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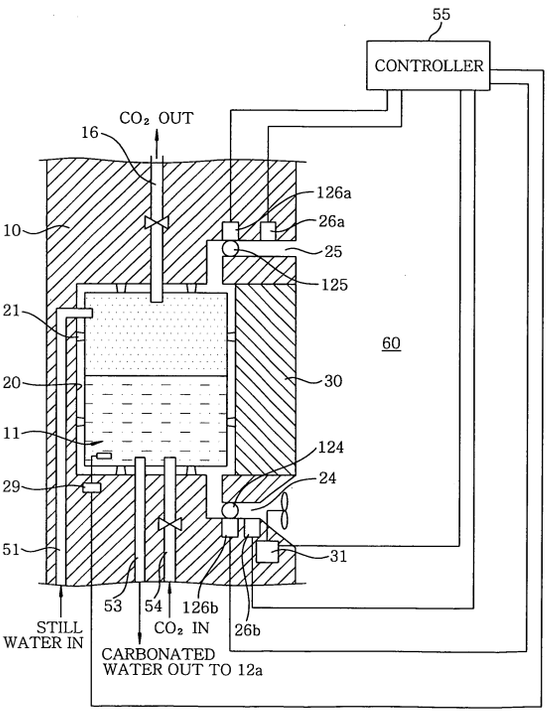
(54) Temperature control apparatus for use in a carbonator of a refrigerator

(57) A temperature control apparatus for use in a carbonator (11) of a refrigerator includes a cover (30) overlaying the carbonator (11) in a recessed portion (20) of a refrigerator door (10); a temperature sensor (29) installed in the carbonator (11); a pair of valve devices (126a,126b) installed at an outlet opening (125) of an outlet path and an inlet opening (124) of an inlet path, respectively; and a controller (55). The temperature sensor (29) transmits a signal to the controller (55) when the temperature of the carbonator (11) is equal to or less than a predetermined value. Then the controls the pair of the valve devices (126a,126b) to open the outlet opening (125) and the inlet opening (124), so that warm air outside the refrigerator is introduced into the recessed portion (20) through the inlet path and the inlet opening (124) while air in the recessed portion (20) is discharged to the outside of the refrigerator through the outlet opening (125) and the outlet path.

FIG.3



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Description

[0001] The present invention relates to a temperature control apparatus for use in a carbonator of a refrigerator; and, more particularly, a temperature control apparatus for use in a carbonator of a refrigerator, which is capable of controlling the temperature of the carbonator by using cool air inside the refrigerator and warm air outside the refrigerator.

[0002] Recently, some of home refrigerators have been designed to produce carbonated water by dissolving carbon dioxide into chilled water and supply it to a user through a dispenser installed in a refrigerator door.

[0003] For example, a conventional carbonated liquid supplying system for use in a refrigerator is disclosed in US Pat No. 4,866,949, entitled "CARBONATED LIQUID REFRIGERATION SYSTEM" and its front plan view is shown in Fig. 1 wherein the carbonator 3 is located in a freezer door 1 and supplies carbonated water to a liquid dispenser 2.

[0004] Further, in US Pat No. 4,866,949, there is also disclosed a refrigeration system for cooling the carbonator, which includes an evaporator disposed in the inside of or around the carbonator 3, and for absorbing heat from the inside of the carbonator 1, and a condenser disposed in the inside of the freezer compartment for dissipating the heat absorbed from the carbonator 1 to the freezer compartment. The evaporator and the condenser are formed of tubes and connected to each other, and a refrigerant circulates therein.

[0005] However, the refrigeration system for cooling the carbonator disclosed US Pat No. 4,866,949 has a problem that its complicated construction and the refrigerant separately used therein increase the manufacturing time and cost.

[0006] It is, therefore, an object of the present invention to provide a temperature control apparatus for use in a carbonator of a refrigerator, which has a simple construction and is operated without a refrigerant.

[0007] In accordance with a preferred embodiment of the present invention, there is provided a temperature control apparatus for use in a carbonator of a refrigerator, including: a cover overlaying the carbonator mounted in a recessed portion formed in an inner surface of a door of the refrigerator; a temperature sensor, installed in the carbonator, for detecting a temperature of the carbonator and generating a signal when the detected temperature is equal to or less than a predetermined temperature; a pair of valve devices, installed at an outlet opening of an outlet path and an inlet opening of an inlet path, respectively, that are formed in the recessed portion, the outlet path and the inlet path being formed in the door of the refrigerator to establish communication between the recessed portion and the outside of the refrigerator; and a controller for controlling the pair of the valve devices in response to the signal from the temperature sensor, wherein if the controller receives the signal from the temperature sensor, the controller controls the pair of the valve devices to open the outlet opening and the inlet opening, so that warm air outside the refrigerator is introduced into the recessed portion through the inlet path and the inlet opening to raise the temperature of the carbonator.

[0008] In accordance with another preferred embodiment of the present invention, there is provided a temperature control apparatus for use in a carbonator of a refrigerator, including: a cover overlaying the carbonator mounted in a recessed portion formed in an inner surface of a door of the refrigerator; a temperature sensor installed in the carbonator and for generating a signal if a temperature of the carbonator is equal to or less than a predetermined temperature; a pair of cooling valve devices which are installed at a cool air inlet channel and a cool air outlet channel, respectively that are formed in the door of the refrigerator, to establish communication between the recessed portion and an inside of the refrigerator; a controller for controlling the pair of the cooling valve devices in response to the signal of the temperature sensor, wherein if the controller receives the signal from the temperature sensor, the controller controls the pair of the cooling valve devices to block the cool air inlet channel and the cool air outlet channel, so that supply of cool air from the inside of the refrigerator to the recessed portion through the cooling inlet channel is shut off and that discharge of air from the recessed portion to the inside of the refrigerator through the cool air outlet channel is shut off.

[0009] 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 provides a front plan view of a refrigerator having a conventional carbonated liquid supplying system and a conventional refrigeration system for cooling a carbonator;

Fig. 2 shows a schematic front plan view of a refrigerator in which a temperature control apparatus for use in a carbonator of a refrigerator in accordance with a preferred embodiment of the present invention is installed;

Fig. 3 describes a partial cross-sectional diagram of the refrigerator shown in Fig. 2 taken along the lines 3-3 and illustrates a preferred embodiment of the present invention;

Fig. 4 sets forth a partial cross-sectional diagram of a modified embodiment of the preferred embodiment shown in Fig. 3; and

Fig. 5 depicts a bottom plan view of a cover of the modified embodiment shown in Fig. 4.

[0010] Hereinafter, embodiments of the present invention will be described in detail with reference to accompanying drawings.

[0011] Referring to Fig. 2, there is illustrated a schematic front plan view of a refrigerator having a temper-

ature control apparatus installed therein for use in a carbonator of a refrigerator in accordance with a preferred embodiment of the present invention. The refrigerator includes a hinged freezer door 10 for closing or opening a freezer compartment 60; a carbonator 11 constituted by a box-shaped container and mounted on an inner surface of the freezer door 10; a dispenser 12 for selectively discharging a chilled water and a carbonated water; a water tank 13 for supplying water to the carbonator 11; and a carbon dioxide (CO_2) storage cylinder 15 for supplying carbon dioxide gas to the carbonator 11.

[0012] Fig. 3 illustrates a partial cross-sectional diagram of the refrigerator shown in Fig. 2 taken along the lines 3-3 and illustrates a preferred embodiment of the present invention. As shown in Fig. 3, the carbonator 11 is mounted in a recessed portion 20 formed in the inner surface of the freezer door 10. Connected to an upper portion of the carbonator 11 are a water supply tube 51 for transferring water from the water tank 13 to the carbonator 11 and a gas exhaust tube 16 for discharging the carbon dioxide gas in the carbonator 11 to the outside of the refrigerator. And, connected to a lower portion of the carbonator 11 are a gas supply tube 54 for transferring carbon dioxide gas from the CO_2 storage cylinder 15 to the carbonator 11 and a carbonated water outlet tube 53 for transferring a carbonated water from the carbonator 11 to a nozzle 12a of the dispenser 12. Installed on an outer surface of or in the inside of the carbonator 11 is a temperature sensor 29 which detects whether the temperature of the carbonator 11 is equal to or less than a predetermined temperature and then transmits a signal to a controller 55.

[0013] The recessed portion 20 has a size slightly greater than that of the carbonator 11 so that the carbonator 11 can be housed therein. Between the carbonator 11 and inner surface of the recessed portion 20, a plurality of protrusion members 21 made of an insulating material are disposed in such a manner that the carbonator 11 is fixedly installed in the recessed portion 20 with five sides of the carbonator 11 spaced apart from the inner surface of the recessed portion 20 while forming gaps therebetween as deep as the height of the protrusion members 21.

[0014] At the front of the recessed portion 20, a cover 30 is provided to overlay the recessed portion 20 and the carbonator 11 mounted therein. The cover 30 is fixed to the inner surface of the freezer door 10 by screws (not shown) or the like. Between the inner surface of the cover 30 and the carbonator 11, a plurality of the protrusion members 21 are disposed to form a gap as deep as the height of the protrusion members 21 between the inner surface of the cover 30 and the back side of the carbonator 11.

[0015] In the freezer door 10 at upper and lower ends of the cover 30, an inlet channel 25 and an outlet channel 24 are formed, respectively. The inlet channel 25 and the outlet channel 24 are intended for establishing communication between the recessed portion 20 and the freezer compartment 60. And solenoid valves 26a and 26b controlled by the controller 55 are installed at the inlet channel 25 and the outlet channel 24, respectively.

[0016] In the inlet channel 25 and the outlet channel 24, an outlet opening 125 of an outlet path (not shown) and an inlet opening 124 of an inlet path (not shown) are formed, respectively, both paths being intended for establishing communication between the recessed portion 20 and the outside of the refrigerator. The inlet path serves to introduce warm air outside the refrigerator into the recessed portion 20, whereas the outlet path serves to discharge the air in the recessed portion 20 to the outside of the refrigerator. Moreover, at the outlet opening 125 and the inlet opening 124, solenoid valves 126a and 126b controlled by the controller 55 are installed, respectively.

[0017] Further, a fan device 31 is installed at the outlet channel 24 to forcedly discharge the air in the recessed portion 20 to the inside of the refrigerator, i.e., the freezer compartment 60. Moreover, a separate fan device (not shown) may be installed at the inlet channel 25 without or in addition to the fan device 31 to forcedly blow the cool air in the freezer chamber 60 into the recessed portion 20.

[0018] The controller 55 controls the solenoid valves 26a, 26b, 126a and 126b in response to the signal from the temperature sensor 29. If the controller 55 receives the signal from the temperature sensor 29, the controller 55 controls the solenoid valves 26a and 26b to block the inlet channel 25 and the outlet channel 24, and controls the fan device 31 to stop its operation. Then, the supply of the cool air of the freezer compartment 60 to the recessed portion 20 is shut off so that the temperature of the carbonator 11 does not lowered. In addition, at this time, the controller 55 controls the solenoid valves 126a and 126b to open the outlet opening 125 and the inlet opening 124, so that the warm air outside the refrigerator is introduced into the recessed portion 20 through the inlet path and the inlet opening 124 to flow into the gaps formed between the carbonator 11 and the inner surfaces of the recessed portion 20 and the cover 30 to raise the temperature of the carbonator 11. And, the air in the recessed portion 20 is discharged to the outside of the refrigerator through the outlet opening 125 and the outlet path.

[0019] In contrast, if the temperature of the carbonator 11 becomes higher than the predetermined temperature, for example, because relatively warm water is supplied to the carbonator 11 from the water tank 13, the controller 55 controls the solenoid valves 126b and 126a to block the inlet opening 124 and the outlet opening 125, respectively, and controls the solenoid valves 26a and 26b to open the inlet channel 25 and the outlet channel 24. So, the warm air is not supplied to the recessed portion 20 from the outside of the refrigerator and the cool air in the freezer compartment 60 is supplied to the recessed portion 20 and then flows through the gaps formed between the carbonator 11 and the inner surfac-

es of the recessed portion 20 and the cover 30 to cool down the carbonator 11. At this time, the controller 55 controls the fan device 31 to start its operation so that the supply of the cool air from the freezer compartment 60 to the recessed portion 20 is facilitated.

[0020] Fig. 4 is a partial cross-sectional diagram of a modified embodiment of the preferred embodiment shown in Fig. 3, wherein like parts to those of the preferred embodiment of the present invention are represented by like reference numerals, and detailed descriptions thereof will be omitted for simplicity.

[0021] As shown in Fig. 4, at the front of the recessed portion 20, a cover 30a for overlaying the recessed portion 20 and the carbonator 11 mounted therein is provided, which is fixed to the inner surface of the freezer door 10 by screws (not shown) or the like. Between the carbonator 11 and the inner surfaces of the recessed portion and the cover 30a, a plurality of the protrusion members 21 are disposed to form gaps therebetween as deep as the height of the protrusion members 21.

[0022] The cover 30a has an empty inner space 37 formed therein. Further, as shown in Fig. 5, the cover 30a has an inlet through hole 32 and an outlet through hole 33 formed in an upper and lower portion of a base plate of the cover 30a, respectively. The inner space 37 communicates the recessed portion 20 through the inlet through hole 32 and the outlet through hole 33. The relatively warmer air in the recessed portion 20 flows into the inner space 37 through the inlet through hole 32 and then is cooled in the inner space 37 indirectly by the cool air of the freezer compartment 60. The air cooled in the inner space 37 descends to the lower portion of the inner space 37 and then flows into the recessed portion 20 through the outlet through hole. The carbonator 11 is then cooled down by help of the air circulation between the recessed portion 20 and the inner space 37 of the cover 30a.

[0023] Further, the outlet opening 125 of the outlet path (not shown) and the inlet opening 124 of the inlet path (not shown) are formed at the upper and the lower portion of the recessed portion 20, respectively. As similar as in the preferred embodiment, both paths are intended for establishing communication between the recessed portion 20 and the outside of the refrigerator. And, at the outlet opening 125 and the inlet opening 124, solenoid valves 126a and 126b controlled by the controller 55a are installed, respectively.

[0024] The controller 55a controls the solenoid valves 126a and 126b in response to the signal from the temperature sensor 29. If the controller 55a receives the signal indicating that the temperature of the carbonator 11 is equal to or less than a predetermined temperature from the temperature sensor 29, the controller 55a controls the solenoid valves 126a and 126b to open the outlet opening 125 and the inlet opening 124. Then, the warm air outside the refrigerator is introduced into the recessed portion 20 through the inlet path and the inlet opening 124. In addition, the air in the recessed portion 20 is discharged to the outside of the refrigerator through the outlet opening 125 and the outlet path. Thus, the temperature of the carbonator 11 mounted in the recessed portion 20 is raised by the warm air flowing through the gaps formed between the carbonator 11 and the inner surfaces of the recessed portion 20 and the cover 30a.

[0025] On the other hand, if the temperature of the carbonator 11 becomes higher than the predetermined temperature, the controller 55a controls the solenoid valves 126a and 126b to block the outlet opening 125 and the inlet opening 124, so that the carbonator 11 is cooled down by the air circulation between the recessed portion 20 and the inner space 37.

[0026] As described above, the temperature control apparatus for use in a carbonator of a refrigerator in accordance with the present invention has a construction in which the temperature of the carbonator mounted in the recessed portion of the freezer door is controlled by the cool air inside the refrigerator and the warm air outside the refrigerator.

[0027] 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 modifications may be made without departing from the scope of the invention as defined in the following claims.

Claims

1. A temperature control apparatus for use in a carbonator of a refrigerator, comprising:

a cover overlaying the carbonator mounted in a recessed portion formed in an inner surface of a door of the refrigerator;
a temperature sensor, installed in the carbonator, for detecting a temperature of the carbonator and generating a signal when the detected temperature is equal to or less than a predetermined temperature;
a pair of valve devices, installed at an outlet opening of an outlet path and an inlet opening of an inlet path, respectively, that are formed in the recessed portion, the outlet path and the inlet path being formed in the door of the refrigerator to establish communication between the recessed portion and the outside of the refrigerator; and
a controller for controlling the pair of the valve devices in response to the signal from the temperature sensor,

wherein if the controller receives the signal from the temperature sensor, the controller controls the pair of the valve devices to open the outlet opening and the inlet opening, so that warm air outside

the refrigerator is introduced into the recessed portion through the inlet path and the inlet opening to raise the temperature of the carbonator.

2. The temperature control apparatus of claim 1, further comprising a plurality of protrusion members disposed between the carbonator and an inner surface of the recessed portion to form a gap therebetween?.

3. The temperature control apparatus of claim 1, further comprising a pair of cooling valve devices which are installed at a cool air inlet channel and a cool air outlet channel, respectively, the cool air inlet channel and a cool air outlet channel being formed in the door of the refrigerator, to establish communication between the recessed portion and an inside of the refrigerator,

wherein if the controller receives the signal from the temperature sensor, the controller controls the pair of the cooling valve devices to block the cool air inlet channel and the cool air outlet channel, so that supply of cool air from the inside of the refrigerator to the recessed portion through the cooling inlet channel is shut off and that discharge of air from the recessed portion to the inside of the refrigerator through the cool air outlet channel is shut off.

4. The temperature control apparatus of claim 3, further comprising a fan device, installed at the cool air outlet channel, for forcedly discharging air in the recessed portion to the inside of the refrigerator,

wherein if the controller receives the signal from the temperature sensor, the controller controls the fan device to stop its operation.

5. The temperature control apparatus of claim 1, wherein the cover has an empty inner space formed therein, and an inlet through hole and an outlet through hole formed in an upper portion and a lower portion of a base plate thereof, respectively for establishing communication between the recessed portion and the inner space,

wherein air in the inner space is cooled down by cool air inside the refrigerator and then flows into the recessed portion through the outlet through hole.

6. A temperature control apparatus for use in a carbonator of a refrigerator, comprising:

a cover overlaying the carbonator mounted in a recessed portion formed in an inner surface of a door of the refrigerator;
a temperature sensor installed in the carbonator and for generating a signal if a temperature of the carbonator is equal to or less than a predetermined temperature;
a pair of cooling valve devices which are installed at a cool air inlet channel and a cool air outlet channel, respectively that are formed in the door of the refrigerator, to establish communication between the recessed portion and an inside of the refrigerator;
a controller for controlling the pair of the cooling valve devices in response to the signal of the temperature sensor,

wherein if the controller receives the signal from the temperature sensor, the controller controls the pair of the cooling valve devices to block the cool air inlet channel and the cool air outlet channel, so that supply of cool air from the inside of the refrigerator to the recessed portion through the cooling inlet channel is shut off and that discharge of air from the recessed portion to the inside of the refrigerator through the cool air outlet channel is shut off.

7. The temperature control apparatus of claim 6, further comprising a fan device installed at the cool air outlet channel and for forcedly discharging air in the recessed portion to the inside of the refrigerator,

wherein if the controller receives the signal from the temperature sensor, the controller controls the fan device to stop its operation.

FIG. 1

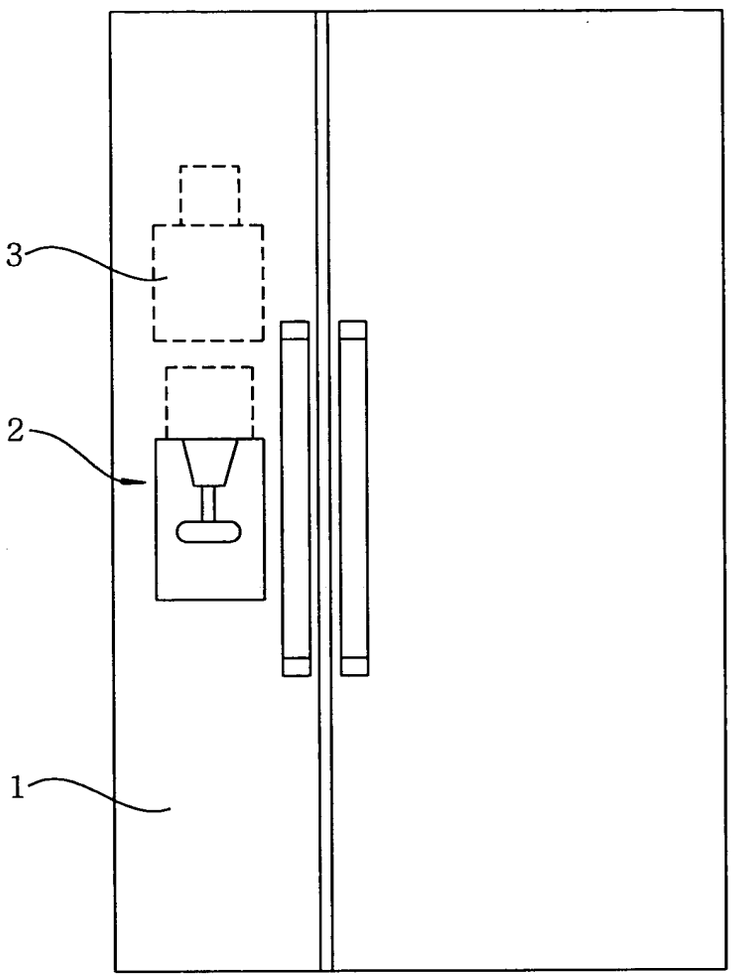


FIG.2

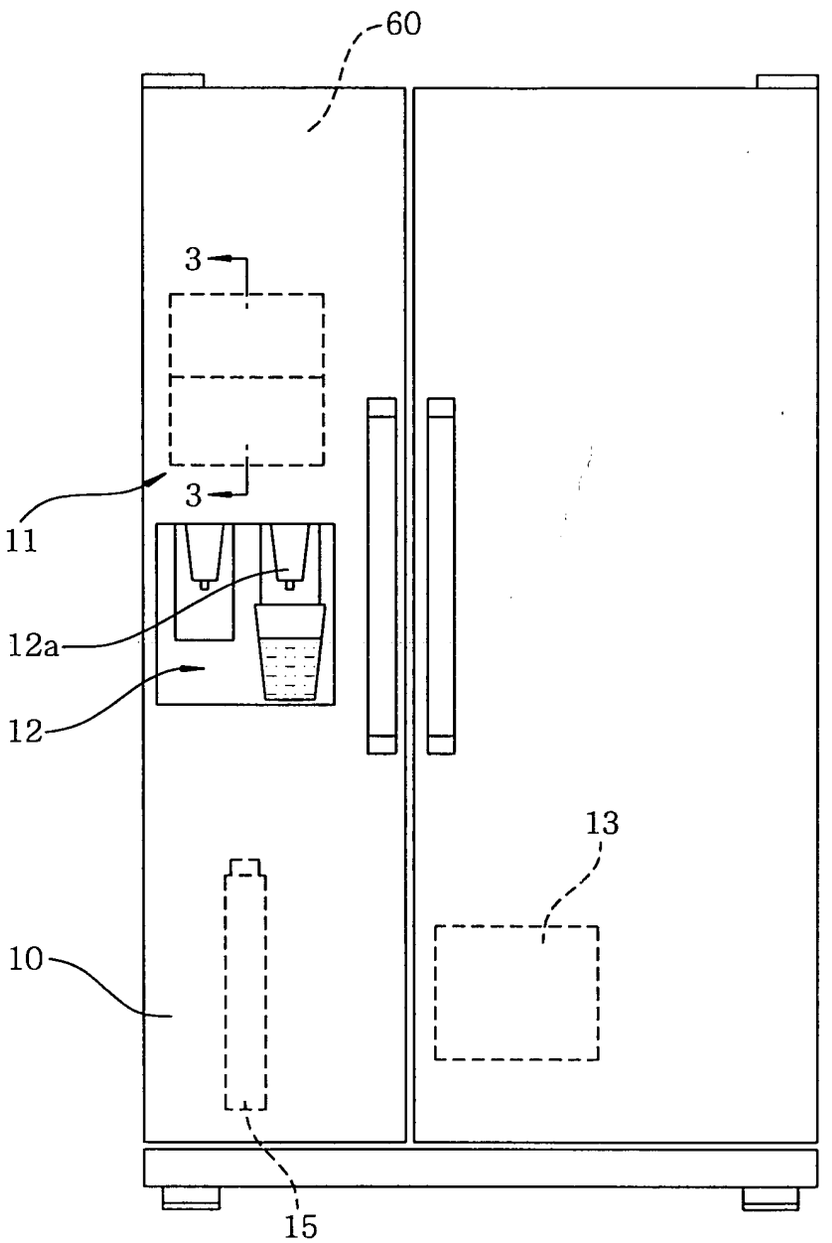


FIG.3

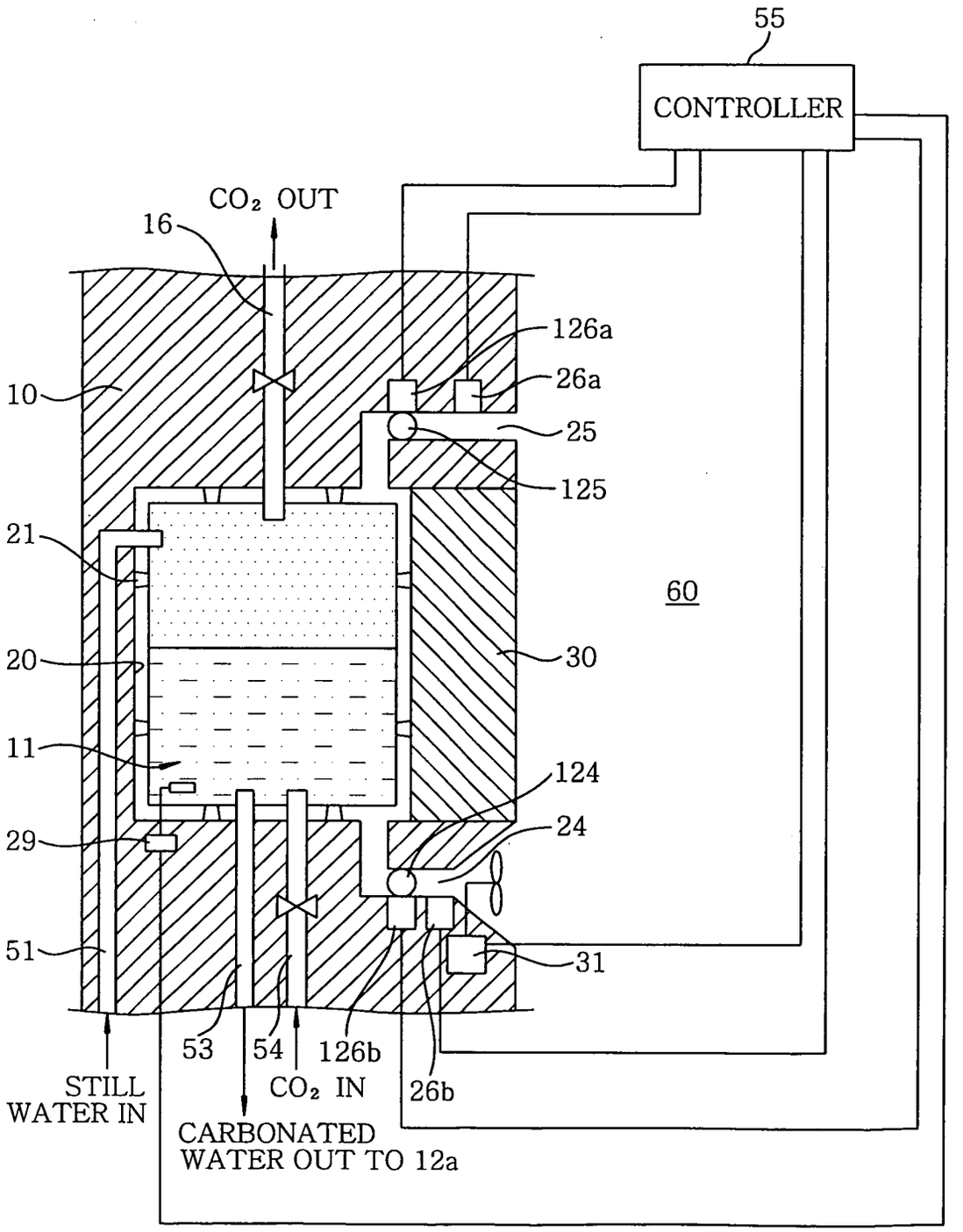

55
CONTROLLER
CO_2 OUT
16
126a
26a
10
25
125
21
60
30
20
11
124
24
29
51
31
53
54
126b
26b
STILL WATER IN
CO_2 IN
CARBONATED WATER OUT TO 12a

FIG. 4

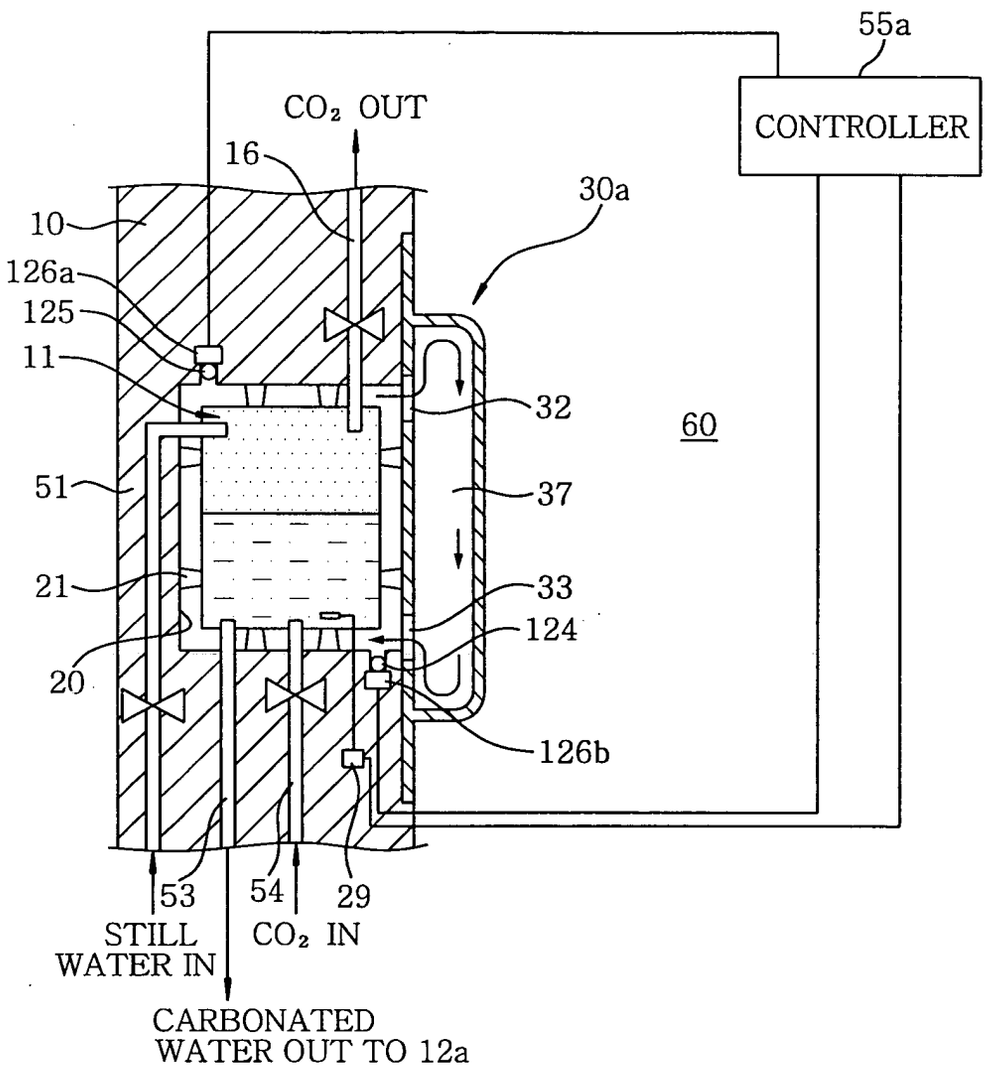
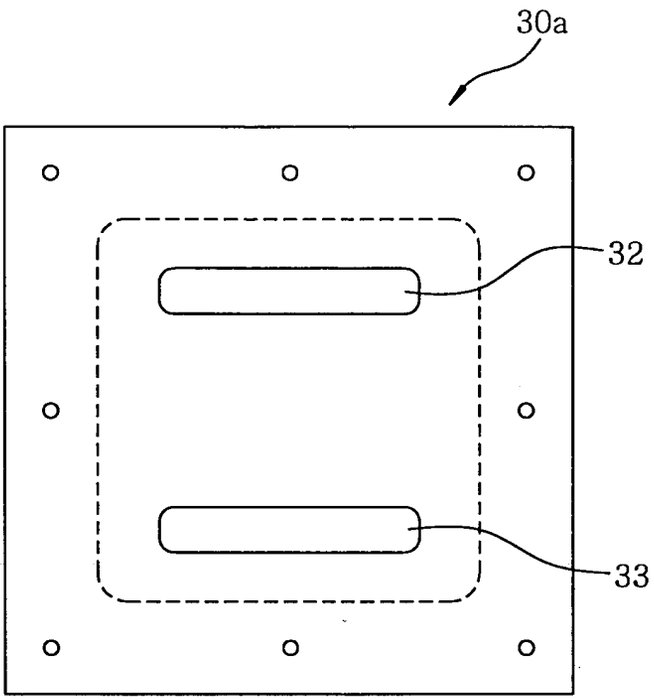

55a
CONTROLLER
CO_2 OUT
16
30a
10
126a
125
11
32
60
51
37
21
33
124
20
126b
53
54
29
STILL WATER IN
CO_2 IN
CARBONATED WATER OUT TO 12a

FIG.5



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EUROPEAN SEARCH REPORT

Application Number
EP 05 00 6582

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 5 484 538 A (WOODWARD ET AL) 16 January 1996 (1996-01-16) * column 5, line 43 - column 8, line 10; figures 2B,3A-3F * -----	1,6	F25D23/12
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

F25D
B67D
B67C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	14 July 2005	Jessen, F

CATEGORY OF CITED DOCUMENTS

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