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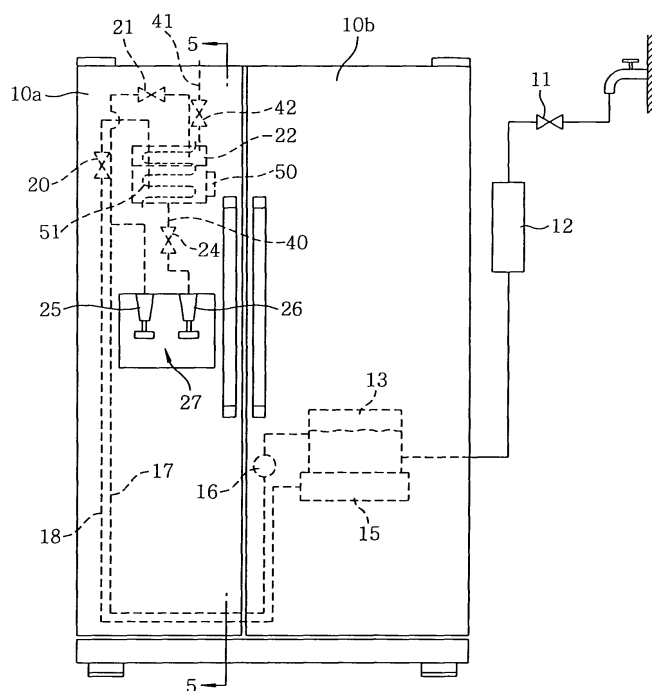
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(54) Refrigerator door with a carbonator installed therein

(57) A refrigerator door with a carbonator installed therein includes a heating device provided at an inner portion of the refrigerator door, for supplying heat to the carbonator. The refrigerator door further includes a temperature detecting device for measuring a temperature of the carbonator and then generating a signal indicating

the measured temperature; and a controller for controlling the heating device according to the signal from the temperature detecting device. If the temperature of the carbonator is lower than or equal to a preset operation temperature, the controller controls the heating device to generate heat.

FIG. 4



Description

[0001] The present invention relates to a refrigerator having a carbonator for producing carbonated water; and, more particularly, to a refrigerator door with a carbonator installed therein, which is capable of preventing a temperature of the carbonator from decreasing below a preset temperature.

[0002] Recently, a household refrigerator capable of supplying carbonated water through a dispenser installed in a refrigerator door has been widely used. Referring to Fig. 1, there is illustrated a front view of a refrigerator having a conventional carbonator. The refrigerator includes a freezer door 100a and a refrigeration door 100b of which inner portions are filled with a thermal insulator. A carbonator 22 for producing carbonated water is installed in the inner portion of the freezer door 100a, and the carbonated water produced in the carbonator 22 is supplied to a user via a carbonated water supply line 40 and a nozzle 26 of a dispenser 27. Further, connected to an upper portion of the carbonator 22 are a water supply conduit 17 for delivering water from a water supply tank 13 installed inside the refrigerator to the carbonator 22 and a carbon dioxide supply conduit 18 for delivering carbon dioxide (CO₂) gas from a CO₂ storage cylinder 15 installed inside the refrigerator to the carbonator 22. Moreover, an exhaust conduit 41 for controlling a pressure in the carbonator 22 is connected to the upper portion of the carbonator 22. The water supply tank 13 receives water from a water source, such as a public water supply system, via a filter 12. A pump 16 provided at the water supply conduit 17 facilitates a water supply from the water supply tank 13 to the carbonator 22. Besides, the water supply conduit 17 delivers water to the nozzle 25 installed at the dispenser 27 so that a user can use cold water.

[0003] Furthermore, controllable closing valves 21, 20, 24 and 42, respectively included in the water supply conduit 17, the carbon dioxide supply conduit 18, the carbonated water supply conduit 40 and the exhaust conduit 41, are connected to a controller (not shown) and are opened and closed by the controller.

[0004] Referring to Fig. 2, there is illustrated a cross-sectional view of the refrigerator taken along a line 2-2 of Fig. 1 (only principal parts of the refrigerator having the conventional carbonator are shown). The carbonator 22 is installed at an inner portion of the freezer door 100a. The installation position thereof approximately corresponds to a central portion of the freezer door 100a in a thickness direction thereof.

[0005] Referring to Fig. 3, there is illustrated a graph showing a temperature change in accordance with a position in the freezer door 100a in the thickness direction thereof. An outer surface temperature of the freezer door 100a is an outside temperature T_o of the refrigerator, and an inner surface temperature of the freezer door 100a is an inner temperature T_f of a freezer compartment 10c. As the position in the freezer door 100a moves from the

outer surface of the freezer door 100a to the inner surface thereof along the thickness direction of the freezer door 100a, the temperature decreases linearly. Accordingly, the central portion of the freezer door 100a, where the carbonator 22 is installed, approximately has an average temperature $((T_o + T_f)/2)$ between the outside temperature T_o of the refrigerator and the freezer compartment temperature T_f. For example, if the outside temperature T_o of the refrigerator is 18°C and the freezer temperature T_f is 20°C below zero, the temperature of the central portion of the freezer door becomes approximately 1°C below zero.

[0006] As described above, in such conventional refrigerator door with the carbonator 22 installed therein, the temperature of the carbonator 22 may decrease below zero. Further, if the temperature of the carbonator 22 decreases below zero, water in the carbonator 22 becomes frozen, thereby hindering the proper operation of the carbonator 22.

[0007] It is, therefore, an object of the present invention to provide a refrigerator door with a carbonator installed therein, which is capable of preventing a temperature of the carbonator installed in the refrigerator door from decreasing below a preset temperature.

[0008] In accordance with a preferred embodiment of the present invention, there is provided a refrigerator door with a carbonator installed therein, including: a heating device provided at an inner portion of the refrigerator door, for supplying heat to the carbonator.

[0009] In accordance with another preferred embodiment of the present invention, there is provided a refrigerator door with a carbonator installed therein, including: a rear wall portion protrudingly formed on an inner surface of the refrigerator door, for suppressing a heat loss of the carbonator to an inside of a refrigerator, wherein the carbonator is installed at a portion of the inner portion of the refrigerator door corresponding to a portion of an inner surface of the refrigerator door where the rear wall portion is formed, and a front area of the rear wall portion covers that of the carbonator.

[0010] The above and other objects and features of the present invention will become apparent from the following description of preferred embodiments, given in conjunction with the accompanying drawings, in which:

Fig. 1 shows a front view of a refrigerator having a conventional carbonator;

Fig. 2 illustrates a cross-sectional view of the refrigerator taken along a line 2-2 of Fig. 1;

Fig. 3 presents a graph showing a temperature change in accordance with a position in a freezer door in a thickness direction thereof;

Fig. 4 offers a front view of a refrigerator having a refrigerator door in accordance with a first preferred embodiment of the present invention;

Fig. 5 sets forth a cross-sectional view of the refrigerator taken along a line 5-5 of Fig. 4;

Fig. 6 describes a diagram of heating system of the

freezer door in accordance with the first preferred embodiment of the present invention;

Fig. 7 describes a flowchart depicting a carbonator temperature controlling method of the controller in accordance with the present invention;

Fig. 8 shows a front view of a refrigerator having a refrigerator door in accordance with the second preferred embodiment of the present invention; and

Fig. 9 illustrates a cross-sectional view of the refrigerator taken along a line 9-9 of Fig. 8.

[0011] Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings, wherein like parts to those of the prior art are represented by like reference numerals, and detailed descriptions thereof will be omitted for simplicity.

[0012] Referring to Fig. 4, there is illustrated a front view of a refrigerator having a refrigerator door in accordance with a first preferred embodiment of the present invention. Further, referring to Fig. 5, there is described a cross-sectional view of the refrigerator taken along a line 5-5 of Fig. 4.

[0013] As shown in Figs. 4 and 5, installed at the freezer door 10a are the carbonator 22 for producing carbonated water and the dispenser 27 for supplying the carbonated water produced in the carbonator 22 to a user. Further, the freezer door 10a includes a heating device 51, e.g., an electric heater, installed in front of the carbonator 22 (see Fig. 5), for providing heat to the carbonator 22; and a temperature detecting device 50 for measuring a temperature of the carbonator 22 and then generating a signal indicating the measured temperature.

[0014] Referring to Fig. 6, there is illustrated a diagram of a heating system of the freezer door 10a in accordance with the first preferred embodiment of the present invention, which is constituted by the heating device 51, the temperature detecting device 50 and a controller 52. The controller 52 receives the signal indicating the measured temperature of the carbonator 22 from the temperature detecting device 50 and then controls the heating device 51 according to the signal. In other words, if the temperature of the carbonator 22 becomes lower than or equal to a preset operation temperature, e.g., 0°C, due to its heat loss to the freezer compartment, the controller 52 controls the heating device 51 to generate heat by supplying current from a power supply 53 to the heating device 51. Then, the heat generated from the heating device 51 is transferred to the carbonator 22 and, accordingly, the temperature of the carbonator 22 increases and water in the carbonator 22 is prevented from being frozen. If the temperature of the carbonator 22 is higher than a preset stop temperature, e.g., 5°C, the controller 52 stops a heat production of the heating device 51 by controlling current not to be supplied from the power supply 53 to the heating device 51.

[0015] Referring to Fig. 7, there is illustrated a flowchart depicting a carbonator temperature controlling

method of the controller 52 in accordance with the present invention. First, the controller 52 receives a signal indicating a temperature Tc of the carbonator 22 from the temperature detecting device 50 (step S700). Then, if the measured temperature Tc of the carbonator 22 is lower than or equal to a preset operation temperature Ta (step S710), the controller 52 controls the heating device 51 to generate heat by supplying current from the power supply 53 to the heating device 51 (step S720). Next, after a preset period of time, the controller 52 receives a signal indicating the temperature Tc of the carbonator 22 (step S725). Thereafter, if the carbonator temperature Tc is higher than a preset stop temperature Ts (step S730), the controller 52 controls the heating device 51 to stop generating heat by stopping a current supply from the power supply 53 to the heating device 51 (step S740). Moreover, the aforementioned carbonator temperature controlling method is carried out at every preset time.

[0016] Hereinafter, a refrigerator door in accordance with a second preferred embodiment of the present invention will be described with reference to Figs. 8 and 9, wherein like parts to those of the first preferred embodiment are represented by like reference numerals, and detailed descriptions thereof will be omitted for simplicity.

[0017] Referring to Fig. 8, there is illustrated a front view of a refrigerator having a refrigerator door in accordance with the second preferred embodiment of the present invention. Further, referring to Fig. 9, there is illustrated a cross-sectional view of the refrigerator taken along a line 9-9 of Fig. 8.

[0018] A freezer door 10a' in accordance with the second preferred embodiment of the present invention is different from the freezer door in accordance with the first preferred embodiment of the present invention in that it further includes a rear wall portion 60 which is formed in such a manner as to protrude from a portion of an inner surface corresponding to a portion of the freezer door 10a' in which the carbonator 22 is installed.

[0019] The rear wall portion 60 is filled with an insulating material identical with that used in the freezer door 10a', and a front area thereof (an area projected on an outer surface of the freezer door 10a) covers that of the carbonator 22. Moreover, a thickness thereof is equal to or greater than or equal to that of the carbonator 22, e.g., 5 cm to 10 cm, and less than or equal to that of a portion of the freezer door 10a' in which neither the rear wall portion 60 nor the dispenser 27 are installed.

[0020] Accordingly, the heat loss of the carbonator 22 to the freezer compartment 10c can be reduced thereby enabling to reduce the frequency of operation of the heating device 51. Further, it is possible to prevent heat from being transferred from an outside of the refrigerator to the freezer compartment 10c through the carbonator 11 installed at the inner portion of the freezer door 10a', thereby enabling to improve an efficiency of the freezer compartment.

[0021] As described above, according to the preferred embodiments of the present invention, it is possible to

prevent a phenomenon in which water in the carbonator becomes frozen due to the heat loss of the carbonator installed in a refrigerator door to the freezer compartment, so that the carbonator can effectively operate.

[0022] While the invention has been shown and described with respect to the preferred embodiments, it will be understood by those skilled in the art that various changes and modification may be made without departing from the scope of the invention as defined in the following claims.

Claims

1. A refrigerator door with a carbonator installed therein, comprising:

a heating device provided at an inner portion of the refrigerator door, for supplying heat to the carbonator.

2. The refrigerator door of claim 1, further comprising:

a temperature detecting device for measuring a temperature of the carbonator and then generating a signal indicating the measured temperature; and

a controller for controlling the heating device according to the signal from the temperature detecting device,

wherein if the temperature of the carbonator is lower than or equal to a preset operation temperature, the controller controls the heating device to generate heat.

3. The refrigerator door of claim 2, wherein if the temperature of the carbonator is higher than a preset stop temperature, the controller controls the heating device to stop generating heat.

4. The refrigerator door of any one of claims 2 and 3, wherein the heating device is constituted by an electric heater, and the controller controls current supplied to the electric heater.

5. The refrigerator door of claim 1, further comprising:

a rear wall portion protrudingly formed on a portion of an inner surface of the refrigerator door corresponding to a portion of the refrigerator door in which the carbonator is installed, for suppressing a heat loss of the carbonator to an inside of a refrigerator, wherein a front area of the rear wall portion covers that of the carbonator.

6. A refrigerator door with a carbonator installed therein, comprising:

a rear wall portion protrudingly formed on an inner surface of the refrigerator door, for suppressing a heat loss of the carbonator to an inside of a refrigerator,

wherein the carbonator is installed at a portion of an inner portion of the refrigerator door corresponding to a portion of the inner surface of the refrigerator door where the rear wall portion is formed, and a front area of the rear wall portion covers that of the carbonator.

7. The refrigerator door of claim 6, wherein a thickness of the rear wall portion is less than or equal to that of the refrigerator door.

8. The refrigerator door of claim 6, wherein a thickness of the rear wall portion is equal to or greater than that of the carbonator.

9. The refrigerator door of claim 6, wherein the refrigerator door is for a freezer compartment.

FIG. 1
(PRIOR ART)

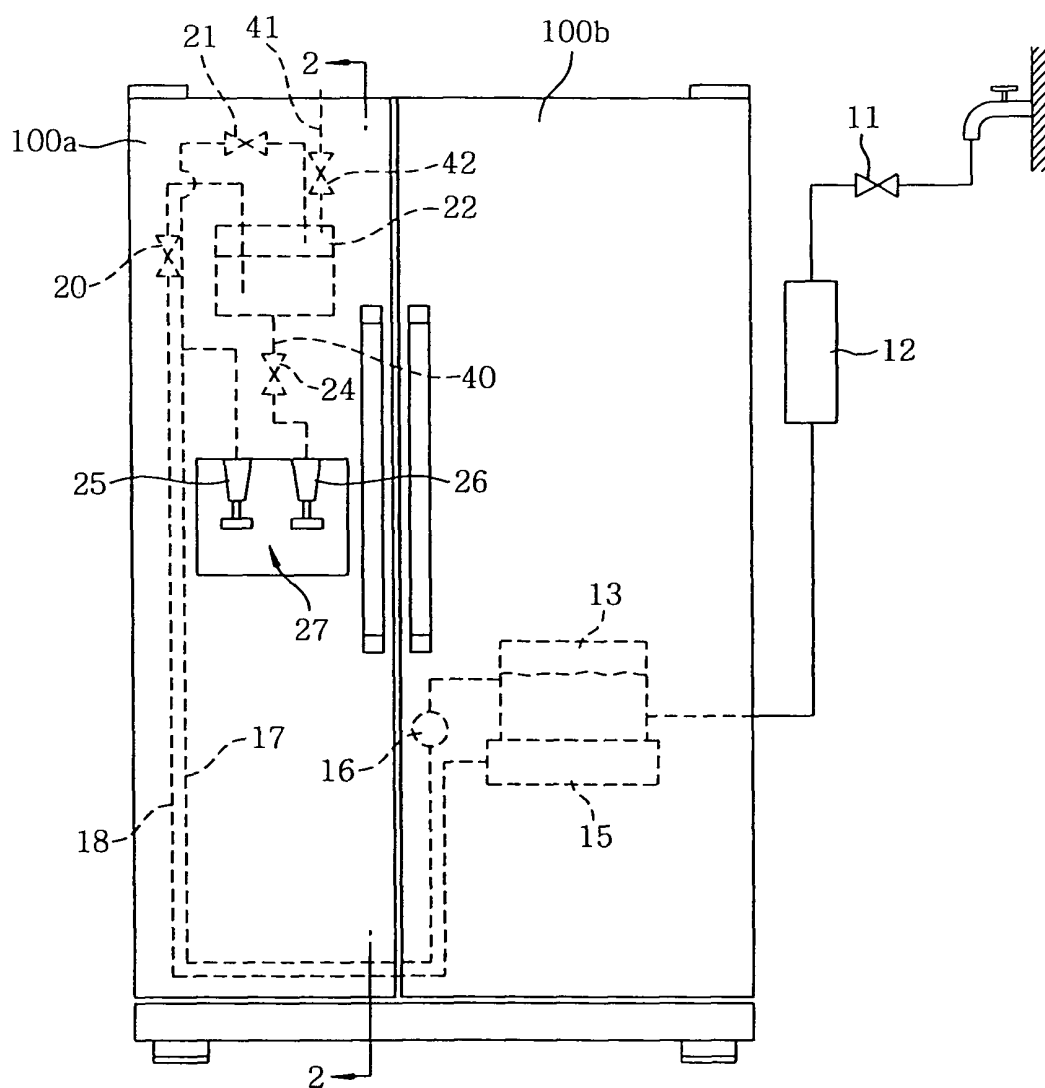


FIG. 2
(PRIOR ART)

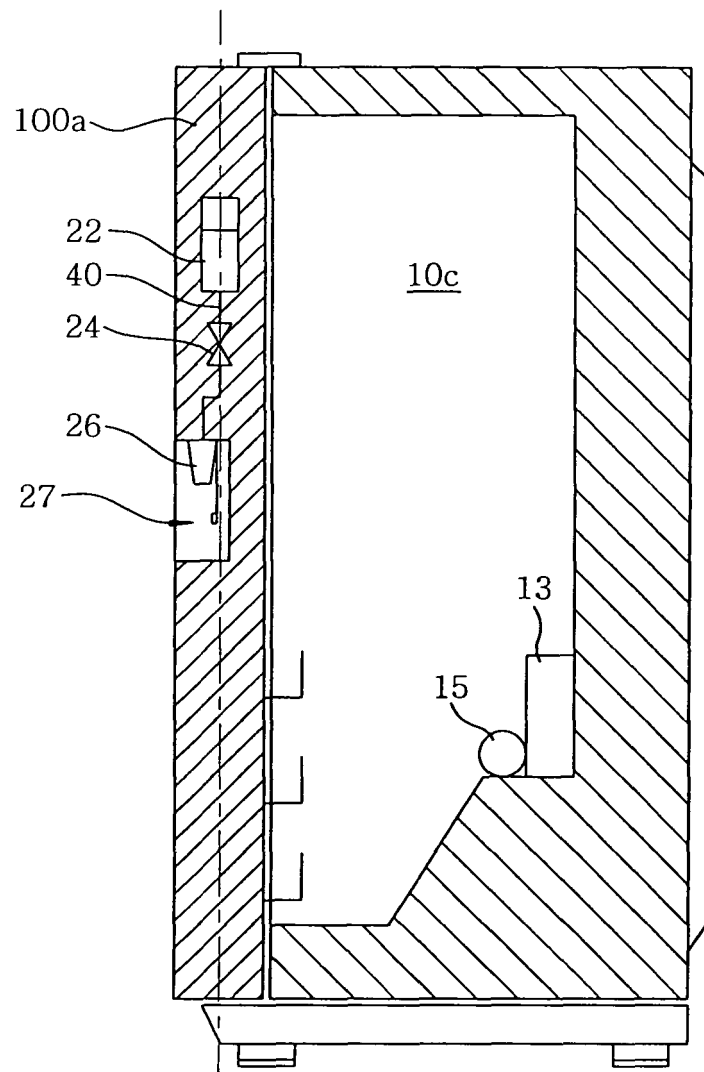


FIG.3

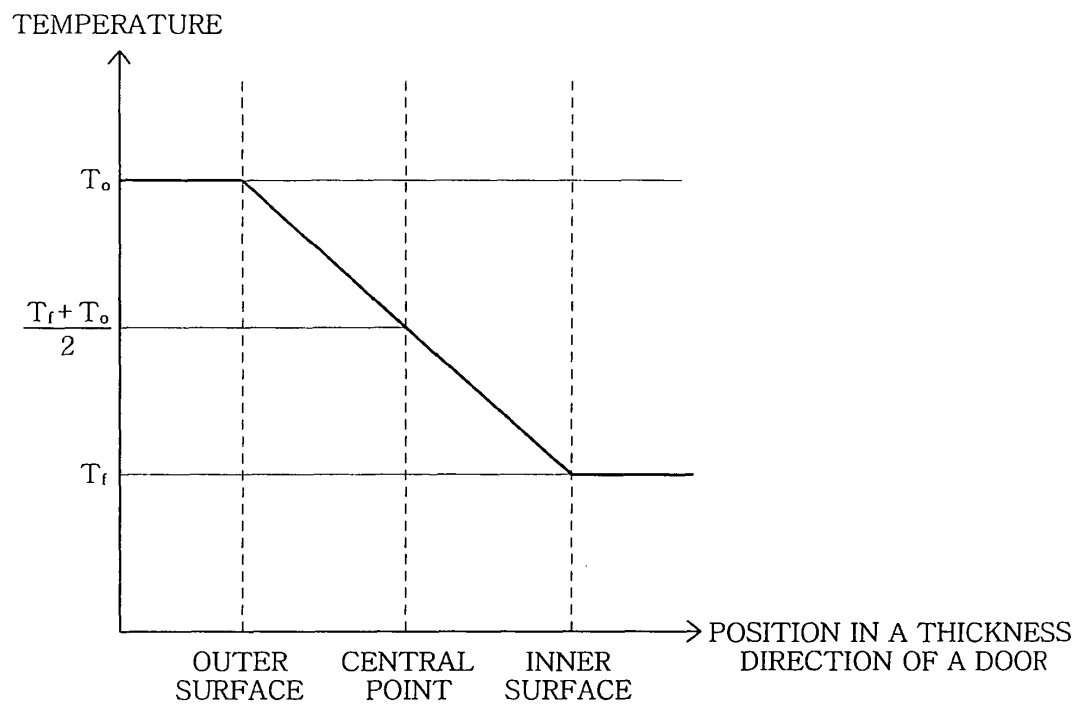


FIG. 4

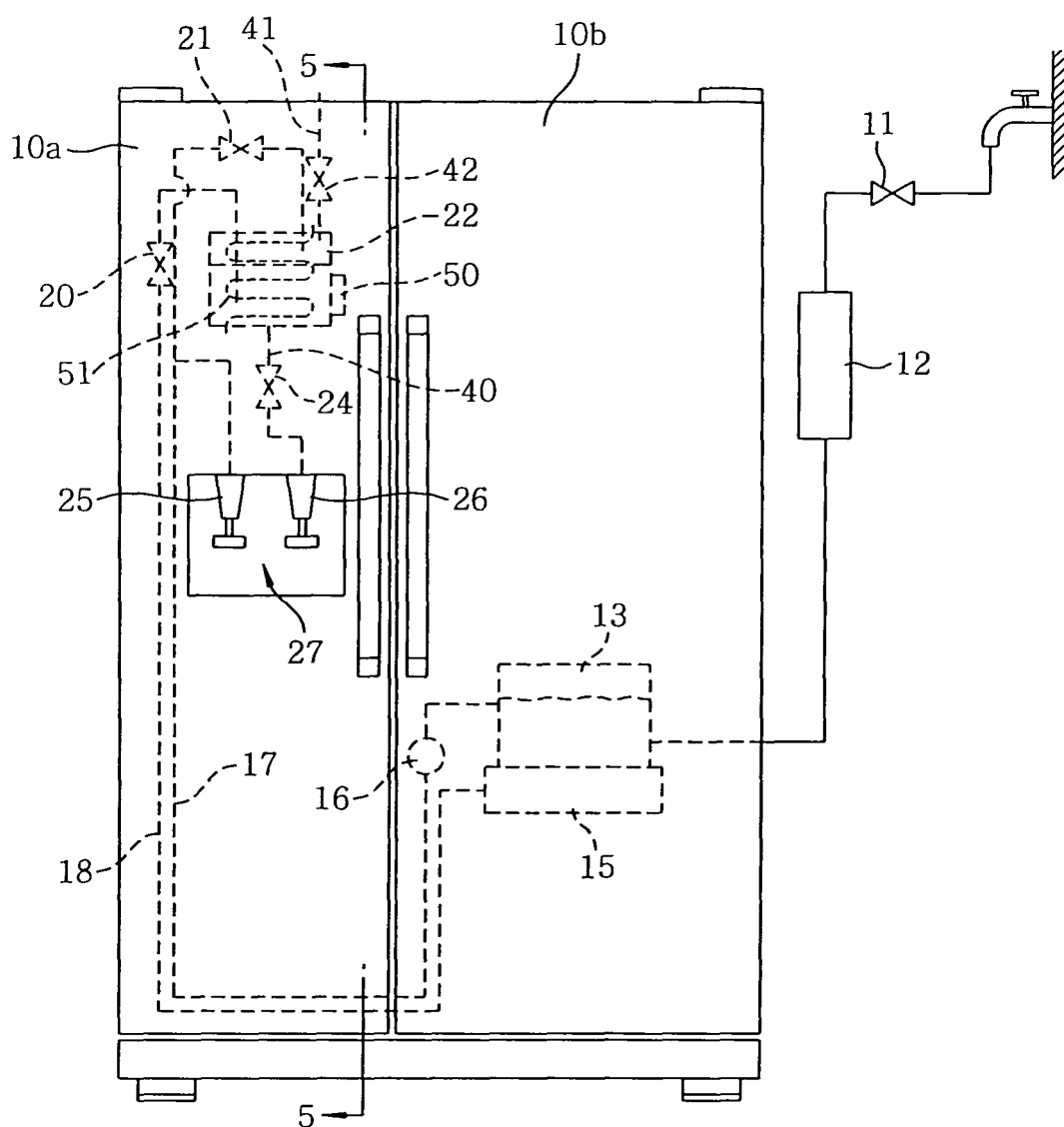


FIG. 5

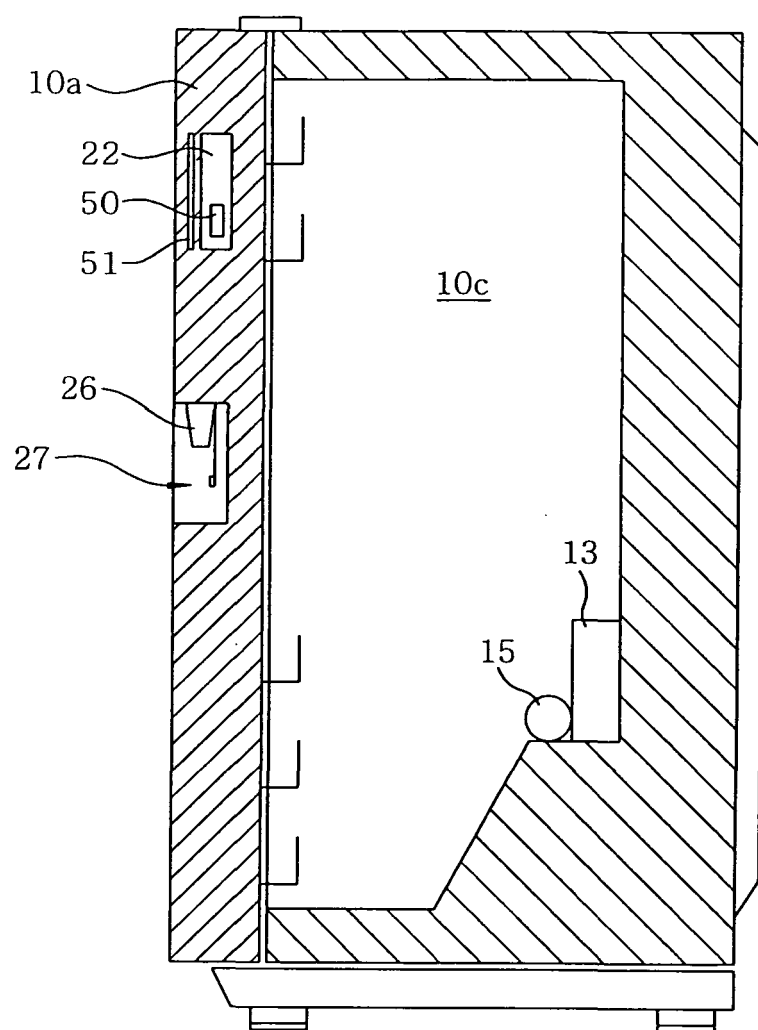


FIG. 6

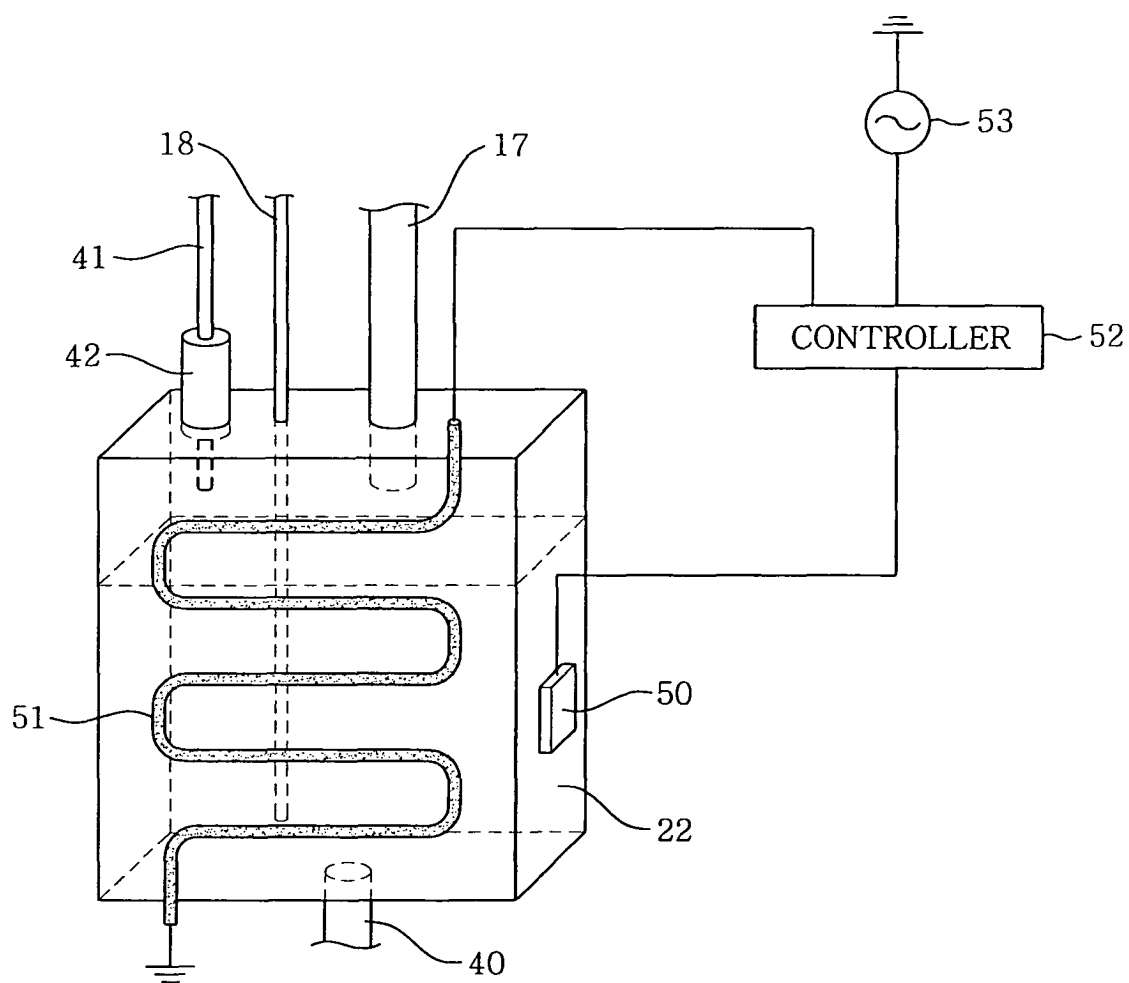


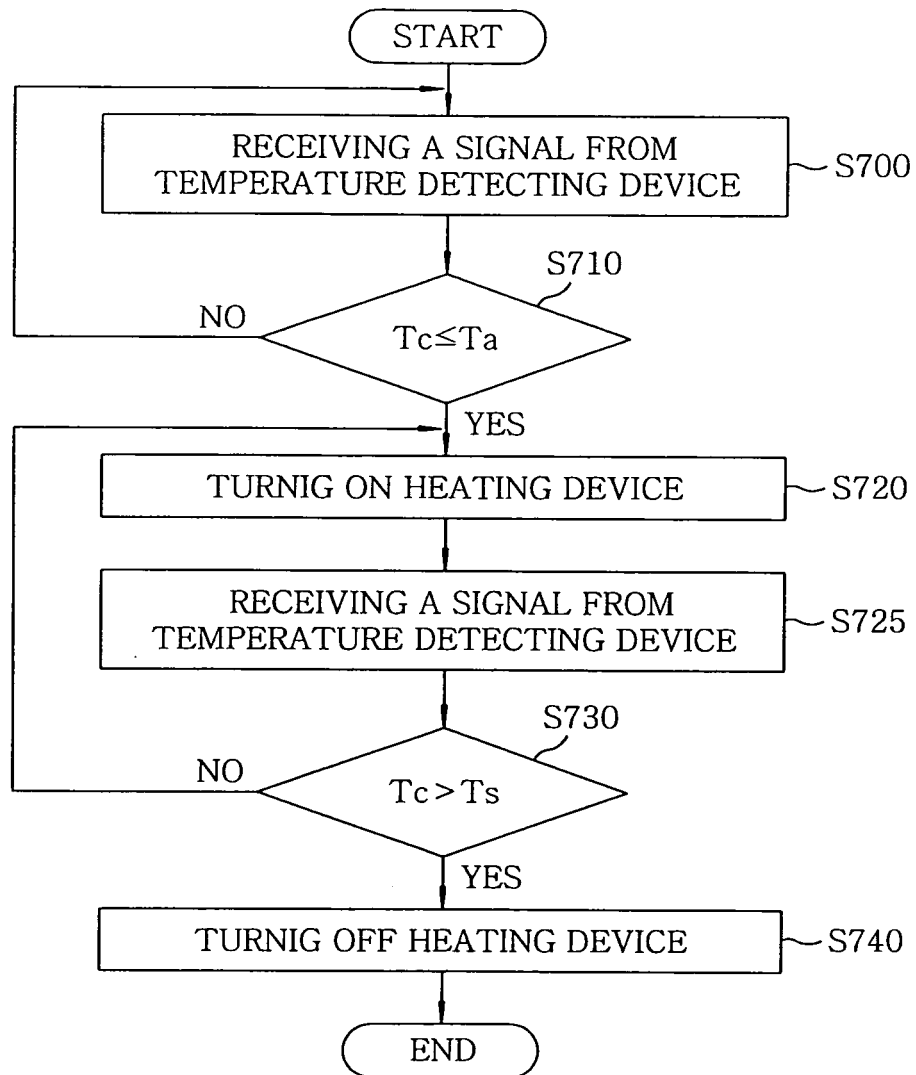
FIG. 7

FIG. 8

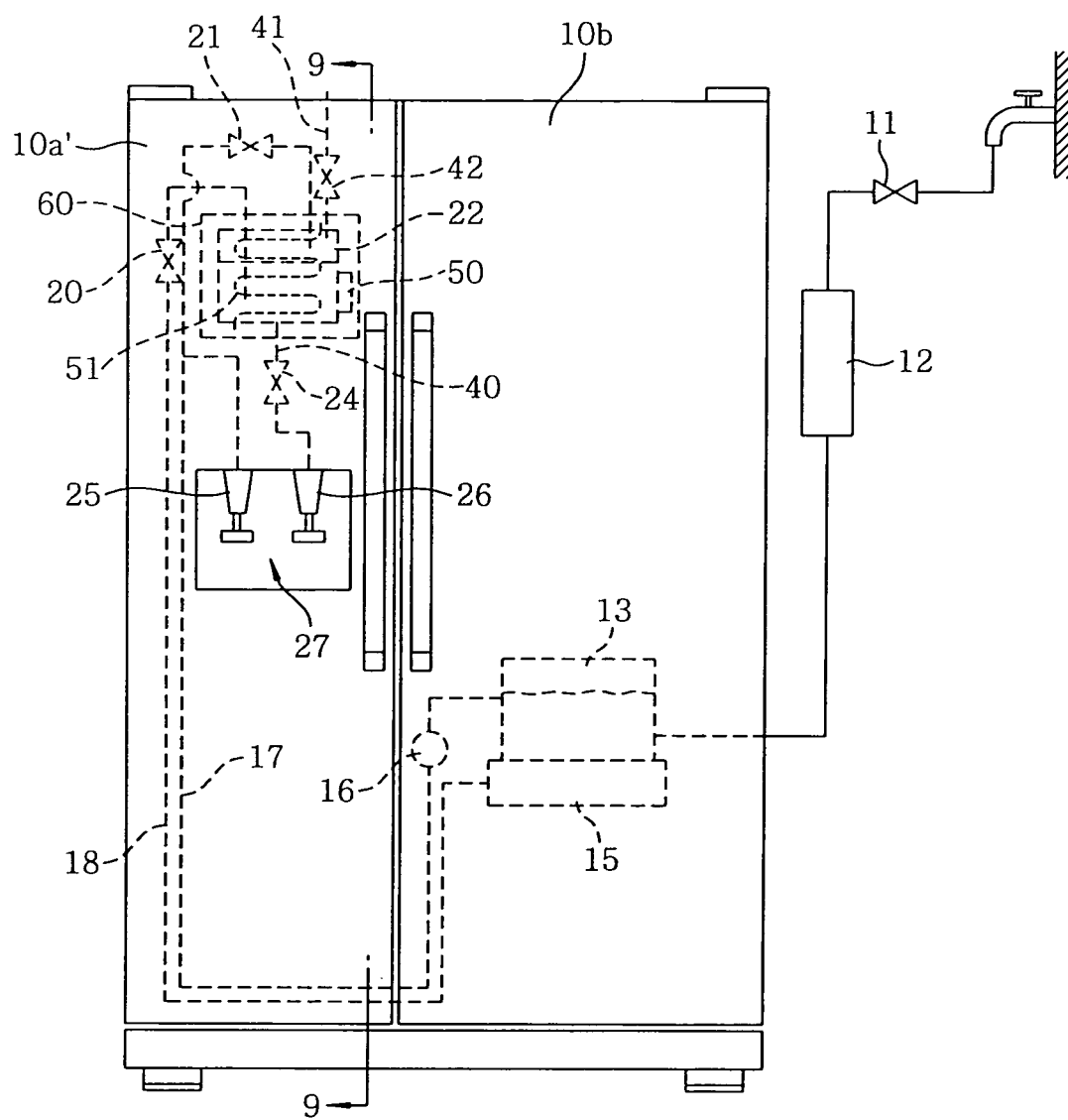


FIG. 9

