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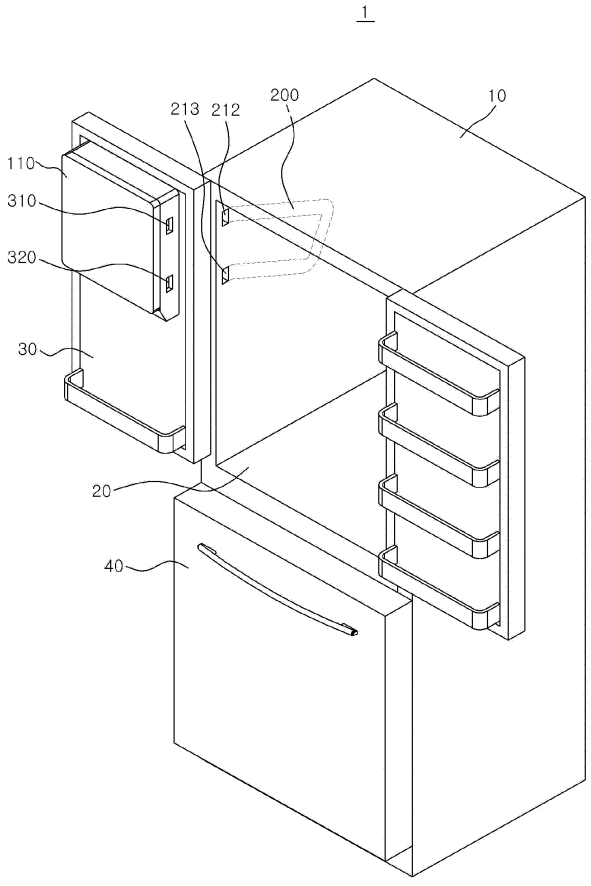
(54) REFRIGERATOR AND ICE MAKING METHOD THEREOF

(57) Refrigerator and an ice making method thereof are disclosed. The refrigerator, comprises a main body (10) configured to form an appearance of the refrigerator, a storage space installed within the main body, a door (30) configured to open and close the storage space, an ice making chamber (100) provided in the door, a cooling duct (210) configured to allow cooling air to be movable in a longitudinal direction, and provided in the main body to have both ends connected to the ice making chamber such that the cooling air circulates in the ice making chamber, and an evaporation coil (220) installed on the cooling duct and configured to cool air to the cooling air through heat exchange with a refrigerant.

FIG. 4



EP 3 106 797 A1

Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is based on and claims priority from Korean Patent Application No. 10-2015-0085584, filed on June 17, 2015, the disclosure of which is incorporated herein in its entirety by reference.

Field of the Invention

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

Background of the Invention

[0003] A Refrigerator, which is a device intended to store food items at low temperatures, may be configured to refrigerate or freeze food items depending on the types of food to be stored.

[0004] The inside of a refrigerator is cooled by continuously supplied cooling air and cooling air is continuously generated through a heat exchanging operation of a refrigerant based on a refrigerating cycle including a process of compression-condensation-expansion-evaporation. The cooling air supplied to the inside of the refrigerator is evenly transferred to the inside of the refrigerator by a convection current to store food items within the refrigerator maintained at a desired temperature.

[0005] In general, a refrigerator body has a rectangular shape with an open front side, and a refrigerating chamber and a freezing chamber may be provided in the refrigerator body. Further, a refrigerating chamber door and a freezing chamber door may be installed on the front side of the body to selectively close the openings. In addition, a plurality of drawers, shelves, receiving boxes, and the like may be provided in a storage space within the refrigerator to keep various food items in an optimal state.

[0006] Conventionally, top mount type refrigerators (in which a freezing chamber is positioned above and a refrigerating chamber is positioned below) are popular in the mainstream, but recently, bottom freeze type refrigerators (in which a freezing chamber is positioned in a lower portion to enhance user convenience) have also been released. Here, the bottom freeze type refrigerator in which the frequently used refrigerating chamber is positioned above and the less frequently used freezing chamber is positioned below is advantageous in that users may easily access the refrigerating chamber. For the bottom freeze type refrigerator, however, since the freezing chamber is positioned below, in order for a user to take ice, the user bends himself or herself over to open the freezing chamber door to take ice.

[0007] In order to solve such a problem, recently, bottom freeze type refrigerators (in which a dispenser for dispensing ice is provided in a refrigerating chamber door positioned in an upper portion thereof) have been released. In this case, an ice making device for generating ice may be provided in the refrigerating chamber door or in the interior of the refrigerating chamber.

[0008] For example, in the bottom freeze type refrigerator in which the ice making device is installed in the refrigerating chamber door, air (cooling air) cooled by an evaporator is dividedly discharged to the freezing chamber and the refrigerating chamber. The cooling air discharged to the freezing chamber side flows to the ice making device along a cooling air supply duct embedded in a sidewall of a main body of the refrigerator and subsequently freezes water, while flowing within the ice making device. Thereafter, the cooling air within the ice making device is discharged to the refrigerating chamber through a cooling air reducing duct embedded in the sidewall of the main body of the refrigerator, lowering an internal temperature of the refrigerating chamber.

[0009] However, since the cooling air of the freezing chamber side is used in the ice making device both through the cooling air supply duct and also the cooling air reducing duct, then the cooling air is moving in the cooling air supply duct and the cooling air reducing duct. Due to this, the supply efficiency of the cooling air may be degraded.

[0010] In addition, since the cooling air of the freezing chamber side should be moved to the ice making device of the refrigerating chamber door, when the refrigerator is continuously operated, power consumption may increase significantly due to the operation of the refrigerator.

Summary of the Invention

[0011] In view of the above, therefore, embodiments of the present invention provide a refrigerator in which cooling air cooled in a cooling air duct can be directly used to generate ice, and an ice making method thereof.

[0012] In one embodiment, the present invention is implemented as a refrigerator including a main body and a storage space installed within the main body. The refrigerator further includes a door configured to open and close the storage space and an ice making chamber provided in the door. The refrigerator further includes a cooling duct configured to allow cooling air to flow in a longitudinal direction, and disposed in the main body with both ends connected to the ice making chamber. The cooling air circulates to the ice making chamber. The refrigerator further includes an evaporation coil disposed in the cooling duct and configured to cool air to generate cooling air through heat exchanging with a refrigerant.

[0013] In another embodiment, the present invention is implemented as an ice making method of a refrigerator. The method includes supplying a refrigerant to an evaporation coil and supplying air to a cooling duct with the evaporation coil wound therearound. The method further includes cooling the air to produce cooling air through heat exchange between the air and the refrigerant and supplying the cooling air to an ice making chamber for

producing ice. The method further includes discharging the cooling air within the ice making chamber to the cooling duct and recooling the discharged cooling air in the cooling duct.

Brief Description of the Drawings

[0014] The above and other objects and features of the present invention will become apparent from the following description of embodiments, given in conjunction with the accompanying drawings, in which:

Fig. 1 is a view illustrating a configuration of an ice making duct of a refrigerator in accordance with an embodiment of the present invention;
Fig. 2 is a cross-sectional view taken along line A-A of Fig. 1;
Fig. 3 is a block diagram illustrating a refrigerating cycle of the ice making duct of the refrigerator in accordance with an embodiment of the present invention;
Fig. 4 is a perspective view illustrating the refrigerator in accordance with an embodiment of the present invention;
Fig. 5 is a view illustrating a connection between an ice making chamber and a cooling duct in the refrigerator in accordance with an embodiment of the present invention;
Fig. 6 is a view illustrating an internal configuration of the ice making chamber of the refrigerator in accordance with an embodiment of the present invention; and
Fig. 7 is a flowchart illustrating an ice making method using an ice making duct of a refrigerator in accordance with an embodiment of the present invention.

Detailed Description of the Embodiments

[0015] Hereinafter, embodiments of the present invention will be described in detail with the accompanying drawings.

[0016] Fig. 1 is a view illustrating a configuration of an ice making duct of a refrigerator in accordance with an embodiment of the present invention, Fig. 2 is a cross-sectional view taken along line A-A of Fig. 1, Fig. 3 is a block diagram illustrating a refrigerating cycle of the ice making duct of the refrigerator in accordance with an embodiment of the present invention, and Fig. 4 is a perspective view illustrating the refrigerator in accordance with an embodiment of the present invention.

[0017] As illustrated in Figs. 1 to 4, the refrigerator in accordance with an embodiment of the present invention may include a main body 10 that forms an appearance, a barrier 20 that demarcates a storage space of the main body 10, a door for opening and closing the storage space, an ice making chamber 110 provided in the door, and an ice making duct 200 for providing cooling air to the ice making chamber 110.

[0018] Here, the refrigerator may include a refrigerating chamber door 30 for selectively closing the refrigerating chamber on both edges of a front surface of the main body 10, and a freezing chamber door 40 for closing a front opening of the freezing chamber. The storage space may include the refrigerating chamber and the freezing chamber demarcated by the barrier 20.

[0019] The refrigerator 1 in accordance with this embodiment is a bottom freezer type refrigerator in which the freezing chamber is positioned in a lower portion thereof, but the present invention is not limited thereto and may be applied to various types of refrigerators. In addition, the configuration of the main body 10, the barrier 20, the refrigerating chamber door 30, and the freezing chamber door 40 corresponds to the configuration of a main body, a barrier, a refrigerating chamber door, and a freezing chamber door applied to general refrigerators, and thus, a detailed description thereof will be omitted.

[0020] The ice making duct 200 may include a cooling duct 210 in which cooling air is movable in a longitudinal direction therein, and an evaporation coil 220 for cooling the cooling duct 210 through conduction.

[0021] Specifically, the cooling duct 210 may include a cooling channel 211, a first duct hole 212, and a second duct hole 213.

[0022] The cooling channel 211, which is a passage in which cooling air moves, may extend in a longitudinal direction within the cooling duct 210. In particular, the cooling channel 211 has a length sufficient for cooling of air with cooling air, and thus, the air, while moving in the cooling channel 211 for a predetermined period of time, may be cooled to cooling air having a temperature (e.g., 14 degrees or lower below zero) allowing for ice making.

[0023] Further, the first duct hole 212 may be provided at one end of the cooling channel 211 to supply the cooling air to the ice making chamber 110, and the second duct hole 213 may be provided at the other end of the cooling channel 211 to receive the cooling air from the ice making chamber 110. For example, the first duct hole 212 may be connected to an upper portion of the ice making chamber 110, the second duct hole 213 may be connected to a lower portion of the ice making chamber 110, and the cooling air within the cooling duct 210 may move from a lower end of the cooling duct 210 to an upper end thereof.

[0024] The cooling duct 210 may extend to be bent in a vertical direction of the main body 10 such that the cooling duct 210 is sloped in a forward direction of the main body 10 within the main body 10. For example, the cooling duct 210 may be bent to have a "⊏" shape or a "C" shape in a forward direction of the main body 10.

[0025] In this manner, since the cooling duct 210 is bent to have a "⊏" shape or a "C" shape, when defrosted water is generated within the cooling duct 210, the defrosted water may move to the lowermost portion of the cooling duct 210 and may be subsequently discharged to the outside through a separate drain device (not shown).

[0026] The cooling duct 210 is installed in the main body 10 of the refrigerator 1, and the ice making chamber 110 is provided within the refrigerating chamber door 30 of the refrigerator 1. Here, the first duct hole 212 and the second duct hole 213 of the cooling duct 210 may be selectively connected to an inlet 310 and an outlet 320 of the ice making chamber 110, respectively, depending on opening and closing of the refrigerating chamber door 30.

[0027] That is, when the refrigerator door 30 is closed to the main body 10, cooling air within the cooling duct 210 may be introduced to the inlet 310 of the ice making chamber 110 through the first duct hole 212, and the cooling air introduced to the ice making chamber 110 may circulate within the ice making chamber 110 to freeze water within the ice making chamber 110 to make ice. Thereafter, the cooling air within the ice making chamber 110 may be discharged to the second duct hole 213 of the cooling duct 210 through the outlet 320, and the cooling air discharged from the ice making chamber 110 may be recooled in the cooling duct 210 and then introduced again to the inlet 310 of the ice making chamber 110.

[0028] The evaporation coil 220 may cool air within the cooling duct 210 to generate cooling air through heat exchanging with a refrigerant. To this end, the evaporation coil 220 is installed to be wound around the cooling duct 210, and thus, when the refrigerant circulates depending on the refrigerating cycle, the evaporation coil 220 may cool the cooling duct 210 through conduction.

[0029] The evaporation coil 220 may serve as an evaporator of the refrigerating cycle. For example, the evaporation coil 220 may implement the refrigerating cycle including a process of compression-condensation-expansion-evaporation, together with a compressor 11, a condenser 12, and an expansion valve 13.

[0030] In this embodiment, the configuration of the compressor 11, the condenser 12, the expansion valve 13, and the evaporation coil 220 is provided as a refrigerating cycle for providing cooling air to the ice making chamber 110, but the configuration may also provide the cooling air to the refrigerating chamber and the freezing chamber of the refrigerator, as well as to the ice making chamber 110. In addition, the configuration of the compressor 11, the condenser 12, and the expansion valve 13 may also share a refrigerant with an evaporator (not shown) for providing cooling air to the refrigerating chamber and the freezing chamber.

[0031] Fig. 5 is a state view illustrating an exemplary connection between the ice making chamber and the cooling duct in the refrigerator in accordance with an embodiment of the present invention, and Fig. 6 is a view illustrating an internal configuration of the ice making chamber of the refrigerator in accordance with an embodiment of the present invention.

[0032] As illustrated in Figs. 5 and 6, the ice making chamber 110 may be provided in the refrigerating chamber door 30 of the refrigerator 1. In this embodiment, a case in which the ice making chamber 110 is provided in an upper portion of the refrigerating chamber door 30 is presented as an example, but this is merely illustrative and the ice making chamber 110 may be installed in other position of the refrigerating chamber door 30.

[0033] The ice making chamber 110 may provide an ice making space 111 in which ice is generated. In addition, an ice maker 120, an ice bank 130, and a circulation fan 330 may be provided within the ice making chamber 110.

[0034] The ice maker 120 may cool water to ice using cooling air introduced to the ice making space 111 and dispense the cooled ice to the ice bank 130. The ice bank 130 may be positioned below the ice maker 120 from which ice is dispensed, and the ice bank 130 may store the dispensed ice and provide the ice to a user through a dispenser unit (not shown). The circulation fan 330 may move the cooling air from the inlet 310 to the outlet 320.

[0035] Fig. 7 is a flowchart illustrating an ice making method using an ice making duct of a refrigerator in accordance with an embodiment of the present invention.

[0036] As illustrated in Fig. 7, the ice making method of the refrigerator in accordance with an embodiment of the present invention may include the steps of supplying a refrigerant to an evaporation coil (step S100), supplying air to a cooling duct with the evaporation coil wound therearound (step S200), cooling the air to cooling air through heat exchanging between the air and the refrigerant (step S300), supplying the cooling air to an ice making chamber for generating ice (step S400), discharging the cooling air within the ice making chamber to the cooling duct (step S500), and recooling the discharged cooling air in the cooling duct (step S600).

[0037] In step S100 of supplying a refrigerant to the evaporation coil, a refrigerant of a refrigerating cycle may be supplied to the evaporation coil. Here, the evaporation coil may form a refrigerating cycle including a process of compression-condensation-expansion-evaporation, together with a compressor, a condenser, and an expansion valve.

[0038] In step S200 of supplying air to the cooling duct with the evaporation coil wound therearound, air may be supplied to the cooling duct to cool the air. The air supplied to the interior of the cooling duct may move from a lower end to an upper end of the cooling duct.

[0039] In step S300 air is cooled to produce cooling air through heat exchange between the air and the refrigerant, air is moved within the cooling duct around which an evaporation coil is wound so as to be cooled to cooling air. Here, air within the cooling duct may move along a cooling channel, while being exchanged with the refrigerant of the evaporation coil for a predetermined period of time, and thus, the air discharged from the cooling duct may be cooled to cooling air having a temperature (e.g., 14 degrees or lower below zero) allowing for ice production.

[0040] In step S400 of supplying cooling air to the ice making chamber to generate ice, the cooling air cooled

in the cooling duct may be supplied to an ice making space of the ice making chamber through an inlet of the ice making chamber. The cooling air introduced to the ice making space may circulate in the ice making space through an operation of a circulation fan, freezing water within the ice making space to produce ice.

[0041] In step S500 of discharging cooling air from the ice making chamber to the cooling duct, the cooling air within the ice making space may be discharged to the cooling duct through an outlet of the ice making chamber.

[0042] In step S600 of recooling the discharged cooling air in the cooling duct, the cooling air introduced to the cooling duct is moved again along the cooling channel of the cooling duct for a predetermined period of time so as to be recooled to cooling air having a temperature lower than a temperature allowing for ice production.

[0043] In accordance with the embodiments of the present invention, since ice is generated using cooling air directly cooled in a cooling duct, the cooling efficiency of ice can be enhanced and the supply efficiency of cooling air can be increased.

[0044] In addition, in accordance with the embodiments of the present invention, since cooling air circulates between the cooling duct and an ice making space of the refrigerator door for a short period of time, the loss of cooling air can be effectively reduced and power consumption depending on the operation of the refrigerator can also be reduced, compared with the related art in which cooling air cooled in a lower portion of the refrigerator moves to the ice making space of the refrigerator door.

[0045] While embodiments of the invention have been shown and described with respect to the embodiments, the present invention is not limited thereto. 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 refrigerator, comprising:

a main body;
a storage space installed within the main body;
a door configured to open and close the storage space;
an ice making chamber provided in the door;
a cooling duct configured to allow cooling air to flow in a longitudinal direction, and disposed in the main body with both ends connected to the ice making chamber wherein the cooling air circulates to the ice making chamber; and
an evaporation coil disposed in the cooling duct and configured to cool air to generate cooling air through heat exchanging with a refrigerant.

2. The refrigerator of claim 1, wherein the evaporation coil is configured to function as an evaporator of a refrigerating cycle and cool the cooling duct through conduction.

3. The refrigerator of claim 1, wherein the cooling duct comprises:

a cooling channel configured to extend in a substantially longitudinal direction within the cooling duct wherein the cooling air may flow therein;
a first duct hole provided at one end of the cooling channel to supply the cooling air to the ice making chamber; and
a second duct hole provided at the other end of the cooling channel to receive the cooling air from the ice making chamber.

4. The refrigerator of claim 3, wherein in the cooling duct, the cooling air flows from a lower end of the cooling duct to an upper end thereof.

5. The refrigerator of claim 3, wherein the first duct hole is coupled to an upper portion of the ice making chamber and the second duct hole is coupled to a lower portion of the ice making chamber.

6. The refrigerator of claim 1, wherein the cooling duct is bent in a vertical direction of the main body wherein the cooling duct is sloped in a forward direction of the main body of the refrigerator within a refrigerating chamber.

7. The refrigerator of claim 1, wherein the cooling duct is disposed in the main body of the refrigerator and the ice making chamber is installed in a refrigerating chamber of the door of the refrigerator, and
wherein both ends of the cooling duct are selectively connected to the ice making chamber depending on opening and closing of the refrigerating chamber door.

8. An ice making method of a refrigerator, the method comprising:

supplying a refrigerant to an evaporation coil;
supplying air to a cooling duct with the evaporation coil wound therearound;
cooling the air to produce cooling air through heat exchange between the air and the refrigerant;
supplying the cooling air to an ice making chamber for producing ice;
discharging the cooling air within the ice making chamber to the cooling duct; and
recooling the discharged cooling air in the cooling duct.

9. The method of claim 8, wherein the cooling the air to produce cooling air through heat exchanging between the air and the refrigerant comprises having cooling air along the cooling channel of the cooling duct for a predetermined period of time so as to be cooled to be cooling air having a temperature lower than a predetermined temperature.

10. The method of claim 8, wherein the supplying of the cooling air to an ice making chamber is performed through a first opening and the discharging of the cooling air within the ice making chamber to the cooling duct is performed through a second opening.

11. A refrigerator, comprising:

a body comprising a storage area;
a door configured to open and close with respect to the storage area;
an ice making chamber disposed in the door;
a cooling duct configured to supply cooling air to the ice making chamber wherein the cooling air flows to the ice making chamber; and
an evaporation module disposed in the cooling duct and configured to cool air to generate the cooling air through heat exchanging.

12. The refrigerator of claim 11, wherein the evaporation module is configured to function as an evaporator of a refrigerating cycle and cool the cooling duct through conduction.

13. The refrigerator of claim 11, wherein the cooling duct comprises:

a cooling channel extending in a substantially longitudinal direction within the cooling duct.

14. The refrigerator of claim 13, wherein the cooling duct comprises:

a first duct hole at one end of the cooling channel to supply the cooling air to the ice making chamber; and
a second duct hole at the other end of the cooling channel to receive air from the ice making chamber.

15. The refrigerator of claim 11, wherein the cooling duct is sloped in a forward direction with respect to the body of the refrigerator.

FIG. 1

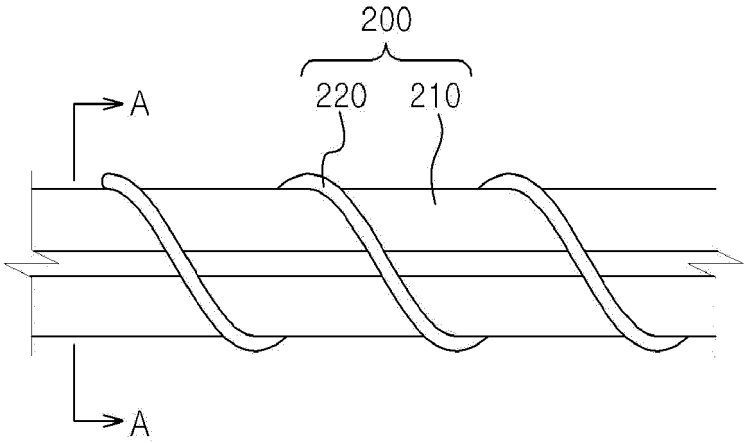


FIG. 2

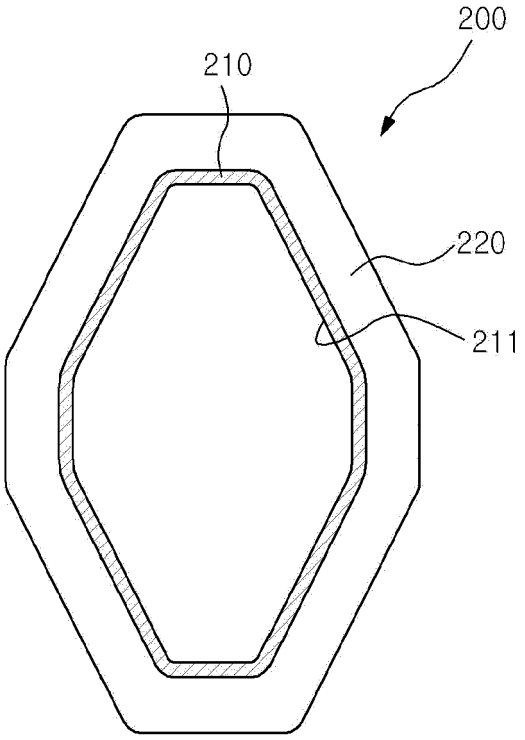


FIG. 3

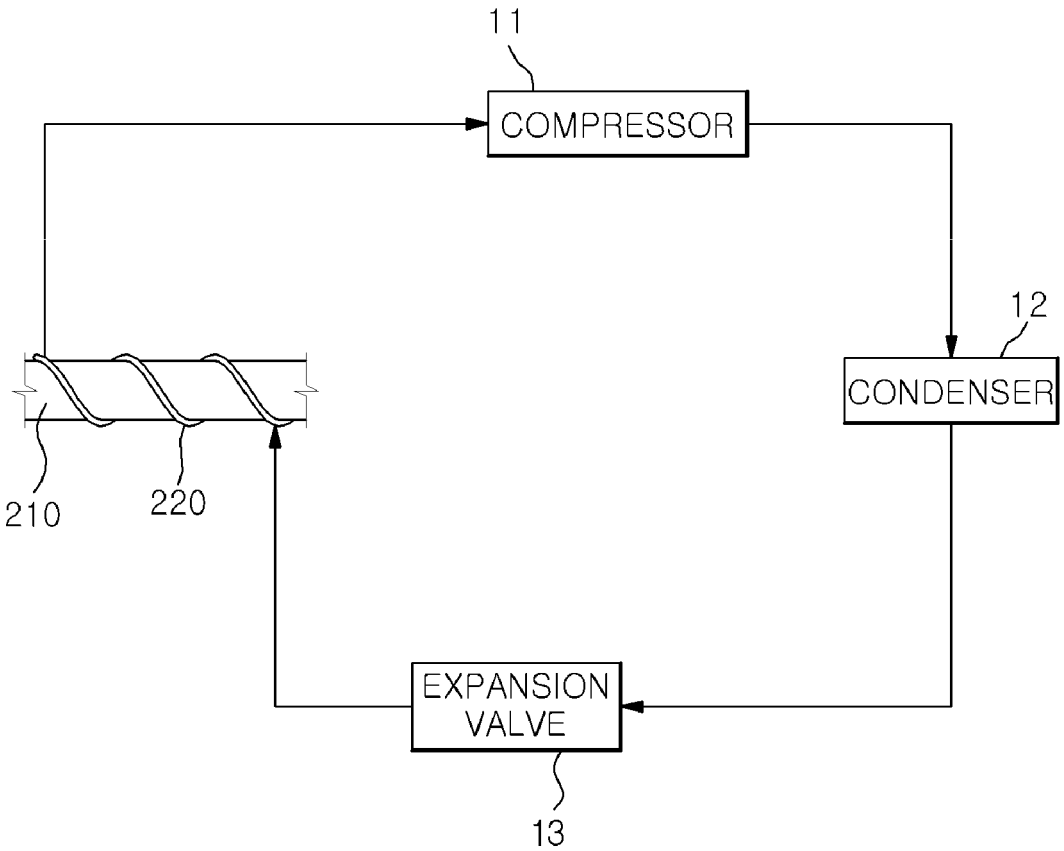


FIG. 4

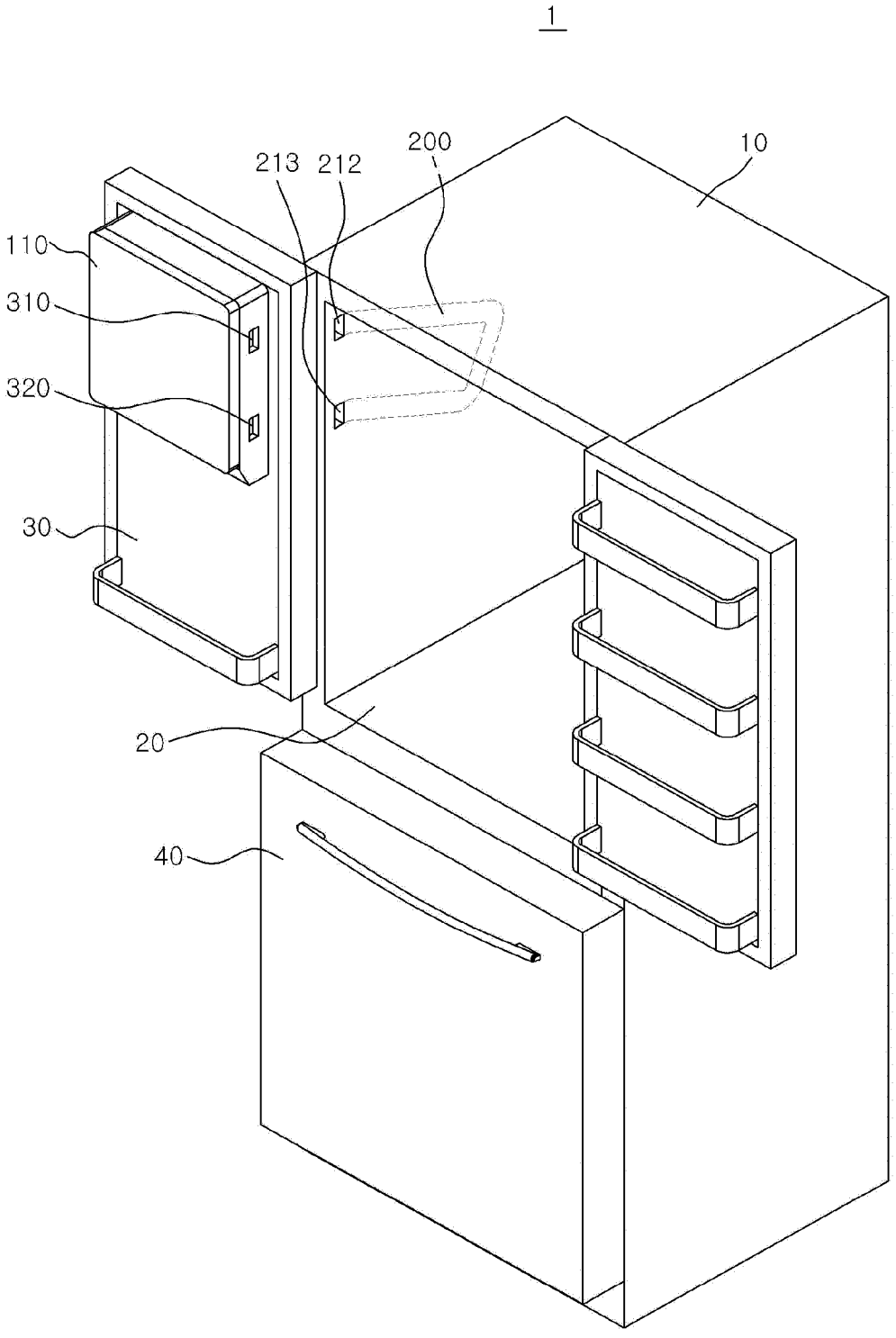


FIG. 5

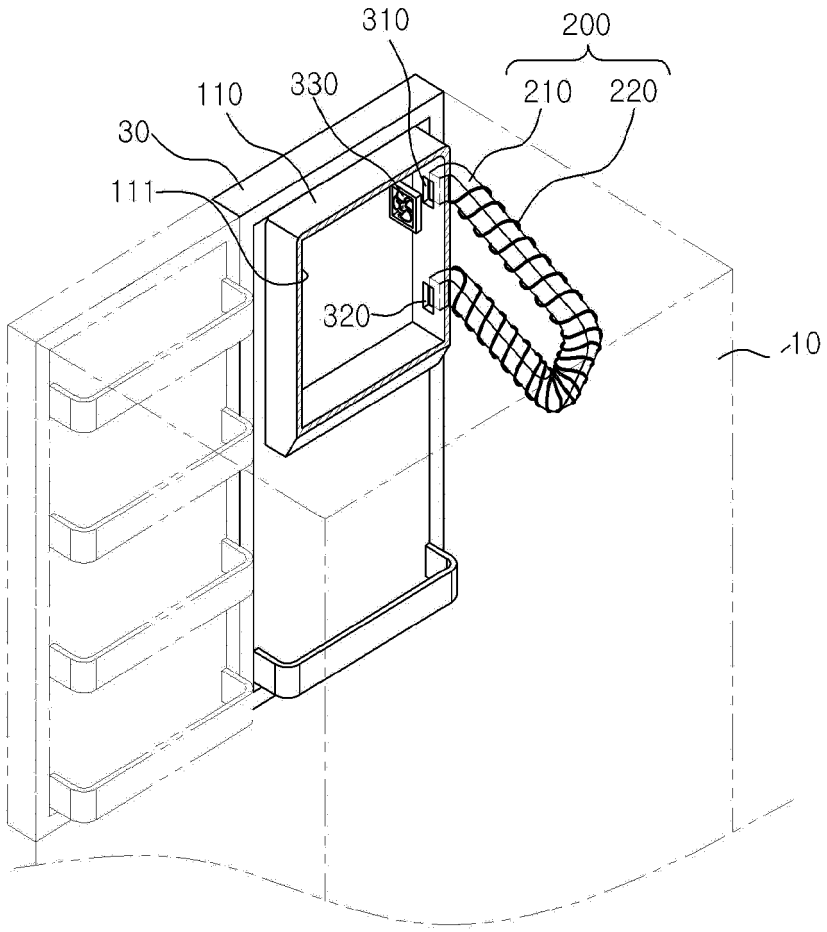


FIG. 6

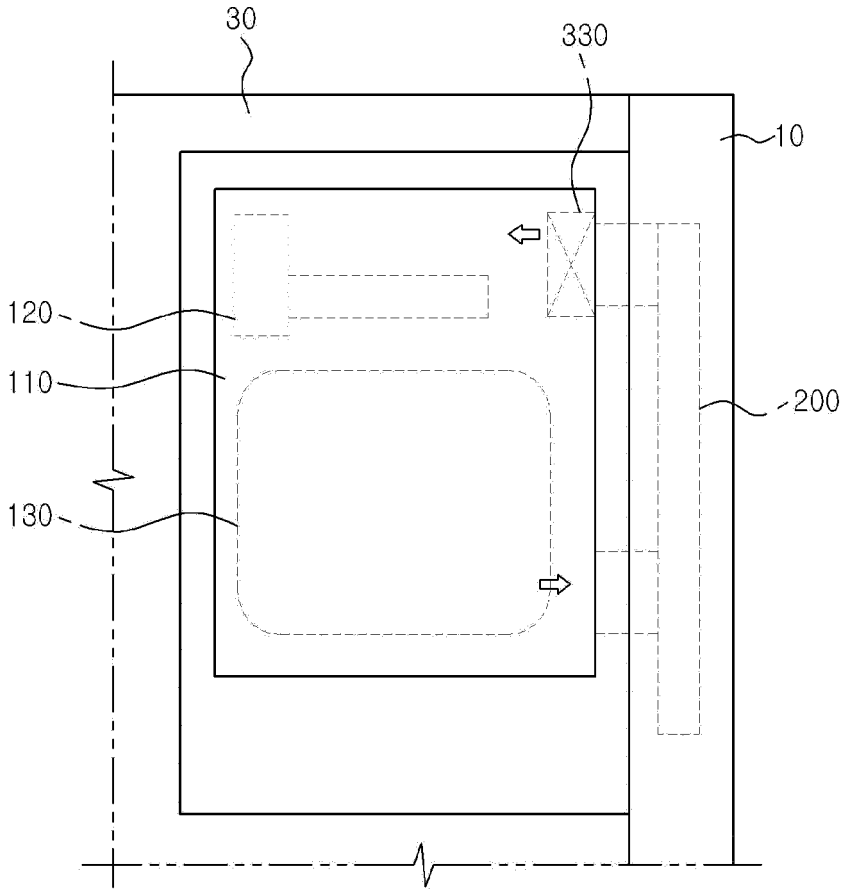
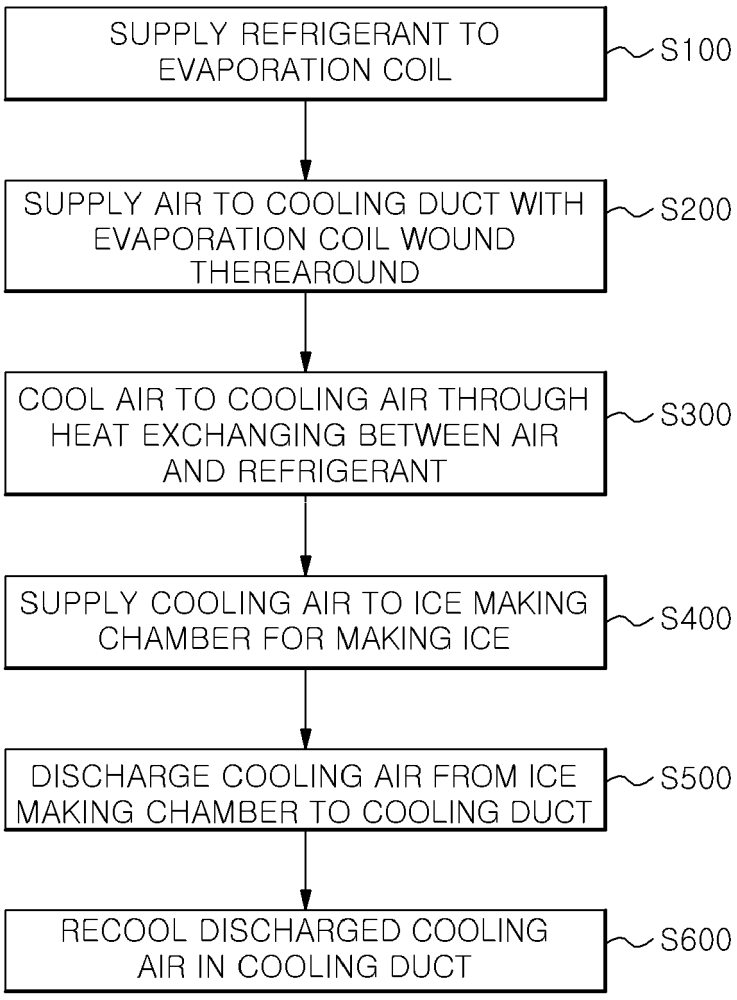


FIG. 7


SUPPLY REFRIGERANT TO EVAPORATION COIL
S100
SUPPLY AIR TO COOLING DUCT WITH EVAPORATION COIL WOUND THEREAROUND
S200
COOL AIR TO COOLING AIR THROUGH HEAT EXCHANGING BETWEEN AIR AND REFRIGERANT
S300
SUPPLY COOLING AIR TO ICE MAKING CHAMBER FOR MAKING ICE
S400
DISCHARGE COOLING AIR FROM ICE MAKING CHAMBER TO COOLING DUCT
S500
RECOOL DISCHARGED COOLING AIR IN COOLING DUCT
S600

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EUROPEAN SEARCH REPORT

Application Number
EP 15 18 6860

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			TECHNICAL FIELDS SEARCHED (IPC) F25C F25D F25B F28D

The present search report has been drawn up for all claims

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

CATEGORY OF CITED DOCUMENTS

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