(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 273 478 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
08.11.2023 Bulletin 2023/45

(21) Application number: **21914637.0**

(22) Date of filing: **30.12.2021**

(51) International Patent Classification (IPC):
F25D 21/14 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
F25D 21/14

(86) International application number:
PCT/CN2021/143127

(87) International publication number:
WO 2022/143906 (07.07.2022 Gazette 2022/27)

(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:
KH MA MD TN

(30) Priority: **04.01.2021 CN 202110002178**
04.01.2021 CN 202120011871 U

(71) Applicants:
- **Qingdao Haier Refrigerator Co., Ltd**
  Qingdao, Shandong 266101 (CN)
- **Haier Smart Home Co., Ltd.**
  Qingdao, Shandong 266101 (CN)

(72) Inventors:
- **ZHAO, Zhenyu**
  Qingdao, Shandong 266101 (CN)
- **ZHANG, Yanqing**
  Qingdao, Shandong 266101 (CN)
- **ZHAO, Bintang**
  Qingdao, Shandong 266101 (CN)
- **SONG, Xiangpeng**
  Qingdao, Shandong 266101 (CN)
- **MOU, Guoliang**
  Qingdao, Shandong 266101 (CN)
- **ZHANG, Fangyou**
  Qingdao, Shandong 266101 (CN)

(74) Representative: **Winter, Brandl - Partnerschaft mbB**
Alois-Steinecker-Straße 22
85354 Freising (DE)

(54) REFRIGERATOR

(57) The present invention provides a refrigerator, comprising: a cabinet body defining a refrigeration compartment; a door body movably connected to the cabinet body and configured to open and close the refrigeration compartment, the door body comprising a door shell and a door liner combined with the door shell; a refrigeration system configured to provide cold energy for the refrigeration compartment; and an ice-making chamber arranged in the door body and having an ice-making assembly arranged therein, the ice-making chamber and the refrigeration compartment being heat-insulated when the door body is closed. The door body is provided with a first drainage pipeline; the cabinet body is provided with a second drainage pipeline; an inlet end of the first drainage pipeline is connected to the ice-making chamber; the door liner is provided with a first connector; an outlet end of the first drainage pipeline is connected to the first connector; the refrigeration compartment is provided with a second connector; an inlet end of the second drainage pipeline is connected to the second connector; when the door body is closed, the first connector is connected to the second connector, and the outlet end of the first drainage pipeline is communicated with the inlet end of the second drainage pipeline; and when the door body is opened, the first connector is separated from the second connector, and drainage in the first drainage pipeline is stored in the first connector.

EP 4 273 478 A1

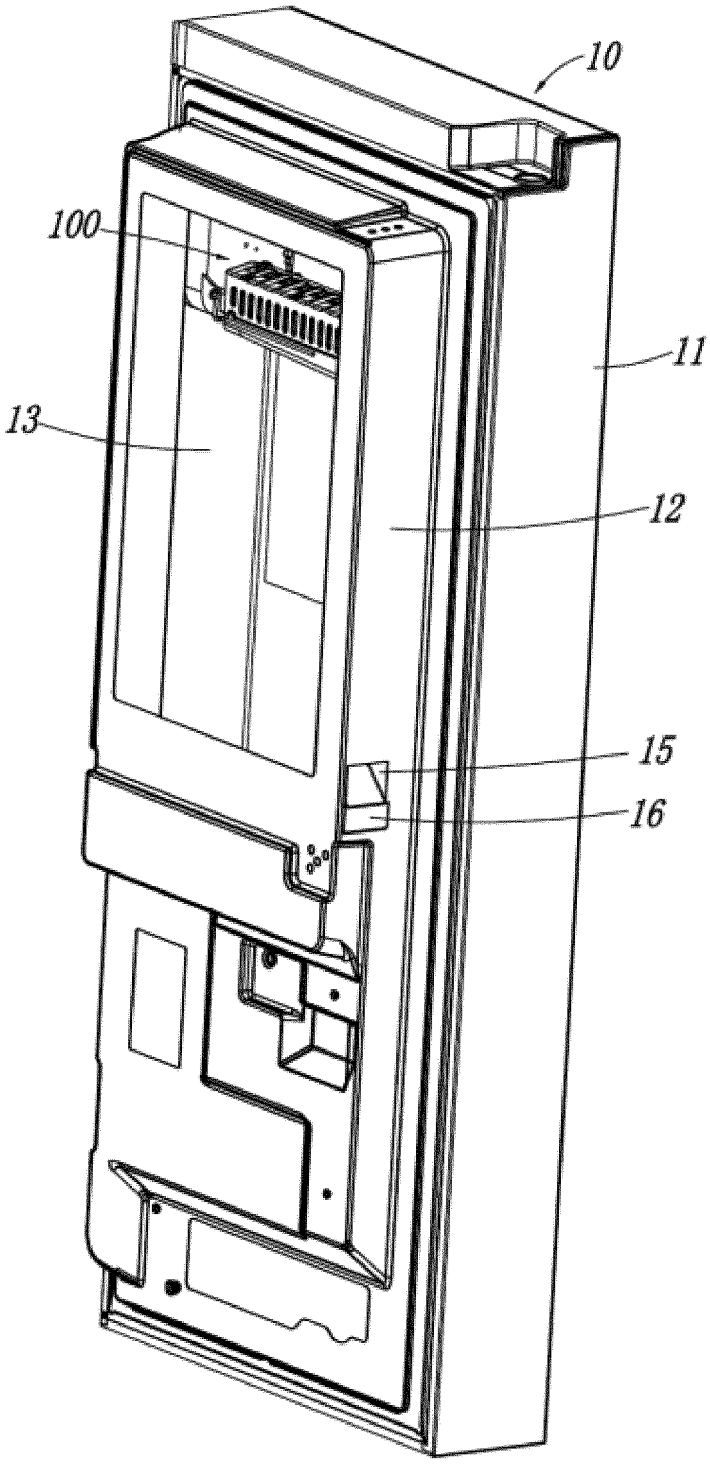

FIG. 1

Description

TECHNICAL FIELD

[0001] The present invention relates to the field of refrigeration appliances, and in particular relates to a refrigerator with an ice maker.

BACKGROUND ART

[0002] An ice maker typically arranged in a freezing chamber of a refrigerator is configured to make ice by means of cold air in the freezing chamber. However, for a refrigerator with a refrigerating chamber and the freezing chamber distributed vertically, a user has to bend down to open a door body of the freezing chamber when taking ice. In order to make it convenient for the user to take ice, in some existing refrigerators, the refrigerating chambers or door bodies of the refrigerating chambers are provided with independent ice-making chambers, ice makers are arranged in the ice-making chambers, and distributors related to the ice makers are arranged on the outer sides of the door bodies.

[0003] However, when the door body of the refrigerating chamber is provided with an independent ice-making chamber, defrosting water produced by the ice maker or other components will accumulate in the ice-making chamber. In an existing refrigerator, to discharge the defrosting water, a pipeline is employed to guide the defrosting water from the ice-making chamber into a water tray below the distributor outside the door body, which may cause some health hazards due to water accumulated in the water tray. Additionally, along the pipeline, cold air in the ice-making chamber may also be released to the external environment, which may increase energy consumption of the refrigerator and bring inconvenience to the user. As a result, it is necessary to further improve the existing technology.

SUMMARY OF THE INVENTION

[0004] An objective of the present invention is to provide a user-friendly, reliable and more energy-efficient refrigerator.

[0005] In order to achieve one of the above-mentioned objects, the present invention provides a refrigerator, comprising:

a cabinet body, the cabinet body defining a refrigeration compartment;

a door body movably connected to the cabinet body and configured to open and close the refrigeration compartment, the door body comprising a door shell and a door liner combined with the door shell, the door liner at least partially extending into the refrigeration compartment when the door body is closed;

a refrigeration system configured to provide cold energy for the refrigeration compartment; and

an ice-making chamber arranged in the door body and having an ice-making assembly arranged therein, the ice-making chamber and the refrigeration compartment being heat-insulated when the door body is closed,

wherein the door body is provided with a first drainage pipeline; the cabinet body is provided with a second drainage pipeline; an inlet end of the first drainage pipeline is connected to the ice-making chamber; the door liner is provided with a first connector; an outlet end of the first drainage pipeline is connected to the first connector; the refrigeration compartment is provided with a second connector; an inlet end of the second drainage pipeline is connected to the second connector; when the door body is closed, the first connector is connected to the second connector, and the outlet end of the first drainage pipeline is communicated with the inlet end of the second drainage pipeline; and when the door body is opened, the first connector is separated from the second connector, and drainage in the first drainage pipeline is stored in the first connector.

[0006] As a further improvement of an embodiment of the present invention, wherein the first connector comprises a cavity arranged on the door liner; a water storage box is detachably mounted in the cavity; the water storage box is located below the outlet end of the first drainage pipeline; the water storage box comprises an opening that is open relative to the outlet end of the first drainage pipeline; and when the door body is closed, the second connector is inserted into the cavity and isolates the opening from the outlet end of the first drainage pipeline.

[0007] As a further improvement of an embodiment of the present invention, wherein the opening comprises a horizontal opening portion and an inclined opening portion; the inclined opening portion is inclined downwards relative to the horizontal opening portion; and when the door body is closed, the second connector is located above the inclined opening portion and at least partially overlapped with the water storage box in a height direction.

[0008] As a further improvement of an embodiment of the present invention, wherein the first connector comprises a cavity arranged on the door liner; the second connector comprises a water receiving nozzle protruding from a liner of the refrigeration compartment; and when the door body is closed, the water receiving nozzle at least partially extends into the cavity to be communicated with the outlet end of the first drainage pipeline.

[0009] As a further improvement of an embodiment of the present invention, wherein a filter cover is connected to the water receiving nozzle, and an edge of the filter cover is embedded into the liner of the refrigeration compartment.

[0010] As a further improvement of an embodiment of the present invention, wherein the water receiving nozzle comprises a funnel portion and a water discharging pipe

communicated with the funnel portion; the water discharging pipe is inserted into the inlet end of the second drainage pipeline; the funnel portion comprises a flat mounting wall provided with the water discharging pipe; and the mounting wall is embedded into the liner of the refrigeration compartment.

[0011] As a further improvement of an embodiment of the present invention, wherein the water receiving nozzle is movably connected to the liner of the refrigeration compartment; the water receiving nozzle moves into the cavity based on closing of the door body; and when the door body is opened, the water receiving nozzle automatically returns to a position to be embedded into the liner.

[0012] As a further improvement of an embodiment of the present invention, further comprising an ice-making assembly arranged in the ice-making chamber, the ice-making assembly comprising:

an ice mold, the ice mold being provided with a plurality of ice cube trays for containing ice-making water;

a refrigerant pipe extending from one end of the ice mold to the other end and located at the bottom of the ice mold, the refrigerant pipe being connected to the refrigeration system;

a heating wire fixed to the bottom of the ice mold and spaced from the refrigerant pipe; and

a drain tray connected below the ice mold, a water outlet being formed at one end of the drain tray, the water outlet being inserted into the inlet end of the first drainage pipeline.

[0013] As a further improvement of an embodiment of the present invention, wherein the door body is pivotally connected to the cabinet body by a hinge, and the first connector and the second connector are arranged on a side close to a pivot axis of the door body.

[0014] As a further improvement of an embodiment of the present invention, wherein a compressor bin for accommodating a compressor is arranged at a bottom of the cabinet body, a water tray is arranged in the compressor bin, and the outlet end of the second drainage pipeline is communicated with the water tray.

[0015] As a further improvement of an embodiment of the present invention, wherein the first connector comprises a water storage box arranged on the door liner; the outlet end of the first drainage pipeline is communicated with the water storage box; a drain valve is arranged at a bottom of the water storage box; the second connector applies a force to the drain valve based on closing of the door body to open the drain valve; and when the door body is opened, the second connector removes the force applied to the drain valve, and the drain valve is automatically closed.

[0016] As a further improvement of an embodiment of the present invention, wherein the first connector comprises a cavity arranged on the door liner; a valve for opening and closing the outlet end of the first drainage pipeline is arranged in the cavity; the second connector applies a force to the valve based on closing of the door body to open the valve; and when the door body is opened, the second connector removes the force applied to the valve, and the valve is automatically closed.

[0017] As a further improvement of an embodiment of the present invention, wherein the first connector comprises a cavity arranged on the door liner; a valve for opening and closing the outlet end of the first drainage pipeline is arranged in the cavity; the valve is opened based on gravity of water reaching a preset value; the valve is connected to a limiting mechanism; when the door body is opened, the limiting mechanism prevents the valve from being opened; and when the door body is closed, the limiting mechanism allows the valve to be opened.

[0018] Compared with the prior art, when the door body 10 is closed, the first drainage pipeline 30 arranged on the door body 10 is communicated with the second drainage pipeline 40 arranged on the cabinet body 20, so that defrosting water in the ice-making chamber 13 can be discharged to the cabinet body 20, which brings convenience for a user to use the refrigerator.

[0019] In order to achieve the above-mentioned object, the other embodiment of the present invention provides a refrigerator, comprising:

a cabinet body, the cabinet body defining a refrigeration compartment;

a door body movably connected to the cabinet body and configured to open and close the refrigeration compartment;

a refrigeration system configured to provide cold energy for the refrigeration compartment; and

an ice-making chamber arranged in the door body and having an ice-making assembly arranged therein, the ice-making chamber and the refrigeration compartment being heat-insulated when the door body is closed,

wherein the door body is provided with a drainage pipeline, an inlet end of the drainage pipeline is connected to the ice-making chamber, the door body is provided with a cavity facing the back of the refrigeration compartment, a water storage box is detachably mounted in the cavity, and an outlet end of the drainage pipeline is communicated with a storage space of the water storage box.

[0020] As a further improvement of an embodiment of the present invention, wherein the door body comprises a door shell and a door liner combined with the door shell; the door liner at least partially extends into the refrigeration compartment when the door body is closed; the cavity is arranged on the door liner.

[0021] As a further improvement of an embodiment of the present invention, wherein the door body is pivotally connected to the cabinet body by a hinge; the door liner comprises a rear surface facing the refrigeration com-

partment, and side surfaces located at two sides of the rear surface and perpendicular to the rear surface; the cavity is arranged on a side surface of the door liner close to a pivot axis of the door body.

[0022] As a further improvement of an embodiment of the present invention, wherein a liquid level sensor is arranged in the cavity; the refrigerator further comprises a controller connected to the liquid level sensor; a display panel connected to the controller is arranged on the door body; and the liquid level sensor transmits a signal to the controller when detecting that a liquid level in the water storage box reaches a preset level, and the controller controls the display panel to give a preset prompt.

[0023] As a further improvement of an embodiment of the present invention, wherein the water storage box comprises four side walls and a bottom wall which form the storage space in a surrounding manner; the four side walls comprise a first side located outside the cavity; the first side wall is provided with an opening; the opening comprises an upper edge and a lower edge; and upper surfaces of the other three side walls are located between the upper edge and the lower edge.

[0024] As a further improvement of an embodiment of the present invention, further comprising an ice-making assembly arranged in the ice-making chamber, the ice-making assembly comprising:

an ice mold, the ice mold being provided with a plurality of ice cube trays for containing ice-making water;

a refrigerant pipe extending from one end of the ice mold to the other end and located at the bottom of the ice mold, the refrigerant pipe being connected to the refrigeration system;

a heating wire fixed to the bottom of the ice mold and spaced from the refrigerant pipe; and

a drain tray connected below the ice mold, a water outlet being formed at one end of the drain tray, the water outlet being inserted into the inlet end of the first drainage pipeline. As a further improvement of an embodiment of the present invention, wherein a heating wire is arranged in the water storage box; an electrical connector connected to the heating wire is arranged in the cavity; the outlet end is connected to a check valve; and the check valve allows a fluid to flow into the water storage box from the outlet end and prevents the fluid from entering the outlet end from the water storage box.

[0025] As a further improvement of an embodiment of the present invention, wherein a valve for opening and closing the outlet end of the drainage pipeline is arranged in the cavity; the water storage box is mounted in the cavity and applies a force to the valve to open the valve; the water storage box is separated from the cavity; and the valve is automatically closed.

[0026] As a further improvement of an embodiment of the present invention, wherein a valve for opening and closing the outlet end of the drainage pipeline is arranged in the cavity; the valve is opened based on gravity of water reaching a preset value; the valve is connected to a limiting mechanism; when the water storage box is mounted in the cavity, the limiting mechanism allows the valve to be opened; and when the water storage box is separated from the cavity, the limiting mechanism prevents the valve from being opened.

[0027] As a further improvement of an embodiment of the present invention, wherein the inlet end and the outlet end of the drainage pipeline are each provided with an end opening cover plate that is open around the pipeline; and the end opening cover plates are abutted against the door liner.

[0028] Compared with the prior art, in embodiments of the present invention, by providing a door body with a drainage pipeline and providing a water storage box in a cavity of the door body, defrosting water in an ice-making chamber can be discharged to the water storage box, so that an adverse impact on use of the refrigerator is prevented, and energy usage is more efficient.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029]

FIG. 1 is a schematic three-dimensional diagram of a door body of a refrigerator according to a preferred embodiment of the present invention;

FIG. 2 is a schematic three-dimensional diagram of a part of a cabinet body of a refrigerator according to a preferred embodiment of the present invention;

FIG. 3 is a side perspective view of the cabinet body of the refrigerator in FIG. 2;

FIG. 4 is a schematic sectional diagram of the refrigerator in FIG. 3 along a line A-A in a door-closed state;

FIG. 5 is a schematic three-dimensional diagram of some assemblies of the refrigerator according to a preferred embodiment of the present invention;

FIG. 6 is a schematic three-dimensional diagram of a water storage box in FIG. 5;

FIG. 7 is a three-dimensional exploded diagram of a water receiving nozzle and a filter cover in FIG. 5;

FIG. 8 is a schematic three-dimensional diagram of an ice-making assembly of a refrigerator according to a preferred embodiment of the present invention;

FIG. 9 is a schematic diagram of a second connector on a cabinet body according to another preferred embodiment of the present invention, in which a door of a refrigerator is in an open state;

FIG. 10 is a schematic diagram of the refrigerator in FIG. 9 in a door-closed state;

FIG. 11 is a schematic diagram of a refrigerator according to yet another preferred embodiment of the present invention, in which a door of the refrigerator is in an open state;

FIG. 12 is a schematic diagram of the refrigerator in

FIG. 11 in a door-closed state;

FIG. 13 is a schematic three-dimensional diagram of a door body of a refrigerator according to still yet another preferred embodiment of the present invention;

FIG. 14 is a schematic diagram of a refrigerator according to a preferred embodiment of the present invention;

FIG. 15 is a schematic three-dimensional diagram of a drainage pipeline and a water storage box on the door body in FIG. 13;

FIG. 16 is a schematic diagram of a liquid level sensor arranged in a cavity of the door body in FIG. 13;

FIG. 17 is a schematic diagram showing that a water storage box is arranged on a door body according to still yet another preferred embodiment of the present invention, in which the water storage box is mounted in a cavity of the door body; and

FIG. 18 is a schematic diagram showing that the water storage box in FIG. 17 is separated from the cavity.

DETAILED DESCRIPTION

[0030] The present invention will be described in detail below with reference to the particular embodiments shown in the accompanying drawings. However, these embodiments are not intended to limit the present invention, and modifications in structures, methods, or functions made by those of ordinary skill in the art according to these embodiments are all included in the scope of protection of the present invention.

[0031] It should be understood that the terms representing spatial relative positions, such as "up", "down", "out", "in" as used herein describe the relationship of a unit or feature relative to another unit or feature in the accompanying drawings for the purpose of illustration. The terms of the spatial relative positions may be intended to include different orientations of the device in use or operation other than the orientations shown in the accompanying drawings.

[0032] Referring to FIGs. 1 to 5, a refrigerator according to a preferred embodiment of the present invention includes a cabinet body 20, a door body 10 movably connected to the cabinet body 20, and a refrigeration system. A refrigeration compartment is defined by the cabinet body 20; the door body 10 is configured to open and close the refrigeration compartment; and the refrigeration system is configured to provide cold energy for the refrigeration compartment. A fan for introducing cold air produced by the refrigeration system into the refrigeration compartment is further arranged in the cabinet body 20. The refrigeration compartment includes a refrigerating chamber 21 and a freezing chamber 22, and of course, may further include other compartments, for example, a variable-temperature chamber. The refrigerating chamber 21 and the freezing chamber 22 are arranged vertically. The door body 10 is configured to open and close the refrigerating chamber 21. The door body 10 is provided with an ice-making chamber 13, and an ice-making assembly 100 is arranged in the ice-making chamber 13. The ice-making chamber 13 and the refrigerating chamber 21 are heat-insulated when the door body 10 is closed. There may be one or two door bodies for opening and closing the refrigerating chamber. The ice-making chamber is arranged in one of the door bodies if two door bodies are provided. In this embodiment, the front-rear direction of the refrigerator takes the side where the door body 10 is arranged as the front and the side where the cabinet body 20 is arranged as the rear, and the left-right direction is perpendicular to the up-down direction and the front-rear direction.

[0033] The refrigeration system includes a compressor 913 and a condenser connected to the outlet side of the compressor 913. The refrigeration system is further configured to provide cold energy for the ice-making assembly 100. The compressor 913 is arranged at the bottom of the cabinet body 20. An evaporator for providing cold energy for the freezing chamber 22 and the refrigerating chamber 21 is arranged at the rear of the freezing chamber. In this embodiment, the ice-making assembly 100 makes ice by means of direct contact with a refrigerant pipe, and the evaporator may be connected in series with the refrigerant pipe for providing cold energy for ice making or in parallel with two sides of the compressor 913 and the condenser.

[0034] Frosting may occur when the ice-making assembly 100 works, and defrosting water is required to be drained in time. In this embodiment, the door body 10 is provided with a first drainage pipeline 30. The door body 10 includes a door shell 11 and a door liner 12 combined with the door shell 11. The door liner 12 at least partially extends into the refrigeration compartment when the door body is closed. A heat insulating material is filled between the door shell 11 and the door liner 12. The first drainage pipeline 30 may be fixed in the heat insulating material when the heat insulating material is foamed between the door shell 11 and the door liner 12. An inlet end 31 of the first drainage pipeline 30 is connected to the ice-making chamber 13, which facilitates connection of water paths. The cabinet body 20 is provided with a second drainage pipeline 40. The door liner 12 is provided with a first connector. An outlet end 32 of the first drainage pipeline 30 is connected to the first connector. The refrigeration compartment is provided with a second connector. An inlet end 41 of the second drainage pipeline 40 is connected to the second connector. When the door body 10 is closed, the first connector is connected to the second connector, and the outlet end 32 of the first drainage pipeline 30 is communicated with the inlet end of the second drainage pipeline 40, so that defrosting water in the ice-making chamber 10 may be discharged to the cabinet body 20 from the door body 10; and when the door body 10 is opened, the first connector is separated from the second connector, water in the first drainage pipeline 30 is stored in the first connector. When the door body 10

is closed, the first drainage pipeline 30 arranged on the door body 10 is communicated with the second drainage pipeline 40 arranged on the cabinet body 20, so that defrosting water in the ice-making chamber 13 can be discharged to the cabinet body 20, which brings convenience for a user to use the refrigerator. Since the opening time of the door body is much shorter than the closing time of the door body, defrosting water produced by the ice-making assembly may be substantially discharged to the second drainage pipeline 40 of the cabinet body, and it is unnecessary for the user to clean the defrosting water.

[0035] Of course, in order to prevent the defrosting water from flowing out when the door body 10 is opened, in this embodiment, the first connector includes a cavity 15 arranged on the door liner 12. A water storage box 16 is detachably mounted in the cavity 15. The water storage box 16 is located below the outlet end 32 of the first drainage pipeline 30. The water storage box 16 includes an opening that is open relative to the outlet end 32 of the first drainage pipeline 30. When the door body 10 is closed, the second connector is inserted into the cavity 15 and isolates the opening of the water storage box 16 from the outlet end 32 of the first drainage pipeline 30. That is, when the door body 10 is opened, defrosting water flowing out of the first drainage pipeline 30 may exactly drop into the water storage box 16 below, while when the door body 10 is closed, defrosting water in the first drainage pipeline 30 may flow into the second drainage pipeline 40.

[0036] Referring to FIGs. 5 and 6, the opening of the water storage box 16 includes a horizontal opening portion 161 and an inclined opening portion 162, and the inclined opening portion 162 is inclined downwards relative to the horizontal opening portion 161. When the door body 10 is closed, the second connector is located above the inclined opening portion 162 and at least partially overlapped with the water storage box 16 in a height direction, so that the space of the cavity 15 is saved, i.e., only the water storage box 16 needs to be accommodated in the cavity 15. The space of the cavity 15 into which the second connector extends is actually partially overlapped with the space occupied by the water storage box 16. The communication between the first drainage pipeline 30 and the water storage box 16 or the second connector may not be adversely affected regardless of whether the door body is opened or closed.

[0037] Further, the second connector includes a water receiving nozzle 26 protruding from a liner 210 of the refrigeration compartment. When the door body 10 is closed, the water receiving nozzle 26 at least partially extends into the cavity 15 to be communicated with the outlet end 32 of the first drainage pipeline 30. The door body 10 is pivotally connected to the cabinet body 20 by a hinge, and the first connector and the second connector are arranged on the side close to the pivot axis of the door body 10. Specifically, the cavity 15 may be arranged on the side of the door liner 12 close to the pivot axis of the door body, and the water receiving nozzle 26 may be arranged on a side wall of the liner 210 of the refrigeration compartment, so that water paths of the water receiving nozzle 26 and the first drainage pipeline 30 may be communicated when the door body is closed.

[0038] Referring to FIG. 7, the water receiving nozzle 26 includes a funnel portion 261 and a water discharging pipe 262 communicated with the funnel portion. The water discharging pipe 262 is inserted into the inlet end 41 of the second water drainage pipeline 40. The funnel portion 261 includes a flat mounting wall 263 provided with the water discharging pipe 262, and the mounting wall 263 is embedded into the liner 210 of the refrigeration compartment to facilitate positioning and mounting of the water receiving nozzle 26. A filter cover 27 is connected to the water receiving nozzle 26, and an edge of the filter cover 27 is also embedded into the liner 210 of the refrigeration compartment. The filter cover 27 is provided to filter drainage of the first drainage pipeline 30, and also to prevent the second drainage pipeline 40 from being blocked by a foreign matter in the refrigeration compartment that falls into the water receiving nozzle 26.

[0039] Further, referring to FIG. 3, a part of the second drainage pipeline 40 may also be arranged in a foam layer of the cabinet body 20. A compressor bin that accommodates a compressor 913 is arranged at the bottom of the cabinet body 20. A water tray 90 is arranged in the compressor bin. The outlet end 42 of the second drainage pipeline 40 is communicated with the water tray. In this way, defrosting water from the door body 10 may be discharged out of the cabinet body 20 by means of the first drainage pipeline 30 and the second drainage pipeline 40. Generally, a heating wire is arranged in the water tray 90, and water in the water tray 90 is evaporated by means of heating evaporation. Of course, water in the water tray 90 may also be used to humidify a moisturizing space of the refrigerator or humidify the external environment. Of course, the outlet end of the second drainage pipeline may also be of other structures, for example, the outlet end is directly communicated with the moisturizing space of the refrigerator, or the outlet end is communicated with the drainage pipeline of the refrigeration compartment, or the outlet end is directly communicated with a humidifying apparatus in the external environment.

[0040] Referring to FIG. 8, the ice-making assembly 100 in the ice-making chamber includes an ice mold 101, and a refrigerant pipe 102 and a heating wire that are arranged at the bottom of the ice mold 101. The ice mold 101 is provided with a plurality of ice cube trays for containing ice-making water. The refrigerant pipe 102 extends from one end of the ice mold to the other end, and the refrigerant pipe 102 is connected to the refrigeration system. The heating wire is fixed to the bottom of the ice mold 101 and spaced from the refrigerant pipe 102. The ice-making assembly 100 further includes a drain tray 103 connected below the ice mold 101. A water outlet 105 is formed at one end of the drain tray 103, and is inserted into the inlet end 31 of the first drainage pipeline

30. In order to make manufacture of the refrigerator more reliable, the inlet end 31 and the outlet end 32 of the first drainage pipeline 30 are provided with end opening cover plates 33 respectively, so that when the door body is foamed, the end opening cover plates 33 may abut against corresponding positions on the door liner 12 to prevent a foaming material from overflowing. Similarly, the inlet end 41 of the second drainage pipeline 40 may also be provided with an end opening cover plate 43 for abutting against the liner 210 of the refrigeration compartment, so that foaming of the cabinet body is more reliable.

[0041] Referring to FIGs. 9 and 10, in another preferred embodiment, the first connector includes a cavity 15 arranged on the door liner 12. A water receiving nozzle 26a is movably connected to the liner 210 of the refrigeration compartment. The water receiving nozzle 26a moves into the cavity 15 of the door body based on closing of the door body 10. When the door body 10 is opened, the water receiving nozzle 26a automatically returns to a position to be embedded into the liner 210. A reset spring 265 is connected between the water receiving nozzle 26a and the liner 210. The reset spring 265 may drive the water receiving nozzle 26a to reset. A driving rod 266 is further connected to the water receiving nozzle 26a, and may work based on the lever principle. When the door body 10 is closed, the door body 10 presses down one end of the driving rod 266, and the other end of the driving rod 266 drives the water receiving nozzle 26a to move and enter the cavity 15 of the door body 10, thereby realizing communication between the outlet end 32 of the first drainage pipeline and the inlet end 41 of the second drainage pipeline. The motion of the water receiving nozzle 26a may be rotation or movement, and the water receiving nozzle 26a may also be driven to move in other ways. Electric driving is unnecessary as long as the water receiving nozzle 26a is driven to move based on closing of the door body, which reduces the cost and consumes no electricity.

[0042] Referring to FIGs. 11 and 12, in yet another embodiment, the first connector includes a water storage box 16a arranged on the door liner 12. The outlet end 32 of the first drainage pipeline is communicated with the water storage box 16a. A drain valve 165 is arranged at the bottom of the water storage box 16a. The second connector applies a force to the drain valve 165 based on closing of the door body 10 to open the drain valve 165. When the door body 10 is opened, and the second connector removes the force applied to the drain valve 165, and the drain valve 165 is automatically closed. The drain valve 165 may be connected to a reset spring 166, and the drain valve 165 may be automatically closed by an elastic force of the reset spring 166. In this way, drainage, produced when the door body is opened, may be stored in the water storage box 16a first, and then water stored in the water storage box 16a may be discharged into the inlet end 41 of the second drainage pipeline when the door body is closed, so it is unnecessary for the user to deal with water stored in the water storage box 16a.

[0043] Of course, the water storage box may not be provided, either, and the drain valve may be directly arranged at the outlet end of the first drainage pipeline. For example, the first connector includes a cavity arranged on the door liner, and a valve for opening and closing the outlet end of the first drainage pipeline is arranged in the cavity. The second connector applies a force to the valve based on closing of the door body to open the valve. When the door body is opened, the second connector removes the force applied to the valve, and the valve is automatically closed. That is, the valve is forced to open, and the valve must be in an open state as long as the door body is closed. Of course, it may be provided that the valve is opened conditionally, for example, an electric valve is opened according to a preset signal, or is opened based on a preset value of gravity borne by the valve. In this way, a limiting mechanism may be connected to the valve. When the door body is opened, the limiting mechanism prevents the valve from being opened, and when the door body is closed, the limiting mechanism allows the valve to be opened.

[0044] In the refrigerator according to the above embodiments, the door body is provided with the first drainage pipeline, the cabinet body is provided with the second drainage pipeline, the door liner is provided with the first connector connected to the first drainage pipeline, and the cabinet body is provided with the second connector connected to the second drainage pipeline. When the door body is closed, the first drainage pipeline and the second drainage pipeline are communicated with each other through the first connector and the second connector, so that ice-making defrosting water on the door body can be discharged to the cabinet body. When the door body is opened, drainage in the first drainage pipeline may be stored in the first connector without adversely affecting use of the refrigerator.

[0045] Referring to FIGs. 13 to 18, a refrigerator provided by still yet another embodiment of the present invention includes a cabinet body 20, a door body 10 movably connected to the cabinet body 20 and a refrigeration system. The cabinet body 20 defines a refrigeration compartment. The door body 10 is configured to open and close the refrigeration compartment. The refrigeration system is configured to provide cold energy for the refrigeration compartment. A fan 220 for introducing cold air produced by the refrigeration system into the refrigeration compartment is further arranged in the cabinet body 20. The refrigeration compartment includes a refrigerating chamber 21 and a freezing chamber 22, and of course, may include other compartments, for example, a variable-temperature chamber. The refrigerating chamber 21 and the freezing chamber 22 are arranged vertically. The door body 10 is configured to open and close the refrigerating chamber 21. The door body 10 is provided with an ice-making chamber 13, and an ice-making assembly 100 and an ice storage box 200 located below the ice-making assembly are arranged in the ice-

making chamber 13. The ice-making chamber 13 and the refrigerating chamber 21 are heat-insulated when the door body 10 is closed. There may be one or two door bodies for opening and closing the refrigerating chamber. The ice-making chamber is arranged in one of the door bodies if two door bodies are provided. In this embodiment, the front-rear direction of the refrigerator takes the side where the door body 10 is arranged as the front and the side where the cabinet body 20 is arranged as the rear, and the left-right direction is perpendicular to the up-down direction and the front-rear direction. Components with the same reference numbers as those in the previous embodiments are of similar structures and have similar functions.

[0046] The refrigeration system includes a compressor 913 and a condenser connected to the outlet side of the compressor 913. The refrigeration system is further configured to provide cold energy for the ice-making assembly 100. The compressor 913 is arranged at the bottom of the cabinet body 20. An evaporator 912 for providing cold energy for the freezing chamber 22 and the refrigerating chamber 21 is arranged behind the freezing chamber. In this embodiment, the ice-making assembly 100 makes ice by means of direct contact with a refrigerant pipe, and the evaporator 912 may be connected in series with the refrigerant pipe for providing cold energy for ice making or in parallel with two sides of the compressor 913 and the condenser.

[0047] Frosting may occur when the ice-making assembly 100 works, and defrosting water is required to be drained in time. In this embodiment, the door body 10 is provided with a drainage pipeline 30. The door body 10 includes a door shell 11 and a door liner 12 combined with the door shell 11. The door liner 12 at least partially extends into the refrigeration compartment when the door body is closed. A heat insulating material is filled between the door shell 11 and the door liner 12. The drainage pipeline 30 may be fixed in the heat insulating material when the heat insulating material is foamed between the door shell 11 and the door liner 12. An inlet end 31 of the drainage pipeline 30 is connected to the ice-making chamber 13, which facilitates connection of water paths. The door body is provided with a cavity 15 facing the back of the refrigeration compartment. A water storage box 16b is detachably mounted in the cavity 15. An outlet end 32 of the drainage pipeline 30 is communicated with a storage space of the water storage box 16b, so that defrosting water produced by ice making may be discharged into the water storage box 16b from the drainage pipeline 30 in time, and the user only needs to clean the water storage box 16b regularly.

[0048] In this embodiment, preferably, the cavity 15 is arranged on the door liner 12, so that the water storage box 16b can only be taken out by opening the door body, and heat insulation of the door body can be ensured to prevent cold air in the refrigeration compartment from escaping. The water storage box 16b may be directly arranged below the outlet end 32 of the first drainage pipeline 30. The upper part of the water storage box 16b is open, so that defrosting water flowing out of the outlet end 32 of the first drainage pipeline 30 directly falls into the water storage box. The door body 10 is pivotally connected to the cabinet body 20 by a hinge. The door liner 12 includes a rear surface facing the refrigeration compartment and side surfaces that are arranged at two sides of the rear surface and are perpendicular to the rear surface. The cavity 15 is arranged on the side surface of the door liner 12 close to the pivot axis of the door body. In this way, the water storage box 16b can only be taken out when the door body is opened at about 90 degrees relative to the cabinet body, protecting the water storage box 16b against misoperation.

[0049] In this embodiment, the specific structure of the ice-making assembly 100 in the ice-making chamber is the same as that in the previous embodiments, and thus will not be repeated herein. Referring to FIG. 16, in order to prevent the user from forgetting to clean up accumulated water in the water storage box 16b, a liquid level sensor may be arranged in the cavity 15. The refrigerator further includes a controller connected to the liquid level sensor. The door body is provided with a display panel connected to the controller. The liquid level sensor transmits a signal to the controller when detecting that the liquid level in the water storage box reaches a preset level, and the controller controls the display panel to give a preset prompt. The preset prompt may be a sound alarm, a light flash, digital or text display on the display panel, and the like. The liquid level sensor in the cavity 15 may be a contact sensor or a non-contact sensor. Of course, the liquid level sensor may simply include a lever 51 and a floating ball 52 connected to one end of the lever. The floating ball 52 extends into the water storage box 16b. An electric contact 53 is arranged at the other end of the lever 51. When the water level reaches a preset level, the floating ball 52 drives the lever 51 to enable the electric contact 53 at the other end to be in contact with an electric contact 153 in the cavity, and an electrical connection signal is fed back to the controller, thereby realizing detection of the highest water level in the water storage box 16b. The structure is simpler, and the cost is lower.

[0050] Specifically, the water storage box 16b includes a four side walls and bottom wall which form the storage space in a surrounding manner. The four side walls include a first side 161b located outside the cavity. The first side wall 161b is provided with an opening 162b. The opening 162b includes an upper edge 163 and a lower edge 164. Upper surfaces of the other three side walls are located between the upper edge 163 and the lower edge 164, so that the water level in the water storage box 16b can be observed through the opening 162b. The water storage box 16b may be conveniently taken out by using the opening 162b as a part of a handle. Further, heating wire may be further arranged in the water storage box 16b. An electrical connector connected to the heating wire is arranged in the cavity 15. The outlet end is con-

nected to a check valve. The check valve allows a fluid to flow into the water storage box from the outlet end and prevents the fluid from entering the outlet end from the water storage box. That is, water vapor evaporated by the heating wire cannot enter the ice-making chamber from the drainage pipeline, and thus cannot adversely affect the temperature of the ice-making chamber. Moreover, when the door body is closed, the opening of the water storage box faces the liner of the refrigeration compartment, the evaporated water vapor condenses on the liner to become water droplets, and the droplets are discharged through a drainage path in the refrigeration compartment.

[0051] Referring to FIGs. 17 and 18, in order to avoid discharging defrosting water when the user cleans the water storage box, a valve 60 for opening and closing the outlet end 32 of the drainage pipeline may be arranged in the cavity 15. The water storage box 16b is mounted in the cavity 15 and applies a force to the valve 60 to open the valve 60, then the water storage box 16b is separated from the cavity 15, and the valve 60 is automatically closed. The valve herein may be an electric valve and may also be implemented by a mechanical structure. For example, the valve 60 is movably connected to the outlet end 32 of the drainage pipeline. A reset spring is connected between the valve 60 and the outlet end 32. When the water storage box 16b is mounted in the cavity 15, the water storage box 16b drives the valve 60 to move to the position of opening the outlet end 32. When the water storage box 16b is separated from the cavity 15, the valve 60 returns to the position of closing the outlet end 32 under the action of the reset spring. The motion of the valve may be rotation or translation. The valve described above is of a simpler structure and is lower in cost. Of course, the valve may also be opened based on gravity of water reaching a preset value. The valve is connected to a limiting mechanism. When the water storage box is mounted in the cavity, the limiting mechanism allows the valve to be opened; and when the water storage box is separated from the cavity, the limiting structure prevents the valve from being opened. That is, the water storage box and the limiting mechanism mutually act to allow the valve to be opened. Even if the user needs to clean the water storage box for a long time, there is no need to worry about leakage of defrosting water. In addition, a relevant prompt may be set to prevent the user from forgetting to put the cleaned water storage box into the cavity.

[0052] In the refrigerator according to the above embodiments, by providing the door body with the drainage pipeline and providing the water storage box in the cavity of the door body, defrosting water in the ice-making chamber can be discharged to the water storage box, which cannot adversely affect use of the refrigerator and is more energy-efficient.

[0053] It should be understood that although the Description is described according to the embodiments, not each embodiment includes only one independent technical solution, such a description manner is only for the sake of clarity, those skilled in the art should take the Description as an integral part, and the technical solutions in the embodiments may be suitably combined to form other embodiments understandable by those skilled in the art.

[0054] The detailed descriptions set forth above are merely specific illustrations of feasible embodiments of the present invention, and are not intended to limit the scope of protection of the present invention. All equivalent embodiments or modifications that do not depart from the art spirit of the present invention should fall within the scope of protection of the present invention.

Claims

1. A refrigerator, comprising:

   a cabinet body, the cabinet body defining a refrigeration compartment;
   a door body movably connected to the cabinet body and configured to open and close the refrigeration compartment, the door body comprising a door shell and a door liner combined with the door shell, the door liner at least partially extending into the refrigeration compartment when the door body is closed;
   a refrigeration system configured to provide cold energy for the refrigeration compartment; and
   an ice-making chamber arranged in the door body and having an ice-making assembly arranged therein, the ice-making chamber and the refrigeration compartment being heat-insulated when the door body is closed,
   wherein the door body is provided with a first drainage pipeline; the cabinet body is provided with a second drainage pipeline; an inlet end of the first drainage pipeline is connected to the ice-making chamber; the door liner is provided with a first connector; an outlet end of the first drainage pipeline is connected to the first connector; the refrigeration compartment is provided with a second connector; an inlet end of the second drainage pipeline is connected to the second connector; when the door body is closed, the first connector is connected to the second connector, and the outlet end of the first drainage pipeline is communicated with the inlet end of the second drainage pipeline; and when the door body is opened, the first connector is separated from the second connector, and drainage in the first drainage pipeline is stored in the first connector.

2. The refrigerator according to claim 1, wherein the first connector comprises a cavity arranged on the door liner; a water storage box is detachably mount-

ed in the cavity; the water storage box is located below the outlet end of the first drainage pipeline; the water storage box comprises an opening that is open relative to the outlet end of the first drainage pipeline; and when the door body is closed, the second connector is inserted into the cavity and isolates the opening from the outlet end of the first drainage pipeline.

3. The refrigerator according to claim 2, wherein the opening comprises a horizontal opening portion and an inclined opening portion; the inclined opening portion is inclined downwards relative to the horizontal opening portion; and when the door body is closed, the second connector is located above the inclined opening portion and at least partially overlapped with the water storage box in a height direction.

4. The refrigerator according to claim 1, wherein the first connector comprises a cavity arranged on the door liner; the second connector comprises a water receiving nozzle protruding from a liner of the refrigeration compartment; and when the door body is closed, the water receiving nozzle at least partially extends into the cavity to be communicated with the outlet end of the first drainage pipeline.

5. The refrigerator according to claim 4, wherein a filter cover is connected to the water receiving nozzle, and an edge of the filter cover is embedded into the liner of the refrigeration compartment.

6. The refrigerator according to claim 4, wherein the water receiving nozzle comprises a funnel portion and a water discharging pipe communicated with the funnel portion; the water discharging pipe is inserted into the inlet end of the second drainage pipeline; the funnel portion comprises a flat mounting wall provided with the water discharging pipe; and the mounting wall is embedded into the liner of the refrigeration compartment.

7. The refrigerator according to claim 4, wherein the water receiving nozzle is movably connected to the liner of the refrigeration compartment; the water receiving nozzle moves into the cavity based on closing of the door body; and when the door body is opened, the water receiving nozzle automatically returns to a position to be embedded into the liner.

8. The refrigerator according to claim 1, further comprising an ice-making assembly arranged in the ice-making chamber, the ice-making assembly comprising:

an ice mold, the ice mold being provided with a plurality of ice cube trays for containing ice-making water;

a refrigerant pipe extending from one end of the ice mold to the other end and located at the bottom of the ice mold, the refrigerant pipe being connected to the refrigeration system;

a heating wire fixed to the bottom of the ice mold and spaced from the refrigerant pipe; and

a drain tray connected below the ice mold, a water outlet being formed at one end of the drain tray, the water outlet being inserted into the inlet end of the first drainage pipeline.

9. The refrigerator according to claim 1, wherein the door body is pivotally connected to the cabinet body by a hinge, and the first connector and the second connector are arranged on a side close to a pivot axis of the door body.

10. The refrigerator according to claim 1, wherein a compressor bin for accommodating a compressor is arranged at a bottom of the cabinet body, a water tray is arranged in the compressor bin, and the outlet end of the second drainage pipeline is communicated with the water tray.

11. The refrigerator according to claim 1, wherein the first connector comprises a water storage box arranged on the door liner; the outlet end of the first drainage pipeline is communicated with the water storage box; a drain valve is arranged at a bottom of the water storage box; the second connector applies a force to the drain valve based on closing of the door body to open the drain valve; and when the door body is opened, the second connector removes the force applied to the drain valve, and the drain valve is automatically closed.

12. The refrigerator according to claim 1, wherein the first connector comprises a cavity arranged on the door liner; a valve for opening and closing the outlet end of the first drainage pipeline is arranged in the cavity; the second connector applies a force to the valve based on closing of the door body to open the valve; and when the door body is opened, the second connector removes the force applied to the valve, and the valve is automatically closed.

13. The refrigerator according to claim 1, wherein the first connector comprises a cavity arranged on the door liner; a valve for opening and closing the outlet end of the first drainage pipeline is arranged in the cavity; the valve is opened based on gravity of water reaching a preset value; the valve is connected to a limiting mechanism; when the door body is opened, the limiting mechanism prevents the valve from being opened; and when the door body is closed, the limiting mechanism allows the valve to be opened.

14. A refrigerator, comprising:

a cabinet body, the cabinet body defining a refrigeration compartment;
a door body movably connected to the cabinet body and configured to open and close the refrigeration compartment;
a refrigeration system configured to provide cold energy for the refrigeration compartment; and
an ice-making chamber arranged in the door body and having an ice-making assembly arranged therein, the ice-making chamber and the refrigeration compartment being heat-insulated when the door body is closed,
wherein the door body is provided with a drainage pipeline, an inlet end of the drainage pipeline is connected to the ice-making chamber, the door body is provided with a cavity facing the back of the refrigeration compartment, a water storage box is detachably mounted in the cavity, and an outlet end of the drainage pipeline is communicated with a storage space of the water storage box.

15. The refrigerator according to claim 14, wherein the door body comprises a door shell and a door liner combined with the door shell; the door liner at least partially extends into the refrigeration compartment when the door body is closed; the cavity is arranged on the door liner; the door body is pivotally connected to the cabinet body by a hinge; the door liner comprises a rear surface facing the refrigeration compartment, and side surfaces located at two sides of the rear surface and perpendicular to the rear surface; the cavity is arranged on a side surface of the door liner close to a pivot axis of the door body; the inlet end and the outlet end of the drainage pipeline are each provided with an end opening cover plate that is open around the pipeline; and the end opening cover plates are abutted against the door liner.

16. The refrigerator according to claim 14, wherein a liquid level sensor is arranged in the cavity; the refrigerator further comprises a controller connected to the liquid level sensor; a display panel connected to the controller is arranged on the door body; and the liquid level sensor transmits a signal to the controller when detecting that a liquid level in the water storage box reaches a preset level, and the controller controls the display panel to give a preset prompt.

17. The refrigerator according to claim 14, wherein the water storage box comprises four side walls and a bottom wall which form the storage space in a surrounding manner; the four side walls comprise a first side located outside the cavity; the first side wall is provided with an opening; the opening comprises an upper edge and a lower edge; and upper surfaces of the other three side walls are located between the upper edge and the lower edge.

18. The refrigerator according to claim 14, wherein a heating wire is arranged in the water storage box; an electrical connector connected to the heating wire is arranged in the cavity; the outlet end is connected to a check valve; and the check valve allows a fluid to flow into the water storage box from the outlet end and prevents the fluid from entering the outlet end from the water storage box.

19. The refrigerator according to claim 14, wherein a valve for opening and closing the outlet end of the drainage pipeline is arranged in the cavity; the water storage box is mounted in the cavity and applies a force to the valve to open the valve; the water storage box is separated from the cavity; and the valve is automatically closed.

20. The refrigerator according to claim 14, wherein a valve for opening and closing the outlet end of the drainage pipeline is arranged in the cavity; the valve is opened based on gravity of water reaching a preset value; the valve is connected to a limiting mechanism; when the water storage box is mounted in the cavity, the limiting mechanism allows the valve to be opened; and when the water storage box is separated from the cavity, the limiting mechanism prevents the valve from being opened.

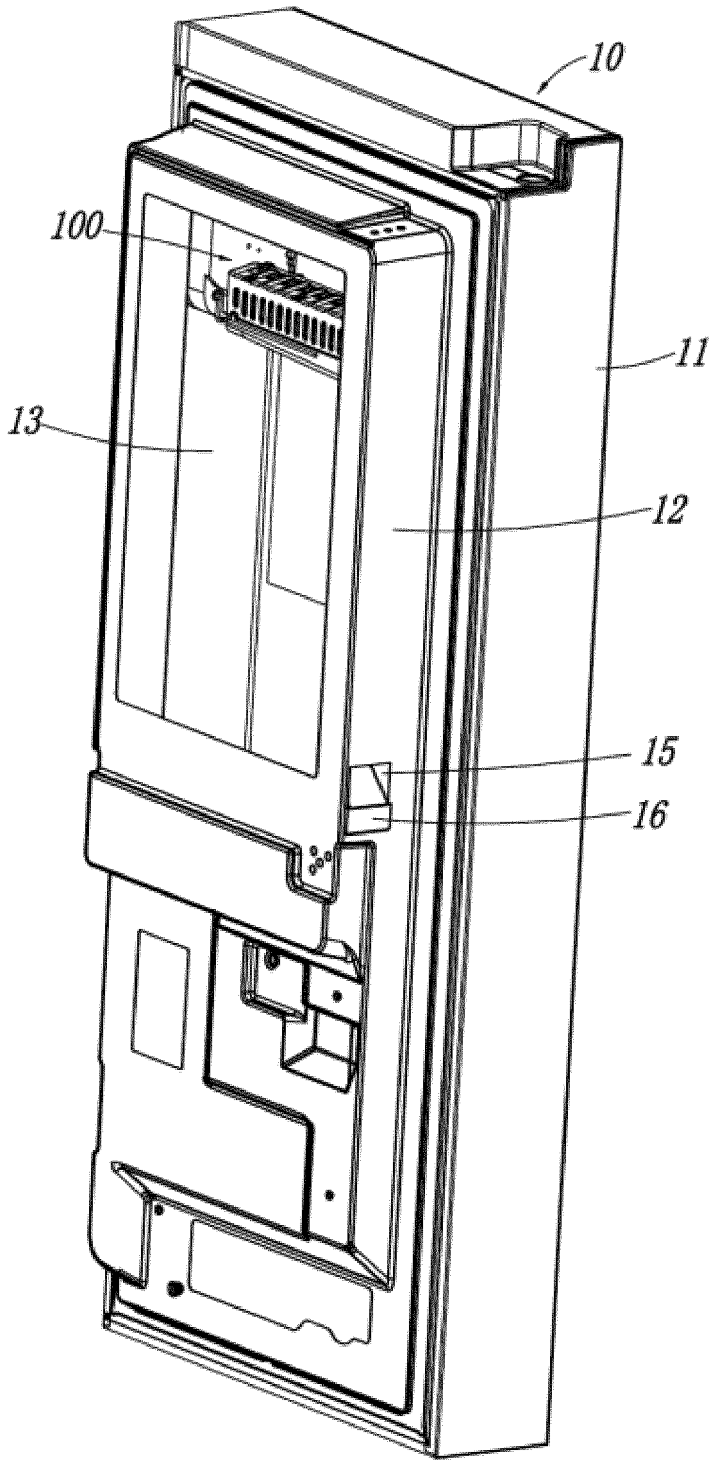

FIG. 1

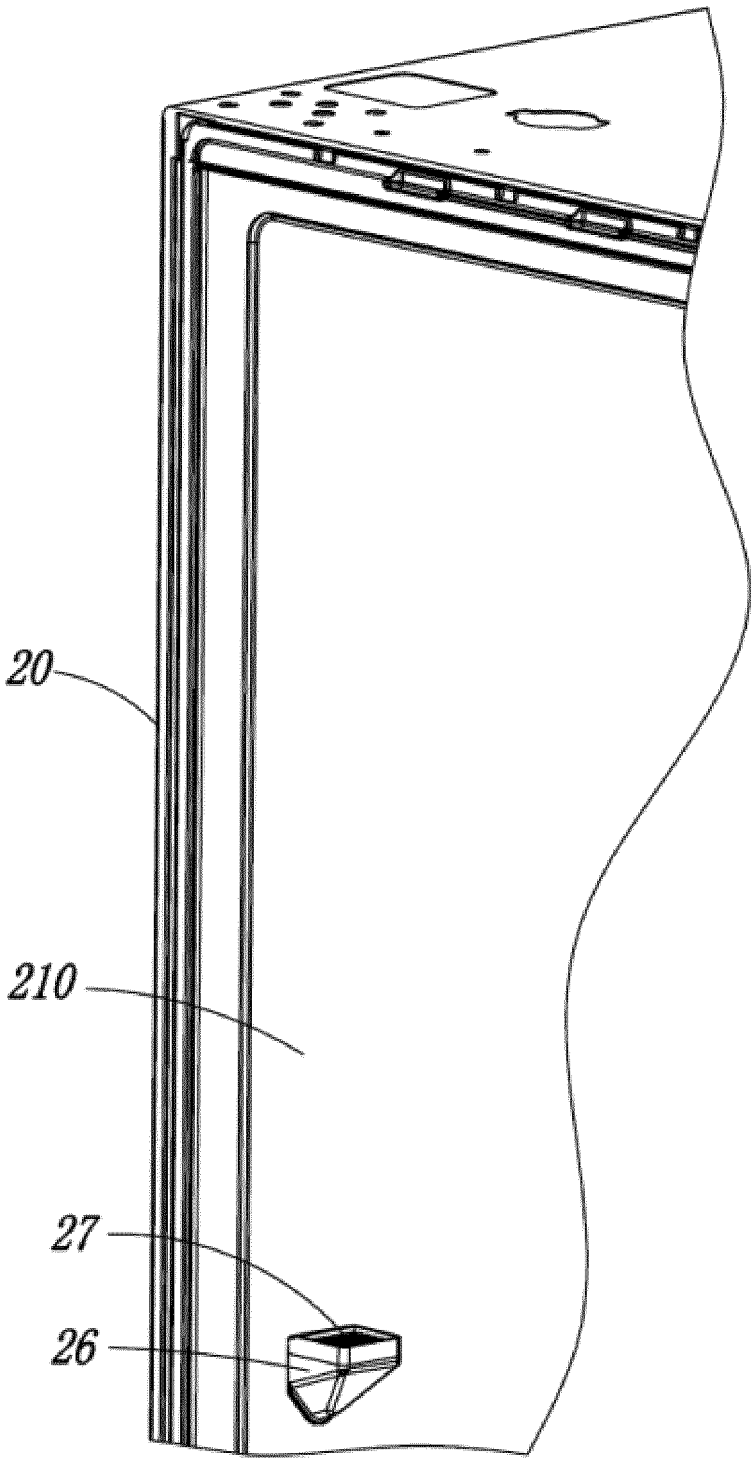

FIG. 2

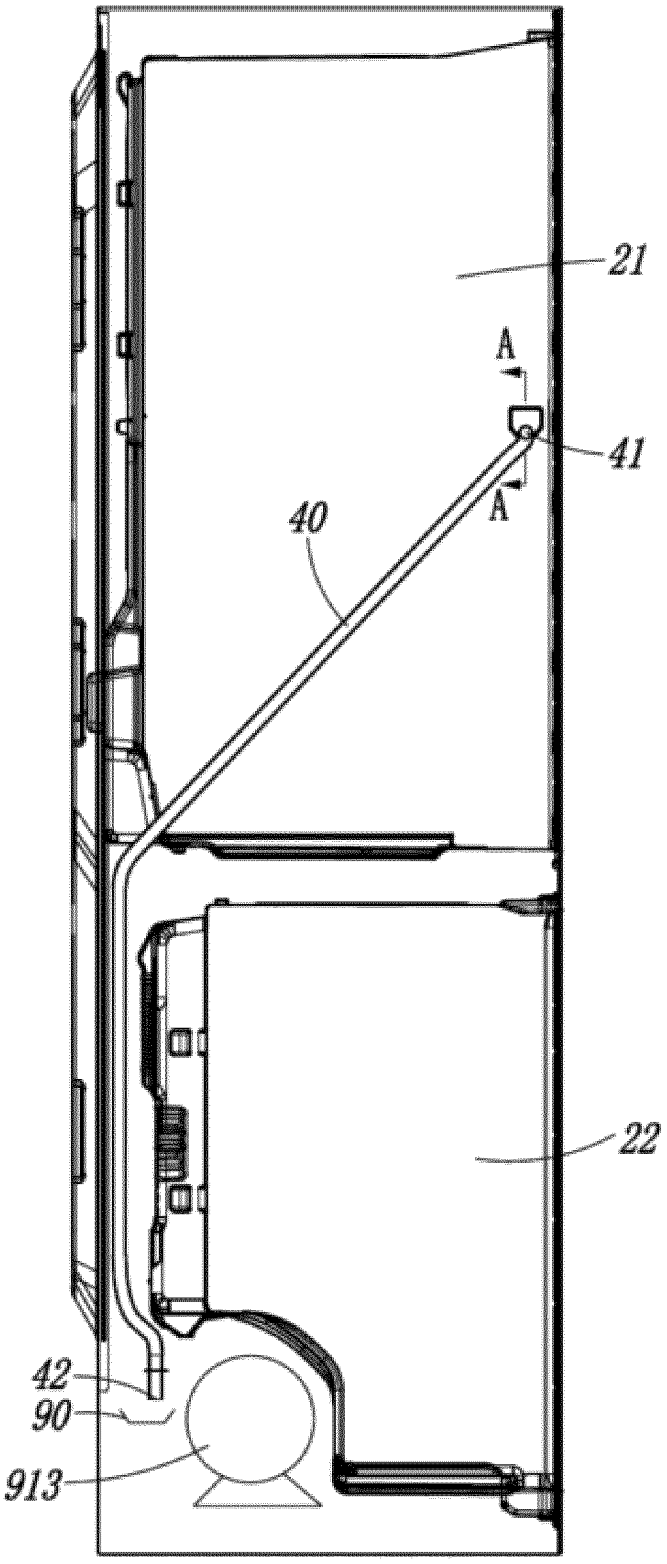

FIG. 3

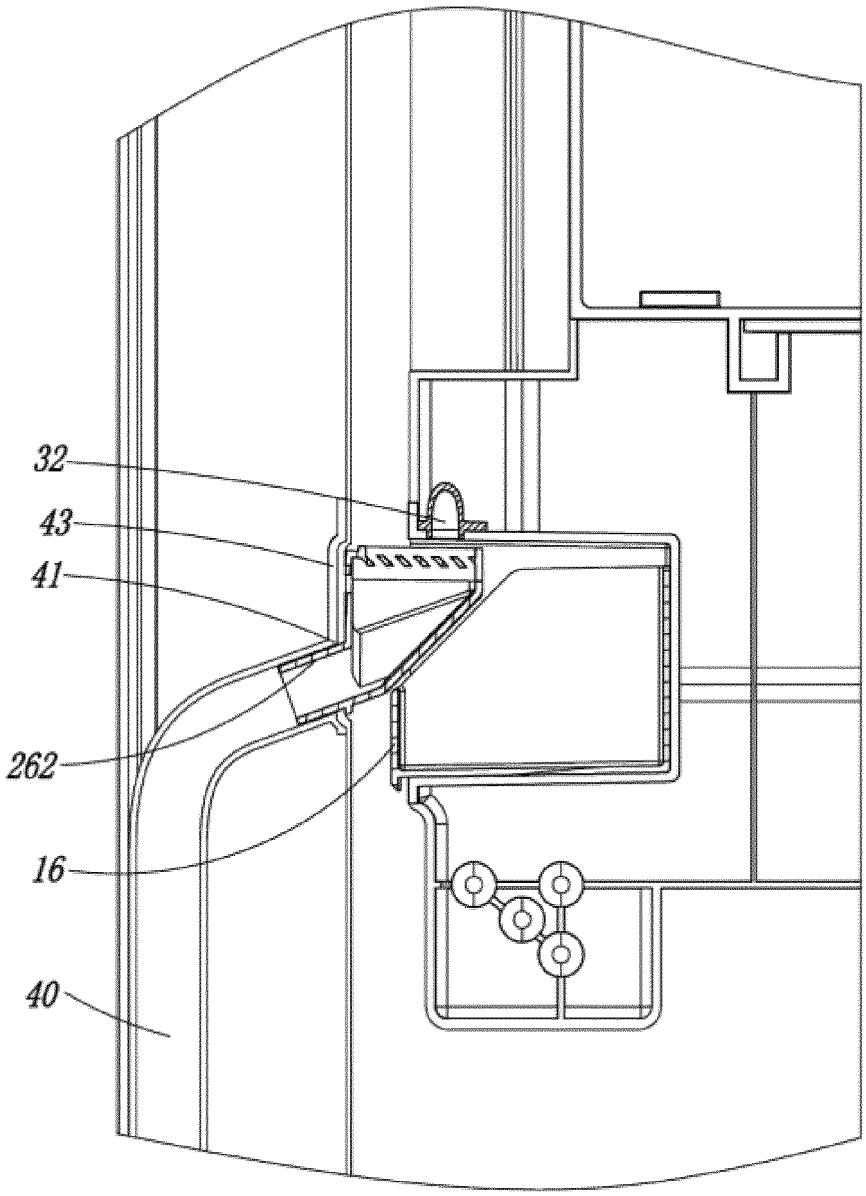

FIG. 4

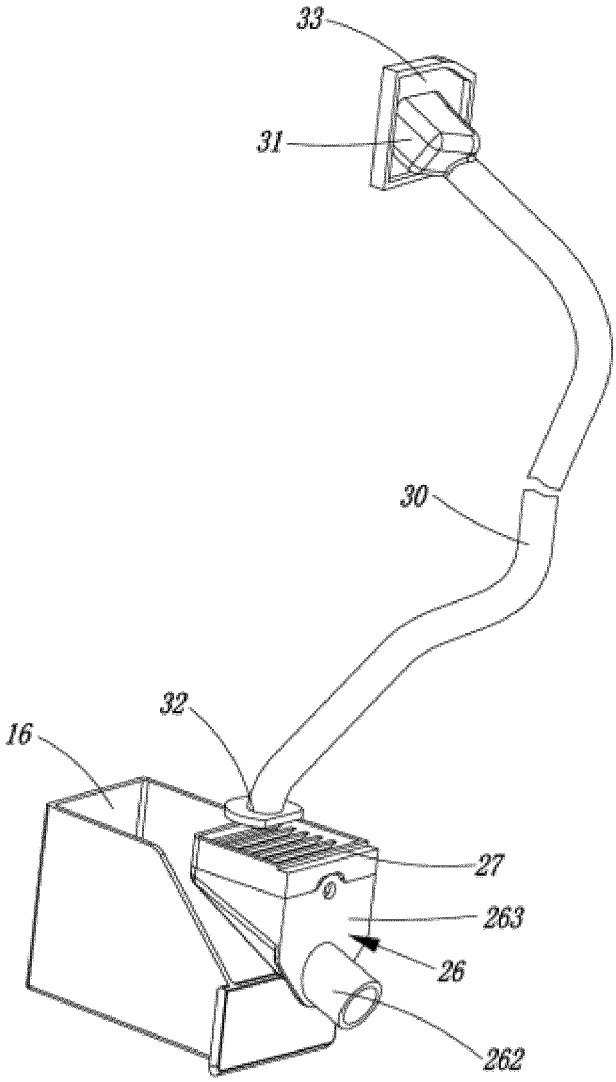

FIG. 5

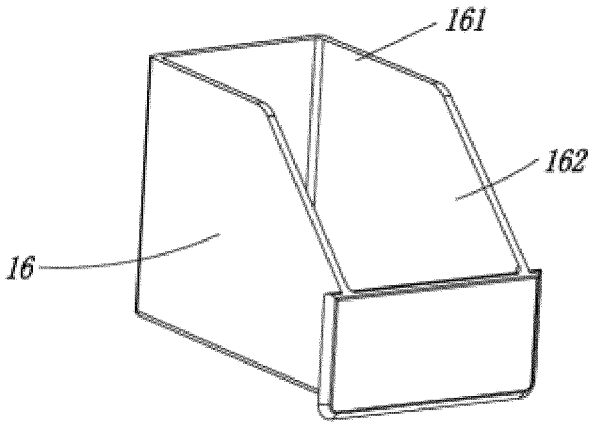

FIG. 6

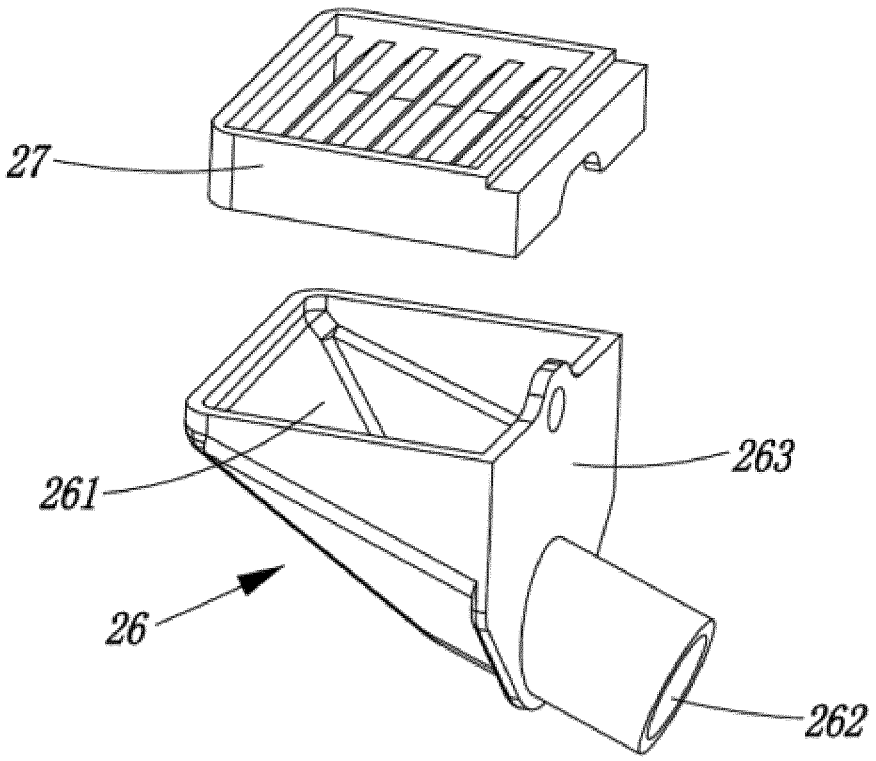

FIG. 7

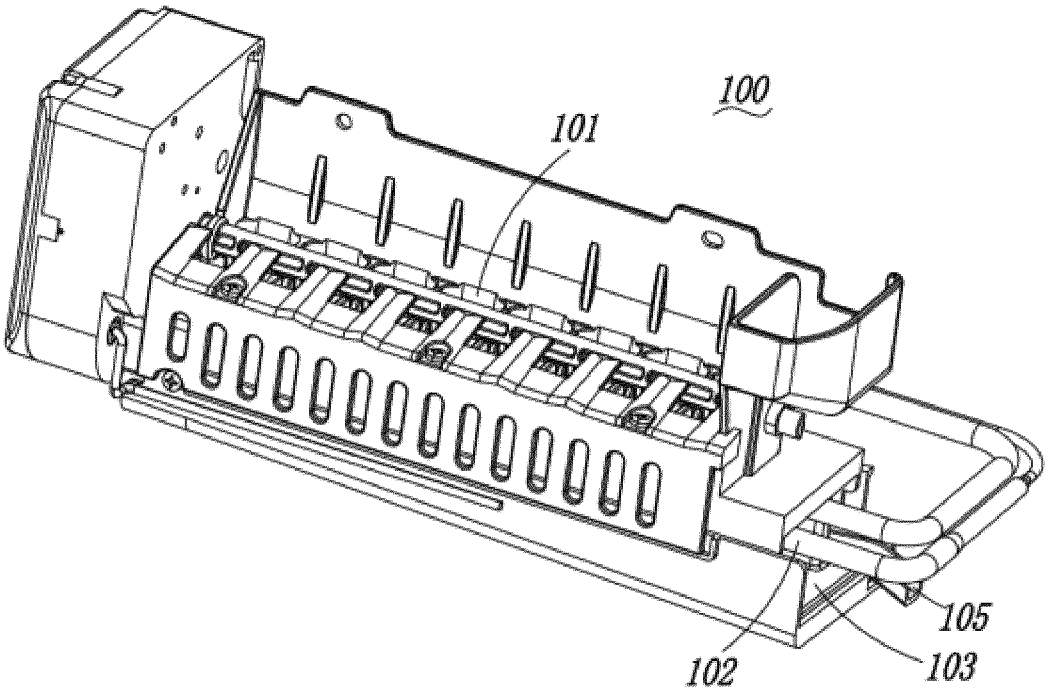

FIG. 8

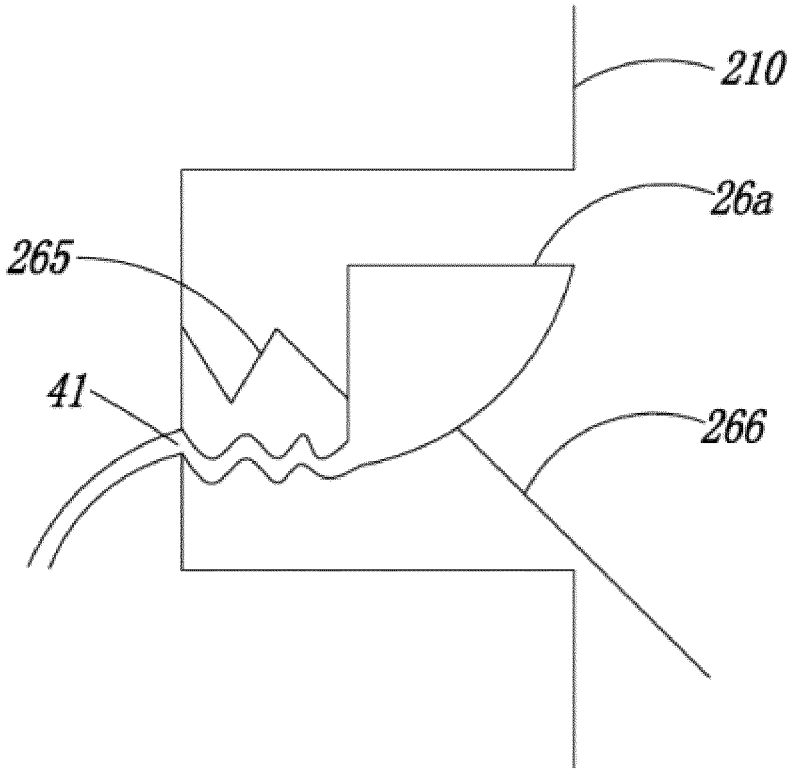

FIG. 9

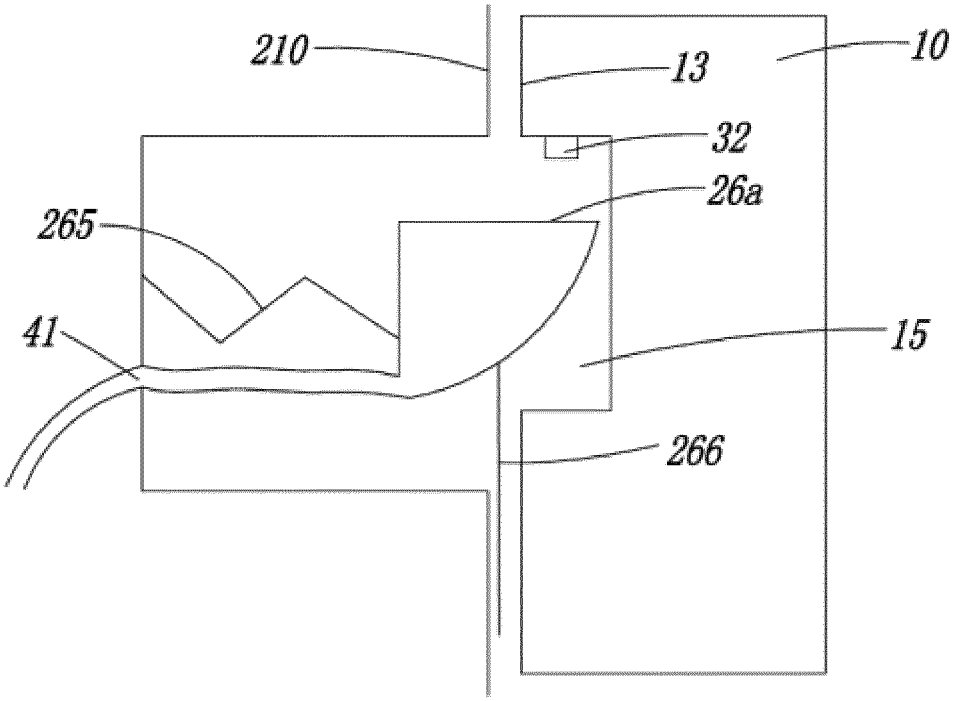

FIG. 10

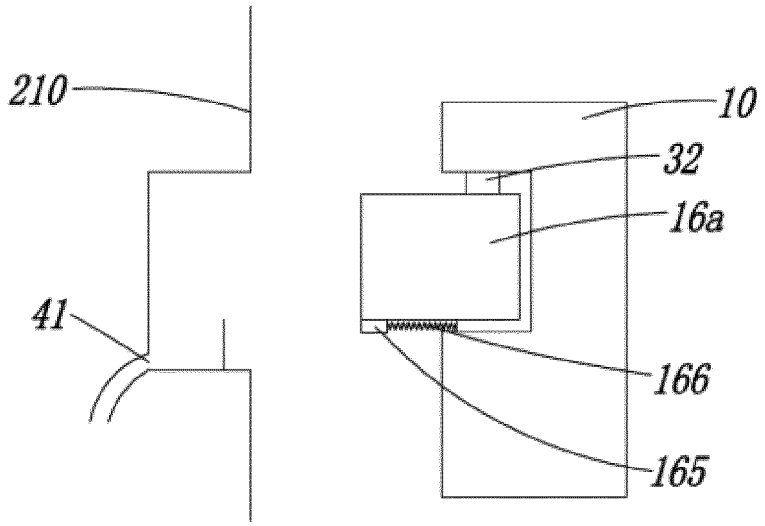

FIG. 11

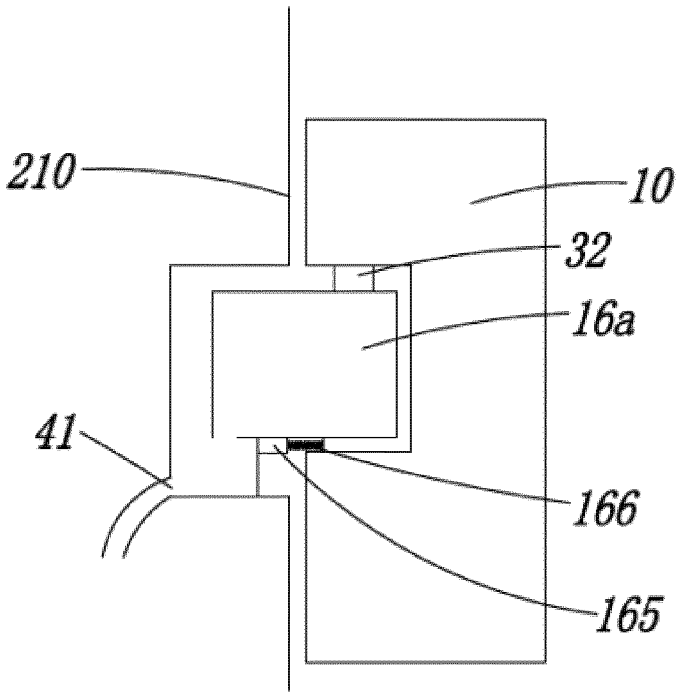

FIG. 12

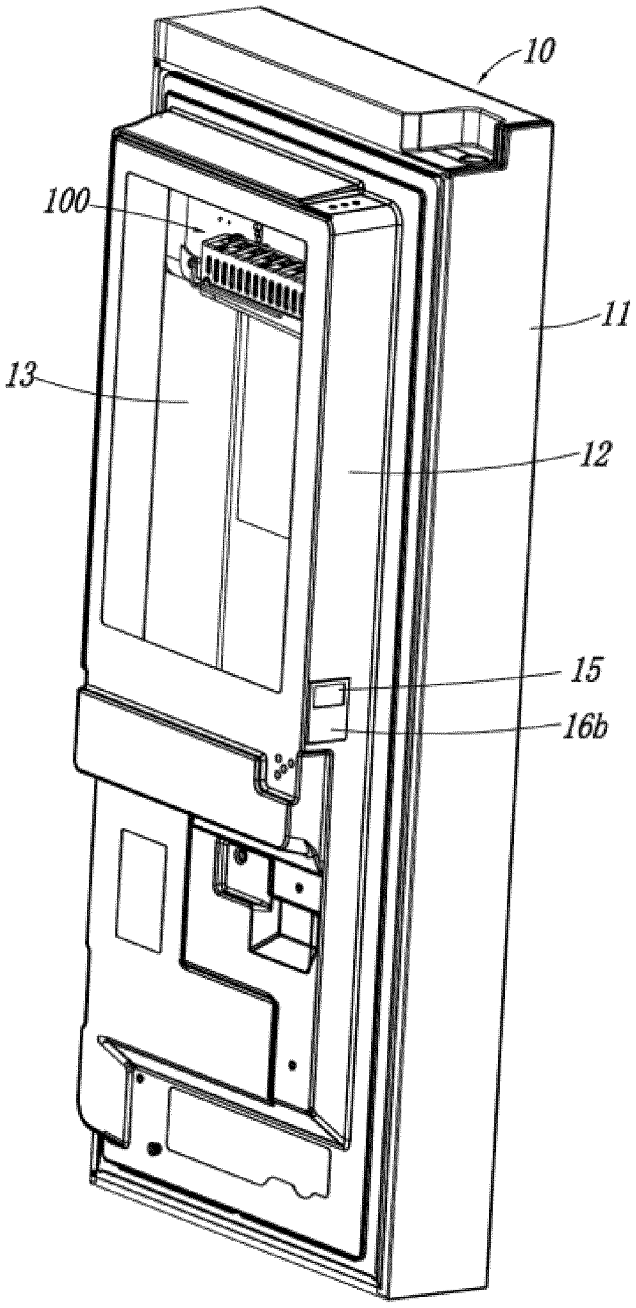

FIG. 13

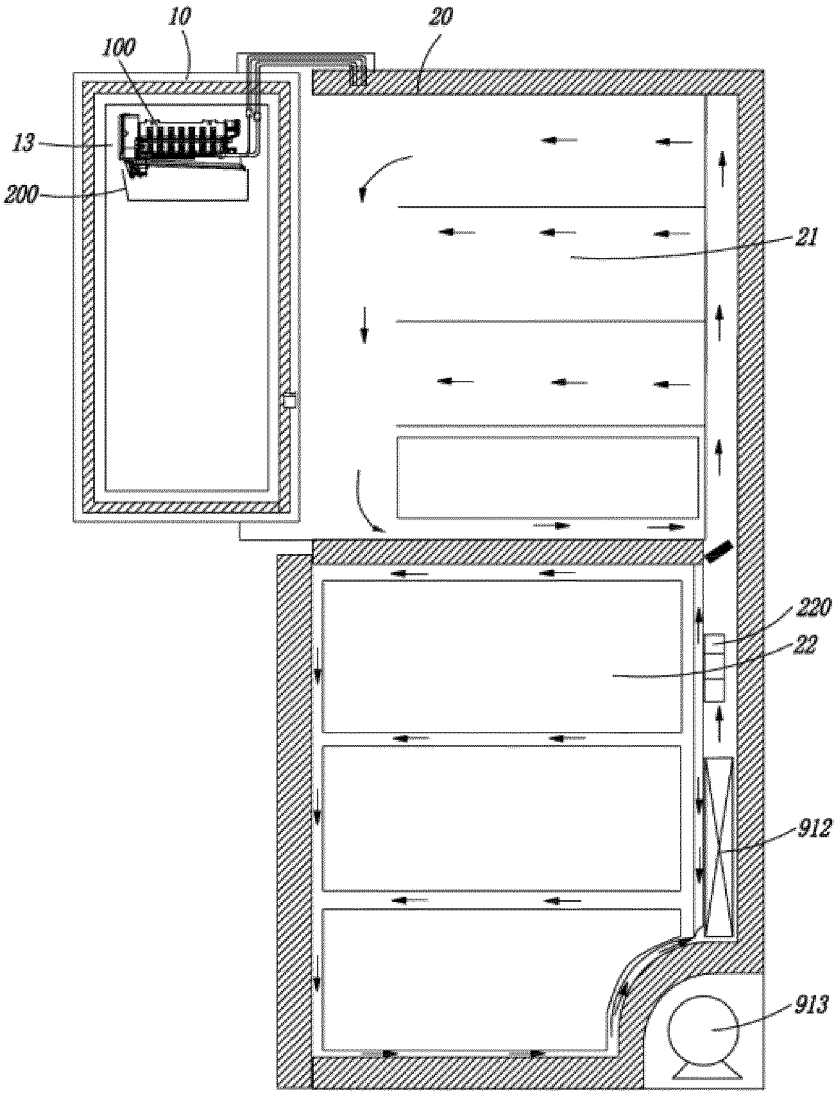

FIG. 14

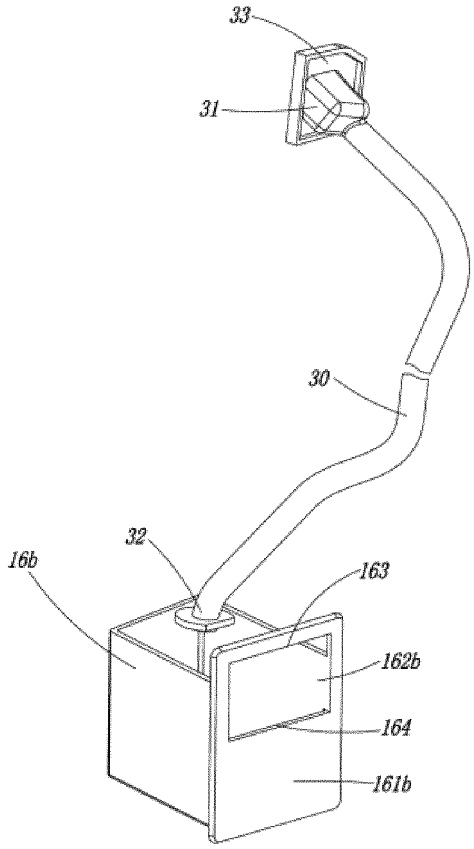

FIG. 15

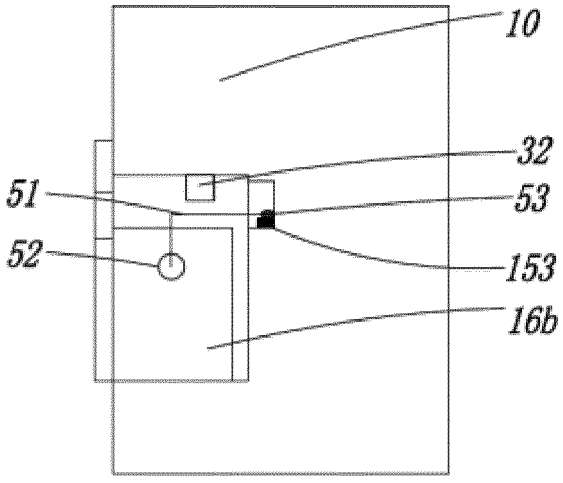

FIG. 16

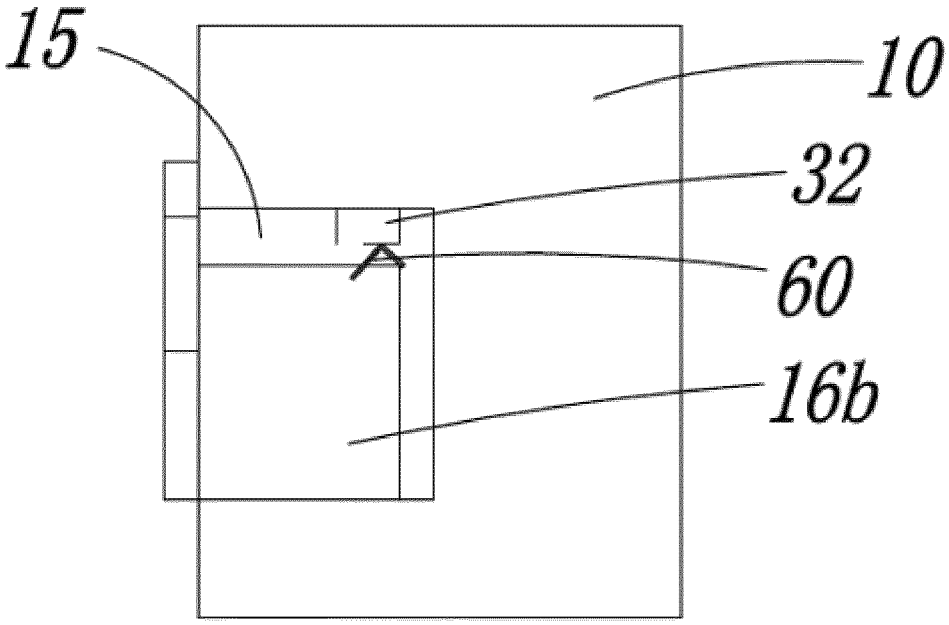

FIG. 17

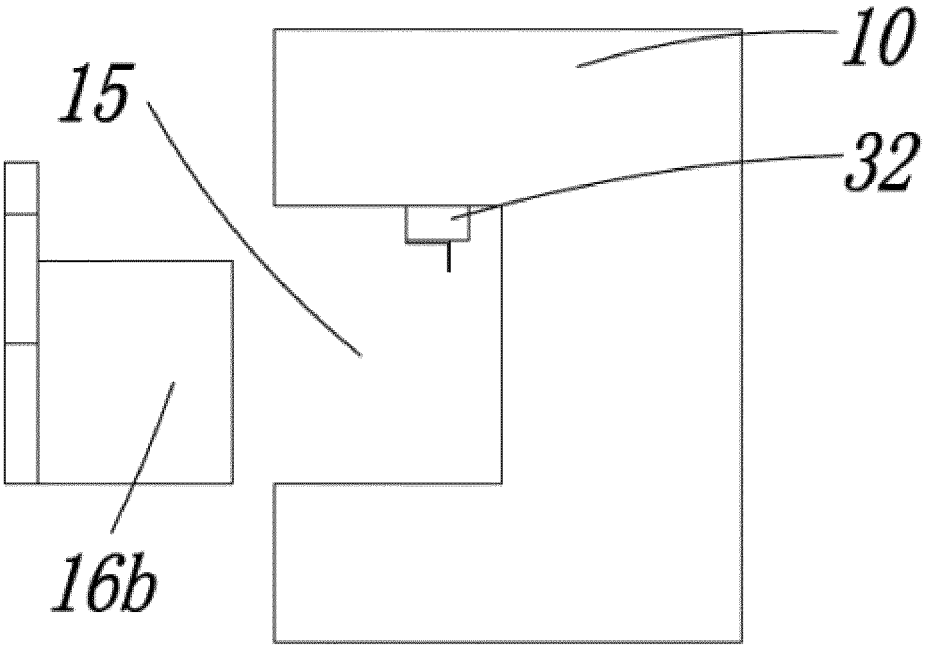

FIG. 18

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/143127

A. CLASSIFICATION OF SUBJECT MATTER

F25D 21/14(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F25D21/14, F25D21/00, F25D23/00, F25C1/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS; VEN; CNTXT; USTXT; CNKI: 海尔, 张延庆, 赵振雨, 张方友, 赵斌堂, 宋向鹏, 牟国梁, 冰箱, 门, 制冰, 排水, 连通, 接口, 蓄水, 加热, 传感器, refrigerator, door, ice mak+, drain+, communication, interface, water storage, heat, sensor

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 214537003 U (QINGDAO HAIER REFRIGERATOR CO., LTD. et al.) 29 October 2021 (2021-10-29) description, paragraphs [0001]-[0044]	14-20
X	US 2016025399 A1 (GENERAL ELECTRIC COMPANY) 28 January 2016 (2016-01-28) description, paragraphs [0001]-[0055] and figures 1-9	1-15, 17-20
Y	US 2016025399 A1 (GENERAL ELECTRIC COMPANY) 28 January 2016 (2016-01-28) description, paragraphs [0001]-[0055] and figures 1-9	16
Y	JP 2012127584 A (HOSHIZAKI ELECTRIC CO., LTD.) 05 July 2012 (2012-07-05) description, paragraphs [0001]-[0034] and figure 4	16
A	CN 102221276 A (HEFEI MIDEA RONGSHIDA REFRIGERATOR CO., LTD. et al.) 19 October 2011 (2011-10-19) entire document	1-20
A	CN 108286855 A (QINGDAO HAIER CO., LTD.) 17 July 2018 (2018-07-17) entire document	1-20
A	US 2010326112 A1 (PRABHAKAR RAGAVENDRA et al.) 30 December 2010 (2010-12-30) entire document	1-20

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 February 2022	**09 March 2022**

Name and mailing address of the ISA/CN	Authorized officer
China National Intellectual Property Administration (ISA/CN) **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China**	
Facsimile No. **(86-10)62019451**	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2021/143127

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 214537003 U	29 October 2021	None	
US 2016025399 A1	28 January 2016	US 10502477 B2	10 December 2019
JP 2012127584 A	05 July 2012	JP 5591678 B2	17 September 2014
CN 102221276 A	19 October 2011	CN 102221276 B	09 January 2013
CN 108286855 A	17 July 2018	WO 2019120104 A1	27 June 2019
US 2010326112 A1	30 December 2010	US 8240159 B2	14 August 2012
		CA 2684206 A1	26 December 2010

Form PCT/ISA/210 (patent family annex) (January 2015)