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(54) **HEATER**

(57) A heater includes a ceramic body having a cylindrical or a tubular shape and extending from a first end toward a second end, a heating resistor located inside the ceramic body, an electrode pad electrically connected to the heating resistor, a lead terminal electrically connected to the electrode pad, and a bonding material having electrical conductivity and bonding the electrode pad and the lead terminal. The electrode pad is located from a side surface to an end surface of the ceramic body.

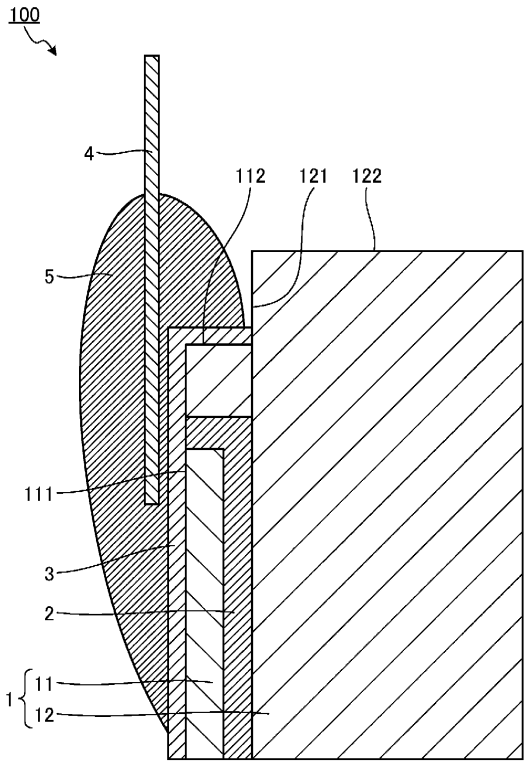

FIG. 3

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a heater used for a liquid heating heater, a gas heating heater, an oxygen sensor heater, or the like.

BACKGROUND OF INVENTION

[0002] As a heater used for a liquid heating heater, for example, a ceramic heater described in Patent Document 1 has been known. The ceramic heater described in Patent Document 1 includes a core member including a heat generation portion therein, a connection terminal portion provided at a side surface of the core material and connected to the heat generation portion, and a lead terminal including one end portion bonded to the connection terminal portion by a brazing material and the other end portion extending along a longitudinal direction of the ceramic heater.

CITATION LIST

PATENT LITERATURE

[0003] Patent Document 1: JP 2016-81608 A

SUMMARY

[0004] In a heater of the present disclosure, the heater includes a ceramic body having a cylindrical or a tubular shape and extending from a first end toward a second end, a heating resistor located inside the ceramic body, an electrode pad electrically connected to the heating resistor, a lead terminal electrically connected to the electrode pad, and a bonding material having electrical conductivity and bonding the electrode pad and the lead terminal, wherein the electrode pad is located from a side surface to an end surface of the ceramic body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005]

FIG. 1A is a perspective view illustrating an example of a heater.
FIG. 1B is a schematic perspective view in which part of the heater illustrated in FIG. 1A is seen through.
FIG. 2A is an enlarged cross-sectional view of the heater illustrated in FIG. 1A, taken along line A-A'.
FIG. 2B is an enlarged cross-sectional view of the heater illustrated in FIG. 1A, taken along line B-B'.
FIG. 3 is an enlarged cross-sectional view of the heater illustrated in FIG. 1A.
FIG. 4 is an enlarged cross-sectional view illustrating another example of the heater.
FIG. 5 is an enlarged cross-sectional view illustrating another example of the heater.
FIG. 6 is an enlarged cross-sectional view illustrating another example of the heater.
FIG. 7 is an enlarged cross-sectional view illustrating another example of the heater.
FIG. 8 is an enlarged cross-sectional view illustrating another example of the heater.
FIG. 9 is an enlarged cross-sectional view illustrating another example of the heater.
FIG. 10 is an enlarged cross-sectional view illustrating another example of the heater.
FIG. 11 is a side view illustrating another example of the heater.
FIG. 12 is a plan view illustrating another example of the heater.
FIG. 13 is a plan view illustrating another example of the heater.

DESCRIPTION OF EMBODIMENTS

[0006] In such a ceramic heater, a terminal connection portion is provided at one surface of a core member. This has resulted in a risk of failure to maintain the bonding strength of the terminal connection portion when vibration occurs in a direction in which the core member and the terminal connection portion are separated from each other. Thus, the terminal connection portion may be peeled off from the core member when used for a long period of time. As a result, it has been difficult to improve the long-term reliability of ceramic heaters.

[0007] In a heater according to an embodiment of the present disclosure, an electrode pad is located from a side surface to an end surface of a ceramic body. Thus, the electrode pad can be provided at a plurality of surfaces of the ceramic body. With this configuration, even when vibration occurs in a direction in which the ceramic body and the electrode pad are separated from each other, the bonding strength of the electrode pad can be maintained. Thus, a risk of peeling of the electrode pad from the ceramic body can be reduced even when used for a long period of time. As a result, the long-term reliability of the heater can be improved.

[0008] A heater 100 will be described in detail.

[0009] FIG. 1A is a perspective view illustrating an example of the heater 100. FIG. 1B is a schematic perspective view in which part of the heater illustrated in FIG. 1A is seen through. As illustrated in FIGs. 1A and 1B, the heater 100 includes a ceramic body 1 having a cylindrical or a tubular shape and extending from a first end 101 toward a second end 102, a heating resistor 2 located inside the ceramic body 1, an electrode pad 3 electrically connected to the heating resistor 2, a lead terminal electrically connected to the electrode pad 3, and a bonding material 5 having electrical conductivity and bonding the electrode pad 3 and the lead terminal 4, wherein the electrode pad 3 is located from a side surface to an end surface of the ceramic body 1.

[0010] In FIGs. 1A and 1B, the first end 101 and the second end 102 of the heater 100 are at the lower left side and the upper right side, respectively. In FIG. 3, the first end 101 and the second end 102 are provided at the upper side and the lower side, respectively. In the following description, the terms "first end 101 side" and "second end 102 side" may be used. Based on the center in the longitudinal direction, which is the direction in which the ceramic body 1 extends, a portion closer to the first end 101 is the "first end 101 side" and a portion closer to the second end 102 is the "second end 102 side". The "first end 101 side" can also be referred to as the vicinity of the first end 101, and the "second end 102 side" can also be referred to as the vicinity of the second end 102.

[0011] The ceramic body 1 is a member provided to protect the heating resistor 2. The ceramic body 1 has a cylindrical or tubular shape having a longitudinal direction. In the heater 100 illustrated in FIG. 1, the ceramic body 1 has a tubular shape.

[0012] The ceramic body 1 includes an insulating ceramic material. The ceramic body 1 includes an insulating ceramic material such as, for example, alumina, silicon nitride, or aluminum nitride. When the ceramic body 1 has a cylindrical shape, the dimensions of the ceramic body 1 can be, for example, 10 mm to 400 mm in length and 5 mm to 60 mm in outer diameter. When the ceramic body 1 has a tubular shape, the dimensions of the ceramic body 1 may be, for example, 10 mm to 400 mm in length, 5 mm to 60 mm in outer diameter, and 3 mm to 50 mm in inner diameter.

[0013] The ceramic body 1 may include a slit-like recess extending from the first end 101 toward the second end 102 in the outer peripheral surface as illustrated in FIGs. 1A and 1B.

[0014] The heating resistor 2 is a member for generating heat when electrical current flows therethrough. The heating resistor 2 is provided inside the ceramic body 1 as illustrated in FIGs. 1B, 2A, and 2B. The heating resistor 2 may be disposed so as to generate the largest amount of heat at the second end 102 side of the ceramic body 1. For example, the heating resistor 2 may extend from the first end 101 side toward the second end 102 side of the ceramic body 1 and may extend from the second end 102 side toward the other first end 101 side after reaching the second end 102 side. As illustrated in FIG. 1B, for example, the heating resistor 2 may include a folded portion in which the heating resistor 2 is provided along a circumferential direction while being repeatedly folded in the longitudinal direction, at the second end 102 side of the ceramic body 1. Further, the heating resistor 2 may be a pair of linear portions at the second end 102 side of the folded portion. The heating resistor 2 may have a pattern in which the heating resistor 2 is repeatedly folded back and forth between the first end 101 side and the second end 102 side, instead of the pattern in which the folded portion with repeated folding is only at the second end 102 side.

[0015] The heating resistor 2 includes a metal material. The metal material includes, for example, tungsten, molybdenum, or rhenium. The heating resistor 2 may include an insulating member. Thus, the resistance value of the heating resistor 2 can be adjusted. The dimensions of the heating resistor 2 can be set to, for example, 0.2 mm to 5 mm in width, 5 mm to 1000 mm in total length, and 0.05 mm to 0.5 mm in thickness.

[0016] The electrode pad 3 is a member for connecting the lead terminal 4 and the heating resistor 2. The electrode pad 3 is provided from a side surface to an end surface of the ceramic body 1. The electrode pad 3 is electrically connected to the heating resistor 2. The electrode pad 3 includes a metal material. The metal material includes, for example, tungsten, molybdenum, or rhenium. Further, a layer of a metal such as nickel, chromium, or gold may be formed on the surface thereof. The dimensions of a portion of the electrode pad 3 provided at the side surface of the ceramic body 1 may be 0.5 mm to 15 mm in length, 0.5 mm to 5 mm in width, and 0.2 mm to 1.5 mm in thickness. The dimensions of a portion of the electrode pad 3 provided at the end surface of the ceramic body 1 may be 0.1 mm to 20 mm in length, 0.1 mm to 20 mm in width, and 0.2 mm to 1.5 mm in thickness. As illustrated in FIG. 1, the electrode pad 3 and the lead terminal 4 may be provided at each of both ends of the heating resistor 2.

[0017] The electrode pad 3 and the heating resistor 2 may be electrically connected to each other via a through-hole conductor, for example, as illustrated in FIG. 2B. Thus, the lead terminal 4 provided at the outer peripheral portion of the ceramic body 1 and the heating resistor 2 provided inside the ceramic body 1 can be electrically connected to each other.

[0018] The lead terminal 4 is a member for supplying power to the heating resistor 2. The lead terminal 4 is electrically connected to an external power supply. The lead terminal 4 is electrically bonded to the electrode pad 3 and extends in the longitudinal direction of the ceramic body 1. The lead terminal 4 is, for example, a linear, rod-shaped, cylindrical, belt-shaped, or string-shaped member. The lead terminal 4 may have, for example, a circular, an elliptical, a polygonal such as a triangular or rectangular cross-sectional shape or may be hollow with these shapes. In the lead terminal 4 illustrated in FIG. 1, the lead terminal 4 has a cylindrical shape. The dimensions of the lead terminal 4, for example, in the case of a cylindrical shape, may be 0.5 mm to 5 mm in diameter and 10 mm to 300 mm in length. As the lead terminal 4, a wire or a plate made of metal such as nickel or copper can be used.

[0019] The bonding material 5 is a member for firmly fixing the lead terminal 4 and the electrode pad 3. The bonding material 5 is located on the electrode pad 3. The bonding material 5 may be, for example, a metal material having electrical conductivity such as silver, copper, or tin.

[0020] In a sample holding unit of the present embodiment, as illustrated in FIGs. 1A, 1B, 2A, and 2B, the

heater 100 includes the ceramic body 1 having a cylindrical or a tubular shape and extending from the first end 101 toward the second end 102, the heating resistor 2 located inside the ceramic body 1, the electrode pad 3 electrically connected to the heating resistor 2, the lead terminal 4 electrically connected to the electrode pad 3, and the bonding material 5 having electrical conductivity and bonding the electrode pad 3 and the lead terminal 4, wherein the electrode pad 3 is located from a side surface to an end surface of the ceramic body 1. Thus, the electrode pad 3 can be provided at a plurality of surfaces of the ceramic body 1. With this configuration, even when vibration occurs in a direction in which the ceramic body 1 and the electrode pad 3 are separated from each other, the bonding strength of the electrode pad 3 can be maintained. Thus, a risk of peeling of the electrode pad 3 from the ceramic body 1 can be reduced even when used for a long period of time. As a result, the long-term reliability of the heater 100 can be improved.

[0021] As illustrated in FIG. 3, the ceramic body 1 may include a first part 11 including the outer periphery of the ceramic body 1 and a second part 12 continuous with the first part 11 and located near the center axis. The first part 11 may include a first side surface 111 including the outer periphery and a first end surface 112 continuous with the first side surface 111. The second part 12 may include a second side surface 121 continuous with the first end surface 112 and extending toward the second end 102 and a second end surface 122 continuous with the second side surface 121.

[0022] The "side surface" illustrated in FIG. 1 includes the first side surface 111 and the second side surface 121, and the "end surface" includes the first end surface 112 and the second end surface 122. Here, since the second part 12 includes the second side surface 121 continuous from the first end surface 112 and extending toward the second end 102 and the second end surface 122 continuous with the second side surface 121, a step can be provided between the second part 12 and the first part 11. Thus, a space for storing the bonding material 5 can be provided between the lead terminal 4, the first end surface 112, and the second side surface 121. This makes it possible to add a larger amount of the bonding material 5. Thus, the bonding strength between the lead terminal 4 and the ceramic body 1 can be increased. As a result, the long-term reliability of the heater 100 can be improved.

[0023] As illustrated in FIG. 3, the electrode pad 3 may be located from the first side surface 111 to the first end surface 112. Here, the second side surface 121 and the second end surface 122 may include a portion not provided with the electrode pad 3. Furthermore, the second side surface 121 and the second end surface 122 may include a portion not provided with the bonding material 5. With the electrode pad 3 located from the first side surface 111 to the first end surface 112, compared with a case where the electrode pad 3 is provided at one surface of the ceramic body 1, the bonding strength of the electrode pad 3 can be maintained even when vibration occurs in the direction in which the ceramic body 1 and the electrode pad 3 are separated from each other. Thus, a risk of peeling of the electrode pad 3 from the ceramic body 1 can be reduced even when used for a long period of time. As a result, the long-term reliability of the heater 100 can be improved.

[0024] As illustrated in FIG. 4, the electrode pad 3 may be located from the first end surface 112 to the second side surface 121. Here, the second end surface 122 may include a portion not provided with the electrode pad 3. Furthermore, the second end surface 122 may include a portion not provided with the bonding material 5. With the electrode pad 3 located from the first end surface 112 to the second side surface 121, a portion between the first end surface 112 and the second side surface 121 that is the boundary between the first part 11 and the second part 12 can be covered by the electrode pad 3. Thus, the possibility of generation of cracks between the first end surface 112 and the second side surface 121 in the ceramic body 1 can be reduced. As a result, the long-term reliability of the heater 100 can be improved. The first part 11 is a portion that can be referred to as a surface layer, and the second part 12 is a portion that can be referred to as a core.

[0025] As illustrated in FIG. 5, the electrode pad 3 may be located from the second side surface 121 to the second end surface 122. Here, the first end surface 112 and the second side surface 121 may be provided with the electrode pad 3 and the bonding material 5. With the electrode pad 3 located from the second side surface 121 to the second end 102 surface 122, the electrode pad 3 can be provided at a larger number of surfaces of the ceramic body 1. With this configuration, even when vibration occurs in a direction in which the ceramic body 1 and the electrode pad 3 are separated from each other, the bonding strength of the electrode pad 3 can be maintained. Thus, a risk of peeling of the electrode pad 3 from the ceramic body 1 can be reduced even when used for a long period of time. As a result, the long-term reliability of the heater 100 can be improved.

[0026] As illustrated in FIG. 6, the heating resistor 2 may be located between the first part 11 and the second part 12 and include an end portion protruding from the first end 101 surface 112, and the end portion and the electrode pad 3 may be bonded to each other. Thus, the number of paths through which electrical current flows from the lead terminal 4 to the heating resistor 2 can be increased. Thus, a risk of failure of electrical connection between the lead terminal 4 and the heating resistor 2 can be reduced. As a result, the long-term reliability of the heater 100 can be improved.

[0027] As illustrated in FIG. 7, the bonding material 5 may be provided in a meniscus form from the first end surface 112 to the second side surface 121. Thus, the bonding material 5 can cover the interface between the first end surface 112 and the second side surface 121, so that a risk of generation of cracks at the interface be-

tween the first end surface 112 and the second side surface 121 of the ceramic body 1 can be reduced. As a result, the long-term reliability of the heater 100 can be improved.

[0028] As illustrated in FIG. 7, the bonding material 5 may be provided in a meniscus form from the first end surface 112 to the lead terminal 4 and a space may be provided between the second side surface 121 and the lead terminal 4. Accordingly, while the lead terminal 4 and the ceramic body 1 are firmly fixed to each other by the bonding material, a region in which the bonding material 5 can thermally expand can be formed by the space provided between the second side surface 121 and the lead terminal 4. Accordingly, a risk of generation of thermal stress between the lead terminal 4 and the bonding material 5 due to thermal expansion of the bonding material 5 can be reduced. Thus, a risk of generation of cracks between the lead terminal 4 and the bonding material 5 can be reduced. As a result, the long-term reliability of the heater 100 can be improved.

[0029] As illustrated in FIG. 8, the bonding material 5 may be located filling the space between the second side surface 121 and the lead terminal 4. Thus, the lead terminal 4 and the ceramic body 1 can be firmly fixed by the bonding material 5. Thus, a risk of peeling between the lead terminal 4 and the ceramic body 1 can be reduced. As a result, the long-term reliability of the heater 100 can be improved. This space between the second side surface 121 and the lead terminal 4 refers to a portion surrounded by a virtual extension line of the first side surface 111 and a virtual extension line of the second end 102 surface 122.

[0030] As illustrated in FIG. 9, the lead terminal 4 may be curved. The expression "curved" as used herein means that, as illustrated in FIG. 9, a portion connecting a portion electrically bonded to the electrode pad 3 and a portion extending toward the first end 101 is curved. With this configuration, vibration generated can be dispersed. Thus, the bonding strength between the lead terminal 4 and the bonding material 5 can be maintained. Thus, a risk of peeling between the lead terminal 4 and the bonding material 5 can be reduced. As a result, the long-term reliability of the heater 100 can be improved. The closer the angle between the portion electrically bonded to the electrode pad 3 and the portion extending toward the first end 101 is to 90 degrees, the larger the effect of the curve at the connecting portion.

[0031] As illustrated in FIG. 10, the bonding material 5 may be provided along the first side surface and extending to the second side surface, and a gap may be provided between the bonding material 5 and the first end 101 surface 121. Accordingly, the bonding material 5 can thermally expand to a portion where the first part 11 is exposed. Accordingly, a risk of generation of thermal stress between the lead terminal 4 and the bonding material 5 due to thermal expansion of the bonding material 5 can be reduced. Thus, a risk of generation of cracks between the lead terminal 4 and the bonding material 5 can be reduced. As a result, the long-term reliability of the heater 100 can be improved.

[0032] As illustrated in FIG. 11, the electrode pad 3 may be narrower at the first end 101 side than at the second end 102 side of the ceramic body 1. The term "narrow" used herein means that the length of the electrode pad 3 at the first end 101 side of the ceramic body 1 is shorter than that at the second end 102 side in the circumferential direction of the ceramic body 1. Thus, when two lead terminals 4, and electrode pads 3 each corresponding to a respective one of the two lead terminals 4 are provided at the first end 101 of the ceramic body 1, the two electrode pads 3 can be separated from each other at a distance. Accordingly, a risk of the two electrode pads 3 being connected to each other can be reduced, and a risk of occurrence of short circuiting can be reduced. As a result, the long-term reliability of the heater 100 can be improved. The electrode pad 3 may have a stepped shape in which the electrode pad 3 is narrower at the first end 101 side than at the second end 102 side of the ceramic body 1. Still, when the electrode pad 3 is tapered toward the first end 101 side of the ceramic body 1, the stress can be further reduced as compared with the stepped shape.

[0033] As illustrated in FIG. 12, the electrode pad 3 may be tapered toward the center of the second part 12 when viewed from the first end 101 side of the ceramic body 1. Thus, the two electrode pads 3 provided at the end surface of the ceramic body 1 can be separated from each other. Thus, a risk of occurrence of short circuiting at the end surface of the ceramic body 1 can be reduced. As a result, the long-term reliability of the heater 100 can be improved.

[0034] As illustrated in FIG. 13, the two electrode pads 3 may have different outer peripheral lengths as viewed from the first end 101 side of the ceramic body 1. Thus, the anode and the cathode can be distinguished from each other when bonding the heater 100 to another component. Thus, the heater 100 can be accurately connected with other members.

[0035] As illustrated in FIG. 13, the two electrode pads 3 may have different inner peripheral lengths as viewed from the first end 101 side of the ceramic body 1. Thus, the anode and the cathode can be distinguished from each other when bonding the heater 100 to another component. Thus, the heater 100 can be accurately connected with other members.

[0036] In particular, making the outer periphery of the electrode pad 3 serving as the cathode longer than that of the anode or increasing the inner peripheral length can make the diameter or the number of lead terminals 4 attached to the electrode pad 3 serving as the cathode larger than that for the anode. This enables the heater 100 to be fixed, with the cathode lead terminal 4 grounded.

REFERENCE SIGNS

[0037]

1 Ceramic body
101 First end
102 Second end
11 First part
111 First side surface
112 First end surface
12 Second part
121 Second side surface
122 Second end surface
2 Heating resistor
3 Electrode pad
4 Lead terminal
5 Bonding material
100 Heater

Claims

1. A heater comprising:

a ceramic body having a cylindrical or a tubular shape and extending from a first end toward a second end;
a heating resistor located inside the ceramic body;
an electrode pad electrically connected to the heating resistor;
a lead terminal electrically connected to the electrode pad; and
a bonding material having electrical conductivity and bonding the electrode pad and the lead terminal, wherein
the electrode pad is located from a side surface to an end surface of the ceramic body.

2. The heater according to claim 1, wherein

the ceramic body comprises:

a first part comprising an outer periphery of the ceramic body, and
a second part continuous with the first part and located near a center axis,

the first part comprises:

a first side surface comprising the outer periphery, and
a first end surface continuous with the first side surface, and

the second part comprises:

a second side surface continuous with the first end surface and extending toward the second end, and
a second end surface continuous with the second side surface.

3. The heater according to claim 2, wherein the electrode pad is located from the first side surface to the first end surface.

4. The heater according to claim 3, wherein the electrode pad is located from the first end surface to the second side surface.

5. The heater according to claim 4, wherein the electrode pad is located from the first side surface to the second end surface.

6. The heater according to claim 2, wherein

the heating resistor is located between the first part and the second part and comprises an end portion protruding from the first end surface, and the end portion and the electrode pad are bonded to each other.

7. The heater according to claim 2, wherein the bonding material is located in a meniscus form from the first end surface to the second side surface.

8. The heater according to claim 2, wherein

the bonding material is located in a meniscus form from the first end surface to the lead terminal, and
a space is provided between the second side surface and the lead terminal.

9. The heater according to claim 2, wherein the bonding material is located filling a space between the second side surface and the lead terminal.

10. The heater according to claim 1, wherein the lead terminal is curved at a portion connecting a portion electrically bonded to the electrode pad and a portion extending in a longitudinal direction of the ceramic body.

11. The heater according to claim 2, wherein

the bonding material is provided along the first side surface and extending to the second side surface, and
a gap is provided between the bonding material and the first end surface.

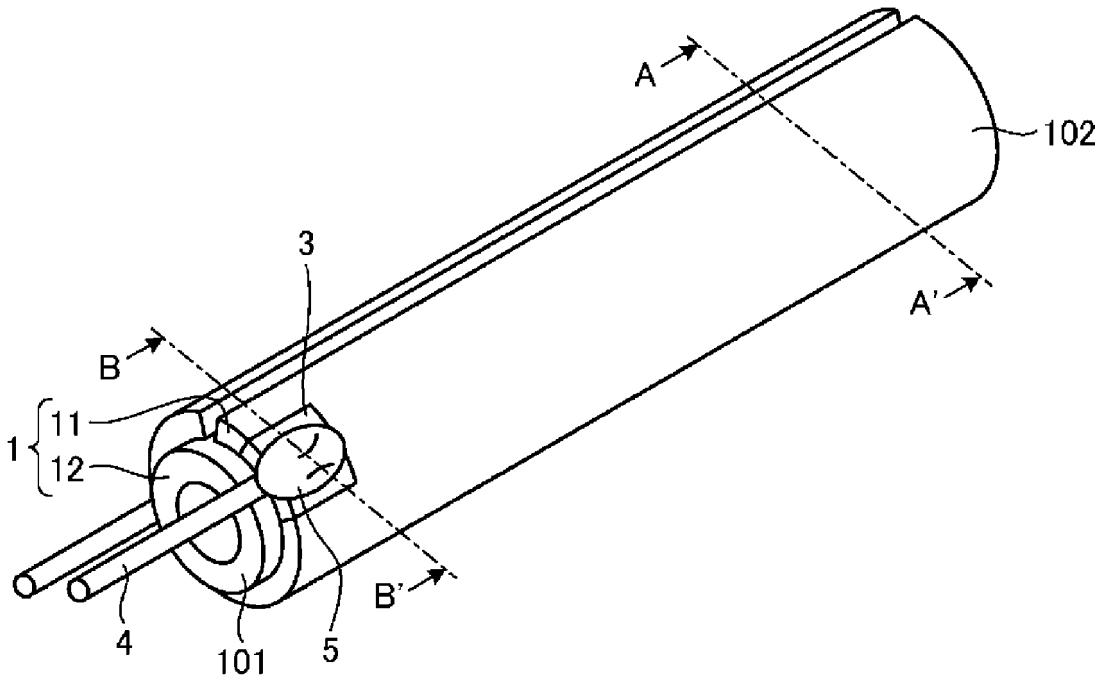

FIG. 1A

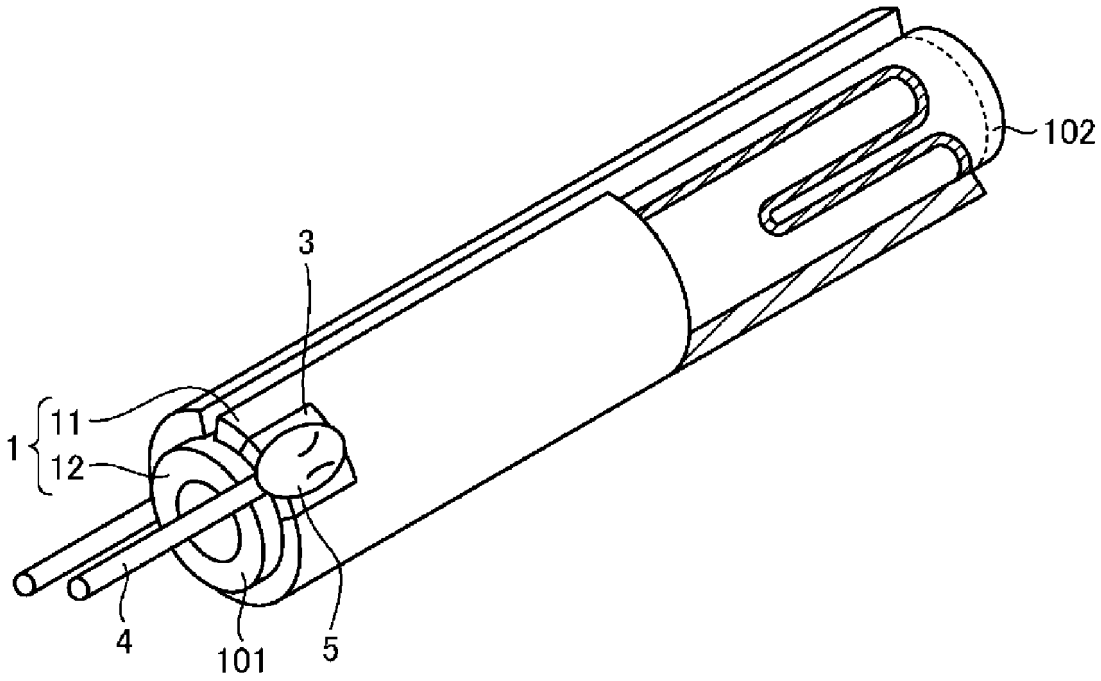

FIG. 1B

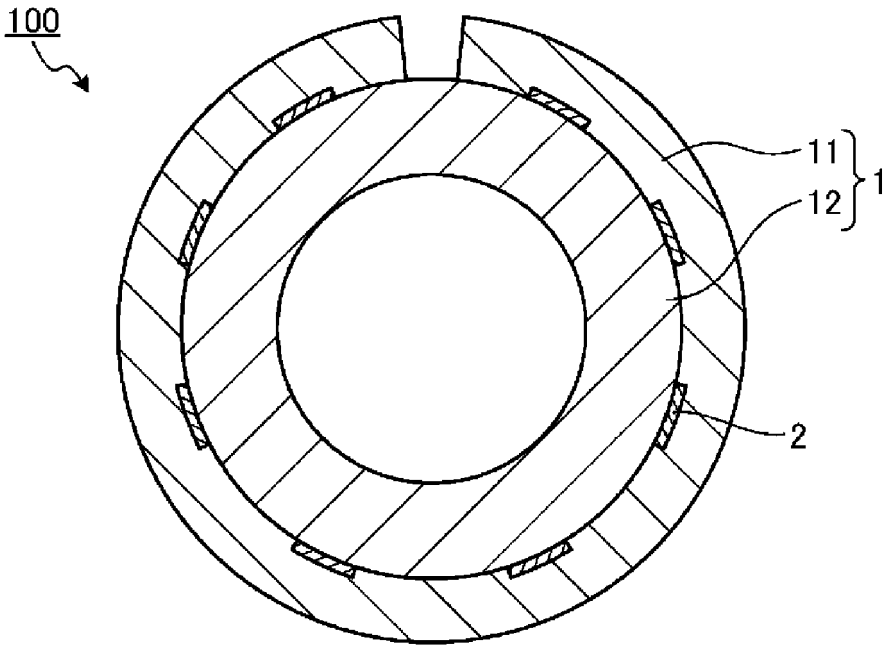

FIG. 2A

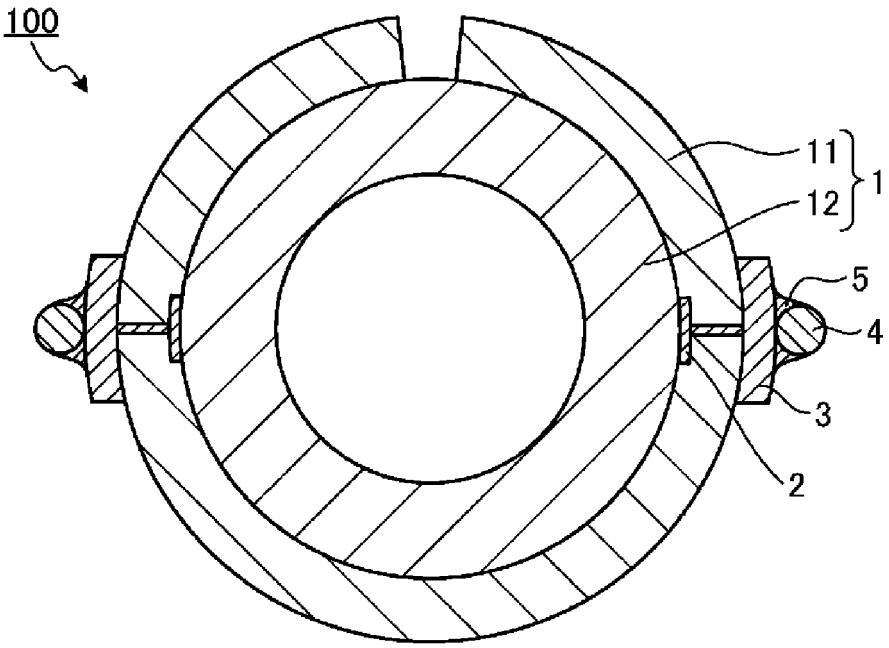

FIG. 2B

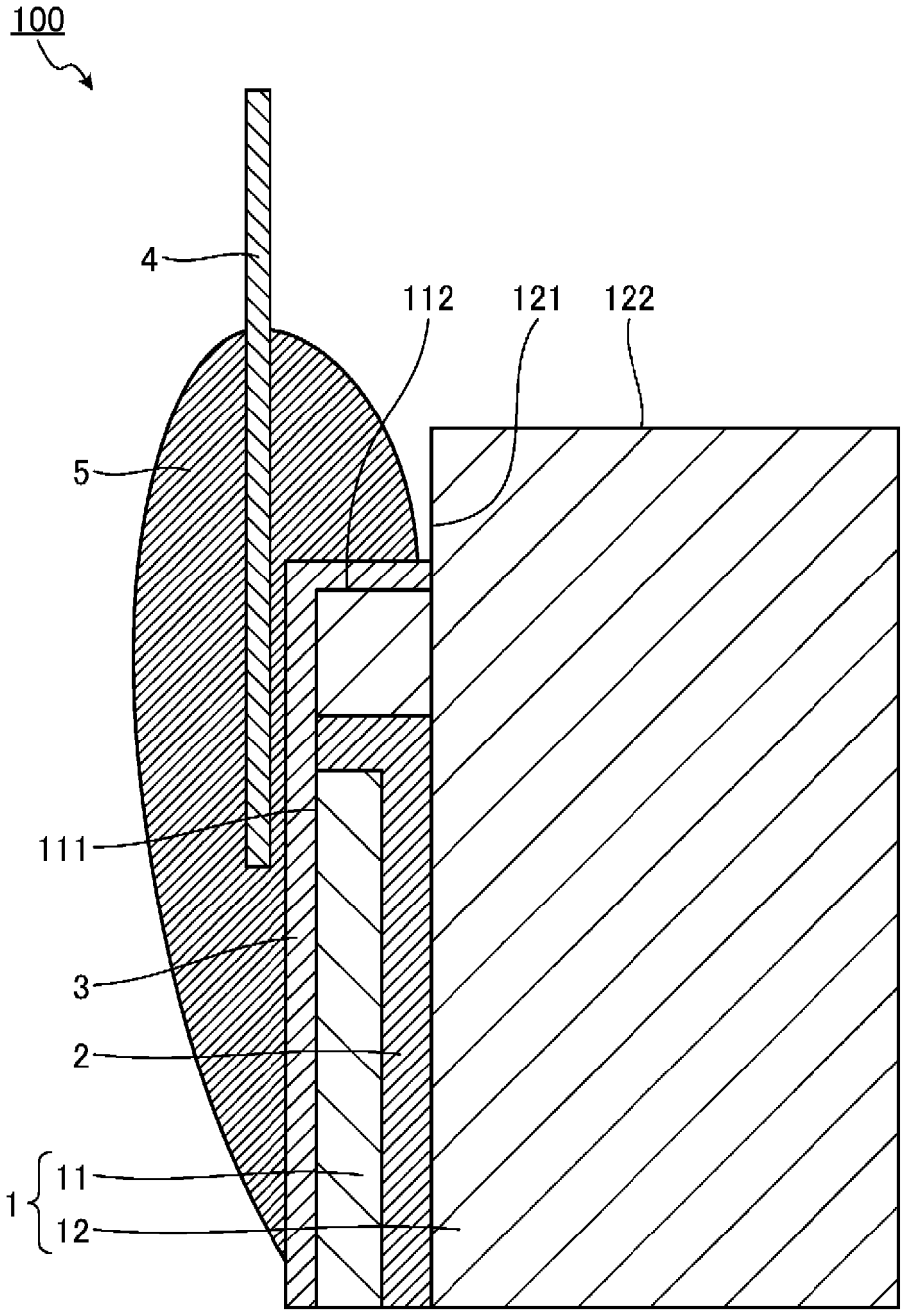

FIG. 3

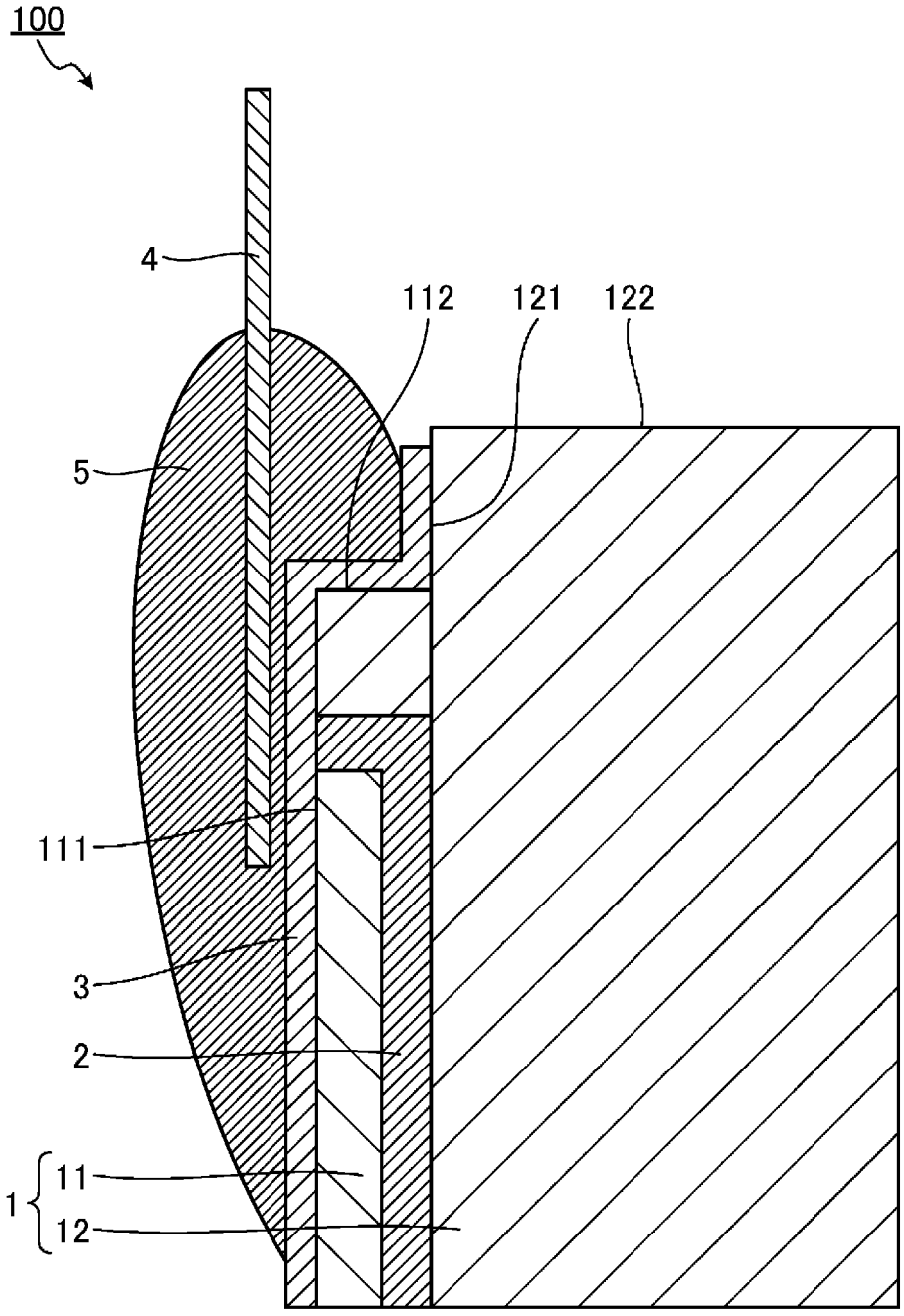

FIG. 4

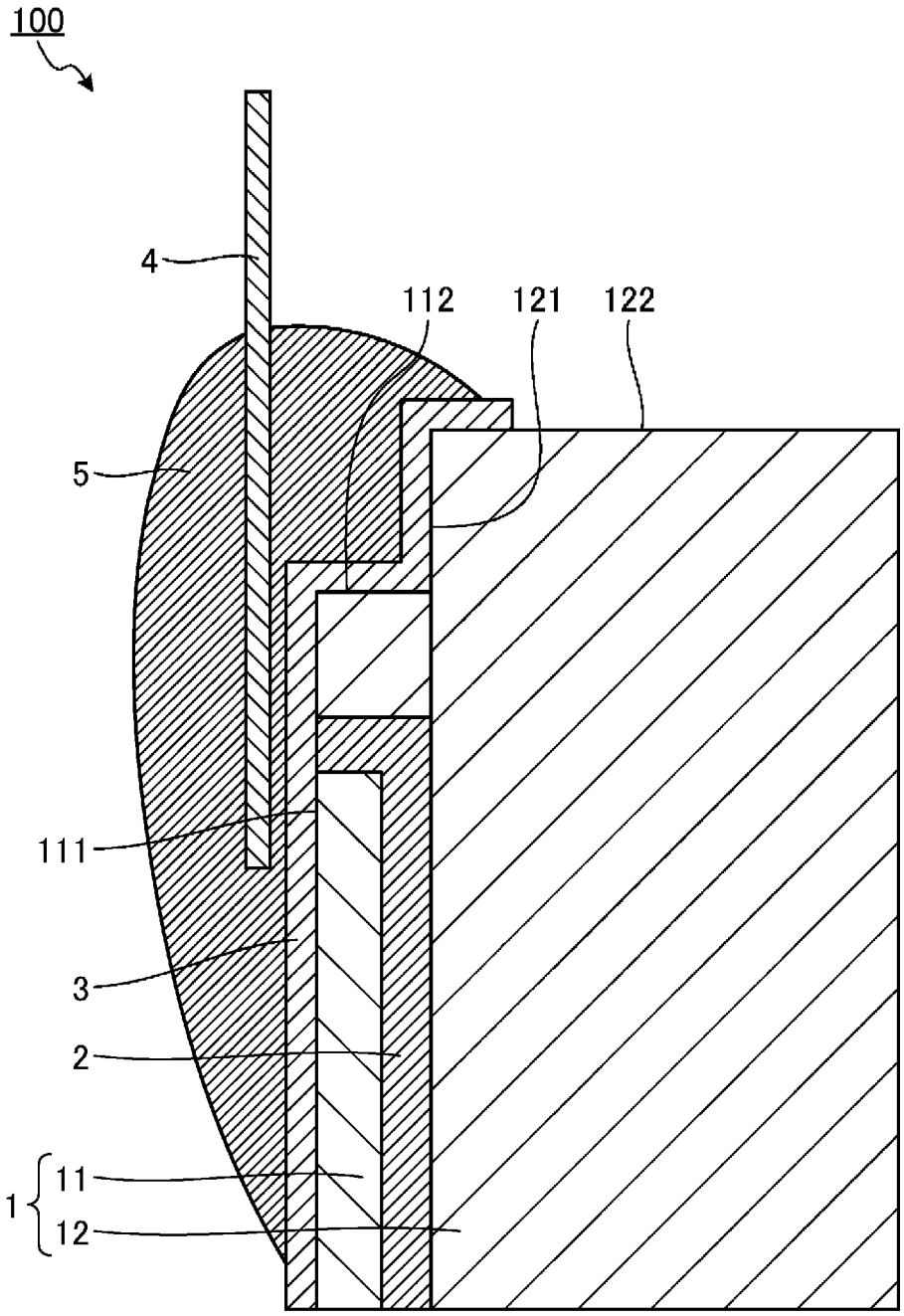

FIG. 5

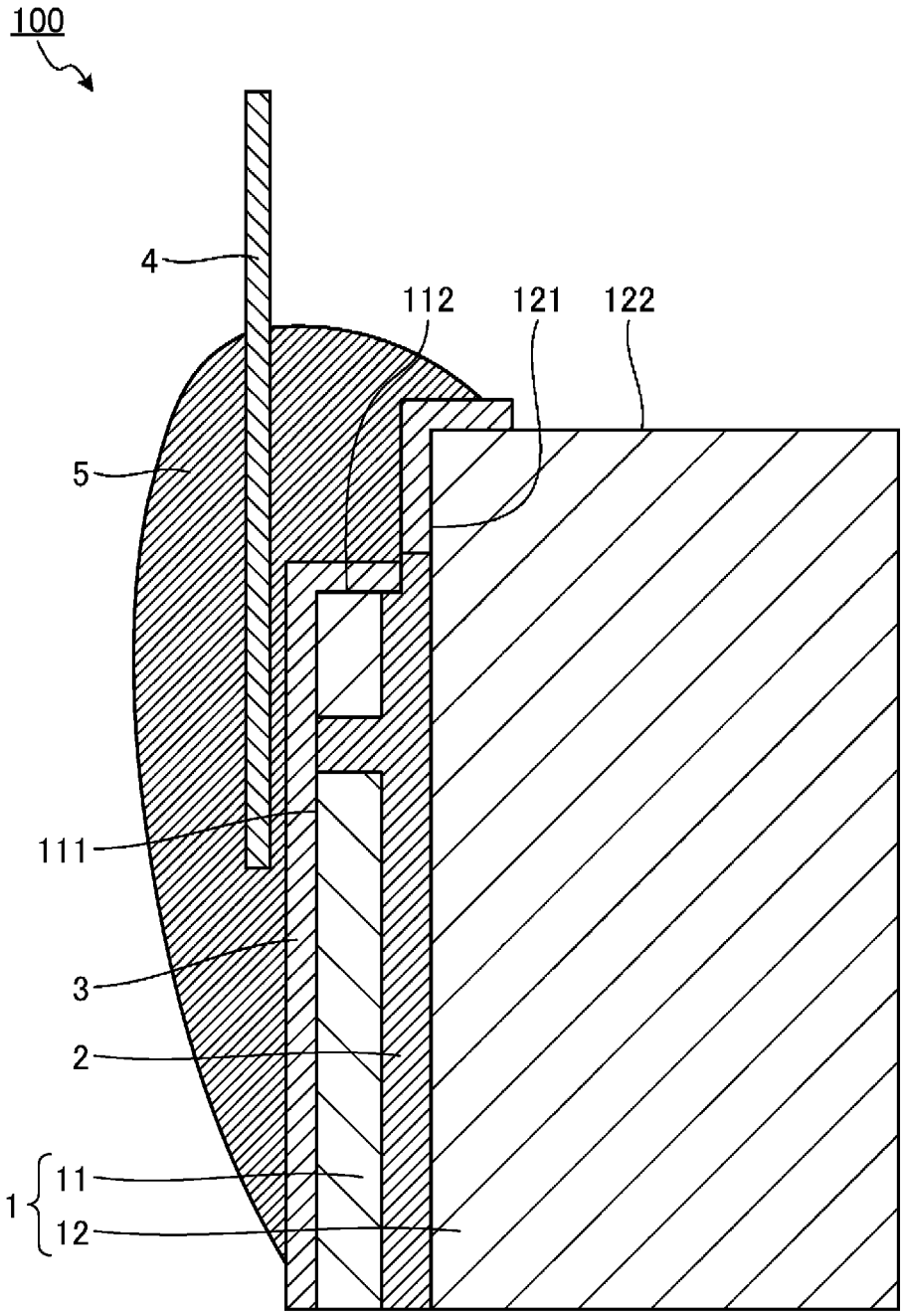

FIG. 6

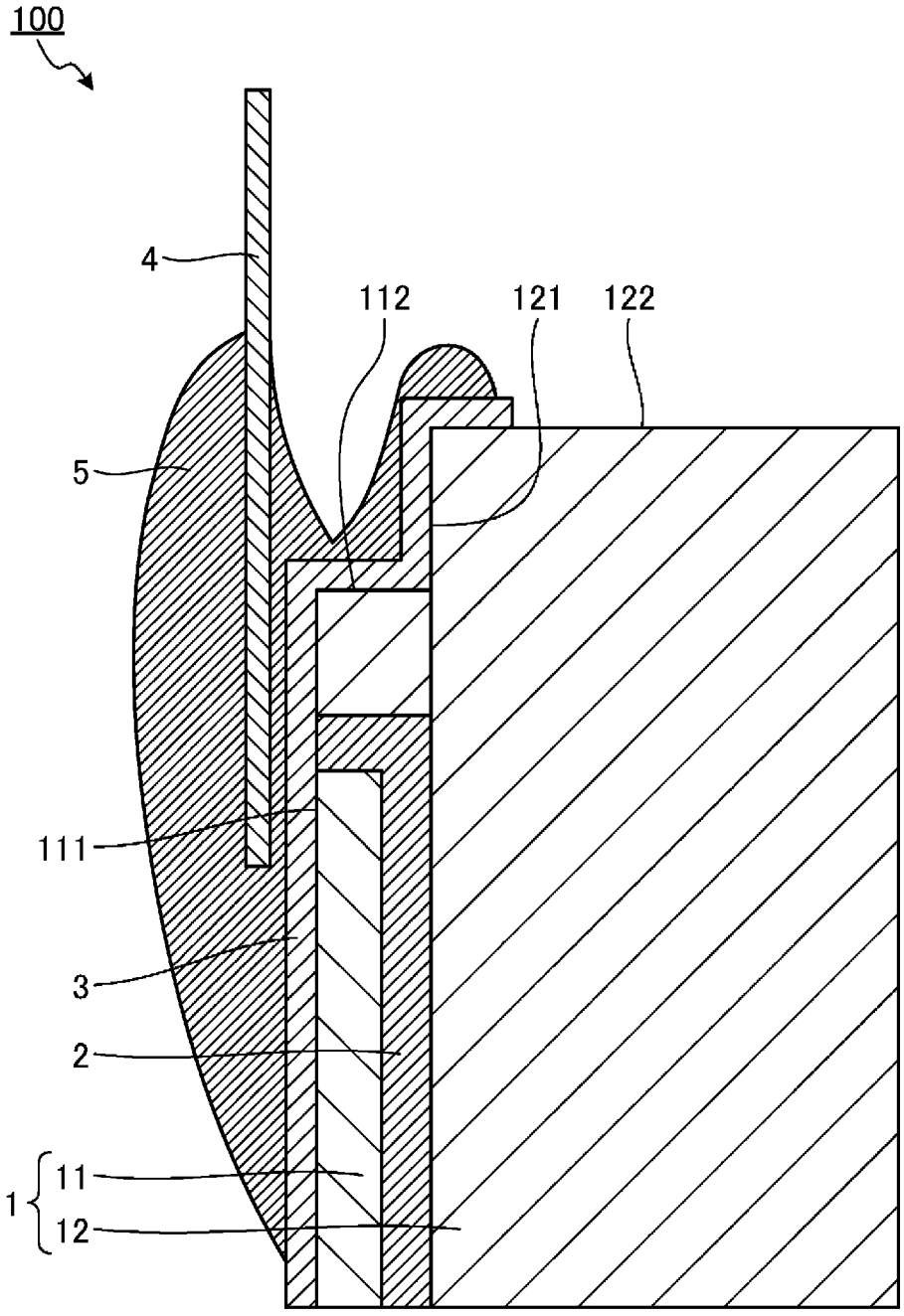

FIG. 7

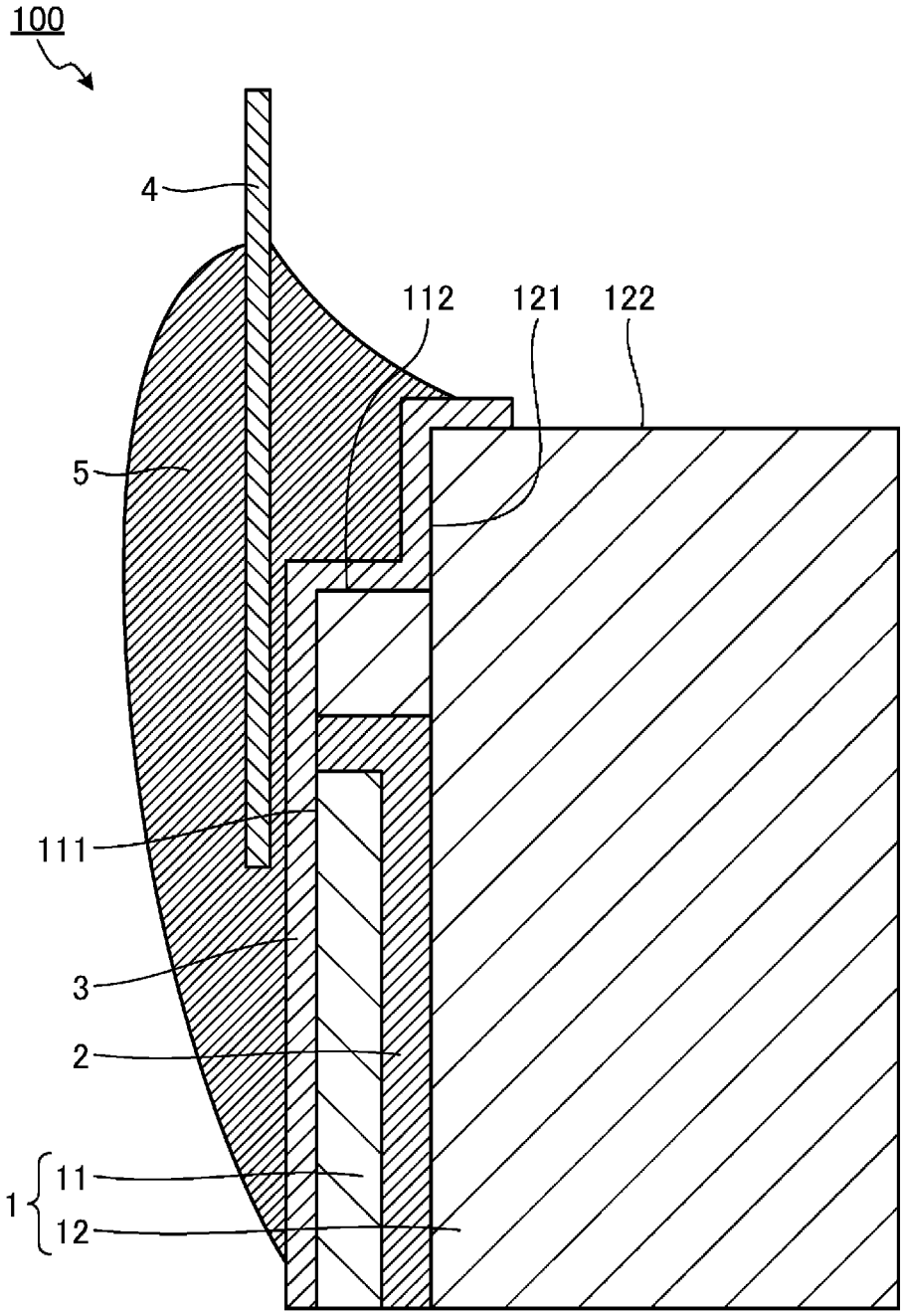

FIG. 8

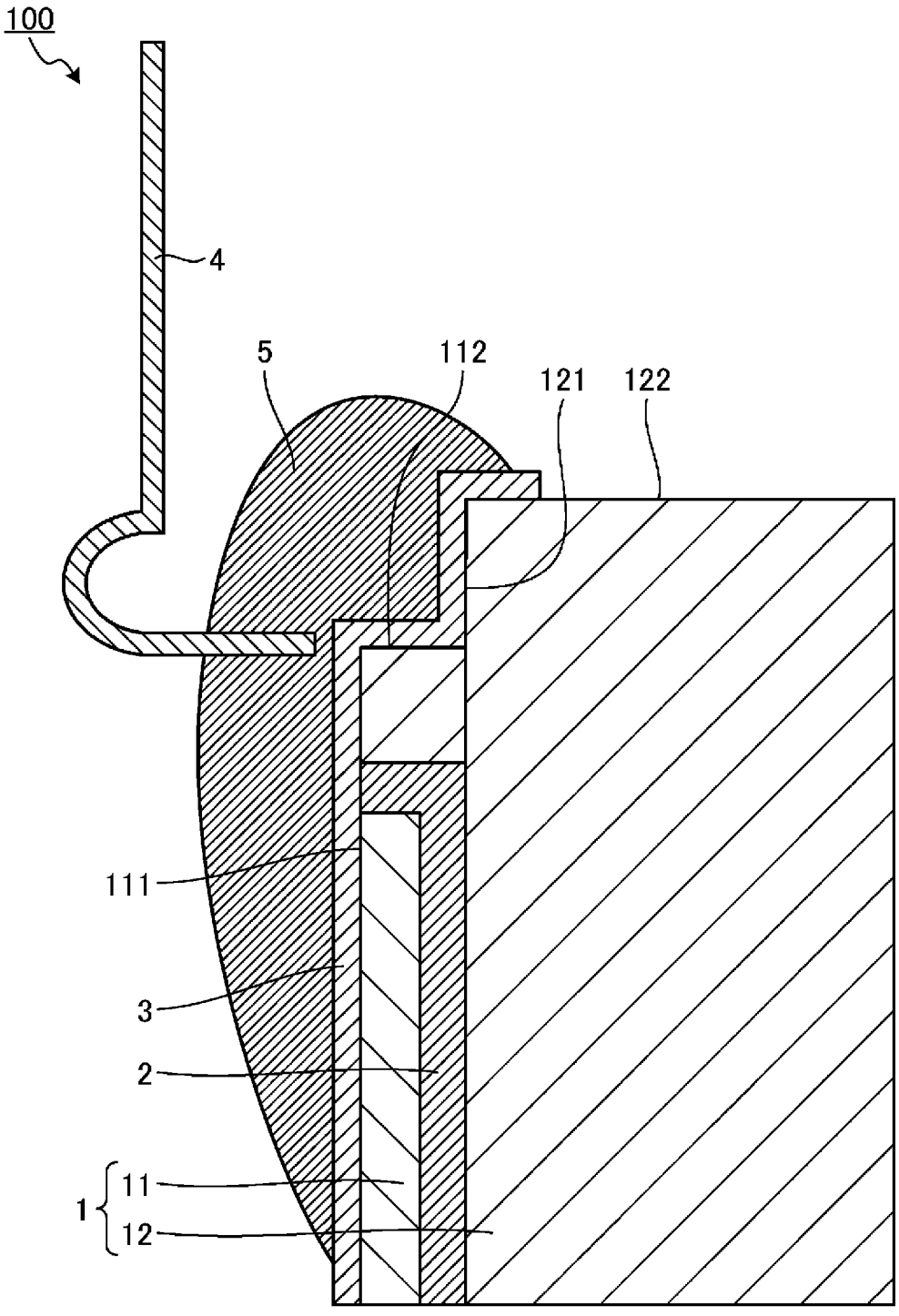

FIG. 9

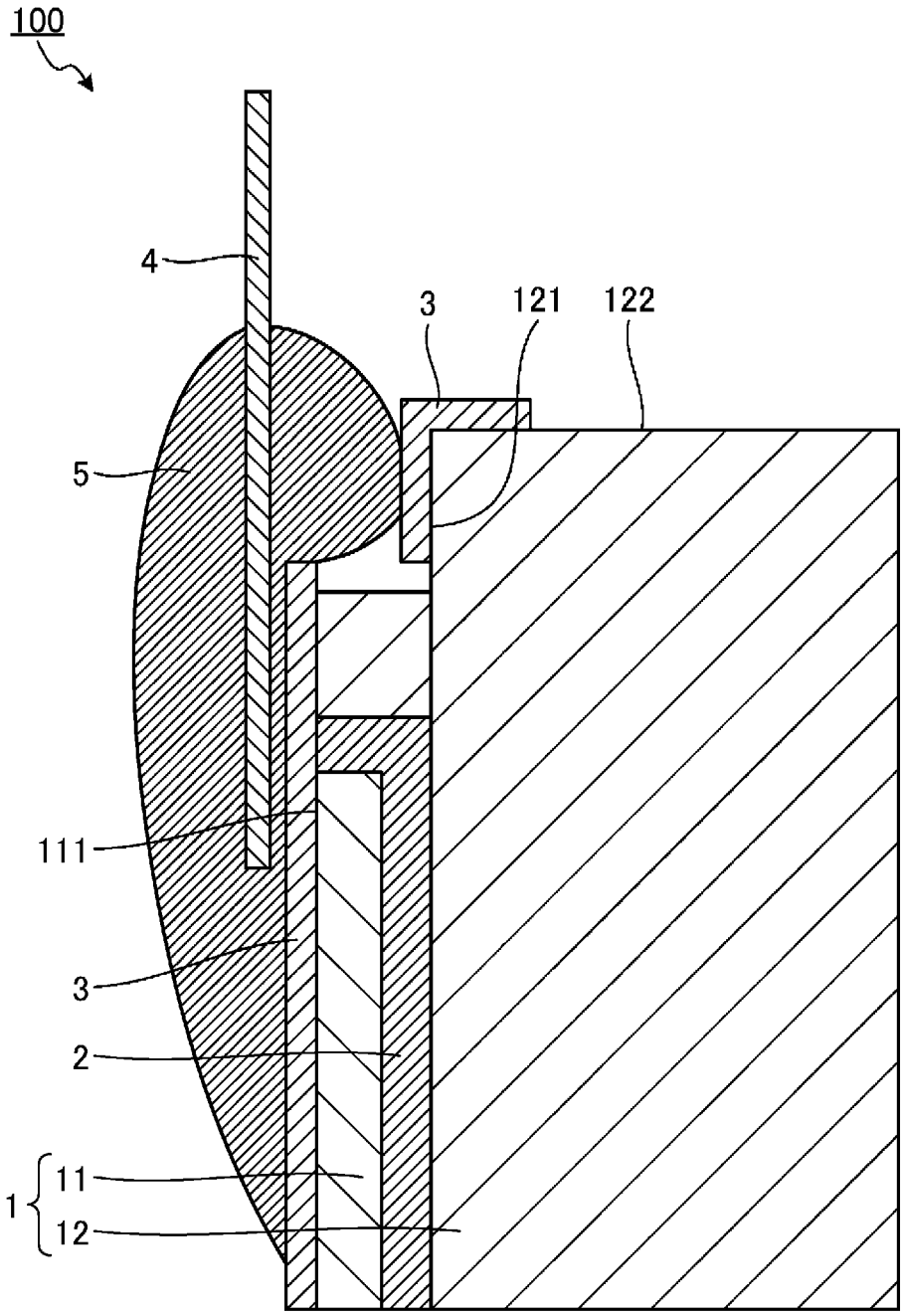

FIG. 10

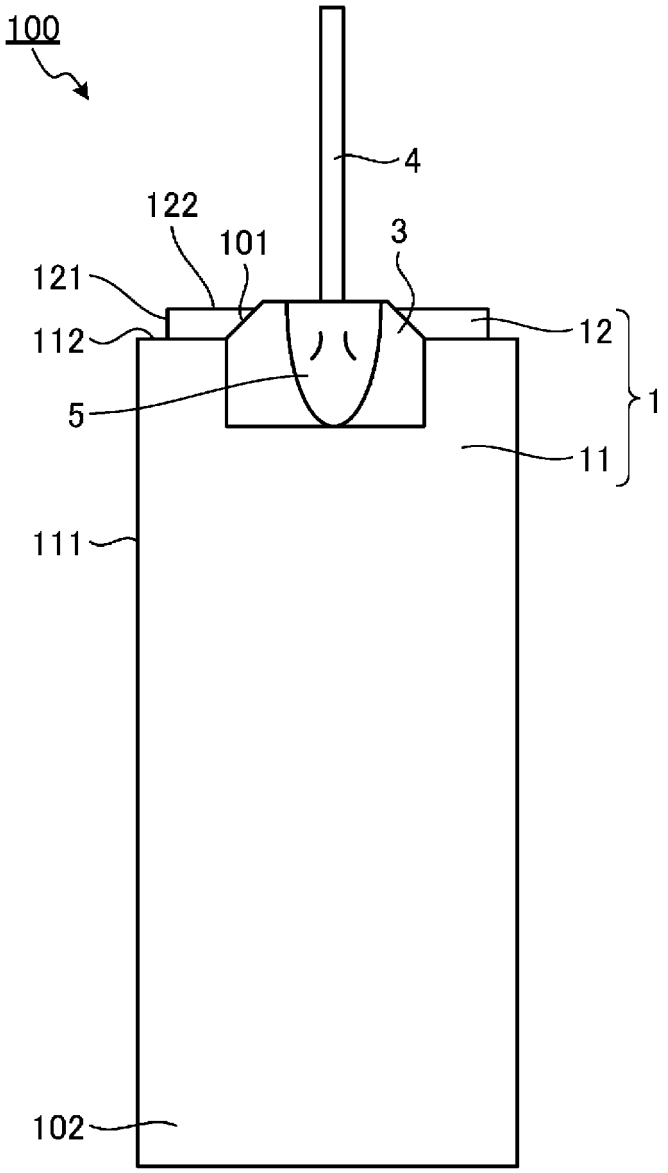

FIG. 11

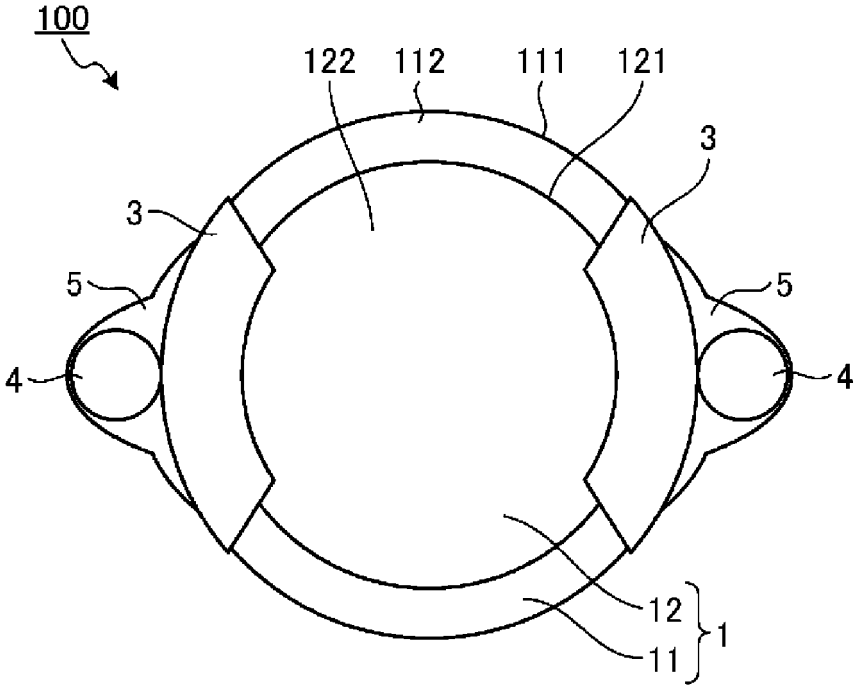

FIG. 12

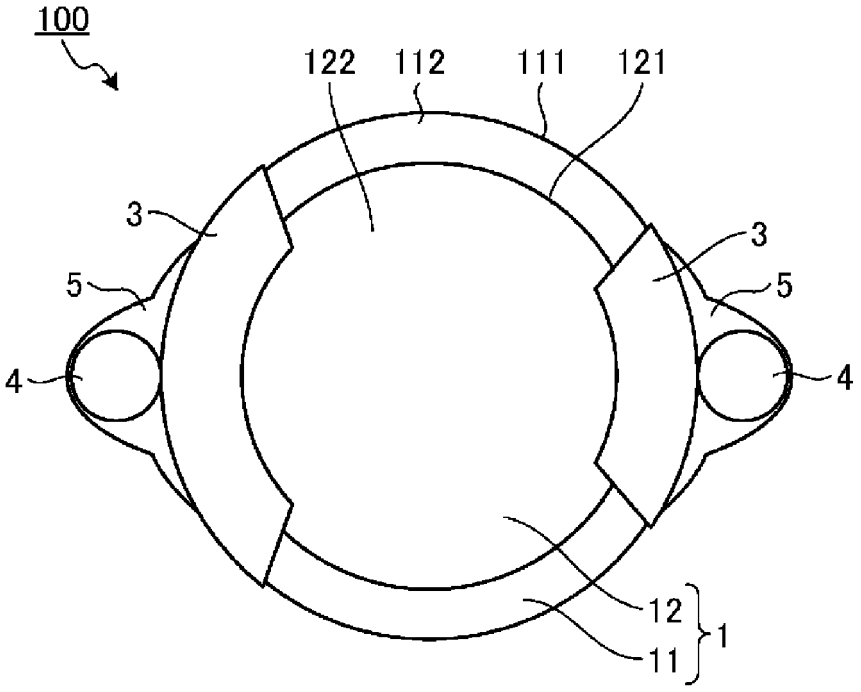

FIG. 13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2022/018056

A. CLASSIFICATION OF SUBJECT MATTER

H05B 3/02(2006.01)i; ***H05B 3/48***(2006.01)i
FI: H05B3/02 A; H05B3/48

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)

H05B3/02-3/82

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

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2022
Registered utility model specifications of Japan 1996-2022
Published registered utility model applications of Japan 1994-2022

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	JP 2001-068254 A (DENSO CORP) 16 March 2001 (2001-03-16) paragraphs [0014]-[0026], fig. 1	1
Y		10
A		2-9, 11
Y	JP 2017-126523 A (KYOCERA CORP) 20 July 2017 (2017-07-20) paragraph [0032], fig. 10	10
A	JP 2006-331936 A (KYOCERA CORP) 07 December 2006 (2006-12-07) entire text, all drawings	1-11
A	JP 2018-018671 A (KYOCERA CORP) 01 February 2018 (2018-02-01) entire text, all drawings	1-11

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

* Special categories of cited documents:
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 June 2022	**28 June 2022**
Name and mailing address of the ISA/JP **Japan Patent Office (ISA/JP)** **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2022/018056

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 2001-068254 A	16 March 2001	(Family: none)	
JP 2017-126523 A	20 July 2017	(Family: none)	
JP 2006-331936 A	07 December 2006	KR 10-2006-0122702 A CN 1870839 A	
JP 2018-018671 A	01 February 2018	(Family: none)	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2016081608 A **[0003]**