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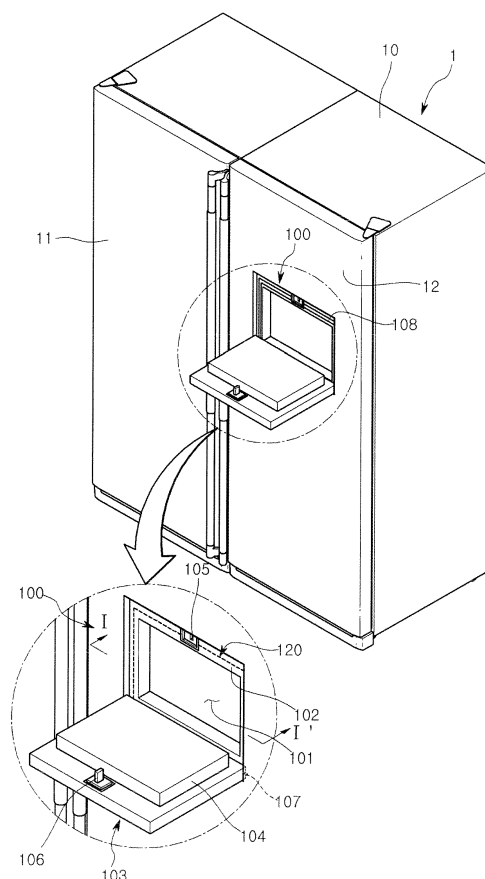
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(54) **Refrigerator and method of controlling the same**

(57) Provided are a refrigerator (1) and a method of controlling the same. The refrigerator includes a main body (10), a rotatable refrigerator door (11,12), a rotatable home bar door (103), a heater (120), and a controller. The main body includes a cool air storage compartment. The rotatable refrigerator door (12) is coupled to the main body (10) and includes an opening in at least one portion of the refrigerator door. The rotatable home bar door (103) is coupled to the refrigerator door (12) to selectively cover the opening. The heater (120) is disposed on at least one side of the home bar door (103). The controller is configured to variably control an amount of heat generated from the heater depending on operating conditions.

Fig. 1



Description

[0001] The present disclosure relates to a refrigerator and a method of controlling the refrigerator.

[0002] In the related art, a refrigerator includes a plurality of compartments for storing foods or other good at low temperatures close to or below zero degrees Celsius. Predetermined sides of the storing compartments are opened for allowing access to the foods stored in the storing compartment.

[0003] Some of recent refrigerators include a home bar installed in a door for preventing unnecessary leakage of cold air caused by frequent opening and closing of the door. Drinks or foods and the like can be accessed through the home bar without having to open the refrigerator door.

[0004] The refrigerator door includes an opening having a predetermined size to access foods through the home bar. The opening may be coupled with a rotatable home bar door to open and close the opening.

[0005] There is a great temperature difference between the inside and the outside of the refrigerator. That is, a refrigerator compartment inside the refrigerator has a temperature ranging from about 2 °C to 3 °C, and the outside of the refrigerator has an ambient temperature (about 15 to 25 °C) of the room where the refrigerator is installed.

[0006] Thus, an insulation material may be inserted into the home bar door to prevent heat transfer caused by the temperature difference between the outside and the inside of the refrigerator.

[0007] The home bar may include a home bar heater to prevent the condensation of moisture in air around the home bar caused by a temperature difference between the outside and the inside of the home bar.

[0008] Since the home bar door of the refrigerator door has an installing structure where a lower end of the opening has less insulating effect, the lower end of the opening generally has a lower temperature than that of other portions of the opening.

[0009] Particularly, to obtain a rotating space of the home bar door, less insulations are inserted into the lower end of the opening than to other portions. Thus, a large amount of cool air inside the refrigerator tends to be emitted through the lower end of the opening to the outside.

[0010] However, the related art home bar heater is adjacent to the home bar door along a predetermined portion of the refrigerator door to supply a constant amount of heat. Thus, a low temperature phenomenon occurs especially in the lower end of the opening among peripheral regions of the opening where the home bar door is installed.

[0011] Also, moisture in air in the lower end of the opening is condensed on the refrigerator by a temperature difference between the lower end of the opening and the peripheral regions of the refrigerator.

[0012] To increase the temperature in the lower end of the opening, the amount of heat provided by the home

bar heater is increased. In this case, there is a need for additional power, thereby increasing power consumption costs, and temperatures of other portions of the opening, i.e., an upper end and both side ends are also increased, thereby reducing cooling efficiency inside the refrigerator.

[0013] Embodiments of the invention provide a refrigerator configured to improve the control structure of home bar heaters provided to a home bar, thereby independently controlling the home bar heaters according to temperature conditions inside and outside the home bar.

[0014] Embodiments of the invention also provide a refrigerator configured to sense an inner temperature of the refrigerator and an ambient temperature of the refrigerator to operate, in phases, a heater corresponding to a difference between the temperatures, thereby emitting just a required amount of heat through the heater.

[0015] In one embodiment, a refrigerator includes: a main body including a cool air storage compartment; at least one rotatable refrigerator door coupled to the main body and including an opening in at least one portion of the refrigerator door; a rotatable home bar door coupled to the refrigerator door to open and close the opening; a heater on at least one side of the home bar door; and a controller configured to control an amount of heat generated from the heater.

[0016] This refrigerator is characterized by at least one sensor providing information about operating conditions, the controller being configured to control the heater to provide a variable amount of heat according to said operating conditions.

[0017] In another embodiment, a method of controlling a refrigerator includes: detecting operating conditions of the refrigerator; and variably controlling the amount of heat provided by the home bar heater according to the detected operating conditions.

[0018] According to an embodiment of the present disclosure, a plurality of heaters are disposed around the home bar and are independently controlled, thereby emitting the larger amount of heat to the portion of the home bar having a low temperature.

[0019] Also, the heaters are independently operated according to a surface temperature around the home bar, and only the required power for keeping a predetermined temperature is consumed, and thus the entire power consumption can be reduced.

[0020] The details of one or more embodiments are set forth in the accompanying drawings and the description below. Other features will be apparent from the description and drawings, and from the claims.

[0021] FIG. 1 is a perspective view illustrating a refrigerator home bar according to an embodiment.

[0022] FIG. 2 is a cross-sectional view taken along line I-I' of FIG. 1.

[0023] FIG. 3 is a block diagram illustrating a refrigerator employing a method of controlling a home bar heater of the refrigerator according to the embodiment of FIG. 1.

[0024] FIG. 4 is a flowchart illustrating the method of

controlling the home bar heater of the refrigerator according to the embodiment of FIG. 1.

[0025] FIG. 5 is a flowchart illustrating a method of controlling a home bar heater of a refrigerator according to another embodiment.

[0026] Reference will now be made in detail to the embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings. The present disclosure may, however, be embodied in different forms and should not be constructed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the present disclosure to those skilled in the art.

[0027] FIG. 1 is a perspective view illustrating a refrigerator home bar 100 according to an embodiment.

[0028] Referring to FIG. 1, a refrigerator 1 includes a main body 10, a freezer compartment door 11, and a refrigerator compartment door 12. The main body 10 has an open front and includes a freezer compartment (not shown) and a refrigerator compartment (not shown). The freezer compartment door 11 and the refrigerator compartment door 12 are configured to respectively cover portions of the open front of the main body 10.

[0029] The refrigerator compartment door 12 includes the home bar 100 in an approximately center thereof to improve storing and accessing of frequently used foods.

[0030] A side-by-side-type refrigerator, including a freezer compartment and a refrigerator compartment at left and right sides, will be exemplified in FIG.

1. However, positions of the freezer compartment and the refrigerator compartment are not limited thereto, and a top-mount-type refrigerator in which a freezer compartment and a refrigerator compartment are vertically arranged, or a bottom freezer-type refrigerator in which a refrigerator compartment is disposed on a top side, and the freezer compartment is disposed on a bottom side may be provided according to other embodiments.

[0031] Also, the home bar 100 may be provided on the freezer compartment door 11, or to both the refrigerator compartment door 12 and the freezer compartment door 11.

[0032] Particularly, the main body 10 includes the refrigerator compartment storing a food required to be at a temperature ranging from about 2 °C to 5 °C, and the freezer compartment storing a food required to be frozen.

[0033] More particularly, the home bar 100 includes an opening 101, a home bar frame 102, and a home bar door 103. The opening 101 allows access to a good inside the refrigerator. The home bar frame 102 is disposed on a periphery around the opening 101 to form an appearance of the home bar 100. The home bar door 103 is configured to open and close the opening 101.

[0034] Although the opening 101 and the home bar frame 102, which are separately referred in function, are

included in the home bar 100, the opening 101 and the home bar frame 102 may be considered as portions of the refrigerator compartment door 12.

[0035] An inner surface of the home bar door 103 is provided with a home bar door liner 104. The home bar door liner 104 contacts the home bar frame 102 to close an inner space of the refrigerator 1 in the state where the home bar door 103 covers the opening 101.

[0036] The home bar door 103 is rotatably mounted at a lower end of the home bar 100, i.e., a hinge portion 107. The hinge portion 107 may be provided to the refrigerator compartment door 12 on both sides of a lower end of the opening 101.

[0037] The home bar door 103 includes a latch member 106 in an inner upper portion thereof. The latch member 106 fixes the home bar door 103 covering the opening 101 to the home bar frame 102.

[0038] The home bar frame 102 includes a latch assembly 105 that is, when the home bar door 103 is closed, interlocked with the latch member 106.

[0039] When the home bar door 103 is closed, the latch member 106 is inserted into the latch assembly 105 and interlocked with the latch assembly 105, to maintain the closing state of the home bar door 103. The home bar door 103 includes a push part (not shown) in a front surface thereof. The push part is configured to perform a push operation for a user to open the home bar door 103. Thus, the latch member 106 with the push part may be one element of an "opening/closing device" for opening/closing the home bar door 103.

[0040] The home bar frame 102 includes a gasket 108 in a front surface thereof. The gasket 108, in the state where the home bar door 103 is closed, contacts the inner surface of the home bar door 103 to close the inner space of the refrigerator 1, thereby preventing the leakage of cool air in the refrigerator 1.

[0041] The home bar frame 102 includes a home bar heater 120 therein. The home bar heater 120 heats the periphery of the opening 101 to prevent wet air, i.e., moisture in air from being condensed by a temperature difference between the inside and the outside of the refrigerator 1.

[0042] Hereinafter, configuration of the home bar heater 120 and a method of controlling the home bar heater 120 will be described with reference to the accompanying drawings.

[0043] FIG. 2 is a cross-sectional view taken along line I-I' of FIG. 1.

[0044] Referring to FIG. 2, the home bar heater 120 according to the embodiment of FIG. 1 may be disposed inside the home bar frame 102. The home bar frame 102 may include an insulation material inserted into the home bar frame 102 to thermally insulate the inside and the outside of the refrigerator 1 from each other.

[0045] Particularly, the home bar heater 120 is disposed around the opening 101. The home bar heater 120 includes a first heater 121 disposed on a lower side of the opening 101, a second heater 122 on an upper side

and a left side of the opening 101, and a third heater 123 disposed on a right side of the opening 101.

[0046] The disposition of the second heater 122 and the third heater 123 is not limited thereto, and a fourth heater may be disposed on the upper side of the opening 101.

[0047] The heaters 121, 122, and 123 may be connected to a controller (that will be described later) to control the amount of heat produced by the heaters 121, 122, and 123. Also, the heaters 121, 122, and 123 may be independently controlled through the controller.

[0048] In this case, since the lower side of the opening 101 has a lower temperature than the other regions of the opening 101, the first heater 121 may be controlled to produce the greater amount of heat than the second and third heaters 122 and 123.

[0049] FIG. 3 is a block diagram illustrating the refrigerator 1 employing a method of controlling the home bar heater 120 of the refrigerator 1 according to the embodiment of FIG. 1.

[0050] Referring to FIG. 3, the refrigerator 1 according to the embodiment of FIG. 1 includes an inner temperature sensor 210 configured to sense an inner temperature of the refrigerator 1, an ambient temperature sensor 220 configured to sense an ambient temperature of the refrigerator 1, a door sensor 230 configured to sense opening of the home bar door 103 and a timer 240 configured to measure operating time of the door sensor 230. the first, second and third heaters 121, 122, and 123 are configured to supply each a predetermined amount of heat to a periphery of the home bar 100. The controller 200 receiving information from the sensors 210, 220, and 230 and the timer 240 to control the heaters 121, 122, and 123.

[0051] Particularly, the inner temperature sensor 210 may be disposed inside the refrigerator compartment into which the home bar 100 is provided, and the ambient temperature sensor 220 may be disposed at a position adapted to measure an outer surface temperature of the home bar door 103.

[0052] Thus, the inner temperature sensor 210 may be configured to sense an increased refrigerator temperature after turning off a compressor (not shown) of the refrigerator 1, and the ambient temperature sensor 220 may be configured to sense the surface temperature decreased when the home bar door 103 is opened and that cool air discharge from the refrigerator 1.

[0053] Particularly, since the lower end of the home bar door 103 has a lower temperature than the other regions, the ambient temperature sensor 220 may be disposed to measure a temperature of the lower end of the home bar door 103.

[0054] The door sensor 230 is disposed on one side of the home bar door 103 to sense the opening and closing of the home bar door 103. The controller 200 may control operation of the timer 240 when the door sensor 230 senses the opening and closing of the home bar door 103.

[0055] Information sensed by the sensors 210, 220, and 230 is delivered to the controller 200, and the controller 200 may independently control the respective heaters 121, 122, and 123.

[0056] The heaters 121, 122, and 123 may be provided with a switch (not shown) configured to turn off/on the heaters 121, 122, and 123. The switch may include a semiconductor switch configured to adjust an amount of current, flowing through the heaters 121, 122, and 123, in phases.

[0057] Thus, the amount of heat produced by the respective heaters 121, 122, and 123 may be controlled in turns through the semiconductor switch. For example, when a difference between an inner temperature of the refrigerator 1 and an ambient temperature of the home bar door 103 is about 20 °C, the controller 200 may independently controls current flowing through the heaters 121, 122, and 123 such that the first heater 121 generates a heat of about 1 kW, and the second and third heaters 122 and 123 generate a heat of about 0.5 kW.

[0058] FIG. 4 is a flowchart illustrating the method of controlling the home bar heater 120 of the refrigerator 1 according to the embodiment of FIG. 1.

[0059] Referring to FIG. 4, in step S10 the refrigerator power is turned on. In steps S11 and S12, the inner temperature sensor 210 and the ambient temperature sensor 220 are operated to respectively detect an inner temperature (a first temperature) and an ambient temperature (a second temperature).

[0060] In step S13, information about the inner temperature and the ambient temperature are delivered to the controller 200, and the controller 200 compares a difference between the inner temperature and the ambient temperature to determine whether the difference is within a "first set range".

[0061] Here, the "first set range" is a predetermined reference difference in temperatures in which the heaters 121, 122, and 123 are controlled to produce heat. That is, when an operating state is within the "first set range" the heaters 121, 122, and 123 are controlled according to a temperature table to set the amount (level) of heat produced by each of the heaters 121, 122, and 123.

[0062] In step S14, when the difference between the inner temperature and the ambient temperature is within the first set range, the respective heaters 121, 122, and 123 may be independently controlled to produce respectively different amounts of heat.

[0063] During step S15, a certain time (predetermined time) elapses. In step S16, the sensors 210 and 220 detect the inner temperature and the ambient temperature to deliver temperature values to the controller 200. In step S17, the controller 200 determines whether the difference between the inner temperature and the ambient temperature is within a "second set range".

[0064] Here, the "second set range" is a temperature range that does not require the operation of the home bar heater 120. This range of temperatures is different from the "first set range".

[0065] That is, the entire range of possible differences between the inner temperature and the ambient temperature may include the "first set range" and the "second set range".

[0066] In step S18, when the difference between the temperatures is within the "second set range", the heaters 121, 122, and 123 are turned off.

[0067] On the other hand, when the difference between the temperatures is out of the "second set range", i.e., within the "first set range", the heaters 121, 122, and 123 are controlled in turns according to the measured difference. That is, the amount of heat produced by the heaters 121, 122, and 123 may be variably controlled.

[0068] FIG. 5 is a flowchart illustrating a method of controlling the home bar heater 120 of the refrigerator 1 according to another embodiment.

[0069] Referring to FIG. 5, in step S20, when the refrigerator power is turned on, in steps S21 and S22, the inner temperature sensor 210 and the ambient temperature sensor 220 are operated to respectively detect the inner temperature and the ambient temperature.

[0070] Then, information about the inner temperature and the ambient temperature are delivered to the controller 200. Then, the controller 200 determines the amount of heat produced by the heaters 121, 122, and 123, corresponding to a difference between the inner temperature and the ambient temperature to turn on the respective heaters 121, 122, and 123 in turns, in step S22.

[0071] In step S23, the door sensor 230 senses whether the home bar door 103 is opened, and when the home bar door 103 is opened, in step S24, the controller 200 operates the timer 240.

[0072] In step S25, the door sensor 230 senses whether the home bar door 103 is closed, and when the home bar door 103 is not closed, an opening period is accumulated through the timer 240.

[0073] When the home bar door 103 is closed, the door sensor 230 senses the closing of the home bar door 103 and stops the operation of the timer 240. Then, the controller 200 checks the opening period of the home bar door 103, in step S26.

[0074] Then, the controller 200 may independently control the on/off of the respective heaters 121, 122, and 123 based on the checked period. That is, the amount of heat produced by the heaters 121, 122, and 123 may be controlled.

[0075] That is, when the home bar door 103 is opened, cool air in the refrigerator 1 is leaked thereby decreasing a peripheral surface temperature of the home bar 100, and thus the heaters 121, 122, and 123 are needed to produce heat.

[0076] The main body 10 may be provided with a memory (not shown) storing data about both the amount of heat produced by the heaters 121, 122, and 123 and a range of temperature changed according to the opening period of the home bar door 103. Thus, the controller 200 may control the heaters 121, 122, and 123 based on the

data stored in the memory.

[0077] According to the above configuration, in the state where the refrigerator 1 is turned on, the heaters 121, 122, and 123 receive a constant voltage, and the heaters 121, 122, and 123 are not always needed to be in an active state. Also, the heaters 121, 122, and 123 provide heat at required positions of the home bar 100 according to temperature variations, thereby reducing power consumption.

[0078] Also, since the heater is provided with a semiconductor switch device adapted to control an amount of current flowing when the switch is closed, not a typical on-off switch controlling just the flowing and stopping of current, the on-off operation of the entire heater is not required in order to provide heat to predetermined portion of the home bar, thereby improving efficiency of the heater.

[0079] Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

Claims

1. A refrigerator comprising:

- a main body (10) including a cool air storage compartment;
- at least a rotatable refrigerator door (11, 12) coupled to the main body and including an opening (101) in at least one portion of the refrigerator door;
- a rotatable home bar door (103) coupled to the refrigerator door to open and close the opening;
- a heater (120) on at least one side of the home bar door; and
- a controller configured to control an amount of heat generated from the heater,

characterized in that the refrigerator comprises at least one sensor (210, 220, 230, 240) providing information about operating conditions, the controller being configured to control the heater to provide a variable amount of heat according to said operating conditions.

2. The refrigerator according to claim 1, comprising an inner temperature sensor (210) configured to provide the controller with a measured temperature inside the main body, and

an ambient temperature sensor (220) configured to provide the controller with a measured temperature outside the home bar door.

3. The refrigerator according to claim 2, wherein the controller is configured to control the heater to provide an amount of heat according to a difference between the temperatures sensed by the inner temperature sensor and the ambient temperature sensor. 5
4. The refrigerator according to any one of claims 1 to 3, wherein the heater comprises a plurality of heaters (121, 122, 123) independently controlled by the controller.
5. The refrigerator according to claim 4, wherein the plurality of heaters is arranged around the opening of the home bar.
6. The refrigerator according to claim 5, wherein among the heaters, the heater disposed on a side of the home bar where the home bar door is mounted generates a greater amount of heat than the other heaters. 20
7. The refrigerator according to any one of claims 1 to 6, further comprising a semiconductor switch configured to control, in turns, the amount of the heat generated from the heater. 25
8. The refrigerator according to any one of claims 1 to 7, comprising a door sensor (230) on one side of the home bar door, the door sensor being configured to sense opening and closing of the home bar door, the controller being configured to control the heater according to the opening and closing of the home bar door. 30
9. The refrigerator according to claim 8, further comprising a timer (240) configured to measure an opening period of the home bar door, the controller being configured to control the heater according to the period measured by the timer. 35
10. A method of controlling a home bar heater of a refrigerator, the method comprising: 40
 - detecting operating conditions of the refrigerator; and
 - variably controlling the amount of heat provided by the home bar heater according to the detected operating conditions. 45
11. The method according to claim 10, wherein detecting operating conditions comprises detecting (S11) a first temperature in the refrigerator and detecting (S12) a second temperature around a home bar door, using a temperature sensors (210, 220); and 50

the amount of heat is provided according to a difference between the first and second temperatures.

12. The method according to claim 11, further comprising determining whether the difference between the first and second temperatures is within a first set range where the home bar heater is allowed to generate heat. 5
13. The method according to claim 11, further comprising determining whether the difference between the first and second temperatures is within a second set range where the home bar heater is turned off. 10
14. The method according to any one of claims 10 to 13, wherein detecting operating conditions comprises detecting whether the home bar door is opened or closed and the amount of heat is provided according to the door opening or closing. 15
15. The method according to claim 14, further comprising measuring the period when the home bar door has been opened and the amount of heat is provided according to the period measured. 20

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Fig. 1

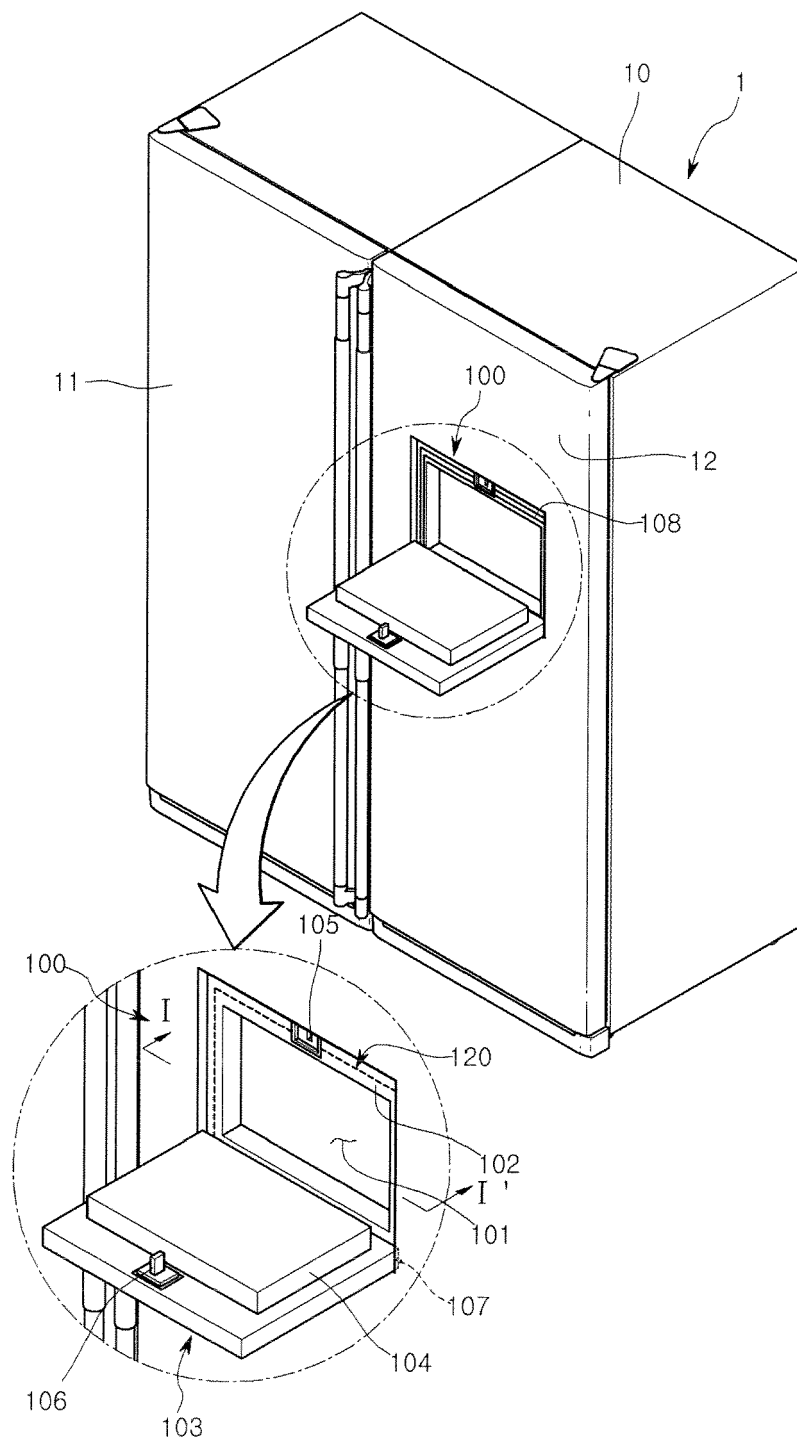


Fig. 2

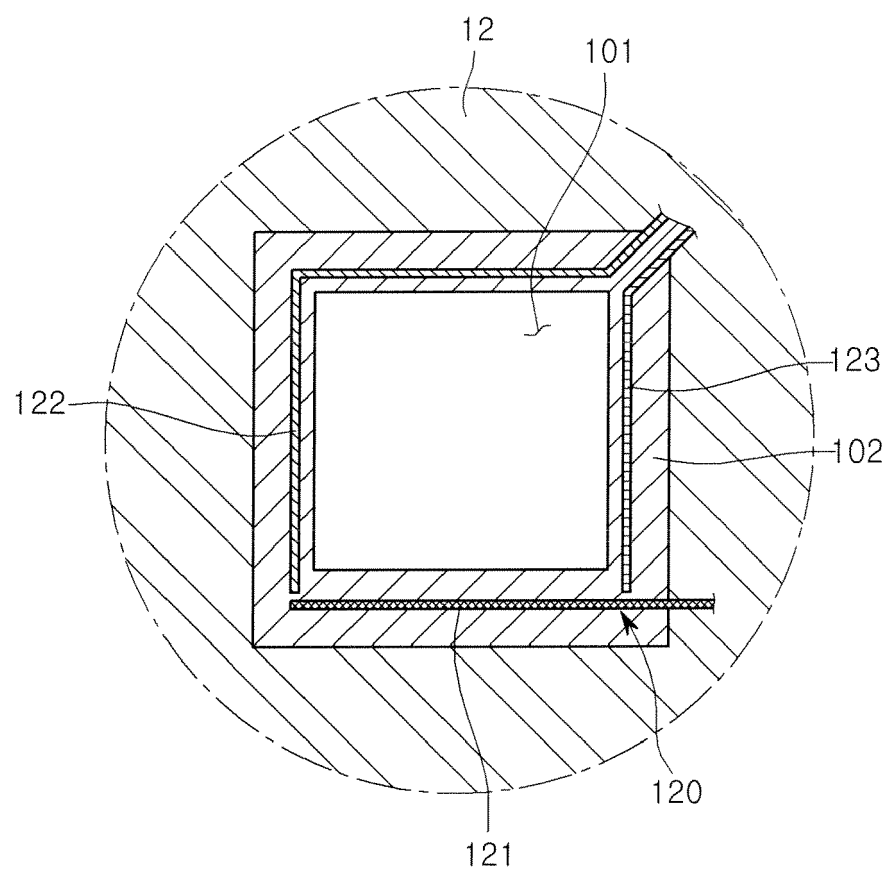


Fig. 3

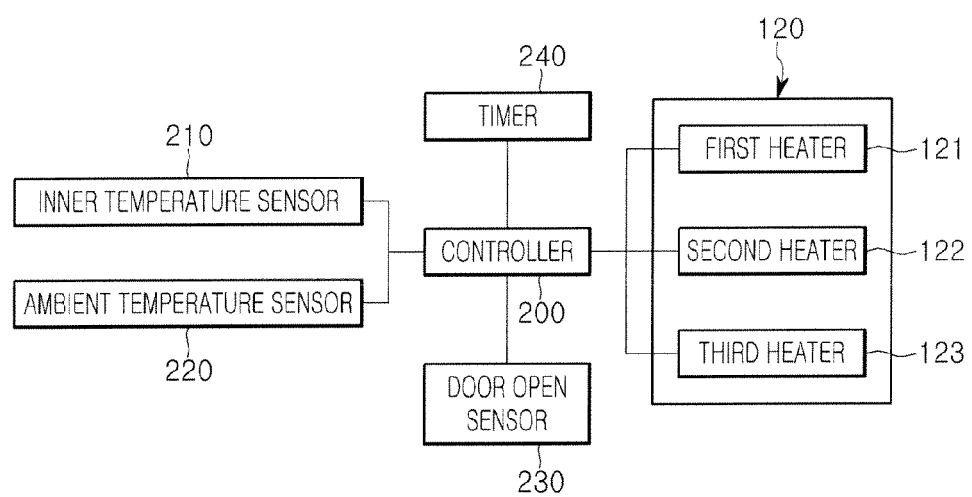


Fig. 4

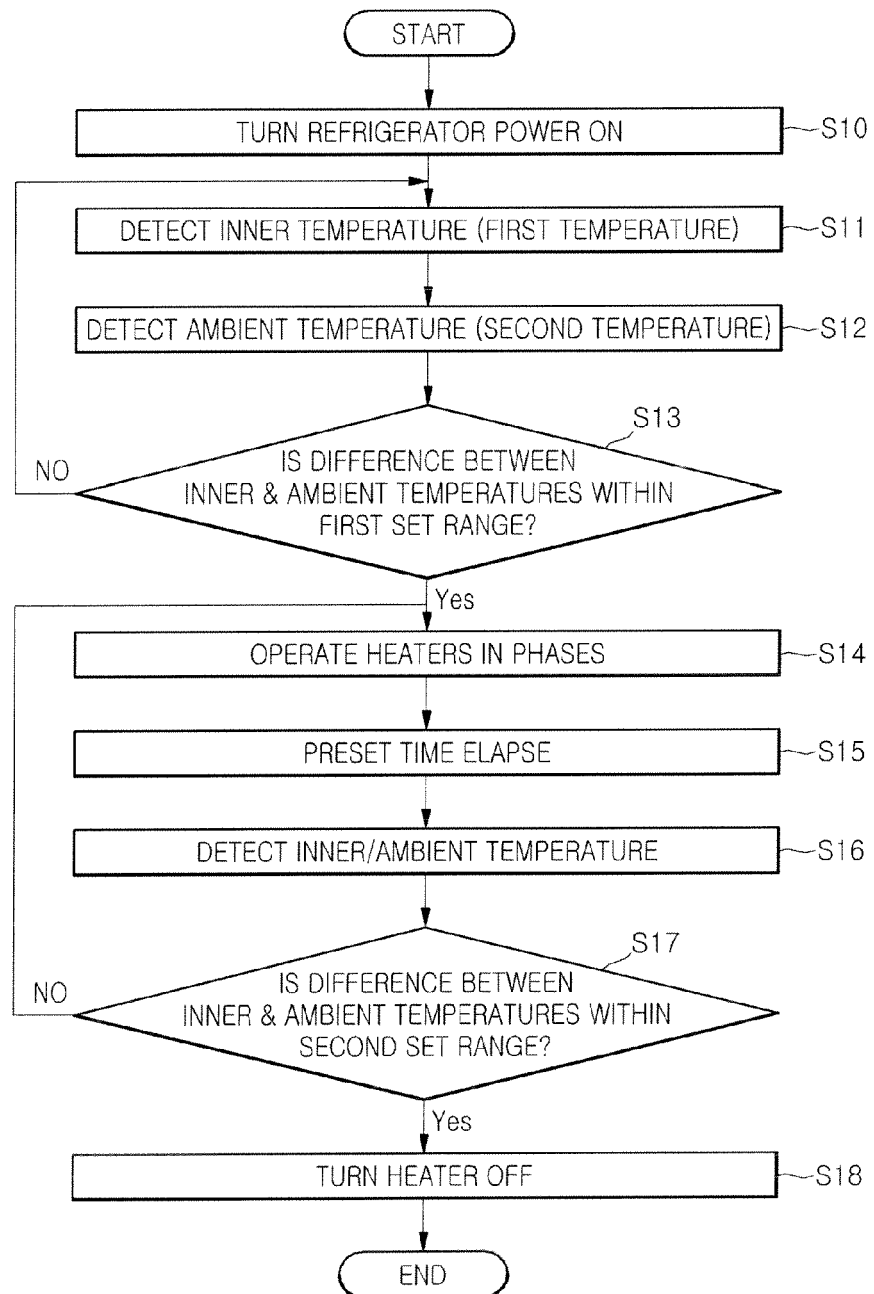


Fig. 5

