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(54) **SEPARATE-COOLING TYPE REFRIGERATOR**

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RÉFRIGÉRATEUR DE TYPE À REFROIDISSEMENT SÉPARÉ

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Description

Technical Field

[0001] The present invention relates to a separate-cooling type refrigerator, and more particularly, to a separate-cooling type refrigerator which can perform rapid cooling by substantially simultaneously cooling a freezing chamber and a refrigerating chamber.

Background Art

[0002] In general, a refrigerator uses a principle of a freezing cycle that compressed and cooled refrigerant absorbs ambient heat and lowers an ambient temperature as it expands and evaporates. The refrigerator includes a compressor, a condenser, an evaporator and an accumulator so as to implement the freezing cycle.

[0003] In addition, the refrigerator includes a plurality of box-shaped storage chambers with open front surfaces to accommodate food. Normally, the front surface openings of the storage chambers are opened and closed by doors with one ends coupled to the front surface openings by means of hinges.

[0004] Moreover, generally, evaporators are installed in the storage chambers respectively to cool air of each storage chamber, so that the refrigerant takes heat from ambient air when it evaporates.

[0005] Korean Registered Utility Model Official Gazette No. 0184118 discloses a refrigerator with a freezing chamber and a refrigerating chamber arranged in the up-down direction, the refrigerator including an evaporator for supplying cool air to the freezing chamber, and a cool air supply passage for supplying the cool air supplied to the freezing chamber through the evaporator and circulated in the freezing chamber to the refrigerating chamber.

[0006] In addition, Korean Registered Patent Official Gazette No. 0182726 disclose a refrigerator with a refrigerating chamber and a freezing chamber arranged in the up-down direction, the refrigerator including a refrigerating chamber evaporator for generating cool air to supply the cool air to the refrigerating chamber, a freezing chamber evaporator for generating cool air to supply the cool air to the freezing chamber, a refrigerating chamber passage for supplying the cool air from the refrigerating chamber evaporator to the refrigerating chamber, and a freezing chamber passage for supplying the cool air from the freezing chamber evaporator to the freezing chamber. That is, a conventional separate-cooling type refrigerator includes one condenser, one compressor and two evaporators, and separately cools a refrigerating chamber and a freezing chamber by the two evaporators.

[0007] In the conventional separate-cooling type refrigerator, when the refrigerating chamber is in need of cooling, it is cooled by the refrigerating chamber evaporator, and when the freezing chamber is in need of cooling, it is cooled by the freezing chamber evaporator. However,

in the case that the refrigerating chamber and the freezing chamber are in need of cooling at the same time, the conventional separate-cooling type refrigerator does not provide any configuration and method of performing rapid cooling.

[0008] Moreover, the conventional separate-cooling type refrigerator needs a method of minimizing power consumption and reducing noise caused by driving of a fan in cooling the refrigerating chamber and the freezing chamber.

[0009] Further, the conventional separate-cooling type refrigerator does not provide any configuration of cooling the refrigerating chamber or the freezing chamber in defrosting the refrigerating chamber evaporator and the freezing chamber evaporator.

[0010] Furthermore, in the case that the refrigerating chamber evaporator needs defrosting, the conventional separate-cooling type refrigerator does not provide any configuration of performing defrosting under low power consumption.

[0011] EP1106943A2 discloses a refrigerator in which two evaporators are controlled by separate valves.

[0012] US2002/144510A1 discloses a refrigerator with a power-saving operation in which the operation of either the evaporators or the fans are delayed.

[0013] US2005/132733A1 discloses a refrigerator where a three-way valve directs refrigerant to either a first or second evaporator or both.

[0014] EP1681525A2 discloses a refrigerator with a three way valve in which refrigerant flowing through a cooling chamber is channelled to a freezer chamber by a connecting duct.

Disclosure of Invention Technical Problem

[0015] In order to solve the foregoing problems, an object of the present invention is to provide a separate-cooling type refrigerator which can substantially simultaneously cool a freezing chamber and a refrigerating chamber.

[0016] Another object of the present invention is to provide a separate-cooling type refrigerator which can perform simultaneous cooling and individual cooling to rapidly cool a freezing chamber and a refrigerating chamber.

[0017] A further object of the present invention is to provide a separate-cooling type refrigerator which can perform cooling by controlling a valve and a fan at the same time.

[0018] A still further object of the present invention is to provide a separate-cooling type refrigerator which can minimize power consumption and noise generation caused by driving of a condensation fan in cooling a freezing chamber and a refrigerating chamber.

[0019] A still further object of the present invention is to provide a separate-cooling type refrigerator which can reduce power consumption and noise generation by controlling driving of a condensation fan according to cooling of a freezing chamber and cooling of a refrigerating cham-

ber.

[0020] A still further object of the present invention is to provide a separate-cooling type refrigerator which can cool a freezing chamber or a refrigerating chamber in defrosting the freezing chamber or the refrigerating chamber.

[0021] A still further object of the present invention is to provide a separate-cooling type refrigerator which can continuously perform cooling in defrosting a freezing chamber or a refrigerating chamber.

[0022] A still further object of the present invention is to provide a defrosting apparatus for a separate-cooling type refrigerator which can considerably reduce power consumption in defrosting.

[0023] A still further object of the present invention is to provide a separate-cooling type refrigerator which can use moisture generated in defrosting to maintain humidity inside a refrigerating chamber.

Technical Solution

[0024] According to the present invention, there is provided a separate-cooling type refrigerator according to claim 1. The separate-cooling type refrigerator, includes a compressor, a condenser for condensing refrigerant from the compressor, a 3-way valve for supplying the refrigerant from the condenser to first and second evaporators, the first and second evaporators for cooling a freezing space and a refrigerating space, respectively, by evaporating the supplied refrigerant, and first and second cooling fans for circulating cool air generated by the first evaporator and the second evaporator, respectively, temperature sensors for sensing temperatures of the freezing space and the refrigerating space, respectively; and a control means for comparing the sensed temperatures with set temperatures of the freezing space and the refrigerating space, respectively, and controlling the 3-way valve to form refrigerant passages toward the first evaporator and the second evaporator, when the freezing space and the refrigerating space are in need of cooling at the same time, the control means judges variation degrees of the sensed temperatures, and selectively forms the refrigerant passage toward the first evaporator or the second evaporator corresponding to the space with a smaller variation degree.

[0025] According to a preferred embodiment of the present invention, there is provided a separate-cooling type refrigerator, including a condensation fan, the condensation fan being operated merely in cooling of the freezing space.

[0026] According to a further preferred embodiment of the present invention, there is provided a defrosting apparatus for a separate-cooling type refrigerator, the defrosting apparatus, including: a heat source supplying unit for supplying heat to the second evaporator for a predetermined time; and a control unit for driving the second blowing fan after the predetermined time.

[0027] According to a still further preferred embodi-

ment of the present invention, there is provided a separate-cooling type refrigerator, wherein, when one of the first and second evaporator units is defrosted, a refrigerant passage is formed toward the other evaporator unit.

Advantageous Effects

[0028] According to the present invention, a separate-cooling type refrigerator can substantially simultaneously cool a freezing chamber and a refrigerating chamber.

[0029] In addition, according to the present invention, a separate-cooling type refrigerator can rapidly cool a freezing chamber and a refrigerating chamber by performing alternate cooling/simultaneous cooling and individual cooling, and can reduce power consumption by not performing unnecessary cooling.

[0030] Moreover, According to the present invention, a separate-cooling type refrigerator can perform rapid cooling by controlling a valve and a fan at the same time.

[0031] Further, according to the present invention, a separate-cooling type refrigerator can perform rapid cooling by continuously driving blowing fans during alternate cooling.

[0032] Furthermore, According to the present invention, a separate-cooling type refrigerator can rapidly cool a freezing chamber and a refrigerating chamber by performing individual cooling while simultaneously cooling the freezing chamber and the refrigerating chamber.

[0033] Still furthermore, according to the present invention, a separate-cooling type refrigerator can minimize power consumption and noise generation caused by driving of a condensation fan in cooling a freezing chamber and a refrigerating chamber.

[0034] Still furthermore, according to the present invention, a separate-cooling type refrigerator can reduce power consumption and noise generation for a relatively long cooling time of a refrigerating chamber, by stopping driving of a condensation fan in cooling the refrigerating chamber.

[0035] Still furthermore, according to the present invention, a separate-cooling type refrigerator can freshly keep food or the like in a freezing chamber and a refrigerating chamber, by cooling the freezing chamber or the refrigerating chamber in defrosting the freezing chamber or the refrigerating chamber.

[0036] Still furthermore, according to the present invention, a separate-cooling type refrigerator can continuously perform cooling in defrosting a freezing chamber or a refrigerating chamber.

[0037] Still furthermore, according to the present invention, a separate-cooling type refrigerator can perform defrosting under low power consumption.

[0038] Still furthermore, according to the present invention, a separate-cooling type refrigerator can moisturize a refrigerating chamber by using moisture generated in defrosting to maintain the humidity inside the refrigerating chamber.

Brief Description of the Drawings

[0039]

Fig. 1 is a view illustrating an embodiment of a separate-cooling type refrigerator according to the present invention;

Fig. 2 is a configuration view illustrating a freezing cycle of the separate-cooling type refrigerator of Fig. 1;

Fig. 3 is a configuration view illustrating the separate-cooling type refrigerator according to the present invention;

Fig. 4 is a flowchart showing a first driving embodiment of the separate-cooling type refrigerator which is not part of the invention.

Fig. 5 is a flowchart showing a second driving embodiment of the separate-cooling type refrigerator according to the present invention;

Fig. 6 is a flowchart showing a third driving embodiment of the separate-cooling type refrigerator according to the present invention;

Fig. 7 is a flowchart showing a fourth driving embodiment of the separate-cooling type refrigerator according to the present invention; and

Fig. 8 is a flowchart showing a fifth driving embodiment of the separate-cooling type refrigerator according to the present invention.

Mode for the Invention

[0040] Hereinafter, a preferred embodiment of the present invention will be mainly described in connection with a side by side type refrigerator with a refrigerating chamber and a freezing chamber arranged in the left-right direction. However, it is apparent that the present invention is applicable to a refrigerator with a refrigerating chamber and a freezing chamber arranged in the up-down direction.

[0041] Fig. 1 is a view illustrating an embodiment of a separate-cooling type refrigerator according to the present invention. The separate-cooling type refrigerator includes an outer casing 100, an inner casing 200, a door 300 and a freezing cycle 400.

[0042] The outer casing 100 defines an outward appearance of the separate-cooling type refrigerator. The inner casing 200 is formed inside the outer casing 100 to define a refrigerating chamber R and a freezing chamber F. In this embodiment, the inner casing 200 is formed inside the outer casing 100 so that the refrigerating chamber R can be defined on the right side in the outer casing 100 and the freezing chamber F can be defined on the left side in the outer casing 100.

[0043] The door 300 opens and closes the refrigerating chamber R or the freezing chamber F defined by the inner casing 200. In this embodiment, the door 300 includes a refrigerating chamber door 310 installed on the right side of the outer casing 100 to open and close the refrigerating

chamber R, and a freezing chamber door 320 installed on the left side of the outer casing 100 to open and close the freezing chamber F. The freezing chamber door 320 can be provided with a dispenser (not shown) for allowing a user to take out water or ice on the outside of the separate-cooling type refrigerator, and the refrigerating chamber door 310 can be provided with a home bar (not shown) for allowing the user to take out food or beverage stored in the refrigerating chamber R on the outside of the separate-cooling type refrigerator.

[0044] The freezing cycle 400 is installed between the outer casing 100 and the inner casing 200 to supply cool air to the refrigerating chamber R and the freezing chamber F. In addition, the freezing cycle 400 includes a condenser 420, a compressor 440, an expansion means 460 and an evaporator 480. The compressor 420 compresses refrigerant into high temperature high pressure refrigerant, the condenser 440 condenses the refrigerant compressed in the compressor 420, the expansion means 460 decompresses the refrigerant condensed in the condenser 440, and the evaporator 480 generates cool air around it by evaporating the refrigerant passing through the expansion means 460. The refrigerating chamber R and the freezing chamber F are cooled by the cool air generated around the evaporator 480.

[0045] The evaporator 480 includes a first evaporator 482 and a second evaporator 484. The first evaporator 482 supplies cool air to the refrigerating chamber R, and the second evaporator 484 supplies cool air to the freezing chamber F. Accordingly, the refrigerating chamber R and the freezing chamber F are independently supplied with cool air. In addition, in this embodiment, the expansion means 460 includes a first expansion means 462 installed on the side of the first evaporator 482, and a second expansion means 464 installed on the side of the second evaporator 484. In this embodiment, the first expansion means 462 and the second expansion means 464 are implemented with capillary tubes.

[0046] The separate-cooling type refrigerator further includes a 3-way valve 500 for supplying the refrigerant condensed in the condenser 440 to the first evaporator 482 and the second evaporator 484, respectively. The 3-way valve 500 is installed between the condenser 440 and the first and second expansion means 462 and 464, supplies some of the refrigerant condensed in the condenser 440 to the first expansion means 462 and the first evaporator 482, and supplies the remaining refrigerant to the second expansion means 464 and the second evaporator 484. Here, in order to control the cool air supplied to the refrigerating chamber R and the freezing chamber F, the 3-way valve 500 can supply the refrigerant to at least one of the first evaporator 482 and the second evaporator 484, or intercept the supplied refrigerant.

[0047] The separate-cooling type refrigerator includes a first blowing fan 620 for supplying the cool air generated in the first evaporator 482 to the refrigerating chamber R, and a second blowing fan 640 for supplying the cool

air generated in the second evaporator 484 to the freezing chamber F. In this embodiment, the first blowing fan 620 is installed in the inner casing 200 defining the refrigerating chamber R so as to blow the cool air generated in the first evaporator 482 to the refrigerating chamber R, and the second blowing fan 640 is installed in the inner casing 200 defining the freezing chamber F so as to blow the cool air generated in the second evaporator 484 to the freezing chamber F.

[0048] The cool air is supplied to the refrigerating chamber R and the freezing chamber F through the freezing cycle 400 with the above-described configuration. A cooling capability of the cool air supplied to the refrigerating chamber R and the freezing chamber F can be controlled by the refrigerant compressed in the compressor 420, and a cooling quantity thereof can be controlled by the first blowing fan 620 or the second blowing fan 640.

[0049] Fig. 2 is a configuration view illustrating the freezing cycle of the separate-cooling type refrigerator of Fig. 1. Referring to Fig. 2, the freezing cycle 400 includes the compressor 420 for compressing refrigerant, the condenser 440 for condensing the compressed refrigerant, a condensation fan 660 for radiating heat of the condenser 440, the 3-way valve 500 for forming and blocking a refrigerant passage toward a first evaporator unit (including the first evaporator 482 and the first expansion means 462) and a second evaporator unit (including the second evaporator 484, the second expansion means 464, an accumulator 700 and a backflow prevention valve 720), the first evaporator unit, and the second evaporator unit.

[0050] The freezing cycle 400 includes a refrigerant passage passing through the first evaporator unit, and a refrigerant passage passing through the second evaporator unit. The refrigerating chamber R is cooled by the refrigerant passage passing through the first evaporator unit, and the freezing chamber F is cooled by the refrigerant passage passing through the second evaporator unit. A means for selecting one of the two refrigerant passages, or selecting or blocking both refrigerant passages is implemented with the 3-way valve 500. The 3-way valve 500 forms or blocks a refrigerant passage under the control of a control unit 30 shown in Fig. 3.

[0051] Fig. 3 is a configuration view illustrating the separate-cooling type refrigerator according to the present invention. As illustrated in Fig. 3, a control apparatus 10 of the separate-cooling type refrigerator includes a refrigerating chamber temperature sensor 12 for sensing a temperature of the refrigerating chamber R, a freezing chamber temperature sensor 14 for sensing a temperature of the freezing chamber F, a refrigerating chamber defrosting sensor 16 for generating a defrosting signal for the first evaporator 482 cooling the refrigerating chamber R, a refrigerating chamber defrosting heater 18 for defrosting the first evaporator 482, a freezing chamber defrosting sensor 20 for generating a defrosting signal for the second evaporator 484 cooling the freezing chamber F, a freezing chamber defrosting heater 22 for de-

frosting the second evaporator 484, a fan driving unit 24 for driving the refrigerating chamber blowing fan 620, the freezing chamber blowing fan 640 and the condensation fan 660, a valve driving unit 26 for driving the 3-way valve 500, a compressor driving unit 28 for driving compression/expansion of the compressor 420, and the control unit 30 for controlling the aforementioned components to cool the refrigerating chamber R and the freezing chamber F. Although a power supply unit for supplying power to each component is not illustrated in Fig. 3, the existence of the power supply unit is clearly recognized by those skilled in the art. Therefore, the description of the power supply unit is omitted.

[0052] The refrigerating chamber temperature sensor 12 and the freezing chamber temperature sensor 14 are mounted on sidewalls of the refrigerating chamber R and the freezing chamber F, respectively, sense temperatures Tr and Tf inside the refrigerating chamber R and the freezing chamber F, and apply the sensed temperatures Tr and Tf to the control unit 30. The refrigerating chamber temperature sensor 12 and the freezing chamber temperature sensor 14 can sense the temperatures Tr and Tf according to sensing commands from the control unit 30, or independently without receiving the sensing commands.

[0053] The refrigerating chamber defrosting sensor 16 and the freezing chamber defrosting sensor 20 are sensors changing resistance values according to temperatures of the first evaporator 482 and the second evaporator 484. As the refrigerant evaporates, it takes ambient heat. The first evaporator 482 and the second evaporator 484 perform cooling by means of the evaporation heat. As ambient moisture is frozen, the first evaporator 482 and the second evaporator 484 are frosted. Accordingly, the control unit 30 recognizes the defrosting signals corresponding to the resistance values based on the temperatures of the first evaporator 482 and the second evaporator 484 from the refrigerating chamber defrosting sensor 16 and the freezing chamber defrosting sensor 20 (when same voltage is applied by the control unit 30, different current values are sensed, and when same current is applied, different voltage values are sensed).

[0054] The refrigerating chamber defrosting heater 18 and the freezing chamber defrosting heater 22 supply heat to the first evaporator 482 and the second evaporator 484 according to operation signals (for example, high signals) from the control unit 30, respectively. The supplied heat serves to remove the frost generated on the first evaporator 482 and the second evaporator 484 due to freezing of the ambient moisture.

[0055] The fan driving unit 24 is a means for driving the refrigerating chamber blowing fan 620, the freezing chamber blowing fan 640 and the condensation fan 660 according to driving commands from the control unit 30. The fan driving unit 24 can be implemented with one means as shown in Fig. 3, or with a plurality of means corresponding to each blowing fan 620 and 640 and the condensation fan 660.

[0056] The valve driving unit 26 controls opening and closing of the 3-way valve 500. Particularly, the valve driving unit 26 forms a refrigerant passage toward the first evaporator unit, forms a refrigerant passage toward the second evaporator unit, and blocks each refrigerant passage according to driving commands from the control unit 30.

[0057] The compressor driving unit 28 drives the compressor 420. For example, when the compressor 420 is a linear compressor, the compressor driving unit 28 generates a PWM signal for applying a driving voltage and applies the PWM signal according to commands of the control unit 30.

[0058] Basically, in an embodiment not forming part of the invention, the control unit 30 receives the refrigerating chamber sensed temperature T_r and the freezing chamber sensed temperature T_f which are the sensed temperatures from the refrigerating chamber temperature sensor 12 and the freezing chamber temperature sensor 14, compares them with a refrigerating chamber set temperature T_{rr} and a freezing chamber set temperature T_{fr} which are prestored set temperatures, respectively, and judges the necessity of cooling in the refrigerating chamber R and the freezing chamber F. According to the cooling judgment, the control unit 30 applies a driving command to the valve driving unit 26, thereby forming a refrigerant passage toward the first evaporator unit and/or the second evaporator unit, or blocking the refrigerant passage. When forming and blocking the refrigerant passage, the control unit 30 drives/stops the compressor 420 to efficiently form and block the refrigerant passage.

[0059] Particularly, in the case that the control unit 30 forms the refrigerant passage toward the first evaporator unit after forming the refrigerant passage toward the second evaporator unit, as the refrigerant remains in the second evaporator 484 and the accumulator 700 of the second evaporator unit, it is necessary to transfer the whole refrigerant to the compressor 420 and the condenser 440. Accordingly, the control unit 30 performs a pump-down operation of transferring the refrigerant remaining in the second evaporator unit to the compressor 420 or the like, by blocking the first evaporator unit and the second evaporator unit through the 3-way valve, and operating the compressor 420. After transferring the whole refrigerant remaining in the second evaporator unit to the compressor 420 or the like, the control unit 30 controls the 3-way valve 500 to form the refrigerant passage toward the first evaporator unit, thereby cooling the refrigerating chamber R.

[0060] In addition, when forming and blocking the refrigerant passage toward the first evaporator unit and/or the second evaporator unit, the control unit 30 applies driving commands to the fan driving unit 24 so as to drive the first blowing fan 620, the second blowing fan 640 and the condensation fan 660, thereby rapidly cooling the refrigerating chamber R and the freezing chamber F.

[0061] Further, the control unit 30 receives the defrosting signals sensed by the refrigerating chamber defrost-

ing sensor 16 and the freezing chamber defrosting sensor 20, and compares them with prestored defrosting conditions (for example, reference voltage and current values, etc.). If the defrosting signal satisfies the defrosting conditions, the control unit 30 applies an operation signal to the refrigerating chamber defrosting heater 18 and/or the freezing chamber defrosting heater 22 to defrost the corresponding evaporator, thereby defrosting the first evaporator 482 and/or the second evaporator 484.

[0062] In first and second driving embodiments of the separate-cooling type refrigerator, whereby only the second driving embodiment is according to the present invention, it is assumed that the refrigerating chamber sensed temperature T_r and the freezing chamber sensed temperature T_f are higher than the prestored refrigerating chamber set temperature T_{rr} and the prestored freezing chamber set temperature T_{fr} , respectively. It is also assumed that the control unit 30 receives the refrigerating chamber sensed temperature T_r and the freezing chamber sensed temperature T_f from the refrigerating chamber temperature sensor 12 and the freezing chamber temperature sensor 14. It must be understood that the control unit 30 receives the refrigerating chamber sensed temperature T_r and the freezing chamber sensed temperature T_f not only in a specific step but in the whole steps at intervals of a predetermined time (for example, 5 seconds, 10 seconds, etc.). In the case that the refrigerating chamber R and the freezing chamber F are in need of cooling at the same time, the separate-cooling type refrigerator substantially simultaneously cools the refrigerating chamber R and the freezing chamber F, so that the refrigerating chamber R and the freezing chamber F rapidly reach desired temperatures. In the substantially simultaneous cooling, the refrigerant passages can be simultaneously formed and maintained for a predetermined time range with regard to the refrigerating chamber R and the freezing chamber F. Otherwise, in the substantially simultaneous cooling, even if the refrigerant passages are not simultaneously but alternately formed in one time point with regard to the refrigerating chamber R and the freezing chamber F, both the refrigerating chamber R and the freezing chamber F can be cooled within a predetermined time range from a time point of requesting simultaneous cooling of the refrigerating chamber R and the freezing chamber F.

[0063] Fig. 4 is a flowchart showing a first embodiment of the separate-cooling type refrigerator which is not part of the invention.

[0064] At step S41, as the refrigerating chamber R and the freezing chamber F are in need of cooling at the same time, the control unit 30 alternately cools the refrigerating chamber R and the freezing chamber F. That is, for example, the control unit 30 cools the refrigerating chamber R for a set time T_{r1} , then cools the freezing chamber F for a set time T_{f1} , and then cools the refrigerating chamber R again for a set time T_{r2} . Therefore, the control unit 30 controls the valve driving unit 26 to form a refrigerant

passage toward the first evaporator unit for the set time $Tr1$ and then to form a refrigerant passage toward the second evaporator unit for the set time $Tf1$. Thereafter, in order to form a refrigerant passage toward the first evaporator unit again, the control unit 30 performs the pump-down operation described above, and forms the refrigerant passage toward the first evaporator unit for the set time $Tr2$. In addition, the control unit 30 drives the blowing fan provided in each evaporator unit with the refrigerant passage formed therein. That is, when cooling the refrigerating chamber R, the control unit 30 applies a driving command to the fan driving unit 24 so as to rotate the refrigerating chamber blowing fan 620. Meanwhile, when cooling the freezing chamber F, the control unit 30 applies a driving command to the fan driving unit 24 so as to rotate the freezing chamber blowing fan 640. The control unit 30 also controls driving of the condensation fan 660 in forming each refrigerant passage.

[0065] The set times $Tr1$, $Tr2$, ... of the refrigerating chamber R can be the same time, or can be set to be reduced according to the progress of the cooling. The set times $Tf1$, $Tf2$, ... of the freezing chamber F are set in the same manner. Moreover, the set times $Tr1$ and $Tf1$ can be the same time, and the set time $Tf1$ can be set longer to rapidly cool the freezing chamber F sensitive to thawing. While step S41 is performed, steps S42 to S50 are carried out.

[0066] At step S42, the control unit 30 compares the freezing chamber sensed temperature Tf with the freezing chamber set temperature Tfr . If the freezing chamber sensed temperature Tf is higher than the freezing chamber set temperature Tfr , the freezing chamber F is in need of cooling. The control unit 30 goes to step S43. If the freezing chamber sensed temperature Tf is equal to or lower than the freezing chamber set temperature Tfr , the freezing chamber F does not need cooling. The control unit 30 goes to step S45.

[0067] At step S43, the control unit 30 compares the refrigerating chamber sensed temperature Tr with the refrigerating chamber set temperature Trr . If the refrigerating chamber sensed temperature Tr is higher than the refrigerating chamber set temperature Trr , the refrigerating chamber R is in need of cooling. The control unit 30 goes to step S44. If the refrigerating chamber sensed temperature Tr is equal to or lower than the refrigerating chamber set temperature Trr , the refrigerating chamber R does not need cooling. As the freezing chamber F needs cooling, the control unit 30 goes to step S49.

[0068] At step S44, in a state where both the refrigerating chamber R and the freezing chamber F are in need of cooling, the control unit 30 continuously alternately cools the refrigerating chamber R and the freezing chamber F. In addition, the control unit 30 performs step S42 again.

[0069] At step S45, the control unit 30 compares the refrigerating chamber sensed temperature Tr with the refrigerating chamber set temperature Trr . If the refrigerating chamber sensed temperature Tr is higher than

the refrigerating chamber set temperature Trr , the refrigerating chamber R is in need of cooling. The control unit 30 goes to step S47. If the refrigerating chamber sensed temperature Tr is equal to or lower than the refrigerating chamber set temperature Trr , the refrigerating chamber R does not need cooling. The control unit 30 goes to step S46.

[0070] At step S46, the control unit 30 ends the alternate cooling of the refrigerating chamber R and the freezing chamber F of step S45, cooling of the refrigerating chamber R of step S48, or cooling of the freezing chamber F of step S50.

[0071] At step S47, the control unit 30 cools only the refrigerating chamber R, instead of alternately cooling the refrigerating chamber R and the freezing chamber F as in the previous step. That is, as the freezing chamber sensed temperature Tf satisfies the freezing chamber set temperature Tfr , the control unit 30 controls the valve driving unit 26 to form a refrigerant passage only toward the first evaporator unit. The control unit 30 applies a driving command to the valve driving unit 26 so as to form the refrigerant passage toward the first evaporator unit. Therefore, the valve driving unit 26 opens the 3-way valve 500 with regard to the first evaporator unit and closes it with regard to the second evaporator unit. Moreover, the control unit 30 applies a driving command for the refrigerating chamber blowing fan 620 to the fan driving unit 24, so that the fan driving unit 24 drives the refrigerating chamber blowing fan 620.

[0072] At step S48, the control unit 30 performs the cooling by step S47 until the refrigerating chamber sensed temperature Tr is equal to or lower than the refrigerating chamber set temperature Trr .

[0073] At step S49, the control unit 30 cools only the freezing chamber F, instead of alternately cooling the refrigerating chamber R and the freezing chamber F as in the previous step. That is, as the refrigerating chamber sensed temperature Tr satisfies the refrigerating chamber set temperature Trr , the control unit 30 controls the valve driving unit 26 to form a refrigerant passage only toward the second evaporator unit. The control unit 30 applies a driving command to the valve driving unit 26 so as to form the refrigerant passage toward the second evaporator unit. Accordingly, the valve driving unit 26 opens the 3-way valve 500 with regard to the second evaporator unit and closes it with regard to the first evaporator unit. In addition, the control unit 30 applies a driving command for the freezing chamber blowing fan 640 to the fan driving unit 24, so that the fan driving unit 24 drives the freezing chamber blowing fan 640.

[0074] At step S50, the control unit 30 performs the cooling by step S49 until the freezing chamber sensed temperature Tf is equal to or lower than the freezing chamber set temperature Tfr .

[0075] In the case that the refrigerating chamber R and the freezing chamber F are in need of cooling at the same time, steps S41 to S44 are carried out. When the freezing chamber F needs not to be cooled due to the previous

alternate cooling, steps S42, S45, S47 and S48 are performed to cool only the refrigerating chamber R. When the refrigerating chamber R needs not to be cooled due to the previous alternate cooling, steps S42, S43, S49 and S50 are performed to cool only the freezing chamber F.

[0076] In addition, steps S42, S43, S45 and S49 can be carried out when the control unit 30 receives the sensed temperatures from the refrigerating chamber temperature sensor 12 and the freezing chamber temperature sensor 14, or after the control unit 30 requests the sensed temperatures thereto.

[0077] Moreover, at steps S41 to S44, in the case that the refrigerating chamber R and the freezing chamber F are in need of cooling at the same time, the control unit 30 can apply control signals to the fan driving unit 24 so as to continuously drive the refrigerating chamber blowing fan 620 and the freezing chamber blowing fan 640. That is, when performing the alternate cooling, the control unit 30 continuously drives the refrigerating chamber blowing fan 620 and the freezing chamber blowing fan 640 to facilitate cool air circulation in the refrigerating chamber R and the freezing chamber F, thereby performing rapid cooling. For example, after forming the refrigerant passage toward the first evaporator unit, the control unit 30 drives the refrigerating chamber blowing fan 620 and the freezing chamber blowing fan 640 together to circulate the cool air previously supplied to the freezing chamber F. In addition, after forming the refrigerant passage toward the second evaporator unit, the control unit 30 operates in the same manner.

[0078] Fig. 5 is a flowchart showing a second driving embodiment of the separate-cooling type refrigerator according to the present invention.

[0079] At step S51, as the refrigerating chamber R and the freezing chamber F are in need of cooling at the same time, the control unit 30 simultaneously cools the refrigerating chamber R and the freezing chamber F. That is, the control unit 30 applies driving commands to the valve driving unit 26 so as to form refrigerant passages toward the first evaporator unit and the second evaporator unit at the same time. The valve driving unit 26 drives the 3-way valve 500 to supply the refrigerant to the first evaporator unit and the second evaporator unit at the same time. In addition, the control unit 30 applies driving commands to the fan driving unit 24 so as to rotate the refrigerating chamber blowing fan 620 and the freezing chamber blowing fan 640 provided in the first evaporator unit and the second evaporator unit with the refrigerant passages formed therein. When forming each refrigerant passage, the control unit 30 controls driving of the condensation fan 660.

[0080] At step S52, the control unit 30 simultaneously cools the refrigerating chamber R and the freezing chamber F for a set time T1 by step S51.

[0081] At step S53, while performing the simultaneous cooling by steps S51 and S52, the control unit 30 continuously receives the sensed temperatures Tr and Tf

from the refrigerating chamber temperature sensor 12 and the freezing chamber temperature sensor 14, respectively. The control unit 30 operates variation degrees ΔTr and ΔTf of the received sensed temperatures Tr and Tf for the set time T1, respectively.

[0082] At step S54, the control unit 30 compares the variation degrees ΔTr and ΔTf operated at step S53 with each other. If ΔTf is larger than ΔTr , the control unit 30 goes to step S55. In this case, a cooling speed of the freezing chamber F is faster than a cooling speed of the refrigerating chamber R, so that the refrigerating chamber R needs to be more cooled. If ΔTf is equal to or smaller than ΔTr , the control unit 30 goes to step S57.

[0083] At step S55, the control unit 30 individually cools the refrigerating chamber R, instead of simultaneously cooling the refrigerating chamber R and the freezing chamber F as in the previous step. That is, as the refrigerating chamber R requires supplementary cooling, the control unit 30 controls the valve driving unit 26 to form a refrigerant passage only toward the first evaporator unit. The control unit 30 applies a driving command to the valve driving unit 26 so as to form the refrigerant passage toward the first evaporator unit. Therefore, the valve driving unit 26 opens the 3-way valve 500 with regard to the first evaporator unit and closes it with regard to the second evaporator unit. Moreover, the control unit 30 applies a driving command for the refrigerating chamber blowing fan 620 to the fan driving unit 24, so that the fan driving unit 24 drives the refrigerating chamber blowing fan 620.

[0084] At step S56, the control unit 30 forms the refrigerant passage toward the first evaporator unit for a set time T2 by step S55, and goes to step S60.

[0085] At step S57, the control unit 30 compares ΔTf with ΔTr . If ΔTf is smaller than ΔTr , the control unit 30 goes to step S58. As the cooling speed of the refrigerating chamber R is faster than the cooling speed of the freezing chamber F, the control unit 30 goes to step S58 and supplementarily individually cools the freezing chamber F. If ΔTf is equal to ΔTr , the control unit 30 goes to step S60.

[0086] At step S58, the control unit 30 individually cools the freezing chamber F, instead of simultaneously cooling the refrigerating chamber R and the freezing chamber F as in the previous step. That is, the control unit 30 controls the valve driving unit 26 to form a refrigerant passage only toward the second evaporator unit. The control unit 30 applies a driving command to the valve driving unit 26 so as to form the refrigerant passage toward the second evaporator unit. Accordingly, the valve driving unit 26 opens the 3-way valve 500 with regard to the second evaporator unit and closes it with regard to the first evaporator unit. Moreover, the control unit 30 applies a driving command for the freezing chamber blowing fan 640 to the fan driving unit 24, so that the fan driving unit 24 drives the freezing chamber blowing fan 640.

[0087] At step S59, the control unit 30 forms the refrigerant passage toward the second evaporator unit for a

set time T3 by step S58, and goes to step S60.

[0088] At step S60, the control unit 30 compares the freezing chamber sensed temperature Tf with the freezing chamber set temperature Tfr. If the freezing chamber sensed temperature Tf is higher than the freezing chamber set temperature Tfr, the freezing chamber F is in need of cooling. The control unit 30 goes to step S61. If the freezing chamber sensed temperature Tf is equal to or lower than the freezing chamber set temperature Tfr, the freezing chamber F does not need cooling. The control unit 30 goes to step S63.

[0089] At step S61, the control unit 30 compares the refrigerating chamber sensed temperature Tr with the refrigerating chamber set temperature Trr. If the refrigerating chamber sensed temperature Tr is higher than the refrigerating chamber set temperature Trr, the refrigerating chamber R is also in need of cooling. That is, the simultaneous cooling is necessary. The control unit 30 goes to step S51. If the refrigerating chamber sensed temperature Tr is equal to or lower than the refrigerating chamber set temperature Trr, the refrigerating chamber R needs not to be cooled. As the freezing chamber F needs individual cooling, the control unit 30 goes to step S62.

[0090] At step S62, the control unit 30 individually cools the freezing chamber F, instead of simultaneously or individually cooling the refrigerating chamber R and the freezing chamber F as in the previous step. That is, as the refrigerating chamber sensed temperature Tr satisfies the refrigerating chamber set temperature Trr, the control unit 30 controls the valve driving unit 26 to form a refrigerant passage only toward the second evaporator unit. The control unit 30 applies a driving command to the valve driving unit 26 so as to form the refrigerant passage toward the second evaporator unit. Accordingly, the valve driving unit 26 opens the 3-way valve 500 with regard to the second evaporator unit and closes it with regard to the first evaporator unit. In addition, the control unit 30 applies a driving command for the freezing chamber blowing fan 640 to the fan driving unit 24, so that the fan driving unit 24 drives the freezing chamber blowing fan 640. The control unit performs the cooling by step S62 until the freezing chamber sensed temperature Tf is equal to or lower than the freezing chamber set temperature Tfr.

[0091] At step S63, the control unit 30 compares the refrigerating chamber sensed temperature Tr with the refrigerating chamber set temperature Trr. If the refrigerating chamber sensed temperature Tr is higher than the refrigerating chamber set temperature Trr, the refrigerating chamber R is in need of cooling. The control unit 30 goes to step S64. If the refrigerating chamber sensed temperature Tr is equal to or lower than the refrigerating chamber set temperature Trr, the refrigerating chamber R does not need cooling either. Accordingly, the control unit 30 ends the process.

[0092] At step S64, the control unit 30 cools only the refrigerating chamber R, instead of simultaneously cool-

ing the refrigerating chamber R and the freezing chamber F as in the previous step. That is, as the freezing chamber sensed temperature Tf satisfies the freezing chamber set temperature Tfr, the control unit 30 controls the valve driving unit 26 to form a refrigerant passage only toward the first evaporator unit. The control unit 30 applies a driving command to the valve driving unit 26 so as to form the refrigerant passage toward the first evaporator unit. Therefore, the valve driving unit 26 opens the 3-way valve 500 with regard to the first evaporator unit and closes it with regard to the second evaporator unit. Moreover, the control unit 30 applies a driving command for the refrigerating chamber blowing fan 620 to the fan driving unit 24, so that the fan driving unit 24 drives the refrigerating chamber blowing fan 620. The control unit performs the cooling by step S64 until the refrigerating chamber sensed temperature Tr is equal to or lower than the refrigerating chamber set temperature Trr.

[0093] In the case that both the refrigerating chamber R and the freezing chamber F are in need of cooling, steps S51 to S59, S60 and S61 are carried out. When the freezing chamber F needs not to be cooled due to the previous simultaneous or individual cooling, steps S60, S63 and S64 are performed to cool only the refrigerating chamber R. When the refrigerating chamber R needs not to be cooled due to the previous simultaneous or individual cooling, steps S60, S61 and S62 are performed to cool only the freezing chamber F. Among steps S51 to S59, S60 and S61, steps S51 to S54 relate to the simultaneous cooling, steps S54 to S56 relate to the individual cooling of the refrigerating chamber R, and steps S54, S57 and S59 relate to the individual cooling of the freezing chamber F.

[0094] In the meantime, the set time T1 of step S52, the set time T2 of step S56 and the set time T3 of step S59 can be the same time, or can be set in the order of $T1 > T3 > T2$. That is, the simultaneous cooling time can be set to be the longest one and the cooling time of the refrigerating chamber R can be set to be the second longest one, thereby preventing thawing of articles accommodated in the freezing chamber F.

[0095] Fig. 6 is a flowchart showing a third driving embodiment of the separate-cooling type refrigerator according to the present invention. According to a control method of Fig. 6, as described above, in the case that the control unit 30 forms a refrigerant passage toward the first evaporator unit after forming a refrigerant passage toward the second evaporator unit, as the refrigerant remains in the second evaporator 484 and the accumulator 700 of the second evaporator unit, it is necessary to transfer the whole refrigerant to the condenser 420 and the compressor 440.

[0096] In detail, at step S71, the control unit 30 judges whether to end current cooling of a freezing space. That is, the control unit 30 judges whether to control the valve driving unit 26 so that the 3-way valve 500 can end the step of forming the refrigerant passage toward the second evaporator unit. At step S71, when ending the cooling

of the freezing chamber F and starting the cooling of the refrigerating chamber R, or when ending the cooling of the freezing chamber F, the control unit 30 goes to step S72.

[0097] At step S72, in order to block the refrigerant passage toward the second evaporator unit cooling the freezing chamber F, the control unit 30 applies driving commands to the valve driving unit 26 so that the 3-way valve 500 can block the refrigerant passages toward the second evaporator unit and the first evaporator unit. Therefore, the 3-way valve 500 blocks the refrigerant passages toward the first and second evaporator units. Here, the control unit 30 applies commands to the fan driving unit 24 so as to stop driving of the refrigerating chamber blowing fan 620 and the freezing chamber blowing fan 640.

[0098] At step S73, the control unit 30 applies a driving command for the compressor 420 to the compressor driving unit 28. Accordingly, the compressor 420 extracts the refrigerant remaining in the second evaporator unit, and transfers the refrigerant to the inside of the compressor 420 and the condenser 440.

[0099] At step S74, the control unit 30 applies a stop command for the condensation fan 660 to the fan driving unit 24. The fan driving unit 24 stops the condensation fan 660, thereby preventing power consumption and noise generation caused by the condensation fan 660. As the control unit 30 blocks both the first and second evaporator units through the 3-way valve 500, the refrigerating chamber R and the freezing chamber F (particularly, the freezing chamber F) are not cooled. Thus, stopping of the condensation fan 600 does not cause any problem.

[0100] At step S75, the control unit 30 continuously performs steps S72 to S74 for a set time. That is, the control unit 30 carries out a pump-down operation for the set time corresponding to a time point of transferring the whole refrigerant remaining in the second evaporator unit.

[0101] At step S76, after extracting the whole refrigerant remaining in the second evaporator unit and the first evaporator unit, the control unit 30 cools the refrigerating chamber R which is a refrigerating space. That is, the control unit 30 controls the valve driving unit 26 so that the 3-way valve 500 can form the refrigerant passage toward the first evaporator unit and maintain a close state with regard to the second evaporator unit. In addition, the control unit 30 applies a driving command for the refrigerating chamber blowing fan 620 and a driving command for the condensation fan 660 to the fan driving unit 24, thereby rotating the refrigerating chamber blowing fan 620 and the condensation fan 660.

[0102] Fig. 7 is a flowchart showing a fourth driving embodiment of the separate-cooling type refrigerator According to the present invention.

[0103] In detail, at step S81, the control unit 30 continuously performs a current operation (cooling or pause) until it receives a defrosting signal from the refrigerating

chamber defrosting sensor 16 and/or the freezing chamber defrosting sensor 20. As set forth above, the control unit 30 can recognize the defrosting signals in a real time from the refrigerating chamber defrosting sensor 16 and the freezing chamber defrosting sensor 20.

[0104] At step S82, the control unit 30 judges whether the received defrosting signal satisfies preset defrosting conditions. If the received defrosting signal satisfies the preset defrosting conditions, the control unit 30 goes to step S83. If not, the control unit 30 goes to step S81, and continuously performs the current operation (cooling or pause) until it receives an additional defrosting signal.

[0105] At step S83, the control unit 30 judges whether the defrosting signal satisfying the preset defrosting conditions is the defrosting signal received from the refrigerating chamber defrosting sensor 16. If the defrosting signal is the defrosting signal received from the refrigerating chamber defrosting sensor 16, the control unit 30 goes to step S84. If the defrosting signal is the defrosting signal received from the freezing chamber defrosting sensor 20, the control unit 30 goes to step S88.

[0106] At step S84, the control unit 30 applies a driving command to the refrigerating chamber defrosting heater 18 so that the refrigerating chamber defrosting heater 18 can supply heat to the refrigerating chamber evaporator 482, thereby performing defrosting. Here, in the case that a refrigerant passage is formed toward the refrigerating chamber evaporator 482 to cool the refrigerating chamber R, the control unit 30 blocks the refrigerant passage toward the refrigerating chamber evaporator 482. That is, the control unit 30 applies a driving command to the valve driving unit 26 so as to block the refrigerant passage toward the first evaporator unit. The valve driving unit 26 closes the 3-way valve 500 with regard to the first evaporator unit. In addition, the control unit 30 stops an operation of the refrigerating chamber blowing fan 620.

[0107] At step S85, the control unit 30 judges whether the freezing chamber F is in need of cooling According to a sensed temperature from the freezing chamber temperature sensor 14. That is, the control unit 30 compares the sensed temperature with a freezing chamber set temperature. If the sensed temperature is higher than the freezing chamber set temperature, as the freezing chamber F needs cooling, the control unit 30 goes to step S86, and if not, the control unit 30 goes to step S87. It must be understood that the control unit 30 receives the freezing chamber sensed temperature not only in step S85 but in the whole steps at intervals of a predetermined time (for example, 5 seconds, 10 seconds, etc.).

[0108] At step S86, the control unit 30 cools only the freezing chamber F. That is, as the control unit 30 defrosts the refrigerating chamber R, it controls the valve driving unit 26 to form a refrigerant passage only toward the second evaporator unit. The control unit 30 applies a driving command to the valve driving unit 26 so as to form the refrigerant passage toward the second evaporator unit. The valve driving unit 26 opens the 3-way valve 500 with regard to the second evaporator unit. In addition,

the control unit 30 applies driving commands for the freezing chamber blowing fan 640 and the condensation fan 660 to the fan driving unit 24, so that the fan driving unit 24 drives the freezing chamber blowing fan 640 and the condensation fan 660. That is, when defrosting the refrigerating chamber R, the control unit 30 continuously cools the freezing chamber F.

[0109] At step S87, the control unit 30 judges whether the defrosting of the refrigerating chamber evaporator 482 has been finished. To this end, the control unit 30 receives the defrosting signal in a real time from the refrigerating chamber defrosting sensor 16. If the defrosting signal does not satisfy the preset defrosting conditions, the control unit 30 ends the defrosting. On the contrary, if the defrosting signal satisfies the defrosting conditions, the control unit 30 goes to step S84 and continuously performs the defrosting.

[0110] At step S88, the control unit 30 applies a driving command to the freezing chamber defrosting heater 22 so that the freezing chamber defrosting heater 22 can supply heat to the freezing chamber evaporator 484, thereby performing defrosting. Here, in the case that a refrigerant passage is formed toward the freezing chamber evaporator 484 to cool the freezing chamber F, the control unit 30 blocks the refrigerant passage toward the freezing chamber evaporator 484. That is, the control unit 30 applies a driving command to the valve driving unit 26 so as to block the refrigerant passage toward the second evaporator unit. The valve driving unit 26 closes the 3-way valve 500 with regard to the second evaporator unit. Moreover, the control unit 30 stops an operation of the freezing chamber blowing fan 640.

[0111] At step S89, the control unit 30 judges whether the refrigerating chamber R is in need of cooling according to a sensed temperature from the refrigerating chamber temperature sensor 12. That is, the control unit 30 compares the sensed temperature with a refrigerating chamber set temperature. If the sensed temperature is higher than the refrigerating chamber set temperature, as the refrigerating chamber R needs cooling, the control unit 30 goes to step S90, and if not, the control unit 30 goes to step S91. It must be understood that the control unit 30 receives the refrigerating chamber sensed temperature not only in step S89 but in the whole steps at intervals of a predetermined time (for example, 5 seconds, 10 seconds, etc.).

[0112] At step S90, the control unit 30 cools only the refrigerating chamber R. That is, as the control unit 30 defrosts the freezing chamber F, it controls the valve driving unit 26 to form a refrigerant passage only toward the first evaporator unit. The control unit 30 applies a driving command to the valve driving unit 26 so as to form the refrigerant passage toward the first evaporator unit. The valve driving unit 26 opens the 3-way valve 500 with regard to the first evaporator unit. In addition, the control unit 30 applies driving commands for the refrigerating chamber blowing fan 620 and the condensation fan 660 to the fan driving unit 24, so that the fan driving unit 24

drives the refrigerating chamber blowing fan 620 and the condensation fan 660. That is, when defrosting the freezing chamber F, the control unit 30 continuously cools the refrigerating chamber R.

[0113] At step S91, the control unit 30 judges whether the defrosting of the freezing chamber evaporator 484 has been finished. To this end, the control unit 30 receives the defrosting signal in a real time from the freezing chamber defrosting sensor 20. If the defrosting signal does not satisfy the preset defrosting conditions, the control unit 30 ends the defrosting. On the contrary, if the defrosting signal satisfies the defrosting condition, the control unit 30 goes to step S88 and continuously performs the defrosting.

[0114] In the above flowchart, when it is assumed that the refrigerating chamber sensed temperature and the freezing chamber sensed temperature are higher than the prestored refrigerating chamber set temperature and the prestored freezing chamber set temperature, step S86 or S90 is directly performed without the judgment of steps S85 and S89.

[0115] For example, as the refrigerating chamber R and the freezing chamber F are in need of cooling at the same time, the control unit 30 alternately cools the refrigerating chamber R and the freezing chamber F. That is, for example, the control unit 30 cools the refrigerating chamber R for a set time $Tr1$, then cools the freezing chamber F for a set time $Tf1$, and then cools the refrigerating chamber R again for a set time $Tr2$. Therefore, the control unit 30 controls the valve driving unit 26 to form a refrigerant passage toward the first evaporator unit for the set time $Tr1$ and then to form a refrigerant passage toward the second evaporator unit for the set time $Tf1$. Thereafter, in order to form a refrigerant passage toward the first evaporator unit again, the control unit 30 performs the pump-down operation described above, and forms the refrigerant passage toward the first evaporator unit for the set time $Tr2$. In addition, the control unit 30 drives the blowing fan provided in each evaporator unit with the refrigerant passage formed therein. That is, when cooling the refrigerating chamber R, the control unit 30 applies a driving command to the fan driving unit 24 so as to rotate the refrigerating chamber blowing fan 620. Meanwhile, when cooling the freezing chamber F, the control unit 30 applies a driving command to the fan driving unit 24 so as to rotate the freezing chamber blowing fan 640.

[0116] The control method according to the present invention can be applied during this alternate cooling.

[0117] According to another embodiment, as the refrigerating chamber R and the freezing chamber F are in need of cooling at the same time, the control unit 30 simultaneously cools the refrigerating chamber R and the freezing chamber F. That is, the control unit 30 applies driving commands to the valve driving unit 26 so as to form refrigerant passages toward the first evaporator unit and the second evaporator unit at the same time. The valve driving unit 26 drives the 3-way valve 500 to supply

the refrigerant to the first evaporator unit and the second evaporator unit at the same time. In addition, the control unit 30 applies driving commands to the fan driving unit 24 so as to rotate the refrigerating chamber blowing fan 620 and the freezing chamber blowing fan 640 provided in the first evaporator unit and the second evaporator unit with the refrigerant passages formed therein.

[0118] The control method according to the present invention can be applied during this simultaneous cooling.

[0119] Fig. 8 is a flowchart showing a fifth driving embodiment of the separate-cooling type refrigerator according to the present invention (as a defrosting apparatus).

[0120] In detail, at step S101, the control unit 30 receives a defrosting signal from the refrigerating chamber defrosting sensor 16. As set forth above, the control unit 30 can recognize the defrosting signal in a real time from the refrigerating chamber defrosting sensor 16.

[0121] At step S102, the control unit 30 judges whether the received defrosting signal satisfies preset defrosting conditions. If the received defrosting signal satisfies the preset defrosting conditions, the control unit 30 goes to step S103. If not, the control unit 30 goes to step S101, and continuously performs a current operation (cooling or pause) until it receives an additional defrosting signal.

[0122] At step S103, the control unit 30 applies a driving command to the refrigerating chamber defrosting heater 18 so that the refrigerating chamber defrosting heater 18 can supply heat to the refrigerating chamber evaporator 482, thereby performing defrosting. When supplying heat by means of the refrigerating chamber defrosting heater 18, the control unit 30 supplies power of the power supply unit (not shown) to the refrigerating chamber defrosting heater 18.

[0123] Here, in the case that a refrigerant passage is formed toward the refrigerating chamber evaporator 482 to cool the refrigerating chamber R, the control unit 30 blocks the refrigerant passage toward the refrigerating chamber evaporator 482. That is, the control unit 30 applies a driving command to the valve driving unit 26 so as to block the refrigerant passage toward the first evaporator unit. The valve driving unit 26 closes the 3-way valve 500 with regard to the first evaporator unit. Moreover, the control unit 30 applies a stop command to the fan driving unit 24 so as to stop driving of the refrigerating chamber blowing fan 620 corresponding to the first evaporator unit.

[0124] At step S104, the control unit 30 controls the refrigerating chamber defrosting heater 18 to supply heat to the refrigerating chamber evaporator 482 for a set time. After the set time elapses, the control unit 30 goes to step S105. Here, the set time is shorter than a time of completely defrosting the refrigerating chamber evaporator 482. As heat is supplied for the set time, the refrigerating chamber evaporator 482 is not completely defrosted but thawed to some extent.

[0125] At step S105, the control unit 30 applies a driv-

ing stop command to the refrigerating chamber defrosting heater 18. The driving stop command corresponds to an operation of the control unit 30 of intercepting power of the power supply unit with regard to the refrigerating chamber defrosting heater 18. Accordingly, power consumed as heat in the defrosting process of the refrigerating chamber R can be considerably saved.

[0126] At step S106, the control unit 30 applies a driving command for the refrigerating chamber blowing fan 620 to the fan driving unit 24. The fan driving unit 24 drives the refrigerating chamber blowing fan 620. As the refrigerating chamber blowing fan 620 rotates, the thawing state of the refrigerating chamber evaporator 482 formed due to the heat supplied in steps S103 and S104 is facilitated, and moisture generated in the thawing and defrosting process is supplied to the inside of the refrigerator R, thereby improving the humidity inside the refrigerator R.

[0127] At step S107, the control unit 30 judges whether the defrosting of the refrigerating chamber evaporator 482 has been finished. To this end, the control unit 30 receives the defrosting signal in a real time from the refrigerating chamber defrosting sensor 16. If the defrosting signal does not satisfy the preset defrosting conditions, the control unit 30 ends the defrosting. On the contrary, if the defrosting signal satisfies the defrosting conditions, the control unit 30 goes to step S106, and continuously performs the defrosting by means of the refrigerating chamber blowing fan 620.

[0128] The present invention is not limited to the embodiments described and illustrated above. It will be apparent that those skilled in the art can make various modifications and changes thereto within the technical spirit of the invention defined by the appended claims. Therefore, such modifications and changes belong to the scope of the invention defined by the claims.

Claims

1. A separate-cooling type refrigerator, comprising a compressor (420), a condenser (440) for condensing refrigerant from the compressor, a condensation fan (660), a 3-way valve (500) for supplying the refrigerant from the condenser (440) to first and second evaporators (482), (484), first and second evaporator units, for cooling a refrigerating space (R) and a freezing space (F), respectively, by evaporating the supplied refrigerant, and first and second blowing fans (620), (640) for circulating cool air generated by the first evaporator unit and the second evaporator unit, respectively, and temperature sensors (14, 12) for sensing temperatures of the freezing space (F) and the refrigerating space (R), respectively; wherein the refrigerator further comprises a control means (30) for comparing the sensed temperatures with set temperatures of the freezing space (F) and the refrigerating space (R), respectively, and con-

trolling the 3-way valve (500) to substantially simultaneously form refrigerant passages toward the first evaporator (482) and the second evaporator (484), to simultaneously cool the refrigerating space (R) and the freezing space (F), when the freezing space (F) and the refrigerating space (R) are in need of cooling at the same time, and

characterised in that, during simultaneously cooling of the refrigerating space (R) and the freezing space (F), the control means (30) judges variation degrees of the sensed temperatures, and selectively forms the refrigerant passage toward the first evaporator (482) or the second evaporator (484) corresponding to the space with a smaller variation degree instead of simultaneously cooling the refrigerating space (R) and the freezing space (F).

2. The separate-cooling type refrigerator of claim 1, wherein the refrigerant passages are simultaneously formed toward the first evaporator unit and the second evaporator unit for a predetermined time.
3. The separate-cooling type refrigerator of any one of claims 1 to 2, wherein the first blowing fan (620) and/or the second blowing fan (640) corresponding to the formed refrigerant passages are driven and/or stopped.
4. The separate-cooling type refrigerator of any one of claims 1 to 2, wherein the condensation fan (660) is driven and stopped according to the progress and completion of the cooling of the freezing space (F).
5. The separate-cooling type refrigerator of either claim 1 or 2, wherein heat is supplied for a predetermined time to the first evaporator unit and/or the second evaporator unit which does not have a refrigerant passage, for defrosting the first evaporator unit and/or the second evaporator unit.
6. The separate-cooling type refrigerator of claim 5, wherein the second blowing fan (640) is driven after the second evaporator unit is defrosted.
7. The separate-cooling type refrigerator of any one of claims 1 to 6, wherein the refrigerator further comprises a heat source supplying unit (22) for supplying heat to the second evaporator (482) for a predetermined time; and a control unit (24) for driving the second blowing fan (640) after the predetermined time.
8. The separate-cooling type refrigerator of claim 7, wherein the control unit (30) supplies power to the heat source supplying unit (22) for a predetermined time.
9. The separate-cooling type refrigerator of claim 7,

comprising a defrosting sensor unit (20) for generating a defrosting signal according to a temperature of the second evaporator (484), wherein the control unit (24) operates the second blowing fan (640) until the defrosting of the second evaporator (484) is finished according to the defrosting signal.

10. The separate-cooling type refrigerator of any one of claims 1 to 9, wherein, when one of the first and second evaporator units is defrosted, a refrigerant passage is formed toward the other evaporator unit.
11. The separate-cooling type refrigerator of claim 10, wherein the space corresponding to the other evaporator unit needs cooling.

Patentansprüche

1. Kühlschrank mit getrennter Kühlung, umfassend einen Kompressor (420), einen Kondensator (440) zum Kondensieren von Kühlmittel von dem Kompressor, ein Kondensationsgebläse (660), ein 3-Wege-Ventil (500) zum Liefern des Kühlmittels von dem Kondensator (440) zu ersten und zweiten Verdampfern (482), (484), erste und zweite Verdampfeinheiten zum Kühlen eines Gefrierraums (F) beziehungsweise eines Kühlraums (R), indem das gelieferte Kühlmittel verdampft wird, und erste und zweite blasende Lüfter (620), (640) zum Zirkulieren von kühler Luft, welche von der ersten Verdampfeinheit beziehungsweise der zweiten Verdampfeinheit erzeugt wird, und Temperatursensoren (14, 12) zum Erfassen von Temperaturen des Gefrierraums (F) beziehungsweise des Kühlraums (R); wobei der Kühlschrank ferner ein Steuer-/Regelmittel (30) zum Vergleichen der erfassten Temperaturen mit festgelegten Temperaturen des Gefrierraums (F) beziehungsweise des Kühlraums (R) und zum Steuern/Regeln des 3-Wege-Ventils (500) umfasst, um im Wesentlichen gleichzeitig Kühlmitteldurchgänge in Richtung des ersten Verdampfers (482) und des zweiten Verdampfers (484) zu bilden, um gleichzeitig den Kühlraum (R) und den Gefrierraum (F) zu kühlen, wenn der Gefrierraum (F) und der Kühlraum (R) gleichzeitig eine Kühlung benötigen, und **dadurch gekennzeichnet, dass** während eines gleichzeitigen Kühlens des Kühlraums (R) und des Gefrierraums (F) das Steuer-/Regelmittel (30) Abweichungsgrade der erfassten Temperaturen bewertet und selektiv den Kühlmitteldurchgang in Richtung des ersten Verdampfers (482) oder des zweiten Verdampfers (484) gemäß dem Raum mit einem kleineren Abweichungsgrad bildet, anstelle gleichzeitig den Kühlraum (R) und den Gefrierraum (F) zu kühlen.

2. Kühlschrank mit getrennter Kühlung nach Anspruch 1, wobei die Kühlmitteldurchgänge gleichzeitig in Richtung der ersten Verdampfeinheit und der zweiten Verdampfeinheit für eine vorbestimmte Zeit gebildet werden. 5
3. Kühlschrank mit getrennter Kühlung nach einem der Ansprüche 1 bis 2, wobei der erste blasende Lüfter (620) oder/und der zweite blasende Lüfter (640) gemäß den gebildeten Kühlmitteldurchgängen betrieben oder/und angehalten werden. 10
4. Kühlschrank mit getrennter Kühlung nach einem der Ansprüche 1 bis 2, wobei das Kondensationsgebläse (660) gemäß dem Fortschritt und der Vollendung des Kühlens des Gefrierraums (F) angetrieben und angehalten wird. 15
5. Kühlschrank mit getrennter Kühlung nach entweder Anspruch 1 oder 2, wobei für eine vorbestimmte Zeit Wärme an die erste Verdampfeinheit oder/und die zweite Verdampfeinheit geliefert wird, welche keinen Kühlmitteldurchgang aufweist, um die erste Verdampfeinheit oder/und die zweite Verdampfeinheit abzutauen. 20 25
6. Kühlschrank mit getrennter Kühlung nach Anspruch 5, wobei der zweite blasende Lüfter (640) angetrieben wird, nachdem die zweite Verdampfeinheit abgetaut wird. 30
7. Kühlschrank mit getrennter Kühlung nach einem der Ansprüche 1 bis 6, wobei der Kühlschrank ferner eine Wärmequelle-Liefereinheit (22) zum Liefern von Wärme an den zweiten Verdampfer (482) für eine vorbestimmte Zeit umfasst; sowie eine Steuer-/Regeleinheit (24) zum Antreiben des zweiten blasenden Lüfters (640) nach der vorbestimmten Zeit. 35
8. Kühlschrank mit getrennter Kühlung nach Anspruch 7, wobei die Steuer-/Regeleinheit (30) die Wärmequelle-Liefereinheit (22) für eine vorbestimmte Zeit mit Leistung versorgt. 40
9. Kühlschrank mit getrennter Kühlung nach Anspruch 7, umfassend eine Abtau-Sensoreinheit (20) zum Erzeugen eines Abtausignals gemäß einer Temperatur des zweiten Verdampfers (484), wobei die Steuer-/Regeleinheit (24) den zweiten blasenden Lüfter (640) betreibt bis das Abtauen des zweiten Verdampfers (484) gemäß dem Abtausignal abgeschlossen ist. 45 50
10. Kühlschrank mit getrennter Kühlung nach einem der Ansprüche 1 bis 9, wobei wenn eine aus der ersten und zweiten Verdampfeinheit abgetaut wird, ein Kühlmitteldurchgang in Richtung der anderen Verdampfeinheit gebildet wird. 55

11. Kühlschrank mit getrennter Kühlung nach Anspruch 10, wobei der der anderen Verdampfeinheit entsprechende Raum Kühlung benötigt.

Revendications

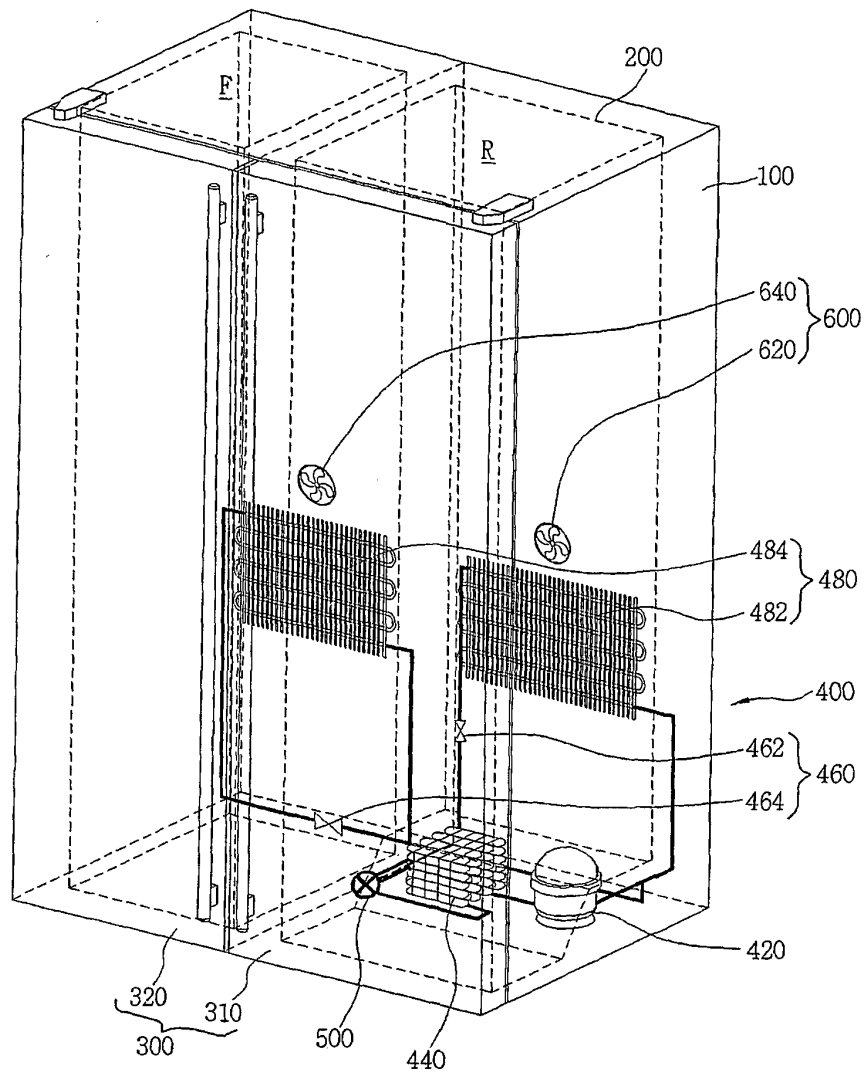
1. Réfrigérateur de type à refroidissement séparé, comprenant un compresseur (420), un condenseur (440) destiné à condenser un réfrigérant provenant du compresseur, un ventilateur de condensation (660), une vanne à trois voies (500) destinée à fournir le réfrigérant provenant du condenseur (440) aux premier et deuxième évaporateurs (482), (484), des première et deuxième unités d'évaporation pour refroidir un espace de réfrigération (R) et un espace de congélation (F), respectivement, par évaporation du réfrigérant fourni, et des premier et deuxième ventilateurs de soufflage (620), (640) pour faire circuler l'air froid généré par la première unité d'évaporation et la deuxième unité d'évaporation, respectivement, et des capteurs de température (14, 12) pour détecter les températures de l'espace de congélation (F) et de l'espace de réfrigération (R), respectivement ; dans lequel, le réfrigérateur comprend en outre un moyen de commande (30) destiné à comparer les températures détectées aux températures réglées de l'espace de congélation (F) et de l'espace de réfrigération (R), respectivement, et à commander la vanne à trois voies (500) pour former sensiblement simultanément des passages de réfrigérant en direction du premier évaporateur (482) et du deuxième évaporateur (484), pour refroidir simultanément l'espace de réfrigération (R) et l'espace de congélation (F), lorsque l'espace de congélation (F) et l'espace de réfrigération (R) ont besoin de refroidissement au même temps, et **caractérisé en ce que** pendant le refroidissement simultané de l'espace de réfrigération (R) et de l'espace de congélation (F), le moyen de commande évalue les degrés de variation des températures détectées, et forme de manière sélective le passage de réfrigérant en direction du premier évaporateur (482) ou du deuxième évaporateur (484) correspondant à l'espace à moindre degré de variation au lieu de refroidir simultanément l'espace de réfrigération (R) et l'espace de congélation (F).
2. Réfrigérateur de type à refroidissement séparé de la revendication 1, dans lequel les passages de réfrigérant sont formés simultanément en direction de la première unité d'évaporation et de la deuxième unité d'évaporation pendant un temps prédéterminé.
3. Réfrigérateur de type à refroidissement séparé de l'une quelconque des revendications 1 et 2, dans lequel le premier ventilateur de soufflage (620) et/ou le deuxième ventilateur de soufflage (640) corres-

pendant aux passages de réfrigérant formés sont entraînés et/ou arrêtés.

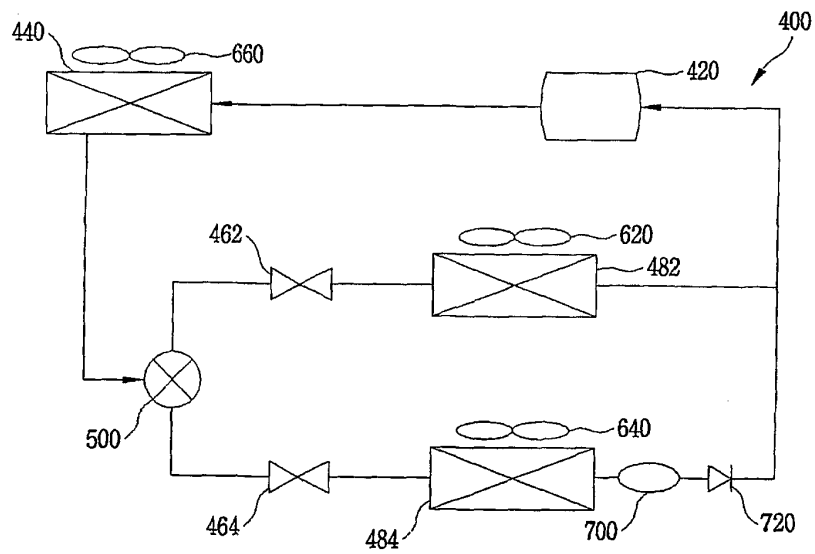
dant à l'autre unité d'évaporation a besoin de refroidissement.

4. Réfrigérateur de type à refroidissement séparé de l'une quelconque des revendications 1 et 2, dans lequel le ventilateur de condensation (660) est entraîné et arrêté en fonction de la progression et de l'achèvement du refroidissement de l'espace de congélation (F). 5
5. Réfrigérateur de type à refroidissement séparé de la revendication 1 ou 2, dans lequel la chaleur est fournie pendant un temps prédéterminé à la première unité d'évaporation et/ou à la deuxième unité d'évaporation qui ne présente pas de passage de réfrigérant, pour dégivrer la première unité d'évaporation et/ou la deuxième unité d'évaporation. 10
6. Réfrigérateur de type à refroidissement séparé de la revendication 5, dans lequel le deuxième ventilateur de soufflage (640) est entraîné après que la deuxième unité d'évaporation est dégivrée. 15
7. Réfrigérateur de type à refroidissement séparé de l'une quelconque des revendications 1 à 6, dans lequel le réfrigérateur comprend en outre une unité d'alimentation en source de chaleur (22) destinée à fournir de la chaleur au deuxième évaporateur (482) pendant un temps prédéterminé ; et une unité de commande (24) destinée à entraîner le deuxième ventilateur de soufflage (640) après le temps prédéterminé. 20
8. Réfrigérateur de type à refroidissement séparé de la revendication 7, dans lequel l'unité de commande (30) fournit de l'énergie à l'unité d'alimentation en source de chaleur (22) pendant un temps prédéterminé. 25
9. Réfrigérateur de type à refroidissement séparé de la revendication 7, comprenant une unité de détection de dégivrage (20) destinée à générer un signal de dégivrage en fonction d'une température du deuxième évaporateur (484), dans lequel l'unité de commande (24) fait fonctionner le deuxième ventilateur de soufflage (640) jusqu'à ce que le dégivrage du deuxième évaporateur (484) soit terminé en fonction du signal de dégivrage. 30
10. Réfrigérateur de type à refroidissement séparé de l'une quelconque des revendications 1 à 9, dans lequel, lorsque l'une des première et deuxième unités d'évaporation est dégivrée, un passage de réfrigérant est formé en direction de l'autre unité d'évaporation. 35
11. Réfrigérateur de type à refroidissement séparé de la revendication 10, dans lequel l'espace correspon-

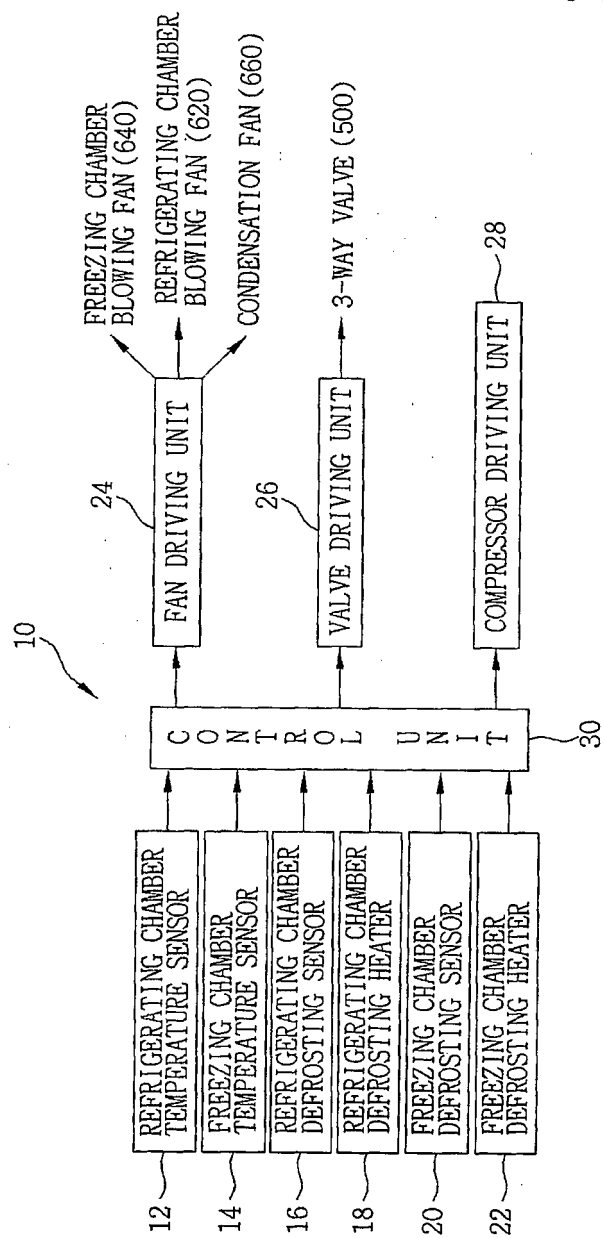
[Fig. 1]



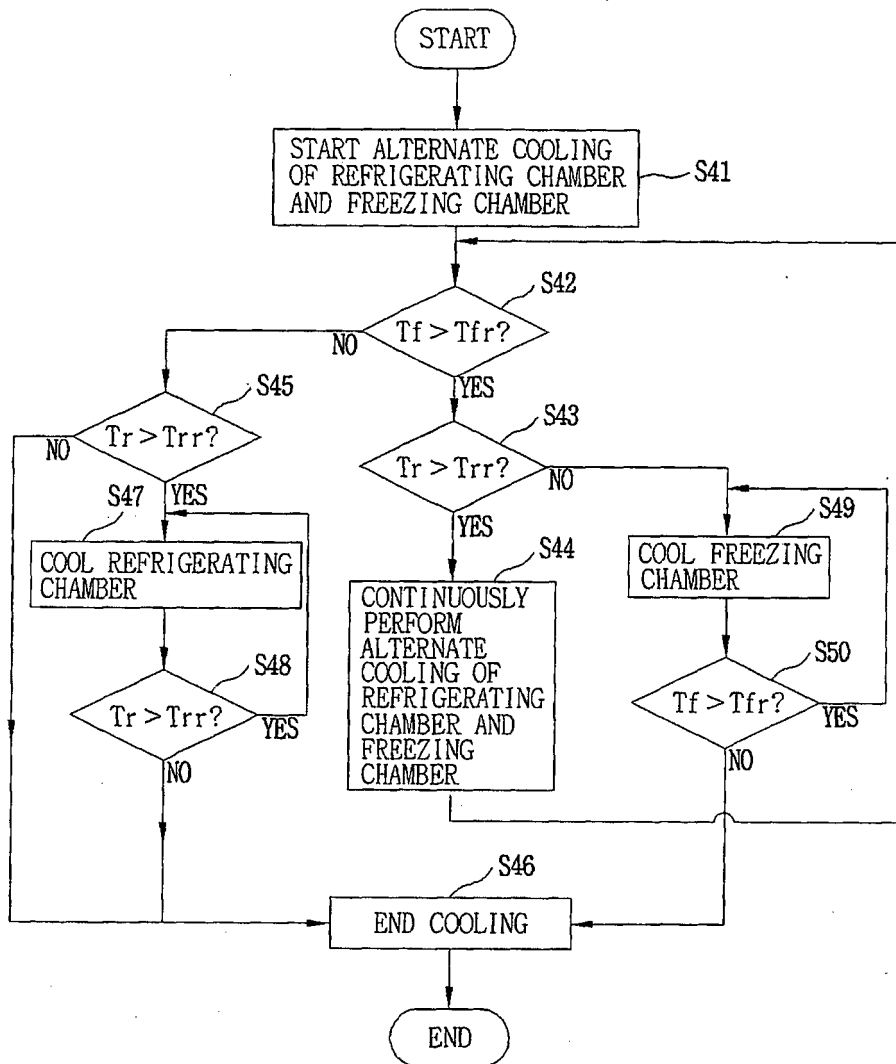
[Fig. 2]



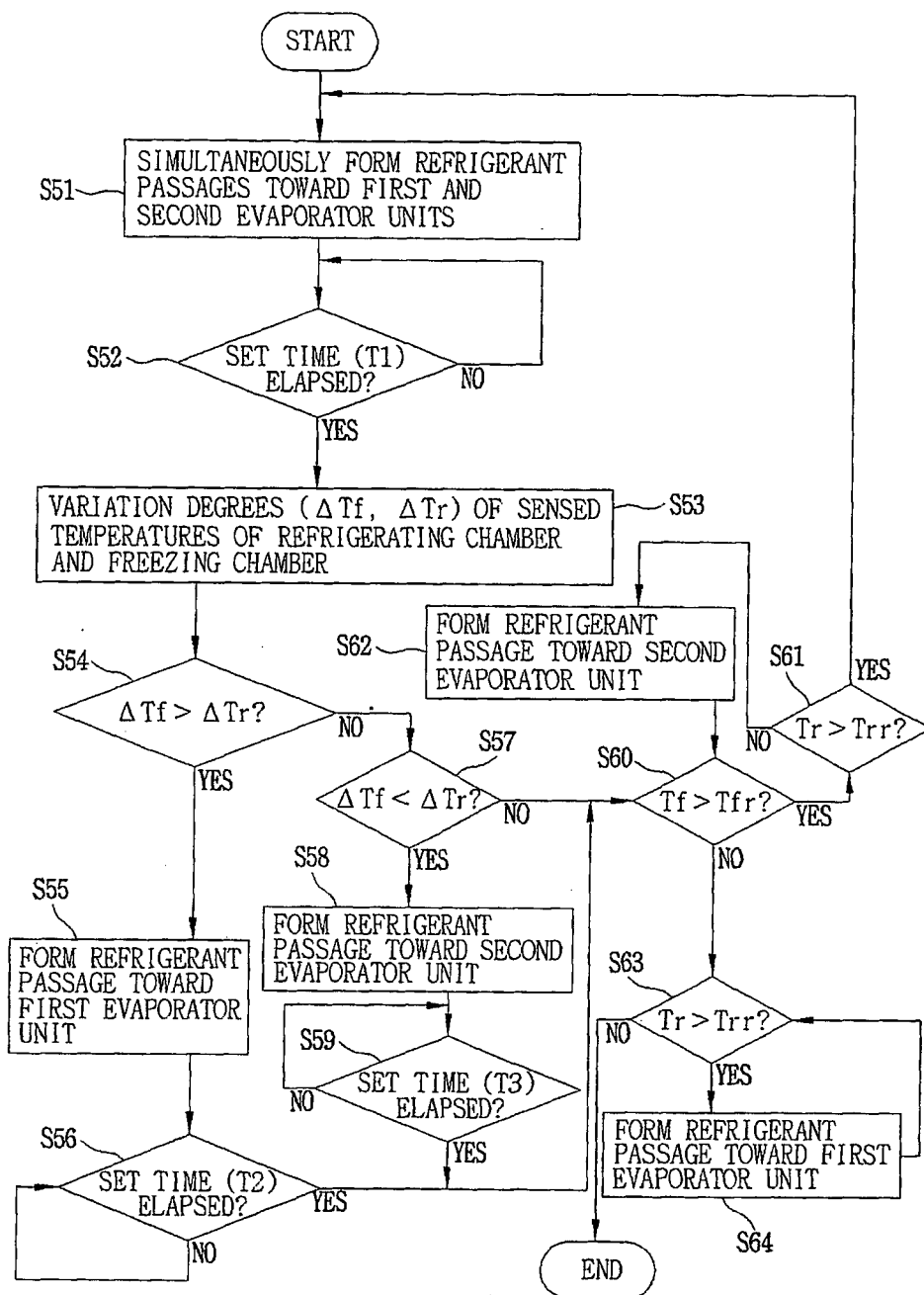
[Fig. 3]



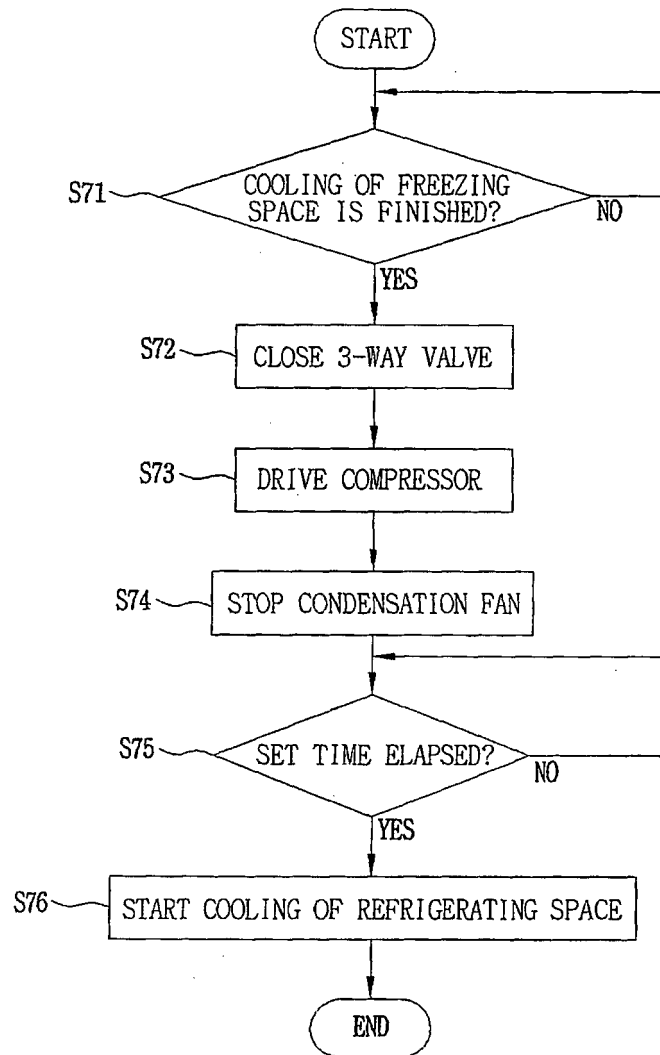
[Fig. 4]



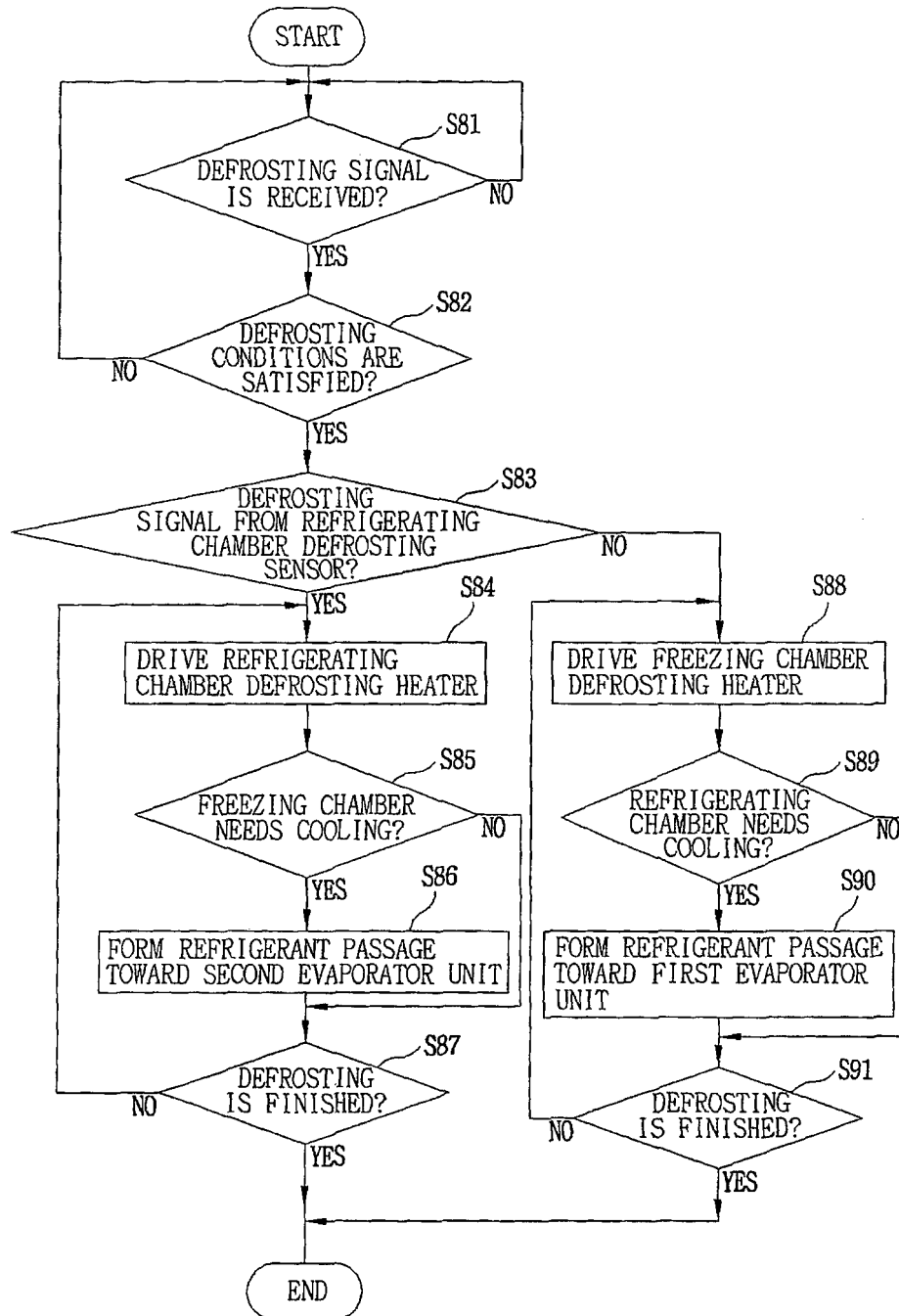
[Fig. 5]



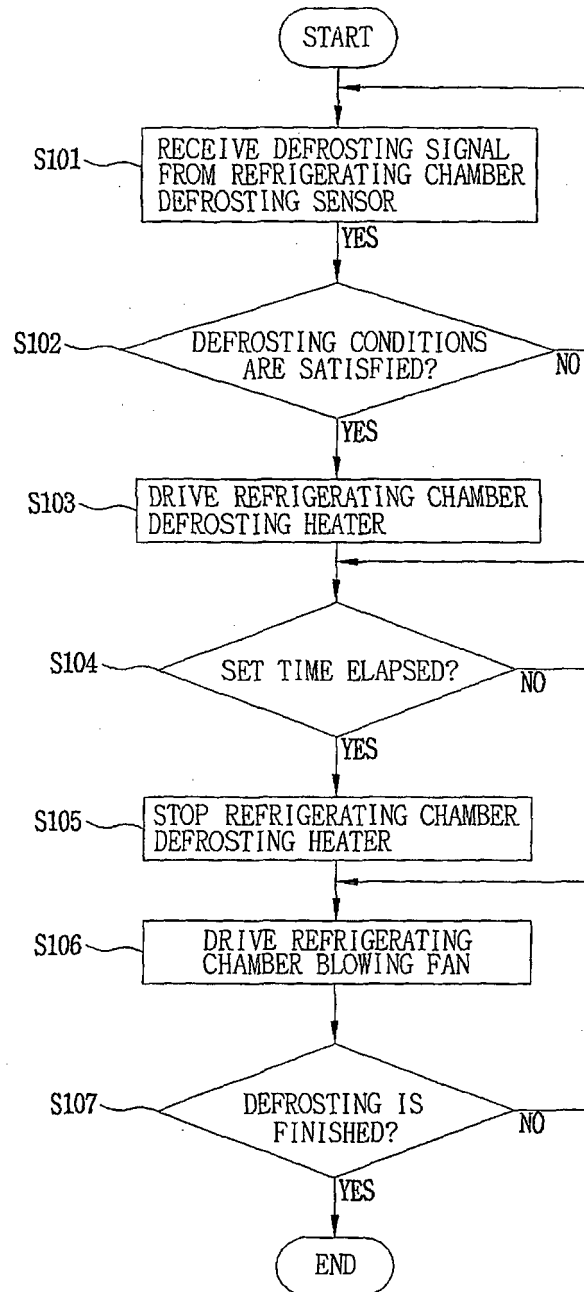
[Fig. 6]



[Fig. 7]



[Fig. 8]



REFERENCES CITED IN THE DESCRIPTION

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