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(72) Inventor: **URAKAWA, Masakazu**
Kusatsu-shi
Shiga 525-8526 (JP)

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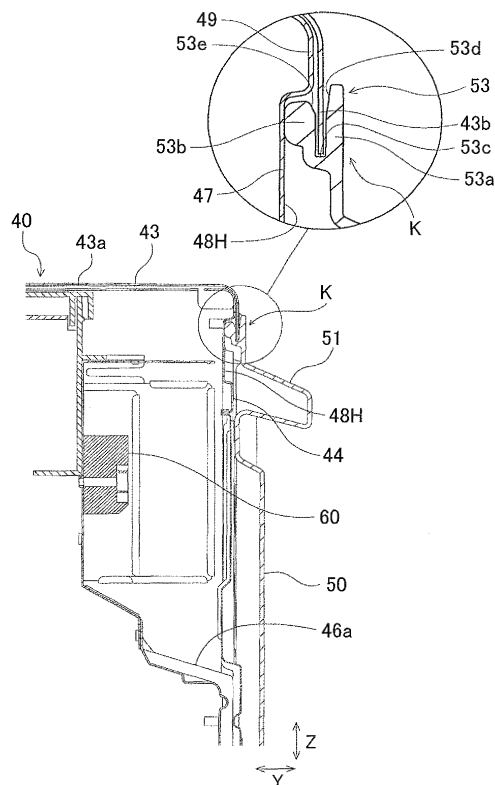
(74) Representative: **HOFFMANN EITLE**
Patent- und Rechtsanwälte
Arabellastraße 4
81925 München (DE)

(71) Applicant: **Daikin Industries, Ltd.**
Osaka-shi, Osaka 530-8323 (JP)

(54) **OUTDOOR UNIT**

(57) Entry of water from the outside of a casing to electrical components inside the casing is restrained. An outdoor unit includes: a casing 40 having a side panel 44 and a top panel 43; a terminal block 60 contained in the casing 40; a wiring opening 46a which opens in the vicinity of the terminal block 60; and a shutoff valve cover 50 which covers the wiring opening 46a. At an upper end portion 53 of the shutoff valve cover 50, there are formed: an outer wall portion 53a positioned outside an edge portion 43b of the top panel 43; an inner wall portion 53b positioned inside the edge portion 43b of the top panel 43; and a recess 53c provided between the outer wall portion 53a and the inner wall portion 53b. At a position above the wiring opening 46a, the edge portion 43b of the top panel 43 is inserted into the recess 53c formed at the upper end portion 53 of the shutoff valve cover 50, and an upper portion 47, which is a portion the side panel 44 that is above the wiring opening 46a, is positioned inside the inner wall portion 53b.

FIG.5



Description

Technical Field

[0001] The present invention relates to an outdoor unit, and particularly relates to an outdoor unit including an opening cover arranged outside the casing.

Background Art

[0002] The casing is provided with, at its side surface, an opening through which wires connected to electrical components contained in the casing are drawn from the inside of the casing to the outside. Further, an opening cover (shutoff valve cover) which covers the opening is attached to an outer side of a side panel of the casing to avoid entry of rainwater or the like from the outside of the casing into the inside of the casing through the opening (for example, see Patent Literature

Citation List

Patent Literature

[0003]

Patent Literature 1: Japanese Unexamined Patent Publication No. 2002-61885

Summary of Invention

Technical Problem

[0004] However, in the outdoor unit of the air conditioner described in the Patent Literature 1, an upper end portion of the shutoff valve cover is engaged with an upper edge portion of the opening, and therefore a distance between this engagement portion and the electrical components is short (since the electrical components are generally disposed in the vicinity of the opening). With this configuration, when the outdoor unit is washed with tap water or subjected to a water pressure caused by a typhoon or the like, there has been a problem that water may enter through a gap existing at the engagement portion (the portion where the shutoff valve cover is engaged with the side panel), to wet the electrical components inside the casing.

[0005] Therefore, the present invention has been made in order to solve the above-described problem, and an object of the present invention is to provide an outdoor unit configured to restrain entry of water from the outside of a casing to electrical components inside the casing.

Solution to Problem

[0006] An outdoor unit in accordance with a first aspect of the invention includes: a casing including a bottom panel, a side panel, and a top panel; an electrical com-

ponent contained in the casing; an opening which is formed at the side panel, and opens in a vicinity of the electrical component; and an opening cover which is positioned outside the side panel and covers the opening, in which outdoor unit, (i) the top panel includes a top plate portion positioned so as to be opposed to the bottom panel, and an edge portion extending downward from an end portion of the top plate portion; (ii) at an upper end portion of the opening cover, there are formed an outer wall portion positioned outside the edge portion of the top panel, an inner wall portion positioned inside the edge portion of the top panel, and a recess provided between the outer wall portion and the inner wall portion; and (iii) at a position above the opening, the edge portion of the top panel is inserted into the recess formed at the upper end portion of the opening cover, and a portion of the side panel which portion is above the opening is positioned inside the inner wall portion.

[0007] The outdoor unit provides the following advantages.

(1) At the position above the opening, engagement is made by the edge portion of the top panel and the upper end portion of the opening cover, and therefore a distance between the engagement portion and the opening is long enough as compared to a case where such a portion for attaching the opening cover is provided near the opening (for example, in the case where the upper end portion of the shutoff valve cover is fitted to the upper edge portion of the opening as described in the Patent Literature 1). This increases a length of a path of entering water from the outside of the casing to the electrical component inside the casing, and therefore an intensity of water which passes through the engagement portion is reduced, which prevents the electrical component from getting wet with water.

(2) Further, the edge portion of the top panel is inserted into the recess provided between the outer wall portion and the inner wall portion, and thereby a meandering gap is formed between the edge portion of the top panel and the upper end portion of the opening cover. The thus-formed trap structure effectively prevents the electrical component from getting wet with water.

(3) Furthermore, the portion of the side panel which portion is above the opening is positioned inside the inner wall portion, and therefore that portion of the side panel functions as a barrier against water, which protects the electrical component from the water. This further prevents the electrical component from getting wet with water.

[0008] An outdoor unit in accordance with a second aspect of the invention is the outdoor unit in accordance with the first aspect, in which the portion of the side panel which portion is above the opening includes a visor portion positioned between the top plate portion of the top

panel and an upper end of the inner wall portion.

[0009] In this outdoor unit, even if water having entered from the outside of the casing passes through the engagement portion made by the edge portion of the top panel and the upper end portion of the opening cover, the visor portion positioned above the inner wall portion prevents the water from passing over the upper portion of the side panel and entering into the inside of the side panel. That is, provision of the visor portion further prevents the electrical component from getting wet with water.

[0010] An outdoor unit in accordance with a third aspect of the invention is the outdoor unit in accordance with the second aspect, in which a protruded end surface of the visor portion is close to or in contact with the edge portion of the top panel.

[0011] In this outdoor unit, substantially no gap is formed between the visor portion of the side panel and the edge portion of the top panel, and this ensures that wetting of the electrical component with water entering through the gap between the visor portion of the side panel and the edge portion of the top panel is prevented.

[0012] An outdoor unit in accordance with a fourth aspect of the invention is the outdoor unit in accordance with the second or third aspect, in which an upper end surface of the visor portion is close to or in contact with the top plate portion of the top panel.

In this outdoor unit, substantially no gap is formed between the visor portion of the side panel and the top plate portion of the top panel, and this ensures that wetting of the electrical component with water entering through the gap between the visor portion of the side panel and the top plate portion of the top panel is prevented.

An outdoor unit in accordance with a fifth aspect of the invention is the outdoor unit in accordance with any one of the second to fourth aspects, in which a lower end surface of the visor portion is close to or in contact with the upper end of the inner wall portion.

In this outdoor unit, substantially no gap is formed between the visor portion of the side panel and the upper end of the inner wall portion of the opening cover, and this ensures that wetting of the electrical component with water entering through the gap between the visor portion of the side panel and the upper end of the inner wall portion is prevented.

[0013] An outdoor unit in accordance with a sixth aspect of the invention is the outdoor unit in accordance with any one of the first to fifth aspects, in which the portion of the side panel which portion is above the opening is close to or in contact with the inner wall portion.

In this outdoor unit, substantially no gap is formed between the inner wall portion and the side panel, and this ensures that wetting of the electrical component with water entering through the gap between the inner wall portion of the opening cover and that portion of the side panel is prevented.

[0014] An outdoor unit in accordance with a seventh aspect of the invention is the outdoor unit in accordance

with any one of the first to sixth aspects, in which the recess is formed along a direction of a width of the opening cover.

[0015] In this outdoor unit, an upper edge of the opening is covered across its whole length, with the result that entry of water from above to the opening is blocked.

[0016] An outdoor unit in accordance with an eighth aspect of the invention is the outdoor unit in accordance with any one of the first to seventh aspects, in which a groove is formed on an outer surface of the side panel, the groove being formed in at least a part of a region which is around the opening.

[0017] In this outdoor unit, water having entered from the outside of the casing is guided by this groove to a predetermined place where the water should be discharged, before reaching the opening positioned in the vicinity of the electrical component.

[0018] An outdoor unit in accordance with a ninth aspect of the invention is the outdoor unit in accordance with the eighth aspect, in which the groove includes a side groove positioned lateral to the opening, into which side groove a lateral end portion of the opening cover is inserted.

[0019] In this outdoor unit, the lateral end portion of the opening cover is inserted into the side groove of the side panel, and thereby a meandering gap is formed between the side groove of the side panel and the lateral end portion of the opening cover. The thus-structured trap structure serves to effectively prevent the electrical component from getting wet with water, at a portion lateral to the opening.

[0020] An outdoor unit in accordance with a tenth aspect of the invention is the outdoor unit in accordance with the ninth aspect, in which the side groove is formed along a direction of a height of the side panel.

[0021] In this outdoor unit, a side edge of the opening is covered across its whole length, with the result that entry of water in a lateral direction to the opening is blocked.

[0022] An outdoor unit in accordance with an eleventh aspect of the invention is the outdoor unit in accordance with the ninth or tenth aspect, in which the side groove includes two side grooves which are provided on both sides of the opening, respectively.

[0023] The structure of this outdoor unit serves to effectively prevent the electrical component from getting wet with water, at both portions lateral to the opening.

[0024] An outdoor unit in accordance with a twelfth aspect is the outdoor unit in accordance with any one of the eighth to eleventh aspects, in which the groove includes an upper groove positioned above the opening, into which upper groove the upper end portion of the opening cover is inserted.

[0025] In this outdoor unit, the upper end portion of the opening cover is inserted into the upper groove of the side panel, and thereby a meandering gap is formed between the upper groove of the side panel and the upper end portion of the opening cover. The thus-structured

trap structure serves to effectively prevent the electrical component from getting wet with water, at a portion above the opening.

[0026] An outdoor unit in accordance with a thirteenth aspect of the invention is the outdoor unit in accordance with the twelfth aspect, in which the upper groove is formed along a direction of a width of the side panel.

[0027] In this outdoor unit, the upper edge of the opening is covered across its whole length, with the result that entry of water from above to the opening is blocked.

Advantageous Effects of Invention

[0028] As described above, the present invention brings about the following advantageous effects.

[0029] In accordance with the first aspect, the following advantageous effects are provided.

(1) At the position above the opening, engagement is made by the edge portion of the top panel and the upper end portion of the opening cover, and therefore the distance between the engagement portion and the opening is long enough as compared to a case where such a portion for attaching the opening cover is provided near the opening. This increases the length of a path of entering water from the outside of the casing to the electrical component inside the casing, and therefore an intensity of water which passes through the engagement portion is reduced, which prevents the electrical component from getting wet with water.

(2) Further, the edge portion of the top panel is inserted into the recess provided between the outer wall portion and the inner wall portion, and thereby the meandering gap is formed between the edge portion of the top panel and the upper end portion of the opening cover. The thus-formed trap structure effectively prevents the electrical component from getting wet with water.

(3) Furthermore, the portion of the side panel which portion is above the opening is positioned inside the engagement portion made by the upper end portion of the opening cover and the edge portion of the top panel, and therefore that portion of the side panel positioned inside the inner wall portion functions as a barrier against water, which protects the electrical component from the water. This further prevents the electrical component from getting wet with water.

[0030] Furthermore, in accordance with the second aspect, even if water having entered from the outside of the casing passes through the engagement portion made by the edge portion of the top panel and the upper end portion of the opening cover, the visor portion positioned above the inner wall portion prevents the water from entering into the inside of the side panel. That is, provision of the visor portion further prevents the electrical component from getting wet with water.

[0031] Furthermore, in accordance with the third aspect, substantially no gap is formed between the visor portion of the side panel and the edge portion of the top panel, and this ensures that wetting of the electrical component with water entering through the gap between the visor portion of the side panel and the edge portion of the top panel is prevented.

Furthermore, in accordance with the fourth aspect, substantially no gap is formed between the visor portion of the side panel and the top plate portion of the top panel, and this ensures that wetting of the electrical component with water entering through the gap between the visor portion of the side panel and the top plate portion of the top panel is prevented.

Furthermore, in accordance with the fifth aspect, substantially no gap is formed between the visor portion of the side panel and the upper end of the inner wall portion of the opening cover, and this ensures that wetting of the electrical component with water entering through the gap between the visor portion of the side panel and the upper end of the inner wall portion is prevented.

[0032] Furthermore, in accordance with the sixth aspect, substantially no gap is formed between the inner wall portion and the side panel, and this ensures that wetting of the electrical component with water entering through the gap between the inner wall portion of the opening cover and that portion of the side panel is prevented.

[0033] Furthermore, in accordance with the seventh aspect, the upper edge of the opening is covered across its whole length, with the result that entry of water from above to the opening is blocked.

[0034] Furthermore, in accordance with the eighth aspect, water having entered from the outside of the casing is guided by this groove to a predetermined place where the water should be discharged, before reaching the opening provided in the vicinity of the electrical component.

[0035] Furthermore, in accordance with the ninth aspect, the lateral end portion of the opening cover is inserted into the side groove of the side panel, and thereby the meandering gap is formed between the side groove of the side panel and the lateral end portion of the opening cover. The thus-structured trap structure serves to effectively prevent the electrical component from getting wet with water, at the portion lateral to the opening.

[0036] Furthermore, in accordance with the tenth aspect, the side edge of the opening is covered across its whole length, with the result that entry of water in the lateral direction to the opening is blocked.

[0037] Furthermore, in accordance with the eleventh aspect, the structure of this aspect serves to effectively prevent the electrical component from getting wet with water, at both portions lateral to the opening.

[0038] Furthermore, in accordance with the twelfth aspect, the upper end portion of the opening cover is inserted into the upper groove of the side panel, and thereby the meandering gap is formed between the upper

groove of the side panel and the upper end portion of the opening cover. The thus-structured trap structure serves to effectively prevent the electrical component from getting wet with water, at the portion above the opening.

[0039] Furthermore, in accordance with the thirteenth aspect, the upper edge of the opening is covered across its whole length, with the result that entry of water from above to the opening is blocked.

Brief Description of Drawings

[0040]

[FIG. 1]

FIG. 1 is a refrigerant piping diagram of an air conditioner related to one embodiment of the present invention.

[FIG. 2]

FIG. 2 is a perspective view showing an overall structure of an outdoor unit of the air conditioner shown in FIG. 1.

[FIG. 3]

FIG. 3 is a front view of a right side panel of the outdoor unit of the air conditioner shown in FIG. 1.

[FIG. 4]

FIG. 4 is an enlarged perspective view of the outdoor unit of the air conditioner shown in FIG. 1, mainly showing the right side panel.

[FIG. 5]

Fig. 5 is a sectional view taken along a line M-M of FIG. 4.

[FIG. 6]

FIG. 6 is a sectional view taken along a line N-N of FIG. 4.

[FIG. 7]

FIG. 7 is an enlarged schematic sectional view showing trap structures created by a top panel, the right side panel, and a shutoff valve cover of the outdoor unit of the air conditioner shown in FIG. 1.

[FIG. 8]

FIG. 8 is a front view showing the shutoff valve cover of the outdoor unit of the air conditioner shown in FIG. 1.

[FIG. 9]

FIG. 9 is a sectional view taken along a line J-J of FIG. 8.

[FIG. 10]

FIG. 10 is an exploded perspective view of an electrical component box and a terminal block mounting plate of the outdoor unit of the air conditioner shown in FIG. 1.

[FIG. 11]

FIG. 11 is an enlarged perspective view of tab portions provided to the electrical component box shown in FIG. 10 with their peripheries.

[FIG. 12]

FIG. 12 is a diagram schematically showing how to deflect a tab portion of the electrical component box

shown in FIG. 10.

[FIG. 13]

FIG. 13 is a diagram schematically showing how to fix wires by the tab portion of the electrical component box shown in FIG. 10.

[FIG. 14]

FIG. 14 is a diagram schematically showing how to deflect a tab portion of an electrical component box of a modification. Description of Embodiments

[0041] The following describes an embodiment of an air conditioner having an outdoor unit in accordance with the present invention, with reference to the drawings.

[Overall Structure of Air Conditioner]

[0042] As shown in FIG. 1, an air conditioner 1 of this embodiment includes: an indoor unit 2 installed on an indoor wall surface or the like; an outdoor unit 3 installed outside a room; and connection pipes 4 which connect the indoor unit 2 to the outdoor unit 3. Further, devices and valves contained in the indoor unit 2 and the outdoor unit 3 are connected to the connection pipes 4, and thereby a refrigerant circuit is constructed. The refrigerant circuit is mainly constituted by: an indoor heat exchanger 20; an outdoor heat exchanger 30; a compressor 31; and an electric expansion valve 32. At the time of cooling operation, a high-temperature and high-pressure refrigerant discharged from the compressor 31 flows into the outdoor heat exchanger 30. Subsequently, the refrigerant condensed in the outdoor heat exchanger (condenser) 30 is decompressed by the electric expansion valve 32, and then flows into the indoor heat exchanger 20. Subsequently, the refrigerant evaporated in the indoor heat exchanger (evaporator) 20 returns to a sucking side of the compressor 31. Air around the indoor heat exchanger 20 is thus cooled, so that cool air is provided to the room. Meanwhile, at the time of heating operation, a high-temperature and high-pressure refrigerant discharged from the compressor 31 flows into the indoor heat exchanger 20. Subsequently, the refrigerant condensed in the indoor heat exchanger (condenser) 20 is decompressed by the electric expansion valve 32, and then flows into the outdoor heat exchanger 30. Subsequently, the refrigerant evaporated in the outdoor heat exchanger (evaporator) 30 returns to the sucking side of the compressor 31. Air around the indoor heat exchanger 20 is thus heated, so that warm air is provided to the room. Note that, the "outdoor unit" of the present invention is applied to the air conditioner in this embodiment; however, the "outdoor unit" of the present invention is also applicable to a water heater. In this case, the water heater includes: the outdoor unit serving as a heat pump unit; and a tank unit.

[Indoor Unit]

[0043] The indoor unit 2 includes: the above-described

indoor heat exchanger 20; and an indoor fan (cross-flow fan) 21 attached along the indoor heat exchanger 20.

[Outdoor Unit]

[0044] The outdoor unit 3 includes: the above-described outdoor heat exchanger 30; the compressor 31 which compresses a refrigerant sucked therein; the electric expansion valve 32 connected to the outdoor heat exchanger 30; an outdoor fan (propeller fan) 33 attached with the outdoor heat exchanger 30; an accumulator 34 connected to the sucking side of the compressor 31; and a four-pass switching valve 35 connected to a discharging side of the compressor 31. Further, the outdoor unit 3 is provided with a fluid shutoff valve 36 and a gas shutoff valve 37 to which the connection pipes 4 are connected.

[Casing]

[0045] As shown in FIG. 2, the above-described devices (the compressor 31, electric expansion valve 32, outdoor fan 33, accumulator 34, and four-pass switching valve 35) are contained in a casing 40 having a substantially box shape. The casing 40 includes: a bottom panel 41 on which the compressor 31 and the like are placed; a side panel 42 provided in a standing manner at an edge portion of the bottom panel 41; and a top panel 43 disposed so as to be opposed to the bottom panel 41. The side panel 42 includes: a right side panel 44 forming a right side surface of the casing 40; a left side panel (not-shown) forming a left side surface of the casing 40; and a front panel 45 forming a front surface of the casing 40. The top panel 43 has: a rectangular top plate portion 43a forming a top surface of the casing 40; and an edge portion 43b perpendicularly connected to end portions of the top plate portion 43a.

[Right Side Panel]

[0046] As shown in FIGs. 3 and 6, the right side panel 44 has: a main body 44a which has a substantially L-shape in horizontal section and is disposed as the right side surface of the casing 40; and a rear plate portion 44b which has a curved portion near a lateral end portion of the main body 44a and is disposed as a rear surface of the casing 40. As shown in FIG. 3, the right side panel 44 is provided with, above its vertically middle portion (i.e., its middle portion with respect to Z direction), a wiring opening 46a through which wires (not-shown) connected to a terminal block 60 disposed in the casing 40 are drawn from the inside of the casing 40 to the outside. The wiring opening 46a opens in the vicinity of the terminal block 60. Specifically, the terminal block 60 is disposed at a position where the terminal block 60 is exposed through the wiring opening 46a, that is, the terminal block 60 is provided within an area corresponding to the wiring opening 46a, with respect to a direction of a height of the right side panel 44 (the Z direction) and a direction of a width

of the right side panel 44 (X direction). Further, the right side panel 44 is provided with, below its vertically middle portion (i.e., the middle portion with respect to the Z direction), a shutoff valve opening 46b through which the above-described fluid shutoff valve 36 and gas shutoff valve 37 are exposed.

[0047] Furthermore, in this embodiment, as shown in FIGs. 5 and 7, an upper portion 47 above the wiring opening 46a is positioned inside an engagement portion K, where an upper end portion 53 of a shutoff valve cover 50 is engaged with the edge portion 43b of the top panel 43. That is, the upper portion 47 is positioned inside an inner wall portion 53b which will be described later. Note that, the upper portion 47 extends to a position above the inner wall portion 53b.

[0048] As shown in FIG. 3, a groove 48 is formed on an outer surface of the right side panel 44, the groove 48 being formed in at least a part of a region which is around the wiring opening 46a. The groove 48 includes: a horizontal groove 48H formed along an upper edge of the wiring opening 46a; and vertical grooves 48L and 48R which are formed along left and right edges of the wiring opening 46a, respectively. The horizontal groove 48H is connected to the vertical grooves 48L and 48R at their ends, and they collectively form a substantially U-shaped groove. With respect to the direction of the width of the right side panel 44 (the X direction), a width W1 of the horizontal groove 48H is designed so as to be longer than a width W2 of the wiring opening 46a, and with respect to the direction of the height of the right side panel 44 (the Z direction), a width W3 of each of the vertical grooves 48L and 48R is designed so as to be longer than a width W4 of the wiring opening 46a. Here, in this embodiment, the right side panel 44 is provided with, above the horizontal groove 48H, a visor portion 49 protruding outward, as shown in FIGs. 5 and 7. The visor portion 49 is positioned above the later-described inner wall portion 53b of the shutoff valve cover 50, and functions to prevent water which has passed through a gap between the edge portion 43b of the top panel 43 and the upper end portion 53 of the shutoff valve cover 50 from passing over the right side panel 44 and entering the inside. In this embodiment, a space is reserved between the top plate portion 43a of the top panel 43 and the inner wall portion 53b, and the visor portion 49 is arranged in this space.

[Shutoff Valve Cover]

[0049] As shown in FIG. 4, the shutoff valve cover (opening cover) 50 made of resin is attached to an outer side of the right side panel 44. The shutoff valve cover 50 is provided to cover: the wiring opening 46a (see FIG. 3) formed in the right side panel 44; wires (not-shown) drawn out through the wiring opening 46a; and the fluid shutoff valve 36 and the gas shutoff valve 37 which are exposed through the shutoff valve opening 46b (see FIG. 3) of the right side panel 44. As shown in FIGs. 4, 8, and 9, the shutoff valve cover 50 is provided with: a grip 51

gripped by an operator at the time of transportation of the outdoor unit; and a swelling portion 52 which swells outward and covers the fluid shutoff valve 36 and the gas shutoff valve 37. The shutoff valve cover 50 of this embodiment is configured so that its upper end portion 53 is engaged with the edge portion 43b of the top panel 43 (see FIGs. 5 and 7). As shown in FIGs. 5, 7, and 9, the upper end portion 53 of the shutoff valve cover 50 includes: an outer wall portion 53a positioned outside the edge portion 43b of the top panel 43; the inner wall portion 53b positioned inside the edge portion 43b of the top panel 43; and a recess 53c provided between the outer wall portion 53a and the inner wall portion 53b. Further, the edge portion 43b of the top panel 43 is inserted into the recess 53c of the upper end portion 53, and thereby engagement is made by the edge portion 43b of the top panel 43 and the upper end portion 53 of the shutoff valve cover 50. Each of the above-described outer wall portion 53a, inner wall portion 53b, and recess 53c extends along the direction of a width of the shutoff valve cover 50 (the X direction).

[0050] Further, as shown in FIG. 6, lateral end portions 54L and 54R of the shutoff valve cover 50 protrude toward the right side panel 44, and are positioned in the abovementioned vertical grooves 48L and 48R of the right side panel 44, respectively. The lateral end portion 54L and 54R respectively have recesses 55L and 55R. These lateral end portion 54L and 54R are slidable within the respective vertical grooves 48L and 48R of the right side panel 44 in a vertical direction (the Z direction). The lateral end portion 54L and 54R are slid upward (from bottom to top) within the vertical grooves 48L and 48R, and thereby the edge portion 43b of the top panel 43 is inserted into the recess 53c formed at the upper end portion 53 of the shutoff valve cover 50. Furthermore, notches 56L and 56R are respectively formed at portions of the lateral end portions 54L and 54R, which respectively face corners 48a and 48b located between a horizontally middle portion of the right side panel 44 (a middle portion with respect to the X direction) and the corresponding vertical grooves 48L and 48R.

[0051] As shown in FIGs. 5, 7, and 9, (i) a portion 53d of a tip portion of the outer wall portion 53a, which portion 53d is opposed to the inner wall portion 53b, and (ii) a portion 53e of a tip portion of the inner wall portion 53b, which portion 53e is opposed to the outer wall portion 53a are tapered, and this facilitates the insertion of the edge portion 43b of the top panel 43 into the recess 53c. Further, in this embodiment, a height H2 of the inner wall portion 53b is shorter than a height H1 of the outer wall portion 53a (see FIG. 9).

[0052] The following describes, in detail, trap structures which prevent electrical components such as the terminal block 60 from getting wet with water.

[Trap Structure P Formed between Shutoff Valve Cover 50 and Top Panel 43]

[0053] As shown in FIG. 7, a trap structure P which prevents entry of water from around the upper end portion 53 of the shutoff valve cover 50 is formed between the upper end portion 53 of the shutoff valve cover 50 and the edge portion 43b of top panel 43. The trap structure P is constructed by inserting the edge portion 43b of the top panel 43 into the recess 53c formed at the upper end portion 53 of the shutoff valve cover 50. The trap structure P includes: a vertical gap A formed between the outer wall portion 53a and the edge portion 43b of the top panel 43; a horizontal gap B formed between a bottom surface of the recess 53c and a lower end surface of the edge portion 43b of the top panel 43; and a vertical gap C formed between the inner wall portion 53b and the edge portion 43b of the top panel 43. The vertical gap A, the horizontal gap B, and the vertical gap C collectively form a meandering gap having a substantially U-shape. Although sizes of the gaps A, B, and C depicted in FIG. 7 are exaggerated, in practice, the edge portion 43b of the top panel 43 is substantially in contact with the upper end portion 53 of the shutoff valve cover 50.

[Trap Structure Q Formed between Shutoff Valve Cover 50 and Right Side Panel 44]

[0054] As shown in FIG. 7, a trap structure Q which prevents entry of water having passed through the gap of the above-described trap structure P is formed between the inner wall portion 53b of the upper end portion 53 of the shutoff valve cover 50 and the right side panel 44. The trap structure Q is constructed by positioning the inner wall portion 53b into the horizontal groove 48H of the right side panel 44. The trap structure Q includes: a horizontal gap D formed between an upper end surface of the inner wall portion 53b and the visor portion 49 of the right side panel 44; and a vertical gap E formed between the horizontal groove 48H and the inner wall portion 53b. The horizontal gap D and the vertical gap E collectively form a substantially L-shaped gap. Although sizes of the gaps D and E depicted in FIG. 7 are exaggerated, in practice, the right side panel 44 is substantially in contact with the inner wall portion 53b of the shutoff valve cover 50.

[0055] The above-described vertical gap A, horizontal gap B, vertical gap C, horizontal gap D, and vertical gap E collectively form a meandering gap having a substantially S-shape.

[Trap Structure R Formed between Top Panel 43 and Right Side Panel 44]

[0056] As shown in FIG. 7, a trap structure R which prevents entry of water having passed through the gap of the trap structure P is formed between the top panel 43 and the visor portion 49 of the right side panel 44. The

trap structure R is constructed by: positioning the visor portion 49 above the inner wall portion 53b; and positioning the visor portion 49 along an inner wall surface of the top panel 43. The trap structure R includes: a vertical gap F formed between the edge portion 43b of the top panel 43 and a protruded end surface of the visor portion 49; and a horizontal gap G formed between the top plate portion 43a of the top panel 43 and an upper end surface of the visor portion 49. These vertical gap F and horizontal gap G collectively form a substantially L-shaped gap. Although sizes of the gaps F and G depicted in FIG. 7 are exaggerated, in practice, there is formed a very small gap between the edge portion 43b of the top panel 43 and the visor portion 49. Note that the edge portion 43b of the top panel 43 may be in contact with the visor portion 49. In this case, the gaps F and G between the edge portion 43b of the top panel 43 and the visor portion 49 are not formed substantially, and this ensures that wetting of the electrical components such as the terminal block 60 with water entering through the gap between the visor portion 49 of the right side panel 44 and the edge portion 43b of the top panel 43 is prevented.

[Trap Structure S Formed between Shutoff Valve Cover 50 and Right Side Panel 44]

[0057] While the above-described trap structures P, Q, and R are provided for preventing the entry of water from around the upper end portion 53 of the shutoff valve cover 50, a trap structure S is provided for preventing entry of water from around the lateral end portions 54L and 54R of the shutoff valve cover 50 as shown in FIG. 6. As shown in FIG. 6, the trap structure S is constructed by positioning the lateral end portions 54L and 54R of the shutoff valve cover 50 into the vertical grooves 48L and 48R of the right side panel 44, respectively.

[Electrical Component Box]

[0058] The following describes, in detail, an electrical component box 70 disposed inside the casing 40, with reference to FIGS. 10 to 13. In the electrical component box 70, a control board 62 on which various electronic components are mounted is attached. The control board 62 controls operation of devices such as the compressor 31, the electric expansion valve 32, the outdoor fan 33, and the like.

[0059] The electrical component box 70 is made of resin, and is one-piece molded. As shown in FIG. 10, a board receiver 70a which receives the control board 62 is provided in the electrical component box 70. The board receiver 70a is a space defined by a top portion 71, a bottom portion 72, a right side portion 73, and a left side portion 74, and the control board 62 is disposed in the electrical component box 70 in a standing manner. The board receiver 70a is provided with, at respective positions, a plurality of support ribs 75 which hold the control board 62 in a predetermined position with respect to a direction

of a depth of the board receiver 70a (the X direction). Further, the board receiver 70a is provided with a claw 76 to be engaged in a notch (not-shown) in the control board 62. The claw 76 is flexible, and the claw 76 is engaged in the notch (not-shown), so that the control board 62 is fixed. Molding holes 78 used for removing a mold are bored through to correspond to the above-described claw 76 and protrusions 77 (see FIG. 10) provided at plural positions in the board receiver 70a.

[0060] Further, a mounting plate installation place 70b where the terminal block mounting plate 61 is to be installed is arranged at an outer surface of the right side portion 73 of the electrical component box 70 of this embodiment. As shown in FIG. 11, the mounting plate installation place 70b is provided with tab portions 80A and 80B each of which is flexible so as to be deflected toward the inside and outside of the electrical component box 70 (i.e. in Y direction). Each of the tab portions 80A and 80B is formed by cutting out a U-shape portion from the right side portion 73 using a pattern. The tab portion 80A is structured so that its one end in the X direction is fixed and its other end in the X direction is free for deflection, while the tab portion 80B is structured so that its one end in the X direction is free for deflection and its other end in the X direction is fixed. With this structure, a direction in which wires 65 (see FIG. 12) held by the tab portion 80A are released is opposite to a direction in which the wires 65 held by the tab portion 80B are released, and therefore it is possible to prevent the wires 65 held by the tab portions 80A and 80B from being released. This makes it easy to handle the wires 65.

[0061] Further, in this embodiment, as shown in FIG. 11, a protrusion 81A is formed on an outer surface (a surface facing the terminal block mounting plate 61) of the tab portion 80A, and a protrusion 81B is formed on an outer surface (a surface facing the terminal block mounting plate 61) of the tab portion 80B. The protrusions 81A and 81B are formed so that they extend along the Z direction. As shown in FIG. 12, the protrusion 81A of the tab portion 80A is pressed by the terminal block mounting plate 61 which is to be installed in the mounting plate installation place 70b, and thereby the tab portion 80A is deflected toward the inside of the electrical component box 70. The tab portion 80A is thus deflected toward the inside of the electrical component box 70, and this allows the tab portion 80A to hold the wires 65 arranged in the electrical component box 70 by clipping the wires 65. Note that FIG. 12 only illustrates the tab portion 80A; however, the same is applied to the tab portion 80B, and therefore the description thereof is omitted. The above-described configuration enables the wires 65 in the electrical component box 70 to be fixed by the tab portions 80A and 80B. In FIG. 12, the wires 65 are fixed at a position before the protrusion 81A, however, the wires 65 may be fixed at a position beyond the protrusion 81A as shown in FIG. 13. In this case, the protrusion 81A functions as means for preventing release of the wires 65, and therefore the wires 65 are fixed more firmly.

[Characteristics of Outdoor Unit of This Embodiment]

[0062] The outdoor unit of this embodiment has following characteristics.

[0063] In the outdoor unit 3 of this embodiment, at a position above the wiring opening 46a, engagement is made by the edge portion 43b of the top panel 43 and the upper end portion 53 of the shutoff valve cover 50, and therefore the distance between the engagement portion K and the wiring opening 46a is long enough as compared to a case where such a portion for attaching the shutoff valve cover 50 is provided near the wiring opening 46a. This increases a length of a path of entering water from the outside of the casing 40 to the electrical components such as the terminal block 60 inside the casing 40, and therefore an intensity of water which passes through the engagement portion K is reduced, which prevents the electrical components such as the terminal block 60 from getting wet with water.

[0064] In the outdoor unit 3 of this embodiment, the edge portion 43b of the top panel 43 is inserted into the recess 53c provided between the outer wall portion 53a and the inner wall portion 53b, and thereby the meandering gap (the vertical gap A, the horizontal gap B, and the vertical gap C) is formed between the edge portion 43b of the top panel 43 and the upper end portion 53 of the shutoff valve cover 50. The thus-formed trap structure P effectively prevents the electrical components such as the terminal block 60 from getting wet with water.

[0065] In the outdoor unit 3 of this embodiment, the upper portion 47 of the right side panel 44 (the portion of the right side panel 44 which is above the wiring opening 46a) is positioned inside the inner wall portion 53b, and therefore the upper portion 47 functions as a barrier against water, which protects the electrical components such as the terminal block 60 from the water. This further prevents the electrical components such as the terminal block 60 from getting wet with water.

[0066] In the outdoor unit 3 of this embodiment, the visor portion 49 is provided to the right side panel 44, and therefore even if water having entered from the outside of the casing 40 passes through the engagement portion K (the trap structure P) made by the edge portion 43b of the top panel 43 and the upper end portion 53 of the shutoff valve cover 50, the visor portion 49 positioned above the inner wall portion 53b prevents the water from passing over the right side panel 44 and entering into the inside of the right side panel 44.

In the outdoor unit 3 of this embodiment, the protruded end surface of the visor portion 49 is close to or in contact with the edge portion 43b of the top panel 43, the upper end surface of the visor portion 49 is close to or in contact with the top plate portion 43a of the top panel 43, and a lower end surface of the visor portion 49 is close to or in contact with the upper end surface of the inner wall portion 53b. In this structure, the gap F between the visor portion 49 and the edge portion 43b, the gap G between the visor portion 49 and the top plate portion 43a, and

the gap D between the visor portion 49 and the upper end surface of the inner wall portion 53b are not formed substantially, and this ensures that wetting of the electrical components with water entering through the gaps between the visor portion 49 and the top panel 43 and between the visor portion 49 and the inner wall portion 53b is prevented.

[0067] In the outdoor unit 3 of this embodiment, the upper portion 47 of the right side panel 44 (the portion of the right side panel 44 which is above the wiring opening 46a) is close to or in contact with the inner wall portion 53b, so that substantially no gap is formed between the inner wall portion 53b and the right side panel 44, and this ensures that wetting of the electrical components such as the terminal block 60 with water entering through the gap between the inner wall portion 53b of the shutoff valve cover 50 and the upper portion 47 of the right side panel 44 is prevented.

[0068] In the outdoor unit 3 of this embodiment, the recess 53c is formed along the direction of the width of the shutoff valve cover 50 (the X direction), and thereby the upper edge of the wiring opening 46a is covered across its whole length, with the result that entry of water from above to the wiring opening 46a is blocked.

[0069] In the outdoor unit 3 of this embodiment, the groove 48 is formed on the outer surface of the right side panel 44, the groove 48 being formed in at least a part of the region around the wiring opening 46a. Therefore, water having entered from the outside of the casing 40 is guided by the groove 48 to a predetermined place where the water should be discharged, before reaching the wiring opening 46a positioned in the vicinity of the electrical components such as the terminal block 60.

[0070] In the outdoor unit 3 of this embodiment, the lateral end portions 54L and 54R of the shutoff valve cover 50 are respectively inserted into the vertical grooves 48L and 48R of the right side panel 44, and thereby meandering gaps are respectively formed between the vertical grooves 48L and 48R of the right side panel 44 and the corresponding lateral end portions 54L and 54R of the shutoff valve cover 50. The thus-structured trap structure S serves to effectively prevent the electrical components such as the terminal block 60 from getting wet with water, at portions lateral to the wiring opening 46a.

Further, the vertical grooves 48L and 48R are formed along the direction of the height of the right side panel 44 (the Z direction), and thereby side edges of the wiring opening 46a are covered across their whole lengths, with the result that entry of water in a lateral direction to the wiring opening 46a is further blocked.

[0071] In the outdoor unit 3 of this embodiment, the vertical grooves 48L and 48R are respectively provided on both lateral sides of the wiring opening 46a, and this structure serves to effectively prevent the electrical components such as the terminal block 60 from getting wet with water, at the both portions lateral to the wiring opening 46a.

[0072] In the outdoor unit 3 of this embodiment, the

upper end portion 53 of the shutoff valve cover 50 is inserted into the horizontal groove 48H of the right side panel 44, and thereby the meandering gap (the horizontal gap D and the vertical gap E) is formed between the horizontal groove 48H of the right side panel 44 and the upper end portion 53 of the shutoff valve cover 50. The thus-structured trap structure Q serves to effectively prevent the electrical components such as the terminal block 60 from getting wet with water, at a portion above the wiring opening 46a.

Furthermore, the horizontal groove 48H is formed along the direction of the width of the right side panel 44 (the X direction), and thereby the upper edge of the wiring opening 46a is covered across its whole length, with the result that entry of water from above to the wiring opening 46a is further blocked.

[0073] Moreover, the outdoor unit 3 of this embodiment employs a structure such that the tab portions 80A and 80B are deflected by being pressed when another member (the terminal block mounting plate 61) is attached to the outer side of the electrical component box 70. This structure brings about the following advantages. (1) This structure is realized without increasing the number of components because currently-used components such as the terminal block mounting plate 61 or the terminal block 60 can be utilized as a member imparting a pressure from the outside. (2) If a protrusion protruding toward the inside of the electrical component box 70, such as the protrusions 77, is provided, a molding hole 78 used for removing the mold and a seal member to fill the hole 78 are needed. However, since the protrusions 81A and 81B are respectively formed on the outer surfaces of the tab portions 80A and 80B, the molding holes 78 and seal members for them are not needed.

[0074] The embodiment of the present invention has been described hereinabove with reference to the drawings. The present invention however should not be limited to the above embodiment. The scope of the present invention is defined not only by the above description of the embodiment, but also by the claims, and shall encompass various modifications within the scope defined in claims and those which are equivalent to the claims.

[0075] For example, in the above-described embodiment, the protrusions 81A and 81B are formed on the tab portions 80A and 80B of the electrical component box 70, and the tab portions 80A and 80B are deflected toward the inside of the electrical component box 70 as a result that the protrusions 81A and 81B are pressed by the terminal block mounting plate 61. However, the present invention is not limited thereto, and may be structured so as to include an electrical component box 170 and a terminal block mounting plate 161 which are of a modification shown in FIG. 14. Specifically, the electrical component box 170 of the modification is provided with a tab portion 180 which does not include a protrusion, and the terminal block mounting plate 161 is provided with, at a portion thereof which faces the tab portion 180, a protrusion 162 such as a screw. In this structure, the

tab portion 180 is pressed by the protrusion 162 provided on the terminal block mounting plate 161, and is deflected toward the inside of the electrical component box 70. This allows the wires 65 in the electrical component box 70 to be fixed by the tab portion 180. That is, the protrusions 81A and 81B provided to deflect the above-described tab portions 80A and 80B may be formed on the tab portions 80A and 80B respectively, or may be formed on the terminal block mounting plate 61, alternatively. Further, when the above-mentioned screw serving as the protrusion 162 is provided for fixing another member, an edge of a head portion of the screw is covered with the corresponding tab portion 80A, 80B.

15 Industrial Applicability

[0076] The present invention realizes an outdoor unit which is configured to restrain entry of water from the outside of its casing to electrical components inside the casing.

Reference Signs List

[0077]

1	air conditioner
3	outdoor unit
40	casing
41	bottom panel
43	top panel
43a	top plate portion
43b	edge portion
44	right side panel
46a	wiring opening (opening)
47	upper portion
48	groove
48H	horizontal groove (upper groove)
48L, 48R	vertical groove (side groove)
49	visor portion
50	shutoff valve cover (opening cover)
53	upper end portion
54L, 54R	lateral end portion
60	terminal block (electrical component)
53a	outer wall portion
53b	inner wall portion
53c	recess

Claims

1. An outdoor unit comprising:

a casing including a bottom panel, a side panel, and a top panel;
an electrical component contained in the casing;
an opening which is formed at the side panel, and opens in a vicinity of the electrical component; and

- an opening cover which is positioned outside the side panel and covers the opening, wherein the top panel includes a top plate portion positioned so as to be opposed to the bottom panel, and an edge portion extending downward from an end portion of the top plate portion; wherein, at an upper end portion of the opening cover, there are formed an outer wall portion positioned outside the edge portion of the top panel, an inner wall portion positioned inside the edge portion of the top panel, and a recess provided between the outer wall portion and the inner wall portion; and wherein, at a position above the opening, the edge portion of the top panel is inserted into the recess formed at the upper end portion of the opening cover, and a portion of the side panel which portion is above the opening is positioned inside the inner wall portion.
2. The outdoor unit according to claim 1, wherein the portion of the side panel which portion is above the opening includes a visor portion positioned between the top plate portion of the top panel and an upper end of the inner wall portion.
3. The outdoor unit according to claim 2, wherein a protruded end surface of the visor portion is close to or in contact with the edge portion of the top panel.
4. The outdoor unit according to claim 2 or 3, wherein an upper end surface of the visor portion is close to or in contact with the top plate portion of the top panel.
5. The outdoor unit according to any one of claims 2 to 4, wherein a lower end surface of the visor portion is close to or in contact with the upper end of the inner wall portion.
6. The outdoor unit according to any one of claims 1 to 5, wherein the portion of the side panel which portion is above the opening is close to or in contact with the inner wall portion.
7. The outdoor unit according to any one of claims 1 to 6, wherein the recess is formed along a direction of a width of the opening cover.
8. The outdoor unit according to any one of claims 1 to 7, wherein a groove is formed on an outer surface of the side panel, the groove being formed in at least a part of a region which is around the opening.
9. The outdoor unit according to claim 8, wherein the groove includes a side groove positioned lateral to the opening, into which side groove a lateral end portion of the opening cover is inserted.
10. The outdoor unit according to claim 9, wherein the side groove is formed along a direction of a height of the side panel.
11. The outdoor unit according to claim 9 or 10, wherein the side groove includes two side grooves which are provided on both sides of the opening, respectively.
12. The outdoor unit according to any one of claims 8 to 11, wherein the groove includes an upper groove positioned above the opening, into which upper groove the upper end portion of the opening cover is inserted.
13. The outdoor unit according to claim 12, wherein the upper groove is formed along a direction of a width of the side panel.

FIG.1

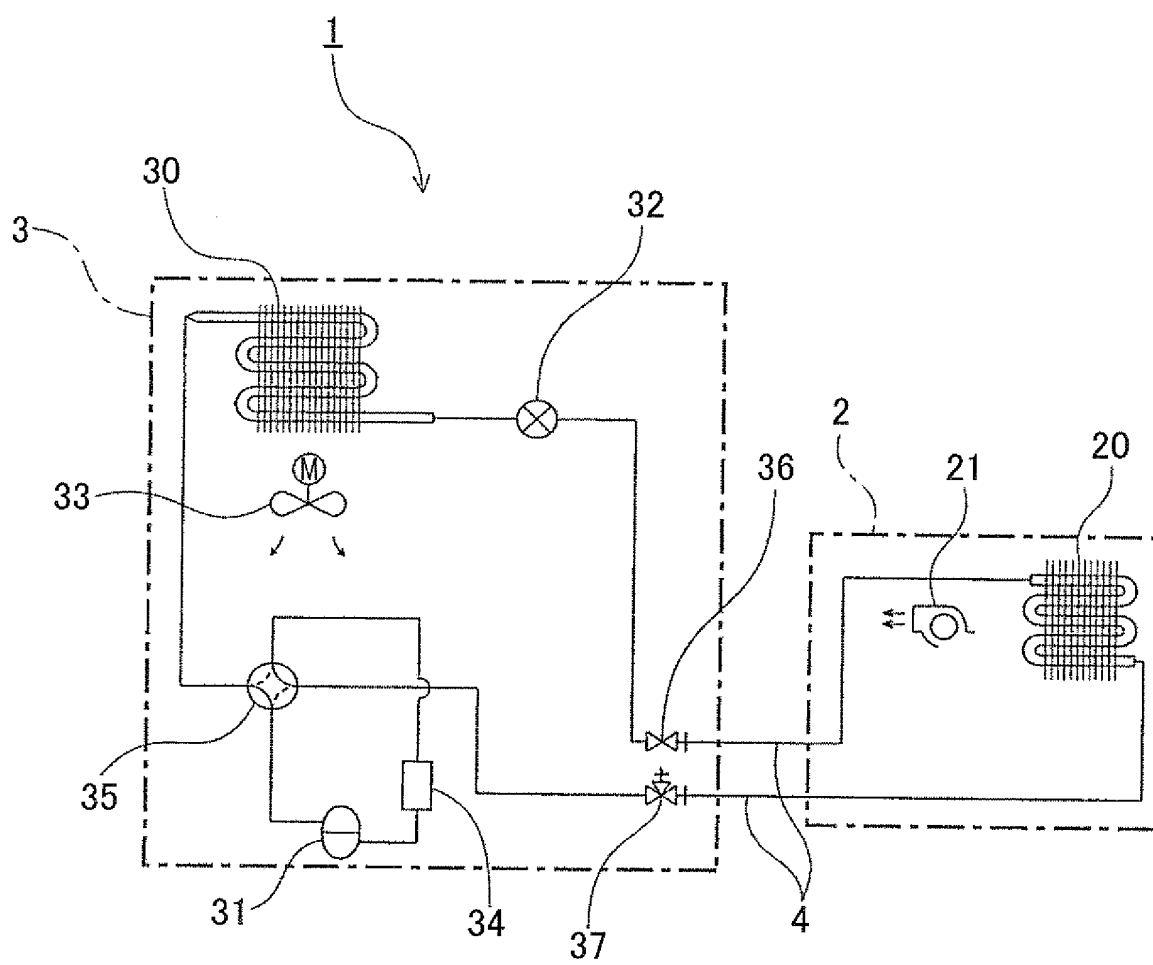


FIG.2

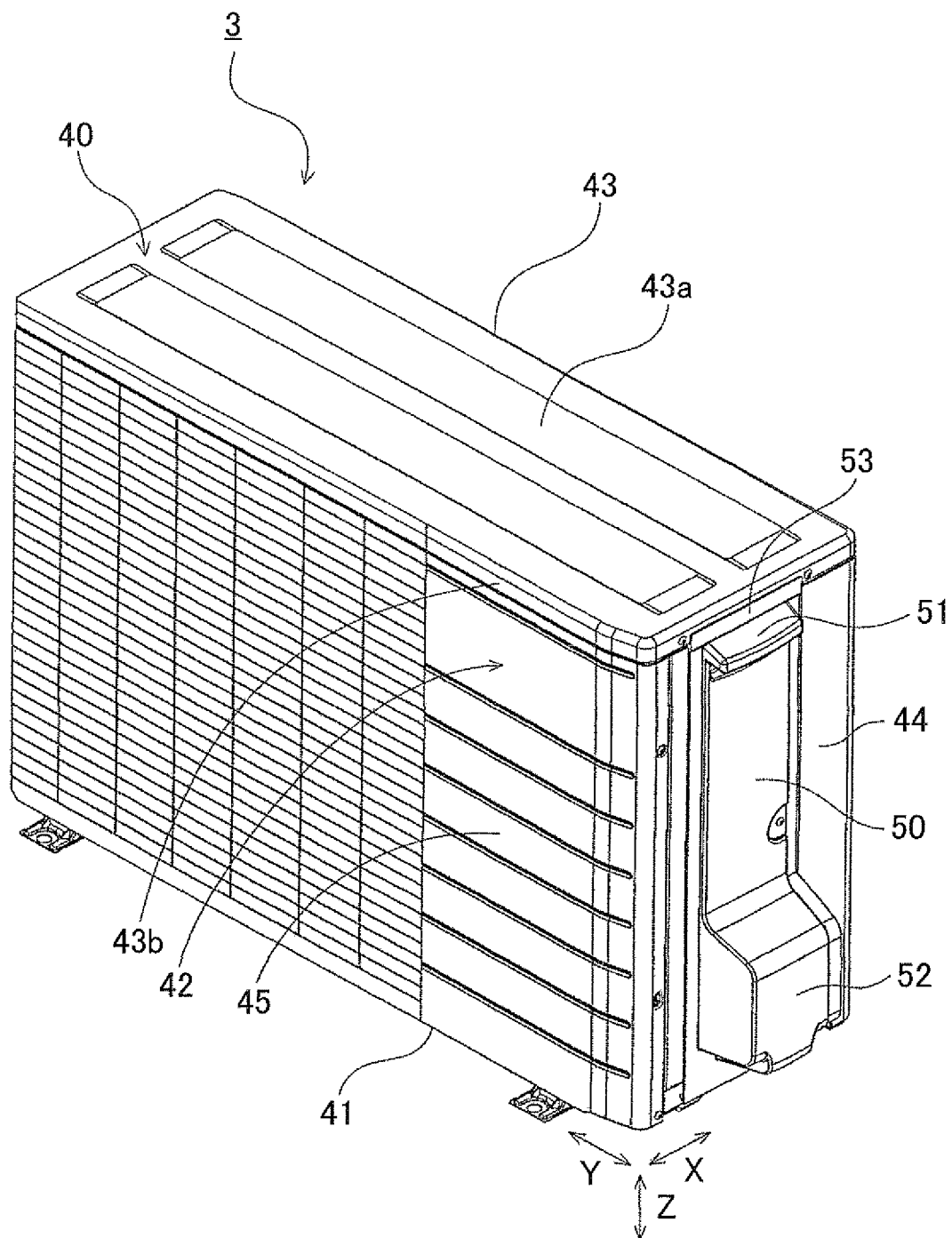


FIG.3

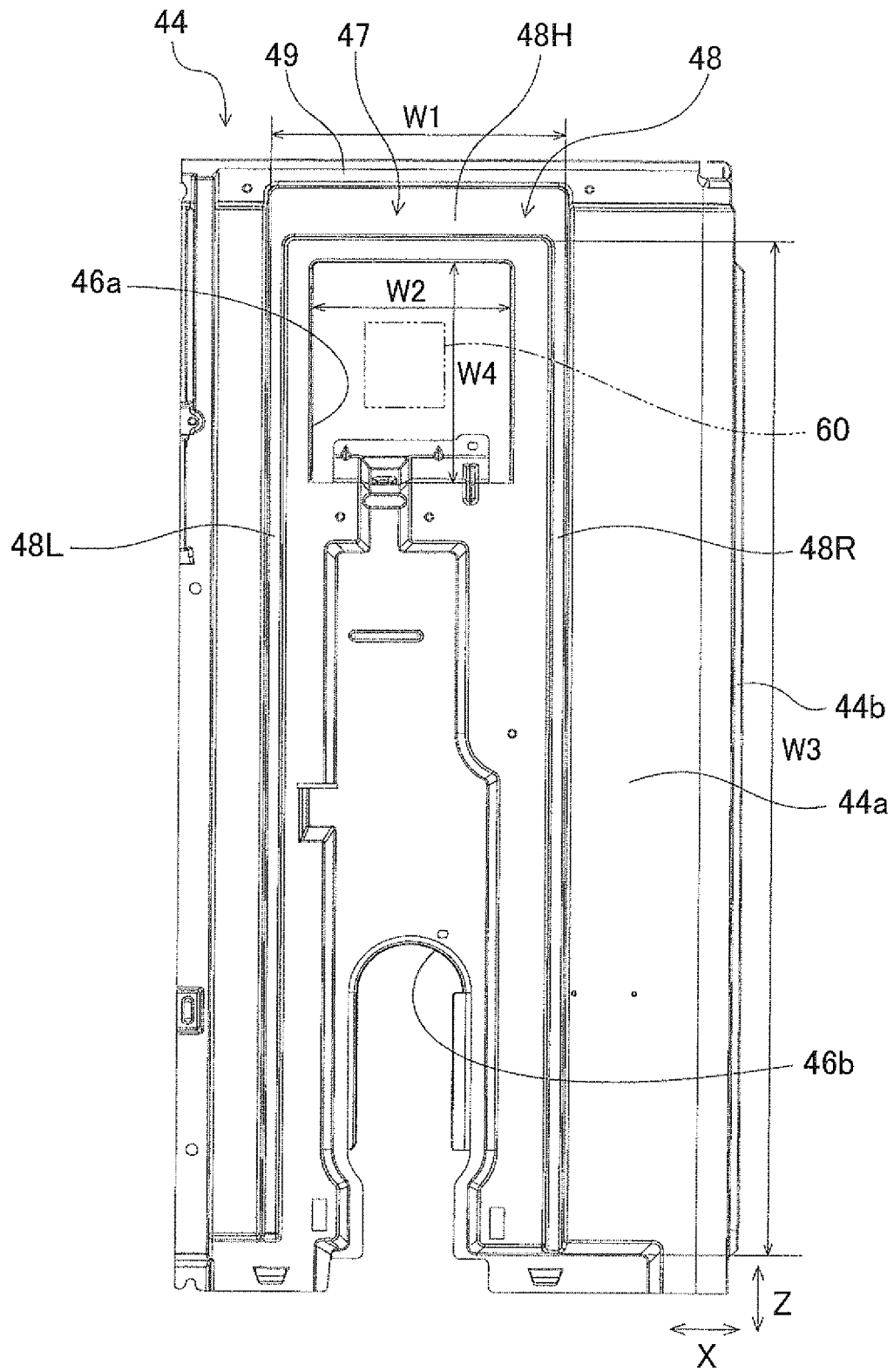


FIG.4

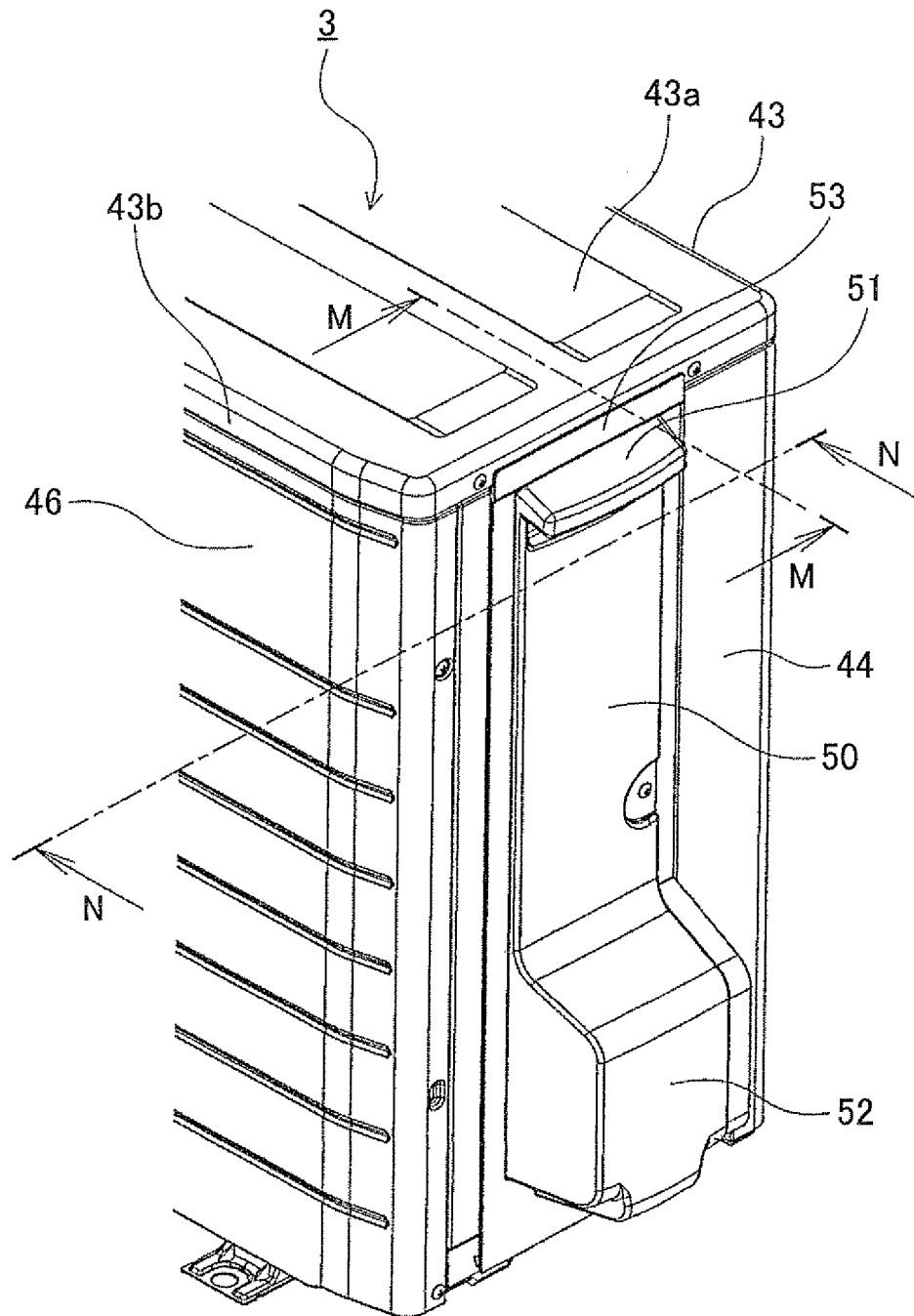


FIG.5

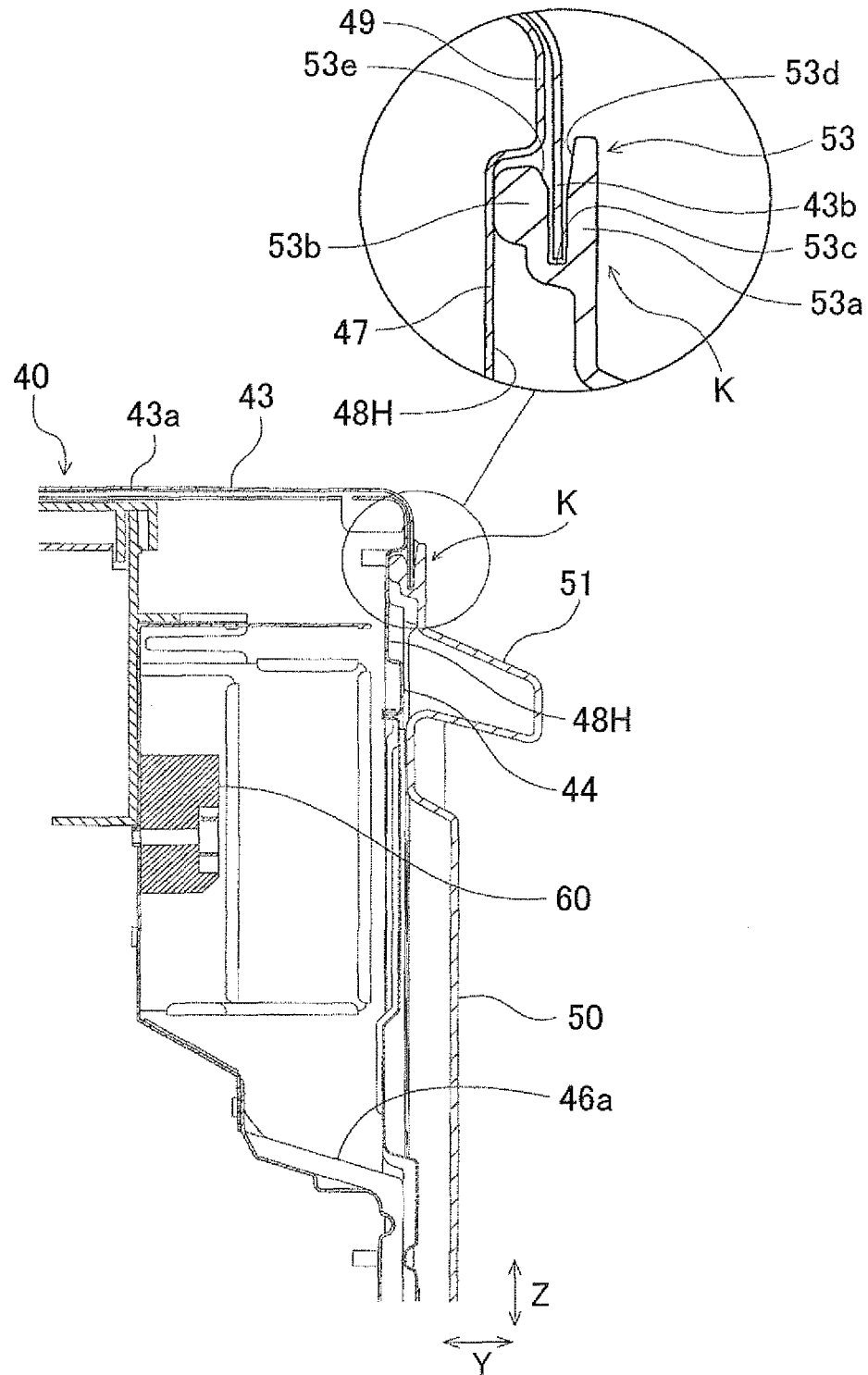


FIG.6

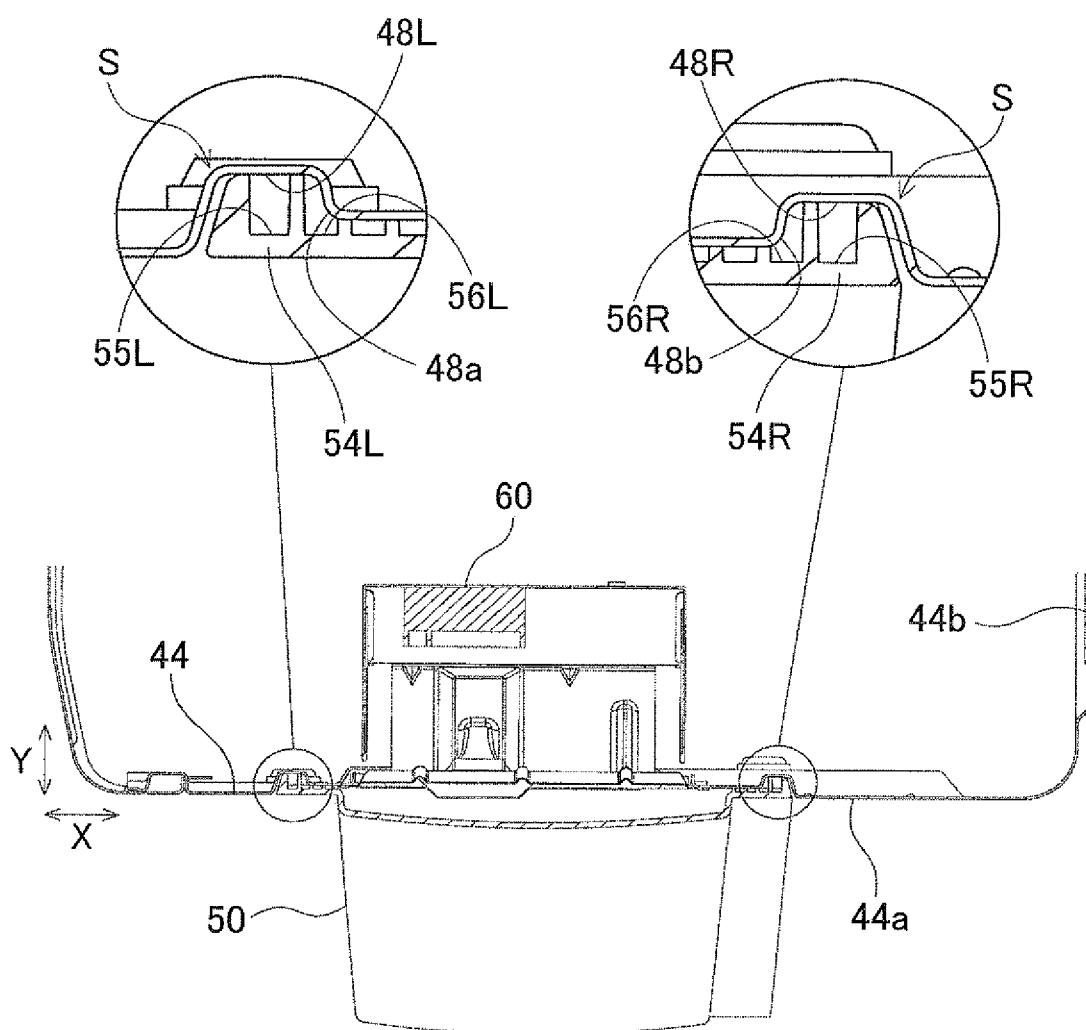


FIG. 7

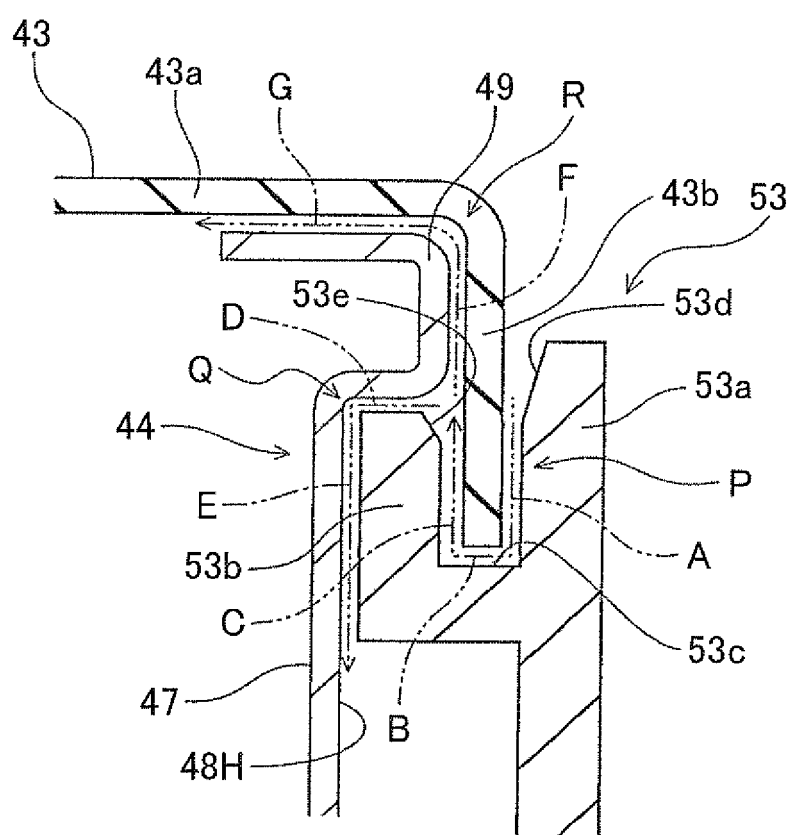


FIG.8

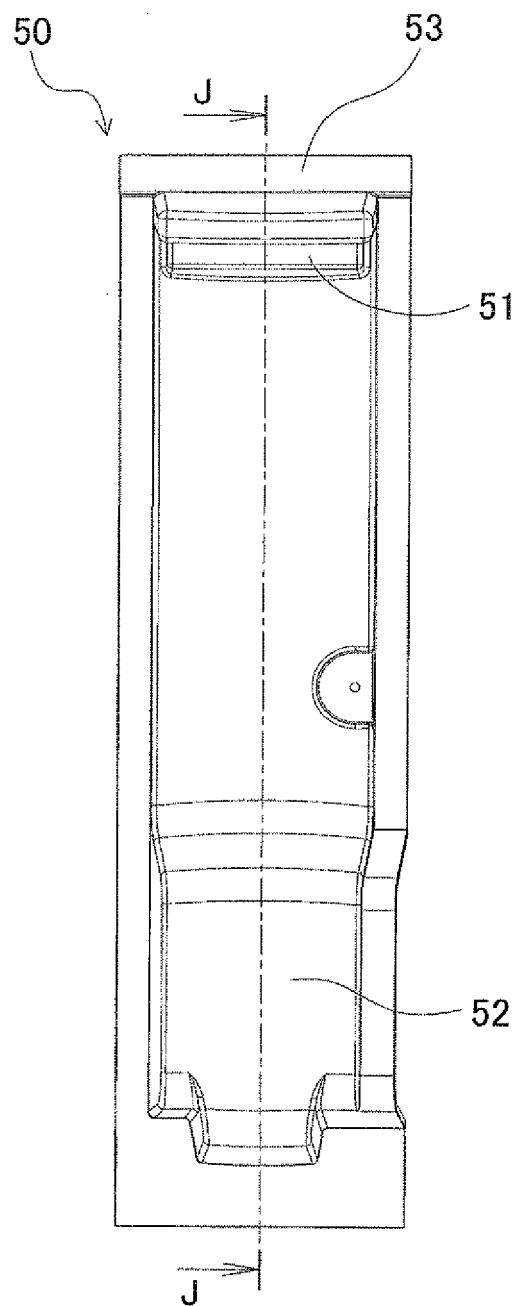


FIG.9

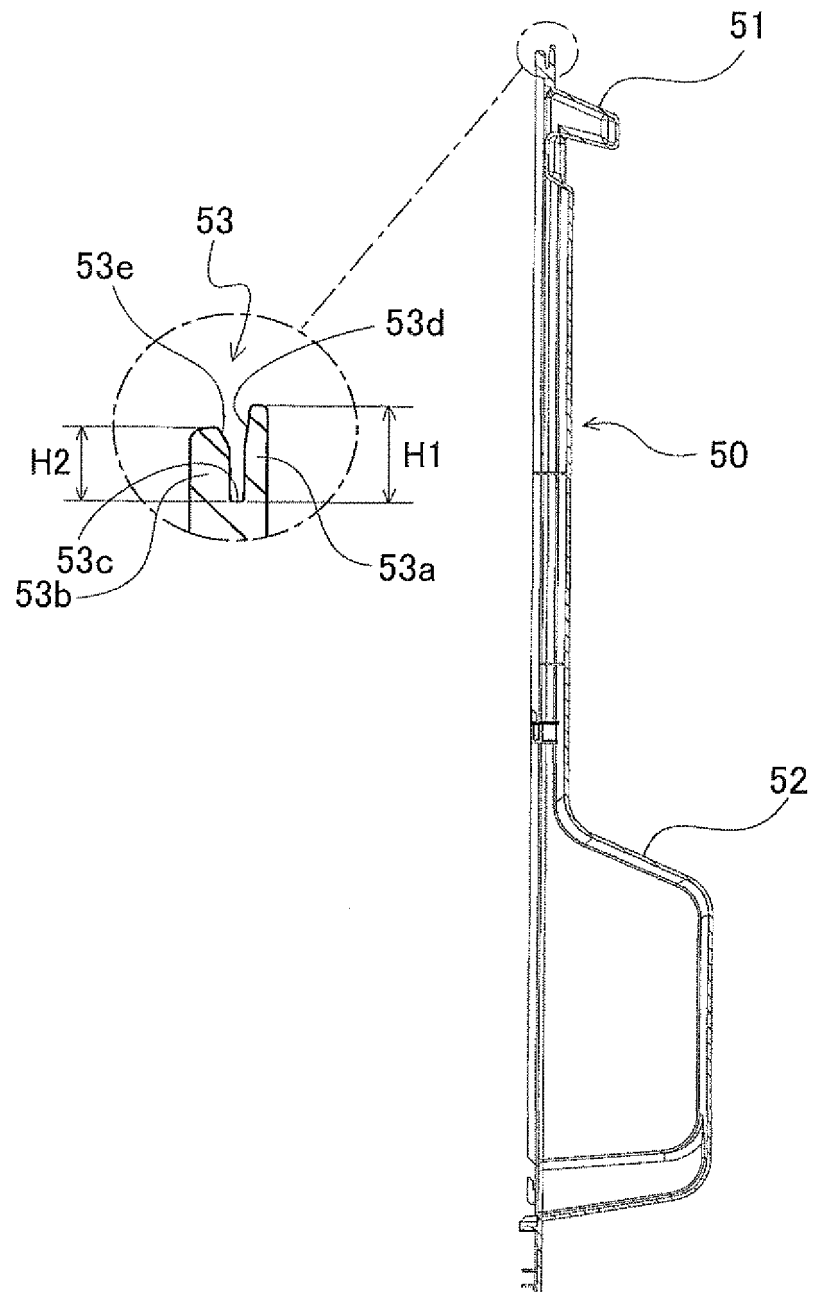


FIG.10

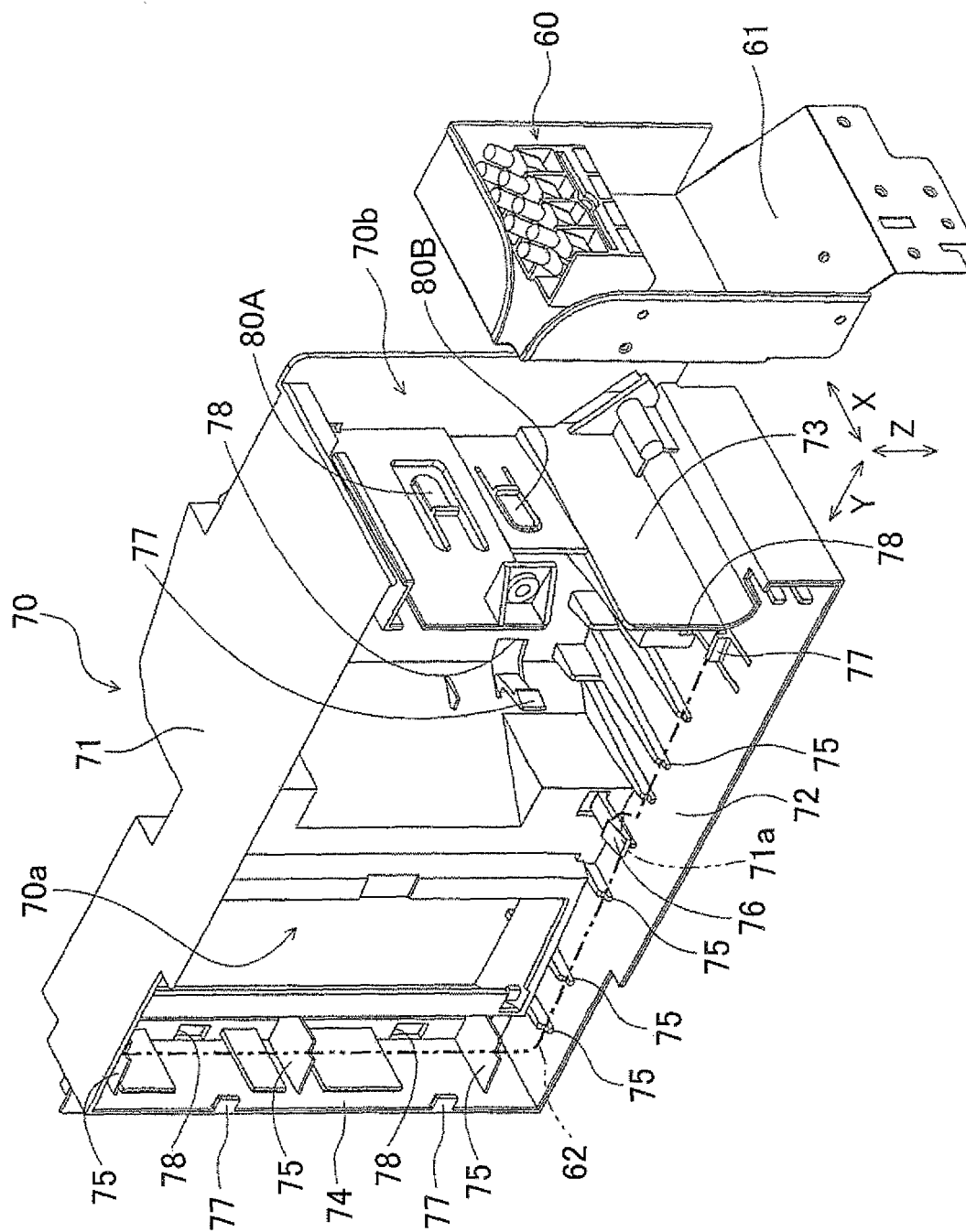


FIG.11

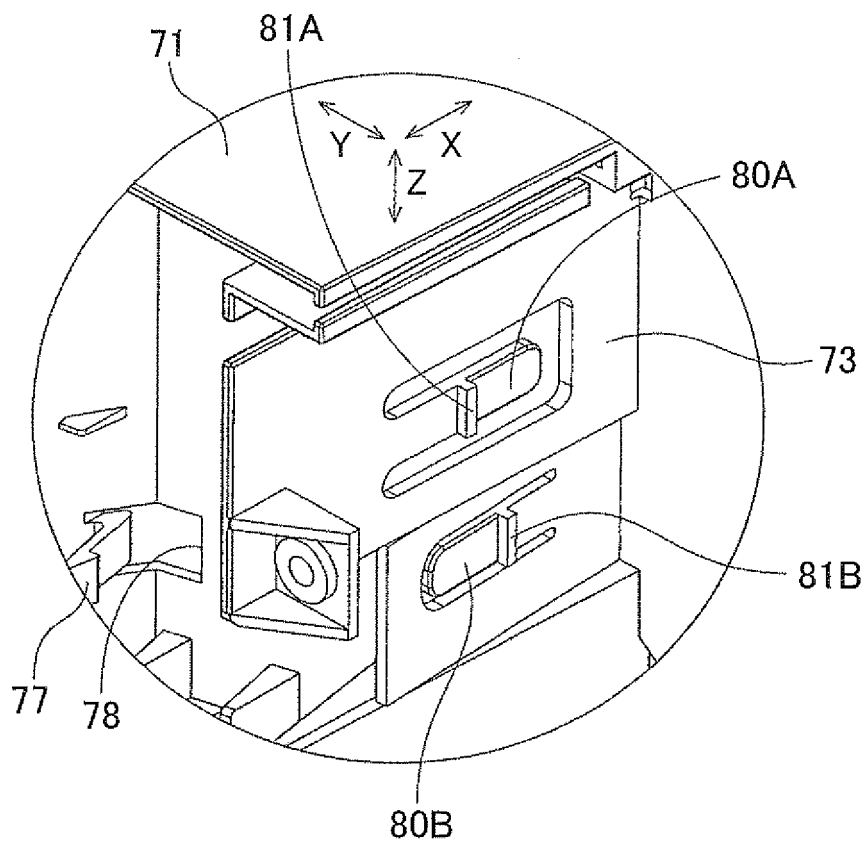


FIG.12

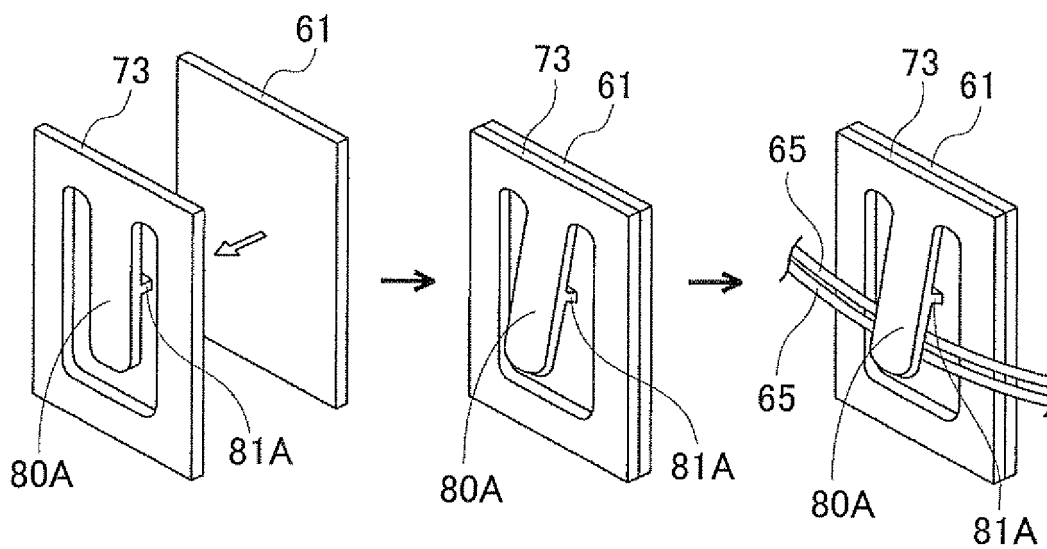


FIG.13

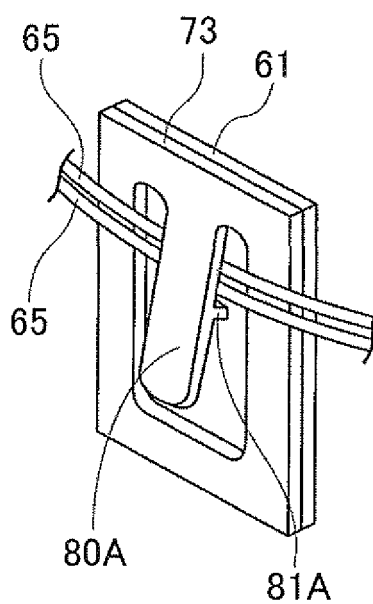
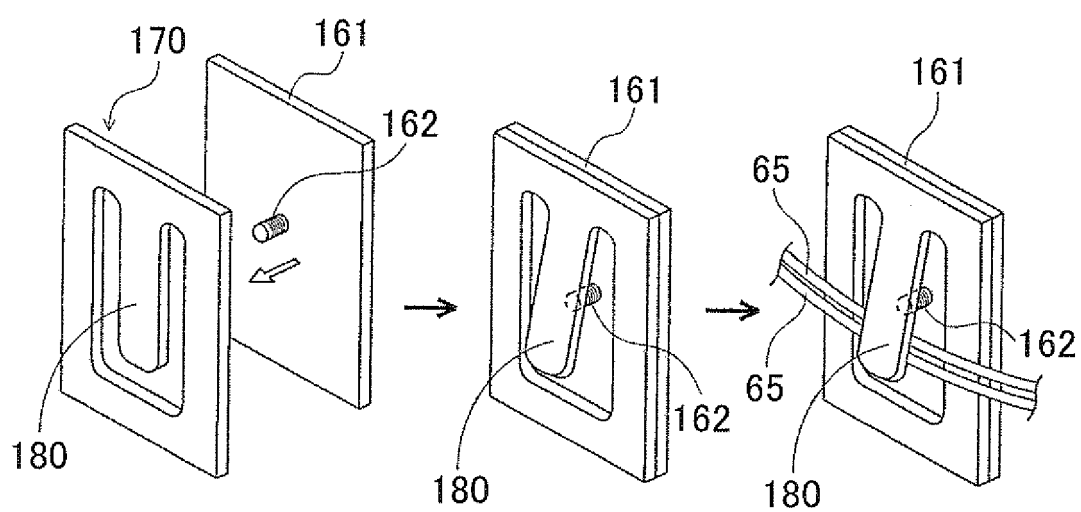


FIG.14



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/057759

A. CLASSIFICATION OF SUBJECT MATTER

F24F1/00 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24F1/00

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2010
Kokai Jitsuyo Shinan Koho	1971-2010	Toroku Jitsuyo Shinan Koho	1994-2010

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	WO 2007/060927 A1 (Daikin Industries, Ltd.), 31 May 2007 (31.05.2007), fig. 2, 3 & US 2008/0307816 A1 & EP 1953466 A1 & WO 2007/060927 A1 & CN 101300455 A	1 2-13
Y	JP 2004-125231 A (Chofu Seisakusho Co., Ltd.), 22 April 2004 (22.04.2004), fig. 3, 4 (Family: none)	2-13
A	JP 2002-061885 A (Daikin Industries, Ltd.), 28 February 2002 (28.02.2002), entire text; all drawings (Family: none)	1-13

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

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Date of the actual completion of the international search
29 June, 2010 (29.06.10)Date of mailing of the international search report
13 July, 2010 (13.07.10)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/057759

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 9-126496 A (Matsushita Electric Industrial Co., Ltd.), 16 May 1997 (16.05.1997), entire text; all drawings (Family: none)	1-13

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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