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(54) **AIR CONDITIONER**

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Description

TECHNICAL FIELD

[0001] The present invention relates to an air conditioner, and particularly to an air conditioner that performs heating through a vapor compression refrigeration cycle.

BACKGROUND ART

[0002] In a case where an air conditioner that performs heating through the vapor compression refrigeration cycle starts a heating operation, conditioned air blown out from an indoor unit of the air conditioner is at substantially the same low temperature as a room temperature at the time point of starting the heating operation, until an indoor heat exchanger of the air conditioner warms up. If the conditioned air at such a low temperature or the conditioned air mixed with indoor air is blown onto a user in the room, the user may feel uncomfortable by cold air blow out from the indoor unit. In order to protect the user from feeling cold by cold air blown out from the air conditioner immediately after the start of the heating operation, for example, the air conditioner described in Patent Literature 1 (JP 9-303844 A) restricts the volume of air blown out from a fan until the temperature of the conditioned air to be blown out rises. Another air conditioner is disclosed in patent document JPH05141755A.

<Technical Problem>

[0003] However, if the volume of air to be blown out is restricted at the time of starting the heating operation as described in Patent Literature 1, the rise in room temperature is also reduced, and it takes time for the room to warm up.

SUMMARY OF THE INVENTION

[0004] Aim of the present invention is to provide an air conditioner which improves the state of the art indicated above. This aim is achieved by the air conditioner according to the corresponding appended independent claims 1 and 7. Preferred embodiments of the invention are provided according to the dependent claims.

[0005] In particular, object of the present invention is to reduce uncomfortable feeling due to cold air and promote a rise in room temperature in an air conditioner that performs heating through a vapor compression refrigeration cycle.

<Solution to Problem>

[0006] In a first aspect, an air conditioner according to claim 1 of the present invention includes: an indoor heat exchanger configured to exchange heat between refrigerant and indoor air in a vapor compression refrigeration cycle; and an indoor fan configured to be able to change an air volume at a time of blowing out, into a room, conditioned air obtained through the heat exchange by the indoor heat exchanger, wherein the air conditioner is configured to perform, when starting heating, first cold air reduction control for performing an air volume restriction of the indoor fan until a temperature of the indoor heat exchanger reaches a first temperature, and second cold air reduction control for cancelling the air volume restriction at the indoor fan when the temperature of the indoor heat exchanger reaches a second temperature lower than the first temperature.

[0007] The air conditioner according to the first aspect performs the first cold air reduction control for restricting the air volume of the indoor fan until the temperature of the indoor heat exchanger reaches the first temperature, and the second cold air reduction control for cancelling the air volume restriction at the indoor fan when the temperature of the indoor heat exchanger reaches the second temperature lower than the first temperature. Therefore, the air conditioner can selectively perform the first cold air reduction control in order to preferentially reduce uncomfortable feeling due to cold air, or the second cold air reduction control in order to preferentially promote a rise in room temperature, wherein wherein the first cold air reduction control or the second cold air reduction control is selected in accordance with a preset selection condition.

[0008] The air conditioner according to the first aspect further includes a flap configured to swing a direction of blowing out the conditioned air from the indoor fan, wherein the selection condition includes, as a condition for selecting the second cold air reduction control, a condition requiring that the flap not be swinging.

[0009] In the air conditioner according to the fourth aspect, the selection condition includes, as a condition for selecting the second cold air reduction control, the condition requiring that the flap not be swinging, and thus the second cold air reduction control is not performed while the flap is swinging to blow out conditioned air to a wide range. Therefore, it is possible to reduce the conditioned air being blown directly onto a user, even if the second cold air reduction control is performed while the user is in the room. If the swing is stopped in order to select the second cold air reduction control, the user is very likely to mistake the stop for a malfunction. The present invention can avoid such a mistake.

[0010] An air conditioner according to a second aspect of the present invention includes alternatively to the first aspect of the present invention, a horizontal flap configured to change an up-down direction of blowing out the conditioned air from the indoor fan, wherein the selection condition includes, as a condition for selecting the second cold air reduction control, a condition requiring that the horizontal flap be oriented upward relative to a predetermined angle.

[0011] In the air conditioner according to the fifth aspect, the selection condition includes, as a condition for selecting the second cold air reduction control, the condition requiring that the horizontal flap be oriented upward relative to the predetermined angle, and thus the second cold air reduction control is not performed when the horizontal flap is oriented at, or downward relative to, the predetermined angle. Therefore, if the predetermined angle is set such that the conditioned air is not blown onto the user in the room, it is possible to reduce the conditioned air being blown directly onto the user, even if the second cold air reduction control is performed while the user is in the room.

[0012] Other preferred aspect of the invention are provided in the appended dependent claims. <Advantageous Effects of Invention>

[0013] The air conditioner according of the present invention makes it possible to reduce uncomfortable feeling due to cold air and to promote a rise in room temperature.

[0014] The air conditioner according of the present invention makes it easy to reduce uncomfortable feeling due to cold air and to promote a rise in room temperature.

[0015] In the air conditioner according to another aspect of the present invention, the second cold air reduction control is not performed when the room is already warm and there is little need to raise the room temperature quickly. This makes it possible to improve an effect of reducing uncomfortable feeling due to cold air.

[0016] In the air conditioner according to the present invention, during the second cold air reduction control, it is possible to prevent a movement of the flap that may be mistaken for a malfunction and a movement of the flap that increases the uncomfortable feeling due to cold air.

[0017] The air conditioner according to aspects of the present invention makes it possible to improve the function of reducing uncomfortable feeling due to cold air.

[0018] The air conditioner according to another aspect of the present invention improves the function of promoting a rise in room temperature.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

FIG. 1 is a perspective view illustrating an appearance of an air conditioner according to an embodiment.

FIG. 2 is a circuit diagram illustrating a schematic configuration of the air conditioner according to the embodiment.

FIG. 3 is a cross-sectional view of an indoor unit in which horizontal flaps are at positions of a ceiling flow being selected as a wind direction.

FIG. 4 is a block diagram illustrating a schematic configuration of a control system of the air conditioner.

FIG. 5 is a cross-sectional view of the indoor unit in which the horizontal flaps are at positions of an upward flow being selected as the wind direction.

FIG. 6 is a cross-sectional view of the indoor unit in which the horizontal flaps are at positions of a vertical flow being selected as the wind direction.

FIG. 7 is a conceptual view illustrating the interior of a room and the indoor unit for describing a difference in the wind direction between an upward flow and a downward flow.

FIG. 8 is a flowchart for describing first cold air reduction control and second cold air reduction control.

FIG. 9 is a flowchart for describing second cold air reduction control and third cold air reduction control in Modification 1A.

FIG. 10 is a circuit diagram illustrating a schematic configuration of an air conditioner according to Modification IB.

FIG. 11 is a block diagram illustrating a schematic configuration of a control system of the air conditioner according to Modification IB.

FIG. 12 is a flowchart for describing first cold air reduction control and second cold air reduction control in Modification 1C.

DESCRIPTION OF EMBODIMENTS

(1) Overall configuration

[0020] A schematic configuration of an air conditioner according to an embodiment of the present invention will be described with reference to FIGS. 1 and 2. An air conditioner 1 illustrated in FIG. 1 includes an indoor unit 3 attached to, for example, a wall surface WL in a room, and an outdoor unit 2 installed outdoors. In FIG. 1, the outdoor unit 2 is illustrated by a broken line since the outdoor unit 2 is located outdoors on the opposite side of the indoor unit 3 with the wall surface WL interposed therebetween. FIG. 2 illustrates a circuit configuration of the air conditioner 1. The air conditioner 1 includes a refrigerant circuit 10, and can execute a vapor compression refrigeration cycle by circulating refrigerant in the refrigerant circuit 10. The indoor unit 3 and the outdoor unit 2 are connected by a connection pipe 4 in order to form the refrigerant circuit 10 through which the refrigerant circulates. As illustrated in FIG. 4, the air conditioner 1 also includes a control unit 50 in order to control internal devices. A remote controller 5 is attached to the air conditioner 1. The remote controller 5 has a function of communicating with the control unit 50 using, for example, an infrared ray. A user can use the remote controller 5 to make various settings for the air conditioner 1.

(1-1) Refrigerant circuit 10

[0021] The refrigerant circuit 10 includes a compressor 11, an outdoor heat exchanger 13, an expansion mechanism 14, an accumulator 15, and an indoor heat exchanger 16. The compressor 11 sucks the refrigerant through a suction port, and discharges the refrigerant compressed inside the compressor 11 to the indoor heat exchanger 16 through a discharge port. The compressor 11 is a variable-capacity inverter compressor that controls the number of rotations by an inverter. As an operating frequency of the compressor 11 increases, the amount of circulating refrigerant increases. As the operating frequency of the compressor 11 decreases, on the other hand, the amount of circulating refrigerant decreases.

[0022] The outdoor heat exchanger 13 includes a first port and a second port. The first port allows the refrigerant to flow between the outdoor heat exchanger 13 and the suction port of the compressor 11 via the accumulator 15. The second port allows the refrigerant to flow between the outdoor heat exchanger 13 and the expansion mechanism 14. The outdoor heat exchanger 13 exchanges heat between outdoor air and the refrigerant flowing through a heat transfer tube (not illustrated) connected between the second port and the first port of the outdoor heat exchanger 13.

[0023] The expansion mechanism 14 is disposed between the outdoor heat exchanger 13 and the indoor heat exchanger 16. The expansion mechanism 14 has a function of expanding and thus decompressing the refrigerant flowing between the outdoor heat exchanger 13 and the indoor heat exchanger 16. The expansion mechanism 14 is configured to change the opening degree thereof. A decrease in the opening degree increases a flow path resistance of the refrigerant passing through the expansion mechanism 14. An increase in the opening degree decreases the flow path resistance of the refrigerant passing through the expansion mechanism 14. During a heating operation, such an expansion mechanism 14 expands and thus decompresses the refrigerant flowing from the indoor heat exchanger 16 toward the outdoor heat exchanger 13. A change in the opening degree of the expansion mechanism 14 changes a flow rate of the refrigerant flowing through the refrigerant circuit 10, even if the state of the other devices attached to the refrigerant circuit 10 does not change.

[0024] The indoor heat exchanger 16 includes a first port and a second port. The first port allows gas refrigerant to flow between the indoor heat exchanger 16 and the discharge port of the compressor 11. The second port allows liquid refrigerant to flow between the indoor heat exchanger 16 and the expansion mechanism 14. The indoor heat exchanger 16 exchanges heat between indoor air and the refrigerant flowing through heat transfer tubes 16b (see FIG. 3) connected between the second port and the first port of the indoor heat exchanger 16.

[0025] The accumulator 15 is disposed between the outdoor heat exchanger 13 and the suction port of the compressor 11. In the accumulator 15, the refrigerant flowing from the outdoor heat exchanger 13 toward the compressor 11 is separated into gas refrigerant and liquid refrigerant. Then, the gas refrigerant is mainly supplied from the accumulator 15 to the suction port of the compressor 11.

[0026] In order to promote heat exchange between the outdoor air and the refrigerant flowing through the heat transfer tube, the outdoor unit 2 includes an outdoor fan 21 that generates a flow of the outdoor air passing through the outdoor heat exchanger 13. The outdoor fan 21 is driven by an outdoor fan motor 21a, whose number of rotations is changeable. In order to promote heat exchange between the indoor air and the refrigerant flowing through the heat transfer tubes 16b, the indoor unit 3 includes an indoor fan 31 that generates a flow of the indoor air passing through the indoor heat exchanger 16. The indoor fan 31 is driven by an indoor fan motor 31a, whose number of rotations is changeable.

(1-2) Configuration of indoor unit 3

[0027] As illustrated in FIG. 3, the indoor unit 3 includes a casing 61, an air filter 62, and a plurality of vertical flaps 63 and horizontal flaps 64 and 65, in addition to the indoor heat exchanger 16 and the indoor fan 31 described above.

(1-2-1) Casing 61

[0028] The casing 61 has a box shape that is elongated in the longitudinal direction (hereinafter also referred to as the right-left direction) and provided with a plurality of openings. A suction port 71 is provided in a top surface portion of the casing 61. When the indoor fan 31 is driven, indoor air near the suction port 71 is taken into the casing 61 through the suction port 71. The indoor air taken in through the suction port 71 passes through the air filter 62 provided on the top surface portion of the casing 61, then passes through the indoor heat exchanger 16, and is sent to the indoor fan 31. A blow-out port 72 is formed in a bottom surface portion of the casing 61. The blow-out port 72 communicates with the interior of the casing 61 via a scroll flow path 72b continuing from the indoor fan 31. The indoor air sucked through the suction port 71 is subjected to heat exchange in the indoor heat exchanger 16, and then blown out from the blow-out port 72 into a room RS through the scroll flow path 72b. A flow path lower surface 72a is provided on the rear side of the scroll flow path 72b. A cross-sectional shape of the flow path lower surface 72a draws a curve that goes away from the rotation center of the indoor fan 31 as the flow path lower surface 72a goes downward.

(1-2-2) Configuration for adjusting wind direction

[0029] The blow-out port 72 is provided with the two horizontal flaps 64 and 65 that extend in the right-left direction. The horizontal flaps 64 and 65 are turnably attached to the casing 61. The horizontal flaps 64 and 65 are configured to independently turn around their respective centers of rotation that extend in the right-left direction, by horizontal flap drive motors 37 provided for the respective horizontal flaps 64 and 65. The horizontal flap drive motors 37 are controlled by an indoor control device 35 (see FIG. 4) provided in the indoor unit 3. The horizontal flaps 64 and 65 adjust, independently or in cooperation with each other, an up-down flow direction of air that is blown out from the blow-out port 72.

[0030] The plurality of vertical flaps 63 having surfaces crossing the right-left direction is provided at the back of the blow-out port 72. The vertical flaps 63 are configured to turn right and left around centers of rotation extending in an up-down direction (direction crossing the right-left direction), by a vertical flap drive motor 38 (see FIG. 4). The indoor control device 35 also controls the vertical flap drive motor 38 that drives the vertical flaps 63. The plurality of vertical flaps 63 adjust the right-left flow direction of air blown out from the blow-out port 72.

(1-2-3) Indoor heat exchanger 16

[0031] The indoor heat exchanger 16 includes a plurality of fins 16a and the plurality of heat transfer tubes 16b penetrating the plurality of fins 16a. The indoor heat exchanger 16 functions as an evaporator or a radiator in accordance with an operating state of the indoor unit 3, and exchanges heat between the refrigerant flowing through the heat transfer tubes 16b and the air passing through the indoor heat exchanger 16. Although the indoor heat exchanger 16 including the fins 16a and the heat transfer tubes 16b has been described herein, the indoor heat exchanger 16 used in the present invention is not limited to a fin-and-tube heat exchanger. For example, a heat exchanger including a flat multi-hole tube instead of the heat transfer tube 16b may be used.

(1-2-4) Indoor fan 31

[0032] As illustrated in FIG. 3, the indoor fan 31 is located substantially at the center of the interior of the casing 61. The indoor fan 31 is a cross-flow fan having a substantially cylindrical shape elongated in the longitudinal direction (right-left direction) of the indoor unit 3. When the indoor fan 31 is driven to rotate, indoor air is sucked through the suction port 71 and passes through the air filter 62, and then passes through the indoor heat exchanger 16. Conditioned air generated in this manner is blown out from the blow-out port 72 into the room RS. The indoor fan 31 rotates in accordance with the number of rotations of the indoor fan motor 31a. The larger the number of rotations, the larger the volume of conditioned air blown out from the blow-out port 72.

(1-3) Schematic configuration of control system

[0033] As illustrated in FIG. 4, the control unit 50 includes an outdoor control device 26 incorporated in the outdoor unit 2, and the indoor control device 35 incorporated in the indoor unit 3. The outdoor control device 26 and the indoor control device 35 are connected to each other by a signal line, and are configured to transmit and receive signals therebetween.

[0034] The outdoor control device 26 of the outdoor unit 2 controls, for example, the compressor 11, the expansion mechanism 14, and the outdoor fan 21 and the like. For that purpose, the outdoor unit 2 includes an outdoor temperature sensor 22, an outdoor heat exchanger temperature sensor 23, a discharge pipe temperature sensor 24, and a suction pipe temperature sensor 25. The outdoor temperature sensor 22 measures a temperature of outdoor air. The outdoor heat exchanger temperature sensor 23 measures a temperature of refrigerant flowing in a specific part of the outdoor heat exchanger 13. The discharge pipe temperature sensor 24 detects a temperature of refrigerant discharged from the compressor 11. The suction pipe temperature sensor 25 detects a temperature of gas refrigerant sucked into the compressor 11. The outdoor control device 26 is connected to the outdoor temperature sensor 22, the outdoor heat exchanger temperature sensor 23, the discharge pipe temperature sensor 24, and the suction pipe temperature sensor 25 in order to receive signals related to the temperatures measured by these sensors 22 to 25. The outdoor control device 26 includes, for example, a CPU (not illustrated) and a memory 26a, and is configured to control the outdoor unit 2 in accordance with a program or the like stored in the memory 26a.

[0035] The indoor control device 35 of the indoor unit 3 controls the indoor fan 31 and the like. For that purpose, the indoor unit 3 includes a room temperature sensor 32 and an indoor heat exchanger temperature sensor 33. The room temperature sensor 32 measures a temperature of indoor air. The indoor heat exchanger temperature sensor 33 measures a temperature of refrigerant flowing in a specific part of the indoor heat exchanger 16. The indoor control device 35 is connected to the room temperature sensor 32 and the indoor heat exchanger temperature sensor 33 in order to receive signals related to the temperatures measured by the room temperature sensor 32 and the indoor heat exchanger temperature sensor 33. The indoor control device 35 includes, for example, a CPU (not illustrated) and a memory 35a, and is configured to control the indoor unit 3 in accordance with a program or the like stored in the memory 35a.

[0036] The remote controller 5 includes a liquid crystal display device 5a and buttons 5b illustrated in FIG. 1. The buttons 5b correspond to, for example, an operation switch 51, a temperature setting switch 52, a wind direction setting switch 53, and an air volume setting switch 54 illustrated in FIG. 4. A user can operate these switches using the buttons 5b. The operation switch 51 is for switching between start and stop of the operation of the air conditioner 1. The start and stop of the operation are switched every time the operation switch 51 is operated. The temperature setting switch 52 is used to input a room temperature desired by the user. The wind direction setting switch 53 is for setting a wind direction. The air volume setting switch 54 is used to input an air volume.

[0037] The control unit 50 sets a target room temperature Tt based on a set temperature Ts input through the temperature setting switch 52. During the heating operation, for example, a temperature (Ts + α1) obtained by adding a constant value α1 to the set temperature Ts is set as the target room temperature Tt. Alternatively, a temperature (Ts + β1) obtained by adding a value β1 calculated in accordance with a predetermined function f1(x) to the set temperature Ts may be set as the target room temperature Tt. When a room temperature Tr becomes higher than the target room temperature Tt, the control unit 50 sets the air conditioner 1 to a thermo-off state. When the room temperature Tr becomes lower than a temperature (Ts - α2) obtained by subtracting a constant value α2 from the set temperature Ts, the control unit 50 sets the air conditioner 1 to a thermo-on state. Alternatively, the control unit 50 may set the air conditioner 1 to the thermo-on state when the room temperature Tr becomes lower than a temperature (Ts - β2) obtained by subtracting a value β2 calculated in accordance with a predetermined function f2(x) from the set temperature Ts. In the thermo-on state, the compressor 11 is driven and heat is transferred by the refrigerant. In the thermo-off state, on the other hand, the compressor 11 is stopped, thus stopping the heat transfer by the refrigerant.

[0038] The control unit 50 controls various devices constituting the air conditioner 1 based on measurement values of the various sensors as described above and a command input from the remote controller 5. The control unit 50 also notifies the user of the status of the input command and the status of control using the liquid crystal display device 5a of the remote controller 5.

(2) Wind direction adjustment

(2-1) Manual setting

[0039] The user can manually adjust the positions of the vertical flaps 63 and the horizontal flaps 64 and 65 using the wind direction setting switch 53 of the remote controller 5. With the indoor unit 3, for example, wind directions called "frontward flow", "rightward flow", and "leftward flow" can be set in the right-left direction. For example, when the "frontward flow" is selected as the wind direction, the vertical flaps 63 stop while extending in the frontrear direction, and conditioned air is blown out forward. When the "rightward flow" is selected as the wind direction, the vertical flaps 63 stop while being inclined to the right, and conditioned air is blown out rightward. When the "leftward flow" is selected as the wind direction, the vertical flaps 63 stop while being inclined to the left, and conditioned air is blown out leftward. The indoor unit 3 is also configured to select, for example, wind directions called "ceiling flow", "upward flow", "downward flow", and "vertical flow" in the up-down direction. When the "ceiling flow" is selected as the wind direction, the indoor unit 3 directs the tips of the horizontal flaps 64 and 65 to their respective highest positions, and blows out conditioned air from the blow-out port 72 in a direction indicated by an arrow Ar1 in FIG. 3, such that the conditioned air flows along a ceiling CE. When the "upward flow" is selected as the wind direction, the indoor unit 3 slightly lowers the tips of the horizontal flaps 64 and 65 as compared with the case of the "ceiling flow", and blows out conditioned air in an upward direction relative to the horizontal direction as indicated by an arrow Ar2 in FIG. 5. When the "downward flow" is selected as the wind direction, the indoor unit 3 blows out conditioned air in a downward direction relative to the horizontal direction. When the "vertical flow" is selected as the wind direction, the indoor unit 3 directs the tips of the horizontal flaps 64 and 65 to their respective lowest positions as illustrated in FIG. 6, and blows out conditioned air such that the conditioned air flows along the wall surface WL. The air flow indicated by an arrow Ar1 in FIG. 7 is an example of the air flow generated when the "ceiling flow" is selected as the wind direction. The air flow indicated by an arrow Ar2 in FIG. 7 is an example of the air flow generated when the "upward flow" is selected as the wind direction. The air flow indicated by an arrow Ar3 in FIG. 7 is an example of the air flow generated when the "downward flow" is selected as the wind direction. The air flow indicated by an arrow Ar4 in FIG. 7 is an example of the air flow generated when the "vertical flow" is selected as the wind direction. Although the case where the up-down wind direction can be selected from among the four different wind directions has been described here, the method of setting the wind directions that can be selected in the up-down wind direction is not limited to this example.

(2-2) Swing setting

[0040] The wind direction setting switch 53 of the remote controller 5 can select how the vertical flaps 63 swing. The wind direction setting switch 53 of the remote controller 5 can also select how the horizontal flaps 64 and 65 swing. Furthermore, the wind direction setting switch 53 can select how the vertical flaps 63 and the horizontal flaps 64 and 65 swing together.

(2-3) Automatic setting

[0041] The wind direction setting switch 53 of the remote controller 5 can be used to select a wind direction automatic mode in which the control unit 50 sets the wind direction. In the wind direction automatic mode, the control unit 50 automatically sets the wind direction in accordance with the program stored in the memory 35a.

(3) Air volume adjustment

[0042] There are two modes of air volume adjustment, i.e., automatic setting and manual setting. In the automatic setting mode, the control unit 50 automatically sets the air volume in accordance with the program stored in the memory 35a. In the manual setting mode, the user can use the air volume setting switch 54 of the remote controller 5 to set, for example, five different air volumes. Here, the five different air volumes are called a first air volume, a second air volume, a third air volume, a fourth air volume, and a fifth air volume in ascending order of air volume.

(4) Heating operation

[0043] During the heating operation of the air conditioner 1, high-temperature, high-pressure refrigerant discharged from the compressor 11 flows into the indoor heat exchanger 16. At this time, the indoor heat exchanger 16 functions as a radiator. Therefore, as the refrigerant flows through the indoor heat exchanger 16, the refrigerant warms indoor air by exchanging heat with the indoor air, and the refrigerant is cooled by radiation. The low-temperature, high-pressure refrigerant, the temperature of which has been lowered by the indoor heat exchanger 16, is decompressed by the expansion mechanism 14 to change into low-temperature, low-pressure refrigerant. The refrigerant that has flowed into the outdoor heat exchanger 13 via the expansion mechanism 14 is warmed by exchanging heat with outdoor air. At this time, the outdoor heat exchanger 13 functions as an evaporator. Then, mainly low-temperature gas refrigerant flowing from the outdoor heat exchanger 13 via the accumulator 15 is sucked into the compressor 11.

(4-1) First cold air reduction control and second cold air reduction control

(4-1-1) Start, cancellation of restriction, and end of first cold air reduction control and second cold air reduction control

[0044] The first cold air reduction control and the second cold air reduction control will be described with reference to the flowchart of FIG. 8. For example, when the button 5b for switching the operation switch 51 of the remote controller 5 is pressed to start the operation (step S1), the control unit 50 determines whether a first start condition has been satisfied (step S2). The first start condition is for determining whether or not to start the first cold air reduction control or the second cold air reduction control. If the first start condition has not been satisfied, neither the first cold air reduction control nor the second cold air reduction control is performed. Therefore, if the first start condition has not been satisfied, the processing proceeds to step S9. If the first start condition has been satisfied, the processing proceeds to next step S3, where it is determined whether a second start condition has been satisfied. The second start condition is for determining whether the first cold air reduction control or the second cold air reduction control is performed. The details of the first start condition and the second start condition will be described later.

[0045] If it is determined in step S3 that the second start condition has been satisfied, the second cold air reduction control is started (step S4) to restrict the air volume. The first start condition and the second start condition are not usually changed after the second cold air reduction control is started. Therefore, until the temperature of the indoor heat exchanger 16 reaches a second temperature, steps S2, S3, S4 and S5 are repeated in a loop and the second cold air reduction control continues. When the temperature of the indoor heat exchanger 16 reaches the second temperature, the processing proceeds from step S5 to step S6, where the air volume restriction of the second cold air reduction control is cancelled. After the air volume restriction is cancelled, the processing proceeds to step S9, where it is determined whether or not to cancel the first cold air reduction control and the second cold air reduction control.

[0046] If it is determined in step S3 that the second start condition has not been satisfied, the first cold air reduction control is started (step S7) to restrict the air volume. The first start condition and the second start condition are not usually changed after the first cold air reduction control is started. Therefore, until the temperature of the indoor heat exchanger 16 reaches a first temperature, steps S2, S3, S7 and S8 are repeated in a loop. When the temperature of the indoor heat exchanger 16 reaches the first temperature, the processing proceeds from step S8 to step S6, where the air volume restriction of the first cold air reduction control is cancelled. After the air volume restriction is cancelled, the processing proceeds to step S9, where it is determined whether or not to cancel the first cold air reduction control and the second cold air reduction control.

[0047] In step S9, the control unit 50 determines whether the room temperature Tr measured by the room temperature sensor 32 has exceeded a threshold temperature Th close to the set temperature Ts. The setting of the threshold temperature Th is a design matter. For example, the threshold temperature Th is set to a value lower than the set temperature Ts by y degrees. In this case, if $Tr > (Ts - y)$ is satisfied, the control unit 50 cancels the cold air reduction control (step S10), and ends the cold air reduction control routine.

[0048] While the started heating operation is continued as it is, the temperature of the indoor heat exchanger 16 usually rises gradually. However, the temperature of the indoor heat exchanger 16 may lower after the heating operation is started but before the temperature reaches the target room temperature Tt. The air conditioner 1 is configured such that, when the temperature of the indoor heat exchanger 16 rises to the first temperature or higher and then falls below the first temperature again during the first cold air reduction control, the air volume is restricted again even after the air volume restriction is once cancelled. Similarly, the air conditioner 1 is configured such that, when the temperature of the indoor heat exchanger 16 rises to the second temperature or higher and then falls below the second temperature again during the second cold air reduction control, the air volume is restricted again even after the air volume restriction is once cancelled.

[0049] Note that the second temperature is set lower than the first temperature in the above-described control. Therefore, the temperature of the indoor heat exchanger 16 at the time when the air volume restriction is cancelled in the second cold air reduction control is lower than the temperature of the indoor heat exchanger 16 at the time when the air volume restriction is cancelled in the first cold air reduction control. In other words, as compared with the first cold air reduction control, the second cold air reduction control prioritizes the function of raising the room temperature Tr over the effect of reducing uncomfortable feeling due to cold air. Meanwhile, in order to reliably reduce the uncomfortable feeling due to cold air, the second cold air reduction control is performed only in a case where the second start condition is satisfied, in which case it is easy to reduce the uncomfortable feeling due to cold air.

(4-1-2) First start condition

[0050] The first start condition includes a condition requiring that the air conditioner be in operation. For example, the air conditioner being in operation is an AND condition; unless the air conditioner is in operation, the first start condition is not satisfied even if the other conditions are satisfied. Alternatively, the first start condition may include a condition requiring that the compressor 11 be driven. For example, if the compressor 11 being driven is an additional AND condition, the cold air reduction control is started only in a case where the air conditioner is in operation and the compressor 11 is driven. Alternatively, the first start condition may also include a condition requiring that the ongoing heating operation not have been reserved. For example, if the ongoing heating operation not having been reserved is an additional AND condition, the cold air reduction control is started only in a case where the air conditioner is in operation, the compressor 11 is driven, and the heating operation has not been reserved. Alternatively, the first start condition may include a condition requiring that the "ceiling flow" not be forcibly selected for removing a warm air accumulation near the ceiling. This additional condition makes it possible to prevent the air volume restriction when it is desired to generate a strong air flow along the ceiling.

(4-1-3) Second start condition

[0051] The second start condition includes a condition requiring that the horizontal flaps 64 and 65 be oriented upward relative to a predetermined angle. For example, when the wind direction is the "upward flow" as illustrated in FIG. 5, the horizontal flaps 64 and 65 are oriented upward relative to a predetermined angle An1 from the horizontal plane. Therefore, if the second start condition requires that the horizontal flaps 64 and 65 be oriented upward relative to the predetermined angle An1, the horizontal flaps 64 and 65 at the time of selecting the "ceiling flow" or "upward flow" as the wind direction satisfy the second start condition.

[0052] Alternatively, the second start condition requiring that the horizontal flaps 64 and 65 be oriented upward relative to the predetermined angle may be instead a condition requiring that the horizontal flaps 64 and 65 be at angles at which conditioned air is blown out horizontally or upward relative to the horizontal direction. In this case, the angles of the horizontal flaps 64 and 65 in the state of the "ceiling flow" satisfy the second start condition. In the state of the "upward flow" in the present embodiment, the conditioned air is blown out horizontally or upward relative to the horizontal direction. Therefore, the angles of the horizontal flaps 64 and 65 in the state of the "upward flow" also satisfy the second start condition.

[0053] Alternatively, the second start condition requiring that the horizontal flaps 64 and 65 be oriented upward relative to the predetermined angle may be instead a condition requiring that the horizontal flaps 64 and 65 be at angles at which the conditioned air is blown out along the ceiling, as well as being blown out horizontally or upward relative to the horizontal direction. In this case, the angles of the horizontal flaps 64 and 65 in the state of the "ceiling flow" satisfy the second start condition.

[0054] Alternatively, the second start condition may include a condition requiring that the flaps not be swinging. For example, if the horizontal flaps 64 and 65 and the vertical flaps 63 not being swinging is an additional AND condition, the second cold air reduction control is started only in a case where none of the horizontal flaps 64 and 65 and the vertical flaps 63 is swinging and the horizontal flaps 64 and 65 are oriented upward relative to the predetermined angle. In the case where there is a plurality of flaps, it is possible to set a condition requiring that some specific flaps not be swinging, for example, only the horizontal flaps 64 and 65 not be swinging. Alternatively, in the case where there is a plurality of flaps, it is possible to set a condition requiring that none of the flaps be swinging.

[0055] Alternatively, the second start condition may include a condition requiring that the difference between the target room temperature Tt and the room temperature Tr be larger than a threshold. For example, if the difference between the target room temperature Tt and the room temperature Tr being larger than the threshold is an additional AND condition, the second cold air reduction control is started only in a case where none of the horizontal flaps 64 and 65 and the vertical flaps 63 is swinging, the horizontal flaps 64 and 65 are oriented upward relative to the predetermined angle, and the difference between the target room temperature Tt and the room temperature Tr is larger than the threshold.

(4-1-4) Air volume restriction and cancellation thereof

[0056] Examples of the method of restricting the air volume restriction include a method of restricting the air volume to the first air volume that is the smallest among those that can be set by the user using the air volume setting switch 54 of the remote controller 5. Alternatively, for example, a dedicated air volume smaller than the first air volume may be set for the first cold air reduction control and the second cold air reduction control. In this case, when the air volume is restricted in the first cold air reduction control and the second cold air reduction control, the air volume is restricted to the dedicated air volume smaller than the first air volume.

[0057] The simplest method of cancelling the air volume is a method of cancelling all the air volume restrictions such that any of the first to fifth air volumes is selectable, when the first temperature is reached during the first cold air reduction control or the second temperature is reached during the second cold air reduction control. Other examples of the method of cancelling the air volume restriction include the following. For example, a plurality of first temperatures is set, including temperatures 1a, 1b, 1c, and Id in ascending order of temperature. When the temperature of the indoor heat exchanger 16 becomes higher than the temperature la, the air volume restriction in the first cold air reduction control is partially cancelled such that the first or second air volume can be selected. When the temperature of the indoor heat exchanger 16 becomes higher than the temperature 1b, the air volume restriction in the first cold air reduction control is further partially cancelled such that any of the first to third air volumes can be selected. When the temperature of the indoor heat exchanger 16 becomes higher than the temperature 1c, the air volume restriction in the first cold air reduction control is further partially cancelled such that any of the first to fourth air volumes can be selected. Finally, when the temperature of the indoor heat exchanger 16 becomes higher than the temperature Id, all the air volume restrictions are further cancelled. As described above, for example, the air volume restrictions may be cancelled stepwise.

[0058] The second cold air reduction control may also be cancelled stepwise. For example, a plurality of second temperatures is set, including temperatures 2a and 2b. In this case, the following relationship is satisfied, in terms of the temperature value: the temperature 2a < the temperature 2b < the temperature 1a < the temperature 1b < the temperature 1c < the temperature 1d. When the temperature of the indoor heat exchanger 16 becomes higher than the temperature 2a, the air volume restriction in the second cold air reduction control is partially cancelled such that any of the first to third air volumes can be selected. Furthermore, when the temperature of the indoor heat exchanger 16 becomes higher than the temperature 2b, all the air volume restrictions in the second cold air reduction control are further cancelled.

[0059] Examples of the cancellation of the air volume restriction include a full cancellation with which all the air volumes selectable by the user, in this case the first to fifth air volumes, become selectable at once, and another full cancellation with which the selectable air volumes increase stepwise until all the air volumes become finally selectable. Examples of the cancellation of the air volume restriction also include a partial cancellation with which only a part of the air volumes becomes selectable. Examples of the partial cancellation include one with which only a part of the air volumes becomes selectable at once and the cancellation process ends, and one with which the selectable air volumes increase stepwise but a part of the air volumes remains unselectable till the end.

(5) Characteristics

(5-1)

[0060] The air conditioner 1 of the above embodiment is configured to perform the first cold air reduction control for restricting the air volume of the indoor fan 31 until the temperature of the indoor heat exchanger 16 reaches the first temperature, and the second cold air reduction control for cancelling the air volume restriction at the indoor fan 31 when the temperature of the indoor heat exchanger 16 reaches the second temperature lower than the first temperature. The control unit 50 is configured to selectively perform the first cold air reduction control in order to preferentially reduce the uncomfortable feeling due to cold air, or the second cold air reduction control in order to preferentially promote a rise in room temperature. Therefore, it is possible to preferentially reduce the uncomfortable feeling due to cold air through the first cold air reduction control, and to preferentially promote a rise in room temperature through the second cold air reduction control. As a result, the air conditioner 1 of the present embodiment has enhanced effects of reducing the uncomfortable feeling due to cold air and promoting a rise in room temperature as compared with the conventional case.

[0061] In the above embodiment, the case where the air volume restriction is cancelled at the first temperature has been described as an example of the first cold air reduction control for restricting the air volume of the indoor fan 31 until the temperature of the indoor heat exchanger 16 reaches the first temperature. However, the first cold air reduction control only needs to restrict the air volume of the indoor fan 31 until the temperature of the indoor heat exchanger 16 reaches the first temperature. The first cold air reduction control does not necessarily have to cancel the air volume restriction at the first temperature.

(5-2)

[0062] The first cold air reduction control or the second cold air reduction control is selected in accordance with a selection condition, i.e., the second start condition. Therefore, this selection condition is set in advance such that the first cold air reduction control is selected in order to preferentially reduce the uncomfortable feeling due to cold air, whereas the second cold air reduction control is selected in order to preferentially promote a rise in room temperature. For example, when the horizontal flaps 64 and 65 are not in the state of the "ceiling flow" being selected as the wind direction, the first cold air reduction control is selected. Meanwhile, when the horizontal flaps 64 and 65 are in the state of the "ceiling flow" being selected as the wind direction and another second start condition is satisfied, the second cold air reduction control is selected. That is, the following selection is achieved. When the horizontal flaps 64 and 65 are in the state of the "ceiling flow" being selected as the wind direction and the uncomfortable feeling due to cold air can be sufficiently reduced, the air volume restriction is cancelled at a low temperature by the second cold air reduction control with which relatively cold conditioned air is blown out. Meanwhile, when the horizontal flaps 64 and 65 are not in the state of the "ceiling flow" being selected as the wind direction and it is difficult to sufficiently reduce the uncomfortable feeling due to cold air, the air volume restriction is cancelled at a high temperature by the first cold air reduction control. As a result, it is easy to reduce the uncomfortable feeling due to cold air and to promote a rise in room temperature.

(5-3)

[0063] In the case where the second start condition as the selection condition includes, as the condition for selecting the second cold air reduction control, the condition requiring that the temperature difference (Tt - Tr) between the target room temperature Tt and the room temperature Tr be larger than the threshold, the second cold air reduction control is not performed when the temperature difference is small and a capacity requirement is low. When the temperature difference (Tt - Tr) is small, the user has less desire to quickly raise the room temperature Tr. As described above, the second cold air reduction control is not performed when the room RS is already warm and there is little need to raise the room temperature quickly. As a result, it is possible to focus on improving the effect of reducing the uncomfortable feeling due to cold air, thus improving the user's comfort.

(5-4)

[0064] For example, in the case where the second start condition as the selection condition for selecting the second cold air reduction control includes the condition requiring that the horizontal flaps 64 and 65 not be swinging, the second cold air reduction control is not performed while the horizontal flaps 64 and 65 are swinging to blow out air to a wide range. Such control makes it possible to reduce conditioned air being blown directly onto the user, even if the second cold air reduction control is performed while the user is in the room RS. If control is performed for stopping the swing of the horizontal flaps 64 and 65 in order to select the second cold air reduction control, the user is very likely to mistake the stop for a malfunction. It is possible to prevent such a mistake by performing control for not stopping the swing under the condition for selecting the second cold air reduction control requiring that the flaps not be swinging. Alternatively, the second start condition may include a condition requiring that the vertical flaps 63 not be swinging, in addition to the horizontal flaps 64 and 65. The horizontal flaps are not limited to the two horizontal flaps 64 and 65, but may be one horizontal flap, or three or more horizontal flaps.

(5-5)

[0065] In the case where the second start condition as the selection condition for selecting the second cold air reduction control includes the condition requiring that the horizontal flaps 64 and 65 be oriented upward relative to the predetermined angle An1, the second cold air reduction control is not performed when the horizontal flaps 64 and 65 are oriented at, or downward relative to, the predetermined angle An1. Therefore, the predetermined angle An1 is set to an angle at which the conditioned air is not blown onto the user in the room RS. As a result, it is possible to reduce relatively cold conditioned air being blown directly onto the user and to improve the function of reducing the uncomfortable feeling due to cold air, even if the second cold air reduction control is performed while the user is in the room RS.

(5-6)

[0066] In the case where the second start condition as the selection condition includes the condition requiring that the horizontal flaps 64 and 65 be at predetermined angles at which the conditioned air is blown out horizontally or upward relative to the horizontal direction, the conditioned air is blown out horizontally or upward relative to the horizontal direction when the second cold air reduction control is performed. As a result, for example, the indoor unit 3 at a high position can be set such that the conditioned air is not blown directly onto the user in the room even if the second cold air reduction control is performed while the user is standing up, making it possible to improve the function of reducing the uncomfortable feeling due to cold air.

(5-7)

[0067] In the case where the second start condition as the selection condition includes the condition requiring that the horizontal flaps 64 and 65 be at predetermined angles at which the conditioned air is blown out along the ceiling, the conditioned air is blown out along the ceiling when the second cold air reduction control is performed. As a result, it is possible to reduce the conditioned air being blown directly onto the user in the room even if the second cold air reduction control is performed while the user is standing up, making it possible to improve the function of reducing the uncomfortable feeling due to cold air.

(6) Modifications

(6-1) Modification 1A

[0068] In the above embodiment, the case where the two types of cold air reduction control, i.e., the first cold air reduction control and the second cold air reduction control are performed has been described. Alternatively, however, another cold air reduction control may be further performed. For example, third cold air reduction control may be further performed, with which the air volume restriction at the indoor fan 31 is cancelled when the temperature of the indoor heat exchanger 16 reaches a third temperature lower than the second temperature. The third cold air reduction control is further performed with which the air volume restriction at the indoor fan 31 is cancelled when the temperature of the indoor heat exchanger 16 reaches the third temperature lower than the second temperature. Therefore, it is possible to rapidly raise the room temperature through the third cold air reduction control in a case of more preferentially promoting a rise in room temperature than in the second cold air reduction control.

[0069] For example, the third cold air reduction control may be added to the control of the air conditioner 1 as illustrated in FIG. 9, with the flowchart illustrated in FIG. 8 partially changed. It is determined whether a third start condition has been satisfied (step S11) between step S3 and step S4 of the flowchart of FIG. 8. If the third start conditions has been satisfied, the third cold air reduction control is started (step S12). If the third start condition has not been satisfied, on the other hand, the processing proceeds to step S4, where the second cold air reduction control is started, and then steps S2 to S5 are repeated in a loop.

[0070] When the third cold air reduction control is started, it is then determined whether the temperature of the indoor heat exchanger 16 has reached the third temperature (step S13). When the temperature of the indoor heat exchanger 16 reaches the third temperature, the processing proceeds to step S14, where the air volume restriction is cancelled. After the operation of step S14 is finished, the processing proceeds to step S9. If the temperature of the indoor heat exchanger 16 has not reached the third temperature, the processing proceeds to step S2. The operation after the processing proceeds to step S9 or step S2 is the same as the already described corresponding operation of the flowchart illustrated in FIG. 8, and thus will not be described again.

[0071] It is assumed here that the control unit 50 is programmed to perform control such that the second start condition includes, for example, a condition requiring that the wind direction be the "ceiling flow" or "upward flow", and the third start condition includes, for example, a condition requiring that the wind direction be the "ceiling flow". That is, the third cold air reduction control focuses on promoting a rise in room temperature as compared with the second cold air reduction control. Therefore, when the temperature of the indoor heat exchanger 16 reaches the third temperature lower than the second temperature, the air volume restriction is cancelled such that, for example, any of the first to fifth air volumes is selectable (step S14).

[0072] As described above, the air conditioner 1 can further perform the third cold air reduction control with which the air volume restriction at the indoor fan 31 is cancelled when the temperature of the indoor heat exchanger 16 reaches the third temperature lower than the second temperature. This makes it possible to rapidly raise the room temperature through the third cold air reduction control in a case of more preferentially promoting a rise in room temperature than in the second cold air reduction control. The third cold air reduction control is performed to improve the function of promoting a rise in room temperature. Meanwhile, the third cold air reduction control is started only in a case where it is easier to reduce the uncomfortable feeling due to cold air than when starting the second cold air reduction control. It is thus possible to achieve both reduction of the uncomfortable feeling due to cold air and promotion of a rise in room temperature.

(6-2) Modification 1B

[0073] In the above embodiment, the air conditioner 1 is configured exclusively for heating. Alternatively, as illustrated in FIGS. 10 and 11, the air conditioner 1 may further include, for example, a four-way switching valve 12 such that heating and cooling can be switched. In the air conditioner 1 configured as illustrated in FIG. 10, the compressor 11 discharges refrigerant compressed inside the compressor 11 to a first port of the four-way switching valve 12 from the discharge port of the compressor 11. The four-way switching valve 12 includes, in addition to the first port, a second port connected to the outdoor heat exchanger 13, a third port connected to the accumulator 15, and a fourth port connected to the indoor heat exchanger 16. During the heating operation of the air conditioner 1, the four-way switching valve 12 causes the refrigerant to flow between the first port and the fourth port and simultaneously causes the refrigerant to flow between the second port and the third port (as illustrated by the broken lines). During the cooling operation and a reverse cycle defrost operation of the air conditioner 1, the four-way switching valve 12 causes the refrigerant to flow between the first port and the second port and simultaneously causes the refrigerant to flow between the third port and the fourth port (as illustrated by the solid lines).

[0074] In the case where the heating operation or the cooling operation can be selected as described above, the first start condition of the flowchart illustrated in FIG. 8 only needs to include, for example as an AND condition, a condition requiring that the heating operation be selected. Since the outdoor control device 26 controls the four-way switching valve 12, the control unit 50 can obtain, from the outdoor control device 26, information indicating which of the heating operation and the cooling operation is currently being performed.

(6-3) Modification 1C

[0075] In the above embodiment, if the situation changes and the determination as to whether the first start condition or the second start condition is satisfied changes during the first cold air reduction control or the second cold air reduction control, the cold air reduction control is allowed to change. However, the method of selecting the first cold air reduction control or the second cold air reduction control is not limited to the method of the above embodiment. For example, the flowchart may be partially changed as illustrated in FIG. 12. In the flowchart illustrated in FIG. 12, when the determination in steps S5 and S8 is "No", the processing returns to steps S4 and S7, respectively. Once the first cold air reduction control or the second cold air reduction control is started, each control is continued until the temperature of the indoor heat exchanger 16 reaches the first temperature or the second temperature, respectively.

REFERENCE SIGNS LIST

[0076]

1	Air conditioner
2	Outdoor unit
3	Indoor unit
10	Refrigerant circuit
11	Compressor
12	Four-way switching valve
13	Outdoor heat exchanger
14	Expansion mechanism
16	Indoor heat exchanger
21	Outdoor fan
31	Indoor fan
32	Room temperature sensor
33	Indoor heat exchanger temperature sensor
63	Vertical flap
64, 65	Horizontal flap

CITATION LIST

PATENT LITERATURE

[0077] <Patent Literature 1> JP 9-303844 A

Claims

1. An air conditioner (1) comprising:

   an indoor heat exchanger (16) configured to exchange heat between refrigerant and indoor air in a vapor compression refrigeration cycle;
   an indoor fan (31) configured to change an air volume at a time of blowing out, into a room, conditioned air obtained through the heat exchange by the indoor heat exchanger,
   wherein the air conditioner (1) is configured to perform, when starting heating, first cold air reduction control for performing an air volume restriction of the indoor fan (31) until a temperature of the indoor heat exchanger (16) reaches a first temperature, and second cold air reduction control for cancelling the air volume restriction at the indoor fan (31) when the temperature of the indoor heat exchanger (16) reaches a second temperature lower than the first temperature, wherein the first cold air reduction control or the second cold air reduction control is selected in accordance with a preset selection condition; and
   a flap (63, 64, 65) configured to swing a direction of blowing out the conditioned air from the indoor fan (31), the air conditioner **characterized in that** the selection condition includes, as a condition for selecting the second cold air reduction control, a condition requiring that the flap (63, 64, 65) is not swinging.

2. The air conditioner (1) according to claim 1, wherein the selection condition includes, as a condition for selecting the second cold air reduction control, a condition requiring that a difference between a target room temperature and a room temperature be larger than a threshold.

3. The air conditioner (1) according to any one of the previous claims , comprising a horizontal flap (64, 65) configured to change an up-down direction of blowing out the conditioned air from the indoor fan (31),
   wherein the selection condition includes, as a condition for selecting the second cold air reduction control, a condition requiring that the horizontal flap (64, 65) is oriented upward relative to a predetermined angle.

4. The air conditioner (1) according to claim 3, wherein the selection condition requires that the predetermined angle of the horizontal flap (64, 65) is an angle at which the conditioned air is blown out horizontally or upward relative to a horizontal direction.

5. The air conditioner (1) according to claim 3, wherein the selection condition requires that the predetermined angle of the horizontal flap (64, 65) is an angle at which the conditioned air is blown out along a ceiling.

6. The air conditioner (1) according to any one of claims 1 to 7, which is configured to further perform third cold air reduction control for cancelling the air volume restriction at the indoor fan (31) when the temperature of the indoor heat exchanger (16) reaches a third temperature lower than the second temperature.

7. An air conditioner (1) comprising:

an indoor heat exchanger (16) configured to exchange heat between refrigerant and indoor air in a vapor compression refrigeration cycle;
an indoor fan (31) configured to change an air volume at a time of blowing out, into a room, conditioned air obtained through the heat exchange by the indoor heat exchanger,
wherein the air conditioner (1) is configured to perform, when starting heating, first cold air reduction control for performing an air volume restriction of the indoor fan (31) until a temperature of the indoor heat exchanger (16) reaches a first temperature, and second cold air reduction control for cancelling the air volume restriction at the indoor fan (31) when the temperature of the indoor heat exchanger (16) reaches a second temperature lower than the first temperature, wherein the first cold air reduction control or the second cold air reduction control is selected in accordance with a preset selection condition; and
a horizontal flap (64, 65) configured to change an up-down direction of blowing out the conditioned air from the indoor fan (31), the air conditioner **characterized in that** the selection condition includes, as a condition for selecting the second cold air reduction control, a condition requiring that the horizontal flap (64, 65) is oriented upward relative to a predetermined angle.

8. The air conditioner (1) according to claim 7, wherein the selection condition requires that the predetermined angle of the horizontal flap (64, 65) is an angle at which the conditioned air is blown out horizontally or upward relative to a horizontal direction.

9. The air conditioner (1) according to claim 7, wherein the selection condition requires that the predetermined angle of the horizontal flap (64, 65) is an angle at which the conditioned air is blown out along a ceiling.

Patentansprüche

1. Klimaanlage (1), umfassend:

einen Innenwärmetauscher (16), der konfiguriert ist, um Wärme zwischen Kältemittel und Innenluft in einem Dampfkompressionskühlkreislauf auszutauschen;
einen Innenventilator (31), der konfiguriert ist, um ein Luftvolumen zu einem Zeitpunkt zum Ausblasen, in einen Raum, klimatisierter Luft, die durch den Wärmeaustausch durch den Innenwärmetauscher erhalten wird, zu ändern,
wobei die Klimaanlage (1) so konfiguriert ist, dass sie beim Starten der Erwärmung, eine erste Kaltluftreduzierungssteuerung zum Durchführen einer Luftvolumenbegrenzung des Innenventilators (31), bis eine Temperatur des Innenwärmetauschers (16) eine erste Temperatur erreicht, und eine zweite Kaltluftreduzierungssteuerung zum Aufheben der Luftvolumenbegrenzung am Innenventilator (31), wenn die Temperatur des Innenwärmetauschers (16) eine zweite Temperatur erreicht, die niedriger als die erste Temperatur ist, durchführt, wobei die erste Kaltluftreduzierungssteuerung oder die zweite Kaltluftreduzierungssteuerung gemäß einer voreingestellten Auswahlbedingung ausgewählt wird; und
eine Klappe (63, 64, 65), die konfiguriert ist, um eine Richtung zum Ausblasen der klimatisierten Luft aus dem Innenventilator (31) zu schwenken,
wobei die Klimaanlage **dadurch gekennzeichnet ist, dass** die Auswahlbedingung, als Bedingung für die Auswahl der zweiten Kaltluftreduzierungssteuerung, eine Bedingung beinhaltet, die erfordert, dass die Klappe (63, 64, 65) nicht schwenkt.

2. Klimaanlage (1) nach Anspruch 1, wobei die Auswahlbedingung, als Bedingung für die Auswahl der zweiten Kaltluftreduzierungssteuerung, eine Bedingung beinhaltet, die erfordert, dass ein Unterschied zwischen einer Zielraumtemperatur und einer Raumtemperatur größer als ein Schwellenwert ist.

3. Klimaanlage (1) nach einem der vorhergehenden Ansprüche, umfassend eine horizontale Klappe (64, 65), die konfiguriert ist, um eine Auf-Ab-Richtung zum Ausblasen der klimatisierten Luft aus dem Innenventilator (31) zu ändern,
wobei die Auswahlbedingung, als Bedingung für die Auswahl der zweiten Kaltluftreduzierungssteuerung, eine Bedingung beinhaltet, die erfordert, dass die horizontale Klappe (64, 65) relativ zu einem vorbestimmten Winkel nach oben ausgerichtet ist.

4. Klimaanlage (1) nach Anspruch 3, wobei die Auswahlbedingung erfordert, dass der vorbestimmte Winkel der horizontalen Klappe (64, 65) ein Winkel ist, in dem die klimatisierte Luft relativ

zu einer horizontalen Richtung horizontal oder nach oben ausgeblasen wird.

5. Klimaanlage (1) nach Anspruch 3, wobei die Auswahlbedingung erfordert, dass der vorbestimmte Winkel der horizontalen Klappe (64, 65) ein Winkel ist, in dem die klimatisierte Luft entlang einer Decke ausgeblasen wird.

6. Klimaanlage (1) nach einem der Ansprüche 1 bis 7, die konfiguriert ist, um eine dritte Kaltluftreduzierungssteuerung zum Aufheben der Luftvolumenbegrenzung am Innenventilator (31) weiter durchzuführen, wenn die Temperatur des Innenwärmetauschers (16) eine dritte Temperatur erreicht, die niedriger als die zweite Temperatur ist.

7. Klimaanlage (1), umfassend:

einen Innenwärmetauscher (16), der konfiguriert ist, um Wärme zwischen Kältemittel und Innenluft in einem Dampfkompressionskühlkreislauf auszutauschen;
einen Innenventilator (31), der konfiguriert ist, um ein Luftvolumen zu einem Zeitpunkt zum Ausblasen, in einen Raum, klimatisierter Luft, die durch den Wärmeaustausch durch den Innenwärmetauscher erhalten wird, zu ändern, wobei die Klimaanlage (1) so konfiguriert ist, dass sie beim Starten der Erwärmung, eine erste Kaltluftreduzierungssteuerung zum Durchführen einer Luftvolumenbegrenzung des Innenventilators (31), bis eine Temperatur des Innenwärmetauschers (16) eine erste Temperatur erreicht, und eine zweite Kaltluftreduzierungssteuerung zum Aufheben der Luftvolumenbegrenzung am Innenventilator (31), wenn die Temperatur des Innenwärmetauschers (16) eine zweite Temperatur erreicht, die niedriger als die erste Temperatur ist, durchführt, wobei die erste Kaltluftreduzierungssteuerung oder die zweite Kaltluftreduzierungssteuerung gemäß einer voreingestellten Auswahlbedingung ausgewählt wird; und
eine horizontale Klappe (64, 65), die konfiguriert ist, um eine Auf-Ab-Richtung zum Ausblasen der klimatisierten Luft aus dem Innenventilator (31) zu ändern, wobei die Klimaanlage **dadurch gekennzeichnet ist, dass** die Auswahlbedingung, als Bedingung für die Auswahl der zweiten Kaltluftreduzierungssteuerung, eine Bedingung beinhaltet, die erfordert, dass die horizontale Klappe (64, 65) relativ zu einem vorbestimmten Winkel nach oben ausgerichtet ist.

8. Klimaanlage (1) nach Anspruch 7, wobei die Auswahlbedingung erfordert, dass der vorbestimmte Winkel der horizontalen Klappe (64, 65) ein Winkel ist, in dem die klimatisierte Luft relativ zu einer horizontalen Richtung horizontal oder nach oben ausgeblasen wird.

9. Klimaanlage (1) nach Anspruch 7, wobei die Auswahlbedingung erfordert, dass der vorbestimmte Winkel der horizontalen Klappe (64, 65) ein Winkel ist, in dem die klimatisierte Luft entlang einer Decke ausgeblasen wird.

Revendications

1. Climatiseur (1), comprenant :

un échangeur de chaleur intérieur (16) configuré pour échanger de la chaleur entre le réfrigérant et l'air intérieur dans un cycle de réfrigération à compression de vapeur ;
un ventilateur intérieur (31) configuré pour changer un volume d'air à un moment de soufflage, dans une pièce, d'air conditionné obtenu par l'échange de chaleur par l'échangeur de chaleur intérieur,
dans lequel le climatiseur (1) est configuré pour effectuer, lors du démarrage du chauffage, une première commande de réduction d'air froid pour effectuer une restriction du volume d'air du ventilateur intérieur (31) jusqu'à ce qu'une température de l'échangeur de chaleur intérieur (16) atteigne une première température, et une deuxième commande de réduction d'air froid pour annuler la restriction du volume d'air en correspondance du ventilateur intérieur (31) lorsque la température de l'échangeur de chaleur intérieur (16) atteint une deuxième température inférieure à la première température, dans lequel la première commande de réduction d'air froid ou la deuxième commande de réduction d'air froid est sélectionnée selon une condition de sélection prédéfinie ; et
un volet (63, 64, 65) configuré pour basculer une direction de soufflage de l'air conditionné du ventilateur intérieur (31),
le climatiseur étant **caractérisé en ce que** la condition de sélection comprend, comme condition de sélection de la deuxième commande de réduction d'air froid, une condition exigeant que le volet (63, 64, 65) ne bascule pas.

2. Climatiseur (1) selon la revendication 1, dans lequel la condition de sélection comprend, comme condition de sélection de la deuxième commande de réduction d'air froid, une condition exigeant qu'une différence entre une température ambiante cible et une température ambiante soit supérieure à un seuil.

3. Climatiseur (1) selon l'une quelconque des revendications précédentes, comprenant un volet horizontal (64, 65) configuré pour changer une direction de haut en bas de soufflage de l'air conditionné du ventilateur intérieur (31),
dans lequel la condition de sélection comprend, comme condition de sélection de la seconde commande de réduction d'air froid, une condition exigeant que le volet horizontal (64, 65) soit orienté vers le haut par rapport à un angle prédéterminé.

4. Climatiseur (1) selon la revendication 3,
dans lequel la condition de sélection exige que l'angle prédéterminé du volet horizontal (64, 65) soit un angle auquel l'air conditionné est soufflé horizontalement ou vers le haut par rapport à une direction horizontale.

5. Climatiseur (1) selon la revendication 3,
dans lequel la condition de sélection exige que l'angle prédéterminé du volet horizontal (64, 65) soit un angle auquel l'air conditionné est soufflé le long d'un plafond.

6. Climatiseur (1) selon l'une quelconque des revendications 1 à 7, étant configuré pour effectuer de plus une troisième commande de réduction d'air froid pour annuler la restriction du volume d'air en correspondance du ventilateur intérieur (31) lorsque la température de l'échangeur de chaleur intérieur (16) atteint une troisième température inférieure à la deuxième température.

7. Climatiseur (1), comprenant :

un échangeur de chaleur intérieur (16) configuré pour échanger de la chaleur entre le réfrigérant et l'air intérieur dans un cycle de réfrigération à compression de vapeur ;
un ventilateur intérieur (31) configuré pour changer un volume d'air à un moment de soufflage, dans une pièce, de l'air conditionné obtenu par l'échange de chaleur par l'échangeur de chaleur intérieur,
dans lequel le climatiseur (1) est configuré pour effectuer, lors du démarrage du chauffage, une première commande de réduction d'air froid pour effectuer une restriction du volume d'air du ventilateur intérieur (31) jusqu'à ce qu'une température de l'échangeur de chaleur intérieur (16) atteigne une première température, et une deuxième commande de réduction d'air froid pour annuler la restriction du volume d'air en correspondance du ventilateur intérieur (31) lorsque la température de l'échangeur de chaleur intérieur (16) atteint une deuxième température inférieure à la première température, dans lequel la première commande de réduction d'air froid ou la deuxième commande de réduction d'air froid est sélectionnée selon une condition de sélection prédéfinie ; et
un volet horizontal (64, 65) configuré pour changer une direction de haut en bas de soufflage de l'air conditionné du ventilateur intérieur (31),
le climatiseur étant **caractérisé en ce que** la condition de sélection comprend, comme condition de sélection de la deuxième commande de réduction d'air froid, une condition exigeant que le volet horizontal (64, 65) soit orienté vers le haut par rapport à un angle prédéterminé.

8. Climatiseur (1) selon la revendication 7,
dans lequel la condition de sélection exige que l'angle prédéterminé du volet horizontal (64, 65) soit un angle auquel l'air conditionné est soufflé horizontalement ou vers le haut par rapport à une direction horizontale.

9. Climatiseur (1) selon la revendication 7,
dans lequel la condition de sélection exige que l'angle prédéterminé du volet horizontal (64, 65) soit un angle auquel l'air conditionné est soufflé le long d'un plafond.

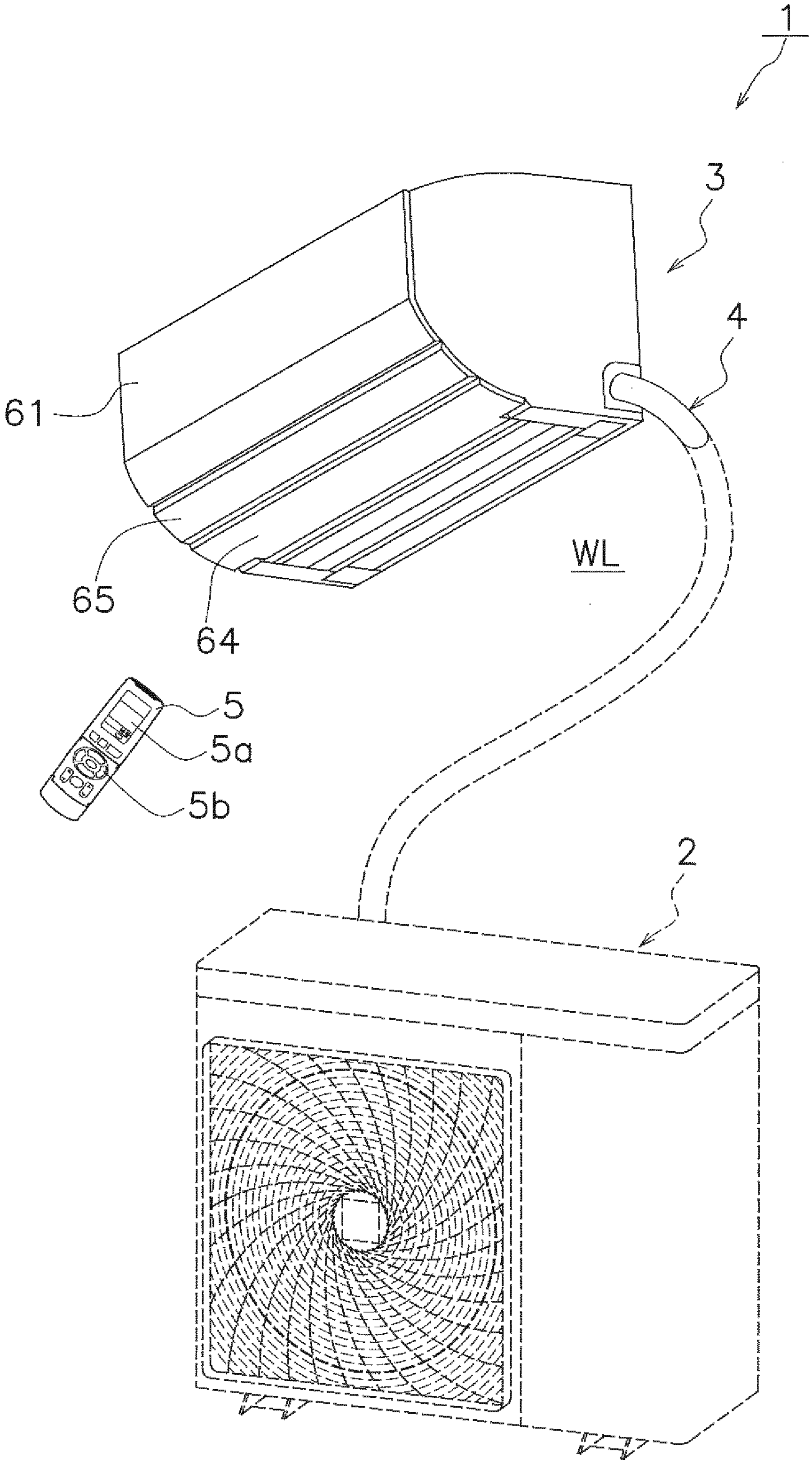


FIG. 1

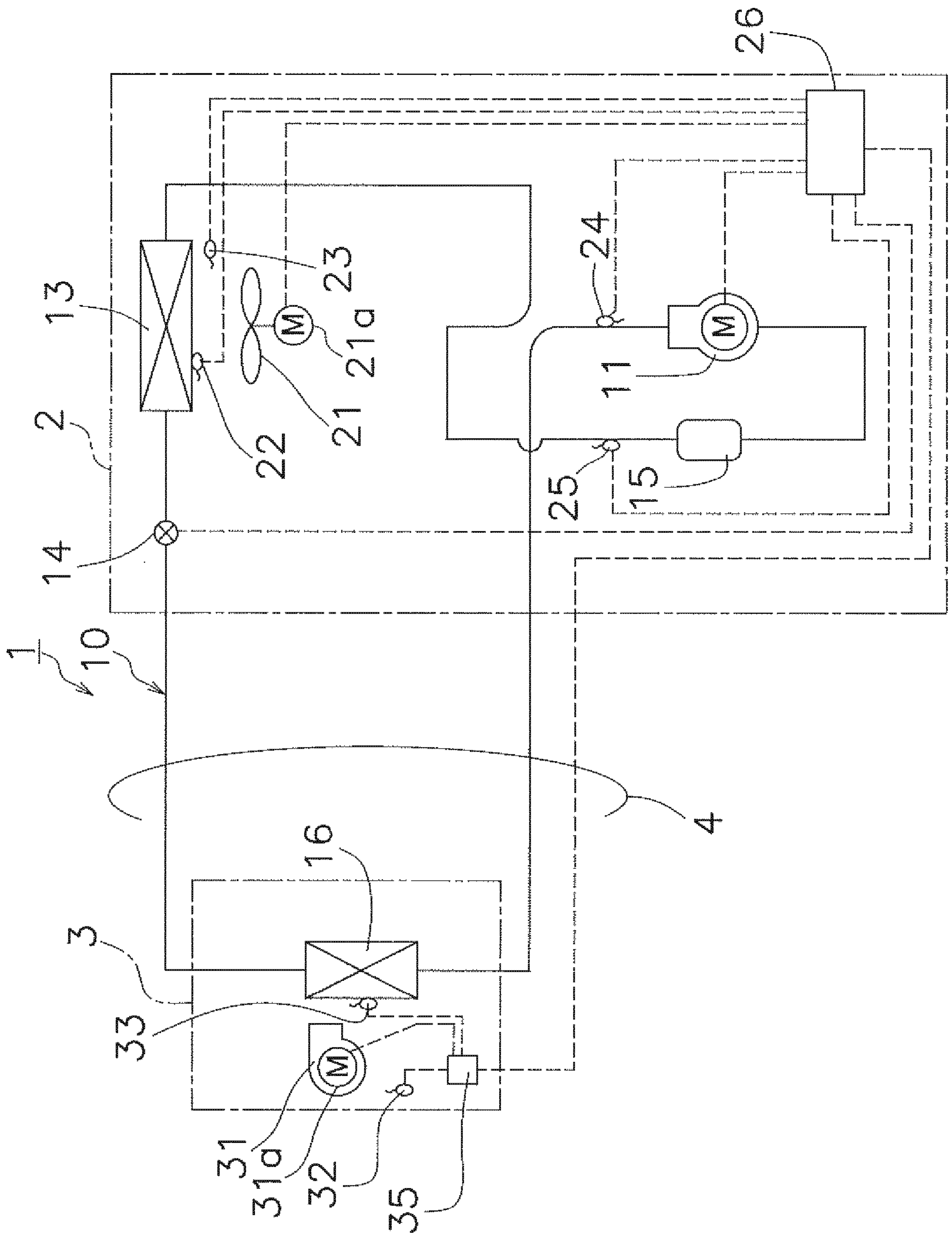


FIG. 2

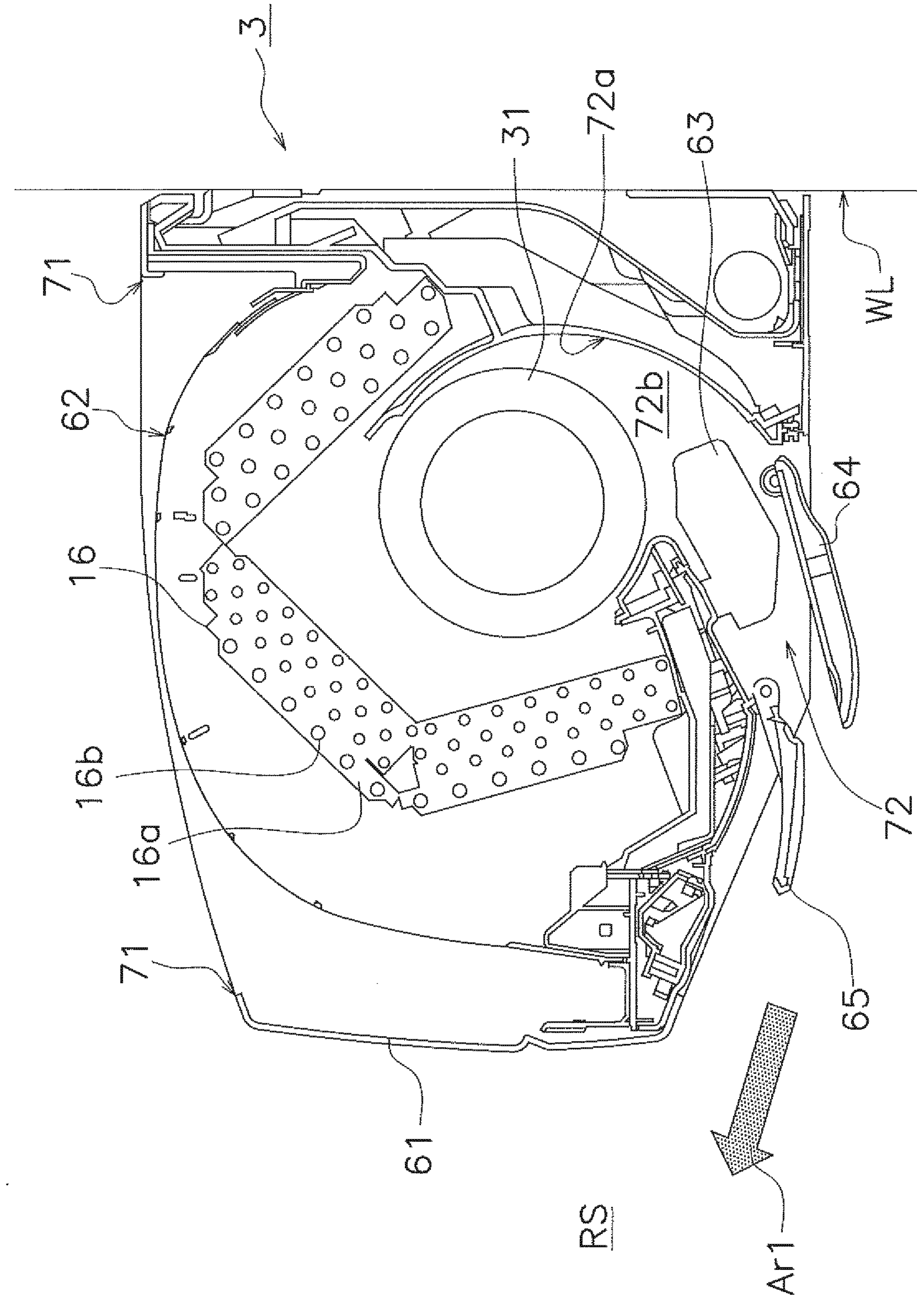
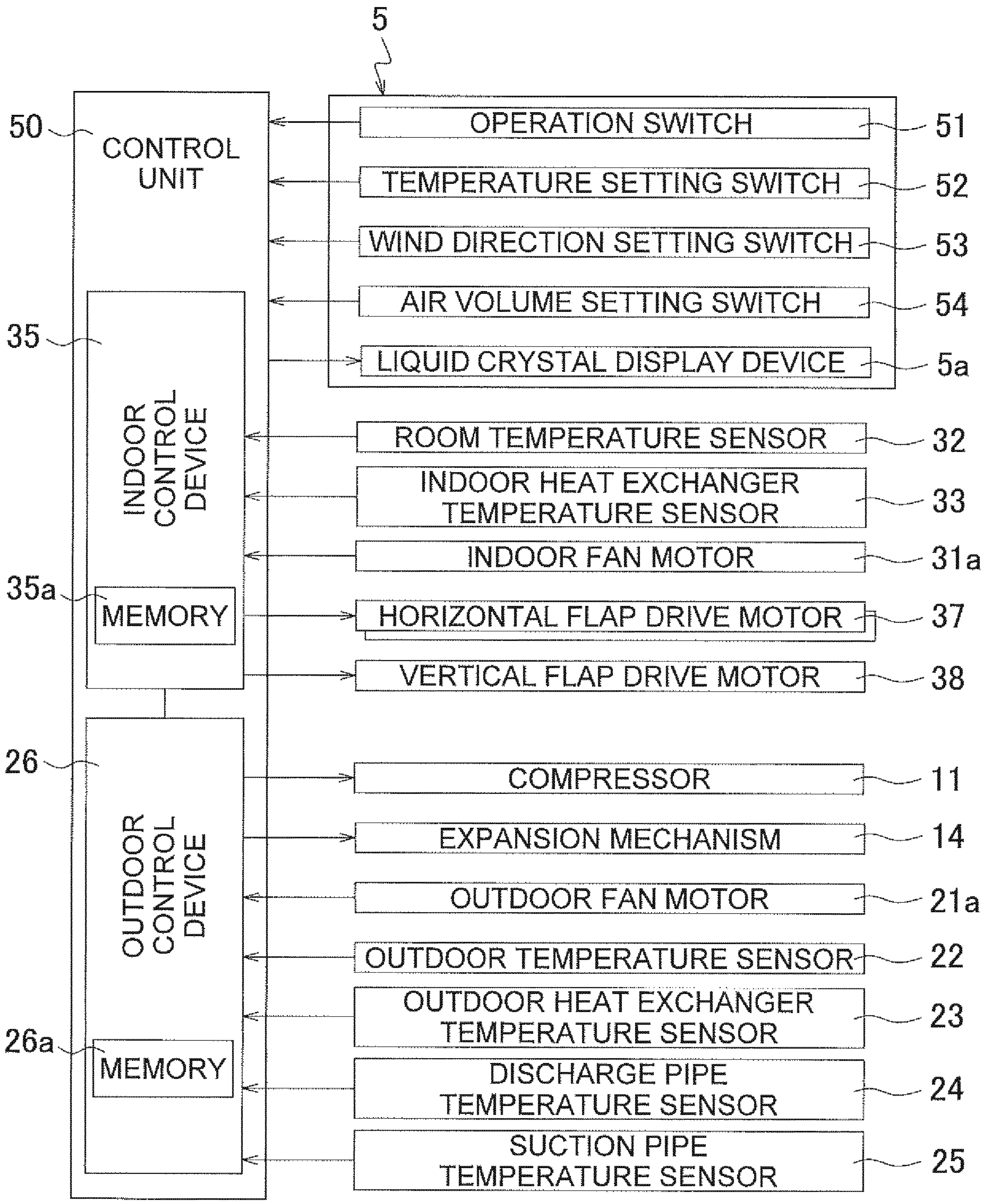


FIG. 3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50
CONTROL UNIT
OPERATION SWITCH
51
TEMPERATURE SETTING SWITCH
52
WIND DIRECTION SETTING SWITCH
53
AIR VOLUME SETTING SWITCH
54
35
LIQUID CRYSTAL DISPLAY DEVICE
5a
INDOOR CONTROL DEVICE
ROOM TEMPERATURE SENSOR
32
INDOOR HEAT EXCHANGER TEMPERATURE SENSOR
33
INDOOR FAN MOTOR
31a
35a
MEMORY
HORIZONTAL FLAP DRIVE MOTOR
37
VERTICAL FLAP DRIVE MOTOR
38
26
COMPRESSOR
11
OUTDOOR CONTROL DEVICE
EXPANSION MECHANISM
14
OUTDOOR FAN MOTOR
21a
OUTDOOR TEMPERATURE SENSOR
22
OUTDOOR HEAT EXCHANGER TEMPERATURE SENSOR
23
26a
MEMORY
DISCHARGE PIPE TEMPERATURE SENSOR
24
SUCTION PIPE TEMPERATURE SENSOR
25

FIG. 4

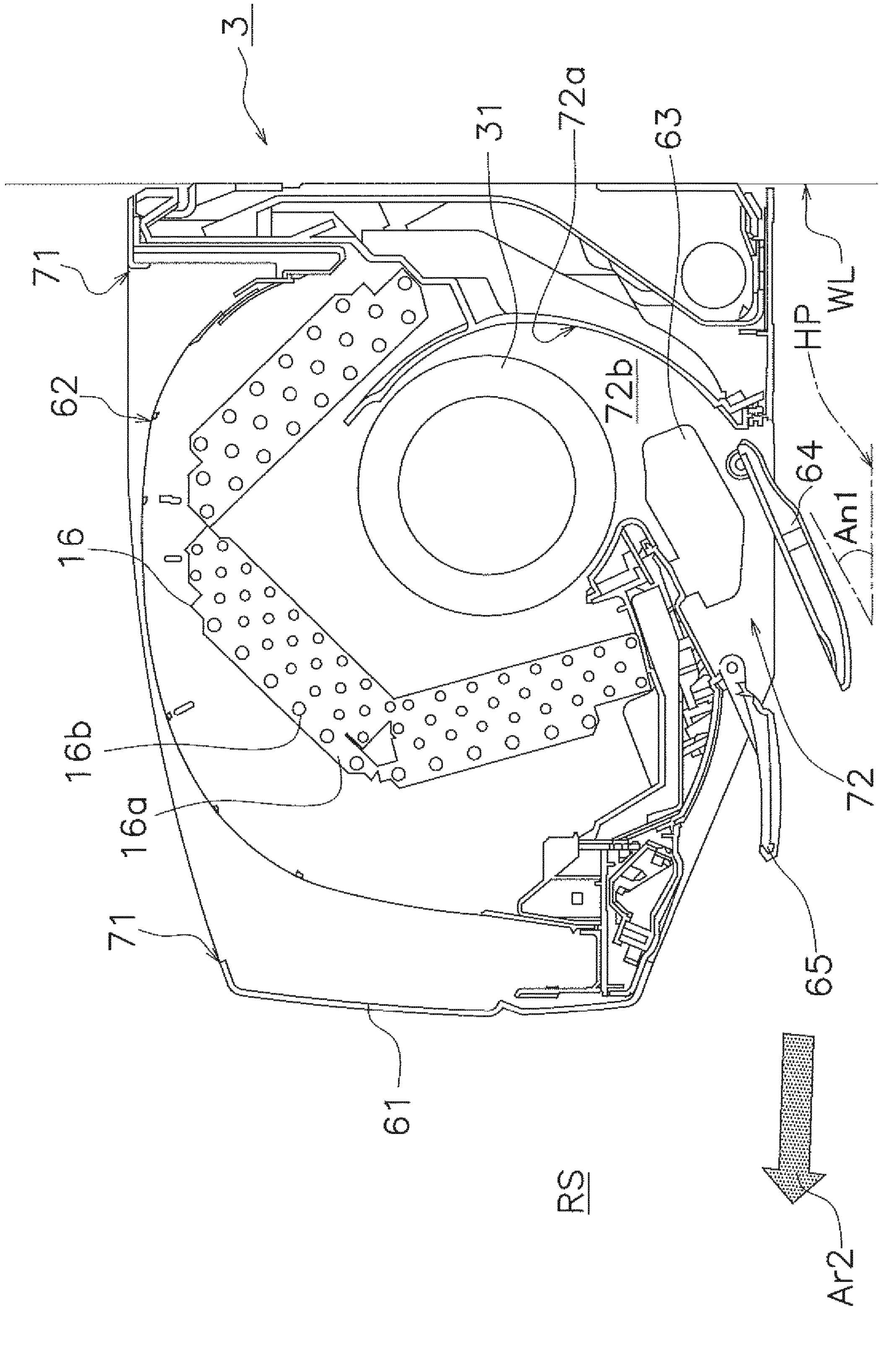

FIG. 5

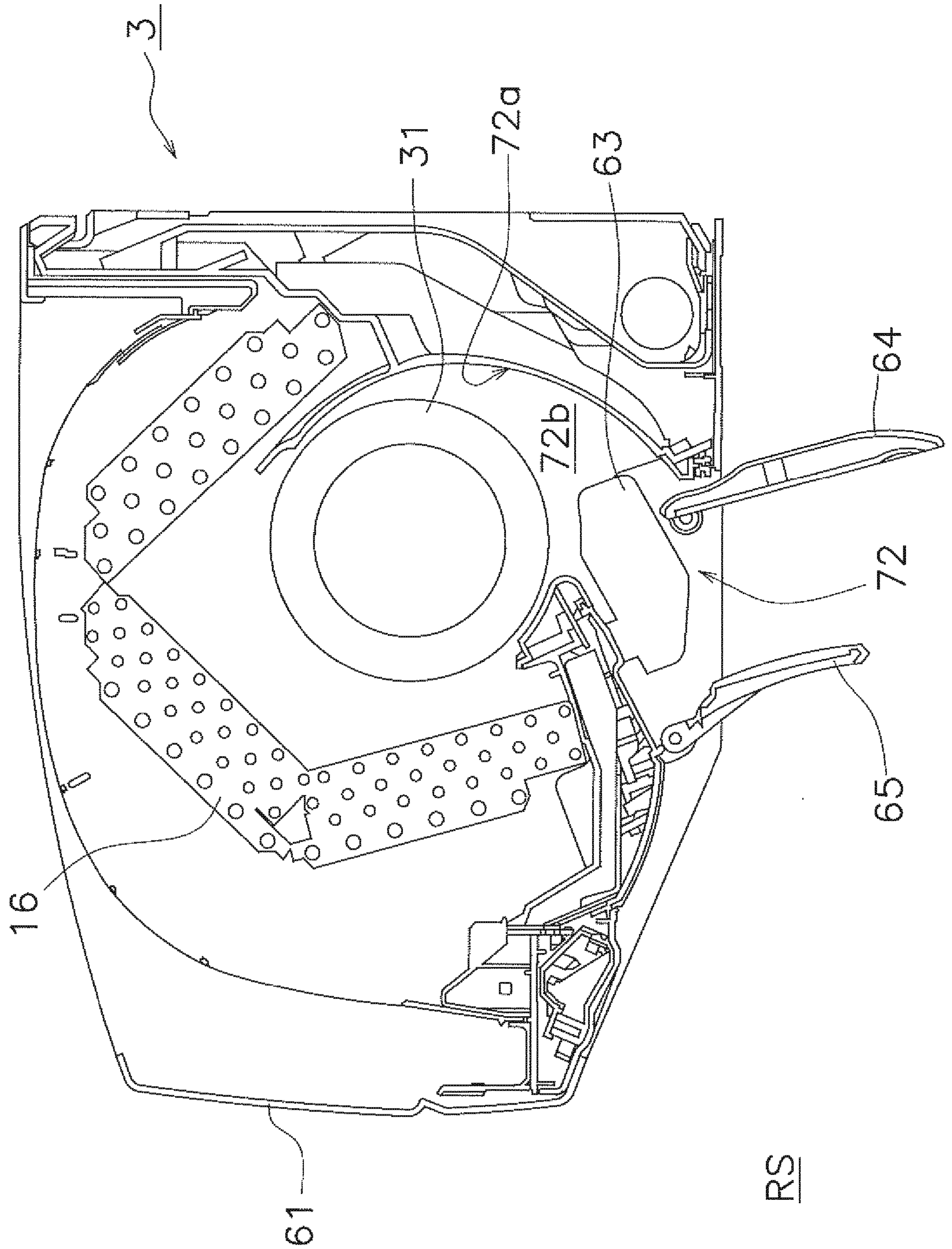

FIG. 6

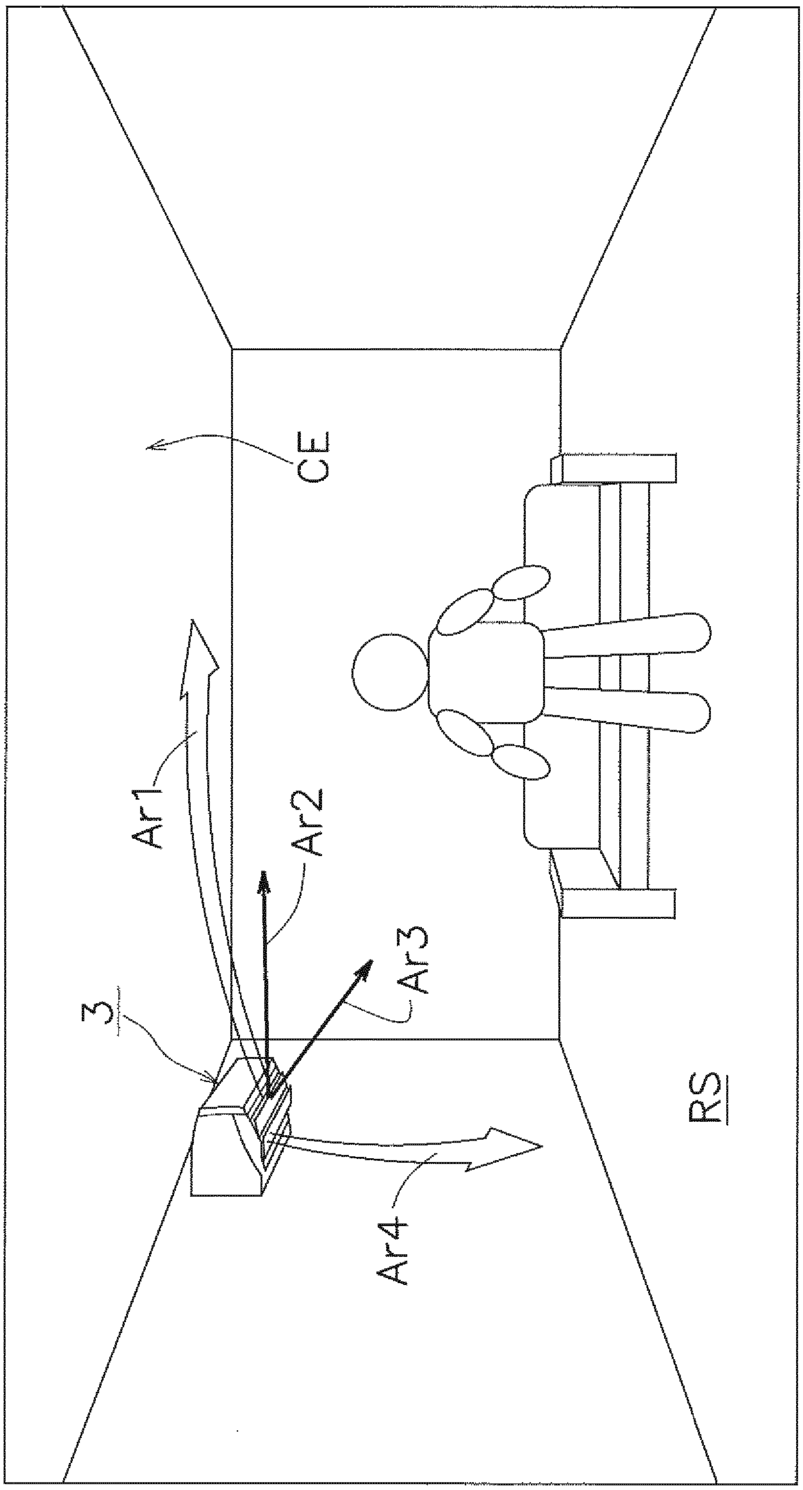

FIG. 7

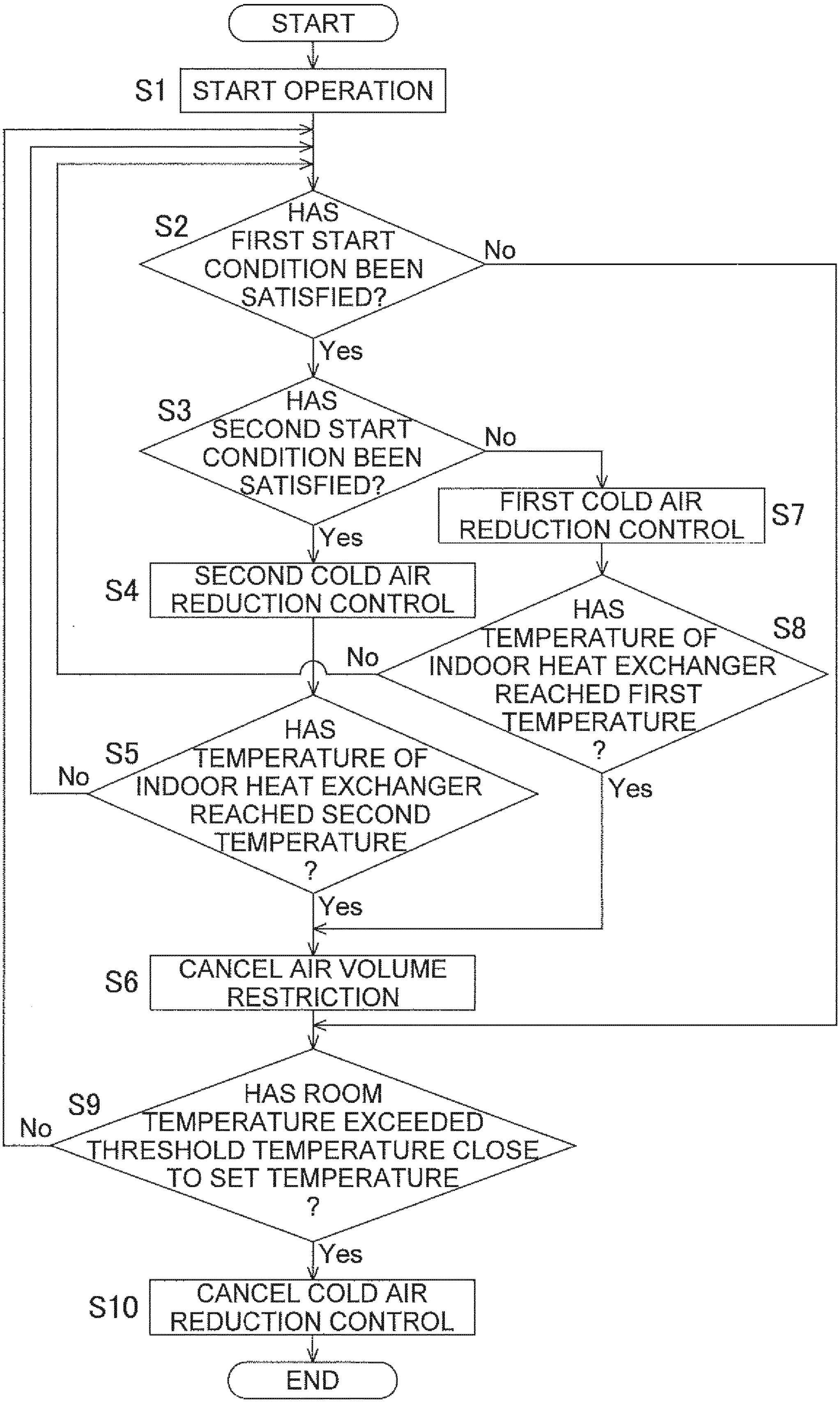
START
S1
START OPERATION
S2
HAS FIRST START CONDITION BEEN SATISFIED?
No
Yes
S3
HAS SECOND START CONDITION BEEN SATISFIED?
No
Yes
FIRST COLD AIR REDUCTION CONTROL
S7
S4
SECOND COLD AIR REDUCTION CONTROL
HAS TEMPERATURE OF INDOOR HEAT EXCHANGER REACHED FIRST TEMPERATURE ?
S8
No
Yes
S5
HAS TEMPERATURE OF INDOOR HEAT EXCHANGER REACHED SECOND TEMPERATURE ?
No
Yes
S6
CANCEL AIR VOLUME RESTRICTION
S9
HAS ROOM TEMPERATURE EXCEEDED THRESHOLD TEMPERATURE CLOSE TO SET TEMPERATURE ?
No
Yes
S10
CANCEL COLD AIR REDUCTION CONTROL
END

FIG. 8

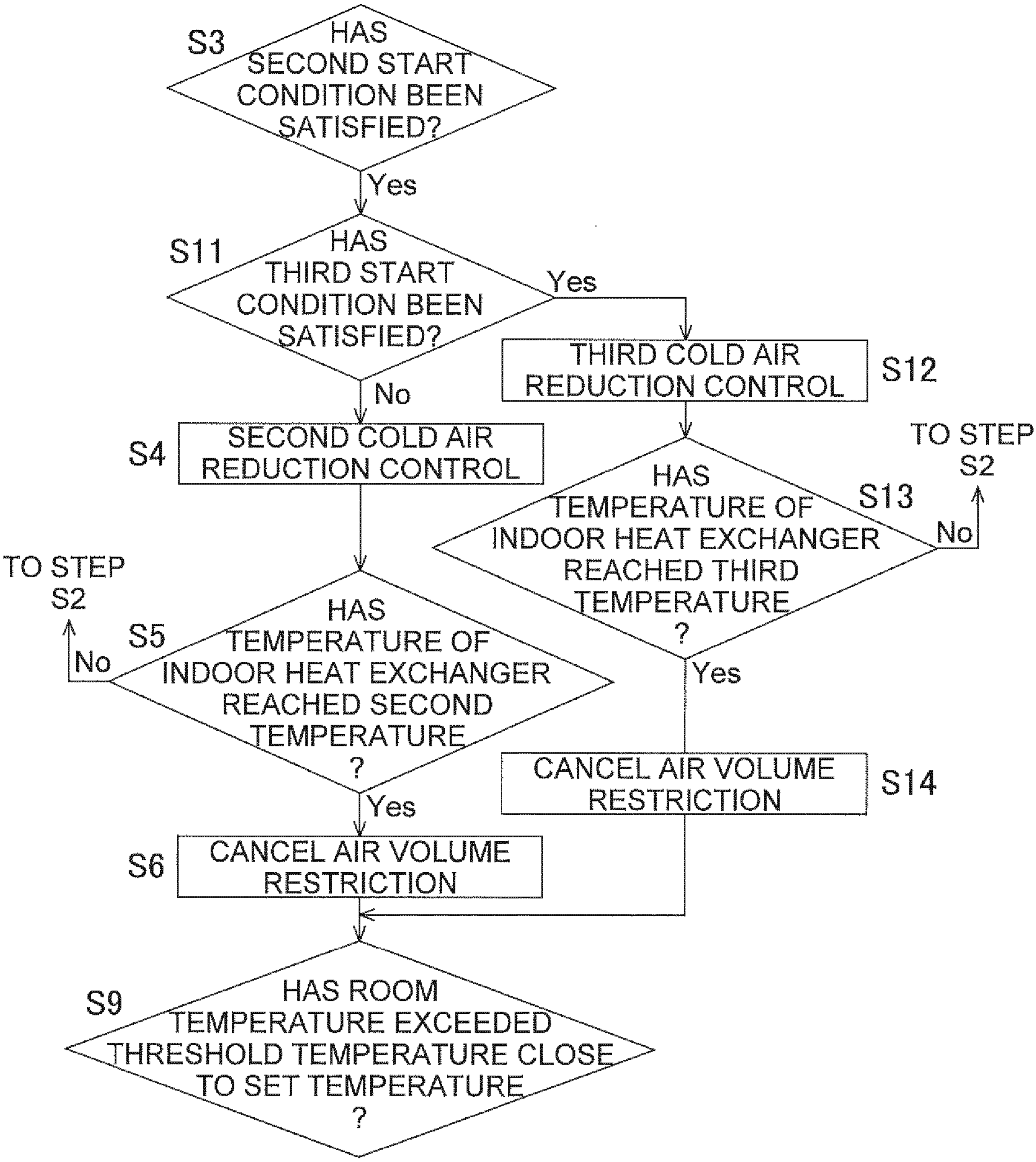
S3
HAS SECOND START CONDITION BEEN SATISFIED?
Yes
S11
HAS THIRD START CONDITION BEEN SATISFIED?
Yes
THIRD COLD AIR REDUCTION CONTROL
S12
No
S4
SECOND COLD AIR REDUCTION CONTROL
TO STEP S2
S13
HAS TEMPERATURE OF INDOOR HEAT EXCHANGER REACHED THIRD TEMPERATURE ?
No
TO STEP S2
S5
No
HAS TEMPERATURE OF INDOOR HEAT EXCHANGER REACHED SECOND TEMPERATURE ?
Yes
CANCEL AIR VOLUME RESTRICTION
S14
Yes
S6
CANCEL AIR VOLUME RESTRICTION
S9
HAS ROOM TEMPERATURE EXCEEDED THRESHOLD TEMPERATURE CLOSE TO SET TEMPERATURE ?

FIG. 9

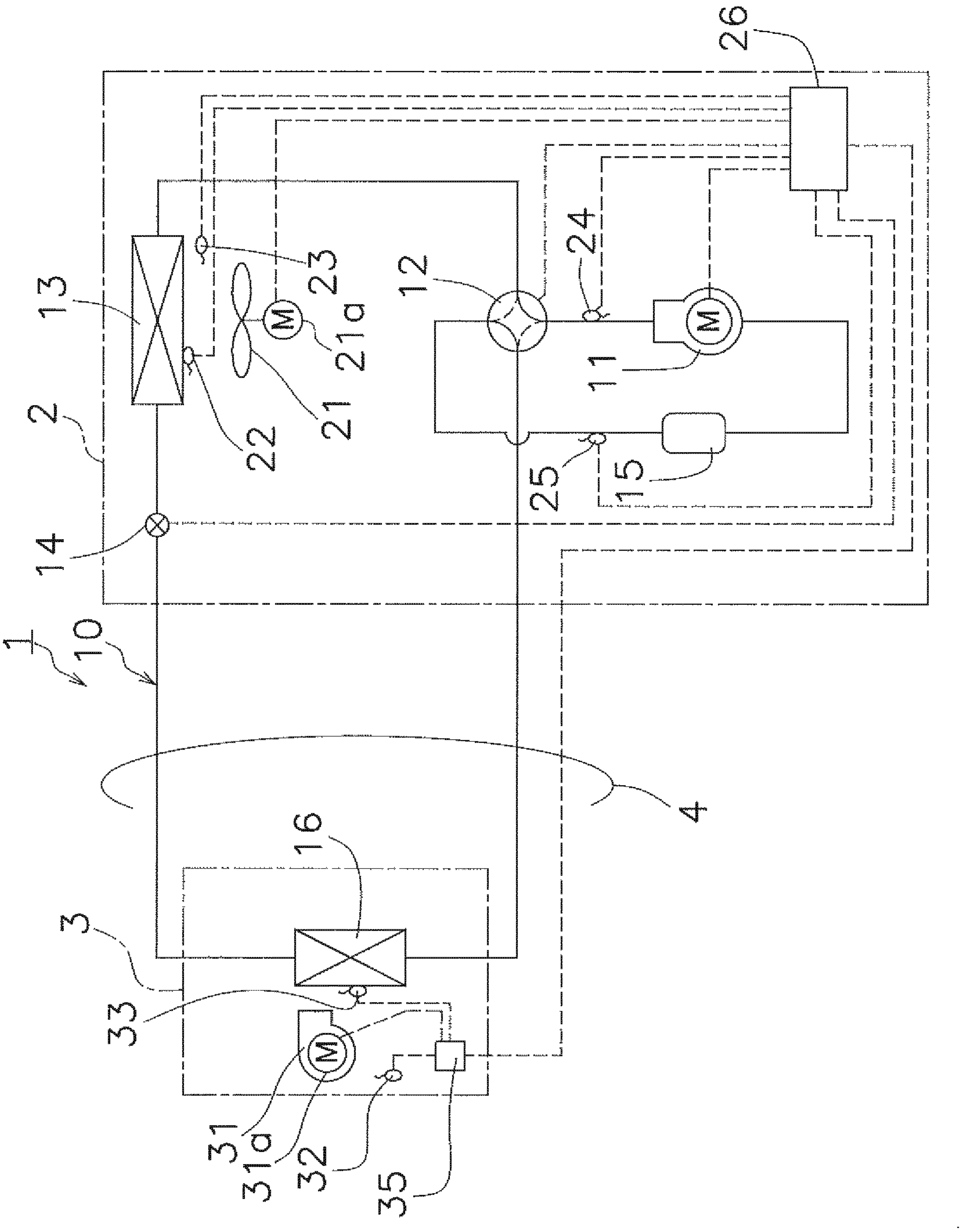

FIG. 10

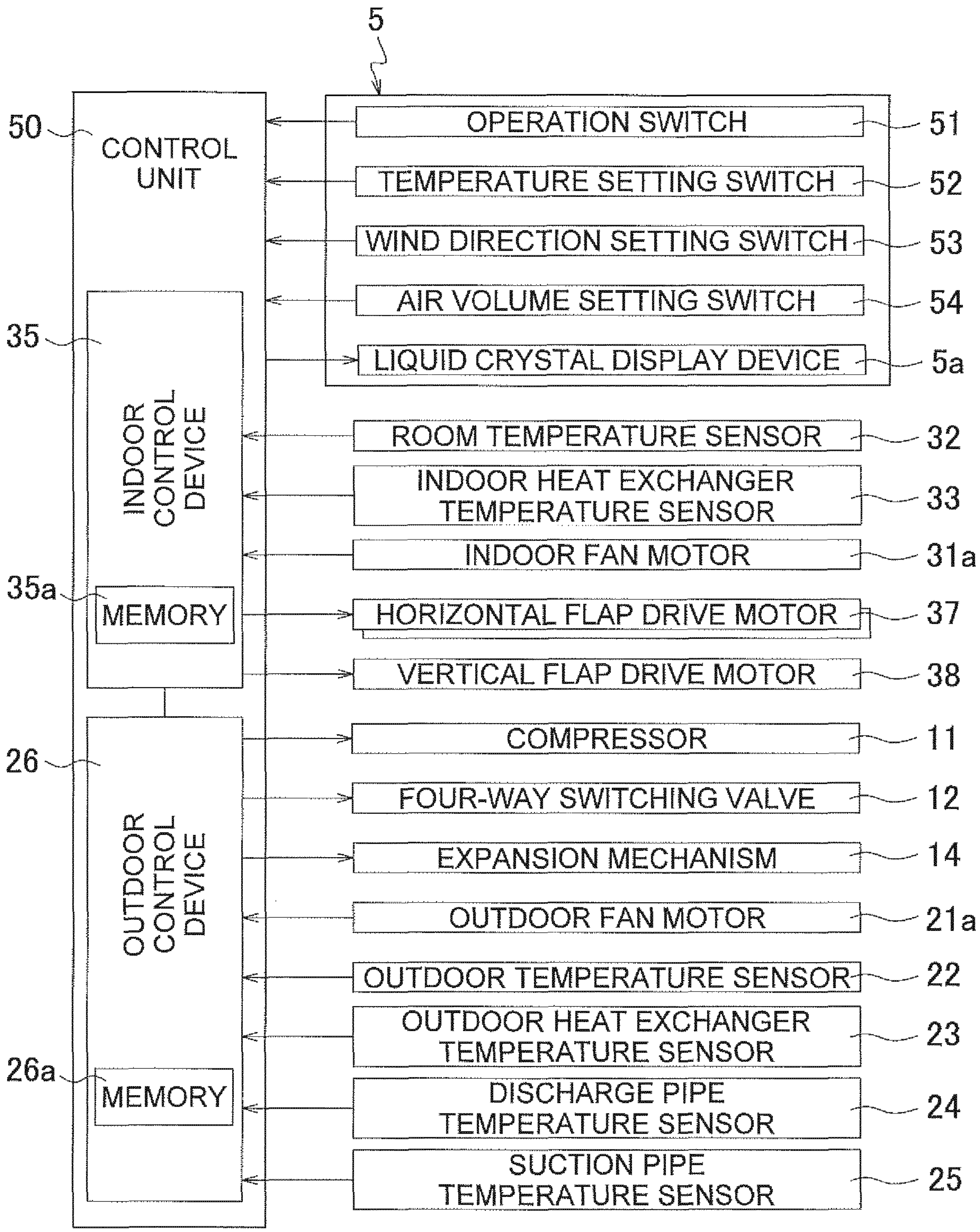
5
50
CONTROL UNIT
OPERATION SWITCH
51
TEMPERATURE SETTING SWITCH
52
WIND DIRECTION SETTING SWITCH
53
AIR VOLUME SETTING SWITCH
54
35
LIQUID CRYSTAL DISPLAY DEVICE
5a
INDOOR CONTROL DEVICE
ROOM TEMPERATURE SENSOR
32
INDOOR HEAT EXCHANGER TEMPERATURE SENSOR
33
INDOOR FAN MOTOR
31a
35a
MEMORY
HORIZONTAL FLAP DRIVE MOTOR
37
VERTICAL FLAP DRIVE MOTOR
38
COMPRESSOR
11
26
OUTDOOR CONTROL DEVICE
FOUR-WAY SWITCHING VALVE
12
EXPANSION MECHANISM
14
OUTDOOR FAN MOTOR
21a
OUTDOOR TEMPERATURE SENSOR
22
OUTDOOR HEAT EXCHANGER TEMPERATURE SENSOR
23
26a
MEMORY
DISCHARGE PIPE TEMPERATURE SENSOR
24
SUCTION PIPE TEMPERATURE SENSOR
25

FIG. 11

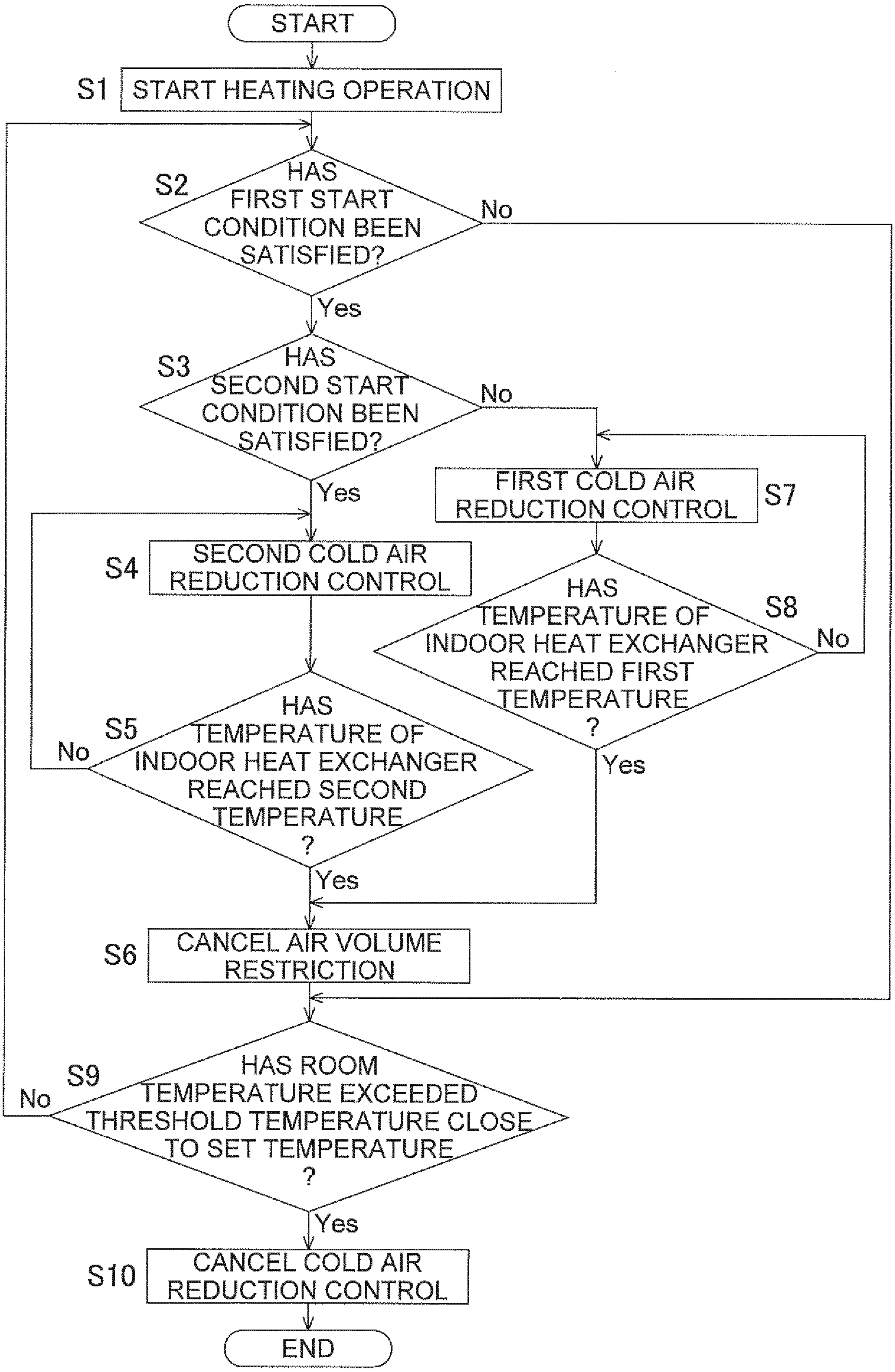
START
S1
START HEATING OPERATION
S2
HAS FIRST START CONDITION BEEN SATISFIED?
No
Yes
S3
HAS SECOND START CONDITION BEEN SATISFIED?
No
Yes
FIRST COLD AIR REDUCTION CONTROL
S7
S4
SECOND COLD AIR REDUCTION CONTROL
HAS TEMPERATURE OF INDOOR HEAT EXCHANGER REACHED FIRST TEMPERATURE ?
S8
No
Yes
S5
HAS TEMPERATURE OF INDOOR HEAT EXCHANGER REACHED SECOND TEMPERATURE ?
No
Yes
S6
CANCEL AIR VOLUME RESTRICTION
S9
HAS ROOM TEMPERATURE EXCEEDED THRESHOLD TEMPERATURE CLOSE TO SET TEMPERATURE ?
No
Yes
S10
CANCEL COLD AIR REDUCTION CONTROL
END

FIG. 12

REFERENCES CITED IN THE DESCRIPTION

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- JP 9303844 A **[0002] [0077]**
- JP H05141755 A **[0002]**