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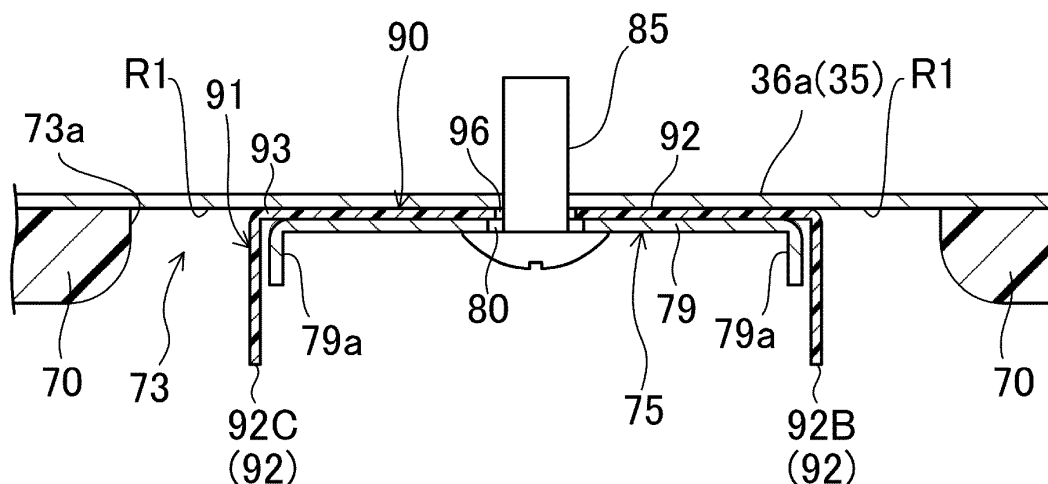
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Osaka-shi, Osaka 530-0001 (JP)(54) **AIR CONDITIONING DEVICE AND COMPONENT UNIT**

(57) A component unit of an air conditioner includes: a support (75) configured to support the heat exchanger (65) and having a fixing part (79) fixed to an inner surface of the top panel (36a) inside the opening (73); and a preventing member (90) configured to prevent conden-

sation water from traveling to the support (75) from a first region (73a) of the inner surface of the top panel (36a) between a first region (R1) defined by the opening (73) and the fixing part (79).

FIG.8**EP 4 560 218 A1**

Description

TECHNICAL FIELD

[0001] The present disclosure relates to an air conditioner and a component unit.

BACKGROUND ART

[0002] The air conditioner of Patent Document 1 includes an indoor unit as a component unit. A heat exchanger having heat transfer tubes is arranged inside a casing of the indoor unit. In the heat exchanger, the air is cooled or heated by a refrigerant. The air with its temperature adjusted by the heat exchanger is supplied to indoor space.

CITATION LIST

PATENT DOCUMENT

[0003] Patent Document 1: Japanese Unexamined Patent Publication No. 2019-100643

SUMMARY OF THE INVENTION

TECHNICAL PROBLEM

[0004] The inventors of the present application have invented the following configuration.

[0005] A heat insulating member is provided on an inner surface of a top panel of the casing of the component unit. The heat exchanger is fixed to the top panel of the casing by a support. Specifically, an opening is formed in the heat insulating member, and a fixing part of the support is fixed to the top panel through the opening.

[0006] In this configuration, the opening is designed to be slightly larger than the fixing part of the support in consideration of manufacturing and assembly errors of the heat insulating member. Thus, part of the inner surface of the top panel between an edge defined by the opening and the fixing part of the support is exposed to the space inside the casing. This may sometimes cause moisture in the air to condense on the exposed surface, generating condensation water.

[0007] On the other hand, if the heat transfer tubes of the heat exchanger are made of an aluminum material, the heat transfer tubes have a higher ionization tendency than the top panel made of an iron-based material. In this case, the heat transfer tubes may be electrically corroded if the condensation water generated on the inner surface of the top panel flows to the heat exchanger along the support.

[0008] An object of the present disclosure is to reduce electrical corrosion of a heat exchanger supported by a support.

SOLUTION TO THE PROBLEM

[0009] A first aspect of the present disclosure is directed to a component unit of an air conditioner, the component unit including: a casing (35) having a top panel (36a) made of a metallic material; a heat exchanger (65) arranged in the casing (35) and having a heat transfer tube (66) made of a material having a higher ionization tendency than the top panel (36a); a heat insulating member (70) configured to cover an inner surface of the top panel (36a) and having an opening (73); a support (75) configured to support the heat exchanger (65) and having a fixing part (79) fixed to an inner surface of the top panel (36a) inside the opening (73); and a preventing member (90) configured to prevent condensation water from traveling to the support (75) from a first region (73a) of the inner surface of the top panel (36a) between a first region (R1) defined by the opening (73) and the fixing part (79).

[0010] In the first aspect, the heat transfer tube (66) of the heat exchanger (65) has a higher ionization tendency than the top panel (36a) of the casing (35). However, the preventing member (90) prevents the condensation water from traveling to the support (75) from the first region (R1) of the inner surface of the top panel (36a) between the first edge (73a) defined by the opening (73) and the fixing part (79). This can reduce electrical corrosion of the heat transfer tube (66).

[0011] A second aspect is an embodiment of the first aspect. In the second aspect, the preventing member (90) is configured to prevent condensation water generated in the first region (R1) from traveling to the support (75).

[0012] In the second aspect, even if the condensation water is generated in the first region (R1), the preventing member (90) prevents the condensation water from traveling to the support (75).

[0013] A third aspect is an embodiment of the second aspect. In the third aspect, the preventing member (90) includes a projection (92) extending downward from the first region (R1).

[0014] In the third aspect, even if the condensation water is generated in the first region (R1), the projection (92) that functions as the preventing member (90) prevents the condensation water from traveling to the support (75).

[0015] A fourth aspect is an embodiment of the third aspect. In the fourth aspect, the preventing member (90) includes the projection (92) and a base (93) that is shorter than the projection (92) and that is formed between the projection (92) and the fixing part (79).

[0016] In the fourth aspect, even if the condensation water is generated in the first region (R1), the projection (92) can prevent the condensation water from traveling to the support (75). The base (93) reduces an area of the first region (R1) exposed to the space inside the casing (35). This can reduce the generation of the condensation water in the first region (R1).

[0017] A fifth aspect is an embodiment of the third

aspect. In the fifth aspect, the projection (92) extends to reach the fixing part (79).

[0018] In the fifth aspect, an area of the first region (R1) covered by the projection (92) is larger, and an area of the first region (R1) exposed to the space inside the casing (35) is smaller. This can reduce the generation of the condensation water in the first region (R1).

[0019] A sixth aspect is an embodiment of the first aspect. In the sixth aspect, the preventing member (90) is configured to eliminate or reduce the generation of the condensation water in the first region (R1) to prevent the condensation water from traveling from the first region (R1) to the support (75).

[0020] In the sixth aspect, the preventing member (90) eliminates or reduces the generation of the condensation water in the first region (R1). This can reduce electrical corrosion of the heat transfer tube (66).

[0021] A seventh aspect is an embodiment of the sixth aspect. In the seventh aspect, the preventing member (90) includes an auxiliary heat insulating member (98) that is formed separately from the heat insulating member (70) and that covers the first region (R1).

[0022] In the seventh aspect, the auxiliary heat insulating member (98) covers the first region (R1) to reduce the generation of the condensation water in the first region (R1).

[0023] An eighth aspect is an embodiment of any one of the first to seventh aspects. In the eighth aspect, the preventing member (90) includes an intermediate portion (95) located between the top panel (36a) and the fixing part (79).

[0024] In the eighth aspect, the intermediate portion (95) is provided between the top panel (36a) and the fixing part (79). This can reduce the generation of the condensation water on part of the inner surface of the top panel (36a) where the fixing part (79) is located.

[0025] A ninth aspect is an embodiment of the eighth aspect. In the ninth aspect, the component unit further includes a fastening member (85) configured to fasten the fixing part (79) to the top panel (36a) together with the intermediate portion (95).

[0026] In the ninth aspect, the intermediate portion (95) of the preventing member (90) and the support (75) can be easily fixed to the top panel (36a) by tightening the fastening member (85) to the top panel (36a).

[0027] A tenth aspect is an embodiment of the ninth aspect. In the tenth aspect, the intermediate portion (95) has higher hardness than the heat insulating member (70).

[0028] In the tenth aspect, the tightening of the fastening member (85) causes less damage to the intermediate portion (95).

[0029] An eleventh aspect is an embodiment of the ninth or tenth aspect. In the eleventh aspect, the fixing part (79) is provided with a fastening hole (80) through which the fastening member (85) passes, and the component unit includes a resin fixing piece (86) arranged under the fixing part (79) and fixed to the fastening

member (85) to close a clearance (C) between a second edge (80a) defined by the fastening hole (80) and the fastening member (85).

[0030] In the eleventh aspect, the fixing piece (86) can prevent the condensation water generated on the top panel (36a) from traveling to the support (75) through the fastening hole (80) of the fixing part (79).

[0031] A twelfth aspect is an embodiment of any one of the eighth to eleventh aspects. In the twelfth aspect, the intermediate portion (95) is provided with a cutout (95a), and the fixing part (79) and the top panel (36a) are configured to be in contact with each other through the cutout (95a).

[0032] In the twelfth aspect, the fixing part (79) of the support (75) and the top panel (36a) are in contact with each other through the cutout (95a), and thus the heat exchanger (65), the support (75), and the casing (35) can be electrically connected to each other, compensating for grounding of these components.

[0033] A thirteenth aspect is an embodiment of any one of the first to twelfth aspects. In the thirteenth aspect, the preventing member (90) is made of a resin material.

[0034] In the thirteenth aspect, the preventing member (90), which is made of a resin material, is less likely to corrode.

[0035] A fourteenth aspect is directed to an air conditioner including the component unit of any one of the first to thirteenth aspects.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036]

FIG. 1 is a piping system diagram illustrating an air conditioner 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 perspective view of a main portion of an indoor heat exchanger and a support.

FIG. 6 is a view of an upper plate of the support as viewed from below.

FIG. 7 is a cross-sectional view taken along line IIV-IIV shown in FIG. 6.

FIG. 8 is a cross-sectional view taken along line IIIV-IIIV shown in FIG. 6.

FIG. 9 is a view corresponding to FIG. 8 and illustrating a first variation.

FIG. 10 is a view corresponding to FIG. 8 and illustrating a second variation.

FIG. 11 is a view corresponding to FIG. 8 and illustrating a third variation.

FIG. 12 is a view corresponding to FIG. 8 and illustrating another embodiment.

DESCRIPTION OF EMBODIMENTS

[0037] Embodiments of the present disclosure will be described in detail below with reference to the drawings. The present disclosure is not limited to the embodiments shown below, and various changes can be made within the scope without departing from the technical concept of the present disclosure. Since each of the drawings is intended to illustrate the present disclosure conceptually, dimensions, ratios, or numbers may be exaggerated or simplified as necessary for the sake of ease of understanding.

(1) General Configuration of Air Conditioning Device

[0038] As illustrated in FIG. 1, an air conditioner (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 conditioner (10).

[0039] The outdoor unit (20) and the indoor unit (30) are connected to each other through a pair of connection pipes (12). In the air conditioner (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.

(2) Outdoor Unit

[0040] The outdoor unit (20) is placed outside. 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).

[0041] The compressor (21) is, for example, a hermetic scroll or hermetic rotary compressor. The compressor (21) sucks and compresses a low-pressure refrigerant, and discharges the refrigerant compressed to high pressure (high-pressure refrigerant).

[0042] 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 the low-pressure refrigerant flowed 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 the low-pressure refrigerant passed through the outdoor heat exchanger (23) is sent to the compressor (21).

[0043] 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.

(3) General Configuration of Indoor Unit

[0044] The indoor unit (30) is placed 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).

[0045] 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).

(3-1) Casing

[0046] 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).

[0047] 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 side plates (36b) extending downward from a peripheral portion of the top panel (36a).

(3-2) Indoor Fan

[0048] 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). The indoor fan (50) is driven by an indoor fan motor (51). The indoor fan motor (51) is fixed to a center portion of the top panel (36a).

(3-3) Bell mouth

[0049] 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).

(3-4) Indoor Heat Exchanger

[0050] 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 in plan view and is arranged to surround the indoor fan (50). The indoor heat exchanger (65) is disposed in the secondary space (37b). The indoor heat exchanger (65) allows the air passing from the inside to the outside to exchange heat with the refrigerant in the

refrigerant circuit.

[0051] The indoor heat exchanger (65) includes a plurality of fins (67) and a heat transfer tube (66) penetrating the fins (67) in the thickness direction. The refrigerant flows through the heat transfer tube (66). The fins (67) are heat transfer members that promote the heat exchange between the refrigerant and the air.

(3-5) Drain Pan

[0052] 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).

[0053] 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 vertically penetrate the drain pan (55).

[0054] 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.

(3-6) Decorative Panel

[0055] 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.

[0056] As illustrated in FIGS. 2 and 4, the decorative panel (40) has a square inlet (41) formed in a center portion. The inlet (41) penetrates the decorative panel (40) in the vertical 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).

[0057] 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).

[0058] 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).

[0059] 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).

(4) Operation

[0060] The air conditioner (10) selectively performs cooling operation and heating operation.

(4-1) Cooling Operation

[0061] 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 (31) functions as an evaporator. The indoor unit (30) cools the air sucked from the indoor space in the indoor heat exchanger (31), and blows the cooled air into the indoor space.

(4-2) Heating Operation

[0062] 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 (31) 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 (31), and blows the heated air into the indoor space.

(4-3) Flow of Air in Indoor Unit

[0063] The indoor fan (50) rotates during the operation of the indoor unit. When the indoor fan (50) rotates, the indoor air in the indoor space flows into the primary space (37a) in the casing (35) through the inlet (41). The air flowed into the primary space (37a) is sucked by the indoor fan (50) and discharged into the secondary space (37b).

[0064] The air flowed into the secondary space (37b) is cooled or heated while passing through the indoor heat

exchanger (65), and then flows separately into the four main outlet paths (57) and the four auxiliary outlet paths (58). The air flowed into the main outlet paths (57) is discharged to the indoor space through the main outlet openings (42). The air flowed into the auxiliary outlet paths (58) is discharged to the indoor space through the auxiliary outlet openings (43).

(5) Features

[0065] The indoor unit (30) of the air conditioner (10) of this embodiment includes a heat insulating case (70), a support (75), a fastening member (85), and a preventing member (90). The heat insulating case (70) is provided inside the casing (35) of the indoor unit (30). The support (75) is fixed to the top panel (36a) of the casing (35) and supports the indoor heat exchanger (65) as a heat exchanger. The preventing member (90) prevents condensation water from traveling to the support (75). Details of these components will be described with reference to FIGS. 4 to 8. In the following description, terms implying any directions such as "upper," "lower," "right," "left," "front," and "rear" are used herein relative to the directions indicated by arrows in FIG. 5 in principle.

(5-1) Heat Insulating Case

[0066] As illustrated in FIG. 4, the heat insulating case (70) covers an inner surface of the casing body (36). The heat insulating case (70) is a heat insulating member made of so-called polystyrene foam. The heat insulating case (70) is a rectangular parallelepiped box-shaped member with an open bottom. The heat insulating case (70) includes a top heat insulating portion (71) formed on the inner surface of the top panel (36a), and side heat insulating portions (72) respectively formed on the inner surfaces of the side plates (36b). The heat insulating case (70) reduces the generation of condensation water on the inner surface of the top panel (36a). Specifically, the heat insulating case (70) covers the inner surface of the top panel (36a) not to expose the inner surface to the space inside the casing (35). This keeps the air from being cooled to the dew-point temperature or lower on the inner surface of the top panel (36a), reducing the generation of the condensation water on the inner surface.

[0067] The heat insulating case (70) has an opening (73) for fixing the support (75) to the top panel (36a). Specifically, the top heat insulating portion (71) of the heat insulating case (70) has the opening (73) corresponding to a portion to which the support (75) is fixed. The indoor unit (30) of this example includes a plurality of supports (75). The heat insulating case (70) has a plurality of openings (73) respectively corresponding to the plurality of supports (75).

[0068] The openings (73) expose the inner surface of the top panel (36a) to the space inside the casing (35). Thus, with the heat insulating case (70) attached to the inside of the casing (35), the supports (75) can be fixed to

the top panel (36a) through the openings (73).

(5-2) Supports

[0069] As illustrated in FIG. 5, the supports (75) are arranged inside the indoor heat exchanger (65) in the casing (35). In other words, the supports (75) are arranged in the primary space (37a) upstream of the indoor heat exchanger (65) in the air flow. Although not shown, the indoor unit (30) of this example includes three supports (75). The supports (75) are provided on different sides of the indoor heat exchanger (65).

[0070] Each support (75) is formed in a plate shape extending in the vertical direction. The support (75) is formed by folding a sheet metal. The support (75) includes a main plate (76), a lower plate (77), a vertical plate (78), and an upper plate (79).

[0071] The main plate (76) extends in the vertical direction along the inner surface of the indoor heat exchanger (65). The main plate (76) is formed in a vertically elongated rectangular plate shape. First raised portions (76a) protruding forward are formed on the left and right sides of the main plate (76).

[0072] The lower plate (77) extends rearward from the lower end of the main plate (76) along the lower surface of the indoor heat exchanger (65). The vertical plate (78) extends upward from the rear end of the lower plate (77) along the outer surface of the indoor heat exchanger (65). The indoor heat exchanger (65) is held between the main plate (76), the lower plate (77), and the vertical plate (78). In other words, the support (75) includes a hook portion that supports the indoor heat exchanger (65) from below.

[0073] The upper plate (79) extends forward from the upper end of the main plate (76). The upper plate (79) extends in a direction away from the indoor heat exchanger (65). The upper plate (79) serves as a fixing part for fixing the support (75) to the top panel (36a). The upper plate (79) is formed in a rectangular shape in plan view. Second raised portions (79a) protrude downward from the front end, right end, and left end of the upper plate (79).

[0074] The opening (73) is formed in the heat insulating case (70) at a position corresponding to the upper plate (79). In other words, the upper plate (79) is located inside the opening (73).

[0075] The upper plate (79) is provided with a first fastening hole (80) in which the fastening member (85) is inserted. The first fastening hole (80) penetrates the upper plate (79) in the thickness direction. The first fastening hole (80) is formed in a circular shape in plan view.

(5-3) Fastening Member

[0076] The fastening member (85) is a component for fixing the support (75) to the top panel (36a). The fastening member (85) may be a screw, or a bolt and a nut. The upper plate (79) of the support (75) is fixed to the top

panel (36a) by tightening the fastening member (85).

(5-4) Relationship between Ionization Tendencies of Main Components

[0077] The casing (35) and the support (75) are made of an iron-based metallic material. In contrast, the heat transfer tube (66) and fins (67) of the indoor heat exchanger (65) are made of an aluminum-based metallic material. Thus, the ionization tendency of the heat transfer tube (66) is higher than that of the top panel (36a). In addition, the ionization tendency of the heat transfer tube (66) is higher than that of the support (75). The ionization tendency of the support (75) is equal to or lower than that of the top panel (36a). The ionization tendency of the fastening member (85) is equal to or lower than that of the top panel (36a). The materials of these components are merely examples, and other materials can be used.

(5-5) Occurrence of Condensation

[0078] The above-described heat insulating case (70) is designed to have the opening (73) slightly larger than the upper plate (79) in plan view in consideration of manufacturing and assembly errors of the heat insulating case (70). If the upper plate (79) and the opening (73) are misaligned due to these errors, the fixing of the upper plate (79) to the top panel (36a) may possibly be failed.

[0079] If the opening (73) is formed to be slightly larger in this way, a region of the inner surface of the top panel (36a) appears between a first edge (73a) defined by the opening (73) and the upper plate (79) (hereinafter referred to as a first region (R1)). Thus, the first region (R1) of the top panel (36a) is exposed to the internal space of the casing (35), and the air may be cooled on the first region (R1), generating the condensation water.

[0080] As described above, the heat transfer tube (66) is made of a material having a higher ionization tendency than the top panel (36a). Thus, if the condensation water travels from the first region (R1) to the heat transfer tube (66) through the support (75), the heat transfer tube (66) may be electrically corroded.

(5-6) Preventing Member

[0081] Considering this issue, the indoor unit (30) of this embodiment is provided with a preventing member (90) that prevents the condensation water from traveling from the first region (R1) to the support (75). The preventing member (90) prevents the condensation water generated in the first region (R1) from traveling to the support (75).

[0082] The preventing member (90) is made of a resin material. The preventing member (90) is preferably made of a heat insulating material. The preventing member (90) has higher hardness than the heat insulating case (70).

[0083] As illustrated in FIGS. 6 to 8, the preventing member (90) is arranged inside the opening (73) of the

heat insulating case (70). The preventing member (90) includes a side portion (91) located in the first region (R1) of the top panel (36a) and an intermediate portion (95) located between the top panel (36a) and the upper plate (79).

[0084] The side portion (91) of the preventing member (90) has projections (92) and a base (93). The preventing member (90) of this embodiment includes a plurality of projections (92) surrounding the upper plate (79). The projections (92) are provided one by one at positions corresponding to the sides of the upper plate (79). Each projection (92) is in the form of a plate. The projections (92) extend downward from the first region (R1).

[0085] Specifically, the projections (92) of this embodiment include a first projection (92A), a second projection (92B), and a third projection (92C). The first region (R1) of this embodiment has relatively large area portions in front of and on the right and left of the upper plate (79). In this embodiment, the three projections (92) are provided to correspond to these portions. The first projection (92A) is located in front of the upper plate (79). The first projection (92A) extends in the left-right direction along the front side of the upper plate (79). The second projection (92B) is located on the right of the upper plate (79). The second projection (92B) extends in the front-back direction along the right side of the upper plate (79). The third projection (92C) is located on the left of the upper plate (79). The third projection (92C) extends in the front-back direction along the left side of the upper plate (79).

[0086] The base (93) is shorter than the projection (92) in the vertical direction. The base (93) is formed between the projections (92) and the upper plate (79) in plan view. In other words, the base (93) is formed to extend over the projections (92) and the upper plate (79) in plan view.

[0087] The intermediate portion (95) is interposed between the top panel (36a) and the upper plate (79). The intermediate portion (95) covers a region of the inner surface of the top panel (36a) located above (on the back side of) the upper plate (79). The intermediate portion (95) is rectangular in plan view. The intermediate portion (95) has higher hardness than the heat insulating case (70). The intermediate portion (95) has a second fastening hole (96) through which the fastening member (85) is inserted. The second fastening hole (96) is formed in a circular shape in plan view. The center of the second fastening hole (96) and the center of the first fastening hole (80) substantially coincide with each other. The second fastening hole (96) has a smaller inner diameter than the first fastening hole (80).

(5-7) Installation of Indoor Heat Exchanger

[0088] The indoor heat exchanger (65) is supported on the top panel (36a) by the following procedure.

[0089] The heat insulating case (70) is attached to the inside of the casing (35). Then, the indoor heat exchanger (65) is hooked on the hook portion of the support (75). Then, the preventing member (90) and the upper plate

(79) of the support (75) are positioned in the opening (73) of the heat insulating case (70). The intermediate portion (95) of the preventing member (90) is sandwiched between the upper plate (79) and the top panel (36a), and the fastening member (85) is tightened to the top panel (36a) with the axial centers of the first fastening hole (80) and the second fastening hole (96) aligned with each other. Thus, the preventing member (90) and the support (75) are fixed to the top panel (36a) with the fastening member (85).

(6) Advantages of Embodiment

[0090] The preventing member (90) prevents the condensation water from traveling to the support (75) from the first region (R1) of the inner surface of the top panel (36a) between the first edge (73a) of the opening (73) and the upper plate (79). Specifically, the preventing member (90) prevents the condensation water generated in the first region (R1) from traveling to the support (75). This keeps the condensation water generated in the first region (R1) from traveling to the aluminum heat transfer tube (66) through the support (75), reducing electrical corrosion of the heat transfer tube (66).

[0091] More specifically, the preventing member (90) includes the projections (92) extending downward from the first region (R1). Thus, if the condensation water is generated in a portion of the first region (R1) located across the side portion (91) from the upper plate (79), the projections (92) can prevent the condensation water from reaching the upper plate (79). Specifically, the condensation water falls downward along the side surfaces of the projections (92), and can be prevented from moving to the upper plate (79). This can keep the condensation water generated in the first region (R1) from traveling to the support (75).

[0092] The preventing member (90) includes the projections (92) and the base (93) that is shorter than the projections (92) and that is formed between the projections (92) and the upper plate (79).

[0093] The projections (92) can prevent the condensation water generated in the first region (R1) from reaching the upper plate (79). In addition, the base (93) can reduce the generation of the condensation water around the upper plate (79). This can further keep the condensation water from traveling from the first region (R1) to the support (75).

[0094] The preventing member (90) includes the intermediate portion (95) located between the top panel (36a) and the upper plate (79). The intermediate portion (95) covers a portion of the inner surface of the top panel (36a) located on the back side of the upper plate (79). Thus, the generation of the condensation water in this portion can be reduced. This can keep the condensation water from traveling to the support (75) through the second fastening hole (96) and the first fastening hole (80).

[0095] The base (93) and the intermediate portion (95) are formed continuously and integrally, and can simulta-

neously reduce the generation of the condensation water in part of the first region (R1) ranging from the vicinity of the upper plate (79) to the back side of the upper plate (79).

[0096] The indoor unit (30) includes the fastening member (85) for fastening the upper plate (79) to the top panel (36a) together with the intermediate portion (95). Thus, tightening the fastening member (85) can fix the preventing member (90) and the support (75) to the top panel (36a) at the same time. In addition, the preventing member (90) can be easily aligned with the upper plate (79).

[0097] The intermediate portion (95) has higher hardness than the heat insulating case (70). Thus, the tightening of the fastening member (85) causes less damage to the intermediate portion (95) or the preventing member (90). This can reduce the generation of the condensation water on the back side of the upper plate (79) due to the damage to the intermediate portion (95).

[0098] The preventing member (90) is made of a resin material. This can reduce electrical corrosion of the preventing member (90) caused by the condensation water. The preventing member (90) made of a heat insulating material can reduce the generation of the condensation water on part of the top panel (36a) covered with the preventing member (90).

(7) Variations

[0099] The above embodiment may be modified as follows. Differences from the above embodiment will be described below.

(7-1) First Variation

[0100] As illustrated in FIG. 9, a preventing member (90) of the first variation is an auxiliary heat insulating member (98). The auxiliary heat insulating member (98) is a component separate from the heat insulating case (70). The auxiliary heat insulating member (98) is arranged inside the opening (73) to cover the first region (R1). The auxiliary heat insulating member (98) may be made of the same material as the heat insulating case (70) or may be made of a different material. The auxiliary heat insulating member (98) may cover the whole of the first region (R1) or may cover part of the first region (R1). The auxiliary heat insulating member (98) reduces the generation of the condensation water in the first region (R1), keeping the condensation water from traveling from the first region (R1) to the support (75). This can reduce electrical corrosion of the heat transfer tube (66).

[0101] The auxiliary heat insulating member (98) has a smaller volume than the heat insulating case (70). Thus, the auxiliary heat insulating member (98) causes less manufacturing and assembly errors than the heat insulating case (70). This allows the auxiliary heat insulating member (98) to be accurately arranged in the opening (73).

(7-2) Second Variation

[0102] As illustrated in FIG. 10, the second variation further includes a resin fixing piece (86) added to the configuration of the above embodiment. The fixing piece (86) is a so-called washer made of resin. The fixing piece (86) is arranged between a head (85a) of the fastening member (85) and the upper plate (79). The fixing piece (86) has a hole through which a threaded portion (85b) of the fastening member (85) is inserted. The fixing piece (86) is fixed to the fastening member (85) to close a clearance (C) between a second edge (80a) defined by the first fastening hole (80) of the upper plate (79) and the threaded portion (85b) of the fastening member (85). The fixing piece (86) prevents the condensation water generated on the top panel (36a) from traveling to the support (75) through the clearance (C). This can reduce electrical corrosion of the heat transfer tube (66). The fixing piece (86), which is made of the resin material, can also be less likely to corrode.

(7-3) Third Variation

[0103] As illustrated in FIG. 11, the third variation includes a cutout (95a) formed in the center of the intermediate portion (95) of the preventing member (90) of the embodiment. The cutout (95a) is a circular opening that enlarges the inner diameter of the second fastening hole (96) of the embodiment. In the third variation, the upper plate (79) and the top panel (36a) are configured to be in contact with each other through the cutout (95a). Specifically, in this example schematically shown in FIG. 11, the center of the upper plate (79) is pressed against the top panel (36a) when the fastening member (85) is tightened. Thus, the second edge (80a) of the upper plate (79) makes contact with the top panel (36a). The top panel (36a) is grounded. Bringing the top panel (36a) and the support (75) into contact with each other can ground the top panel (36a), the support (75), and the heat exchanger (65). This can reduce sparks and electric shock to workers due to charging of the indoor heat exchanger (65).

(8) Other Embodiments

[0104] The embodiment and variations may be modified as follows.

[0105] The support (75) and the preventing member (90) may be provided in the outdoor unit (20) as a component unit. In this case, the support (75) supports the outdoor heat exchanger (23) as a heat exchanger.

[0106] The support (75) may be placed outside the indoor heat exchanger (65). In other words, the support (75) may be arranged in the secondary space (37b) downstream of the indoor heat exchanger (65) in the air flow.

[0107] The preventing member (90) may be made of a metallic material. In this case, the ionization tendency of the preventing member (90) is preferably equal to or

lower than that of the top panel (36a). The potential difference between the preventing member (90) and the indoor heat exchanger (65) is preferably smaller than the potential difference between the top panel (36a) and the indoor heat exchanger (65).

[0108] The preventing member (90) may have a single projection (92), two projections (92), or four or more projections (92). When the four projections (92) are provided, the projections (92) are preferably arranged one by one in correspondence with the four sides of the upper plate (79).

[0109] As illustrated in FIG. 12, the projection (92) of the embodiment may extend to reach the upper plate (79). The preventing member (90) of this configuration does not have the base (93) shorter than the projection (92) of the above-described embodiment. The projection (92) has the same height in every part. In this configuration, an area of the first region (R1) covered by the projection (92) is larger, and an area of the first region (R1) exposed to the space inside the casing (35) is smaller. This can reduce the generation of the condensation water in the first region (R1).

[0110] While the embodiments and the 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 embodiment, the variations thereof, and the other embodiments may be combined and replaced with each other.

[0111] The ordinal numbers such as "first," "second," and "third" described above 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

[0112] As can be seen from the foregoing description, the present disclosure is useful for an air conditioner and a component unit.

DESCRIPTION OF REFERENCE CHARACTERS

[0113]

10	Air Conditioning Device
35	Casing
36a	Top Panel
65	Indoor Heat Exchanger (Heat Exchanger)
67	Heat Transfer Tube
70	Heat Insulating Case (Heat Insulating Member)
73	Opening
73a	First Edge
75	Support
79	Upper Part (Fixing Part)
80	First Fastening Hole (Fastening Hole)
80a	Second Edge
85	Fastening Member
86	Fixing Piece

90 Preventing Member
 92 Projection
 93 Base
 95 Intermediate Portion
 95a Cutout
 98 Auxiliary Heat Insulating Member
 C Clearance
 R1 First Region

Claims

1. A component unit of an air conditioner, the component unit comprising:

a casing (35) having a top panel (36a) made of a metallic material;
 a heat exchanger (65) arranged in the casing (35) and having a heat transfer tube (66) made of a material having a higher ionization tendency than the top panel (36a);
 a heat insulating member (70) configured to cover an inner surface of the top panel (36a) and having an opening (73);
 a support (75) configured to support the heat exchanger (65) and having a fixing part (79) fixed to an inner surface of the top panel (36a) inside the opening (73); and
 a preventing member (90) configured to prevent condensation water from traveling to the support (75) from a first region (73a) of the inner surface of the top panel (36a) between a first region (R1) defined by the opening (73) and the fixing part (79).

2. The component unit of claim 1, wherein the preventing member (90) is configured to prevent condensation water generated in the first region (R1) from traveling to the support (75).

3. The component unit of claim 2, wherein the preventing member (90) includes a projection (92) extending downward from the first region (R1).

4. The component unit of claim 3, wherein the preventing member (90) includes the projection (92) and a base (93) that is shorter than the projection (92) and that is formed between the projection (92) and the fixing part (79).

5. The component unit of claim 3, wherein the projection (92) extends to reach the fixing part (79).

6. The component unit of claim 1, wherein the preventing member (90) is configured to eliminate or reduce the generation of the condensation water in the first region (R1) to prevent the condensation water from traveling from the first region (R1)

to the support (75).

7. The component unit of claim 6, wherein the preventing member (90) includes an auxiliary heat insulating member (98) that is formed separately from the heat insulating member (70) and that covers the first region (R1).

8. The component unit of any one of claims 1 to 7, wherein the preventing member (90) includes an intermediate portion (95) located between the top panel (36a) and the fixing part (79).

9. The component unit of claim 8, further comprising: a fastening member (85) configured to fasten the fixing part (79) to the top panel (36a) together with the intermediate portion (95).

10. The component unit of claim 9, wherein the intermediate portion (95) has higher hardness than the heat insulating member (70).

11. The component unit of claim 9 or 10, wherein

the fixing part (79) is provided with a fastening hole (80) through which the fastening member (85) passes, and
 the component unit includes a resin fixing piece (86) arranged under the fixing part (79) and fixed to the fastening member (85) to close a clearance (C) between a second edge (80a) defined by the fastening hole (80) and the fastening member (85).

12. The component unit of any one of claims 8 to 11, wherein

the intermediate portion (95) is provided with a cutout (95a), and
 the fixing part (79) and the top panel (36a) are configured to be in contact with each other through the cutout (95a).

13. The component unit of any one of claims 1 to 12, wherein the preventing member (90) is made of a resin material.

14. An air conditioner comprising the component unit according to any one of claims 1 to 13.

FIG.1

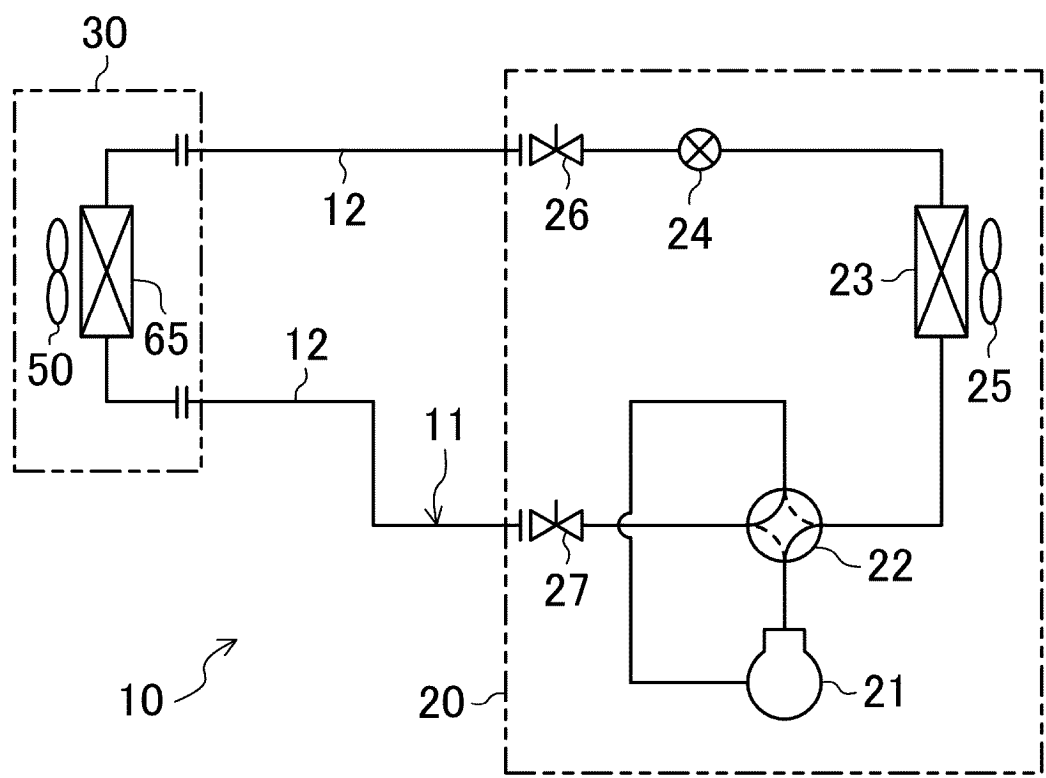


FIG.2

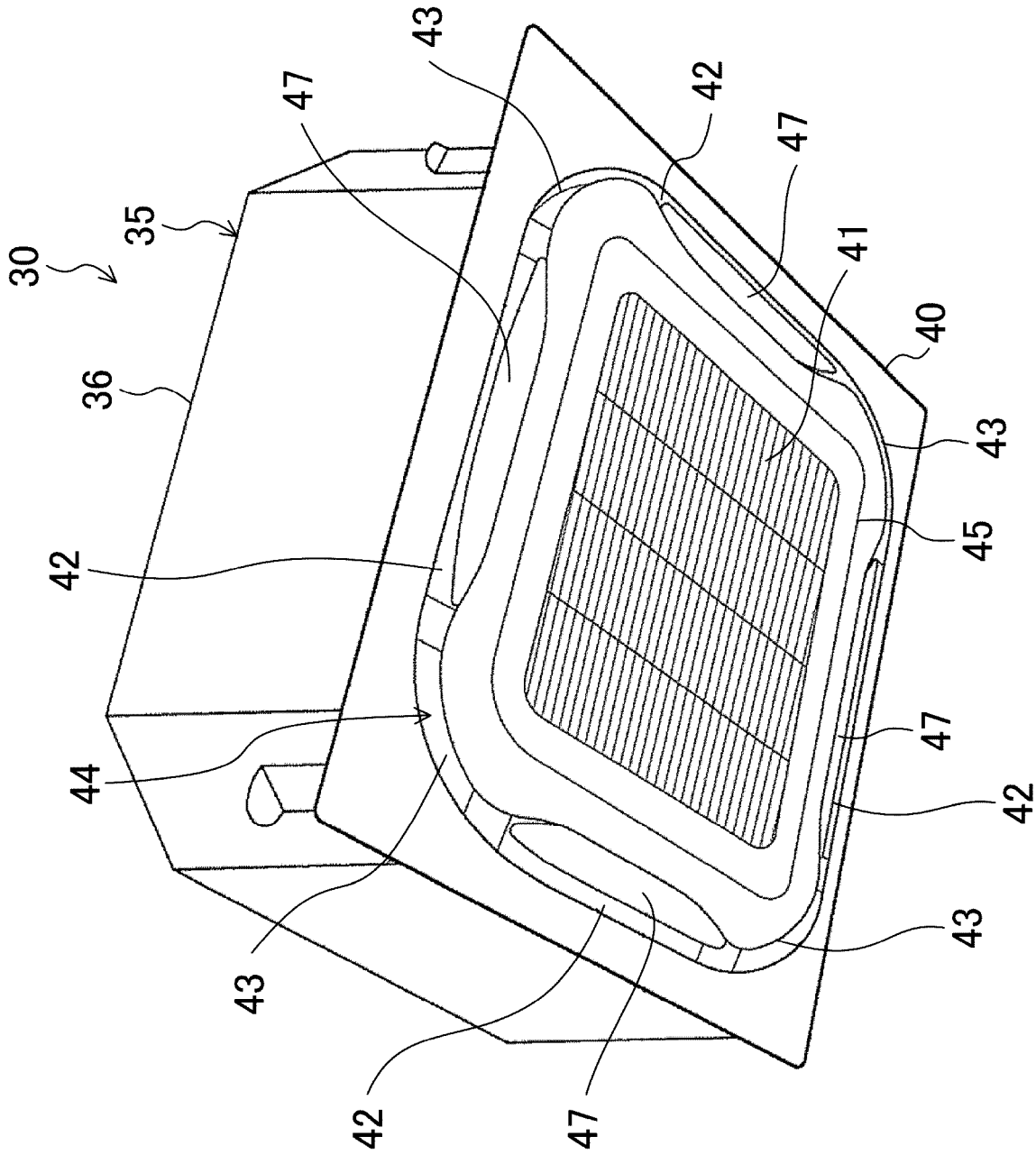


FIG.3

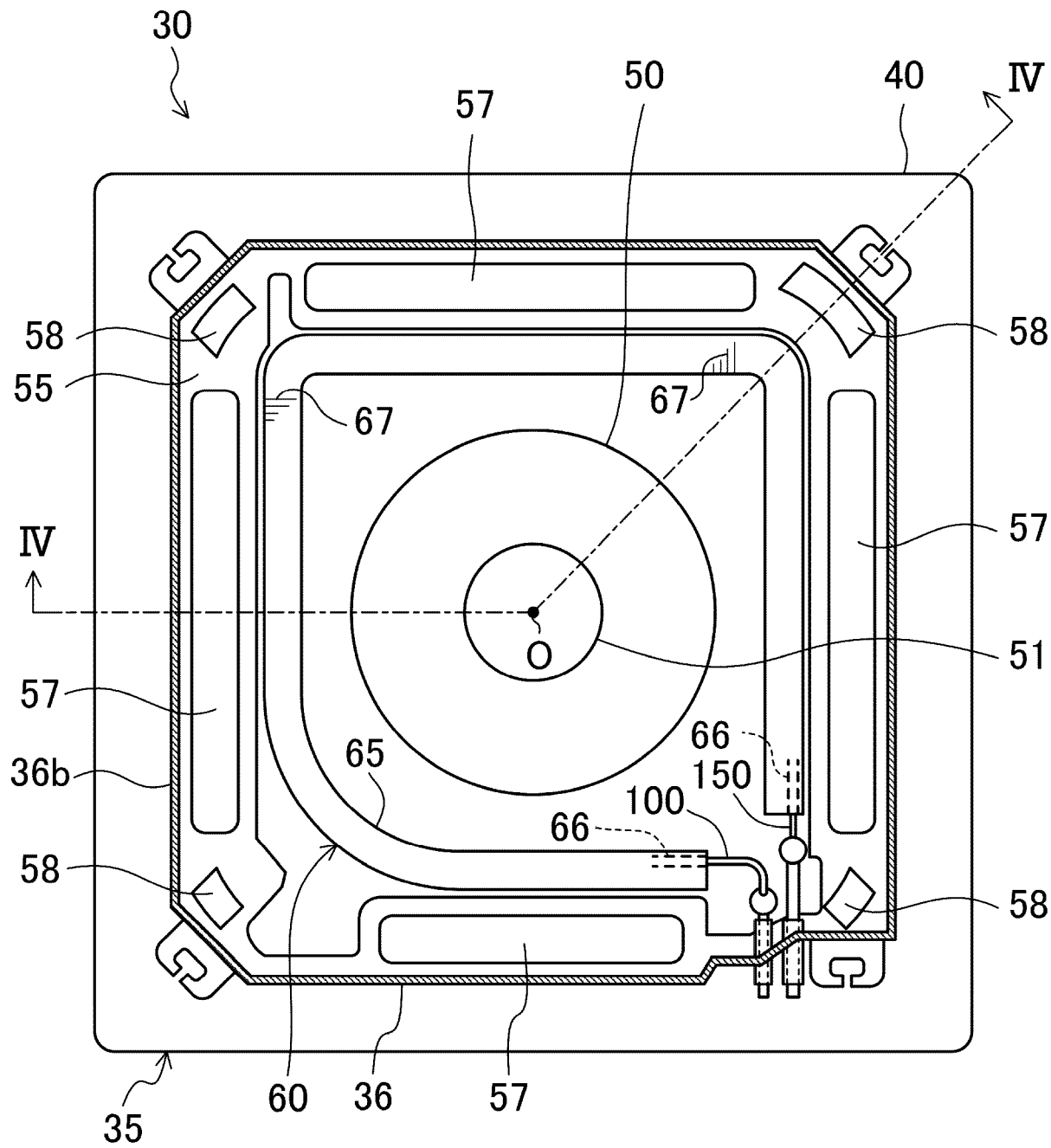


FIG.4

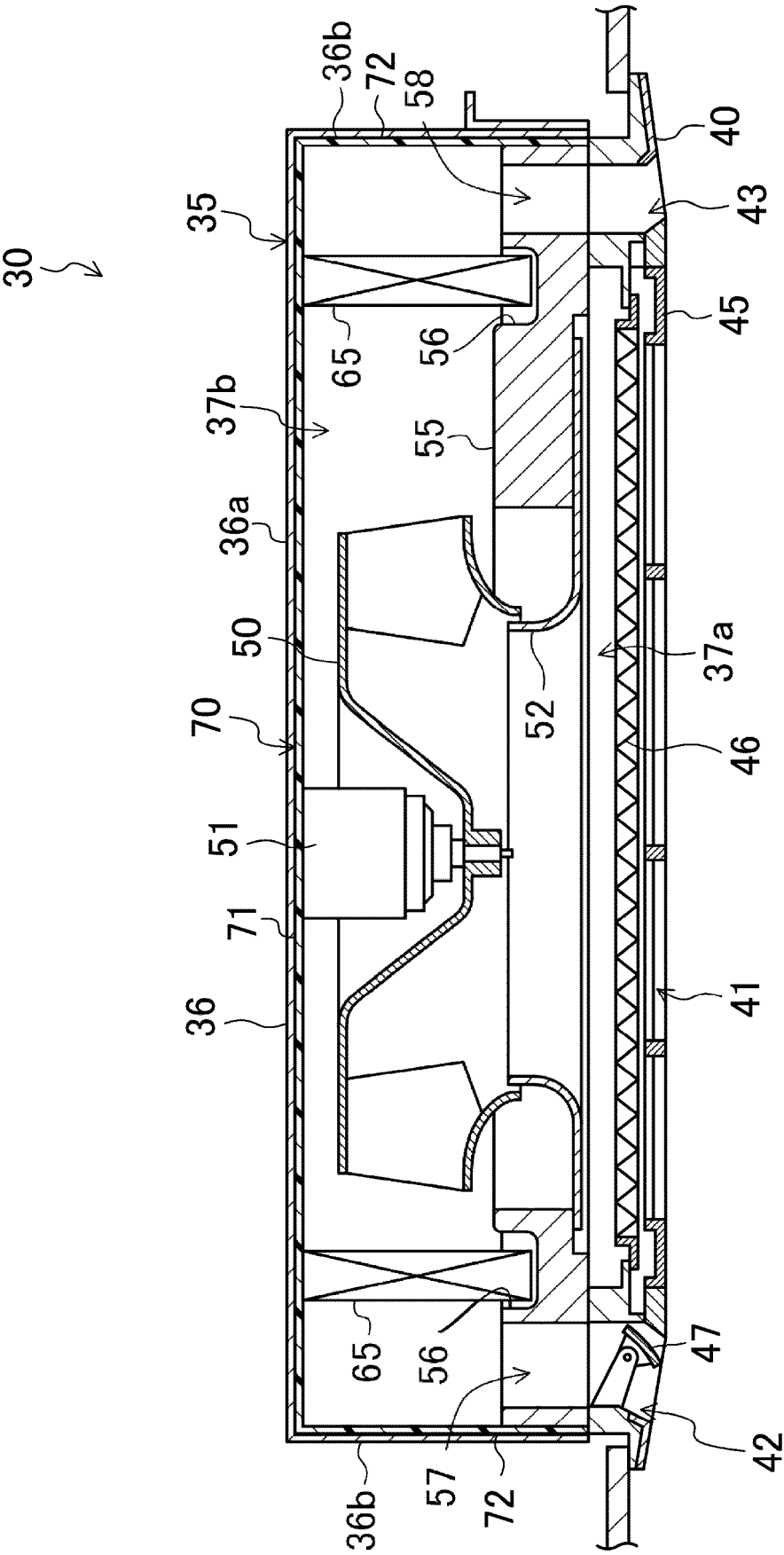


FIG.5

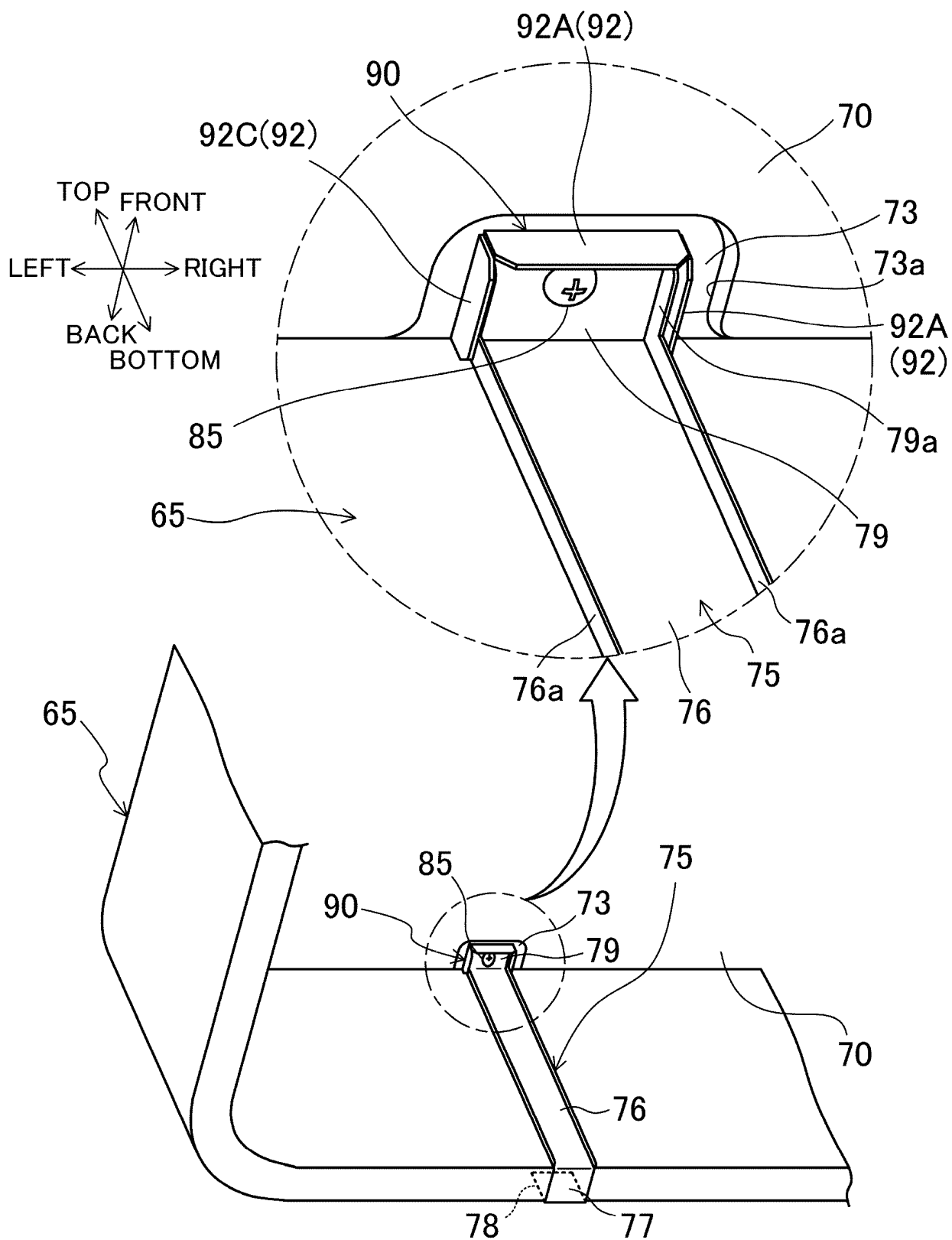


FIG.6

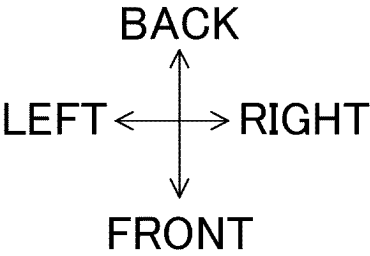
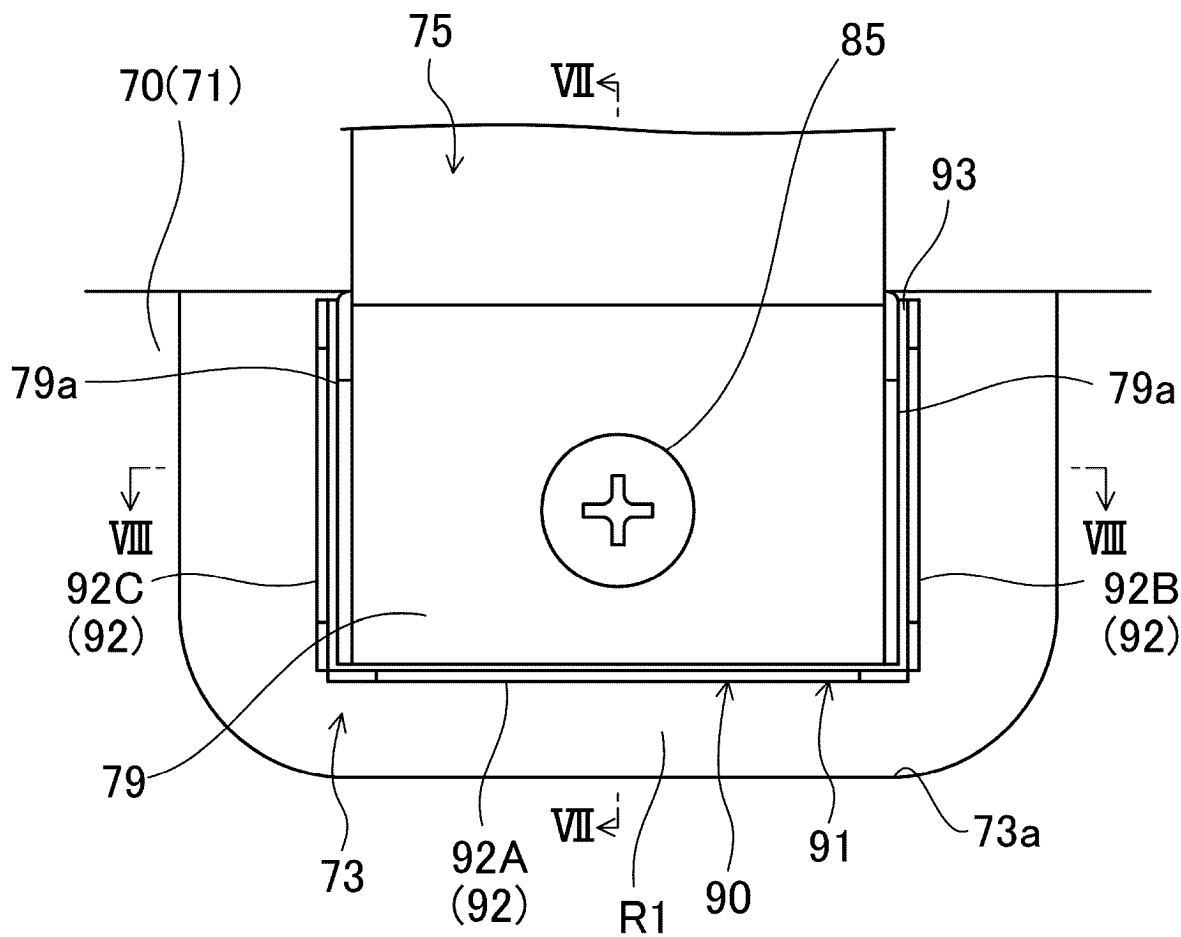


FIG.7

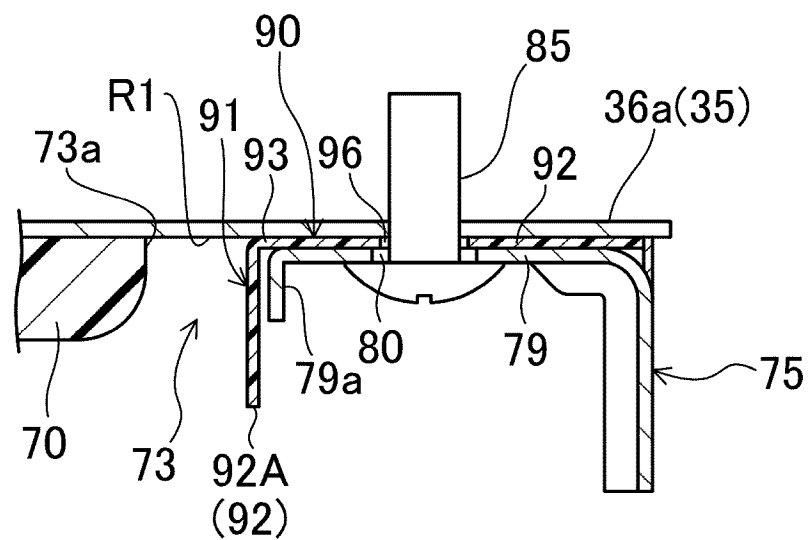


FIG.8

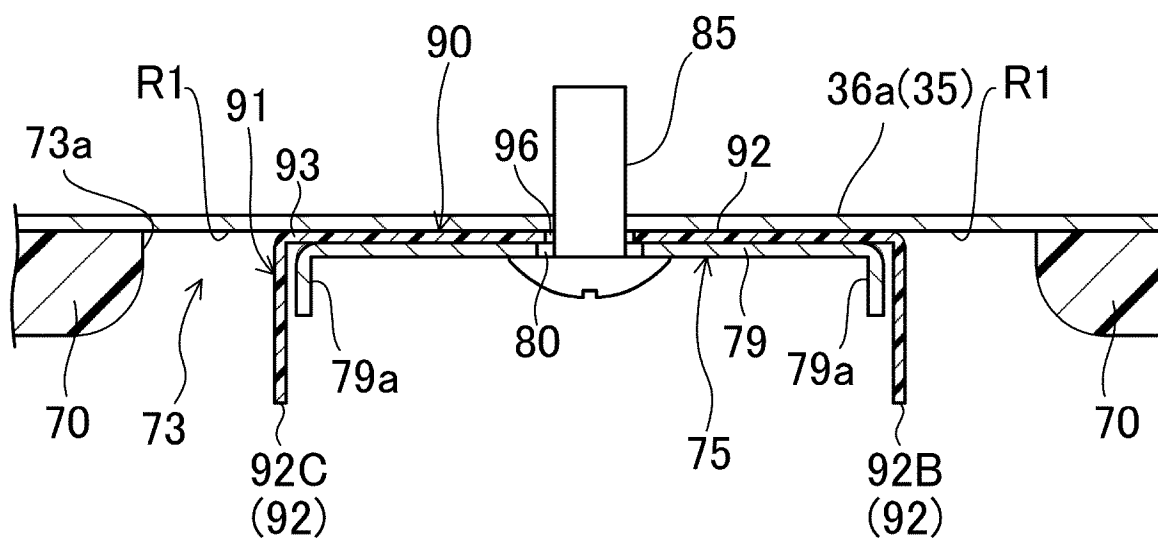


FIG.9

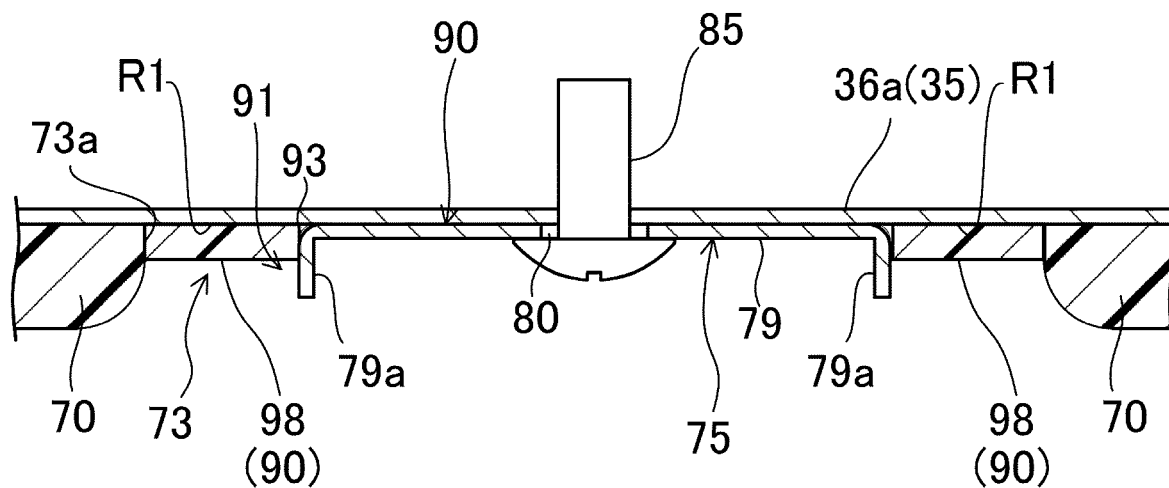


FIG.10

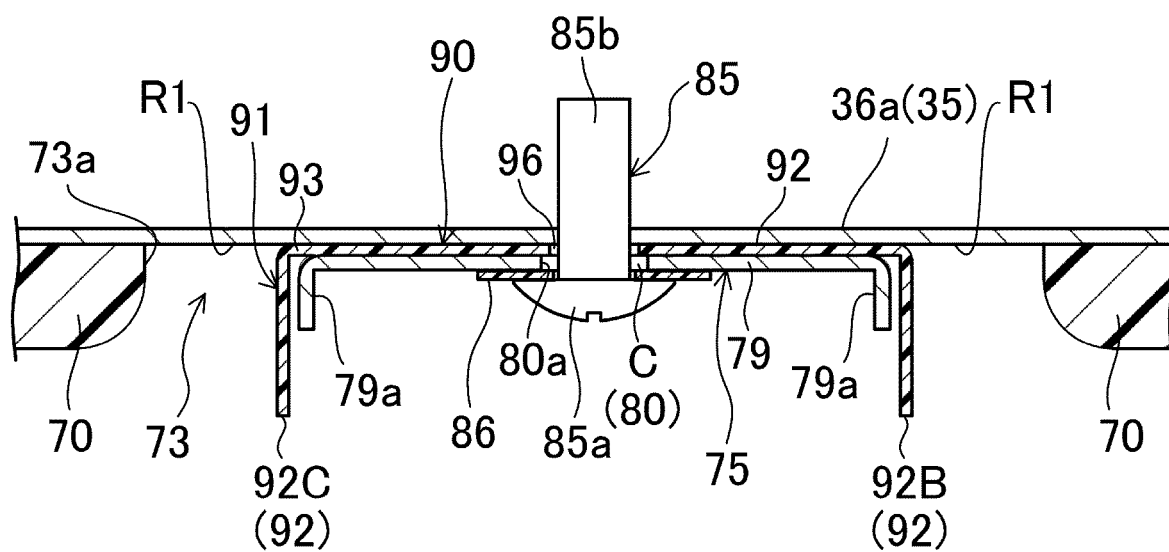


FIG. 11

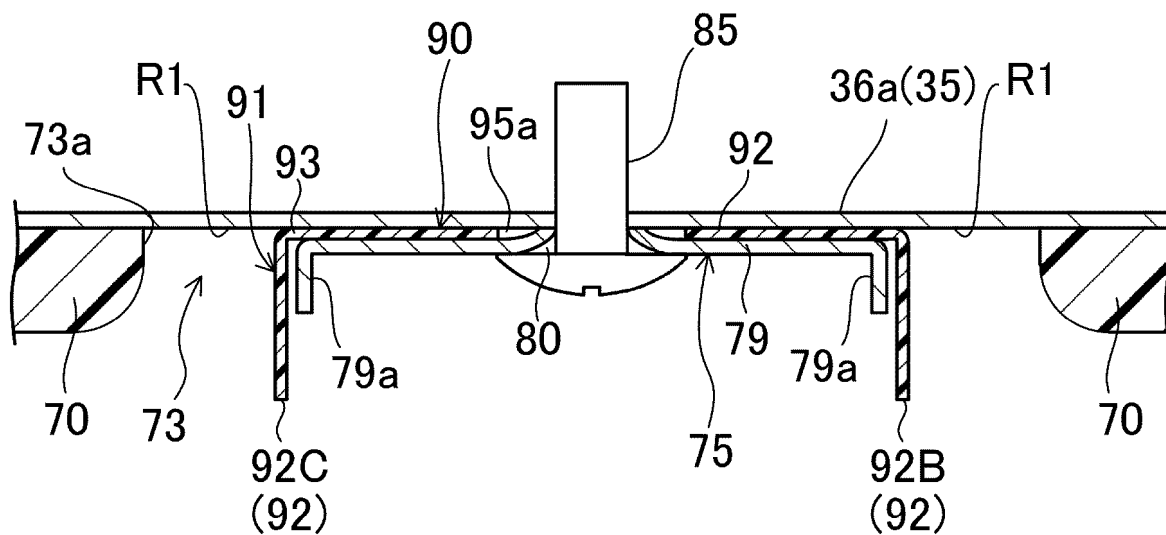
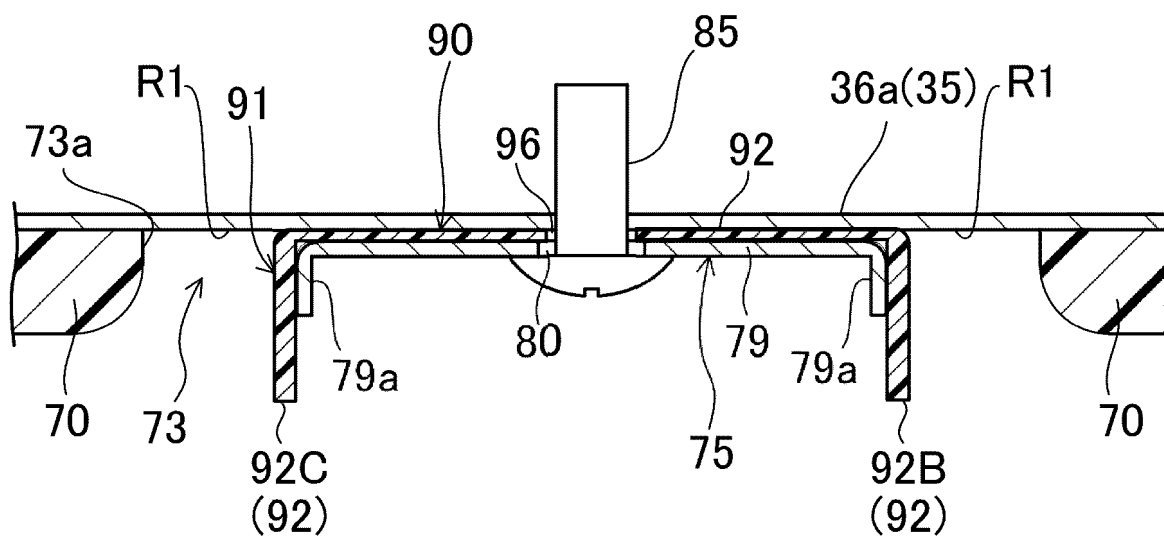


FIG.12



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2023/029991

A. CLASSIFICATION OF SUBJECT MATTER

F24F 13/22(2006.01)i; **F24F 1/0047**(2019.01)i; **F24F 13/20**(2006.01)i
 FI: F24F1/0007 361B; F24F1/0047; F24F1/0007 401D; F24F13/22 222

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)

F24F13/22; F24F1/0047; F24F13/20

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	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 6590/1983 (Laid-open No. 113127/1984) (SANYO ELECTRIC CO., LTD.) 31 July 1984 (1984-07-31), description, page 2, line 18 to page 5, line 14, fig. 1-3	1, 6-8, 13-14
A		2-5, 9-12
A	WO 2020/174646 A1 (MITSUBISHI ELECTRIC CORP.) 03 September 2020 (2020-09-03) entire text, all drawings	1-14
A	JP 2013-213634 A (MITSUBISHI ELECTRIC CORP.) 17 October 2013 (2013-10-17) entire text, all drawings	1-14
A	JP 07-198155 A (SANYO ELECTRIC CO., LTD.) 01 August 1995 (1995-08-01) entire text, all drawings	1-14
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 148150/1987 (Laid-open No. 53816/1989) (FUJITSU GENERAL LTD.) 03 April 1989 (1989-04-03), entire text, all drawings	1-14

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

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"&" document member of the same patent family
"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	

Date of the actual completion of the international search

29 September 2023

Date of mailing of the international search report

10 October 2023

Name and mailing address of the ISA/JP

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 Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2023/029991

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 26610/1983 (Laid-open No. 132027/1984) (DAIKIN INDUSTRIES, LTD.) 04 September 1984 (1984-09-04), entire text, all drawings	1-14
A	JP 2013-015296 A (PANASONIC CORP.) 24 January 2013 (2013-01-24) entire text, all drawings	1-14
A	KR 2007-0099224 A (LG ELECTRONICS INC.) 09 October 2007 (2007-10-09) entire text, all drawings	1-14
A	JP 2004-156886 A (MITSUBISHI HEAVY IND., LTD.) 03 June 2004 (2004-06-03) entire text, all drawings	1-14

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/JP2023/029991

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JP 07-198155 A	01 August 1995	(Family: none)	
JP 64-53816 U1	03 April 1989	(Family: none)	
JP 59-132027 U1	04 September 1984	(Family: none)	
JP 2013-015296 A	24 January 2013	WO 2013/005437 A1 entire text, all drawings	
KR 2007-0099224 A	09 October 2007	(Family: none)	
JP 2004-156886 A	03 June 2004	(Family: none)	

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REFERENCES CITED IN THE DESCRIPTION

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