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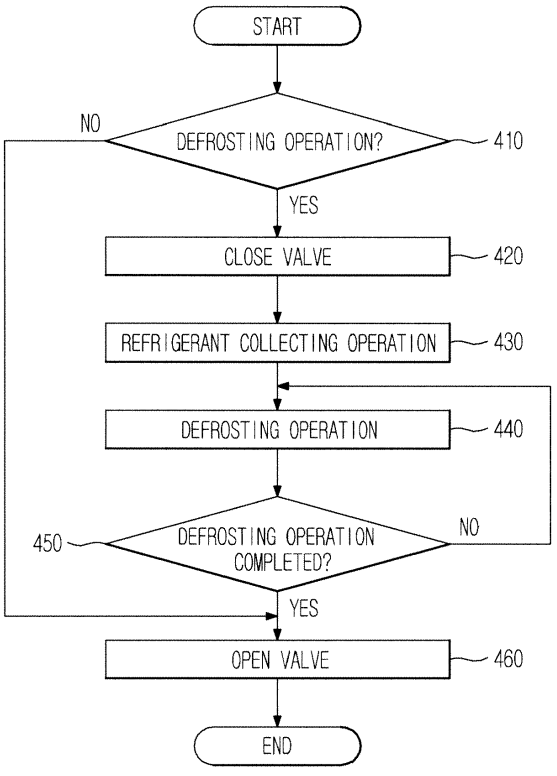
(54) Refrigerator and control method thereof

(57) A control method includes determining whether to perform a defrosting operation of an evaporator, closing a valve to prevent refrigerant from moving into the evaporator if implementation of the defrosting operation is determined, performing a refrigerant collecting operation, and opening the valve upon completion of the defrosting operation. Intercepting a flow path of the refrigerant to prevent the refrigerant from moving into the evaporator during defrosting prevents explosion due to leakage of the refrigerant.

FIG. 5



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Description

BACKGROUND

1. Field

[0001] Embodiments relate to a refrigerator in which a freezing compartment and a refrigerating compartment are respectively provided with evaporators to enable independent cooling of the freezing compartment and the refrigerating compartment, and a control method thereof.

2. Description of the Related Art

[0002] A refrigerator serves to keep food fresh at a low temperature for a long time by lowering the interior temperature of a storage compartment thereof via a refrigeration cycle in which refrigerant undergoes compression, condensation, expansion and evaporation.

[0003] Conventional refrigerators, in which a freezing compartment and a refrigerating compartment are respectively provided with evaporators, may be classified into parallel-cycle refrigerators using a 3-way valve to enable independent operation of the freezing compartment and the refrigerating compartment, and serial-cycle refrigerators in which the evaporators of the freezing compartment and the refrigerating compartment are connected in series without a valve.

[0004] The above described conventional refrigerators may have a risk of explosion if refrigerant leaks from a refrigerant pipe during defrosting of the evaporators of the freezing compartment and the refrigerating compartment.

[0005] In addition, the conventional cycle refrigerators may cause deterioration in cooling efficiency of the freezing compartment and increase energy consumption because of a higher evaporation temperature of the refrigerating compartment upon simultaneous cooling of the freezing compartment and the refrigerating compartment.

SUMMARY

[0006] Therefore, it is one aspect to provide a refrigerator and a control method thereof, in which a flow path to a freezing compartment evaporator and a refrigerating compartment evaporator is intercepted during defrosting, preventing explosion of the refrigerator.

[0007] It is another aspect to provide a refrigerator and a control method thereof, which may increase cooling efficiency of a freezing compartment upon simultaneous cooling of the freezing compartment and a refrigerating compartment.

[0008] Additional aspects will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the invention.

[0009] In accordance with one aspect, a refrigerator includes a compressor, a condenser to condense refrigerant compressed in the compressor, a freezing compartment evaporator and a refrigerating compartment evaporator installed respectively in a freezing compartment and a refrigerating compartment to evaporate the condensed refrigerant into gas-phase refrigerant, a valve to open or close a flow path of the refrigerant, and a control unit to close the valve if implementation of a defrosting operation of any one of the freezing compartment evaporator and the refrigerating compartment evaporator is determined.

[0010] The valve may be a 3-way valve connected to a discharge pipe of the condenser and suction pipes of the freezing compartment evaporator and the refrigerating compartment evaporator.

[0011] The valve may be an On-Off valve connected to a discharge pipe of the condenser and suction pipes of the freezing compartment evaporator and the refrigerating compartment evaporator.

[0012] The control unit may determine whether to perform the defrosting operation of the freezing compartment evaporator and the refrigerating compartment evaporator, closes the valve to prevent the refrigerant from moving into the freezing compartment evaporator and the refrigerating compartment evaporator if implementation of the defrosting operation of the freezing compartment evaporator and the refrigerating compartment evaporator is determined, performs a refrigerant collecting operation, and opens the closed valve upon completion of the defrosting operation.

[0013] The refrigerant collecting operation may be performed in such a manner that the compressor is operated in a closed state of the valve to move the refrigerant distributed in the freezing compartment evaporator and the refrigerating compartment evaporator into the condenser.

[0014] In accordance with another aspect, a control method of a refrigerator includes determining whether to perform a defrosting operation of a freezing compartment evaporator and a refrigerating compartment evaporator, closing the valve to prevent refrigerant from moving into the freezing compartment evaporator and the refrigerating compartment evaporator if implementation of the defrosting operation of the freezing compartment evaporator and the refrigerating compartment evaporator is determined, performing a refrigerant collecting operation, and opening the closed valve upon completion of the defrosting operation.

[0015] Implementation of the refrigerant collecting operation may include operating the compressor in a closed state of the valve to move the refrigerant distributed in the freezing compartment evaporator and the refrigerating compartment evaporator into the condenser.

[0016] In accordance with another aspect, a refrigerator includes a freezing compartment evaporator, a refrigerating compartment evaporator, a freezing compartment fan and a refrigerating compartment fan, which are independently installed in a freezing compartment and a

refrigerating compartment, and a control unit to reduce revolutions per minute of the refrigerating compartment fan upon simultaneous cooling of the freezing compartment and the refrigerating compartment, wherein the freezing compartment evaporator is located at a front end of the refrigerating compartment evaporator and is connected in series to the refrigerating compartment evaporator.

[0017] In accordance with another aspect, a control method of a refrigerator including a refrigerating compartment evaporator, a freezing compartment evaporator located at a front end of the refrigerating compartment evaporator and connected in series thereto, a refrigerating compartment fan and a freezing compartment fan to enable independent cooling of a freezing compartment and a refrigerating compartment, includes determining whether or not a freezing compartment and a refrigerating compartment are simultaneously cooled, and reducing revolutions per minute of the refrigerating compartment fan to reduce evaporation capacity of the refrigerating compartment if simultaneous cooling of the freezing compartment and the refrigerating compartment is determined.

[0018] In accordance with another aspect, a refrigerator includes a first refrigerant circuit, through which refrigerant discharged from a compressor moves toward an entrance of the compressor by way of a condenser, a valve, a first expansion device, a first evaporator and a second evaporator, and a control unit to control opening/closing of the valve according to whether or not a defrosting operation of the first evaporator and the second evaporator is performed.

[0019] The control unit may determine whether to perform the defrosting operation of the first evaporator and the second evaporator, close the valve to prevent the refrigerant from moving into the first evaporator and the second evaporator if implementation of the defrosting operation of any one of the first evaporator and the second evaporator is determined, perform a refrigerant collecting operation, and open the closed valve upon completion of the defrosting operation.

[0020] The refrigerant collecting operation may be performed in such a manner that the compressor is operated in a closed state of the valve to move the refrigerant distributed in the first evaporator and the second evaporator into the condenser.

[0021] The valve may be an On-Off valve connected to a discharge pipe of the condenser and suction pipes of the first evaporator and the second evaporator.

[0022] The refrigerator may further include a second refrigerant circuit, through which the refrigerant discharged from the compressor moves toward a suction side of the compressor by way of the condenser, the valve, a second expansion device and the second evaporator. The valve may be a 3-way valve connected to a discharge pipe of the condenser and suction pipes of the first evaporator and the second evaporator.

[0023] In accordance with another aspect, a control method of a refrigerator including a first refrigerant circuit, through which refrigerant discharged from a compressor moves toward an entrance of the compressor by way of a condenser, a valve, a first expansion device, a first evaporator and a second evaporator, and a control unit to control opening/closing of the valve according to whether or not a defrosting operation of the first evaporator and the second evaporator is performed, includes determining whether to perform a defrosting operation of the first evaporator and the second evaporator, closing the valve to prevent refrigerant from moving into the first evaporator and the second evaporator if implementation of any one of the defrosting operation of the first evaporator and the second evaporator is determined, performing a refrigerant collecting operation, and opening the closed valve upon completion of the defrosting operation.

[0024] In accordance with a further aspect, a control method of a refrigerator including a first refrigerant circuit, through which refrigerant discharged from a compressor moves toward an entrance of the compressor by way of a condenser, a valve, a first expansion device, a first evaporator and a second evaporator, a second refrigerant circuit, through which the refrigerant discharged from the compressor moves toward a suction side of the compressor by way of the condenser, the valve, a second expansion device and the second evaporator, and a control unit to control opening/closing of the valve according to whether or not a defrosting operation of the first evaporator and the second evaporator is performed, the control method includes determining whether to perform a defrosting operation of the first evaporator and the second evaporator, closing the valve to prevent refrigerant from moving into the first evaporator and the second evaporator if implementation of any one of the defrosting operation of the first evaporator and the second evaporator is determined, performing a refrigerant collecting operation, and opening the closed valve upon completion of the defrosting operation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] These and/or other aspects of the invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

FIG. 1 is a front view illustrating an exterior configuration of a refrigerator according to an embodiment;

FIG. 2 is a front view illustrating an interior configuration of the refrigerator according to the embodiment;

FIG. 3 is a control block diagram of the refrigerator according to the embodiment;

FIG. 4A is a serial refrigerant circuit according to an embodiment;

FIG. 4B is a parallel refrigerant circuit according to an embodiment;

FIG. 5 is a flow chart illustrating the valve control of the refrigerant circuit of FIGS. 4A and 4B;

FIG. 6 is a refrigerant circuit according to another embodiment;

FIG. 7 is a flow chart illustrating the fan control of the refrigerant circuit of FIG. 6 upon simultaneous cooling of a freezing compartment and a refrigerating compartment; and

FIG. 8 is a refrigerant circuit according to a further embodiment.

DETAILED DESCRIPTION

[0026] Reference will now be made in detail to the embodiments, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. Hereinafter, a refrigerator and a control method thereof according to an exemplary embodiment will be described in detail with reference to FIGS. 1 to 8.

[0027] FIG. 1 is a front view illustrating an exterior configuration of the refrigerator according to the embodiment, and FIG. 2 is a front view illustrating an interior configuration of the refrigerator according to the embodiment.

[0028] Referring to FIGS. 1 and 2, the refrigerator according to the embodiment of the present invention includes a body 10 in which a freezing compartment 12 and a refrigerating compartment 14 are defined, and doors 13 and 15 hingedly coupled to the body 10 to open or close the freezing compartment 12 and the refrigerating compartment 14 respectively.

[0029] The freezing compartment 12 and the refrigerating compartment 14 are horizontally divided by a partition 11 provided in the body 10 to prohibit movement of cold air between the compartments 12 and 14. A freezing compartment evaporator 32 and a refrigerating compartment evaporator 34 are individually installed in a rear region of the freezing compartment 12 and the refrigerating compartment 14, to enable cooling of the respective compartments 12 and 14.

[0030] FIG. 3 is a control block diagram of the refrigerator according to the embodiment.

[0031] Referring to FIG. 3, a control unit 110 is connected to an input unit 121, a temperature sensing unit 122, and a defrosting sensing unit 123.

[0032] The input unit 121 serves to input a user control command to the control unit 110 and is provided with a plurality of buttons including, e.g., a mode selection button to control operations of the freezing compartment and the refrigerating compartment, and a temperature setting button to set respective temperatures of the freezing compartment and the refrigerating compartment.

[0033] The temperature sensing unit 122 is mounted, e.g., to inner walls of the freezing compartment and the refrigerating compartment. The temperature sensing unit 122 serves to sense the interior temperature of the freezing compartment and the refrigerating compartment and transmit the sensed temperature value to the control unit 110. The temperature value constitutes data to determine the operational condition (simultaneous cooling or individual cooling) of the freezing compartment and the refrigerating compartment.

[0034] The temperature sensing operation using the temperature sensing unit 122 may be performed in response to a sensing command from the control unit 110, or may be performed independently even without receiving the sensing command.

[0035] The defrosting sensing unit 123 may adopt a sensor, a resistance value of which varies based on the temperature of the freezing compartment evaporator and the refrigerating compartment evaporator.

[0036] Considering the principle of a defrosting sensing operation in detail, the freezing compartment evaporator and the refrigerating compartment evaporator are frosted by moisture because they perform a cooling operation as refrigerant received therein evaporates by absorbing heat from the surrounding air. The frosted evaporator may cause a variation in the resistance value of the sensor. Thereby, the control unit 100 determines whether to perform a defrosting operation upon receiving a voltage or current signal corresponding to the resistance value of the sensor from the defrosting sensing unit 123.

[0037] The control unit 110 is also connected to a compressor drive unit 131, a fan drive unit 132, a valve drive unit 133, a defrosting heater drive unit 134 and a display unit 135.

[0038] The compressor drive unit 131 drives a compressor based on a drive control signal of the control unit 110. If the compressor is a linear compressor, the compressor drive unit 131 performs, e.g., generation and application of a Pulse Width Modulation (PWM) signal for drive voltage application based on a command from the control unit 110.

[0039] The fan drive unit 132 drives a freezing compartment fan 132a, a refrigerating compartment fan 132b, and a condenser fan 132c based on a drive control signal of the control unit 110. The fan drive unit 132 may be a single unit as illustrated in FIG. 3, or may include a plurality of units corresponding to the respective fans 132a, 132b and 132c.

[0040] In the present embodiment, the fan drive unit 132 functions to reduce revolutions per minute of the refrigerating compartment fan 132b upon simultaneous cooling of the freezing compartment and the refrigerating compartment. This may reduce the evaporation capacity of the refrigerating compartment evaporator, thereby preventing an increase in the evaporation temperature of the freezing compartment.

[0041] The valve drive unit 133 performs opening/closing of a valve based on a drive control signal of the control unit 110. The valve may be a 3-way valve or On-Off valve.

[0042] In the present embodiment, the valve drive unit 133 closes the valve to intercept a flow path to the freezing compartment evaporator and the refrigerating compartment evaporator if any one of the freezing compartment and the refrigerating compartment is subjected to a defrosting operation. The valve drive unit 133 again opens the valve to enable movement of refrigerant upon completion of the defrosting operation. Opening or closing the valve by the valve drive unit 133 according to whether the defrosting operation is performed or not may eliminate any risk of explosion due to leakage of refrigerant from a refrigerant pipe during the defrosting operation.

[0043] The defrosting heater drive unit 134 drives defrosting heaters provided in the freezing compartment and the refrigerating compartment. The defrosting heater drive unit 134 supplies heat to the freezing compartment evaporator and the refrigerating compartment evaporator based on a drive control signal of the control unit 110. The supplied heat acts to remove frost formed on the freezing compartment evaporator and the refrigerating compartment evaporator.

[0044] The display unit 135 displays the operational state of the refrigerator, various setting values, temperature, and so on.

[0045] A memory unit 140 stores temperature control values and defrosting conditions based on the operational condition of the freezing compartment and the refrigerating compartment determined by the control unit 110. The memory unit 140 stores a control factor for a valve control operation to intercept the flow path to the freezing compartment evaporator and the refrigerating compartment evaporator during the defrosting operation. The memory unit 140 also stores a control factor to reduce revolutions per minute of the refrigerating compartment fan 132b upon simultaneous cooling of the freezing compartment and the refrigerating compartment.

[0046] The control unit 110 determines whether to perform startup of the refrigerator by comparing the temperatures of the freezing compartment and the refrigerating compartment sensed by the temperature sensing unit 122 with preset temperatures stored in the memory unit 140.

[0047] If the temperature of the freezing compartment or the refrigerating compartment is higher than a preset temperature by a predetermined value or more, the compressor is operated after load of the compartment is calculated according to a temperature difference. The startup time of the refrigerator is the operation time of the compressor.

[0048] The control unit 110 also compares the defrosting signal transmitted from the defrosting sensing unit 123 with the defrosting conditions stored in the memory unit 140. If any one(s) of the evaporators fulfills the defrosting conditions, the control unit 110 controls the corresponding evaporator(s) to perform a defrosting operation. The defrosting conditions may be set by, e.g., a reference voltage value or a reference current value.

[0049] In the present embodiment, if it is determined to perform a defrosting operation upon the freezing compartment and the refrigerating compartment, the control unit 110 transmits a valve closing control signal to the valve drive unit 133. After completion of the defrosting operation, the control unit 110 again opens the valve, allowing the refrigerant to move into the freezing compartment evaporator and the refrigerating compartment evaporator.

[0050] In the present embodiment, the control unit 110 reduces revolutions per minute of the refrigerating compartment fan 132b upon simultaneous cooling of the freezing compartment and the refrigerating compartment.

[0051] FIG. 4A is a serial refrigerant circuit according to an embodiment.

[0052] In FIG. 4A, the serial refrigerant circuit 200 according to the embodiment of the present invention includes a compressor 210, a condenser 220, a valve 230, an expansion device 240, a refrigerating compartment evaporator 250, and a freezing compartment evaporator 260.

[0053] The compressor 210 compresses suctioned low-temperature and low-pressure gas-phase refrigerant to discharge high-temperature and high-pressure gas-phase refrigerant.

[0054] The condenser 220 is connected to a high-pressure discharge pipe of the compressor 210 and condenses the compressed high-temperature and high-pressure gas-phase refrigerant from the compressor 210 into liquid-phase refrigerant via heat exchange with the surrounding air.

[0055] The valve 230 is an On-Off valve to open or close the flow path of the refrigerant having passed through the condenser 220.

[0056] In the present embodiment, the valve 230 opens or closes the flow path to the refrigerating compartment evaporator and the freezing compartment evaporator according to whether the defrosting operation of the refrigerator is performed or not.

[0057] The room-temperature and high-pressure liquid-phase refrigerant, condensed in the condenser 220, is introduced into the expansion device 240 by way of the valve 230. The expansion device 240 includes a capillary tube or an expansion valve to expand and decompress the room-temperature and high-pressure liquid-phase refrigerant into low-temperature and low-pressure two-phase refrigerant in the mixture of liquid-phase and gas-phase components.

[0058] The freezing compartment evaporator 260 and the refrigerating compartment evaporator 250 evaporate the expanded low-temperature and low-pressure liquid-phase refrigerant from the expansion device 240 into gas-phase refrigerant by absorbing heat from the surrounding air, thereby supplying cold air. The freezing

compartment evaporator 260 and the refrigerating compartment evaporator 250 constitute a serial circulation configuration to enable independent operation of the freezing compartment and the refrigerating compartment.

[0059] In the serial refrigerant circuit 200, the refrigerant circulates in the sequence of the compressor 210→ the condenser 220→ the valve 230→ the expansion device 240→the refrigerating compartment evaporator 250→ the freezing compartment evaporator 260→ the compressor 210.

[0060] In addition, the condenser 220 is provided with a condenser fan 221 and a condenser fan motor 222 to drive the condenser fan 221. The refrigerating compartment evaporator 250 and the freezing compartment evaporator 260 are respectively provided with a refrigerating compartment fan 252 and a freezing compartment fan 262 to blow cold air generated from the respective evaporators 250 and 260. Also, a refrigerating compartment fan motor 253 and a freezing compartment fan motor 263 are provided respectively to drive the refrigerating compartment fan 252 and the freezing compartment fan 262, and defrosting heaters 251 and 261 are provided to remove frost formed on the refrigerating compartment evaporator 250 and the freezing compartment evaporator 260.

[0061] FIG. 4B is a parallel refrigerant circuit according to an embodiment.

[0062] In FIG. 4B, the parallel refrigerant circuit 300 according to the embodiment of the present invention includes a compressor 310, a condenser 320, a valve 330, a first expansion device 341, a second expansion device 342, a refrigerating compartment evaporator 350, and a freezing compartment evaporator 360.

[0063] The valve 330 is a 3-way valve having a single entrance and two exits to selectively switch the flow path of the refrigerant having passed through the condenser 320 based on an operational mode (simultaneous or individual operation of the freezing compartment). The single entrance is connected to a discharge pipe of the condenser 320 and the two exits are connected respectively to the first expansion device 341 and the second expansion device 342.

[0064] In the present embodiment, the valve 330 opens or closes a flow path to the refrigerating compartment evaporator 350 and a flow path to the freezing compartment evaporator 360 according to whether the defrosting operation of the refrigerator is performed or not.

[0065] In the parallel refrigerant circuit 300, the refrigerant circulates in the sequence of the compressor 310→ the condenser 320→ the valve 330→ the first expansion device 341→ the refrigerating compartment evaporator 350→ the freezing compartment evaporator 360→ the compressor 310, or in the sequence of the compressor 310→ the condenser 320→the valve 330→ the second expansion device 342→ the freezing compartment evaporator 360→the compressor 310.

[0066] Other configurations are identical to those of FIG. 4A, and a description thereof is replaced by that of FIG. 4A.

[0067] Hereinafter, a control method of the above described refrigerant circuit and effects thereof will be described.

[0068] A conventional refrigerant circuit control method may cause explosion during a defrosting operation using a defrosting heater because if leakage of explosive refrigerant occurs during driving of the defrosting heater, the temperature of the leaked refrigerant may rise to a spontaneous combustion point. The refrigerant circuit control method according to the present embodiment, which may eliminate the explosion risk of the conventional refrigerant circuit control method, will be described hereinafter with reference to FIG. 5.

[0069] FIG. 5 is a flow chart illustrating the valve control of the refrigerant circuit of FIGS. 4A and 4B.

[0070] First, if power is input to the refrigerator, the defrosting sensing unit senses a resistance value of the sensor that varies depending on the temperature of the evaporator of the refrigerator, and transmits a voltage or current signal corresponding to the resistance value to the control unit. The control unit compares the voltage or current signal transmitted from the defrosting sensing unit with preset defrosting conditions, thereby determining whether to perform a defrosting operation of the refrigerating compartment evaporator and the freezing compartment evaporator (410).

[0071] If implementation of the defrosting operation of the freezing compartment evaporator or the refrigerating compartment evaporator is determined, the control unit closes the valve before the defrosting operation of the corresponding evaporator begins (420). This may intercept movement of refrigerant to the refrigerating compartment evaporator and the freezing compartment evaporator prior to the defrosting operation.

[0072] After closing the valve in operation 420, a refrigerant collecting operation is performed to collect and move the refrigerant distributed in the freezing compartment evaporator and the refrigerating compartment evaporator into the condenser (430).

[0073] In the refrigerant collecting operation 430, the compressor is turned on in a closed state of the valve to allow the refrigerant distributed in the refrigerating compartment evaporator and the freezing compartment evaporator to be moved into the condenser. The refrigerant collecting operation 430 may prevent the refrigerant from being present in the refrigerating compartment evaporator and the freezing compartment evaporator.

[0074] Once the refrigerant collecting operation 430 is completed, the defrosting operation of the refrigerating compartment evaporator or the freezing compartment evaporator is performed (440), and the compressor is turned off.

[0075] After implementation of the defrosting operation 440, the control unit determines whether or not the defrosting operation is completed (450). If completion of the defrosting operation of the corresponding evaporator is

determined, the control unit again opens the closed valve (460) and restarts the compressor.

[0076] With the valve control of the refrigerant circuit illustrated in FIG. 5, no refrigerant is present in the refrigerating compartment evaporator and the freezing compartment evaporator during the defrosting operation, thereby eliminating any risk of explosion due to refrigerant leakage.

[0077] Meanwhile, the conventional refrigerant circuit and control method thereof may cause deterioration in the cooling efficiency of the freezing compartment upon simultaneous cooling of the freezing compartment and the refrigerating compartment because the temperature of the refrigerating compartment is higher than the temperature of the freezing compartment. This may make it difficult to store food fresh and may increase energy consumption.

[0078] A refrigerant circuit and control method thereof to prevent deterioration of the cooling efficiency and the increased energy consumption will be described with reference to FIGS. 6 and 7.

[0079] FIG. 6 is a refrigerant circuit according to another embodiment.

[0080] In FIG. 6, the refrigerant circuit 500 according to the present embodiment includes a compressor 510, a condenser 520, an expansion device 530, a freezing compartment evaporator 540, and a refrigerating compartment evaporator 550.

[0081] In the refrigerant circuit 500 of the present embodiment, the freezing compartment evaporator 540 is located at a front end of the refrigerating compartment evaporator 550 and is connected in series to the refrigerating compartment evaporator 550. Thus, refrigerant is circulated in the sequence of the compressor 510→ the condenser 520→ the expansion device 530→ the freezing compartment evaporator 540→ the refrigerating compartment evaporator 550→ the compressor 510. That is, as the refrigerant is first supplied into the freezing compartment evaporator 540 and thereafter, is supplied into the refrigerating compartment evaporator 550, it may be possible to prevent deterioration in the cooling efficiency of the freezing compartment due to a higher evaporation temperature of the refrigerating compartment evaporator 550.

[0082] Further, the refrigerant circuit 500 of the present embodiment enables omission of the valve, achieving cost reduction.

[0083] Other configurations are identical to those of FIG. 4A, and a description thereof is replaced by that of FIG. 4A.

[0084] FIG. 7 is a flow chart illustrating the fan control of the refrigerant circuit of FIG. 6 upon simultaneous cooling of the freezing compartment and the refrigerating compartment.

[0085] First, it is determined whether or not the compressor is in operation (610). If it is determined that the compressor is not in operation, both the freezing compartment fan and the refrigerating compartment fan are stopped (630). In this case, the temperature of each compartment of the refrigerator is a preset temperature or less.

[0086] On the other hand, if it is determined that the compressor is in operation, it is determined whether or not cooling of the freezing compartment is performed (620). If cooling of the freezing compartment is being performed, it is determined whether or not cooling of the refrigerating compartment is performed (640).

[0087] The refrigerating compartment fan is controlled to reduce revolutions per minute thereof upon simultaneous cooling of the freezing compartment and the refrigerating compartment (660). In this case, the temperature of each compartment of the refrigerator is a preset temperature or more.

[0088] If cooling of any one of the freezing compartment and the refrigerating compartment is being performed (640 and 650), revolutions per minute of each fan is kept normal (670).

[0089] With the control to reduce revolutions per minute of the refrigerating compartment fan upon simultaneous cooling of the freezing compartment and the refrigerating compartment, the evaporation capacity of the refrigerating compartment evaporator may be reduced, thereby improving the cooling efficiency of the freezing compartment.

[0090] FIG. 8 is a refrigerant circuit according to a further embodiment.

[0091] Referring to FIG. 8, a compressor 710, a condenser 720, a valve 730, an expansion device 740, a freezing compartment evaporator 750 and a refrigerating compartment evaporator 760 are connected to one another via a refrigerant pipe, thereby defining a single closed-loop refrigerant circuit. Other configurations are identical to those of FIG. 4A, and a description thereof is replaced by that of FIG. 4A.

[0092] In the present embodiment, the valve 730 is an On-Off valve to prevent explosion due to leakage of refrigerant from the refrigerant pipe during defrosting. The valve 730 is closed before the defrosting operation of any one of the refrigerating compartment evaporator and the freezing compartment evaporator begins. Then, the valve 730 is again opened upon completion of the defrosting operation of the corresponding evaporator, enabling movement of refrigerant.

[0093] To allow the refrigerant to be supplied first into the freezing compartment evaporator 750, the freezing compartment evaporator 750 is located at a front end of the refrigerating compartment evaporator 760 and is connected in series to the refrigerating compartment evaporator 760. Also, to prevent the temperature of the freezing compartment from rising upon simultaneous operation of the freezing compartment and the refrigerating compartment, a control operation to reduce revolutions per minute of a refrigerating compartment fan 762 is performed. Thereby, the evaporation capacity of the refrigerating compartment evaporator 760 is reduced, restricting an increase in the evaporation temperature of the

refrigerant in the freezing compartment and the temperature of the refrigerant suctioned into the compressor. This may improve the cooling efficiency of the freezing compartment and reduce energy consumption of the refrigerator.

[0094] The refrigerator and the control method thereof according to the exemplary embodiments have been described in detail. Although the double door type refrigerator in which the doors are provided side by side at the freezing compartment and the refrigerating compartment has been described, the embodiments are also applicable to a top mount type refrigerator in which a freezing compartment is located in an upper region of the refrigerator, and a bottom freezer type refrigerator having triple doors.

[0095] As is apparent from the above description, a refrigerator and a control method thereof according to the embodiment may intercept a refrigerant flow path to a refrigerating compartment evaporator and a freezing compartment evaporator during defrosting, thereby preventing explosion due to leakage of refrigerant.

[0096] Further, as a result of locating the freezing compartment evaporator at a front end of the refrigerating compartment evaporator and connecting the freezing compartment evaporator to the refrigerating compartment evaporator in series, it may be possible to reduce revolutions per minute of a refrigerating compartment fan upon simultaneous cooling of the freezing compartment and the refrigerating compartment, resulting in an improvement in the cooling efficiency of the freezing compartment. This may achieve energy reduction and also, may achieve cost reduction due to omission of a valve to open or close the refrigerant flow path.

[0097] Although a few embodiments have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

Claims

1. A refrigerator comprising:

   a compressor;
   a condenser to condense refrigerant compressed in the compressor;
   an evaporator to evaporate the condensed refrigerant;
   a valve to open or close a flow path of the refrigerant; and
   a control unit to close the valve upon a defrosting operation of the evaporator.

2. The refrigerator according to claim 1, wherein the control unit determines whether to perform the defrosting operation of the evaporator, closes the valve to prevent the refrigerant from moving into the evaporator if implementation of the defrosting operation of the evaporator is determined, performs a refrigerant collecting operation, and opens the closed valve upon completion of the defrosting operation.

3. The refrigerator according to claim 2, wherein the refrigerant collecting operation is performed in such a manner that the compressor is operated in a closed state of the valve to move the refrigerant distributed in the evaporator into the condenser.

4. The refrigerator according to claim 1, wherein the evaporator includes a freezing compartment evaporator and a refrigerating compartment evaporator.

5. A control method of a refrigerator including a compressor, a condenser, an evaporator and a valve, the control method comprising:

   determining whether to perform a defrosting operation of the evaporator;
   closing the valve to prevent refrigerant from moving into the evaporator if implementation of the defrosting operation of the evaporator is determined;
   performing a refrigerant collecting operation; and
   opening the closed valve upon completion of the defrosting operation.

6. The control method according to claim 5, wherein implementation of the refrigerant collecting operation includes operating the compressor in a closed state of the valve to move the refrigerant distributed in the evaporator into the condenser.

7. The control method according to claim 5, wherein the evaporator includes a freezing compartment evaporator and a refrigerating compartment evaporator.

8. A refrigerator comprising a freezing compartment evaporator, a refrigerating compartment evaporator, a freezing compartment fan and a refrigerating compartment fan, which are independently installed in a freezing compartment and a refrigerating compartment, the refrigerator further comprising:

   a control unit to reduce revolutions per minute of the refrigerating compartment fan upon simultaneous cooling of the freezing compartment and the refrigerating compartment,
   wherein the freezing compartment evaporator is located at a front end of the refrigerating compartment evaporator and is connected in series to the refrigerating compartment evaporator.

9. A control method of a refrigerator including a refrigerating compartment evaporator, a freezing compartment evaporator located at a front end of the refrigerating compartment evaporator and connected in series thereto, a refrigerating compartment fan and a freezing compartment fan to enable independent cooling of a freezing compartment and a refrigerating compartment, the control method comprising:

determining whether or not a freezing compartment and a refrigerating compartment are simultaneously cooled; and
reducing revolutions per minute of the refrigerating compartment fan to reduce evaporation capacity of the refrigerating compartment if simultaneous cooling of the freezing compartment and the refrigerating compartment is determined.

10. A refrigerator comprising:

a first refrigerant circuit, through which refrigerant discharged from a compressor moves toward an entrance of the compressor by way of a condenser, a valve, a first expansion device, a first evaporator and a second evaporator; and a control unit to control opening/closing of the valve according to whether or not a defrosting operation of the first evaporator and the second evaporator is performed.

11. The refrigerator according to claim 10, wherein the control unit determines whether to perform the defrosting operation of the first evaporator and the second evaporator, closes the valve to prevent the refrigerant from moving into the first evaporator and the second evaporator if implementation of the defrosting operation of any one of the first evaporator and the second evaporator is determined, performs a refrigerant collecting operation, and opens the closed valve upon completion of the defrosting operation

12. The refrigerator according to claim 11, wherein the refrigerant collecting operation is performed in such a manner that the compressor is operated in a closed state of the valve to move the refrigerant distributed in the first evaporator and the second evaporator into the condenser.

13. The refrigerator according to claim 10, further comprising a second refrigerant circuit, through which the refrigerant discharged from the compressor moves toward a suction side of the compressor by way of the condenser, the valve, a second expansion device and the second evaporator.

14. A control method of a refrigerator comprising: a first refrigerant circuit, through which refrigerant discharged from a compressor moves toward an entrance of the compressor by way of a condenser, a valve, a first expansion device, a first evaporator and a second evaporator; and a control unit to control opening/closing of the valve according to whether or not a defrosting operation of the first evaporator and the second evaporator is performed, the control method comprising:

determining whether to perform a defrosting operation of the first evaporator and the second evaporator;
closing the valve to prevent refrigerant from moving into the first evaporator and the second evaporator if implementation of any one of the defrosting operation of the first evaporator and the second evaporator is determined;
performing a refrigerant collecting operation; and
opening the closed valve upon completion of the defrosting operation.

15. A control method of a refrigerator comprising: a first refrigerant circuit, through which refrigerant discharged from a compressor moves toward an entrance of the compressor by way of a condenser, a valve, a first expansion device, a first evaporator and a second evaporator; a second refrigerant circuit, through which the refrigerant discharged from the compressor moves toward a suction side of the compressor by way of the condenser, the valve, a second expansion device and the second evaporator; and a control unit to control opening/closing of the valve according to whether or not a defrosting operation of the first evaporator and the second evaporator is performed, the control method comprising:

determining whether to perform a defrosting operation of the first evaporator and the second evaporator;
closing the valve to prevent refrigerant from moving into the first evaporator and the second evaporator if implementation of any one of the defrosting operation of the first evaporator and the second evaporator is determined;
performing a refrigerant collecting operation; and
opening the closed valve upon completion of the defrosting operation.

FIG. 1

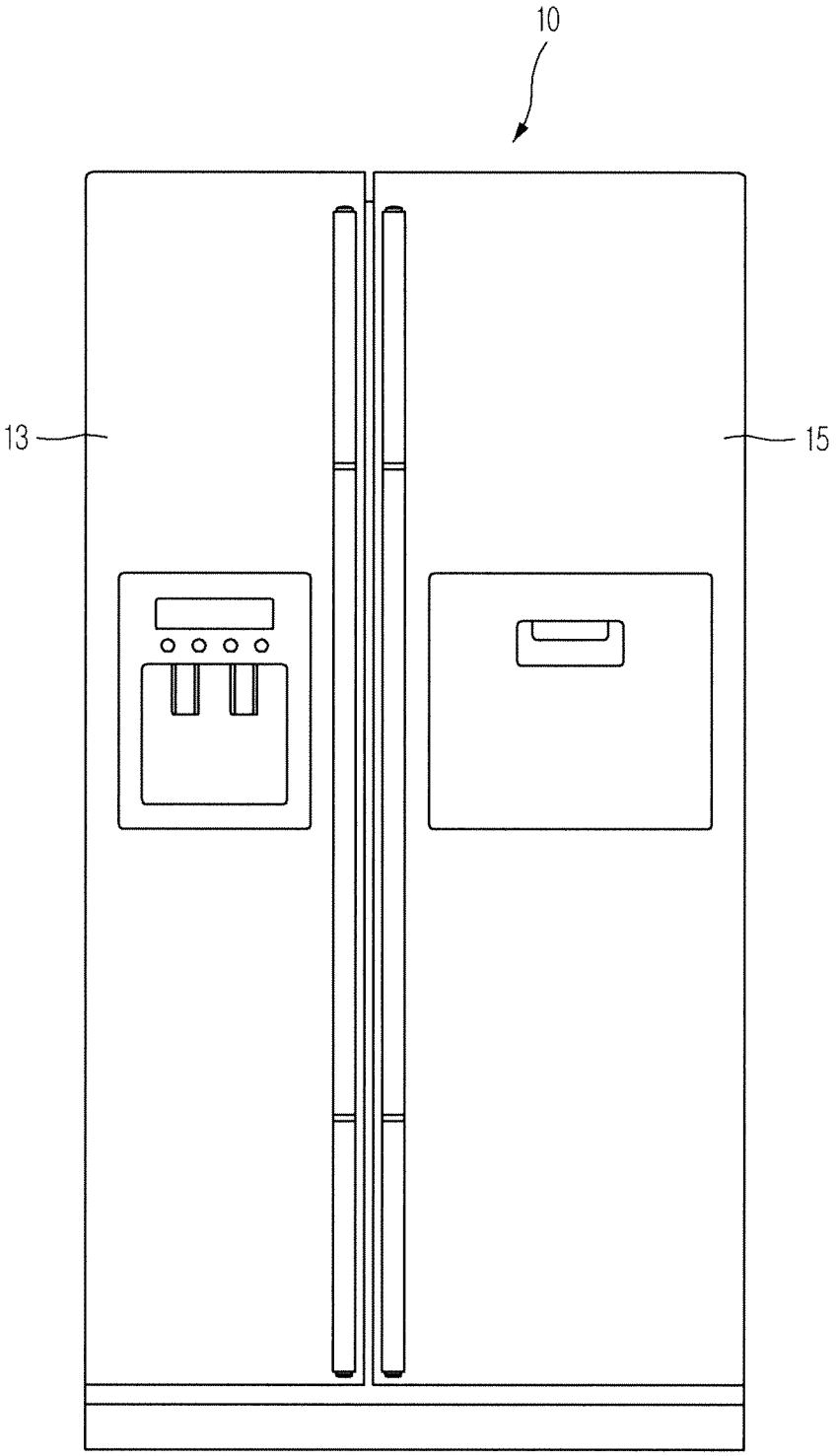

FIG. 2

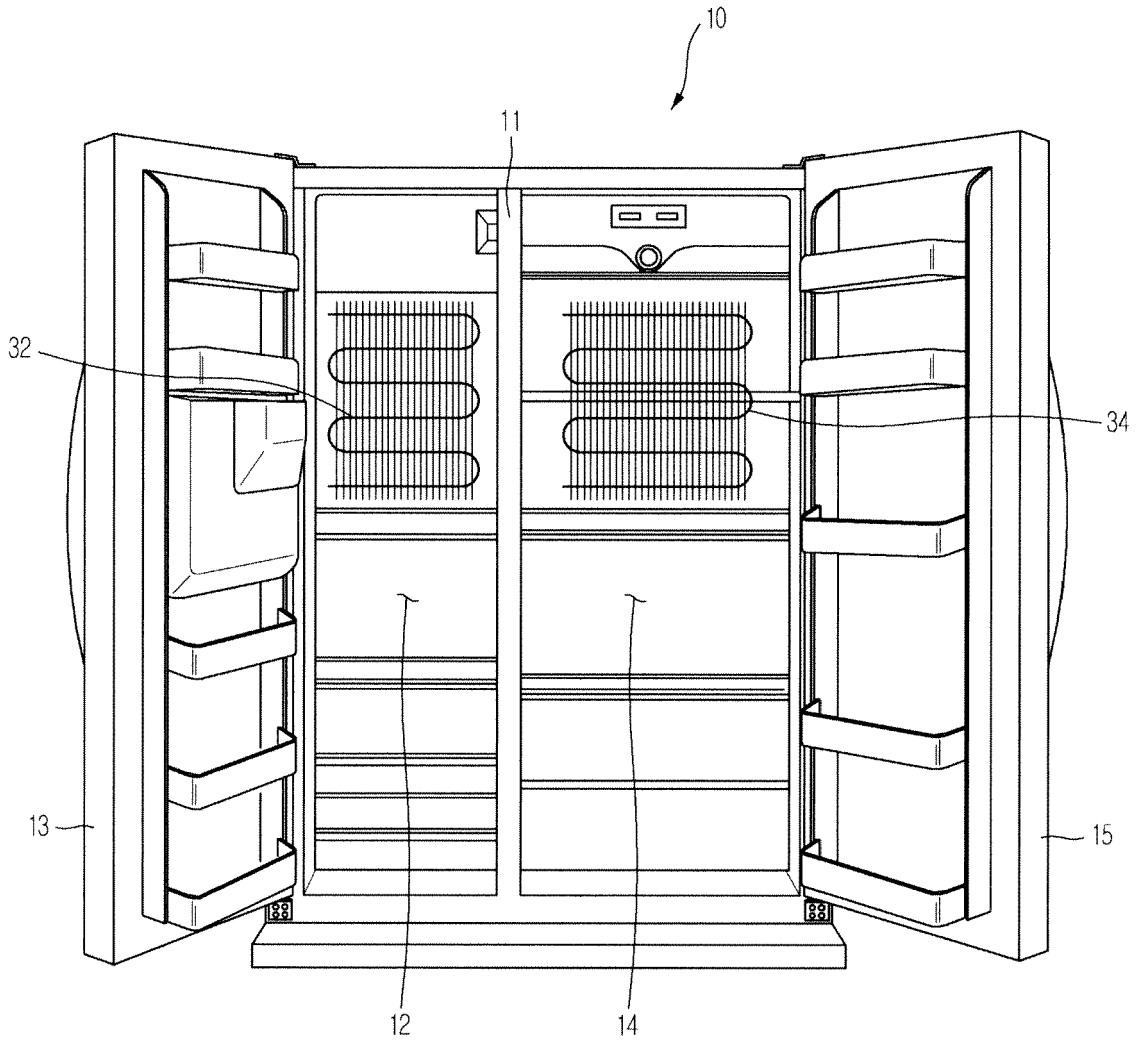

FIG. 3

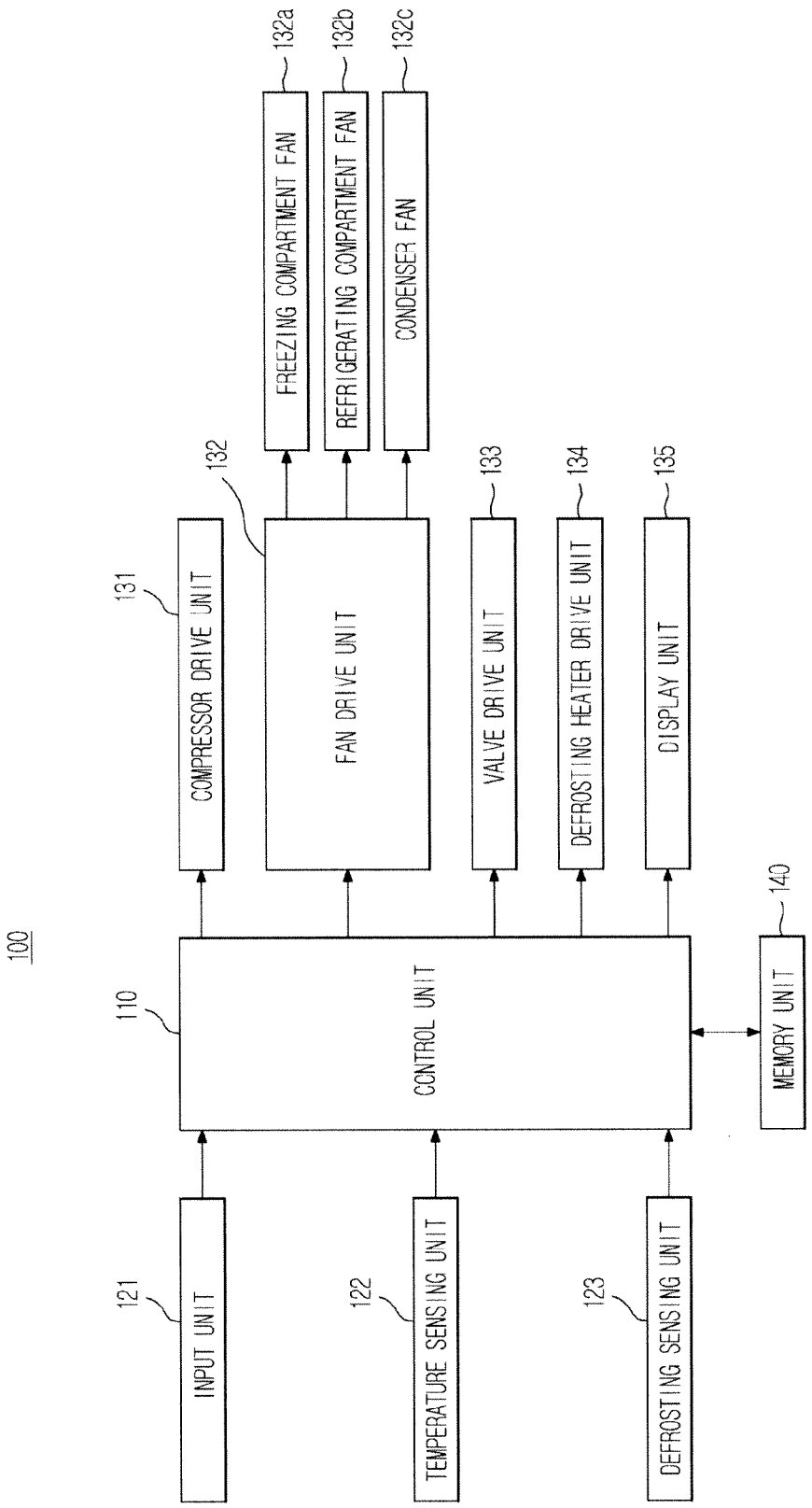
100
110
CONTROL UNIT
121
INPUT UNIT
122
TEMPERATURE SENSING UNIT
123
DEFROSTING SENSING UNIT
131
COMPRESSOR DRIVE UNIT
132
FAN DRIVE UNIT
132a
FREEZING COMPARTMENT FAN
132b
REFRIGERATING COMPARTMENT FAN
132c
CONDENSER FAN
133
VALVE DRIVE UNIT
134
DEFROSTING HEATER DRIVE UNIT
135
DISPLAY UNIT
140
MEMORY UNIT

FIG. 4A

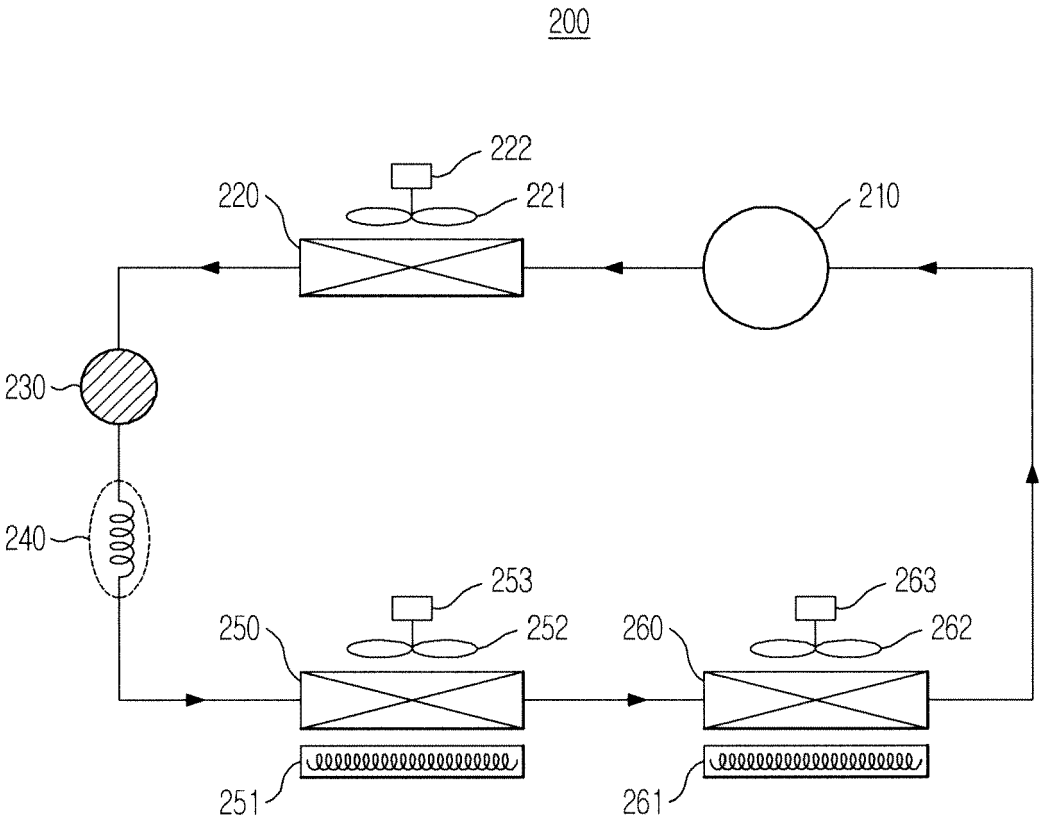

FIG. 4B

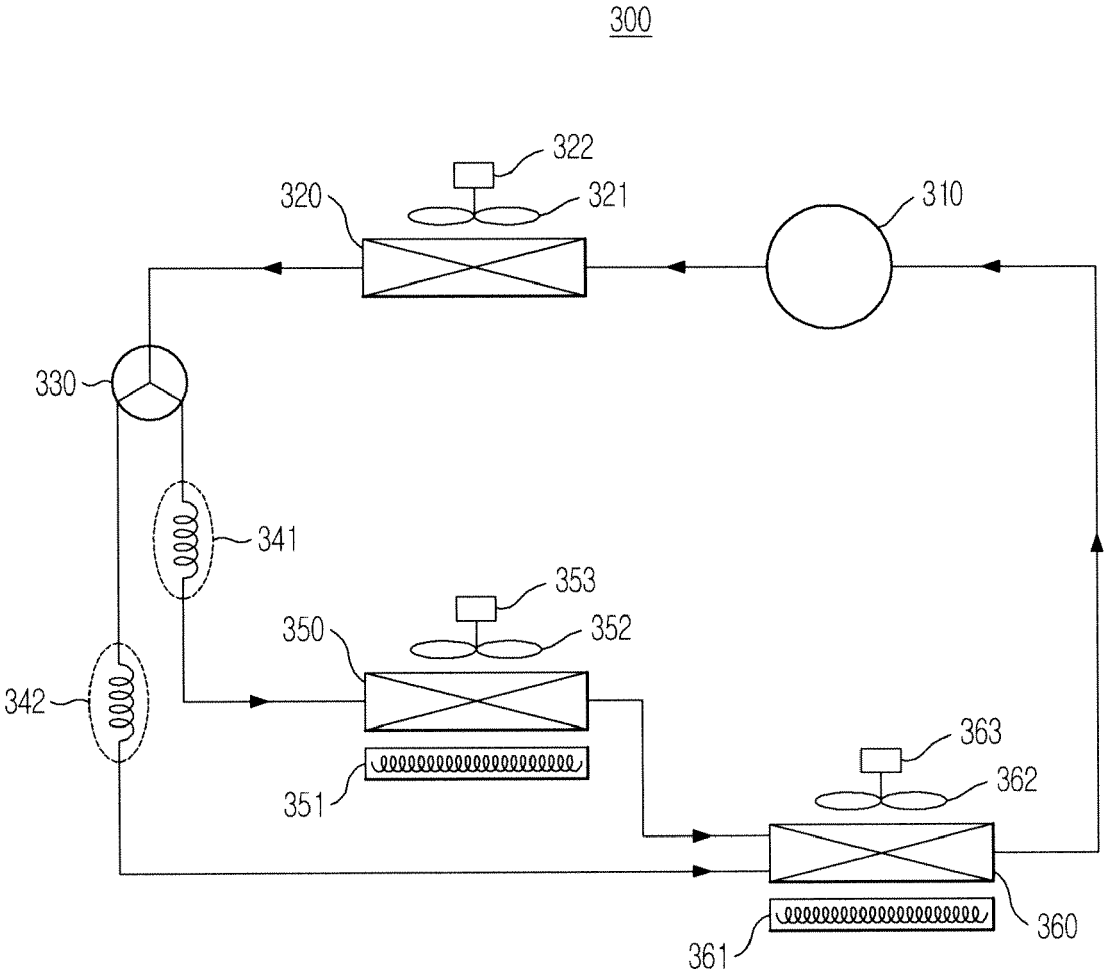

FIG. 5

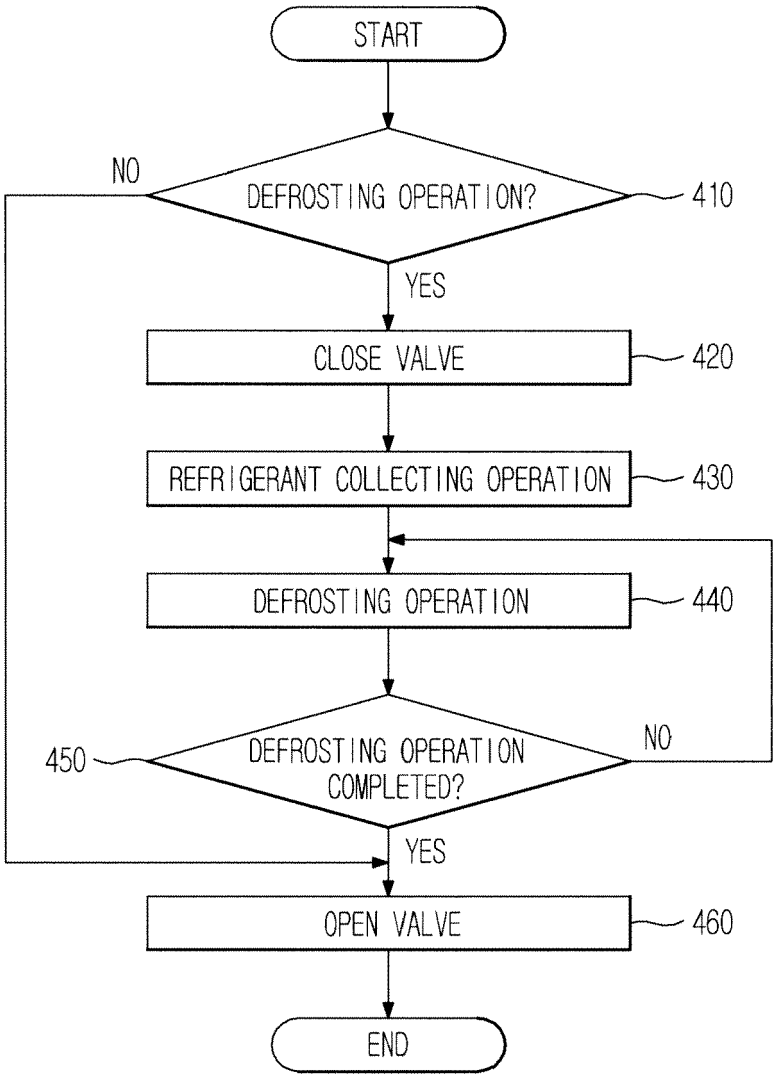
START
DEFROSTING OPERATION?
410
NO
YES
CLOSE VALVE
420
REFRIGERANT COLLECTING OPERATION
430
DEFROSTING OPERATION
440
DEFROSTING OPERATION COMPLETED?
450
NO
YES
OPEN VALVE
460
END

FIG. 6

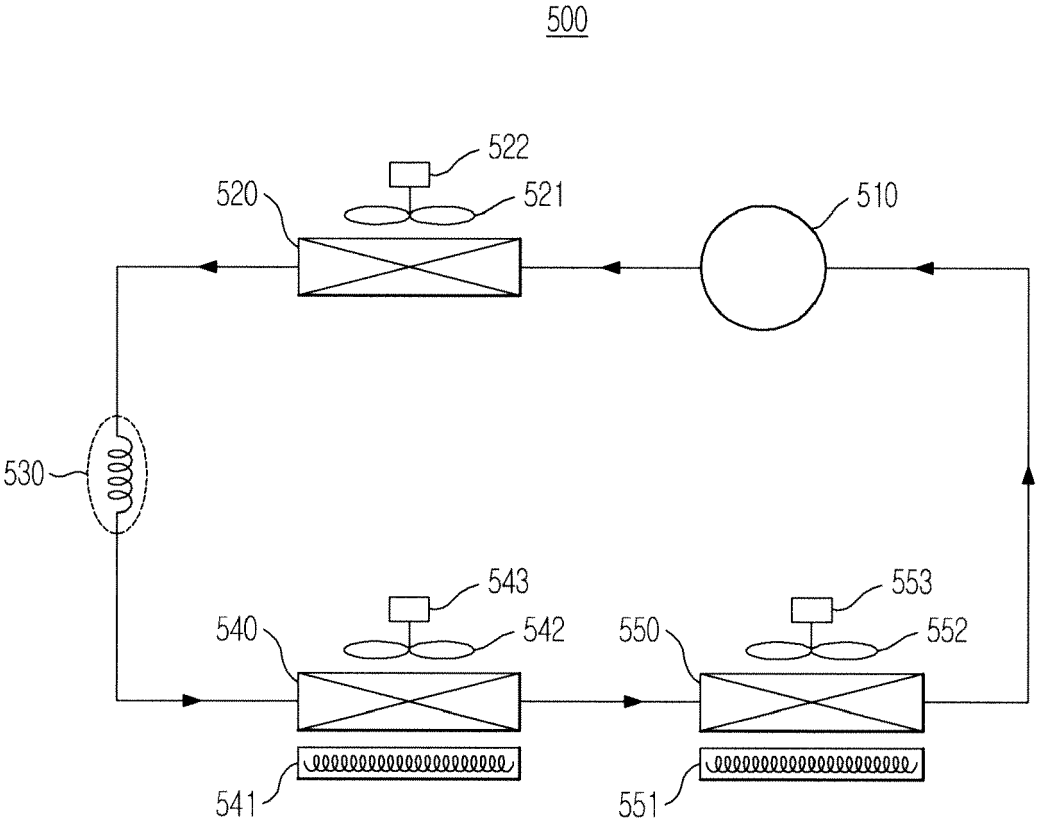

FIG. 7

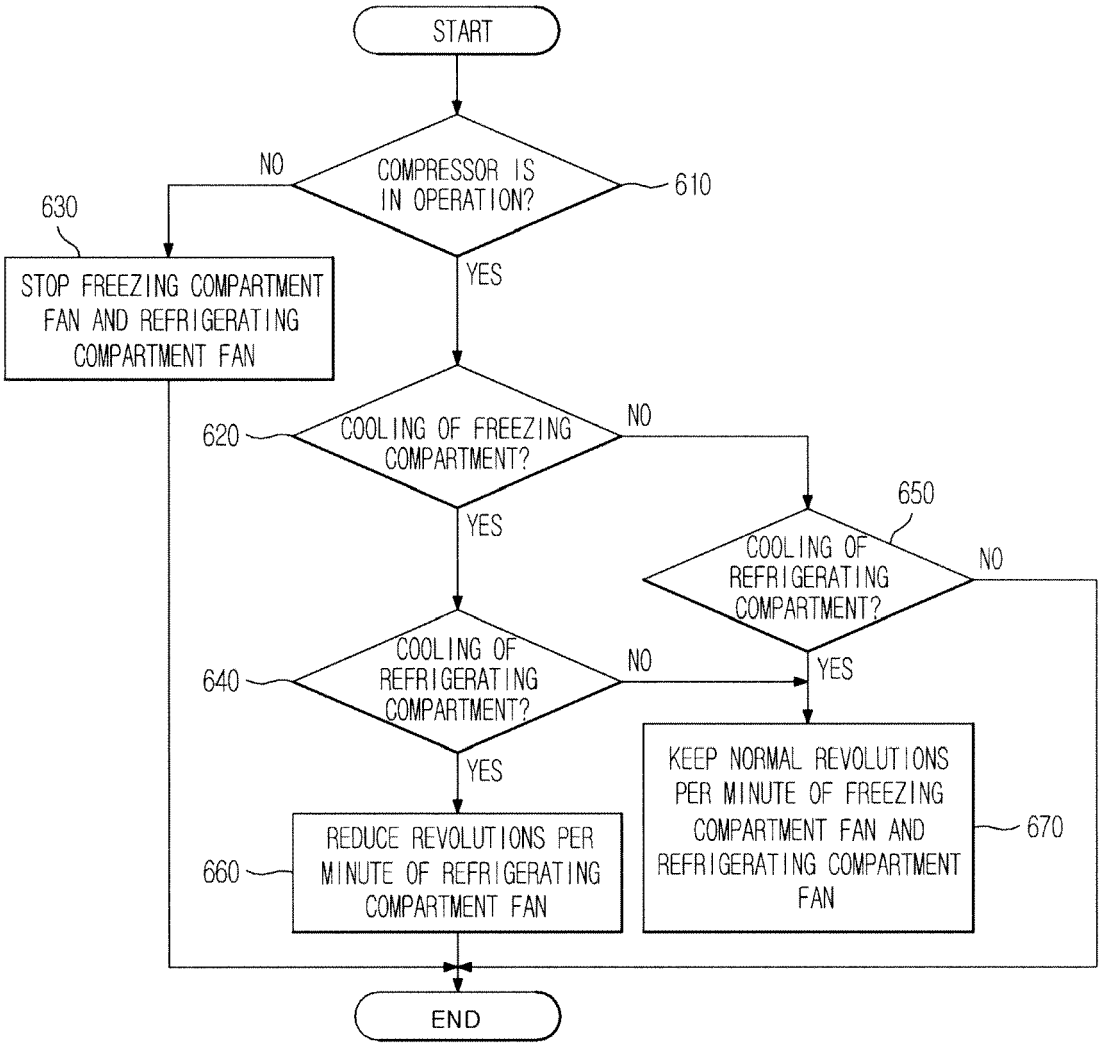
START
COMPRESSOR IS IN OPERATION?
610
NO
YES
630
STOP FREEZING COMPARTMENT FAN AND REFRIGERATING COMPARTMENT FAN
620
COOLING OF FREEZING COMPARTMENT?
NO
YES
650
COOLING OF REFRIGERATING COMPARTMENT?
NO
YES
640
COOLING OF REFRIGERATING COMPARTMENT?
NO
YES
660
REDUCE REVOLUTIONS PER MINUTE OF REFRIGERATING COMPARTMENT FAN
KEEP NORMAL REVOLUTIONS PER MINUTE OF FREEZING COMPARTMENT FAN AND REFRIGERATING COMPARTMENT FAN
670
END

FIG. 8