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(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)**
- **ZHU, Xiaobing**  
**Qingdao, Shandong 266101 (CN)**
- **ZHANG, Yanqing**  
**Qingdao, Shandong 266101 (CN)**
- **SONG, Xiangpeng**  
**Qingdao, Shandong 266101 (CN)**
- **LU, Yong**  
**Qingdao, Shandong 266101 (CN)**
- **WANG, Hao**  
**Qingdao, Shandong 266101 (CN)**

(74) Representative: **Winter, Brandl - Partnerschaft**  
**mbB**

**Alois-Steinecker-Straße 22**  
**85354 Freising (DE)**

(54) **REFRIGERATOR AND REFRIGERATOR MANUFACTURING METHOD**

(57) This application provides a refrigeration, comprising: an ice-making compartment, wherein the ice-making compartment is provided with an ice-making device, the ice-making device comprises an ice-making tray; a refrigerant pipe, a portion of which is located within the ice-making compartment; the ice-making compartment is provided with a heat conduction component, the heat conduction component comprises a side heat conduction plate and a bottom heat conduction plate; a side wall of the ice-making tray is in closely contact with the side heat conduction plate, and the bottom of the ice-making tray is supported on the bottom heat conduction plate, the refrigerant pipe within the ice-making compartment is positioned between the heat conduction component and the ice-making tray, the refrigerant pipe in thermal contact with both the side heat conduction plate and the bottom heat conduction plate.

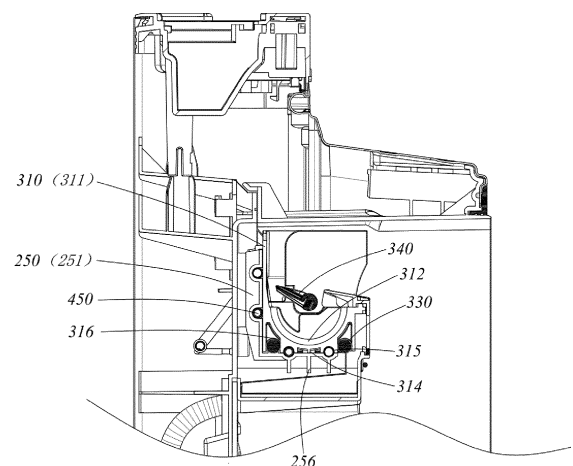


FIG.3

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## Description

### TECHNICAL FIELD

**[0001]** The application refers to a field of household appliances, particularly to a refrigerator and a method for manufacturing a refrigerator.

### BACKGROUND OF THE PRESENT INVENTION

**[0002]** To satisfy the diverse needs of users, some refrigerators are equipped with ice-making compartments in which ice-making devices are installed to produce ice cubes. Some refrigerators supply cooling capacity directly to the ice-making devices through refrigerant pipes. However, the contact area between the refrigerant pipes and the ice-making machine is small, leading to limited cooling capacity transfer. This does not fully utilize the cooling capacity of the refrigerant within the pipes and affects the efficiency of ice making.

### SUMMARY

**[0003]** To solve the aforementioned technical problems, the application provides a refrigerator wherein a heat conduction component is set inside the ice-making compartment of the refrigerator, the heat conduction component thermal contact with both a side and a bottom of the ice-making tray.

**[0004]** The present application provides a refrigerator, comprising:

an ice-making compartment, wherein the ice-making compartment is provided with an ice-making device, the ice-making device comprises an ice-making tray; a refrigerant pipe, a portion of which is located within the ice-making compartment; the ice-making compartment is provided with a heat conduction component, the heat conduction component comprises a side heat conduction plate and a bottom heat conduction plate; a side wall of the ice-making tray is in closely contact with the side heat conduction plate, and the bottom of the ice-making tray is supported on the bottom heat conduction plate, the refrigerant pipe within the ice-making compartment is positioned between the heat conduction component and the ice-making tray, the refrigerant pipe in thermal contact with both the side heat conduction plate and the bottom heat conduction plate.

**[0005]** As a further improvement of an embodiment of the present application, characterized in that the side heat conduction plate is provided with a first pipe accommodating groove, and the bottom heat conduction plate is provided with a second pipe accommodating groove, at least a portion of the refrigerant pipe located within the first accommodating groove and second pipe accommodating groove.

**[0006]** As a further improvement of an embodiment of the present application, characterized in that the depth of the first pipe accommodating groove is greater than or equal to the diameter of the refrigerant pipe, one side wall of the ice-making tray is a plane covering the side heat conduction plate, and a top of the side wall of the ice-making tray is provided with a hook that hangs on a top of the side heat conduction plate.

**[0007]** As a further improvement of an embodiment of the present application, characterized in that a side of the heat conduction plate which is face to the wall of the ice-making compartment is provided with a first heat exchange rib.

**[0008]** As a further improvement of an embodiment of the present application, characterized in that the depth of the second pipe accommodating groove is less than the diameter of the refrigerant pipe, and the bottom of the ice-making tray is provided with a third pipe accommodating groove that matches with the second pipe accommodating groove and a second heat exchange rib, the second heat exchange rib abutting against the bottom heat conduction plate.

**[0009]** As a further improvement of an embodiment of the present application, characterized in that the bottom heat conduction plate is provided with a third heat exchange rib on a surface facing away from a side of the ice-making tray.

**[0010]** As a further improvement of an embodiment of the present application, characterized in that the heat conduction component is L-shaped, the first pipe accommodating groove and second pipe accommodating groove are parallel, and the refrigerant pipe is bent along the first pipe accommodating groove and the second pipe accommodating groove in serpentine shape, a plane containing a refrigerant pipe connecting the first pipe accommodating groove and the second pipe accommodating groove at an angle to both the side heat conduction plate and the bottom heat conduction plate.

**[0011]** As a further improvement of an embodiment of the present application, characterized in that the refrigerator further comprises a water collection tray positioned beneath the bottom heat conduction plate, the water collection tray comprises a water collection tray shell and a heat conduction plate placed inside the water collection tray shell, and the bottom of the heat conduction plate is equipped with a heating wire.

**[0012]** As a further improvement of an embodiment of the present application, characterized in that the refrigerator further comprises a water collection tray positioned beneath the ice-making tray, the bottom heat conduction plate located between the ice-making tray and the water collection tray, the bottom of the ice-making tray is equipped with a defrosting heating wire and a defrosting heating wire mounting portion for installing the defrosting heating wire, a portion of the defrosting heating wire located between the ice-making tray and the bottom heat conduction plate, and another portion located between the bottom heat conduction plate and the water collection

tray.

**[0013]** As a further improvement of an embodiment of the present application, characterized in that the refrigerator comprises a cabinet, a storage compartment formed inside the cabinet comprises a refrigeration compartment and a freezing compartment, the cabinet is connected with a refrigeration door for opening and closing the refrigeration compartment, the ice-making compartment is formed within the refrigeration door, a compressor is set on a cabinet side, an inlet end of the refrigerant pipe is connected with a side of the compressor through an intake pipe, and an outlet end of the refrigerant pipe is connected with a side of the compressor through a return pipe; both the intake pipe and the return pipe extend from the cabinet side to a door side; the refrigeration door comprises a door shell and a door liner, the door liner is provided with the ice-making compartment, and another portion of the refrigerant pipe is located between the door shell and the door liner.

**[0014]** As a further improvement of an embodiment of the present application, characterized in that the side heat conduction plate is provided with a first pipe accommodating groove, and the bottom heat conduction plate is provided with a second pipe accommodating groove, the refrigerant pipe located within the first pipe accommodating groove and second pipe accommodating groove; a wall of the ice-making compartment is provided with a bracket mounting opening, a mounting bracket is set at the bracket mounting opening, insulating material is filled between the mounting bracket and the door shell, the heat conduction component is mounted on the mounting bracket, and the mounting bracket is provided with a pipe guide groove corresponding to the first pipe accommodating groove and the second pipe accommodating groove the pipe guide groove is on one side of the heat conduction component, the refrigerant pipe passing in or out of the ice-making compartment through the pipe guide grooves.

**[0015]** As a further improvement of an embodiment of the present application, characterized in that the bracket mounting opening is also provided with a fixed bracket that matches with the mounting bracket, insulating material is filled between the fixed bracket and the door shell, and the fixed bracket is provided with a pipe fixing groove that match the pipe guide groove.

**[0016]** As a further improvement of an embodiment of the present application, characterized in that the bracket mounting opening comprises a first opening set in a rear wall of the ice-making compartment and a second opening set in a side wall of the ice-making compartment, the first opening and second opening are connected; the mounting bracket comprises a side bracket that matches with the first opening and a bottom bracket that extends perpendicularly from the side bracket; the bottom bracket and the fixed bracket are set at the second opening, and a shape of the assembly of the fixed bracket and the bottom bracket matches with a shape of the second opening, a connecting surface of the fixed bracket with the

side wall of the ice-making compartment is inclined.

**[0017]** This application also provide a method for manufacturing a refrigerator, for manufacturing the refrigerator according to any of the preceding embodiment, the method comprising:

pre-installing the refrigerant pipe on the side heat conduction plate and the bottom heat conduction plate, and installing the refrigerant pipe and the heat conduction component on the door shell;  
assembling the door liner with the door shell and injecting foam material, the ice-making compartment shell is provided with a mounting opening corresponding to the heat conduction component.

**[0018]** As a further improvement of an embodiment of the present application, "pre-installing the refrigerant pipe on the side heat conduction plate and the bottom heat conduction plate, and installing the refrigerant pipe and the heat conduction component on the door shell" specifically comprises:

bending the refrigerant pipe into a predetermined shape and placing the refrigerant pipe into the first pipe accommodating groove of the side heat conduction plate and the second pipe accommodating groove of the bottom heat conduction plate;  
fixing the side heat conduction plate of the heat conduction component to a mounting bracket, and embedding the refrigerant pipe into a pipe guide groove on one side of the mounting bracket, the pipe guide groove is located on one side of the mounting bracket and corresponds to the first pipe accommodating groove and the second pipe accommodating groove;  
installing the mounting bracket at a predetermined location on the door shell, the mounting bracket is provided with a support leg that support on the door shell; a wall of the ice-making compartment is provided with a bracket mounting opening for installing the mounting bracket;  
the method further comprises:  
installing a fixed bracket on the mounting bracket, where the fixed bracket is provided with a pipe fixing groove that matches with the pipe guide groove, and the refrigerant pipe is fixed within the pipe groove formed by the pipe guide groove and the pipe fixing groove.

**[0019]** The refrigerator and the manufacturing method thereof provided by this application feature a heat conduction component inside the ice-making compartment that makes thermal contact with both a side wall and a bottom wall of the ice-making tray. The refrigerant pipe is placed between the heat conduction component and the ice-making tray, enlarging the area of thermal contact between the heat conduction component and the ice-making tray. With a high rate of heat exchange between the refrigerant pipe and the ice-making tray, it is possible

to fully utilize the cooling capacity of the refrigerant, thus enhancing the efficiency of ice making. Additionally, when the ice-making compartment is set in the door, it can also reduce condensation.

## BRIEF DESCRIPTION OF THE DRAWINGS

### [0020]

Figure 1 is a three-dimensional schematic of a refrigerator according to an embodiment of the application;  
 Figure 2 is a three-dimensional schematic of the refrigerator refrigeration door component as shown in Figure 1;  
 Figure 3 is a sectional schematic of the refrigeration door as shown in Figure 2;  
 Figure 4 is a schematic of the refrigeration system of the refrigerator as shown in Figure 2;  
 Figure 5 is a three-dimensional schematic of the heat conduction component as shown in Figure 3;  
 Figure 6 is a three-dimensional schematic of the ice-making tray as shown in Figure 3;  
 Figure 7 is a three-dimensional schematic of the ice-making compartment as shown in Figure 2;  
 Figure 8 is an exploded schematic of the refrigeration door as shown in Figure 2;  
 Figure 9 is another exploded schematic of a part of the refrigeration door as shown in Figure 2;  
 Figure 10 is a three-dimensional schematic of the water collection tray as shown in Figure 7;  
 Figure 11 is a three-dimensional schematic of another embodiment of the ice-making device according to the application;  
 Figure 12 is a three-dimensional schematic of the defrosting heating wire as shown in Figure 11.

## DETAILED DESCRIPTION OF EMBODIMENT

**[0021]** To enable those skilled in the art to better understand the technical solutions of the present application, the technical solutions in the embodiments of the present application will be clearly and completely described below with reference to the drawings in the embodiments of the present application. Obviously, the described embodiments are only part of the embodiments of the present application, rather than all of them. Based on the embodiments in this application, all other embodiments obtained by those of ordinary skill in the art without creative efforts shall fall within the protection scope of the present application.

**[0022]** Refer to Figure 1, an embodiment of the application provides a refrigerator, the refrigerator comprises a cabinet and a door for opening and closing the cabinet, the door can be pivotally connected to the cabinet through a hinge 500. A storage compartments formed inside the refrigerator cabinet can comprise a refrigeration compartment and a freezing compartment, and the door may

comprise a refrigeration door 100 for opening and closing the refrigeration compartment and a freezer door for the freezing compartment.

**[0023]** Refer to Figure 2, the refrigeration door 100 of the refrigerator can be provided with an ice-making compartment 200. The refrigeration door 100 of the refrigerator can comprise a door shell 110 and a door liner 120, insulating material can be filled between the door shell 110 and the door liner 120, insulating material can be foam material. The door liner 120 can directly form an indentation towards the door shell 110 to form the ice-making compartment 200, or an independent ice-making compartment shell 210 can be installed on the refrigeration door, such as by opening a hole on the door liner 120 and installing the ice-making compartment shell 210 at the hole, with insulating material filled between the door shell 110 and the door liner 120, and between the door shell 110 and the ice-making compartment shell 210, forming the ice-making compartment 200 inside the ice-making compartment shell 210. An ice-making compartment door can also be set up on ice-making compartment 200, the ice-making compartment door can be filled with insulating material, such as foam material or a VIP (Vacuum Insulation Panel) insulation panel, thus isolating the ice-making compartment 200 from the refrigeration compartment.

**[0024]** Of course, the ice-making compartment 200 can also be set inside the refrigeration compartment, such as by installing an independent insulated shell inside the refrigeration compartment to form the ice-making compartment 200, or by setting an insulated shell at the top of the refrigeration compartment together with the inner wall of the refrigeration compartment to collectively form the ice-making compartment 200. Alternatively, the ice-making compartment 200 could also be directly formed by the cabinet alongside the refrigeration and freezing compartments.

**[0025]** Refer to Figure 3, in this embodiment, the ice-making compartment 200 can be equipped with an ice-making device 300, the ice-making device 300 may comprise an ice-making tray 310, within which several ice-making cells can be set. The refrigerator can also comprise a water supply device, which can automatically supply liquid water to the ice-making tray 310, where the liquid water can freeze into ice within the ice-making tray 310.

**[0026]** The ice-making compartment 200 can also be equipped with an ice storage box, which can be set below the ice-making tray 310. The ice-making device 300 can also comprise a discharging mechanism 340, and after the water in the ice-making tray 310 is completely frozen, the discharging mechanism 340 can be started to discharge the ice into the ice storage box for storage.

**[0027]** Refer to Figure 4, the refrigerator also comprises a refrigeration system 400, the refrigeration system 400 can comprise a compressor 410, a condenser 420, a cabinet evaporator 440, and a refrigerant pipe 450. The cabinet evaporator 440 and the refrigerant pipe 450 can

be connected in parallel relative to the compressor 410, i.e., a two-way solenoid valve 430 can be connected after the condenser 420 to form two parallel refrigerant branches. The cabinet evaporator 440 and the refrigerant pipe 450 are set on the two refrigerant branches, respectively. After being compressed by the compressor 410, the refrigerant flows through the condenser 420 and can be controlled by the two-way solenoid valve 430 to flow through the cabinet evaporator 440 to cool the refrigeration and freezing compartments, or control the refrigerant to flow through the refrigerant pipe 450 to cool the ice-making compartment 200.

**[0028]** In this embodiment, a compressor chamber can be set on a the cabinet side, where the compressor 410 and the condenser 420 can be installed inside the compressor chamber. The cabinet side can also be provided with an evaporator compartment, the cabinet evaporator 440 can be installed inside the evaporator compartment. The evaporator compartment can be connected to the refrigeration and freezing compartments through air ducts, and a fan can also be installed inside the evaporator compartment. The fan can drive the cold air in the evaporator compartment through the air ducts into the interior of the refrigeration and freezing compartments.

**[0029]** The refrigerant inlet of the refrigerant pipe 450 can be connected to the solenoid valve 430 through an intake pipe 460, and the refrigerant outlet of the refrigerant pipe 450 can be connected to the solenoid valve 430 through a return pipe 470. The refrigerant pipe 450 can be partially set within the insulation layer, such as partially embedded within the foam layer, and partially directly placed inside the ice-making compartment 200 to directly cool the ice-making tray 310.

**[0030]** In this embodiment, the ice-making compartment 200 is set on the refrigeration door 100, as shown in Figure 1, where the refrigeration door 100 is connected to the cabinet through a hinge 500. The intake pipe 460 and return pipe 470 connected to the refrigerant pipe 450 can pass through the hinge 500 hole from the cabinet side and enter the insulation layer of the door from the hinge axle on the door to connect with the refrigerant pipe 450. A thermally insulated hinge box cover 510 can be set on the hinge 500, which can cover the exposed portions of the intake pipe 460 and return pipe 470 on the outside of the refrigerator to prevent condensation. Thus, the refrigerant from the compressor 410 can be intermittently supplied to the refrigerant pipe 450 to avoid excessive cooling capacity of the refrigerant pipe 450 that cannot be fully utilized, leading to excessive condensation at the intake pipe 460 and return pipe 470.

**[0031]** Refer to Figures 3, 5, and 6, in one embodiment of the application, the ice-making compartment 200 can be equipped with a heat conduction component 250, the heat conduction component 250 is made from materials with high thermal conductivity, such as aluminum. The heat conduction component 250 can be mounted on a wall of the ice-making compartment 200 and fixed to the wall of the ice-making compartment 200 with screws or

other fasteners. The heat conduction component 250 comprises a side heat conduction plate 251 and a bottom heat conduction plate 252. One side wall 311 of the ice-making tray 310 can be closely contact with the side heat conduction plate 251 to achieve thermal contact, and the bottom 312 of the ice-making tray 310 can be supported on the bottom heat conduction plate 252 to make thermal contact.

**[0032]** The refrigerant pipe 450 within the ice-making compartment 200 can be positioned between the heat conduction component 250 and the ice-making tray 310. The refrigerant pipe 450 can be partially placed between the side heat conduction plate 251 and one side wall of the ice-making tray 310, and partially between the bottom heat conduction plate 252 and the bottom of the ice-making tray 310. The refrigerant pipe 450 can make thermal contact with both the side heat conduction plate 251 and the bottom heat conduction plate 252. Thus, the cooling capacity of the refrigerant pipe 450 can be transferred to both the side heat conduction plate 251 and the bottom heat conduction plate 252 and further transferred to the ice-making tray. With the ice-making tray 310 in contact with both the side heat conduction plate 251 and the bottom heat conduction plate 252, a large area for heat transfer is achieved, allowing the refrigerant pipe 450 to efficiently exchange heat, fully utilizing the cooling capacity.

**[0033]** The side heat conduction plate 251 is provided with a first pipe accommodating groove 253, the opening of the first pipe accommodating groove 253 can face a side wall 311 of the ice-making tray 310. The bottom heat conduction plate 252 is provided with a second pipe accommodating groove 254, the opening of the second pipe accommodating groove 254 can face the bottom 312 of the ice-making tray 310. The refrigerant pipe 450 within the ice-making compartment 200 is placed within both the first pipe accommodating groove 253 and the second pipe accommodating groove 254 and is located between the heat conduction component 250 and the ice-making tray 310.

**[0034]** In this embodiment, as seen in Figures 7 to 9, the refrigerant pipe 450 can be partially embedded within the foam layer of the refrigeration door 100. The refrigerant pipe 450 can enter into the inside of the ice-making compartment 200 from the inner of the foam layer, and then pass into the pipe groove from one end of the first pipe accommodating groove 253, extend along the first pipe accommodating groove 253 and then enter into the second pipe accommodating groove 254, finally exiting from the end of the second pipe accommodating groove 254 and enter into the foam layer of the refrigeration door 100. Thus, via the heat conduction component 250, the refrigerant pipe 450 within the ice-making compartment 200 can be secured, allowing the refrigerant pipe 450 to be positioned both in the side wall 311 and the bottom 312 of the ice-making tray 310, increasing the area of thermal contact with the ice-making tray 310. The setting of both the first and second pipe accommodating grooves also facilitates the installation of the refrigerant pipe.

**[0035]** As the refrigerant flows through the refrigerant pipe 450, the cooling capacity of the refrigerant is partially transferred to the heat conduction component 250, some cooling capacity also being directly transferred to the ice-making tray 310. Because the side wall 311 of the ice-making tray 310 is in closely contact with the side heat conduction plate 251 of the heat conduction component 250, a large area for heat contact is created between the ice-making tray 310 and the side heat conduction plate 251, allowing the cooling capacity of the side heat conduction plate 251 to be transferred to the side wall of the ice-making tray 310. Similarly, since the bottom of the ice-making tray 310 is supported on the bottom heat conduction plate 252 and in thermal contact with the bottom heat conduction plate 252, the cooling capacity of the bottom of the ice-making tray 310 can also be directly transferred to the bottom of the ice-making tray 310 through the bottom heat conduction plate 252. This way, the transfer of cooling capacity between the refrigerant pipe 450 and the ice-making tray 310 is magnified, enhancing ice-making efficiency and fully utilizing the cooling capacity of the refrigerant pipe 450, reducing condensation at the intake pipe 460 and the return pipe 470 at the hinge 500.

**[0036]** Furthermore, in this embodiment of the application, the depth of the first pipe accommodating groove 253 is greater than or equal to the diameter of the refrigerant pipe 450. One side wall 311 of the ice-making tray 310 is a plane covering the side heat conduction plate 251, and the side wall 311 which is connected to the heat conduction plate 251 is higher than the opposite side wall, ensuring that the operation of the discharging mechanism 340 is not obstructed, and the refrigerant pipe 450 is entirely placed within the first pipe accommodating groove 253. The side wall 311 of the ice-making tray 310 can closely contact the side heat conduction plate 251, increasing the area for heat contact. Additionally, the top of one side wall 311 of the ice-making tray 310 is provided with a hook 313, the hook 313 hangs on the top of the side heat conduction plate 251. During assembly, the ice-making tray 310 can be directly hung onto the heat conduction component 250 from above, without the refrigerant pipe 450 causing obstruction or interference, making installation convenient.

**[0037]** Furthermore, as illustrated, in one embodiment of the application, a side heat conduction plate 251 which is face to a wall of the ice-making compartment 200 is provided with the first heat exchange rib 255. The first heat exchange rib 255 may comprise several spaced ribs extending vertically, the hook 313 at the top of the side wall 311 of the ice-making tray 310 can hang between two adjacent heat exchange ribs, thereby reducing the movement of the ice-making tray 310. The first heat exchange rib 255 can abut against the wall of the ice-making compartment 200, allowing part of the cooling capacity of the refrigerant pipe 450 to be directly transferred to the ice-making tray 310 through the side heat conduction plate 251, while another part can be directly dissipated

into the interior of the ice-making compartment 200 through the first heat exchange rib 255 to lower the internal temperature of the ice-making compartment 200, preventing the ice in the ice storage box from melting and allowing the refrigerant's cooling capacity to be fully utilized, further reducing condensation.

**[0038]** Additionally, in this embodiment of the application, the depth of the second pipe accommodating groove 254 is less than the diameter of the refrigerant pipe 450. The bottom of the ice-making tray 310 is provided with a third pipe accommodating groove 315 that matches with the second pipe accommodating groove 254 and a second heat exchange rib 314, the second heat exchange rib 314 abutting against the bottom heat conduction plate 252. When the ice maker is installed onto the heat conduction plate, the third pipe accommodating groove 315 combines with the second pipe accommodating groove 254 to form a closed circular accommodating groove, with the refrigerant pipe 450 placed inside this circular groove. The cooling capacity of the refrigerant through the refrigerant pipe 450 can be directly transferred to the bottom of the ice-making tray 310 and the bottom heat conduction plate 252, the cooling capacity of the bottom heat conduction plate 252 also being transferred to the bottom of the ice-making tray 310 through the second heat exchange rib 314, thereby supplying sufficient cooling capacity to the ice-making tray 310 and enhancing ice-making efficiency.

**[0039]** Further, in this embodiment of the application, a side of the bottom heat conduction plate 252 which is face away from the side of the ice-making tray 310 is provided with a third heat exchange rib 256. The cooling capacity of the refrigerant can be partially dissipated through the third heat exchange rib 256 into the interior of the ice-making compartment 200, cooling the temperature of the ice-making compartment 200, ensuring that the cooling capacity of the refrigerant is fully transferred to the ice-making compartment 200, and reducing the occurrence of condensation at the intake pipe 460 and the return pipe 470.

**[0040]** Moreover, in this embodiment of the application, the bottom of the ice-making tray 310 is also equipped with a defrosting heating wire 315. After the completion of ice-making, the defrosting heating wire 315 is activated to heat the ice-making tray 310 to assist in detaching the ice cubes from the ice-making tray 310. Specifically, a defrosting heating wire accommodating groove 316 can be set at the bottom of the ice-making tray 310, the space between the side wall 311 of the ice-making tray 310 and the third pipe accommodating groove 315 can form the defrosting heating wire accommodating groove 316. In horizontal plane, the defrosting heating wire 315 can be U-shaped, both sides of the U-shaped wire placed within the defrosting heating wire accommodating groove 316, and at least one side of the defrosting heating wire 315 located between the bottom heat conduction plate 252 and the bottom of the ice-making tray 310, allowing the heat from the defrosting heating

wire 315 to be transferred through the heat conduction component to the ice-making tray, accelerating ice-discharging process.

**[0041]** Further, in this embodiment of the application, the heat conduction component 250 is L-shaped, the side heat conduction plate 251 and the bottom heat conduction plate 252 set perpendicularly. The first pipe accommodating groove 253 and second pipe accommodating groove 254 are parallel, and both are parallel to the length direction of the ice-making tray 310. Specifically, the first pipe accommodating groove 253 can comprise at least two spaced parallel accommodating grooves, and the second pipe accommodating groove 254 can also comprise at least two spaced parallel accommodating grooves. The refrigerant pipe 450 can enter into the first pipe accommodating groove 253 from one end of the first pipe accommodating groove 253 and exit from an end of the second pipe accommodating groove 254. The refrigerant pipe 450 is bent along the first pipe accommodating grooves 253 and second pipe accommodating grooves 254 in serpentine shape, a plane H containing the refrigerant pipe 450 connecting the first pipe accommodating grooves 253 and second pipe accommodating grooves 254 at an angle to both the side heat conduction plate 251 and the bottom heat conduction plate 252. Specifically, an angle between plane H and the bottom heat conduction plate 252 can be between 30° and 60°. In this example, the angle between plane H and the bottom heat conduction plate 252 is 45°, facilitating the bending and assembly of the refrigerant pipe 450 with the heat conduction plates.

**[0042]** As shown in Figure 7, the refrigerator also comprises a water collection tray 320 positioned beneath the bottom heat conduction plate 252. During an ice-discharging process, activation of the defrosting heating wire may cause condensation to form on the bottom of the ice-making tray 310 or on the heat conduction component. During the ice-making process or the water supply process, water droplets may also fall from the ice-making tray 310 or the heat conduction component. The water collection tray 320 can catch these droplets, preventing them from dripping into the ice storage box and causing the ice cubes therein to stick together.

**[0043]** A drainage outlet can be set on a wall of the ice-making compartment 200, and the foam layer of the door of the ice-making compartment 200 can have a channel connecting the drainage outlet and the external drainage pipe of the refrigerator. The water collection tray 320 may have a drainage spout 322 that matches the drainage outlet, both ends of the water collection tray 320 can be opening, and the drainage spout 322 located in the middle of the water collection tray 320. The bottom surface of the water collection tray 320 can be sloped, with the position of the drainage spout being the lowest point to guide water in the tray to the drainage spout 322 for discharge.

**[0044]** In this embodiment, the water collection tray 320 may comprise a water collection tray shell 321 and

a heat conduction plate installed inside the water collection tray shell 321, the heat conduction plate can be made of aluminum, as shown in Figure 10. The water collection tray shell 321 can be an insulated shell, the drainage spout 322 set on the water collection tray shell 321. The ends of the water collection tray shell 321 in the length direction can be open, and barriers on both sides in the width direction are connected to a wall of the ice-making compartment 200 and the ice-making tray 310, respectively.

**[0045]** A fan can be installed at any open end of the water collection tray shell 321. During the ice-making process, the fan can be activated to transfer the cold air between the bottom heat conduction plate 252 and the water collection tray 320 into the interior of the ice-making compartment 200. When the refrigeration system 400 needs to defrost, the temperature of the refrigerant pipe 450 increases, at which point the fan can be shut off to avoid blowing hot air into the entire ice-making compartment 200, while the insulated water collection tray shell 321 also prevents hot air from entering the ice storage box, causing the ice cubes inside to melt. A heating wire can also be set on the surface of the heat conduction plate opposite to the water collection tray 320 shell to prevent water inside the tray from freezing.

**[0046]** Refer to Figures 11 and 12, in another embodiment of the application, the water collection tray shell 321 may not comprise an aluminum plate and heating wire. Instead, the defrosting heating wire extends between the bottom heat conduction plate 252 and the water collection tray shell 320, with part of the defrosting heating wire 330 positioned between the ice-making tray 310 and the bottom heat conduction plate 252, and another part between the bottom heat conduction plate 252 and the water collection tray 320.

**[0047]** In this embodiment, on a horizontal plane, the defrosting heating wire 330 can be U-shaped to be installed at the bottom of the ice-making tray 310, with both sides of the U-shaped wire placed on either side of the bottom of the ice-making tray 310. On a vertical plane, the defrosting heating wire 330 can also be U-shaped, with both sides of the U placed between the ice-making tray 310 and the bottom heat conduction plate 252, as well as between the bottom heat conduction plate 252 and the water collection tray 320, thus, without the need for installing additional heating wires, using the defrosting heating wire 330 can simultaneously achieve defrosting and prevent water in the water collection tray 320 from freezing.

**[0048]** Furthermore, as shown in Figures 3 to 9, in one embodiment of the application, the rear wall is defined as a surface of the ice-making compartment shell 210 opposite the door of the ice-making compartment. The side heat conduction plate 251 of the heat conduction component 250 can be connected to the rear wall of the ice-making compartment shell 210. A bracket mounting opening 220 can be set on the ice-making compartment shell 210, and a mounting bracket 230 can be installed

at the bracket mounting opening 220, with insulating material filled between the mounting bracket 230 and the door shell 110. When the insulating material is foam, the mounting bracket 230 can be directly fixed at the bracket mounting opening 220 of the ice-making compartment shell 210 through the foaming process. The heat conduction component 250 can be installed on the mounting bracket 230 and fixedly connected to the mounting bracket 230 with screws or other fasteners. A mounting bracket 230 is provided with a pipe guide groove 233 corresponding to the first pipe accommodating grooves 253 and second pipe accommodating grooves 254, the mounting bracket 230 is positioned on one side of the heat conduction component 250, allowing the refrigerant pipe 450 to enter or exit the ice-making compartment 200 through the pipe guide grooves 233.

**[0049]** In this embodiment, the refrigerant pipe 450 enters into either the first pipe accommodating groove 253 or the second pipe accommodating groove 254 in the ice-making compartment 200 through one end of the pipe guide groove 233, and then enters into the foam layer from the other end of the pipe guide groove 233. The pipe guide groove 233 can one-to-one correspond with the first pipe accommodating groove 253 and the second pipe accommodating groove 254, allowing the end of the refrigerant pipe 450 on one side of the heat conduction component 250 to enter into the foam layer through the pipe guide groove 233. This arrangement prevents deformation or displacement of the refrigerant pipe 450 during the manufacturing process.

**[0050]** Furthermore, in this embodiment of the application, a fixed bracket 240 that matches with the mounting bracket 230 is also set at the bracket mounting opening 220. Foam material can be filled between the fixed bracket 240 and the door shell 110 and the fixed bracket 240 can be directly fixed with foaming. The fixed bracket 240 is provided with a pipe fixing groove 241 that matches with the pipe guide groove 233. During the manufacturing process, the refrigerant pipe 450 can be assembled with the heat conduction component 250 and the mounting bracket 230 first, embedding the refrigerant pipe 450 into the first pipe accommodating groove 253 and the second pipe accommodating groove 254 and the pipe guide groove 233, then assembling the fixed bracket 240 with the mounting bracket 230 to further secure the refrigerant pipe 450, and finally securing the mounting bracket 230 and the fixed bracket 240 at the bracket mounting opening 220 of the ice-making compartment shell 210 with foaming.

**[0051]** The bracket mounting opening 220 comprises a first opening 221 set in the rear wall of the ice-making compartment shell 210 and a second opening 222 set in the side wall of the ice-making compartment shell 210, the first opening 221 connected to the second opening 222. The mounting bracket 230 comprises a side bracket 231 installed at the first opening 221, the side heat conduction plate 251 of the heat conduction component 250 fixedly connected to the side bracket 231 of the mounting

bracket 230. An edge of the side bracket 231 is provided with the pipe guide groove 233. The mounting bracket 230 also comprises a bottom bracket 232 that extends perpendicularly from the side bracket 231, the bottom bracket 232 is positioned on one side of the bottom heat conduction plate 252. Specifically, the bottom bracket 232 can be set parallel to the bottom heat conduction plate 252, the bottom bracket 232 is provided with a pipe guide groove 233 corresponding to the second pipe accommodating groove 254. The shape of the fixed bracket 240 matched with the bottom bracket 232 corresponds to the shape of the second opening 222. The fixed bracket 240 is conical, with the connection surface 242 of the fixed bracket 240 to the side wall of the ice-making compartment shell 210 being inclined, forming an angle with the rear wall of the ice-making compartment shell 210, thus reducing material leakage during the foaming process.

**[0052]** One embodiment of the application also provides a method for manufacturing a refrigerator, which can be used to manufacture the refrigerator described in the above embodiments, especially the refrigerator door in the mentioned embodiments.

**[0053]** The refrigerator manufacturing method comprises:

Pre-installing the refrigerant pipe on the side heat conduction plate and the bottom heat conduction plate, and installing the refrigerant pipe and the heat conduction component onto the door shell;  
Assembling the door liner 120 with the door shell 110 and injecting foam material, a wall of the ice-making compartment is provided with an installation opening corresponding to the heat conduction component.

**[0054]** The refrigerant pipe 450 can be assembled with the heat conduction component 250 first, and then assemble the heat conduction component 250 with the door shell 110; or the heat conduction component 250 and the refrigerant pipe 450 can be assembled with the door shell 110 first, followed by assembling the refrigerant pipe 450 with the heat conduction component 250. The heat conduction component 250 can be installed onto the door shell 110 using the mounting bracket 230. The mounting bracket 230 can be set independently from the heat conduction component 250 or can be integrated with the heat conduction component 250.

**[0055]** In this embodiment, an independent ice-making compartment shell can be set. First, the ice-making compartment shell 210 can be assembled with the door liner 120, then the door liner with the ice-making compartment shell 210 can be assembled with the pre-installed door shell 110 and injected with foam material. The installation opening can be directly set on the ice-making compartment shell 210.

**[0056]** Furthermore, the refrigerator manufacturing method may also comprise:

Passing the intake pipe 460 and the return pipe 470 through the door shell 110 hinge axis into the interior of the door shell 110;

Connecting the refrigerant inlet of the refrigerant pipe 450 with the intake pipe 460 and connecting the refrigerant outlet with the return pipe 470.

**[0057]** The refrigerant pipe 450 can be connected with the intake pipe 460 and the return pipe 470 first, and then assembling with the refrigerant pipe 450 and the heat conduction component 250; or the refrigerant pipe 450 can be assembled with the heat conduction component 250 first, and after installing the heat conduction component 250 onto the door shell 110, then the refrigerant pipe 450 can be connected with the intake pipe 460 and the return pipe 470.

**[0058]** Thus, in the manufacturing process, by first fixing the refrigerant pipe 450 with the heat conduction component 250 and securing the heat conduction component 250 on the door shell 110, it is possible to prevent the refrigerant pipe 450 from shifting under the pressure of the foaming material during the foaming process, making subsequent installations inconvenient. This ensures the contact area between the refrigerant pipe 450, the heat conduction component 250, and the ice-making tray 310, guaranteeing the efficiency of heat transfer.

**[0059]** Furthermore, in one embodiment of the application, "pre-installing the refrigerant pipe on the side heat conduction plate and the bottom heat conduction plate, and then installing the refrigerant pipe and the heat conduction component onto the door shell" specifically comprises:

Bending the refrigerant pipe 450 into a predetermined shape and placing it into the first pipe accommodating groove 253 of the side heat conduction plate 251 and the second pipe accommodating groove 254 of the bottom heat conduction plate 252, and installing the heat conduction component 250 onto the door shell 110;

Fixing the side heat conduction plate 251 of the heat conduction component 250 to the mounting bracket 230, and embedding the refrigerant pipe 450 into the pipe guide groove 233 on one side of the mounting bracket 230;

Installing the mounting bracket 230 at a predetermined location on the door shell 110, where the mounting bracket 230 is provided with support feet 234 that support on the door shell 110;

A wall of the ice-making compartment is provided with a bracket mounting opening 220 for installing the mounting bracket 230.

**[0060]** In this embodiment, the mounting bracket 230 is pre-installed on the door shell 110, which can be connected to the door shell 110 using double-sided adhesive tape or the like for the support feet 234 of the mounting bracket 230. After injecting foam material, the bracket

mounting opening 220 can be set on the ice-making compartment shell 210. The mounting bracket 230 matches with the bracket mounting opening 220 on the ice-making compartment shell 210 and is directly fixed with foam material. There is a connecting surface between the mounting bracket 230 and the ice-making compartment shell 210, which can be inclined to reduce the leakage of foam material. At the same time, the pipe guide groove 233 on the mounting bracket 230 can further guide and limit the refrigerant pipe 450, fixing it in the proper position.

**[0061]** Furthermore, in this embodiment of the application, the refrigerator manufacturing method also comprises:

Installing the fixed bracket 240 onto the mounting bracket 230, the fixed bracket 240 provided with a pipe fixing groove 241 that matches the pipe guide groove 233, securing the refrigerant pipe 450 within the pipe groove formed by the pipe guide groove 233 and the pipe fixing groove 241.

**[0062]** In this embodiment, the refrigerant pipe 450 is secured using the fixed bracket 240 and the mounting bracket 230, the fixed bracket 240 and the mounting bracket 230 being separately set, facilitating assembly. The fixed bracket 240 is conical, making it easier to match with the ice-making compartment shell 210 during the subsequent foaming process and also reducing material leakage.

**[0063]** In summary, the refrigerator provided by the application, by directly setting the heat conduction component 250 inside the ice-making compartment 200 and ensuring thermal contact with both the side wall and the bottom of the ice-making tray 310, maximizes the transfer of the cooling capacity of the refrigerant pipe 450 to the ice-making tray 310. This enhances ice-making efficiency and utilization of cooling capacity, reducing condensation at the intake pipe 460 and the return pipe 470.

**[0064]** It should be understood that although the specification is described according to embodiments, not every embodiment contains only a single independent technical solution. This description method is only for clarity. Those skilled in the art should consider the specification as a whole. The technical solutions in the embodiments can also be appropriately combined to form other embodiments understood by those skilled in the art.

**[0065]** The series of detailed explanations listed above are just for the feasibility embodiments of the application and are not intended to limit the scope of protection of the application. Any equivalent embodiments or changes made without departing from the spirit of the application should be comprised within the scope of protection of the application.

## Claims

1. A refrigerator, comprising:

- an ice-making compartment, wherein the ice-making compartment is provided with an ice-making device, the ice-making device comprises an ice-making tray;  
 a refrigerant pipe, a portion of which is located within the ice-making compartment;  
**characterized in that**, the ice-making compartment is provided with a heat conduction component, the heat conduction component comprises a side heat conduction plate and a bottom heat conduction plate; a side wall of the ice-making tray is in closely contact with the side heat conduction plate, and the bottom of the ice-making tray is supported on the bottom heat conduction plate, the refrigerant pipe within the ice-making compartment is positioned between the heat conduction component and the ice-making tray, the refrigerant pipe in thermal contact with both the side heat conduction plate and the bottom heat conduction plate.
2. The refrigerator according to claim 1, **characterized in that** the side heat conduction plate is provided with a first pipe accommodating groove, and the bottom heat conduction plate is provided with a second pipe accommodating groove, at least a portion of the refrigerant pipe located within the first accommodating groove and second pipe accommodating groove.
  3. The refrigerator according to claim 2, **characterized in that** the depth of the first pipe accommodating groove is greater than or equal to the diameter of the refrigerant pipe, one side wall of the ice-making tray is a plane covering the side heat conduction plate, and a top of the side wall of the ice-making tray is provided with a hook that hangs on a top of the side heat conduction plate.
  4. The refrigerator according to claim 1, **characterized in that** a side of the heat conduction plate which is face to the wall of the ice-making compartment is provided with a first heat exchange rib.
  5. The refrigerator according to claim 2, **characterized in that** a depth of the second pipe accommodating groove is less than the diameter of the refrigerant pipe, and the bottom of the ice-making tray is provided with a third pipe accommodating groove that matches with the second pipe accommodating groove and a second heat exchange rib, the second heat exchange rib abutting against the bottom heat conduction plate.
  6. The refrigerator according to claim 1, **characterized in that** the bottom heat conduction plate is provided with a third heat exchange rib on a surface facing away from a side of the ice-making tray.
  7. The refrigerator according to claim 2, **characterized in that** the heat conduction component is L-shaped, the first pipe accommodating groove and second pipe accommodating groove are parallel, and the refrigerant pipe is bent along the first pipe accommodating groove and the second pipe accommodating groove in serpentine shape, a plane containing a refrigerant pipe connecting the first pipe accommodating groove and the second pipe accommodating groove at an angle to both the side heat conduction plate and the bottom heat conduction plate.
  8. The refrigerator according to claim 1, **characterized in that** the refrigerator further comprises a water collection tray positioned beneath the bottom heat conduction plate, the water collection tray comprises a water collection tray shell and a heat conduction plate placed inside the water collection tray shell, and the bottom of the heat conduction plate is equipped with a heating wire.
  9. The refrigerator according to claim 1, **characterized in that** the refrigerator further comprises a water collection tray positioned beneath the ice-making tray, the bottom heat conduction plate located between the ice-making tray and the water collection tray, the bottom of the ice-making tray is equipped with a defrosting heating wire and a defrosting heating wire mounting portion for installing the defrosting heating wire, a portion of the defrosting heating wire located between the ice-making tray and the bottom heat conduction plate, and another portion located between the bottom heat conduction plate and the water collection tray.
  10. The refrigerator according to claim 1, **characterized in that** the refrigerator comprises a cabinet, a storage compartment formed inside the cabinet comprises a refrigeration compartment and a freezing compartment, the cabinet is connected with a refrigeration door for opening and closing the refrigeration compartment, the ice-making compartment is formed within the refrigeration door, a compressor is set on a cabinet side, an inlet end of the refrigerant pipe is connected with a side of the compressor through an intake pipe, and an outlet end of the refrigerant pipe is connected with a side of the compressor through a return pipe; both the intake pipe and the return pipe extend from the cabinet side to a door side; the refrigeration door comprises a door shell and a door liner, the door liner is provided with the ice-making compartment, and another portion of the refrigerant pipe is located between the door shell and the door liner.
  11. The refrigerator according to claim 10, **characterized in that** the side heat conduction plate is provided with a first pipe accommodating groove, and the

bottom heat conduction plate is provided with a second pipe accommodating groove, the refrigerant pipe located within the first pipe accommodating groove and the second pipe accommodating groove; a wall of the ice-making compartment is provided with a bracket mounting opening, a mounting bracket is set at the bracket mounting opening, insulating material is filled between the mounting bracket and the door shell, the heat conduction component is mounted on the mounting bracket, and the mounting bracket is provided with a pipe guide groove corresponding to the first pipe accommodating groove and the second pipe accommodating groove the pipe guide groove is on one side of the heat conduction component, the refrigerant pipe passing in or out of the ice-making compartment through the pipe guide groove.

12. The refrigerator according to claim 11, **characterized in that** the bracket mounting opening is also provided with a fixed bracket that matches with the mounting bracket, insulating material is filled between the fixed bracket and the door shell, and the fixed bracket is provided with a pipe fixing groove that matches the pipe guide groove.
13. The refrigerator according to claim 12, **characterized in that** the bracket mounting opening comprises a first opening set in a rear wall of the ice-making compartment and a second opening set in a side wall of the ice-making compartment, the first opening and second opening are connected; the mounting bracket comprises a side bracket that matches with the first opening and a bottom bracket that extends perpendicularly from the side bracket; the bottom bracket and the fixed bracket are set at the second opening, and a shape of the assembly of the fixed bracket and the bottom bracket matches with a shape of the second opening, a connection surface of the fixed bracket with the side wall of the ice-making compartment is inclined.
14. A method for manufacturing a refrigerator, for manufacturing the refrigerator according to claim 10, **characterized in that**, the method comprising:  
  
pre-installing the refrigerant pipe on the side heat conduction plate and the bottom heat conduction plate, and installing the refrigerant pipe and the heat conduction component on the door shell;  
  
assembling the door liner with the door shell and injecting foam material, the ice-making compartment shell is provided with a mounting opening corresponding to the heat conduction component.

15. The refrigerator manufacturing method according to

claim 14, **characterized in that** "pre-installing the refrigerant pipe on the side heat conduction plate and the bottom heat conduction plate, and installing the refrigerant pipe and the heat conduction component on the door shell" specifically comprises:

bending the refrigerant pipe into a predetermined shape and placing the refrigerant pipe into the first pipe accommodating groove of the side heat conduction plate and the second pipe accommodating groove of the bottom heat conduction plate;  
fixing the side heat conduction plate of the heat conduction component to a mounting bracket, and embedding the refrigerant pipe into a pipe guide groove on one side of the mounting bracket, the pipe guide groove is located on one side of the mounting bracket and corresponds to the first pipe accommodating groove and the second pipe accommodating groove;  
installing the mounting bracket at a predetermined location on the door shell, the mounting bracket is provided with a support feet that supports on the door shell; a wall of the ice-making compartment is provided with a bracket mounting opening for installing the mounting bracket; the method further comprises:  
installing a fixed bracket on the mounting bracket, where the fixed bracket is provided with a pipe fixing groove that matches with the pipe guide groove, and the refrigerant pipe is fixed within the pipe groove formed by the pipe guide groove and the pipe fixing groove.

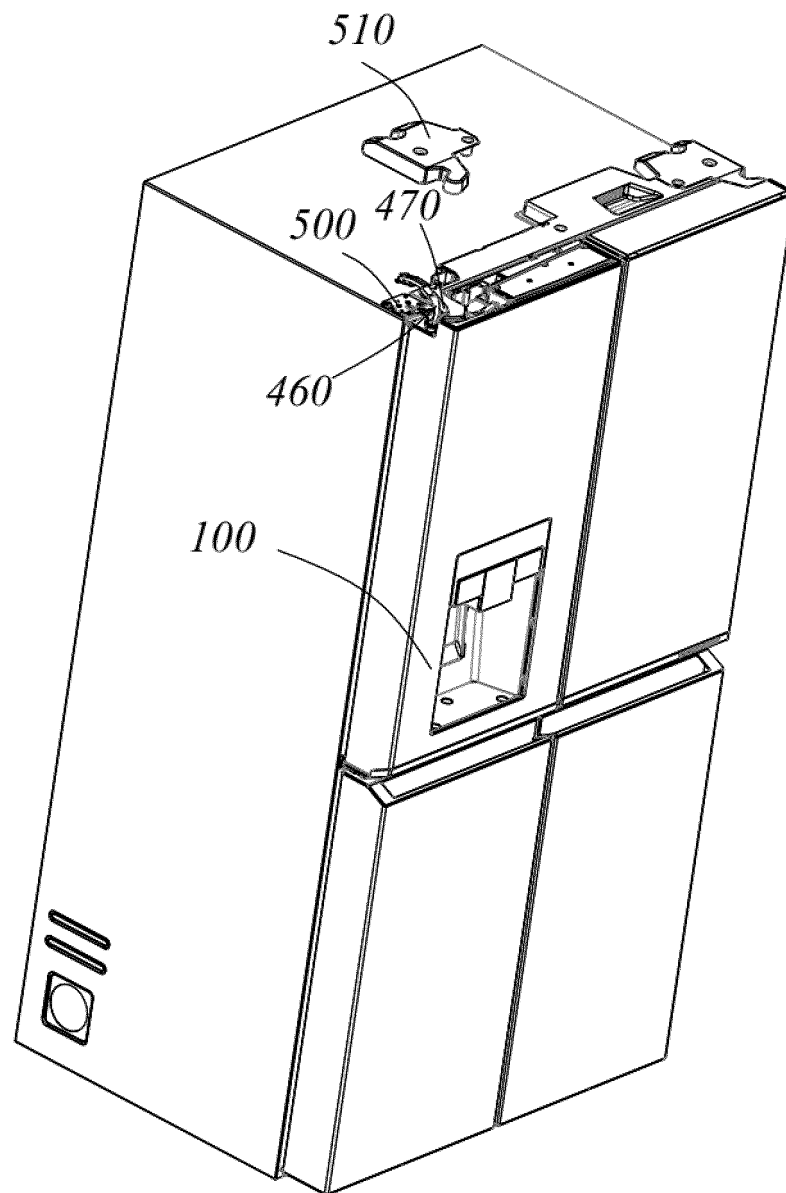


FIG.1

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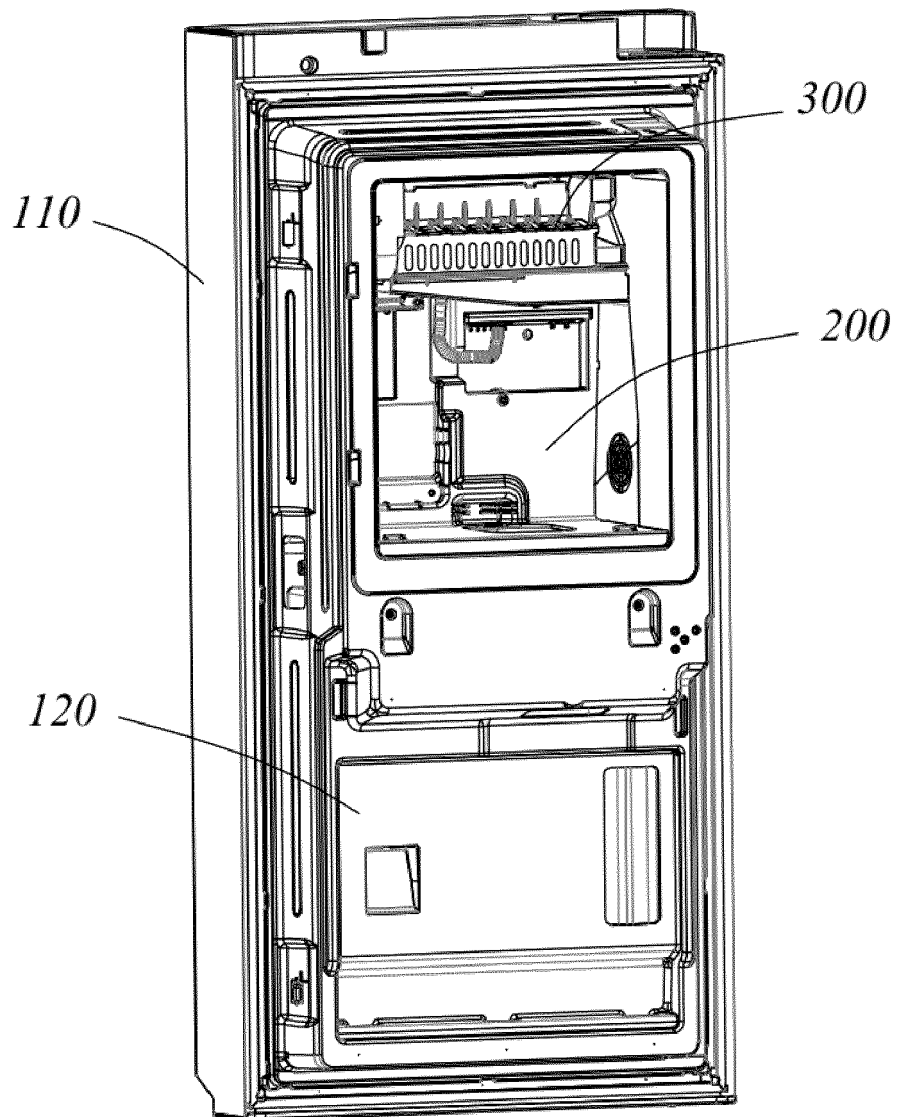


FIG.2

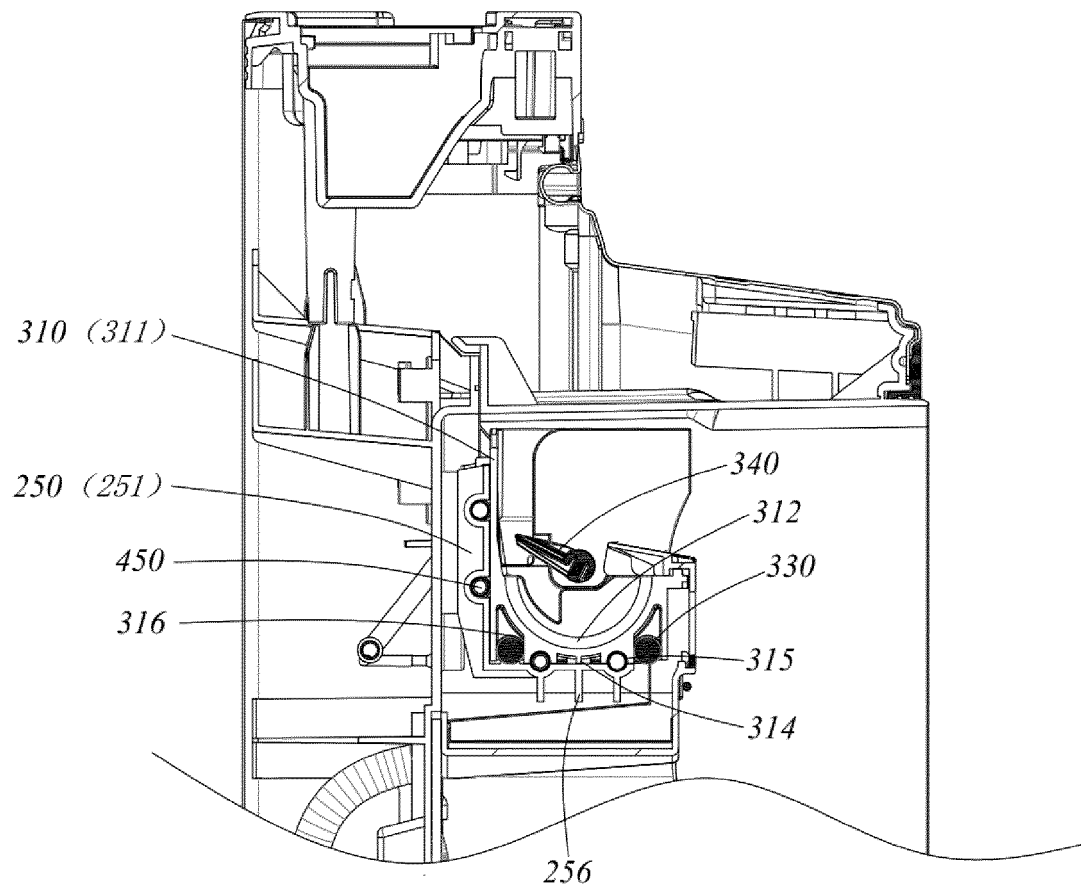


FIG.3

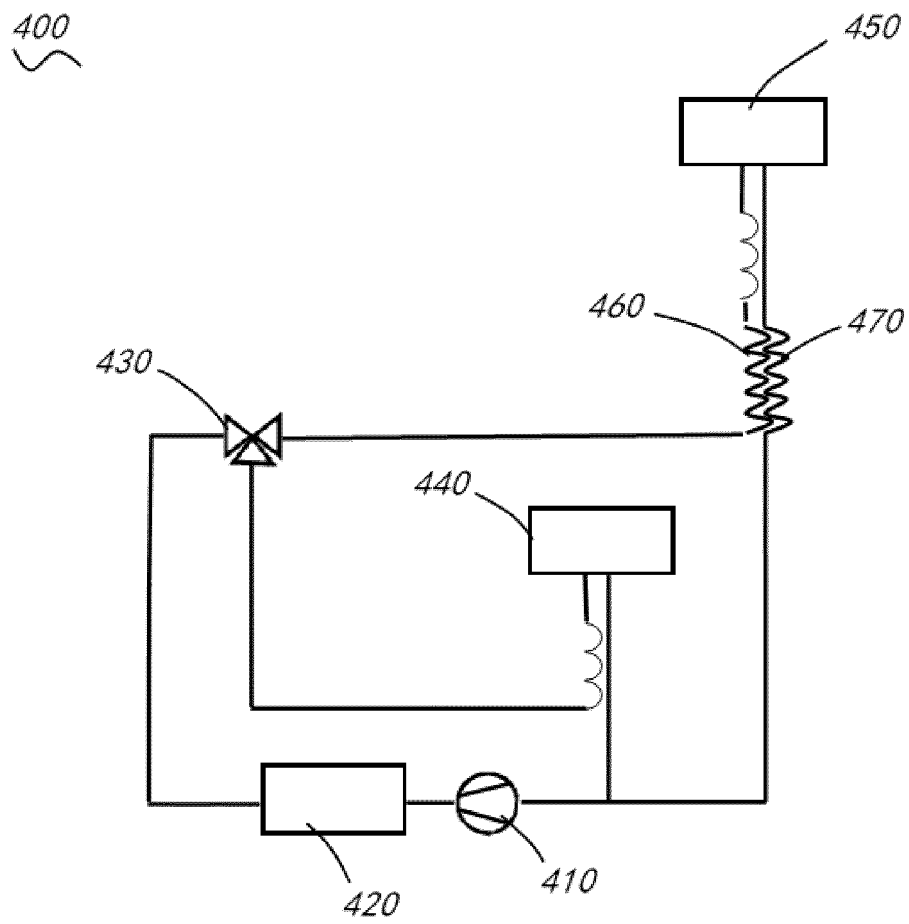


FIG.4

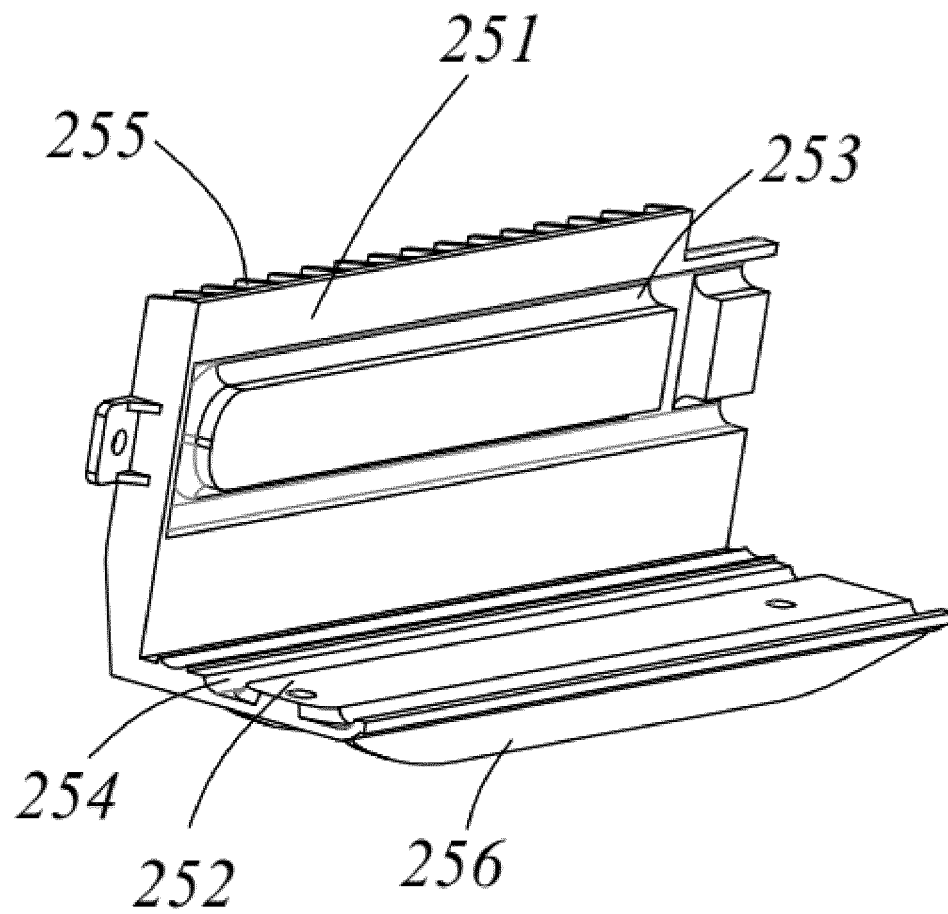


FIG.5

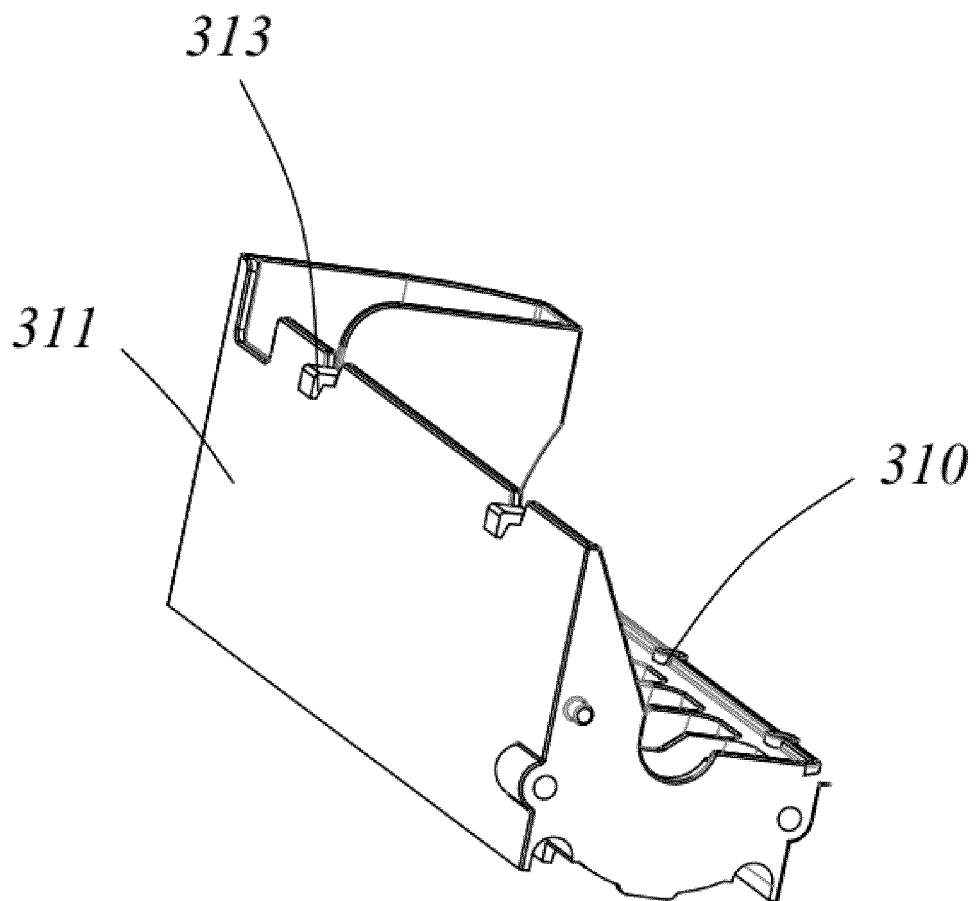


FIG.6

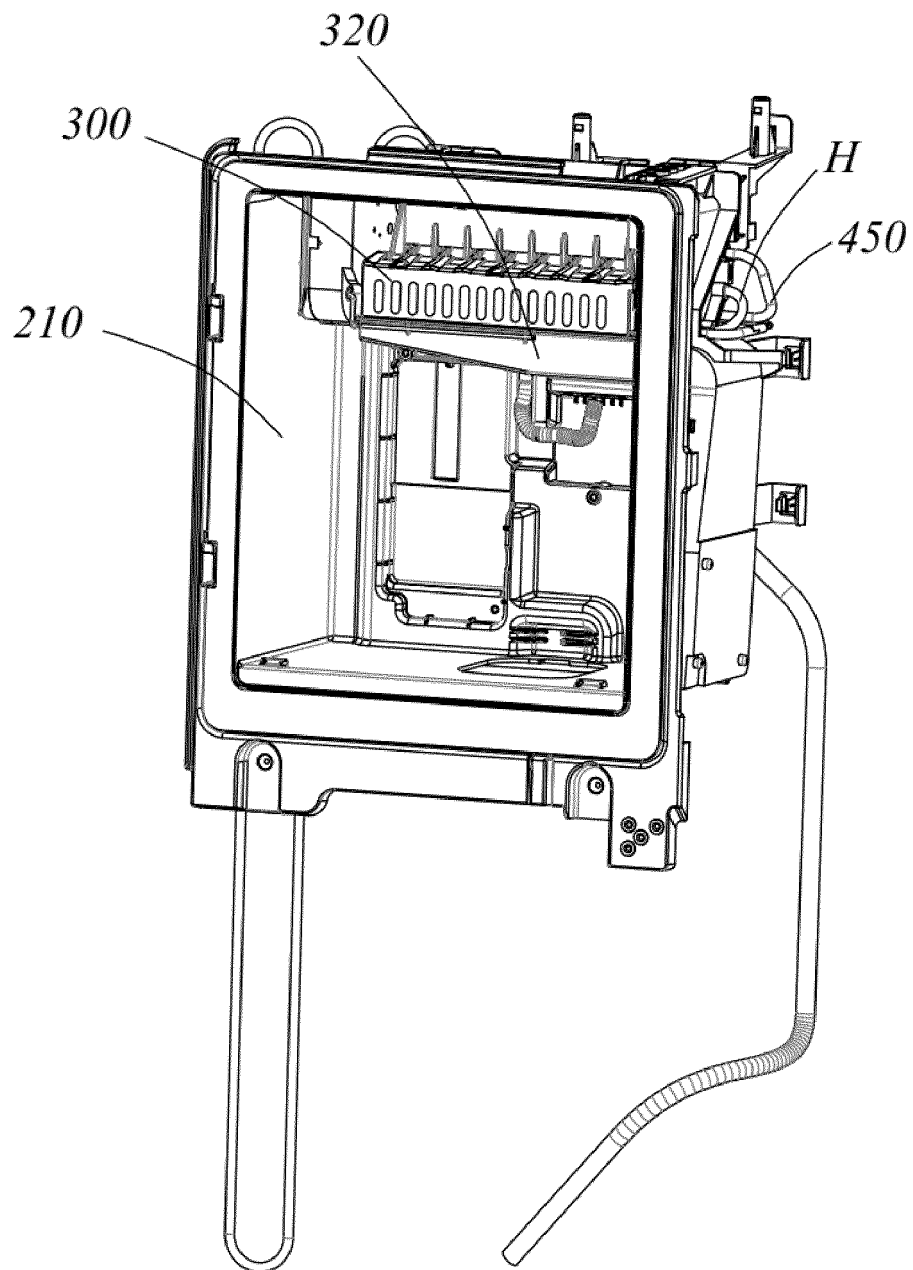


FIG. 7

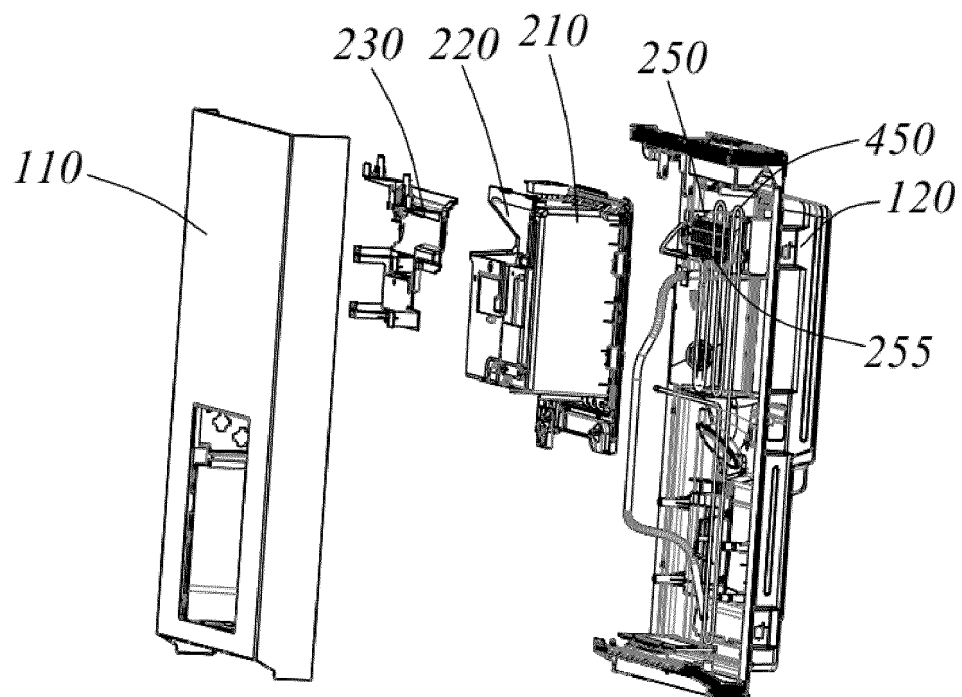


FIG.8

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/130923

**A. CLASSIFICATION OF SUBJECT MATTER**

F25D 11/02(2006.01)i; F25D 23/00(2006.01)i; F25C 1/04(2018.01)i; F25C 5/08(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)

F25D; F25C

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)

CNTXT; CNKI; WPABS; DWPI; USTXT; EPTXT; WOTXT; ISL Web of Science: 制冰, 冰箱, 侧壁, 底部, 制冷剂, 冷媒, 管, 板, ice, maker, refrigerator, side, bottom, refrigerant, pipe, tube, board, plate

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                | Relevant to claim No. |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X         | CN 214581959 U (QINGDAO HAIER INTELLIGENT TECH RESEARCH AND DEVELOPMENT CO., LTD. et al.) 02 November 2021 (2021-11-02)<br>description, paragraphs [0045]-[0068], and figures 1-3 | 1-15                  |
| A         | CN 109373680 A (HEFEI MIDEA REFRIGERATOR CO., LTD. et al.) 22 February 2019 (2019-02-22)<br>entire document                                                                       | 1-15                  |
| A         | CN 106257202 A (DONGBU DAEWOO ELECTRONICS CORPORATION) 28 December 2016 (2016-12-28)<br>entire document                                                                           | 1-15                  |

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

\* Special categories of cited documents:

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"&amp;" document member of the same patent family

Date of the actual completion of the international search

01 January 2023

Date of mailing of the international search report

17 January 2023

Name and mailing address of the ISA/CN

China National Intellectual Property Administration (ISA/  
CN)  
No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing  
100088, China

Authorized officer

Facsimile No. (86-10)62019451

Telephone No.

INTERNATIONAL SEARCH REPORT  
Information on patent family members

International application No.  
**PCT/CN2022/130923**

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| Patent document cited in search report |           |   | Publication date (day/month/year) | Patent family member(s) |            |    | Publication date (day/month/year) |
|----------------------------------------|-----------|---|-----------------------------------|-------------------------|------------|----|-----------------------------------|
| CN                                     | 214581959 | U | 02 November 2021                  | None                    |            |    |                                   |
| CN                                     | 109373680 | A | 22 February 2019                  | None                    |            |    |                                   |
| CN                                     | 106257202 | A | 28 December 2016                  | US                      | 2016370054 | A1 | 22 December 2016                  |
|                                        |           |   |                                   | KR                      | 101661615  | B1 | 30 September 2016                 |