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(54) **AIR CONDITIONER**

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Description

BACKGROUND

1. Technical Field

[0001] The present disclosure relates to an air conditioner for conditioning air in a room, and particularly to an air conditioner that blows out, from a blow port, air in different temperature regions.

2. Description of the Related Art

[0002] A general air conditioner is of a separate type for reducing noises and vibrations in a room. In the separate type, devices being the source of large noises and vibrations are disposed in an outdoor unit, and devices with small noises and vibrations are disposed in an indoor unit. A general air conditioner of the separate type is structured mainly as follows. The outdoor unit is provided with a compressor, an outdoor-side heat exchanger, an outdoor-side blower fan, a four-way valve, an expansion valve and the like, and the indoor unit is provided with an indoor-side heat exchanger, an indoor-side blower fan, a controller and the like. The outdoor unit and the indoor unit are mechanically and electrically connected to each other with refrigerant piping and control lines. The indoor unit of the air conditioner of the separate type structured in this manner is mounted, for example, on the wall surface of a room, and air conditioning operation is carried out so that the temperature in the room attains a desired temperature.

[0003] Recent public awareness about preserving the global environment and preventing the global warming has been increasing demand for air conditioners with improved energy-saving performance. In order to improve the energy-saving performance of an air conditioner, it is important to improve the energy efficiency of the devices structuring the air conditioner, so that the power consumption of the whole apparatus reduces. In particular, as to air conditioners, there have been proposed various structures for reducing the power consumption by carrying out air conditioning so that at least the desired region in the room attains a desired temperature, while avoiding wasteful air conditioning in an attempt to attain the desired temperature in the entire room.

[0004] For example, Unexamined Japanese Patent Publication No. H08-68568 proposes sending air of different temperatures from a blow-out port which is the blow port of the indoor unit to the room, so that comfortable air conditioning, i.e., so-called head-cool and feet-warm air conditioning, is carried out. In this conventional air conditioner, a plurality of refrigerant passages are provided at the indoor unit. A particular refrigerant passage is specified by control exerted over opening and closing operations of valves respectively provided to the refrigerant passages. A refrigerant is caused to flow through the specified refrigerant passage. Thus, air conditioning

supporting various operation modes is carried out.

WO 2009/044772 A1 discloses an air conditioner in which an air outlet path leading from an indoor fan to an air outlet opening is a single path and in which there is no partition member in the air outlet path. In an operation mode in which one part of an indoor heat exchanger is used as an evaporator and the other part is used as a condenser, a control device controls a refrigerant flow path control section such that a second front face heat exchange section functions as the evaporator and both a first front face heat exchange section and a rear face heat exchange section function as the condenser, and at the same time, the control device controls first and second horizontal flaps and first and second vertical flaps such that a local space in a room is heated and at the same time another local space is cooled.

[0005] EP 1 445 548 A1 describes an air conditioner that can accomplish humidification with a minimal number of additional parts. The air conditioner is provided with a first heat exchanging section, a second heat exchanging section, a pressure adjusting mechanism, and a humidifying means. The first heat exchanging section and the second heat exchanging section are connected together in series and both are configured to function as either an evaporator or a condenser with respect to the refrigerant passing through the inside thereof. The pressure adjusting mechanism serves to connect the first heat exchanging section and second heat exchanging section together in series and is capable of adjusting the pressure of the refrigerant such that one of the heat exchanging sections functions as an evaporator and the other heat exchanging section functions as a condenser. The humidifying means serves to direct condensation water adhered to the outside surface of the first heat exchanging section to the vicinity of the outside surface of the second heat exchanging section so that the conditioned air is humidified after it exchanges heat with the second heat exchanging section.

SUMMARY

[0006] The above-described conventional air conditioner has the following structure. Exerting valve opening and closing control forms a heat non-exchanging part at part of the heat exchanger of the indoor unit. The air having passed through the heat non-exchanging part (original-temperature air) is sent to the blow-out port as it is, and blown into the room being the air conditioning target, together with air having exchanged heat, from the blow-out port. In this manner, the above-described conventional air conditioner blows out layers of the air having exchanged heat (warm air or cool air) and the original-temperature air from the blow-out port, thereby improving efficiency particularly in a stable operation mode.

[0007] Such a conventional air conditioner is intended to condition the air of the entire room to fall within a pre-determined temperature range. It is difficult with the conventional air conditioner to positively condition the air to

attain the temperature at which a human in the room feels comfortable, in accordance with the human's position, the human's activity amount and the like. In particular, in the case where a plurality of humans are present in the room being the air conditioning target, it is impossible with the conventional air conditioner to condition the air to attain the temperatures at which respective humans feel comfortable.

[0008] An object of the present disclosure is to carry out optimum air conditioning for a room being the air conditioning target, and to provide an air conditioner capable of carrying out air conditioning which makes any human in the room feel comfortable by targeting the air conditioning to the human in the room, while avoiding wasteful air conditioning and thus reducing power consumption.

[0009] An air conditioner of the present disclosure has a refrigerant circuit in which a refrigerant circulates through a compressor, an indoor-side heat exchanger, a pressure reducer, and an outdoor-side heat exchanger, and the air conditioner is structured by an indoor unit and an outdoor unit. The indoor unit includes: the indoor-side heat exchanger having a first heat exchanging region and a second heat exchanging region; a pressure adjuster provided between the first heat exchanging region and the second heat exchanging region and adjusting a refrigerant pressure; and an indoor-side fan that causes air from an aspiration port formed at an upper part of the indoor unit to exchange heat at the indoor-side heat exchanger and to be formed into airflow blown out from a blow-out port formed at a lower part of the indoor unit. The second heat exchanging region and the first heat exchanging region are disposed on an aspiration side of the air conditioner along a rotation direction of the indoor-side fan. The pressure adjuster in a heating operation mode reduces pressure to cause the first heat exchanging region to function as a first condenser to attain a first condensation temperature, and to cause the second heat exchanging region to function as a second condenser to attain a second condensation temperature lower than the first condensation temperature.

[0010] The present disclosure provides an air conditioner capable of carrying out optimum air conditioning for the room being the air conditioning target. Thus, carrying out air conditioning targeting to the human in the room, the air conditioner can surely carry out air conditioning which makes any human in the room feel comfortable while avoiding wasteful air conditioning.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

FIG. 1 is a vertical cross-sectional view showing the schematic structure of an indoor unit in an air conditioner according to a first exemplary embodiment of the present disclosure;

FIG. 2 is a perspective view of the indoor unit of the air conditioner according to the first exemplary em-

bodiment as seen from the lower right side;

FIG. 3 is a perspective view of the indoor unit of the air conditioner according to the first exemplary embodiment as seen from the upper right side;

FIG. 4 is a schematic diagram of a refrigerant circuit of the air conditioner according to the first exemplary embodiment;

FIG. 5 is a diagram showing a specific refrigerant passage in a heat exchanger of the air conditioner according to the first exemplary embodiment;

FIG. 6 is a graph showing temperatures at several sites in the heat exchanger, in a heating operation mode of the air conditioner according to the first exemplary embodiment;

FIG. 7 is a p-h diagram of the air conditioner according to the first exemplary embodiment;

FIG. 8 is a graph showing changes in the heating capacity and in the blow-out temperature in the ratio of a second heat exchanging region to all the heat exchanging regions in the heat exchanger;

FIG. 9 is a contour diagram of the case in which, in the heating operation mode of the air conditioner according to the first exemplary embodiment, heat exchange is carried out at a first heat exchanging region and at the second heat exchanging region;

FIG. 10 is a diagram for describing the condition defining a separator of the indoor unit of the air conditioner according to the first exemplary embodiment;

FIG. 11 is a vertical cross-sectional view showing an exemplary structure satisfying Condition 1, in the heating operation mode of the air conditioner according to the first exemplary embodiment;

FIG. 12 is a vertical cross-sectional view showing an exemplary structure satisfying Condition 2, in the heating operation mode of the air conditioner according to the first exemplary embodiment;

FIG. 13 is a perspective view showing exemplary rotation positions of a vertical wind direction louver and a horizontal wind direction louver of the air conditioner according to the first exemplary embodiment;

FIG. 14 is a perspective view showing exemplary rotation positions of the vertical wind direction louver and the horizontal wind direction louver of the air conditioner according to the first exemplary embodiment;

FIG. 15A is a diagram describing the effect of a mini blade in a wind direction louver assembly of the air conditioner according to the first exemplary embodiment;

FIG. 15B is a diagram describing the effect of the mini blade in the wind direction louver assembly of the air conditioner according to the first exemplary embodiment;

FIG. 16 is a flowchart showing filtering processes of thermal sensation sensing control executed in the air conditioner according to the first exemplary embodiment; and

FIG. 17 is a flowchart showing air conditioning control based on thermal sensation executed in the air conditioner according to the first exemplary embodiment.

DETAILED DESCRIPTION

[0012] An air conditioner according to a first aspect of the present disclosure includes a refrigerant circuit in which a refrigerant circulates through a compressor, an indoor-side heat exchanger, a pressure reducer, and an outdoor-side heat exchanger, the air conditioner being structured by an indoor unit and an outdoor unit. The indoor unit includes: the indoor-side heat exchanger having a first heat exchanging region and a second heat exchanging region; a pressure adjuster provided between the first heat exchanging region and the second heat exchanging region and adjusting a refrigerant pressure; and an indoor-side fan that causes air from an aspiration port formed at an upper part of the indoor unit to exchange heat at the indoor-side heat exchanger and to be formed into airflow blown out from a blow-out port formed at a lower part of the indoor unit. The second heat exchanging region and the first heat exchanging region are disposed on an aspiration side of the air conditioner along a rotation direction of the indoor-side fan. The pressure adjuster in a heating operation mode reduces pressure to cause the first heat exchanging region to function as a first condenser to attain a first condensation temperature, and to cause the second heat exchanging region to function as a second condenser to attain a second condensation temperature lower than the first condensation temperature.

[0013] The air conditioner according to the first aspect of the present disclosure structured as described above is capable of carrying out the two-temperature operation mode for the room being the air conditioning target. Thus, avoiding wasteful air conditioning and reducing power consumption, the air conditioner can carry out air conditioning which makes the human in the room feel comfortable.

[0014] An air conditioner according to a second aspect of the present disclosure may further include a separator that separates the blow-out port according to the first aspect into a first blow-out port on a front side of the indoor unit and a second blow-out port on a back side of the indoor unit. In the heating operation mode, air of a first temperature being higher than a room temperature may be blown out from the first blow-out port, and air at a second temperature being higher than the first temperature may be blown out from the second blow-out port.

[0015] This structure suppresses the wind at the first temperature and the wind at the second temperature from mixing with each other. Thus, the wind can be blown as being clearly separated into two temperatures.

[0016] An air conditioner according to a third aspect of the present disclosure may further include, in the structure of the second aspect: a rear guider that is provided

on a back side of the indoor-side fan and guides the airflow from the indoor-side fan to the second blow-out port; and a stabilizer that is provided on a front side of the indoor-side fan so as to oppose to the rear guider and guides the airflow from the indoor-side fan to the first blow-out port. The separator may be provided in the blow-out port between the rear guider and the stabilizer to separate the blow-out port into the first blow-out port and the second blow-out port. Air having exchanged heat at the second condensation temperature of the second heat exchanging region may be mainly blown out from the first blow-out port, and air having exchanged heat at the first condensation temperature of the first heat exchanging region may be mainly blown out from the second blow-out port.

[0017] This structure suppresses the wind at the first temperature and the wind at the second temperature from mixing with each other. Further, the wind direction is surely controlled, whereby the effect on room temperature adjustment improves.

[0018] In an air conditioner according to a fourth aspect of the present disclosure, in the structure according to one of the second and third aspects, the separator may be horizontally divided into two pieces so as to be rotatable independently of each other, and may be capable of vertically changing respective blow-out directions of the first blow-out port and the second blow-out port independently of each other.

[0019] This structure can adjust temperatures of a plurality of regions in the room individually and simultaneously.

[0020] An air conditioner according to a fifth aspect of the present disclosure may further include, in the structure according to one of the second to fourth aspects, a wind direction louver assembly that is rotatable to direct vertically and horizontally the airflow guided to the blow-out port. The wind direction louver assembly may have a vertical wind direction louver and a horizontal wind direction louver. The vertical wind direction louver may be structured by three-level blades made up of an upper level blade disposed on a front side in the blow-out port, a lower level blade disposed on a back side in the blow-out port, and the separator disposed between the upper level blade and the lower level blade to serve as a middle level blade, the three-level blades being vertically rotatable independently of one another.

[0021] This structure can adjust temperatures of a plurality of regions in the room individually and simultaneously.

[0022] An air conditioner according to a sixth aspect of the present disclosure may further include, in the structure according to one of the second to fourth aspects, a wind direction louver assembly that is rotatable to direct vertically and horizontally the airflow guided to the blow-out port. The wind direction louver assembly may have a vertical wind direction louver and a horizontal wind direction louver. The vertical wind direction louver may be structured by three-level blades made up of an upper

level blade disposed on a front side in the blow-out port, a lower level blade disposed on a back side in the blow-out port, and the separator disposed between the upper level blade and the lower level blade to serve as a middle level blade, the three-level blades being vertically rotatable independently of one another. The horizontal wind direction louver may include an upper horizontal blade provided between the upper level blade and the separator, and a lower horizontal blade provided between the lower level blade and the separator.

[0023] This structure can adjust temperatures of a plurality of regions in the room individually and simultaneously.

[0024] In an air conditioner according to a seventh aspect of the present disclosure, in the structure according to the sixth aspect, the upper horizontal blade may be structured by a plurality of blades of an identical shape juxtaposed to each other and divided into right and left blade groups at a center in a horizontal direction of the upper horizontal blade, the right and left blade groups being horizontally rotatable independently of each other to change blow-out directions horizontally. The lower horizontal blade may be structured by a plurality of blades of an identical shape juxtaposed to each other and divided into right and left blade groups at a center in a horizontal direction of the lower horizontal blade, the right and left blade groups being horizontally rotatable independently of each other to change blow-out directions horizontally. As used herein, the term "identical shape" includes the term "substantially identical shape".

[0025] This structure can adjust temperatures of a plurality of regions in the room individually and simultaneously.

[0026] In the following, a description will be given of an exemplary embodiment of an air conditioner of the present disclosure with reference to the drawings. Note that, identical elements are denoted by the identical reference character, and any repetitive descriptions may be omitted. Further, the drawings are schematic views focused on respective constituents, for easier understanding.

[0027] Note that, the exemplary embodiment described in the following is merely an example of the air conditioner of the present disclosure. For example, numerical values, shapes, structures, steps and the order of steps are of the exemplary nature, and are not intended to limit the present disclosure. In the present specification, the horizontal direction or the right and left directions refers to the direction as seen from an observer facing the apparatus or the device. Of those constituents described in the exemplary embodiment, the constituents not described in the independent claim which represents the most generic concept are presented as arbitrary constituents. The exemplary embodiments share identical structure other than any varied part in their respective Variations. The structures of Variations can be combined. Such a structure obtained by the combining exhibits the effect of the combined structures. Further, while a spe-

cific structure will be described as to the air conditioner according to the exemplary embodiment, the present disclosure is not limited to the specific structure of the following exemplary embodiment and includes air conditioners obtained by application of any structure based on the similar technical idea.

FIRST EXEMPLARY EMBODIMENT

[0028] An air conditioner according to a first exemplary embodiment is a so-called separate type air conditioner, in which an indoor unit and an outdoor unit are connected to each other by refrigerant piping, control lines and the like. The indoor unit and the outdoor unit structure a heat pump, and the outdoor unit is provided with a compressor. The indoor unit of the air conditioner according to the first exemplary embodiment is a wall-mounted indoor unit, which is mounted on a wall surface inside a room.

[0029] FIG. 1 is a vertical cross-sectional view showing the schematic structure of the indoor unit of the air conditioner according to the first exemplary embodiment of the present disclosure. FIG. 1 shows one state of the air conditioner according to the first exemplary embodiment in an air conditioning operation.

[0030] As shown in FIG. 1, indoor unit 1 includes upper-surface opening 2a that is formed at an upper part of indoor unit 1 and functions as an air aspiration port, and blow-out port 2b that functions as a blow port that blows out air having undergone heat exchange inside indoor unit 1. Further, blow-out port 2b formed at a lower part of indoor unit 1 is provided with wind direction louver assembly 3, which is wind direction changing means capable of opening and closing blow-out port 2b and adjusting the air-blow direction toward any direction vertically or horizontally. Wind direction louver assembly 3 is structured by vertical wind direction louver 30 formed by a plurality of blades that vertically change the wind direction, and horizontal wind direction louver 40 formed by a plurality of blades that horizontally change the wind direction.

[0031] Inside indoor unit 1, what are provided are filter 4 for removing dust in the room air, indoor-side heat exchanger 5 that exchanges heat with the room air taken in from upper-surface opening 2a through filter 4, and indoor-side fan 6 that causes air aspirated from the aspiration port being upper-surface opening 2a to exchange heat with heat exchanger 5 and to be formed into airflow blown into the room from blow-out port 2b. Indoor-side fan 6 may be, for example, a laterally disposed cylindrical cross-flow fan that generates circumferential direction airflow. As shown in FIG. 1, indoor-side heat exchanger 5 is provided to be substantially inverted V-shaped, to substantially surround three sides, namely, the front side, the upper side, and the back side excluding the blow-out direction under indoor-side fan 6. Indoor-side heat exchanger 5 is structured by back-side heat exchanging part 5a, first heat exchanging part 5b on the upper side of a front-side heat exchanging part, and second heat

exchanging part 5c on the lower side of the front-side heat exchanging part.

[0032] Further, inside indoor unit 1, airflow passage 7 extending from the downstream side of indoor-side fan 6 to blow-out port 2b is disposed on the downstream side of indoor-side fan 6 and provided on the back side. Airflow passage 7 is structured by rear guider 8 which is a back-side guiding part having a function of guiding the back-side airflow to blow-out port 2b, stabilizer 9 which is a front-side guiding part provided on the front side of indoor-side fan 6 so as to oppose to rear guider 8, and has a function of stably guiding the front side airflow in airflow passage 7, and opposite sidewall surfaces (not shown) of indoor unit 1. Stabilizer (front-side guiding part) 9 forms, in conjunction with rear guider (back-side guiding part) 8, blow-out port 2b, and has a function of guiding the airflow from indoor-side fan 6 to blow-out port 2b. Front panel 2c is provided on the front side of indoor unit 1. Front panel 2c is openable for replacing or cleaning filter 4 or the like in indoor unit 1.

[0033] FIGS. 2 and 3 are each a perspective view of the air conditioner according to the first exemplary embodiment. FIG. 2 shows the front side of indoor unit 1 where blow-out port 2b and the like of the air conditioner appear, as seen from the lower right side. FIG. 3 is a diagram as seen from the upper right side of indoor unit 1, showing upper-surface opening 2a which is the air aspiration port of the air conditioner.

[0034] As shown in FIG. 2, at blow-out port 2b, wind direction louver assembly 3 is rotatably provided, so that blow-out port 2b can be opened or closed. Wind direction louver assembly 3 is structured by vertical wind direction louver 30 formed by a plurality of blades that vertically change the wind direction, and horizontal wind direction louver 40 formed by a plurality of blades that horizontally change the wind direction.

[0035] Vertical wind direction louver 30 has a three-level blade structure including the upper, middle, and lower levels, respectively corresponding to upper level blade 31 positioned on the front side in blow-out port 2b, lower level blade 33 positioned on the back side in blow-out port 2b, and middle level blade 32 positioned at the center in blow-out port 2b between upper level blade 31 and lower level blade 33. As will be described later, middle level blade 32 between upper level blade 31 and lower level blade 33 has a function as a separator between two temperatures in blow-out port 2b. Further, middle level blade 32 which is the separator is divided into two pieces at its center in the horizontal direction, and thus has middle-level left blade 32a and middle-level right blade 32b.

[0036] Horizontal wind direction louver 40 includes upper horizontal blades 40a disposed at upper blow-out region FA that is formed between upper level blade 31 and middle level blade 32 (the separator), and lower horizontal blades 40b disposed at lower blow-out region BA that is formed between middle level blade 32 (the separator) and lower level blade 33. That is, horizontal wind direction louver 40 has an upper-lower two-level struc-

ture. Details of vertical wind direction louver 30 and horizontal wind direction louver 40 in wind direction louver assembly 3 will be described later. Note that, in the structure of the present first exemplary embodiment, upper blow-out region FA serves as a first blow-out port, and lower blow-out region BA serves as a second blow-out port.

[0037] Further, indoor unit 1 of the air conditioner according to the first exemplary embodiment is provided with an electrical component unit (not shown) and the like. The electrical component unit includes controller 50 (see FIG. 1). Controller 50 controls driving of vertical wind direction louver 30, horizontal wind direction louver 40, indoor-side fan 6, and the compressor of the outdoor unit, and thus controls the air conditioning operation of the air conditioner. Controller 50 is structured by a microcomputer and the like, and controls the air conditioning operation of the air conditioner based on various kinds of information obtained from a plurality of sensors described below.

[0038] The sensors used in the air conditioner according to the first exemplary embodiment include human sensor 10, thermal sensation sensor 11, a floor temperature sensor (not shown), a sunlight sensor (not shown), and a plurality of temperature sensors (18a, 18b) that detect temperatures of several sites in heat exchanger 5 which will be described later, all of these sensors being provided at indoor unit 1. Human sensor 10 and thermal sensation sensor 11 detect presence of a human, shifting of a human, thermal image information and the like based on infrared rays from an air-conditioning target region in the room. The floor temperature sensor detects the floor temperature in the air-conditioning target region. Sunlight sensor detects a sunlight state in the air-conditioning target region. Various kinds of information detected by the sensors are sent to controller 50. The operation of the air conditioner is controlled based on the various kinds of information. Further, part of the various kinds of information such as the states detected by the sensors is displayed on light emitting display 19 provided at front panel 2c of indoor unit 1.

[0039] Human sensor 10 is a pyroelectric infrared sensor that senses infrared rays radiated from a human body. Human sensor 10 detects presence/absence of a human and shift of a human by a change in the infrared ray amount in the air-conditioning target region.

[0040] Thermal sensation sensor 11 is a thermopile sensor, which is structured by a multitude of thermoelectric element type sensor elements arranged in a matrix. A condensing lens is provided in front of the sensor elements arranged in a matrix. In the first exemplary embodiment, for example, the sensor elements are arranged in an 8 by 8 matrix. The sensor elements arranged in a matrix of thermal sensation sensor 11 according to the first exemplary embodiment rotate, in a state where their longitudinal and lateral sides are inclined relative to the rotation axis, and scan. Then, the sensor elements output signals indicative of thermal image information.

[0041] The thermopile sensor, which is thermal sensation sensor 11 of the air conditioner according to the first exemplary embodiment, generates thermal image information (temperature distribution information) of the floor surface and the wall surface of the room being the air-conditioning target region and/or two-dimensional thermal image information of thermal image information (temperature distribution information) of a human in the room. The thermal image information is generated by an infrared ray amount detected by thermal sensation sensor 11. Details of the air conditioning control using human sensor 10 and thermal sensation sensor 11 of the air conditioner according to the first exemplary embodiment will be described later.

Structure of Refrigerant Circuit

[0042] FIG. 4 is a diagram schematically showing a refrigerant circuit of the air conditioner according to the first exemplary embodiment of the present disclosure. In the air conditioner according to the first exemplary embodiment, indoor-side heat exchanger 5 is provided to be substantially inverted V-shaped and to substantially surround three sides, namely, the front side, the upper side, and the back side excluding the blow-out direction under indoor-side fan 6. In indoor-side heat exchanger 5, back-side heat exchanging part 5a and front-side first heat exchanging part 5b form first heat exchanging region X, and front-side second heat exchanging part 5c forms second heat exchanging region Y. As shown in the refrigerant circuit shown in FIG. 4, pressure adjuster 12 which adjusts the refrigerant pressure is provided at a refrigerant pipeline (a refrigerant passage) between first heat exchanging region X formed by back-side heat exchanging part 5a and front-side first heat exchanging part 5b and second heat exchanging region Y formed by front-side second heat exchanging part 5c. In the structure of the air conditioner according to the first exemplary embodiment, pressure adjuster 12 of the heating operation mode functions as an expansion valve that reduces the refrigerant pressure. Note that, employing the expansion valve that exhibits, when fully opened, low pressure loss comparable to that of a straight pipe prevents a reduction in efficiency in a normal heating operation and a normal cooling operation.

[0043] As shown in FIG. 4, in the refrigerant circuit of the air conditioner according to the first exemplary embodiment, motor-operated four-way valve 14 is connected to the discharge side of compressor 13. In the heating operation mode, the refrigerant from compressor 13 is sent to back-side heat exchanging part 5a and front-side first heat exchanging part 5b of heat exchanger 5. The refrigerant sent to back-side heat exchanging part 5a and front-side first heat exchanging part 5b is sent to front-side second heat exchanging part 5c via pressure adjuster 12. In the refrigerant circuit in the heating operation mode, the refrigerant circulation circuit is formed, in which refrigerant circulation circuit the refrigerant flows from

front-side second heat exchanging part 5c, passing through pressure reducer 15, which is an outdoor-side expansion valve, and outdoor-side heat exchanger 16, to compressor 13 via motor-operated four-way valve 14. Outdoor-side fan 17 is provided in close proximity to outdoor-side heat exchanger 16. Note that, in the cooling operation mode, motor-operated four-way valve 14 switches and the flow of the refrigerant is reversed.

Structure of Heat Exchanger

[0044] As has been described above, in the air conditioner according to the first exemplary embodiment, pressure adjuster 12 is provided between first heat exchanging region X formed by back-side heat exchanging part 5a and front-side first heat exchanging part 5b, and second heat exchanging region Y formed by front-side second heat exchanging part 5c. Thus, pressure adjuster 12 is capable of setting a difference in refrigerant pressure between first heat exchanging region X and second heat exchanging region Y.

[0045] FIG. 5 exemplarily shows a specific refrigerant passage in heat exchanger 5 (5a, 5b, 5c) in the structure of the air conditioner according to the first exemplary embodiment, and is a vertical cross-sectional view of indoor unit 1 of the air conditioner. The direction of the flow of the refrigerant in the refrigerant passage shown in FIG. 5 is that in the heating operation mode.

[0046] As shown in FIG. 5, in heat exchanger 5 of the air conditioner according to the first exemplary embodiment, the refrigerant in the heating operation mode flows in from refrigerant inlets (A, B, C, D) provided at four points in first heat exchanging region X. That is, the refrigerant is supplied from two refrigerant inlets (A, B) at back-side heat exchanging part 5a in first heat exchanging region X and two refrigerant inlets (C, D) at front-side first heat exchanging part 5b. The refrigerant supplied from the two refrigerant inlets (A, B) at back-side heat exchanging part 5a exchanges heat at back-side heat exchanging part 5a, and sent to pressure adjuster 12 from two extraction parts (E, F). Similarly, the refrigerant supplied from two refrigerant inlets (C, D) at front-side first heat exchanging part 5b exchanges heat at front-side first heat exchanging part 5b, and sent to pressure adjuster 12 from two extraction parts (G, H). In the heating operation mode, the refrigerant having its pressure reduced by pressure adjuster 12 is sent to four introduction parts (I, J, K, L) at front-side second heat exchanging part 5c which is second heat exchanging region Y. The refrigerant having exchanged heat at front-side second heat exchanging part 5c is sent from four extraction parts (M, N, O, P) to introduction part (Q) of supercooling part 5d provided on the external air intake side at front-side first heat exchanging part 5b. Then, the refrigerant having exchanged heat at supercooling part 5d is sent from extraction part (R) to introduction part (S) of supercooling part 5e provided on the external air intake side at back-side heat exchanging part 5a. Extraction part (T) of su-

percooling part 5e serves as the refrigerant outlet at heat exchanger 5 in the heating operation mode. Note that, the flow of refrigerant in the cooling operation mode is the reverse of the flow in the heating operation mode.

[0047] As has been described above, in the heating operation mode of the air conditioner according to the first exemplary embodiment, a refrigerant is sent from compressor 13 to first heat exchanging region X in heat exchanger 5. As a result, since the high-temperature refrigerant flows in first heat exchanging region X, first heat exchanging region X serves as a heat exchanging region that provides a first condensation temperature which is a high temperature. The refrigerant extracted from first heat exchanging region X subsequently has its pressure reduced by pressure adjuster 12 and becomes a middle-temperature refrigerant. The middle-temperature refrigerant is sent to second heat exchanging region Y that provides a second condensation temperature lower than the first condensation temperature at front-side second heat exchanging part 5c. In the first exemplary embodiment, the high temperature in a two-temperature operation mode, which will be described later, is a temperature relatively higher than a middle temperature of the air blown out at that time, and the middle temperature is a temperature between the high temperature and the temperature in the room (room temperature). For example, in the structure of the first exemplary embodiment, the high temperature of the blown out air falls within a range of 30°C to 55°C. The middle temperature falls within a range lower than the high temperature by a predetermined temperature, with the relative difference in temperature between the high temperature and the middle temperature being 5°C or higher. The high temperature and the middle temperature are determined based on setting conditions, and various kinds of information obtained from various kinds of sensors.

[0048] As has been described above, in the heating operation mode of the air conditioner according to the first exemplary embodiment, heat exchange is performed at heat exchanger 5 of indoor unit 1 to provide two types of temperatures (the high temperature, the middle temperature). FIG. 6 is a graph showing temperatures at several sites in first heat exchanging region X and second heat exchanging region Y of heat exchanger 5, in the heating operation mode of the air conditioner according to the first exemplary embodiment. In the graph of FIG. 6, the temperature graph plotted by a broken line is the temperature transition at several sites in heat exchanger 5 in the normal operation mode (a one-temperature operation mode), and the temperature graph plotted by a solid line is the temperature transition at several sites in heat exchanger 5 in the two-temperature operation mode. As shown in FIG. 6, in the normal operation mode, it can be seen that heat exchange at 40°C is carried out at first heat exchanging region X and second heat exchanging region Y of heat exchanger 5. On the other hand, by pressure adjuster 12 reducing the refrigerant pressure, heat exchange at 40°C is carried out at first

heat exchanging region X, and heat exchange at 33°C is carried out at second heat exchanging region Y. In this manner, pressure adjuster 12 adjusting the refrigerant pressure at first heat exchanging region X and second heat exchanging region Y allows the air conditioner to switch between the one-temperature operation mode (normal operation) and the two-temperature operation mode, thereby conditioning the air in the air-conditioning target region of the room to any desired temperature.

[0049] FIG. 7 is a p-h diagram of the air conditioner according to the first exemplary embodiment. The vertical axis represents the refrigerant pressure [Mpa] and the horizontal axis represents the specific enthalpy [kJ/kg]. In FIG. 7, reference character 1 → reference character 2 shows compressor 13 compressing refrigerant. In FIG. 7, reference character 2 → reference character 3 shows that first heat exchanging region X functions as a first condenser. The heat of condensation here exchanges heat with aspirated air so that the air attains the high temperature. As has been described above, the high-temperature air is guided by the airflow generated by indoor-side fan 6 to rear guider 8, and blown into the room being the air conditioning target mainly from lower blow-out region BA.

[0050] In FIG. 7, reference character 3 → reference character 4 shows pressure adjuster 12 in indoor unit 1 rapidly reducing the pressure to a predetermined pressure. In reference character 4 → reference character 5, second heat exchanging region Y functions as a second condenser. The heat of condensation here provides the middle-temperature air. The middle-temperature air is guided by the airflow generated by indoor-side fan 6, and blown into the room being the air conditioning target mainly from upper blow-out region FA.

[0051] In FIG. 7, reference character 5 → reference character 6 shows the function of pressure reducer 15, and reference character 6 → reference character 1 shows the function of outdoor-side heat exchanger 16 as an evaporator.

[0052] FIG. 8 shows the result obtained from an experiment conducted by the inventor, being changes in heating capacity and changes in blow-out temperature difference (in the two-temperature operation mode), against the ratio of second heat exchanging region Y to all the heat exchanging regions in heat exchanger 5. The ratio of the heat exchanging region is calculated based on the heat exchange area. As shown in FIG. 8, when second heat exchanging region Y which is the heat exchanging region to attain the middle temperature is 50%, the temperature difference between the middle temperature from upper blow-out region FA and the high temperature from lower blow-out region BA is about 10°C. Further, when second heat exchanging region Y is 50%, the heating capacity is about 75% as compared to the case where all the heat exchanging regions are first heat exchanging region X. With the air conditioner of the present disclosure, the heating capacity and the temperature difference required in the two-temperature opera-

tion mode are set taken into consideration of the intended use of the air conditioner, and the proper ratio of second heat exchanging region Y to all the heat exchanging regions is determined. In the first exemplary embodiment, for example, the heating capacity required in the two-temperature operation mode is 80% or greater; the temperature difference between the high temperature and the middle temperature exchanging heat is 6°C or greater; and the ratio of second heat exchanging region Y to all the heat exchanging regions is about 30%. Note that, these numerical values are of an exemplary nature, and the parameters are determined in accordance with the specification of each air conditioner designed taken into consideration of the air conditioning target.

[0053] FIG. 9 is a contour diagram of the case in which, in the heating operation mode of the air conditioner according to the first exemplary embodiment, heat exchange to attain the high temperature is carried out at first heat exchanging region X of heat exchanger 5 and heat exchange to attain the middle temperature is carried out at second heat exchanging region Y. FIG. 9 is a black and white picture converted from a full-color picture. In FIG. 9, black color shows that heat exchange to attain the high temperature is carried out at first heat exchanging region X provided on the upper side of indoor-side fan 6, and gray color shows that heat exchange to attain the middle temperature is carried out at second heat exchanging region Y provided on the front side of indoor-side fan 6. In the contour diagram of FIG. 9, the region indicated by reference character 100 is a 35°C to 36°C region. The region indicated by reference character 101 is a 34°C to 35°C region. The region indicated by reference character 102 is a 32°C to 33°C region. The region indicated by reference character 103 is a 30°C to 31 °C region. The region indicated by reference character 104 is a 27°C to 28°C region.

[0054] As shown in FIG. 9, the air having undergone heat exchange to attain the high temperature at first heat exchanging region X is sent by the airflow generated by indoor-side fan 6, which is a cross-flow fan, to blow-out port 2b via airflow passage 7. Here, it can be seen that the air having undergone heat exchange to attain the high temperature, for example the high-temperature air indicated by reference character 100, flows mainly along rear guider 8, which is the back-side guiding part, to blow-out port 2b. Accordingly, most of the high-temperature air from first heat exchanging region X is guided by rear guider 8 to lower blow-out region BA between middle level blade 32, which is the separator of vertical wind direction louver 30, and lower level blade 33, and blown into the room from the back-side region which is the wall side in blow-out port 2b.

[0055] On the other hand, the middle-temperature air from second heat exchanging region Y is sent by the airflow generated by indoor-side fan 6 to blow-out port 2b via airflow passage 7. For example, the middle-temperature air indicated by reference character 104 is mainly guided by stabilizer 9, which is the front-side guiding

part provided on the front side than the blow-out position of indoor-side fan 6, to upper blow-out region FA between upper level blade 31 of vertical wind direction louver 30 and middle level blade 32 being the separator. In this manner, the middle-temperature air is mainly guided by stabilizer 9, and blown into the room from the region in blow-out port 2b distanced from the wall, that is, the front side region in blow-out port 2b.

[0056] As has been described above, in the air conditioner according to the first exemplary embodiment, as shown in FIG. 9, the air having undergone heat exchange to attain the high temperature mainly flows along rear guider 8 on the back side, and is blown into the room from lower blow-out region BA between middle level blade 32 being the separator and lower level blade 33. On the other hand, the air having undergone heat exchange to attain the middle temperature mainly flows along stabilizer 9 on the front side, and is blown into the room from upper blow-out region FA between middle level blade 32 being the separator and upper level blade 31. In this manner, with the air conditioner according to the first exemplary embodiment, in the two-temperature operation mode of the heating operation mode, middle-temperature air is blown out from upper blow-out region FA, and high-temperature air is blown out from lower blow-out region BA. Thus, the middle-temperature air is blown to push down the high-temperature air. As a result, the high-temperature air immediately after blown into the room is prevented from rising. Thus, the present exemplary embodiment is capable of sending high-temperature air to any air-conditioning target region in the room.

Separator Function

[0057] In the structure of the air conditioner according to the first exemplary embodiment, blow-out port 2b is provided with vertical wind direction louver 30 of the three-level structure, and middle level blade 32 in vertical wind direction louver 30 has the function of the separator for separately blowing air of two temperatures (high temperature + middle temperature) at blow-out port 2b.

[0058] FIG. 10 is a diagram for describing the condition defining the position of middle level blade 32 being the separator at blow-out port 2b, in the cross-sectional view of FIG. 1. In FIG. 10, $\alpha 1$ and $\beta 1$ each represent an angle about the rotation center of indoor-side fan 6, for showing the ratio between second heat exchanging region Y and first heat exchanging region X in heat exchanger 5. $\alpha 1$ is an angle showing the spreading of second heat exchanging region Y about the rotation center of indoor-side fan 6. $\beta 1$ is an angle showing the spreading of first heat exchanging region X about the rotation center of indoor-side fan 6. Note that, $\alpha 1$ is an angle formed between: a line connecting between the farthest end (front-side lower end) in second heat exchanging region Y as seen from the rotation center of indoor-side fan 6 and the rotation center of indoor-side fan 6; and a line connecting between the center point at the boundary of first heat

exchanging region X and second heat exchanging region Y and the rotation center of indoor-side fan 6. β_1 is an angle formed between a line connecting between the farthest end (back-side end) in first heat exchanging region X as seen from the rotation center of indoor-side fan 6 and the rotation center of indoor-side fan 6; and a line connecting between the center point of the boundary of first heat exchanging region X and second heat exchanging region Y and the rotation center of indoor-side fan 6.

[0059] α_2 and β_2 in FIG. 10 represent the positional ratio of the separator in blow-out port 2b by angles of spreading in the vertical direction, in order to define the position of middle level blade 32 being the separator in vertical wind direction louver 30. α_2 represents upper blow-out region FA (the first blow-out port) between upper level blade 31 and middle level blade 32 by an angle of spreading in the vertical direction. β_2 represents lower blow-out region BA (the second blow-out port) between middle level blade 32 and lower level blade 33 by an angle of spreading in the vertical direction. In order to define α_2 and β_2 , as shown in FIG. 10, α_2 and β_2 are each defined by an angle representing spreading in the vertical direction, the origin of which spreading is the intersection of a tangent at the most downstream point (the blow-out point) in rear guider 8 and the tangent at the most downstream point (the blow-out point) in stabilizer 9 disposed so as to oppose to rear guider 8. Note that, α_2 is an angle representing spreading in the vertical direction formed between a tangent at the most downstream point (blow-out point) in stabilizer 9 and a line connecting between the most upstream point of middle level blade 32 which is the separator and the above-described origin. Further, β_2 is an angle representing spreading in the vertical direction formed between a tangent at the most downstream point (blow-out point) in rear guider 8 and a line connecting between the most upstream point in middle level blade 32 and the above-described origin.

[0060] As described above, defining the ratio between first heat exchanging region X and second heat exchanging region Y by α_1 and β_1 and defining the position of middle level blade 32 which is the separator in blow-out port 2b by α_2 and β_2 , setting middle level blade 32 to satisfy the following conditions realizes different blow-out temperatures in the air conditioning operation mode.

[0061] For example, providing middle level blade 32 which is the separator so as to satisfy the condition: $\alpha_2/(\alpha_2 + \beta_2) > \alpha_1/(\alpha_1 + \beta_1)$ (Condition 1) causes, in the heating operation mode, the high-temperature air to be surely blown out from lower blow-out region BA (the second blow-out port) between middle level blade 32 and lower level blade 33 at blow-out port 2b, and causes the middle-temperature air to be blown out from upper blow-out region FA (the first blow-out port) between upper level blade 31 and middle level blade 32. Here, the high-temperature air blown out from lower blow-out region BA of blow-out port 2b exhibits a great temperature difference from the middle-temperature air blown out from upper

blow-out region FA. That is, satisfying Condition 1: $\alpha_2/(\alpha_2 + \beta_2) > \alpha_1/(\alpha_1 + \beta_1)$ includes the state where the disposition position of middle level blade 32 which is the separator is on the side nearer to the back side in blow-out port 2b, and lower blow-out region BA (the second blow-out port) in blow-out port 2b becomes narrower than upper blow-out region FA (the first blow-out port). In this case, Condition 1 may be satisfied by changing the region ratio between first heat exchanging region X and second heat exchanging region Y in heat exchanger 5. FIG. 11 is a vertical cross-sectional view showing an exemplary structure satisfying Condition 1: $\alpha_2/(\alpha_2 + \beta_2) > \alpha_1/(\alpha_1 + \beta_1)$ in the heating operation mode of the air conditioner according to the first exemplary embodiment.

[0062] Further, conversely, providing middle level blade 32 which is the separator so as to satisfy the condition: $\alpha_2/(\alpha_2 + \beta_2) \leq \alpha_1/(\alpha_1 + \beta_1)$ (Condition 2) causes, in the heating operation mode, the middle-temperature air to be blown out by a relatively small amount from upper blow-out region FA (the first blow-out port) between upper level blade 31 and middle level blade 32 in blow-out port 2b, and causes the high-temperature air to be blown out by a relatively great amount from lower blow-out region BA (the second blow-out port) between middle level blade 32 and lower level blade 33. Here, the high-temperature air blown out from lower blow-out region BA (the second blow-out port) of blow-out port 2b exhibits a small temperature difference from the middle-temperature air blown out from upper blow-out region FA (the first blow-out port). That is, satisfying Condition 2: $\alpha_2/(\alpha_2 + \beta_2) \leq \alpha_1/(\alpha_1 + \beta_1)$ includes the state where the disposition position of middle level blade 32 which is the separator is on the side nearer to the front side in blow-out port 2b, and upper blow-out region FA (the first blow-out port) in blow-out port 2b becomes narrower than lower blow-out region BA (the second blow-out port). In this case, Condition 2 may be satisfied by changing the region ratio between first heat exchanging region X and second heat exchanging region Y in heat exchanger 5. Accordingly, in the structure of Condition 2, while a large amount of high-temperature air is blown out from lower blow-out region BA (the second blow-out port), the high-temperature air from lower blow-out region BA (the second blow-out port) is lower in temperature as compared to that in the structure of Condition 1. FIG. 12 is a vertical cross-sectional view showing an exemplary structure satisfying Condition 2: $\alpha_2/(\alpha_2 + \beta_2) \leq \alpha_1/(\alpha_1 + \beta_1)$ in the heating operation mode of the air conditioner according to the first exemplary embodiment.

[0063] Note that, with reference to FIG. 10, α_1 and β_1 have been shown as angles about the rotation center of indoor-side fan 6 for showing the region ratio between first heat exchanging region X and second heat exchanging region Y in heat exchanger 5, and α_2 and β_2 have been shown as angles representing the positional ratio of the separator in blow-out port 2b for defining the position of middle level blade 32 which is the separator in vertical wind direction louver 30. However, the present

disclosure is not limited by such definitions. α_1 and β_1 may be defined by the heat exchanging area ratio or by the heat exchanging channel ratio in the heat exchanger. Further, α_2 and β_2 may be defined by the position dividing ratio of the separator in blow-out port 2b.

[0064] For example, it may be defined with α_1 representing the heat exchange area or the heat exchanging channel ratio in second heat exchanging region Y, and β_1 representing the heat exchange area or the heat exchanging channel ratio in first heat exchanging region X. Here, α_2 and β_2 are each defined as an angle representing spreading in the vertical direction, the origin of which spreading is the intersection of a tangent at the most downstream point of blow-out port 2b in rear guider 8 and a tangent at the most downstream point of blow-out port 2b in stabilizer 9. α_2 may be defined as an angle representing spreading in the vertical direction of the first blow-out port (front-side blow-out region FA) formed between upper level blade 31 and middle level blade 32. β_2 may be defined as an angle representing spreading in the vertical direction of the second blow-out port (rear-side blow-out region RA) formed between middle level blade 32 and lower level blade 33. Further, α_2 and β_2 may be defined by the ratio between the opposing distance from middle level blade 32 which is the separator in blow-out port 2b to upper level blade 31 and the opposing distance from middle level blade 32 to lower level blade 33 in the state where the blow-out direction surfaces of the three-level structure blades of vertical wind direction louver 30 are arranged in parallel to each other.

Separate Blow Control by Wind Direction Louver Assembly

[0065] Next, a description will be given of separate blow control using wind direction louver assembly 3 provided in blow-out port 2b of the air conditioner according to the first exemplary embodiment. As described above, vertical wind direction louver 30 of wind direction louver assembly 3 has the three-level structure of the upper, middle, and lower levels, namely, upper level blade 31, middle level blade 32, and lower level blade 33. Further, middle level blade 32 having the function of the separator is divided into two pieces at its center in the horizontal direction, and thus has middle-level left blade 32a and middle-level right blade 32b. The blades of vertical wind direction louver 30 are driven by a drive motor, e.g., a stepping motor, which is connected at one of right and left ends of the rotation center axis of each blade. Accordingly, upper level blade 31, lower level blade 33, and middle-level left blade 32a and middle-level right blade 32b of middle level blade 32 can vertically rotate independently of each other, thereby setting the wind direction from blow-out port 2b to any desired vertical direction.

[0066] Further, horizontal wind direction louver 40 has the upper-lower two-level structure which includes upper horizontal blades 40a disposed at upper blow-out region FA (the first blow-out port) formed between upper level

blade 31 and middle level blade 32, and lower horizontal blades 40b disposed at lower blow-out region BA (the second blow-out port) formed between middle level blade 32 and lower level blade 33. Upper horizontal blades 40a are structured by a plurality of horizontal wind direction changing blades of a substantially identical shape being horizontally juxtaposed. Upper horizontal blades 40a are divided into a left-region blade group and a right-region blade group at the center. Similarly, lower horizontal blades 40b are structured by a plurality of horizontal wind direction changing blades of a substantially identical shape being horizontally juxtaposed. Further, lower horizontal blades 40b are divided into a left-region horizontal blade group and a right-region horizontal blade group at the center.

[0067] Upper horizontal blades 40a disposed at upper blow-out region FA (the first blow-out port) are divided into upper left blades 41a which are the left-region horizontal blade group and upper right blades 41b which are the right-region horizontal blade group. The horizontal wind direction changing blades of respective upper left blades 41a and upper right blades 41b are coupled to separate coupling bars so that the blades of each group are interlocked. Accordingly, respective horizontal blade groups of upper left blades 41a and upper right blades 41b horizontally rotate independently of each other, thereby specifying the upper-side air blow-out direction from blow-out port 2b separately between right and left.

[0068] Lower horizontal blades 40b disposed at lower blow-out region BA (the second blow-out port) are divided into lower left blades 42a which are the left-region horizontal blade group and lower right blades 42b which are the right-region horizontal blade group. The horizontal wind direction changing blades of respective lower left blades 42a and lower right blades 42b are coupled to separate coupling bars so that the blades of each group are interlocked. Accordingly, respective the horizontal blade groups of lower left blades 42a and lower right blades 42b horizontally rotate independently of each other, thereby specifying the lower-side air blow-out direction from blow-out port 2b separately between right and left.

[0069] These coupling bars are respectively coupled to the rotation shaft of separate drive motors for the horizontal wind direction louver, e.g., stepping motors. The rotation of the drive motors causes the horizontal wind direction changing blades of the right and left blade groups horizontally change the direction.

[0070] In the air conditioner shown in FIG. 2, vertical wind direction louver 30 shows a certain state in the heating operation mode, in which upper level blade 31, middle level blade 32, and lower level blade 33 have rotated in a diagonally front downward direction. On the other hand, middle-level left blade 32a and middle-level right blade 32b divided into the left and right pieces are oriented differently. The upper blow-out left region between upper level blade 31 and middle-level left blade 32a is formed narrower as compared to the upper blow-out right region

between upper level blade 31 and middle-level right blade 32b, and middle-level left blade 32a is oriented less downward as compared to middle-level right blade 32b. Such a disposition of middle-level left blade 32a and middle-level right blade 32b causes the air blow-out direction from the upper blow-out left region to be higher than the air blow-out direction from the upper blow-out right region. Since the upper blow-out left region is narrower than the upper blow-out right region, the wind velocity increases by the corresponding amount and the reaching distance increases.

[0071] Further, in the air conditioner shown in FIG. 2, both the upper horizontal blades 40a and lower horizontal blades 40b of horizontal wind direction louver 40 separately blow air in the left and right directions, respectively. That is, upper left blades 41a in upper horizontal blades 40a are disposed so as to blow air on the left hand of an observer facing the air conditioner, and upper right blades 41b are disposed so as to blow air on the right hand of the observer facing the air conditioner. Accordingly, in upper blow-out region FA (the first blow-out port), the air from the upper blow-out left region is blown in the left side of the room, and the air from the upper blow-out right region is blown in the right side of the room.

[0072] Further, lower left blades 42a in lower horizontal blades 40b are disposed to blow air on the left hand of an observer facing the air conditioner, and lower right blades 42b are disposed so as to blow air on the right hand of the observer facing the air conditioner. Accordingly, in lower blow-out region BA (the second blow-out port), the air from the lower blow-out left region is blown in the left side, and the air from the lower blow-out right region is blown in the right side.

[0073] As a result, with the air conditioner shown in FIG. 2 in the heating operation mode, the high-temperature air from the lower blow-out right region is blown relatively strongly in the right-hand room region with reference to an observer facing the air conditioner, and the middle-temperature air from upper blow-out left region is blown out relatively strongly in the left-hand room region with reference to the observer facing the air conditioner.

[0074] FIGS. 13 and 14 are perspective views each showing exemplary rotation positions of vertical wind direction louver 30 and horizontal wind direction louver 40 of wind direction louver assembly 3 of the air conditioner according to the first exemplary embodiment. FIGS. 13 and 14 show the front side of indoor unit 1 where blow-out port 2b and the like of the air conditioner appear, as seen from the lower side.

[0075] In the air conditioner shown in FIG. 13, the three-level blades of vertical wind direction louver 30, namely, upper level blade 31, middle level blade 32, and lower level blade 33 are disposed substantially in parallel to each other so as to be oriented substantially in the identical direction. As shown in FIG. 13, middle-level left blade 32a and middle-level right blade 32b, which are divided into left and right pieces and structure as a whole middle level blade 32 being the separator, are oriented

in the identical direction and disposed in a manner of a single blade as a whole. Upper horizontal blades 40a of both the left and right groups in horizontal wind direction louver 40 shown in FIG. 13 are disposed so as to blow the air from upper blow-out region FA in the right-hand region of the room. Further, lower horizontal blades 40b of both the left and right groups are disposed so as to blow the air from lower blow-out region BA in the left-hand region of the room.

[0076] With the air conditioner shown in FIG. 14, similarly to FIG. 13, upper level blade 31, middle level blade 32, and lower level blade 33 of vertical wind direction louver 30 are disposed substantially in parallel to each other so as to be oriented substantially in the identical direction. Both upper horizontal blades 40a and lower horizontal blades 40b of horizontal wind direction louver 40 shown in FIG. 14 are disposed so as to blow air separately between the left and right directions, as shown in FIG. 2.

[0077] As described above, with the air conditioner according to the first exemplary embodiment, wind direction louver assembly 3 structured by vertical wind direction louver 30 of the upper, middle, and lower three-level structure and horizontal wind direction louver 40 of the upper-lower two-level structure provided in blow-out port 2b realize separate blowing of the middle-temperature air and the high-temperature air from upper blow-out region FA which is the first blow-out port and from lower blow-out region BA which is the second blow-out port in any desired directions. Further, the upper and lower parts of horizontal wind direction louver 40 are each divided into two pieces so as to cause the air to be separately blown in the right and left directions. Accordingly, blow-out port 2b of the air conditioner according to the first exemplary embodiment is the blow-out region which is divided in quarters of upper, lower, right and left regions, which may be set to blow air in different directions from each other. Accordingly, the structure of the air conditioner according to the first exemplary embodiment can condition the air so that any air-conditioning target region in the room attains a desired temperature.

Mini Blade

[0078] As shown in FIGS. 13 and 14, mini blades 20 are respectively formed at middle-level left blade 32a and middle-level right blade 32b which structure middle level blade 32 being the separator. Mini blades 20 are formed on the upstream side on the upper surface side of middle-level left blade 32a and middle-level right blade 32b. Mini blades 20 are provided in parallel to the upper surfaces of middle-level left blade 32a and middle-level right blade 32b with a predetermined clearance. Mini blades 20 are each formed by a thin elongated plate, and supported by a plurality of supporters 20a projectively provided at the upper surfaces of middle-level left blade 32a and middle-level right blade 32b. Supporters 20a supporting mini blades 20 are each structured by a short thin plate so as

to create smooth airflow in the clearance between the upper surfaces of middle-level left blade 32a and middle-level right blade 32b and mini blades 20.

[0079] FIGS. 15A and 15B describe the effect of mini blades 20 in wind direction louver assembly 3 of the air conditioner according to the first exemplary embodiment. FIG. 15B is a cross-sectional view showing the area around mini blades 20 formed at the upper surface of middle level blade 32 in blow-out port 2b. FIG. 15A shows the airflow from blow-out port 2b in the case where the mini blades are not provided at middle level blade 320. FIG. 15B shows the airflow from blow-out port 2b in the case where mini blades 20 are provided at middle level blade 32.

[0080] As shown in FIGS. 15A and 15B, the air from airflow passage 7 is separately blown out from blow-out port 2b as two flows. That is, one of the flows is blown out from upper blow-out region FA formed between upper level blade 31 and middle level blade 32/320, and the other flow is blown out from lower blow-out region BA formed between middle level blade 32/320 and lower level blade 33. However, as shown in FIG. 15A, in the case where the mini blades are not provided at middle level blade 320, for example when the air from airflow passage 7 is directed further downward by the blades such as in the heating operation mode, the air from airflow passage 7 hits the upstream end of middle level blade 320 and leaves the blade surface without flowing along the blade surface, becoming turbulent flow such as vortex generated on the upper surface side of middle level blade 320. In this manner, turbulent flow such as vortex generated in upper blow-out region FA between upper level blade 31 and middle level blade 320 may influence the air from lower blow-out region BA between middle level blade 320 and lower level blade 33, causing the air from upper blow-out region FA and air from lower blow-out region BA to mix with each other. As a result, disadvantageously, the middle-temperature air from upper blow-out region FA and the high-temperature air from lower blow-out region BA cannot be separately blown. In order to solve such a problem, in the air conditioner according to the first exemplary embodiment, mini blades 20 are provided to middle level blade 32.

[0081] As shown in FIG. 15B, in the case where mini blades 20 are provided at middle level blade 32, for example when the air from airflow passage 7 is directed further downward by the blades such as in the heating operation mode, the air from airflow passage 7 is guided by vertical wind direction louver 30 and blown downward from upper blow-out region FA (the first blow-out port) and lower blow-out region BA (the second blow-out port). At this time, the air from airflow passage 7 does not leave the blade surface of middle level blade 32 particularly by virtue of mini blades 20 provided at the upstream end of middle level blade 32, being free of vertex or the like on the upper surface side of middle level blade 32. Thus, the air flows smoothly on the upper surface side of middle level blade 32. As a result, the middle-temperature air

from upper blow-out region FA (the first blow-out port) and the high-temperature air from lower blow-out region BA (the second blow-out port) can be surely blown out separately. Note that, while the foregoing description has been given of the effect of regularizing the airflow exhibited by mini blades 20 in the case where, as in the heating operation mode, the air from airflow passage 7 is directed downward by middle level blade 32, it has been verified that mini blades 20 exhibit the airflow regularizing effect in upper blow-out region FA (the first blow-out port) also in the case where middle level blade 32 is at other position by rotation.

Thermal Sensation Sensing Control

[0082] With the air conditioner according to the first exemplary embodiment, the driving of the air conditioner is controlled based on various kinds of information obtained from human sensor 10, thermal sensation sensor 11, a floor temperature sensor, a sunlight sensor, and a plurality of temperature sensors detecting the temperature of several sites in heat exchanger 5.

[0083] For example, human sensor 10 and thermal sensation sensor 11 detect the presence of a human, the shifting of a human, and thermal image information based on infrared rays from the air-conditioning target region in the room. Thermal sensation is sensed according to thermal image information acquired by the thermopile sensor which is thermal sensation sensor 11 of the air conditioner according to the first exemplary embodiment.

[0084] The air conditioner according to the first exemplary embodiment is structured to sense "thermal sensation" of a human in the air-conditioning target region based on the thermal image information obtained from thermal sensation sensor 11. Here, as the index of "thermal sensation" representing "hot" and "cold" feeling that a human feels, generally, the PMV (Predicted Mean Vote) scale is often used. The PMV scale employs the 7-point thermal sensation scale ranging from "+3 (hot)" to "-3 (cold)". The first exemplary embodiment employs the 9-point thermal sensation scale proposed by the Subcommittee of Thermal Sensation of the Society of Heating, Air-Conditioning and Sanitary Engineers of Japan as the thermal sensation scale. The 9-point assessment scale adds "+4 (very hot)" and "-4 (very cold)" respectively to the positive and negative points of the PMV scale. Using this thermal sensation scale, the first exemplary embodiment exerts thermal sensation sensing control, which will be described later.

[0085] Note that, in the description of the first exemplary embodiment given below, "thermal sensation" refers to numerical values within the range of "-4" to "+4" of the thermal sensation scale. Similarly, as to the terms relating to "thermal sensation" such as "average thermal sensation", "standard thermal sensation", and "sensed thermal sensation" which will appear later, they also refer to the numerical values within the range of "-4" to "+4" of the thermal sensation scale.

[0086] In the thermal sensation sensing control exerted by the air conditioner according to the first exemplary embodiment, air conditioning control is exerted specifying that "thermal sensation" that the general people generally feel with the temperature set to the air conditioner is "standard thermal sensation". Further, the thermal sensation sensing control is exerted employing this "standard thermal sensation" as "target thermal sensation". In the thermal sensation sensing control of the first exemplary embodiment, temperature shift control and separate blow control are exerted so that the difference from the "standard thermal sensation" falls within " ± 0.5 ", which is the target thermal sensation zone. The temperature shift control and the separate blow control will be described later. Note that, there is an experimental result showing that 80% people do not feel uncomfortable within thermal sensation scale " ± 1 ", on PPD (Predicted Percentage of Dissatisfied). Based on the experimental result, the thermal sensation sensing control of the first exemplary embodiment is exerted so that the difference from the "target thermal sensation" on the thermal sensation scale falls within a range of " ± 0.5 ".

[0087] In the room being the air conditioning target, in the case where a human is in a resting state and where a human's activity amount is small, with the air conditioning operation being fully stable, obtaining the difference ($t_{cl} - t_r$) between a human body surface temperature (t_{cl}) and a wall surface temperature (t_r) makes it possible to estimate his/her heat radiation amount (H).

[0088] When a human's heat radiation amount (H) and his/her metabolic rate (thermogenesis amount M) balance with each other ($H = M$), it can be estimated that his/her heat balance is well and he/she is feeling comfortable. On the other hand, when the heat radiation amount (H) is greater than the metabolic rate (thermogenesis amount M) ($H > M$), it can be estimated that he/she is feeling cold corresponding to the degree of the greatness. Conversely, when heat radiation amount (H) is smaller than the metabolic rate ($H < M$), it can be estimated that he/she is feeling hot.

[0089] Accordingly, in the case where a human is in a resting state and where a human's activity amount is small, his/her "thermal sensation" can be sensed in a contactless manner by: extracting the ambient temperature, and the human body surface temperature and the ambient wall surface temperature from thermal image information obtained from the thermopile sensor being thermal sensation sensor 11; and sensing his/her heat radiation amount (H).

[0090] The air conditioner according to the first exemplary embodiment exerts air conditioning control by: sensing a human's heat radiation amount in a contactless manner when his/her activity amount is small or he/she is in a resting state; and sensing his/her "thermal sensation" based on the estimated heat radiation amount. However, it is difficult to specify the region where the human is present (the human existing region) in the air-conditioning target region (the residential space) just with the

thermal image information obtained from thermal sensation sensor 11. Further, it is difficult to determine whether or not the human's activity amount is small or he/she is in a resting state.

[0091] Accordingly, the thermal sensation sensing control based on thermal sensation sensing with the air conditioner according to the first exemplary embodiment is structured to sense the presence/position of a human in the air-conditioning target region, his/her active state, and his/her "thermal sensation" using, in conjunction with the temperature distribution information from the thermal image information obtained from the thermopile sensor which is thermal sensation sensor 11, human body detection information obtained from a plurality of infrared sensors of human sensor 10, and temperature information obtained from other sensor relating to the air-conditioning target region.

[0092] Note that, while the description is given based on that the air conditioner according to the first exemplary embodiment exerts the thermal sensation sensing control using the thermal image information obtained from thermal sensation sensor 11, the human body detection information obtained from human sensor 10, and temperature information (room temperature information) from a plurality of temperature sensors (such as a room temperature sensor and a floor temperature sensor), the present disclosure is not limited thereto. The air conditioner may exert the air conditioning control according to the first exemplary embodiment by acquiring room temperature information from the thermal image information of thermal sensation sensor 11, and using thermal image information obtained from thermal sensation sensor 11 and the human body detection information obtained from human sensor 10.

[0093] Note that, in the first exemplary embodiment, the description is given of the case where a human is in a resting state and where a human's activity amount is small, that is, the case where the metabolic rate (thermogenesis amount M) can be regarded as a substantially constant value. In the case where the activity amount is greater than the certain value, the metabolic rate (thermogenesis amount M) corresponding to the activity amount should be calculated. Then, by comparing the calculated metabolic rate (thermogenesis amount M) against his/her heat radiation amount H, the "thermal sensation", i.e., whether he/she is feeling hot or cold, should be sensed.

[0094] As shown in FIG. 2, human sensor 10 according to the first exemplary embodiment is structured by three infrared sensors being horizontally juxtaposed on the left end side of the front surface of indoor unit 1. Human sensor 10 is, for example, a pyroelectric infrared sensor that senses presence/absence of a human by sensing infrared rays radiated from the human body. In the air conditioner according to the first exemplary embodiment, the infrared sensors of human sensor 10 output a pulse signal in accordance with a change in the sensed infrared ray amount, and controller 50 determines presence/ab-

sence of a human based on the pulse signal.

[0095] In the air conditioner according to the first exemplary embodiment, whether a human in the air-conditioning target region is in a resting state where he/she little moves, or in an active state where he/she actively moves is determined, based on a signal output from human sensor 10. Specifically, controller 50 determines the magnitude of a human's activity amount or a resting state, based on a signal output from human sensor 10 within a predetermined detecting time (e.g., two minutes).

[0096] Further, in the air conditioner according to the first exemplary embodiment, the human body position determining region in the air-conditioning target region is divided into plurality of sensing regions based on signals output from the three infrared sensors of human sensor 10. In the air conditioner, the regions respectively sensed by the three infrared sensors of human sensor 10 overlap each other. Based on signals from respective infrared sensors, presence/absence of a human in each of a plurality of sensing regions in the air-conditioning target region is detected.

[0097] In the case where it is determined that a human's activity amount is "small" or a human is in a "resting state", "thermal sensation" of the human in each sensing region is determined, and thus the sensing process in all the human body position determining regions completes.

Air Conditioning Control by Thermal Sensation Sensing

[0098] As has been described above, every time the "thermal sensation" of all the regions (all the human body position determining regions) in the air-conditioning target region is determined, the air conditioning control by thermal sensation sensing, which is described below, is executed. Note that, the air conditioning control by thermal sensation sensing is executed after the air conditioner starts the air conditioning operation and learns, from the temperature information of a plurality of various temperature sensors, that the temperature in the room being the air conditioning target has entered a stable state satisfying a certain condition as to the set conditions. When the air conditioner starts the air conditioning operation, it is the normal operation mode in which: pressure adjuster 12 of heat exchanger 5 of indoor unit 1 does not perform pressure adjustment; and first heat exchanging region X and second heat exchanging region Y perform one combined heat exchanging operation, substantially performing the one-temperature heat exchanging operation (the one-temperature operation mode).

[0099] FIG. 16 is a flowchart showing filtering processes (exclusion determining processes) of the thermal sensation sensing control executed in the air conditioner according to the first exemplary embodiment. The filtering processes are processes performed based on the thermal image information obtained from thermal sensation sensor 11, and are exclusion determining processes performed for each human information in the room being the air conditioning target.

[0100] In step 101 in FIG. 16, a "thermal sensation sensor start determination" is made, in which whether or not the temperature of the air conditioning target room reaches a predetermined temperature, for example, the current set temperature. The "thermal sensation sensor start determination" in step 101 is one filtering process performed in order not to exert the thermal sensation sensing control until the room temperature reaches a predetermined temperature. In the first exemplary embodiment, the current set temperature in the air conditioner is employed as the predetermined temperature which is the threshold value in the "thermal sensation sensor start determination". When the room temperature reaches the predetermined temperature, the filtering process for each human information is started (step 102).

[0101] In step 103, a "thermal sensation abnormal value excluding determination" is made. The "thermal sensation" of the human thermal sensation scale according to the first exemplary embodiment is an index within a range of " ± 4 ". However, since controller 50 simply calculates the "thermal sensation" in the room being the air conditioning target based on the thermal image information obtained from thermal sensation sensor 11, controller 50 may derive a numerical value that cannot be human's "thermal sensation". That is, when controller 50 derives by calculation a value as "thermal sensation" that exceeds "+4" or that is less than "-4", controller 50 determines such values as irregular data (unnecessary data) and excludes the calculation result. In step 103, it is determined whether the sensed "thermal sensation" of the thermal sensation scale falls within a normal value range from "-4" to "+4" inclusive.

[0102] In step 104, a "human detection correctness excluding determination" is made. Controller 50 extracts a human region temperature from two-dimensional thermal image information obtained from thermal sensation sensor 11, based on the difference between the background temperature being the reference and the human region temperature, and calculates the "thermal sensation" of a human in the room being the air conditioning target. Accordingly, when the sampling count of the background temperature is low, such as at a time point immediately after thermal sensation sensor 11 starts measurement, the detection precision of the "thermal sensation" reduces. Accordingly, in the air conditioning control by thermal sensation sensing according to the first exemplary embodiment, any information with low sampling count is excluded. In step 104, whether or not the sampling count is equal to or higher than a predetermined count is determined, in order to exclude the case with low sampling count of the background temperature.

[0103] In step 105, a "human sensor detecting region excluding determination" is made. The thermal sensation sensing control is exerted in conjunction with the human position determination result according to the human body detection information obtained from human sensor 10. Accordingly, the information indicative of any "thermal sensation" calculated from the thermal image information

mation in a region where no human is present according to the human position determination result from human sensor 10 cannot be employed as information for exerting the air conditioning control by thermal sensation sensing. Therefore, the calculation result indicative of such "thermal sensation" is excluded. In step 105, when any "thermal sensation" is sensed in a region where no human is present according to the human position determination result from human sensor 10, this information is excluded.

[0104] In step 106, a "thermal sensation sensor detecting region excluding determination" is made. Since thermal sensation sensor 11 is a thermopile sensor, it cannot accurately sense "thermal sensation" as to the position spaced apart by a predetermined distance or greater. Then, for example in the case where the floor distance to a target human with whom the "thermal sensation" is calculated exceeds the predetermined distance, this "thermal sensation" is not accurate and thus the calculation result in this case is excluded. Further, when the human position is too near, the area occupied by the human in the thermal image information becomes extremely great and the "thermal sensation" cannot be accurately sensed. Therefore, in the case where an angle formed between a horizontal plane of a detecting part of human sensor 10 and a line connecting between the detecting part and the human feet position (the floor surface) exceeds a predetermined angle, the area occupied by the human in the thermal image information is great and the "thermal sensation" cannot be sensed accurately. Thus, the calculation result in this case is excluded. In step 106, for example, a determination is made as to whether or not the floor distance with whom the "thermal sensation" is calculated is within a predetermined distance, and an angle formed between the horizontal plane of the position of the detecting part of human sensor 10 and a line connecting between the detecting part and the human feet position (the floor surface) is within a predetermined angle.

[0105] In step 107, a "human information region allocation" is performed. In the filtering processes (the exclusion determining processes) in steps 103 to 106, the human information (information on a human's "thermal sensation") having passed through the filtering processes is allocated to a plurality of human body position determining regions in the room being the air conditioning target, and converted to "thermal sensation" for each human body position determining region. Note that, when a plurality of pieces of human information exist in an identical region, the average value of the "thermal sensation" of that region is employed as the region's "thermal sensation (average thermal sensation)".

[0106] Note that, the human information (information on a human's "thermal sensation") which has been determined as not applicable in steps 103 to 106 is discarded. In step 109, completion of the filtering processes on the sensed human information is checked, and control transits to the next filtering process for each human body

position determining region (step 110).

[0107] In step 111, a "human position excluding determination" is made. Since thermal sensation sensor 11 is a thermopile sensor, thermal sensation sensor 11 may erroneously recognize a motionless heat source (for example, a television set, a floor lamp and the like) as a human. Accordingly, in step 111, collating with the human body detection information obtained from human sensor 10 which sense a movement of a human, when it is determined that the sensed "thermal sensation" is in the region where no human is present according to the human body detection information, this measurement result obtained from thermal sensation sensor 11 is excluded. In step 111, it is determined as to whether or not a human is present according to the human body detection information in the corresponding region where the "thermal sensation" is sensed according to the thermal image information obtained from thermal sensation sensor 11. When the "thermal sensation" is sensed in the region where no human is present according to the human body detection information, such sensing information is discarded.

[0108] In step 112, a "block activity amount excluding determination" is made. In the air conditioning control by thermal sensation sensing according to the first exemplary embodiment, the index of the thermal sensation scale is set based on that a human is in a resting state or a human's activity amount is "small". Therefore, in the case where a human in the air-conditioning target region is performing an activity of a certain level or greater (activity amount > small), control is switched from the control based on sensing a human's "thermal sensation" according to the thermal image information obtained from thermal sensation sensor 11 to a control of estimating a human's activity amount ("great", "medium", "small" or "resting state") based on the human detected response count according to the human body detection information obtained from human sensor 10. Specifically, whether or not a human is present is determined based on signals that correspond to any change in the infrared ray amount sensed by the infrared sensors of human sensor 10, and the human's activity amount ("great", "medium", "small" and "resting state") is estimated based on the human detected response count in the human body position determining regions within a predetermined time (for example, two minutes).

[0109] As has been described above, in step 112, whether or not a human's activity amount is less than "medium" is determined, based on the human body detection information obtained from human sensor 10. That is, whether or not a human's activity amount is equal to or smaller than "small" (including a "resting state") is determined. In step 112, when it is determined that the human's activity amount is "small" or a "resting state", the "thermal sensation" of the human in each region is determined in step 113, to complete the filtering processes of all the regions (step 115).

[0110] The filtering processes of all the regions in ther-

mal sensation sensing in steps 101 to 115 are performed every time thermal sensation sensor 11 acquires thermal image information. Thus, with the air conditioner, "thermal sensation" in all the regions is constantly precisely monitored and determined.

[0111] FIG. 17 is a flowchart showing air conditioning control based on thermal sensation sensed in the above-described manner. In step 201 of FIG. 17, whether or not the sensed "thermal sensation" is distributed in a plurality of sensing regions, that is, whether or not humans are present in a plurality of sensing regions is determined. When the sensed "thermal sensation" is present in a plurality of sensing regions, in step 202, a determination is made as to whether or not the plurality of sensing regions where the presence of humans is detected differ from each other in "thermal sensation" by a predetermined value or greater. When the difference among the plurality of sensing regions in "thermal sensation" is equal to or greater than the predetermined value, it is determined that the separate blow control is necessary, and pressure adjuster 12 is driven to enter the two-temperature operation mode (step 203). For example, in the heating operation, pressure adjuster 12 is caused to reduce pressure so that heat exchange to attain the high temperature (for example, from 35°C to 55°C) is carried out at first heat exchanging region X, and heat exchange to attain the middle temperature (the temperature lower than the high temperature by a predetermined temperature) is carried out at second heat exchanging region Y. The temperature of first heat exchanging region X and second heat exchanging region Y in heat exchanger 5 at this time is detected by a plurality of temperature sensors 18a, 18b (see FIG. 4) and input to controller 50, to be used in air conditioning control.

[0112] In step 204, the separate blow control (wind direction control and wind volume control) is exerted on corresponding sensed regions by vertical wind direction louver 30, horizontal wind direction louver 40 and indoor-side fan 6 in accordance with the difference in "thermal sensation" determined in step 202. That is, controller 50 controls the wind direction and/or the wind volume so that "thermal sensation" of the humans in respective sensed regions becomes uniform and/or becomes "standard thermal sensation" that is determined by the current set temperature. For example, vertical wind direction louver 30 and horizontal wind direction louver 40 rotate to change the blow-out ratio, so that, in the regions differing from each other in "thermal sensation", the difference in "thermal sensation" becomes equal to or smaller than a predetermined value (for example, 0.5).

[0113] Note that, in the first exemplary embodiment, the "standard thermal sensation" refers to "thermal sensation" that general people feel when the room temperature is at the set temperature. For example, the "standard thermal sensation" that general people feel when the set temperature is 20°C is approximately "-1", and the "standard thermal sensation" that general people feel when the set temperature is 25°C is approximately "+1".

Further, this "standard thermal sensation" may be changed according to seasons.

[0114] On the other hand, in step 201, when the sensed "thermal sensation" is not distributed in a plurality of regions and a plurality of humans are present in one region, "average thermal sensation" of the region where the plurality of humans are present is calculated (step 205). The "average thermal sensation" is also applied in step 202 to the case where a plurality of pieces of "thermal sensation" respectively exist in a plurality of regions, and the "average thermal sensation" is calculated for each region.

[0115] In step 206, a determination is made as to whether or not the difference between the calculated "average thermal sensation" and the "standard thermal sensation" determined by the current set temperature is equal to or greater than a predetermined value, for example, whether or not the difference exceeds " ± 1 ". When the difference between the "average thermal sensation" and the "standard thermal sensation" is equal to or greater than the predetermined value, controller 50 exerts air conditioning control by changing the wind direction and/or the wind volume to the air-conditioning target region and/or shifting the target temperature (temperature shift control), so that the difference between the "average thermal sensation" and the "standard thermal sensation" falls within the target thermal sensation zone, i.e., within " ± 0.5 " (step 207).

[0116] The air conditioning control in steps 201 to 207 is exerted every predetermined time, and air conditioning control based on thermal sensation sensing corresponding to a human's activity amount is exerted. Accordingly, in the case where the presence of a human become extinct, the air conditioning control by thermal sensation sensing may be ended.

[0117] Note that, the thermal image information according to the first exemplary embodiment transmitted from thermal sensation sensor 11 to controller 50 includes data such as the number of detected humans, positions of the humans, and their "thermal sensation".

Separate Blow Control with Air Conditioner

[0118] As has been described above, the air conditioner according to the first exemplary embodiment specifies a human existing region in the room being the air conditioning target based on the human body detection information obtained from human sensor 10 and thermal image information obtained from thermal sensation sensor 11, and estimates human's "thermal sensation" based on a radiation amount of a human in the human existing region. Then, the air conditioner exerts air conditioning control so as to attain the "standard thermal sensation", which is the thermal sensation that general people feel "comfortable", at the temperature set by that human.

[0119] As has been described above, the air conditioner according to the first exemplary embodiment includes vertical wind direction louver 30 structured by a plurality

of blades that vertically change the wind blow-out direction, and horizontal wind direction louver 40 that is structured by a plurality of blades that horizontally change the blow-out wind direction. Further, vertical wind direction louver 30 has a three-level structure, namely, upper level blade 31, middle level blade 32, and lower level blade 33. Middle level blade 32 is divided into two pieces at its center in the horizontal direction (middle-level left blade 32a, middle-level right blade 32b). Horizontal wind direction louver 40 has an upper-lower two-level structure which includes upper horizontal blades 40a disposed at upper blow-out region FA (the first blow-out port) formed between upper level blade 31 and middle level blade 32, and lower horizontal blades 40b disposed at lower blow-out region BA (the second blow-out port) formed between middle level blade 32 and lower level blade 33. Further, upper horizontal blades 40a and lower horizontal blades 40b are divided into a left-region blade group and a right-region blade group at the center, so that wind can be blown separately between right and left directions.

[0120] As has been described above, in the air conditioner according to the first exemplary embodiment, blow-out port 2b is divided into upper and lower blow out ports, namely, upper blow-out region FA (the first blow-out port) and lower blow-out region BA (the second blow-out port), from each of which upper and lower regions air can be separately blown in the right and left directions. Therefore, controller 50 exerts the separate blow control on wind direction louver assembly 3, based on a human existing region that is specified based on the human body detection information obtained from human sensor 10 and the thermal image information obtained from thermal sensation sensor 11, and the sensed "thermal sensation" of the human in the human existing region.

[0121] In the following, a description will be given of Specific Examples [1] to [5] of the separate blow control of wind direction louver assembly 3 of the air conditioner according to the first exemplary embodiment. Note that, the following Examples [1] to [4] are the cases where, in the heating operation mode, a human is present in each of the right and left regions in the room being the air conditioning target, and the separate blow control is exerted based on the sensed "thermal sensation" of each of the humans. Further, Example [5] is the case where, in the heating operation mode, a human is present in the room being the air conditioning target, and the separate blow control is exerted when the human's activity amount is great and when it is small.

[1] Firstly, in the air conditioner of Specific Example 1, controller 50 determines that both humans respectively present in the right and left regions in the room being the air conditioning target are feeling "comfortable". In this case, pressure adjuster 12 provided at the refrigerant pipeline connecting between first heat exchanging region X and second heat exchanging region Y is set so as not to perform pressure adjustment, and heat exchanger 5 functions as a single

heat exchanger, whereby the "one-temperature operation mode" is entered. Here, air is blown out from upper blow-out region FA and lower blow-out region BA of wind direction louver assembly 3 at a substantially identical temperature between upper blow-out region FA and lower blow-out region BA, and upper horizontal blades 40a and lower horizontal blades 40b each horizontally oscillate continuously. Alternatively, in order to cause the air to be blown in the right and left regions where the humans are present, upper left blades 41a and lower left blades 42a may be oriented to the left region and upper right blades 41b and lower right blades 42b may be oriented to the right region, that is, they may be rotated so as to be allocated to their respective directions, and the blow-out operation may be carried out with the blades being fixed to that positions.

[2] In the air conditioner of Specific Example 2, the difference in the "thermal sensation" between the humans respectively present in the right and left regions in the room being the air conditioning target is equal to or greater than " ± 1 " and controller 50 determines that the human in the left region is feeling "cold" and the human in the right region is feeling "comfortable". In this case, pressure adjuster 12 is set to reduce the pressure. As a result, heat exchanger 5 enters the "two-temperature operation mode", in which heat is exchanged at first heat exchanging region X and second heat exchanging region Y to attain different temperatures (the high temperature and the middle temperature). Accordingly, the blow-out direction of upper horizontal blades 40a and that of lower horizontal blades 40b are set such that the middle-temperature air is blown out into the right region from upper blow-out region FA in wind direction louver assembly 3, and the high-temperature air is blown out into the left region from lower blow-out region BA. Note that, under such setting, an experiment conducted by the inventor showed a floor temperature difference (the temperature measured at a height of 10 cm from the floor) of 3°C between the right region and the left region.

[3] In the air conditioner of Specific Example 3, the difference in the "thermal sensation" between the humans respectively present in the right and left regions in the room being the air conditioning target is equal to or greater than " ± 1 " and controller 50 determines that the human in the left region is feeling "cold" and the human in the right region is feeling "a bit warm". In this case, pressure adjuster 12 is set to reduce the pressure, and heat exchanger 5 enters the "two-temperature operation mode". The blow-out direction of lower horizontal blades 40b is set such that the high-temperature air is blown out into the left region from lower blow-out region BA in wind direction louver assembly 3. Further, the middle-temper-

ature air blown out from upper blow-out region FA is blown out into the left region by upper left blades 41a of upper horizontal blades 40a, and blown into the right region by upper right blades 41b. That is, upper horizontal blades 40a in upper blow-out region FA is set to separately blow in the right and left directions. Under such setting, an experiment conducted by the inventor showed a floor temperature difference of 5°C between the right region and the left region.

[4] In the air conditioner of Specific Example 4, the difference in the "thermal sensation" between the humans respectively present in the right and left regions in the room being the air conditioning target is equal to or greater than " ± 1 " and controller 50 determines that the human in the left region is feeling "cold" and the human in the right region is feeling "hot". In this case, pressure adjuster 12 is set to reduce the pressure, and heat exchanger 5 enters the "two-temperature operation mode". The blow-out direction of lower horizontal blades 40b is set such that the high-temperature air is blown out into the left region from lower blow-out region BA in wind direction louver assembly 3. Similarly, the blow-out direction of both the right and left blades of upper horizontal blades 40a is set to the left region such that the middle-temperature air blown out from upper blow-out region FA is blown out into the left region. Under such setting, an experiment conducted by the inventor showed a floor temperature difference of 8°C between the right region and the left region.

[5] In the air conditioner of Specific Example 5, the "two-temperature operation mode" is executed when just a single human is present in the room being the air conditioning target of the heating operation mode. In Specific Example 5, the separate blow control is exerted in the case where a human's activity amount is great (where a shift amount is great) and the case where a human's activity amount is small (where a shift amount is small).

[0122] In the case where a human's shift amount is great, the high-temperature air from lower blow-out region BA in wind direction louver assembly 3 is blown toward the region where the human is present. Simultaneously, upper horizontal blades 40a in upper blow-out region FA is driven to horizontally oscillate so that the middle-temperature air blown out from upper blow-out region FA is blown into the entire room being the air conditioning target. As a result, in the case where a human's shift amount in the room being the air conditioning target is great, the air conditioning to heat the entire room is carried out while still targeting to the human, with reduced variations in the temperature in the room being the air conditioning target.

[0123] On the other hand, when the human's shift

amount in the room being the air conditioning target is small and the human's activity amount is small, the "two-temperature operation mode" is executed toward the region where the human is present. That is, the high-temperature air from lower blow-out region BA is blown toward the region where the human is present. Simultaneously, the middle-temperature air blown out from upper blow-out region FA is also blown toward the region where the human is present. In the air conditioner according to the first exemplary embodiment, the high-temperature air is blown into the human's feet side in the room from lower blow-out region BA by wind direction louver assembly 3, and the middle-temperature air is blown into the region higher than such feet side in the room from upper blow-out region FA. Accordingly, the air conditioner executes the "two-temperature operation mode" in which the heating operation is performed to warm the feet side and keep the head side at a temperature lower than the feet side. Thus, comfort control (the head-cool and feet-warm mode) for the human in the room is exerted. An experiment conducted by the inventor with this air conditioner showed that the temperature around the head of the human in the room being the air conditioning target is 24.9°C when the temperature around the feet is 30.2°C, achieving a temperature difference of 5°C or higher in the head-cool and feet-warm mode.

[0124] As described above, the air conditioner according to the first exemplary embodiment specifies a human existing region in the room being the air conditioning target based on human body detection information obtained from human sensor 10 and thermal image information obtained from thermal sensation sensor 11. The air conditioner senses the human's "thermal sensation", and exerts air conditioning control such that the human's "thermal sensation" becomes the "standard thermal sensation" at the temperature set by the human, which "standard thermal sensation" is the thermal sensation that the general people feel "comfortable". As has been described above, the air conditioner according to the first exemplary embodiment exerts air conditioning control by rotationally controlling the blow-out direction of horizontal wind direction louver 40 to the right and left regions in the room being the air conditioning target. Further, the air conditioner has vertical wind direction louver 30 having the upper, middle, and lower three-level structure blades which vertically change the blow-out direction. Therefore, the air conditioner can be set to blow air into the front and rear regions in the room being the air conditioning target, for example, into each of the region near indoor unit 1 in the room, the region far from indoor unit 1, and the middle region between the near and far regions.

[0125] As described above, vertical wind direction louver 30 has the upper, middle, and lower three-level structure made up of upper level blade 31, middle level blade 32, and lower level blade 33. Middle level blade 32 is divided into two pieces at its center in the horizontal direction (middle-level left blade 32a, middle-level right

blade 32b). Accordingly, by vertical wind direction louver 30 of the three-level structure rotationally disposed at desired vertical positions, air from blow-out port 2b can be blown in the direction of any near and far regions in the room being the air conditioning target. Further, having their respective vertical directions changed, middle-level left blade 32a and middle-level right blade 32b divided into two pieces at the horizontal center of middle level blade 32 can change the vertical blow-out direction and the blow-out velocity (blow-out wind amount) from the quartered blow-out regions in wind direction louver assembly 3 provided in blow-out port 2b. That is, the quartered blow-out regions are: (1) an upper blow-out left region between upper level blade 31 and middle-level left blade 32a; (2) an upper blow-out right region between upper level blade 31 and middle-level right blade 32b; (3) a lower blow-out left region between middle-level left blade 32a and lower level blade 33; and (4) a lower blow-out right region between middle-level right blade 32b and lower level blade 33. In this manner, wind direction louver assembly 3 including vertical wind direction louver 30 and horizontal wind direction louver 40 changing the vertical blow-out direction, the horizontal blow-out direction, and the blow-out velocity (blow-out wind amount) with the quartered blow-out regions realizes separate blowing in front, rear, right and left regions in the room being the air conditioning target, for example, the right and left regions near indoor unit 1, the right and left regions far from indoor unit 1, and right and left middle regions between the near and far regions.

[0126] Further, the "two-temperature operation mode" and the separate blow control of wind direction louver assembly 3 of the air conditioner according to the first exemplary embodiment can carry out air conditioning optimum for a human according to his/her shift amount even when he/she is the only one person present in the room being the air conditioning target.

[0127] As described above, the air conditioner according to the first exemplary embodiment can carry out air conditioning optimum for the room being the air conditioning target, targeting to the human in the room. Thus, avoiding wasteful air conditioning and reducing power consumption, the air conditioner can surely carrying out air conditioning which makes the human in the room feel comfortable.

[0128] As has been described above, the air conditioner of the present disclosure specifies a human existing region where a human is present in an air-conditioning target region based on a signal indicative of a change in an infrared ray amount from a human sensor. The air conditioner exerts the "two-temperature operation mode" and the separate blow control finely with the wind direction louver assembly, to exert air conditioning control comfortable for the human and/or so that thermal sensation of the human in the air-conditioning target region becomes the "standard thermal sensation" that the general people feel at the temperature set by the human in the room, based on the radiation amount from the human

according to thermal image information obtained from the thermal sensation sensor. Thus, the air conditioner can exert precise and human-friendly air conditioning control.

[0129] While the present disclosure has been described in some detail in the exemplary embodiment, the disclosed content of the exemplary embodiment may change in its details of the structure. The combination or orders of elements of the exemplary embodiment may be changed without departing from the scope of the claims.

[0130] The present disclosure provides an air conditioner that can finely exert air conditioning control on a human in an air-conditioning target region that makes the human feel comfortable. Accordingly, the air conditioner is highly practical.

Claims

1. An air conditioner comprising a refrigerant circuit in which a refrigerant circulates through a compressor (13), an indoor-side heat exchanger (5), a pressure reducer (15), and an outdoor-side heat exchanger (16), the air conditioner being structured by an indoor unit (1) and an outdoor unit, wherein the indoor unit (1) includes:

the indoor-side heat exchanger (5) having a first heat exchanging region (X) and a second heat exchanging region (Y);
a pressure adjuster (12) provided between the first heat exchanging region (X) and the second heat exchanging region (Y) and adjusting a refrigerant pressure; and
an indoor-side fan (6) that causes air from an aspiration port formed at an upper part of the indoor unit (1) to exchange heat at the indoor-side heat exchanger (5) and to be formed into airflow blown out from a blow-out port (2b) formed at a lower part of the indoor unit (1),

the second heat exchanging region (Y) and the first heat exchanging region (X) are disposed on an aspiration side of the air conditioner along a rotation direction of the indoor-side fan (6), and

characterized in that

the pressure adjuster (12) in a heating operation mode reduces pressure to cause the first heat exchanging region (X) to function as a first condenser to attain a first condensation temperature, and to cause the second heat exchanging region (Y) to function as a second condenser to attain a second condensation temperature lower than the first condensation temperature.

2. The air conditioner according to claim 1, further comprising
a separator that separates the blow-out port (2b) into
a first blow-out port on a front side of the indoor unit
(1) and a second blow-out port on a back side of the
indoor unit (1),
wherein
in the heating operation mode, air at a first temper-
ature being higher than a room temperature is blown
out from the first blow-out port, and air at a second
temperature being higher than the first temperature
is blown out from the second blow-out port.
3. The air conditioner according to claim 2, further com-
prising:
a rear guider (8) that is provided on a back side
of the indoor-side fan (6) and guides the airflow
from the indoor-side fan (6) to the second blow-
out port; and
a stabilizer (9) that is provided on a front side of
the indoor-side fan (6) so as to oppose to the
rear guider (8) and guides the airflow from the
indoor-side fan (6) to the first blow-out port,
wherein
the separator is provided in the blow-out port
(2b) between the rear guider (8) and the stabi-
lizer (9) to separate the blow-out port (2b) into
the first blow-out port and the second blow-out
port, and
air having exchanged heat at the second con-
densation temperature of the second heat ex-
changing region is mainly blown out from the
first blow-out port, and air having exchanged
heat at the first condensation temperature of the
first heat exchanging region is mainly blown out
from the second blow-out port.
4. The air conditioner according to one of claims 2 and
3, wherein
the separator is horizontally divided into two pieces
so as to be rotatable independently of each other,
and is configured to vertically change respective
blow-out directions of the first blow-out port and the
second blow-out port independently of each other.
5. The air conditioner according to one of claims 2 to
4, further comprising
a wind direction louver assembly (3) that is rotatable
to direct vertically and horizontally the airflow guided
to the blow-out port,
wherein
the wind direction louver assembly (3) has a vertical
wind direction louver (30) and a horizontal wind di-
rection louver (40), and
the vertical wind direction louver (30) is structured
by three-level blades made up of an upper level blade
(31) disposed on a front side in the blow-out port

(2b), a lower level blade (33) disposed on a back
side in the blow-out port (2b), and the separator dis-
posed between the upper level blade (31) and the
lower level blade (33) to serve as a middle level blade
(32), the three-level blades being vertically rotatable
independently of one another.

6. The air conditioner according to one of claims 2 to
4, further comprising
a wind direction louver assembly (3) that is rotatable
to direct vertically and horizontally the airflow guided
to the blow-out port (2b),
wherein
the wind direction louver assembly (3) has a vertical
wind direction louver (30) and a horizontal wind di-
rection louver (40),
the vertical wind direction louver (30) is structured
by three-level blades made up of an upper level blade
(31) disposed on a front side in the blow-out port
(2b), a lower level blade (33) disposed on a back
side in the blow-out port (2b), and the separator dis-
posed between the upper level blade and the lower
level blade (33) to serve as a middle level blade (32),
the three-level blades being vertically rotatable in-
dependently of one another, and
the horizontal wind direction louver (40) includes an
upper horizontal blade (40a) provided between the
upper level blade (31) and the separator, and a lower
horizontal blade (40b) provided between the lower
level blade (33) and the separator.
7. The air conditioner according to claim 6, wherein
the upper horizontal blade (40a) is structured by a
plurality of blades of an identical shape juxtaposed
to each other and divided into right and left blade
groups at a center in a horizontal direction of the
upper horizontal blade (40a), the right and left blade
groups being horizontally rotatable independently of
each other to change blow-out directions horizontal-
ly, and
the lower horizontal blade (40b) is structured by a
plurality of blades of an identical shape juxtaposed
to each other and divided into right and left blade
groups at a center in a horizontal direction of the
lower horizontal blade (40b), the right and left blade
groups being horizontally rotatable independently of
each other to change blow-out directions horizontal-
ly.

Patentansprüche

1. Klimaanlage, die einen Kältemittelkreislauf umfasst,
in dem ein Kältemittel durch einen Verdichter (13),
einen innenseitigen Wärmetauscher (5), einen
Druckminderer (15) und einen außenseitigen Wär-
metauscher (16) zirkuliert,
wobei die Klimaanlage mit einer Inneneinheit (1) und

einer Außeneinheit aufgebaut ist,
wobei die Inneneinheit (1) aufweist:

den innenseitigen Wärmetauscher (5) mit einem
ersten Wärmeaustauschbereich (X) und einem
zweiten Wärmeaustauschbereich (Y);
eine Druckeinstelleinrichtung (12), die zwischen
dem ersten Wärmeaustauschbereich (X) und
dem zweiten Wärmeaustauschbereich (Y) vor-
gesehen ist und einen Kältemitteldruck einstellt;
und
ein innenseitiges Gebläse (6), das bewirkt, dass
Luft von einer Ansaugöffnung, die an einem o-
beren Teil der Inneneinheit (1) ausgebildet ist, an
dem innenseitigen Wärmetauscher (5) Wärme
austauscht und zu einem Luftstrom geformt
wird, der aus einer Ausblasöffnung (2b) ausge-
blasen wird, die an einem unteren Teil der In-
neneinheit (1) ausgebildet ist,

wobei der zweite Wärmeaustauschbereich (Y) und
der erste Wärmeaustauschbereich (X) an einer An-
saugseite der Klimaanlage entlang einer Drehrich-
tung des innenseitigen Gebläses (6) angeordnet
sind, und

dadurch gekennzeichnet, dass

die Druckeinstelleinrichtung (12) in einem Heizbe-
triebsmodus den Druck reduziert, um zu bewirken,
dass der erste Wärmeaustauschbereich (X) als ein
erster Kondensator arbeitet, um eine erste Konden-
sationstemperatur zu erreichen, und um zu bewir-
ken, dass der zweite Wärmeaustauschbereich (Y)
als ein zweiter Kondensator arbeitet, um eine zweite
Kondensationstemperatur zu erreichen, die niedri-
ger als die erste Kondensationstemperatur ist.

2. Klimaanlage nach Anspruch 1, ferner umfassend
einen Separator, der die Ausblasöffnung (2b) in eine
erste Ausblasöffnung an einer Vorderseite der In-
neneinheit (1) und eine zweite Ausblasöffnung an
einer Rückseite der Inneneinheit (1) unterteilt,
wobei im Heizbetriebsmodus Luft mit einer ersten
Temperatur, die höher als eine Raumtemperatur ist,
aus der ersten Ausblasöffnung ausgeblasen wird,
und Luft mit einer zweiten Temperatur, die höher als
die erste Temperatur ist, aus der zweiten Ausblas-
öffnung ausgeblasen wird.

3. Klimaanlage nach Anspruch 2, ferner umfassend:

eine hintere Führung (8), die an einer Rückseite
des innenseitigen Gebläses (6) vorgesehen ist
und den Luftstrom von dem innenseitigen Ge-
bläse (6) zu der zweiten Ausblasöffnung führt;
und
einen Stabilisator (9), der an einer Vorderseite
des innenseitigen Gebläses (6) so vorgesehen
ist, dass er der hinteren Führung (8) gegenüber-

liegt, und der den Luftstrom von dem innensei-
tigen Gebläse (6) zu der ersten Ausblasöffnung
führt, wobei

der Separator in der Ausblasöffnung (2b) zwi-
schen der hinteren Führung (8) und dem Stabi-
lisator (9) vorgesehen ist, um die Ausblasöff-
nung (2b) in die erste Ausblasöffnung und die
zweite Ausblasöffnung zu unterteilen, und
Luft, die bei der zweiten Kondensationstempe-
ratur des zweiten Wärmeaustauschbereichs
Wärme ausgetauscht hat, hauptsächlich aus
der ersten Ausblasöffnung ausgeblasen wird,
und Luft, die bei der ersten Kondensationstem-
peratur des ersten Wärmeaustauschbereichs
Wärme ausgetauscht hat, hauptsächlich aus
der zweiten Ausblasöffnung ausgeblasen wird.

4. Klimaanlage nach einem der Ansprüche 2 und 3,
wobei
der Separator horizontal in zwei unabhängig vonein-
ander drehbare Teile unterteilt ist und dafür konfigu-
riert ist, die jeweiligen Ausblasrichtungen der ersten
Ausblasöffnung und der zweiten Ausblasöffnung un-
abhängig voneinander vertikal zu verändern.
5. Klimaanlage nach einem der Ansprüche 2 bis 4, fer-
ner umfassend:

eine Windrichtungslamellenanordnung (3), die
drehbar ist, um den der Ausblasöffnung zuge-
führten Luftstrom vertikal und horizontal zu len-
ken, wobei

die Windrichtungslamellenanordnung (3) eine
vertikale Windrichtungslamelle (30) und eine
horizontale Windrichtungslamelle (40) aufweist,
und

die vertikale Windrichtungslamelle (30) mit drei-
stufigen Lamellen aufgebaut ist, die von einer
oberen Lamelle (31), die an einer Vorderseite in
der Ausblasöffnung (2b) angeordnet ist, einer
unteren Lamelle (33), die an einer Rückseite in
der Ausblasöffnung (2b) angeordnet ist, und
dem Separator, der zwischen der oberen Lamel-
le (31) und der unteren Lamelle (33) angeordnet
ist, um als eine mittlere Lamelle (32) zu dienen,
gebildet werden, wobei die dreistufigen Lamel-
len unabhängig voneinander vertikal drehbar
sind.

6. Klimaanlage nach einem der Ansprüche 2 bis 4, fer-
ner umfassend:

eine Windrichtungslamellenanordnung (3), die
drehbar ist, um den der Ausblasöffnung (2b) zu-
geführten Luftstrom vertikal und horizontal zu
lenken, wobei

die Windrichtungslamellenanordnung (3) eine
vertikale Windrichtungslamelle (30) und eine

horizontale Windrichtungslamelle (40) aufweist, die vertikale Windrichtungslamelle (30) mit dreistufigen Lamellen aufgebaut ist, die von einer oberen Lamelle (31), die an einer Vorderseite in der Ausblasöffnung (2b) angeordnet ist, einer unteren Lamelle (33), die an einer Rückseite in der Ausblasöffnung (2b) angeordnet ist, und dem Separator, der zwischen der oberen Lamelle und der unteren Lamelle (33) angeordnet ist, um als eine mittlere Lamelle (32) zu dienen, gebildet werden, wobei die dreistufigen Lamellen unabhängig voneinander vertikal drehbar sind, und die horizontale Windrichtungslamelle (40) eine obere horizontale Lamelle (40a), die zwischen der oberen Lamelle (31) und dem Separator vorgesehen ist, und eine untere horizontale Lamelle (40b), die zwischen der unteren Lamelle (33) und dem Separator vorgesehen ist, aufweist.

7. Klimaanlage nach Anspruch 6, wobei die obere horizontale Lamelle (40a) mit mehreren Lamellen identischer Form aufgebaut ist, die nebeneinander angeordnet sind und in horizontaler Richtung in einer Mitte der oberen horizontalen Lamelle (40a) in rechte und linke Lamellengruppen unterteilt sind, wobei die rechte und die linke Lamellengruppe unabhängig voneinander horizontal drehbar sind, um die Ausblasrichtungen horizontal zu verändern, und die untere horizontale Lamelle (40b) mit mehreren Lamellen identischer Form aufgebaut ist, die nebeneinander angeordnet sind und in horizontaler Richtung in einer Mitte der unteren horizontalen Lamelle (40b) in rechte und linke Lamellengruppen unterteilt sind, wobei die rechte und die linke Lamellengruppe unabhängig voneinander horizontal drehbar sind, um die Ausblasrichtungen horizontal zu verändern.

Revendications

1. Climatiseur comprenant un circuit de fluide frigorigène, dans lequel un fluide frigorigène circule à travers un compresseur (13), un échangeur de chaleur côté intérieur (5), un réducteur de pression (15) et un échangeur de chaleur côté extérieur (16), le climatiseur étant structuré par une unité intérieure (1) et une unité extérieure, l'unité intérieure (1) comprenant :
- l'échangeur de chaleur côté intérieur (5) comprenant une première région d'échange de chaleur (X) et une deuxième région d'échange de chaleur (Y) ;
- un dispositif de réglage de pression (12) disposé entre la première région d'échange de chaleur (X) et la deuxième région d'échange de chaleur

(Y) et réglant une pression de fluide frigorigène ; et

un ventilateur côté intérieur (6) qui amène l'air provenant d'un orifice d'aspiration formé au niveau d'une partie supérieure de l'unité intérieure (1) à échanger de la chaleur au niveau de l'échangeur de chaleur côté intérieur (5) et à être transformé en flux d'air soufflé à partir d'un orifice de soufflage (2b) formé au niveau d'une partie inférieure de l'unité intérieure (1),

la deuxième région d'échange de chaleur (Y) et la première région d'échange de chaleur (X) étant disposées sur un côté aspiration du climatiseur le long d'une direction de rotation du ventilateur côté intérieur (6) et

caractérisé en ce que

le dispositif de réglage de pression (12), dans un mode de fonctionnement de chauffage, réduit la pression pour amener la première région d'échange de chaleur (X) à fonctionner en tant que premier condenseur pour atteindre une première température de condensation et pour amener la deuxième région d'échange de chaleur (Y) à fonctionner en tant que deuxième condenseur pour atteindre une deuxième température de condensation inférieure à la première température de condensation.

2. Climatiseur selon la revendication 1, comprenant en outre un séparateur qui sépare l'orifice de soufflage (2b) en un premier orifice de soufflage sur un côté avant de l'unité intérieure (1) et en un deuxième orifice de soufflage sur un côté arrière de l'unité intérieure (1), où, dans le mode de fonctionnement de chauffage, de l'air à une première température supérieure à une température ambiante est soufflé à partir du premier orifice de soufflage et de l'air à une deuxième température supérieure à la première température est soufflé à partir du deuxième orifice de soufflage.
3. Climatiseur selon la revendication 2, comprenant en outre :
- un guide arrière (8) qui est disposé sur un côté arrière du ventilateur côté intérieur (6) et qui guide le flux d'air à partir du ventilateur côté intérieur (6) vers le deuxième orifice de soufflage ; et
- un stabilisateur (9) qui est disposé sur un côté avant du ventilateur côté intérieur (6) de façon à s'opposer au guide arrière (8) et qui guide le flux d'air à partir du ventilateur côté intérieur (6) vers le premier orifice de soufflage, le séparateur étant disposé dans l'orifice de soufflage (2b) entre le guide arrière (8) et le stabilisateur (9) pour séparer l'orifice de soufflage (2b) en premier orifice de soufflage et en deuxième orifice de soufflage et

- de l'air ayant échangé de la chaleur à la deuxième température de condensation de la deuxième région d'échange de chaleur étant principalement soufflé à partir du premier orifice de soufflage et de l'air ayant échangé de la chaleur à la première température de condensation de la première région d'échange de chaleur étant principalement soufflé à partir du deuxième orifice de soufflage.
4. Climatiseur selon l'une des revendications 2 et 3, dans lequel le séparateur est divisé horizontalement en deux parties pouvant tourner indépendamment l'une de l'autre et étant conçu pour changer verticalement les directions de soufflage respectives du premier orifice de soufflage et du deuxième orifice de soufflage, indépendamment l'une de l'autre.
5. Climatiseur selon l'une des revendications 2 à 4, comprenant en outre
un ensemble volet de direction de vent (3) qui peut tourner pour diriger verticalement et horizontalement le flux d'air guidé vers l'orifice de soufflage, l'ensemble volet de direction de vent (3) présentant un volet de direction de vent vertical (30) et un volet de direction de vent horizontal (40) et le volet de direction de vent vertical (30) étant structuré par des lames à trois niveaux constituées d'une lame de niveau supérieur (31) disposée sur un côté avant dans l'orifice de soufflage (2b), d'une lame de niveau inférieur (33) disposée sur un côté arrière dans l'orifice de soufflage (2b) et du séparateur disposé entre la lame de niveau supérieur (31) et la lame de niveau inférieur (33) pour servir de lame de niveau intermédiaire (32), les lames à trois niveaux pouvant tourner verticalement indépendamment l'une de l'autre.
6. Climatiseur selon l'une des revendications 2 à 4, comprenant en outre
un ensemble volet de direction de vent (3) qui peut tourner pour diriger verticalement et horizontalement le flux d'air guidé vers l'orifice de soufflage (2b), l'ensemble volet de direction de vent (3) présentant un volet de direction de vent vertical (30) et un volet de direction de vent horizontal (40), le volet de direction de vent vertical (30) étant structuré par des lames à trois niveaux constituées d'une lame de niveau supérieur (31) disposée sur un côté avant dans l'orifice de soufflage (2b), d'une lame de niveau inférieur (33) disposée sur un côté arrière dans l'orifice de soufflage (2b) et du séparateur disposé entre la lame de niveau supérieur et la lame de niveau inférieur (33) pour servir de lame de niveau intermédiaire (32), les lames à trois niveaux pouvant tourner verticalement indépendamment l'une de l'autre et le volet de direction de vent horizontal (40) compre-

nant une lame horizontale supérieure (40a) disposée entre la lame de niveau supérieur (31) et le séparateur et une lame horizontale inférieure (40b) disposée entre la lame de niveau inférieur (33) et le séparateur.

7. Climatiseur selon la revendication 6, dans lequel la lame horizontale supérieure (40a) est structurée par une pluralité de lames d'une forme identique juxtaposées et divisées en groupes de lames de droite et de gauche au centre dans une direction horizontale de la lame horizontale supérieure (40a), les groupes de lames de droite et de gauche pouvant tourner horizontalement indépendamment l'un de l'autre pour changer les directions de soufflage horizontalement et la lame horizontale inférieure (40b) est structurée par une pluralité de lames de forme identique juxtaposées et divisées en groupes de lames de droite et de gauche au centre dans une direction horizontale de la lame horizontale inférieure (40b), les groupes de lames de droite et de gauche pouvant tourner horizontalement indépendamment l'un de l'autre pour changer les directions de soufflage horizontalement.

FIG. 1

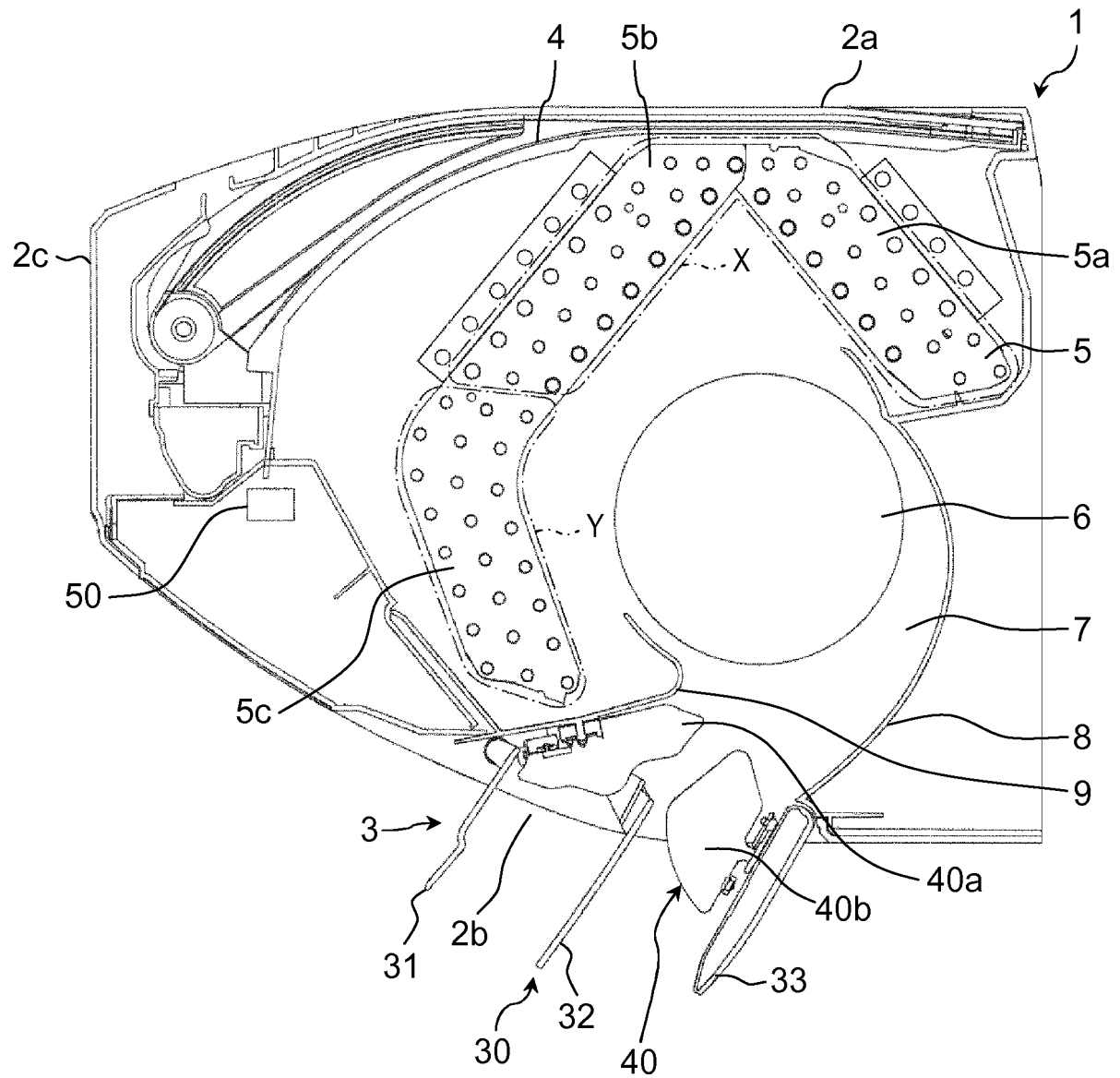


FIG. 2

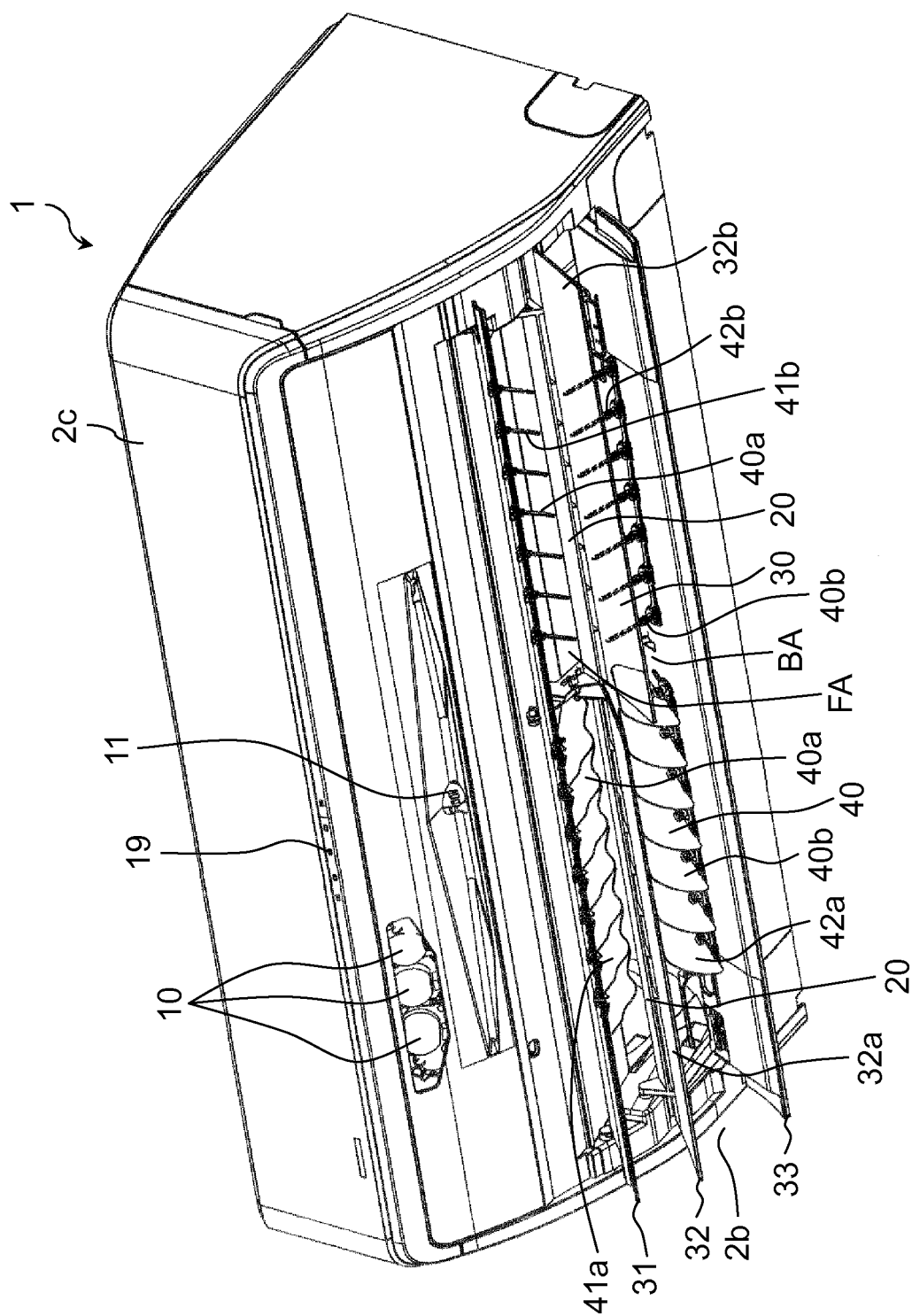


FIG. 3

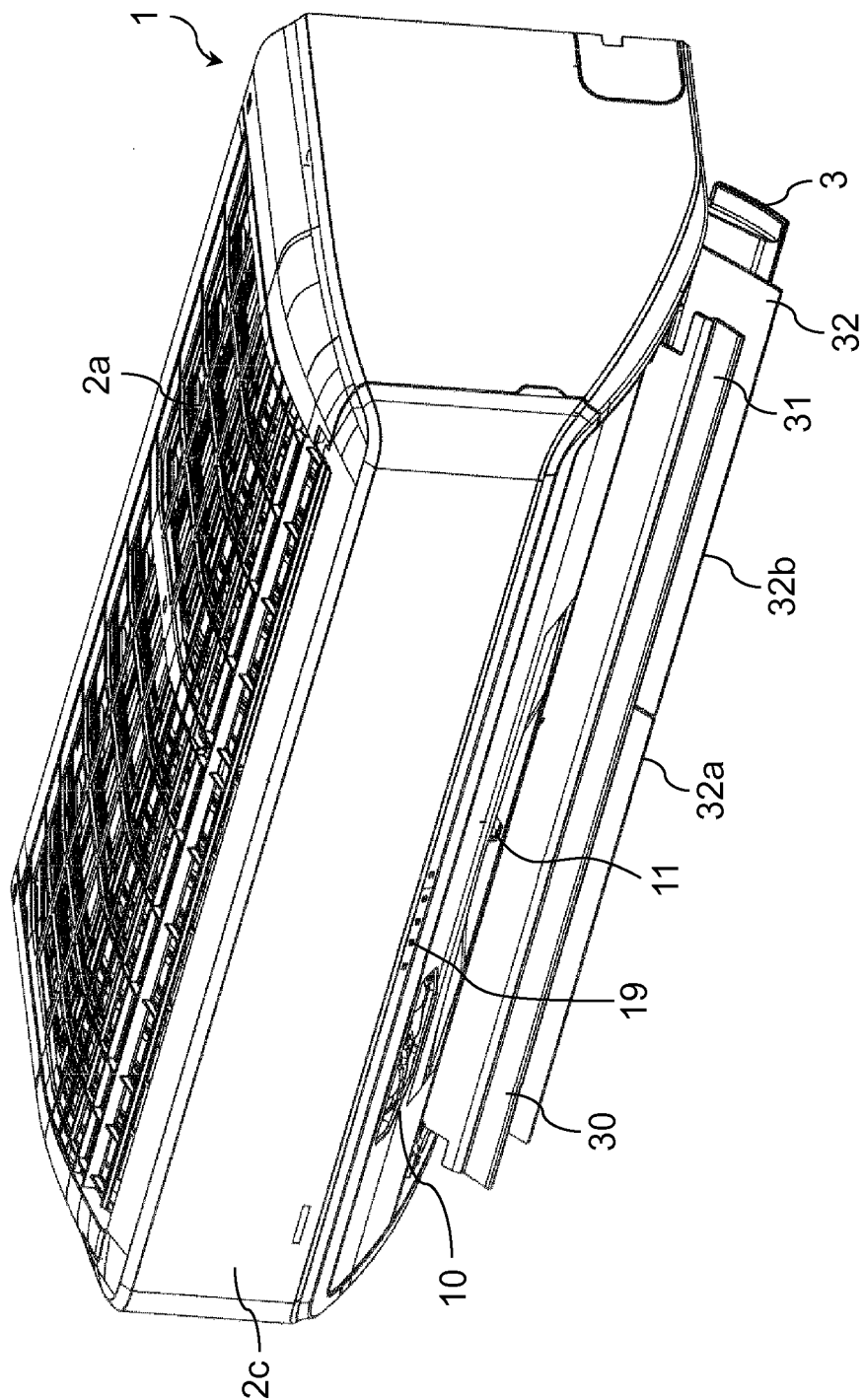


FIG. 4

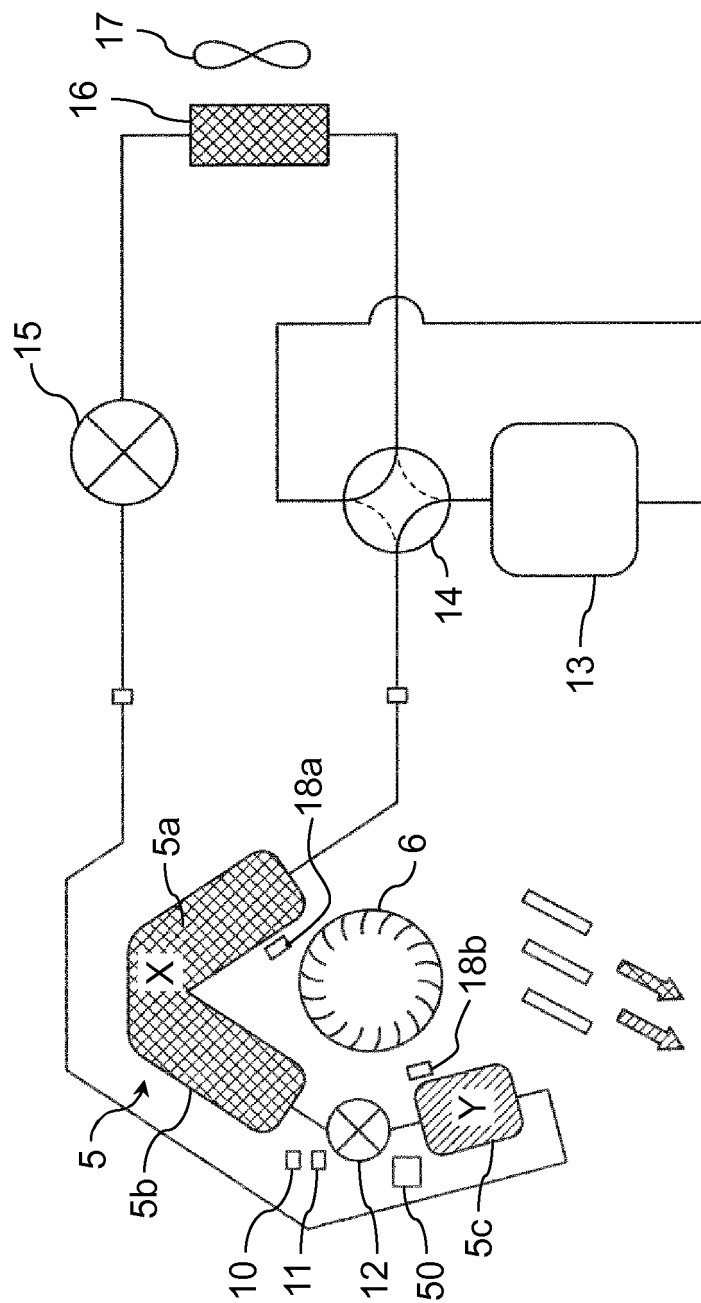


FIG. 5

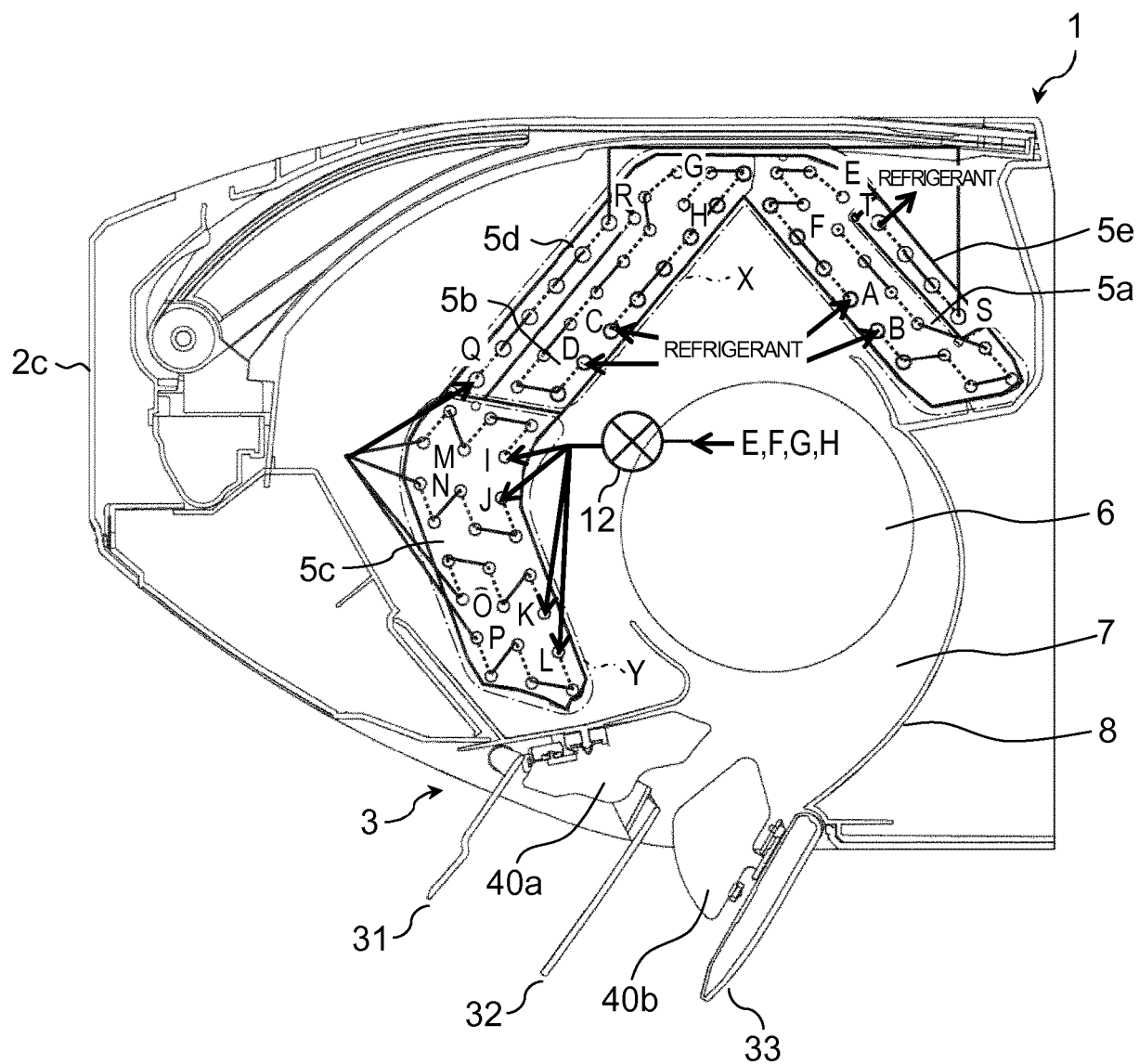


FIG. 6

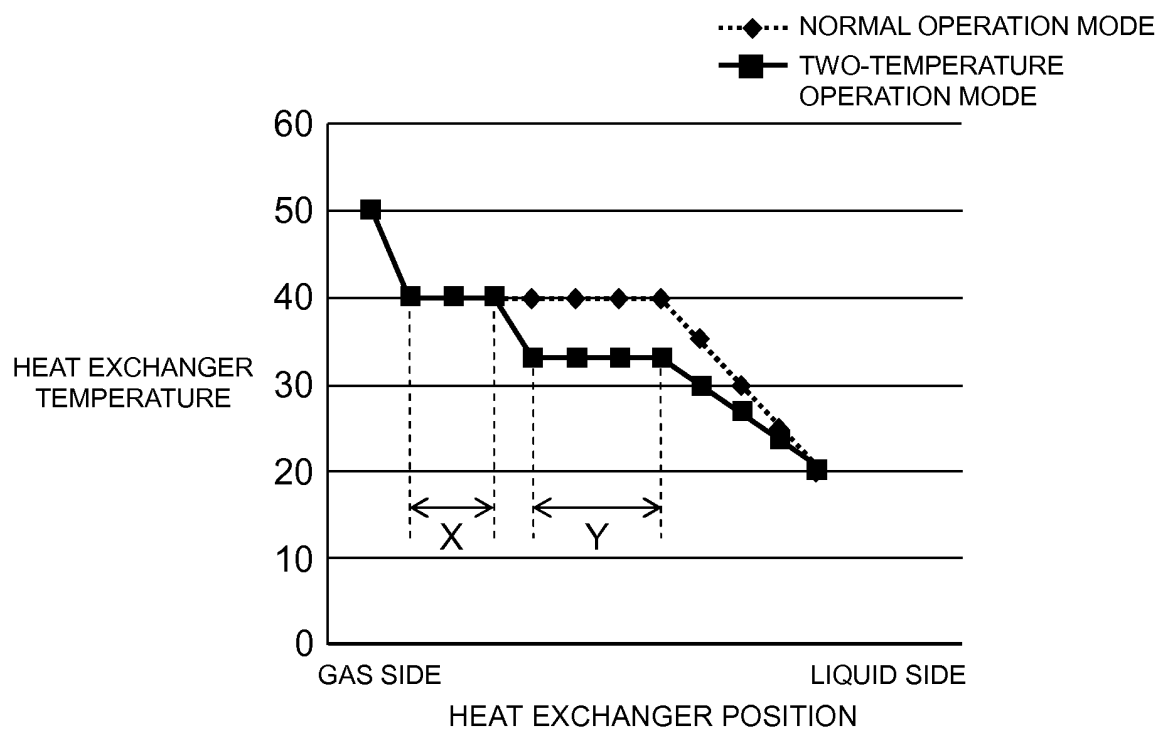


FIG. 7

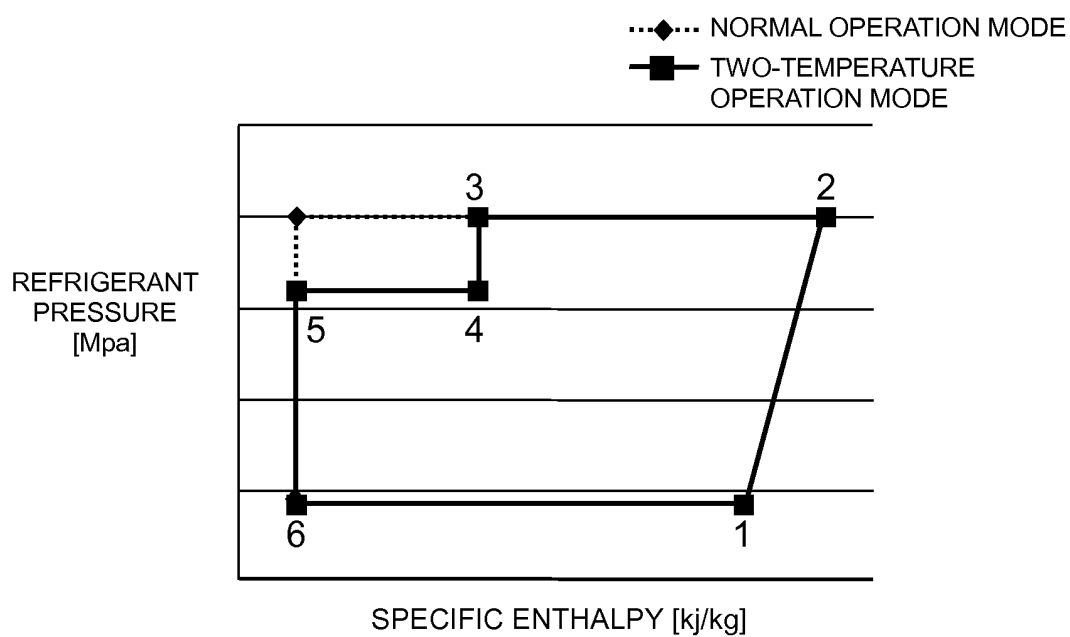


FIG. 8

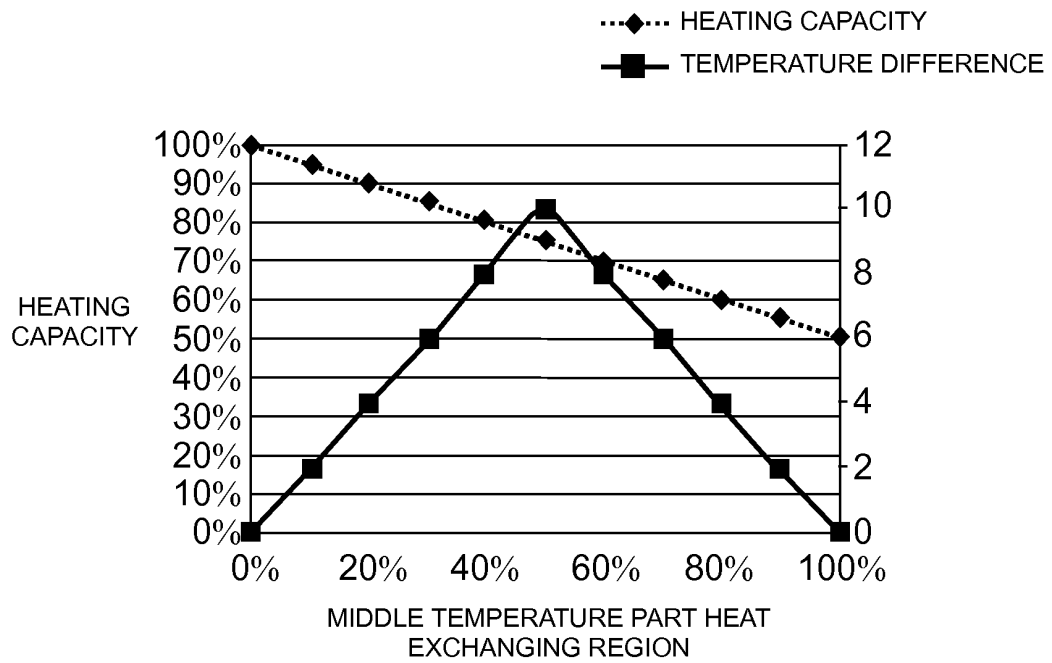


FIG. 9

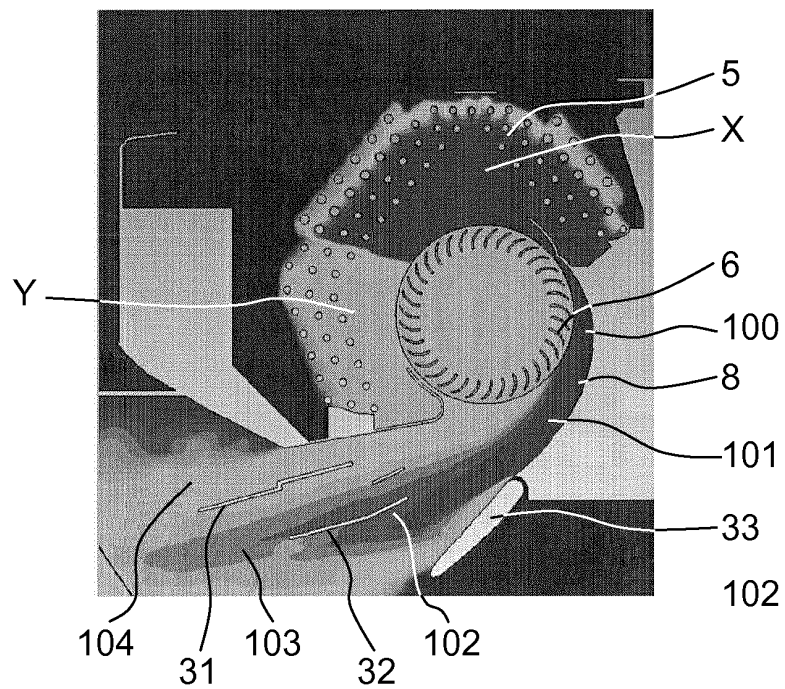


FIG. 10

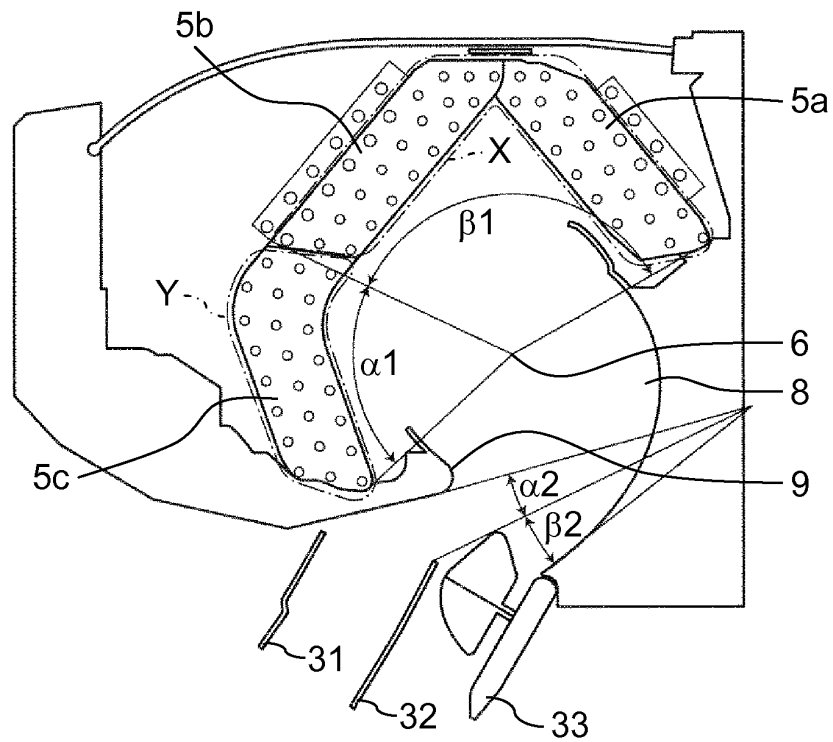


FIG. 11

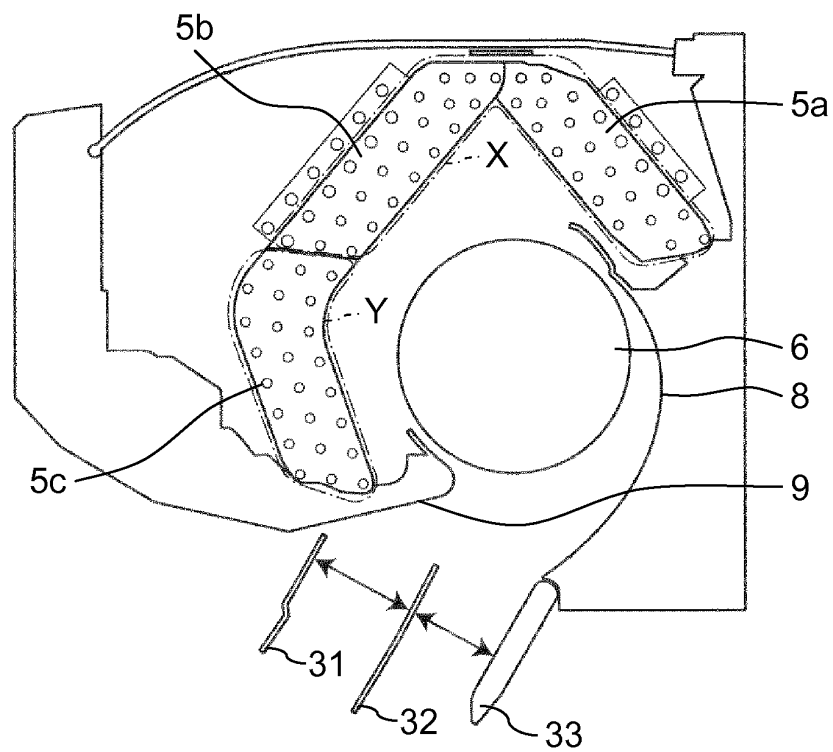


FIG. 12

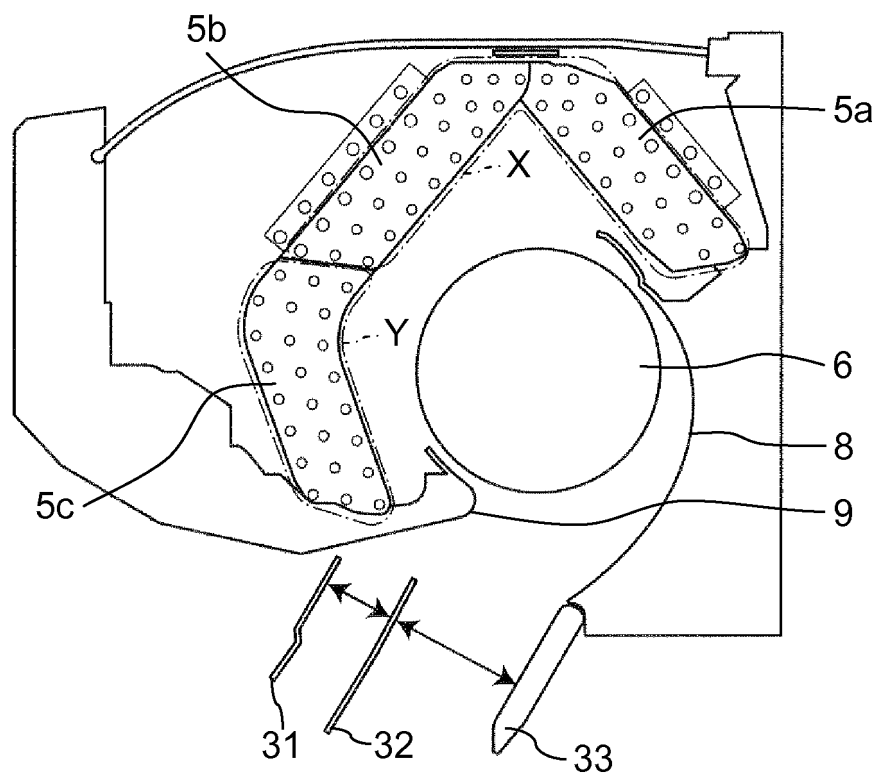


FIG. 13

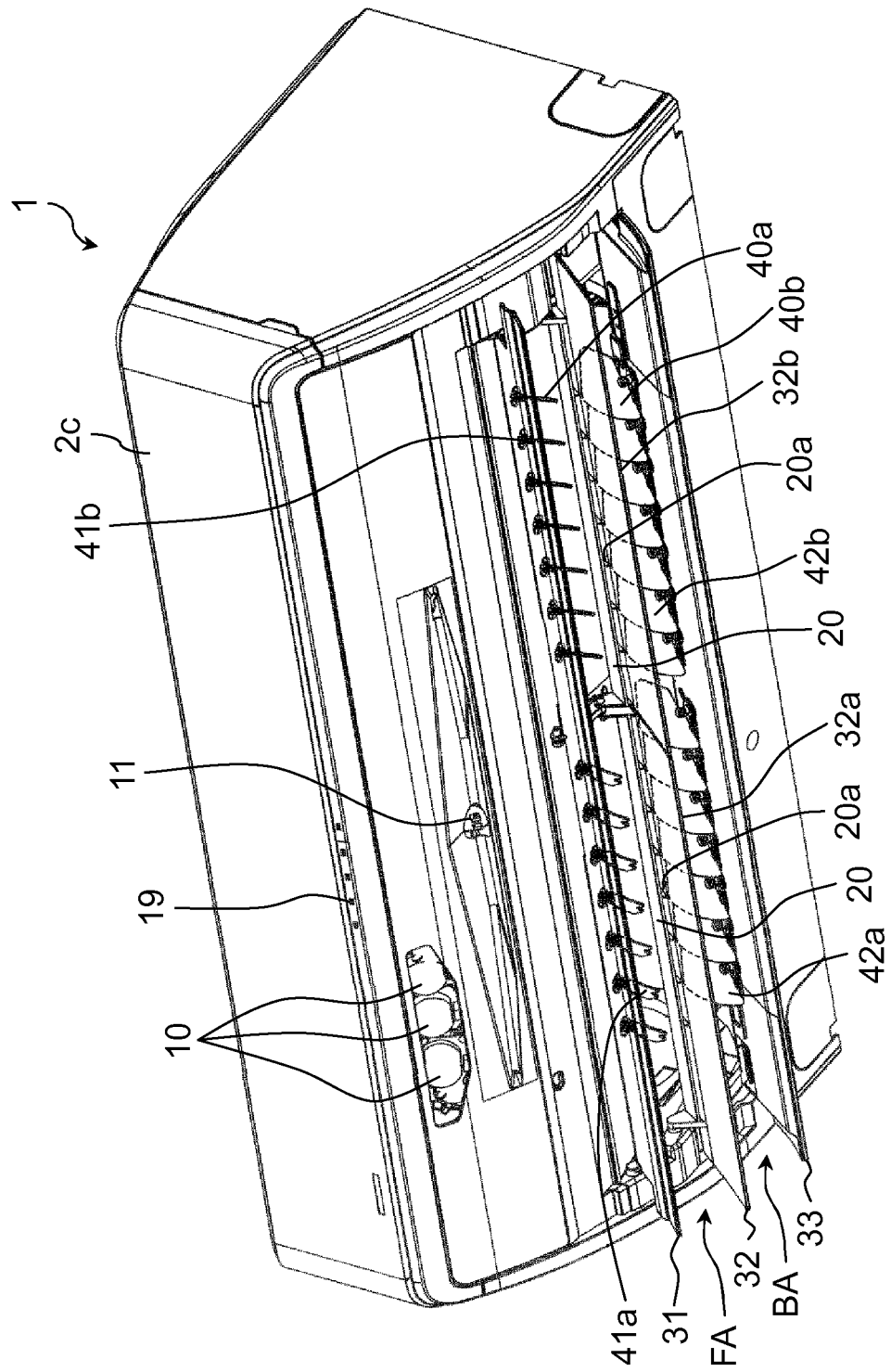


FIG. 14

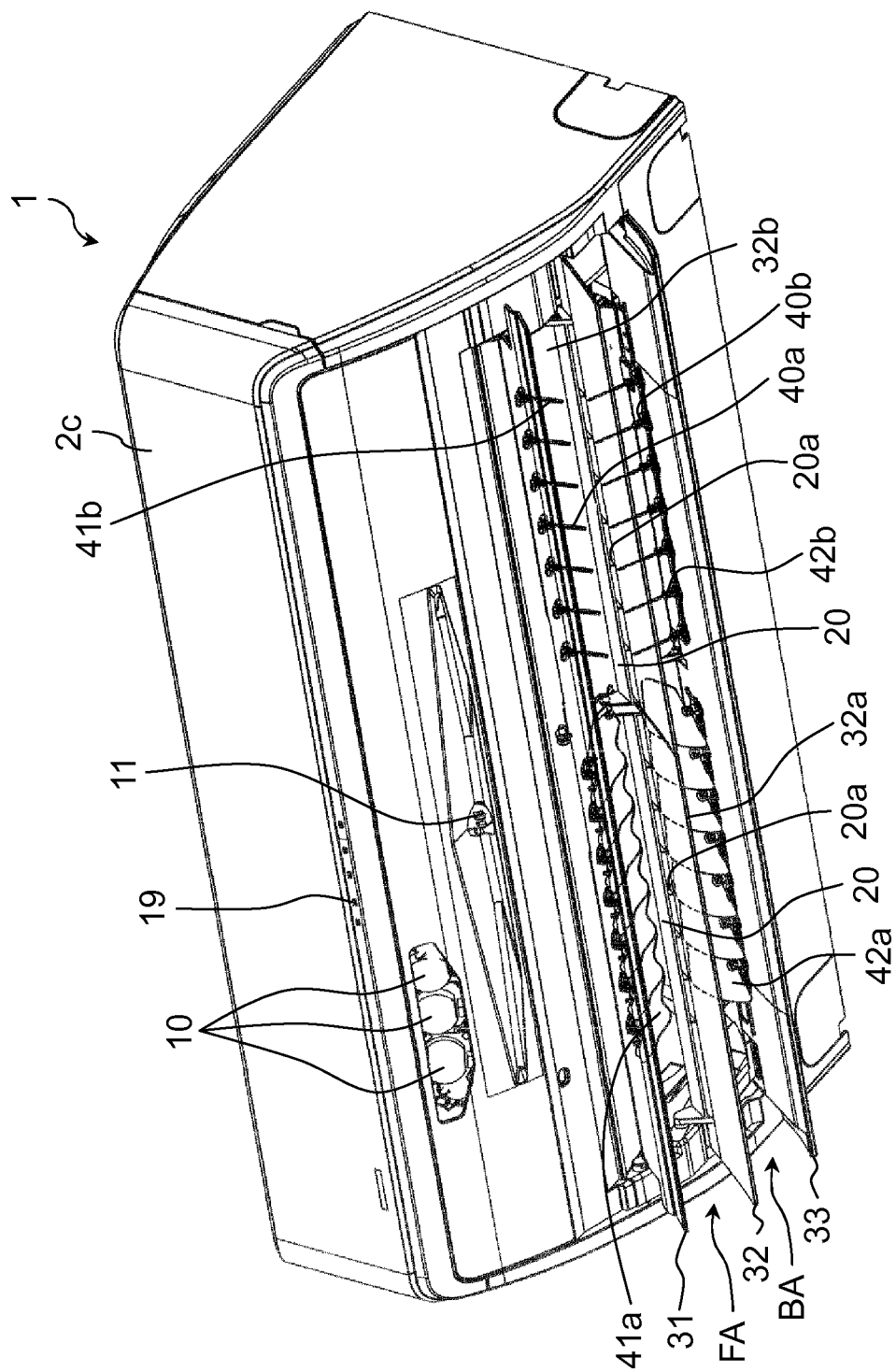


FIG. 15A

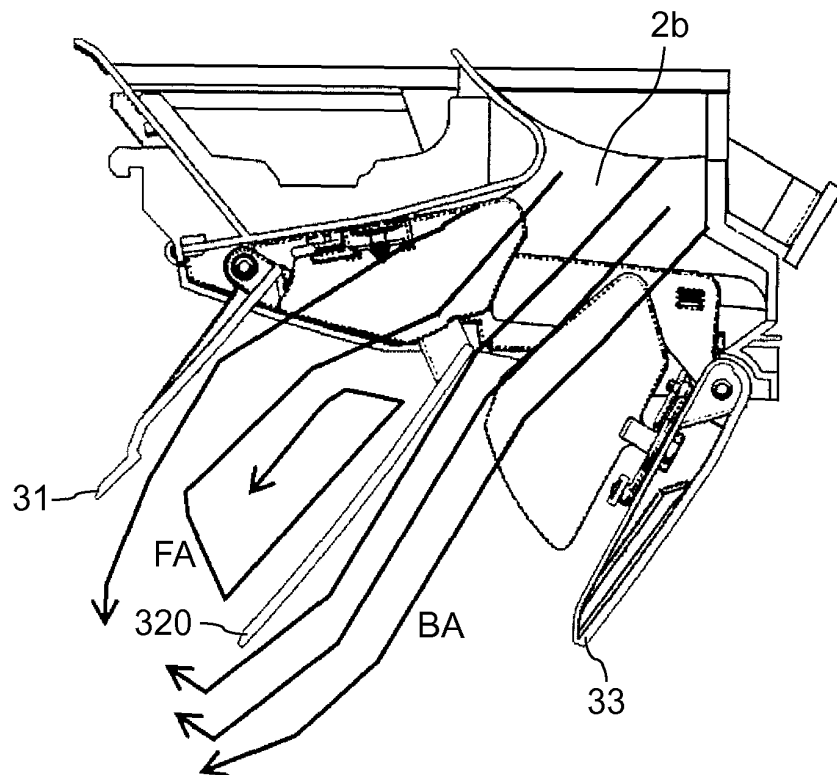


FIG. 15B

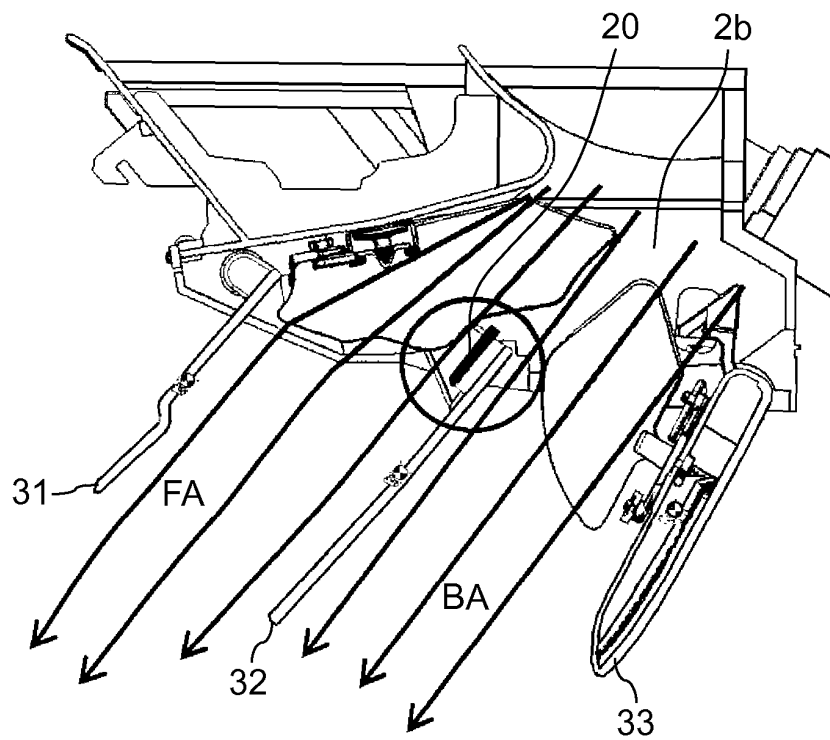


FIG. 16

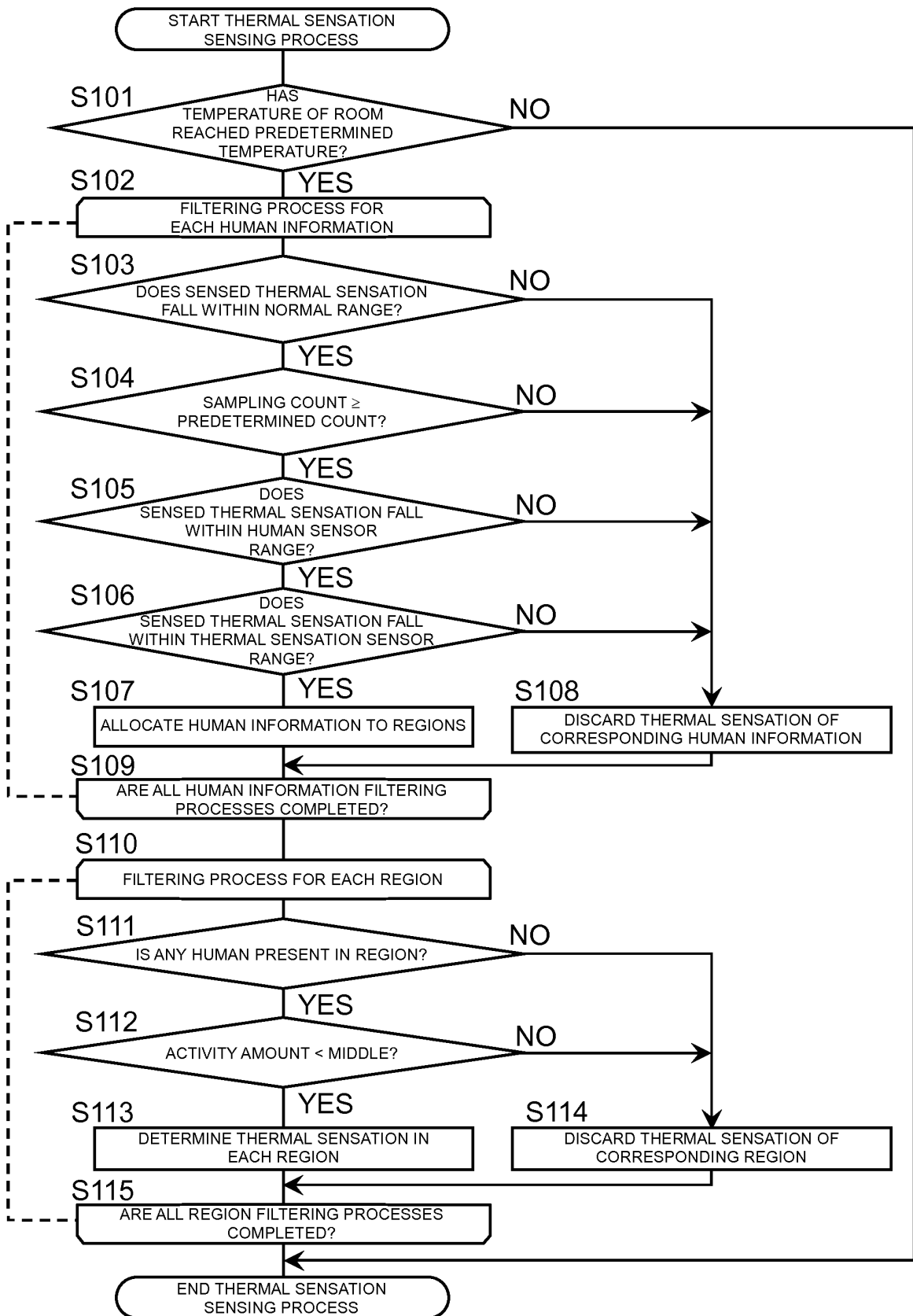
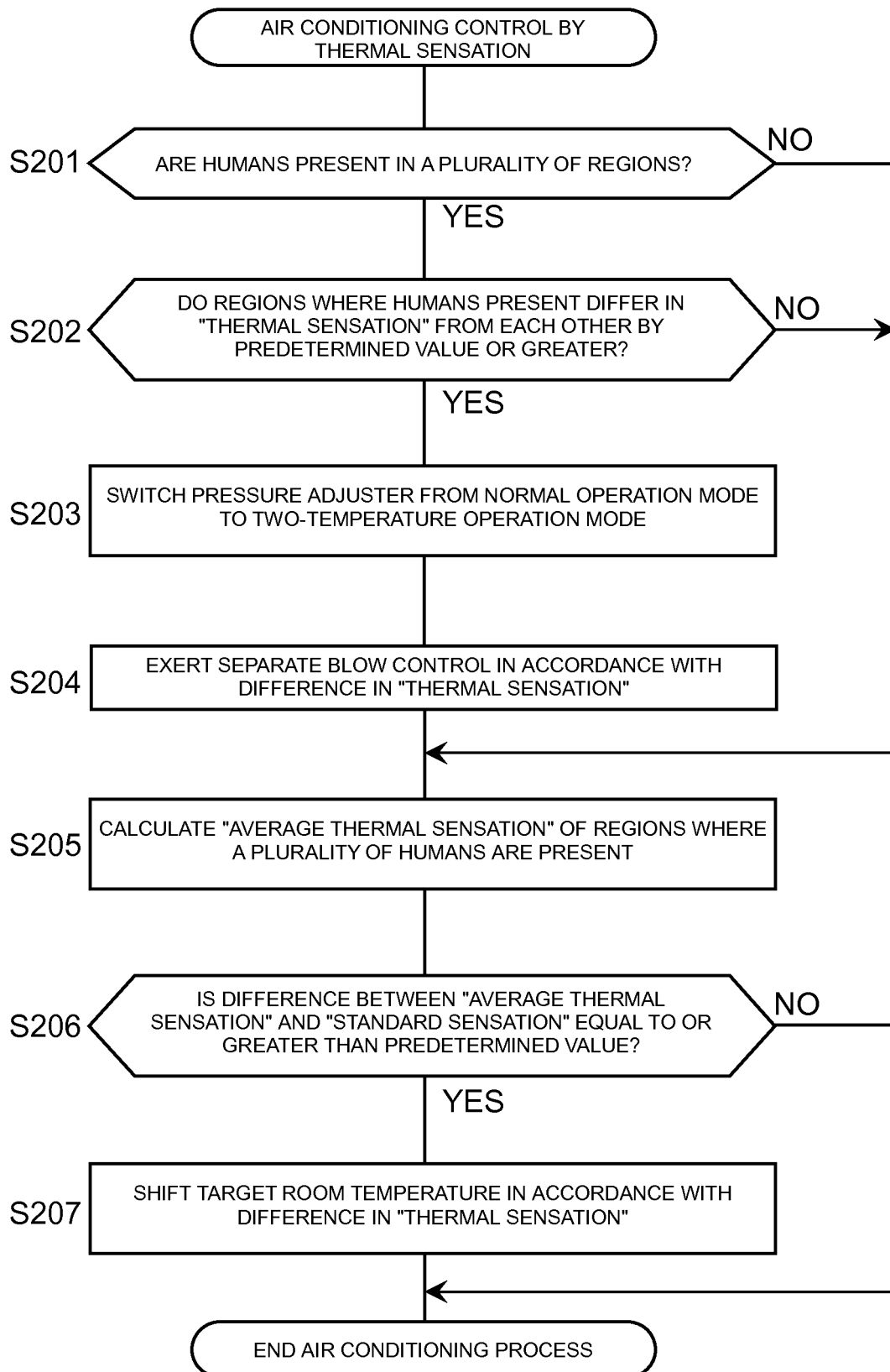


FIG. 17



REFERENCES CITED IN THE DESCRIPTION

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