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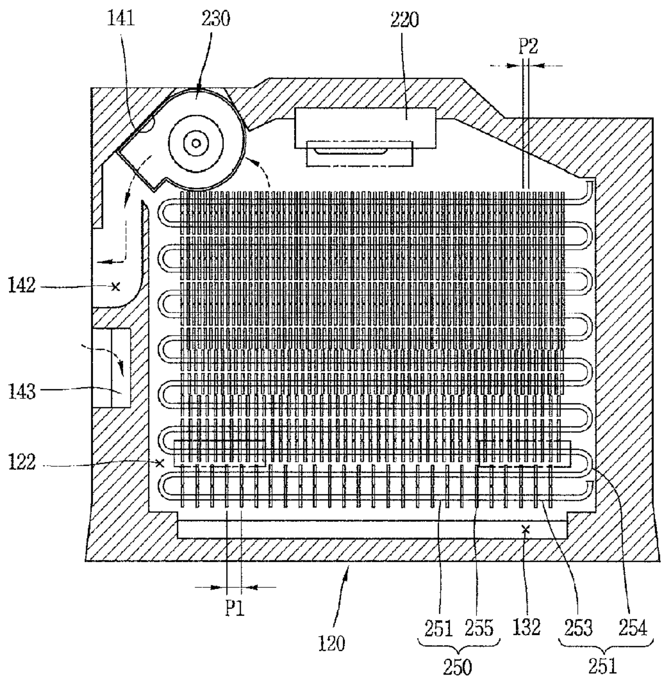
(54) **Title**: REFRIGERATOR

[Fig. 7]



(57) **Abstract**: A refrigerator having a refrigerator body including a first cooling chamber and a second cooling chamber, a barrier wall located between the first cooling chamber and the second cooling chamber, an evaporator configured to provide cooling air, a first cooling fan configured to provide cooling air of the evaporator to the first cooling chamber, and a second cooling fan configured to provide cooling air of the evaporator to the second cooling chamber is provided. A method of providing cooling air flow in a refrigerator is also provided.

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Description

Title of Invention: REFRIGERATOR

Technical Field

[1] The present invention relates to a refrigerator and, more particularly, to a refrigerator having an expanded internal space and is capable of independently or simultaneously cooling a plurality of cooling chambers with a single evaporator.

Background Art

[2] A refrigerator is a device for refrigerating or freezing food items to keep them fresh. The refrigerator includes a refrigerator main body including a plurality of cooling chambers, doors for opening and closing each cooling chamber, and a refrigerating cycle mechanism for providing cooling air (i.e., cool air, cold air, etc.) to the cooling chambers.

[3] The refrigerating cycle mechanism is configured as a vapor compression type refrigerating cycle device generally including a compressor for compressing a refrigerant, a condenser for condensing the refrigerant by releasing heat of the refrigerant, an expansion device for depressurizing and expanding the refrigerant, and an evaporator for allowing the refrigerant to absorb ambient latent heat so as to be evaporated.

[4] In general, a cooling air circulation flow path is formed on a rear wall of each cooling chamber to allow cooling air to be circulated. An evaporator may be provided in the cooling air circulation flow path to allow air to be cooled while passing through the evaporator. In addition, a cooling air supply flow path may be formed within the cooling chamber to allow cooling air, which has passed through the evaporator, to be supplied to each cooling chamber.

[5] In the related art refrigerator, because the evaporator, which has a lower temperature than that of the cooling air of the cooling chamber, is disposed on the rear wall of the cooling chamber, a loss of cooling air through the rear wall may occur. Thus, in consideration of this, the thickness of the rear wall may be increased to limit this loss.

[6] In addition, the related art refrigerator has a single cooling fan disposed at one side of the single evaporator. When a cooling chamber positioned far from the evaporator and the cooling fan is cooled, the same evaporator and cooling fan are operated. As a result, when the cooling air is transferred to the corresponding cooling chamber, a loss of cooling air is possibly generated. In addition, the configuration of the cooling air flow path is complicated and lengthened in order to supply cooling air of the cooling chamber positioned far from the evaporator. Consequently, the flow resistance of the cooling air is increased making it difficult to quickly resolve a temperature deviation

and lengthen an operation time.

[7] In addition, in the related art refrigerator, because the plurality of cooling chambers are cooled with the single evaporator, even if one of the cooling chambers already satisfies a temperature condition, the operation is continuously performed to satisfy a temperature condition for another cooling chamber, resulting in that the cooling chamber already satisfying the temperature condition is overcooled.

Disclosure of Invention

Technical Problem

[8] Meanwhile, in some related art refrigerators, an evaporator is disposed in each cooling chamber in order to independently cool the individual cooling chamber. However, also, in this case, each evaporator is disposed to be close to the rear wall of the individual cooling chamber, thereby requiring that the thickness of the rear wall of the individual cooling chambers be increased to restrain a leakage of cold energy of cooling air through the rear wall of each cooling chamber. Because of these arrangements, the storage space of each the individual cooling chambers are reduced.

[9] In addition, when the evaporator is disposed in the individual cooling chamber, the flow path of the refrigerant is lengthened. Not only does this increase the flow resistance of the refrigerant but also generates increased pressure of the refrigerant.

Solution to Problem

[10] Therefore, in order to address the above matters, the various features described herein have been conceived.

[11] An aspect of the present invention provides a refrigerator in which an internal usage space is increased without increasing the size of the external appearance.

[12] Another aspect of the present invention provides a refrigerator capable of independently or simultaneously cooling each cooling chamber with a single evaporator and increasing an internal usage space without increasing the size of the external appearance.

[13] Another aspect of the present invention is to provide a refrigerator capable of varying a cooling capacity of an evaporator according to which cooling chamber the cooling air is supplied.

[14] According to an aspect of the present invention, there is provided a refrigerator having a refrigerator body including a first cooling chamber and a second cooling chamber, a barrier wall located between the first cooling chamber and the second cooling chamber, an evaporator configured to provide cooling air, a first cooling fan configured to provide cooling air of the evaporator to the first cooling chamber, and a second cooling fan configured to provide cooling air of the evaporator to the second cooling chamber.

[15] According to another aspect of the present invention, there is provided a method for providing cooling air flow in a refrigeration having refrigerator having a body defining a refrigerating chamber and a freezing chamber, an evaporator configured to provide cooling air, a first fan configured to provide cooling air of the evaporator to the refrigerating chamber, and a second fan configured to provide cooling air of the evaporator to the freezing chamber, a first refrigerant flow path to provide refrigerant to the evaporator, and a second refrigerant flow path to provide refrigerant to the evaporator. The method includes providing cooling air to the refrigerating chamber by operating the first fan and flowing refrigerant through the second flow path and providing cooling air to the freezing chamber by operating the second fan and flowing refrigerant through the first flow path.

[16] 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.

Advantageous Effects of Invention

[17] According to the present invention, because the evaporator having a very low temperature compared with cooling air in the cooling chamber is disposed within the barrier wall, the thickness of the rear wall due to an otherwise disposition of the evaporator can be reduced. Thus, the internal usage space, namely, a food item receiving space, can be increased without increasing the external appearance (size) of the refrigerator body.

[18] In addition, because the evaporator can be disposed within the barrier wall, a leakage of cooling air can be prevented, and because cooling air is directly transferred to the cooling chamber, an increase in the temperature of the cooling chamber can be restrained. Accordingly, a cooling operation period of the cooling chamber can be lengthened.

[19] Also, because the evaporator can be disposed within the barrier wall and the first and second cooling fans for blowing cooling air to each cooling chamber are provided at one side of the evaporator, the internal usage space can be increased without increasing the external appearance. Because each cooling chamber can be simultaneously or independently cooled, the operation efficiency can be improved. In addition, the cooling air supply flow path for supplying cooling air to each cooling chamber is shortened to simplify the configuration and reduce a loss of cooling air flow. Thus, a temperature deviation of each cooling chamber can be resolved more quickly.

[20] Moreover, because the first and second branch flow paths are formed at the refrigerant entrance of the evaporator and the first and second capillary tubes can be provided at the first and second branch flow paths, respectively, the cooling capability (freezing capability) of the evaporator can be varied according to each cooling chamber to which cooling air is to be supplied. Thus, generation and supply of cooling air can be properly adjusted according to each load amount of the respective cooling chambers, namely, the freezing chamber and the refrigerating chamber, improving the operation efficiency.

Brief Description of Drawings

[21] The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention and wherein:

[22] FIG. 1 is a perspective view of a refrigerator according to an exemplary embodiment of the present invention;

[23] FIG. 2 is a vertical-sectional view of the refrigerator of FIG. 1;

[24] FIG. 3 is an enlarged view of a major portion of the refrigerator of FIG. 2;

[25] FIG. 4 is a front view of the major portion of the refrigerator of FIG. 3;

[26] FIG. 5 is a perspective view of the major portion of the refrigerator of FIG. 3;

[27] FIG. 6 is a perspective view showing a partial section of a barrier wall taken along line VI-VI of FIG. 5;

[28] FIG. 7 is a plan view of an evaporator area of the refrigerator of FIG. 2;

[29] FIG. 8 is a front view of a guide member of the refrigerator of FIG. 2;

[30] FIG. 9 is a rear perspective view of the guide member of the refrigerator of FIG. 8;

[31] FIG. 10 illustrates the configuration of a refrigerating system of the refrigerator of FIG. 1;

[32] FIG. 11 illustrates a modification of a switching valve of the refrigeration cycle of FIG. 10; and

[33] FIG. 12 is a schematic block diagram of the refrigerator of FIG. 1.

Best Mode for Carrying out the Invention

[34] A refrigerator according to exemplary embodiments of the present invention will now be described with reference to the accompanying drawings.

[35] FIG. 1 is a perspective view of a refrigerator according to an exemplary embodiment of the present invention, FIG. 2 is a vertical-sectional view of the refrigerator of FIG. 1, FIG. 3 is an enlarged view of a major portion of the refrigerator of FIG. 2, FIG. 4 is a front view of the major portion of the refrigerator of FIG. 3, FIG. 5 is a perspective view of the major portion of the refrigerator of FIG. 3, FIG. 6 is a perspective view showing a partial section of a barrier wall taken along line VI-VI of FIG. 5, and FIG. 7

is a plan view of an evaporator area of the refrigerator of FIG. 2;

[36] As shown in FIGS. 1 and 2, the refrigerator according to an exemplary embodiment of the present invention includes a refrigerator body 110 including first and second cooling chambers 150 and 160 partitioned up and down by a horizontally disposed barrier wall 120, an evaporator 250 disposed at an inner side of the barrier wall 120, a first cooling fan 210 disposed at one side of the evaporator 250 to blow cooling air to the first cooling chamber 150, and a second cooling fan 220 disposed at another side of the evaporator 250 to blow cooling air to the second cooling chamber 160.

[37] In this exemplary embodiment, one of the first and second cooling chambers 150 and 160 may be configured as a refrigerating chamber and the other may be configured as a freezing chamber. Alternatively, the first and second cooling chambers 150 and 160 may both be configured as freezing chambers or refrigerating chambers. For purposes of description, and not intended to be limiting, the first cooling chamber 150 is configured as a refrigerating chamber and the second cooling chamber 160 is configured as a freezing chamber.

[38] The barrier wall 120 may be horizontally positioned at the interior of the refrigerator body 110 in order to partition the internal space into the first and second cooling chambers 150 and 160. The refrigerating chamber 150 may be formed at an upper side of the barrier wall 120 and the freezing chamber 160 may be formed at a lower side of the barrier wall 120.

[39] The refrigerator body 110 may include an outer case 111a forming an external appearance, an inner case 111b separately disposed at an inner side of the outer case 111a, and an insulation material 111c charged between the outer case 111a and the inner case 111b.

[40] A mechanical chamber 170 may be formed at a lower region of a rear side of the refrigerator body 110. A refrigerating system may be provided in the refrigerator body 110 in order to supply cooling air to the interior of the freezing chamber 160 and the refrigerating chamber 150. The refrigerating system may be configured as a vapor compression type refrigerating system in which a refrigerant is compressed, condensed, expanded and evaporated while being circulated. The vapor compression type refrigerating system will be described later.

[41] The refrigerating chamber 150 may have a pair of refrigerating chamber doors 155. The freezing chamber 160 may have a freezing chamber door 165 to open and close the freezing chamber 160. The refrigerating chamber doors 155 may be configured to be rotated by using both sides of the refrigerating chamber 150 as a rotation shaft. The freezing chamber door 165 may be configured as a drawer-type door that slides in an inward/outward direction.

[42] One of the refrigerating chamber doors 155 may have an ice making chamber 180.

The ice making chamber 180 may include an ice maker (not shown) for making ice upon receiving water from the exterior. An ice bank (not shown) for keeping ice made in storage may be provided at a lower side of the ice maker.

[43] At least one side wall cooling air duct 190 may be provided at one side of the refrigerating chamber 150 to provide cooling air to the ice making chamber 180. In this exemplary embodiment, a pair of side wall cooling air ducts 190 may be formed. One of the side wall cooling air ducts 190 may form a cooling air supply flow path while the other may form a cooling air return flow path along which cooling air which has passed through the ice making chamber 180 returns.

[44] The evaporator 250 may be provided within the barrier wall 120. Accordingly, because the evaporator 250, which is at a low temperature compared with cooling air in the freezing chamber 160, is not installed at the rear wall, the actual internal usage space of the freezing chamber 160 and/or refrigerating chambers 150 can be increased without increasing the size of the external appearance of the refrigerator main body 110. In addition, a leakage of cooling air of the evaporator 250 to outside through the rear wall can be reduced. In addition, in order to prevent a leakage of cooling air formed by the evaporator 250, the thickness of the rear wall, which is formed to be relatively thick, can be somewhat reduced. Accordingly, the size of the internal usage space of the freezing chamber 160 and/or the refrigerating chamber 150 can be increased as much.

[45] The evaporator 250 may include a heat pipe 251 in which the refrigerant flows, and a plurality of heat transfer plates 255 coupled with the heat pipe 251. The heat pipe 251 may be configured to be disposed in a row on the same plane. The heat pipe 251 may include straight pipe parts disposed along a left/right direction of the barrier wall 120 and a connection pipe part connecting the straight pipe parts.

[46] As shown in FIG. 7, the heat transfer plate 255 may be coupled to the straight pipe part at certain pitches. A pitch P1 of the heat transfer plate 255 disposed at the first and second suction openings side may be larger than a pitch (P2) of the heat transfer plate 255 disposed at the first and second cooling fans 210 and 220. Accordingly, air from the refrigerating chamber 150 and the freezing chamber 160 having a relatively high humidity is introduced to be first frosted, so an air flow resistance of the upper stream heat pipe 251 and the heat transfer plate 255 having a large amount of frost can be reduced.

[47] An evaporator accommodating part 122 may be formed at the inner side of the barrier wall 120 in order to accommodate the evaporator 250. The evaporator accommodating part 122 (FIG. 3) may be formed to have an opening at an upper portion thereof. An evaporator cover 125 (FIG. 5) may be provided at an upper side of the evaporator 250 in order to close the upper opening of the evaporator accommodating

part 122. A discharge hole may be formed at a central region of a rear side of an upper surface of the barrier wall 120. A defrosting heater (not shown) may be provided at one portion (e.g., at a lower portion) of the evaporator 250 to defrost the evaporator 250.

[48] A lower surface of the evaporator accommodating part 122 may be formed to slope downward toward the rear of the refrigerator. Accordingly, the evaporator 250 may be accommodated such that it is slopes downwardly toward the rear of the refrigerator. The lower surface of the evaporator accommodating part 122 and the evaporator 250 may be disposed to have a slope of about 4 to 6 degrees from horizontal. Accordingly, when the evaporator 250 is defrosted, defrost water can flow smoothly toward the rear of the refrigerator.

[49] First and second suction openings 131 and 132 may be formed at a front portion of the barrier wall 120 in order to suck cooling air from the refrigerating chamber 150 and the freezing chamber 160. The first suction opening 131 may be formed on an upper surface of the barrier wall 120 and the second suction opening 132 may be formed on a lower surface of the barrier wall.

[50] In particular, the first suction opening 131 may be formed at the evaporator cover 125 in a penetrating manner. A plurality of first suction openings 131 may also be formed. The first suction openings 131 may be separated along a horizontal direction of the barrier wall 120. Accordingly, air of the refrigerating chamber 150 can be sucked to both regions of the evaporator 250 to undergo a heat-exchange process. In this exemplary embodiment, the first suction openings 131 may be formed in a rectangular shape. The first suction opening 131 may be formed such that its width is larger than its length. Accordingly, air of the refrigerating chamber 150 and a contact area (heat exchange area) of the evaporator 250 can be reduced, and the suction amount of air of the refrigerating chamber 150 can be increased. Accordingly, because a large quantity of cooling air at a relatively low temperature is supplied to the refrigerating chamber 150, a particular portion can be prevented from being overcooled and a temperature deviation in the refrigerating chamber 150 can be quickly resolved.

[51] The second suction opening 132 may be formed at a central region of the barrier wall 120. Accordingly, air of the freezing chamber 160 can be sucked to the central region of the evaporator 250 so as to be heat-exchanged over a relatively wide area.

[52] The second suction opening 132 may have a stripe shape such that its length is longer than its width. Accordingly, air of the freezing chamber 160 and a contact area (heat exchange area) of the evaporator 250 can be increased and the suction amount of air of the freezing chamber 160 can be properly maintained. Because air of the freezing chamber 160 is heat-exchanged with the evaporator 250 over a larger area, the freezing chamber 160 can be cooled more quickly at a lower temperature.

[53] As shown in FIGS. 3 to 5, a refrigerating cooling air duct 152 may be provided at a

rear side of the refrigerating chamber 150 in order to supply cooling air to the refrigerating chamber 150. Here, the refrigerating cooling air duct 152 may be formed to be thin and long. The refrigerating cooling air duct 152 may have a length corresponding to the height of the refrigerating chamber 150 and a width larger than a half of the width of the refrigerating chamber 150. Accordingly, the thickness of the refrigerating cooling air duct 152 can be reduced to increase the actual usage space of the refrigerating chamber 150. A plurality of cooling air discharge holes 153 may be formed at upper, central, and lower regions of the refrigerating cooling air duct 152 in order to discharge cooling air.

[54] The first cooling fan 210 may be located at a lower region of the refrigerating cooling air duct 152. A first cooling fan accommodating part 157 may be formed at a lower region of the refrigerating cooling air duct 152 in order to accommodate the first cooling fan 210. In this exemplary embodiment, the first cooling fan 210 may be configured as a centrifugal fan that sucks cooling air in an axial line direction and discharge it in a radial direction. The first cooling fan 210 may be disposed such that its suction opening points to the front side and its discharge hole points to the upper side. A duct suction opening 158 may be formed at one side of the first cooling fan accommodating part 157 such that it is open at its lower side in order to communicate with a discharge hole 127 of the barrier wall 120. The first cooling fan accommodating part 157 may be formed to be thick so as to be protruded forwardly compared with peripheral part (upper part) in order to secure a space of the suction opening to suck cooling air by the first cooling fan 210.

[55] As shown in FIGS. 6 and 7, an ice making fan 230 may be provided at the barrier wall 120 to provide cooling air to the ice making chamber 180. The ice making fan 230 may be configured as a centrifugal fan that sucks air in an axial direction and discharges it in a radial direction. Accordingly, because the axial directional length of the ice making fan 230 is reduced, the ice making fan 230 can be easily accommodated within the barrier wall 120 without increasing the thickness of the barrier wall 120. Thus, the ice making fan 230 does not protrude toward the freezing chamber 160 or toward the refrigerating chamber 150, and thus, the actual usage space of the freezing chamber 160 or the refrigerating chamber 150 can be increased.

[56] The ice making fan 230 may be disposed such that its suction opening points toward a lower side and its discharge hole points toward a horizontal direction. An ice making fan accommodating part 141 may be provided at the barrier wall 120 in order to accommodate the ice making fan 230. The barrier wall 120 may include a cooling air flow path 142 formed to communicate with the ice making fan accommodating part 141 in order to allow cooling air discharged from the ice making fan 230 to flow therealong. A discharge hole 143 may be formed at one side of the cooling air flow

path 142 to allow cooling air which has passed through the ice making chamber 180 to return so as to be discharged to the freezing chamber 160. Each lower end of the side wall cooling air duct 190 may be connected to one side (the left side on the drawing) of the barrier wall 120. With this configuration, the ice making fan 230 sucks cooling air which has passed through the evaporator 250 and discharges it to the cooling air flow path 142, and the cooling air is supplied to the ice making chamber 180 along the side wall cooling air duct 190 connected to the cooling air flow path 140. The cooling air supplied to the ice making chamber 180 performs ice making operation, downwardly flows along the side wall cooling air duct 190, passes through the barrier wall 120, and is then discharged to the freezing chamber 160.

[57] A second cooling fan 220 may be provided at a rear side of the freezing chamber 160 in order to blow the cooling air which has passed through the evaporator 250 toward the freezing chamber 160. The second cooling fan 220 may be configured as a centrifugal fan that sucks air in the axial direction and discharges it in the radial direction. The second cooling fan 220 may be configured such that one side thereof sucks air and the other side discharges it in the same direction as the air suction direction. In this exemplary embodiment, as shown in FIG. 2, the second cooling fan 220 may be disposed at a front side of the first cooling fan 210. Thus, air at a lower temperature is restrained from being leaked outside the refrigerator through the rear wall.

[58] A guide member 270 may be provided near the second cooling fan 220 in order to guide flowing of the cooling air which has passed through the evaporator 250. The guide member 270 is disposed at an upper portion of a rear side of the freezing chamber 160, demarcating the internal space. Namely, the guide member 270 demarcates the internal space into an evaporator 250 side space in which cooling air is formed and a food storage space (substantially, the freezing chamber) in which food items are actually accommodated).

[59] FIG. 8 is a front view of a guide member of the refrigerator of FIG. 2, and FIG. 9 is a rear perspective view of the guide member of the refrigerator of FIG. 8.

[60] With reference to FIGS. 8 and 9, the guide member 270 may include an upper plate part 271 and a fan accommodating part 281. The upper plate part 271 is formed to have a length corresponding to a horizontal width of the barrier wall 120, and may be connected with a lower surface of the rear side of the barrier wall 120. The fan accommodating part 281 may have a horizontal width smaller than that of the upper plate part 271 and may extend from the center of the upper plate part 271 downwardly. A cooling air discharge hole 283 is penetratingly formed in the fan accommodating part 281 in order to allow cooling air blown by the second cooling fan 220 to be discharged.

[61] A defrost water guide flow path may be formed within the guide member 270 in order to guide defrost water flowing after generated as the evaporator 250 is defrosted.

The guide member 270 may be defined as a flow path formation member in the aspect that it includes the cooling air flow path and the defrost water guide flow path.

[62] The upper plate part 271 may be formed to slope to allow defrost water to be collected. The upper plate part 271 may include a first slope portion 272aand a second slope portion 272b to allow defrost water to be collected to one side of the fan accommodating part 281 and flow. The first slope portion 272a and the second slope portion 272b are formed to slope downwardly to the rear side, and may be formed to slope toward each other so that the lowermost point is formed to which defrost water is met at the boundary region of the first slope portion 272a and the second slope portion 272b. The defrost water joined at the lowermost point of the first slope portion 272a and the second slope portion 272b flows downwardly along one side wall.

[63] A flange 273 may be formed at both end portions of the upper plate part 272 along a lengthwise direction such that it is in contact with the lower surface of the barrier wall 120. Insertion holes 275 may be penetratingly formed on the flange 273 to allow a fastening member (not shown) such as a screw to be inserted thereinto so as to be fastened with the lower surface of the barrier wall 120.

[64] An overflow preventing rib 285 may be formed at a rear side of the upper plate part 271 and the fan accommodating part 281 to prevent the collected defrost water from overflowing. The overflow preventing rib 285 is formed to a predetermined height so as to prevent defrost water from overflowing. The overflow preventing rib 285 formed at the upper plate part 271 may extend to a boundary region of the second slope portion 272b by way of the upper region of the fan accommodating part 281 along the rear edge portions of the first slope portion 272a. Accordingly, defrost water flowing along the first slope portion 272a can flow to one region of the fan accommodating part 281, bypassing the front side, to drop, rather than dropping to the cooling air discharge hole 283 of the front side of the fan accommodating part 281 from the upper region of the fan accommodating part 281. Thus, defrost water can be restrained from dropping to the cooling air discharge hole 283. Thus, when an air cooling operation is resumed, because defrost does not flow to the front side of the fan accommodating part 281, defrost water can be prevented from being frozen to shut the cooling air discharge hole 283 and thus degradation of discharging of cooling air can be prevented.

[65] A drain unit 287 may be formed at the lower portion of the fan accommodating part 281 in order to discharge defrost water. The lower surface of the fan accommodating part 281 may be formed to have a slope to allow defrost water to be collected at the drain unit 287. A drainpipe (not shown) may be connected to the drain unit 287. The drainpipe may be drawn out to the mechanic chamber 170 formed at the lower portion of the rear side of the main body 110.

[66] FIG. 10 illustrates the configuration of a refrigerating system of the refrigerator of

FIG. 1, and FIG. 11 illustrates a modification of a switching valve of the refrigeration cycle of FIG. 10.

[67] As shown in FIGS. 10 and 11, the refrigerator may include a refrigerating system 240 for supplying cooling air to the freezing chamber 160 and the refrigerating chamber 150. The refrigerating system 240 may include a compressor 241 for compressing a refrigerant, a condenser 243 for condensing the refrigerant by releasing heat of the refrigerant, an expansion device 247 for depressurizing and expanding the refrigerant, and an evaporator 250 for allowing the refrigerant to absorb ambient latent heat so as to be evaporated.

[68] The compressor 241, the condenser 243, and the expansion device 247 may be disposed in the mechanic chamber 170, and the evaporator 250 may be disposed in the barrier wall 120.

[69] A blow fan 245 for blowing air may be provided at one side of the condenser 243 in order to accelerate heat release of the condenser 243. First and second cooling fans 210 and 220 may be provided at one side of the evaporator 250 in order to provide cooling air which has passed through the evaporator 250 to the refrigerating chamber 150 and the freezing chamber 160. An ice making fan 230 may be provided at the same side of the evaporator 250 or at a different side. It is also understood that the first and second cooling fans 210 and 220 may be provided at the same side or at different sides.

[70] First and second branch flow paths 261 and 262 may be formed at a refrigerant entrance side of the evaporator 250. A valve assembly 265 may be provided at an end portion of each entrance of the first and second branch flow paths 261 and 262 in order to selectively open and close them. In this exemplary embodiment, the valve assembly 265 may be configured as a flow path valve to allow the refrigerant moved from the condenser 243 to move to the evaporator 250 through the first branch flow path 261 or through the second branch flow path 262. Alternatively, the valve assembly 265 may be configured to allow the refrigerant to move through one of the first and second branch flow paths 261 and 262 or to move through both of the first and second branch flow paths 261 and 262.

[71] In another exemplary embodiment, as shown in FIG. 11, the valve assembly 265 may include a first switching valve 266 disposed at the first branch flow path 261 to open and close the first branch flow path 261, and a second switching valve 267 disposed at the second branch flow path 262 to open and close the second branch flow path 262. The first and second switching valves 266 and 267 may be configured to be operated (driven) by electric force.

[72] The expansion device 247 may be provided at the first and second branch flow paths 261 and 262. The expansion device 247 may include a first capillary tube 248 provided at the first branch flow path 261 and a second capillary tube 249 provided at the second

branch flow path 262. In these exemplary embodiments, the first and second capillary tubes 248 and 249 may be formed to have a different diameter (inner diameter) and/or length. For example, the inner diameter of the first capillary tube 248 may be larger than that of the second capillary tube 249. In addition, the first capillary tube 248 may be longer than the second capillary tube 249. Accordingly, as the inner diameter of each of the capillary tubes 248 and 249 increases, a flow amount increases, and as the length of each of the capillary tubes 248 and 249 increases, the temperature of the refrigerant may go down. As a result, the inner diameter and length of the first and second capillary tubes 248 and 249 may be properly adjusted depending on the desired results. In the present exemplary embodiment, the first capillary tube 248 has a larger flow amount (diameter) of refrigerant compared with the second capillary tube 249, and is formed to have a larger length to make the temperature of the refrigerant lower.

[73] FIG. 12 is a schematic block diagram of the refrigerator of FIG. 1.

[74] As shown in FIG. 12, the refrigerator may include a controller 290 implemented as a microprocessor or the like including a control program. A freezing chamber temperature sensor 291 and a refrigerating chamber temperature sensor 292 for detecting the temperature of the refrigerating chamber 150 and the freezing chamber 160, respectively, may be connected to the controller 290 to receive a detect signal. In addition, the controller 290 may be connected with the first and second cooling fans 210 and 220 to control them so that cooling air can be provided to the refrigerating chamber 150 and/or the freezing chamber 160 according to detected temperature conditions of the refrigerating chamber 150 and the freezing chamber 160. Also, the valve assembly 265, which may be a single flow path valve or the first and second switching valves 266 and 267, can be connected with the controller 290 so as to be controlled in order to adjust conditions of the refrigerant (the flow amount of the refrigerant and/or the temperature of the refrigerant) introduced to the evaporator 250 according to the operation of the refrigerating chamber 150 and the freezing chamber 160.

[75] With such a configuration, when cooling air is to be supplied to the refrigerating chamber 150 based on the detection results of the refrigerating chamber temperature sensor 291, the controller 290 can control the first cooling fan 210 to be rotated. When the first cooling fan 210 is rotated, air of the refrigerating chamber 150 is sucked to the interior of the barrier wall 120 through the first suction opening 131, and the sucked air is heat-exchanged to be cooled while passing through the evaporator 250. The cooled air is introduced to the refrigerating cooling air duct 152 by way of (sucked and discharged) the first cooling fan 210.

[76] The cooling air that has been introduced into the refrigerating cooling air duct 152 is discharged to the interior of the refrigerating chamber 150 through each cooling air

discharge hole 153. In this case, the controller 290 may control the valve assembly 265 to allow the refrigerant to flow along the second branch flow path 262. Namely, passing through the condenser 243, the refrigerant is introduced into the second branch flow path 262 through the valve assembly 265, and then depressurized and expanded through the second capillary tube 249. The refrigerant, which has been depressurized and expanded through the second capillary tube 249, is introduced into the evaporator 250 and then absorbs heat from air sucked through the first suction opening 131 so as to be evaporated. The evaporated refrigerant is sucked again into the compressor 241, in which it is compressed and discharged repeatedly to perform a cooling operation.

[77] When cooling air is to be supplied to the freezing chamber 160 based on the detection results of the freezing chamber temperature sensor 292, the controller 290 may control the second cooling fan 220 to be rotated. When the second cooling fan 220 is rotated, air of the freezing chamber 160 is sucked to the interior of the barrier wall 120 through the second suction opening 132. The air that has been sucked into the barrier wall 120 is cooled while passing through the evaporator 250, and sucked by the second cooling fan 220 so as to be discharged to the interior of the freezing chamber 160. At this time, the controller 290 may control the valve assembly 265 to allow the refrigerant to flow along the first branch flow path 261.

[78] The refrigerant, which has been condensed while passing through the condenser 243, flows to the first branch flow path 261 through the valve assembly 265. Then the refrigerant is depressurized and expanded while passing through the first capillary tube 248. In this case, because the first capillary tube 248 has a larger inner diameter and is longer than the second capillary tube 249, a larger flow amount of refrigerant at a lower temperature can be introduced to the evaporator 250. Introduced into the evaporator 250, the refrigerant absorbs heat from air sucked through the second suction opening 132 so as to be evaporated, and the evaporated refrigerant is sucked into the compressor 241, in which it is repeatedly compressed and discharged to perform a cooling operation.

[79] When cooling air is intended to be supplied to both the refrigerating chamber 150 and the freezing chamber 160 based on the temperature detection results of the refrigerating chamber temperature sensor 291 and the freezing chamber temperature sensor 292, the controller 290 may control the first and second cooling fans 210 and 220 to be rotated simultaneously. When the first and second cooling fans 210 and 220 are rotated, air in the refrigerating chamber 150 is sucked into the barrier wall 120 through the first suction opening 131 and air in the freezing chamber 160 is sucked into the barrier wall 120 through the second suction opening 132.

[80] Sucked into the barrier wall 120, the air is brought into contact with the evaporator 250 so as to be cooled, and then discharged to the refrigerating chamber 150 and the

freezing chamber 160 by the first and second cooling fans 210 and 220, respectively. In this case, the controller 290 may control the valve assembly 265 to allow the refrigerant, which has passed through the condenser 243, to flow to both the first and second branch flow paths 261 and 262. Accordingly, the refrigerant, which has passed through the condenser 243, is depressurized and expanded while passing through first and second capillary tubes 248 and 249, and then introduced into the evaporator 250. Accordingly, a larger amount of cooling air can be formed to sufficiently cool both the freezing chamber 160 and the refrigerating chamber 150. Thus, a temperature deviation of the refrigerating chamber 150 and the freezing chamber 160 can be quickly resolved.

[81] When cooling air is to be supplied to the ice making chamber 180, the controller 290 may control the ice making fan to be rotated. When the ice making fan 230 is rotated, air that has been cooled while passing through the evaporator 250 is sucked into the ice making fan 230 and then discharged to the cooling air flow path 142. In this case, the controller 290 may control the valve assembly 265 to allow the refrigerant, which has passed through the condenser 243. to flow to both the first and second branch flow paths 261 and 262. Accordingly, the refrigerant, which has passed through the condenser 243, is depressurized and expanded while passing through first and second capillary tubes 248 and 249, and then introduced into the evaporator 250. As a result, a larger amount of cooling air can be formed to be provided to the ice making chamber. It should be understood that, depending on the amount of cooling air needed by the ice making chamber, the controller 290 may control the valve assembly 265 to allow refrigerant, which has passed through the condenser 243, to flow to the first branch flow path 261.

[82] The cooling air discharged to the cooling air flow path 142 flows upwardly along the side wall cooling air duct 190 and is then introduced into the ice making chamber 180, whereby the cooling air cools the ice making chamber 180 and then flows downwardly through the side wall cooling air duct 190. Flowing down along the side wall cooling air duct 190, the cooling air passes through the discharge hole 143 penetratingly formed at the barrier wall 120, and is then discharged to the freezing chamber 160.

[83] Meanwhile, after a certain time lapses, a defrosting operation may be performed to remove frost formed on the surface of the evaporator 250. During the defrosting operation, the controller 290 may control the first and second cooling fans 210 and 220 to be stopped. When power is applied to a defrosting heater (not shown), it heats to remove the frost formed on the surface of the evaporator 250. In this case, defrost water generated as the frost is melt flows to the rear side along the lower surface of the evaporator accommodating part 122. After flowing to the rear side, the defrost water is collected by the upper plate part 271 of the guide member 270, moves along the

overflow preventing rib 284 of the upper plate part 271, drops from the lowermost point, namely, the confluence, and is downwardly moved to the lower side of the fan accommodating part 281. Moved to lower side of the fan accommodating part 281, the defrost water is exhausted to the mechanic chamber 170 through the drain unit 287 and the drainpipe.

[84] As so far described, according to an exemplary embodiment of the present invention, because the evaporator having a very low temperature compared with cooling air in the cooling chamber is disposed within the barrier wall, the thickness of the rear wall due to an otherwise disposition of the evaporator can be reduced. Thus, the internal usage space, namely, a food item receiving space, can be increased without increasing the external appearance (size) of the refrigerator body.

[85] In addition, because the evaporator can be disposed within the barrier wall, a leakage of cooling air can be prevented, and because cooling air is directly transferred to the cooling chamber, an increase in the temperature of the cooling chamber can be restrained. Accordingly, a cooling operation period of the cooling chamber can be lengthened.

[86] Also, because the evaporator can be disposed within the barrier wall and the first and second cooling fans for blowing cooling air to each cooling chamber are provided at one side of the evaporator, the internal usage space can be increased without increasing the external appearance. Because each cooling chamber can be simultaneously or independently cooled, the operation efficiency can be improved. In addition, the cooling air supply flow path for supplying cooling air to each cooling chamber is shortened to simplify the configuration and reduce a loss of cooling air flow. Thus, a temperature deviation of each cooling chamber can be resolved more quickly.

[87] Moreover, because the first and second branch flow paths are formed at the refrigerant entrance of the evaporator and the first and second capillary tubes can be provided at the first and second branch flow paths, respectively, the cooling capability (freezing capability) of the evaporator can be varied according to each cooling chamber to which cooling air is to be supplied. Thus, generation and supply of cooling air can be properly adjusted according to each load amount of the respective cooling chambers, namely, the freezing chamber and the refrigerating chamber, improving the operation efficiency.

[88] As the present invention 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 construed 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.

[89] The invention thus being described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

Claims

[Claim 1] A refrigerator comprising:
a refrigerator body including a first cooling chamber and a second cooling chamber;
a barrier wall located between the first cooling chamber and the second cooling chamber;
an evaporator configured to provide cooling air;
a first cooling fan configured to provide cooling air of the evaporator to the first cooling chamber; and
a second cooling fan configured to provide cooling air of the evaporator to the second cooling chamber.

[Claim 2] The refrigerator of claim 1, wherein the barrier wall is substantially horizontal.

[Claim 3] The refrigerator of claim 1, wherein the evaporator is located in the barrier wall.

[Claim 4] The refrigerator of claim 3, wherein the refrigerator includes a door located at a front of the refrigerator for opening and closing one of the first cooling chamber and the second cooling chamber, and
wherein the evaporator is disposed to be sloped downwardly from the front of the refrigerator to a rear of the refrigerator.

[Claim 5] The refrigerator of claim 4, wherein a portion of the barrier wall disposed at an upper side of the evaporator gradually increases in thickness from the front to the rear.

[Claim 6] The refrigerator of claim 1, wherein a first cooling air suction opening is formed at an upper surface of the barrier wall and a second cooling air suction opening is formed at a lower surface of the barrier wall.

[Claim 7] The refrigerator of claim 1, wherein the evaporator is disposed to be sloped downwardly from a front of the refrigerator to a rear of the refrigerator.

[Claim 8] The refrigerator of claim 1, further comprising:
a guide member disposed in the second cooling chamber, the guide member being configured to guide an air flow.

[Claim 9] The refrigerator of claim 8, wherein the guide member includes a defrost water flow path configured to guide defrost water to flow away from the barrier wall.

[Claim 10] The refrigerator of claim 9, wherein a drain unit is located at a lower portion of the guide member.

[Claim 11] The refrigerator of claim 1, wherein the first cooling chamber is a refrigerating chamber and the second cooling chamber is a freezing chamber.

[Claim 12] The refrigerator of claim 11, further comprising:
a door for opening and closing the refrigerating chamber;
an ice making chamber formed at the door of the refrigerating chamber;
a side wall cooling air duct to guide cooling air generated in the evaporator to the ice making chamber; and
an ice making fan to blow cooling air to the side wall cooling air duct.

[Claim 13] The refrigerator of claim 12, wherein the ice making fan is disposed within the barrier wall.

[Claim 14] The refrigerator of claim 1, further comprising:
a door for opening and closing the first cooling chamber;
an ice making chamber formed at a door of the first cooling chamber;
a side wall cooling air duct for guiding cooling air generated in the evaporator to the ice making chamber; and
an ice making fan for blowing cooling air to the side wall cooling air duct.

[Claim 15] The refrigerator of claim 1, further comprising:
first and second branch flow paths formed at a refrigerant entrance of the evaporator; and
first and second expansion devices disposed at the first and second branch flow paths, respectively.

[Claim 16] The refrigerator of claim 15, wherein the first and second expansion devices are first and second capillary tubes, respectively.

[Claim 17] The refrigerator of claim 16, wherein a diameter of the first capillary tube is larger than a diameter of the second capillary tube.

[Claim 18] The refrigerator of claim 15, further comprising a valve assembly for selectively opening and closing one of the first branch flow path, the second branch flow path, and both first and second branch flow paths.

[Claim 19] The refrigerator of claim 18, wherein the valve assembly includes:
a first valve disposed at the first branch flow path; and
a second valve disposed at the second branch flow path.

[Claim 20] The refrigerator of claim 18, wherein the valve assembly includes a flow path switching valve disposed at an upper stream side of the first and second branch flow paths to selectively control flow to one of the first branch flow path, the second branch flow path, and both first and second branch flow paths.

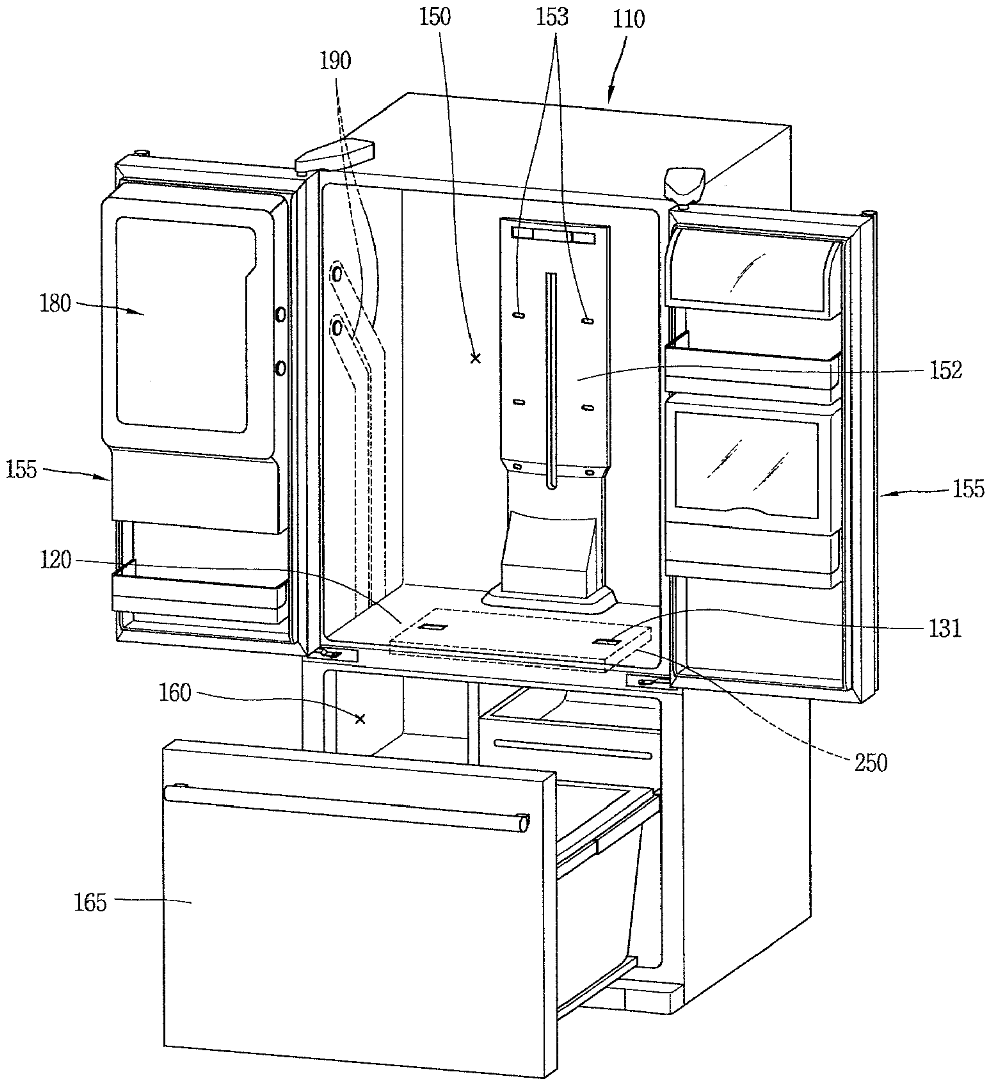
[Claim 21] The refrigerator of claim 1, wherein the evaporator is the only evaporator providing cooling air to the first and second cooling chambers.

[Claim 22] A method of providing cooling air flow in a refrigerator, the refrigerator having a body defining a refrigerating chamber and a freezing chamber, an evaporator configured to provide cooling air, a first fan configured to provide cooling air of the evaporator to the refrigerating chamber, a second fan configured to provide cooling air of the evaporator to the freezing chamber, a first refrigerant flow path to provide refrigerant to the evaporator, and a second refrigerant flow path to provide refrigerant to the evaporator, the method comprising:
providing cooling air to the refrigerating chamber by operating the first fan and flowing refrigerant through the second flow path; and
providing cooling air to the freezing chamber by operating the second fan and flowing refrigerant through the first flow path.

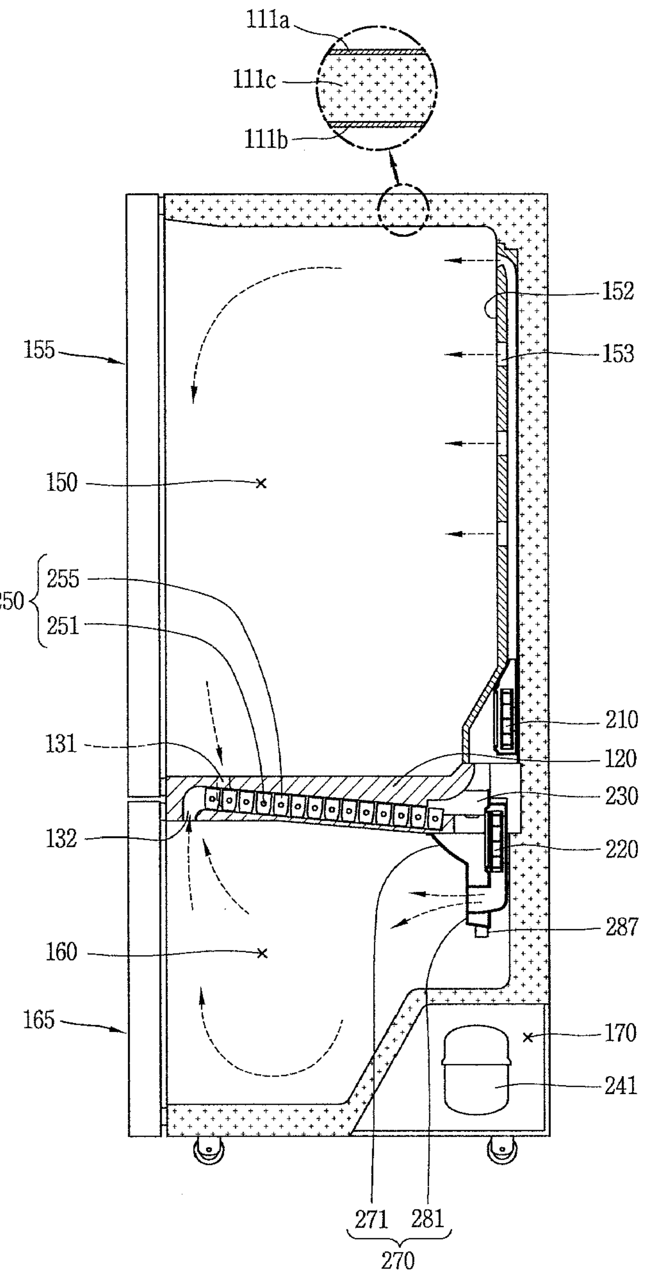
[Claim 23] The method of claim 22, where providing cooling air to the refrigerating chamber and providing cooling air to the freezing chamber occur simultaneously.

[Claim 24] The method of claim 22, wherein the refrigerator further includes an ice making chamber and a third fan configured to provide cooling air of the evaporator to the ice making chamber, the method comprising:
providing cooling air to the ice making chamber by operating the third fan and flowing refrigerant through both the first and second flow paths.

[Fig. 1]



[Fig. 2]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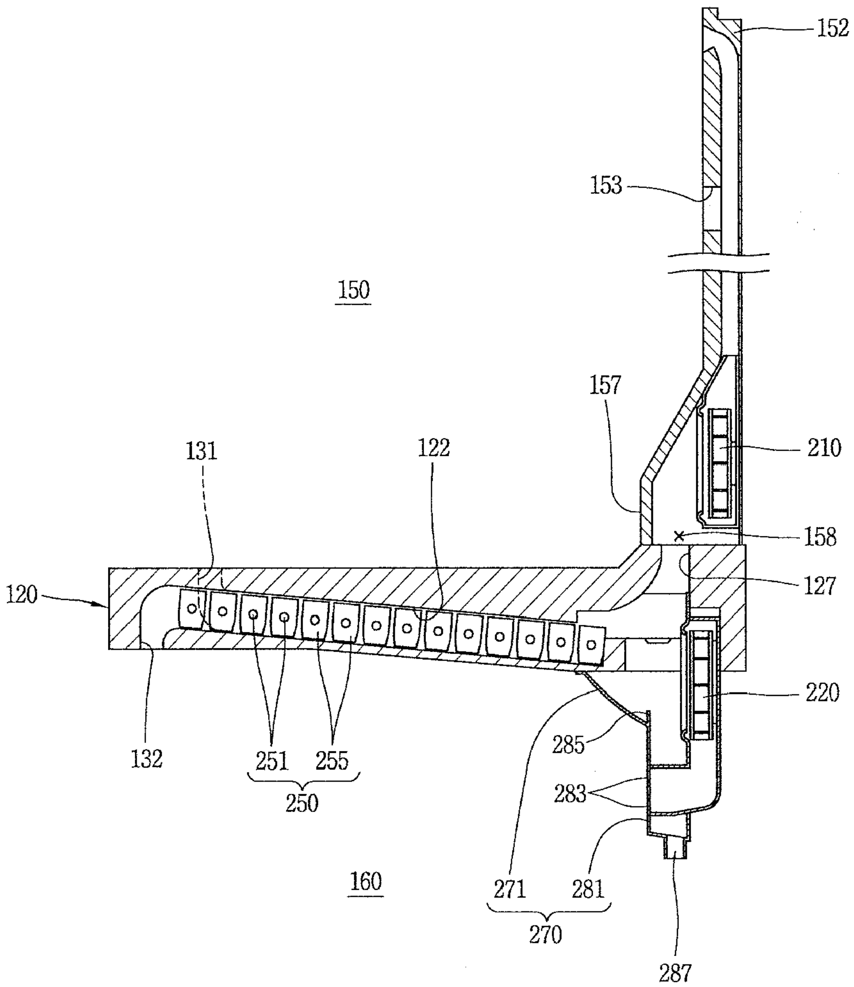
[Fig. 3]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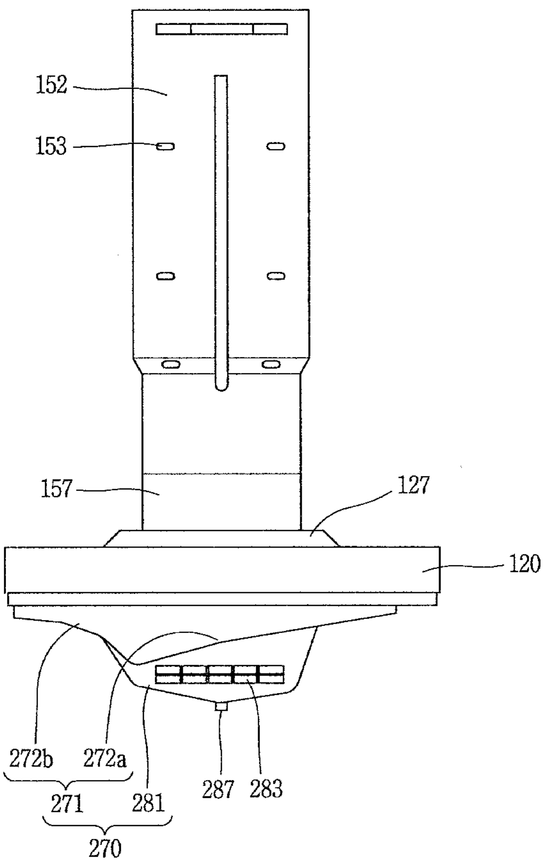
[Fig. 4]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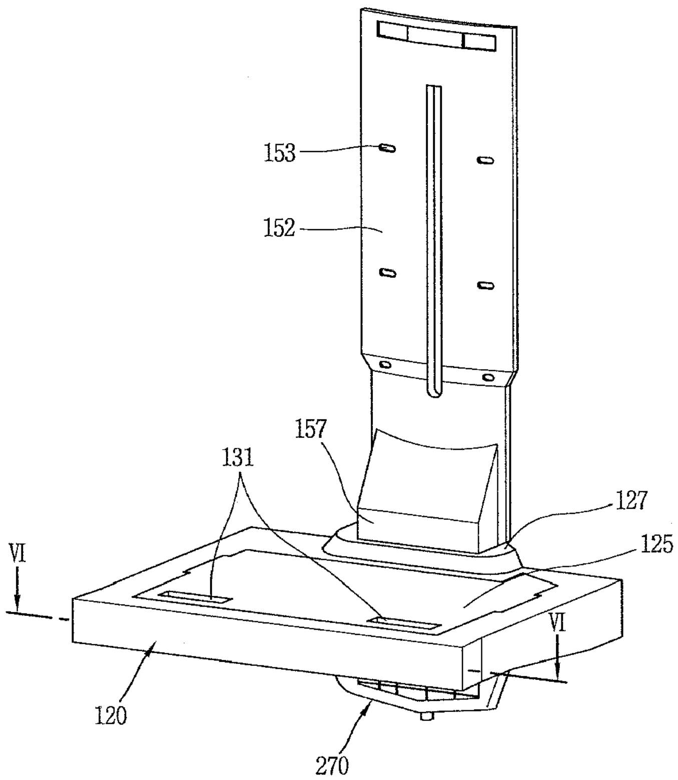
[Fig. 5]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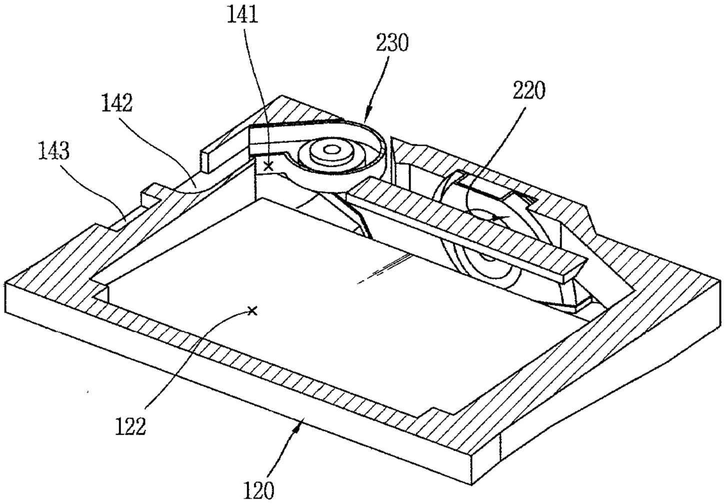
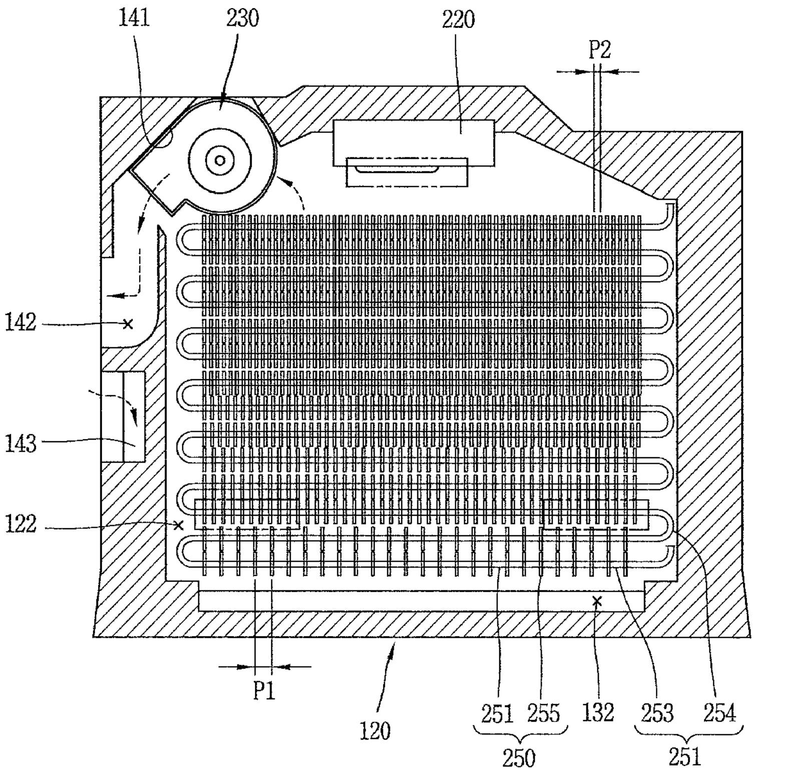
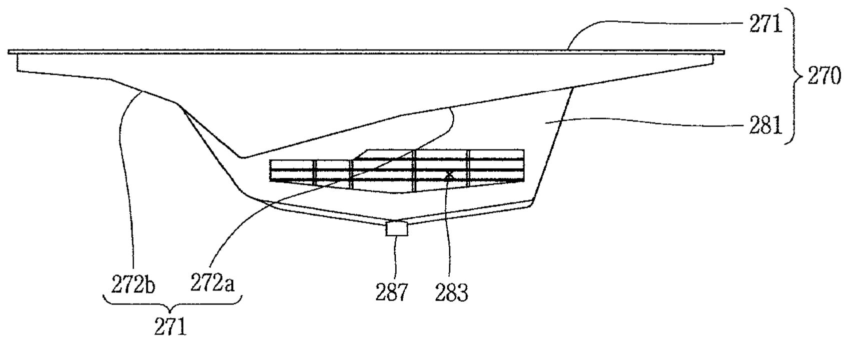
[Fig. 6]



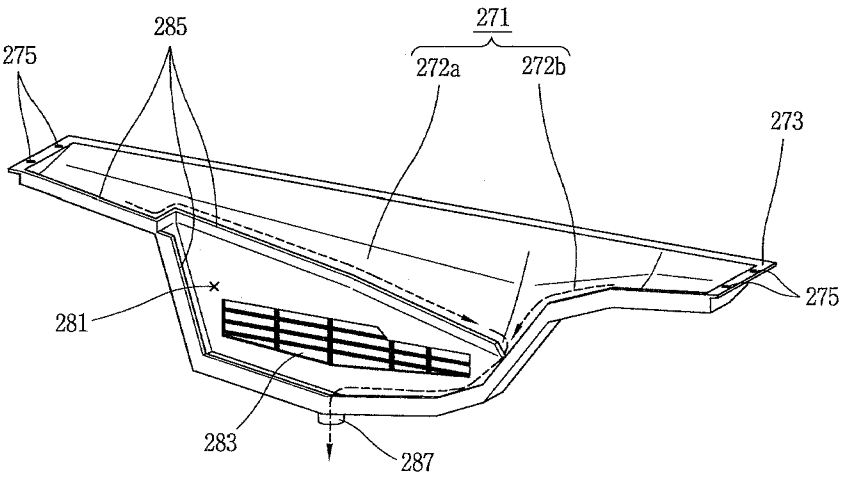
[Fig. 7]



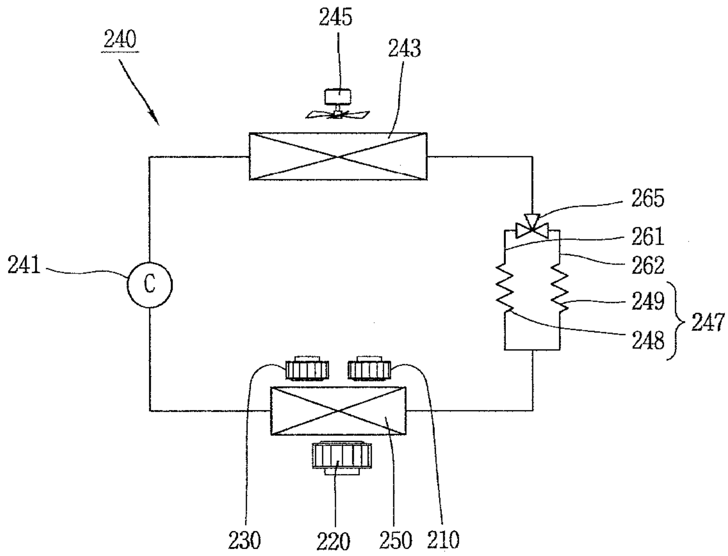
[Fig. 8]



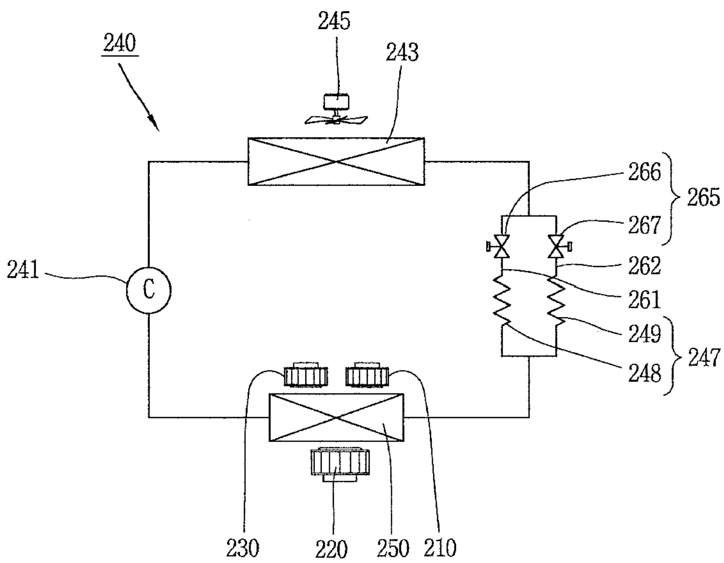
[Fig. 9]



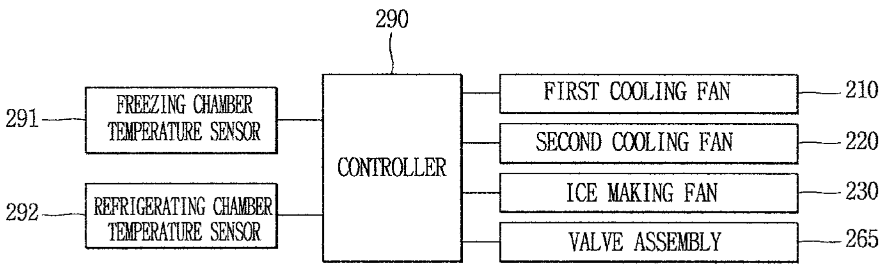
[Fig. 10]



[Fig. 11]



[Fig. 12]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FIRST COOLING FAN
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ICE MAKING FAN
230
VALVE ASSEMBLY
265