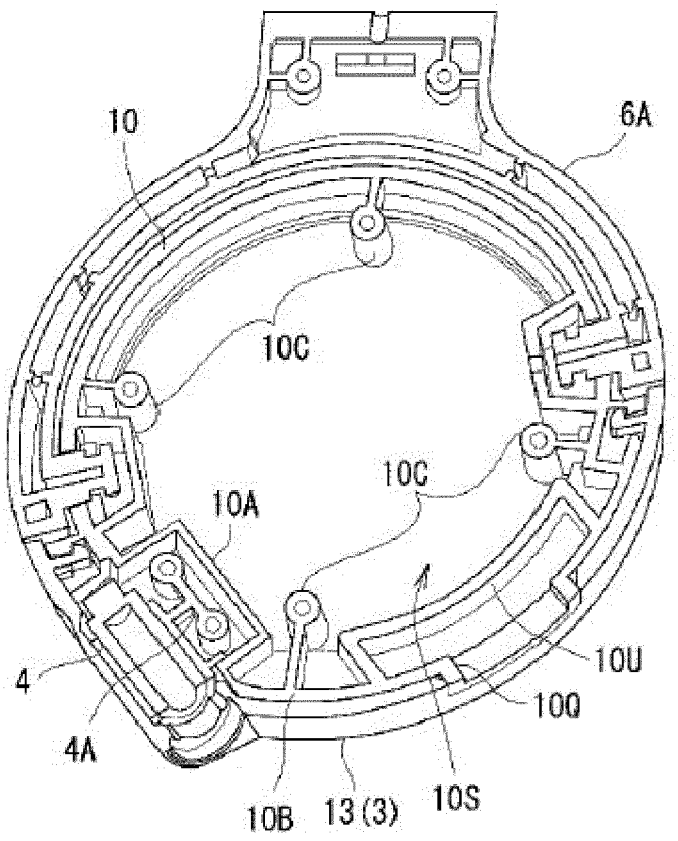


FIG. 4

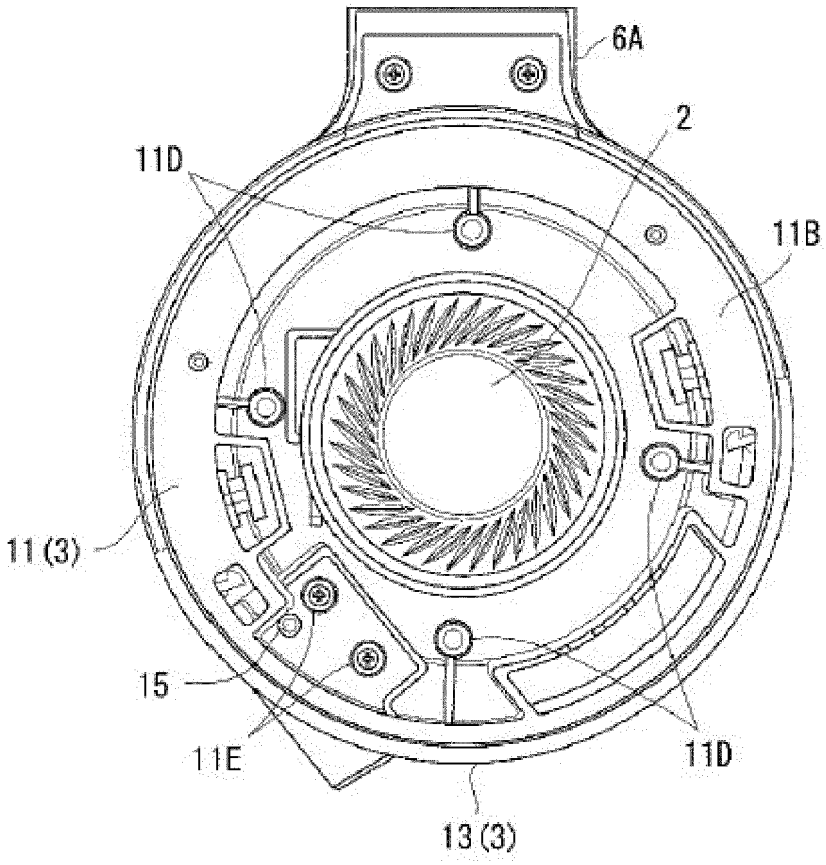
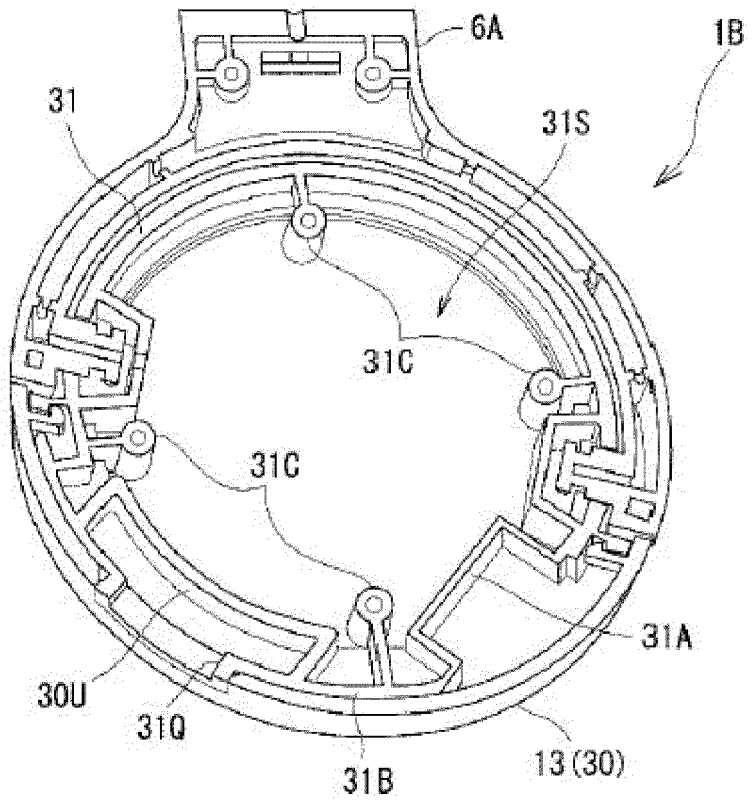


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2016/079849

A. CLASSIFICATION OF SUBJECT MATTER
H04R1/10(2006.01)i

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)
H04R1/10

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2016
Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 2011-40969 A (JVC Kenwood Holdings, Inc.), 24 February 2011 (24.02.2011), paragraphs [0015] to [0029]; fig. 1 to 3 (Family: none)	1,4,5 2,3
Y	Tokucho|MDR-Z7|Headphone|Sony, Sony Marketing Inc., 21 October 2014 (21.10.2014), [online], [retrieval date 19 December 2016 (19.12.2016)], Internet: <URL:http://web.archive.org/web/20141021194619/http://www.sony.jp/headphone/products/MDR-Z7/feature_1.html>	2,3

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
19 December 2016 (19.12.16)	27 December 2016 (27.12.16)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2011507462 A **[0004]**