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(57)

ABSTRACT

A refrigerator including a buffer unit for restrict heat transfer between a defrosting heater and an ice maker on the refrigerator. The defrosting heater is disposed at the evaporator and can remove frost on the evaporator. A cold air duct guides cold air generated by the evaporator to the ice maker during the cooling process. A cold air supply passageway is disposed below an ice making tray inside the ice maker. The buffer unit is coupled between the cold air duct and the cold air supply passageway. The buffer unit has a curved up inner surface which facilitates formation of a heat vortex therein, thereby effectively restricting heat transfer from the cold air duct to the ice maker during the defrosting process.

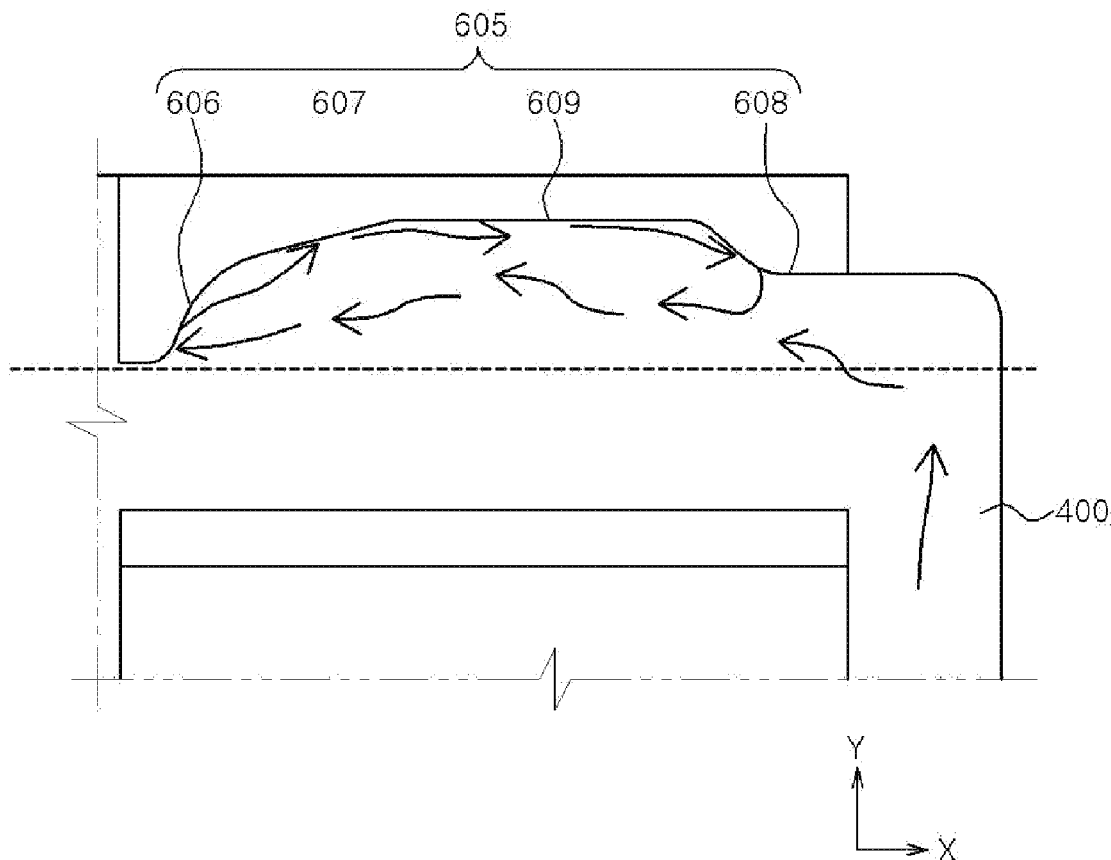


FIG. 1

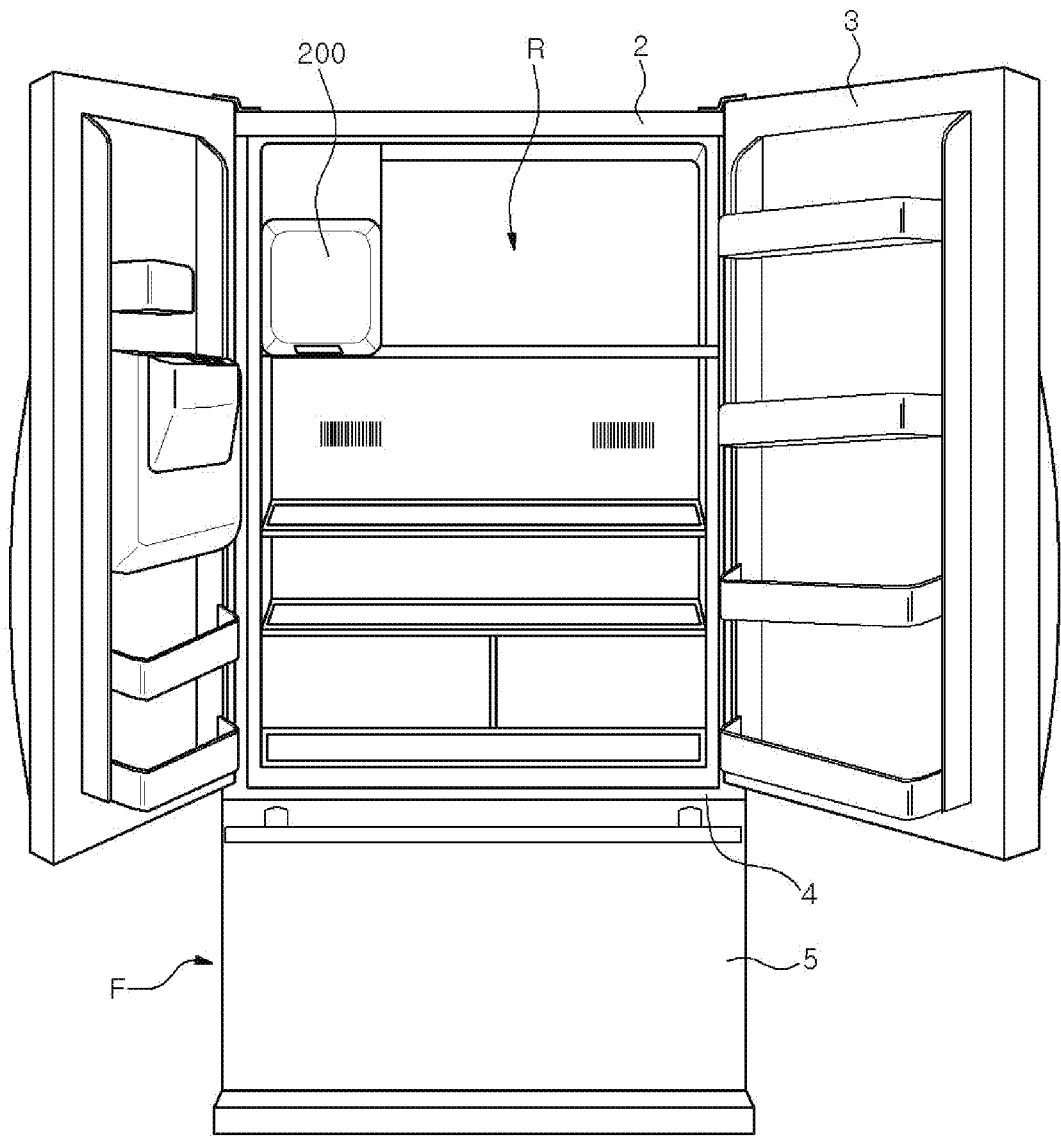


FIG. 2

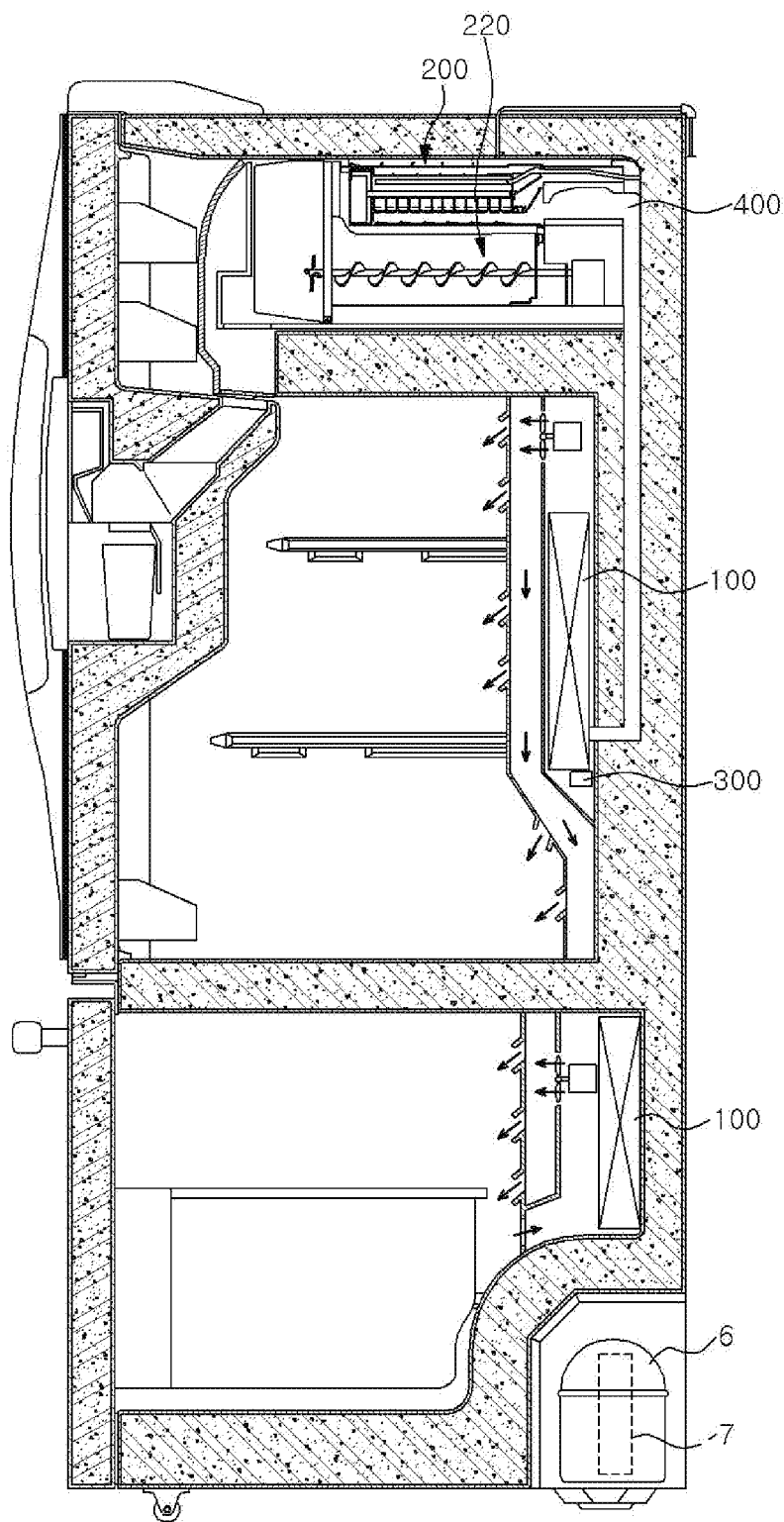


FIG. 3

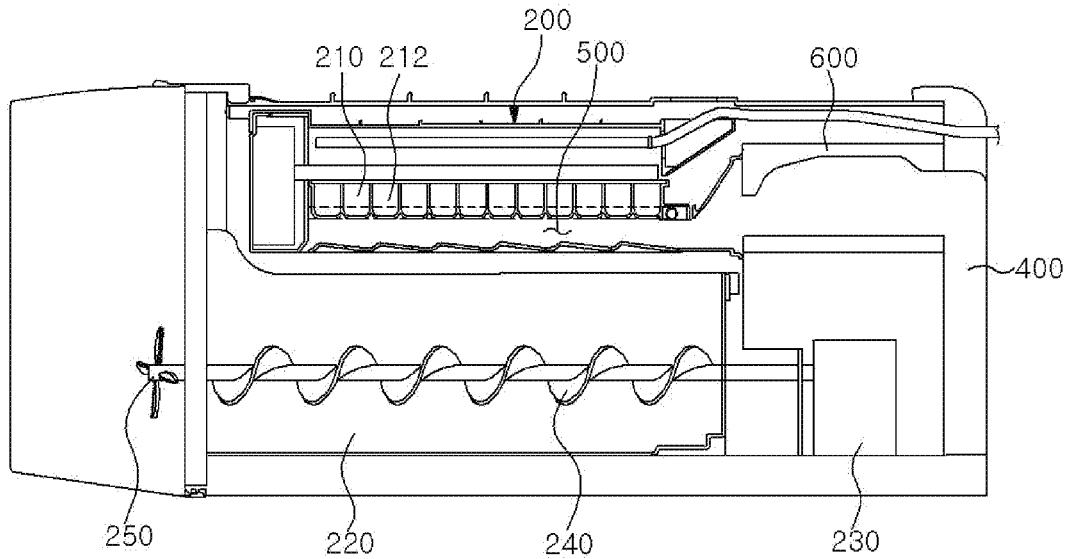


FIG. 4

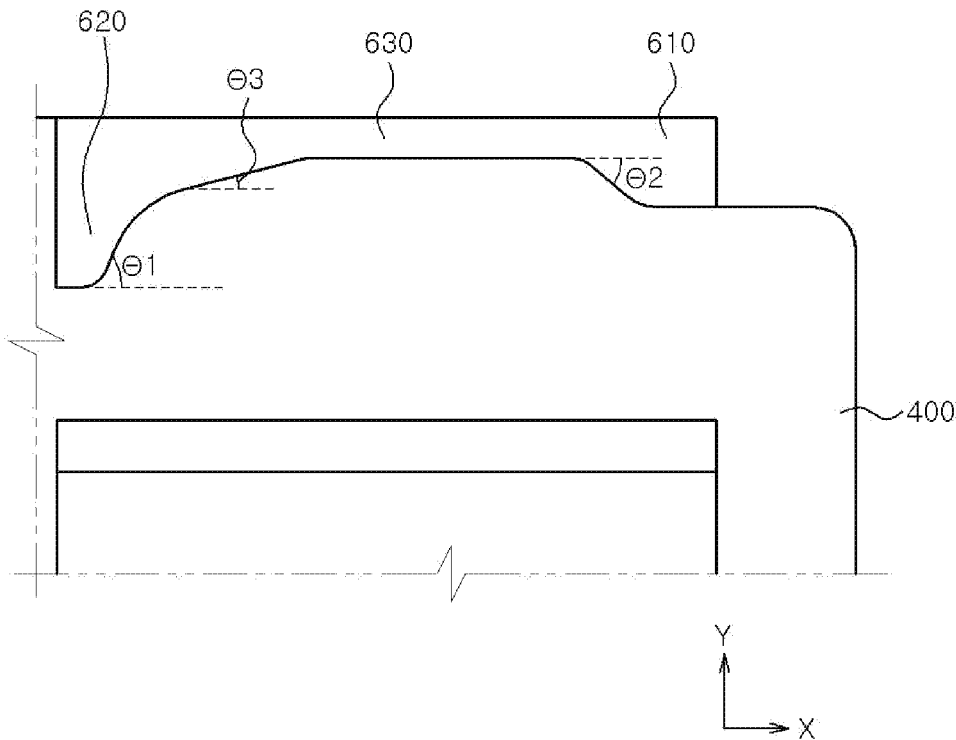
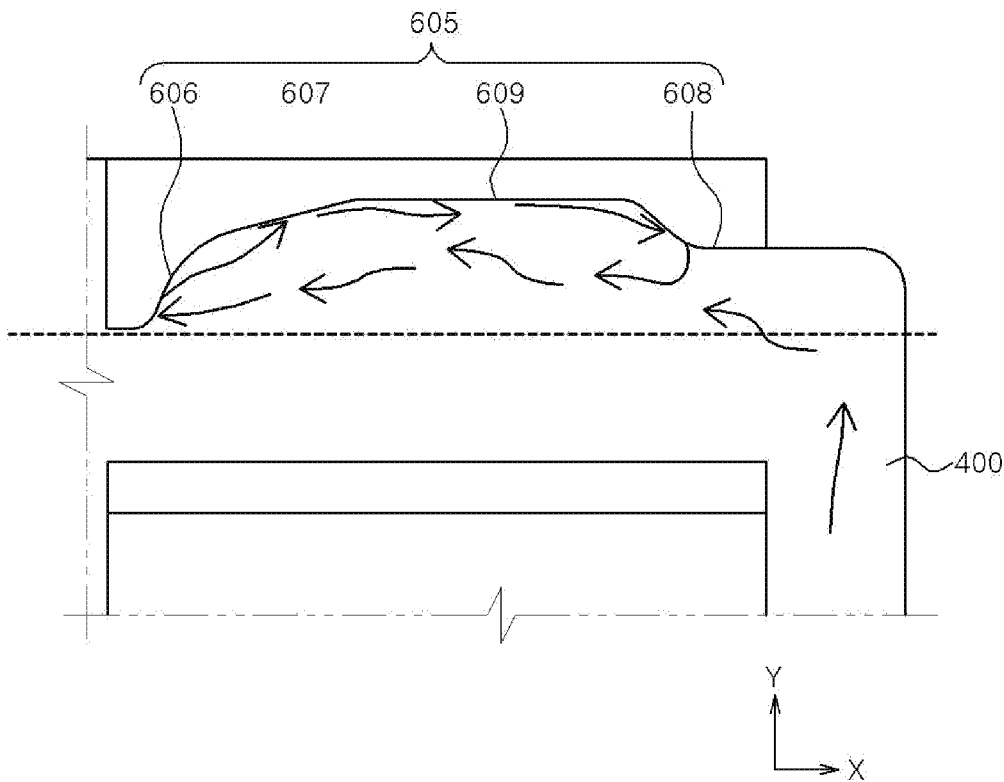


FIG. 5



REFRIGERATOR

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is based on and claims priority from Korean Patent Application No. 10-2016-0044964, filed on Apr. 12, 2016, the disclosure of which is incorporated herein in its entirety by reference for all purposes.

TECHNICAL FIELD

[0002] Embodiments of the present disclosure relate to refrigerators, and more particularly, to defrosting mechanisms in the refrigerators.

BACKGROUND

[0003] In general, a refrigerator is an appliance for storing various types of items, e.g., food, at low temperature. Low temperature in the refrigerator is achieved by circulating cold air that can be continuously generated through a heat exchange process by using a refrigerant. During operation, the refrigerant goes through repetitive cycles of compression, condensation, expansion and evaporation.

[0004] A main body of the refrigerator may have a rectangular parallel-piped shape with an open front surface. Typically, the main body encloses a refrigeration room or compartment and a freezer, each with its own door. The refrigerator may include a plurality of drawers, shelves, vegetable compartments and the like for sorting and storing different types of items.

[0005] Conventionally, top mount type refrigerators were widely used, with a freezer positioned at the upper side and a refrigeration compartment positioned at a lower side. Recently, the bottom freezer type refrigerators have been developed, where a freezer is located at the lower side and a refrigeration compartment is located at the top. Because typically users access the refrigeration compartment more often than the freezer, a bottom freezer type refrigerator allows a user to conveniently access the refrigeration compartment that is located at the upper portion of the refrigerator. Unfortunately, on the other hand, it can be inconvenient for a user to access the freezer if the user often needs to lower or bend down to access the freezer, e.g., for taking ice out of the freezer.

[0006] Therefore, some bottom-freeze-type refrigerators are equipped with a dispenser for dispensing ice, e.g., ice cubes or crushed ice. The dispenser is typically located in a refrigeration compartment door. Accordingly, the ice-making device for producing ice may be installed in the refrigeration compartment door or the interior of the refrigeration compartment.

[0007] Generally, since the surface of the evaporator is cooler than the rest of the refrigerator interior, condensate water may be generated on the surface of the evaporator through heat exchange between a refrigerant and air circulating in the refrigerator. The condensate water freezes on the surface of the evaporator and becomes frost. Accumulation of frost on the evaporator can significantly decrease the amount of heat absorbed by the evaporator from the air. Therefore, the heat exchange efficiency of the evaporator is impaired remarkably.

[0008] Usually, to remove frost on the evaporator, the cooling cycles of the refrigerator are stopped and a

defrosting process is activated for melting the frost. A defrosting heater may be used and may be disposed below the evaporator.

[0009] However, heat generated by the defrosting heater during the defrosting process may be transferred to the ice maker and may melt ice produced and stored therein. Therefore, the defrosting process may unfortunately result in a deterioration of the ice making efficiency of the refrigerator.

[0010] Patent Document 1: Korean Patent No. 10-2012-0072774 (Published on Jul. 4, 2012)

SUMMARY

[0011] Embodiments of the present disclosure provide a refrigerator capable of restricting heat transfer from a defrosting heater into an ice maker during a defrosting operation, thereby improving both ice making efficiency and power efficiency.

[0012] According to an embodiment of the present disclosure, a refrigerator includes: an evaporator; an ice maker; a defrosting heater configured to remove frost on the evaporator; a cold air duct configured to guide cold air supplied from the evaporator to the ice maker; a cold air supply passageway disposed below the ice maker; and a buffer unit coupled between the cold air duct and the cold air supply passageway and configured to prevent heat transfer from the defrosting heater to the ice maker.

[0013] The buffer unit has a curved-up inner surface which facilitates formation of a heat vortex therein, thereby effectively and advantageously restricting heat transfer from the cold air duct to the ice maker during the defrosting process.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. 1 shows an exemplary refrigerator according to an embodiment of the present disclosure.

[0015] FIG. 2 is a side cross sectional view of the refrigerator shown in FIG. 1.

[0016] FIG. 3 is a side view illustrating the configuration of an exemplary ice maker of the refrigerator shown in FIG. 1 according to an embodiment of the present disclosure.

[0017] FIG. 4 shows an exemplary buffer unit of the refrigerator shown in FIG. 1 according to an embodiment of the present disclosure.

[0018] FIG. 5 shows, by arrows, flow paths of cold air in the exemplary buffer unit of the refrigerator shown in FIG. 1 according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0019] Hereinafter, configurations and operations of embodiments are described in detail with reference to the accompanying drawings. The following description is one of various patentable aspects of the disclosure and may form a part of the detailed description of the disclosure.

[0020] However, in describing the disclosure, detailed descriptions of known configurations or functions that may obscure the disclosure are omitted.

[0021] The disclosure may be variously modified and may include various embodiments. Specific embodiments are exemplarily illustrated in the drawings and described in the detailed description of the embodiments. However, it should be understood that they are not intended to limit the disclosure to specific embodiments but rather to extend to all

modifications, similarities, and alternatives which are encompassed in the spirit and scope of the disclosure.

[0022] The terms used herein, including ordinal numbers such as “first” and “second” may be used to describe, and not to limit, various components. The terms simply distinguish the components from one another without indicating any sequence thereof.

[0023] When it is said that a component is “coupled” “coupled” or “linked” to another component, it should be understood that the former component may be directly coupled or linked to the latter component or a third component may be interposed between the two components.

[0024] Specific terms used in the present application are used simply to describe specific embodiments without limiting the disclosure. An expression used in the singular encompasses the expression of the plural, unless it has a clearly different meaning in the context.

[0025] FIG. 1 shows an exemplary refrigerator according to an embodiment of the present disclosure. FIG. 2 is a side cross sectional view of the refrigerator shown in FIG. 1.

[0026] Referring to FIGS. 1 and 2, a refrigerator 1 according to an embodiment may include: a main body 2 forming an outer body and having a food storage space 2; a barrier 4 for dividing a storage space in the main body 2 into a refrigeration compartment R disposed at an upper side and a freezer F disposed at a lower side; refrigeration compartment doors 3 which are disposed at both front edges of the main body 2 and used to seal the refrigeration compartment R by rotation; a freezer door 5 used to seal the freezer F; an evaporator 100 for generating cold air; an ice maker 200 for making ice by using cold air supplied from the evaporator; a defrosting heater 300, disposed at the evaporator 100 and used to remove frost deposited on the evaporator 100; a cold air duct 400 for guiding the cold air generated by the evaporator 100 to the ice maker 200; a cold air supply passageway 500 located below an ice making tray 210 inside the ice maker 200, where cold air supplied from the cold air duct 400 can be applied to a bottom surface of the ice making tray 210; and a buffer unit 600 for coupling the cold air duct 400 and the cold air supply passageway 500.

[0027] A general refrigeration process of the refrigerator 1 includes repeated cycles of compression, condensation, expansion and evaporation.

[0028] Specifically, a refrigerant in a low-temperature and low-pressure gaseous state is compressed and transformed into a high-temperature and high-pressure gaseous state by the compressor 6. Then, the refrigerant in the high-temperature and high-pressure gaseous state is condensed into a high-temperature and high-pressure liquid state by a condenser 7. The refrigerant in the high-temperature and high-pressure liquid state is expanded into a low-temperature and low-pressure liquid state by an expansion device (not shown). Thereafter, the refrigerant in the low-temperature and low-pressure liquid state is supplied to the evaporator 100. In the evaporator 100, the refrigerant in the low-temperature and low-pressure liquid state absorbs heat from its surroundings and evaporates. Accordingly, air near the evaporator 100 loses heat and becomes cold air.

[0029] FIG. 3 is a side view illustrating the configuration of an exemplary ice maker of the refrigerator shown in FIG. 1 according to an embodiment of the present disclosure. FIG. 4 shows an exemplary buffer unit of the refrigerator shown in FIG. 1 according to an embodiment of the present disclosure.

[0030] Referring to FIGS. 3 and 4, the ice maker 200 can make ice by using cold air supplied from the evaporator 100. For example, in the bottom freezer type refrigerator in which the ice maker 200 is disposed at the refrigeration compartment door 3, cold air is discharged to the freezer F and the refrigeration compartment R. Cold air flows through the cold air duct 400 formed in the sidewall of the main body 2 of the refrigerator 1 and then freezes water while flowing inside the ice maker 200.

[0031] In the present embodiment, the ice maker 200 is disposed at an upper side of the refrigeration compartment R. However, this implementation is merely exemplary. The ice maker 200 may be disposed at any other suitable location in the refrigeration compartment R or may be disposed at the refrigeration compartment doors 3, etc.

[0032] In the ice maker 200, a cold air passage 200 may be formed below an ice making tray 210. Through the cold air passage 200, cold air supplied from the cold air duct 400 can flow through the bottom of the ice making tray 210.

[0033] Cold air flowing through the cold air passage 500 can exchange heat with the ice making tray 210. Accordingly, water stored in an ice making space 212 of the ice making tray 210 freezes and transforms into ice. Ice thus made can fall to a bucket 220 disposed below the ice making tray 210.

[0034] Upon a transfer member 240 being rotated by a driving unit 230, ice stored in the bucket 220 moves toward an outlet and can then be crushed by a crushing member 250. Crushed ice can be dispensed to a user responsive to a user command.

[0035] Generally, since the surface of the evaporator is cooler than the rest of the refrigerator interior, condensate water may be generated on the surface of the evaporator through heat exchange between a refrigerant and air circulating in the refrigerator. The condensate water freezes on the surface of the evaporator and becomes frost. Accumulation of frost on the evaporator can significantly decrease the amount of heat absorbed by the evaporator from the air. Therefore, the heat exchange efficiency of the evaporator is impaired remarkably.

[0036] Usually, to remove frost on the evaporator 100, the cooling cycles of the refrigerator are stopped and a defrosting process is activated for melting the frost. A defrosting heater 300 is used to heat up the evaporator surface and may be disposed below the evaporator 100.

[0037] However, in the defrosting process in which the defrosting heater 300 is turned on, the evaporator 100 is disabled and the cooling process to generate cold air is paused. Heat generated by the defrosting heater 300 can be transferred to the ice maker 200 (e.g., through the cold air duct 400) and cause the temperature to increase inside the ice maker 200.

[0038] According to embodiments of the present disclosure, the refrigerator 1 uses a buffer unit 600 to restrict heat transfer to the ice maker 200.

[0039] The buffer unit 600 can be coupled between the cold air duct 400 and the cold air supply passageway 500. The buffer unit 600 may be made of expanded polystyrene (EPS) for instance. However, this implementation is merely exemplary. The buffer unit 600 can be made of any suitable material.

[0040] The buffer unit 600 may contain heat generated by the defrosting heater 200. As the buffer unit 600 is made of EPS as described above, it can effectively prevent heat

generated by the defrosting heater 300 from being transferred outside of the buffer unit 600 (e.g., to the ice maker 200).

[0041] The buffer unit 600 may include: an inlet part 610 coupled to the cold air duct 400; an outlet part 620 coupled to the cold air supply passageway 500; and a residing part 630 for coupling the inlet part 610 and the outlet part 620. The buffer unit 600 may have a curved surface 605.

[0042] The curved surface 605 is formed above an end portion of the cold air duct 400 and curved upward. In this configuration, heat dissipation may be obstructed by the curved surface 605 and thereby heat can be contained in the buffer unit 600.

[0043] The curved surface 605 may include: a first collision surface 606 extending from the outlet part 620 and inclined at a first angle θ_1 ; a second collision surface 607 coupled to the first collision surface 606 and disposed closer to the inlet part 610 than the first collision surface 606; an introducing surface 608 extending from the inlet part 610 and inclined at a second angle θ_2 ; and a coupling surface 609 for coupling the introducing surface 608 and the second collision surface 607.

[0044] The first collision surface 606 and the second collision surface 607 may form the outlet part 620 of the buffer unit 600. The coupling surface 609 may form the residing part 630 of the buffer unit 600. The introducing surface 608 may form the inlet part 610 of the buffer unit 600.

[0045] A cross sectional area of the outlet part 620 may be greater than that of the inlet part 610. Therefore, heat flowing from the inlet part 610 is prevented from reaching the introducing surface 608 of the inlet part 610 but is caused to reach the first collision surface 606 of the outlet part 620.

[0046] More specifically, cold air flowing from the cold air duct 400 may first reach the first collision surface 606 and then reach the second collision surface 607. At this time, the second collision surface 607 may be inclined at a third angle θ_3 smaller than the first angle θ_1 . The first to the third angles (81 to 83) denote angles between the respective surfaces and lines extending in the X-axis in FIG. 4.

[0047] Since the inclined angle of the first collision surface 606 is different from that of the second collision surface 607, a coupling portion between the first collision surface 606 and the outlet part 620 may be configured lower than that between the introducing surface 608 and the inlet part 610. Accordingly, the moving direction of the heat or the cold air from the cold air duct 400 may be changed. Further, a cold air vortex, and thus a heat vortex, can be generated in the buffer unit 600, as described in greater detail with reference to FIG. 5.

[0048] FIG. 5 shows, by arrows, generation of vortex in the buffer unit of the refrigerator shown in FIG. 1.

[0049] Referring to FIG. 5, the defrosting heater 300 is activated to remove frost formed on the evaporator 100. At this time, heat generated by the defrosting heater 300 flows through the cold air duct 400.

[0050] More specifically, heat moving through the cold air duct 400 rises by convection and flows into the inlet part 610 of the buffer unit 600. At this point, heat flowing into the inlet part 610 moves toward the outlet part 620 along the residing part 630.

[0051] Since the first collision surface 606 inclined by the first angle θ_1 forms the outlet part 620, the moving direction

of the heat may be changed when the heat reaches the inclined surface of the first collision surface 606.

[0052] More specifically, the moving direction of the heat flowing into the inlet part 610 is changed by the first collision surface 606. The heat is thus redirected and then reaches the second collision surface 607.

[0053] Since the second collision surface 607 is inclined at the third angle θ_3 smaller than the first angle θ_1 , the moving direction of the heat may be changed again. Next, heat redirected by the second collision surface 607 moves in the X direction in FIG. 5 along the coupling surface 609 and then reaches the introducing surface 608. The introducing surface 608 is inclined at a second angle θ_2 smaller than the first angle θ_1 and greater than the third angle θ_3 , so that the moving direction of the heat may be redirected toward the outlet part 620.

[0054] As a result of the above-described processes, a vortex is generated and the heat may reside in the curved surface 605 for an extended time. Because the heat may stay in the buffer unit 600 during the operation of the defrosting heater 300, the inflow of heat into the ice maker 200 can be effectively reduced. Moreover, the ice making efficiency of the ice maker 200 can be advantageously improved. Furthermore, in this configuration, heat control can be achieved without requiring a separate damper member at the cold air duct 400. Advantageously, as a result, manufacturing costs can be reduced and manufacturing processes can be simplified.

[0055] From the foregoing, it will be appreciated that various embodiments of the present disclosure have been described herein for purposes of illustration, and that various modifications may be made without departing from the scope and spirit of the present disclosure. The exemplary embodiments disclosed in the specification of the present disclosure do not limit the present disclosure. The scope of the present disclosure will be interpreted by the claims below, and it will be construed that all techniques within the scope equivalent thereto belong to the scope of the present disclosure.

What is claimed is:

1. A refrigerator comprising:

- an evaporator configured to supply cold air for the refrigerator;
- an ice maker configured to make ice by using the cold air;
- a defrosting heater configured to remove frost from the evaporator;
- a cold air duct configured to guide cold air supplied from the evaporator to the ice maker;
- a cold air supply passageway disposed below the ice maker; and
- a buffer unit coupled between the cold air duct and the cold air supply passageway and configured to restrict heat transfer from the defrosting heater to the ice maker.

2. The refrigerator of claim 1, wherein the ice maker comprises an ice tray, wherein the cold air supply passageway is disposed below the ice tray.

3. The refrigerator of claim 2, wherein cold air supplied from the cold air duct is applied to a bottom surface of the ice tray.

4. The refrigerator of claim 1, wherein the defrosting heater is disposed proximate to the evaporator.

5. The refrigerator of claim 1, wherein the buffer unit is disposed above an end portion of the cold air duct and has a substantially curved surface that is curved upward.

6. The refrigerator of claim 5, wherein the buffer unit comprises:

- an inlet part coupled to the cold air duct;
- an outlet part coupled to the cold air supply passageway; and
- a residing part disposed between the inlet part and the outlet part and having a curved surface, wherein a cross sectional area of the outlet part is greater than a cross sectional area of the inlet part.

7. The refrigerator of claim 6, wherein the curved surface comprises:

- a first collision surface extending from the outlet part and inclined at a first angle; and
- a second collision surface coupled to the first collision surface and disposed closer to the inlet part than the first collision surface.

8. The refrigerator of claim 7, wherein cold air flowing from the cold air duct reaches the first collision surface before reaching the second collision surface.

9. The refrigerator of claim 8, wherein the curved surface further comprises an introducing surface extending from the inlet part and inclined at a second angle.

10. The refrigerator of claim 9, wherein the curved surface further comprises a coupling surface coupled between the introducing surface and the second collision surface.

11. The refrigerator of claim 7, wherein the second collision surface is inclined at a third angle smaller than the first angle.

12. The refrigerator of claim 11, wherein a connection portion between the first collision surface and the outlet part is positioned lower than a connection portion between the introducing surface and the inlet part.

13. The refrigerator of claim 1, wherein the buffer unit comprises expanded polystyrene (EPS).

14. A refrigerator comprising:

- an evaporator configured to generate cold air;
- an ice maker configured to make ice by using the cold air;
- a defrosting heater disposed proximate to the evaporator and configured to remove frost from the evaporator;
- a cold air duct configured to guide cold air flow from the evaporator to the ice maker;
- a cold air supply passageway disposed in the ice maker and coupled to the cold air duct; and

a buffer unit coupled between the cold air duct and the cold air supply passageway, wherein the buffer unit is configured to restrict heat transfer from the defrosting heater to the ice maker, and wherein further an inner top surface of the buffer unit is curved upward.

15. The refrigerator of claim 14, wherein an end portion of the cold air duct is disposed inside the ice maker.

16. The refrigerator of claim 14, wherein heat generated during operation of the defrosting heater and supplied into the ice maker through the cold air duct reaches the curved surface and temporally stays inside the end portion of the cold air duct due to a vortex generated by collision between the heat and the curved surface.

17. The refrigerator of claim 14, wherein the buffer unit comprises:

- an inlet part coupled to the cold air duct;
- an outlet part coupled to the cold air supply passageway; and
- a residing part disposed between the inlet part and the outlet part and having a curved surface, wherein a cross sectional area of the outlet part is greater than a cross sectional area of the inlet part.

18. The refrigerator of claim 17, wherein the curved surface comprises:

- a first collision surface extending from the outlet part and inclined at a first angle; and
- a second collision surface coupled to the first collision surface and disposed closer to the inlet part than the first collision surface, wherein cold air flowing from the cold air duct reaches the first collision surface before reaching the second collision surface, wherein the second collision surface is inclined at an angle smaller than the first angle.

19. The refrigerator of claim 18, wherein the curved surface further comprises:

- an introducing surface extending from the inlet part and inclined at a second angle; and
- a coupling surface coupled between the introducing surface and the second collision surface.

20. The refrigerator of claim 18, wherein a connection portion between the first collision surface and the outlet part is positioned lower than a connection portion between the introducing surface and the inlet part.

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