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(54) AIR CONDITIONER

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Description

TECHNICAL FIELD

[0001] The present invention relates to an air conditioner.

BACKGROUND ART

[0002] For example, Patent Literature 1 describes, as a technique for bringing an indoor heat exchanger of an air conditioner into a clean state, an air conditioner "including a moisture providing section configured to cause water to adhere to a fin surface after air heating operation. Note that the water providing section causes water to adhere to the fin surface of the indoor heat exchanger by performing air cooling operation after the air heating operation.

[0003] Patent Literature 2 shows a self-cleaning method of an air conditioner heat exchanger. The method comprises the steps that an air conditioner is controlled to enter a self-cleaning mode; the environmental temperature of the heat exchanger to be cleaned is detected, and the target evaporation temperature of the heat exchanger to be cleaned is determined according to the detected environmental temperature; the operation frequency of a compressor is adjusted according to the target evaporation temperature of the heat exchanger to be cleaned and the actual evaporation temperature, and the heat exchanger to be cleaned is controlled to frost; and after the surface of the heat exchanger to be cleaned is covered with a frost layer or an ice layer, the air conditioner is controlled to enter the defrosting mode of the heat exchanger to be cleaned.

[0004] Patent Literature 3 shows a self-cleaning heat exchanger which has a reversible fan located between two tube banks with a pressure switch connected thereto. The fan rotates in one direction blowing across the first tube bank and drawing air over the second tube bank. The pressure switch and fan are interconnected by two relays. When the refrigerant pressure in the tube banks exceeds the threshold pressure, the relay is closed and grounded and electric current flows through the relay. The change in direction of current flow will revers the polarity of the windings in the motor and thus the rotation of the motor and the fan thereby reversing air flow to remove debris form one tube bank while withdrawing heat from the other.

CITATION LIST

PATENT LITERATURE

[0005]

PATENT LITERATURE 1: Japanese Patent No. 4931566
PATENT LITERATURE 2: CN 106 765 873 A
PATENT LITERATURE 3: US 5 226 285 A

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0006] However, in the technique described in Patent Literature 1, even when the normal air cooling operation is performed after the air heating operation, there is a probability that the amount of water adhering to the indoor heat exchanger lacks for cleansing the indoor heat exchanger.

[0007] The present invention is an invention for solving the above-described problem, and is intended to provide an air conditioner configured so that an indoor heat exchanger can be properly cleansed.

SOLUTION TO THE PROBLEMS

[0008] The above problem is solved by the subject matter of the appended claims. In particular, the air conditioner of the present invention includes a refrigerant circuit configured such that refrigerant sequentially circulates in a refrigeration cycle through a compressor, a condenser, an expansion valve (e.g., an outdoor expansion valve 34), and an evaporator, and a control unit configured to control at least the compressor and the expansion valve. One of the condenser or the evaporator is an outdoor heat exchanger, and the other one of the condenser or the evaporator is an indoor heat exchanger. The control unit is configured to cause the indoor heat exchanger to function as the evaporator, and is further configured to thaw out the indoor unit heat exchanger and to cause a blower fan (e.g., an indoor fan 14) to rotate backward during the freezing processing of freezing the indoor heat exchanger. Other aspects of the present invention will be described in later-described embodiments.

ADVANTAGEOUS EFFECTS OF THE INVENTION

[0009] According to the present invention, the air conditioner configured so that the indoor heat exchanger can be properly cleansed can be provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Fig. 1 is an external configuration view of an air conditioner according to a first embodiment;
Fig. 2 is a view for describing a longitudinal sectional configuration of an indoor unit of the air conditioner according to the first embodiment;
Fig. 3 is a diagram for describing a refrigerant circuit of the air conditioner according to the first embodiment;
Fig. 4 is a functional block diagram of the air conditioner according to the first embodiment;

Fig. 5 is a flowchart of cleansing processing executed by a control unit of the air conditioner according to the first embodiment;

Fig. 6 is a flowchart of the processing of freezing an indoor heat exchanger;

Fig. 7 is a map of a relationship between the relative humidity of indoor air and a freezing time;

Fig. 8 is a map of a relationship between an outdoor temperature and the rotation rate of a compressor;

Fig. 9 is a graph for describing one example of a temporal change in the temperature of the indoor heat exchanger;

Fig. 10 is a chart for describing drive states of the compressor and an indoor fan;

Fig. 11A is a schematic view of a frost state during the freezing processing in a case where the indoor fan is brought into a stop state;

Fig. 11B is a schematic view of a frost state during the freezing processing in a case where a backward rotation state and the stop state of the indoor fan are combined;

Fig. 12 is a flowchart of the processing of thawing out the indoor heat exchanger;

Fig. 13 is a flowchart of the processing of drying the indoor heat exchanger; and

Fig. 14 is a view for describing a longitudinal sectional configuration of an indoor unit of an air conditioner according to a second embodiment.

DESCRIPTION OF THE EMBODIMENTS

«First Embodiment»

<Configuration of Air Conditioner>

[0011] Fig. 1 is an external configuration view of an air conditioner 100 according to a first embodiment. Fig. 1 illustrates a front view of an indoor unit 10, an outdoor unit 30, and a remote controller 40 included in the air conditioner 100. The air conditioner 100 is equipment configured to perform air conditioning by circulation of refrigerant in a refrigeration cycle (a heat pump cycle). As illustrated in Fig. 1, the air conditioner 100 includes the indoor unit 10 placed inside a room (an air conditioning target space), the outdoor unit 30 placed outside the room, and the remote controller 40 operated by a user.

[0012] The indoor unit 10 includes a remote controller signal transmission/receiving unit 11. The remote controller signal transmission/receiving unit 11 is configured to transmit/receive, via infrared communication etc., a predetermined signal between the remote controller signal transmission/receiving unit 11 and the remote controller 40. For example, the remote controller signal transmission/receiving unit 11 receives, from the remote controller 40, signals such as an operation/stop command, a set temperature change, an operation mode change, and a timer setting. Moreover, the remote controller signal transmission/receiving unit 11 transmits an indoor temperature detection value etc. to the remote controller 40. Note that although not shown in Fig. 1, the indoor unit 10 and the outdoor unit 30 are connected to each other through a refrigerant pipe and are connected to each other through a communication line.

[0013] Fig. 2 is a view for describing a longitudinal sectional configuration of the indoor unit 10 of the air conditioner 100 according to the first embodiment. In addition to the remote controller signal transmission/receiving unit 11 (see Fig. 1), the indoor unit 10 includes an indoor heat exchanger 12, a drain pan 13, an indoor fan 14 (a blower fan), a housing base 15, filters 16, a front panel 17, a right-to-left wind direction plate 18, and an upper-to-lower wind direction plate 19.

[0014] The indoor heat exchanger 12 includes fins 12a and heat transfer pipes 12g. The heat transfer pipes 12g are arranged in two lines in a zigzag pattern in an air flow direction. Heat is exchanged between refrigerant flowing in the heat transfer pipes 12g and indoor air. The drain pan 13 is configured to receive water dripped from the indoor heat exchanger 12, and is arranged below the indoor heat exchanger 12. Note that the water dropped onto the drain pan 13 is discharged to the outside through a drain hose (not shown). The indoor fan 14 is, for example, a cylindrical cross flow fan, and is driven in the direction (a clockwise direction, a forward rotation direction) of an arrow of the figure by an indoor fan motor 14a (see Fig. 4). The housing base 15 is a housing in which equipment such as the indoor heat exchanger 12 and the indoor fan 14 is placed. Note that in the present embodiment, a filter side (an upstream side) in the indoor heat exchanger 12 is a front surface 12f, and an indoor fan 14 side (a downstream side) in the indoor heat exchanger 12 is a rear surface 12r.

[0015] The filters 16 are configured to remove grit and dust from air taken in through an air suction port h1 etc., and are placed on the upper and front sides of the indoor heat exchanger 12. The front panel 17 is a panel placed to cover the front filter 16, and is rotatable forward about a lower end. Note that the front panel 17 may be configured not to rotate.

[0016] The right-to-left wind direction plate 18 is a plate-shaped member configured to adjust, in a right-to-left direction, a flow direction of air blown to the inside of the room. The right-to-left wind direction plate 18 is arranged on the downstream side of the indoor fan 14, and is configured to rotate in the right-to-left direction by a right-to-left wind direction plate motor 21 (see Fig. 4).

[0017] The upper-to-lower wind direction plate 19 is a plate-shaped member configured to adjust, in an upper-to-lower direction, the flow direction of air blown to the inside of the room. The upper-to-lower wind direction plate 19 is arranged on the downstream side of the indoor fan 14, and is configured to rotate in the upper-to-lower direction by an upper-to-lower wind direction plate motor 22 (see Fig. 4).

[0018] The air sucked through the air suction port h1 exchanges heat with the refrigerant flowing in the heat transfer pipes 12g, and the air subjected to heat exchange is guided to a blown air path h2. The air flowing in the blown air path h2 is guided in a predetermined direction by the right-to-left wind direction plate 18 and the upper-to-lower wind direction plate 19, and is further blown to the inside of the room through an air blowing port h3.

[0019] Fig. 3 is a diagram for describing a refrigerant circuit Q of the air conditioner 100 according to the first embodiment. Note that solid arrows of Fig. 3 indicate the flow of refrigerant in air heating operation. Moreover, dashed arrows of Fig. 3 indicate the flow of refrigerant in air cooling operation. As illustrated in Fig. 3, the outdoor unit 30 includes a compressor 31, an outdoor heat exchanger 32, an outdoor fan 33, an outdoor expansion valve 34 (an expansion valve), and a four-way valve 35.

[0020] The compressor 31 is equipment configured to compress low-temperature low-pressure gas refrigerant by driving of a compressor motor 31a to discharge the resultant refrigerant as high-temperature high-pressure gas refrigerant. The outdoor heat exchanger 32 is a heat exchanger configured to exchange heat between refrigerant flowing in a heat transfer pipe (not shown) of the outdoor heat exchanger 32 and external air sent from the outdoor fan 33.

[0021] The outdoor fan 33 is a fan configured to send the external air to the outdoor heat exchanger 32 by driving of an outdoor fan motor 33a, and is placed in the vicinity of the outdoor heat exchanger 32. The outdoor expansion valve 34 has the function of decompressing refrigerant condensed in a "condenser" (one of the outdoor heat exchanger 32 or the indoor heat exchanger 12). Note that the refrigerant decompressed in the outdoor expansion valve 34 is guided to an "evaporator" (the other one of the outdoor heat exchanger 32 or the indoor heat exchanger 12).

[0022] The four-way valve 35 is a valve configured to switch a refrigerant flow path according to the operation mode of the air conditioner 100. That is, in the air cooling operation in which refrigerant flows in the direction of the dashed arrows, the refrigerant circulates in the refrigeration cycle in the refrigerant circuit Q formed in such a manner that the compressor 31, the outdoor heat exchanger 32 (the condenser), the outdoor expansion valve 34, and the indoor heat exchanger 12 (the evaporator) are sequentially connected in an annular shape through the four-way valve 35.

[0023] Moreover, in the air heating operation in which refrigerant flows in the direction of the solid arrows, the refrigerant circulates in the refrigeration cycle in the refrigerant circuit Q formed in such a manner that the compressor 31, the indoor heat exchanger 12 (the condenser), the outdoor expansion valve 34, and the outdoor heat exchanger 32 (the evaporator) are sequentially connected in an annular shape through the four-way valve 35.

[0024] That is, in the refrigerant circuit Q in which refrigerant sequentially circulates in the refrigeration cycle through the compressor 31, the "condenser," the outdoor expansion valve 34, and the "evaporator," one of the "condenser" or the "evaporator" is the outdoor heat exchanger 32, and the other one of the "condenser" or the "evaporator" is the indoor heat exchanger 12.

[0025] Fig. 4 is a block diagram of control functions of the air conditioner 100 according to the first embodiment. The indoor unit 10 illustrated in Fig. 4 includes, in addition to the above-described configuration, an image capturing unit 23, an environment detection unit 24, and an indoor control circuit 25. The image capturing unit 23 is configured to capture an image of the inside of the room (the air conditioning target space), and includes an image capturing element such as a charge coupled device (CCD) sensor or a complementary metal oxide semiconductor (CMOS) sensor. Based on an image capturing result of the image capturing unit 23, a person (a person staying in the room) inside the room is detected by the indoor control circuit 25. Note that a "person detection unit" configured to detect the person present in the air conditioning target space includes the image capturing unit 23 and the indoor control circuit 25.

[0026] The environment detection unit 24 has the function of detecting an indoor room state and an equipment state of the indoor unit 10, and includes an indoor temperature sensor 24a, a humidity sensor 24b, and an indoor heat exchanger temperature sensor 24c. The indoor temperature sensor 24a is a sensor configured to detect the temperature of the inside of the room (the air conditioning target space). The indoor temperature sensor 24a is placed on an air suction side with respect to the filters 16 (see Fig. 2). Thus, when the indoor heat exchanger 12 is frozen as described later, a detection error due to influence of thermal radiation of the indoor heat exchanger 12 can be reduced.

[0027] The humidity sensor 24b is a sensor configured to detect the humidity of air inside the room (the air conditioning target space), and is placed at a predetermined position of the indoor unit 10. The indoor heat exchanger temperature sensor 24c is a sensor configured to detect the temperature of the indoor heat exchanger 12 (see Fig. 2), and is placed at the indoor heat exchanger 12. Detection values of the indoor temperature sensor 24a, the humidity sensor 24b, and the indoor heat exchanger temperature sensor 24c are output to the indoor control circuit 25.

[0028] Although not shown in the figure, the indoor control circuit 25 includes electronic circuits such as a central processing unit (CPU), a read only memory (ROM), a random access memory (RAM), and various interfaces. A program stored in the ROM is read and loaded into the RAM, and various types of processing are executed by the CPU.

[0029] As illustrated in Fig. 4, the indoor control circuit 25 includes a storage unit 25a and an indoor control unit 25b. The storage unit 25a stores, in addition to the predetermined program, the image capturing result of the image capturing unit 23, the detection result of the environment detection unit 24, and data received via the remote controller signal transmission/receiving unit 11, for example. The indoor control unit 25b executes predetermined control based on the data stored in the storage unit 25a. Note that processing executed by the indoor control unit 25b will be described later.

[0030] The outdoor unit 30 includes, in addition to the above-described configuration, an outdoor temperature sensor 36 and an outdoor control circuit 37. The outdoor temperature sensor 36 is a sensor configured to detect the temperature (an external air temperature) of the outside of the room, and is placed at a predetermined spot of the outdoor unit 30. Note that although not shown in Fig. 4, the outdoor unit 30 includes each sensor configured to detect the suction temperature, discharge temperature, discharge pressure, etc. of the compressor 31 (see Fig. 3). A detection value of each sensor including the outdoor temperature sensor 36 is output to the outdoor control circuit 37.

[0031] Although not shown in the figure, the outdoor control circuit 37 includes electronic circuits such as a CPU, a ROM, a RAM, and various interfaces, and is connected to the indoor control circuit 25 through a communication line. As illustrated in Fig. 4, the outdoor control circuit 37 includes a storage unit 37a and an outdoor control unit 37b. The storage unit 37a stores, in addition to a predetermined program, the detection value of each sensor including the outdoor temperature sensor 36, for example. Based on the data stored in the storage unit 37a, the outdoor control unit 37b controls the compressor motor 31a (i.e., the compressor 31), the outdoor fan motor 33a, the outdoor expansion valve 34, etc. Hereinafter, the indoor control circuit 25 and the outdoor control circuit 37 will be referred to as a "control unit K."

[0032] Next, the processing of cleansing the indoor heat exchanger 12 (see Fig. 2) will be described.

[0033] As described above, the filters 16 (see Fig. 2) configured to collect grit and dust are placed on the upper and front sides (the air suction side) of the indoor heat exchanger 12. However, in some cases, fine grit and dust pass through the filters 16, and adhere to the indoor heat exchanger 12. The indoor heat exchanger 12 is preferably cleansed on a regular basis. For this reason, in the present embodiment, moisture contained in air taken in the indoor unit 10 is frozen in the indoor heat exchanger 12, and thereafter, ice of the indoor heat exchanger 12 is melted for cleansing the indoor heat exchanger 12. Such a series of processing is called "cleansing processing" of the indoor heat exchanger 12.

[0034] Fig. 5 is a flowchart of the cleansing processing executed by the control unit K of the air conditioner 100 according to the first embodiment. This flowchart will be described with reference to Figs. 3 and 4, as necessary. Note that it is assumed that predetermined air conditioning operation (the air cooling operation, the air heating operation, etc.) is performed until "START" of Fig. 5.

[0035] Moreover, it is assumed that a start condition for the cleansing processing of the indoor heat exchanger 12 is satisfied upon "START." This "start condition for the cleansing processing" is, for example, a condition (timing at which cleansing needs to be performed due to contamination adhering to a surface of the indoor heat exchanger 12) that an integrated value of an air conditioning operation execution time after the end of previous cleansing processing reaches a predetermined value. Note that a time period for performing the cleansing processing may be set by operation of the remote controller 40 by the user.

[0036] At a step S101, the control unit K stops the air conditioning operation for a predetermined time (e.g., several minutes). The above-described predetermined time is a time for stabilizing the refrigeration cycle, and is set in advance. For example, when the air heating operation performed until "START" is interrupted and the indoor heat exchanger 12 is frozen (S102), the control unit K controls the four-way valve 35 such that refrigerant flows in a direction opposite to that in the air heating operation.

[0037] If a refrigerant flow direction is changed suddenly, an overload is on the compressor 31, and sound etc. provides a feeling of discomfort to the user. For this reason, in the present embodiment, the air conditioning operation is stopped for the predetermined time (S101) prior to freezing (S102) of the indoor heat exchanger 12. In this case, the control unit K may freeze the indoor heat exchanger 12 after the predetermined time has elapsed after the air conditioning operation has been stopped.

[0038] Note that in the case of interrupting the air cooling operation and freezing the indoor heat exchanger 12, the processing of the step S101 may be omitted. This is because the refrigerant flow direction during the air cooling operation (upon START) and the refrigerant flow direction during freezing (S102) of the indoor heat exchanger 12 are the same as each other.

[0039] Next, at the step S102, the control unit K freezes the indoor heat exchanger 12 (the control unit K executes freezing processing). That is, the control unit K causes the indoor heat exchanger 12 to function as the evaporator, thereby forming frost on the surface of the indoor heat exchanger 12 from moisture contained in air taken in the indoor unit 10 and freezing the indoor heat exchanger 12. Moreover, during the freezing processing of freezing the indoor heat exchanger 12, the control unit K rotates the indoor fan 14 (the blower fan) backward (a counterclockwise direction in Fig. 2) to promote formation of frost on the fins close to the rear surface 12r (the downstream side, see Fig. 2) of the indoor heat exchanger 12, thereby freezing the indoor heat exchanger 12.

[0040] At a step S103, the control unit K thaws out the indoor heat exchanger 12 (ice adhering to the surface of the indoor heat exchanger 12). For example, the control unit K causes the indoor heat exchanger 12 to function as the condenser to melt ice on the surface of the indoor heat exchanger 12, thereby thawing out the indoor heat exchanger 12. In this manner, grit and dust adhering to the indoor heat exchanger 12 are rinsed away. Note that thawing may be natural thawing or thawing by contact of wind formed by rotation of the indoor fan 14.

[0041] At a step S104, the control unit K dries the indoor heat exchanger 12. For example, the control unit K dries water on the surface of the indoor heat exchanger 12 by driving of the indoor fan 14. In this manner, the indoor heat exchanger 12 can be brought into a clean state. After the processing of the step S104 has been performed, the control unit K ends a series of processing (END).

[0042] Next, details of each step of Fig. 5 will be described.

[0043] Fig. 6 is a flowchart of the processing (S102 of Fig. 5) of freezing the indoor heat exchanger 12 (as necessary, see Figs. 3 and 4). At a step S102a, the control unit K makes a default setting. At this point, the control unit K sets a backward rotation determination code N for the indoor fan 14 to 0 (zero), and brings the indoor fan 14 into a stop state.

[0044] At a step S102b, the control unit K controls the four-way valve 35. That is, the control unit K controls the four-way valve 35 such that the outdoor heat exchanger 32 functions as the condenser and the indoor heat exchanger 12 functions as the evaporator. Note that in the case of performing the air cooling operation right before the "cleansing processing" (a series of processing illustrated in Fig. 5) is performed, a control device maintains the state of the four-way valve 35 at the step S102a.

[0045] At a step S102c, the control unit K sets a freezing time. Specifically, the control unit K sets the freezing time based on the relative humidity of the indoor air (the air in the air conditioning target space). Note that the "freezing time" is a time for which predetermined control (S102c to S102e) for freezing the indoor heat exchanger 12 is continued. Of the freezing time of the present embodiment, a time (a backward rotation time) for rotating the indoor fan 14 backward may be set to a predetermined rate.

[0046] Fig. 7 is a map of a relationship between the relative humidity of the indoor air and the freezing time. The horizontal axis of Fig. 7 is the relative humidity of the indoor air, and is detected by the humidity sensor 24b (see Fig. 4). The vertical axis of Fig. 7 is the freezing time set corresponding to the relative humidity of the indoor air. As illustrated in Fig. 7, the control unit K shortens the freezing time for freezing the indoor heat exchanger 12 as the relative humidity of the indoor air increases. This is because a higher relative humidity of the indoor air results in a greater moisture amount in a predetermined volume of indoor air, and therefore, moisture easily adheres to the indoor heat exchanger 12. The freezing time is set as described above so that a suitable amount of moisture necessary for cleansing the indoor heat exchanger 12 can adhere to the indoor heat exchanger 12 and can be further frozen. Similarly, the control unit K shortens the backward rotation time of the indoor fan 14 for freezing the indoor heat exchanger 12 as the relative humidity of the indoor air increases.

[0047] When the relative humidity of the indoor air is equal to or higher than a predetermined value, the indoor fan 14 is not necessarily rotated backward. This is because when the relative humidity of the indoor air is equal to or higher than the predetermined value, if the indoor fan 14 is rotated backward, water droplets might be dropped from the front panel 17 due to excessive wetness of a rear surface of the front panel 17, and such a situation needs to be prevented.

[0048] Note that instead of the map (a data table) illustrated in Fig. 7, a predetermined mathematical expression may be used. Alternatively, instead of the relative humidity of the indoor air, the control unit K may set the freezing time based on the absolute humidity of the indoor air. That is, the control unit K may shorten the freezing time as the absolute humidity of the indoor air increases.

[0049] Next, at the step S102d of Fig. 6, the control unit K sets the rotation rate of the compressor 31. That is, based on an outdoor temperature as the detection value of the outdoor temperature sensor 36, the control unit K sets the rotation rate of the compressor motor 31a to drive the compressor 31.

[0050] Fig. 8 is a map of a relationship between the outdoor temperature and the rotation rate of the compressor 31. Upon freezing of the indoor heat exchanger 12, the control unit K increases the rotation rate of the compressor motor 31a as the outdoor temperature increases, as illustrated in Fig. 8. This is because for drawing heat from the indoor air in the indoor heat exchanger 12, sufficient heat radiation in the outdoor heat exchanger 32 is necessary accordingly. For example, in the case of a relatively-high outdoor temperature, the control unit K increases the rotation rate of the compressor motor 31a to increase the temperature and pressure of refrigerant discharged from the compressor 31. With this configuration, heat exchange in the outdoor heat exchanger 32 is properly performed, and therefore, freezing of the indoor heat exchanger 12 is properly performed. Note that instead of the map (a data table) illustrated in Fig. 8, a predetermined mathematical expression may be used.

[0051] Note that in normal air conditioning operation (the air cooling operation and the air heating operation), the rotation rate of the compressor 31 is often controlled based on, e.g., the temperature of refrigerant discharged from the compressor 31. On the other hand, when the indoor heat exchanger 12 is frozen, the temperature of refrigerant discharged from the compressor 31 tends to be lower than that of the normal air conditioning operation, and therefore, the outdoor temperature is used as another parameter.

[0052] Next, at the step S102e of Fig. 6, the control unit K adjusts the opening degree of the outdoor expansion valve 34. Note that at the step S102e, the opening degree of the outdoor expansion valve 34 is preferably lower than that of the normal air cooling operation. With this configuration, lower-temperature lower-pressure refrigerant than that of the normal air cooling operation flows into the indoor heat exchanger 12 through the outdoor expansion valve 34. Thus, water adhering to the indoor heat exchanger 12 is easily frozen, and the amount of power consumption necessary for freezing of the indoor heat exchanger 12 can be reduced.

[0053] At a step S102f, the control unit K determines whether or not the temperature TE of the indoor heat exchanger 12 is within a predetermined range ($T1 \leq TE \leq T2$). The "predetermined range" is a range suitable for freezing, in the indoor heat exchanger 12, moisture contained in air taken in the indoor unit 10, and is set in advance.

[0054] At the step S102f, in a case where the temperature of the indoor heat exchanger 12 is outside the predetermined range (S102f: No), the processing of the control unit K returns to the step S102e. For example, in a case where the temperature of the indoor heat exchanger 12 is higher than the predetermined range, the control unit K further decreases the opening degree of the outdoor expansion valve 34 (S102e). As described above, when the indoor heat exchanger 12 is frozen, the control unit K adjusts the opening degree of the outdoor expansion valve 34 such that the temperature TE of the indoor heat exchanger 12 falls within the predetermined range.

[0055] Fig. 9 is a graph for describing one example of a temporal change in the temperature TE of the indoor heat exchanger 12. The horizontal axis of Fig. 9 is a time elapsed after "START" of Fig. 6. The vertical axis of Fig. 9 is the temperature TE (the detection value of the indoor heat exchanger temperature sensor 24c: see Fig. 4) of the indoor heat exchanger 12. Note that the predetermined range F in which the temperature is lower than 0°C is a temperature range as a reference for determination of the step S102f (see Fig. 6), and is set in advance as described above.

[0056] As illustrated in Fig. 9, the temperature of the indoor heat exchanger 12 gradually decreases as the "time elapsed" after the start of the predetermined control of freezing the indoor heat exchanger 12 increases. When an elapsed time t_A is exceeded, the temperature of the indoor heat exchanger 12 falls within the predetermined range F. With this configuration, reliability of the indoor unit 10 can be ensured (an excessive decrease in the temperature of the indoor heat exchanger 12 can be suppressed) while the indoor heat exchanger 12 can be frozen.

[0057] Note that when the elapsed time t_A is exceeded, freezing of the indoor heat exchanger 12 progresses, and therefore, the thickness of ice on the indoor heat exchanger 12 increases as time proceeds. With this configuration, a sufficient amount of water necessary for cleansing of the indoor heat exchanger 12 can be frozen in the indoor heat exchanger 12.

[0058] In the present embodiment, the control unit K starts backward rotation of the indoor fan 14 at a time point t21 at which the temperature TE of the indoor heat exchanger 12 reaches equal to or lower than a predetermined temperature (equal to or lower than T2). In Fig. 9, the control unit K rotates the indoor fan 14 backward between the time point t21 and a time point t22 so that the rear surface 12r (see Fig. 2) of the indoor heat exchanger 12 can be also sufficiently frozen.

[0059] At the step S102f of Fig. 6, in a case where the temperature TE of the indoor heat exchanger 12 falls within the predetermined range (S102f: Yes), the processing of the control unit K proceeds to a step S102g.

[0060] At the step S102g, the control unit K determines whether or not the backward rotation determination code N of the indoor fan 14 is 1. When the backward rotation determination code N is not 1 (S102g: No), the indoor fan 14 is rotated backward at a step S102h, and the processing proceeds to a step S102i. When the backward rotation determination code N is 1 (S102g: Yes), the processing of the control unit K proceeds to a step S102k.

[0061] At the step S102i, the control unit K determines whether or not the backward rotation time (a period between the time points t21 to t22) of the indoor fan 14 has elapsed. When the backward rotation time of the indoor fan 14 does not elapse yet (S102i: No), the processing of the control unit K returns to the step S102h. When the backward rotation time of the indoor fan 14 has elapsed (S102i: Yes), the processing of the control unit K proceeds to a step S102j.

[0062] At the step S102j, the control unit K stops the indoor fan 14, and sets the backward rotation determination code N of the indoor fan 14 to 1. The processing of the control unit K proceeds to the step S102k.

[0063] At the step S102k, the control unit K determines whether or not the freezing time set at the step S102c has elapsed. In a case where a predetermined freezing time has not elapsed after "START" (S102k: No), the processing of the control unit K returns to the step S102d. On the other hand, in a case where the predetermined freezing time has elapsed after "START" (S102k: Yes), the control unit K ends a series of processing for freezing the indoor heat exchanger 12 (END).

[0064] Note that the determination processing of the step S102f is not necessarily performed based on the time elapsed after the "START" of Fig. 6, but is performed based on a time (a time elapsed after the time point t21 illustrated in Fig. 9) elapsed after the temperature TE of the indoor heat exchanger 12 has fallen within the predetermined range F.

[0065] Although not shown in Fig. 6, the control unit K preferably does not perform freezing of the indoor heat exchanger 12 in a case where the outdoor temperature is below zero. This is for preventing freezing of a great amount of dropped water due to thawing of the indoor heat exchanger 12 in the drain hose (not shown) and preventing interference with water discharge through the drain hose.

[0066] Fig. 10 is a chart for describing drive states of the compressor 31 and the indoor fan 14. The horizontal axis of Fig. 10 is a time point. The vertical axis of Fig. 10 indicates a drive state of ON/OFF of the compressor 31 and a drive state of ON/OFF of the indoor fan 14. In an example illustrated in Fig. 10, the predetermined air conditioning operation is performed until a time point t1, and the compressor 31 and the indoor fan 14 are driven (i.e., in an ON state). Thereafter, the compressor 31 and the indoor fan 14 are stopped between the time points t1 to t2 (the step S101 of Fig. 5). Then, freezing of the indoor heat exchanger 12 is performed between the time points t2 to t3 (the step S102 of Fig. 5). Such a period between the time points t2 to t3 is the freezing time set at the step S102b (see Fig. 6).

[0067] In the example illustrated in Fig. 10, during the freezing processing of the indoor heat exchanger 12, the indoor fan 14 is stopped between the time points t2 to t21, and is driven in a backward rotation direction between the time points t21 to t22. Then, the indoor fan 14 is stopped between the time points t22 to t3. As illustrated in Fig. 10, an effect in the case of rotating the indoor fan 14 backward will be described with reference to Figs. 11A and 11B. Note that processing after the time point t3 will be described later.

[0068] Fig. 11A is a schematic view of a frost state during the freezing processing in a case where the indoor fan 14 is in the stop state. Fig. 11B is a schematic view of a frost state during the freezing processing in a case where a backward rotation state and the stop state of the indoor fan 14 are combined.

[0069] As illustrated in Fig. 11A, when the indoor fan 14 is stopped without backward rotation during the freezing processing of the indoor heat exchanger 12, air sucked due to a natural convection current is cooled on a front surface 12f side (see Fig. 2) of the indoor heat exchanger 12. When having flowed to a rear surface 12r side of the indoor heat exchanger 12, the air is dried, and therefore, the amount of adhering frost on the rear surface 12r side of the indoor heat exchanger 12 is small. For holding cleanness of the entirety of the indoor heat exchanger 12, there is an issue that the amount of frost adhering to the rear surface 12r side of the indoor heat exchanger 12 is increased.

[0070] On the other hand, as illustrated in Fig. 11B, the indoor fan 14 is rotated backward during the freezing processing of the indoor heat exchanger 12, and accordingly, the amount of frost adhering to the rear surface 12r side of the indoor heat exchanger 12 is increased. Contamination can be rinsed way by water generated upon melting of the frost, and the cleanness of the entirety of the indoor heat exchanger can be held.

[0071] Note that the control unit K may open the upper-to-lower wind direction plate 19 (see Fig. 2) upon backward rotation of the indoor fan 14. With this configuration, the amount of wind upon backward rotation of the indoor fan 14 can be increased, and the amount of adhering frost can be increased.

[0072] Next, thawing processing and drying processing will be described.

[0073] Fig. 12 is a flowchart of the processing (S103 of Fig. 5) of thawing out the indoor heat exchanger 12 (as necessary, see Figs. 3 and 4). The control unit K executes a series of processing illustrated in Fig. 12 after the indoor heat exchanger 12 has been frozen by the processing of the step S102 (see Fig. 6).

[0074] At a step S103a, the control unit K determines whether or not an indoor temperature (the temperature of the air conditioning target space) is equal to or higher than a predetermined value. This predetermined value is a threshold as a reference for determination on whether or not the indoor heat exchanger 12 functions as the condenser, and is set in advance.

[0075] At the step S103a, in a case where the indoor temperature is equal to or higher than the predetermined value (S103a: Yes), the control unit K ends the processing of thawing out the indoor heat exchanger 12 (END). As subsequently described, when the indoor heat exchanger 12 is unfrozen, the four-way valve 35 is controlled as in the air heating operation. This is because in a case where the indoor temperature is equal to or higher than the predetermined value, a thermal load on a condensation side of the refrigeration cycle becomes too much and a balance with an evaporation side is lost. Moreover, the reason is that in a case where the indoor temperature is relatively high, ice on the indoor heat exchanger 12 is naturally melted as time proceeds.

[0076] Unlike the time points t3 to t4 of Fig. 10, processing after a step S103b is a control method of a variation. At the step S103b, the control unit K controls the four-way valve 35. That is, the control unit K controls the four-way valve 35 such that the indoor heat exchanger 12 functions as the condenser and the outdoor heat exchanger 32 functions as the evaporator. That is, the control unit K controls the four-way valve 35 as in the air heating operation.

[0077] At a step S103c, the control unit K closes the upper-to-lower wind direction plate 19 (see Fig. 2). This can prevent water droplets from flowing into the room together with air even when the indoor fan 14 is subsequently driven (S103d).

[0078] At the step S103d, the control unit K drives the indoor fan 14. Accordingly, air is taken in through the air suction port h1 (see Fig. 2), and the taken air further leaks to the inside of the room through, e.g., a clearance between the upper-to-lower wind direction plate 19 and the front panel 17. This can suppress an excessive increase in the temperature of the indoor heat exchanger 12 (the condenser).

[0079] At a step S103e, the control unit K sets the rotation rate of the compressor 31 to a predetermined value, and drives the compressor 31. At a step S103f, the control unit K adjusts the opening degree of the outdoor expansion valve 34. The compressor 31 and the outdoor expansion valve 34 are controlled as necessary as described above, and therefore, high-temperature refrigerant flows through the indoor heat exchanger 12 as the condenser. As a result, ice on the indoor heat exchanger 12 is melted at once, and therefore, grit and dust adhering to the indoor heat exchanger 12 are rinsed away. Then, water containing the grit and the dust is dropped onto the drain pan 13 (see Fig. 2), and is discharged to the outside through the drain hose (not shown).

[0080] At a step S103g, the control unit K determines whether or not a predetermined time has elapsed after "START" of Fig. 11. The predetermined time is a time necessary for thawing out the indoor heat exchanger 12, and is set in advance. In a case where the predetermined time has not elapsed after "START" at the step S103g (S103g: No), the processing of the control unit K returns to the step S103f. On the other hand, in a case where the predetermined time has elapsed after "START" (S103g: Yes), the control unit K ends a series of processing for thawing out the indoor heat exchanger 12 (END).

[0081] Note that instead of a series of processing illustrated in Fig. 12, the compressor 31 and the indoor fan 14 may be maintained in the stop state as illustrated in the time chart (the time points t3 to t4) of Fig. 10. This is because ice on the indoor heat exchanger 12 is naturally melted at room temperature without the indoor heat exchanger 12 functioning as the condenser. Thus, power consumption necessary for thawing of the indoor heat exchanger 12 can be reduced. Moreover, water droplets adhering to the inside of the upper-to-lower wind direction plate 19 (see Fig. 2) can be reduced.

[0082] Fig. 13 is a flowchart of the processing (S104 of Fig. 5) of drying the indoor heat exchanger 12. The control unit K executes a series of processing illustrated in Fig. 12 after the indoor heat exchanger 12 has been unfrozen by the processing (see Fig. 11) of the steps S103a to S103g.

[0083] At a step S104a, the control unit K maintains the drive states of the four-way valve 35, the compressor 31, the indoor fan 14, etc. That is, the control unit K controls, as in thawing of the indoor heat exchanger 12, the four-way valve 35 such that the indoor heat exchanger 12 serves as the condenser, and continuously drives the compressor 31, the indoor fan 14, etc. Since the control similar to that of the air heating operation is performed as described above, high-temperature refrigerant flows in the indoor heat exchanger 12, and air is taken in the indoor unit 10. As a result, water adhering to the indoor heat exchanger 12 is evaporated.

[0084] Next, at a step S104b, the control unit K determines whether or not a predetermined time has elapsed after the processing of the step S104a has been started. In a case where the predetermined time has not elapsed (S104b: No), the processing of the control unit K returns to the step S104a. On the other hand, in a case where the predetermined time has elapsed (S104b: Yes), the processing of the control unit K proceeds to a step S104c.

[0085] At the step S104c, the control unit K executes air blowing operation. That is, the control unit K stops the compressor 31, and drives the indoor fan 14 at a predetermined rotation rate. With this configuration, the inside of the indoor unit 10 is dried, and an antibacterial/antifungal effect is provided.

[0086] Note that during the processing of the step S104a or the step S104c, the upper-to-lower wind direction plate 19 (see Fig. 2) may be closed or opened.

[0087] Next, at a step S104d, the control unit K determines whether or not a predetermined time has elapsed after the processing of the step S104c has been started. In a case where the predetermined time has not elapsed (S104d: No), the processing of the control unit K returns to the step S104c. On the other hand, in a case where the predetermined time has elapsed (S104d: Yes), the control unit K ends a series of processing of drying the indoor heat exchanger 12 (END).

[0088] Note that in the time chart illustrated in Fig. 10, air blowing (S104c of Fig. 12) is performed at time points t5 to t6 after air heating (S104a of Fig. 12) has been performed at the time points t4 to t5 (after operation in the same refrigerant flow as that of air heating has been performed). Air heating and air blowing are sequentially performed as described above so that the indoor heat exchanger 12 can be efficiently dried.

<Advantageous Effects>

[0089] According to the first embodiment, the control unit K causes the indoor heat exchanger 12 to function as the evaporator, and the indoor fan 14 (the blower fan) to rotate backward during the freezing processing of freezing the indoor heat exchanger 12. With this configuration, the amount of frost adhering to the rear surface 12r (see Fig. 2) side of the indoor heat exchanger 12 can be increased.

[0090] Specifically, in the case of the indoor heat exchanger 12 configured such that two or more lines of the heat transfer pipes 12g are arranged in the air flow direction, the amount of frost adhering to the front surface 12f (see Fig. 2) side of the indoor heat exchanger 12 tends to be greater than that on the rear surface 12r (see Fig. 2). Thus, according to the first embodiment, the amount of frost adhering to the indoor heat exchanger 12 can be equalized.

[0091] Note that in Fig. 10, the indoor fan 14 takes, during the freezing processing between the time points t2 to t3, a pattern of the stop state, the backward rotation state, and the stop state, but the present invention is not limited to above. For example, the pattern may be a pattern of the backward rotation state and the stop state or a pattern of the stop state and the backward rotation state.

[0092] The control unit K opens the upper-to-lower wind direction plate 19 in the case of rotating the indoor fan 14 backward. With this configuration, the air amount is increased so that the amount of frost adhering to the rear surface 12r (see Fig. 2) side of the indoor heat exchanger 12 can be increased.

[0093] During the freezing processing, the control unit K performs both the freezing processing of stopping the indoor fan 14 and the freezing processing of rotating the indoor fan 14 backward. With this configuration, the amount of adhering frost can be equalized between the front surface 12f (see Fig. 2) side and the rear surface 12r (see Fig. 2) side of the indoor heat exchanger 12.

[0094] The control unit K is configured such that the freezing processing time for stopping the indoor fan 14 (e.g., an added-up time of the time between the time points t2 to t21 and the time between the time points t22 to t3 in Fig. 10) is longer than the freezing processing time for rotating the indoor fan 14 backward (e.g., the time between the time points t21 to t22 in Fig. 10). With this configuration, a forward flow portion (see Fig. 11A) and a backward flow portion (see Fig. 11B) can be formed as portions frozen with frost, and the amount of adhering frost on the forward flow portion can be increased.

[0095] The control unit K starts backward rotation of the indoor fan 14 after the temperature of the indoor heat exchanger 12 has reached equal to or lower than the predetermined temperature (e.g., equal to or lower than T2 of Fig. 9). With this configuration, the backward rotation time of the indoor fan 14 can be shortened.

[0096] The control unit K repeats stopping and backward rotation of the indoor fan 14 during the freezing processing. With this configuration, the amount of adhering frost can be equalized between the front surface 12f (see Fig. 2) side and the rear surface 12r (see Fig. 2) side of the indoor heat exchanger 12.

[0097] The control unit K may be configured not to rotate the blower fan forward during the freezing processing. The flow of cool air in an indoor space can be prevented, and no feeling of discomfort is provided to the user.

[0098] After the indoor heat exchanger 12 has been frozen (S102 of Fig. 5), ice on the indoor heat exchanger 12 is unfrozen (S103). With this configuration, more moisture (ice) can adhere to the indoor heat exchanger 12 as compared to the normal air cooling operation. Moreover, a great amount of water flows on the surface of the indoor heat exchanger 12 by thawing of the indoor heat exchanger 12, and therefore, grit and dust adhering to the indoor heat exchanger 12 can be rinsed away.

[0099] When the indoor heat exchanger 12 is frozen, the control unit K sets, for example, the freezing time based on the relative humidity of the indoor air (S102c of Fig. 6, see Fig. 7). With this configuration, a suitable amount of water necessary for cleansing of the indoor heat exchanger 12 can be frozen in the indoor heat exchanger 12.

[0100] When the indoor heat exchanger 12 is frozen, the control unit K sets the rotation rate of the compressor motor 31a based on the outdoor temperature (S 102d of Fig. 6, see Fig. 8). With this configuration, heat radiation can be properly performed in the outdoor heat exchanger 32 during freezing of the indoor heat exchanger 12.

[0101] When the indoor heat exchanger 12 is frozen, the control unit K adjusts the opening degree of the outdoor expansion valve 34 based on the temperature of the indoor heat exchanger 12 (S102e of Fig. 6). With this configuration, the temperature of refrigerant flowing in the indoor heat exchanger 12 can be sufficiently decreased, and moisture contained in air taken in the indoor unit 10 can be frozen in the indoor heat exchanger 12.

[0102] It has been described that the freezing time is changed based on the relative humidity of the indoor air in Fig. 7, but the present invention is not limited to above. Fig. 10 illustrates the time between the time points t1 to t6 as the entire time for freezing and cleansing, but the entire time for freezing and cleansing may be changed based on the room temperature and humidity of the indoor air. Specifically, the indoor heat exchanger 12 is less frozen when the room temperature is high, and the indoor heat exchanger 12 is less frozen when the humidity is low.

[0103] In a case where the air conditioning operation before the time point t1 in Fig. 10 is the air cooling operation or dehumidification operation, a temperature change in the temperature TE (see Fig. 9) of the indoor heat exchanger 12 is slower than that in the case of the air heating operation. In the case of the air cooling operation or the dehumidification operation, water droplets often adhere to the fins 12a, and there is a probability that squeak noise is caused from the fins 12a at a temperature below zero. For this reason, the temperature change in the temperature TE of the indoor heat exchanger 12 is slow so that occurrence of the squeak noise can be prevented.

<<Second Embodiment>>

[0104] The first embodiment describes the example of the wall-mounted indoor unit 10 illustrated in Fig. 2, but the present invention is not limited to above. A second embodiment describes that the present invention is also applicable to a ceiling-embedded indoor unit 10A. Note that the same reference numerals are used to represent the same components as those illustrated in Figs. 2 and 4, and description thereof will be omitted.

[0105] Fig. 14 is a view for describing a longitudinal sectional configuration of the indoor unit 10A of an air conditioner according to the second embodiment. The indoor unit 10A is configured as a box body in such a substantially octagonal planar shape that four corners of a square being cut out, and is embedded in a ceiling R above a ceiling opening. An indoor heat exchanger 12A and an indoor fan 14A are arranged inside the indoor unit 10A. Moreover, a lower opening of the indoor unit 10A is covered with a substantially square ceiling panel 2. An air suction port h1 is formed at a center portion of the ceiling panel 2. A rectangular air blowing port h3 along each side edge of the ceiling panel 2 is formed outside the air suction port h1.

[0106] In the indoor unit 10A, when the indoor fan 14 is driven by an indoor fan motor 14Aa arranged inside, indoor air inside a room is sucked into the indoor unit 10A from the air suction port h1 through filters 16, and turns into conditioned air by cooling or heating in the course of passing through the indoor heat exchanger 12A. The conditioned air is guided to a wind direction louver 26 from the air blowing port h3, and then, is blown to the inside of the room. Note that in Fig. 14, 13A is a support frame also serving as a drain pan, and 27 is a wind guide plate.

[0107] In the second embodiment, a control unit K also causes the indoor heat exchanger 12A to function as an evaporator, and also the indoor fan 14A (a blower fan) to rotate backward during the freezing processing of freezing the indoor heat exchanger 12A. With this configuration, the amount of frost adhering to a rear surface 12r side of the indoor heat exchanger 12A can be increased.

[0108] Each embodiment has been described in detail for clearly describing the present invention, and the present invention is not limited to those including all configurations described above. Moreover, addition/omission/replacement of other configurations can be made to some of the configurations of each embodiment. Further, the mechanisms and configurations necessary for description have been described above, and all mechanisms and configurations for a product are not necessarily described.

[0109] For example, each first embodiment has described the indoor heat exchanger 12 configured such that the heat transfer pipes 12g are arranged in two lines in the zigzag pattern in the air flow direction, but the present invention is not limited to above. The heat transfer pipes 12g are not necessarily arranged in the zigzag pattern. Alternatively, the heat transfer pipes 12g are not limited to two lines, and a single line of the heat transfer pipe 12g or three or more lines of the heat transfer pipes 12g may be arranged.

DESCRIPTION OF REFERENCE SIGNS

[0110]

100	air conditioner
10, 10A	indoor unit
12, 12A	indoor heat exchanger (evaporator/condenser)
12f	front surface
12r	rear surface
14, 14A	indoor fan (blower fan)
17	front panel
18	right-to-left wind direction plate
19	upper-to-lower wind direction plate
23	image capturing unit (person detection unit)
26	wind direction louver
27	wind guide plate
30	outdoor unit
31	compressor
31a	compressor motor (motor of compressor)
32	outdoor heat exchanger (condenser/evaporator)
33	outdoor fan
34	outdoor expansion valve (expansion valve)
35	four-way valve
40	remote controller
K	control unit
Q	refrigerant circuit

Claims

1. An air conditioner (100) comprising:

   a refrigerant circuit (Q) configured such that refrigerant sequentially circulates in a refrigeration cycle through a compressor (31), a condenser, an expansion valve (34), and an evaporator; and
   a control unit (K) configured to control at least the compressor (31) and the expansion valve (34),
   wherein one of the condenser or the evaporator is an outdoor heat exchanger (32), and the other one of the condenser or the evaporator is an indoor heat exchanger (12, 12A), and
   the control unit (K) is configured to cause the indoor heat exchanger (12, 12A) to function as the evaporator, and
   the control unit (K) is configured to thaw out the indoor heat exchanger (32), **characterized in that** the control unit (K) is further configured to cause a blower fan (14, 14A) to rotate backward during freezing processing of freezing the indoor heat exchanger (12, 12A).

2. The air conditioner (100) according to claim 1, wherein
   the control unit (K) opens a wind direction plate (27) in a case of rotating the blower fan (14, 14A) backward.

3. The air conditioner (100) according to claim 1, wherein
   the control unit (K) performs, during the freezing processing, both freezing processing of stopping the blower fan (14, 14A) and freezing processing of rotating the blower fan (14, 14A) backward.

4. The air conditioner (100) according to claim 3, wherein
   a time of the freezing processing of stopping the blower fan (14, 14A) is longer than a time of the freezing processing of rotating the blower fan (14, 14A) backward.

5. The air conditioner (100) according to claim 1, wherein
   the control unit (K) starts backward rotation of the blower fan (14,14A) after a temperature of the indoor heat exchanger (12, 12A) has reached a temperature equal to or lower than a predetermined temperature.

6. The air conditioner (100) according to claim 1, wherein

the control unit (K) repeats stopping and backward rotation of the blower fan (14, 14A) during the freezing processing.

7. The air conditioner (100) according to claim 1, wherein
the control unit (K) does not rotate the blower fan (14, 14A) forward during the freezing processing.

8. The air conditioner (100) according to claim 1, wherein
the indoor heat exchanger (12, 12A) is configured such that two or more lines of heat transfer pipes are arranged in an air flow direction.

Patentansprüche

1. Klimaanlage (100), die Folgendes umfasst:

    einen Kühlkreislauf (Q), der so konfiguriert ist, dass Kühlmittel in einem Kühlzyklus der Reihe nach durch einen Kompressor (31), einen Kondensator, ein Expansionsventil (34) und einen Verdampfer umläuft; und
    eine Steuereinheit (K), die konfiguriert ist, wenigstens den Kompressor (31) und das Expansionsventil (34) zu steuern,
    wobei der Kondensator oder der Verdampfer ein Außenbereich-Wärmetauscher (32) ist und der jeweils andere des Kondensators und des Verdampfers ein Innenraum-Wärmetauscher (12, 12A) ist, und
    die Steuereinheit (K) konfiguriert ist, zu veranlassen, dass der Innenraum-Wärmetauscher (12, 12A) als Verdampfer arbeitet, und
    die Steuereinheit (K) konfiguriert ist, den Innenraum-Wärmetauscher (32) abzutauen, **dadurch gekennzeichnet, dass**
    die Steuereinheit (K) ferner konfiguriert ist, zu veranlassen, dass sich ein Gebläse (14, 14A) während eines Gefrierverfahrens zum Gefrieren des Innenraum-Wärmetauschers (12, 12A) rückwärts dreht.

2. Klimaanlage (100) nach Anspruch 1, wobei
die Steuereinheit (K) eine Windrichtungsplatte (27) öffnet, falls sich das Gebläse (14, 14A) rückwärts dreht.

3. Klimaanlage (100) nach Anspruch 1, wobei
die Steuereinheit (K) während des Gefrierverfahrens das Gefrierverfahren zum Stoppen des Gebläses (14, 14A) und das Gefrierverfahren zum Rückwärtsdrehen des Gebläses (14, 14A) ausführt.

4. Klimaanlage (100) nach Anspruch 3, wobei
eine Zeitdauer des Gefrierverfahrens zum Stoppen des Gebläses (14, 14A) länger als eine Zeitdauer des Gefrierverfahrens zum Rückwärtsdrehen des Gebläses (14, 14A) ist.

5. Klimaanlage (100) nach Anspruch 1, wobei
die Steuereinheit (K) das Rückwärtsdrehen des Gebläses (14, 14A) startet, nachdem eine Temperatur des Innenraum-Wärmetauschers (12, 12A) eine Temperatur erreicht hat, die einer festgelegten Temperatur gleicht oder niedriger ist.

6. Klimaanlage (100) nach Anspruch 1, wobei
die Steuereinheit (K) das Stoppen und Rückwärtsdrehen des Gebläses (14, 14A) während des Gefrierverfahrens wiederholt.

7. Klimaanlage (100) nach Anspruch 1, wobei
die Steuereinheit (K) das Gebläse (14, 14A) während des Gefrierverfahrens nicht vorwärts dreht.

8. Klimaanlage (100) nach Anspruch 1, wobei
der Innenraum-Wärmetauscher (12, 12A) so konfiguriert ist, dass zwei oder mehr Leitungen von Wärmeübertragungsrohren in einer Luftströmungsrichtung angeordnet sind.

Revendications

1. Appareil de conditionnement d'air (100) comprenant :

    un circuit de réfrigérant (Q) configuré de telle sorte qu'un réfrigérant circule séquentiellement dans un cycle de réfrigération à travers un compresseur (31), un condenseur, une vanne d'expansion (34) et un évaporateur ; et
    une unité de commande (K) configurée pour commander au moins le compresseur (31) et la vanne d'expansion (34),
    dans lequel un élément parmi le condensateur et l'évaporateur est un échangeur de chaleur externe (32), et l'autre élément parmi le condensateur et l'évaporateur est un échangeur de chaleur interne (12, 12A), et
    l'unité de commande (K) est configurée pour amener l'échangeur de chaleur interne (12, 12A) à fonctionner comme évaporateur, et
    l'unité de commande (K) est configurée pour dégeler l'échangeur de chaleur interne (32),
    caractérisé en ce que
    l'unité de commande (K) est en outre configurée pour amener un ventilateur de soufflage (14, 14A) à se mettre en rotation vers l'arrière pendant le processus de gel consistant à geler l'échangeur de chaleur interne (12, 12A).

2. Appareil de conditionnement d'air (100) selon la re-

vendication 1, dans lequel l'unité de commande (K) ouvre une plaque de direction de flux d'air (27) dans un cas d'une rotation du ventilateur de soufflage (14, 14A) vers l'arrière.

3. Appareil de conditionnement d'air (100) selon la revendication 1, dans lequel l'unité de commande (K) effectue, pendant le processus de gel, à la fois un processus de gel consistant à arrêter le ventilateur de soufflage (14, 14A) et un processus de gel consistant à mettre en rotation le ventilateur de soufflage (14, 14A) vers l'arrière.

4. Appareil de conditionnement d'air (100) selon la revendication 3, dans lequel une durée du processus de gel consistant à arrêter le ventilateur de soufflage (14, 14A) est plus longue qu'une durée du processus de gel consistant à mettre en rotation le ventilateur de soufflage (14, 14A) vers l'arrière.

5. Appareil de conditionnement d'air (100) selon la revendication 1, dans lequel l'unité de commande (K) démarre une rotation vers l'arrière du ventilateur de soufflage (14, 14A) après qu'une température de l'échangeur de chaleur interne (12, 12A) a atteint une température égale ou inférieure à une température prédéterminée.

6. Appareil de conditionnement d'air (100) selon la revendication 1, dans lequel l'unité de commande (K) répète un arrêt et une rotation vers l'arrière du ventilateur de soufflage (14, 14A) pendant le processus de gel.

7. Appareil de conditionnement d'air (100) selon la revendication 1, dans lequel l'unité de commande (K) ne met pas en rotation le ventilateur de soufflage (14, 14A) vers l'avant pendant le processus de gel.

8. Appareil de conditionnement d'air (100) selon la revendication 1, dans lequel l'échangeur de chaleur interne (12, 12A) est configuré de telle sorte que deux ou plusieurs conduites de tubes de transfert de chaleur sont agencées dans une direction de flux d'air.

FIG. 1

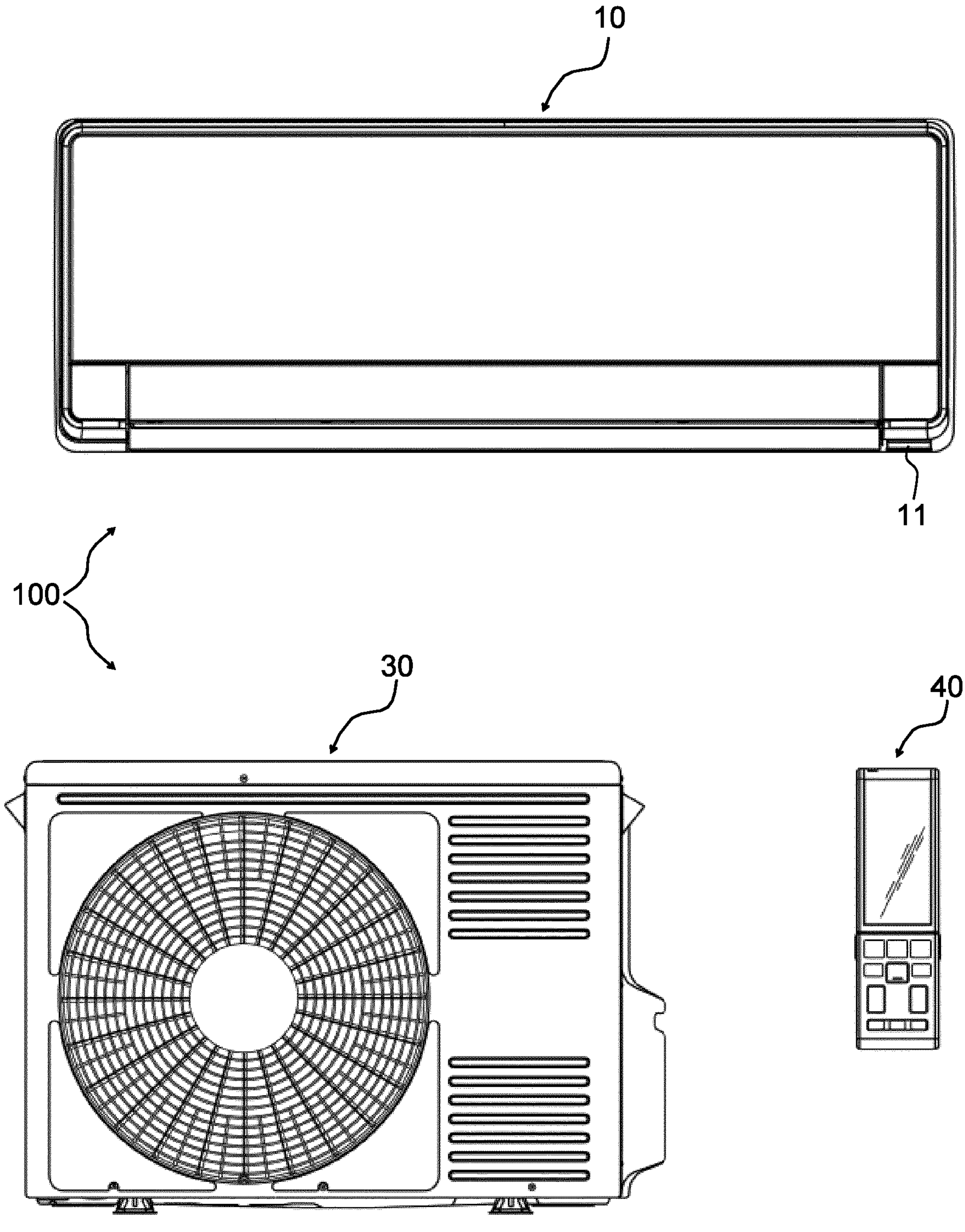


FIG. 2

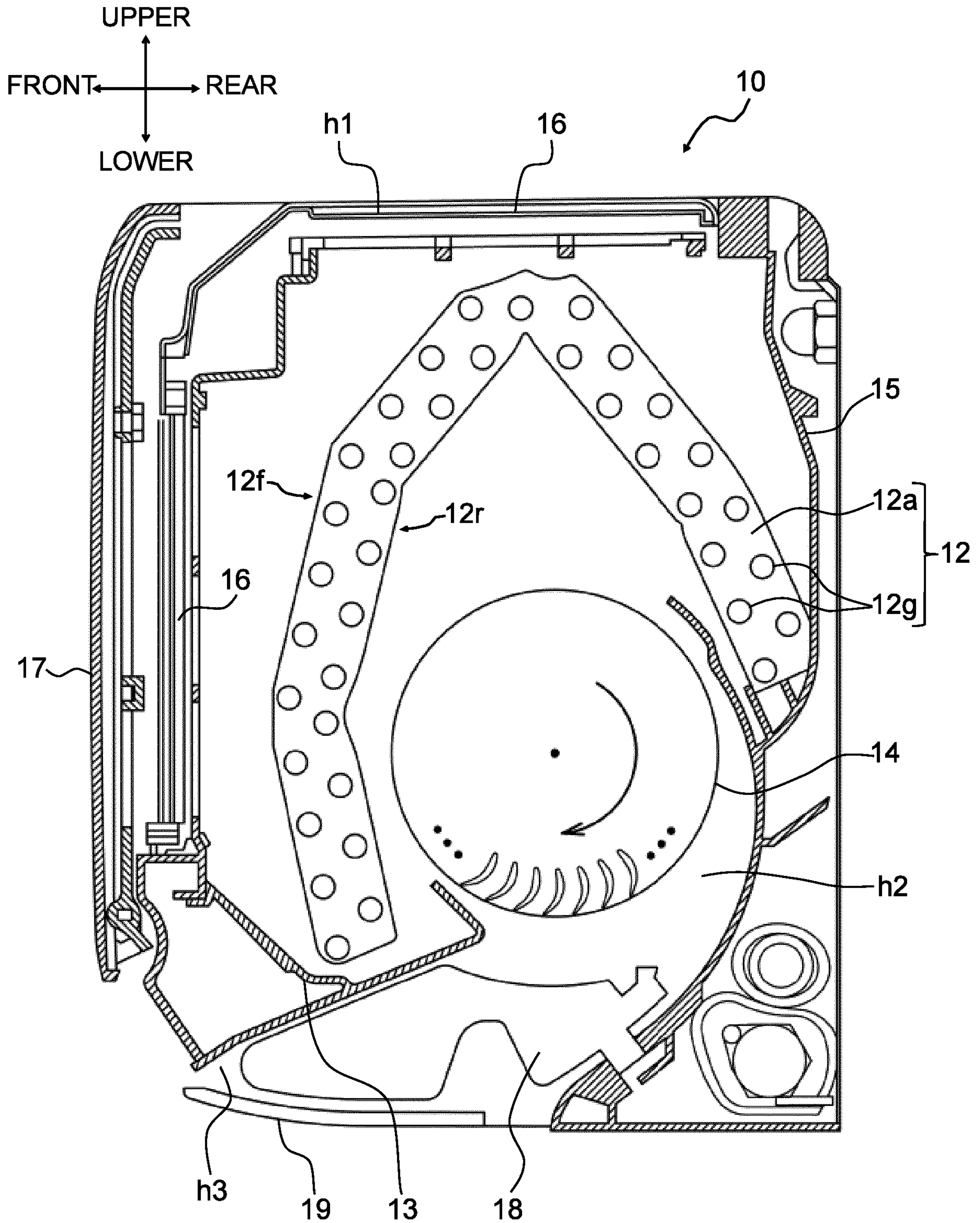

UPPER
FRONT
REAR
LOWER
10
h1
16
15
12f
12r
12a
12
12g
16
17
14
h2
h3
19
13
18

FIG. 3

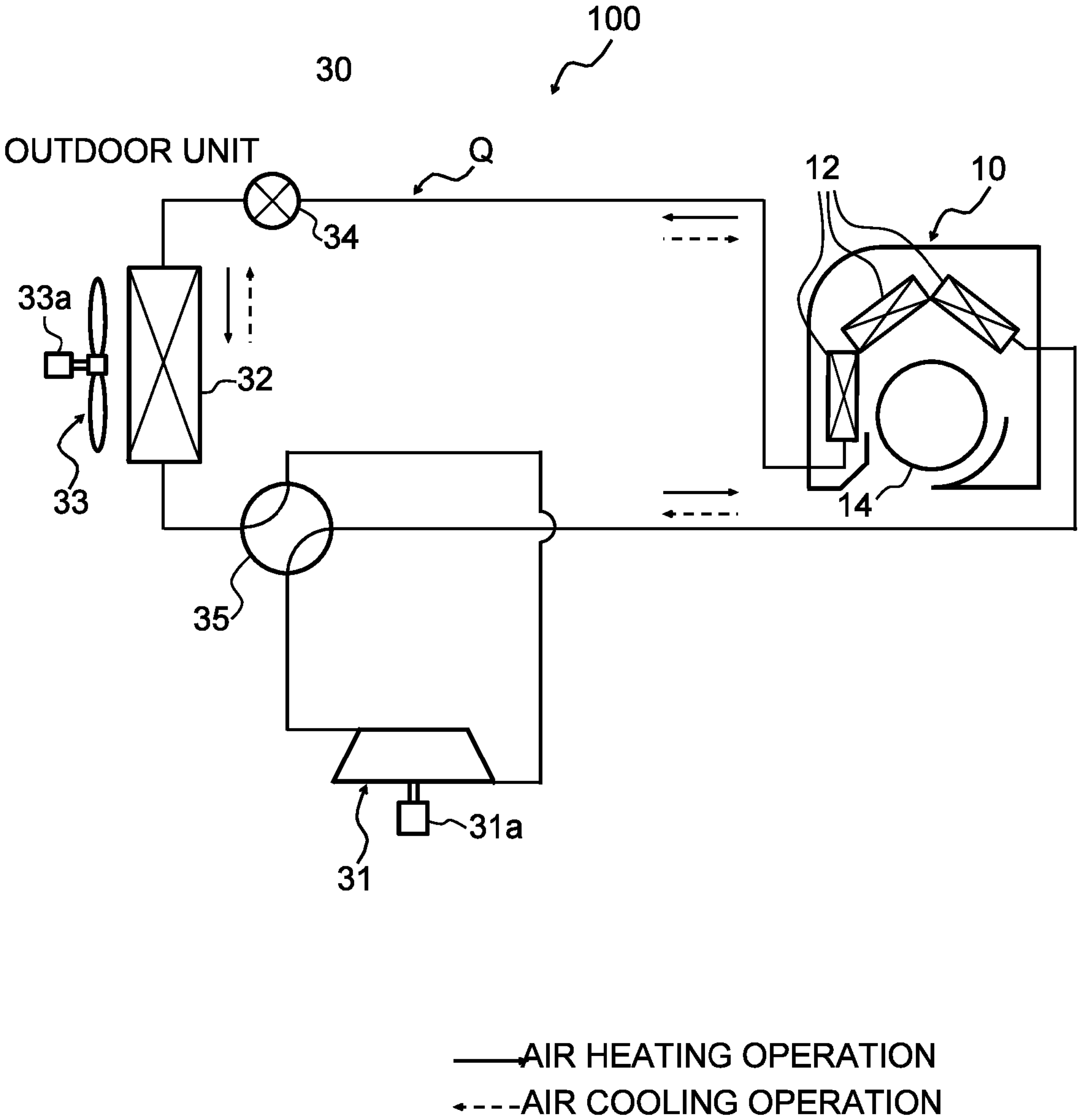
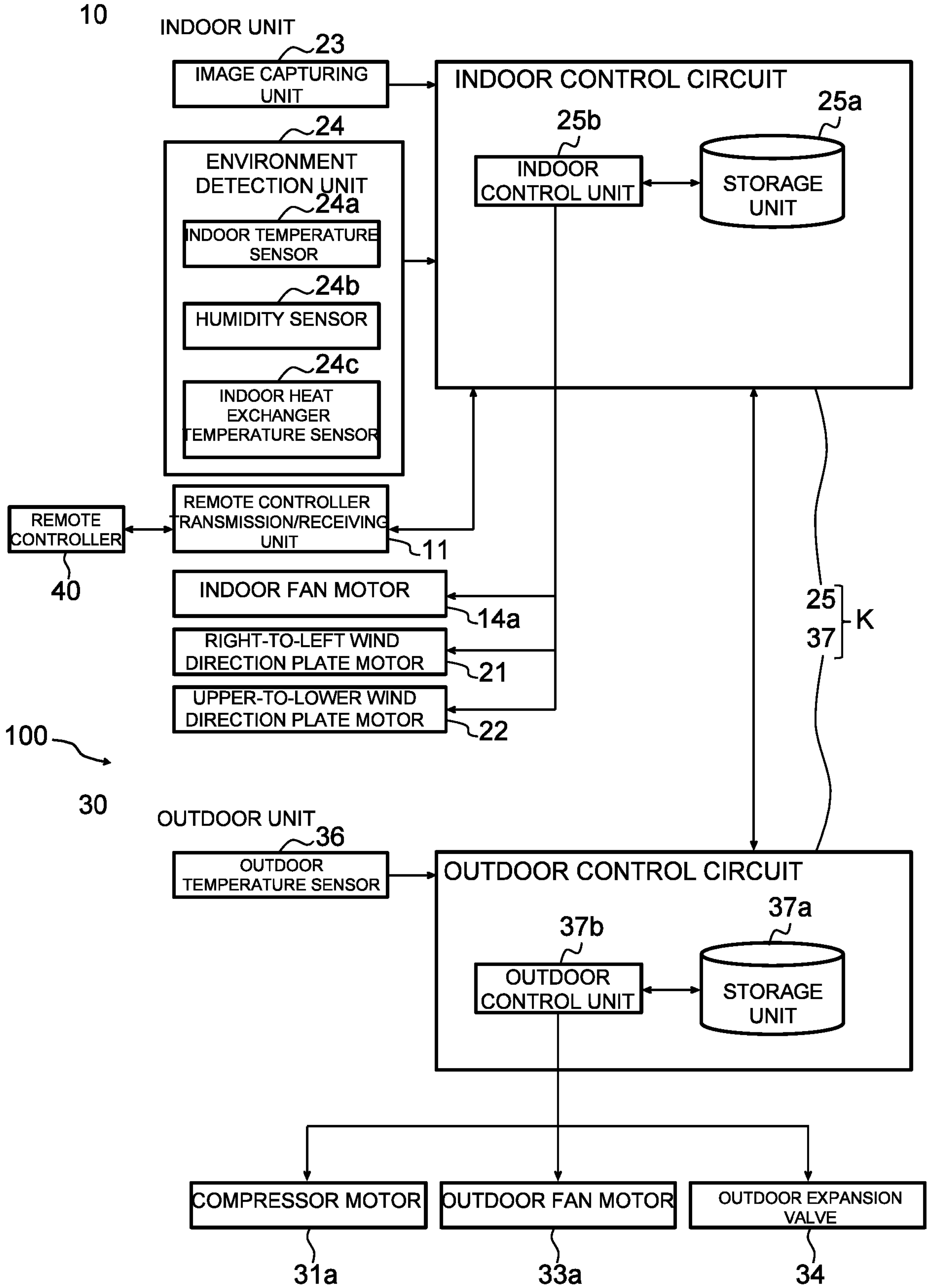

100
30
OUTDOOR UNIT
Q
12
10
34
33a
32
33
14
35
31a
31
AIR HEATING OPERATION
AIR COOLING OPERATION

FIG. 4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INDOOR UNIT
23
IMAGE CAPTURING UNIT
24
ENVIRONMENT DETECTION UNIT
24a
INDOOR TEMPERATURE SENSOR
24b
HUMIDITY SENSOR
24c
INDOOR HEAT EXCHANGER TEMPERATURE SENSOR
INDOOR CONTROL CIRCUIT
25a
25b
INDOOR CONTROL UNIT
STORAGE UNIT
REMOTE CONTROLLER
40
REMOTE CONTROLLER TRANSMISSION/RECEIVING UNIT
11
INDOOR FAN MOTOR
14a
RIGHT-TO-LEFT WIND DIRECTION PLATE MOTOR
21
UPPER-TO-LOWER WIND DIRECTION PLATE MOTOR
22
25
37
K
100
30
OUTDOOR UNIT
36
OUTDOOR TEMPERATURE SENSOR
OUTDOOR CONTROL CIRCUIT
37a
37b
OUTDOOR CONTROL UNIT
STORAGE UNIT
COMPRESSOR MOTOR
OUTDOOR FAN MOTOR
OUTDOOR EXPANSION VALVE
31a
33a
34

FIG. 5

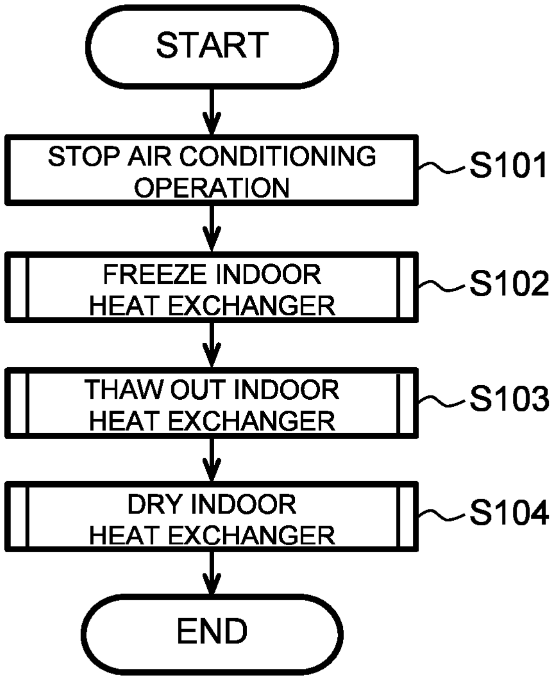

START
STOP AIR CONDITIONING OPERATION
S101
FREEZE INDOOR HEAT EXCHANGER
S102
THAW OUT INDOOR HEAT EXCHANGER
S103
DRY INDOOR HEAT EXCHANGER
S104
END

FIG. 6

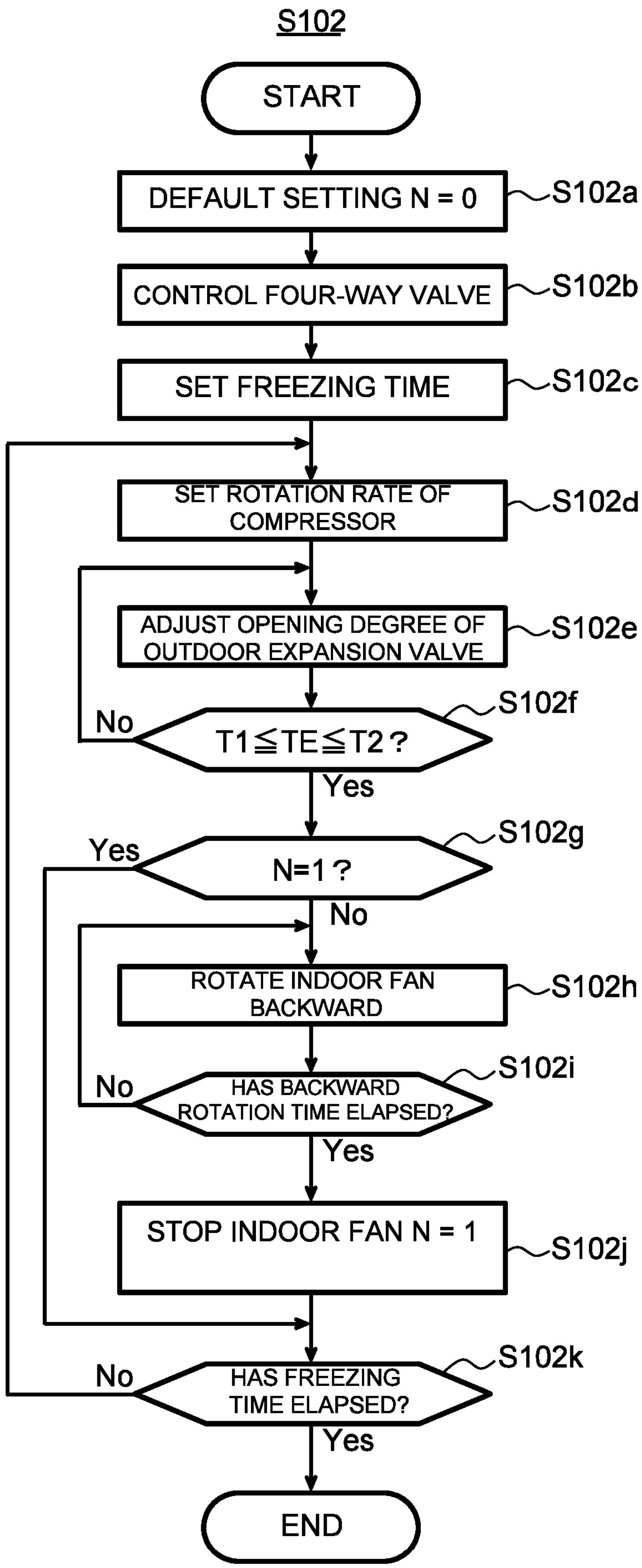

S102
START
DEFAULT SETTING N = 0
S102a
CONTROL FOUR-WAY VALVE
S102b
SET FREEZING TIME
S102c
SET ROTATION RATE OF COMPRESSOR
S102d
ADJUST OPENING DEGREE OF OUTDOOR EXPANSION VALVE
S102e
T1≦TE≦T2 ?
S102f
No
Yes
N=1 ?
S102g
Yes
No
ROTATE INDOOR FAN BACKWARD
S102h
HAS BACKWARD ROTATION TIME ELAPSED?
S102i
No
Yes
STOP INDOOR FAN N = 1
S102j
HAS FREEZING TIME ELAPSED?
S102k
No
Yes
END

FIG. 7

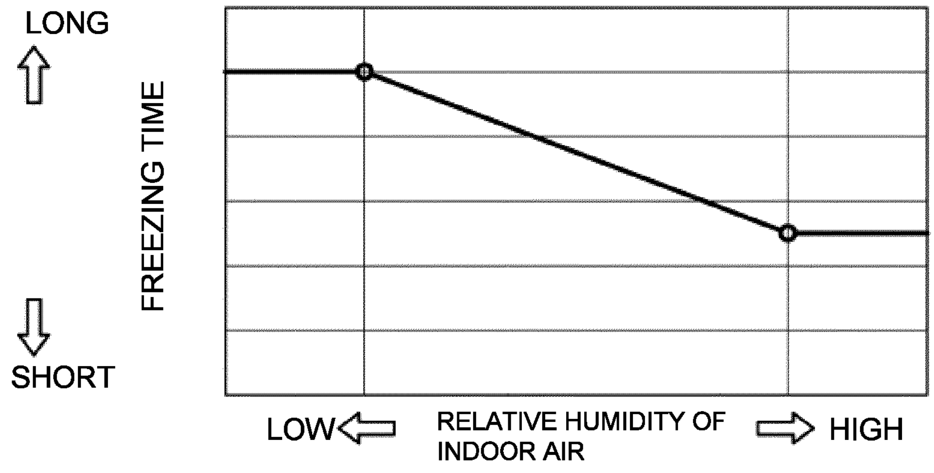


FIG. 8

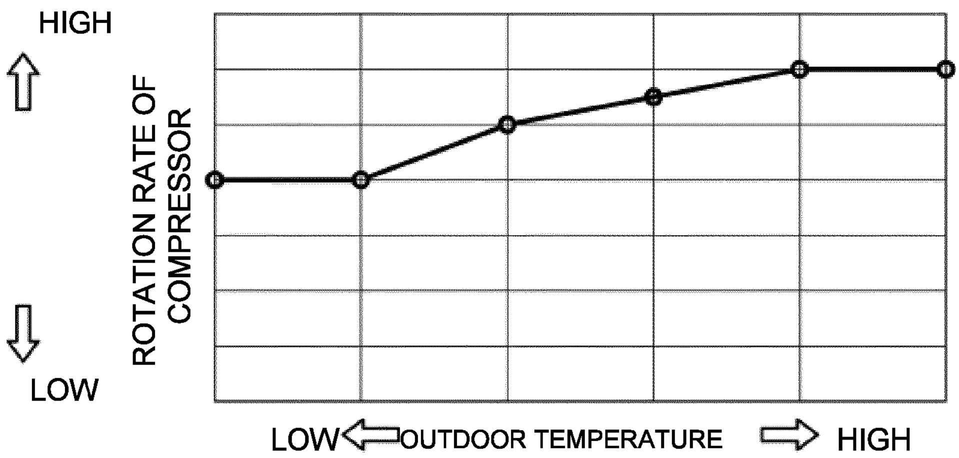


FIG. 9

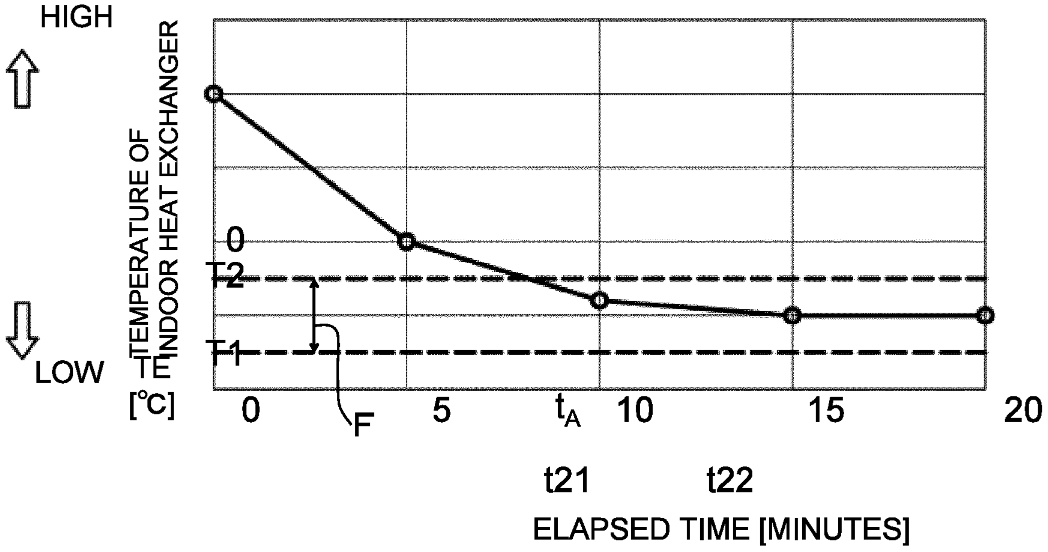


FIG. 10

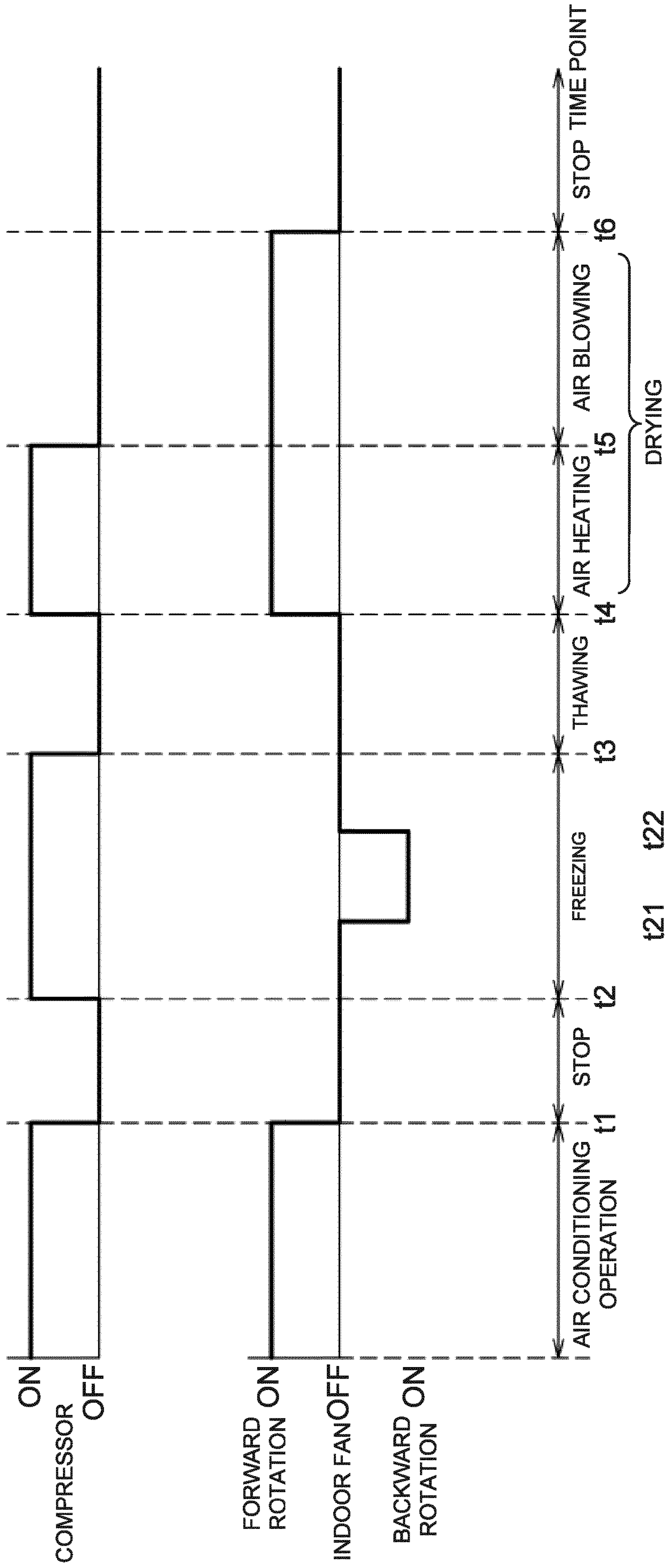

COMPRESSOR
ON
OFF
FORWARD ROTATION
ON
INDOOR FAN
OFF
BACKWARD ROTATION
ON
AIR CONDITIONING OPERATION
t1
STOP
t2
FREEZING
t21
t22
t3
THAWING
t4
AIR HEATING
t5
AIR BLOWING
DRYING
t6
STOP TIME POINT

FIG. 11A

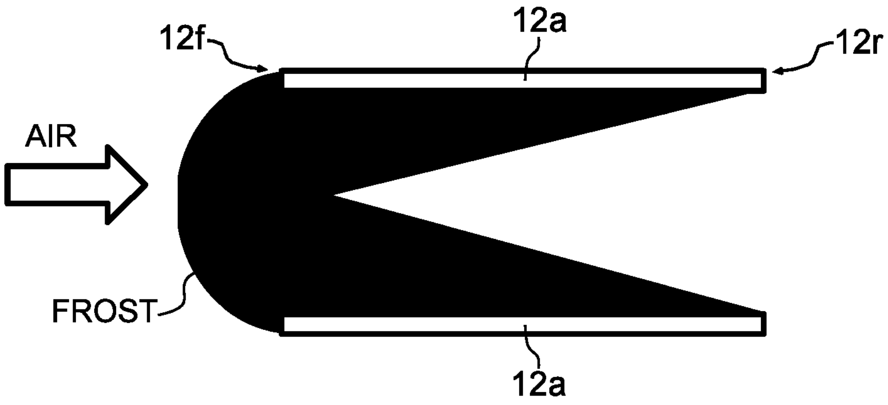


FIG. 11B

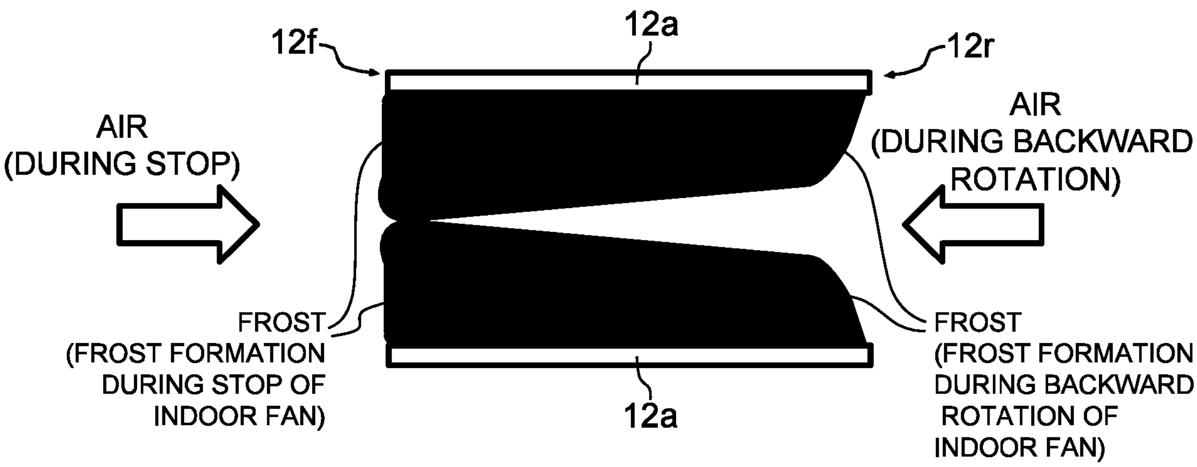


FIG. 12

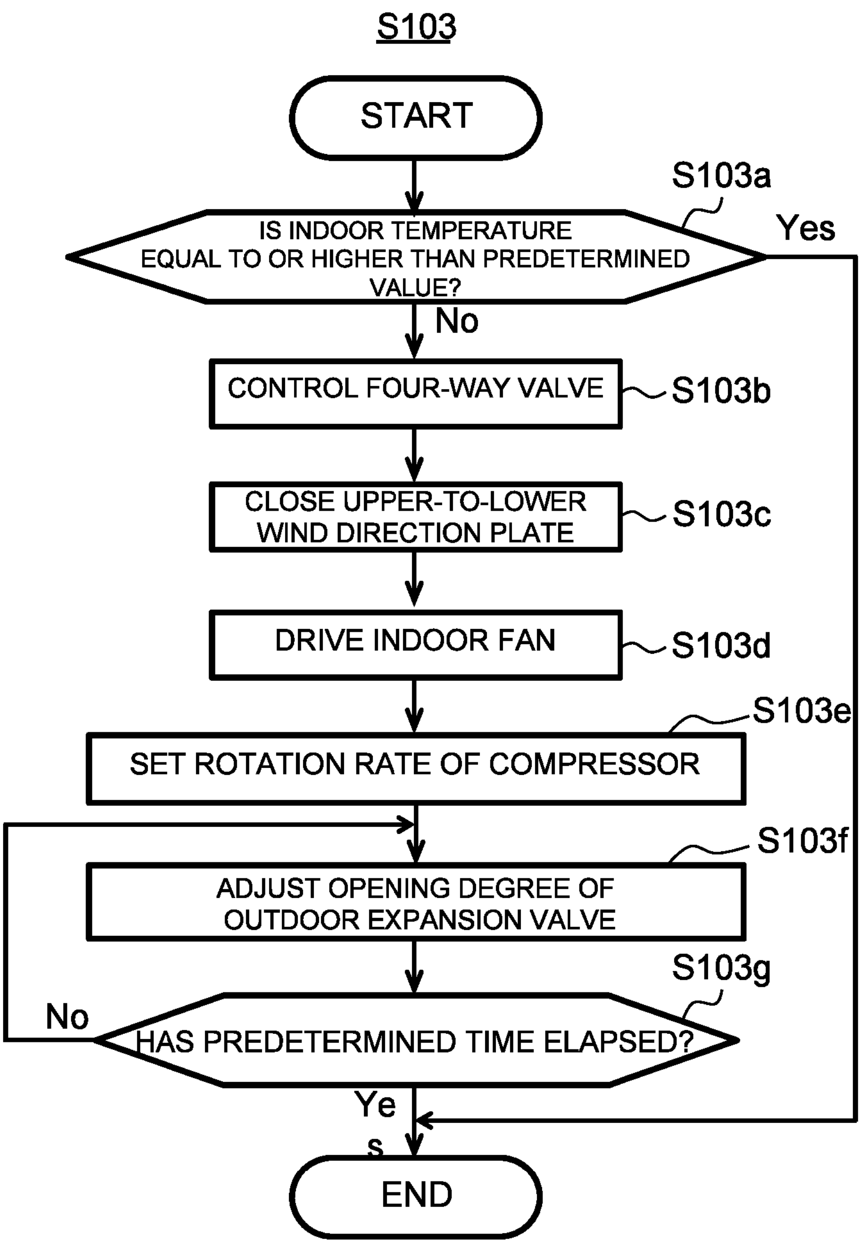

S103
START
S103a
IS INDOOR TEMPERATURE EQUAL TO OR HIGHER THAN PREDETERMINED VALUE?
Yes
No
CONTROL FOUR-WAY VALVE
S103b
CLOSE UPPER-TO-LOWER WIND DIRECTION PLATE
S103c
DRIVE INDOOR FAN
S103d
S103e
SET ROTATION RATE OF COMPRESSOR
S103f
ADJUST OPENING DEGREE OF OUTDOOR EXPANSION VALVE
S103g
No
HAS PREDETERMINED TIME ELAPSED?
Yes
END

FIG. 13

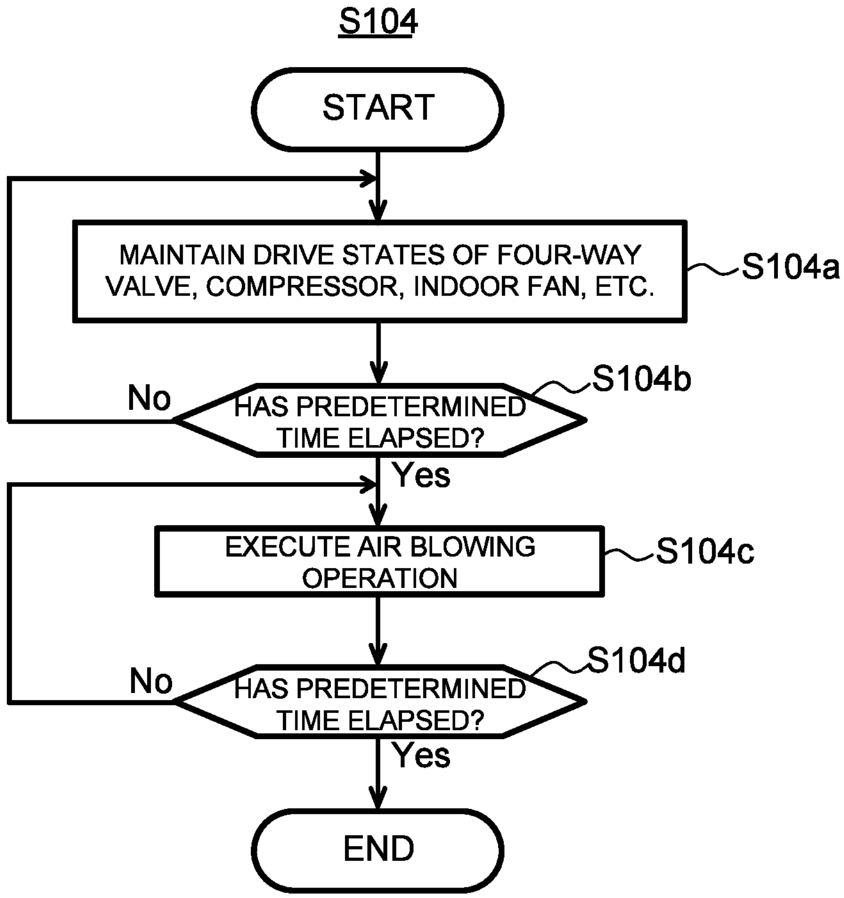
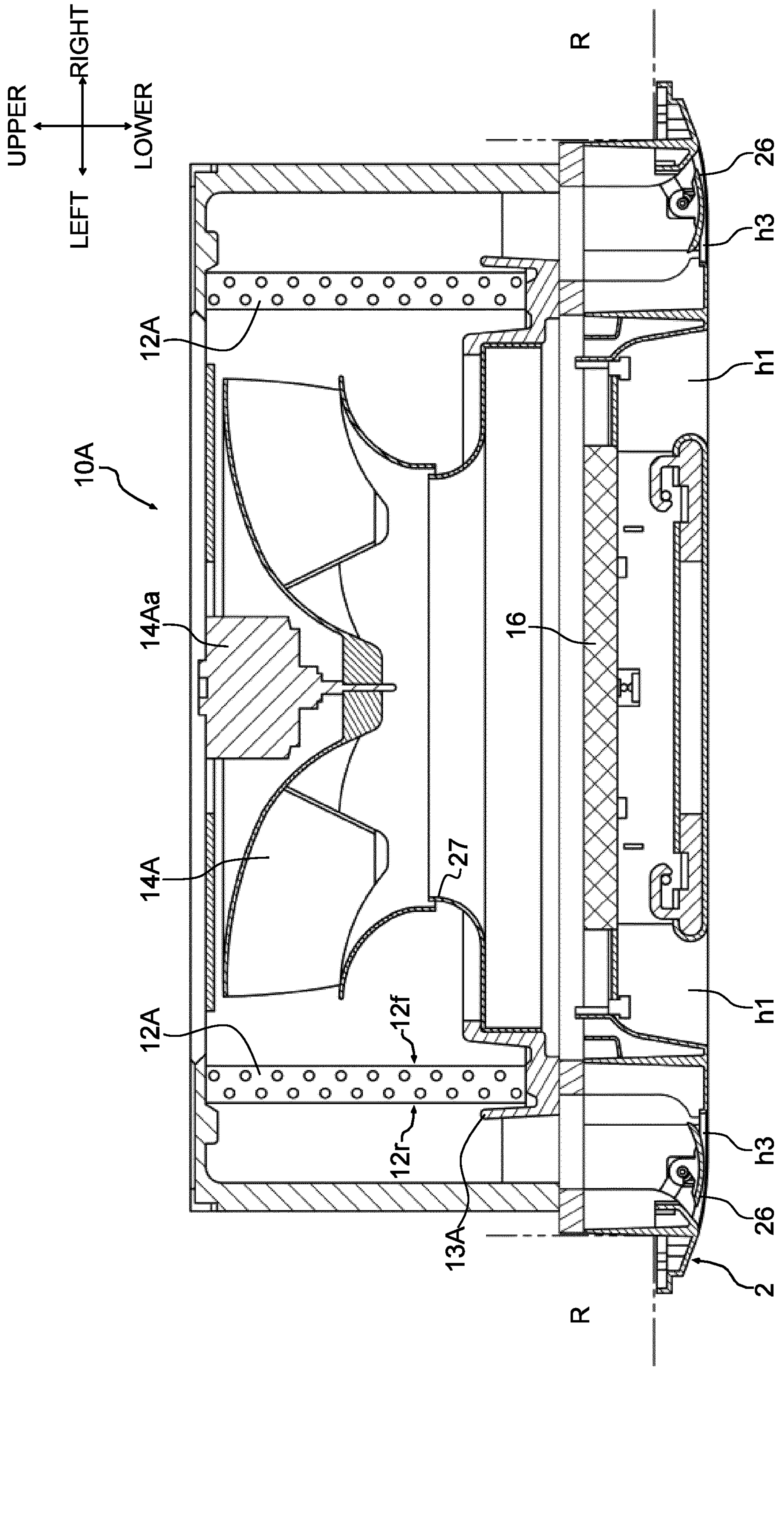

S104
START
MAINTAIN DRIVE STATES OF FOUR-WAY VALVE, COMPRESSOR, INDOOR FAN, ETC.
S104a
HAS PREDETERMINED TIME ELAPSED?
S104b
No
Yes
EXECUTE AIR BLOWING OPERATION
S104c
HAS PREDETERMINED TIME ELAPSED?
S104d
No
Yes
END

FIG. 14


UPPER
LOWER
RIGHT
LEFT
R
26
h3
h1
h1
h3
26
2
R
12A
10A
14Aa
14A
12A
12f
12r
13A
16
27

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 4931566 B **[0005]**
- CN 106765873 A **[0005]**
- US 5226285 A **[0005]**