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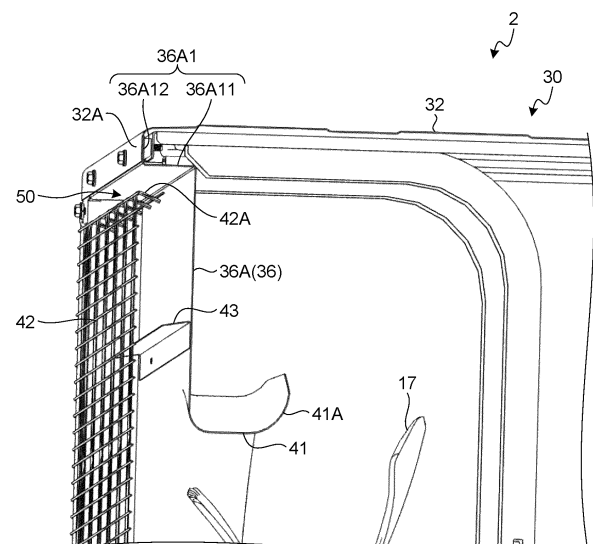
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(54) **HEAT PUMP CYCLE DEVICE**

(57) A housing (30) has a front surface panel (36) provided with a blowout port (41) for blowing out air heat-exchanged with a refrigerant in an outdoor heat exchanger to the outside of a housing (30) by the rotation of an outdoor fan (17), a top surface panel (32) disposed above the front surface panel (36), and a fan guard (42) disposed on the front surface panel (36) so as to cover the blowout port (41). When a direction in which air is blown out from the blowout port (41) is a front side, the front surface panel (36) is disposed rearward of a front end portion (32A) of the top surface panel (32), and the fan guard (42) is disposed on the front surface panel (36) with a predetermined gap between an upper end portion (42A) of the fan guard (42) and the top surface panel (32). The housing (30) includes the handgrip portion (50) which is formed between the upper end portion (42A) of the fan guard (42) and the top surface panel (32) and into which fingers can be inserted to hold the housing (30) during transportation.

FIG.5



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Description

Field

[0001] The present invention relates to a heat pump cycle apparatus having an outdoor machine in which a handle portion for transportation and installation is included in a housing.

Background

[0002] In general, an outdoor machine used in a heat pump cycle apparatus includes a compressor that compresses a refrigerant, a heat exchanger that performs heat exchange between the refrigerant and air, a fan that blows air to the heat exchanger, and the like, and these devices are housed in a housing. In this type of outdoor machine, the compressor and the heat exchanger increase in size as the air-conditioning capacity increases, and thus the outdoor machine itself tends to be large and heavy. Therefore, in the related art, there is disclosed a technique in which a plurality of handle portions for holding the outdoor machine is provided around a housing of the outdoor machine, thereby enabling a plurality of workers (for example, two workers) to transport and install the outdoor machine which is a large and heavy object (for example, refer to Patent Literature 1). In Patent Literature 1, for example, when a side on which a blowout port for blowing out air to the outside of the housing is formed is defined as a front surface of the housing, a plurality of handles for transportation is formed on each of the front surface and the rear surface of the housing.

Citation List

Patent Literature

[0003] Patent Literature 1: JP 2004-85155 A

Summary

Technical Problem

[0004] In recent years, in a heat pump cycle apparatus, not only an indoor machine installed indoors but also an outdoor machine installed outdoors may be needed to have high designability. Therefore, as in Patent Literature 1, when a handle portion is provided on the front surface of the housing of the outdoor machine, which is easily visible to people, the designability of the outdoor machine is significantly impaired.

[0005] On the other hand, when a plurality of handle portions is provided on, for example, the side surface and the rear surface of the housing except for the front surface of the housing, it is difficult to balance an outdoor machine because the front surface of the outdoor machine can hardly be held during transportation and installation work of the outdoor machine, and transportation may become

difficult.

[0006] The disclosed technique has been made in view of the above, and an object of the disclosed technique is to provide a heat pump cycle apparatus that can be easily transported without impairing the designability.

Solution to Problem

[0007] According to an aspect of an embodiment, a heat pump cycle apparatus comprising an outdoor machine having a housing which houses therein a heat exchanger and a fan which blows air to the heat exchanger, the housing having a front surface panel provided with a blowout port for blowing out air heat-exchanged with a refrigerant in the heat exchanger to an outside of the housing by rotation of the fan, a top surface panel disposed above the front surface panel, and a fan guard disposed on the front surface panel so as to cover the blowout port, wherein when a direction in which air is blown out from the blowout port is a front side, the front surface panel is disposed rearward of an end portion on the front side of the top surface panel, the fan guard is disposed on the front surface panel with a predetermined gap between an end portion on an upper side of the fan guard and the top surface panel, and the housing comprises a handgrip portion which is formed between the end portion on the upper side of the fan guard and the top surface panel and into which fingers can be inserted to hold the outdoor machine when the outdoor machine is transported.

Advantageous Effects of Invention

[0008] According to one aspect of the heat pump cycle apparatus disclosed in the present application, the heat pump cycle apparatus can be easily transported without impairing the designability.

Brief Description of Drawings

[0009]

FIG. 1 is a circuit configuration diagram illustrating an example of a refrigerant circuit and a water circuit of a heat pump cycle apparatus according to the present embodiment.

FIG. 2 is an external perspective view of an outdoor machine as viewed from the front surface side.

FIG. 3 is an external perspective view of the outdoor machine as viewed from the rear surface side.

FIG. 4 is a perspective view illustrating an internal structure of the outdoor machine.

FIG. 5 is a partial cross-sectional view of a handgrip portion of the outdoor machine taken along the line V-V in FIG. 2 as viewed from the X direction.

FIG. 6 is a view illustrating the relationship between the positions of the handgrip portion and handle portions formed on a housing and the position of

the center of gravity of the outdoor machine when the outdoor machine is viewed from the upper surface. FIG. 7 is a view illustrating the relationship between the positions of the handle portions formed on the housing and the position of the center of gravity of the outdoor machine when the outdoor machine is viewed from the front surface.

FIG. 8 is a schematic diagram illustrating the relationship between the height positions of the handle portions when the outdoor machine is lifted, as viewed from the front surface of the outdoor machine.

FIG. 9 is a schematic diagram illustrating a movement in which a worker lifts a load by bending and stretching the knees.

FIG. 10 is a top view illustrating the positions of the handle portions provided in the outdoor machine.

FIG. 11 is a diagram illustrating a state in which three workers are transporting the outdoor machine.

FIG. 12 is a partially enlarged front view of an outdoor machine according to a modification as viewed from the front surface.

Description of Embodiments

[0010] In the following, embodiments of a heat pump cycle apparatus disclosed in the present application will be described in detail with reference to the drawings. Note that the disclosed technique is not limited by the present embodiment. In addition, the embodiments described below may be appropriately modified within a range in which no contradiction occurs.

Embodiments

<Configuration of Heat Pump Cycle Apparatus>

[0011] FIG. 1 is a circuit configuration diagram illustrating an example of a refrigerant circuit and a water circuit of a heat pump cycle apparatus according to the present embodiment. The heat pump cycle apparatus 1 includes an outdoor machine 2 and an indoor machine 3, and the outdoor machine 2 and the indoor machine 3 are connected to each other by a water pipe to form a water circuit 4. The heat pump cycle apparatus 1 performs cooling or heating of a room (space) in which the indoor machine 3 is disposed by circulating cold water or hot water in the water circuit 4 of the outdoor machine 2 and the indoor machine 3. Note that, although the heat pump cycle apparatus 1 illustrated in FIG. 1 includes one indoor machine 3, the heat pump cycle apparatus may include a plurality of indoor machines 3 connected in parallel to the outdoor machine 2.

[0012] As illustrated in FIG. 1, the outdoor machine 2 has a compressor 11, a four-way valve 12, an outdoor heat exchanger (heat exchanger) 13, an outdoor expansion valve 14, a water-refrigerant heat exchanger 15, an accumulator 16, and an outdoor fan (fan) 17. The compressor 11, the four-way valve 12, the outdoor heat

exchanger 13, the outdoor expansion valve 14, the water-refrigerant heat exchanger 15, and the accumulator 16 are connected to each other by a refrigerant pipe 18 to form a refrigerant circuit 10. The refrigerant circuit 10 is completed inside the outdoor machine 2 to constitute a refrigeration cycle. In addition to the refrigerant pipe 18, a water pipe 19 is connected to the water-refrigerant heat exchanger 15. The water pipe 19 extends to the outside of the outdoor machine 2 and is connected to an indoor unit 23 (described later) of the indoor machine 3 to form the water circuit 4.

[0013] The compressor 11 is, for example, a capability variable compressor of a high-pressure container type capable of changing an operation capacity, and compresses a sucked low-pressure gas refrigerant to discharge a high-pressure gas refrigerant. The four-way valve 12 is connected to a refrigerant discharge side of the compressor 11, and the accumulator 16 is connected to a refrigerant suction side of the compressor.

[0014] The four-way valve 12 is a valve for switching the direction in which the refrigerant flows in the refrigerant circuit 10, and include a first port 12A to a fourth port 12D. The first port 12A is connected to the refrigerant discharge side of the compressor 11. A second port 12B is connected to one refrigerant inlet/outlet 13A of the outdoor heat exchanger 13. A third port 12C is connected to the refrigerant inflow side of the accumulator 16. The fourth port 12D is connected to one refrigerant inlet/outlet 15A of the water-refrigerant heat exchanger 15.

[0015] As the outdoor heat exchanger 13, for example, a fin-tube heat exchanger is used. The outdoor heat exchanger 13 exchanges heat between a refrigerant and the outside air taken into the outdoor machine 2 by the rotation of the outdoor fan 17. The other refrigerant inlet/outlet 13B of the outdoor heat exchanger 13 is connected to the other refrigerant inlet/outlet 15B of the water-refrigerant heat exchanger 15 via the outdoor expansion valve 14. The outdoor heat exchanger 13 functions as a condenser when the heat pump cycle apparatus 1 performs cooling operation, to condense (liquefy) the gas refrigerant. In addition, the outdoor heat exchanger 13 functions as an evaporator when the heat pump cycle apparatus 1 performs heating operation, to evaporate (vaporize) the liquid refrigerant.

[0016] The outdoor expansion valve 14 is provided between the other refrigerant inlet/outlet 13B of the outdoor heat exchanger 13 and the other refrigerant inlet/outlet 15B of the water-refrigerant heat exchanger 15. The outdoor expansion valve 14 is, for example, an electronic expansion valve, and decompresses (expands) the liquid refrigerant passing through the outdoor expansion valve 14 by adjusting the valve opening degree.

[0017] As the water-refrigerant heat exchanger 15, for example, a plate heat exchanger is used. The water-refrigerant heat exchanger 15 exchanges heat between the refrigerant circulating in the refrigerant circuit 10 and the water circulating in the water circuit 4. The water-

refrigerant heat exchanger 15 functions as an evaporator when the heat pump cycle apparatus 1 performs cooling operation or defrosting operation, to evaporate (vaporize) the liquid refrigerant. The water-refrigerant heat exchanger 15 functions as a condenser when the heat pump cycle apparatus 1 performs heating operation, to condense (liquefy) the gas refrigerant. The water-refrigerant heat exchanger 15 has a water inlet 15C and a water outlet 15D, and the water pipe 19 is connected to each of the water inlet 15C and the water outlet 15D to constitute a part of the water circuit 4. In addition, for example, a circulation pump 21 for circulating water in the water circuit 4 is provided on the water inlet 15C side, and an air vent valve 22 for venting air entering the water circuit 4 is provided on the water outlet 15D side.

[0018] The refrigerant inflow side of the accumulator 16 is connected to the third port 12C of the four-way valve 12, and the refrigerant outflow side of the accumulator is connected to the refrigerant inflow side of the compressor 11. The accumulator 16 is formed as a hollow high-pressure container, separates the refrigerant flowing into the inside thereof into a gas refrigerant and a liquid refrigerant, and causes only the gas refrigerant to be sucked into the compressor 11.

[0019] The outdoor fan 17 is disposed near the outdoor heat exchanger 13 and blows air toward the outdoor heat exchanger 13. Specifically, the outdoor fan 17 takes the outside air into the outdoor machine 2 from a suction port 44, which will be described later, of the outdoor machine 2 and discharges the outside air heat-exchanged with the refrigerant in the outdoor heat exchanger 13 to the outside of the outdoor machine 2 from a blowout port 41, which will be described later.

[0020] On the other hand, the indoor machine 3 has an indoor unit 23. As the indoor unit 23, for example, a floor heating device or a radiator is used. One refrigerant inlet/outlet 23A of the indoor unit 23 is connected to the water outlet 15D of the water-refrigerant heat exchanger 15. The other refrigerant inlet/outlet 23B of the indoor unit 23 is connected to the water inlet 15C of the water-refrigerant heat exchanger 15 via the circulation pump 21. Thus, the indoor unit 23 is connected to the water-refrigerant heat exchanger 15 by the water pipe 19 to constitute the water circuit 4, and the water circulating in the water circuit 4 dissipates or absorbs heat in the indoor unit 23, thereby heating or cooling the air-conditioned space in which the indoor machine 3 is installed.

<Movement during Operation>

[0021] The flow of refrigerant and the flow of water during the operation of the heat pump cycle apparatus 1 will now be described. Note that, in FIG. 1, the dashed arrows indicate the flow of the refrigerant during the heating operation, and the solid arrows indicate the flow of the refrigerant during the cooling operation.

[0022] When the heat pump cycle apparatus 1 performs heating operation, the four-way valve 12 is

switched so that the first port 12A communicates with the fourth port 12D and the second port 12B communicates with the third port 12C. Thus, the refrigerant circuit 10 enters a heating cycle in which the water-refrigerant heat exchanger 15 functions as a condenser and the outdoor heat exchanger 13 functions as an evaporator.

[0023] When the compressor 11 is driven in the above-described state of the refrigerant circuit 10, the refrigerant discharged from the compressor 11 flows into the four-way valve 12, and flows from the four-way valve 12 into the water-refrigerant heat exchanger 15. The high-temperature gas refrigerant flowing into the water-refrigerant heat exchanger 15 is condensed by exchanging heat with the water circulating in the water circuit 4 of the water-refrigerant heat exchanger 15 by the movement of the circulation pump 21. On the other hand, the water circulating in the water circuit 4 is heated by the refrigerant in the water-refrigerant heat exchanger 15 to become hot water. The hot water flows into the indoor unit 23 of the indoor machine 3 through the water pipe 19 of the water circuit 4. The hot water then dissipates heat in the indoor unit 23, thereby heating the room in which the indoor machine 3 is installed.

[0024] The liquid refrigerant heat-exchanged with water and condensed in the water-refrigerant heat exchanger 15 is decompressed while passing through the outdoor expansion valve 14, and then flows into the outdoor heat exchanger 13. The refrigerant flowing into the outdoor heat exchanger 13 exchanges heat with the outside air flowing into the outdoor machine 2 by the rotation of the outdoor fan 17 and evaporates. The gas refrigerant evaporated in the outdoor heat exchanger 13 passes through the four-way valve 12 and the accumulator 16 in this order, and is sucked into the compressor 11 and compressed again.

[0025] When the heat pump cycle apparatus 1 performs cooling operation or defrosting operation, the four-way valve 12 is switched so that the first port 12A communicates with the second port 12B and the third port 12C communicates with the fourth port 12D. Thus, the refrigerant circuit 10 enters a cooling cycle in which the water-refrigerant heat exchanger 15 functions as an evaporator and the outdoor heat exchanger 13 functions as a condenser.

[0026] When the compressor 11 is driven in the above-described state of the refrigerant circuit 10, the refrigerant discharged from the compressor 11 flows into the four-way valve 12, and flows from the four-way valve 12 into the outdoor heat exchanger 13. The high-temperature gas refrigerant flowing into the outdoor heat exchanger 13 is condensed by exchanging heat with the outdoor air taken into the outdoor machine 2 by the rotation of the outdoor fan 17. Note that, when the defrosting operation is performed, the frost generated in the outdoor heat exchanger 13 is melted by the heat of the refrigerant flowing into the outdoor heat exchanger 13.

[0027] The liquid refrigerant condensed in the outdoor

heat exchanger 13 is decompressed while passing through the outdoor expansion valve 14, and then flows into the water-refrigerant heat exchanger 15. The liquid refrigerant flowing into the water-refrigerant heat exchanger 15 is evaporated by exchanging heat with the water circulating in the water circuit 4 of the water-refrigerant heat exchanger 15 by the operation of the circulation pump 21. On the other hand, the water circulating in the water circuit 4 is cooled by the refrigerant in the water-refrigerant heat exchanger 15 to become cold water. The cold water flows into the indoor unit 23 of the indoor machine 3 through the water pipe 19 of the water circuit 4. The cold water then absorbs heat from the indoor air in the indoor unit 23, thereby cooling the room in which the indoor machine 3 is installed. Note that, when the defrosting operation is performed, the circulation of water in the water circuit 4 is stopped by stopping the circulation pump 21 in order to suppress a decrease in the indoor temperature.

[0028] The gas refrigerant evaporated in the water-refrigerant heat exchanger 15 passes through the four-way valve 12 and the accumulator 16 in this order, and is sucked into the compressor 11 and compressed again.

<Structure of Outdoor Machine>

[0029] The external appearance and the internal structure of the outdoor machine 2 will now be described. FIG. 2 is an external perspective view of the outdoor machine as viewed from the front surface side, and FIG. 3 is an external perspective view of the outdoor machine as viewed from the rear surface side. FIG. 4 is a perspective view illustrating the internal structure of the outdoor machine. Note that directions such as front and rear, up and down, and left and right described below indicate directions when the outdoor machine 2 is viewed from the front surface side in a state in which the outdoor machine 2 is installed, with a direction in which air is blown out from the blowout port 41, which will be described later, as the front.

[0030] As illustrated in FIGS. 2 and 3, the outdoor machine 2 includes a housing 30 having a rectangular parallelepiped box shape in which the dimension in the left-right direction (width direction) is larger than the dimension in the front-rear direction (depth direction). The housing 30 includes a bottom plate (bottom surface panel) 31 disposed so as to face the installation surface, a top surface panel 32 disposed above the bottom plate 31 in the height direction, and a side surface panel portion 33 that connects the bottom plate 31 and the top surface panel 32 and partitions the inside and the outside of the housing 30.

[0031] As illustrated in FIG. 4, the inside of the housing 30 is divided into a heat exchange chamber RA and a machine chamber RB by a partition plate 34 erected on the bottom plate 31. In the heat exchange chamber RA, the outdoor heat exchanger 13 is disposed on the rear surface side of the heat exchange chamber RA, and the outdoor fan 17 is disposed on the front surface side. The

outdoor heat exchanger 13 is formed by being bent in an L-shape when viewed from the upper surface (the top surface panel 32 side), and is supported by the bottom plate 31 along the left side surface side from the rear surface side of the heat exchange chamber RA.

[0032] The outdoor fan 17 is attached to a pair of support members 35, 35 erected on the bottom plate 31. The outdoor fan 17 is a so-called axial-flow fan, and draws outside air into the heat exchange chamber RA from the outside of the outdoor machine 2, that is, from the suction port 44 (described later) formed on the rear surface side of the outdoor heat exchanger 13 and a suction opening 46 (described later) formed on the left side surface side, by rotational driving of the outdoor fan 17 by a fan motor not illustrated. Then, the air heat-exchanged with the refrigerant in the outdoor heat exchanger 13 is blown out forward from the blowout port 41 (described later) formed on the front surface side of the heat exchange chamber RA. As described above, the outdoor machine 2 is a front blowout type outdoor machine that blows out the heat-exchanged air from the front surface side.

[0033] In the lower space of the machine chamber RB, circuit components such as the compressor 11, the accumulator 16, the four-way valve 12 (FIG. 1), and the outdoor expansion valve 14 (FIG. 1) that constitute a part of the refrigerant circuit 10 are disposed, and the circuit components are connected to each other by the refrigerant pipe 18. The compressor 11 and the accumulator 16 are fixed to the bottom plate 31. In the lower space of the machine chamber RB, circuit components such as the water-refrigerant heat exchanger 15, the air vent valve 22, and the circulation pump 21 that constitute a part of the water circuit 4 are disposed, and the circuit components are connected to each other by the water pipe 19. In this embodiment, the water-refrigerant heat exchanger 15 is disposed near a corner portion between the rear surface side and the right side surface side in the lower space of the machine chamber RB (housing 30), and a connection port 47 of the water pipe 19, which will be described later, is provided on the rear surface side.

[0034] In the upper space of the machine chamber RB, an electrical unit 25 having electrical components for controlling the operation of the outdoor machine 2 is disposed. The electrical unit 25 includes a control board 27 and a terminal portion 26 to which wires such as a power supply line and a control line are connected, and is fixed to the partition plate 34. In this embodiment, the terminal portion 26 is disposed near the right side surface side in the upper space of the machine chamber RB so as to face the right side surface side.

[0035] The side surface panel portion 33 of the housing 30 will now be described. The side surface panel portion 33 is formed by combining a plurality of panel members. In the present embodiment, as illustrated in FIGS. 2 and 3, the side surface panel portion 33 includes a front surface panel 36, a rear surface panel 37, a right side surface panel 38, a left side surface panel 39, and a

service panel 40. The front surface panel 36, the rear surface panel 37, the right side surface panel 38, and the left side surface panel 39 are each formed in an L-shape that includes two adjacent surfaces of the housing 30 and a corner portion interposed between the two surfaces when the housing 30 is viewed from the upper surface.

[0036] Specifically, the front surface panel 36 integrally includes a first front surface portion 36A forming a part of the front surface of the housing 30 and a first left side surface portion 36B forming a part of the left side surface of the housing 30. The rear surface panel 37 integrally includes a first rear surface portion 37A forming a part of the rear surface of the housing 30 and a first right side surface portion 37B forming a part of the right side surface of the housing 30. The right side surface panel 38 integrally includes a second right side surface portion 38A forming a part of the right side surface of the housing 30 and a second front surface portion 38B forming a part of the front surface of the housing 30. The left side surface panel 39 integrally includes a second left side surface portion 39A forming a part of the left side surface of the housing 30 and a second rear surface portion 39B forming a part of the rear surface of the housing 30.

[0037] The first front surface portion 36A of the front surface panel 36 is disposed on the front surface side of the heat exchange chamber RA, and the second front surface portion 38B of the right side surface panel 38 is disposed on the front surface side of the machine chamber RB. The first front surface portion 36A and the second front surface portion 38B are disposed side by side in the left-right direction and form the front surface of the housing 30. The first front surface portion 36A is formed with the blowout port 41 through which the air heat-exchanged in the heat exchange chamber RA is blown out. The blowout port 41 has, for example, a circular bell mouth 41A, and a portion of the outdoor fan 17 is disposed within the bell mouth 41A. A net-like fan guard 42 that covers the blowout port 41 is provided in front of the front surface panel 36. The fan guard 42 is formed in an L-shape when the fan guard 42 is viewed from above, and is disposed along the first front surface portion 36A to the first left side surface portion 36B of the front surface panel 36. The fan guard 42 is fixed to the front surface panel 36 with a predetermined interval between an upper end portion (end portion on the upper side) 42A of the fan guard 42 and the top surface panel 32. In addition, a water shielding plate 43 extending in the left-right (width) direction is provided above the blowout port 41 in the first front surface portion 36A.

[0038] The first rear surface portion 37A of the rear surface panel 37 and the second rear surface portion 39B of the left side surface panel 39 are disposed side by side in the left-right direction with an interval therebetween, and form a rear surface of the housing 30. The outdoor heat exchanger 13 is disposed so as to be exposed between the first rear surface portion 37A and the second rear surface portion 39B, and the exposed area serves as the suction port 44. A net-like fin guard 45 is provided

behind the suction port 44. In addition, the first rear surface portion 37A is disposed on the rear surface side of the machine chamber RB, and a pair of connection ports 47, 47 for connection to the above-described water pipe 19 of the water circuit 4 is provided at a lower portion of the first rear surface portion 37A.

[0039] The second right side surface portion 38A of the right side surface panel 38 and the first right side surface portion 37B of the rear surface panel 37 are disposed side by side in the front-rear direction with an interval therebetween, and form a right side surface of the housing 30. The above-described service panel 40 is detachably disposed between the second right side surface portion 38A and the first right side surface portion 37B. By removing the service panel 40, the inside of the machine chamber RB can be accessed, and maintenance of the electrical unit 25 and various circuit components can be easily performed.

[0040] The second left side surface portion 39A of the left side surface panel 39 and the first left side surface portion 36B of the front surface panel 36 are disposed side by side in the front-rear direction and form a left side surface of the housing 30. The second left side surface portion 39A faces a portion of the outdoor heat exchanger 13, and the second left side surface portion 39A is formed with a plurality of suction openings 46.

[0041] Since the outdoor machine 2 is a heavy object, a plurality of handle portions 51, 52, 53 for transporting the outdoor machine 2 is provided on the side surface panel portion 33 of the housing 30. The handle portions 51 to 53 are each disposed near the corner portions of the housing 30. On the other hand, from the viewpoint of improving the designability of the outdoor machine 2, the front surface panel 36 of the housing 30 is provided with a handgrip portion 50 that functions as a handle portion with an inconspicuous appearance.

<Handgrip Portion>

[0042] The handgrip portion 50 will now be described. FIG. 5 is a partial cross-sectional view of the handgrip portion of the outdoor machine taken along the line V-V in FIG. 2 as viewed from the X direction. As illustrated in FIG. 5, the handgrip portion 50 is formed between the upper end portion 42A of the fan guard 42 disposed on the front surface panel 36 and the top surface panel 32, and is a portion into which fingers of a worker are inserted to hold the outdoor machine 2 when the outdoor machine 2 is transported or moved (installed). The first front surface portion 36A of the front surface panel 36 is disposed rearward of a front end portion 32A of the top surface panel 32, and the handgrip portion 50 is formed by connecting a bent portion 36A1 formed by bending an upper end of the first front surface portion 36A forward and the front end portion 32A of the top surface panel 32.

[0043] Specifically, the front end portion 32A (the end portion on the front side) of the top surface panel 32 is bent downward, and the bent portion 36A1 has a first bent

portion 36A11 that is bent forward and a second bent portion 36A12 that is formed by further bending a tip of the first bent portion 36A11 upward. By fixing the second bent portion 36A12 of the first front surface portion 36A and the front end portion 32A of the top surface panel 32 with a screw, the handgrip portion 50 is formed as a structure in which the top surface front portion of the housing 30 extends forward in an eaves shape. Note that the first bent portion 36A11 may be provided with a recessed portion that is recessed upward so as to be more easily gripped by the worker.

[0044] Thus, the outdoor machine 2 can be held during transportation by putting fingers on the handgrip portion 50. In addition, the handgrip portion 50 is formed as a part of the structure of the housing 30 between the upper end portion 42A of the fan guard 42 and the top surface panel 32. Therefore, even when the outdoor machine 2 is viewed from the front surface side in particular, the handgrip portion 50 is unlikely to be visually recognized as a so-called handle portion, and thus the designability of the outdoor machine 2 can be prevented from being impaired.

[0045] In the present embodiment, as illustrated in FIG. 2, the handgrip portion 50 is formed along the width direction (left-right direction) of the first front surface portion 36A of the front surface panel 36. Therefore, a worker can optionally select a place to hold the handgrip portion 50, and the workability at the time of transportation and installation can be improved.

<Handle Portion>

[0046] The handle portion will now be described. FIG. 6 is a view illustrating the relationship between the positions of the handgrip portion and handle portions formed on the housing and the position of the center of gravity of the outdoor machine when the outdoor machine is viewed from the upper surface. FIG. 7 is a view illustrating the relationship between the positions of the handle portions formed on the housing and the position of the center of gravity of the outdoor machine when the outdoor machine is viewed from the front surface. In FIGS. 6 and 7, components included in the outdoor machine are appropriately omitted to illustrate the position of the handle portion. FIG. 8 is also a schematic diagram illustrating the relationship between the height positions of the handle portions when the outdoor machine is lifted, as viewed from the front surface of the outdoor machine. FIG. 9 is a schematic diagram illustrating a movement in which a worker lifts a load by bending and stretching the knees. As described above, in the present embodiment, the outdoor machine 2 includes three (plurality of) handle portions, which are the second handle portion 51, the third handle portion 52, and the fourth handle portion 53, in addition to the handgrip portion 50 functioning as the first handle portion. The second handle portion 51 to the fourth handle portion 53 are each provided on the side surface panel portion 33 of the housing 30, are recesses

protruding to the inside of the housing 30, and are portions on which fingers of a worker are put when the outdoor machine 2 is transported or installed. In general, the outdoor machine 2 has a different weight balance (position of the center of gravity) depending on the arrangement of circuit components such as the compressor 11 and the outdoor heat exchanger 13 which are housed inside the housing 30. Therefore, in order to facilitate the work of transporting and installing the outdoor machine 2 by a plurality of workers gripping the handle portion, the arrangement position of the handle portion is important.

[0047] In the present embodiment, as illustrated in FIG. 6, the handgrip portion (first handle portion) 50 and three handle portions, which are the second handle portion 51 to the fourth handle portion 53, are disposed so as to surround the position of the center of gravity G of the outdoor machine 2 when the housing 30 is viewed from the upper surface. In other words, the second handle portion 51 to the fourth handle portion 53 and the handgrip portion 50 are disposed such that the center of gravity G of the outdoor machine 2 is present in a first virtual area VA formed by connecting the first handle portion (handgrip portion) 50 to the fourth handle portion 53 adjacent to each other by a first virtual line VL when the housing 30 is viewed from the upper surface.

[0048] Here, the center of gravity G of the outdoor machine 2 refers to a point of action of the resultant force of gravity acting on the mass of each component constituting the outdoor machine 2, and for example, refers to a point at which the outdoor machine 2 can be supported in a well-balanced manner when the outdoor machine 2 is suspended. The center of gravity G of the outdoor machine 2 is regarded as an aggregate of the components of the outdoor machine 2, and can be calculated from the weights and the centers of gravity of the components by using a known formula. In addition, the center of gravity G of the outdoor machine 2 can also be obtained from a design drawing of the outdoor machine 2 by using computer-aided design (CAD) software.

[0049] When the outdoor machine 2 is lifted, an upward force is applied to each of the first handle portion (handgrip portion) 50 to the fourth handle portion 53. As described above, since the center of gravity G of the outdoor machine 2 is present inside the first virtual area VA, the upward force applied to the first handle portion (handgrip portion) 50 to the fourth handle portion 53 surrounds the downward force (gravity) applied to the center of gravity G of the outdoor machine 2. Therefore, when the outdoor machine 2 is lifted, the upward force and the downward force applied to the outdoor machine 2 are easily balanced, and the force for rotating the outdoor machine 2 can be suppressed. Therefore, the outdoor machine 2, which is a heavy object, can be transported and installed in a stable state.

[0050] As illustrated in FIG. 7, the second handle portion 51 to the fourth handle portion 53 are provided at positions higher than the position of the center of gravity

G when the housing 30 is viewed from the front surface (side surface). In other words, the second handle portion 51 to the fourth handle portion 53 are disposed such that the second handle portion 51 to the fourth handle portion 53 adjacent to each other are connected by a second virtual line VL1 and the center of gravity G of the outdoor machine 2 is present in a second virtual area VA1 below the second virtual line VL1 when the housing 30 is viewed from the front surface (side surface).

[0051] According to this configuration, since the outdoor machine 2 can be lifted and held at a position higher than the position of the center of gravity G, the force for rotating the outdoor machine 2 can be suppressed when the outdoor machine 2 is lifted. Therefore, the outdoor machine 2, which is a heavy object, can be transported and installed in a stable state.

[0052] As illustrated in FIGS. 2 and 3, the second handle portion 51 to the fourth handle portion 53 are each provided near the corner portion of the side surface panel portion 33. Specifically, the second handle portion 51 is provided on the right side surface side of the rear surface of the housing 30, that is, on the first rear surface portion 37A of the rear surface panel 37. The third handle portion 52 is provided on the front surface side of the right side surface of the housing 30, that is, on the second right side surface portion 38A of the right side surface panel 38. In addition, the third handle portion 52 is provided on the rear surface side of the left side surface, that is, at a corner portion of the left side surface panel 39 across the second left side surface portion 39A and the second rear surface portion 39B of the left side surface panel 39.

[0053] As described above, the second handle portion 51 to the fourth handle portion 53 are each provided near the corner portions of the side surface panel portion 33, and thus the second handle portion 51 to the fourth handle portion 53 can be disposed at a distance from each other. The outdoor machine 2 can be transported by a plurality of persons, and the workability of transportation and installation can be improved.

[0054] In the outdoor machine 2, a large number of circuit components such as the compressor 11 and the water-refrigerant heat exchanger 15 are disposed in the machine chamber RB. Therefore, when the outdoor machine 2 is viewed from the upper surface, as illustrated in FIG. 6, the position of the center of gravity G when the outdoor machine 2 is viewed from the upper surface is largely deviated from the center of the outdoor machine 2 toward the machine chamber RB side, that is, toward the right side surface (the second right side surface portion 38A of the right side surface panel 38) side of the housing 30. In this case, in order to stably transport the outdoor machine 2, the height positions at which the second handle portion 51 to the fourth handle portion 53 are provided are devised.

[0055] In the present embodiment, the handle portions disposed on the side to which the center of gravity G is deviated, that is, the second handle portion 51 disposed on the first rear surface portion 37A of the rear surface

panel 37 and the third handle portion 52 disposed on the second right side surface portion 38A of the right side surface panel 38 are each provided at positions of the same height H1 from the bottom plate 31. According to this configuration, when one or two workers lift the outdoor machine 2 by putting their hands on the second handle portion 51 and the third handle portion 52, the occurrence of a difference in force received by the workers can be suppressed. Therefore, the outdoor machine 2 can be prevented from falling in the front-rear direction due to the difference in force, and the outdoor machine 2 can be stably transported.

[0056] The fourth handle portion 53 disposed on the left side surface panel 39 on the opposite side is provided at a position of a height H2 from the bottom plate 31. The height H1 of the second handle portion 51 and the third handle portion 52 from the bottom plate 31 is set to be higher than the height H2 of the fourth handle portion 53 from the bottom plate 31. When the outdoor machine 2 in which the position of the center of gravity G is deviated is lifted, a larger weight load is applied to the second handle portion 51 and the third handle portion 52 on the side closer to the center of gravity G. In the present embodiment, the height H1 of the second handle portion 51 and the third handle portion 52 on the side closer to the center of gravity G is set higher than the height H2 of the fourth handle portion 53 on the side farther from the center of gravity G. Therefore, as illustrated in FIG. 8, when the outdoor machine 2 is lifted, the height at which the second handle portion 51 and the third handle portion 52 on the large weight load (so-called heavy) side are lifted can be suppressed to be lower than the height at which the fourth handle portion 53 on the small weight load (so-called light) side is lifted. Thus, the second handle portion 51 and the third handle portion 52 are held to reduce the burden on the worker who transports the outdoor machine 2, and the height of the second handle portion 51 and the third handle portion 52 from the bottom plate 31 when the outdoor machine 2 is lifted as illustrated in FIG. 8 is the same as the height of the fourth handle portion from the bottom plate 31, whereby the outdoor machine 2 can be stably transported.

[0057] In the present embodiment, the height H1 of the second handle portion 51 and the third handle portion 52 from the bottom plate 31, the handle portions being on the side closer to the center of gravity G, is set to be 450 (mm) or more and 500 (mm) or less. In addition, the height H2 of the fourth handle portion 53 from the bottom plate 31, the handle portion being on the side farther from the center of gravity G, is set to be 410 (mm) or more and 460 (mm) or less. By setting each of the heights H1 and H2 within the above-described ranges, when an adult (for example, male) worker M having a general physique lifts the outdoor machine 2 as illustrated in FIG. 9, the worker M can lift the outdoor machine 2 to a needed height only by extension of the knees in a state of stretching the hips and arms. Therefore, physical damage to the worker during transportation can be reduced, and the outdoor machine

2 can be transported safely and efficiently. Further, by setting each of the heights H1 and H2 within the above-described ranges, the worker can raise the height between the bottom plate 31 of the outdoor machine 2 and the installation surface to be higher than the height dimensions of the skit for transportation and the leg portion for installation. Therefore, the outdoor machine 2 can be safely installed at the installation location.

[0058] In the present embodiment, the second handle portion 51 provided on the above-described rear surface panel 37 is disposed near the corner portion of the housing 30 on the machine chamber RB side. Since heavy circuit components such as the compressor 11 and the water-refrigerant heat exchanger 15 are disposed in the machine chamber RB, the second handle portion 51 is disposed near the corner portion on the machine chamber RB side which is heavier than the heat exchange chamber RA, whereby the workability of the transporting work of the outdoor machine 2 is further improved.

[0059] In the present embodiment, the second handle portion 51 to the fourth handle portion 53 are each provided on the side surface panel portion 33 excluding the service panel 40, that is, the rear surface panel 37, the right side surface panel 38, and the left side surface panel 39. According to this configuration, in a case where the service panel 40 is removed and the device in the machine chamber RB is operated, for example, even if a situation occurs in which the wiring does not reach the terminal portion 26 at the time of connection, the outdoor machine 2 can be easily moved by using the second handle portion 51 to the fourth handle portion 53.

[0060] The movement of transporting the outdoor machine 2 will now be described. FIG. 10 is a top view illustrating the positions of the handle portions provided in the outdoor machine 2, and FIG. 11 is a diagram illustrating a state in which three workers are transporting the outdoor machine 2. As described above, the housing 30 of the outdoor machine 2 is provided with the handgrip portion 50 functioning as the first handle portion, and the second handle portion 51 to the fourth handle portion 53. The handgrip portion 50 is provided on the first front surface portion 36A of the front surface panel 36, and the second handle portion 51 is provided on the first rear surface portion 37A of the rear surface panel 37. In addition, the third handle portion 52 is provided on the second right side surface portion 38A of the right side surface panel 38, and the fourth handle portion 53 is provided at a corner portion between the second left side surface portion 39A and the second rear surface portion 39B of the left side surface panel 39. Therefore, in the present embodiment, the first handle portion (handgrip portion) 50 to the fourth handle portion 53 can be disposed at a distance from each other, and the directions in which the hand of a worker enters the first handle portion (handgrip portion) 50 to the fourth handle portion 53 do not overlap as indicated by white arrows in FIG. 10.

[0061] Therefore, as illustrated in FIG. 11, for example,

three workers can easily transport the outdoor machine 2, which is a heavy object. In the example of FIG. 11, one first worker M1 lifts the heat exchange chamber RA (FIG. 6) side which is relatively light, and two second worker M2 and third worker M3 lift the machine chamber RB (FIG. 6) side which is relatively heavy. In this case, the first worker M1 puts the right hand on the first handle portion (handgrip portion) 50 and puts the left hand on the fourth handle portion 53. On the other hand, the second worker M2 puts the right hand on the second handle portion 51 and holds the right side surface of the housing 30 with the left hand. In addition, the third worker M3 puts the right hand on the third handle portion 52 and puts the left hand on the first handle portion (handgrip portion) 50. Thus, since the three first worker M1 to third worker M3 lift the outdoor machine 2 at intervals around the outdoor machine 2, the outdoor machine 2 can be stably transported.

[0062] As described above, the outdoor machine 2 of the heat pump cycle apparatus 1 according to the present embodiment has the housing 30 which houses therein the outdoor heat exchanger 13 and the outdoor fan 17 which blows air to the outdoor heat exchanger 13. The housing 30 has the front surface panel 36 provided with the blowout port 41 for blowing out air heat-exchanged with a refrigerant in the outdoor heat exchanger 13 to the outside of the housing 30 by the rotation of the outdoor fan 17, the top surface panel 32 disposed above the front surface panel 36, and the fan guard 42 disposed on the front surface panel 36 so as to cover the blowout port 41. When a direction in which air is blown out from the blowout port 41 is a front side, the front surface panel 36 is disposed rearward of the front end portion 32A of the top surface panel 32, and the fan guard 42 is disposed on the front surface panel 36 with a predetermined gap between the upper end portion 42A of the fan guard and the top surface panel 32. The housing 30 includes the handgrip portion 50 which is formed between the upper end portion 42A of the fan guard 42 and the top surface panel 32 and into which fingers can be inserted to hold the outdoor machine 2 when the outdoor machine 2 is transported. According to this configuration, since the handgrip portion 50 appears to be the design of the housing 30 and the fan guard 42, the designability of the outdoor machine 2 can be prevented from being impaired. Further, since the handgrip portion 50 is a structure provided in a part of the housing 30, the handgrip portion has sufficient strength to be held, and the outdoor machine 2 can be easily transported.

[0063] In the outdoor machine 2 of the heat pump cycle apparatus 1 according to the present embodiment, since the handgrip portion 50 is formed along the width direction of the front surface panel 36, the worker can optionally select a portion to be held, and workability during transportation and installation can be improved.

[0064] In the outdoor machine 2 of the heat pump cycle apparatus 1 according to the present embodiment, the front surface panel 36 has, at the upper end portion thereof, the bent portion 36A1 extending forward from

the upper end portion, and the handgrip portion 50 is formed by connecting the bent portion 36A1 and the front end portion 32A of the top surface panel 32. According to this configuration, since the handgrip portion 50 can be formed as a structure of the housing 30 having sufficient strength, the outdoor machine 2 can be easily transported. Further, the outdoor machine 2 can be manufactured at a lower cost than, for example, the case where the handle portions are provided on all the panels of the housing.

[0065] In the outdoor machine 2 of the heat pump cycle apparatus 1 according to the present embodiment, the housing 30 has the side surface panel portion 33 which partitions the inside and the outside of the housing 30 together with the front surface panel 36, and the side surface panel portion 33 is provided with the second handle portion 51 to the fourth handle portion 53 for transporting the outdoor machine 2. According to this configuration, since the worker holds the handgrip portion 50 and the second handle portion 51 to the fourth handle portion 53 during the transportation and installation work, the worker can safely perform the work without losing the balance, and the workability of the transportation and installation work can be improved.

[0066] In the outdoor machine 2 of the heat pump cycle apparatus 1 according to the present embodiment, the side surface panel portion 33 has the rear surface panel 37 which is disposed on the side opposite to the front surface panel 36 with the outdoor heat exchanger 13 interposed therebetween and forms a part of the rear surface of the housing 30, the right side surface panel 38 which forms a part of the right side surface of the housing 30, and the left side surface panel 39 which forms a part of the left side surface of the housing 30, and one of the second handle portion 51 to the fourth handle portion 53 is provided on each of the rear surface panel 37, the right side surface panel 38, and the left side surface panel 39. According to this configuration, workability is improved when the outdoor machine 2 is transported and installed by three or more workers.

[0067] The outdoor machine 2 of the heat pump cycle apparatus 1 according to the present embodiment has the compressor 11 and the water-refrigerant heat exchanger 15 which exchanges heat between a refrigerant and water, the heat exchange chamber RA in which the outdoor heat exchanger 13 and the outdoor fan 17 are disposed and the machine chamber RB in which the compressor 11 and the water-refrigerant heat exchanger 15 are disposed are provided inside the housing 30, and the second handle portion 51 provided on the rear surface panel 37 is disposed on the machine chamber RB side. According to this configuration, since the second handle portion 51 is provided on the machine chamber RB side which is heavier than the heat exchange chamber RA, the workability when the outdoor machine 2 is transported and installed can be further improved.

[0068] In the outdoor machine 2 of the heat pump cycle apparatus 1 according to the present embodiment, the

housing 30 has the service panel 40 which covers a part of the machine chamber RB and is detachable from the housing 30, and the second handle portion 51 to the fourth handle portion 53 are each provided on the rear surface panel 37, the right side surface panel 38, and the left side surface panel 39, which exclude the service panel 40. According to this configuration, in a case where the service panel 40 is removed and the device in the machine chamber RB is operated, for example, even if a situation occurs in which the wiring does not reach the terminal portion 26 at the time of connection, the outdoor machine 2 can be easily moved by using the second handle portion 51 to the fourth handle portion 53.

[0069] A modification of the present embodiment will now be described. FIG. 12 is a partially enlarged front view of an outdoor machine according to the modification as viewed from the front surface. In the above-described embodiment, the configuration in which the handgrip portion 50 is formed along the width direction of the first front surface portion 36A of the front surface panel 36 has been described, but the embodiment is not limited thereto. For example, as illustrated in FIG. 12, a housing 30A of an outdoor machine 2A includes a fan guard 142, and the fan guard 142 has a widthwise central portion of an upper end portion (an end portion on the upper side) 142A extending to the top surface panel 32. As described above, the handgrip portions 50 may be formed only on both sides in the width direction of the first front surface portion 36A of the front surface panel 36, and also in this configuration, the worker can hold the outdoor machine 2A by inserting fingers into the handgrip portion 50, and can easily transport the outdoor machine 2A without impairing the designability.

[0070] As described above, an embodiment of the heat pump cycle apparatus according to the present disclosure has been described, but the embodiment is not limited thereto. For example, in the present embodiment, a configuration is adopted in which three handle portions, which are the second handle portion 51 to the fourth handle portion 53, are provided in the housing 30, but four or more handle portions may be provided. A configuration is adopted in which the rear surface panel 37, the right side surface panel 38, and the left side surface panel 39 are each provided with one handle portion, but each panel may be provided with two or more handle portions. In the present embodiment, a configuration is adopted in which one fourth handle portion 53 is provided on the left side surface (left side surface panel 39) of the housing 30 on the side farther from the center of gravity G, but a handle portion may be provided at each of both corner portions of the left side surface. In this case, it is preferable that the heights from the bottom plate 31 to the respective handle portions are the same. Further, in the present embodiment, a heat pump cycle apparatus which performs air-conditioning operation by circulating water between the outdoor machine 2 and the indoor machine 3 has been described, but the heat pump cycle apparatus may be an air conditioner which performs air-

conditioning operation by supplying a refrigerant to the indoor machine and causing the refrigerant to dissipate or absorb heat by the indoor heat exchanger without having the water-refrigerant heat exchanger in the outdoor machine.

Reference Signs List

[0071]

1 HEAT PUMP CYCLE APPARATUS
 2, 2A OUTDOOR MACHINE
 11 COMPRESSOR
 13 OUTDOOR HEAT EXCHANGER (HEAT EXCHANGER)
 15 WATER-REFRIGERANT HEAT EXCHANGER
 17 OUTDOOR FAN (FAN)
 30, 30A HOUSING
 31 BOTTOM PLATE (BOTTOM SURFACE PANEL)
 32 TOP SURFACE PANEL
 32A FRONT END PORTION (END PORTION ON FRONT SIDE)
 33 SIDE SURFACE PANEL PORTION
 36 FRONT SURFACE PANEL
 36A FIRST FRONT SURFACE PORTION
 36A1 BENT PORTION
 36A11 FIRST BENT PORTION
 36A12 SECOND BENT PORTION
 36B FIRST LEFT SIDE SURFACE PORTION
 37 REAR SURFACE PANEL
 37A FIRST REAR SURFACE PORTION
 37B FIRST RIGHT SIDE SURFACE PORTION
 38 RIGHT SIDE SURFACE PANEL
 38A SECOND RIGHT SIDE SURFACE PORTION
 38B SECOND FRONT SURFACE PORTION
 39 LEFT SIDE SURFACE PANEL
 39A SECOND LEFT SIDE SURFACE PORTION
 39B SECOND REAR SURFACE PORTION
 40 SERVICE PANEL
 41 BLOWOUT PORT
 42, 142 FAN GUARD
 42A, 142A UPPER END PORTION (END PORTION ON UPPER SIDE)
 50 HANDGRIP PORTION (FIRST HANDLE PORTION)
 51 SECOND HANDLE PORTION
 52 THIRD HANDLE PORTION
 53 FOURTH HANDLE PORTION
 G CENTER OF GRAVITY
 RA HEAT EXCHANGE CHAMBER
 RB MACHINE CHAMBER
 VA FIRST VIRTUAL AREA
 VA1 SECOND VIRTUAL AREA
 VL FIRST VIRTUAL LINE
 VL1 SECOND VIRTUAL LINE (VIRTUAL LINE)

Claims

1. A heat pump cycle apparatus comprising an outdoor machine having

a housing which houses therein a heat exchanger and a fan which blows air to the heat exchanger,
 the housing having a front surface panel provided with a blowout port for blowing out air heat-exchanged with a refrigerant in the heat exchanger to an outside of the housing by rotation of the fan, a top surface panel disposed above the front surface panel, and a fan guard disposed on the front surface panel so as to cover the blowout port, wherein
 when a direction in which air is blown out from the blowout port is a front side, the front surface panel is disposed rearward of an end portion on the front side of the top surface panel,
 the fan guard is disposed on the front surface panel with a predetermined gap between an end portion on an upper side of the fan guard and the top surface panel, and
 the housing comprises a handgrip portion which is formed between the end portion on the upper side of the fan guard and the top surface panel and into which fingers can be inserted to hold the outdoor machine when the outdoor machine is transported.

2. The heat pump cycle apparatus according to claim 1, wherein the handgrip portion is formed along a width direction of the front surface panel.

3. The heat pump cycle apparatus according to claim 1 or 2, wherein

the front surface panel has, at an upper end portion thereof, a bent portion extending forward from the upper end portion, and
 the handgrip portion is formed by connecting the bent portion and the top surface panel.

4. The heat pump cycle apparatus according to any one of claims 1 to 3, wherein the housing has a side surface panel portion which partitions an inside and an outside of the housing together with the front surface panel, and the side surface panel portion is provided with handle portions for transporting the outdoor machine.

5. The heat pump cycle apparatus according to claim 4, wherein

the side surface panel portion has a rear surface panel which is disposed on a side opposite to the front surface panel with the heat exchanger

interposed therebetween and forms a part of a rear surface of the housing, a right side surface panel which forms a part of a right side surface of the housing, and a left side surface panel which forms a part of a left side surface of the housing, and
at least one of the handle portions is provided on each of the rear surface panel, the right side surface panel, and the left side surface panel.

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6. The heat pump cycle apparatus according to claim 5, having

a compressor, and a water-refrigerant heat exchanger which exchanges heat between a refrigerant and water, wherein
a heat exchange chamber in which the heat exchanger and the fan are disposed and a machine chamber in which the compressor and the water-refrigerant heat exchanger are disposed
are provided inside the housing, and
the handle portion provided on the rear surface panel is disposed on a side of the machine chamber.

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7. The heat pump cycle apparatus according to claim 6, wherein

the housing has a service panel which covers a part of the machine chamber and is detachable from the housing, and
the handle portions are provided on the side surface panel portion excluding the service panel.

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FIG.1

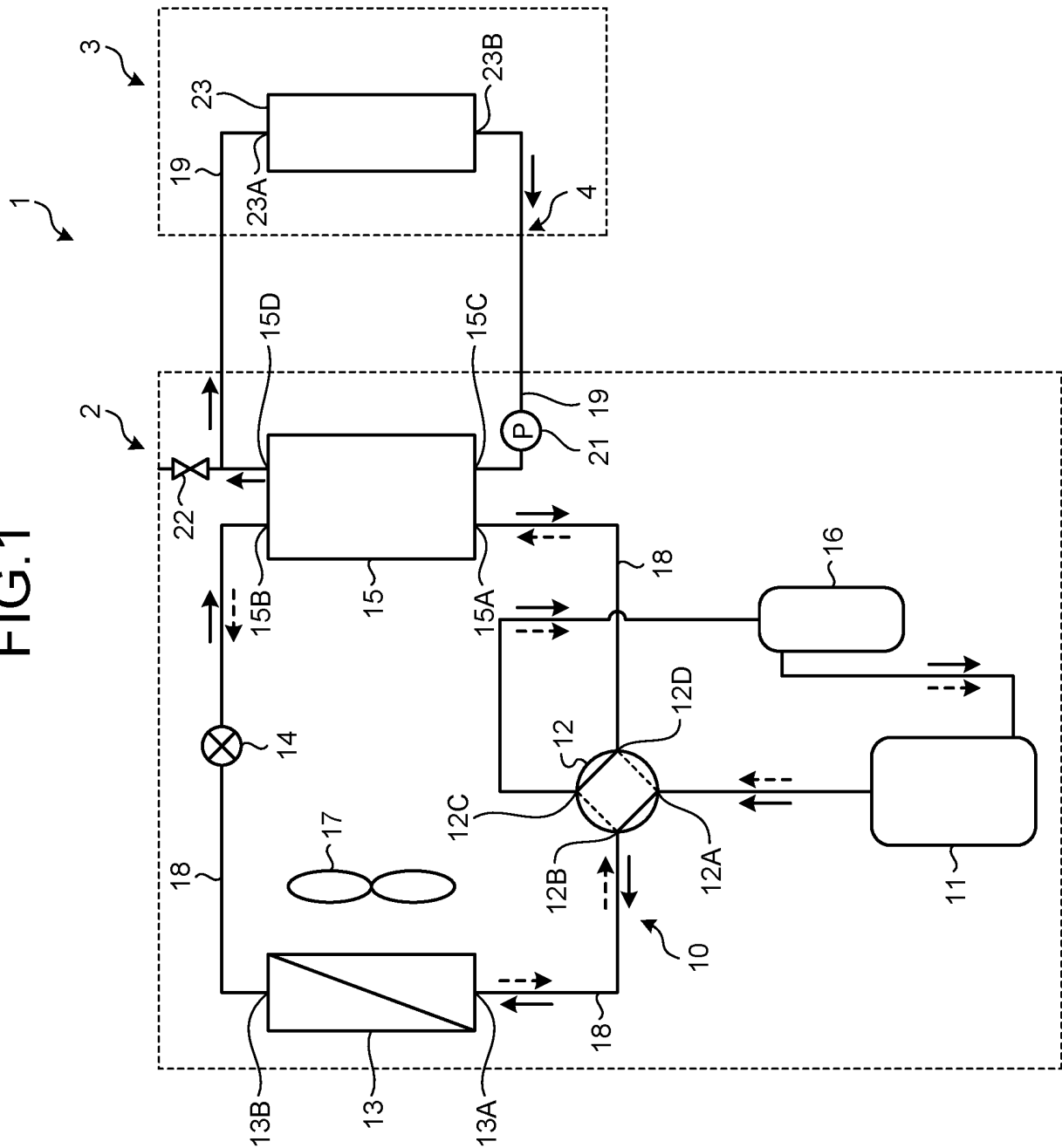


FIG.2

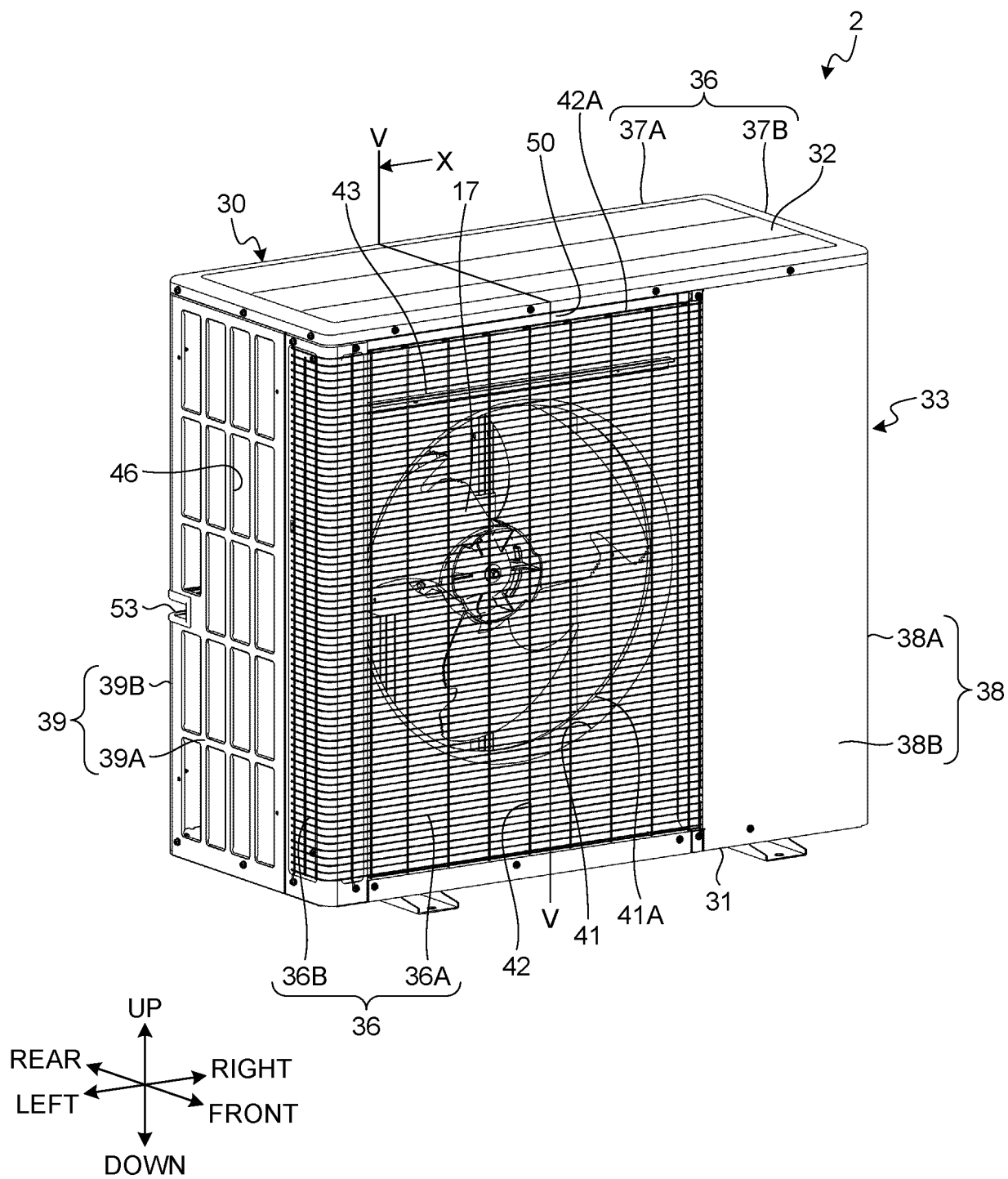


FIG.3

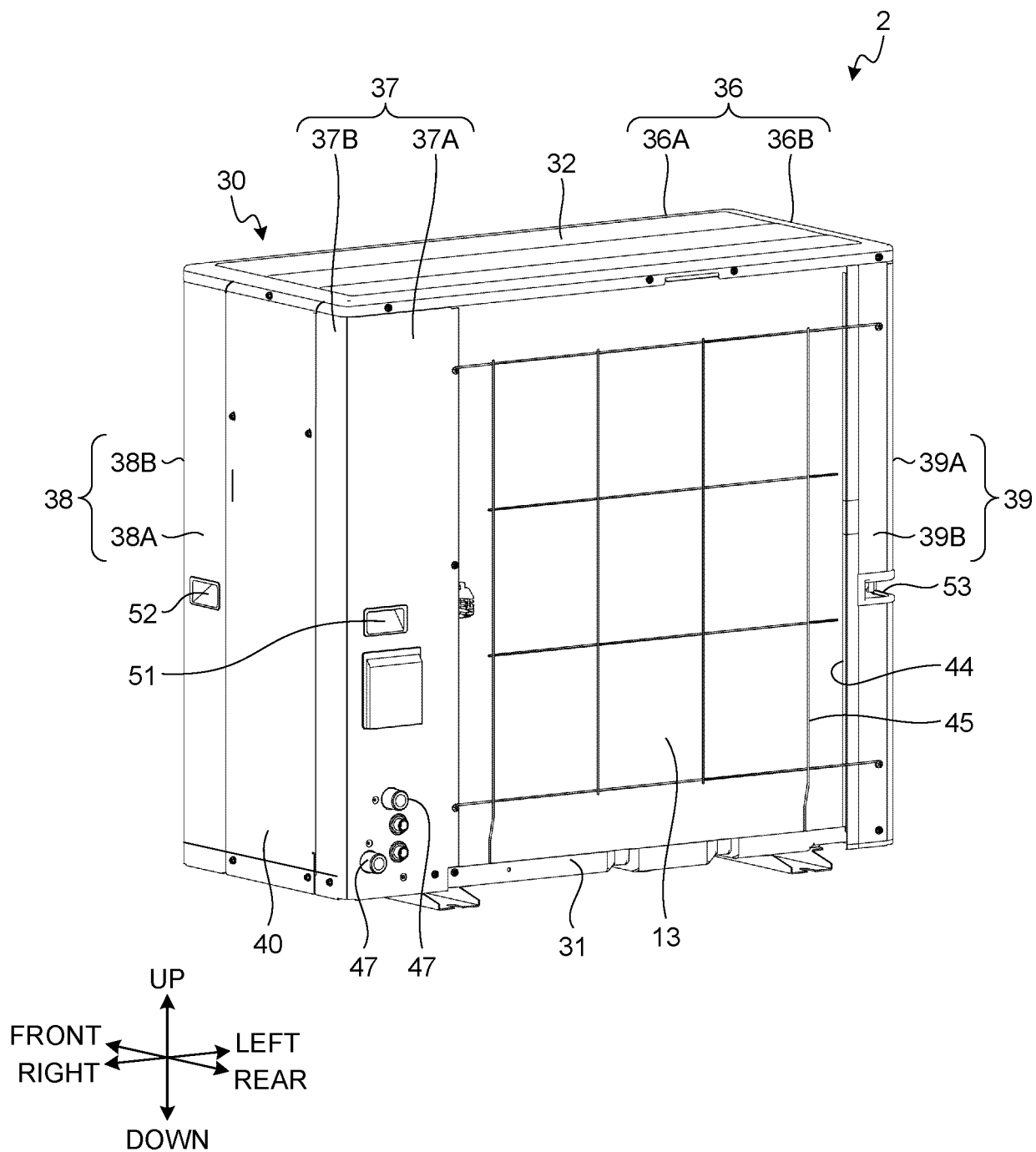


FIG.4

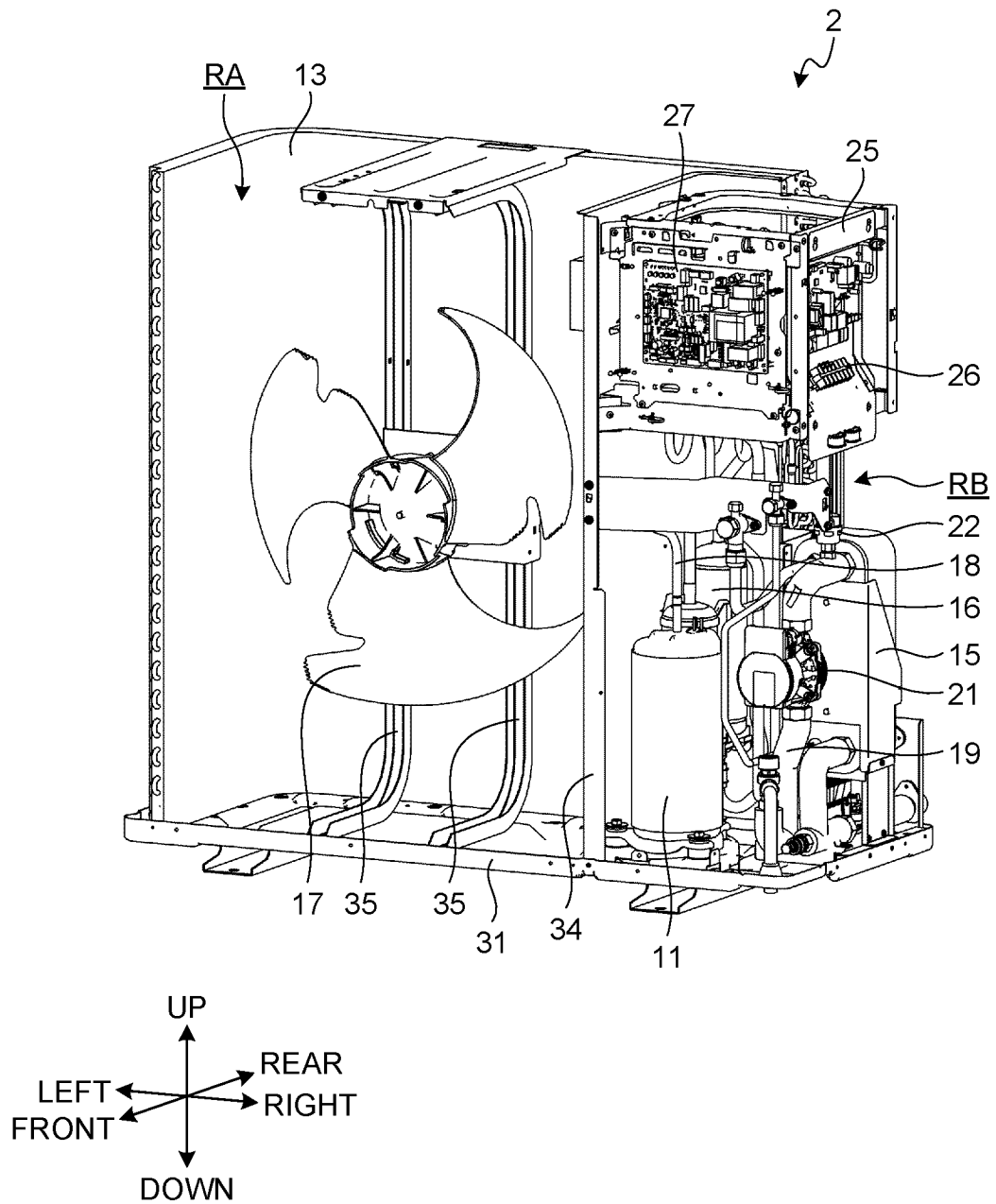


FIG.5

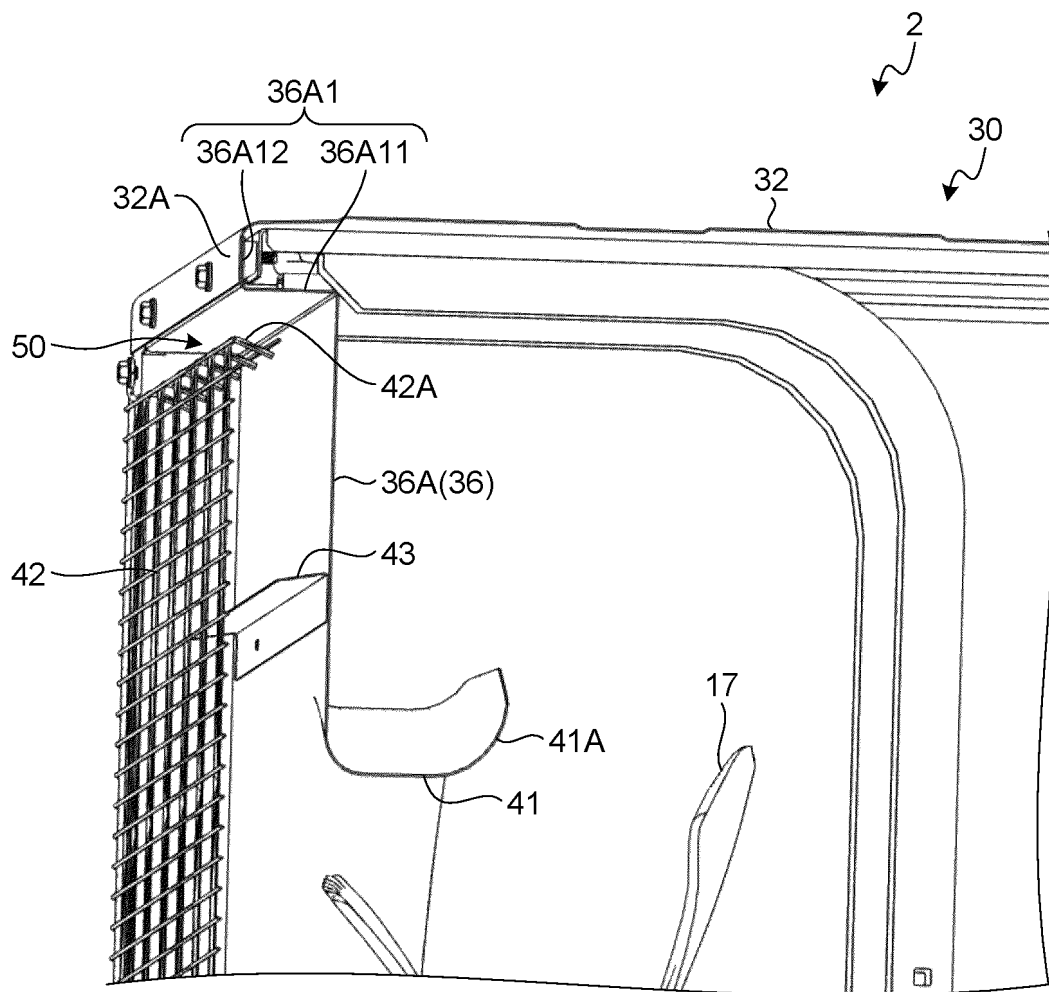


FIG.6

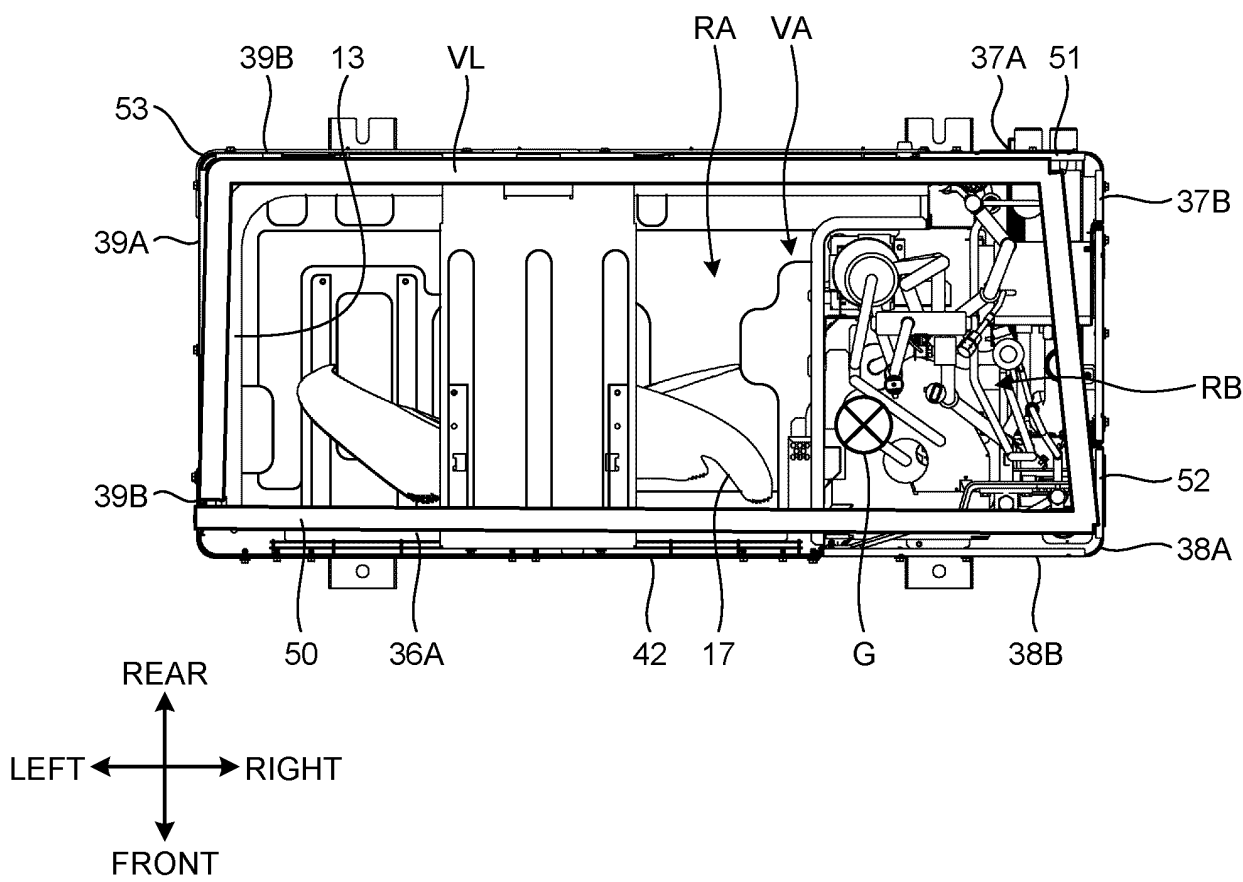


FIG.7

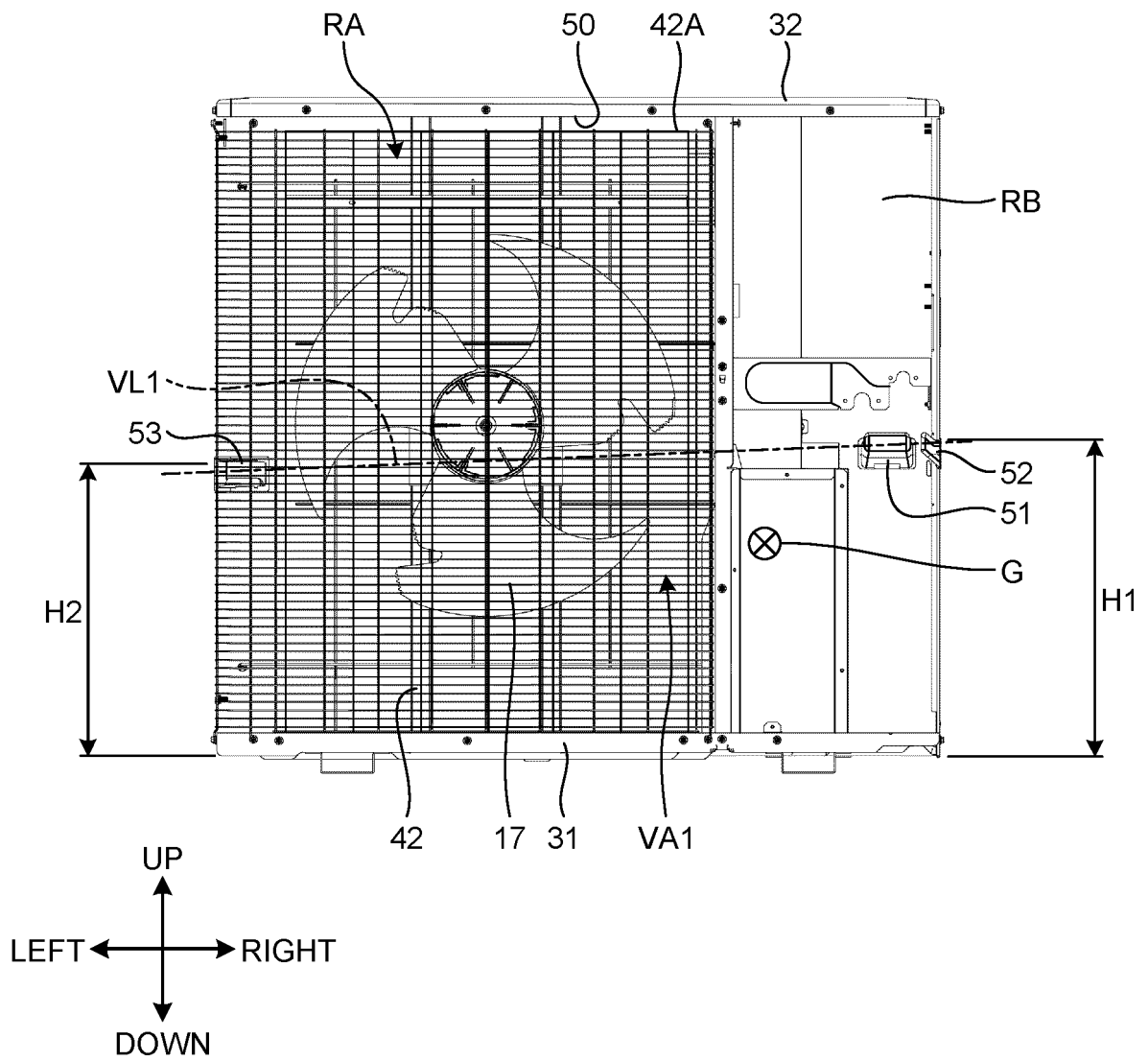


FIG.8

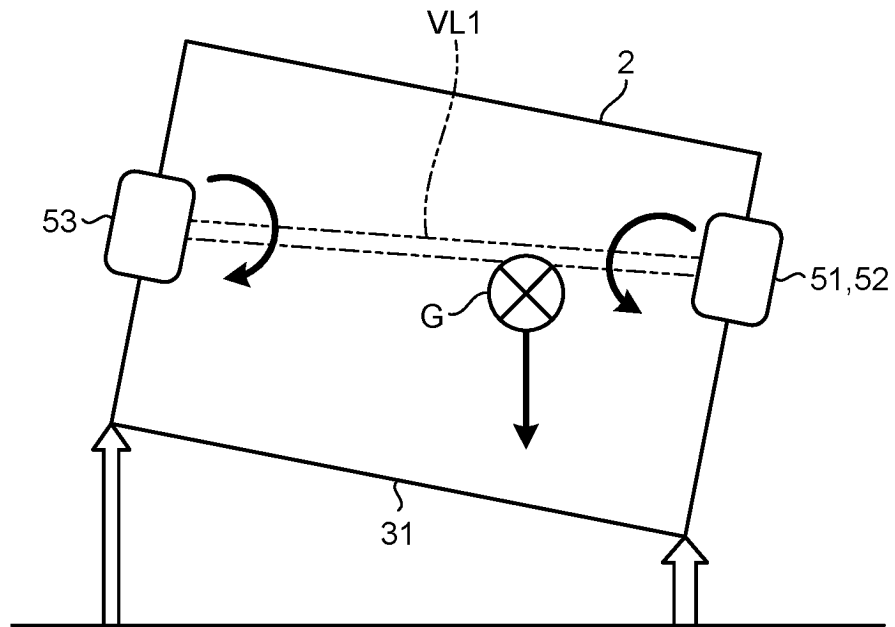


FIG.9

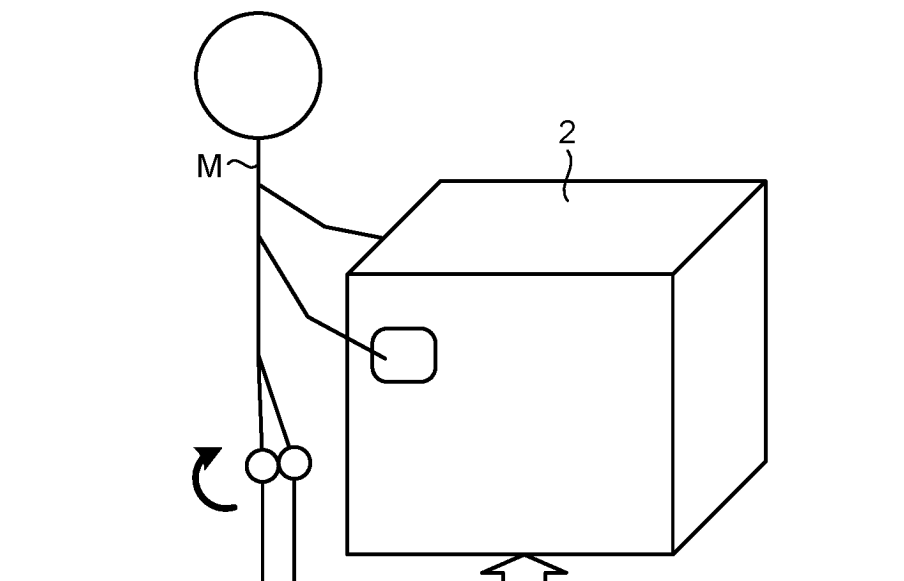


FIG.10

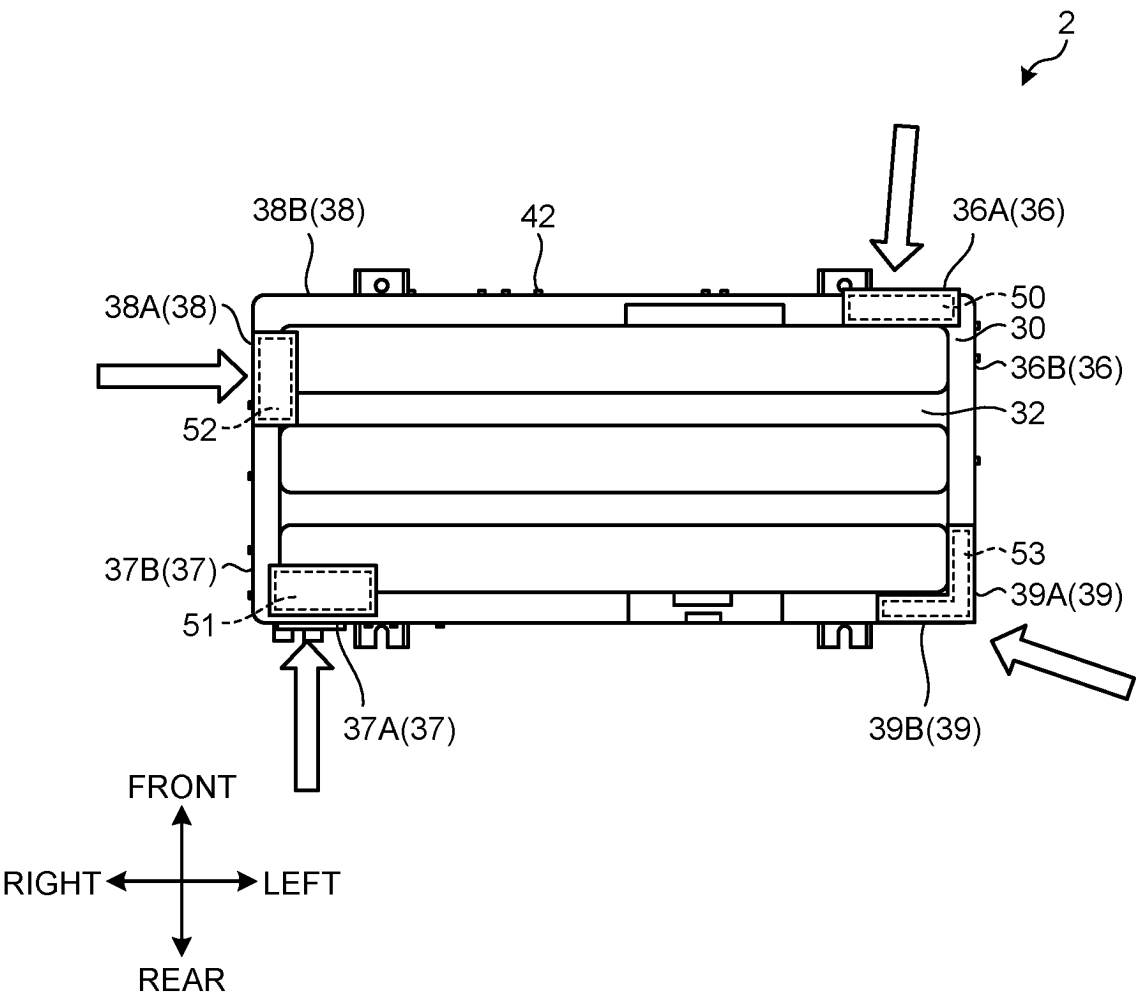


FIG.11

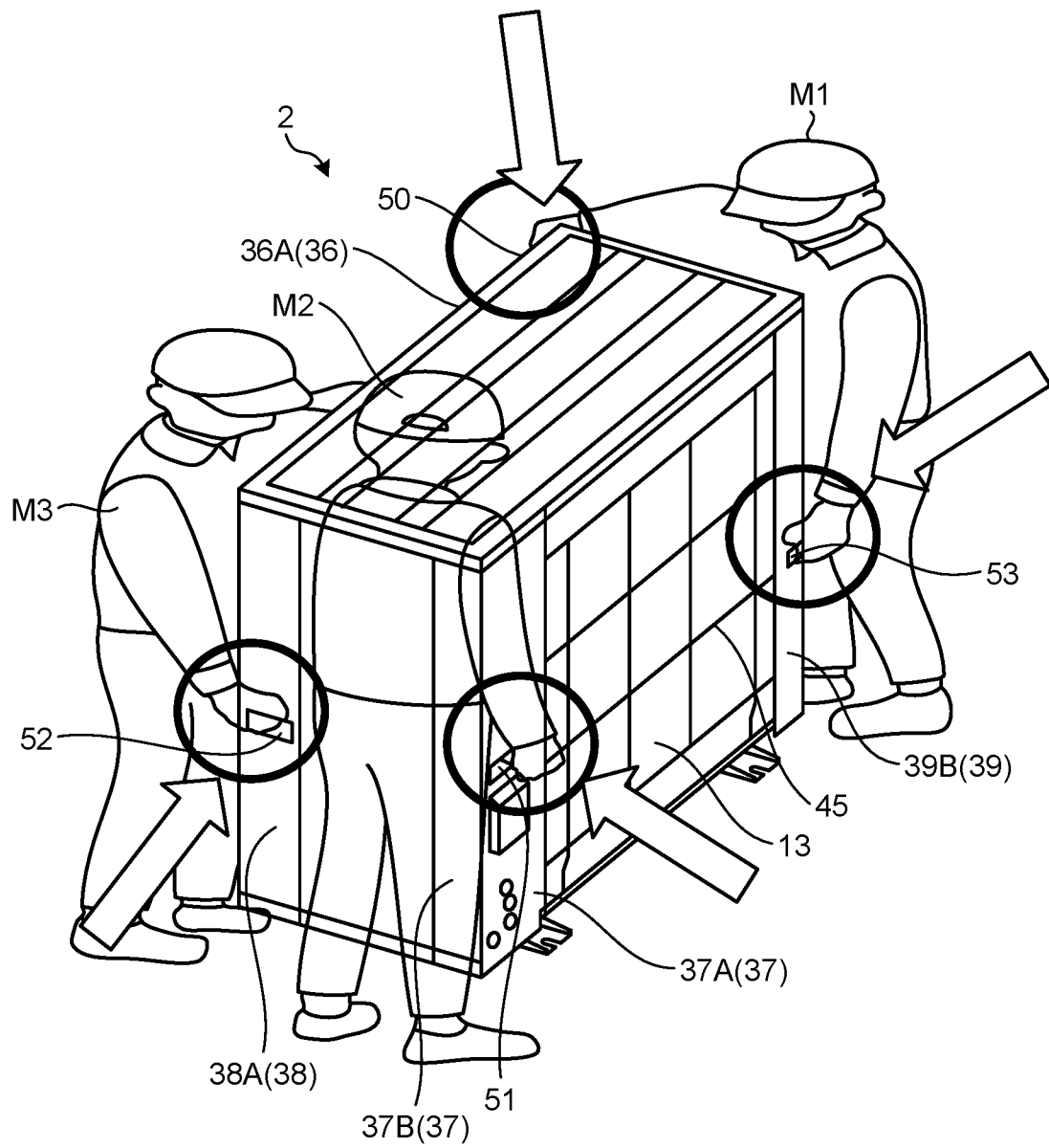
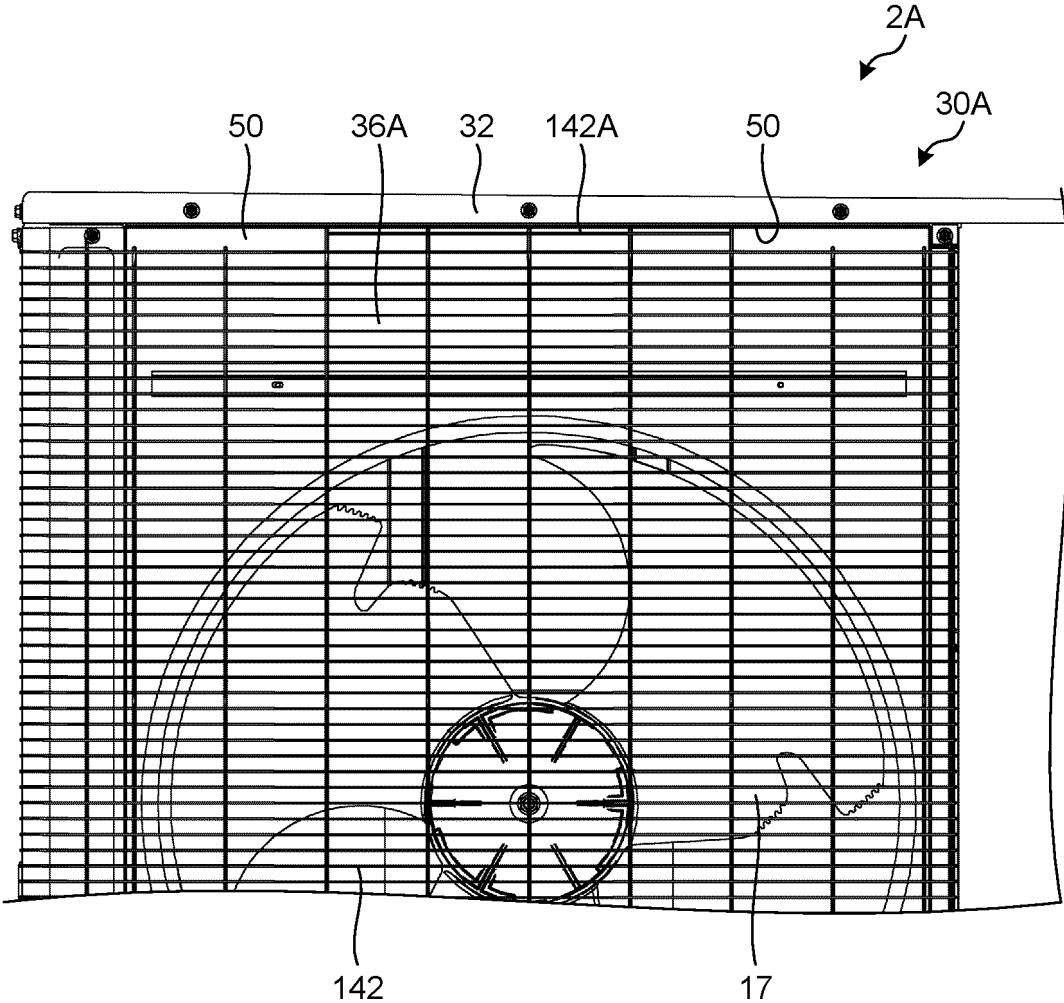


FIG.12



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2023/007186

A. CLASSIFICATION OF SUBJECT MATTER F24F 1/56 (2011.01)i FI: F24F1/56 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) F24F1/56 F24F13/20 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Published examined utility model applications of Japan 1922-1996 Published unexamined utility model applications of Japan 1971-2023 Registered utility model specifications of Japan 1996-2023 Published registered utility model applications of Japan 1994-2023 Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)	
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 2013-124822 A (MITSUBISHI ELECTRIC CORP) 24 June 2013 (2013-06-24) paragraphs [0011]-[0029], fig. 1-7	1-4 5-7
Y	WO 2018/025325 A1 (MITSUBISHI ELECTRIC CORP) 08 February 2018 (2018-02-08) paragraphs [0021]-[0052], fig. 1-4	5-7
Y	JP 2014-114983 A (PANASONIC CORP) 26 June 2014 (2014-06-26) paragraphs [0052]-[0054], fig. 1-2	6-7
Y	JP 9-189436 A (SANYO ELECTRIC CO LTD) 22 July 1997 (1997-07-22) paragraphs [0011], [0025], fig. 1-4	7
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family	
Date of the actual completion of the international search 27 April 2023	Date of mailing of the international search report 16 May 2023	
Name and mailing address of the ISA/JP Japan Patent Office (ISA/JP) 3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915 Japan	Authorized officer Telephone No.	

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2023/007186

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WO	2018/025325	A1	08 February 2018	(Family: none)	
JP	2014-114983	A	26 June 2014	(Family: none)	
JP	9-189436	A	22 July 1997	(Family: none)	

REFERENCES CITED IN THE DESCRIPTION

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