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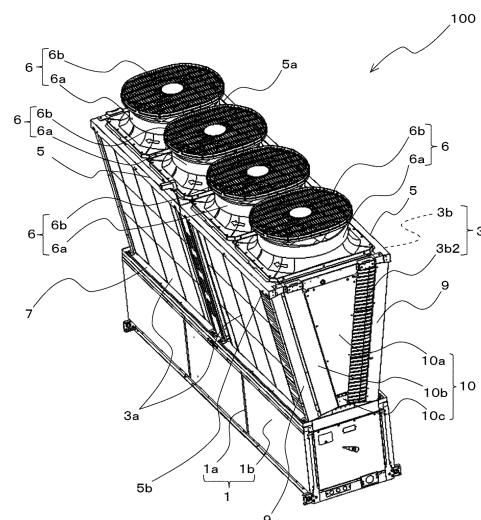
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(54) **OUTDOOR UNIT FOR REFRIGERATION CYCLE DEVICE**

(57) An outdoor unit for a refrigeration cycle apparatus includes: a heat exchanger having an outer surface inclined downward; a drain pan on which the heat exchanger is set; a top frame on which a fan is set, the top frame being disposed at a top of the heat exchanger; and a support attached to the drain pan and the top frame, the support extending between the drain pan and the top frame.

FIG. 1



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Description

Technical Field

[0001] The present disclosure relates to an outdoor unit for a refrigeration cycle apparatus. The outdoor unit is usable as, for example, a heat source unit for a heat pump apparatus.

Background Art

[0002] Patent Literature 1 discloses an outdoor unit for a refrigeration cycle apparatus. The outdoor unit includes an oblong box forming a machine chamber, a plurality of heat exchangers set in the long-side direction of the box, and fan guards that are set at the plurality of heat exchangers and that accommodate respective fans. The plurality of heat exchangers are each disposed to face each other. The plurality of heat exchangers are set on the box such that each outer surface thereof faces obliquely downward.

[0003] When the outdoor unit for a refrigeration cycle apparatus in Patent Literature 1 is used for, for example, a large building, a plurality of the outdoor units are disposed side by side in the short-side direction of the box, and spaces are formed between the boxes of the outdoor units adjacent to each other and between the heat exchangers of the outdoor units adjacent to each other. The spaces formed between the boxes of the outdoor units adjacent to each other and between the heat exchangers of the outdoor units adjacent to each other are usable as workspaces for maintenance checks of the outdoor units.

Citation List

Patent Literature

[0004] Patent Literature 1: International Publication No. 2011/013672

Summary of Invention

Technical Problem

[0005] A top frame is set on each pair of the plurality of heat exchangers of the outdoor unit for a refrigeration cycle apparatus in Patent Literature 1. The fan is set on the top frame. Thus, for heat exchanger replacement, the fan has to be detached before the top frame is detached. However, the fan has to be detached in a space above the top frame. Thus, not all the steps of the heat exchanger replacement can be performed in the workspace formed between the outdoor units adjacent to each other.

[0006] The present disclosure has been made to solve the above problem, and an object of the present disclosure is to provide an outdoor unit for a refrigeration cycle apparatus, all the steps of heat exchanger replacement

being able to be performed in the workspace formed between the outdoor units adjacent to each other.

Solution to Problem

[0007] An outdoor unit for a refrigeration cycle apparatus according to an embodiment of the present disclosure includes: a heat exchanger having an outer surface inclined downward; a drain pan on which the heat exchanger is set; a top frame on which a fan is set, the top frame being disposed at a top of the heat exchanger; and a support attached to the drain pan and the top frame, the support extending between the drain pan and the top frame.

Advantageous Effects of Invention

[0008] The outdoor unit for a refrigeration cycle apparatus according to the embodiment of the present disclosure includes the support joined to the drain pan and the top frame to be located therebetween. Thus, it is possible to attach and detach the heat exchanger in the space between the outdoor units adjacent to each other with the top frame supported by the support. Accordingly, the fan does not have to be detached from the outdoor unit for a refrigeration cycle apparatus according to the embodiment of the present disclosure. As a result, all the steps of heat exchange unit replacement can be performed in the space formed between the outdoor units adjacent to each other.

Brief Description of Drawings

[0009]

[Fig. 1] Fig. 1 is a perspective view illustrating an example of the external structure of an outdoor unit for a refrigeration cycle apparatus according to Embodiment 1.

[Fig. 2] Fig. 2 is an exploded perspective view of a fan in Fig. 1.

[Fig. 3] Fig. 3 is an enlarged perspective view illustrating part of the structure of a top frame from which a fan has been detached.

[Fig. 4] Fig. 4 is a side view of a modification example of the outdoor unit in Fig. 1 when viewed in the long-side direction from a side thereof.

[Fig. 5] Fig. 5 is a schematic top view illustrating an example of the disposition pattern of a first heat exchanger and a second heat exchanger of the outdoor unit according to Embodiment 1.

[Fig. 6] Fig. 6 illustrates a first modification example of the disposition pattern of the first heat exchanger and the second heat exchanger in Fig. 5.

[Fig. 7] Fig. 7 illustrates a second modification example of the disposition pattern of the first heat exchanger and the second heat exchanger in Fig. 5.

[Fig. 8] Fig. 8 is an exploded view illustrating the po-

sitional relationship between the second heat exchanger and a support of the outdoor unit in Embodiment 1.

[Fig. 9] Fig. 9 is a perspective view illustrating an example of the structure of the support in Embodiment 1.

[Fig. 10] Fig. 10 is a perspective view illustrating the positional relationship between a drain pan and the supports when viewed from the inside of the outdoor unit.

[Fig. 11] Fig. 11 is a perspective view illustrating the structure of a base to be attached to the drain pan.

[Fig. 12] Fig. 12 is a perspective view illustrating the positional relationship between the top frame and the support when viewed from the outside of the outdoor unit.

[Fig. 13] Fig. 13 illustrates another modification example of the outdoor unit in Fig. 1.

[Fig. 14] Fig. 14 is a schematic view illustrating the positional relationship between the drain pan and the supports when the outdoor unit is viewed in the long-side direction from a side of the outdoor unit.

[Fig. 15] Fig. 15 is a perspective view illustrating the outdoor unit in Fig. 1 from which the supports have been detached.

[Fig. 16] Fig. 16 is a perspective view illustrating the outdoor unit in Fig. 15 from which one first heat exchanger has been detached.

[Fig. 17] Fig. 17 is a perspective view illustrating an example of the attachment mode of a design panel different from that in the outdoor unit in Fig. 1.

[Fig. 18] Fig. 18 is a perspective view illustrating an example of the positional relationship between the design panel and the base when viewed from the inside of the outdoor unit.

[Fig. 19] Fig. 19 is an enlarged front view of the part in Fig. 18 where a drain pan maintenance panel is attached.

[Fig. 20] Fig. 20 is a perspective view illustrating the structure of the drain pan maintenance panel.

[Fig. 21] Fig. 21 is a perspective view illustrating an example of the attachment mode of the drain pan maintenance panel when viewed from the inside of the outdoor unit.

[Fig. 22] Fig. 22 is a sectional view taken along line A-A in Fig. 19.

Description of Embodiments

Embodiment 1

[0010] An outdoor unit 100 for a refrigeration cycle apparatus according to Embodiment 1 will be described. Fig. 1 is a perspective view illustrating an example of the external structure of the outdoor unit 100 for a refrigeration cycle apparatus according to Embodiment 1. In the following drawings including Fig. 1, the size relationships or the shapes of the components may differ from those

of actual ones. In addition, in the following drawings, the same components or parts or components or parts having the same functions have the same reference signs or have no reference signs. Basically, the positional relationships between the components of the outdoor unit 100 in, for example, an up-down direction, a left-right direction, or a front-rear direction are directions when the outdoor unit 100 is set in a usable state.

[0011] Although not illustrated, the outdoor unit 100 for a refrigeration cycle apparatus is connected to an indoor unit by heat medium pipes. A heat medium such as water or brine is circulated, by, for example, operation of a pump apparatus, between the outdoor unit 100 and the indoor unit. In the outdoor unit 100, high-temperature or low-temperature heat is discharged from a high-temperature or low-temperature heat medium passing through the inside thereof. The outdoor unit 100 has an oblong shape in top view. When a refrigeration cycle apparatus is used for, for example, a large building, a plurality of the outdoor units 100 are disposed side by side in the short-side direction. Such an outdoor unit 100 for a refrigeration cycle apparatus is also referred to as a chilling unit and is usable as, for example, a heat source unit for a heat pump apparatus.

[0012] The outdoor unit 100 includes a box 1, which is set on a floor, heat exchangers 3, which are disposed at the top of the box 1, and top frames 5, which are disposed at the top of heat exchange. A drain pan 7, on which the heat exchangers 3 are set, is disposed at the top of the box 1. Fans 6 are set on the top frames 5.

[0013] The box 1 has an oblong rectangular shape. The box 1 is formed of frames 1a and side walls 1b, which close the spaces between the frames 1a adjacent to each other. A machine chamber of the outdoor unit 100 is formed in the internal space of the box 1. Although not illustrated, for example, a compressor, a pressure reducing device, and a water-cooled heat exchanger are accommodated in the machine chamber. The compressor, the heat exchangers 3, the pressure reducing device, and the water-cooled heat exchanger are connected by refrigerant pipes to circulate refrigerant. Most of the refrigerant pipes are accommodated in the machine chamber. The compressor sucks low-pressure refrigerant and discharges high-pressure refrigerant. For example, a scroll compressor is used as the compressor. The pressure reducing device decompresses and expands high-pressure liquid refrigerant. For example, an expansion valve is used as the pressure reducing device. The water-cooled heat exchanger causes heat exchange to be performed between a heat medium and refrigerant flowing in an internal passage thereof. For example, a plate heat exchanger is used as the water-cooled heat exchanger. The width of the box 1 in the short-side direction is set to be smaller than the width of the top frame 5 in the short-side direction.

[0014] In addition, although not illustrated, an electrical component box in which, for example, a controller configured to control operation of the compressor and an

expansion device is accommodated is accommodated in the machine chamber. For example, a microcomputer is used as the controller.

[0015] The drain pan 7 is a water container for discharging drain water produced in the heat exchangers 3 to the outside of the outdoor unit 100. The drain pan 7 is disposed at the top of the box 1 and is provided below the heat exchangers 3. In addition, the drain pan 7 functions as a top plate of the box 1 and partitions off the machine chamber from the space in which the heat exchangers 3 are disposed. For example, the drain pan 7 is attached to the frames 1a of the box 1 by screwing or other methods. Although not illustrated, a drain pipe that is connected to the drain pan 7 and through which drain water received by the drain pan 7 is discharged to the outside can be provided in a space below the drain pan 7, that is, closer to the machine chamber.

[0016] The heat exchangers 3 cause heat exchange to be performed between air passing through the heat exchangers 3 and refrigerant flowing in the heat exchangers 3. The heat exchangers 3 are set on a heat exchanger setting plate 7a, which will be described later in Fig. 10, of the drain pan 7. Although not illustrated, for example, the heat exchangers 3 are detachably attached to supports 9 and design panels 10 via attachments attached to the supports 9 and the design panels 10 by screwing or other methods. First heat exchangers 3a and second heat exchangers 3b are used as the heat exchangers 3. The first heat exchangers 3a and the second heat exchangers 3b are disposed along a pair of edges extending in the long-side direction of the drain pan 7 to face each other with spaces therebetween. Two first heat exchangers 3a and two second heat exchangers 3b are disposed in the outdoor unit 100 in Fig. 1, but each of the numbers of the first heat exchangers 3a and the second heat exchangers 3b provided therein may be one or three or more. For example, an air-cooled finned tube heat exchanger is used as each of the first heat exchanger 3a and the second heat exchanger 3b. Details of the heat exchangers 3 will be described later. In the following description, the first heat exchanger 3a and the second heat exchanger 3b are referred to as the heat exchangers 3 when it is unnecessary to particularly distinguish the first heat exchanger 3a and the second heat exchanger 3b.

[0017] The top frames 5 and the fans 6 form the top of the outdoor unit 100. The top frames 5 are each made of a rectangular metal plate and cover the tops of the heat exchangers 3. The top frame 5 includes a setting surface 5a, on which the fans 6 are set, and edge surfaces 5b, which extend downward from respective edges of the setting surface 5a. The edge surfaces 5b of the top frame 5 extend downward to cover the tops of the heat exchangers 3.

[0018] Fig. 2 is an exploded perspective view of the fan 6 in Fig. 1. Fig. 3 is an enlarged perspective view illustrating part of the structure of the top frame 5 from which the fan 6 has been detached. The fan 6 includes a bell mouth 6a, which defines an air passage of the

outdoor unit 100, a fan guard 6b, which is disposed at the top of the bell mouth 6a and which has vent holes, and a fan body 6c, which is accommodated in the bell mouth 6a. In Fig. 1, four fans 6 are set on the top frames 5, but the number of the fans 6 is not limited to four as long as the number thereof is one or more. For example, an axial fan such as a propeller fan is used as the fan body 6c.

[0019] The setting surface 5a of the top frame 5 has an opening 5a1, which is in communication with the inside of the bell mouth 6a. The top frame 5 includes fan setting racks 5c, which cross the opening 5a1 and are attached to the setting surface 5a. The fan body 6c is attached to the fan setting rack 5c by screwing or other methods. The bell mouth 6a is attached to the setting surface 5a, which is around the opening 5a1, by screwing or other methods. In Fig. 1, two top frames 5 are provided, and two fans 6 are set on each of the top frames 5. However, the configuration is not limited thereto. For example, four top frames 5 may be provided, and one fan 6 may be set on each of the top frames 5. Alternatively, one top frame 5 may be provided, and four fans 6 may be set on the top frame 5. When a plurality of top frames 5 are provided, the top frames 5 can be joined to each other by welding, screwing, or other methods.

[0020] By rotation of the fan bodies 6c, air outside the outdoor unit 100 is guided, from the outside of the outdoor unit 100, into the internal space surrounded by the first heat exchangers 3a, the second heat exchangers 3b, and the drain pan 7 and is subjected to heat exchange in the first heat exchangers 3a and the second heat exchangers 3b. The air that has been subjected to heat exchange in the first heat exchangers 3a and the second heat exchangers 3b is blown out from the vent holes of the fan guards 6b via the openings 5a1, which are provided in the respective top frames 5, and the bell mouths 6a. That is, an air passage is formed in the space surrounded by the first heat exchangers 3a, the second heat exchangers 3b, and the drain pan 7 of the outdoor unit 100.

[0021] Next, the disposition and the configuration of the heat exchangers 3 will be described with reference to Fig. 1.

[0022] In Fig. 1, the first heat exchangers 3a and the second heat exchangers 3b are disposed such that each outer surface of the first heat exchangers 3a and the second heat exchangers 3b, that is, each surface thereof into which air flows, is inclined downward. Thus, when a plurality of the outdoor units 100 are disposed side by side in the short-side direction, an inverted V-shaped space is formed between the heat exchangers 3 of the outdoor units 100 adjacent to each other, and airflow can be guided, from the inverted V-shaped space, into the first heat exchangers 3a and the second heat exchangers 3b. Accordingly, even when a plurality of the outdoor units 100 are disposed side by side in the short-side direction of the box 1, a space does not have to be provided between the top frames 5 adjacent to each other. As a result,

it is possible to effectively use the space in which the outdoor units 100 are disposed. In addition, as described above, since the width of the box 1 in the short-side direction is set to be smaller than the width of the top frame 5 in the short-side direction, a space is formed between the boxes 1 of the outdoor units 100 adjacent to each other. As a result, it is possible to secure a workspace for, for example, maintenance checks of the machine chambers.

[0023] In the outdoor unit 100 in Fig. 1, both the outer surfaces of the first heat exchanger 3a and the second heat exchanger 3b are inclined downward, but the configuration is not limited thereto. It is sufficient that at least one of the outer surfaces of the first heat exchanger 3a and the second heat exchanger 3b be inclined downward.

[0024] Fig. 4 is a side view of a modification example of the outdoor unit 100 in Fig. 1 when viewed in the long-side direction from a side thereof. In the outdoor unit 100 in Fig. 4, only the outer surface of the second heat exchanger 3b is inclined downward. The first heat exchanger 3a is attached in the direction perpendicular to a floor. When a plurality of the outdoor units 100 are disposed side by side in the short-side direction, and the outdoor unit 100 in Fig. 4 is disposed as the leftmost row, it is possible to inhibit a space that cannot be effectively used from being formed at the left of the outdoor unit 100 in Fig. 4. In addition, when a plurality of the outdoor units 100 are disposed side by side in the short-side direction, the outdoor unit 100 disposed as the rightmost row can have a configuration in which only the outer surface of the first heat exchanger 3a is inclined downward and in which the second heat exchanger 3b is attached in the direction perpendicular to a floor.

[0025] Fig. 5 is a schematic top view illustrating an example of the disposition pattern of the first heat exchanger 3a and the second heat exchanger 3b of the outdoor unit 100 according to Embodiment 1. Fig. 6 illustrates a first modification example of the disposition pattern of the first heat exchanger 3a and the second heat exchanger 3b in Fig. 5. Fig. 7 illustrates a second modification example of the disposition pattern of the first heat exchanger 3a and the second heat exchanger 3b in Fig. 5. Figs. 5 to 7 are schematic views for illustrating the disposition pattern of the first heat exchanger 3a and the second heat exchanger 3b. The actual shapes of the first heat exchanger 3a and the second heat exchanger 3b in top view differ from the shapes in Figs. 5 to 7 because at least surfaces thereof into which air flows are inclined downward.

[0026] In Fig. 5, the first heat exchanger 3a and the second heat exchanger 3b each having a flat shape are disposed so as to face each other. To improve the heat exchange performance of the first heat exchanger 3a and the second heat exchanger 3b, two or more first heat exchangers 3a and two or more second heat exchangers 3b have been arranged as rows. However, air that has passed through the first heat exchanger 3a and the sec-

ond heat exchanger 3b as outer rows passes through the first heat exchanger 3a and the second heat exchanger 3b as inner rows. Thus, there has been a case in which sufficient heat exchange performance cannot be achieved. In addition, there has been a case in which the outdoor unit 100 is increased in size to secure the space in which the first heat exchangers 3a and the second heat exchangers 3b are accommodated.

[0027] Examples of a method for achieving sufficient heat exchange performance without increasing the numbers of the first heat exchangers 3a and the second heat exchangers 3b as rows include a method using the first heat exchanger 3a and the second heat exchanger 3b each having an L shape in Fig. 6 instead of the first heat exchanger 3a and the second heat exchanger 3b each having a flat shape in Fig. 5. The use of the first heat exchanger 3a and the second heat exchanger 3b each having an L shape in Fig. 6 instead of the first heat exchanger 3a and the second heat exchanger 3b each having a flat shape in Fig. 5 enables an increase in the heat exchange region without impairing heat exchange performance. Figs. 1 and 4 illustrate examples using the second heat exchanger 3b having an L shape in Fig. 6.

[0028] In addition, the use of the first heat exchanger 3a and the second heat exchanger 3b each having a U shape in Fig. 7 instead of the first heat exchangers 3a and the second heat exchangers 3b in Figs. 5 and 6 enables a further increase in the heat exchange region without impairing heat exchange performance.

[0029] Each lower right bent region of the second heat exchangers 3b in Figs. 6 and 7 corresponds to a bent portion 3b1 illustrated in Figs. 8, 15, and 16 described later. In addition, each lower end flat heat exchange region of the second heat exchangers 3b in Figs. 6 and 7 corresponds to a short-side heat exchange region 3b2 illustrated in Figs. 8, 15, and 16 described later and in Figs. 1 and 4. The bent portion 3b1 and the short-side heat exchange region 3b2 will be described later.

[0030] To facilitate replacement of the first heat exchangers 3a and the second heat exchangers 3b, the supports 9, which are attached to the drain pan 7 and the top frames 5 and which extend from the drain pan 7 to the top frames 5, are provided in the outdoor unit 100 in Embodiment 1. The structure and the disposition of the supports 9 will be described with reference to Figs. 1 and 8 to 12.

[0031] Fig. 8 is an exploded perspective view illustrating the positional relationship between the second heat exchanger 3b and the support 9 of the outdoor unit 100 in Embodiment 1 when viewed from above the drain pan 7. Fig. 9 is a perspective view illustrating an example of the structure of the support 9 in Embodiment 1. Fig. 10 is a perspective view illustrating the positional relationship between the drain pan 7 and the supports 9 when viewed from the inside of the outdoor unit 100. Fig. 11 is a perspective view illustrating the structure of a base 11 to be attached to the drain pan 7. Fig. 12 is a perspective view illustrating the positional relationship between the

top frame 5 and the support 9 when viewed from the outside of the outdoor unit 100.

[0032] The supports 9 are capable of supporting the top frame 5 when the heat exchangers 3 are detached. The supports 9 are disposed not to interfere with the heat exchangers 3. For example, the supports 9 are disposed to support four corners of the setting surface 5a of the top frame 5.

[0033] As illustrated in Fig. 9, for example, the support 9 includes a beam 9a, which has an L shape, a first attachment component 9b, and a second attachment component 9c, the first attachment component 9b and the second attachment component 9c being disposed at respective ends of the beam 9a. The beam 9a having an L shape enables an increase in the strength of the support 9, whereby the top frame 5 is stably supported. The shape of the beam 9a is not limited to an L shape and may be a flat shape as long as the support 9 is capable of stably supporting the top frame 5.

[0034] As illustrated in Fig. 10, the drain pan 7 includes the heat exchanger setting plate 7a, on which the heat exchangers 3 are set. For example, the heat exchanger setting plate 7a is a metal plate made of stainless steel or other materials and is integrally formed with the drain pan 7. The heat exchanger setting plate 7a has a plurality of holes 7b, which guide water droplets produced in the heat exchangers 3 to the drain pan 7.

[0035] In addition, the base 11, which includes a body surface 11a having a triangular shape, is attached to the drain pan 7. As illustrated in Fig. 11, the base 11 includes two attachment plates 11b, which are continuous with the body surface 11a and which are disposed to be apart from each other. The base 11 is attached to the drain pan 7 via the attachment plates 11b by screwing, welding, or other methods.

[0036] In addition, as illustrated in Figs. 10 and 11, the base 11 includes support surfaces 11c, which are disposed along oblique sides of the body surface 11a having a triangular shape. As illustrated in Fig. 10, when the heat exchanger setting plate 7a is set on the support surfaces 11c, upper surfaces of the heat exchanger setting plate 7a are surfaces inclined downward from the center of the outdoor unit 100 toward the outside. The second attachment component 9c of the support 9 is attached to the support surface 11c of the base 11 via the heat exchanger setting plate 7a by screwing or other methods. The base 11 is also referred to as a pillar and can be integrally formed with the drain pan 7 to serve as part of the drain pan 7.

[0037] The above configuration enables the drain pan 7 to support the heat exchanger 3 such that the outer surface of the heat exchanger 3 is inclined downward. In addition, with the above configuration, the support 9 is supported to extend, along the outer surface of the heat exchanger 3, from the drain pan 7 to the top frame 5. Thus, the above configuration enables the drain pan 7 to stably support both the heat exchanger 3 and the support 9.

[0038] As illustrated in Figs. 9 and 12, the first attachment component 9b includes a top frame setting surface 9b1, which is disposed at an end of the beam 9a to form an L shape, and a top frame attachment surface 9b2, which is joined to the top frame setting surface 9b1. The top frame setting surface 9b1 supports a lower edge corner 5b1 of the edge surface 5b of the top frame 5. The top frame attachment surface 9b2 is attached to the outer side of the edge surface 5b of the top frame 5 by screwing or other methods.

[0039] As illustrated in Fig. 8, the support 9 is disposed, along the outer surface of the second heat exchanger 3b, outside the bent portion 3b1 of the second heat exchanger 3b. Here, the bent portion 3b1 of the second heat exchanger 3b denotes the boundary region in top view between a heat exchange region of the second heat exchanger 3b extending in the long-side direction of the drain pan 7 and the short-side heat exchange region 3b2 of the second heat exchanger 3b extending in the short-side direction of the drain pan 7. The space between fins adjacent to each other of the bent portion 3b1 of the second heat exchanger 3b is larger than that of any other heat exchange region of the second heat exchanger 3b. The number of fins of the bent portion 3b1 is smaller than that of any other heat exchange region of the second heat exchanger 3b.

[0040] As illustrated in Fig. 1, when viewed in the short-side direction of the box 1, the support 9 is inclined from the top frame 5 toward the drain pan 7, is disposed along the outer surface of the second heat exchanger 3b, and is provided at a position that does not interfere with the second heat exchanger 3b.

[0041] With the above configuration, even when the second heat exchanger 3b in Fig. 8, that is, the second heat exchanger 3b having an L shape in Fig. 6, is replaced with the second heat exchanger 3b having a flat shape in Fig. 5 or the second heat exchanger 3b having a U shape in Fig. 7, the support 9 does not interfere with the second heat exchanger 3b. Thus, even when the second heat exchanger 3b is changed, the support 9 does not have to be replaced. Accordingly, the outdoor unit 100 can be formed by using the same support 9. As a result, with the above configuration, it is possible to improve the serviceability of the outdoor unit 100, to reduce the number of man-hours for designing the support 9, and to reduce costs due to the use of the common support 9.

[0042] In addition, when the support 9 is disposed outside the bent portion 3b1 of the second heat exchanger 3b, it is possible to minimize the amount of airflow that passes through the second heat exchanger 3b and that is blocked by the support 9. The space between fins adjacent to each other of the bent portion 3b1 is larger than that of any other heat exchange region of the second heat exchanger 3b, and the number of fins of the bent portion 3b1 is smaller than that of any other heat exchange region of the second heat exchanger 3b. Accordingly, the effect of the bent portion 3b1 on the heat exchange performance of the second heat exchanger 3b

is small. Thus, when the support 9 is disposed outside the bent portion 3b1 of the second heat exchanger 3b, it is possible to minimize impairment of the heat exchange performance of the second heat exchanger 3b.

[0043] Fig. 13 illustrates another modification example of the outdoor unit 100 in Fig. 1. The example in which the supports 9 are disposed to support four corners of the setting surface 5a of the top frame 5 has been described above. For example, as illustrated in Fig. 13, the supports 9 may be disposed to support two corners on a diagonal line of the setting surface 5a of the top frame 5. When the supports 9 are disposed to support two corners on a diagonal line of the setting surface 5a of the top frame 5, it is possible to reduce the number of components of the outdoor unit 100 and to thus reduce the manufacturing cost of the outdoor unit 100. In addition, when the heat exchanger 3 having an L shape in Fig. 6 or the heat exchanger 3 having a U shape in Fig. 7 is used, for example, it is possible to inhibit ventilation in a part such as the bent portion 3b1 of the second heat exchanger 3b from being prevented by the support 9.

[0044] Fig. 14 is a schematic view illustrating the positional relationship between the drain pan 7 and the supports 9 when the outdoor unit 100 is viewed in the long-side direction from a side of the outdoor unit 100. Fig. 15 is a perspective view illustrating the outdoor unit 100 in Fig. 1 from which the supports 9 have been detached. Fig. 16 is a perspective view illustrating the outdoor unit 100 in Fig. 15 from which one first heat exchanger 3a has been detached.

[0045] As described above, the support 9 is attached to the inside of each of the drain pan 7 and the top frame 5. Thus, a depth hd of the drain pan 7 has to be adjusted to detach the support 9 from the drain pan 7.

[0046] In the following description, the dimension from an upper end of the drain pan 7 to a lower end of the top frame 5 is an opening dimension he , the dimension of a long side of the support 9 is a length L , and the dimension of a short side of the bottom of the support 9 is a length d . In addition, the inclination of a long side of the support 9 relative to the vertical direction is an angle θ , and the inclination of the short side of the support 9 relative to the horizontal direction is an angle α .

[0047] A distance H from the lower end of the top frame 5 to the bottom of the drain pan 7 is expressed by the sum of the depth hd of the drain pan 7 and the opening dimension he from the upper end of the drain pan 7 to the lower end of the top frame 5. To detach the support 9 in the workspace between the outdoor units 100 adjacent to each other, first, a lower part of the outdoor unit 100 has to be detached from the support 9. Thus, the distance H from the lower end of the top frame 5 to the bottom of the drain pan 7 has to be larger than the length L of the long side of the support 9. Accordingly, the relationship between the distance H from the lower end of the top frame 5 to the bottom of the drain pan 7 and the length L of the long side of the support 9 is expressed by an expression (1):

$$H = he + hd > L \quad \dots(1)$$

[0048] On the other hand, in view of the relationship illustrated in Fig. 14, the opening dimension he from the upper end of the drain pan 7 to the lower end of the top frame 5 is expressed by the following expression.

$$he = L \times \cos \theta - d \times \sin \alpha \quad \dots(2)$$

[0049] Thus, the following relational expression (3) holds when the expression (2) is substituted into the expression (1):

$$hd > L \times (1 - \cos \theta) + d \times \sin \alpha \quad \dots(3)$$

[0050] Accordingly, when the drain pan 7 is formed such that the depth hd of the drain pan 7 satisfies the expression (3), it is possible to easily detach the support 9 in the workspace between the outdoor units 100 adjacent to each other.

[0051] In addition, when the length of the short side of the bottom of the support 9 is smaller than the length of a short side of the top of the support 9, the variable d of the expression (3) can be small. This further facilitates detachment of the support 9 and enables a size reduction of the drain pan 7. Furthermore, the supports 9 other than the detached support 9 are attached to the top frame 5, and the top frame 5 is thus kept supported by the supports 9. The width of the drain pan 7 in the short-side direction is set such that a lower end of the support 9 does not interfere with the upper end of the drain pan 7 during detachment of the support 9.

[0052] Similarly, the relational expression (3) holds for the case of detachment of the first heat exchanger 3a or the second heat exchanger 3b. For example, the depth hd of the drain pan 7 can be calculated by using the expression (3) in which the dimension of a long side of the first heat exchanger 3a is a length L , the dimension of a short side of the bottom of the first heat exchanger 3a is a length d , the inclination of a long side of the first heat exchanger 3a relative to the vertical direction is an angle θ , and the inclination of the short side of the first heat exchanger 3a relative to the horizontal direction is an angle α . Then, when the drain pan 7 is formed such that the depth hd of the drain pan 7 satisfies the expression (3), it is possible to easily detach the first heat exchanger 3a in the workspace between the outdoor units 100 adjacent to each other. In addition, when the drain pan 7 is formed such that the depth hd of the drain pan 7 satisfies the expression (3), it is possible to easily detach the second heat exchanger 3b in the workspace between the outdoor units 100 adjacent to each other. In this case, the top frame 5 is kept supported by the supports 9. Thus, it is possible to replace the first heat exchanger 3a and the second heat exchanger 3b with the top frame 5 at

tached.

[0053] Next, the design panel 10, which is attached between the first heat exchanger 3a and the second heat exchanger 3b and which forms some of the contours of the outdoor unit 100, will be described with reference to Figs. 1, 17, and 18.

[0054] Fig. 17 is a perspective view illustrating an example of the attachment mode of the design panel 10 different from that in the outdoor unit 100 in Fig. 1. Fig. 18 is a perspective view illustrating an example of the positional relationship between the design panel 10 and the base 11 when viewed from the inside of the outdoor unit 100.

[0055] The design panel 10 is formed by a main panel 10a, a sub panel 10b, which is attached to a side of the main panel 10a, and a drain pan maintenance panel 10c, which is disposed below the main panel 10a. For example, the main panel 10a is formed as a plate-like component having a trapezoidal shape whose upper end is longer than a lower end thereof. For example, an upper end of the main panel 10a is attached to the edge surface 5b of the top frame 5 by screwing or other methods. In the example of the outdoor unit 100 in Fig. 1, a left end of the main panel 10a is joined to the sub panel 10b by screwing or other methods, and a right end of the main panel 10a is joined to the short-side heat exchange region 3b2 of the second heat exchanger 3b. In the example in Fig. 17, the right end of the main panel 10a is joined to the sub panel 10b by screwing or other methods.

[0056] For example, the sub panel 10b is formed as a plate-like component having a quadrilateral shape. For example, an upper end of the sub panel 10b is attached to the edge surface 5b of the top frame 5 by screwing or other methods. As illustrated in Fig. 18, a lower end of the sub panel 10b is set on the base 11. In the example of the outdoor unit 100 in Fig. 1, a left end of the sub panel 10b is joined to the support 9 by screwing or other methods. In the example in Fig. 17, a right end of the sub panel 10b is joined to the support 9 by screwing or other methods.

[0057] Fig. 19 is an enlarged front view of the part in Fig. 18 where the drain pan maintenance panel 10c is attached. The drain pan maintenance panel 10c is disposed to close the opening formed between the main panel 10a, the sub panel 10b, the base 11, and the short-side heat exchange region 3b2 of the second heat exchanger 3b. As illustrated in Fig. 19, for example, the drain pan maintenance panel 10c is detachably attached to the main panel 10a by screwing or other methods.

[0058] Provision of the design panel 10 in the outdoor unit 100 enables inhibition of so-called short cycling that airflow blown out from the vent holes of the fan guards 6b is directly taken into the air passage of the outdoor unit 100 without passing through the heat exchangers 3.

[0059] The first heat exchanger 3a and the second heat exchanger 3b each having an L shape in Fig. 6 are used in Fig. 1. Thus, the design panel 10 is formed by three panels of the main panel 10a, the sub panel 10b, and the

drain pan maintenance panel 10c. In the case in Fig. 1, the short-side heat exchange region 3b2 of the second heat exchanger 3b having an L shape is located between the main panel 10a and the support 9.

[0060] On the other hand, when the second heat exchanger 3b having a flat shape in Fig. 5 is used in Fig. 1, there is no region corresponding to the short-side heat exchange region 3b2 of the second heat exchanger 3b having an L shape in Figs. 1 and 6. Thus, the space between the main panel 10a and the support 9 has to be closed to prevent short cycling of airflow. However, the space between the left end of the main panel 10a and the support 9 can be closed with a panel shaped to form a pair with the sub panel 10b.

[0061] In addition, when the first heat exchanger 3a having a U shape in Fig. 7 is used in Fig. 1, a heat exchange region of the first heat exchanger 3a, the heat exchange region being not illustrated and being shaped to form a pair with the short-side heat exchange region 3b2, is formed at the position of the sub panel 10b in Fig. 1. Thus, the design panel 10 is formed by the main panel 10a and the drain pan maintenance panel 10c and does not include the sub panel 10b.

[0062] As described above, the design panel 10 includes the main panel 10a and the drain pan maintenance panel 10c. Whether a plurality of sub panels 10b, one sub panel 10b, or no sub panel 10b is used can be selected according to the shapes of the first heat exchanger 3a and the second heat exchanger 3b. Thus, the design panel 10 can be formed by combining a plurality of identical panels according to the shapes of the first heat exchanger 3a and the second heat exchanger 3b. Accordingly, in Embodiment 1, manufacture of the main panel 10a, the drain pan maintenance panel 10c, and a plurality of sub panels 10b enables the first heat exchanger 3a and the second heat exchanger 3b to be flexibly replaced and thus enables provision of the outdoor unit 100 having a high degree of freedom in design.

[0063] Fig. 20 is a perspective view illustrating the structure of the drain pan maintenance panel 10c. Fig. 21 is a perspective view illustrating an example of the attachment mode of the drain pan maintenance panel 10c when viewed from the inside of the outdoor unit 100. Fig. 22 is a sectional view taken along line A-A in Fig. 19. The drain pan maintenance panel 10c is continuous with a guide component 12, which is configured to guide, to the drain pan 7, water droplets flowing from the main panel 10a and the sub panel 10b to the drain pan maintenance panel 10c. The guide component 12 is a plate-like component inclined from a joint portion 12b, where the guide component 12 and the drain pan maintenance panel 10c are joined to each other, toward an end portion 12a. The guide component 12 is attached to the body surface 11a of the base 11 such that water droplets flow in the space between the guide component 12 and the body surface 11a of the base 11. For example, the space between the guide component 12 and the body surface 11a of the base 11 in which water droplets flow is adjusted

by changing the joint strength produced by screwing or other methods. The guide component 12 is inclined from the joint portion 12b, where the guide component 12 and the drain pan maintenance panel 10c are joined to each other, toward the end portion 12a.

[0064] When the drain pan maintenance panel 10c is provided with the guide component 12, as represented by solid arrows in Figs. 21 and 22, paths along which water droplets adhered to an inner surface of the design panel 10 are guided to the drain pan 7 are formed between the guide component 12 and the body surface 11a of the base 11. Water droplets that have dripped from the guide component 12 pass through the space between the two attachment plates 11b, which are illustrated in Fig. 11 and which are disposed to be apart from each other, and flow out to the drain pan 7. Thus, it is possible to inhibit the drain pan 7 and the design panel 10 from being soiled due to water dripping from the design panel 10 or splashes of dripped water. In addition, when the drain pan maintenance panel 10c is attached, it is possible to inhibit so-called short cycling that airflow blown out from the vent holes of the fan guards 6b is directly taken into the air passage chamber of the outdoor unit 100. Furthermore, when the drain pan maintenance panel 10c is detached, an opening is formed close to the drain pan 7. Thus, it is possible to facilitate maintenance such as cleaning of the drain pan 7.

Reference Signs List

[0065] 1: box, 1a: frame, 1b: side wall, 3: heat exchanger, 3a: first heat exchanger, 3b: second heat exchanger, 3b1: bent portion, 3b2: short-side heat exchange region, 5: top frame, 5a: setting surface, 5a1: opening, 5b: edge surface, 5b1: lower edge corner, 5c: fan setting rack, 6: fan, 6a: bell mouth, 6b: fan guard, 6c: fan body, 7: drain pan, 7a: heat exchanger setting plate, 7b: hole, 9: support, 9a: beam, 9b: first attachment component, 9b1: top frame setting surface, 9b2: top frame attachment surface, 9c: second attachment component, 10: design panel, 10a: main panel, 10b: sub panel, 10c: drain pan maintenance panel, 11: base, 11a: body surface, 11b: attachment plate, 11c: support surface, 12: guide component, 12a: end portion, 12b: joint portion, 100: outdoor unit

Claims

1. An outdoor unit for a refrigeration cycle apparatus, the outdoor unit comprising:

a heat exchanger having an outer surface inclined downward;
a drain pan on which the heat exchanger is set;
a top frame on which a fan is set, the top frame being disposed at a top of the heat exchanger;
and
a support attached to the drain pan and the top

frame, the support extending between the drain pan and the top frame.

2. The outdoor unit for a refrigeration cycle apparatus of claim 1, the outdoor unit further comprising a plurality of supports each of which extending, along the outer surface of the heat exchanger, between the drain pan and the top frame.
3. The outdoor unit for a refrigeration cycle apparatus of claim 1 or 2, wherein the support has an L shape.
4. The outdoor unit for a refrigeration cycle apparatus of any one of claims 1 to 3, wherein the support is detachably attached to the drain pan and the top frame.
5. The outdoor unit for a refrigeration cycle apparatus of claim 4, wherein when a dimension of a long side of the support is a length L, a dimension of a short side of the support is a length d, an inclination of the long side of the support relative to a vertical direction is an angle θ , and an inclination of the short side of the support relative to a horizontal direction is an angle α , the drain pan is formed such that a depth hd of the drain pan satisfies an expression of $hd > L \times (1 - \cos \theta) + d \times \sin \alpha$.
6. The outdoor unit for a refrigeration cycle apparatus of any one of claims 1 to 5, wherein the heat exchanger has a flat shape, an L shape, or a U shape.
7. The outdoor unit for a refrigeration cycle apparatus of any one of claims 1 to 6, the outdoor unit further comprising a design panel attached between the drain pan and the top frame.
8. The outdoor unit for a refrigeration cycle apparatus of claim 7, wherein the design panel is formed of a combination of a plurality of panels.
9. The outdoor unit for a refrigeration cycle apparatus of claim 8, wherein

one of the plurality of panels is a drain pan maintenance panel, and

the drain pan maintenance panel is provided with a guide component configured to guide, to the drain pan, water droplets adhered to an inner surface of the drain pan maintenance panel.

FIG. 1

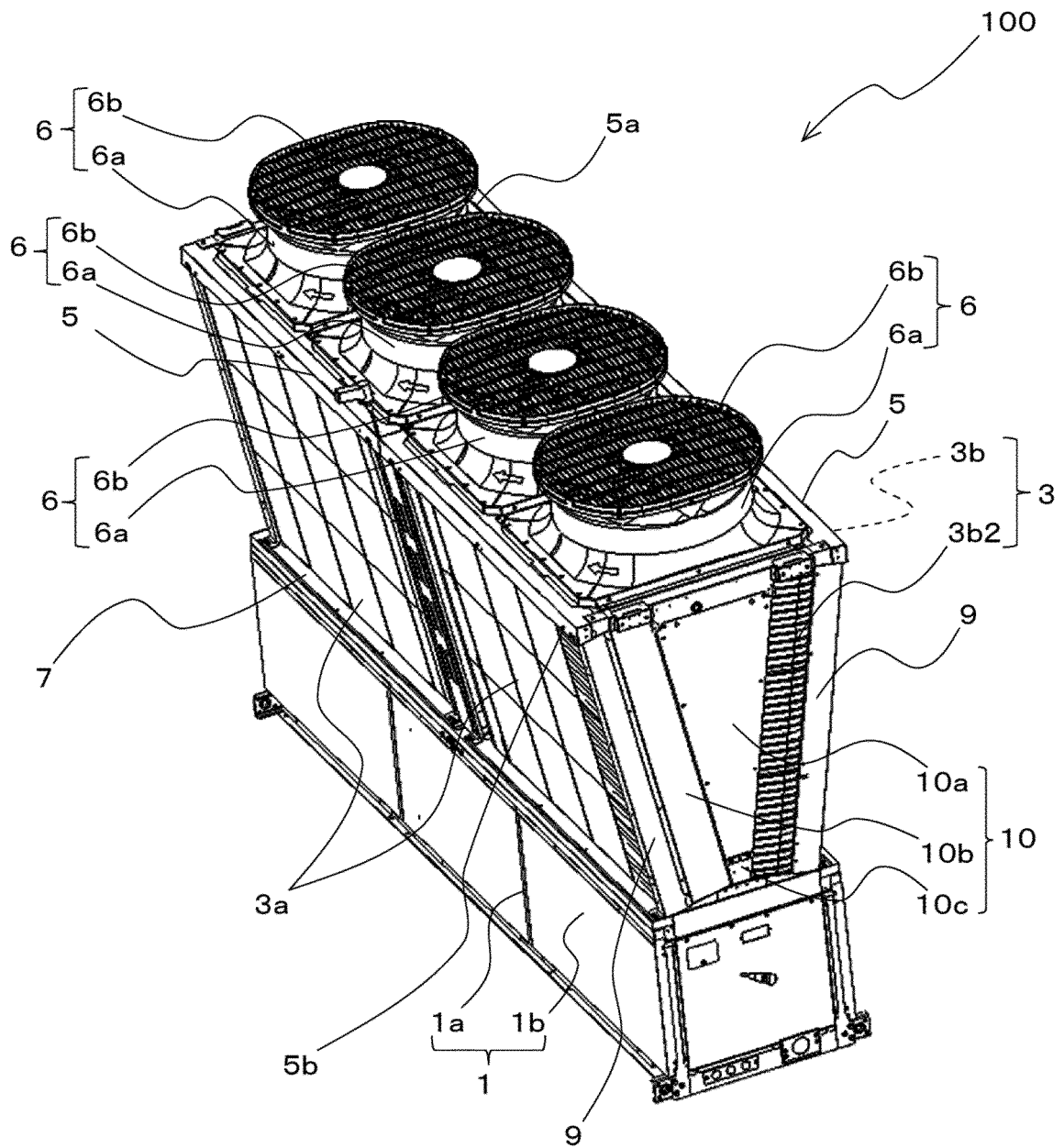


FIG. 2

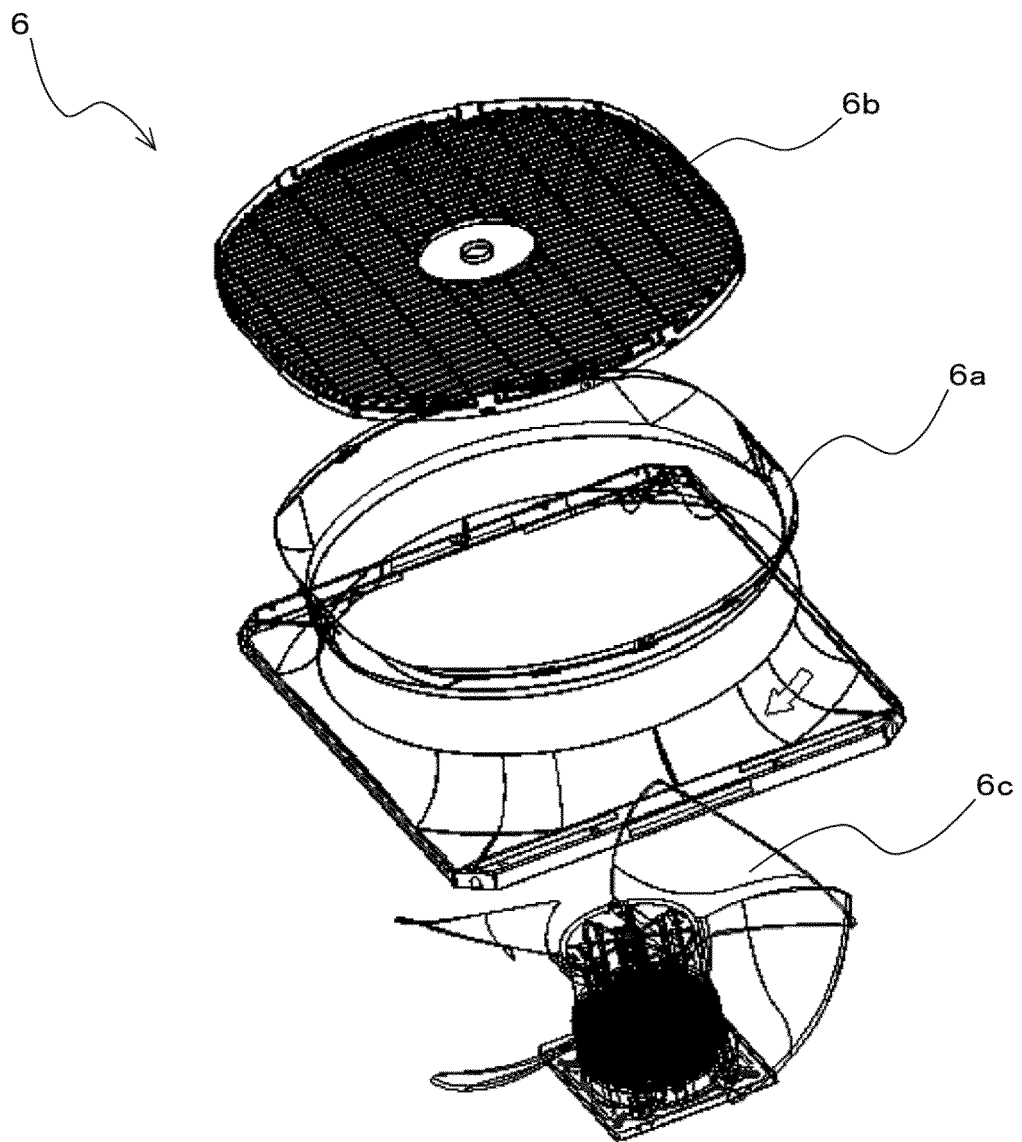


FIG. 3

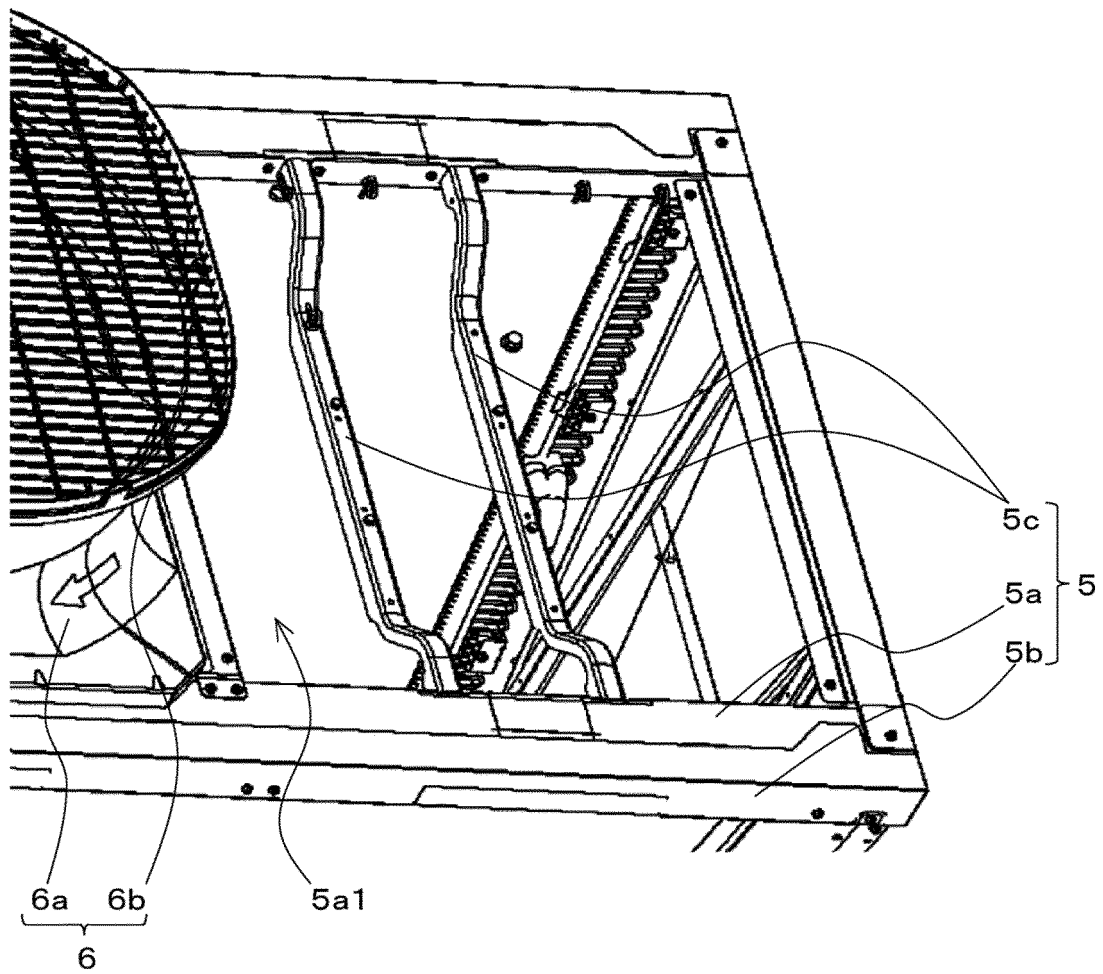


FIG. 4

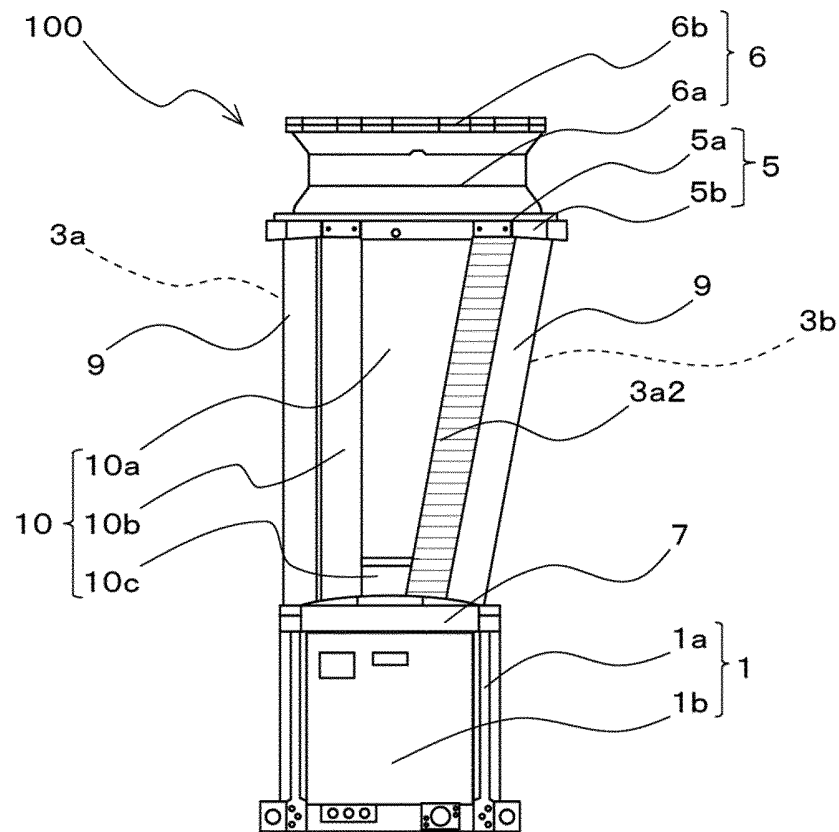


FIG. 5

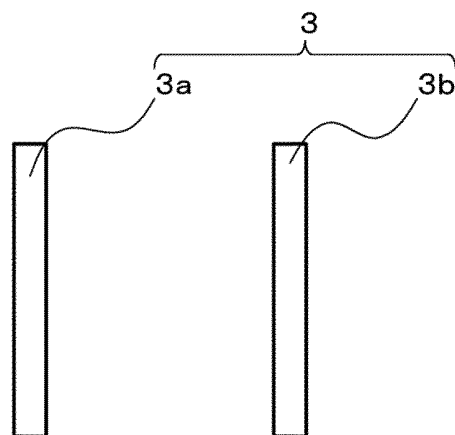


FIG. 6

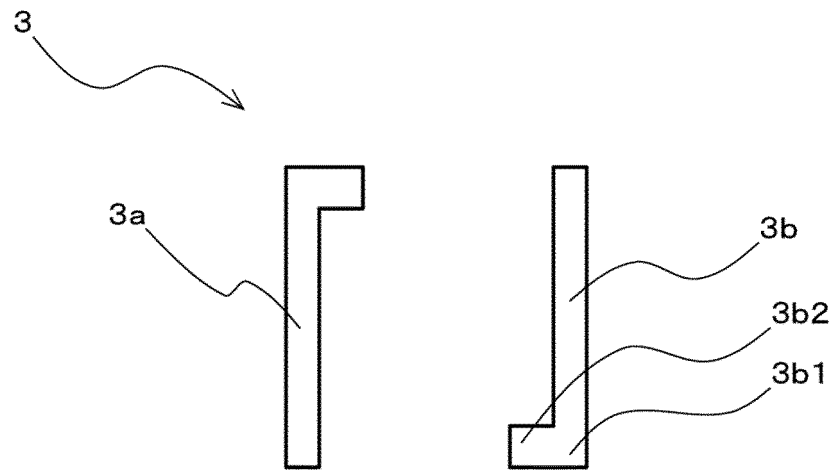


FIG. 7

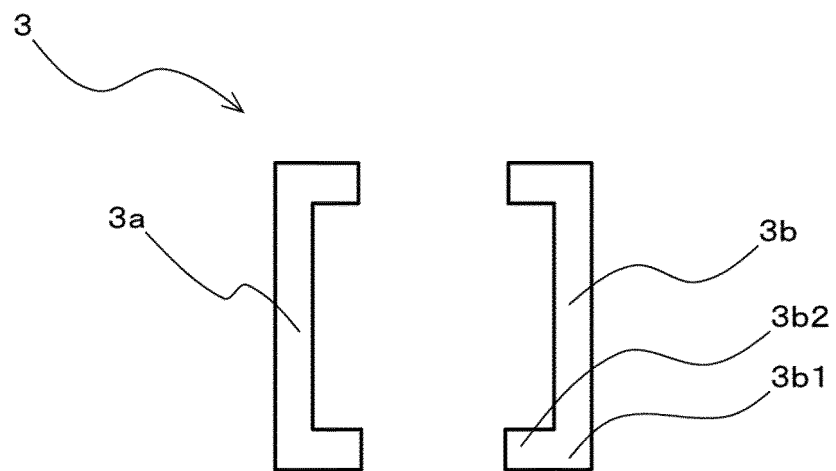


FIG. 8

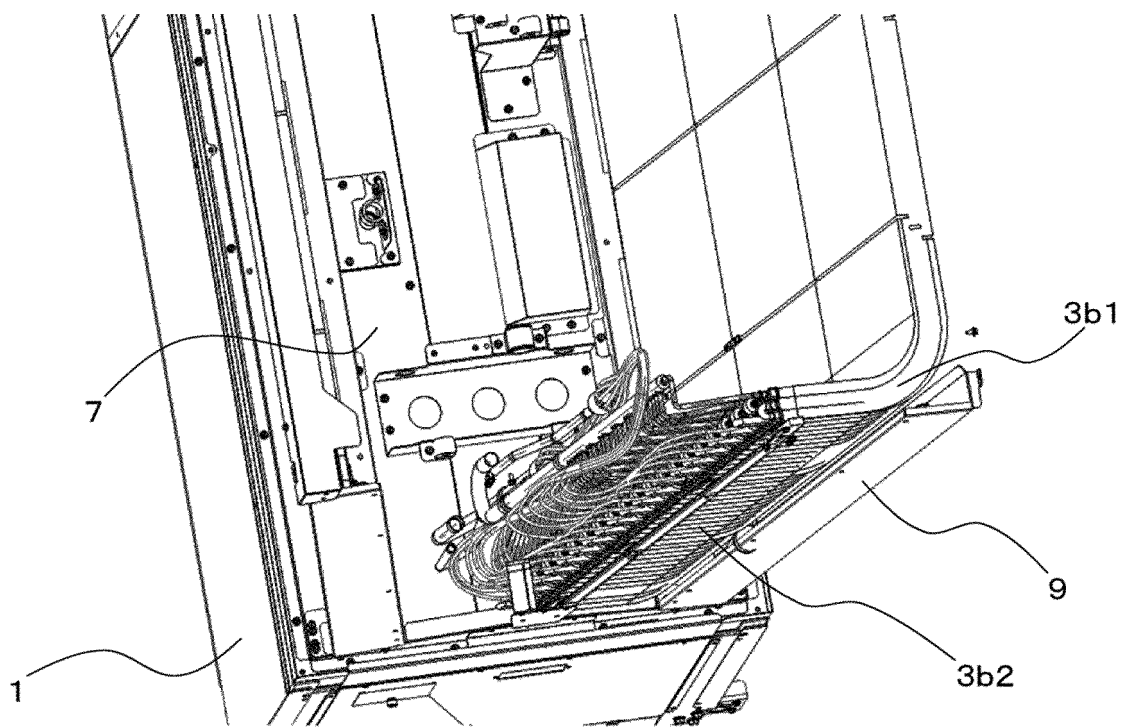


FIG. 9

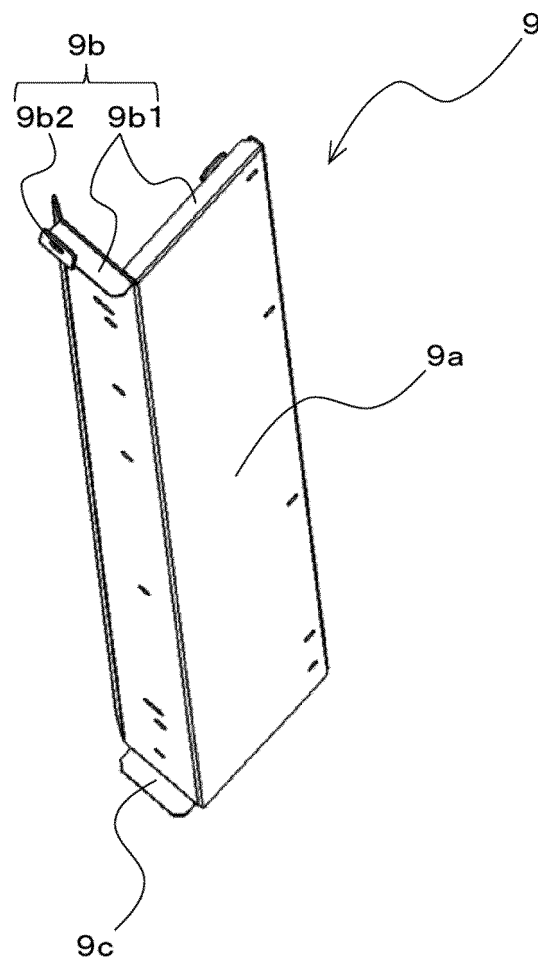


FIG. 10

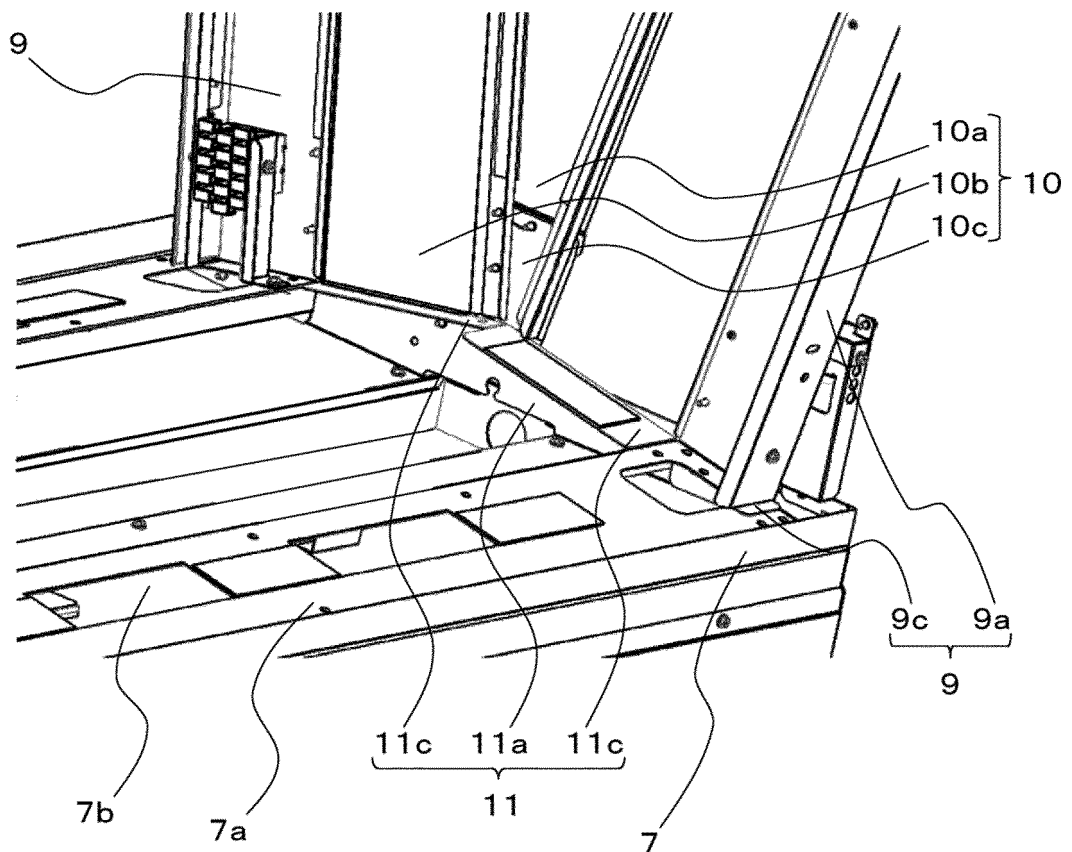


FIG. 11

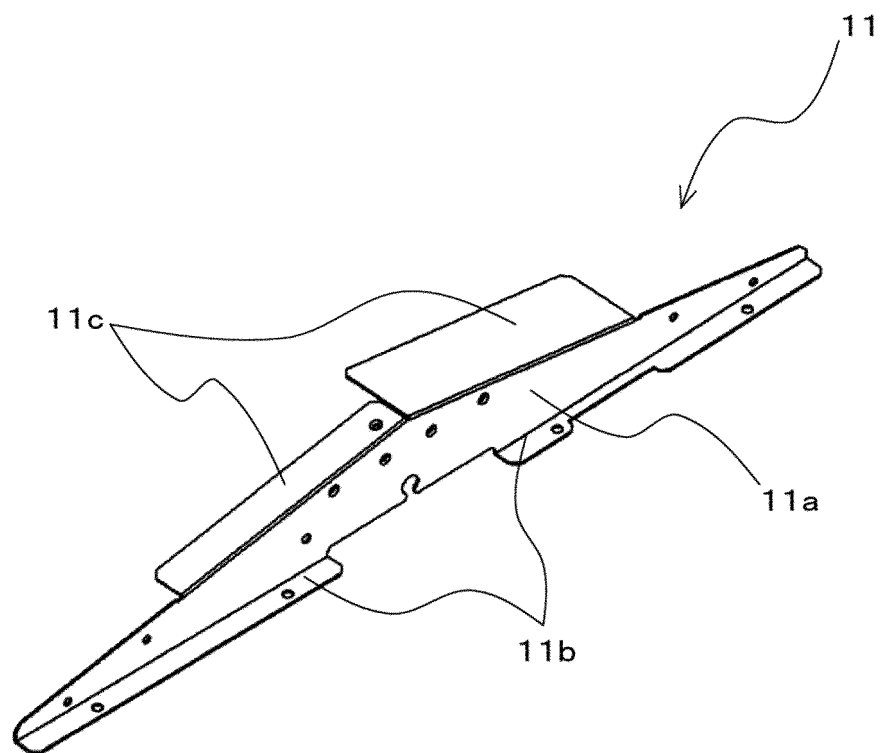


FIG. 12

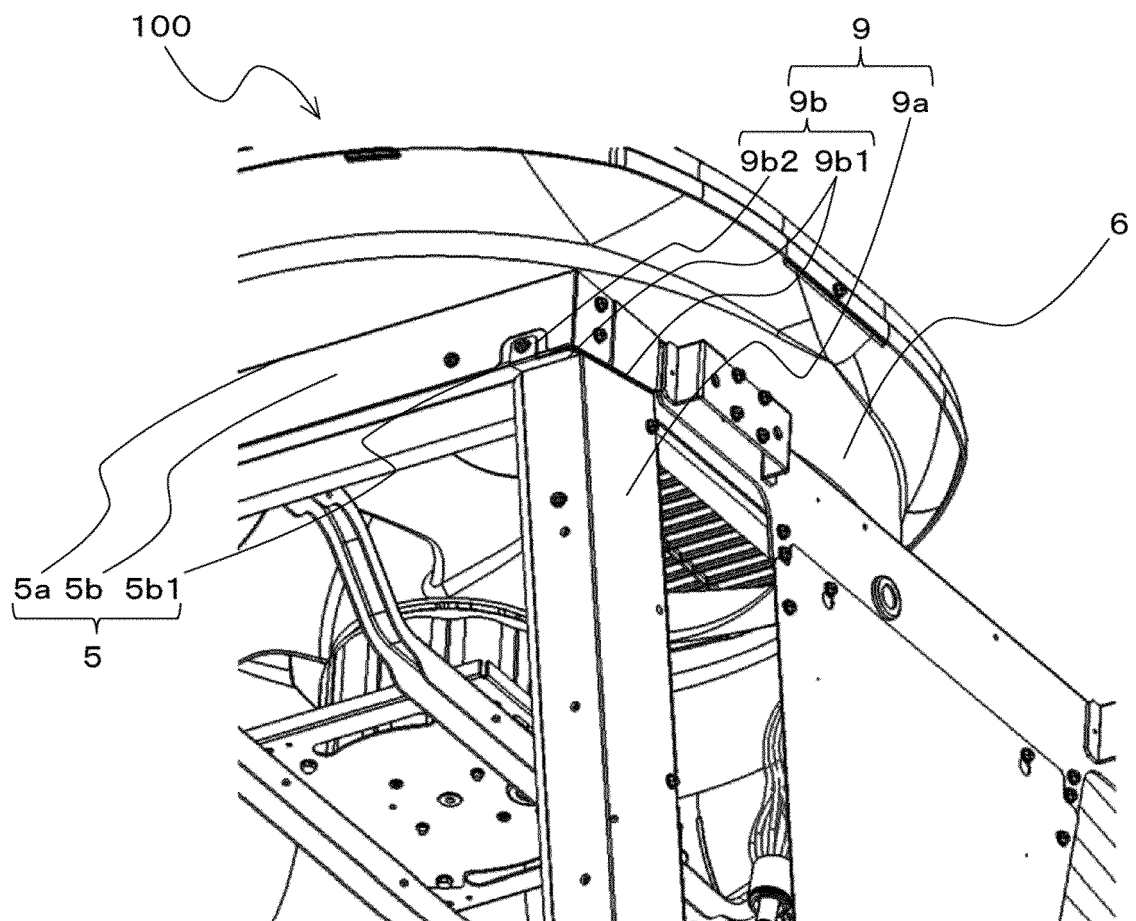


FIG. 13

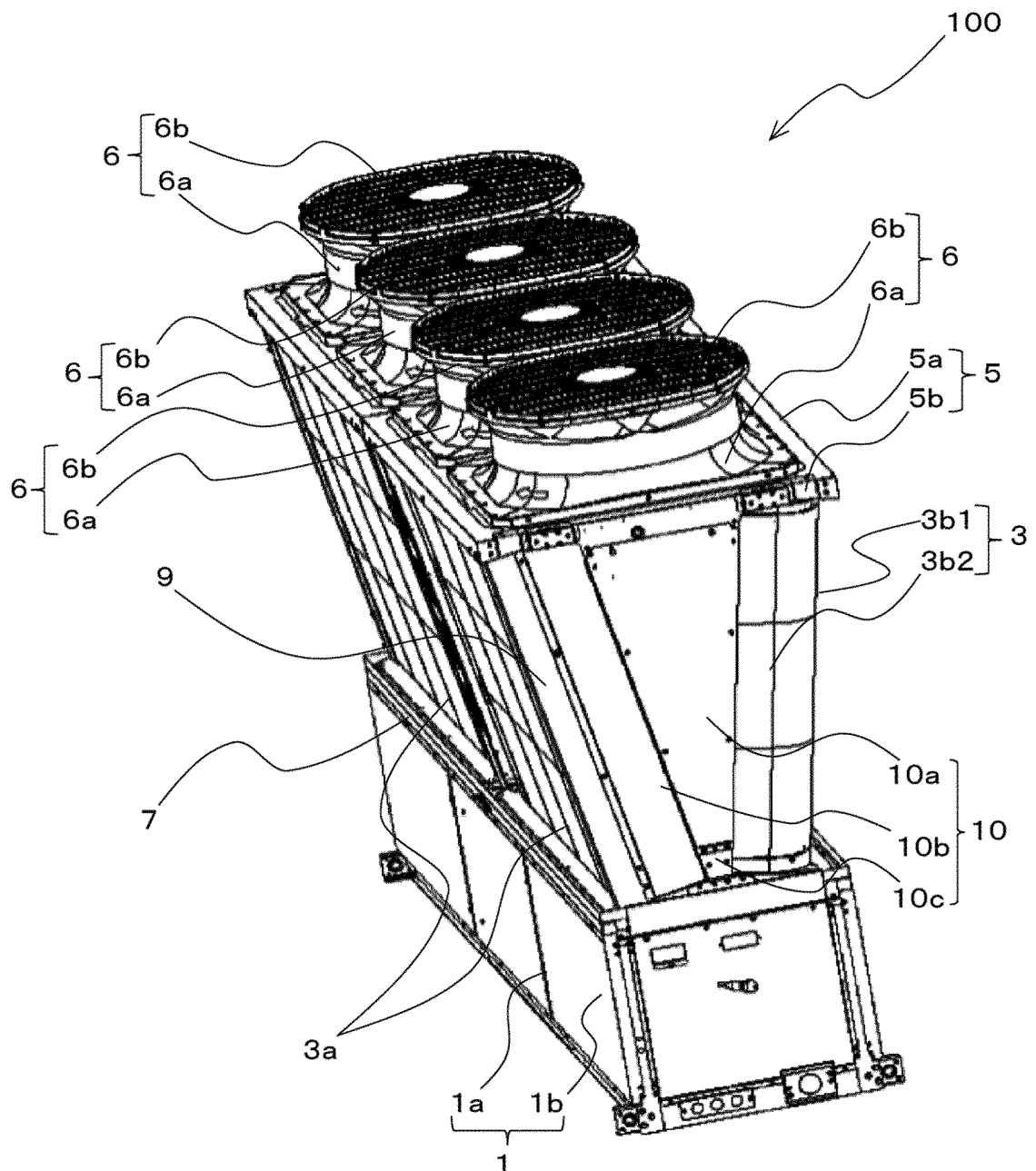


FIG. 14

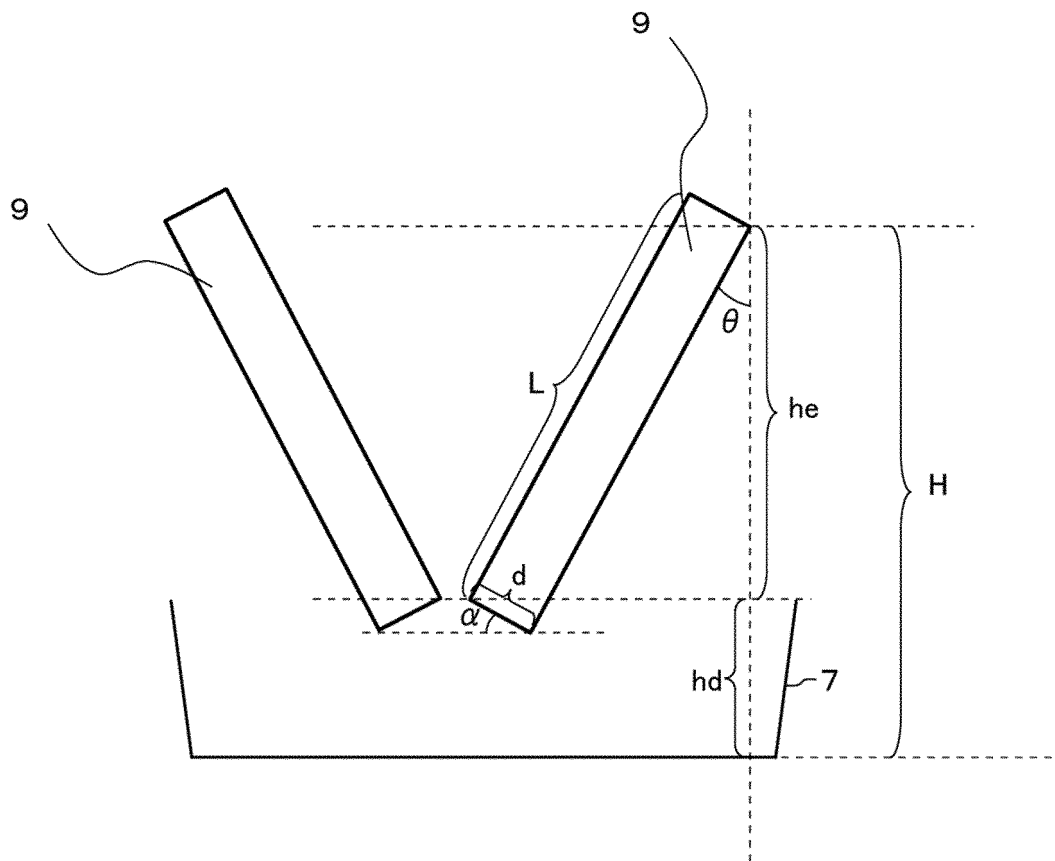


FIG. 15

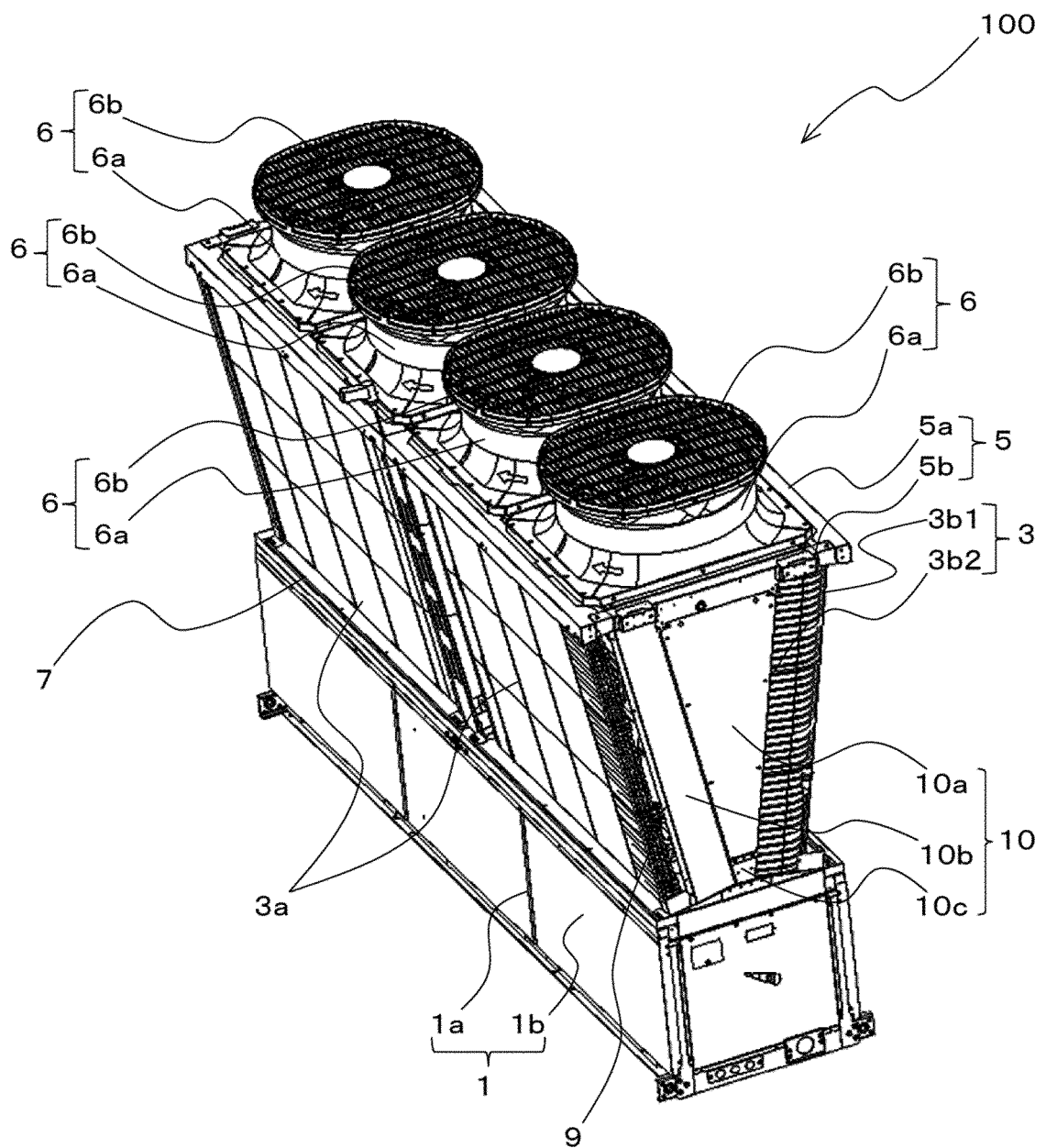


FIG. 16

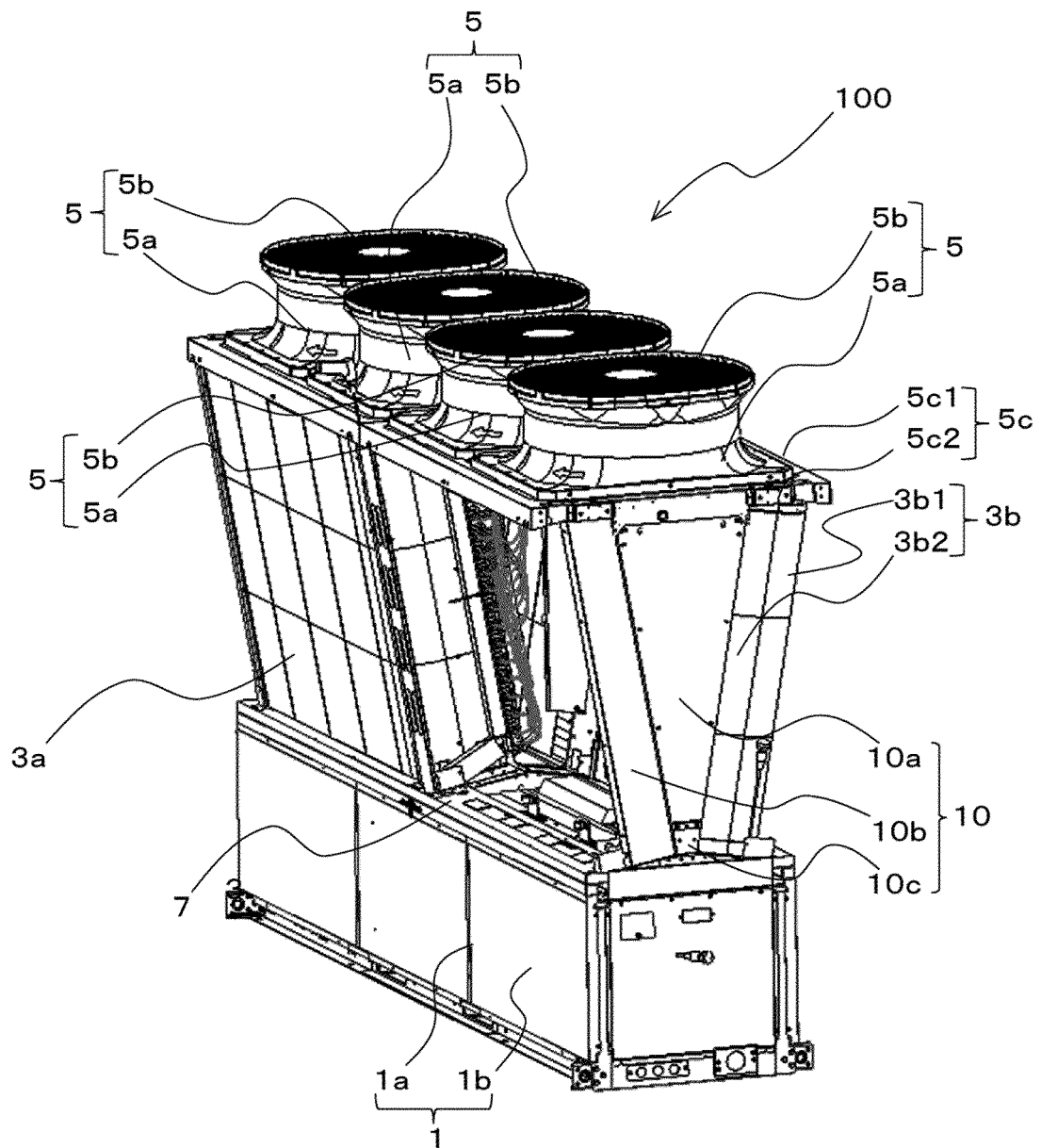


FIG. 17

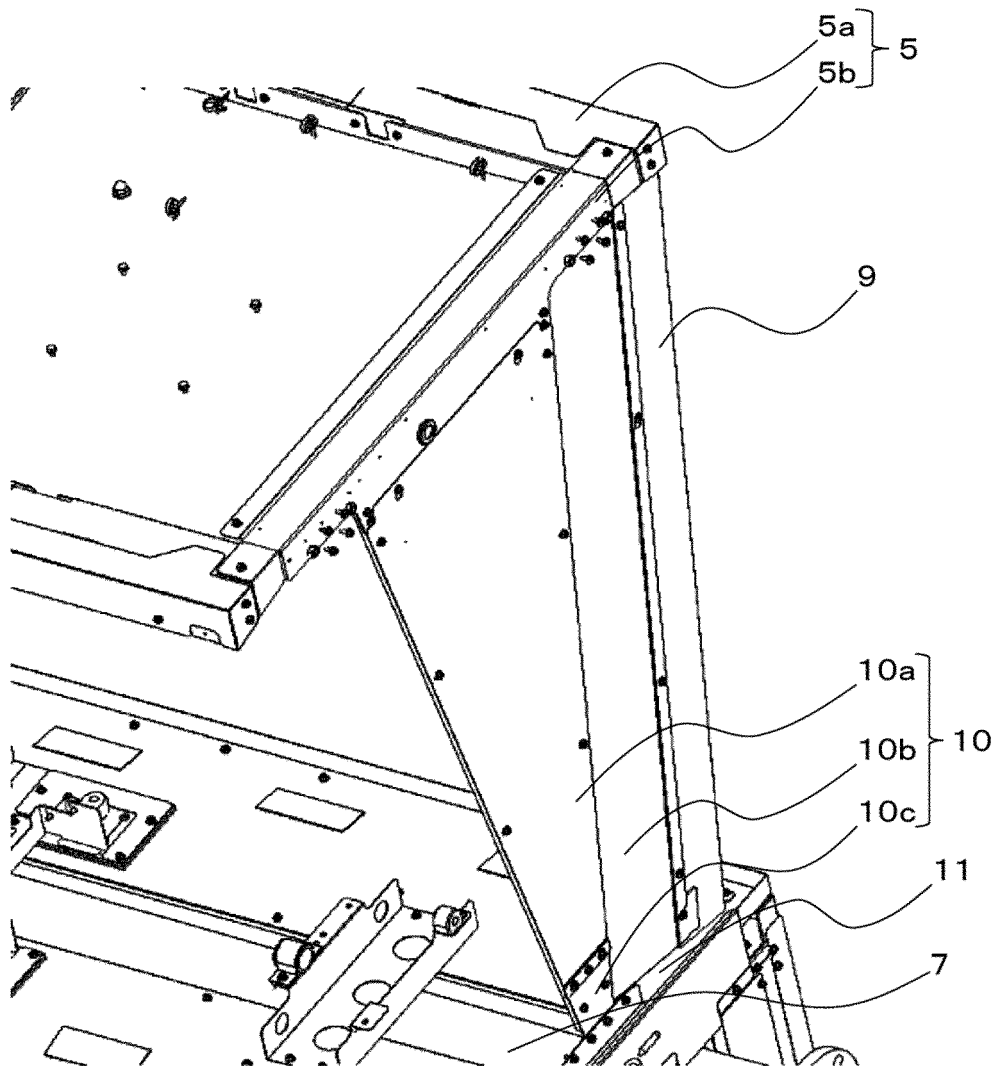


FIG. 18

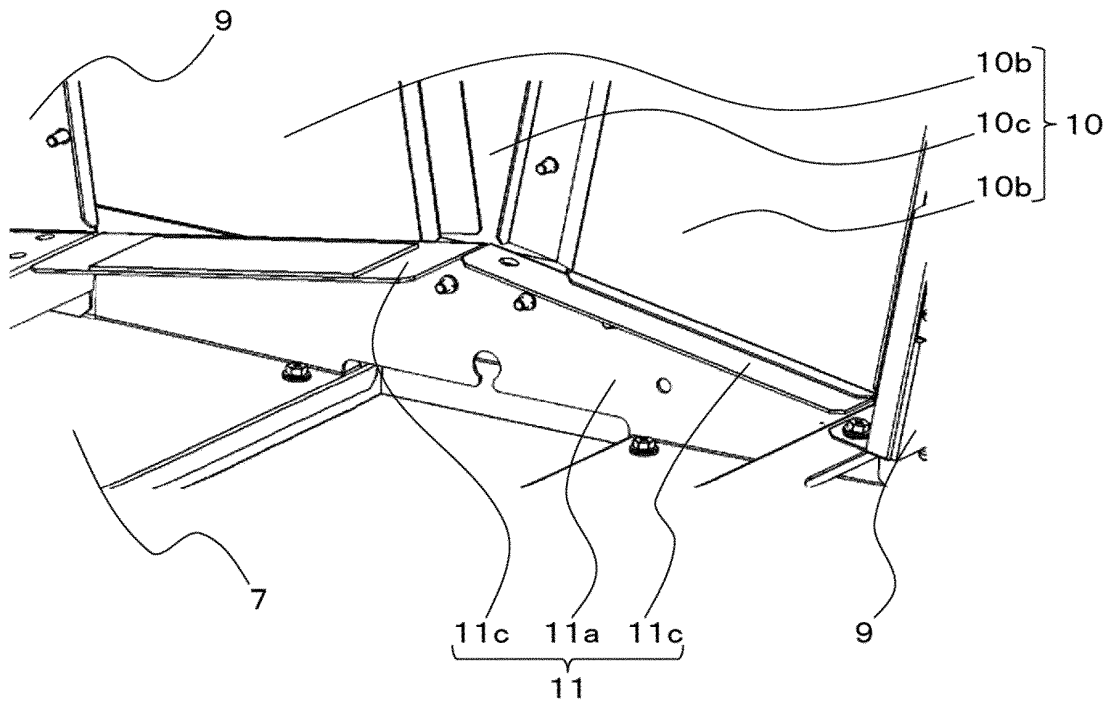


FIG. 19

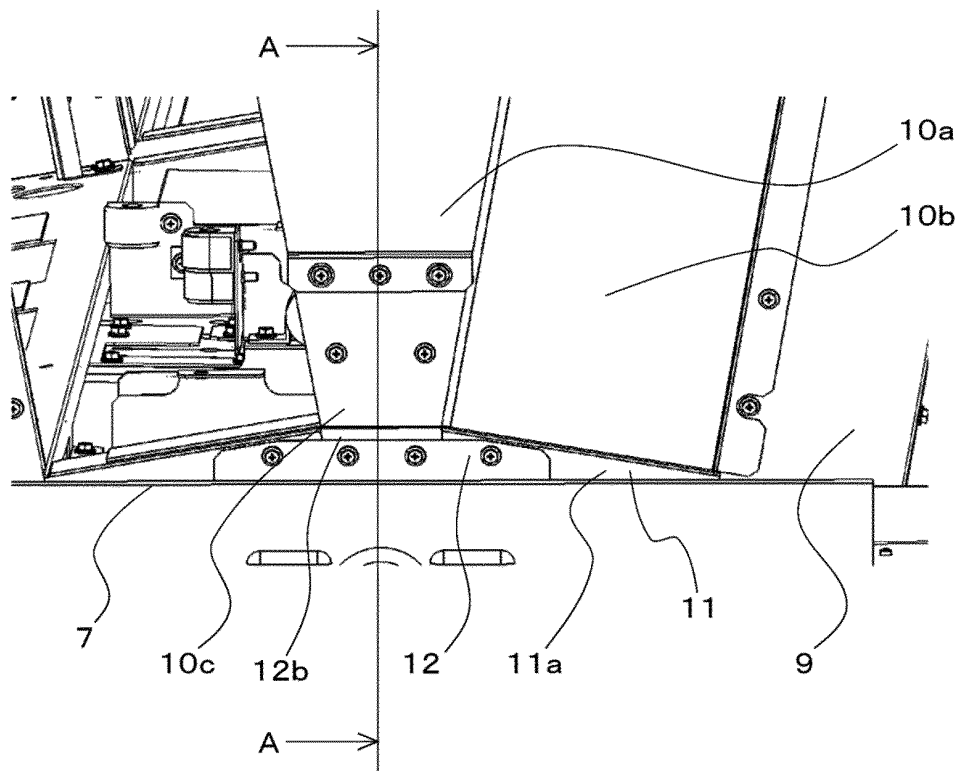


FIG. 20

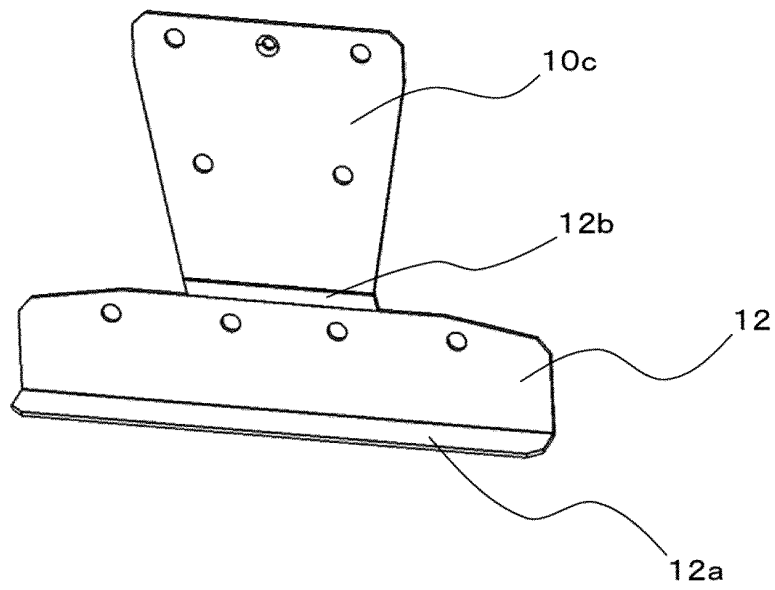


FIG. 21

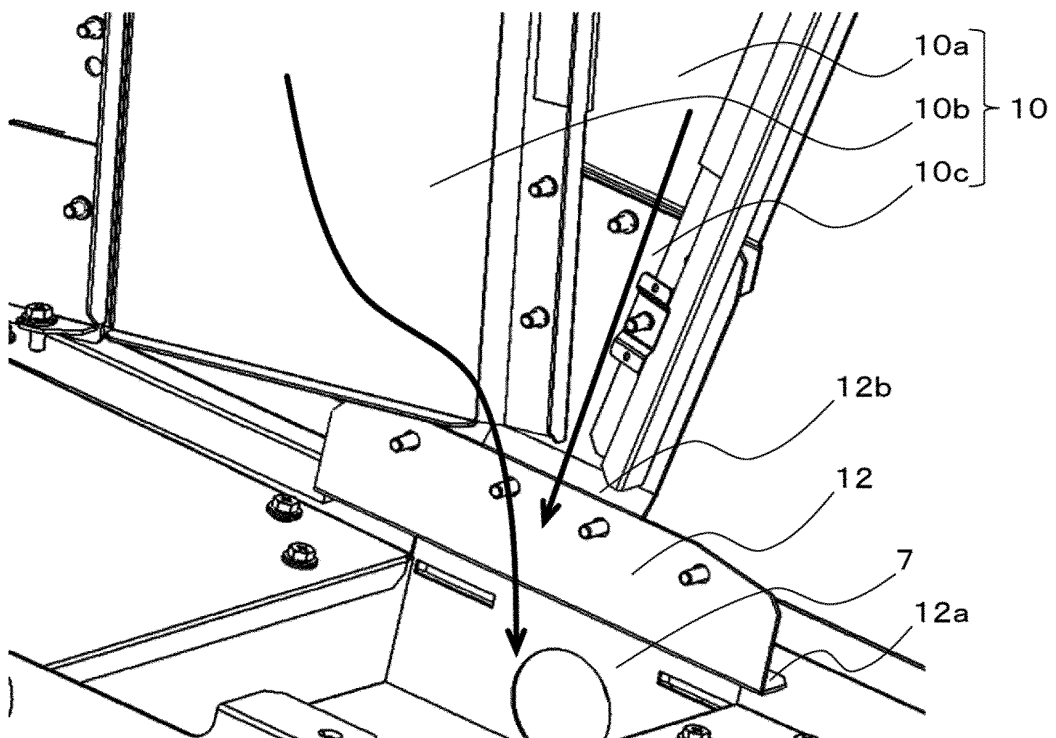
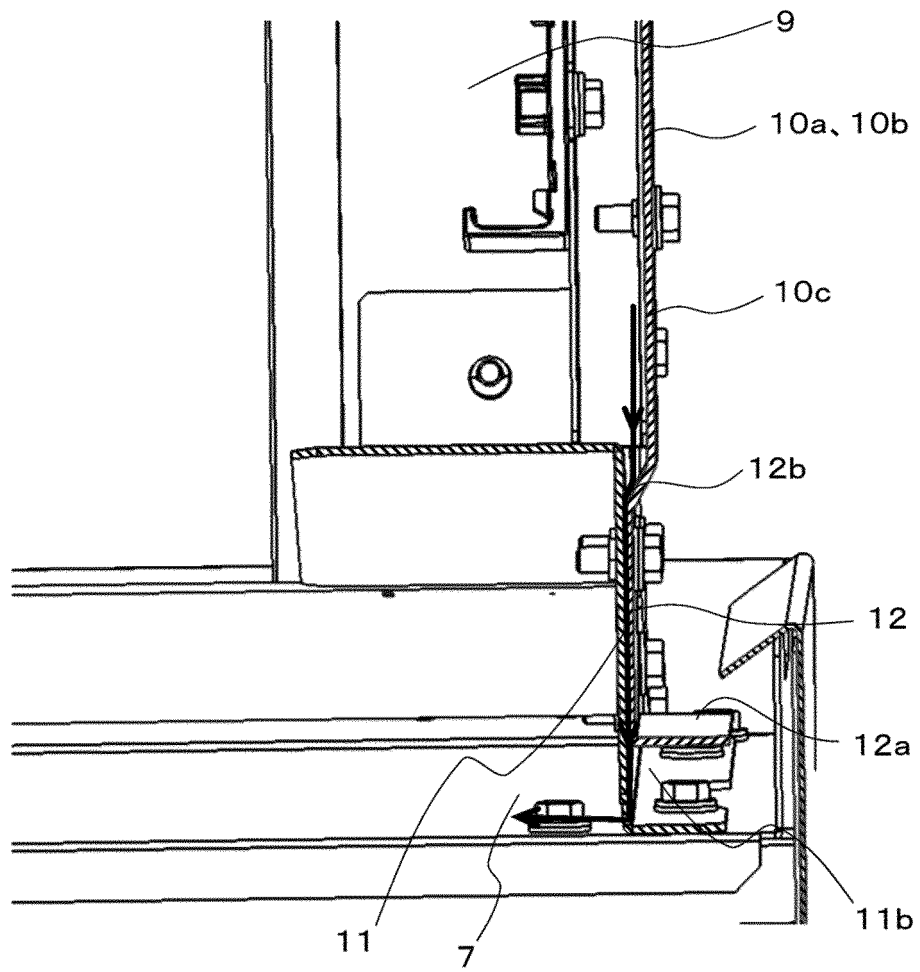


FIG. 22



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2020/006953

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. F24F1/56 (2011.01) i, F24F13/20 (2006.01) i
FI: F24F1/56, F24F13/20

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)

Int. Cl. F24F13/20, F24F1/56

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 1971-2020

Registered utility model specifications of Japan 1996-2020

Published registered utility model applications of Japan 1994-2020

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2018-169095 A (DAIKIN INDUSTRIES, LTD.) 01 November 2018, paragraphs [0004]-[0066], fig. 1-9	1-9
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 177220/1983 (Laid-open No. 83866/1985) (MITSUBISHI ELECTRIC CORP.) 10 June 1985, description, page 3, line 19 to page 4, line 10, page 6, line 20 to page 7, line 5, page 7, line 20 to page 9, line 11, fig. 1-4	1-9
Y	JP 2012-117720 A (SANYO ELECTRIC CO., LTD.) 21 June 2012, paragraphs [0022], [0054]	4-9

☒ 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
15.05.2020

Date of mailing of the international search report
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Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No. PCT/JP2020/006953
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 6-74489 A (DAIKIN INDUSTRIES, LTD.) 15 March 1994, paragraph [0028]	4-9

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

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/JP2020/006953

Patent Documents referred to in the Report	Publication Date	Patent Family	Publication Date
JP 2018-169095 A	01.11.2018	(Family: none)	
JP 60-83866 U1	10.06.1985	(Family: none)	
JP 2012-117720 A	21.06.2012	(Family: none)	
JP 6-74489 A	15.03.1994	(Family: none)	

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2011013672 A [0004]