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(54) **REFRIGERATOR**

(57) The present invention provides a refrigerator, comprising: a cabinet defining a chilling compartment; a door body movably connected to the cabinet and configured to open and close the chilling compartment, the door body comprises a door shell and a door liner engaged with the door shell, the door liner extending at least partially into the chilling compartment when the door body is closed; a refrigerating system for providing cold to said chilling compartment; an ice-making chamber defined by the door liner, the ice-making chamber accommodating an ice-making assembly, the ice-making chamber being thermally insulated from the chilling compartment when the door body is closed; wherein the door body is provided

ed with a heat exchanger connected to the refrigerating system, and a refrigerant pipe and a liquid storage bag which are connected to the heat exchanger, a pipeline of the refrigerating system is connected to the heat exchanger through a hinge of the door body, the refrigerant pipe comprises a direct cooling section in contact with the ice-making assembly, and the refrigerant from the refrigerating system passes through the heat exchanger, the liquid storage bag and the direct cooling section in turn, and then returns from the heat exchanger to the refrigerating system, and the heat exchanger and the liquid storage bag are disposed between the door liner and the door shell.

EP 4 273 483 A1

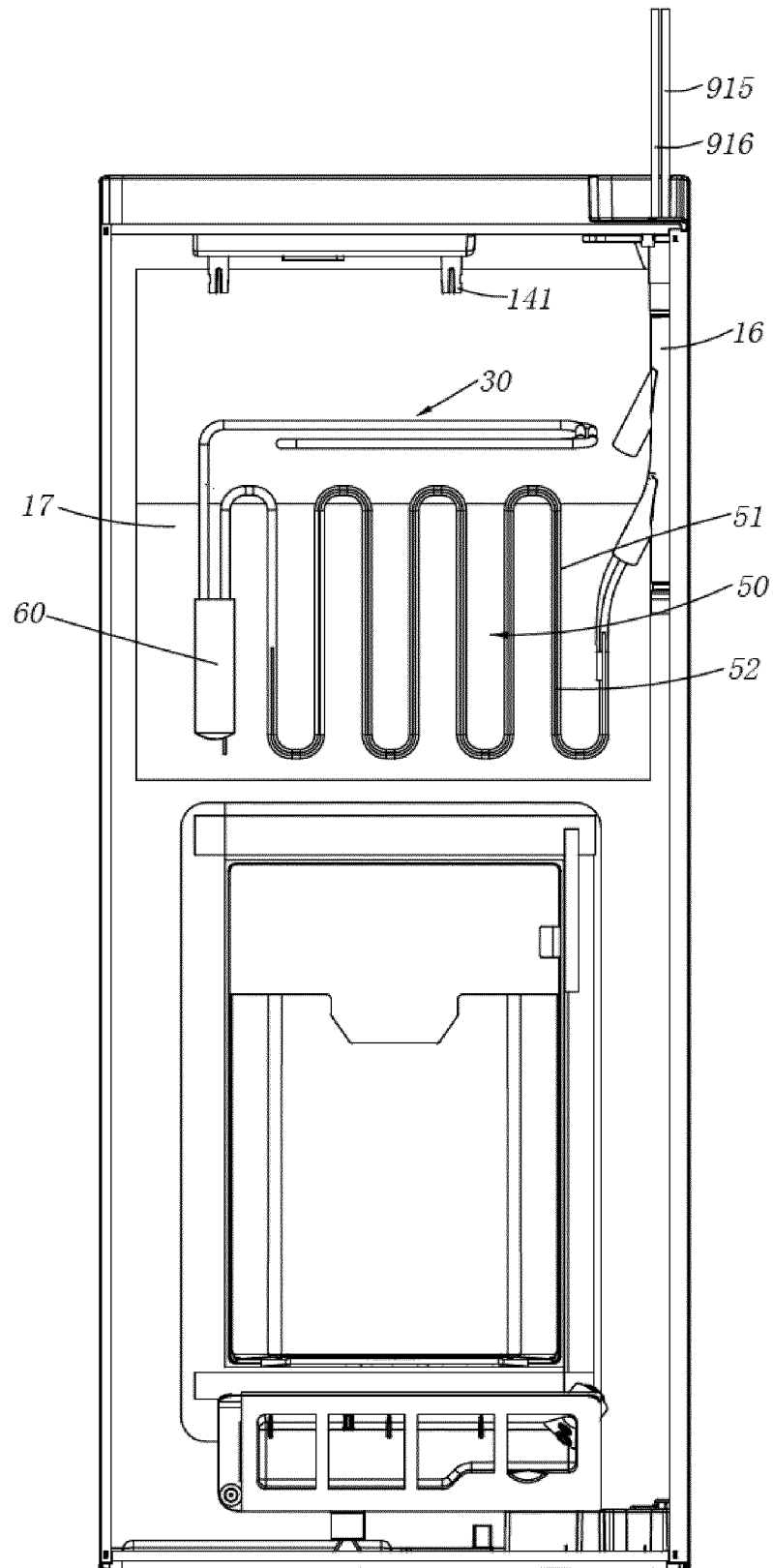


Fig.10

Description

TECHNICAL FIELD

[0001] The present invention relates to the field of refrigerating appliances, and particularly to a refrigerator having ice making function.

BACKGROUND

[0002] An ice maker is usually disposed in a freezing chamber of a refrigerator to make ice by virtue of the cold air in the freezing chamber. As for a refrigerator with a refrigerating chamber above the freezing chamber, a user needs to bend down to open the door body of the freezing chamber upon taking out of ice. To enable the user to conveniently take ice, an independent ice-making chamber is disposed in the refrigerating chamber or a door body of the refrigerating chamber of some conventional refrigerators, the ice maker is disposed in the ice-making chamber, and a dispenser associated with the ice maker is disposed on an outer side of the door body.

[0003] However, where the independent ice-making chamber is disposed on the door body of the refrigerating chamber, cold air needs to be introduced from the cabinet into the ice-making chamber of the door body to achieve cold supply to make ice. The door body needs to be often opened and closed so that the cold air is apt to leak, thereby increasing the energy consumption of the refrigerator. Furthermore, introduction of cold air from the cabinet is apt to cause mixing of smells. Therefore, there arise refrigerators in which ice is made by using a refrigerant pipe in direct contact with the ice maker. In such a type of refrigerators, the refrigerant usually needs to be introduced from the cabinet into the door body, usually passing through the hinge between the door body and the cabinet, but there may be condensation on the hinge. Therefore, the prior art needs to be further improved.

SUMMARY

[0004] An object of the present invention is to provide a reliable refrigerator for use.

[0005] In order to achieve the above-mentioned object, the present invention provides a refrigerator, wherein the refrigerator comprises:

- a cabinet defining a chilling compartment;
- a door body movably connected to the cabinet and configured to open and close the chilling compartment, the door body comprising a door shell and a door liner engaged with the door shell, the door liner extending at least partially into the chilling compartment when the door body is closed;
- a refrigerating system for providing cold to said chilling compartment;
- an ice-making chamber defined by the door liner, the ice-making chamber accommodating an ice-making

assembly, the ice-making chamber being thermally insulated from the chilling compartment when the door body is closed;

wherein the door body is provided with a heat exchanger connected to the refrigerating system, and a refrigerant pipe and a liquid storage bag which are connected to the heat exchanger, a pipeline of the refrigerating system is connected to the heat exchanger through a hinge of the door body, the refrigerant pipe comprises a direct cooling section in contact with the ice-making assembly, and the refrigerant from the refrigerating system passes through the heat exchanger, the liquid storage bag and the direct cooling section in turn, and then returns from the heat exchanger to the refrigerating system, and the heat exchanger and the liquid storage bag are disposed between the door liner and the door shell.

[0006] As a further improvement of an embodiment of the present invention, wherein the heat exchanger and the liquid storage bag are disposed in turn from a side adjacent to a pivoting side of the door body towards the other side, and the connection of the heat exchanger with the liquid storage bag enables the refrigerant to enter the liquid storage bag from top to bottom.

[0007] As a further improvement of an embodiment of the present invention, wherein the heat exchanger comprises a cooling pipe connected between the refrigerating system and the liquid storage bag and an air return pipe connected between the refrigerant pipe and the refrigerating system, the cooling pipe and the air return pipe contact each other and form a plurality of bends on the door body, and a diameter of the cooling pipe is greater than the diameter of the air return pipe.

[0008] As a further improvement of an embodiment of the present invention, wherein the refrigerator further comprises a bracket engaged with the door liner and connected to the ice-making assembly, the refrigerant pipe comprises the direct cooling section in direct contact with the ice-making assembly and further comprises a connecting portion connected between the liquid storage bag and the direct cooling section, the connecting portion is bent upward and extends horizontally at a side of the bracket facing away from the ice-making chamber, and enters the ice-making chamber from a side adjacent to a pivoting side of the door body.

[0009] As a further improvement of an embodiment of the present invention, wherein the door body further comprises an upper door beam connected to the top of the door shell and the door liner, and the bracket is connected to the upper door beam.

[0010] As a further improvement of an embodiment of the present invention, wherein the upper door beam extends downwards to form at least two connecting sleeves, correspondingly the bracket extends upwards to form at least two connecting posts, a clamping slot is provided on a circumferential wall of each of the connecting sleeves, a clamping block is provided on each of the

connecting posts, and the connecting posts are inserted into the corresponding connecting sleeves until the clamping blocks are clamped into the clamping slots.

[0011] As a further improvement of an embodiment of the present invention, wherein the bracket comprises a bracket body and a support arm extending from an end of the bracket body adjacent to the pivoting side of the door body, the support arm extends away from a rear of the door shell, a portion of the refrigerant pipe is supported on the support arm, a fixing member is connected to the bracket, the fixing member is snap-fitted with the support arm, and a portion of the refrigerant pipe is fixed between the fixing member and the support arm.

[0012] As a further improvement of an embodiment of the present invention, wherein the door liner is provided with a first opening and a second opening which are communicated with each other, the first opening is located at a front portion of the ice-making chamber, the second opening is located at a side of the ice-making chamber adjacent to the pivoting side of the door body, the bracket closes the first opening, a portion of the fixing member and a portion of the support arm abut against an edge of the second opening, and the other portion of the fixing member and the other portion of the support arm are located in the ice-making chamber.

[0013] As a further improvement of an embodiment of the present invention, wherein a positioning member is fixedly connected to the refrigerant pipe, the positioning member is connected to the support arm, and the support arm limits the movement of the refrigerant pipe in an extension direction of the direct cooling section by the positioning member.

[0014] As a further improvement of an embodiment of the present invention, wherein a pipeline of the refrigerating system comprises an inlet pipe from the cabinet to the door body and a return pipe from the door body to the cabinet, both the inlet pipe and the return pipe pass through a hinge between the door body and the cabinet, and at least a part of the inlet pipe and the return pipe passing through the hinge is wrapped by closed-pore foam.

[0015] As a further improvement of an embodiment of the present invention, wherein a thermal insulation layer is disposed between the door shell and the door liner, the door liner comprises an inner door liner forming the ice-making chamber, a flat foam is disposed between the thermal insulation layer and the heat exchanger, the heat exchanger is supported on the flat foam, and the flat foam is disposed between the thermal insulation layer and the inner door liner.

[0016] As a further improvement of an embodiment of the present invention, wherein the liquid storage bag is wrapped with silica gel or foam, and the liquid storage bag and the heater exchanger are spaced apart from each other and supported on the flat foam.

[0017] As a further improvement of an embodiment of the present invention, wherein the cooling pipe and the air return pipe are bent after extending vertically up and

down on the door body, the liquid storage bag is constructed in a cylindrical shape, and an axial direction of the liquid storage bag is parallel to a direction in which the cooling pipe and the air return pipe extend up and down.

[0018] As compared with the prior art, with the heat exchanger and the liquid storage bag being provided on the door body, more cold can be dissipated out, thereby preventing the frosting on the pipeline of the refrigerating system caused when the refrigerant fails to totally evaporate and passes through the hinge of the door body, and making the use of the refrigerator more reliable.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

FIG 1 is a schematic view of a refrigerator according to a preferred embodiment of the present invention; FIG 2 is a perspective view of a door body of the refrigerator of FIG 1;

FIG 3 is an exploded perspective view of a door body of the refrigerator of FIG 2;

FIG 4 is a cross-sectional view taken along line A-A of FIG 2;

FIG 5 is a perspective view illustrating a bracket and a fixing member on the door body of FIG 2 are assembled together with a refrigerant pipe;

FIG 6 is a perspective view illustrating the bracket and the fixing member on the door body of FIG 2 are assembled together with the refrigerant pipe as viewed from another perspective;

FIG 7 is an exploded perspective view of FIG 5;

FIG 8 is an enlarged view of a circled portion of FIG 7;

FIG 9 is a perspective view of a fixing member of FIG 5;

FIG 10 is a schematic plan view of the door body of the refrigerator of FIG 2 with a door liner hidden.

DETAILED DESCRIPTION

[0020] The present invention will be described in detail in conjunction with embodiments shown in the figures. However, the embodiments are not intended to limit the present invention. Structural, methodological or functional variations made by those having ordinary skill in the art according to the embodiments are all included in the protection scope of the present invention.

[0021] It should be appreciated that terms indicating spatial relative positions such as "up", "down", "in" and "out" used in the text herein are intended to describe a relationship of one unit or feature shown in figures relative to another unit or feature for an easy description purpose. The terms indicating spatial relative positions may be intended to include different orientations besides the orientations shown in the figures in use or operation of the device.

[0022] Referring to FIG 1, a preferred embodiment of

the present invention provides a refrigerator comprising a cabinet 20, a door body 10 movably connected to the cabinet 20 and a refrigerating system, wherein the cabinet 20 defines a chilling compartment, the door body 10 is configured to open and close the chilling compartment, the refrigerating system is configured to supply cold to the chilling compartment, a fan 220 for introducing cold air generated by the refrigerating system into the chilling compartment is also disposed in the cabinet 20, and the chilling compartment comprises a refrigerating chamber 21 and a freezing chamber 22. Certainly, the chilling compartment may also comprise more chambers such as a temperature variable chamber. The refrigerating chamber 21 and the freezing chamber 22 are disposed vertically. In the present embodiment, the door body 10 is used to open and close the refrigerating chamber 21.

[0023] The door body 10 is provided with an ice-making chamber 13. An ice-making assembly 100 is accommodated in the ice-making chamber 13, and an ice bin 200 below the ice-making assembly 10 is also accommodated in the ice-making chamber 13. The ice-making chamber 13 is thermally insulated from the refrigerating chamber 21 when the door body 10 is closed. One or two door bodies may be provided to open and close the refrigerating chamber, for example, two door bodies may be provided, and the ice-making chamber may be provided at one of the door bodies. In the present embodiment, in a front-rear direction of the refrigerator, the side where the door body 10 is provided is the front, and the side where the cabinet 20 is provided is the rear; a left-right direction is perpendicular to an up-down direction and the front-rear direction.

[0024] The refrigerating system comprises a compressor 913, and a condenser connected to an outlet side of the compressor 913. The refrigerating system is also used to supply cold to the ice-making assembly 100, the compressor 913 is provided at the bottom of the cabinet 20, and an evaporator 912 for supplying cold to the freezing chamber 22 and the refrigerating chamber 21 is provided in the rear of the freezing chamber 22. In the present embodiment, the ice-making assembly 100 makes ice by making direct contact with the refrigerant pipe, and the evaporator 912 may be connected in series with the refrigerant pipe which supplies cold for the ice making or in parallel with both sides of the compressor 913 and the condenser.

[0025] Referring to FIG 2 through FIG 9, the door body 10 comprises a door shell 11 and a door liner 12 engaged with the door shell 11; the door liner 12 extends at least partially into a chilling compartment when the door body is closed, the door liner 12 defines the ice-making chamber 13, and the ice-making chamber 13 is thermally insulated from the chilling compartment when the door body is closed. The door body 10 further comprises an upper door beam 14 mounted on the top of the door shell 11 and the door liner 12, wherein a foaming space is defined between the door shell 11, the upper door beam 14 and the door liner 12, and the foaming space is filled

with an insulation layer to ensure thermal insulation of the ice-making chamber 13 on the door body 10 from the external environment and thermal insulation of the chilling compartment from the external environment.

[0026] The door body 10 further comprises a bracket 15 connected to the ice-making assembly 100, wherein the bracket 15 is fixedly connected to the upper door beam 14, wherein the upper door beam 14 extends downwards to form two connecting sleeves 141, correspondingly the bracket 15 extends upwards to form two connecting posts 151, a clamping slot 142 is provided on a circumferential wall of the connecting sleeves 141, a clamping block 152 is provided on the connecting post 151, the two connecting posts 151 are inserted into the corresponding connecting sleeves 141, and the clamping block 152 is caught by the clamping slot 142, thereby achieving the mounting of the bracket 15. In addition, at least two notch grooves 143 communicated with an opening at the lower end of the connecting sleeve 141 are provided at an interval in a circumferential direction of the connecting sleeve 141 to facilitate the deformation of the connecting sleeve 141 upon receiving the connecting post 151, thereby making the mounting of the bracket 15 more labor-saving. The bracket 15 extends from one side to the other side of the door body in the left-right direction, and a circuit structure and a waterway structure for the ice-making assembly may be connected to the bracket 15. The door liner 12 is provided with an opening 123 communicated with the ice-making chamber 13; the opening 123 is approximately at a position corresponding to the bracket 15; a part of the bracket 15 is adhered to the door liner 12 at a position corresponding to the periphery of the opening 123; another part of the bracket 15 is exposed from the opening 123 in the ice-making chamber 13; upon completion of the foaming of the door body 10 is foamed, the part of the bracket 15 adhered to the door liner 12 is closely adhered to the door liner 12.

[0027] The door body 10 is pivotally connected to the cabinet 20, and the refrigerant pipe 30 for supplying cold to the ice-making assembly 100 extends from the door liner 12 adjacent to a pivoting side of the door body 10 into the ice-making chamber 13, wherein the refrigerant pipe 30 comprises a fixed section 31 adjacent to the pivoting side of the door body 10 and a direct cooling section 32 in contact with the ice-making assembly 100, and the fixed section 31 is supported on the bracket 15. Specifically, the bracket 15 comprises a bracket body 153 and a support arm 154 extending from the bracket body 153 adjacent to the pivoting side of the door body 10, the support arm 154 extends away from a rear of the door shell 11, and the support arm 154 is provided with a first groove 1541 accommodating the refrigerant pipe 30, wherein the direct cooling section is configured as a U-shape, and two first grooves 1541 are provided on the corresponding support arm 154 to respectively accommodate two ends of the fixed section 31 corresponding to the U-shape. A fixing member 40 is connected to the bracket 15, the fixing member 40 is provided with a sec-

ond groove 441 for accommodating the refrigerant pipe, and likewise, two second groove 441 are provided at positions corresponding to the positions of the first grooves 1541, respectively. The connection of the fixing member 40 with the bracket 15 enables the fixed section 31 of the refrigerant pipe 30 to be limited in a space enclosed by the first grooves 1541 and the second grooves 441. The shapes of the first grooves 1541 and the second grooves 441 match the outer shape of the refrigerant pipe 30, so that the fixed section 31 of the refrigerant pipe 30 is fixed between the support arm 154 and the fixing member 40, and the degrees of freedom of the fixed section 31 in the up-down direction and the front-rear direction are limited by the support arm 154 and the fixing member 40.

[0028] In order to achieve the reliable mounting of the fixing member 40 on the bracket 15, front and rear ends of the fixing member 40 are respectively provided with snap-fitting hooks or snap-fitting grooves 411 and 412, and correspondingly the bracket body 153 and the support arm 154 are respectively provided with snap-fitting portions 1531, 1542 mating with the snap-fitting hooks or snap-fitting grooves 411, 412, and the fixing member 40 is fixed relative to the bracket 15 by the connection of the snap-fitting hooks or snap-fitting grooves with the corresponding snap-fitting portions. In order to further ensure the reliability of the connection, two limiting plates 442 and 443 protrude downwards from the fixing member 40, the two limiting plates 442 and 443 are arranged apart along the extension direction of the direct cooling section 32, a step shape is formed on the support arm 154, and the two limiting plates 442 and 443 are respectively snap-fitted at both ends of an upper step 155 of the support arm 154, so that the fixing member 40 is more reliably fixed on the bracket 15. Specifically, a snap-fitting hook 445 is provided on opposite side walls of the two limiting plates 442 and 443, correspondingly a snap-fitting groove is provided at both ends of the upper step 155 of the support arm 154, and the fixing of the fixing member 40 relative to the bracket 15 along the extension direction of the direct cooling section 32 is achieved in a way that the snap-fitting hooks 445 on the limiting plates 442 and 443 mate with the snap-fitting grooves on the upper step 155. The snap-fitting of the fixing member 40 with the bracket 15 in two directions facilitates the mounting of the refrigerant pipe 30 and can achieve the reliable fixing of the fixed section 31 of the refrigerant pipe 30.

[0029] In addition, the second grooves 441 and the limiting plates 442 and 443 on the fixing member 40 can be arranged apart in the front-rear direction, an upper plate portion 43 is formed above the second grooves 441 and the limiting plates 442 and 443, a side plate portion 45 is formed on a side of the fixing member 40 facing the direct cooling section 32, the side plate portion 45 connects the upper plate portion 43 with the second grooves 441 and the limiting plates 442 and 443 in the up-down direction, a front end plate 41 and a rear end plate 42 are formed at front and rear ends of the fixing member 40, the hooks or catching grooves 411 and 412 at the front

and rear ends of the fixing member 40 are respectively formed on the front end plate 41 and the rear end plate 42, a width of a lower step 156 of the support arm 154 in the extension direction of the direct cooling section 32 is substantially equal to the width of the upper plate portion 43, and the side plate portion 54 and the side of the lower step 156 of the support arm 154 away from the direct cooling section 32 form a filling space 46. Upon assembling, both the upper plate portion 43 and the lower step 156 of the support arm 154 abut against the door liner 12; when foaming is performed for the door body, the foaming material as an insulating layer is filled between the door liner 12 and the door shell 11, and meanwhile the foaming material is also filled in the filling space 46 formed by the fixing member 40 and the support arm 154, thereby making the affixation of the fixed section 31 of the refrigerant pipe 30 by the fixing member 40 and the support arm 154 firmer.

[0030] Furthermore, a positioning member 33 is fixedly connected to the fixed section 31 to prevent the fixed section 31 of the refrigerant pipe 30 from displacing along the extension direction of the direct cooling section 32 after being mounted in the first grooves 1541. The positioning member 33 is snap-fitted to the support arm 154 so as to fix the position of the refrigerant pipe 30 relative to the support arm 154, wherein the positioning member 33 is connected between both ends of the U-shape corresponding to the direct cooling section in a fixing manner such as welding and bonding. Preferably two positioning members 33 are arranged apart. The two positioning members 33 are caught on left and right ends of the upper step 155 of the support arm 154, respectively. As such, the support arm 154 restricts the movement of the refrigerant pipe 30 in the extension direction of the direct cooling section 32 by the positioning members 33, thereby making the fixing of the refrigerant pipe 30 more reliable.

[0031] With reference to FIG 9, the door body 10 is further provided with a heat exchanger 50 and a liquid storage bag 60 which are connected to the refrigerating system, a pipeline of the refrigerating system passes through a hinge of the door body and is connected to the heat exchanger 50; the refrigerant pipe 30 is connected to the heat exchanger 50 and the liquid storage bag 60 respectively; the refrigerant from the refrigerating system passes through the heat exchanger 50, the liquid storage bag 60 and the refrigerant pipe 30 in turn, returns through the refrigerant pipe 30 to the heat exchanger 50, and then returns from the heat exchanger 50 to the refrigerating system, and both the heat exchanger 50 and the liquid storage bag 60 are provided between the door liner 12 and the door shell 11. A part of the refrigerant pipe 30 is located at the bottom of the ice-making assembly, and the evaporation area is small, so that a large amount of cold of the refrigerant does not escape. If this cold does not escape, it will enter the pipeline of the refrigerating system and exit the door body through the hinge. When the cold passes through the hinge, it will condense or even form frost. With the heat exchanger 50 and the liquid

storage bag 60 being provided on the door body 10, the cold of the refrigerant may be dissipated, thereby solving the problem of condensation when the pipeline of the refrigerating system passes through the hinge. In addition, the addition of the liquid storage bag 60 to the door body 10 allows the refrigerant to be stored and allows the refrigerant to dissipate more cold.

[0032] In the present embodiment, the heat exchanger 50 and the liquid storage bag 60 are arranged in turn from a side adjacent to the pivoting side of the door body 10 towards the other side, and the connection of the heat exchanger 50 and the liquid storage bag 60 allows the refrigerant to enter and exit the liquid storage bag 60 in the up-down direction, thus making more compact use of the space inside the door body 10 without increasing the volume of the door body. The heat exchanger 50 comprises a cooling pipe 51 connected between the refrigerating system and the liquid storage bag 60 and an air return pipe 52 connected between the refrigerant pipe 30 and the refrigerating system. The cooling pipe 51 and the air return pipe 52 are in contact with each other and form a plurality of bends on the door body 10, thereby effectively improving the heat exchange effect, namely, evaporating the refrigerant at the cooling pipe 51 by heat exchange, and condensing the refrigerant at the air return pipe 52. By arranging the cooling pipe 51 and the air return pipe 52 on the door body in a circuitous manner, the length of the air return pipe 52 is increased, and the cool can be sufficiently dissipated. A diameter of the cooling pipe 51 is larger than the diameter of the air return pipe 52, so that the heat exchange efficiency of the heat exchanger can be improved.

[0033] Furthermore, the refrigerant pipe 30 further comprises a connection portion 35 connected between the liquid storage bag 60 and the direct cooling section 32. The connection portion 35 is bent upward and extends horizontally at a side of the bracket 15 facing away from the ice-making chamber 13, and enters the ice-making chamber 13 via two bends from a position adjacent to the pivoting side of the door body, thereby further increasing the length of the refrigerant pipe 30 to dissipate the cold.

[0034] With reference to FIG 10, a plurality of bends formed on the door body by the cooling pipe 31 and the air return pipe 32 may be formed by bending after extending vertically up and down; specifically, the cooling pipe 31 and the air return pipe 32 may comprise 5-15 vertical extension sections, and preferably 7-11 vertical extension sections in the present embodiment, which not only ensure that every two vertical extension sections have a pre-set interval, but also give thoughts to the heat exchange effect and the full utilization of the space of the door body. Certainly, the plurality of bends formed on the door body by the cooling pipe 31 and the air return pipe 32 may also be formed by bending after extending in the horizontal direction, and the number of horizontal extension sections may be the same as the number of vertical extension sections. In this way, the effect of in-

creasing the length and improving the heat exchange efficiency can be achieved. In addition, the liquid storage bag 60 may be provided in the form of a cylinder that is disposed with an axial direction parallel to the vertical extension section of the heat exchanger 50 to facilitate the assembling within the door body. Furthermore, in order to prevent noise occurring in the operation of the liquid storage bag 60, a soundproof material such as silica gel or foam may wrap the outside of the liquid storage bag 60, thereby reducing noise.

[0035] The pipeline of the refrigerating system comprises an inlet pipe 915 from the cabinet to the door body and a return pipe 916 from the door body to the cabinet, wherein both the inlet pipe 915 and the return pipe 916 pass through a hinge between the door body and the cabinet, and at least a part of the inlet pipe 915 and the return pipe 916 passing through the hinge is wrapped by closed-pore foam, so that the inlet pipe 915 and the return pipe 916 do not come into contact with air, thereby solving the problem of condensation on the part of the pipeline passing through the hinge. Furthermore, a protective pipe 16 extending downward from the hinge is provided in the door body, and the inlet pipe 915 and the return pipe 916 may be wrapped in the protective pipe 16. In addition, a water pipe for supplying water to the ice-making assembly may also be wrapped in the protective pipe 16 to facilitate the assembling of the door body.

[0036] In addition, the heat exchanger 50 and the liquid storage bag 60 are preferably provided on a thermal insulation layer between the door shell 11 and the door liner 12. In order to facilitate mounting the heat exchanger, a flat foam 17 may be provided to support the heat exchanger 50 and the liquid storage bag 60, and the flat foam 17 may be adhered to the door shell 11 or the door liner 12, wherein the door liner 12 comprises an inner door liner 122 forming the ice-making chamber and an outer door liner 121 bonded to the rear side of the inner door liner 122. The flat foam 17 is disposed between the thermal insulation layer and the heat exchanger 50, and the flat foam 17 is disposed between the thermal insulation layer and the inner door liner 122, so that the heat exchanger 50 does not directly contact the door body, thus not causing deformation of the foam door body. The thermal insulation layer comprises a foamed material layer. Furthermore, in order to enhance the thermal insulation effect of the door body, the thermal insulation layer may further comprise a VIP (Vacuum Insulation Panel) layer 18 arranged between the door shell 11 and the door liner 12, the flat foam 17 is adhered to the VIP layer 18, and the heat exchanger 50 does not directly contact the VIP layer 18, thus not causing condensation on the outside of the door body during the operation of the refrigerator.

[0037] In the refrigerator of the above-described embodiment, with the bracket 15 and the fixing member 40 being provided on the door body, the foaming of the door body after the refrigerant pipe 30 is duly pre-fixed is facilitated, and the displacement of the refrigerant pipe 30

is prevented during the foaming process, so that the manufacture of the door body 10 is more reliable. In addition, with the heat exchanger 50 and the liquid storage bag 60 being provided on the door body 10, more cold can be dissipated out, thereby preventing the frosting on the pipeline of the refrigerating system caused when the refrigerant fails to totally evaporate and passes through the hinge of the door body, and making the use of the refrigerator more reliable.

[0038] The present invention further relates to a method for manufacturing a refrigerator door body in the above embodiment, comprising the following steps:

providing a door body having an upper door beam 14, a door shell 11 and a door liner 12, wherein the door liner 12 is formed with an ice-making chamber 13 accommodating an ice-making assembly;

providing a bracket 15 connected to the ice-making assembly, to assemble the upper door beam 14 together with the door shell 11, and mount the bracket 15 on the upper door beam 14;

providing a refrigerant pipe 30 for supplying cold to the ice-making assembly, the refrigerant pipe 30 extending from the door liner 11 adjacent to a pivoting side of the door body into the ice-making chamber 13, the refrigerant pipe 30 comprising a fixed section 31 adjacent to the pivoting side of the door body and a direct cooling section 32 in contact with the ice-making assembly, the fixed section 31 being supported on the bracket 15;

providing a fixing member 40 fixedly connected to the bracket 15 to limit the refrigerant pipe 30 between the fixing member 40 and the bracket 15;

engaging the door liner 12 with a back surface of the door shell 11, an opening 123 communicated with the ice-making chamber being formed on the door liner 12, a part of the bracket 15 being attached to the door liner 12 at a position corresponding to an outer circumference of the opening 123, another part of the bracket 15 being exposed from the opening 123 in the ice-making chamber 13, and a foaming space being defined between the door shell 11, the upper door beam 14 and the door liner 12;

performing foaming in the foaming space to press the bracket 15 to be tightly attached to the door liner 12.

[0039] In the above manufacturing method, the refrigerant pipe 30 is pre-fixed by the bracket 15 and the fixing member 40, and the refrigerant pipe 30 does not displace when the door body is foamed, so that the door body is more reliably manufactured.

[0040] Specifically, the opening 123 comprises a first opening 1231 and a second opening 1232 communicated with each other, wherein the first opening is located at a front portion of the ice-making chamber 13, and the second opening 1232 is located at a side of the ice-making chamber 13 adjacent to the pivoting side of the door

body; the bracket 15 comprises a bracket body 153 and a support arm 154 extending from an end of the bracket body 153 adjacent to the pivoting side of the door body, and the support arm 154 extends away from a rear of the door shell 11; the refrigerant pipe 30 is firstly supported on the support arm 154, and then the fixing member 40 is mounted on the support arm 154 so as to fix the refrigerant pipe 30; when the door liner 12 is engaged with the back surface of the door shell 11, the bracket body 153 closes the first opening 1231, the fixing member 40 and the support arm 154 abut against an edge of the second opening 1232, and then foaming is performed; after foaming, a part of the fixing member 40 is located in the ice-making chamber 13, so that the fixing member 40 can be further tightly fixed to the bracket 15.

[0041] The above manufacturing method further comprises the following steps: providing a heat exchanger 50 and a liquid storage bag 60, connecting the heat exchanger 50, the refrigerant pipe 30 with the liquid storage bag 60 in a flow path, the refrigerant pipe 30 comprising a connection portion 35 connected between the liquid storage bag 60 and the direct cooling section 32, bending the connection portion 35 upwardly and then allowing the connection portion 35 to extend horizontally at a side of the bracket 15 facing away from the ice-making chamber 13, and then enter the ice-making chamber 13 via two bends.

[0042] Furthermore, a positioning member 33 is fixedly connected to the fixed section 32 of the refrigerant pipe 30, a first groove 1541 corresponding to the refrigerant pipe 30 is provided on the support arm 154, the refrigerant pipe 30 is mounted on the support arm 154, specifically, the refrigerant pipe 30 is placed in the first groove 1541 on the support arm 154, the positioning member 33 is snap-fitted on the support arm 154, the movement of the refrigerant pipe 30 in the extension direction of the direct cooling section 32 is limited by the positioning member 33 and the support arm 154, and then the fixing member 40 is mounted.

[0043] The heat exchanger 50 comprises a cooling pipe 51 connected between the refrigerating system and the liquid storage bag 60 and an air return pipe 52 connected between the refrigerant pipe 30 and the refrigerating system. The cooling pipe 51 and the air return pipe 52 are in contact with each other and form a plurality of bends on the door body, the heat exchanger 50 is fixed on the flat foam 17, the flat foam 17 is fixed on the vacuum insulation panel 18, the vacuum insulation panel 18 is fixed on a back surface of the door shell 11, and then the door liner 12 is engaged with the back surface of the door shell 11.

[0044] The upper door beam 14 extends downwards to form two connecting sleeves 141, correspondingly the bracket 15 extends upwards to form two connecting posts 151, a clamping slot 142 is provided on a circumferential wall of the connecting sleeves 141, a clamping block 152 is provided on the connecting post 151, and mounting the bracket 15 on the upper door beam 14 is specifically

inserting the two connecting posts 151 into the corresponding connecting sleeves 141 until the clamping blocks 152 are clamped into the clamping slots 142.

[0045] The fixing member 40 is provided with a second groove 441 for accommodating the refrigerant pipe 30; front and rear ends of the fixing member 40 are respectively provided with snap-fitting hooks or snap-fitting grooves 411 and 412, and correspondingly the bracket body 153 and the support arm 154 are respectively provided with snap-fitting portions 1531, 1542 mating with the snap-fitting hooks or snap-fitting grooves 411, 412; the fixing member 40 extends downward to form two limiting plates 442 and 443, the two limiting plates 442 and 443 are arranged apart in the extension direction of the direct cooling section 32, and a step shape is formed on the support arm 154; connecting the fixing member 40 fixedly with the bracket 15 is specifically making the second groove 441 align with the fixed section 31, and pressing down the fixing member 40 so that the snap-fitting hooks or snap-fitting grooves 411 and 412 at the front and rear ends of the fixing member 40 are connected to the corresponding snap-fitting portions 1531 and 1542, to snap-fit the two limiting plates 442 and 443 at both ends of the upper step 155 of the support arm 154, respectively.

[0046] By the above-mentioned manufacturing method, the refrigerating pipe may be fixed on the bracket, and then foaming is performed for the door body, to solve the problem that the refrigerating pipe cannot be accurately assembled; if the fixing is inaccurate, the position of the refrigerating pipe deviates in the left-right direction, there will occur a case in which the ice-making assembly is difficult to be installed or cannot be installed after the foaming, thereby causing the whole door body to be scrapped. Therefore, according to the above-mentioned manufacturing method, the probability of scrapping of the door body after foaming is extremely small, thereby reducing the cost of manufacturing the door body.

[0047] It should be understood that although the description is described according to the embodiments, not every embodiment only includes one independent technical solution, that such a description manner is only for the sake of clarity, that those skilled in the art should take the description as an integral part, and that the technical solutions in the embodiments may be suitably combined to form other embodiments understandable by those skilled in the art.

[0048] 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, wherein the refrigerator comprises:

a cabinet defining a chilling compartment;
a door body movably connected to the cabinet and configured to open and close the chilling compartment, the door body comprising a door shell and a door liner engaged with the door shell, the door liner extending at least partially into the chilling compartment when the door body is closed;
a refrigerating system for providing cold to said chilling compartment;
an ice-making chamber defined by the door liner, the ice-making chamber accommodating an ice-making assembly, the ice-making chamber being thermally insulated from the chilling compartment when the door body is closed;
wherein the door body is provided with a heat exchanger connected to the refrigerating system, and a refrigerant pipe and a liquid storage bag which are connected to the heat exchanger, a pipeline of the refrigerating system is connected to the heat exchanger through a hinge of the door body, the refrigerant pipe comprises a direct cooling section in contact with the ice-making assembly, and the refrigerant from the refrigerating system passes through the heat exchanger, the liquid storage bag and the direct cooling section in turn, and then returns from the heat exchanger to the refrigerating system, and the heat exchanger and the liquid storage bag are disposed between the door liner and the door shell.

2. The refrigerator according to claim 1, wherein the heat exchanger and the liquid storage bag are disposed in turn from a side adjacent to a pivoting side of the door body towards the other side, and the connection of the heat exchanger with the liquid storage bag enables the refrigerant to enter the liquid storage bag from top to bottom.

3. The refrigerator according to claim 1, wherein the heat exchanger comprises a cooling pipe connected between the refrigerating system and the liquid storage bag and an air return pipe connected between the refrigerant pipe and the refrigerating system, the cooling pipe and the air return pipe contact each other and form a plurality of bends on the door body, and a diameter of the cooling pipe is greater than the diameter of the air return pipe.

4. The refrigerator according to claim 1, wherein the refrigerator further comprises a bracket engaged with the door liner and connected to the ice-making assembly, the refrigerant pipe comprises the direct

cooling section in direct contact with the ice-making assembly and further comprises a connecting portion connected between the liquid storage bag and the direct cooling section, the connecting portion is bent upward and extends horizontally at a side of the bracket facing away from the ice-making chamber, and enters the ice-making chamber from a side adjacent to a pivoting side of the door body.

5. The refrigerator according to claim 4, wherein the door body further comprises an upper door beam connected to the top of the door shell and the door liner, and the bracket is connected to the upper door beam.

6. The refrigerator according to claim 5, wherein the upper door beam extends downwards to form at least two connecting sleeves, correspondingly the bracket extends upwards to form at least two connecting posts, a clamping slot is provided on a circumferential wall of each of the connecting sleeves, a clamping block is provided on each of the connecting posts, and the connecting posts are inserted into the corresponding connecting sleeves until the clamping blocks are clamped into the clamping slots.

7. The refrigerator according to claim 4, wherein the bracket comprises a bracket body and a support arm extending from an end of the bracket body adjacent to the pivoting side of the door body, the support arm extends away from a rear of the door shell, a portion of the refrigerant pipe is supported on the support arm, a fixing member is connected to the bracket, the fixing member is snap-fitted with the support arm, and a portion of the refrigerant pipe is fixed between the fixing member and the support arm.

8. The refrigerator according to claim 7, wherein the door liner is provided with a first opening and a second opening which are communicated with each other, the first opening is located at a front portion of the ice-making chamber, the second opening is located at a side of the ice-making chamber adjacent to the pivoting side of the door body, the bracket closes the first opening, a portion of the fixing member and a portion of the support arm abut against an edge of the second opening, and the other portion of the fixing member and the other portion of the support arm are located in the ice-making chamber.

9. The refrigerator according to claim 7, wherein a positioning member is fixedly connected to the refrigerant pipe, the positioning member is connected to the support arm, and the support arm limits the movement of the refrigerant pipe in an extension direction of the direct cooling section by the positioning member.

10. The refrigerator according to claim 1, wherein a pipeline of the refrigerating system comprises an inlet pipe from the cabinet to the door body and a return pipe from the door body to the cabinet, both the inlet pipe and the return pipe pass through a hinge between the door body and the cabinet, and at least a part of the inlet pipe and the return pipe passing through the hinge is wrapped by closed-pore foam.

11. The refrigerator according to claim 1, wherein a thermal insulation layer is disposed between the door shell and the door liner, the door liner comprises an inner door liner forming the ice-making chamber, a flat foam is disposed between the thermal insulation layer and the heat exchanger, the heat exchanger is supported on the flat foam, and the flat foam is disposed between the thermal insulation layer and the inner door liner.

12. The refrigerator according to claim 11, wherein the liquid storage bag is wrapped with silica gel or foam, and the liquid storage bag and the heater exchanger are spaced apart from each other and supported on the flat foam.

13. The refrigerator according to claim 3, wherein the cooling pipe and the air return pipe are bent after extending vertically up and down on the door body, the liquid storage bag is constructed in a cylindrical shape, and an axial direction of the liquid storage bag is parallel to a direction in which the cooling pipe and the air return pipe extend up and down.

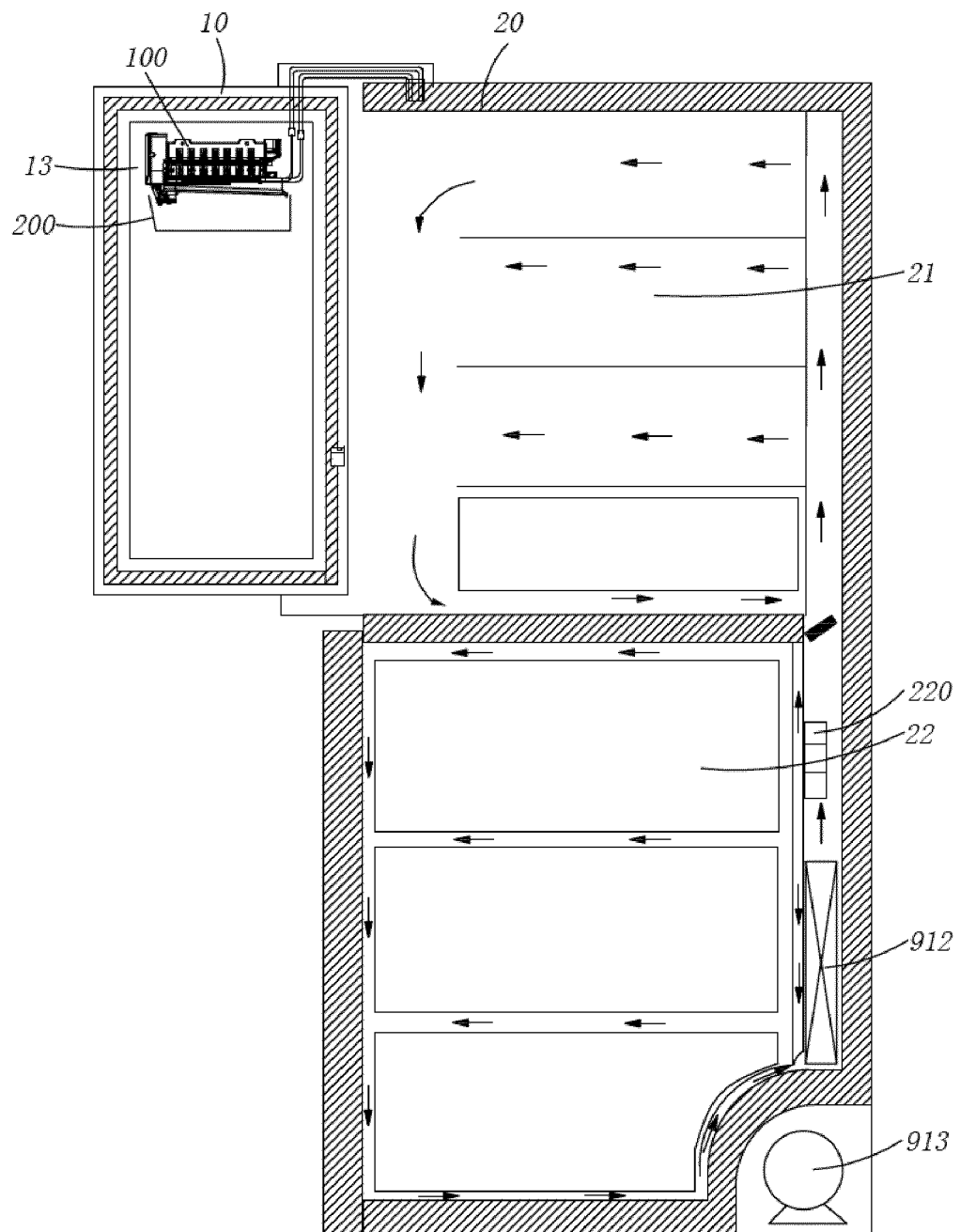


Fig.1

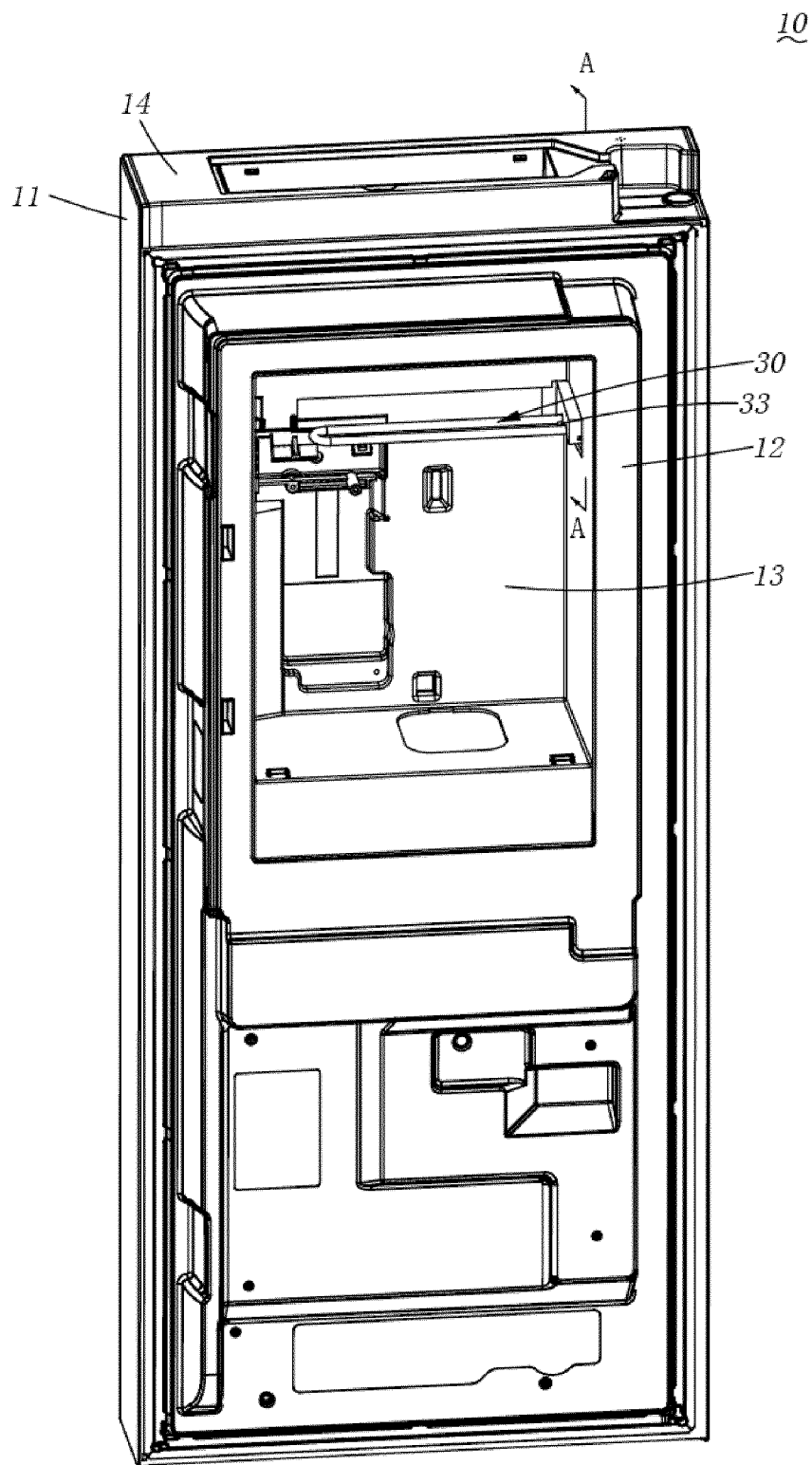


Fig.2

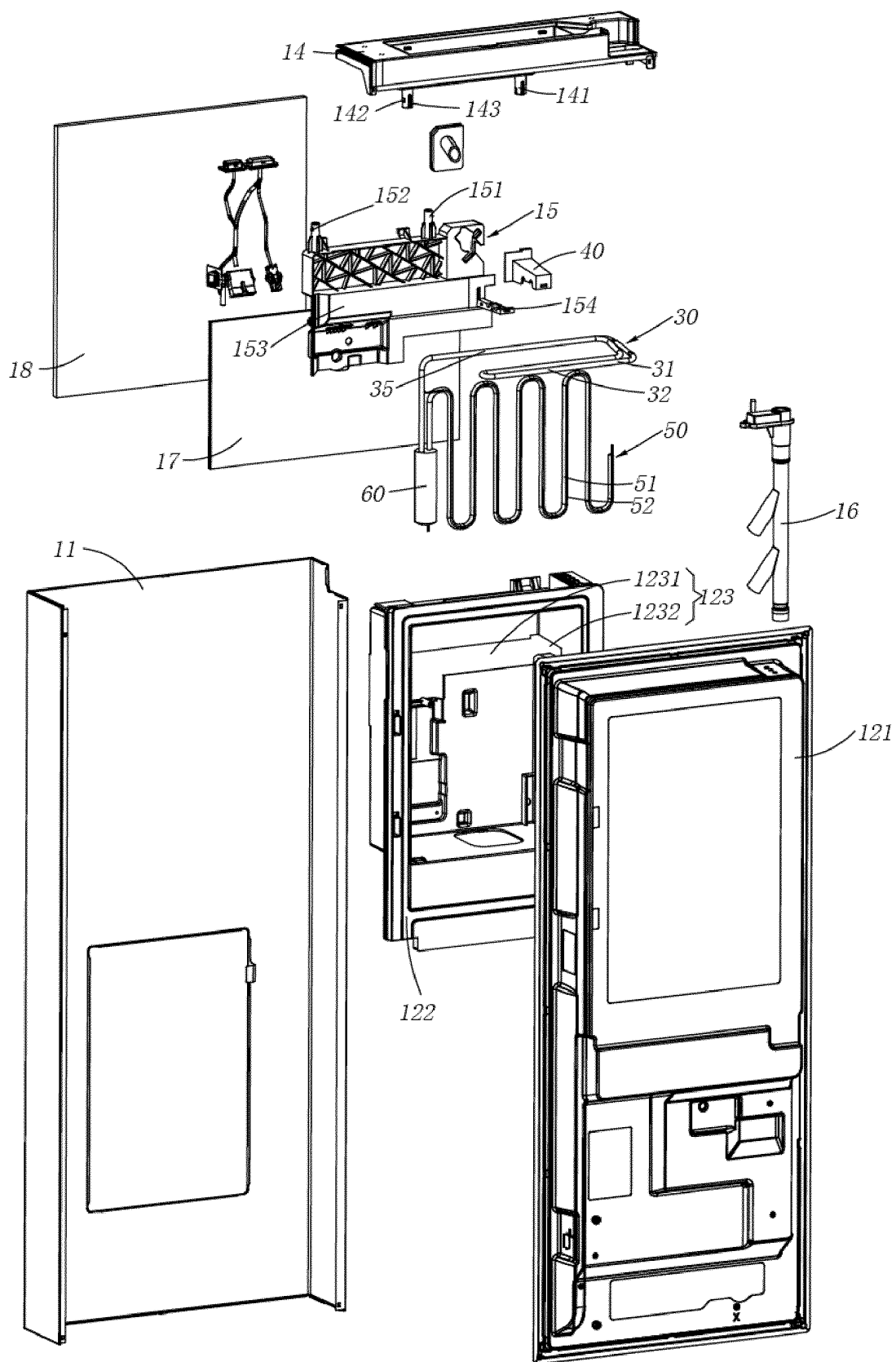


Fig.3

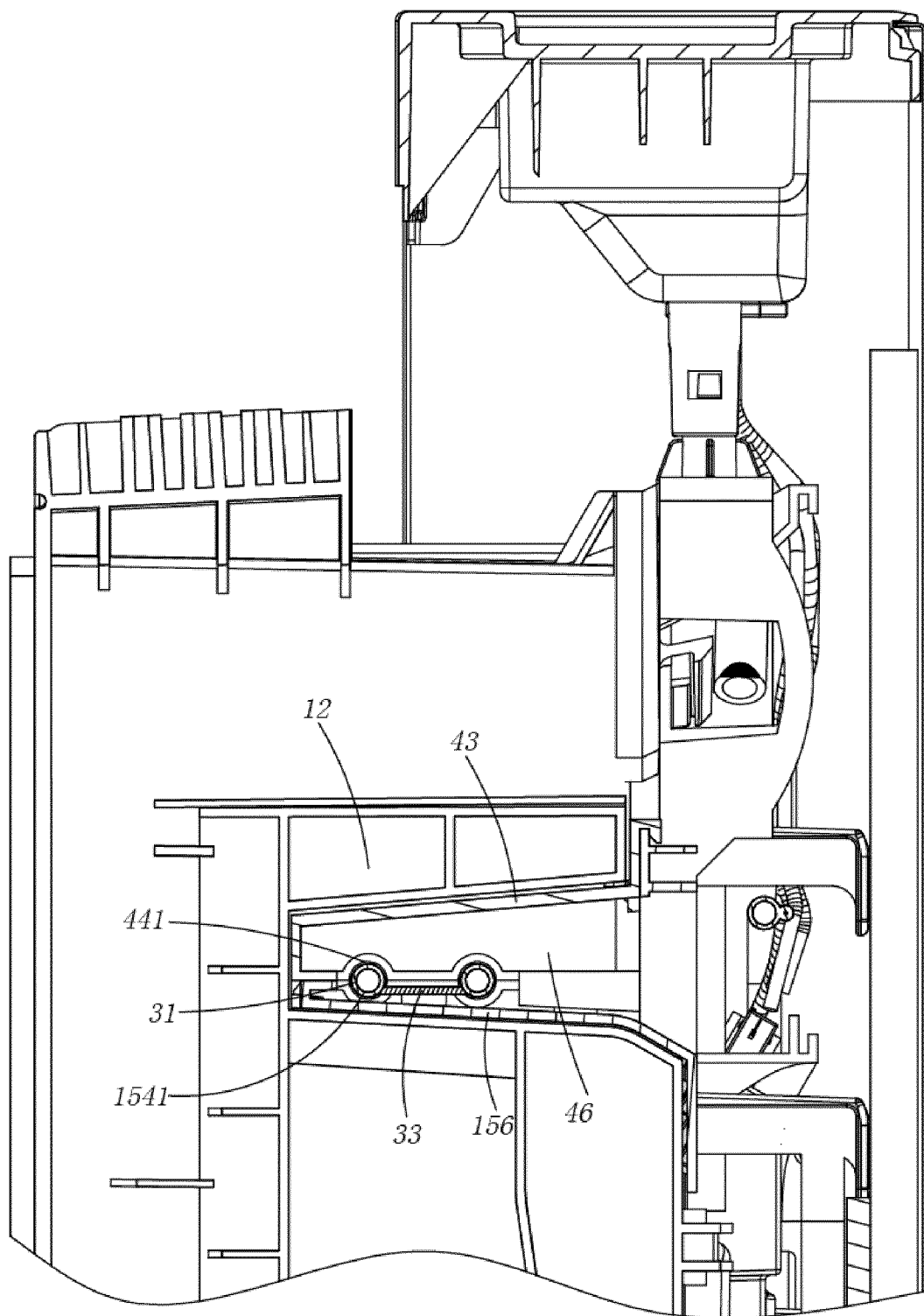


Fig.4

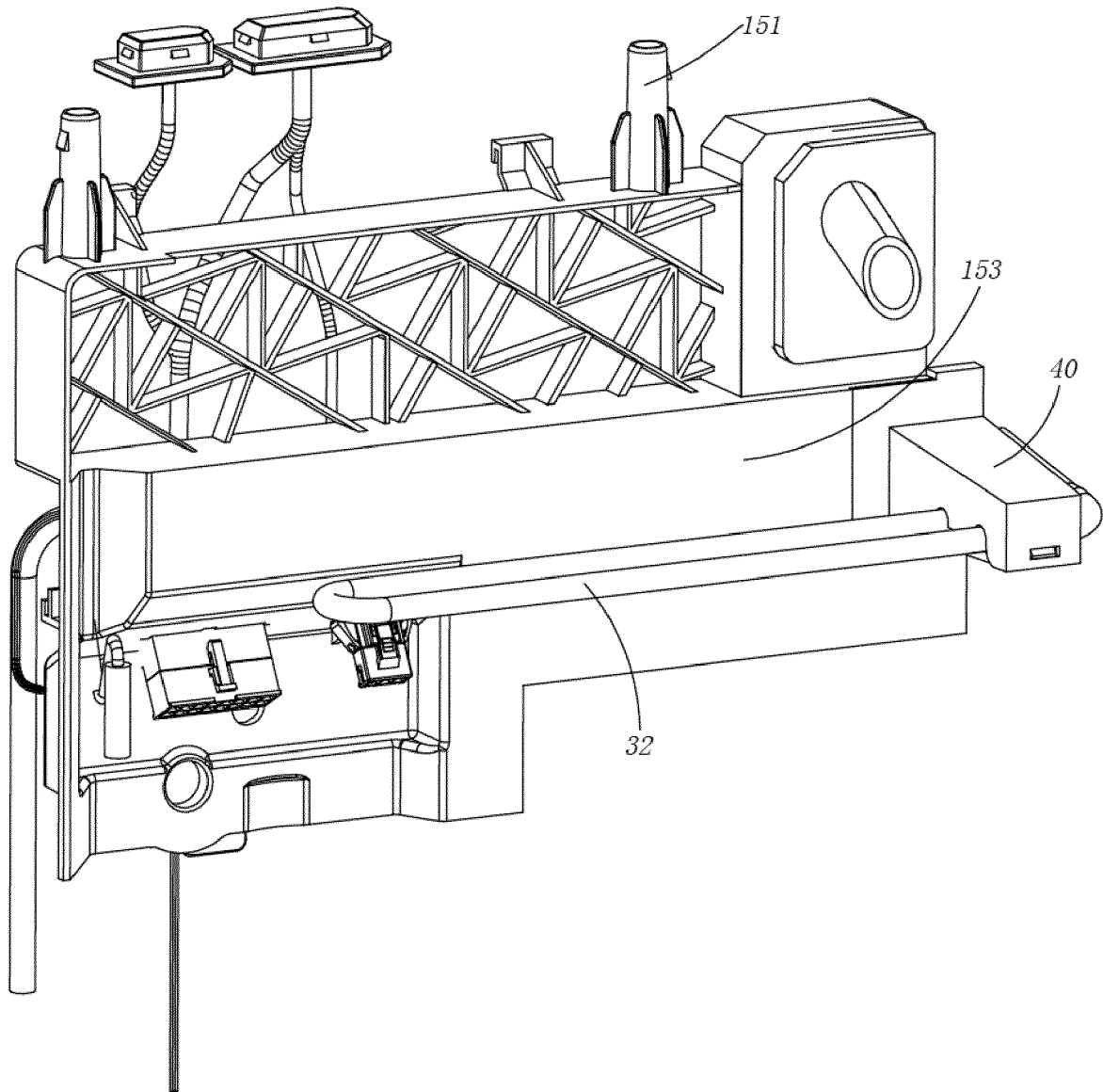


Fig.5

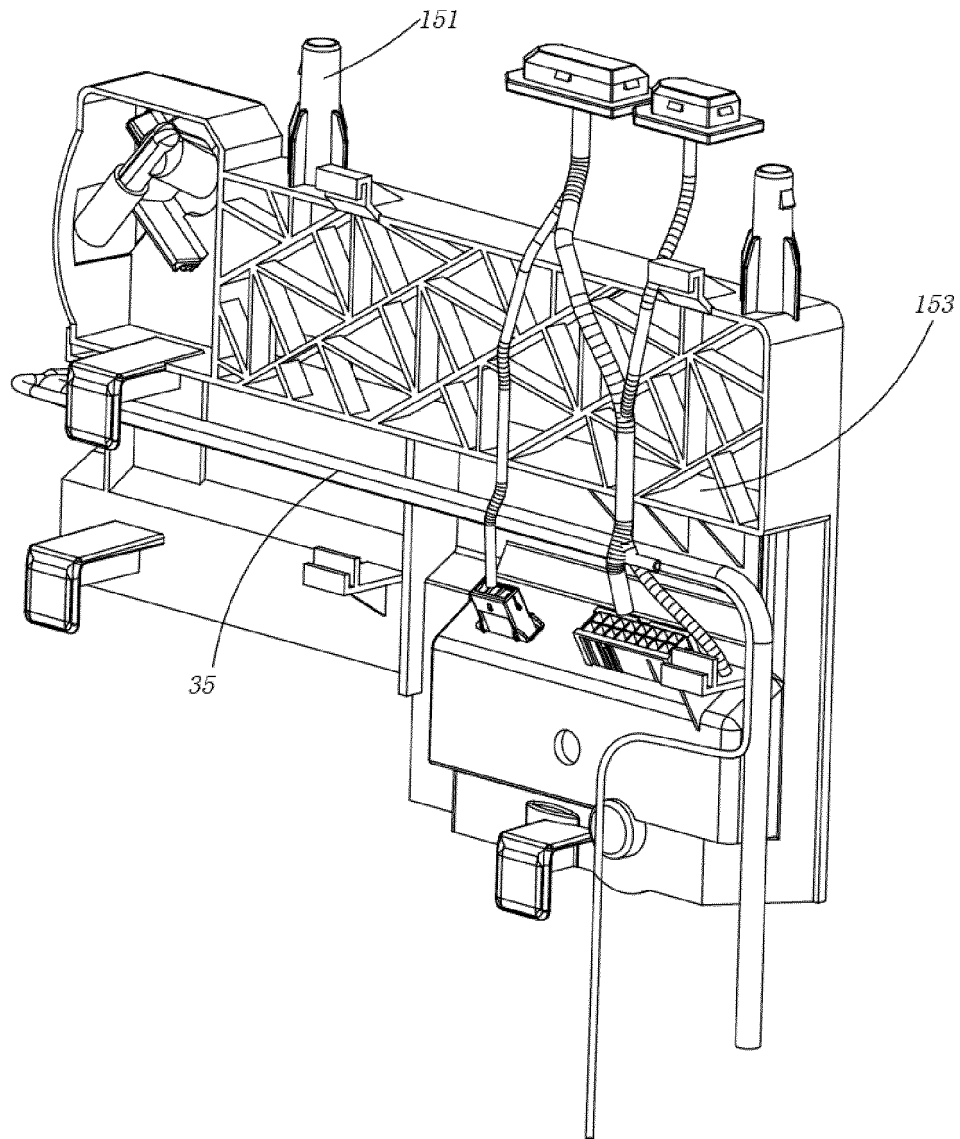


Fig.6

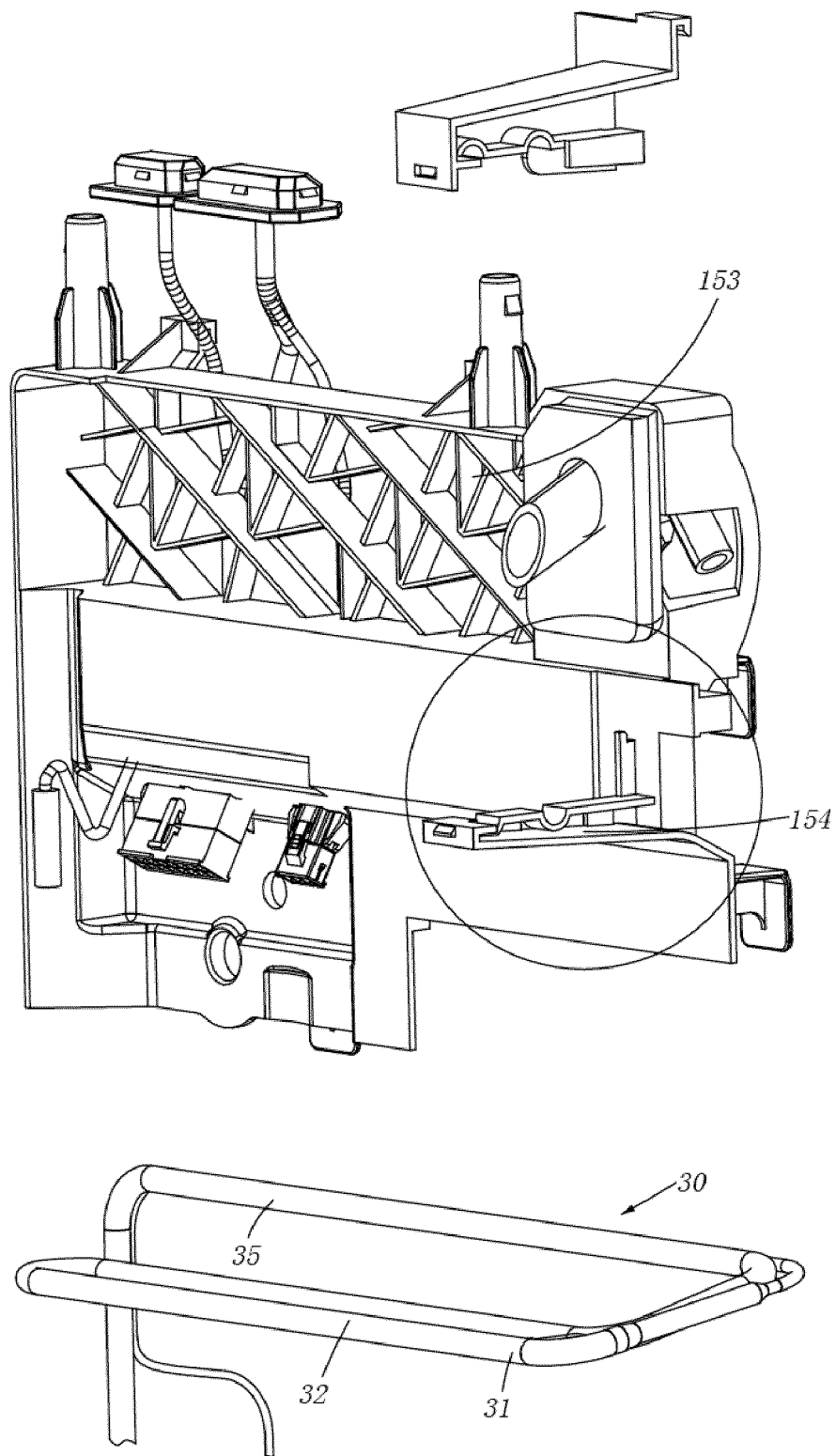


Fig.7

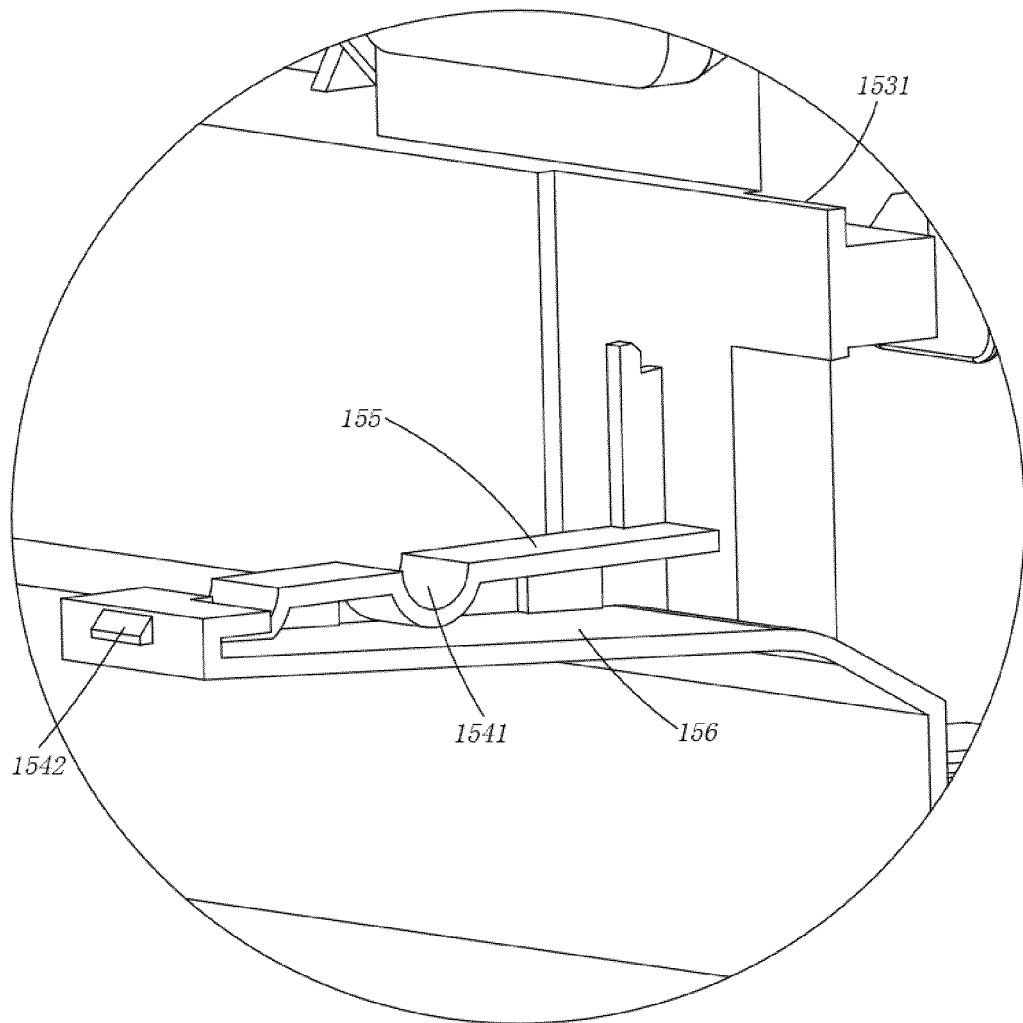


Fig.8

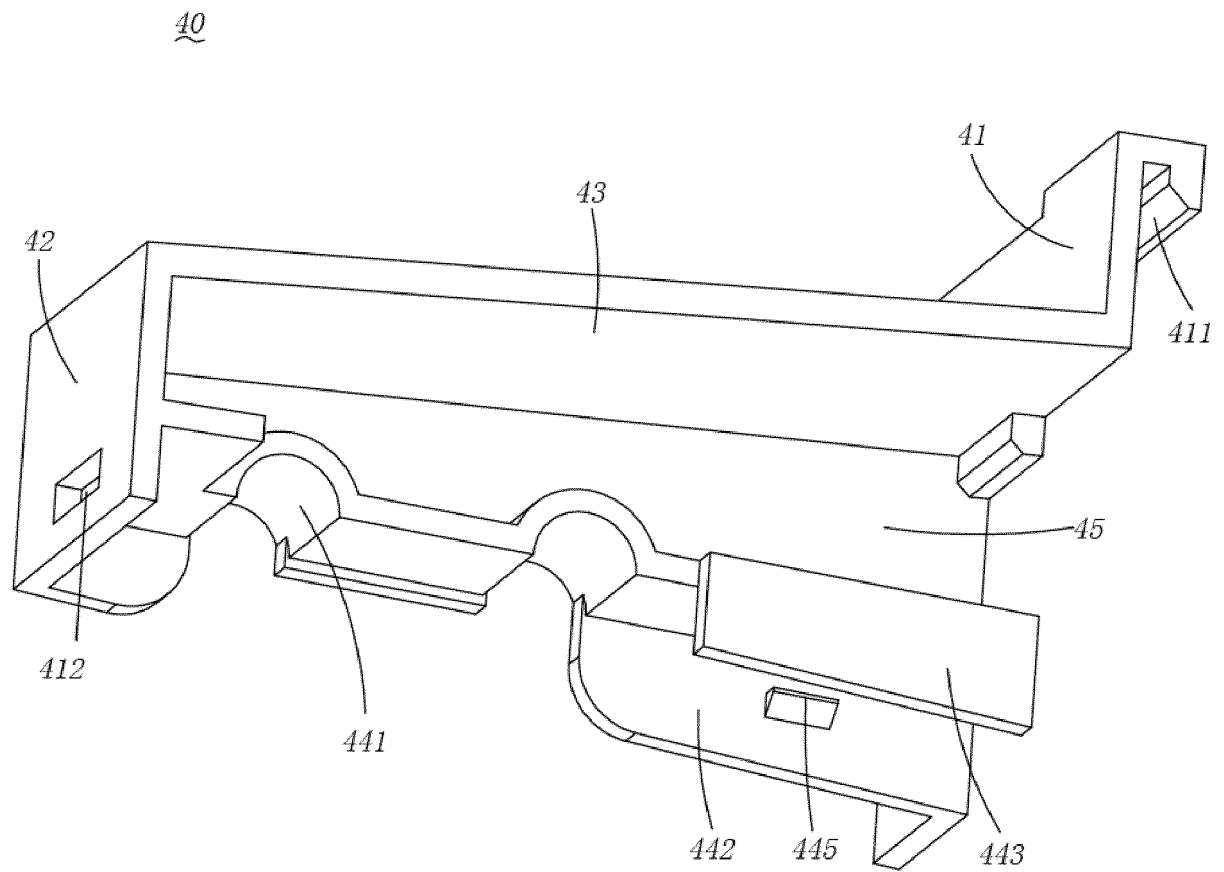


Fig.9

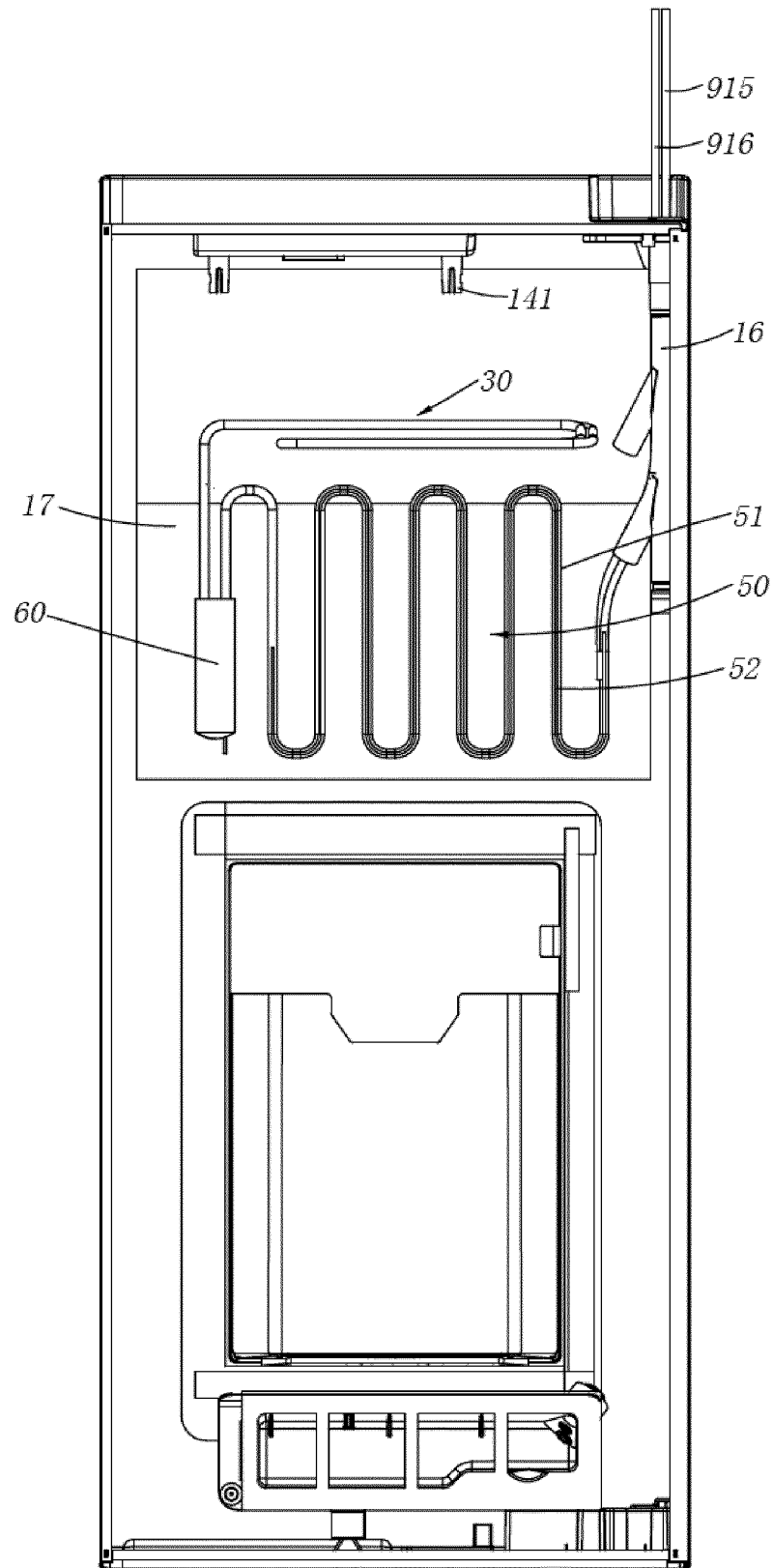


Fig.10

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2021/143132

A. CLASSIFICATION OF SUBJECT MATTER

F25D 23/12(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)

F25D23/12, F25D23/00, F25D19/00, 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, 阳军, 杜启海, 牟国梁, 冰箱, 门, 制冰, 换热器, 储液, 制冷剂, refrigerator, door, ice maker, heat exchanger, liquid storage, refrigerant

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 107367120 A (DONGBU DAEWOO ELECTRONICS CORPORATION) 21 November 2017 (2017-11-21) description, paragraphs [0001]-[0057] and figures 1-5	1-13
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A	CN 102221276 A (HEFEI MIDEA RONGSHIDA REFRIGERATOR CO., LTD. et al.) 19 October 2011 (2011-10-19) entire document	1-13
A	US 2011146325 A1 (LG ELECTRONICS INC.) 23 June 2011 (2011-06-23) entire document	1-13
A	US 2018142934 A1 (HAIER US APPLIANCE SOLUTIONS, INC.) 24 May 2018 (2018-05-24) entire document	1-13

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

* Special categories of cited documents:

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“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

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Name and mailing address of the ISA/CN

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Authorized officer

Telephone No.

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2021/143132

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