



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
21.12.2016 Bulletin 2016/51

(51) Int Cl.:
F25C 5/00 (2006.01) F25D 23/02 (2006.01)

(21) Application number: **15186862.7**

(22) Date of filing: **25.09.2015**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
MA

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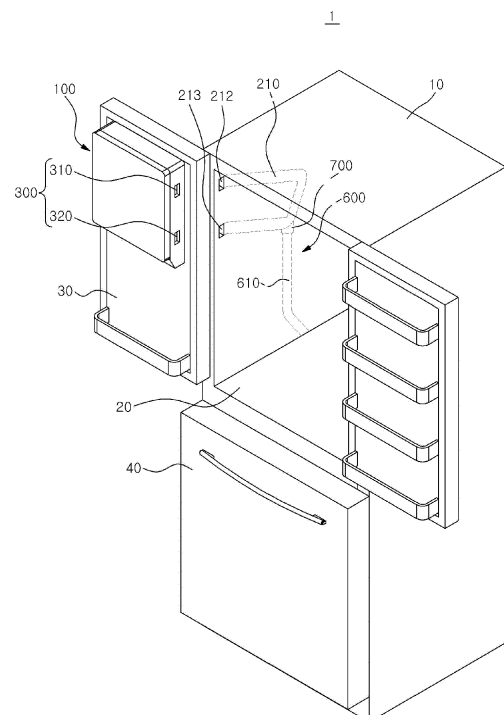
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(30) Priority: **16.06.2015 KR 20150085275**

(54) **ICE MAKING SYSTEM AND METHOD FOR A REFRIGERATOR**

(57) Ice making system and method for a refrigerator is disclosed. The ice making system includes an ice making unit (100) that makes ice cubes; a cold air generator (200) that cools air inside a cooling duct (210) so as to produce cold air; a cold air circulation unit (300) that supplies the cold air from the cold air generator to the ice making unit, and discharges the cold air from the ice making unit to the cold air generator; and an opening/closing unit (700) that discharges defrost water produced from the cooling duct to an outside.

FIG. 1



Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority to and the benefit of the Republic of Korea Patent Application Serial Number 10-2015-0085275, having a filing date of June 16, 2015, filed in the Korean Intellectual Property Office, the disclosure of which is herein incorporated by reference in its entirety.

FIELD OF THE INVENTION

[0002] The present invention relates to an ice making system and method for a refrigerator.

BACKGROUND

[0003] A refrigerator unit is an apparatus intended to store food items at low temperatures. The refrigerator unit may store foods in a frozen or refrigerated state according to the types of food intended to be stored.

[0004] The interior of the refrigerator unit is cooled by cold air that is constantly supplied. The cold air is constantly generated through a heat exchanging operation with a refrigerant based on a refrigeration cycle. The cycle includes a process of compression-condensation-expansion-evaporation that are sequentially performed. The cold air supplied to the inside of the refrigerator unit is evenly distributed due to convection of air to store food, drink, and other items within the refrigerator unit at desired temperatures.

[0005] In general, a main body of the refrigerator unit has a rectangular, hexahedral shape which is open at a front surface. The front surface may provide access to a refrigeration compartment and a freezer compartment defined within the body of the refrigerator unit. Further, hinged doors may be fitted to the front side of the refrigerator body in order to selectively open and/or close openings to the refrigeration compartment and the freezer compartment. In addition, a number of drawers, racks, shelves, storage boxes, and the like may be provided in the refrigeration compartment and the freezer compartment within the refrigerator unit that are configured for optimally storing various foods, drinks, and other items within a storage space inside the refrigerator unit.

[0006] Conventionally, refrigerator units were configured as a top mount type in which a freezer compartment is positioned above a refrigeration compartment. Recently, bottom freezer type refrigerator units position the freezer compartment below the refrigeration compartment to enhance user convenience. In the bottom freezer type refrigerator unit, the more frequently used refrigeration compartment is advantageously positioned at the top so that a user may conveniently access the compartment without bending over at the waist, as previously required by the top mount type refrigerator unit. The less frequently used freezer compartment is positioned at the

bottom.

[0007] However, a bottom freezer type refrigerator unit may lose its design benefits when a user wants to access the lower freezer compartment on a more frequent basis.

For example, prepared ice that is stored in the freezer compartment may be a popular item accessed frequently by a particular user. In a bottom freezer type refrigerator unit, since the freezer compartment is positioned below the refrigeration compartment, the user would have to bend over at the waist in order to open the freezer compartment door to access the ice.

[0008] In order to solve such a problem, bottom freezer type refrigerators may include a dispenser configured for dispensing ice that is provided in a refrigeration compartment door. In this case, the ice dispenser is also positioned in the upper portion of the refrigerator unit, and more specifically is located above the freezer compartment. In this case, an ice maker for generating ice may be provided in the refrigeration compartment door or in the interior of the refrigeration compartment.

[0009] For example, in a bottom freezer type refrigerator having an ice making device in the refrigeration compartment door, cold air that has been produced by an evaporator is divided and discharged both into the freezer compartment and into the refrigeration compartment. Here, cold air that was discharged into the freezer compartment flows to the ice making device via a cold air supply duct arranged in a sidewall of the body of the refrigerator unit, and then freezes water while circulating inside the ice making device. Thereafter, the cold air is discharged from the ice making device into the refrigeration compartment via a cold air restoration duct arranged in the sidewall of the body of the refrigerator unit, so the cold air can reduce the temperature inside the refrigeration compartment.

[0010] However, because cold air flows through multiple ducts when making ice cubes using the ice making device in the above-mentioned refrigerator, the efficiency of the refrigerator unit may be lessened. That is, because cold air flows to the ice making device via the cold air supply duct, and then flows from the ice making device to the refrigeration compartment via the cold air restoration duct, the efficiency of supplying cold air for the refrigerator unit may be less than optimum.

[0011] Further, frost may be produced in both the cold air supply duct and the cold air restoration duct due to the cold air. When the cold air supply duct and the cold air restoration duct are not sufficiently defrosted, the cold air may not be efficiently supplied to the ice making device and the refrigeration compartment, in part due to blockage. This may cause a problem in that an excessive amount of electricity may be wasted during the operation of the refrigerator to overcome the affects of frost.

SUMMARY

[0012] In view of the above, therefore, embodiments of the present invention provide an ice making system

and method for a refrigerator unit in which cold air produced from a cooling duct can be efficiently used to make ice cubes, and from which defrost water produced from the cooling duct can be efficiently drained to the outside.

[0013] Embodiments of the present invention can also provide an ice making system and method for a refrigerator unit that can efficiently intercept outside hot air using an opening/closing unit of the cooling duct, and can increase cooling efficiency of the refrigerator unit by draining defrost water produced to the outside of the cooling duct.

[0014] In one embodiment of the present invention, there is provided an ice making system for a refrigerator unit, including: an ice making unit that makes ice cubes; a cold air generator that cools air inside a cooling duct so as to produce cold air; a cold air circulation unit that supplies the cold air from the cold air generator to the ice making unit and discharges the cold air from the ice making unit to the cold air generator; and an opening/closing unit that discharges defrost water produced from the cooling duct to the outside.

[0015] Advantages of embodiments of the present invention include the ability of a refrigerator unit to efficiently defrost the cooling duct and efficiently drain defrost water produced during the defrosting process to the outside of the cooling duct.

[0016] Another advantage of embodiments of the present invention includes the ability of a refrigerator unit to efficiently intercept outside hot air using the opening/closing unit of the cooling duct, and to increase the cooling efficiency of the refrigerator unit by draining defrost water produced from the refrigerator to the outside.

[0017] A further advantage of embodiments of the present invention include the ability of a refrigerator unit to make ice cubes using the cold air directly produced from the cooling duct, thereby increasing the efficiencies of making ice and supplying cold air.

[0018] Still another advantage of embodiments of the present invention include the ability of a refrigerator unit to circulate the cold air only a short distance within an ice making space defined between the cooling duct and the refrigeration compartment door, when compared to a conventional technique in which cold air produced from the lower part of a refrigerator unit flows to an ice making space defined in a refrigeration compartment door located in the upper part of the refrigerator unit. As such, embodiments of the present invention can reduce the loss of cold air when making ice by reducing the distance of travel of cold air, thereby increasing the efficiency of the ice making unit, and saving electricity during the operation of the refrigerator unit.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The accompanying drawings, which are incorporated in and form a part of this specification and in which like numerals depict like elements, illustrate embodiments of the present disclosure and, together with

the description, serve to explain the principles of the disclosure.

FIG. 1 is a perspective view of a refrigerator unit showing an ice making system, in accordance with one embodiment of the present disclosure.

FIG. 2 is a view showing a connection between an ice making unit and a cooling duct of a cold air generator in the ice making system for a refrigerator unit, in accordance with one embodiment of the present disclosure.

FIG. 3 is a cross-sectional view showing an internal construction of an ice making system for a refrigerator unit, in accordance with one embodiment of the present disclosure.

FIG. 4 is a block diagram illustrating a cold air generator implementing a refrigeration cycle of an ice making system for a refrigerator unit, in accordance with one embodiment of the present disclosure.

FIG. 5 is a perspective view showing an opening/closing unit of an ice making system for a refrigerator unit, in accordance with one embodiment of the present disclosure.

FIG. 6 is a sectional view taken along line A--A of FIG. 5, in accordance with one embodiment of the present disclosure.

FIG. 7 is a sectional view showing an operation of the opening/closing unit of the ice making system based on the line A--A of FIG. 5, in accordance with one embodiment of the present disclosure.

FIG. 8 is a perspective view illustrating another opening/closing unit of an ice making system for a refrigerator unit, in accordance with one embodiment of the present disclosure.

FIG. 9 is a sectional view taken along line B--B of FIG. 8, in accordance with one embodiment of the present disclosure.

FIG. 10 is a flow diagram illustrating a method for making ice within a refrigerator unit, in accordance with one embodiment of the present disclosure.

DETAILED DESCRIPTION

[0020] Reference will now be made in detail to the various embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings. While described in conjunction with these embodiments, it will be understood that they are not intended to limit the disclosure to these embodiments. On the contrary,

the disclosure is intended to cover alternatives, modifications and equivalents, which may be included within the spirit and scope of the disclosure as defined by the appended claims. Furthermore, in the following detailed description of the present disclosure, numerous specific details are set forth in order to provide a thorough understanding of the present disclosure. However, it will be understood that the present disclosure may be practiced without these specific details. In other instances, well-known methods, functions, constituents, procedures, and components have not been described in detail so as not to unnecessarily obscure aspects and/or features of the present disclosure.

[0021] FIG. 1 is a perspective view showing an ice making system for a refrigerator unit, in accordance with one embodiment of the present disclosure. FIG. 2 is a view showing a connection between an ice making unit and a cooling duct of a cold air generator in the ice making system for the refrigerator unit of FIG. 1, in accordance with one embodiment of the present disclosure. FIG. 3 is a cross-sectional view showing an internal construction of an ice making system for the refrigerator unit of FIG. 1, in accordance with one embodiment of the present disclosure.

[0022] As shown in FIGS. 1 to 3, the ice making system for the refrigerator unit according to exemplary embodiments of the present invention can make ice cubes by freezing water using cold air produced from a cooling duct 210, and can efficiently drain defrost water produced from the cooling duct to the outside.

[0023] In particular, the refrigerator unit 1 may include a refrigerator body 10 that defines an external appearance or exterior. A barrier 20 is configured for dividing the interior cavity of the refrigerator body 10 into a refrigeration compartment at the top thereof, and a freezer compartment at the bottom thereof. One or more doors may be configured to selectively isolate the interiors of the compartments from the surrounding environment. For example, a pair of refrigeration compartment doors 30 may be hinged to opposite edges of the front of the refrigeration compartment, and are configured through rotation thereof to selectively open and close the refrigeration compartment. A freezer compartment door 40 may be hinged to an edge of the front of the freezer compartment, and is configured through rotation thereof to selectively open and close the freezer compartment.

[0024] Although the refrigerator unit 1 of exemplary embodiments of the present invention is a bottom freezer type refrigerator in which the freezer compartment is provided in the lower part of the refrigerator body, it should be understood that the present invention may be adapted to various types of refrigerators without being limited to the bottom freezer type refrigerator

[0025] The ice making system of the present invention includes an ice making unit 100, a cold air generator 200, a cold air circulation unit 300, a drainage unit 600, and an opening/closing unit 700.

[0026] Described in detail, the ice making unit 100

changes the phase of water to ice using cold air. The ice making unit may be provided on an inner surface of the refrigeration compartment door 30. Although the ice making unit 100 of the present embodiment is provided on the upper part or portion of the refrigeration compartment door 30, the location is provided merely for illustration purposes only. It should be understood that the ice making unit 100 may be provided on another position of the refrigeration compartment door 30, in a different position within the interior of the refrigeration compartment, and the like.

[0027] The ice making unit 100 may include an ice making cabinet 110, an ice maker 120, and an ice bank 130.

[0028] In particular, the ice making cabinet 110 may be provided on the inside surface of the refrigeration compartment door 30, and may define an ice making space 111 in which ice cubes are produced. The ice maker 120 can freeze water using cold air flowing into the ice making space 111, such as when making ice cubes. The ice maker 120 can discharge the ice cubes into the ice bank 130. The ice bank 130 is provided at a location below the ice maker 120 and is configured to receive ice cubes discharged from the ice maker 120. The ice bank 130 can store the ice cubes discharged from the ice maker 120, and can dispense ice cubes to users using an ice dispenser unit (not shown).

[0029] The cold air circulation unit 300 functions to introduce cold air from the cold air generator 200 into the ice making space 111 of the ice making unit 100. The cold air circulation unit 300 may also be configured to discharge the cold air from the ice making space 111 to the cold air generator 200, to undergo a new refrigeration cycle.

[0030] For example, the cold air circulation unit 300 may include an inlet hole 310 provided on an upper part of the ice making unit 100 and an outlet hole provided on a lower part of the ice making unit 100. The inlet hole 310 in the ice making unit 100 may be provided at a location corresponding to a first duct hole 212 of the cooling duct 210. The outlet hole 320 may be provided at a location corresponding to a second duct hole 213 of the cooling duct 210. A circulation fan 330 may be configured to circulate cold air from the inlet hole 310 to the outlet hole 320 through the ice making unit 100.

[0031] Accordingly, when the refrigeration compartment door 30 is closed onto the refrigerator body 10, the cold air inside the cooling duct 210 flows into the inlet hole 310 of the ice making unit 100 via the first duct hole 212. In the ice making unit 100, the cold air introduced from the cooling duct 210 circulates inside the ice making space 111 by operation of the circulation fan 330. In that manner, water contained inside the ice making space 111 gradually freezes, and given enough refrigeration cycles ice cubes may be formed. Thereafter, the cold air circulating inside the ice making unit 100 may be discharged into the second duct hole 213 of the cooling duct 210 via the outlet hole 320. The cold air discharged from the ice making unit 100 is cooled again inside the cooling

duct 210 prior to being reintroduced into the inlet hole 310, via the first duct hole 212, of the ice making unit 100.

[0032] The drainage unit 600 can efficiently drain defrost water produced from the cooling duct 210 to the outside.

[0033] To this end, the drainage unit 600 may include a hollow drain hose 610 through which defrost water can flow from the cooling duct 210 to be drained. A defrost water tray 50 is configured to collect the defrost water drained from the drain hose 610. In particular, the drain hose 610 may be connected to a lower bent portion of the U-shaped cooling duct 210, such that the upper end of the drain hose 610 communicates and/or connects with the cooling duct 210. Thus, the drain hose 610 can efficiently drain the defrost water discharged from the cooling duct 210 onto the defrost water tray 50

[0034] FIG. 4 is a block diagram illustrating a cold air generator 200 of the ice making system for the refrigerator unit 1 of FIGS. 1-3, in accordance with one embodiment of the present disclosure.

[0035] As shown in FIG. 4, the cold air generator 200 can cool air flowing through the cooling duct 210, thereby producing cold air. The cold air generator 200 can supply the cold air to the ice making unit 100. The cold air generator 200 may be provided inside the refrigerator body 10 of the refrigerator unit 1. More specifically, the cold air generator 200 may be provided on the sidewall of the refrigerator body 10, in one embodiment. In another embodiment, the cold air generator 200 may be provided in the lower part of the refrigerator body 10.

[0036] The cold air generator 200 includes the cooling duct 210 that is provided in the sidewall of the refrigerator body. The cooling duct is configured to form a cooling line through which air flows. An evaporation coil 220 is configured to be wound around the cooling duct 210, such that the air inside and traveling through the cooling duct is cooled by a heat exchanging operation between the air and a refrigerant. A compressor 230 is configured to compresses the refrigerant discharged from the evaporation coil 220 so as to change the refrigerant to a high temperature and high pressure vapor or gas refrigerant. A condenser 240 is configured to condense the gas refrigerant so as to change the gas refrigerant to a high pressure liquid refrigerant. An expansion valve 250 is configured to perform adiabatic expansion of the liquid refrigerant, and supplies the liquid refrigerant to the evaporation coil 220. A heater (not shown) is configured to defrost the cooling duct 210 by heating the duct 210, thereby producing defrost water.

[0037] In particular, the first duct hole 212 may be provided on the upper end of the cooling duct 210, such that the first duct hole 212 can communicate with, or is connected to, the inlet hole 310 of the ice making unit 100 when the refrigeration compartment door 30 is closed. The second duct hole 213 may be provided on the lower end of the cooling duct 210, such that the second duct hole 213 can communicate with, or is connected to, the outlet hole 320 of the ice making unit 100 when the re-

frigeration compartment door 30 is closed. Further, the heater may include a heat transfer tape the covers the outer surface of the cooling duct 210, so as to provide heat to the cooling duct 210.

[0038] In some embodiments, the compressor 230, the condenser 240, the expansion valve 250, and the evaporation coil 220 are configured to implement a refrigeration cycle for the purpose of supplying cold air. The refrigeration cycle composed of four processes (e.g., compression, condensation, expansion, and evaporation) is performed in which a heat exchanging operation between air and refrigerant is implemented. Accordingly, air inside the cooling duct 210 may be cooled to become cold air by a heat exchanging operation performed, in part, between the air inside the cooling duct 210 and the refrigerant inside the evaporation coil 220. In particular, the evaporation coil 220 cools the cooling duct 210 through heat conduction. Further, the cooling channel defined by and within the cooling duct 210 is sufficiently long such that air inside the cooling line can be efficiently cooled. As such, when the air flows through the cooling line for a predetermined period of time (dependent in part on the length of and flow of air through the cooling duct 210), the air can be cooled to a predetermined temperature (for example, 14 degrees Fahrenheit below zero or lower) at which the cold air can efficiently make ice cubes.

[0039] In one embodiment, the compressor 230, the condenser 240, and the expansion valve 250 may form a refrigeration cycle that can be implemented to supply cold air to both the refrigeration compartment and the freezer compartment of the refrigerator unit 1.

[0040] FIG. 5 is a perspective view showing the construction of an opening/closing unit of an ice making system for a refrigerator unit 1 of FIGS. 1 to 3, in accordance with one embodiment of the present disclosure. FIG. 6 is a cross-sectional view taken along line A-A of FIG. 5, in accordance with one embodiment of the present disclosure. FIG. 7 is a cross-sectional view showing an operation of the opening/closing unit 700 taken along line A-A of FIG. 5, in accordance with one embodiment of the present disclosure.

[0041] As shown in FIGS. 5 to 7, the opening/closing unit 700 is configured to intercept outside hot air. The opening/closing unit 700 is configured to drain defrost water produced from the cooling duct 210 to the outside. In particular, the opening/closing unit 700 is configured to drain defrost water produced from the interior of the refrigerator unit 1 to the outside of the cooling duct 210, thereby increasing the cooling efficiency of the refrigerator unit 1.

[0042] Specifically, the opening/closing unit 700 may include a cap 710 arranged in a lowermost part of the cooling duct 210, such that the cap 710 communicates with and/or connects to the cooling duct 210. A lid 720 is connected to a predetermined portion of the cap 710. In particular, the lid 720 of the cap 710 is opened by a weight of defrost water draining from cooling duct 210. The lid 720 can be elastically returned to an original po-

sition thereof after the defrost water is discharged, thereby closing the cap 710.

[0043] In particular, a gap may be formed between the inner circumference of the cap 710 and the outer circumference of the lid 720. When the cold air inside the cooling duct 210 is cooled, the gap may become frosted, so the cold air may not be effectively and/or efficiently discharged through the frosted gap. To defrost the gap, the cooling duct 210 is heated by a heater. Thus, defrost water is produced from the cooling duct 210.

[0044] Although the opening/closing unit 700 of the exemplary embodiment is configured as a cap combined with and/or connected to the upper end of the drain hose 610, it is noted that the construction of the opening/closing unit 700 may be changed without being limited to the cap structure in other embodiments. In these other embodiments, the opening/closing unit 700 may be configured such that the unit 700 can elastically restore an original shape thereof using an elastic member.

[0045] Further, the opening/closing unit 700 may be configured as an openable cap configured to open or close a hole that is formed in the lowermost part of the cooling duct 210. In that manner, the opening/closing unit 700 is configured to communicate with the cooling duct 210. For example, the opening/closing unit 700 may be configured as a cap that is provided in the lowermost part of the cooling duct 210, so as to communicate with and/or connect to the cooling duct 210. A lid connected to the cap is configured to selectively open the cap in response to a weight of defrost water. In this case, the opening/closing unit 700 may be provided with a drain hose.

[0046] FIG. 8 is a perspective view showing an alternate construction of an opening/closing unit of an ice making system for a refrigerator unit 1 of FIGS. 1-3, in accordance with one embodiment of the present disclosure. FIG. 9 is a cross-sectional view taken along line B--B of FIG. 8, in accordance with one embodiment of the present disclosure.

[0047] As shown in FIGS. 8 and 9, in the opening/closing unit 700', a cap 710' may be provided with a stop rim 711 that protrudes radially inwards from the outside edge of the cap 710'.

[0048] In particular, a lid 720' may be provided in of the opening/closing unit 700' in such a way that the edge of the lid 720' overlaps with the stop rim 711 of the cap 710'. Further, a water collecting space 712, configured to temporarily collect defrost water therein, may be defined on an upper surface of the lid 720'. When a predetermined amount of defrost water is contained in the water collecting space 712, the lid 720' opens the cap 710' due to the weight of the defrost water, thus discharging the defrost water. After the defrost water is discharged, the lid 720' is elastically returned to an original position thereof, thus closing the cap 710'.

[0049] FIG. 10 is a flow diagram illustrating method for making ice in a refrigerator unit, in accordance with one embodiment of the present disclosure.

[0050] As shown in FIG. 10, the ice making method for

the refrigerator unit may include: a step of cooling air using the cooling duct so as to produce cold air (S100); a step of supplying the cold air to the ice making unit so as to make ice cubes (S200); a step of discharging the cold air from the ice making unit to the cooling duct (S300); a step of cooling the discharged cold air again in the cooling duct (S400); a step of defrosting the cooling duct by heating the cooling duct, thereby producing defrost water (S500); a step of opening the opening/closing unit provided in a lowermost part of the cooling duct (S600); and a step of draining the defrost water discharged from the opening/closing unit to the outside (S700) of the cooling duct.

[0051] In the step of cooling air using the cooling duct so as to produce cold air (S100), air is cooled to become cold air by making the air flow through the cooling duct on which the evaporation coil is wound. In this case, the air inside the cooling duct flows through the cooling line for a predetermined period of time while losing heat by the refrigerant flowing in the evaporation coil. In that manner, the air discharged from the cooling line can be cooled to a predetermined temperature (for example, 14 degrees Fahrenheit below zero or lower) at which the cold air can efficiently make ice cubes.

[0052] In the step of supplying the cold air to the ice making unit so as to make ice cubes (S200), the cold air cooled in the cooling duct is supplied to the ice making space of the ice making unit through the inlet hole of the ice making unit. In particular, the cold air supplied to the ice making space circulates in the ice making space by operation of the circulation fan, and can freeze water contained inside the ice making space, thereby making ice cubes.

[0053] In the step of discharging the cold air from the ice making unit to the cooling duct (S300), the cold air is discharged from the ice making space into the cooling duct through the outlet hole of the ice making unit.

[0054] In the step of cooling the discharged cold air again in the cooling duct (S400), the cold air discharged into the cooling duct flows through the cooling line of the cooling duct for a predetermined period of time, thereby being cooled to a predetermined temperature or lower at which the cold air can freeze water to make ice cubes.

[0055] In the step of defrosting the cooling duct by heating the cooling duct, thereby producing the defrost water (S500), the heater is operated to defrost the cooling duct. In particular, the heater may be configured as a heat transfer tape that covers the surface of the evaporation coil. However, it should be understood that various heating units configured to heat the cooling duct may be used as the heater, without being limited to the heat transfer tape covering the surface of the evaporation coil.

[0056] In the step of opening the opening/closing unit provided in the lowermost part of the cooling duct (S600), the lid of the opening/closing unit is opened by the weight of defrost water. When the defrost water is discharged through the cap of the opening/closing unit, the lid is elastically returned to an original position thereof, thereby

closing the cap.

[0057] In the step of draining the defrost water discharged from the opening/closing unit to the outside (S700), the defrost water discharged from the opening/closing unit is drained to the outside of the cooling duct. Here, the defrost water produced from the defrosted cooling duct is drained to the defrost water tray provided in a machine room of the refrigerator unit through the drain hose extending from the lower end of the cooling duct.

[0058] The foregoing description, for purpose of explanation, has been described with reference to specific embodiments of an ice maker and a method for deodorizing the same. However, the illustrative discussions above are not intended to be exhaustive or to limit the invention to the precise forms disclosed. It should be construed that the present invention has the widest range in compliance with the basic idea disclosed in the invention. Many modifications and variations are possible in view of the above teachings. Although it is possible for those skilled in the art to combine and substitute the disclosed embodiments to embody the other types that are not specifically disclosed in the invention, they do not depart from the scope of the present invention as well. The embodiments were chosen and described in order to best explain the principles of the invention and its practical applications, to thereby enable others skilled in the art to best utilize the invention. Further, 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.

[0059] The process parameters and sequence of steps described and/or illustrated herein are given by way of example only and can be varied as desired. For example, while the steps illustrated and/or described herein may be shown or discussed in a particular order, these steps do not necessarily need to be performed in the order illustrated or discussed. The various example methods described and/or illustrated herein may also omit one or more of the steps described or illustrated herein or include additional steps in addition to those disclosed.

[0060] Embodiments according to the invention are thus described. While the present disclosure has been described in particular embodiments, it should be appreciated that the invention should not be construed as limited by such embodiments.

Claims

1. An ice making system for a refrigerator, the ice making system comprising:

an ice making unit that makes ice cubes;
a cold air generator that cools air inside a cooling duct so as to produce cold air;
a cold air circulation unit that supplies the cold air from the cold air generator to the ice making

unit and discharges the cold air from the ice making unit to the cold air generator; and
an opening/closing unit that discharges defrost water produced from the cooling duct to an outside.

2. The ice making system for the refrigerator according to Claim 1, wherein the opening/closing unit comprises:

a cap provided in a lowermost part of the cooling duct such that the cap communicates with the cooling duct; and
a lid connected to a predetermined portion of the cap such that the lid opens the cap in response to a weight of the defrost water.

3. The ice making system for the refrigerator according to Claim 1, wherein the opening/closing unit includes an elastic member elastically restoring an original shape of the opening/closing unit.

4. The ice making system for the refrigerator according to Claim 1, further comprising:

a drainage unit that drains the defrost water discharged from the opening/closing unit to the outside through a drain hose communicating with the opening/closing unit.

5. The ice making system for the refrigerator according to Claim 4, wherein the opening/closing unit comprises:

a cap provided in a lowermost part of the cooling duct such that the cap communicates with the cooling duct, the cap being combined with an upper end of the drain hose; and
a lid connected to a predetermined portion of the cap such that the lid opens the cap in response to a weight of the defrost water.

6. The ice making system for the refrigerator according to Claim 5, wherein the cap is provided with a stop rim that protrudes from an edge of the cap such that the stop rim overlaps with an edge of the lid.

7. The ice making system for the refrigerator according to Claim 1, wherein the cold air generator comprises:

the cooling duct through which the air flows;
an evaporation coil wound around the cooling duct such that the air is cooled by a heat exchanging operation between the air and a refrigerant;
a compressor that compresses the refrigerant discharged from the evaporation coil so as to change the refrigerant to a high temperature and

- high pressure gas refrigerant;
 a condenser that condenses the gas refrigerant
 so as to change the gas refrigerant to a high
 pressure liquid refrigerant;
 an expansion valve that performs adiabatic ex- 5
 pansion of the liquid refrigerant and supplies the
 refrigerant to the evaporation coil; and
 a heater that defrosts the cooling duct by heating
 the cooling duct, thereby producing the defrost
 water.
8. The ice making system for the refrigerator according
 to Claim 1, wherein the ice making unit comprises:
- an ice making cabinet defining an ice making
 space;
 an ice maker making the ice cubes using the
 cold air; and
 an ice bank storing the ice cubes.
9. The ice making system for the refrigerator according
 to Claim 1, wherein the cold air generator comprises:
- an inlet hole provided on an upper part of the 25
 ice making unit such that the cold air flows from
 the cooling duct into the ice making unit;
 an outlet hole provided on a lower part of the ice
 making unit such that the cold air is discharged
 from the ice making unit into the cooling duct;
 and 30
 a circulation fan that circulates the cold air from
 the inlet hole to the outlet hole.
10. The ice making system for the refrigerator according
 to Claim 1, wherein: 35
- the cooling duct is provided in a refrigerator
 body, and the ice making unit is provided on a
 refrigeration compartment door of the refrigera- 40
 tor; and
 the cooling duct communicates with the ice mak-
 ing unit when the refrigeration compartment
 door is closed.
11. The ice making system for the refrigerator according 45
 to Claim 7, wherein the evaporation coil functions as
 an evaporator of a refrigeration cycle, and cools the
 cooling duct through heat conduction.
12. An ice making method for a refrigerator, the method 50
 comprising:
- cooling air using a cooling duct so as to produce
 cold air;
 supplying the cold air to an ice making unit so 55
 as to make ice cubes;
 discharging the cold air from the ice making unit
 to the cooling duct;
- cooling the discharged cold air again in the cool-
 ing duct;
 defrosting the cooling duct by heating the cool-
 ing duct, thereby producing defrost water;
 opening an opening/closing unit provided in a
 lowermost part of the cooling duct; and
 draining the defrost water discharged from the
 opening/closing unit to an outside.
13. The ice making method for the refrigerator according
 to claim 12, wherein in the opening of the open-
 ing/closing unit provided in the lowermost part of the
 cooling duct, a lid of the opening/closing unit is
 opened by a weight of the defrost water.
14. The ice making method for the refrigerator according
 to claim 12, wherein in the cooling of the air using
 the cooling duct so as to produce the cold air, the air
 flows through a cooling line of the cooling duct for a
 predetermined lengthy period of time, thereby being
 cooled to a predetermined temperature or lower and
 producing the cold air.
15. A refrigerator, comprising:
- a freezer compartment located within a main
 body of the refrigerator;
 a refrigeration compartment located within the
 main body of the refrigerator, wherein the freez-
 er compartment is located below the refrigera-
 tion compartment;
 an ice making unit that makes ice cubes;
 a cold air generator that cools air inside a cooling
 duct so as to produce cold air;
 a cold air circulation unit that supplies the cold
 air from the cold air generator to the ice making
 unit and discharges the cold air from the ice mak-
 ing unit to the cold air generator; and
 an opening/closing unit that discharges defrost
 water produced from the cooling duct to an out-
 side.

FIG. 1

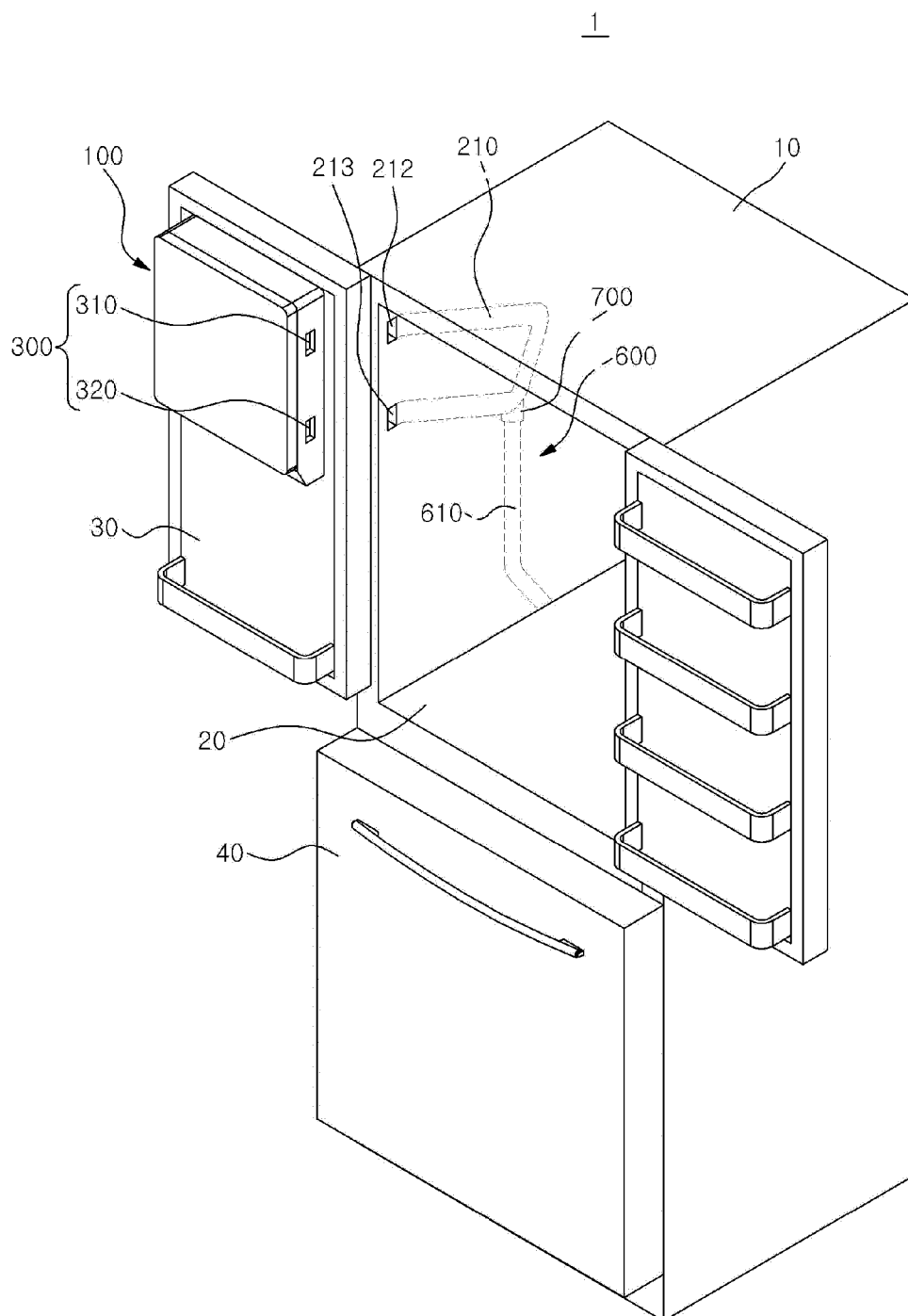


FIG. 2

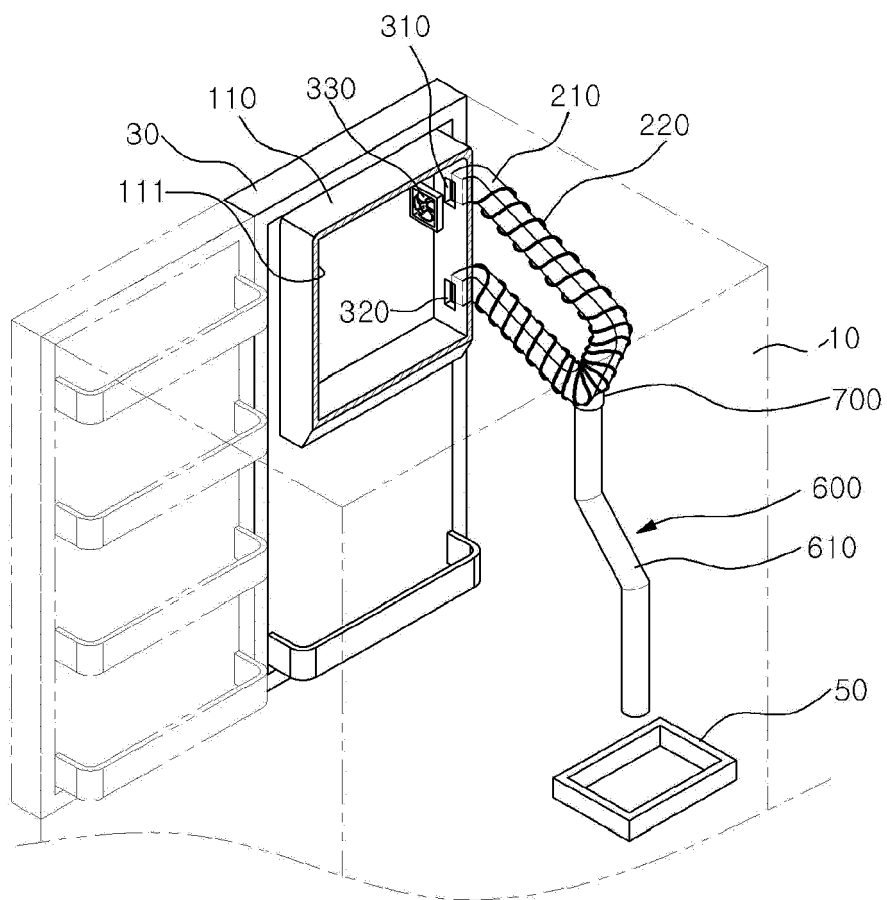


FIG. 3

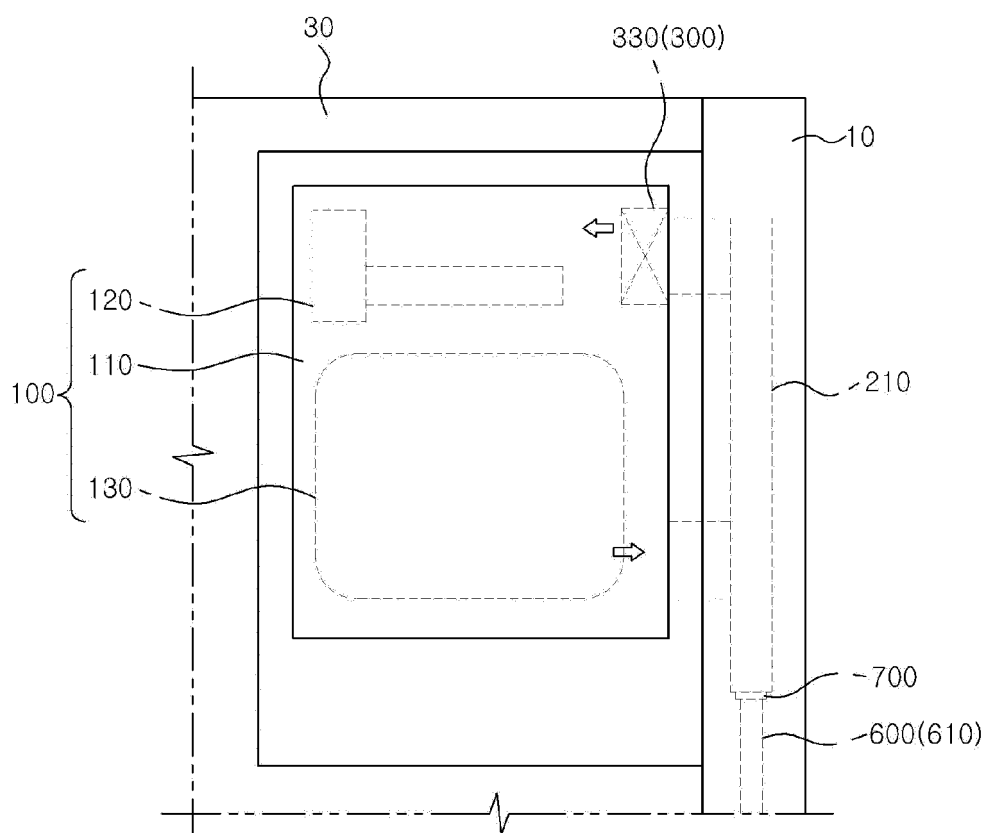


FIG. 4

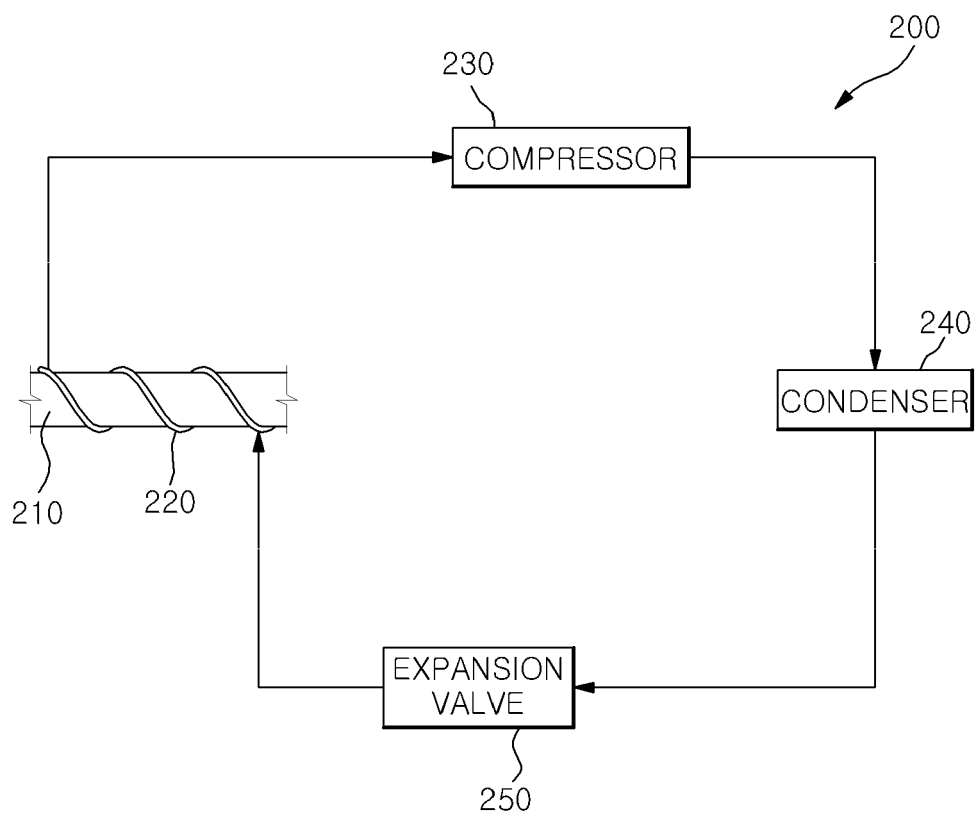


FIG. 5

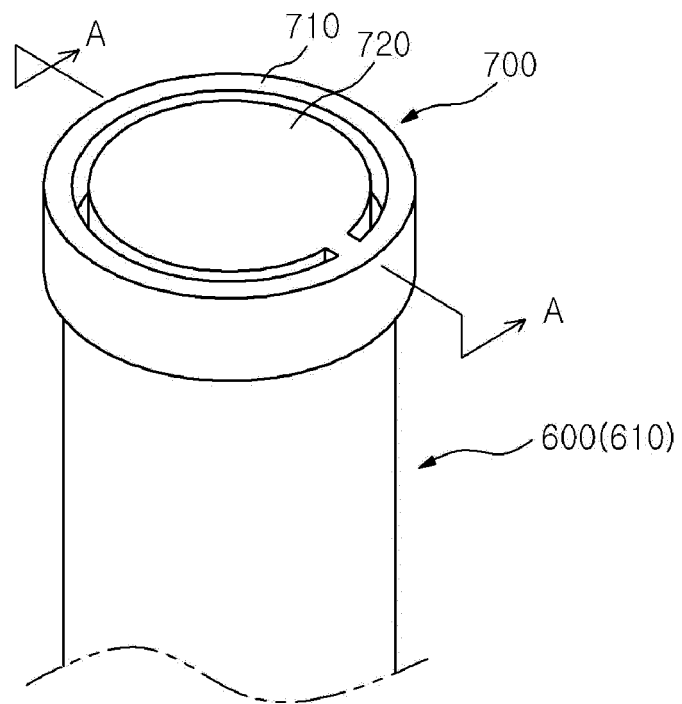


FIG. 6

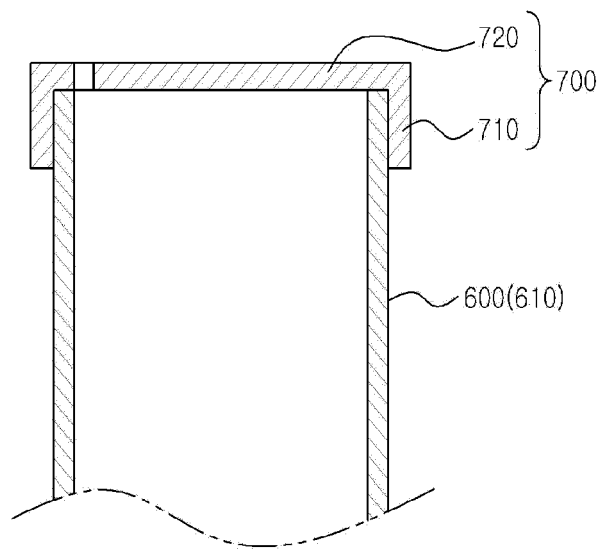


FIG. 7

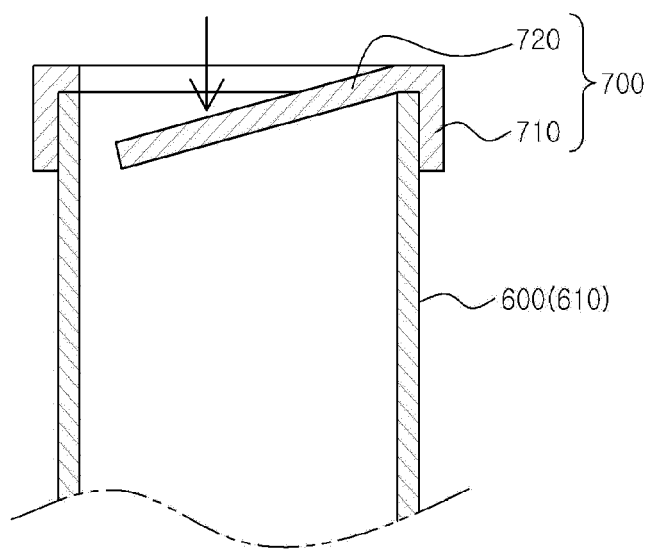


FIG. 8

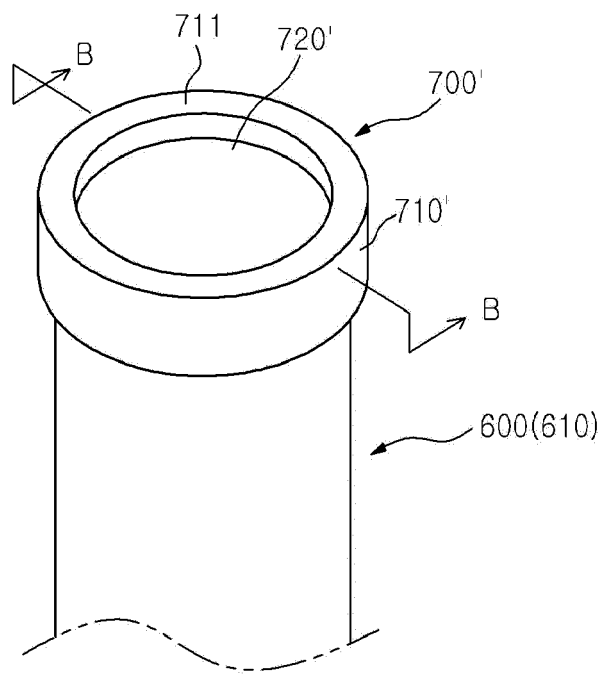


FIG. 9

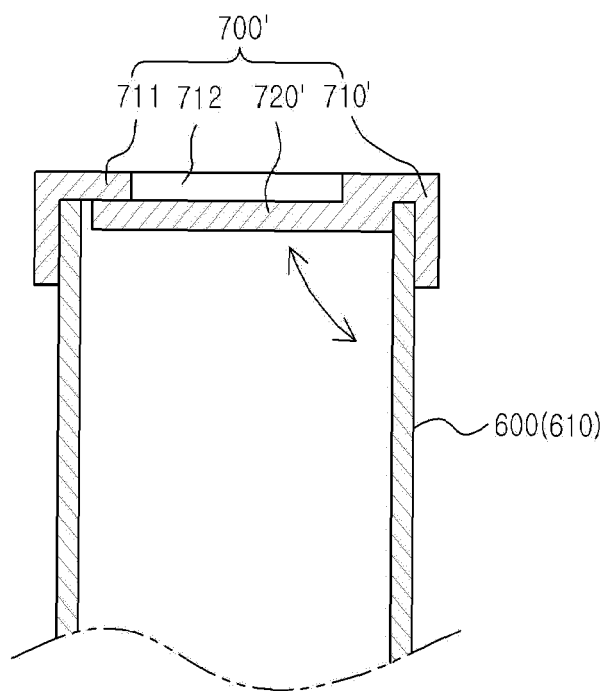
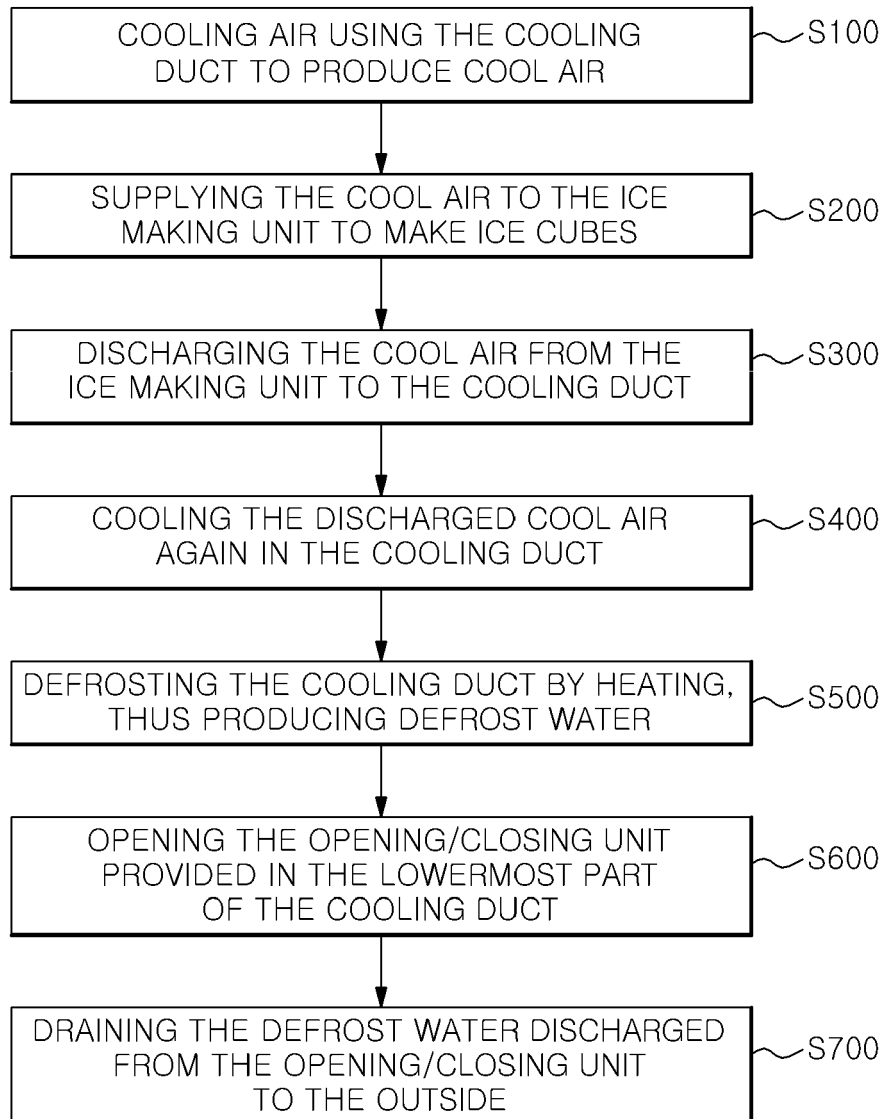


FIG. 10



EUROPEAN SEARCH REPORT

Application Number
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Place of search The Hague		Date of completion of the search 2 November 2016	Examiner Canköy, Necdet
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