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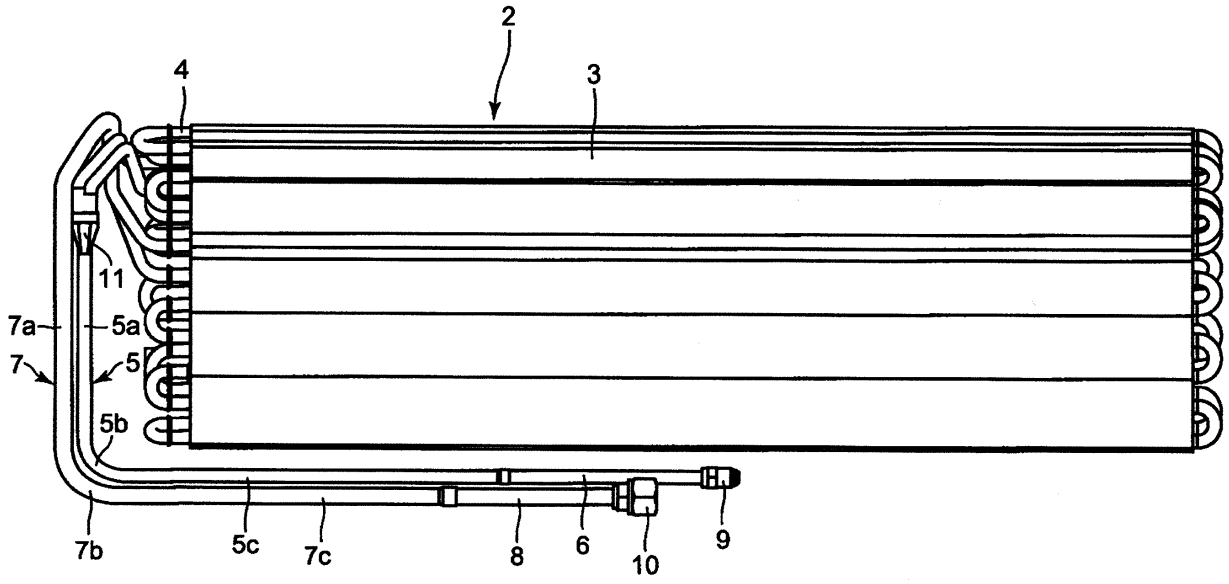
(54) **AIR CONDITIONER INDOOR UNIT**

(57) An air conditioner indoor unit has a first refrigerant tubing (5, 7) of which one end part is connected to an indoor heat exchanger (2) and that is formed of aluminum or an aluminum alloy, a second refrigerant tubing (6, 8) of which one end part is connected to the other end part of the first refrigerant tubing (5, 7) and that is formed of copper or a copper alloy, and a flare union (9, 10) connected to the other end part of the second refrigerant tubing (6, 8). The connection between the other end part of the first refrigerant tubing (5, 7) and the one end part of the second refrigerant tubing (6, 8) is between an end at the flare union (9, 10) side of a bend section (5b, 7b) of the first refrigerant tubing (5, 7) and the end at the flare union (9, 10) side of the second refrigerant tubing (6, 8). As a result, it is possible to prevent the occurrence of large torsional stress and bending stress at the connection.

Fig.3



EP 3 101 353 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to air conditioner indoor units.

BACKGROUND ART

[0002] There is a conventional air conditioner indoor unit in which an indoor heat exchanger 101 as illustrated in Fig. 5 is provided in a casing (see JP 2013-155892 A (PTL 1), for instance). One end part of a connection tube 102 is connected to the indoor heat exchanger 101 and refrigerant is guided by the connection tube 102 to the indoor heat exchanger 101 or an outdoor heat exchanger (not shown).

[0003] The connection tube 102 extends downward from an upper part of the indoor heat exchanger 101, then bends, and extends horizontally. The connection tube 102 is composed of a first refrigerant tube 103 placed on a side nearer to the indoor heat exchanger 101 and a second refrigerant tube 104 placed on a side opposite to the indoor heat exchanger 101. The first refrigerant tube 103 is formed of aluminum or aluminum alloy. The second refrigerant tube 104 is formed of copper or copper alloy.

[0004] The other end part (which is an end part opposite to the side nearer to the indoor heat exchanger 101) of the first refrigerant tube 103 is connected to one end part (which is an end part on the side nearer to the indoor heat exchanger 101) of the second refrigerant tube 104. A connection 106 between the first refrigerant tube 103 and the second refrigerant tube 104 is provided in a part of the connection tube 102 that extends vertically. A flare union 105 is brazed onto the other end part (which is an end part opposite to the side nearer to the indoor heat exchanger 101) of the second refrigerant tube 104.

CITATION LIST

Patent Literature

[0005] PTL1: JP 2013-155892 A

SUMMARY OF INVENTION

Technical Problem

[0006] When the indoor unit is installed on a wall inside a room, a worker may have to bend the connection tube 102 depending on an installation site for the indoor unit. Then the worker vertically moves a part of the connection tube 102 that extends horizontally or turns the part around the first refrigerant tube 103. Thus a torsional stress, a bending stress, and/or the like are caused in the connection 106 of the first refrigerant tube 103 and the second refrigerant tube 104. The connection 106 consisting of the different metals is vulnerable to the torsional stress, the bending stress, and the like.

[0007] Therefore, the conventional air conditioner indoor unit has a problem in that the connection 106 between the first refrigerant tube 103 and the second refrigerant tube 104 is in great danger of being broken.

[0008] An object of the invention is to provide an air conditioner indoor unit in which the danger of breakage in the connection between the first refrigerant tube and the second refrigerant tube can be decreased.

Solution to Problem

[0009] To solve the above problem, an air conditioner indoor unit according to the present invention comprises:

a casing,
an indoor heat exchanger provided in the casing,
a first refrigerant tubing formed of aluminum or aluminum alloy and having one end part connected to the indoor heat exchanger,
a second refrigerant tubing formed of copper or copper alloy and having one end part connected to the other end part of the first refrigerant tubing, and
a joint part connected to the other end part of the second refrigerant tubing,
wherein the first refrigerant tubing includes an elongate part that extends along a lateral part of the casing and a bend part that connects with an end part of the elongate part on a side nearer to the joint part and that is bent toward the joint part, and
wherein a connection between the other end part of the first refrigerant tubing and the one end part of the second refrigerant tubing is between an end of the bend part on the side nearer to the joint part and an end of the second refrigerant tubing on the side nearer to the joint part.

[0010] With the above arrangement, the connection between the other end part of the first refrigerant tubing and the one end part of the second refrigerant tubing is placed between the end of the bend part on the side nearer to the joint part (i.e., a joint part-side end of the bend part) and the end of the second refrigerant tubing on the side nearer to the joint part (i.e., a joint part-side end of the second refrigerant tubing). Thus, when, for example, the second refrigerant tubing is moved relative to the elongate part of the first refrigerant tubing, a torsional stress, a bending stress, and/or the like that would be caused in the connection part is smaller than a torsional stress, a bending stress, and/or the like that would be caused in the elongate part. Therefore, danger of breakage in the connection can be reduced.

[0011] In one embodiment, the connection between the other end part of the first refrigerant tubing and the one end part of the second refrigerant tubing is placed on the side nearer to the joint part with respect to a midpoint between the end of the bend part on the side nearer

to the joint part and the end of the second refrigerant tubing on the side nearer to the joint part.

[0012] With the above arrangement, because the connection between the other end part of the first refrigerant tubing and the one end part of the second refrigerant tubing is placed on the side nearer to the joint part with respect to the midpoint between the end of the bend part on the side nearer to the joint part and the end of the second refrigerant tubing on the side nearer to the joint part, a possibility that a great torsional stress, a great bending stress, and/or the like are caused in the connection can reliably be reduced.

Advantageous Effects of Invention

[0013] The air conditioner indoor unit according to the present invention has a casing, an indoor heat exchanger provided in the casing, a first refrigerant tubing formed of aluminum or aluminum alloy and having one end part connected to the indoor heat exchanger, a second refrigerant tubing formed of copper or copper alloy and having one end part connected to the other end part of the first refrigerant tubing, and a joint part connected to the other end part of the second refrigerant tubing. And, the first refrigerant tubing includes an elongate part that extends along a lateral part of the casing and a bend part that connects with an end part of the elongate part on a side nearer to the joint part and that is bent toward the joint part, and a connection between the other end part of the first refrigerant tubing and the one end part of the second refrigerant tubing is placed between an end of the bend part on the side nearer to the joint part and an end of the second refrigerant tubing on the side nearer to the joint part. Thus, it is possible to reduce a torsional stress, a bending stress, and/or the like that would be caused in the connection part when, for example, the second refrigerant tubing is moved relative to the elongate part of the first refrigerant tubing. Therefore, danger of breakage in the connection can be reduced.

BRIEF DESCRIPTION OF DRAWINGS

[0014]

Fig. 1 is a schematic perspective view of an air conditioner indoor unit in accordance with an embodiment of the invention;

Fig. 2 is another schematic perspective view of the indoor unit;

Fig. 3 is a back view of an indoor heat exchanger of the indoor unit and of peripheral parts thereof;

Fig. 4 is another schematic perspective view of the indoor unit; and

Fig. 5 is a schematic representation for description on a configuration of a conventional air conditioner indoor unit.

DESCRIPTION OF EMBODIMENTS

[0015] Hereinbelow, an air conditioner of the invention will be described in detail with reference to an embodiment illustrated in the drawings.

[0016] Fig. 1 is a schematic perspective view of an air conditioner indoor unit in accordance with an embodiment of the invention, as seen looking diagonally from a lower front side. Fig. 2 is a schematic perspective view of the indoor unit, as seen looking diagonally from an upper back side.

[0017] As illustrated in Figs. 1 and 2, the indoor unit includes a casing 1 and an indoor heat exchanger 2 (illustrated in Fig. 3) provided in the casing 1. Air inlet 1a through which indoor air is taken in is provided on an upper part of the casing 1. An air outlet 1b through which indoor air having passed through the indoor heat exchanger 2 is blown off is provided on a lower part of the casing 1. The air outlet 1b is provided with a wind directing vane 12. A cross-flow fan (not illustrated) is provided downstream of the indoor heat exchanger 2 and upstream of the air outlet 1b. In the air conditioner, a compressor, a four-way valve, an outdoor heat exchanger, and expansion means (such as expansion valve) of an outdoor unit not illustrated and the indoor heat exchanger 2 are circularly connected so as to form a major part of a refrigerant circuit.

[0018] Fig. 3 is a back view of the indoor heat exchanger 2 and peripheral parts thereof.

[0019] The indoor heat exchanger 2 includes a heat exchange part 3 and a plurality of heat exchanger tubes 4, 4, ... that penetrate through the heat exchange part 3. The heat exchange part 3 and the heat exchanger tubes 4 are formed of aluminum or aluminum alloy.

[0020] The indoor unit includes a first refrigerant tube 5 for liquid, a second refrigerant tube 6 for liquid that communicates with the first refrigerant tube 5 for liquid, a first refrigerant tube 7 for gas, a second refrigerant tube 8 for gas that communicates with the first refrigerant tube 7 for gas, a flare union 9 for liquid, and a flare union 10 for gas. The first refrigerant tube 5 for liquid and the first refrigerant tube 7 for gas are formed of aluminum or aluminum alloy. The second refrigerant tube 6 for liquid and the second refrigerant tube 8 for gas are formed of copper or copper alloy. Each of the first refrigerant tube 5 for liquid and the first refrigerant tube 7 for gas is an example of the first refrigerant tubing. Each of the second refrigerant tube 6 for liquid and the second refrigerant tube 8 for gas is an example of the second refrigerant tubing. Each of the flare union 9 for liquid and the flare union 10 for gas is an example of the joint part.

[0021] The first refrigerant tube 5 for liquid is connected to one end part of a heat exchanger tube 4 through a shunt merger 11. The first refrigerant tube 5 for liquid includes a lateral side straight part 5a that extends along a lateral part of the casing 1, a bend part 5b that connects with an end of the lateral side straight part 5a on a side nearer to the flare union 9 for liquid and that is bent toward

the flare union 9 for liquid, and a bottom side straight part 5c that connects with an end of the bend part 5b on the side nearer to the flare union 9 for liquid and that extends along a bottom part of the casing 1. The lateral side straight part 5a is an example of the elongate part.

[0022] One end part (which is an end part on a side nearer to the bottom side straight part 5c) of the second refrigerant tube 6 for liquid is connected to the other end part (which is an end part on a side nearer to the second refrigerant tube 6 for liquid) of the first refrigerant tube 5 for liquid. More particularly, the end part of the bottom side straight part 5c on the side nearer to the second refrigerant tube 6 for liquid is expanded in diameter in comparison with other parts of the bottom side straight part 5c so that the one end part of the second refrigerant tube 6 for liquid is to be inserted into the end part of the bottom side straight part 5c. The end part of the bottom side straight part 5c on the side nearer to the second refrigerant tube 6 for liquid is fixed to the one end part of the second refrigerant tube 6 for liquid by brazing filler metal between the end part and the one end part of the second refrigerant tube 6 for liquid. The end part of the bottom side straight part 5c on the side nearer to the second refrigerant tube 6 for liquid and peripheral parts thereof are inserted into a heat shrinkable tube so as not to be exposed. The flare union 9 for liquid is connected to the other end part of the second refrigerant tube 6 for liquid.

[0023] That is, a connection between the other end part of the first refrigerant tube 5 for liquid and the one end part of the second refrigerant tube 6 for liquid is placed between the end of the bend part 5b on the side nearer to the flare union 9 for liquid and the end of the second refrigerant tube 6 for liquid on the side nearer to the flare union 9 for liquid. More precisely, the connection is placed on the side nearer to the flare union 9 for liquid with respect to a midpoint between the end of the bend part 5b on the side nearer to the flare union 9 for liquid and the end of the second refrigerant tube 6 for liquid on the side nearer to the flare union 9 for liquid.

[0024] The first refrigerant tube 7 for gas is connected to one end part of another heat exchanger tube 4 through a shunt merger (not illustrated). The first refrigerant tube 7 for gas includes a lateral side straight part 7a that extends along the lateral part of the casing 1, a bend part 7b that connects with an end of the lateral side straight part 7a on a side nearer to the flare union 10 for gas and that is bent toward the flare union 10 for gas, and a bottom side straight part 7c that connects with an end of the bend part 7b on the side nearer to the flare union 10 for gas and that extends along the bottom part of the casing 1. The lateral side straight part 7a is an example of the elongate part.

[0025] One end part (which is an end part on a side nearer to the bottom side straight part 7c) of the second refrigerant tube 8 for gas is connected to the other end part (which is an end part on a side nearer to the second refrigerant tube 8 for gas) of the first refrigerant tube 7 for gas. More particularly, the end part of the bottom side straight part 7c on the side nearer to the second refrigerant tube 8 for gas is expanded in diameter in comparison with other parts of the bottom side straight part 7c so that the one end part of the second refrigerant tube 8 for gas is to be inserted into the end part. The end part of the bottom side straight part 7c on the side nearer to the second refrigerant tube 8 for gas is fixed to the one end part of the second refrigerant tube 8 for gas by brazing filler metal between the end part and the one end part of the second refrigerant tube 8 for gas. The end part of the bottom side straight part 7c on the side nearer to the second refrigerant tube 8 for gas and peripheral parts thereof are inserted into a heat shrinkable tube so as not to be exposed. The flare union 10 for gas is connected to the other end part of the second refrigerant tube 8 for gas.

[0026] That is, a connection between the other end part of the first refrigerant tube 7 for gas and the one end part of the second refrigerant tube 8 for gas is placed between the end of the bend part 7b on the side nearer to the flare union 10 for gas and the end of the second refrigerant tube 8 for gas on the side nearer to the flare union 10 for gas. More precisely, the connection is placed on the side nearer to the flare union 10 for gas with respect to a midpoint between the end of the bend part 7b on the side nearer to the flare union 10 for gas and the end of the second refrigerant tube 8 for gas on the side nearer to the flare union 10 for gas.

[0027] According to the air conditioner indoor unit that has configurations described above, during installation of the indoor unit, the bottom side straight part 5c of the first refrigerant tube 5 for liquid and the second refrigerant tube 6 for liquid may be moved toward the lateral side straight part 5a of the first refrigerant tube 5 for liquid, as illustrated in Fig. 4. On this occasion, a torsional stress, a bending stress, and/or the like are caused in the lateral side straight part 5a, whereas there is little danger of breakage in the lateral side straight part 5a because no connection of different metals is provided in the lateral side straight part 5a.

[0028] Furthermore, a torsional stress, a bending stress, and/or the like that are caused between the end of the bend part 5b on the side nearer to the flare union 9 for liquid and the end of the second refrigerant tube 6 for liquid on the side nearer to the flare union 9 for liquid are smaller than the torsional stress, the bending stress, and/or the like that are caused in the lateral side straight part 5a of the first refrigerant tube 5 for liquid. And, the connection between the other end part of the first refrigerant tube 5 for liquid and the one end part of the second refrigerant tube 6 for liquid is placed between the end of the bend part 5b on the side nearer to the flare union 9 for liquid and the end of the second refrigerant tube 6 for liquid on the side nearer to the flare union 9 for liquid. Thus danger of breakage in the connection can be reduced.

[0029] The connection between the other end part of

the first refrigerant tube 5 for liquid and the one end part of the second refrigerant tube 6 for liquid is placed on the side nearer to the flare union 9 for liquid with respect to the midpoint between the end of the bend part 5b on the side nearer to the flare union 9 for liquid and the end of the second refrigerant tube 6 for liquid on the side nearer to the flare union 9 for liquid. Thus a possibility that a great torsional stress, a great bending stress, and/or the like are caused in the connection can reliably be reduced.

[0030] Even if the bottom side straight part 7c of the first refrigerant tube 7 for gas and the second refrigerant tube 8 for gas are moved toward the lateral side straight part 7a of the first refrigerant tube 7 for gas, effects similar to those described above can be obtained in the first refrigerant tube 7 for gas and the second refrigerant tube 8 for gas.

[0031] The heat exchange part 3 and the heat exchanger tubes 4 are formed of aluminum or aluminum alloy and thus production costs can be reduced.

[0032] Though the connection between the other end part of the first refrigerant tube 5 for liquid and the one end part of the second refrigerant tube 6 for liquid is placed on the side nearer to the flare union 9 for liquid with respect to the midpoint between the end of the bend part 5b on the side nearer to the flare union 9 for liquid and the end of the second refrigerant tube 6 for liquid on the side nearer to the flare union 9 for liquid in the embodiment, the connection may be placed on the side nearer to the bend part 5b with respect to the midpoint between the end of the bend part 5b on the side nearer to the flare union 9 for liquid and the end of the second refrigerant tube 6 for liquid on the side nearer to the flare union 9 for liquid.

[0033] Though the connection between the other end of the first refrigerant tube 7 for gas and the one end of the second refrigerant tube 8 for gas is placed on the side nearer to the flare union 10 for gas with respect to the midpoint between the end of the bend part 7b on the side nearer to the flare union 10 for gas and the end of the second refrigerant tube 8 for gas on the side nearer to the flare union 10 for gas in the embodiment, the connection may be placed on the side nearer to the bend part 7b with respect to the midpoint between the end of the bend part 7b on the side nearer to the flare union 10 for gas and the end of the second refrigerant tube 8 for gas on the side nearer to the flare union 10 for gas.

[0034] In the embodiment, the first refrigerant tube 5 for liquid, the second refrigerant tube 6 for liquid, the first refrigerant tube 7 for gas, and the second refrigerant tube 8 for gas may be integrated by being covered with heat insulator.

[0035] Though the specific embodiment of the invention has been described, the invention is not limited to the above embodiment and can be embodied with modification in various ways within the scope of the invention.

REFERENCE SIGNS LIST

[0036]

1	casing
1a	air inlet
1b	air outlet
2	indoor heat exchanger
3	heat exchange part
4	heat exchanger tube
5	first refrigerant tube for liquid
5a	lateral side straight part
5b	bend part
5c	bottom side straight part
6	second refrigerant tube for liquid
7	first refrigerant tube for gas
7a	lateral side straight part
7b	bend part
7c	bottom side straight part
8	second refrigerant tube for gas
9	flare union for liquid
10	flare union for gas

Claims

1. An air conditioner indoor unit comprising:

a casing (1),
an indoor heat exchanger (2) provided in the casing (1),
a first refrigerant tubing (5, 7) formed of aluminum or aluminum alloy and having one end part connected to the indoor heat exchanger (2),
a second refrigerant tubing (6, 8) formed of copper or copper alloy and having one end part connected to the other end part of the first refrigerant tubing (5, 7), and
a joint part (9, 10) connected to the other end part of the second refrigerant tubing (6, 8),
wherein the first refrigerant tubing (5, 7) includes an elongate part (5a, 7a) that extends along a lateral part of the casing (1) and a bend part (5b, 7b) that connects with an end part of the elongate part (5a, 7a) on a side nearer to the joint part (9, 10) and that is bent toward the joint part (9, 10), and
wherein a connection between the other end part of the first refrigerant tubing (5, 7) and the one end part of the second refrigerant tubing (6, 8) is between an end of the bend part (5b, 7b) on the side nearer to the joint part (9, 10) and an end of the second refrigerant tubing (6, 8) on the side nearer to the joint part (9, 10).

2. The air conditioner indoor unit as claimed in Claim 1, wherein the connection between the other end part of the first refrigerant tubing (5, 7) and the one end

part of the second refrigerant tubing (6, 8) is placed on the side nearer to the joint part (9, 10) with respect to a midpoint between the end of the bend part (5b, 7b) on the side nearer to the joint part (9, 10) and the end of the second refrigerant tubing (6, 8) on the side nearer to the joint part (9, 10).

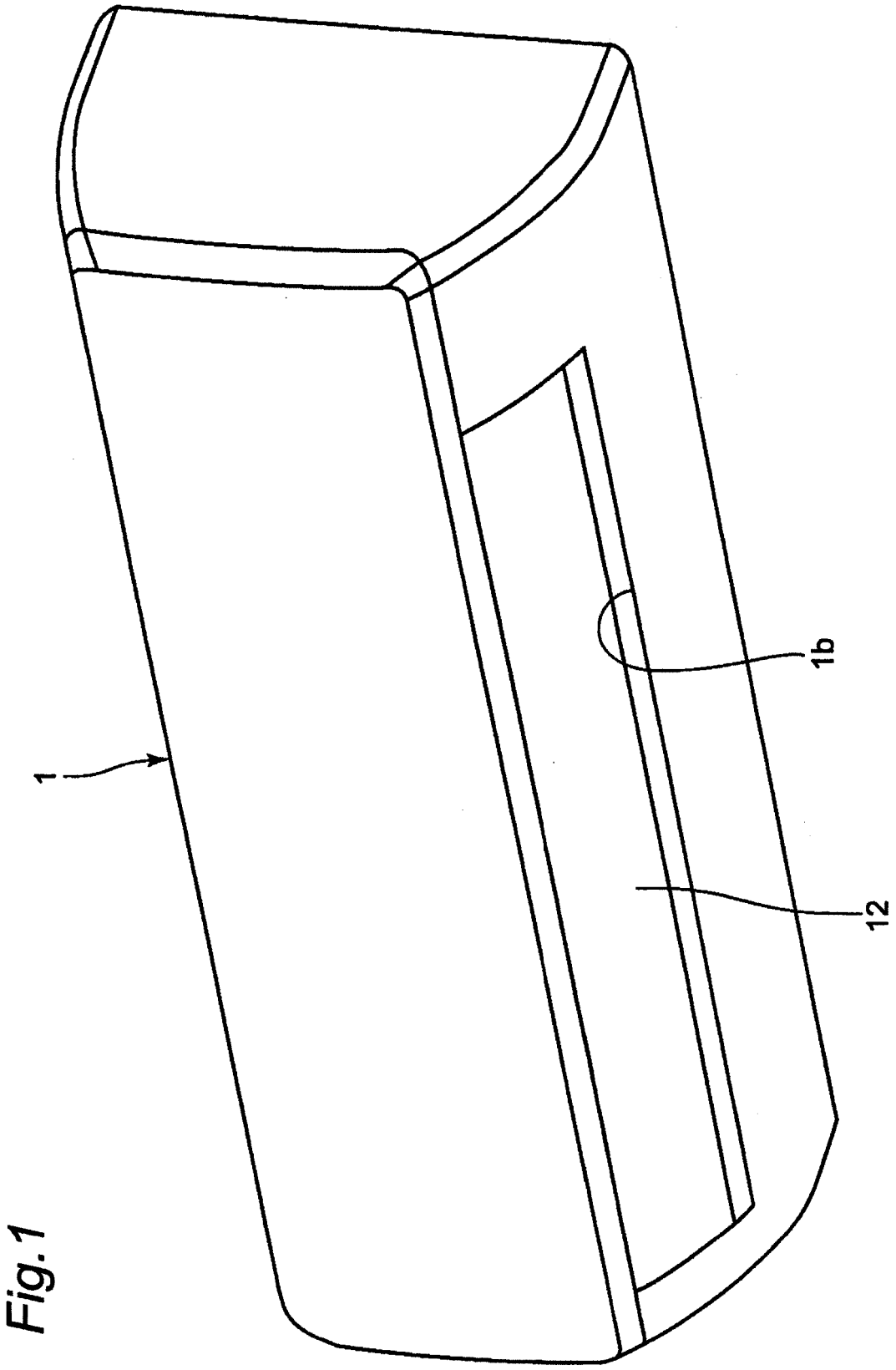


Fig.1

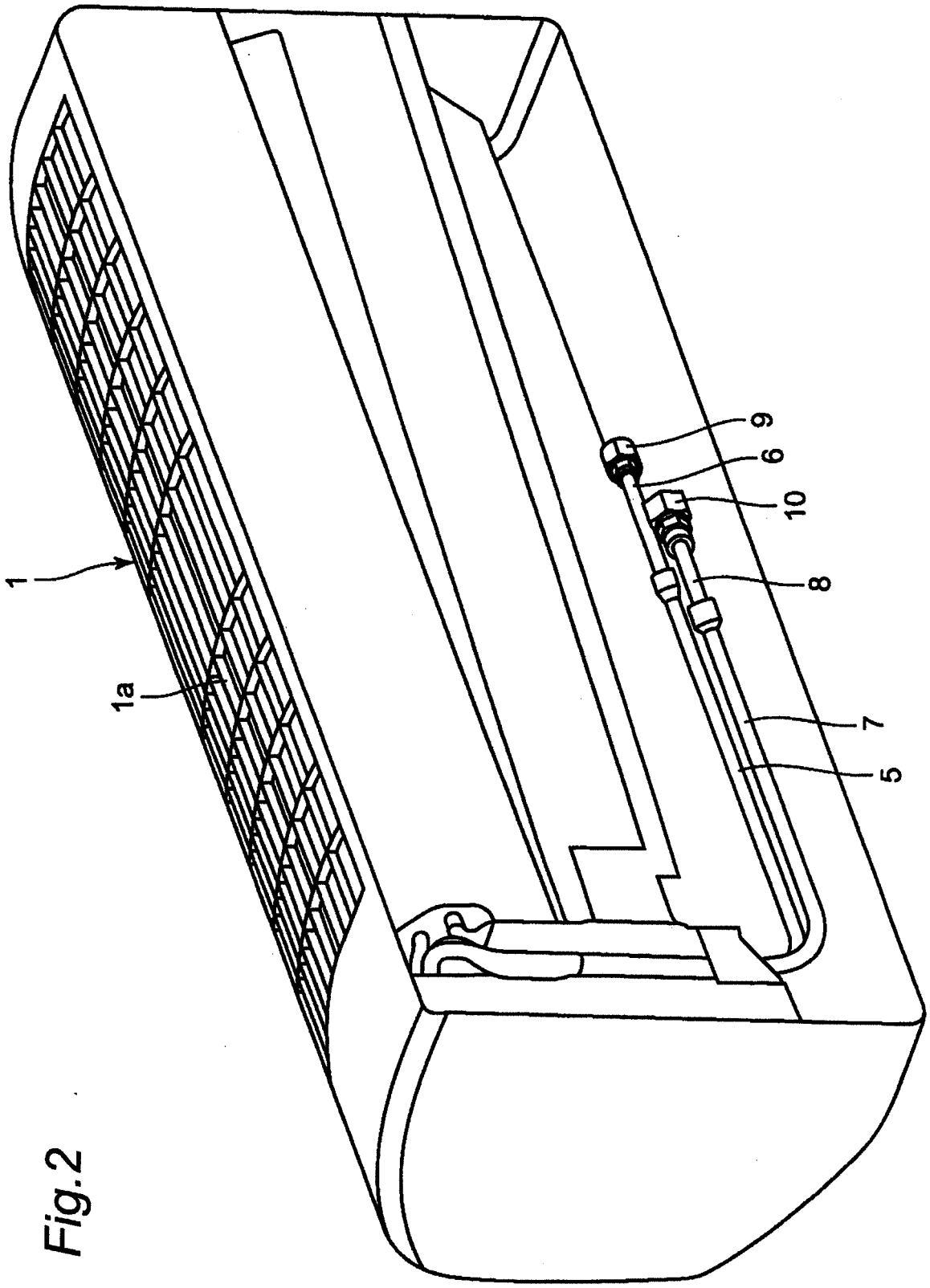


Fig.2

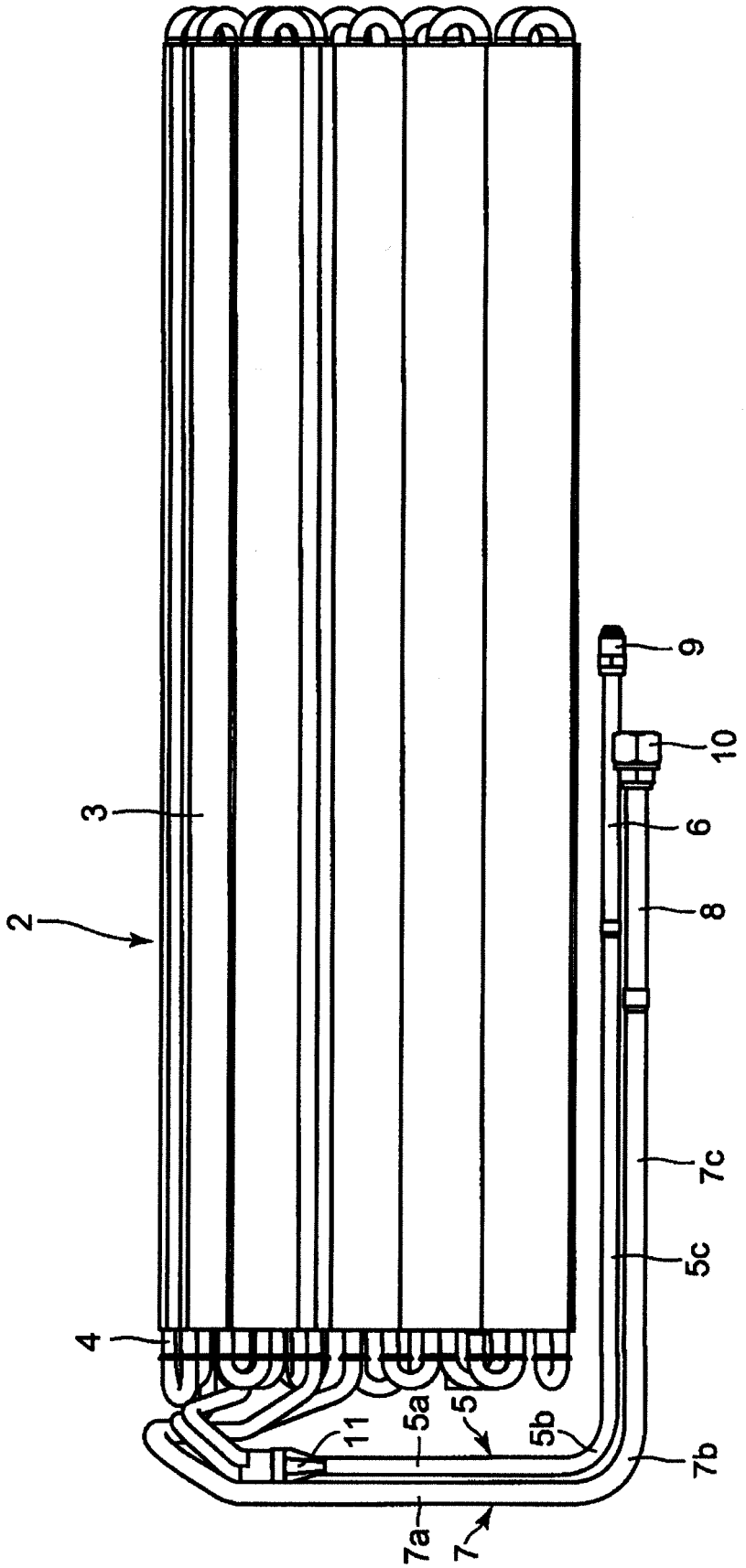


Fig.3

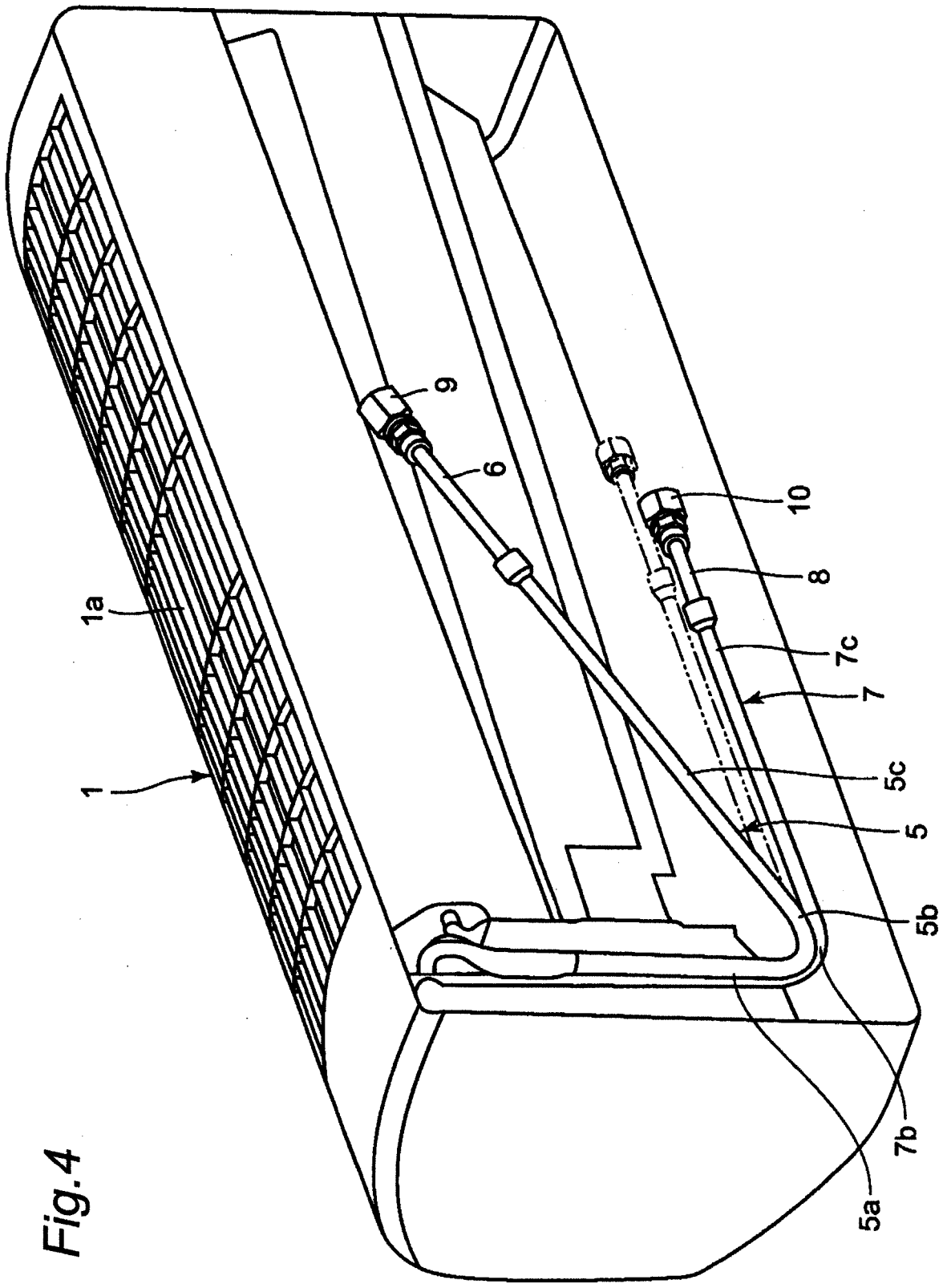
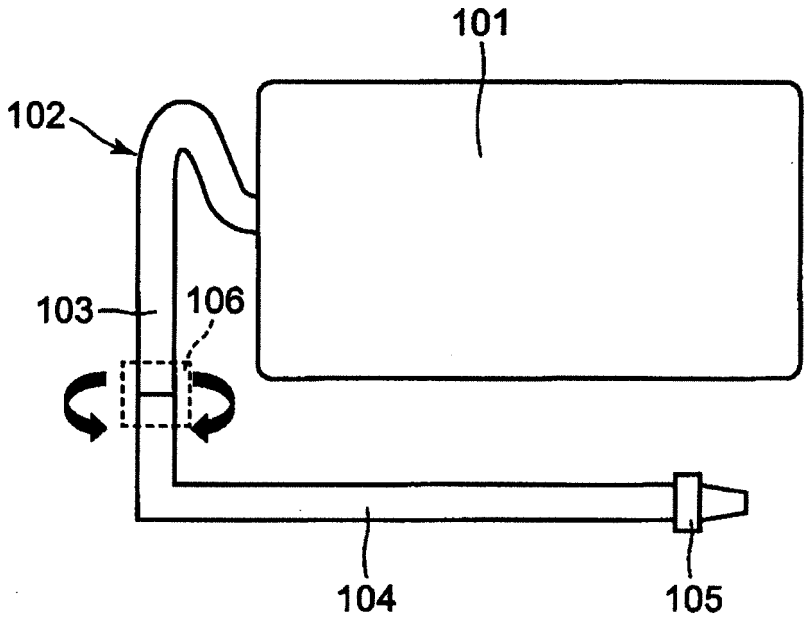


Fig.4

Fig.5



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2015/050130

A. CLASSIFICATION OF SUBJECT MATTER
F24F1/00(2011.01)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)
F24F1/00

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 1996-2015
Kokai Jitsuyo Shinan Koho 1971-2015 Toroku Jitsuyo Shinan Koho 1994-2015

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.
Y	JP 2012-42169 A (Mitsubishi Electric Corp.), 01 March 2012 (01.03.2012), paragraphs [0019] to [0032]; fig. 1 to 3, 6 & EP 2423609 A2 & CN 102374592 A	1-2
Y	JP 2002-156134 A (Hitachi, Ltd.), 31 May 2002 (31.05.2002), paragraph [0027]; fig. 11 to 12 (Family: none)	1-2
A	JP 2000-55452 A (Hitachi, Ltd.), 25 February 2000 (25.02.2000), paragraph [0012]; fig. 3 to 4 (Family: none)	1-2

☐ 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	Date of mailing of the international search report
01 April 2015 (01.04.15)	14 April 2015 (14.04.15)
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 2013155892 A **[0002] [0005]**