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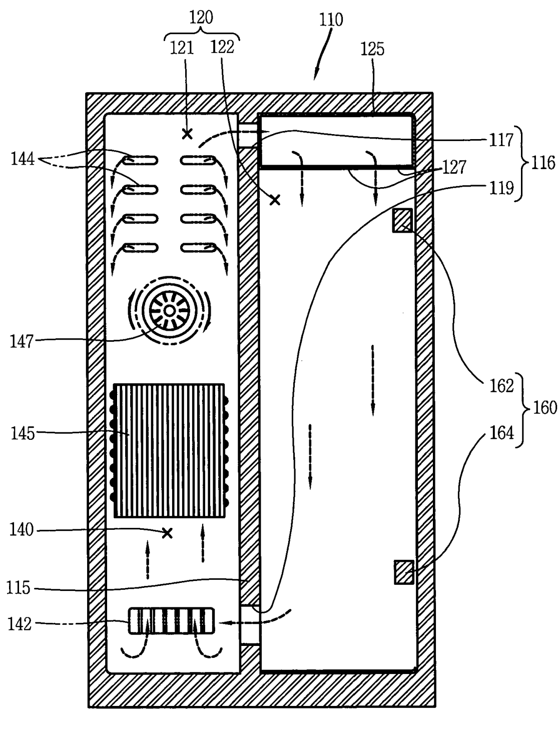
(54) Refrigerator

(57) A refrigerator includes: a refrigerator body (110) having a storage chamber (120); a circulation path (140) having a plurality of openings (142, 144) spaced from each other and communicated with the storage chamber (120), an evaporator (145) configured to cool air, and a cooling fan (147) which can be forward and backward rotated, and configured to circulate cool air in the storage chamber (120); a temperature sensor (160) disposed at upper and lower sides of the storage chamber (120), and configured to sense temperatures of the storage chamber (120); and a controller (150) configured to control a rotation direction of the cooling fan (147), based on the result by the temperature sensor (160).

FIG. 3



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present disclosure relates to a refrigerator, and particularly, to a refrigerator capable of rapidly solving a deviation in an inner temperature of a storage chamber.

2. Background of the Invention

[0002] As is well known, a refrigerator is an apparatus for storing food items in a frozen or cool state.

[0003] The refrigerator may include a refrigerator body having a storage chamber therein, and a refrigerating cycle device configured to provide cool air to the storage chamber.

[0004] FIG. 1 is an exemplary view of a refrigerator in accordance with the related art, and FIG. 2 is a view showing an evaporator and a cooling fan of the refrigerator of FIG. 1.

[0005] As shown in FIG. 1, the refrigerator may include a refrigerator body 10 having a storage chamber 20 therein, and a refrigerating cycle device (not shown) configured to provide cool air to the refrigerator body 10.

[0006] The refrigerating cycle device may be configured as a vapor-compression type refrigerating cycle device including a compressor configured to compress a refrigerant, a condenser configured to condense a refrigerant, an expander configured to depressurization-expand a refrigerant, and an evaporator configured to evaporate a refrigerant by absorbing peripheral latent heat.

[0007] The storage chamber 20 may be provided in the refrigerator body 10.

[0008] The storage chamber 20 may include a freezing chamber 21 and a refrigerating chamber 22.

[0009] A door 30 configured to open and close the storage chamber 20 may be provided on a front surface of the refrigerator body 10.

[0010] The door 30 may include a freezing chamber door 31 configured to open and close the freezing chamber 21, and a refrigerating chamber door 32 configured to open and close the refrigerating chamber 22.

[0011] The freezing chamber 21 and the refrigerating chamber 22 may be partitioned from each other by a mullion (partition wall) 15. The mullion 15 may be arranged in upper and lower directions of the refrigerator body 10.

[0012] A circulation path 40 along which air circulates to be cooled, may be provided at a rear region of the freezing chamber 21.

[0013] The circulation path 40 may be formed at a rear region of the freezing chamber 21 in upper and lower directions.

[0014] An inlet 42 through which air is introduced into the refrigerator may be formed at a lower region of the circulation path 40.

[0015] An outlet 44 through which air is discharged from the refrigerator may be formed at an upper region of the circulation path 40.

[0016] An evaporator 45 configured to cool air may be provided at the circulation path 40.

[0017] A cooling fan 47 may be disposed above the evaporator 45. Under such configuration, flow of air along the circulation path 40 can be accelerated.

[0018] A communication unit (not shown) penetrated so that the freezing chamber 21 and the refrigerating chamber 22 can be communicated with each other, may be formed at an upper region of the mullion 15. Under such configuration, cool air inside the freezing chamber 21 can be provided to the refrigerating chamber 22.

[0019] A cool air duct 25 may be disposed at an upper region of the refrigerating chamber 22. A cool air discharge hole (not shown) through which cool air is discharged, may be formed at the cool air duct 25.

[0020] The cool air duct 25 may be installed so as to be communicated with the communication unit. Under such configuration, cool air supplied from the freezing chamber 21 can be discharged into the refrigerating chamber 22.

[0021] A suction hole 19 through which air inside the refrigerating chamber 22 is sucked to the freezing chamber 21, may be formed at a lower region of the refrigerating chamber 22.

[0022] However, the conventional refrigerator may have the following problems.

[0023] Firstly, since cool air is discharged from the upper side of the storage chamber 20, a temperature deviation between upper and lower regions inside the storage chamber 20 may increase.

[0024] This may cause food items stored in the upper region of the storage chamber 20 to be overcooled, and cause the lower region to be under-cooled.

[0025] In order to prevent the upper region of the refrigerating chamber 22 from being overcooled, the amount of cool air to be supplied may be reduced or, supplying of cool air may be stopped. In this case, food items stored in a middle or lower region of the refrigerating chamber 22, may be slowly or insufficiently cooled.

SUMMARY OF THE INVENTION

[0026] Therefore, an aspect of the detailed description is to provide a refrigerator capable of rapidly solving a deviation in an inner temperature of a storage chamber.

[0027] Another aspect of the detailed description is to provide a refrigerator capable of directly supplying cool air into a lower region of a storage chamber.

[0028] Still another aspect of the detailed description is to provide a refrigerator capable of preventing an upper region of a storage chamber from being overcooled, and capable of rapidly cooling a lower region of the storage chamber.

[0029] To achieve these and other advantages and in accordance with the purpose of this specification, as embodied and broadly described herein, there is provided a refrigerator, comprising: a refrigerator body having a storage chamber; a circulation path having a plurality of openings spaced from each other and communicated with the storage chamber an evaporator configured to cool air, and a cooling fan which can be forward and backward rotated, and configured to circulate cool air in the storage chamber; a temperature sensor disposed at upper and lower sides of the storage chamber, and configured to sense temperatures of the storage chamber; and a controller configured to control a rotation direction of the cooling fan, based on the result by the temperature sensor.

[0030] The refrigerator body may be provided with a mullion disposed in upper and lower directions. And, the storage chamber may be provided with a freezing chamber and a refrigerating chamber disposed in a state where the mullion is formed therebetween.

[0031] An upper communication portion and a lower communication portion through which an upper region and a lower region of the refrigerating chamber are communicated with the freezing chamber, respectively, may be formed at the mullion. And, the temperature sensor may be provided at the refrigerating chamber.

[0032] The controller may be configured to control the cooling fan to backward rotate, when an upper temperature of the refrigerating chamber is less than an upper preset temperature, and a lower temperature of the refrigerating chamber exceeds a lower preset temperature.

[0033] The controller may be configured to control the cooling fan to forward rotate, when an upper temperature of the refrigerating chamber exceeds an upper preset temperature, and a lower temperature of the refrigerating chamber exceeds a lower preset temperature.

[0034] The plurality of openings may include an upper opening provided at an upper region of the storage chamber, and a lower opening provided at a lower region of the storage chamber.

[0035] When the cooling fan forward rotates, air may be introduced into the lower opening, and cool air may be discharged to the upper opening. On the other hand, when the cooling fan backward rotates, air may be introduced into the upper opening, and cool air may be discharged to the lower opening.

[0036] The cooling fan may be configured as a centrifugal fan.

[0037] The refrigerator may further comprise a blowing fan provided at a region to which air inside the refrigerating chamber is sucked, when the cooling fan forward rotates.

[0038] The controller may be configured to drive the blowing fan when the cooling fan backward rotates.

[0039] The circulation path may be formed at the freezing chamber and the refrigerating chamber, respectively.

[0040] The temperature sensor may include an upper temperature sensor configured to sense a temperature of an upper region of each storage chamber (freezing chamber and refrigerating chamber), and a lower temperature sensor configured to sense a temperature of a lower region of said each storage chamber (freezing chamber and refrigerating chamber).

[0041] The controller may control the cooling fan of the freezing chamber to backward rotate, when an upper temperature of the freezing chamber is less than an upper preset temperature, and a lower temperature of the freezing chamber exceeds a lower preset temperature.

[0042] The controller may control the cooling fan of the freezing chamber to forward rotate, when an upper temperature of the freezing chamber exceeds the upper preset temperature, and a lower temperature of the freezing chamber exceeds the lower preset temperature.

[0043] The controller may control the cooling fan of the refrigerating chamber to forward rotate, when an upper temperature of the refrigerating chamber exceeds an upper preset temperature, and a lower temperature of the refrigerating chamber exceeds a lower preset temperature. And, the controller may control the cooling fan of the refrigerating chamber to backward rotate, when an upper temperature of the refrigerating chamber is less than an upper preset temperature, and a lower temperature of the refrigerating chamber exceeds a lower preset temperature.

[0044] According to another aspect of the present invention, there is provided a refrigerator, comprising: a refrigerator body having a plurality of storage chambers; an evaporator installed at each of the storage chambers; a cooling fan disposed at one side of the evaporator, and forward or backward rotatable; a circulation path formed to enclose the evaporator and the cooling fan, and having a plurality of openings at upper and lower parts thereof so as to be communicated with the storage chamber; a plurality of temperature sensors installed at upper and lower sides of each of the storage chambers, and configured to sense an inner temperature of each of the storage chambers; and a controller configured to control a rotation direction of the cooling fan, based on a result by the temperature sensors.

[0045] According to still another aspect of the present invention, there is provided a refrigerator, comprising: a refrigerator body having a plurality of storage chambers; an evaporator installed at a first storage chamber; a cooling fan disposed above the evaporator, and forward and backward rotatable; a circulation path formed to enclose the evaporator and the cooling fan, and having a plurality of openings at upper and lower parts thereof so as to be communicated with the storage chamber; an upper communication portion disposed at an upper region of each of the two storage chambers; a lower communication portion disposed at a lower region of each of the two storage chambers; a blowing fan disposed at the lower communication portion; a plurality of temperature sensors installed at upper and lower regions of a second storage chamber, and configured to sense a temperature of the second storage chamber; and a controller configured to control a rotation direction of the cooling fan and ON/OFF of the blowing fan, based on a results by the plurality of temperature sensors.

[0046] A mullion disposed in upper and lower directions and configured to partition the first and second storage chambers from each other, may be provided at the refrigerator body. The upper communication portion and the lower communication portion may be formed at the mullion.

[0047] The first storage chamber may be a freezing chamber, and the second storage chamber may be a refrigerating chamber.

[0048] Further scope of applicability of the present application will become more apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from the detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0049] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate exemplary embodiments and together with the description serve to explain the principles of the invention.

[0050] In the drawings:

FIG. 1 is an exemplary view of a refrigerator in accordance with the related art;
FIG. 2 is a view showing an evaporator and a cooling fan of the refrigerator of FIG. 1;
FIG. 3 is a view showing a configuration of a refrigerator according to an embodiment of the present invention;
FIG. 4 is a control block diagram of the refrigerator of FIG. 3;
FIG. 5 is a view showing circulation of cool air when a cooling fan of the refrigerator of FIG. 3 backward rotates;
FIG. 6 is a view showing a configuration of a refrigerator according to another embodiment of the present invention;
FIG. 7 is a control block diagram of the refrigerator of FIG. 6;
FIG. 8 is a view showing a configuration of a refrigerator according to still another embodiment of the present invention; and
FIG. 9 is a control block diagram of the refrigerator of FIG. 8.

DETAILED DESCRIPTION OF THE INVENTION

[0051] Description will now be given in detail of the exemplary embodiments, with reference to the accompanying drawings. For the sake of brief description with reference to the drawings, the same or equivalent components will be provided with the same reference numbers, and description thereof will not be repeated.

[0052] Hereinafter, a refrigerator according to the present invention will be explained in more detail with reference to the attached drawings.

[0053] As shown in FIGS. 3 to 5, a refrigerator according to an embodiment of the present invention may include a refrigerator body 110 having a storage chamber 120; a circulation path 140 having a plurality of openings 142 and 144 spaced from each other and communicated with the storage chamber 120, an evaporator 145 configured to cool air, and a cooling fan 147 which can be forward and backward rotated, and configured to circulate cool air in the storage chamber 120; a temperature sensor 160 configured to sense a temperature of the storage chamber 120; and a controller 150 configured to control a rotation direction of the cooling fan 147, based on a result by the temperature sensors 160. The storage chamber 120 indicates a space for storing food items in a cooled state. The refrigerator body 110 may include one of a freezing chamber 121 and a refrigerating chamber 122.

[0054] The storage chamber 120 may be provided in the refrigerator body 110.

[0055] The storage chamber 120 may include the freezing chamber 121 and the refrigerating chamber 122.

[0056] The refrigerator body 110 may be provided with a door (not shown) configured to open and close the storage chamber 120.

[0057] The door may include a freezing chamber door configured to open and close the freezing chamber 121, and a refrigerating chamber door configured to open and close the refrigerating chamber 122.

[0058] The freezing chamber 121 and the refrigerating chamber 122 may be disposed side by side, in a state where a vertically-arranged mullion (partition wall) 115 is disposed therebetween. The freezing chamber 121 and the refrigerating chamber 122 may be formed to have a length greater than a width (with in right and left directions).

[0059] A circulation path 140 along which air inside the freezing chamber 121 circulates to be cooled, may be provided at the freezing chamber 121.

[0060] The circulation path 140 may be formed at a rear region of the freezing chamber 121.

[0061] The circulation path 140 may be formed in upper and lower directions of the freezing chamber 121.

[0062] The circulation path 140 may be provided with openings 142 and 144 through which air inside the freezing chamber 121 flows.

[0063] For instance, the lower opening 142 through which air inside the freezing chamber 121 can be introduced to the circulation path 140, may be provided at a lower region of the freezing chamber 121.

[0064] The upper opening 144 through which air inside the circulation path 140 can be discharged to the outside, may be provided at an upper region of the freezing chamber 121.

[0065] The upper opening 144 may be implemented as a plurality of openings spaced from each other in upper and lower directions.

[0066] The circulation path 140 may be provided with an evaporator 145. Under such configuration, air can be cooled while circulating along the circulation path 140.

[0067] A cooling fan 147 may be provided at the circulation path 140. Under such configuration, flowing of air inside the circulation path 140 can be accelerated.

[0068] The cooling fan 147 may be provided at one side of the evaporator 145.

[0069] The cooling fan 147 may be disposed above the evaporator 145.

[0070] The cooling fan 147 may be configured to forward rotate (e.g., clockwise rotation) and backward rotate (e.g., counterclockwise rotation). For instance, the cooling fan 147 may be configured to suck air below the evaporator 145, and to discharge the sucked air to the upper side, while forward rotating.

[0071] For instance, the cooling fan 147 may be configured as a centrifugal fan for sucking air in an axial direction and discharging the sucked air in a radial direction.

[0072] The upper opening 144 may be a discharge hole for freezing chamber cool air, in that air cooled while flowing along the circulation path 140 (i.e., cool air) is discharged therefrom.

[0073] A communication unit 116 configured to communicate the freezing chamber 121 and the refrigerating chamber 122 with each other, may be formed at the mullion 115.

[0074] The communication unit 116 may be formed at an upper region and a lower region of the mullion 115, respectively.

[0075] The communication unit 116 may be provided with an upper communication portion 117 and a lower communication portion 119 spaced from each other in upper and lower directions.

[0076] The upper communication portion 117 may be a cool air inlet, in that cool air inside the freezing chamber 121 is introduced into the cooling chamber 122, when the cooling fan 147 is forward rotated.

[0077] The lower communication portion 119 may be a suction hole, in that cool air inside the refrigerating chamber 122 is introduced into the circulation path 140, when the cooling fan 147 is forward rotated.

[0078] A cool air duct 125 may be disposed at an upper region of the refrigerating chamber 122 so as to be communicated with the upper communication portion 117. The cool air duct 125 may be provided with a plurality of cool air discharge holes 127 through which cool air is discharged, when the cooling fan 147 is forward rotated. The cool air discharge holes 127 may be configured to discharge cool air to the front side and/or the lower side of the cool air duct 125.

[0079] The temperature sensing configured to sense an inner temperature of the refrigerating chamber 122 may be provided in the refrigerating chamber 122.

[0080] The temperature sensor 160 may be provided with an upper temperature sensor 162 configured to sense a temperature of an upper region of the refrigerating chamber 122.

[0081] The temperature sensor 160 may be provided with a lower temperature sensor 164 configured to sense a temperature of a lower region of the refrigerating chamber 122.

[0082] The refrigerator according to this embodiment may include a controller 150 configured to control the cooling fan 147 based on a sensed temperature in the refrigerating chamber 122.

[0083] For instance, the controller 150 may be implemented as a microprocessor having a control program.

[0084] The controller 150 may be configured to sense an inner temperature of the refrigerating chamber 122 by the temperature sensor 160. If an upper temperature and a lower temperature of the refrigerating chamber 122 exceed an upper preset temperature and a lower preset temperature, respectively, the controller 150 may control the cooling fan 147 to forward rotate. Here, the upper preset temperature and the lower preset temperature may be set to be different from each other, or to be the same.

[0085] The controller 150 may be configured to sense an inner temperature of the refrigerating chamber 122 by the temperature sensor 160. If an upper temperature is less than the upper preset temperature and a lower temperature exceeds the lower preset temperature, the controller 150 may control the cooling fan 147 to backward rotate.

[0086] Under such configuration, the controller 150 may sense the temperature of the refrigerating chamber 122 under control of the temperature sensor 160.

[0087] If an upper temperature of the refrigerating chamber 122 exceeds the upper preset temperature, and a lower temperature of the refrigerating chamber 122 exceeds the lower preset temperature as a sensing result, the controller 150 may control the cooling fan 147 to forward rotate.

[0088] Once the cooling fan 147 is forward rotated, air inside the freezing chamber 121 and the refrigerating chamber 122 may be sucked to the circulation path 140 via the lower opening 142 and the lower communication portion 119, respectively.

[0089] The sucked air moves to the upper side along the circulation path 140, and contacts the evaporator 145. During such process, the air may be heat-exchanged to be cooled.

[0090] The air cooled while passing through the evaporator 145, may be discharged to the upper side via the cooling fan 147. Some of the discharged cool air may be discharged to the freezing chamber 121, and other thereof may be introduced to the cool air duct 125 through the upper communication portion 117.

[0091] The cool air introduced into the cool air duct 125 may be discharged to the refrigerating chamber 122, and may move to the lower side to thus cool the refrigerating chamber 122.

[0092] Once the cooling fan 147 starts to forward rotate, cool air is intensively-discharged to an upper region of the refrigerating chamber 122. This may cause the temperature of the upper region of the refrigerating chamber 122, to be more rapidly lowered than that of a central region and/or a lower region of the refrigerating chamber 122.

[0093] Temperature changes inside the refrigerating chamber 122 will be explained in more detail. In a case where the refrigerating chamber 122 is divided into a plurality of sections (e.g., four sections) in upper and lower directions, the uppermost section may have a relatively low temperature (median temperature or average temperature), and may have a greatest temperature change.

[0094] On the other hand, the lowermost section of the refrigerating chamber 122 may have a relatively high temperature (median temperature or average temperature), and may have a smallest temperature change. The second and third sections may have temperature (change) characteristics that the median temperature (or average temperature) is increased towards the lowermost section, but the degree of change is decreased towards the lowermost section.

[0095] Alternatively, the controller 150 may sense the temperature of the refrigerating chamber 122 under control of the temperature sensor 160. If an upper temperature of the refrigerating chamber 122 is less than the upper preset temperature, and a lower temperature of the refrigerating chamber 122 exceeds the lower preset temperature, the controller 150 may control the cooling fan 147 to backward rotate.

[0096] Once the cooling fan 147 is backward rotated, as shown in FIG. 5, a flowing direction of air along the circulation path 140 may be changed. That is, the cooling fan 147 may suck air disposed at the upper side, and may discharge the sucked air to the lower side. Under such configuration, air may be sucked to the upper opening 144 of the freezing chamber 121, and may be discharged to the lower opening 142.

[0097] Air inside the refrigerating chamber 122 may be introduced to the freezing chamber 121 through the upper communication portion 117, and cool air disposed below the circulation path 140 may be directly supplied to a lower region of the refrigerating chamber 122 through the lower communication portion 119. Under such configuration, the lower region of the refrigerating chamber 122 can be rapidly cooled. Further, since cool air inside the freezing chamber 121 is not directly supplied to the sufficiently-cooled upper region of the refrigerating chamber 122, food items stored in the upper region of the refrigerating chamber 122 are not overcooled.

[0098] Hereinafter, a refrigerator according to another embodiment of the present invention will be explained with reference to FIGS. 6 and 7. The same components as those of the aforementioned embodiment will be provided with the same reference numerals, and the same explanations will be omitted.

[0099] As shown in FIG. 6, a refrigerator according to another embodiment of the present invention may include a refrigerator body 110 having a storage chamber 120; a circulation path 140 having a plurality of openings 142 and 144 spaced from each other and communicated with the storage chamber 120, an evaporator 145 configured to cool air, and a cooling fan 147 which can be forward and backward rotated, and configured to circulate cool air in the storage chamber 120; a temperature sensor 160 configured to sense a temperature of the storage chamber 120; and a controller 150 configured to control a rotation direction of the cooling fan 147, based on a result by the temperature sensors 160.

[0100] The refrigerator body 110 may be provided with a mullion 115 disposed in upper and lower directions.

[0101] The storage chamber 120 may be formed to be provided with the mullion 115.

[0102] The storage chamber 120 may include a freezing chamber 121 and a refrigerating chamber 122.

[0103] A circulation path 140 may be provided at the freezing chamber 121.

[0104] The circulation path 140 may be provided with an upper opening 144 and a lower opening 142.

[0105] An evaporator 145 may be disposed at the circulation path 140.

[0106] A cooling fan 147 may be provided at the circulation path 140.

[0107] The cooling fan 147 may be configured to forward rotate or backward rotate.

[0108] A communication portion 116 may be formed at the mullion 115. The communication portion 116 may be provided with an upper communication portion 117 and a lower communication portion 119.

[0109] The lower communication portion 119 may be a suction hole through which air inside the refrigerating chamber 122 is sucked to the circulation path 140, when the cooling fan 147 is forward rotated.

[0110] A blowing fan 155 may be provided at the lower communication portion 117. In this embodiment, the blowing fan 155 is disposed in the lower communication portion. However, the blowing fan 155 may be provided at the circulation path 140.

[0111] The blowing fan 155 may be configured to blow cool air inside the freezing chamber 121 into the refrigerating chamber 122 when rotated.

[0112] The blowing fan 155 may be configured as a small fan having a smaller blowing capacity than the cooling fan 147.

[0113] The blowing fan 155 may be configured as an axial fan.

[0114] The refrigerator may include a controller 150 configured to control the cooling fan 147 based on a sensed temperature in the storage chamber 120.

[0115] As shown in FIG. 7, the temperature sensor 160 configured to sense an inner temperature of the storage chamber 120 (more specifically, the refrigerating chamber 122) may be connected to the controller 150 so as to transmit or receive an electric signal.

[0116] The cooling fan 147 and the blowing fan 155 may be connected to the controller 150 in a controllable manner.

[0117] The controller 150 may control the blowing fan 155 to rotate when the cooling ran 147 is backward rotated. Under such configuration , can be increased the amount of cool air provided to the refrigerating chamber 122 when the cooling fan 147 is backward rotated. Accordingly, a lower region of the refrigerating chamber 122 can be more rapidly cooled. In the related art, a peripheral temperature of the lower region of the refrigerating chamber 122 is increased when food items of a high temperature are introduced into the lower region, and the upper region of the refrigerating chamber 122 is overcooled due to cool air continuously supplied thereto for cooling of the lower region. However, in the present invention, the lower region can be rapidly cooled, and the upper region can be prevented from being overcooled.

[0118] Under such configuration, the controller 150 may sense the temperature of the refrigerating chamber 122 under control of the temperatures sensor 160.

[0119] If an upper temperature of the refrigerating chamber 122 exceeds an upper preset temperature and a lower temperature of the refrigerating chamber 122 exceeds a lower preset temperature, the controller 150 may control the cooling fan 147 to forward rotate.

[0120] Once the cooling fan 147 is forward rotated, air inside the freezing chamber 121 and the refrigerating chamber 122 is sucked to the circulation path 140 through the lower opening 142 and the lower communication portion 119. Then, the sucked air may be cooled by the evaporator 145. Some of the cooled air may be discharged to the freezing chamber 121, and other thereof may be introduced into the cool air duct 125 via the upper communication portion 117 thus to be discharged to the refrigerating chamber 122. Under such configuration, the upper region of the refrigerating chamber 122 can be more rapidly cooled.

[0121] The controller 150 may sense the temperature of the refrigerating chamber 122 under control of the temperature sensor 160. If the upper temperature of the refrigerating chamber 122 is less than the upper preset temperature and the lower temperature of the refrigerating chamber 122 exceeds the lower preset temperature, the controller 150 may control the cooling fan 147 to backward rotate. The controller 150 may control the blowing fan 155 to rotate when the cooling fan 147 backward rotates.

[0122] Once the cooling fan 147 starts to backward rotate, air may be sucked to the upper opening 144 of the freezing chamber 121, and cool air may be discharged to the lower opening 142. Further, air inside the refrigerating chamber 122 may be sucked to the freezing chamber 121 through the upper communication portion 117 of the refrigerating chamber 122. And, cool air disposed below the circulation path 140 may be directly supplied to the lower region of the refrigerating chamber 122 through the lower communication portion 119. Here, the blowing fan 155 may serve to increase the amount of air by controlling cool air to rapidly move towards the refrigerating chamber 122 via the lower communication portion 119. Under such configuration, the lower region of the refrigerating chamber 122 can be more rapidly cooled. Further, since cool air is not directly supplied to the sufficiently-cooled upper region of the refrigerating chamber 122, food items stored in the upper region of the refrigerating chamber 122 are not overcooled.

[0123] Hereinafter, a refrigerator according to still another embodiment of the present invention will be explained with reference to FIGS. 8 and 9. -

[0124] As shown in FIGS. 8 and 9, the refrigerator according to still another embodiment of the present invention may include a refrigerator body 110 having a storage chamber 120; a circulation path 140 having a plurality of openings 172, 174, 192 and 194 spaced from each other and communicated with the storage chamber 120, an evaporator 145 configured to cool air, and a cooling fan 147 which can be forward and backward rotated, and configured to circulate cool air in the storage chamber 120; a temperature sensor 160 configured to sense an inner temperature of the storage chamber 120; and a controller 150 configured to control a rotation direction of the cooling fan 147, based on a result by the temperature sensor 160.

[0125] The refrigerator body 110 may be provided with the storage chamber 120.

[0126] A temperature sensor 160 for sensing an inner temperature of the storage chamber 120 may be provided in the storage chamber 120.

[0127] The storage chamber 120 may be provided with a freezing chamber 121 and a refrigerating chamber 122 partitioned from each other in a state where a mullion 115 is disposed therebetween.

[0128] The temperature sensor 160 may include a freezing chamber temperature sensor 180 provided at the freezing chamber 121, and a refrigerating chamber temperature sensor 200 provided at the refrigerating chamber 122.

[0129] A circulation path 140 may be provided at the storage chamber 120.

[0130] The circulation path 140 may be provided at the freezing chamber 121 and the refrigerating chamber 122, respectively.

[0131] The circulation path 140 may include a freezing chamber circulation path 170 provided at the freezing chamber 121, and a refrigerating chamber circulation path 190 provided at the refrigerating chamber 122.

[0132] A cooling fan 147 may be provided at the circulation path 140.

[0133] The cooling fan 147 may include a freezing chamber cooling fan 177 provided at the freezing chamber circulation path 170, and a refrigerating chamber cooling fan 197 provided at the refrigerating chamber circulation path 190.

[0134] The evaporator 145 may include a freezing chamber evaporator 175 provided at the freezing chamber circulation path 170, and a refrigerating chamber evaporator 195 provided at the refrigerating chamber circulation path 190. Under such configuration, air inside the freezing chamber 121 and the refrigerating chamber 122 can be cooled while flowing along the circulation paths 170 and 190, respectively.

[0135] The cooling fan 147 may include a freezing chamber cooling fan 177 provided at the freezing chamber circulation path 170, and a refrigerating chamber cooling fan 197 provided at the refrigerating chamber circulation path 190. Under such configuration, flow of air inside the freezing chamber circulation path 170 and the refrigerating chamber circulation path 190 can be accelerated.

[0136] The freezing chamber cooling fan 177 may be configured to forward rotate and backward rotate.

[0137] The freezing chamber circulation path 170 may be provided with a lower opening 172 and an upper opening 174 through which air inside the freezing chamber 121 can be introduced and discharged out.

[0138] A freezing chamber temperature sensor 180 configured to sense an inner temperature of the freezing chamber 121 may be provided at the freezing chamber 121.

[0139] The freezing chamber temperature sensor 180 may be provided with a freezing chamber upper temperature sensor 182 and a freezing chamber lower temperature sensor 184.

[0140] A refrigerating chamber circulation path 190 through which air circulates to be cooled, may be provided at the refrigerating chamber 122.

[0141] A refrigerating chamber evaporator 195 may be provided at the refrigerating chamber circulation path 190. Under such configuration, air inside the refrigerating chamber 122 can circulate to be cooled.

[0142] A refrigerating chamber cooling fan 197 may be provided at the refrigerating chamber circulation path 190. Under such configuration, flow of air inside the refrigerating chamber circulation path 190 can be accelerated.

[0143] The refrigerating chamber cooling fan 197 may be configured to forward rotate and backward rotate.

[0144] A refrigerating chamber temperature sensor 200 configured to sense an inner temperature of the refrigerating chamber 122 may be provided at the refrigerating chamber 122.

[0145] The refrigerating chamber temperature sensor 200 may be provided with a refrigerating chamber upper temperature sensor 202 and a refrigerating chamber lower temperature sensor 204.

[0146] The freezing chamber cooling fan 177 and the refrigerating chamber cooling fan 197 may be configured as an axial fan, respectively. Under such configuration, can be reduced the amount of air discharged through the lower openings 172 and 192 when rotation directions of the cooling fans 177 and 197 are converted.

[0147] Alternatively, the freezing chamber cooling fan 177 and the refrigerating chamber cooling fan 197 may be configured as a centrifugal fan, respectively. In this case, a freezing chamber blowing fan (not shown) and a refrigerating chamber blowing fan (not shown) may be provided at the lower openings, respectively. The freezing chamber blowing fan may be driven when the freezing chamber cooling fan 177 is backward rotated, and the refrigerating chamber blowing fan may be driven when the refrigerating chamber cooling fan 197 is backward rotated.

[0148] The refrigerator according to this embodiment may include a controller 150 configured to sense each temperature inside the freezing chamber 121 and the refrigerating chamber 122, and to control the cooling fans 177 and 197 to forward rotate or backward rotate based on the sensed temperatures.

[0149] As shown in FIG. 9, the freezing chamber temperature sensor 180 and the refrigerating chamber temperature sensor 200 may be connected to the controller 150. Under such configuration, the controller 150 may recognize inner temperatures of the freezing chamber 121 and the refrigerating chamber 122.

[0150] The freezing chamber cooling fan 177 and the refrigerating chamber cooling fan 197 may be connected to the controller 150, so that they can be controlled based on temperatures sensed by the temperature sensors 180 and 200.

[0151] If an upper temperature of the freezing chamber exceeds an upper preset temperature and a lower temperature of the freezing chamber exceeds a lower preset temperature as a sensing result by the freezing chamber temperature sensor 180, the controller 150 may control the freezing chamber cooling fan 177 to forward rotate.

[0152] If the upper temperature of the freezing chamber is less than the upper preset temperature and the lower temperature of the freezing chamber exceeds the lower preset temperature as a sensing result by the freezing chamber temperature sensor 180, the controller 150 may control the freezing chamber cooling fan 177 to backward rotate.

[0153] If an upper temperature of the refrigerating chamber exceeds an upper preset temperature and a lower temperature of the refrigerating chamber exceeds a lower preset temperature as a sensing result by the refrigerating chamber temperature sensor 200, the controller 150 may control the refrigerating chamber cooling fan 197 to forward rotate.

[0154] If the upper temperature of the refrigerating chamber is less than the upper preset temperature and the lower temperature of the refrigerating chamber exceeds the lower preset temperature as a sensing result by the refrigerating chamber temperature sensor 200, the controller 150 may control the refrigerating chamber cooling fan 197 to backward rotate.

[0155] Under such configuration, once the refrigerator starts to operate, the controller 150 may sense the temperature inside each storage chamber 120 by each temperature sensor.

[0156] The controller 150 may control the cooling fans 177 and 197 of the corresponding storage chamber 120 to forward rotate or backward rotate, based on sensed temperatures of the storage chamber 120.

[0157] More specifically, if an upper temperature and a lower temperature of the storage chamber 120 exceed an upper preset temperature and a lower preset temperature, respectively, the controller 150 may control the cooling fan of the corresponding storage chamber 120 to forward rotate. This can allow cool air to be intensively discharged to an upper region of the corresponding storage chamber 120, and thus to rapidly cool the upper region.

[0158] On the other hand, if the upper temperature of the storage chamber 120 is less than the upper preset temperature and the lower temperature exceeds the lower preset temperature, the controller 150 may control the cooling fans 177 and 197 to backward rotate. This can allow cool air to be discharged to the lower region of the corresponding storage chamber 120 to intensively cool the lower region, and prevent the sufficiently-cooled upper region from being overcooled.

[0159] As aforementioned, in the refrigerator according to one embodiment of the present invention, a discharge direction of cool air discharged into the storage chamber is controlled. This can prevent a deviation in an inner temperature of the storage chamber.

[0160] Further, the cooling fan is controlled so that a supply direction of cool air can be converted, based on the result of a sensed temperature inside the storage chamber. This can allow a deviation in an inner temperature of the storage chamber to be rapidly solved.

[0161] Further, if the temperature of the lower region of the storage chamber exceeds the lower preset temperature, the controller may control the cooling fan to be backward rotate, so that cool air can be directly discharged to the lower region of the storage chamber. This can allow the lower region of the storage chamber to be more rapidly cooled.

[0162] Besides, if the upper temperature and the lower temperature of the storage chamber exceed the upper preset temperature and the lower preset temperature, respectively, the controller may control the cooling fan to forward rotate, so that cool air can be discharged to the upper region of the storage chamber. This can allow cool air inside the storage chamber to be circulated by the cooling fan, and to be circulated by convection. As a result, the storage chamber can be more rapidly cooled.

[0163] Further, if the temperature inside the storage chamber is high, the cooling fan is forward rotated to firstly cool the upper region of the storage chamber. Then, if the upper region of the is cooled, the cooling fan is backward rotated to directly supply cool air to the lower region of the storage chamber. This can prevent the upper region of the storage chamber from being overcooled, and allow the lower region of the storage chamber to be more rapidly cooled.

[0164] The foregoing embodiments and advantages are merely exemplary and are not to be considered as limiting the present disclosure. The present teachings can be readily applied to other types of apparatuses. This description is intended to be illustrative, and not to limit the scope of the claims. Many alternatives, modifications, and variations will be apparent to those skilled in the art. The features, structures, methods, and other characteristics of the exemplary embodiments described herein may be combined in various ways to obtain additional and/or alternative exemplary embodiments.

[0165] As the present features may be embodied in several forms without departing from the characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be considered broadly within its scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalents of such metes and bounds are therefore intended to be embraced by the appended claims.

Claims

1. A refrigerator, comprising:

a refrigerator body (110) having a storage chamber (120);
a circulation path (140) having a plurality of openings (142, 144) spaced from each other and communicated with the storage chamber (120), an evaporator (145) configured to cool air, and a cooling fan (147) which can be forward and backward rotated, and configured to circulate cool air in the storage chamber (120);
a temperature sensor (160) disposed at upper and lower sides of the storage chamber (120), and configured to sense temperatures of the storage chamber (120); and
a controller (150) configured to control a rotation direction of the cooling fan (147), based on the result by the temperature sensor (160).

2. The refrigerator of claim 1, wherein the refrigerator body (110) is provided with a mullion (115) disposed in upper and lower directions, and the storage chamber (120) is provided with a freezing chamber (121) and a refrigerating chamber (122) disposed in a state where the mullion (115) is formed therebetween.

3. The refrigerator of claim 2, wherein an upper communication portion (117) and a lower communication portion (119) through which an upper region and a lower region of the refrigerating chamber (122) are communicated with the freezing chamber (121), respectively, are formed at the mullion (115), and wherein the temperature sensor (160) is provided at the refrigerating chamber (122).

4. The refrigerator of claim 3, wherein the controller (150) is configured to control the cooling fan (147) to backward rotate, when an upper temperature of the refrigerating chamber (122) is less than an upper preset temperature, and a lower temperature of the refrigerating chamber (122) exceeds a lower preset temperature.

5. The refrigerator of claim 3 or 4, wherein the controller (150) is configured to control the cooling fan (147) to forward rotate, when an upper temperature of the refrigerating chamber (122) exceeds an upper preset temperature, and a lower temperature of the refrigerating chamber (122) exceeds a lower preset temperature.

6. The refrigerator of one of claims 1 to 5, wherein the plurality of openings (142, 144) include an upper opening (144) provided at an upper region of the storage chamber (120), and a lower opening (142) provided at a lower region of the storage chamber (120).

7. The refrigerator of claim 6, wherein when the cooling fan (147) forward rotates, air is introduced into the lower opening (142), and cool air is discharged to the upper opening (144), and
wherein when the cooling fan (147) backward rotates, air is introduced into the upper opening (144), and cool air is discharged to the lower opening (142).

8. The refrigerator of one of claims 1 to 7, wherein the cooling fan (147) is configured as a centrifugal fan.

9. The refrigerator of one of claims 5 to 8, further comprising a blowing fan (155) provided at a region to which air inside the refrigerating chamber (122) is sucked, when the cooling fan (147) forward rotates.

10. The refrigerator of claim 9, wherein the controller (150) is configured to drive the blowing fan (155) when the cooling fan (147) backward rotates.

11. The refrigerator of claim 2, wherein the circulation path (140) is formed at the freezing chamber (121) and the refrigerating chamber (122), respectively.

12. The refrigerator of claim 11, wherein the temperature sensor (160) includes:

an upper temperature sensor (162) configured to sense a temperature of an upper region of each storage chamber (120); and
a lower temperature sensor (164) configured to sense a temperature of a lower region of said each storage chamber (120).

13. The refrigerator of claim 12, wherein the controller (150) controls the cooling fan (147) of the freezing chamber (121) to backward rotate, when an upper temperature of the freezing chamber (121) is less than an upper preset temperature, and a lower temperature of the freezing chamber (121) exceeds a lower preset temperature.

14. The refrigerator of claim 12 or 13, wherein the controller (150) controls the cooling fan (147) of the freezing chamber (121) to forward rotate, when the upper temperature of the freezing chamber (121) exceeds the upper preset temperature, and the lower temperature of the freezing chamber (121) exceeds the lower preset temperature.

15. The refrigerator of one of claims 12 to 14, wherein the controller (150) controls the cooling fan (147) of the refrigerating chamber (122) to forward rotate, when an upper temperature of the refrigerating chamber (122) exceeds an upper preset temperature, and a lower temperature of the refrigerating chamber (122) exceeds a lower preset temperature, and
wherein the controller (150) controls the cooling fan (147) of the refrigerating chamber (122) to backward rotate, when the upper temperature of the refrigerating chamber (122) is less than the upper preset temperature, and the lower temperature of the refrigerating chamber (122) exceeds the lower preset temperature.

FIG. 1

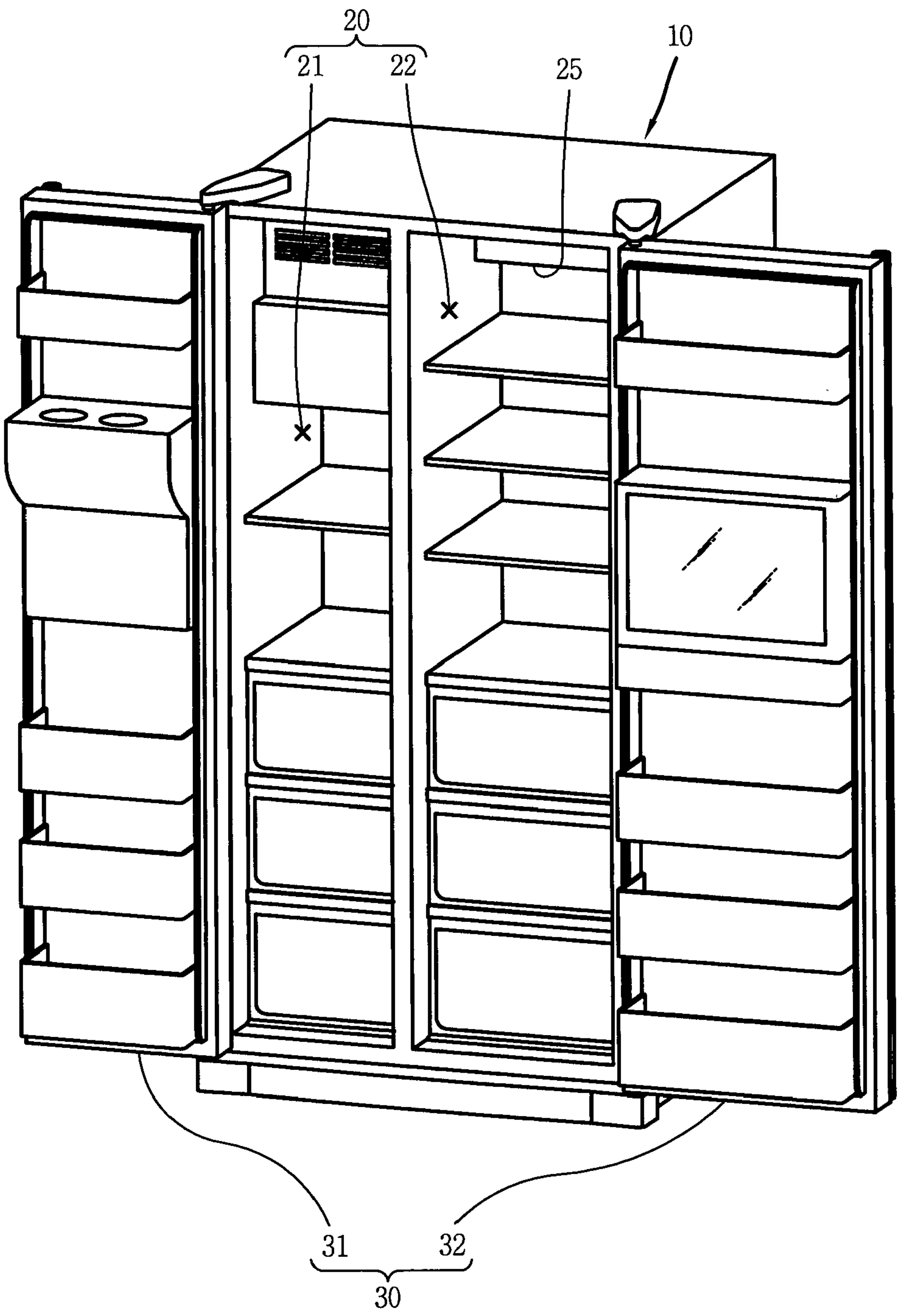


FIG. 2

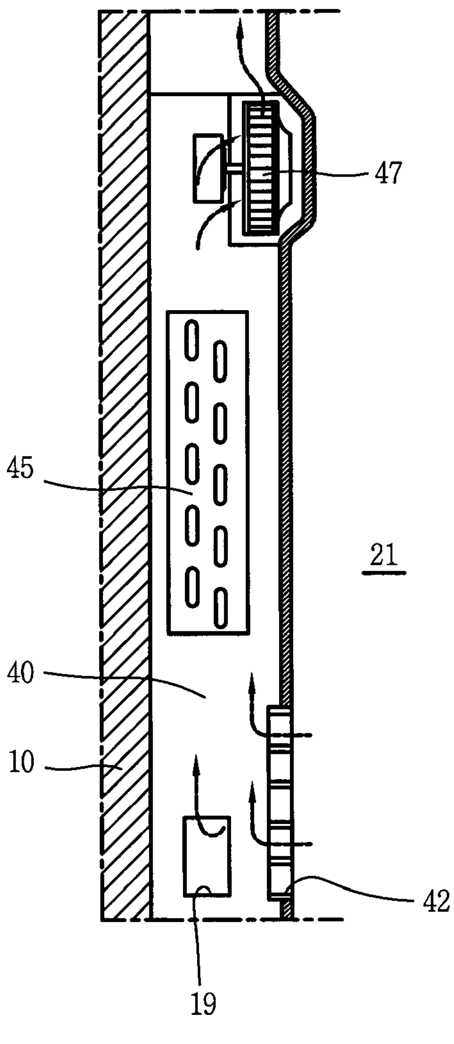
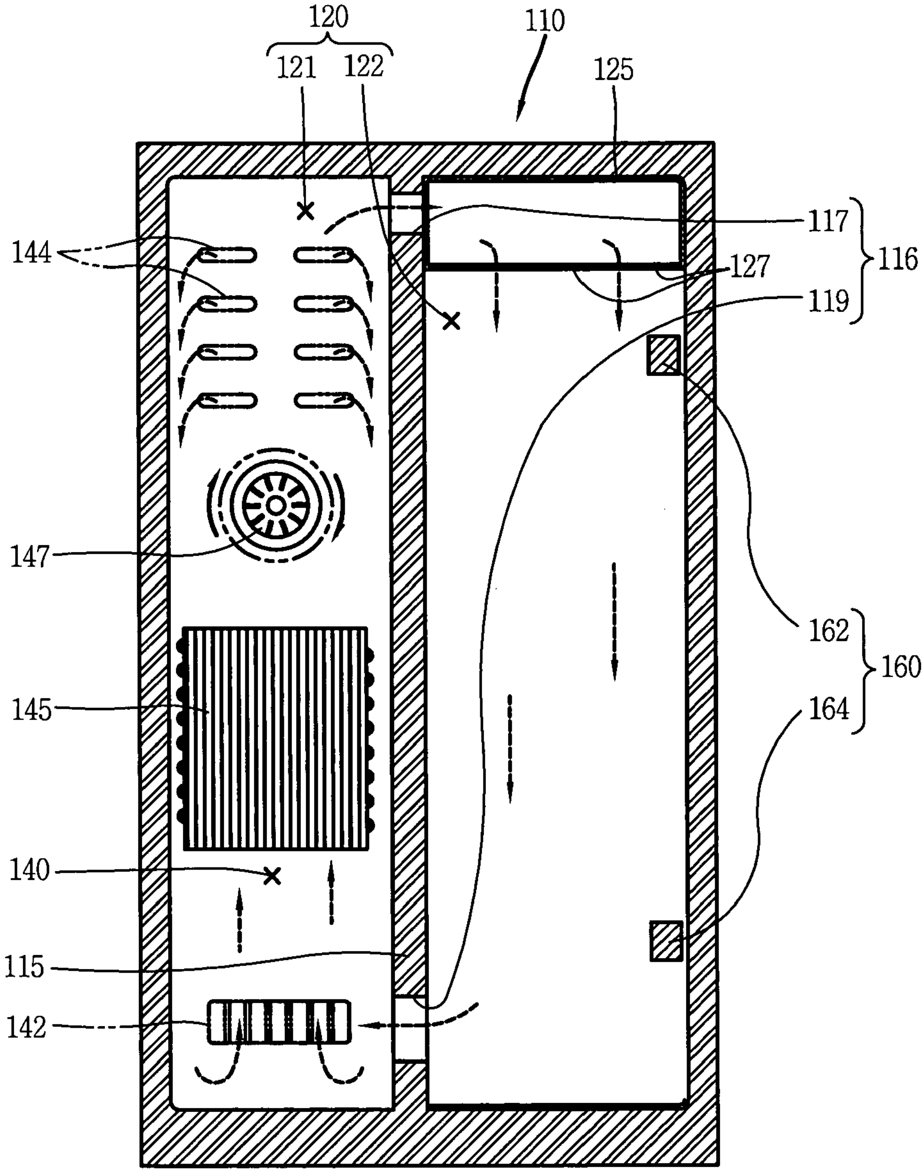


FIG. 3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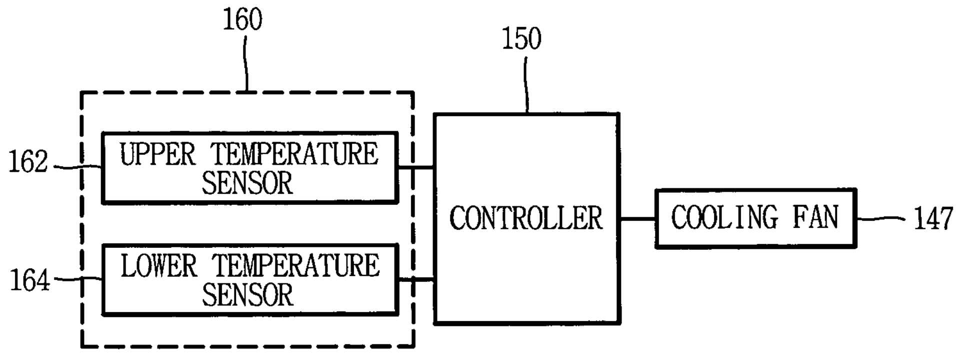
122
125
117
116
127
119
144
147
162
160
164
145
140
115
142

FIG. 4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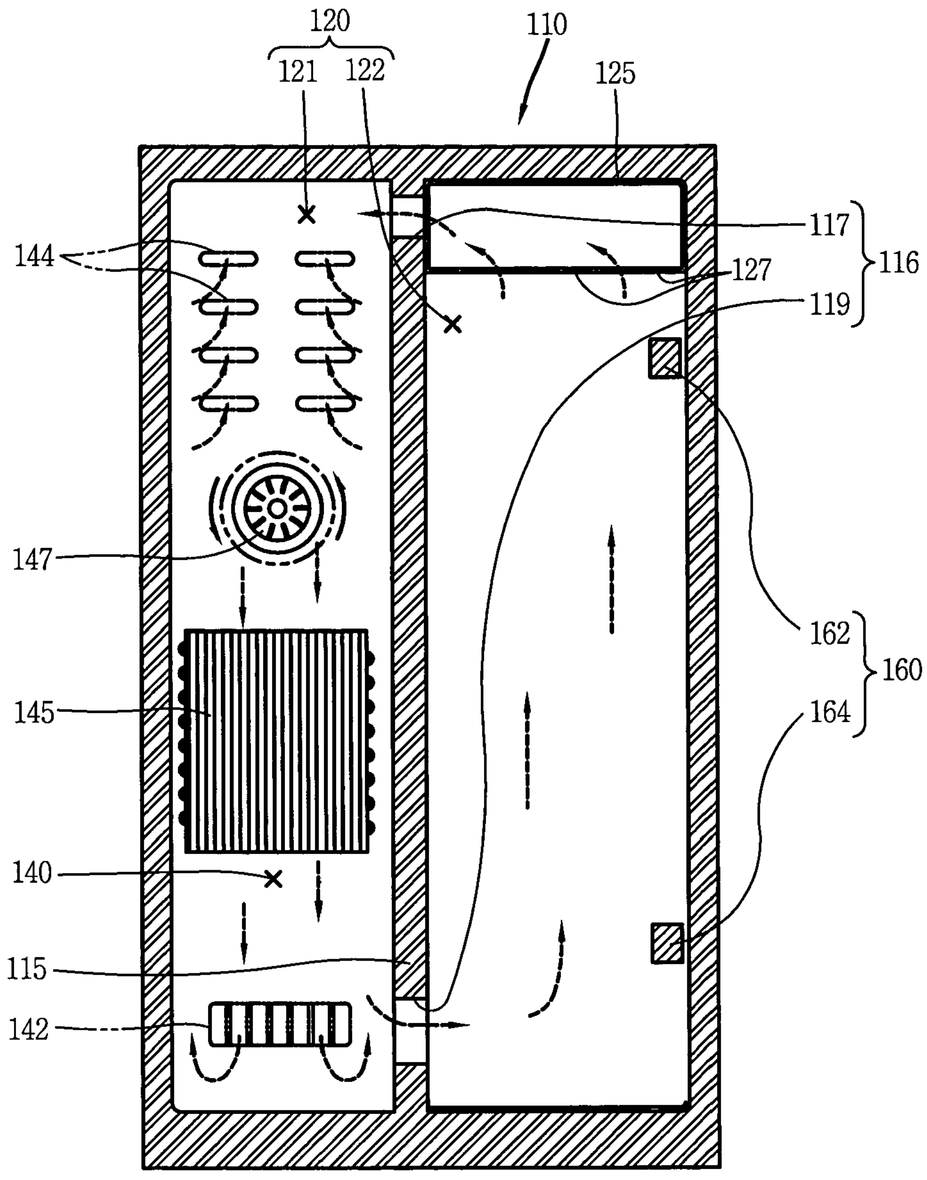
150
162
UPPER TEMPERATURE SENSOR
164
LOWER TEMPERATURE SENSOR
CONTROLLER
COOLING FAN
147

FIG. 5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117
116
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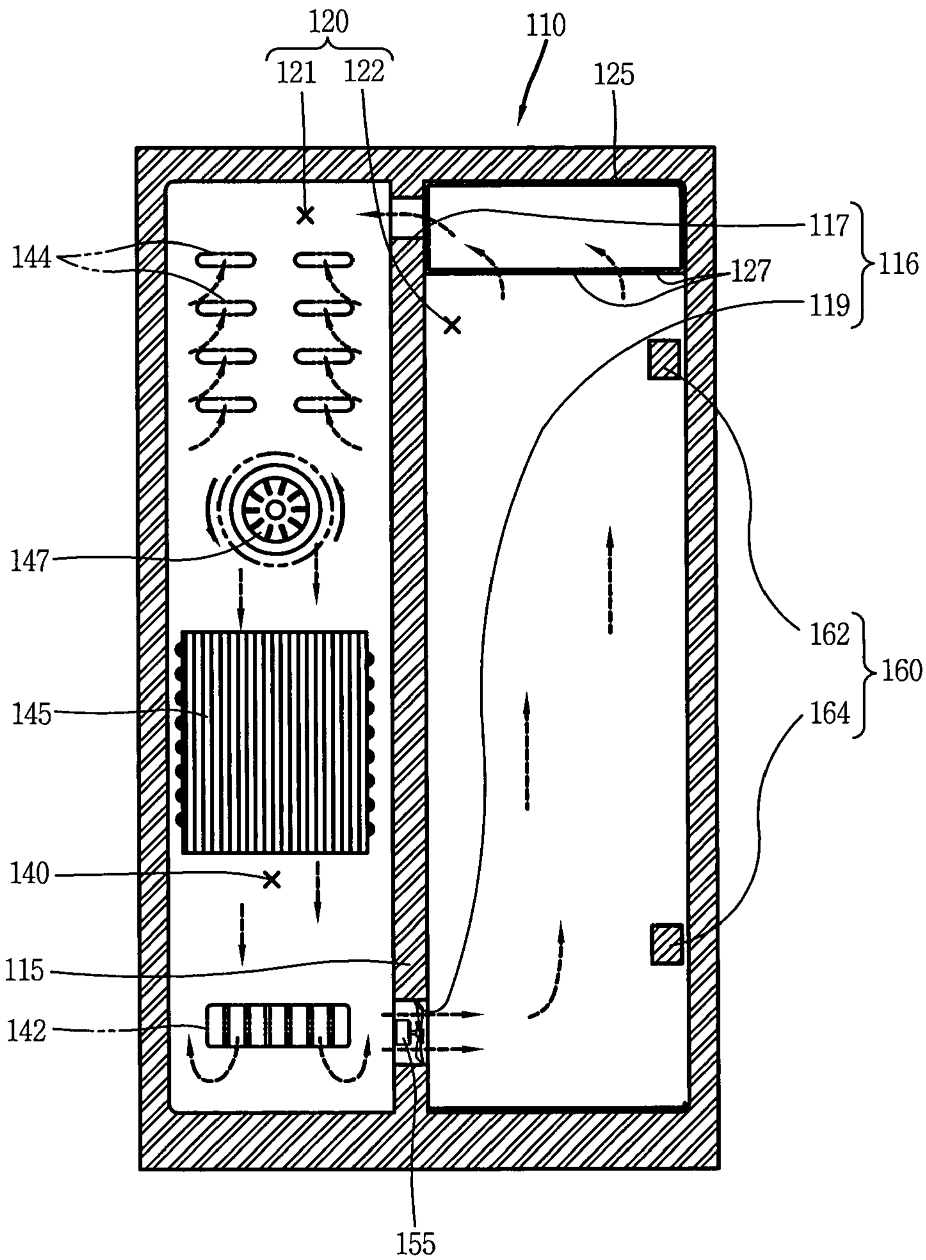
127
119
147
162
160
145
164
140
115
142

FIG. 6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127
119
147
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160
164
145
140
115
142
155

FIG. 7

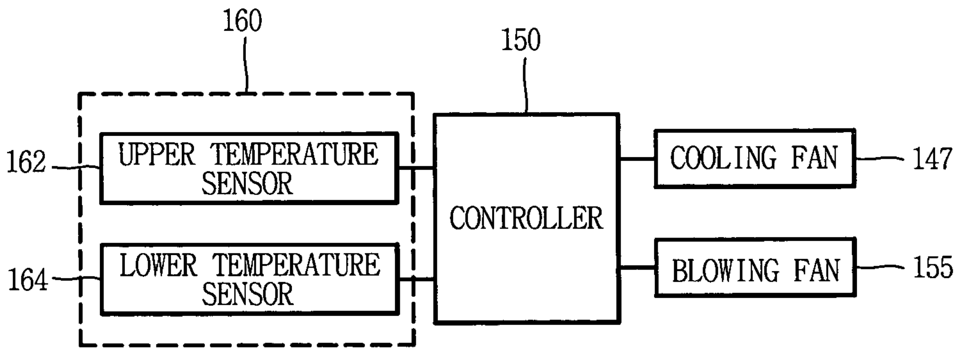
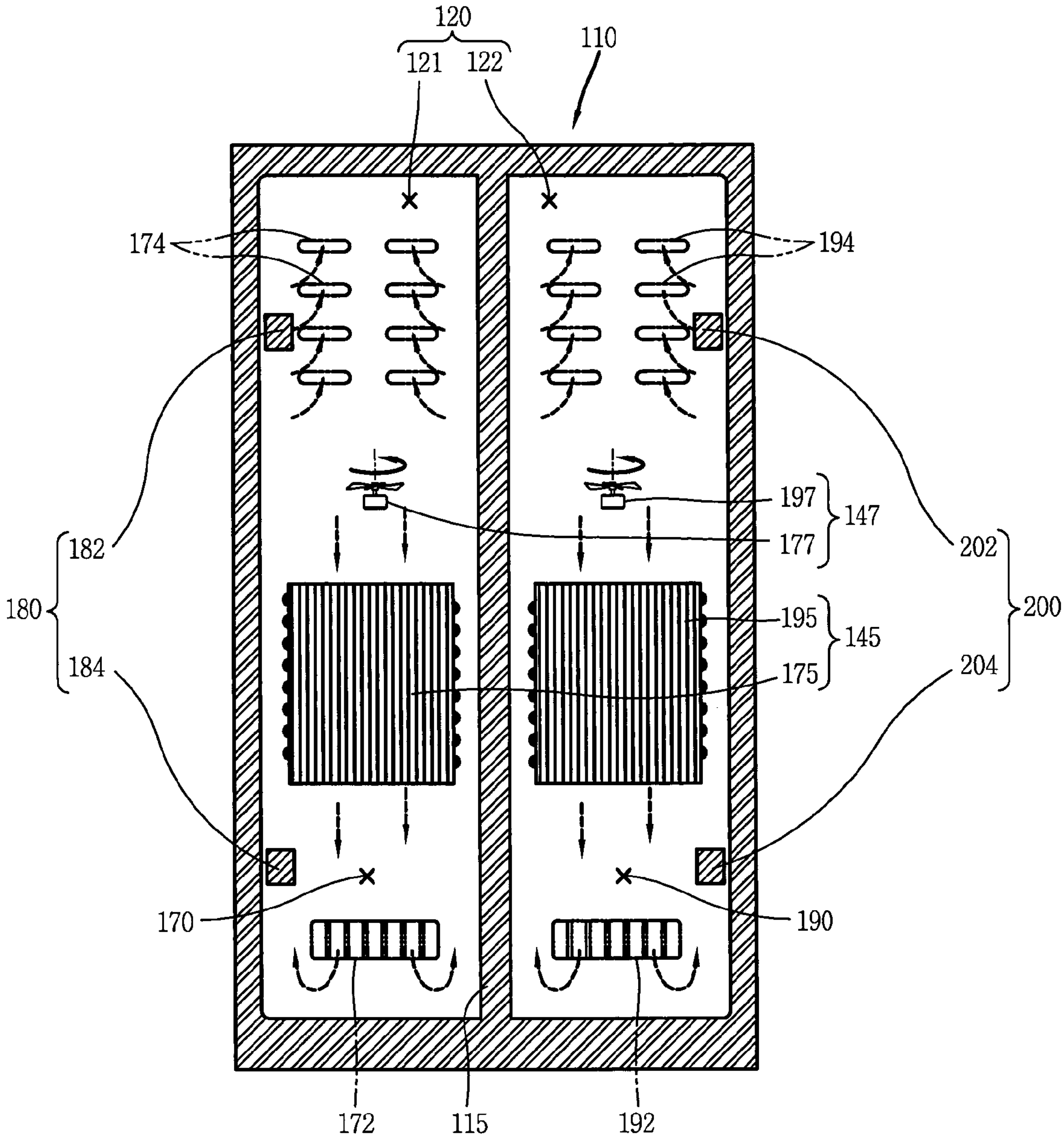

160
150
162
UPPER TEMPERATURE SENSOR
164
LOWER TEMPERATURE SENSOR
CONTROLLER
COOLING FAN
147
BLOWING FAN
155

FIG. 8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122
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174
194
182
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177
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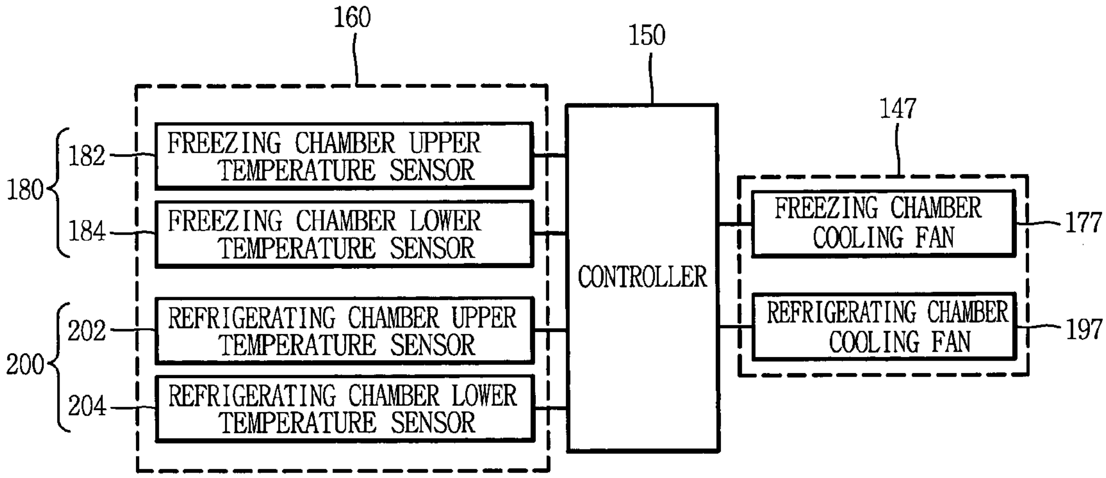
195
145
175
202
200
204
170
190
172
115
192

FIG. 9


160
150
147
180
182
FREEZING CHAMBER UPPER TEMPERATURE SENSOR
184
FREEZING CHAMBER LOWER TEMPERATURE SENSOR
200
202
REFRIGERATING CHAMBER UPPER TEMPERATURE SENSOR
204
REFRIGERATING CHAMBER LOWER TEMPERATURE SENSOR
CONTROLLER
FREEZING CHAMBER COOLING FAN
177
REFRIGERATING CHAMBER COOLING FAN
197