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

(11) **EP 4 579 149 A1**

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

(43) Date of publication:
02.07.2025 Bulletin 2025/27

(21) Application number: **23871827.4**

(22) Date of filing: **08.09.2023**

(51) International Patent Classification (IPC):
F25B 41/42 *(2021.01)* ***F24F 1/0067*** *(2019.01)*
F25B 41/40 *(2021.01)* ***F28F 19/00*** *(2006.01)*
F28F 21/08 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
F24F 1/0067; F25B 41/40; F25B 41/42; F28F 19/00; F28F 21/08

(86) International application number:
PCT/JP2023/032843

(87) International publication number:
WO 2024/070590 (04.04.2024 Gazette 2024/14)

(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 ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(30) Priority: **27.09.2022 JP 2022153757**

(71) Applicant: **DAIKIN INDUSTRIES, LTD.**
Osaka-shi, Osaka 530-0001 (JP)

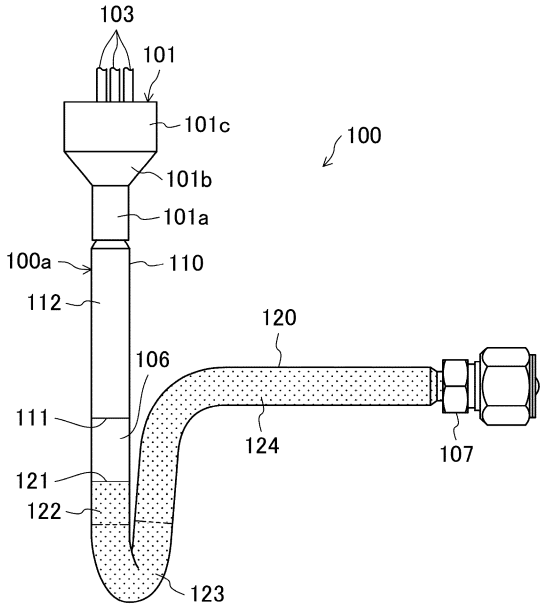
(72) Inventors:
- **SAKAMAKI Tomohiko**
  Osaka-shi, Osaka 530-0001 (JP)
- **OMIYA Akira**
  Osaka-shi, Osaka 530-0001 (JP)
- **KIMURA Tsuyoshi**
  Osaka-shi, Osaka 530-0001 (JP)
- **MIYATANI Naonobu**
  Osaka-shi, Osaka 530-0001 (JP)

(74) Representative: **Hoffmann Eitle**
Patent- und Rechtsanwälte PartmbB
Arabellastraße 30
81925 München (DE)

(54) COMPONENT UNIT OF AIR CONDITIONING DEVICE

(57) A refrigerant pipe (120) is connected to a distributor (100a). A material of the distributor (100a) is aluminum or aluminum alloy. A material of the refrigerant pipe (120) is copper or copper alloy. The distributor (100a) has a first connecting port (111) that is open downward. The refrigerant pipe (120) has a second connecting port (121) that is open upward. The first connecting port (111) of the distributor (100a) opening downward is connected to the second connecting port (121) of the refrigerant pipe (120) opening upward.

FIG.7



EP 4 579 149 A1

Description

TECHNICAL FIELD

[0001] The present disclosure relates to a component unit forming an air conditioning apparatus.

BACKGROUND ART

[0002] In a component unit forming an air conditioning apparatus, a pipe through which refrigerant flows may include a portion (aluminum pipe portion) made of aluminum or aluminum alloy and a portion (copper pipe portion) made of copper or copper alloy in a mixed manner. Aluminum has a higher ionization tendency than that of copper. For this reason, when condensed water generated on the surface of the copper pipe portion and containing copper ions adheres to the aluminum pipe portion, the aluminum pipe portion may be corroded.

[0003] Patent Document 1 (particularly, see FIG. 2) discloses that in order to solve the above-described problem, a U-shaped or inverted U-shaped pipe is provided between an aluminum heat transfer tube and a copper pipe in a heat exchanger. In this structure, the condensed water generated on the surface of the copper pipe cannot reach the aluminum heat transfer tube by being inhibited by the U-shaped or inverted U-shaped pipe.

CITATION LIST

PATENT DOCUMENT

[0004] Patent Document 1: Japanese Patent No. 5853203

SUMMARY OF THE INVENTION

TECHNICAL PROBLEM

[0005] Usually, a heat exchanger is provided with a plurality of heat transfer tubes. A distributor for distributing refrigerant to the plurality of heat transfer tubes is connected to the heat exchanger. There may be a case where the material of the distributor is aluminum or aluminum alloy and the material of a refrigerant pipe connected to the distributor is copper or copper alloy. A structure for reducing corrosion of the distributor made of aluminum or aluminum alloy in this case has not been studied.

[0006] It is an object of the present disclosure to reduce corrosion of a distributor made of aluminum or aluminum alloy.

SOLUTION TO THE PROBLEM

[0007] A first aspect of the present disclosure is directed to a component unit (20, 30) included in an air conditioning apparatus (10), the component unit (20, 30) including: a heat exchanger (65) having a plurality of heat transfer tubes (66); a refrigerant pipe (120, 170); and a distributor (100a, 150a) to which the heat exchanger (65) and the refrigerant pipe (120, 170) are connected, the distributor (100a, 150a) being configured to distribute a refrigerant flowing therein from the refrigerant pipe (120, 170) to the plurality of heat transfer tubes (66), a material of each of the heat transfer tubes (66) and the distributor (100a, 150a) being aluminum or aluminum alloy, a material of the refrigerant pipe (120, 170) being copper or copper alloy, the distributor (100a, 150a) having a first connecting port (111, 161) that is open downward in a state in which the component unit (20, 30) is installed, one end of the refrigerant pipe (120, 170) being a second connecting port (121, 171) that is open upward in the state in which the component unit (20, 30) is installed, the second connecting port (121, 171) of the refrigerant pipe (120, 170) being connected to the first connecting port (111, 161) of the distributor (100a, 150a) directly or through a metal pipe (106, 156) made of a material different from the material of each of the distributor (100a, 150a) and the refrigerant pipe (120, 170).

[0008] According to the first aspect of the present disclosure, the second connecting port (121, 171) of the refrigerant pipe (120, 170) opening upward is connected to the first connecting port (111, 161) of the distributor (100a, 150a) opening downward. A portion of the refrigerant pipe (120, 170) near the second connecting port (121, 171) is located below a portion of the distributor (100a, 150a) near the first connecting port (111, 161). Accordingly, condensed water generated on the surface of the refrigerant pipe (120, 170) and containing copper ions flows downward by gravitation and therefore does not adhere to the distributor (100a, 150a) made of aluminum or aluminum alloy.

[0009] The material of each of the distributor (100a, 150a) and the heat transfer tubes (66) to which the distributor (100a, 150a) is connected is aluminum or aluminum alloy. The condensed water generated on the surface of the heat transfer tubes (66) may adhere to the distributor (100a, 150a), but the condensed water does not contain copper ions.

[0010] Accordingly, the condensed water containing copper ions does not adhere to the distributor (100a, 150a) made of aluminum or aluminum alloy. Thus, according to the first aspect, it is possible to reduce corrosion of the distributor (100a, 150a) due to the adhesion of the condensed water containing copper ions.

[0011] A second aspect of the present disclosure is an embodiment of the first aspect. In the second aspect, the distributor (100a, 150a) includes: a distributor body (101, 151) connected to the heat exchanger (65), the distributor body (101, 151) being configured to distribute the refrigerant flowing therein to the plurality of heat transfer tubes (66); and a collecting pipe (110, 160) having one end connected to the distributor body (101, 151) and another end forming the first connecting port (111, 161).

[0012] According to the second aspect, the distributor (100a, 150a) includes the distributor body (101, 151) and the collecting pipe (110, 160). A portion of the refrigerant pipe (120, 170) near the second connecting port (121, 171) is located below a portion of the collecting pipe (110, 160) near the first connecting port (111, 161). Accordingly, condensed water generated on the surface of the refrigerant pipe (120, 170) and containing copper ions does not adhere to the collecting pipe (110, 160) made of aluminum or aluminum alloy.

[0013] A third aspect of the present disclosure is an embodiment of the second aspect. In the third aspect, the collecting pipe (110, 160) is located below the distributor body (101, 151) in the state in which the component unit (20, 30) is installed.

[0014] In the distributor (100a, 150a) of the third aspect, the collecting pipe (110, 160) is located below the distributor body (101, 151).

[0015] A fourth aspect of the present disclosure is an embodiment of the second aspect. In the fourth aspect, a portion or an entirety of the collecting pipe (110, 160) is a first upright pipe portion (112, 162) extending in an up-down direction, and a lower end of the first upright pipe portion (112, 162) is the first connecting port (111, 161).

[0016] According to the fourth aspect, the lower end of the first upright pipe portion (112, 162) is the first connecting port (111, 161). A portion of the refrigerant pipe (120, 170) near the second connecting port (121, 171) is located below the first upright pipe portion (112, 162). Accordingly, condensed water generated on the surface of the refrigerant pipe (120, 170) and containing copper ions does not adhere to the first upright pipe portion (112, 162) of the collecting pipe (110, 160) made of aluminum or aluminum alloy.

[0017] A fifth aspect of the present disclosure is an embodiment of the fourth aspect. In the fifth aspect, the entirety of the collecting pipe (110, 160) is the first upright pipe portion (112, 162).

[0018] According to the fifth aspect, the entirety of the collecting pipe (110, 160) has a shape extending in the up-down direction. The lower end of the collecting pipe (110, 160) is the first connecting port (111, 161). In this aspect, the entirety of the collecting pipe (110, 160) made of aluminum or aluminum alloy is located above the second connecting port (121, 171) of the refrigerant pipe (120, 170) made of copper or copper alloy. It is thus possible to reduce corrosion of the collecting pipe (110, 160) of the distributor (100a, 150a) due to adhesion of condensed water containing copper ions.

[0019] A sixth aspect of the present disclosure is an embodiment of the fourth or fifth aspect. In the sixth aspect, the first upright pipe portion (112, 162) is a straight pipe.

[0020] According to the sixth aspect, the first upright pipe portion (112, 162) is a straight pipe. It is thus possible to reduce the size of a portion of the internal space of the component unit (20, 30) occupied by the first upright pipe portion (112, 162). According to this aspect, it is thus possible to reduce corrosion of the distributor (100a, 150a) due to the adhesion of the condensed water containing copper ions while reducing the size of the component unit (20, 30).

[0021] A seventh aspect of the present disclosure is an embodiment of the sixth aspect. In the seventh aspect, an extension direction of the first upright pipe portion (112, 162) is a vertical direction in the state in which the component unit (20, 30) is installed.

[0022] According to the seventh aspect, the first upright pipe portion (112, 162) extends in the vertical direction in the state in which the component unit (20, 30) is installed. It is thus possible to further reduce the size of a portion of the internal space of the component unit (20, 30) occupied by the first upright pipe portion (112, 162). According to this aspect, it is thus possible to reduce corrosion of the distributor (100a, 150a) due to the adhesion of the condensed water containing copper ions while reducing the size of the component unit (20, 30).

[0023] An eighth aspect of the present disclosure is an embodiment of any one of the first to seventh aspects. In the eighth aspect, a portion of the refrigerant pipe (120, 170) is a second upright pipe portion (122, 172) extending in an up-down direction, and an upper end of the second upright pipe portion (122, 172) is the second connecting port (121, 171).

[0024] According to the eighth aspect, the second upright pipe portion (122, 172) of the refrigerant pipe (120, 170) is located below a portion of the distributor (100a, 150a) near the first connecting port (111, 161). Accordingly, condensed water generated on the surface of the second upright pipe portion (122, 172) made of copper or copper alloy does not adhere to the distributor (100a, 150a) made of aluminum or aluminum alloy.

[0025] A ninth aspect of the present disclosure is an embodiment of the eighth aspect. **In** the ninth aspect, the second upright pipe portion (122, 172) is a straight pipe.

[0026] According to the ninth aspect, the second upright pipe portion (122, 172), which is a portion of the refrigerant pipe (120, 170), is a straight pipe. It is thus possible to reduce the size of a portion of the internal space of the component unit (20, 30) occupied by the second upright pipe portion (122, 172) of the refrigerant pipe (120, 170). According to this aspect, it is thus possible to reduce corrosion of the distributor (100a, 150a) due to the adhesion of the condensed water containing copper ions while reducing the size of the component unit (20, 30).

[0027] A tenth aspect of the present disclosure is an embodiment of the ninth aspect. In the tenth aspect, an extension direction of the second upright pipe portion (122, 172) is a vertical direction in the state in which the component unit (20, 30) is installed.

[0028] According to the tenth aspect, the second upright pipe portion (122, 172) of the refrigerant pipe (120, 170) extends in the vertical direction in the state in which the component unit (20, 30) is installed. The condensed water having adhered to the surface of the second upright

pipe portion (122, 172) and containing copper ions flows downward along the second upright pipe portion (122, 172) extending in the vertical direction and therefore does not reach the first upright pipe portion (112, 162) located above the second upright pipe portion (122, 172).

[0029] An eleventh aspect of the present disclosure is an embodiment of the seventh aspect. In the eleventh aspect, a portion of the refrigerant pipe (120, 170) is a second upright pipe portion (122, 172) that is a straight pipe extending in an up-down direction, an upper end of the second upright pipe portion (122, 172) is the second connecting port (121, 171), and the first upright pipe portion (112, 162) and the second upright pipe portion (122, 172) are arranged in a straight line.

[0030] According to the eleventh aspect, the first upright pipe portion (112, 162) of the collecting pipe (110, 160) and the second upright pipe portion (122, 172) of the refrigerant pipe (120, 170) are arranged in a straight line. It is thus possible to reduce the size of a portion of the internal space of the component unit (20, 30) occupied by the first upright pipe portion (112, 162) and the second upright pipe portion (122, 172). According to this aspect, it is thus possible to reduce corrosion of the distributor (100a, 150a) due to the adhesion of the condensed water containing copper ions while reducing the size of the component unit (20, 30).

[0031] A twelfth aspect of the present disclosure is an embodiment of any one of the eighth to eleventh aspects. In the twelfth aspect, the refrigerant pipe (120, 170) has a U-shaped pipe portion (123) that is a U-shaped portion continuous with a lower end of the second upright pipe portion (122, 172).

[0032] According to the refrigerant pipe (120, 170) of the twelfth aspect, the U-shaped pipe portion (123) is continuous with the lower end of the second upright pipe portion (122, 172).

[0033] A thirteenth aspect of the present disclosure is an embodiment of the fourth aspect. In the thirteenth aspect, the collecting pipe (110, 160) is a pipe that meanders up and down, and a portion of the collecting pipe (110, 160) is the first upright pipe portion (112, 162).

[0034] According to the thirteenth aspect, a portion of the collecting pipe (110, 160) that meanders up and down serves as the first upright pipe portion (112, 162) including the first connecting port (111, 161).

[0035] A fourteenth aspect of the present disclosure is an embodiment of any one of the first to thirteenth aspect. In the fourteenth aspect, the refrigerant pipe (120) is a pipe through which a refrigerant in a gas-liquid two-phase state or in a liquid single-phase state flows during an operation of the component unit (20, 30).

[0036] According to the fourteenth aspect, the refrigerant in a gas-liquid two-phase state or in a liquid single-phase state flows through the refrigerant pipe (120) during the operation of the component unit (20, 30).

[0037] A fifteenth aspect of the present disclosure is an embodiment of any one of the first to thirteenth aspects. In the fifteenth aspect, the refrigerant pipe (170) is a pipe through which a refrigerant in a gas single-phase state flows during an operation of the component unit (20, 30).

[0038] According to the fifteenth aspect, the refrigerant in a gas single-phase state flows through the refrigerant pipe (170) during the operation of the component unit (20, 30).

[0039] A sixteenth aspect of the present disclosure is an embodiment of any one of the first to fifteenth aspects. The component unit of the sixteenth aspect further includes: a casing (35) configured to house the heat exchanger (65), wherein the first connecting port (111, 161) of the distributor (100a, 150a) and the second connecting port (121, 171) of the refrigerant pipe (120, 170) are located in an inside of the casing (35).

[0040] According to the sixteenth aspect, the heat exchanger (65), the first connecting port (111, 161) of the distributor (100a, 150a), and the second connecting port (121, 171) of the refrigerant pipe (120, 170) are located in the inside of the casing (35).

[0041] A seventeenth aspect of the present disclosure is an embodiment of the sixteenth aspect. In the seventeenth aspect, an end of the refrigerant pipe (120, 170) opposite to the second connecting port (121, 171) is exposed to an outside of the casing (35), and the refrigerant pipe (120, 170) is provided with a cover member (105, 155) configured to cover a portion of the refrigerant pipe (120, 170) and close a clearance between the refrigerant pipe (120, 170) and the casing (35).

[0042] According to the seventeenth aspect, the clearance between the casing (35) and the refrigerant pipe (120, 170) arranged so as span across the inside and outside of the casing (35) is closed by the cover member (105, 155).

BRIEF DESCRIPTION OF THE DRAWINGS

[0043]

FIG. 1 is a piping system diagram illustrating an air conditioning apparatus according to an embodiment.

FIG. 2 is a perspective view of an indoor unit as viewed obliquely from below.

FIG. 3 is a schematic plan view of the indoor unit with a top panel of a casing body omitted.

FIG. 4 is a schematic sectional view of the indoor unit taken along line IV-O-IV in FIG. 3.

FIG. 5 is an enlarged view of a main part of FIG. 3.

FIG. 6 is a perspective view of a liquid pipe unit according to the embodiment.

FIG. 7 is a front view of the liquid pipe unit according to the embodiment.

FIG. 8 is a front view of a gas pipe unit according to the embodiment.

FIG. 9 is a front view of a liquid pipe unit according to a first variation of the embodiment.

FIG. 10 is a front view of a liquid pipe unit according to a second variation of the embodiment.

FIG. 11 is a front view of a liquid pipe unit according to a third variation of the embodiment.
FIG. 12 is a front view of a liquid pipe unit according to a fourth variation of the embodiment.
FIG. 13 is a front view of a liquid pipe unit according to the fourth variation of the embodiment.

DESCRIPTION OF EMBODIMENTS

[0044] An air conditioning apparatus (10) of an embodiment will be described.

- Air Conditioning Apparatus -

[0045] As illustrated in FIG. 1, an air conditioning apparatus (10) includes an outdoor unit (20) and an indoor unit (30). Each of the outdoor unit (20) and the indoor unit (30) is a component unit forming the air conditioning apparatus (10).

[0046] The outdoor unit (20) and the indoor unit (30) are connected to each other through a pair of connection pipes (12). In the air conditioning apparatus (10), the outdoor unit (20), the indoor unit (30), and the connection pipes (12) form a refrigerant circuit (11) that performs a vapor compression refrigeration cycle.

<Outdoor Unit>

[0047] The outdoor unit (20) is installed outdoors. The outdoor unit (20) has a compressor (21), a four-way switching valve (22), an outdoor heat exchanger (23), an outdoor fan (25), an expansion valve (24), a liquid-side shutoff valve (26), and a gas-side shutoff valve (27).

[0048] The compressor (21) is, for example, a hermetic scroll or rotary compressor. The compressor (21) sucks and compresses a low-pressure refrigerant, and discharges the refrigerant compressed to high pressure (high-pressure refrigerant).

[0049] The four-way switching valve (22) is a valve for changing the flow of refrigerant in the refrigerant circuit (11). The four-way switching valve (22) switches between a first state indicated by solid lines in FIG. 1 and a second state indicated by broken lines in FIG. 2. In the first state, the high-pressure refrigerant discharged from the compressor (21) is sent to the outdoor heat exchanger (23), and low-pressure refrigerant flowing in from the indoor unit (30) is sent to the compressor (21). In the second state, the high-pressure refrigerant discharged from the compressor (21) is sent to the indoor unit (30), and low-pressure refrigerant having passed through the outdoor heat exchanger (23) is sent to the compressor (21).

[0050] The outdoor heat exchanger (23) is a heat exchanger that allows heat exchange between the refrigerant and outdoor air. The outdoor heat exchanger (23) is, for example, a fin-and-tube heat exchanger. The outdoor fan (25) is a fan for supplying the outdoor air to the outdoor heat exchanger (23). The expansion valve (24) is an electric expansion valve having a variable opening degree.

<Indoor Unit>

[0051] The indoor unit (30) is installed in an indoor space which is a space to be air-conditioned. The indoor unit (30) has an indoor heat exchanger (65) and an indoor fan (50). The indoor unit (30) will be described in detail later.

<Operation>

[0052] The air conditioning apparatus (10) selectively performs cooling operation and heating operation.

[0053] In the cooling operation, the four-way switching valve (22) is set to the first state, and the refrigerant circulates through the refrigerant circuit (11). In the refrigerant circuit (11), the outdoor heat exchanger (23) functions as a radiator, and the indoor heat exchanger (65) functions as an evaporator. The indoor unit (30) cools the air sucked from the indoor space in the indoor heat exchanger (65), and discharges the cooled air into the indoor space.

[0054] In the heating operation, the four-way switching valve (22) is set to the second state, and the refrigerant circulates through the refrigerant circuit (11). In the refrigerant circuit (11), the indoor heat exchanger (65) functions as a radiator, and the outdoor heat exchanger (23) functions as an evaporator. The indoor unit (30) heats the air sucked from the indoor space in the indoor heat exchanger (65), and discharges the heated air into the indoor space.

- Configuration of Indoor Unit -

[0055] As illustrated in FIG. 2, the indoor unit (30) of this embodiment is a ceiling-embedded indoor unit. As illustrated in FIGS. 3 and 4, the indoor unit (30) includes a casing (35), the indoor fan (50), the indoor heat exchanger (65), a drain pan (55), and a bell mouth (52).

[0056] A liquid pipe unit (100) and a gas pipe unit (150) are joined to the indoor heat exchanger (65). The indoor heat exchanger (65), the liquid pipe unit (100), and the gas pipe unit (150) form a heat exchanger assembly (60).

<Casing>

[0057] The casing (35) includes a casing body (36) and a decorative panel (40). The casing (35) houses the indoor fan (50), the indoor heat exchanger (65), the drain pan (55), and the bell mouth (52).

[0058] The casing body (36) is a member having a generally rectangular parallelepiped box-like shape with an open bottom. The casing body (36) has a generally flat plate-shaped top panel (36a), and a side plate (36b) extending downward from a peripheral portion of the top panel (36a). The decorative panel (40) will be described later.

<Indoor Fan>

[0059] As illustrated in FIG. 4, the indoor fan (50) is a so-called turbo fan. The indoor fan (50) discharges air sucked from below outward in a radial direction. The indoor fan (50) is disposed at the center in the casing body (36). An indoor fan motor (51) drives the indoor fan (50). The indoor fan motor (51) is fixed to a center portion of the top panel (36a).

<Bell Mouth>

[0060] The bell mouth (52) is disposed below the indoor fan (50). The bell mouth (52) is a member that guides the air flowed into the casing (35) to the indoor fan (50). The bell mouth (52) and the drain pan (55) divide the internal space of the casing (35) into a primary space (37a) located on the inlet side of the indoor fan (50) and a secondary space (37b) located on the outlet side of the indoor fan (50).

<Indoor Heat Exchanger>

[0061] The indoor heat exchanger (65) is a so-called cross-fin-type fin-and-tube heat exchanger. As illustrated in FIG. 3, the indoor heat exchanger (65) is formed in a rectangular tubular shape, and is disposed so as to surround the indoor fan (50). The indoor heat exchanger (65) is disposed in the secondary space (37b). The indoor heat exchanger (65) allows heat exchange of the air passing from the inside to the outside with the refrigerant in the refrigerant circuit.

<Drain Pan>

[0062] The drain pan (55) is a member made of so-called polystyrene foam. As illustrated in FIG. 4, the drain pan (55) is disposed to close the lower end of the casing body (36). The drain pan (55) has an upper surface provided with a water receiving groove (56) extending along the lower end of the indoor heat exchanger (65). The water receiving groove (56) receives a lower end portion of the indoor heat exchanger (65). The water receiving groove (56) receives drain water generated in the indoor heat exchanger (65).

[0063] As illustrated in FIG. 2, the drain pan (55) is provided with four main outlet paths (57) and four auxiliary outlet paths (58). The main outlet paths (57) and the auxiliary outlet paths (58) are passages through which the air that has passed through the indoor heat exchanger (65) flows, and penetrate the drain pan (55) in the up-down direction.

[0064] The main outlet paths (57) are through holes each having an elongated rectangular cross section. The main outlet paths (57) are arranged along the four sides of the casing body (36), respectively. The auxiliary outlet paths (58) are through holes each having a slightly-curved rectangular cross section. The auxiliary outlet paths (58) are arranged at the four corners of the casing body (36), respectively.

<Decorative Panel>

[0065] The decorative panel (40) is a resin member formed in a thick rectangular plate shape. A lower portion of the decorative panel (40) is in a square shape slightly larger than the top panel (36a) of the casing body (36). The decorative panel (40) is disposed to cover the lower end of the casing body (36). A lower surface of the decorative panel (40) is exposed to the indoor space.

[0066] As illustrated in FIGS. 2 and 4, the decorative panel (40) has one inlet (41) in a square shape at a center portion. The inlet (41) penetrates the decorative panel (40) in the up-down direction to communicate with the primary space (37a) in the casing (35). The inlet (41) is provided with a grid-like intake grille (45). A filter (46) is disposed above the intake grille (45).

[0067] The decorative panel (40) includes a substantially rectangular loop-shaped outlet (44) surrounding the inlet (41). As illustrated in FIG. 2, the outlet (44) is divided into four main outlet openings (42) and four auxiliary outlet openings (43).

[0068] The main outlet openings (42) are elongated rectangular openings. The main outlet openings (42) are arranged along the four sides of the decorative panel (40), respectively. The main outlet openings (42) of the decorative panel (40) correspond to the main outlet paths (57) of the drain pan (55) on a one-on-one basis. Each main outlet opening (42) communicates with a corresponding one of the main outlet paths (57). Each main outlet opening (42) is provided with an airflow direction adjusting flap (47).

[0069] The auxiliary outlet openings (43) are quarter circular arc-shaped openings. The auxiliary outlet openings (43) are arranged at the four corners of the decorative panel (40), respectively. The auxiliary outlet openings (43) of the decorative panel (40) correspond to the auxiliary outlet paths (58) of the drain pan (55) on a one-on-one basis. Each auxiliary outlet opening (43) communicates with a corresponding one of the auxiliary outlet paths (58).

<Liquid Pipe Unit>

[0070] As illustrated in FIG. 5, the liquid pipe unit (100) includes one liquid-side distributor (100a), one liquid-side refrigerant pipe (120), and a plurality of liquid-side branch pipes (103). FIG. 5 shows only one liquid-side branch pipe (103).

[0071] One end of the liquid-side refrigerant pipe (120) and one end of each liquid-side branch pipe (103) are connected to the liquid-side distributor (100a). The liquid-side distributor (100a) is a member that distributes refrigerant flowing in from the liquid-side refrigerant pipe (120) to the plurality of liquid-side branch pipes (103).

[0072] The other end of each liquid-side branch pipe

(103) is connected to a corresponding heat transfer tube (66) of the indoor heat exchanger (65). The liquid-side branch pipe (103) allows the liquid-side distributor (100a) to communicate with the heat transfer tube (66) of the indoor heat exchanger (65).

[0073] The liquid-side refrigerant pipe (120) extends to the outside of the casing body (36) through a through hole formed in the side plate (36b) of the casing body (36). The other end of the liquid-side refrigerant pipe (120) is exposed to the outside of the casing body (36).

[0074] A liquid-side cover member (105) is attached to the liquid-side refrigerant pipe (120). The liquid-side cover member (105) is a cylindrical member made of foamed resin. The liquid-side cover member (105) covers a portion of the liquid-side refrigerant pipe (120) that spans across the inside and outside of the casing body (36) to close a clearance between the edge of the through hole formed in the side plate (36b) and the liquid-side refrigerant pipe (120).

<Gas Pipe Unit>

[0075] As illustrated in FIG. 5, the gas pipe unit (150) includes one gas-side distributor (150a), one gas-side refrigerant pipe (170), and a plurality of gas-side branch pipes (153). FIG. 5 shows only one gas-side branch pipe (153).

[0076] One end of the gas-side refrigerant pipe (170) and one end of each gas-side branch pipe (153) are connected to the gas-side distributor (150a). The gas-side distributor (150a) is a member that distributes refrigerant flowing in from the gas-side refrigerant pipe (170) to the plurality of gas-side branch pipes (153). The gas-side distributor (150a) is a so-called gas header.

[0077] The other end of each gas-side branch pipe (153) is connected to a corresponding heat transfer tube (66) of the indoor heat exchanger (65). The gas-side branch pipe (153) allows the gas-side distributor (150a) to communicate with the heat transfer tube (66) of the indoor heat exchanger (65).

[0078] The gas-side refrigerant pipe (170) extends to the outside of the casing body (36) through a through hole formed in the side plate (36b) of the casing body (36). The other end of the gas-side refrigerant pipe (170) is exposed to the outside of the casing body (36).

[0079] A gas-side cover member (155) is attached to the gas-side refrigerant pipe (170). The gas-side cover member (155) is a cylindrical member made of foamed resin. The gas-side cover member (155) covers a portion of the gas-side refrigerant pipe (170) that spans across the inside and outside of the casing body (36) to close a clearance between the edge of the through hole formed in the side plate (36b) and the gas-side refrigerant pipe (170).

<Flow of Air in Indoor Unit>

[0080] The indoor fan (50) rotates during the operation of the indoor unit (30). When the indoor fan (50) rotates, indoor air in the indoor space flows into the primary space (37a) in the casing (35) through the inlet (41). The air that has flowed into the primary space (37a) is sucked by the indoor fan (50) and discharged into the secondary space (37b).

[0081] The air flowed into the secondary space (37b) is cooled or heated while passing through the indoor heat exchanger (65), and then flows into the four main outlet paths (57) and the four auxiliary outlet paths (58) separately. The air that has flowed into the main outlet paths (57) is discharged to the indoor space through the main outlet openings (42). The air that has flowed into the auxiliary outlet paths (58) is discharged to the indoor space through the auxiliary outlet openings (43).

- Liquid Pipe Unit -

[0082] The liquid pipe unit (100) will be described in detail with reference to FIGS. 6 and 7.

[0083] As described above, the liquid pipe unit (100) includes one liquid-side distributor (100a), one joint pipe (106), one liquid-side refrigerant pipe (120), and a plurality of liquid-side branch pipes (103). In the state in which the outdoor unit (20) having the liquid pipe unit (100) is installed, the liquid-side refrigerant pipe (120) is connected to the lower end of the liquid-side distributor (100a), and the liquid-side branch pipes (103) are connected to the upper end of the liquid-side distributor (100a).

<Liquid-Side Distributor>

[0084] The liquid-side distributor (100a) includes a liquid-side distributor body (101) and a liquid-side collecting pipe (110). The material of each of the liquid-side distributor body (101) and the liquid-side collecting pipe (110) is aluminum or aluminum alloy.

<Liquid-Side Distributor Body>

[0085] The liquid-side distributor body (101) is a distributor body that distributes refrigerant flowing therein to the plurality of liquid-side branch pipes (103).

[0086] The liquid-side distributor body (101) has a smaller-diameter portion (101a), an intermediate portion (101b), and a larger-diameter portion (101c). The smaller-diameter portion (101a), the intermediate portion (101b), and the larger-diameter portion (101c) of the liquid-side distributor body (101) are arranged in order from the bottom to the top.

[0087] The smaller-diameter portion (101a) is a slightly thick circular tubular portion. The intermediate portion (101b) is an inverted truncated cone-shaped portion. The smaller-diameter end (lower end) of the intermediate portion (101b) is continuous with the upper end of the smaller-diameter portion (101a). The larger-diameter end (upper end) of the intermediate portion (101b) is

continuous with the lower end of the larger-diameter portion (101c). The larger-diameter portion (101c) is a columnar portion. The larger-diameter portion (101c) has a plurality of connection holes (101d).

[0088] Each connection hole (101d) is open to the upper end surface of the larger-diameter portion (101c). The plurality of connection holes (101d) are arranged at equal intervals along the outer periphery of the upper end surface of the larger-diameter portion (101c). The liquid-side distributor body (101) has therein a communication space that allows communication between the internal space of the smaller-diameter portion (101a) and all of the connection holes (101d).

<Liquid-Side Collecting Pipe>

[0089] The liquid-side collecting pipe (110) is a collecting pipe connected to the liquid-side distributor body (101).

[0090] The liquid-side collecting pipe (110) is a straight circular pipe. One end (upper end) of the liquid-side collecting pipe (110) is inserted into the lower end of the smaller-diameter portion (101a) of the liquid-side distributor body (101). The liquid-side collecting pipe (110) is joined to the smaller-diameter portion (101a) of the liquid-side distributor body (101) by brazing. The liquid-side collecting pipe (110) communicates with a space inside the liquid-side distributor body (101).

[0091] The liquid-side collecting pipe (110) is arranged substantially coaxially with the liquid-side distributor body (101). The center axis direction (extension direction) of the liquid-side collecting pipe (110) is substantially the vertical direction. The other end (lower end) of the liquid-side collecting pipe (110) is a first connecting port (111) that is open downward. The entirety of the liquid-side collecting pipe (110) is a first upright pipe portion (112) including the first connecting port (111) and extending in the up-down direction.

<Liquid-Side Branch Pipe>

[0092] The liquid-side branch pipes (103) are circular pipes with a relatively small diameter. The material of the liquid-side branch pipes (103) is aluminum or aluminum alloy. The number of the liquid-side branch pipes (103) is the same as the number of the connection holes (101d) of the liquid-side distributor body (101). Only three liquid-side branch pipes (103) are shown in FIGS. 6 and 7.

[0093] One end of each of the liquid-side branch pipes (103) is inserted into the corresponding connection hole (101d) of the liquid-side distributor body (101), and is joined to the liquid-side distributor body (101) by brazing. The other end of each of the liquid-side branch pipes (103) is joined to the corresponding heat transfer tube (66) of the indoor heat exchanger (65) by brazing. Each liquid-side branch pipe (103) makes the corresponding heat transfer tube (66) of the indoor heat exchanger (65) communicate with a space in the liquid-side distributor body (101).

<Joint Pipe>

[0094] The joint pipe (106) is a relatively-short circular tubular member. The joint pipe (106) is arranged substantially coaxially with the liquid-side collecting pipe (110). The upper end of the joint pipe (106) is joined to the first connecting port (111), which is the lower end of the liquid-side collecting pipe (110), by brazing.

[0095] The joint pipe (106) is a metal pipe. The material of the joint pipe (106) is stainless steel. The main component of stainless steel is iron (Fe). The ionization tendency of iron (Fe) is higher than the ionization tendency of copper (Cu) and lower than the ionization tendency of aluminum (Al).

<Liquid-Side Refrigerant Pipe>

[0096] The liquid-side refrigerant pipe (120) is a refrigerant pipe through which refrigerant in a gas-liquid two-phase state or in a liquid single-phase state flows during the operation of the indoor unit (30).

[0097] The liquid-side refrigerant pipe (120) is a circular tubular member bent at two points. The liquid-side refrigerant pipe (120) includes a second upright pipe portion (122), a U-shaped pipe portion (123), and an inverted L-shaped pipe portion (124). The material of the liquid-side refrigerant pipe (120) is copper or copper alloy.

[0098] The second upright pipe portion (122) is a circular tubular portion that is short and straight. The center axis direction (extension direction) of the second upright pipe portion (122) is substantially the vertical direction. The second upright pipe portion (122) is arranged substantially coaxially with the joint pipe (106). The upper end of the second upright pipe portion (122) is a second connecting port (121) that is open upward. The second connecting port (121) is joined to the lower end of the joint pipe (106) by brazing.

[0099] The U-shaped pipe portion (123) is a circular tubular portion curved in a U-shape. One end of the U-shaped pipe portion (123) is continuous with the lower end of the second upright pipe portion (122).

[0100] The inverted L-shaped pipe portion (124) is a circular tubular portion curved in an inverted L-shape. One end of the inverted L-shaped pipe portion (124) is continuous with the other end of the U-shaped pipe portion (123). A flare joint (107) is attached to the other end of the inverted L-shaped pipe portion (124). The material of the flare joint (107) is brass.

<Arrangement of First Upright Pipe Portion and Second Upright Pipe Portion>

[0101] In the liquid pipe unit (100) of this embodiment, the second upright pipe portion (122) of the liquid-side refrigerant pipe (120) is arranged below the first upright

pipe portion (112) of the liquid-side collecting pipe (110). The first upright pipe portion (112), the second upright pipe portion (122), and the joint pipe (106) are arranged in a straight line. The center axis direction of each of the first upright pipe portion (112), the second upright pipe portion (122), and the joint pipe (106) is substantially the vertical direction. The first upright pipe portion (112), the second upright pipe portion (122), and the joint pipe (106) are located inside the casing (35) of the indoor unit (30). Thus, the first connecting port (111) of the liquid-side collecting pipe (110) and the second connecting port (121) of the liquid-side refrigerant pipe (120) are located inside the casing (35) of the indoor unit (30).

[0102] <Flow of Refrigerant in Liquid Pipe Unit>

[0103] During the cooling operation of the air conditioning apparatus (10) in which the indoor heat exchanger (65) functions as an evaporator, the refrigerant in the gas-liquid two-phase state that has passed through the expansion valve (24) flows through the liquid pipe unit (100).

[0104] Specifically, the refrigerant that has flowed through the expansion valve (24) into the liquid pipe unit (100) flows through the liquid-side refrigerant pipe (120) into the liquid-side distributor (100a), and is distributed to all of the liquid-side branch pipes (103) connected to the liquid-side distributor body (101). The refrigerant flowing through the respective liquid-side branch pipes (103) flows into a corresponding heat transfer tube (66) of the indoor heat exchanger (65).

[0105] As described above, the refrigerant in the gas-liquid two-phase state that has flowed into the liquid pipe unit (100) flows vertically upward through the second upright pipe portion (122), the joint pipe (106), and the first upright pipe portion (112) in sequence, and then flows into the liquid-side distributor body (101). Thus, the refrigerant flowing through the liquid-side refrigerant pipe (120) flows into the liquid-side distributor body (101) with a liquid refrigerant and a gas refrigerant generally uniformly mixed. In the liquid-side distributor body (101), the liquid refrigerant and the gas refrigerant are generally equally distributed to the liquid-side branch pipes (103).

[0106] During the heating operation of the air conditioning apparatus (10) in which the indoor heat exchanger (65) functions as a radiator, the refrigerant in the liquid single-phase state that has flowed out of the indoor heat exchanger (65) flows through the liquid pipe unit (100).

[0107] Specifically, the refrigerant that has flowed out of the heat transfer tubes (66) of the indoor heat exchanger (65) flows through the liquid-side branch pipes (103) into the liquid-side distributor body (101) of the liquid-side distributor (100a). Flows of the refrigerant that has flowed into the liquid-side distributor body (101) from the liquid-side branch pipes (103) merge together. The refrigerant merged in the liquid-side distributor body (101) passes through the liquid-side collecting pipe (110) and the liquid-side refrigerant pipe (120) in sequence and flows out of the indoor unit (30).

- Gas Pipe Unit -

[0108] The gas pipe unit (150) will be described in detail with reference to FIG. 8.

[0109] As described above, the gas pipe unit (150) includes one gas-side distributor (150a), one joint pipe (156), one gas-side refrigerant pipe (170), and a plurality of gas-side branch pipes (153).

<Gas-Side Distributor>

[0110] The gas-side distributor (150a) includes a gas-side distributor body (151) and a gas-side collecting pipe (160). The material of each of the gas-side distributor body (151) and the gas-side collecting pipe (160) is aluminum or aluminum alloy.

<Gas-Side Distributor Body>

[0111] The gas-side distributor body (151) is a distributor body that distributes refrigerant flowing therein to the plurality of gas-side branch pipes (153).

[0112] The gas-side distributor body (151) is a so-called gas header. The gas-side distributor body (151) is an elongated cylindrical member with its both ends closed. The gas-side distributor body (151) is installed in a posture in which its center axis direction is substantially the vertical direction.

<Gas-Side Collecting Pipe>

[0113] The gas-side collecting pipe (160) is a collecting pipe connected to the gas-side distributor body (151).

[0114] The gas-side collecting pipe (160) is a circular pipe that meanders up and down. The gas-side collecting pipe (160) has one first semicircular portion (163a) and one second semicircular portion (163b). The gas-side collecting pipe (160) also has a first upright pipe portion (162).

[0115] A portion of the gas-side collecting pipe (160) near one end is formed into a straight pipe extending generally in the horizontal direction. The one end of the gas-side collecting pipe (160) is joined to a side portion of the gas-side distributor body (151). The internal space of the gas-side collecting pipe (160) communicates with the internal space of the gas-side distributor body (151).

[0116] The first semicircular portion (163a) is a semicircular arc-shaped portion facing upward. The first semicircular portion (163a) is disposed near the one end of the gas-side collecting pipe (160). The second semicircular portion (163b) is a semicircular arc-shaped portion facing downward. The second semicircular portion (163b) is disposed near the other end of the gas-side collecting pipe (160). One end of the first semicircular portion (163a) and one end of the second semicircular portion (163b) are connected together through a straight pipe portion.

[0117] The first upright pipe portion (162) is a straight

circular tubular portion. The center axis direction (extension direction) of the first upright pipe portion (162) is substantially the vertical direction. The upper end of the first upright pipe portion (162) is continuous with the other end of the second semicircular portion (163b). The lower end of the first upright pipe portion (162) is a first connecting port (161) that is open downward.

<Gas-Side Branch Pipe>

[0118] The gas-side branch pipes (153) are circular pipes formed in a U-shape. The material of the gas-side branch pipes (153) is aluminum or aluminum alloy.

[0119] The gas-side branch pipes (153) are arranged in a posture in which their open ends are directed laterally. The plurality of gas-side branch pipes (153) are aligned in the center axis direction (vertical direction) of the gas-side distributor body (151). A curved portion of each of the gas-side branch pipes (153) is joined to the gas-side distributor body (151). The internal space of each gas-side branch pipe (153) communicates with the internal space of the gas-side distributor body (151). A pair of open ends (153a) of each of the gas-side branch pipes (153) are joined to the corresponding heat transfer tubes (66) of the indoor heat exchanger (65) by brazing.

<Joint Pipe>

[0120] The joint pipe (156) is a relatively-short circular tubular member. The joint pipe (156) is disposed substantially coaxially with the first upright pipe portion (162) of the gas-side collecting pipe (160). The upper end of the joint pipe (156) is joined to the first connecting port (161), which is the lower end of the first upright pipe portion (162), by brazing.

[0121] The joint pipe (156) is a metal pipe. The material of the joint pipe (156) is stainless steel, similarly to the joint pipe (106) of the liquid pipe unit (100).

<Gas-Side Refrigerant Pipe>

[0122] The gas-side refrigerant pipe (170) is a refrigerant pipe through which refrigerant in a gas single-phase state flows during the operation of the indoor unit (30).

[0123] The gas-side refrigerant pipe (170) is a circular pipe bent in an L-shape. The material of the gas-side refrigerant pipe (170) is copper or copper alloy.

[0124] One end (an upward end) of the gas-side refrigerant pipe (170) is a second connecting port (171) that is open upward. A straight pipe portion of the gas-side refrigerant pipe (170) including the second connecting port (171) is a second upright pipe portion (172). The center axis direction (extension direction) of the second upright pipe portion (172) is substantially the vertical direction. The second upright pipe portion (172) is disposed substantially coaxially with the joint pipe (106). The second connecting port (171), which is the upper end of the second upright pipe portion (172), is joined to the lower end of the joint pipe (156) by brazing.

[0125] A flare joint (157) is attached to the other end (an end facing laterally) of the gas-side refrigerant pipe (170). The material of the flare joint (157) is brass.

<Arrangement of First Upright Pipe Portion and Second Upright Pipe Portion>

[0126] In the gas pipe unit (150) of this embodiment, the second upright pipe portion (172) of the gas-side refrigerant pipe (170) is disposed below the first upright pipe portion (162) of the gas-side collecting pipe (160). The first upright pipe portion (162), the second upright pipe portion (172), and the joint pipe (156) are arranged in a straight line. The center axis direction of each of the first upright pipe portion (162), the second upright pipe portion (172), and the joint pipe (156) is substantially the vertical direction. The first upright pipe portion (162), the second upright pipe portion (172), and the joint pipe (156) are located inside the casing (35) of the indoor unit (30).

<Flow of Refrigerant in Gas Pipe Unit>

[0127] During the cooling operation of the air conditioning apparatus (10) in which the indoor heat exchanger (65) functions as an evaporator, the refrigerant in the gas single-phase state that has flowed out of the indoor heat exchanger (65) flows through the liquid pipe unit (100).

[0128] Specifically, the refrigerant that has flowed out of the heat transfer tubes (66) of the indoor heat exchanger (65) flows through the corresponding gas-side branch pipes (153) into the gas-side distributor body (151). Flows of the refrigerant which has flowed into the gas-side distributor body (151) from the gas-side branch pipes (153) merge together, which then passes through the gas-side collecting pipe (160) and the gas-side refrigerant pipe (170) in sequence and flows out of the indoor unit (30).

[0129] During the heating operation of the air conditioning apparatus (10) in which the indoor heat exchanger (65) functions as a radiator, the refrigerant in the gas single-phase state that is discharged from the compressor (21) flows through the gas pipe unit (150).

[0130] Specifically, the refrigerant that has been discharged from the compressor (21) and flowed into the gas pipe unit (150) passes through the gas-side refrigerant pipe (170) and the gas-side collecting pipe (160) in sequence, flows into the gas-side distributor body (151), and is distributed to all of the gas-side branch pipes (153). The refrigerant that has flowed into each gas-side branch pipe (153) is distributed to the two open ends (153a), and flows into the corresponding heat transfer tubes (66) of the indoor heat exchanger (65).

-Feature (1) of Embodiment-

[0131] In the liquid pipe unit (100) of this embodiment,

the liquid-side refrigerant pipe (120) is connected to the liquid-side collecting pipe (110) of the liquid-side distributor (100a). The first connecting port (111) of the liquid-side collecting pipe (110) and the second connecting port (121) of the liquid-side refrigerant pipe (120) are connected to each other through the joint pipe (106). The first upright pipe portion (112) of the liquid-side collecting pipe (110) includes the first connecting port (111). The second upright pipe portion (122) of the liquid-side refrigerant pipe (120) includes the second connecting port (121).

[0132] In the state in which the indoor unit (30) is installed, the second upright pipe portion (122) of the liquid-side refrigerant pipe (120) made of copper or copper alloy is located below the first upright pipe portion (112) of the liquid-side collecting pipe (110) made of aluminum or aluminum alloy. The condensed water generated on the surface of the second upright pipe portion (122) and containing copper ions flows downward by gravitation and therefore does not adhere to the first upright pipe portion (112).

[0133] The material of the heat transfer tubes (66) to which the liquid-side distributor (100a) is connected is aluminum or aluminum alloy. The condensed water generated on the surfaces of the heat transfer tubes (66) may adhere to the liquid-side distributor (100a), but the condensed water does not contain copper ions.

[0134] Accordingly, the condensed water containing copper ions does not adhere to the liquid-side distributor (100a). Thus, according to this embodiment, it is possible to reduce corrosion of the liquid-side distributor (100a) due to the adhesion of the condensed water containing copper ions.

-Feature (2) of Embodiment-

[0135] Here, when the refrigerant in the gas-liquid two-phase state flows through the liquid pipe unit (100), it is desirable that the center axis direction of the pipe through which the refrigerant in the gas-liquid two-phase state is introduced into the liquid-side distributor body (101) is set to be the vertical direction so that the liquid refrigerant and the gas refrigerant in the liquid-side distributor body (101) be distributed equally to the plurality of liquid-side branch pipes (103). In other words, it is desirable that the pipe through which the refrigerant in the gas-liquid two-phase state is introduced into the liquid-side distributor body (101) has a portion extending in the vertical direction.

[0136] In the liquid pipe unit (100) of this embodiment, the first upright pipe portion (112) of the liquid-side collecting pipe (110) and the second upright pipe portion (122) of the liquid-side refrigerant pipe (120) are arranged in a straight line in a posture in which their center axis direction is substantially the vertical direction. It is thus possible to make the direction of flow of the refrigerant passing through the liquid-side refrigerant pipe (120) and the liquid-side collecting pipe (110) in sequence and flowing into the liquid-side distributor body (101) be substantially vertically upward. As a result, the liquid refrigerant and the gas refrigerant in the liquid-side distributor body (101) can be equally distributed to the plurality of liquid-side branch pipes (103).

[0137] Since the first upright pipe portion (112) of the liquid-side collecting pipe (110) and the second upright pipe portion (122) of the liquid-side refrigerant pipe (120) are arranged in the vertical direction, it is possible to cause the condensed water generated on the surface of the second upright pipe portion (122) and containing copper ions to flow downward by gravitation with reliability. As a result, it is possible to prevent the condensed water containing copper ions from adhering to the first upright pipe portion (112) of the liquid-side distributor (100a) reliably.

-Feature (3) of Embodiment-

[0138] In the liquid pipe unit (100) of this embodiment, the first upright pipe portion (112) of the liquid-side collecting pipe (110) and the second upright pipe portion (122) of the liquid-side refrigerant pipe (120) are formed in the shape of a straight pipe, and are arranged in a straight line in a posture in which their center axis direction is substantially the vertical direction. It is thus possible to minimize the size of a region of the internal space of the casing (35) occupied by the first upright pipe portion (112) and the second upright pipe portion (122). According to this embodiment, it is thus possible to reduce corrosion of the liquid-side distributor (100a) due to the adhesion of the condensed water containing copper ions while reducing the size of the indoor unit (30).

-Feature (4) of Embodiment-

[0139] In the gas pipe unit (150) of this embodiment, the first connecting port (161) of the gas-side collecting pipe (160) of the gas-side distributor (150a) and the second connecting port (171) of the gas-side refrigerant pipe (170) are connected to each other through the joint pipe (156). The first upright pipe portion (162) of the gas-side collecting pipe (160) includes the first connecting port (161). The second upright pipe portion (172) of the gas-side refrigerant pipe (170) includes the second connecting port (171).

[0140] In the state in which the indoor unit (30) is installed, the second upright pipe portion (172) of the gas-side refrigerant pipe (170) made of copper or copper alloy is located below the first upright pipe portion (162) of the gas-side collecting pipe (160) made of aluminum or aluminum alloy. The condensed water generated on the surface of the second upright pipe portion (172) and containing copper ions flows downward by gravitation and therefore does not adhere to the first upright pipe portion (162).

[0141] Thus, according to this embodiment, it is possible to reduce corrosion of the gas-side collecting pipe (160) due to the adhesion of the condensed water containing copper ions.

-Feature (5) of Embodiment-

[0142] In the gas pipe unit (150) of this embodiment, the first upright pipe portion (162) of the gas-side collecting pipe (160) and the second upright pipe portion (172) of the gas-side refrigerant pipe (170) are arranged in a straight line in a posture in which their center axis direction is substantially the vertical direction. It is thus possible to cause the condensed water generated on the surface of the second upright pipe portion (172) and containing copper ions to flow downward by gravitation with reliability. As a result, it is possible to prevent the condensed water containing copper ions from adhering to the first upright pipe portion (162) of the gas-side distributor (150a) reliably.

-First Variation of Embodiment-

[0143] As illustrated in FIG. 9, in the liquid pipe unit (100) of this embodiment, the first connecting port (111) of the liquid-side collecting pipe (110) and the second connecting port (121) of the liquid-side refrigerant pipe (120) may be directly joined to each other. In this case, the joint pipe (106) is omitted from the liquid pipe unit (100).

[0144] In the gas pipe unit (150) of this embodiment, the first connecting port (161) of the gas-side collecting pipe (160) and the second connecting port (171) of the gas-side refrigerant pipe (170) may be directly joined to each other. In this case, the joint pipe (156) is omitted from the gas pipe unit (150).

-Second Variation of Embodiment-

[0145] As illustrated in FIG. 10, the second upright pipe portion (122) of the liquid-side refrigerant pipe (120) may be omitted from the liquid pipe unit (100) of this embodiment. In this case, one end of the U-shaped pipe portion (123) of the liquid-side refrigerant pipe (120) serves as the second connecting port (121) that is open upward.

[0146] The second upright pipe portion (172) of the gas-side refrigerant pipe (170) may be omitted from the gas pipe unit (150) of this embodiment. In this case, an end of a quarter circular arc-shaped portion of the gas-side refrigerant pipe (170) serves as the second connecting port (171) that is open upward.

-Third Variation of Embodiment-

[0147] As illustrated in FIG. 11, in the liquid pipe unit (100) of this embodiment, the liquid-side collecting pipe (110) of the liquid-side distributor (100a) may be a circular pipe that meanders up and down. The liquid-side collecting pipe (110) of this variation has one first semicircular portion (113a) and one second semicircular portion (113b).

[0148] In this variation, a portion of the liquid-side collecting pipe (110) near one end is formed into a straight pipe extending generally in the vertical direction. The one end of the liquid-side collecting pipe (110) is joined to the lower end of a liquid-side distributor body (101). The internal space of the liquid-side collecting pipe (110) communicates with the internal space of the liquid-side distributor body (101).

[0149] The first semicircular portion (113a) is a semicircular arc-shaped portion facing upward. The first semicircular portion (113a) is disposed near the one end of the liquid-side collecting pipe (110). The second semicircular portion (113b) is a semicircular arc-shaped portion facing downward. The second semicircular portion (113b) is disposed near the other end of the liquid-side collecting pipe (110). One end of the first semicircular portion (113a) and one end of the second semicircular portion (113b) are connected together through a straight pipe portion.

[0150] A first upright pipe portion (112) is a straight circular tubular portion. The center axis direction of the first upright pipe portion (112) is substantially the vertical direction. The upper end of the first upright pipe portion (112) of this variation is continuous with the other end of the second semicircular portion (113b). The lower end of the first upright pipe portion (112) is a first connecting port (111) that is open downward, and is joined to a joint pipe (106).

[0151] The liquid-side refrigerant pipe (120) of this variation is a circular pipe bent in an L-shape. One end (an upward end) of the liquid-side refrigerant pipe (120) is a second connecting port (121) that is open upward. A straight pipe portion of the liquid-side refrigerant pipe (120) including the second connecting port (121) is a second upright pipe portion (122). The center axis direction of the second upright pipe portion (122) is substantially the vertical direction. The second upright pipe portion (122) is arranged substantially coaxially with the joint pipe (106). The second connecting port (121), which is the upper end of the second upright pipe portion (122), is joined to the lower end of the joint pipe (106) by brazing. A flare joint (107) is attached to the other end (an end facing laterally) of the liquid-side refrigerant pipe (120).

-Fourth Variation of Embodiment-

[0152] As illustrated in FIG. 12, the liquid-side collecting pipe (110) of the liquid-side distributor (100a) and the joint pipe (106) may be omitted from the liquid pipe unit (100) of this embodiment.

[0153] In the liquid pipe unit (100) of this variation, a liquid-side distributor (100a) is formed by only a liquid-side distributor body (101), and the lower end of a smaller-diameter portion (101a) of the liquid-side distributor body (101) serves as a first connecting port (111) that is open downward. In the liquid pipe unit (100) of this variation, a liquid-side refrigerant pipe (120) is directly connected to the liquid-side distributor body (101). A second connecting port (121), which is the upper end of a second upright pipe portion (122) of the liquid-side refrigerant pipe (120), is joined to the lower end of the smaller-diameter portion (101a) of the liquid-side distri-

butor body (101) by brazing.

[0154] The liquid pipe unit (100) of this variation may include a joint pipe (106) as illustrated in FIG. 13. In this case, the first connecting port (111), which is the lower end of the smaller-diameter portion (101a) of the liquid-side distributor body (101), is joined to the upper end of the joint pipe (106) by brazing, and the second connecting port (121), which is the upper end of the second upright pipe portion (122) of the liquid-side refrigerant pipe (120), is joined to the lower end of the joint pipe (106) by brazing.

-Fifth Variation of Embodiment-

[0155] In the liquid pipe unit (100) of this embodiment, the shape of each of the first upright pipe portion (112) and the second upright pipe portion (122) is not limited to a straight tubular shape. The shape of each of the first upright pipe portion (112) and the second upright pipe portion (122) may be slightly curved or slightly bent as long as it is a tubular shape extending in the up-down direction.

[0156] In the gas pipe unit (150) of this embodiment, the shape of each of the first upright pipe portion (162) and the second upright pipe portion (172) is not limited to a straight tubular shape. The shape of each of the first upright pipe portion (162) and the second upright pipe portion (172) may be slightly curved or slightly bent as long as it is a tubular shape extending in the up-down direction.

-Sixth Variation of Embodiment-

[0157] In the liquid pipe unit (100) of this embodiment, the extension direction of each of the first upright pipe portion (112) and the second upright pipe portion (122) is not limited to the vertical direction. The extension direction of each of the first upright pipe portion (112) and the second upright pipe portion (122) may be a direction (diagonal direction) slightly inclined with respect to the vertical direction.

[0158] In the gas pipe unit (150) of this embodiment, the extension direction of each of the first upright pipe portion (162) and the second upright pipe portion (172) is not limited to the vertical direction. The extension direction of each of the first upright pipe portion (162) and the second upright pipe portion (172) may be a direction (diagonal direction) slightly inclined with respect to the vertical direction.

-Seventh Variation of Embodiment-

[0159] One or both of the liquid pipe unit (100) and the gas pipe unit (150) of this embodiment may be connected to a heat transfer tube of the outdoor heat exchanger (23) provided in the outdoor unit (20) as a component unit.

[0160] While the embodiments and variations thereof have been described above, it will be understood that various changes in form and details may be made without departing from the spirit and scope of the claims. The elements according to the embodiments, the variations thereof, and the other embodiments may be combined and replaced with each other. In addition, the expressions of "first," "second," "third," . . . , in the specification and claims are used to distinguish the terms to which these expressions are given, and do not limit the number and order of the terms.

INDUSTRIAL APPLICABILITY

[0161] As can be seen from the foregoing description, the present disclosure is useful for a component unit of an air conditioning apparatus.

DESCRIPTION OF REFERENCE CHARACTERS

[0162]

10	Air Conditioning Apparatus
20	Outdoor Unit (Component Unit)
30	Indoor Unit (Component Unit)
35	Casing
65	Indoor Heat Exchanger (Heat Exchanger)
66	Heat Transfer Tube
100a	Liquid-Side Distributor
101	Liquid-Side Distributor Body (Distributor Body)
105	Cover Member
106	Joint Pipe (Metal Pipe)
110	Liquid-Side Collecting Pipe (Collecting Pipe)
111	First Connecting Port
112	First Upright Pipe Portion
120	Liquid-Side Refrigerant Pipe (Refrigerant Pipe)
121	Second Connecting Port
122	Second Upright pipe portion
123	U-Shaped Pipe Portion
150a	Gas-Side Distributor
151	Gas-Side Distributor Body (Distributor Body)
155	Cover Member
156	Joint Pipe (Metal Pipe)
160	Gas-Side Collecting Pipe (Collecting Pipe)
161	First Connecting Port
162	First Upright Pipe Portion
170	Gas-Side Refrigerant Pipe (Refrigerant Pipe)
171	Second Connecting Port
172	Second Upright Pipe Portion

Claims

1. A component unit (20, 30) included in an air conditioning apparatus (10), the component unit (20, 30) comprising:

   a heat exchanger (65) having a plurality of heat transfer tubes (66);
   a refrigerant pipe (120, 170); and
   a distributor (100a, 150a) to which the heat

exchanger (65) and the refrigerant pipe (120, 170) are connected, the distributor (100a, 150a) being configured to distribute a refrigerant flowing therein from the refrigerant pipe (120, 170) to the plurality of heat transfer tubes (66),
a material of each of the heat transfer tubes (66) and the distributor (100a, 150a) being aluminum or aluminum alloy,
a material of the refrigerant pipe (120, 170) being copper or copper alloy,
the distributor (100a, 150a) having a first connecting port (111, 161) that is open downward in a state in which the component unit (20, 30) is installed,
one end of the refrigerant pipe (120, 170) being a second connecting port (121, 171) that is open upward in the state in which the component unit (20, 30) is installed,
the second connecting port (121, 171) of the refrigerant pipe (120, 170) being connected to the first connecting port (111, 161) of the distributor (100a, 150a) directly or through a metal pipe (106, 156) made of a material different from the material of each of the distributor (100a, 150a) and the refrigerant pipe (120, 170).

2. The component unit of claim 1, wherein

the distributor (100a, 150a) includes:
a distributor body (101, 151) connected to the heat exchanger (65), the distributor body (101, 151) being configured to distribute the refrigerant flowing therein to the plurality of heat transfer tubes (66); and
a collecting pipe (110, 160) having one end connected to the distributor body (101, 151) and another end forming the first connecting port (111, 161).

3. The component unit of claim 2, wherein
the collecting pipe (110, 160) is located below the distributor body (101, 151) in the state in which the component unit (20, 30) is installed.

4. The component unit of claim 2, wherein

a portion or an entirety of the collecting pipe (110, 160) is a first upright pipe portion (112, 162) extending in an up-down direction, and
a lower end of the first upright pipe portion (112, 162) is the first connecting port (111, 161).

5. The component unit of claim 4, wherein
the entirety of the collecting pipe (110, 160) is the first upright pipe portion (112, 162).

6. The component unit of claim 4 or 5, wherein
the first upright pipe portion (112, 162) is a straight pipe.

7. The component unit of claim 6, wherein
an extension direction of the first upright pipe portion (112, 162) is a vertical direction in the state in which the component unit (20, 30) is installed.

8. The component unit of any one of claims 1 to 7, wherein

a portion of the refrigerant pipe (120, 170) is a second upright pipe portion (122, 172) extending in an up-down direction, and
an upper end of the second upright pipe portion (122, 172) is the second connecting port (121, 171).

9. The component unit of claim 8, wherein
the second upright pipe portion (122, 172) is a straight pipe.

10. The component unit of claim 9, wherein
an extension direction of the second upright pipe portion (122, 172) is a vertical direction in the state in which the component unit (20, 30) is installed.

11. The component unit of claim 7, wherein

a portion of the refrigerant pipe (120, 170) is a second upright pipe portion (122, 172) that is a straight pipe extending in an up-down direction,
an upper end of the second upright pipe portion (122, 172) is the second connecting port (121, 171), and
the first upright pipe portion (112, 162) and the second upright pipe portion (122, 172) are arranged in a straight line.

12. The component unit of any one of claims 8 to 11, wherein
the refrigerant pipe (120, 170) has a U-shaped pipe portion (123) that is a U-shaped portion continuous with a lower end of the second upright pipe portion (122, 172).

13. The component unit of claim 4, wherein

the collecting pipe (110, 160) is a pipe that meanders up and down, and
a portion of the collecting pipe (110, 160) is the first upright pipe portion (112, 162).

14. The component unit of any one of claims 1 to 13, wherein
the refrigerant pipe (120) is a pipe through which a refrigerant in a gas-liquid two-phase state or in a liquid single-phase state flows during an operation of the component unit (20, 30).

15. The component unit of any one of claims 1 to 13, wherein
the refrigerant pipe (170) is a pipe through which a refrigerant in a gas single-phase state flows during an operation of the component unit (20, 30).

16. The component unit of any one of claims 1 to 15 further comprising:

a casing (35) configured to house the heat exchanger (65), wherein
the first connecting port (111, 161) of the distributor (100a, 150a) and the second connecting port (121, 171) of the refrigerant pipe (120, 170) are located in an inside of the casing (35).

17. The component unit of claim 16, wherein

an end of the refrigerant pipe (120, 170) opposite to the second connecting port (121, 171) is exposed to an outside of the casing (35), and
the refrigerant pipe (120, 170) is provided with a cover member (105, 155) configured to cover a portion of the refrigerant pipe (120, 170) and close a clearance between the refrigerant pipe (120, 170) and the casing (35).

FIG.1

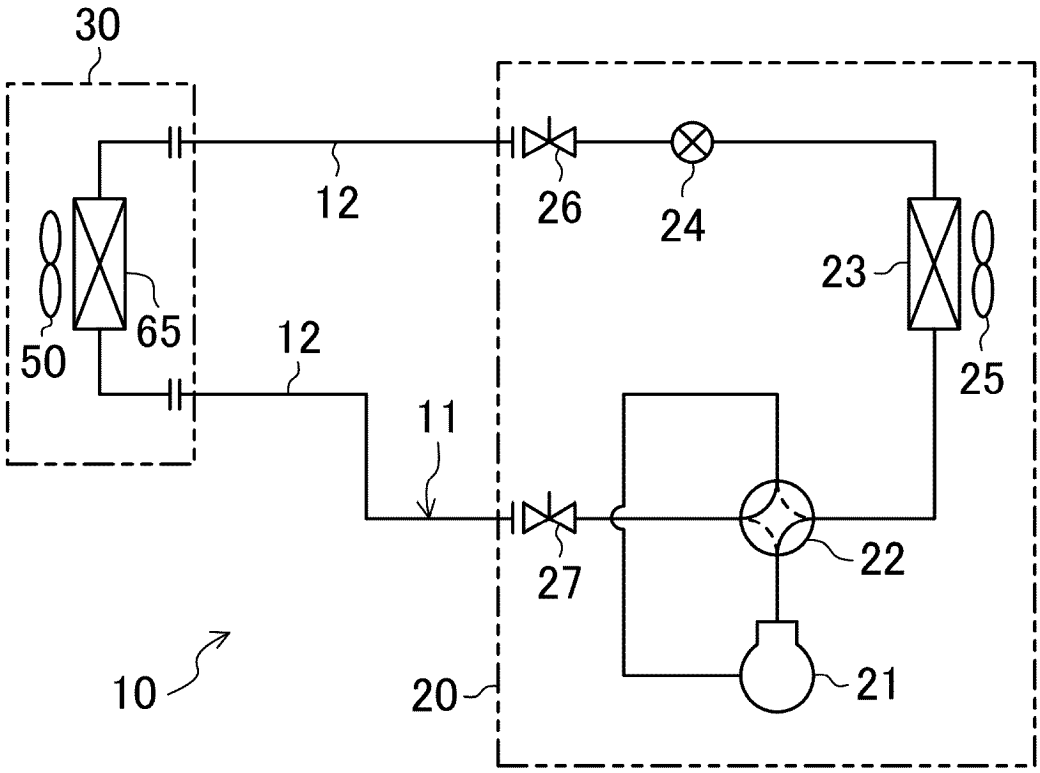


FIG.2

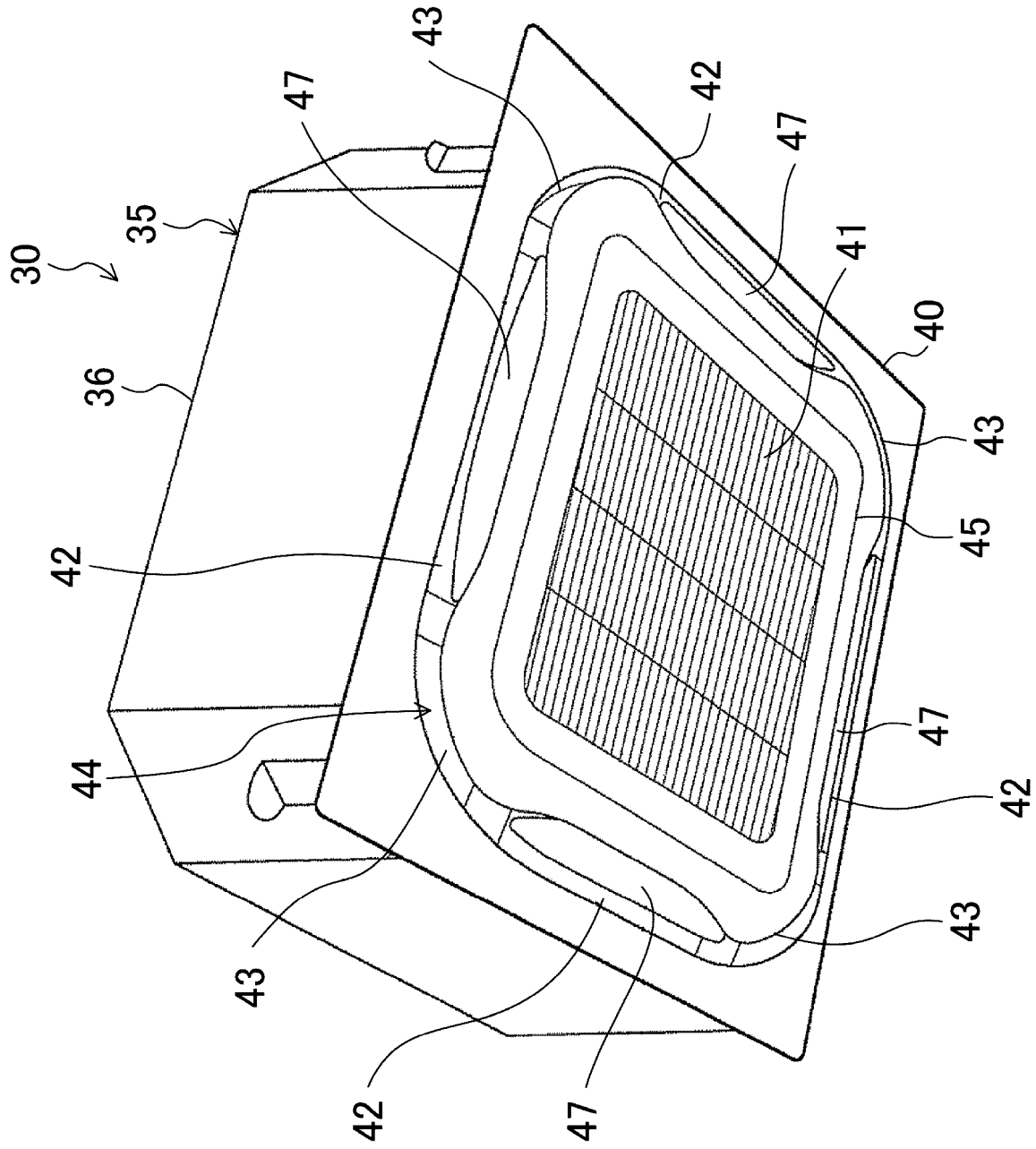


FIG.3

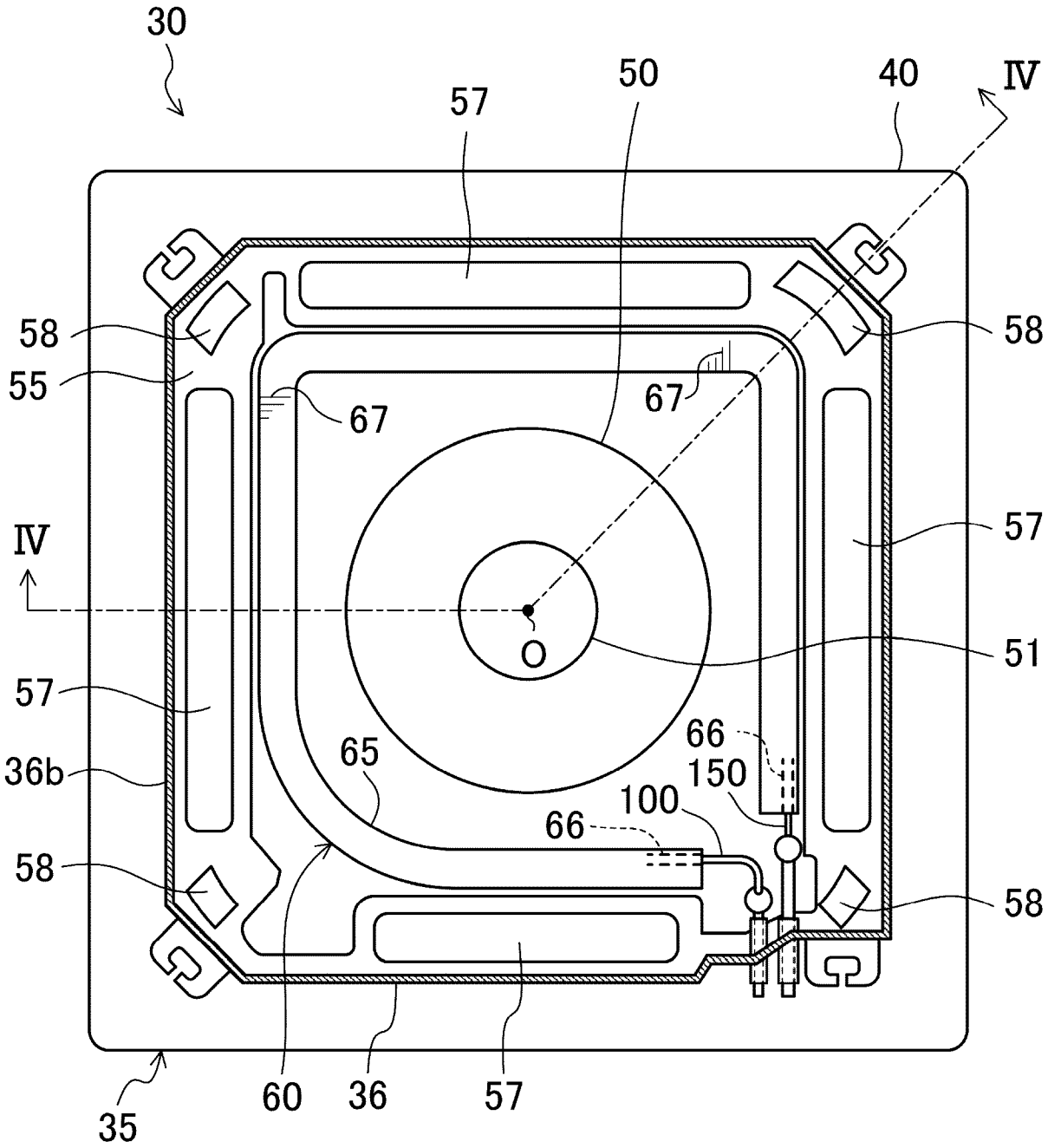

30
57
50
40
IV
58
55
67
67
58
IV
57
O
51
57
36b
65
66
150
100
66
58
58
35
60
36
57

FIG.4

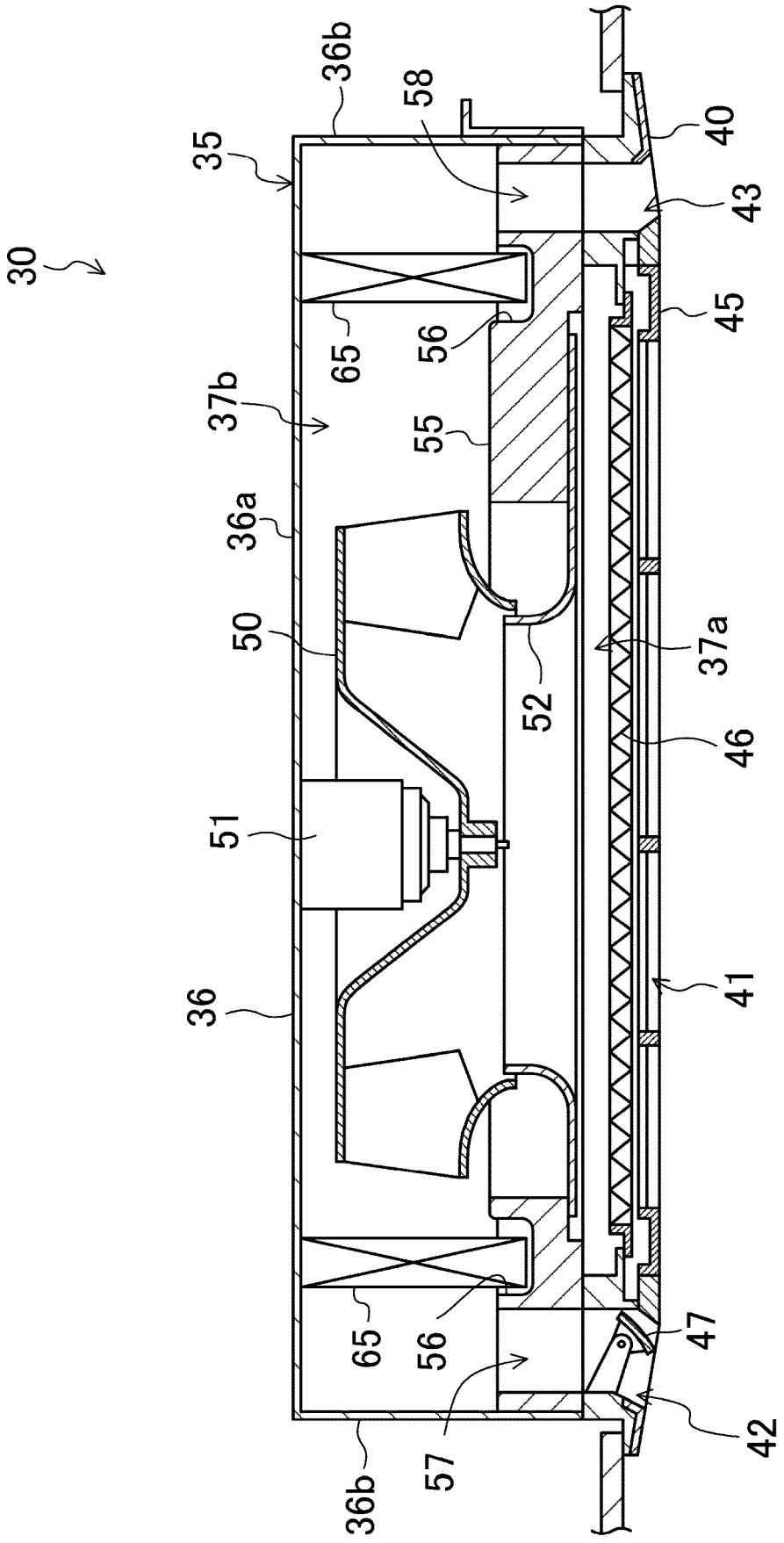

30
35
36b
58
40
43
45
65
56
37b
55
36a
50
52
37a
46
51
36
41
47
42
57
36b

FIG.5

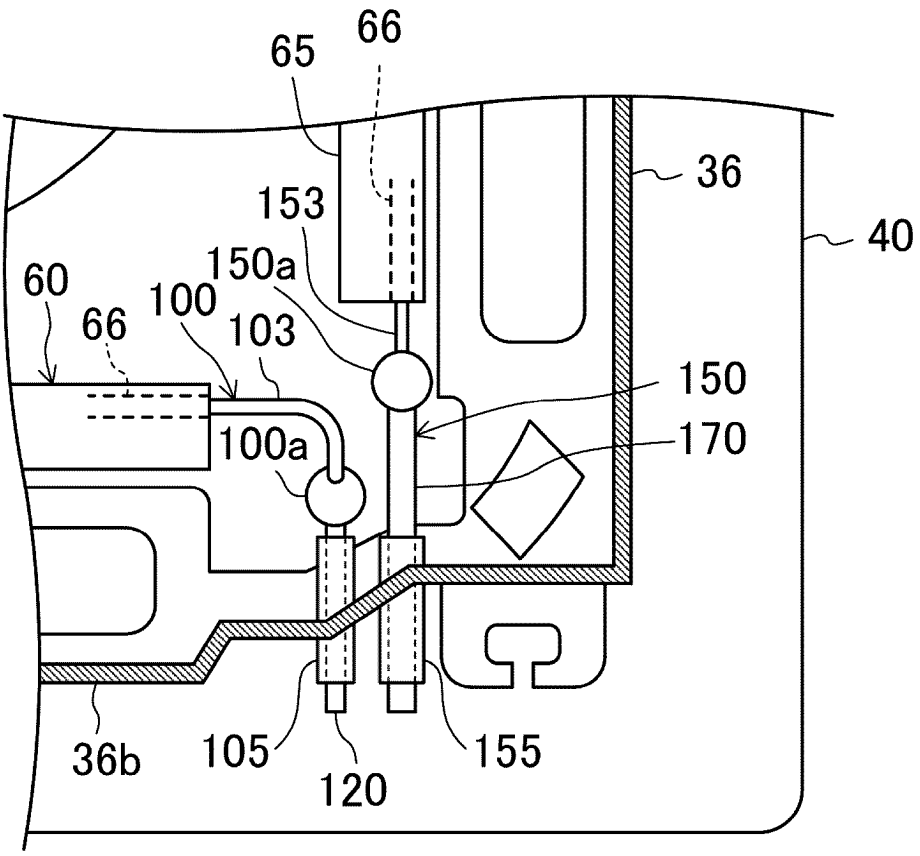


FIG.6

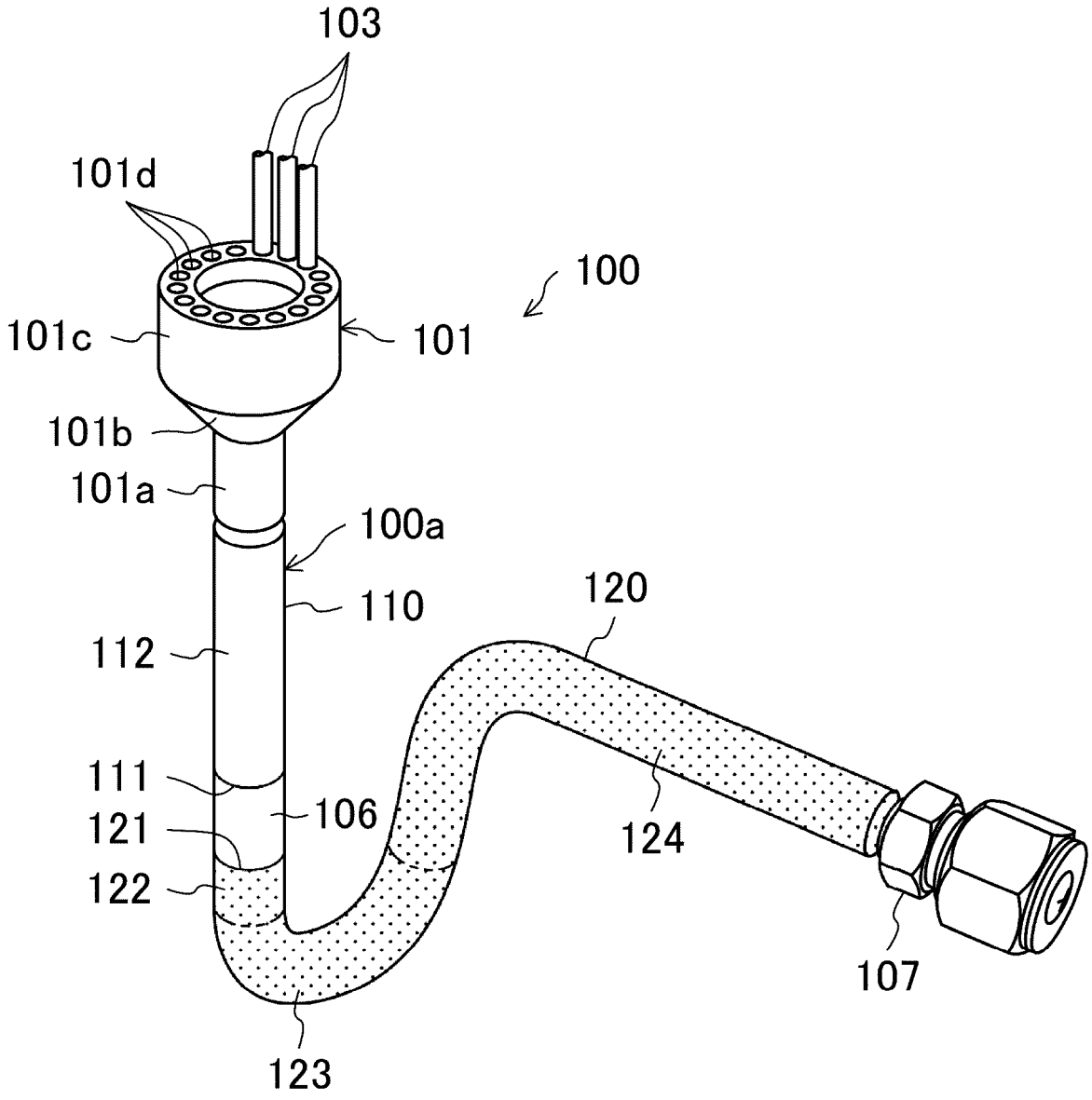

103
101d
100
101c
101
101b
101a
100a
110
120
112
111
106
121
124
122
107
123

FIG.7

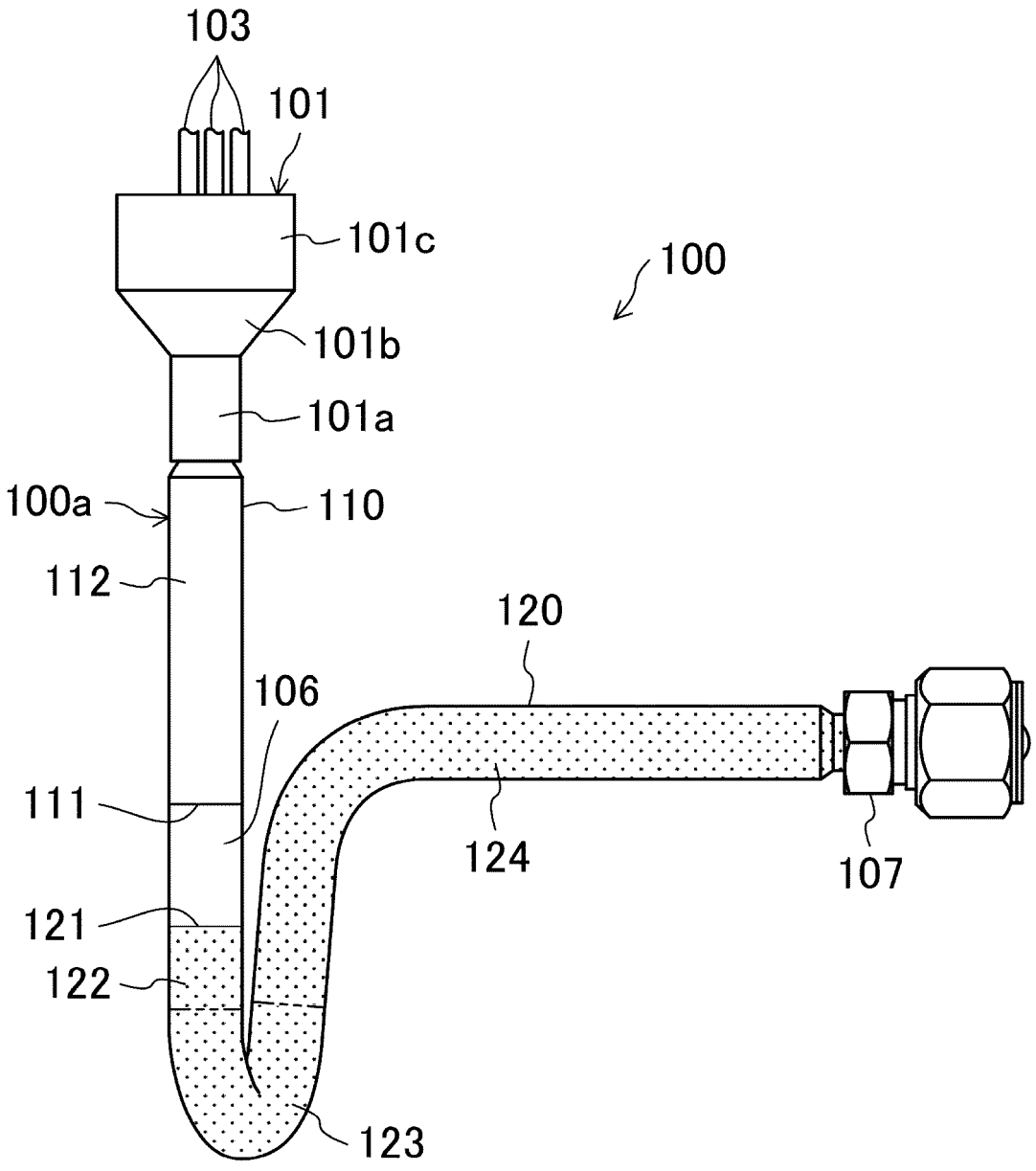

103
101
101c
100
101b
101a
100a
110
112
120
106
111
124
107
121
122
123

FIG.8

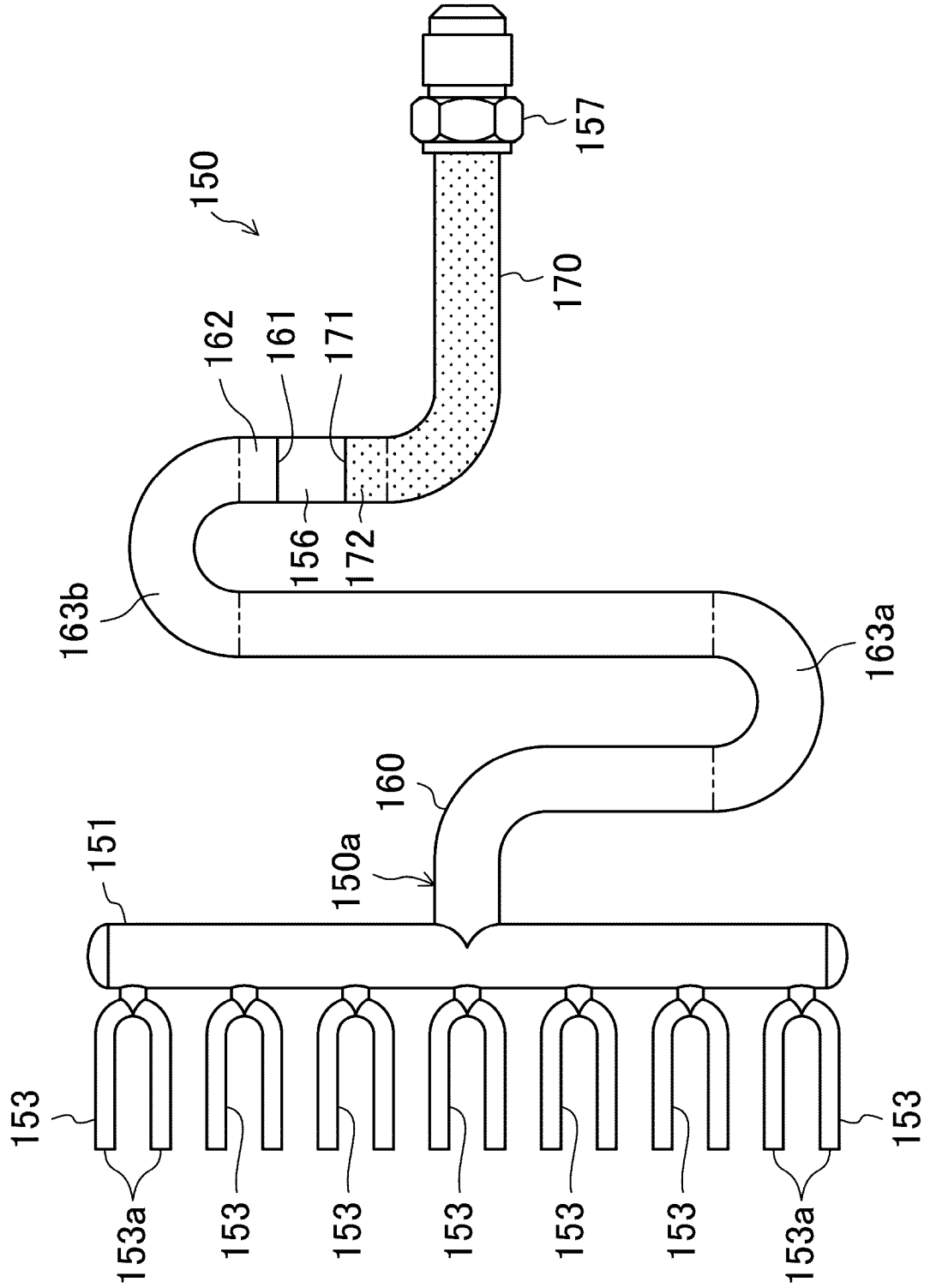

150
157
170
162
161
171
156
172
163b
163a
160
151
150a
153
153a
153
153
153
153
153
153a
153

FIG.9

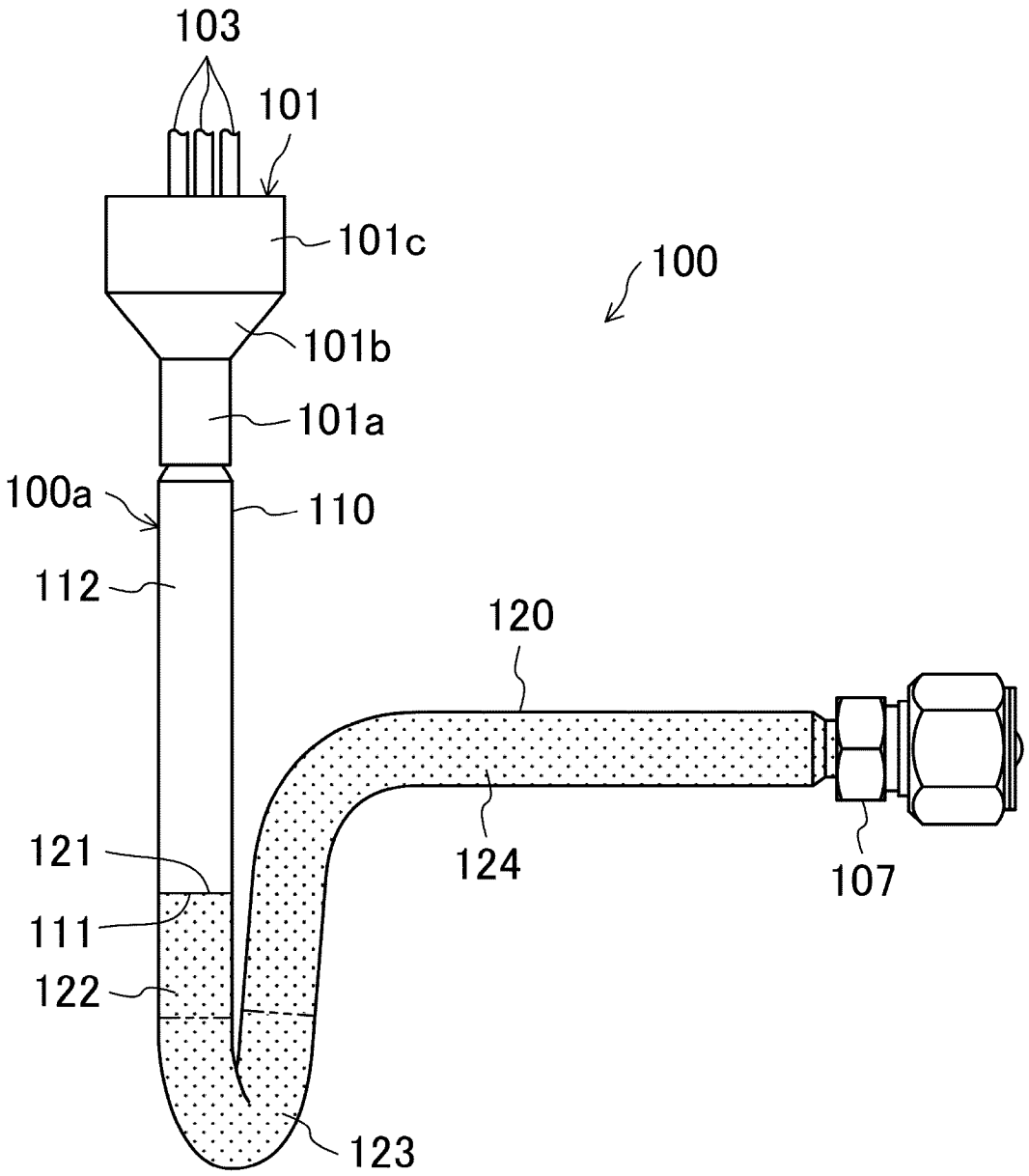

103
101
101c
100
101b
101a
100a
110
112
120
121
124
107
111
122
123

FIG.10

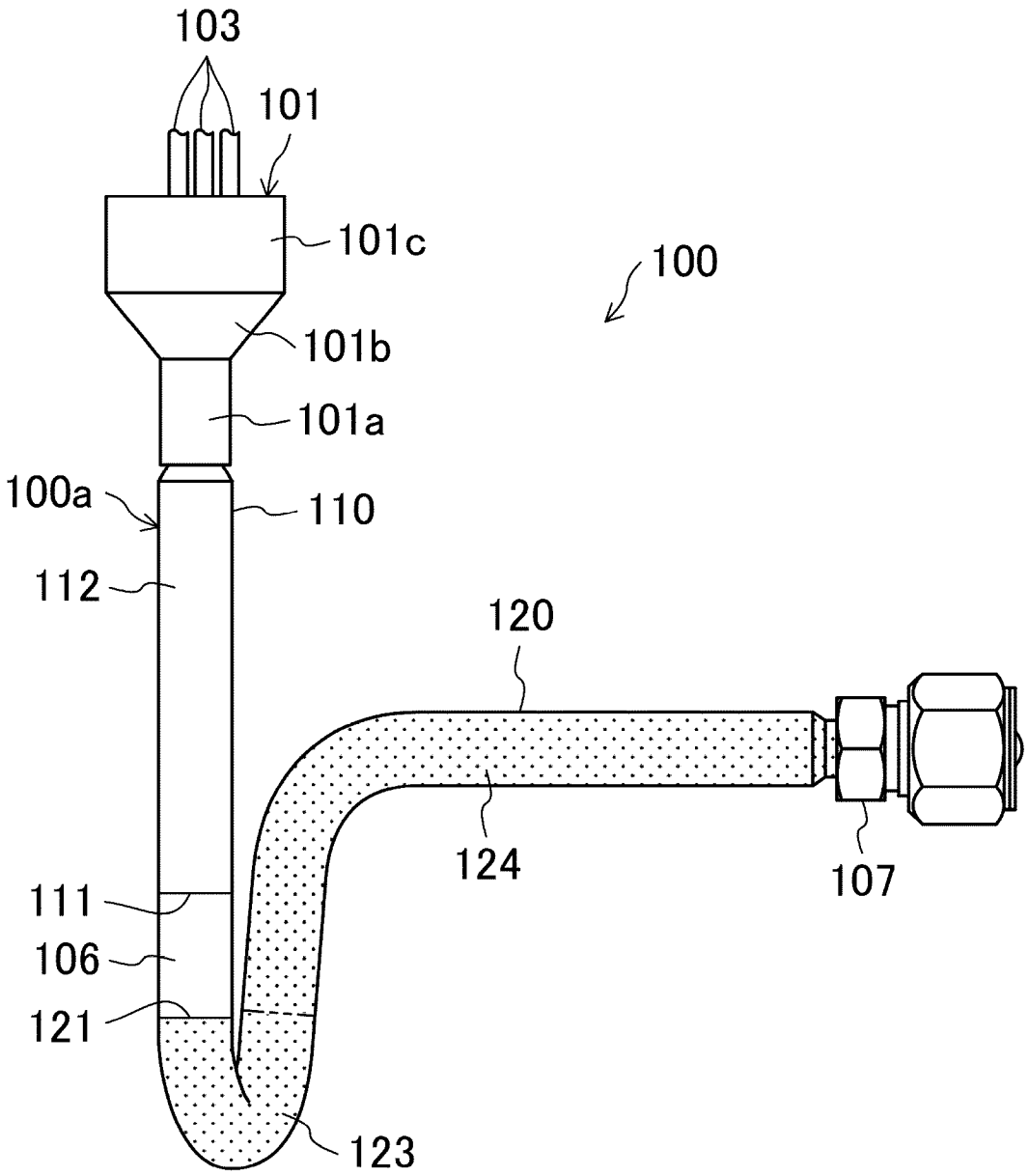

103
101
101c
100
101b
101a
100a
110
112
120
124
107
111
106
121
123

FIG.11

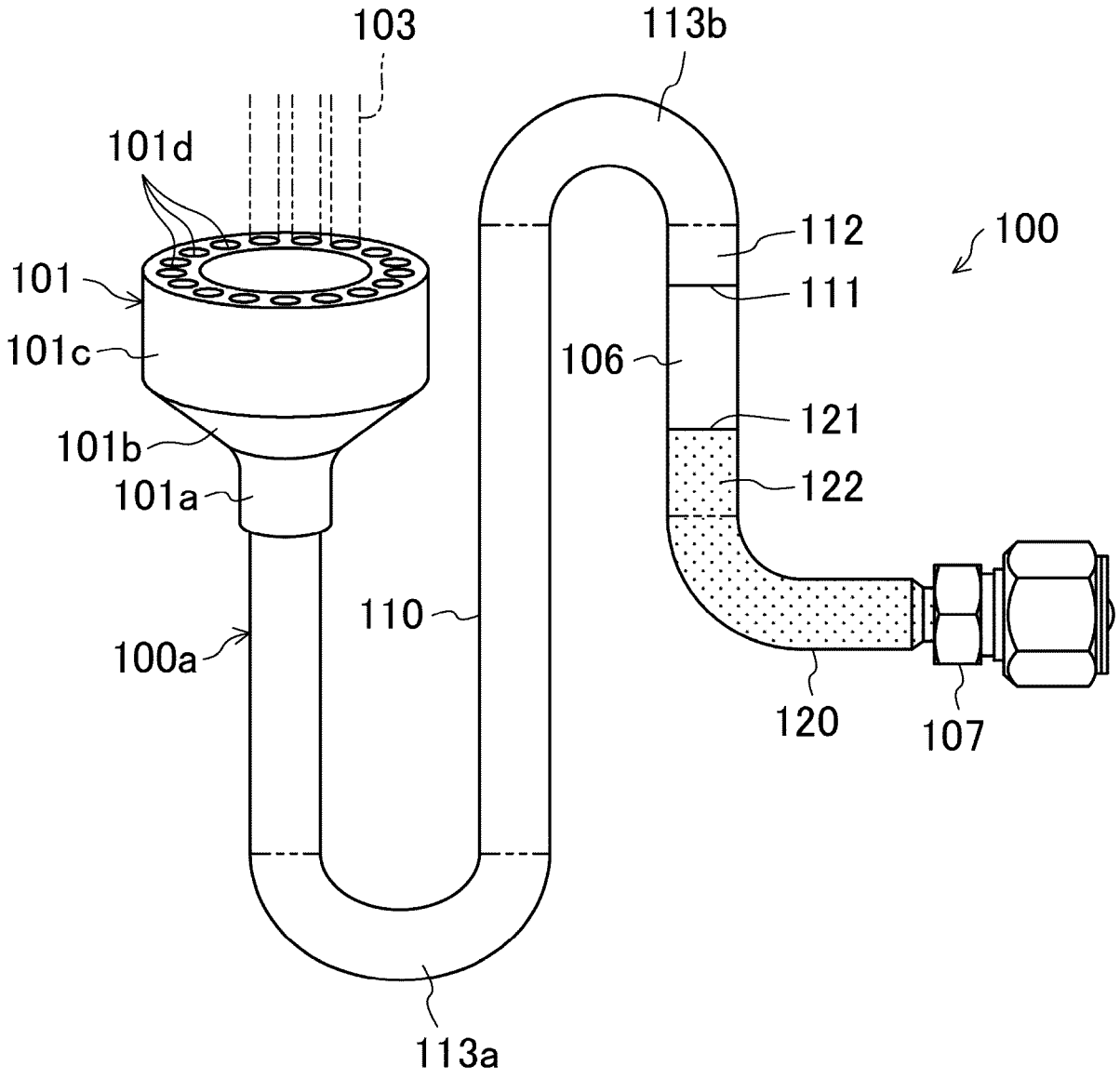

103
113b
101d
112
100
101
111
101c
106
121
101b
122
101a
110
100a
120
107
113a

FIG.12

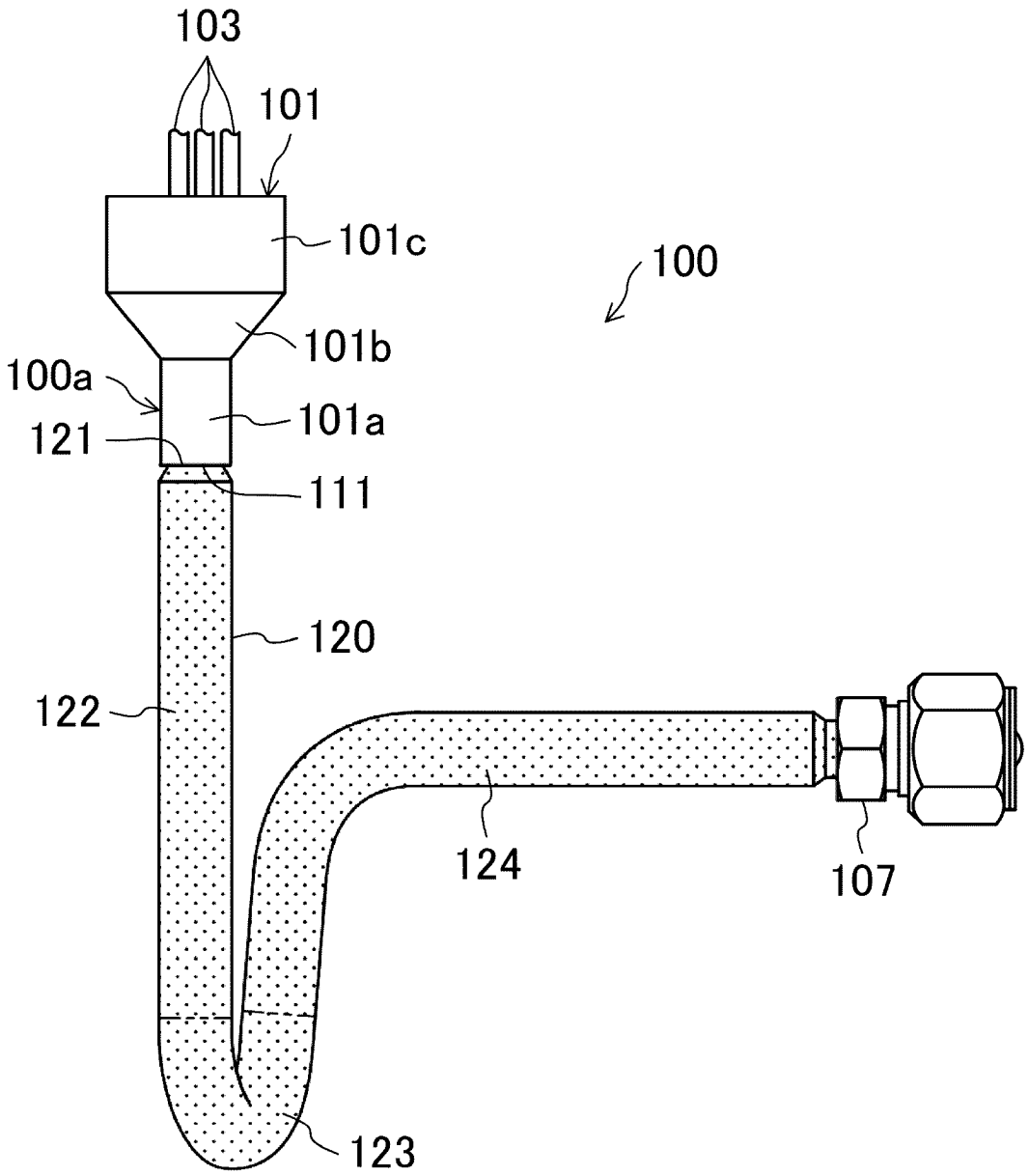
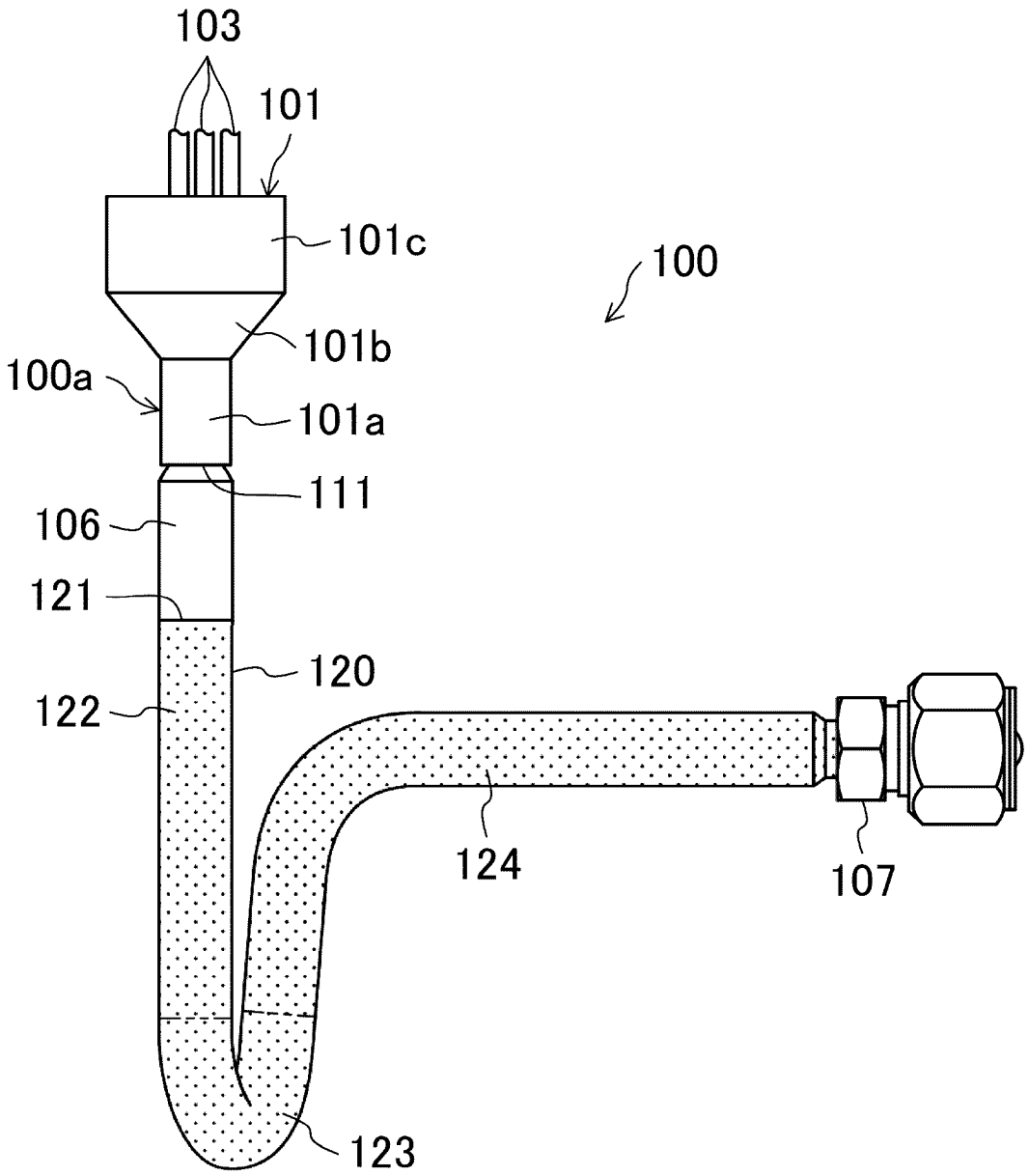


FIG.13



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2023/032843

A. CLASSIFICATION OF SUBJECT MATTER

F25B 41/42(2021.01)i; ***F24F 1/0067***(2019.01)i; ***F25B 41/40***(2021.01)i; ***F28F 19/00***(2006.01)i; ***F28F 21/08***(2006.01)i
FI: F25B41/42; F24F1/0067; F25B41/40 D; F28F19/00 511Z; F28F21/08 A; F28F21/08 E

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)

F25B41/42; F28F9/02-9/18

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 1971-2023
Registered utility model specifications of Japan 1996-2023
Published registered utility model applications of Japan 1994-2023

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 2018-9742 A (HITACHI-JOHNSON CONTROLS AIR CONDITIONING, INC.) 18 January 2018 (2018-01-18) paragraphs [0002], [0003], [0016], [0017], [0024]-[0027], [0033]-[0039], [0042],[0044], fig. 1-4	1-2, 4, 6-11, 13-15
Y		1–2, 4, 6–17
X	JP 2009-92274 A (HITACHI APPLIANCES INC.) 30 April 2009 (2009-04-30) paragraphs [0026], [0043], [0091], [0110], [0113]-[0116], [0385]-[0403], fig. 19, 20	1-11, 14
Y		1-2, 4, 6-17
Y	JP 2010-112667 A (MITSUBISHI ELECTRIC CORP.) 20 May 2010 (2010-05-20) paragraphs [0010], [0042], fig. 10	12
Y	WO 2015/037354 A1 (MITSUBISHI ELECTRIC CORP.) 19 March 2015 (2015-03-19) paragraphs [0031], [0034], [0039], fig. 2-3A, 5A	16-17
A	JP 2013-155892 A (MITSUBISHI ELECTRIC CORP.) 15 August 2013 (2013-08-15) paragraphs [0014], [0021]-[0032], [0037]-[0044], fig. 1-4	1-17

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"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
17 November 2023	**28 November 2023**
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/JP2023/032843

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 2018-9742 A	18 January 2018	(Family: none)	
JP 2009-92274 A	30 April 2009	(Family: none)	
JP 2010-112667 A	20 May 2010	US 2010/0116461 A1 paragraphs [0012], [0057], fig. 10 EP 2184549 A2 CN 101737868 A	
WO 2015/037354 A1	19 March 2015	US 2016/0109162 A1 paragraphs [0069], [0076]-[0078], [0089]-[0091], fig. 2-3A, 5A EP 3045833 A1 CN 104456721 A CN 204313385 U JP 2015-55448 A	
JP 2013-155892 A	15 August 2013	EP 2620736 A2 paragraphs [0014], [0021]-[0032], [0037]-[0044], fig. 1-4 CN 103225847 A	

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 5853203 B **[0004]**