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

(11) **EP 4 553 426 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
14.05.2025 Bulletin 2025/20

(21) Application number: **24212079.8**

(22) Date of filing: **11.11.2024**

(51) International Patent Classification (IPC):
F25C 1/04 *(2018.01)* ***F25C 1/24*** *(2018.01)*
F25C 5/08 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
F25C 1/04; F25C 1/24; F25C 5/08

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
GE KH MA MD TN

(30) Priority: **10.11.2023 KR 20230155324**
18.06.2024 KR 20240079162

(71) Applicant: **LG Electronics Inc.**
Yeongdeungpo-gu
Seoul 07336 (KR)

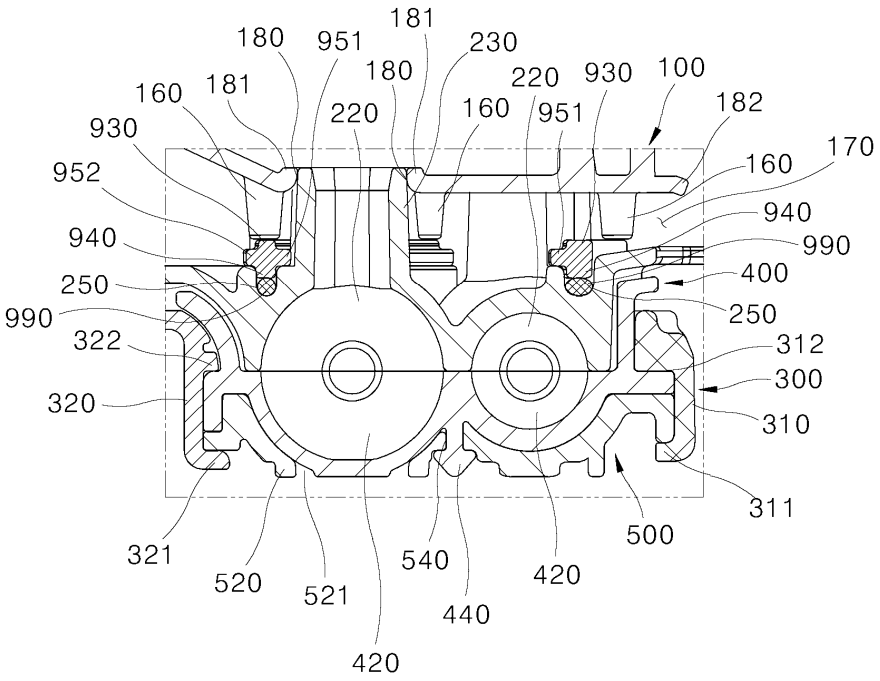
(72) Inventors:
- **KIM, Yong Hyun**
  08592 Seoul (KR)
- **CHOI, Soo Young**
  08592 Seoul (KR)

(74) Representative: **Ter Meer Steinmeister & Partner Patentanwälte mbB**
Nymphenburger Straße 4
80335 München (DE)

(54) ICE MAKER AND REFRIGERATOR INCLUDING THE SAME

(57) Disclosed is an ice maker comprising: an upper tray (200) including a plurality of upper chambers (220) and having a heating wire receiving groove (250) defined therein; a lower tray (400) including a plurality of lower chambers; a heating wire (990) inserted into the heating wire receiving groove (250); a heating wire cover (900) seated on the heating wire receiving groove (250) so as to cover the heating wire (990); and an upper cover (100) disposed on top of the upper tray (200) and including at least one pressing portion (160) pressing the heating wire cover (900). Accordingly, a heat transfer efficiency at which a heat amount from the heating wire is transferred to the ice tray is increased.

FIG. 20



EP 4 553 426 A1

Description

BACKGROUND

Field

[0001] The present disclosure relates to an ice maker and a refrigerator including the same.

Description of Related Art

[0002] A refrigerator is an electrical appliance that supplies cold air made by circulating refrigerant to a storage compartment to keep various types of objects fresh for a long period of time in the storage compartment.

[0003] The refrigerator may include an ice maker that makes ice using cold air.

[0004] The ice maker may make ice by receiving water supplied from a water source or a water tank into an ice tray.

[0005] The ice tray may include one or more ice chambers configured to have a shape corresponding to a desired shape of ice to be made.

[0006] Ice may be made as the water introduced into the ice chamber is cooled by the cold air flowing through the ice tray.

[0007] Ice made in the ice maker may be removed from the ice maker using various schemes, such as a heating scheme of heating the ice tray or a twisting scheme of changing a shape of the ice tray.

[0008] For example, when using the heating scheme that heats the ice tray to remove the ice therefrom, the ice may be removed from the ice tray by heating an outer surface of the ice tray with a heating wire.

[0009] In this regard, a plurality of ice chambers may be provided. In this case, when heating amounts applied to the ice chambers using the heating wire are not equal to each other, a difference between times taken for the ices to be respectively removed from the ice chambers may be great.

[0010] Furthermore, when the heating wire is not properly attached to the ice chamber, or closely contacting degrees of the heating wire with the ice chambers are different from each other, ice-removal failure may occur in some ice chambers.

[0011] In addition, during an assembly process of the ice maker that is composed of multiple parts, the ice tray and heating wire which have been fixed to each other may be removed from each other under the assembly process.

SUMMARY

[0012] A object of the present disclosure is to provide an ice maker capable of closely contacting an ice tray and a heating wire with each other, and a refrigerator including the same.

[0013] Furthermore, an object of the present disclosure is to provide an ice maker capable of closely contacting a plurality of ice chambers and a heating wire with each other so that heating amounts applied to the ice chambers using the heating wire are as equal to each other as possible, and a refrigerator including the same.

[0014] Furthermore, an object of the present disclosure is to provide an ice maker capable of maintaining a state in which a heating wire cover is temporarily fixed to an ice tray before the heating wire cover closely contacts and is completely assembled to the ice tray, so that the temporarily fixed heating wire cover to the ice tray is not removed from the ice tray during an assembly process of other components than the heating wire cover, and a refrigerator including the same.

[0015] One or more of the objects of the present technique is achieved by the subject-matter of the independent claim(s).

[0016] According to a first aspect of the present technique, an ice maker includes: an upper or first tray including a plurality of upper or first chambers and having a heating wire receiving groove defined therein; a lower or second tray including a plurality of lower or second chambers; a heating wire inserted into the heating wire receiving groove; a heating wire cover seated on the heating wire receiving groove so as to cover the heating wire; and an upper or first cover disposed on top of or over or adjacent to the upper or first tray and including at least one pressing portion pressing the heating wire cover.

[0017] One or both of the upper/first tray and the lower/second tray is configured to be movable so that upper/-first tray and the lower/second tray contact each other to define a complete ice chamber. In other words, the one or both of the upper/first tray and the lower/second tray is configured to be movable so that the upper/first chambers and the lower/second chambers contact each other to define plurality of ice chambers. The number of the upper/first chambers may be same as number of the lower/second chambers, thus the number of ice chambers defined when the upper/first tray and the lower/second tray are in contact with each other is same as the number of the upper/first chambers which in turn is same as the number of the lower/second chambers. The movement may be rotational or translational or a combination thereof. Only one of the two trays may move for example the lower/second tray or both may move.

[0018] In the present disclosure, the two trays may or may not be aligned in up-down direction (i.e. vertical direction) and thus can be referred to as the first and the second trays for example may be aligned in side-by-side or horizontal direction. Similarly, albeit optionally, the upper cover and the lower cover may not be aligned in up-down direction or vertical direction and thus can be referred to as the first and the second covers (the lower cover/second cover being optional). It may be noted that the present disclosure envisages all possible combinations - namely the two trays are aligned in up-down direction but one or more of the two covers is not aligned in up-down direction (one or both covers may be aligned

in horizontal direction); the two trays are not aligned in up-down direction (may be aligned in horizontal direction or side by side for example so as to come in contact by horizontal translational motion) but one or both of the two covers may be aligned in up-down direction; the two trays are not aligned in up-down direction (may be aligned in horizontal direction or side by side for example so as to come in contact by horizontal translational motion) and one or both of the two covers are also not aligned in up-down direction (one or both covers may be aligned in horizontal direction). All other features described in this disclosure may be applied to any of the aforementioned alignment of trays and/or one or both of the covers.

[0019] In general, it may be noted that all references to upper and lower may be independent of up-down direction and may be applied in other direction/orientation and may be referred to as first and second and so on and so forth.

[0020] According to a second aspect of the present technique, a refrigerator is provided including an ice-maker according to the first aspect described herein.

[0021] According to a third aspect of the present technique, a refrigerator is provide including at least one storage compartment; at least one door for opening and closing the storage compartment; and an ice maker mounted into the storage compartment or the door, wherein the ice maker includes: an ice tray including a plurality of chambers and having a heating wire receiving groove defined therein; a heating wire inserted into the heating wire receiving groove; a heating wire cover seated on the heating wire receiving groove so as to cover the heating wire; and an ice cover disposed on top of the ice tray and including one or more pressing portions pressing the heating wire cover.

[0022] One or more or all of the following may be combined with any of the above-mentioned aspects.

[0023] The upper tray may further include an upper plate, wherein a cold air flow path may be defined between the upper cover and the upper tray.

[0024] The heating wire receiving groove may be depressed in a downward direction beyond an uppermost surface of the upper plate.

[0025] The upper chamber may protrude in a downward direction beyond an uppermost surface of the upper plate.

[0026] The heating wire inserted into the heating wire receiving groove is positioned lower than the uppermost surface of the upper plate.

[0027] The heating wire receiving groove may at least partially extend along at least a partial area of an outer circumference of each of the upper chambers.

[0028] The upper tray may further include a plurality of inlet guides respectively communicating with the plurality of upper chambers and respectively extending upwardly from the plurality of upper chambers, wherein the heating wire receiving groove may at least partially extend along at least a partial area of an outer circumference of each of the plurality of inlet guides.

[0029] One of the plurality of inlet guides may act as a water-supply guide constituting a water-supply path, wherein in an area of the heating wire receiving groove corresponding to the water-supply guide, the heating wire receiving groove may extend along a portion of an inner circumference of the water-supply guide.

[0030] The heating wire cover may include: a heating wire cover body having a closed curve shape and including a hollow space defined therein; and at least one side extension protruding outwardly from a side surface of the heating wire cover body, wherein the upper tray includes at least one fixing hook fixing the side extension.

[0031] The fixing hook may be constructed to temporarily fix the heating wire cover to the heating wire receiving groove.

[0032] The heating wire cover may include: a heating wire cover body having a closed curve shape and including a hollow space defined therein; an upper convex portion protruding upwardly from an upper surface of the heating wire cover body and extending along a shape of the heating wire cover body; and a lower convex portion protruding downwardly from a lower surface of the heating wire cover body and extending along the shape of the heating wire cover body, wherein the heating wire cover body may be positioned out of the heating wire receiving groove, and the lower convex portion may be inserted into the heating wire receiving groove.

[0033] A width of each of the upper convex portion and the lower convex portion may be smaller than a width of the heating wire cover body.

[0034] Each of the upper convex portion and the lower convex portion may extend in a continuous manner.

[0035] The upper convex portion may extend in a discontinuous pattern manner.

[0036] Each of the upper convex portions may be positioned to overlap each of the inlet guides in a front-back direction.

[0037] The pressing portion presses the upper convex portion in a downward direction, and thus, the lower convex portion presses the heating wire in a downward direction.

[0038] The pressing portion may protrude downwardly from a lower surface of the upper cover.

[0039] The pressing portion may include a plurality of pressing portions, wherein the pressing portions adjacent to each other are arranged to be spaced apart from each other.

[0040] The upper tray may further include a plurality of inlet guides respectively communicating with the plurality of upper chambers and respectively extending upwardly from the plurality of upper chambers, wherein each of the pressing portions overlaps with each of the inlet guides in a frontward-backward direction.

[0041] An outer diameter of the pressing portion may be smaller than an outer diameter of the inlet guide.

[0042] A refrigerator according to one embodiment of the present disclosure includes at least one storage compartment; at least one door for opening and closing

the storage compartment; and an ice maker mounted into the storage compartment or the door, wherein the ice maker includes: an ice tray including a plurality of chambers and having a heating wire receiving groove defined therein; a heating wire inserted into the heating wire receiving groove; a heating wire cover seated on the heating wire receiving groove so as to cover the heating wire; and an ice cover disposed on top of the ice tray and including one or more pressing portions pressing the heating wire cover.

[0043] In the ice maker and the refrigerator according to the present disclosure, the pressing portion of the ice cover may press the heating wire cover covering the heating wire installed in the ice tray, so that the ice tray and the heating wire may be brought into close contact with each other. Accordingly, the heat transfer efficiency at which the heat amount from the heating wire is transferred to the ice tray may be increased.

[0044] Furthermore, in the ice maker and the refrigerator according to the present disclosure, the lower convex portion of the heating wire cover including the lower convex portion protruding downwardly and extending along the heating wire cover body may press the heating wire, so that the plurality of ice chambers and the heating wire may be brought into close contact with each other. Thus, the heat amounts respectively applied to the ice chambers from the heating wire may be as uniform as possible. Accordingly, the difference between the times respectively taken for the ices to be respectively removed from the ice chambers may be reduced, and the occurrence of the ice-removal failure in some of the ice chambers may be reduced.

[0045] Furthermore, in the ice maker and the refrigerator according to the present disclosure, the ice tray on which the heating wire cover is seated includes the one or more fixing hooks to temporarily fix the heating wire cover, so that the heating wire temporarily fixed to the ice tray is not removed from its original position during the assembly of other parts, thereby allowing the heating wire cover to be maintained in the temporarily fixed state before being completely assembled to the ice tray in a close contact manner therewith.

BRIEF DESCRIPTION OF DRAWINGS

[0046]

FIG. 1 is a front view of a refrigerator in a state in which a door is closed.

FIG. 2 is a front view of the refrigerator in a state in which the door is open.

FIG. 3 is an exploded perspective view of the door when an ice maker is mounted into the door.

FIG. 4 is a rear perspective view of the door when the ice maker is mounted into the door.

FIG. 5 and FIG. 6 are a front perspective view and a rear perspective view of the ice maker, respectively.

FIG. 7 and FIG. 8 are side cross-sectional views of the ice maker before and after ice removal, respectively.

FIG. 9 is an exploded perspective view of the ice maker.

FIG. 10 is a top perspective view of an upper tray.

FIG. 11 is a plan view of the upper tray.

FIG. 12 is a diagram showing that a heating wire has been installed in the upper tray.

FIG. 13 is a diagram showing that the heating wire has been installed in the upper tray according to another embodiment.

FIG. 14 and FIG. 15 are top and bottom perspective views of the heating wire cover, respectively.

FIG. 16 is a diagram showing a heating wire cover according to another embodiment.

FIG. 17 is a diagram showing that the heating wire cover has been seated on the upper tray to which the heating wire has been coupled.

FIG. 18 is a diagram showing that the heating wire cover has been seated on the upper tray according to another embodiment.

FIG. 19 is an enlarged diagram of the heating wire cover temporarily fixed to the upper tray via a fixing hook of the upper tray.

FIG. 20 is a side cross-sectional view of a state in which a lower tray, the upper tray, the heating wire cover, and an upper cover of the ice maker are combined with each other.

FIG. 21 is a bottom perspective view of the upper cover.

FIG. 22 is a bottom perspective view of the upper cover according to another embodiment.

FIG. 23 is an enlarged cross-sectional view of a partial area where a pressing portion of the upper cover presses the heating wire according to another embodiment.

FIG. 24 and FIG. 25 illustrate various embodiments in which the heating wire may be pressed without a separate heating wire cover, respectively.

FIGS. 26 to 28 illustrate various embodiments of the heating wire cover.

DETAILED DESCRIPTIONS

[0047] Hereinafter, an ice maker according to some embodiments of the present disclosure and a refrigerator including the same will be described.

[0048] First, with reference to FIGS. 1 to 9, an ice maker according to one embodiment of the present disclosure, and a refrigerator including the same, and a connection relationship of major component constituting the refrigerator will be described.

[0049] With reference to FIGS. 1 to 4, a refrigerator 1 may include a cabinet 2 having one or more storage compartments defined therein, one or more first doors 11 located at a front surface of the cabinet 2 for opening and closing a refrigerating compartment, and a second door 12 located at a front surface of the cabinet 2 for

opening and closing a freezing compartment. The cabinet, the first door, and the second door may constitute an outer appearance of the refrigerator 1.

[0050] The present disclosure describes a refrigerator of a type in which the refrigerating compartment is disposed on top of the freezing compartment. However, the concept of the present disclosure may also be applied to a refrigerator of a type in which the refrigerating compartment is disposed under the freezing compartment, or a refrigerator including only the freezing compartment, or a refrigerator of a type in which the freezing compartment and the refrigerating compartment are arranged in a horizontal direction. Furthermore, the present disclosure describes an example in which the ice maker 30 is mounted into the first door 11. However, the concept of the present disclosure may also be applied to a case in which the ice maker 30 is disposed in the storage compartment such as the freezing compartment or the refrigerating compartment.

[0051] A dispenser 13 capable of dispensing water and/or ice may be disposed at a front surface of either the first door 11 or the second door 12.

[0052] The first door 11 may include an outer casing 21 and a door liner 22 coupled to the outer casing 21. The door liner 22 may define a back surface of the first door 11 and may define an ice-making compartment 14 in which an ice maker 30 is disposed. The ice-making compartment 14 may be opened and closed by an ice-making compartment door 24 that is pivotably connected to the door liner 22 via a hinge 23.

[0053] The cabinet 2 may include a cold air supply duct hole 2a that communicates with an evaporator (not shown) and supplies cold air to the ice-making compartment 14, and a cold air collection duct hole 2b that collects the cold air from the ice-making compartment 14. A door supply duct 25 and a door collection duct 26 may be mounted on the first door 11. The door supply duct 25 may have a cold air inlet hole 25a positioned at one end thereof and a door supply duct hole 25h positioned at the other end thereof and communicating with the ice-making compartment 14. The door collection duct 26 may have a cold air outlet hole 26a positioned at one end thereof and a door collection duct hole 26h positioned at the other end thereof and communicating with the ice-making compartment 14. When the first door 11 has closed the refrigerating compartment, the cold air inlet hole 25a of the door supply duct 25 may be aligned with and communicate with the cold air supply duct hole 2a, while the cold air outlet hole 26a of the door collection duct 26 may be aligned with and communicate with the cold air collection duct hole 2b. Each of the door supply duct 25 and the door collection duct 26 may extend from an outer sidewall 28 of the door liner 22 to an inner sidewall 27 thereof defining the ice-making compartment 14.

[0054] The ice maker 30, an ice bin 20 in which ice discharged from the ice maker 30 is stored, and a support mechanism 40 may be disposed within the ice-making compartment 14. The support mechanism 40 may include a support body 41 that supports and fixes the ice maker 30, and an ice opening 40h through which ice from the ice bin 20 is discharged. The ice opening 40h may communicate with an ice duct hole 15h formed in the inner sidewall 27. For example, when a user manipulates the dispenser 13 to withdraw the ice, the ice removed from the ice maker 30 and stored in the ice bin 20 may pass through the ice duct 15 communicating with the ice opening 40h and the ice duct hole 15h and be discharged to an outside through an ice chute 16 of the dispenser 13. Furthermore, the user may open the first door 11 to directly obtain ice from the ice bin 20. An ice discharge module 50 that guides the stored ice to be easily discharged and crushes the ice may be additionally disposed in the ice bin 20.

[0055] Referring to FIG. 5 to FIG. 9, the ice maker 30 may include an upper assembly 31 and a lower assembly 32. The upper assembly 31 may include an upper cover 100 and an upper tray 200. The lower assembly 32 may include a lower cover 300, a lower tray 400, and a lower supporter 500.

[0056] The lower assembly 32 may be pivotably connected to the upper assembly 31 via a connection shaft 850 so as to pivot about one axis. The lower assembly 32 together with the upper assembly 31 may make a spherical ice while being in contact with the upper assembly 31. The upper assembly 31 has hemispherical upper chambers 220, and the lower assembly 32 has hemispherical lower chambers 420. The lower assembly 32 and the upper assembly 31 may be combined with each other to constitute ice chambers 33, wherein each ice chamber is composed of each hemispherical upper and lower chambers. Thus, a spherical ice may be made in each ice chamber 33. Hereinafter, an example will be described in which the ice chambers 33 are arranged in a matrix manner including a first row and a second row, wherein five ice chambers 33 are arranged in the first row and six ice chambers 33 are arranged in the second row. However, the present disclosure is not limited thereto.

[0057] When the upper assembly 31 and the lower assembly 32 have been combined with each other to constitute the ice chamber 33, water may be supplied to the ice chamber 33 through a water supply 130 formed in the upper cover 100. When the lower assembly 32 pivots after the ice is made, the spherical ice made between the upper assembly 31 and the lower assembly 32 may be removed from the ice chamber 33. The lower assembly 32 may be pivotable in both directions under an operation of a driving unit 800 connected to one side of the upper tray 200.

[0058] An upper ejector 600 including upper ejecting pins 620 may be disposed on top of the upper assembly 31 so that the ice may be removed from the upper assembly 31 using the upper ejector 600. The number of the upper ejecting pins 620 may be equal to the number of the ice chambers 33. When the upper ejecting pin 620 extends through the upper assembly 31 and is inserted

into the ice chamber 33 to press the ice therein, the pressed ice may be removed from the upper assembly 31.

[0059] Furthermore, a lower ejector 700 including lower ejecting pins 720 may be further included so that ice closely contacting the lower assembly 32 may be removed therefrom using the lower ejector. The number of the lower ejecting pins 720 may be equal to the number of the ice chambers 33. For example, the lower ejector 700 may be fixed to the upper assembly 31. When the lower assembly 32 pivots, the lower ejector 700 may press a lower surface of the lower chamber 420 to deform the lower chamber to remove the ice from the lower chamber 420.

[0060] During a pivot movement of the lower assembly 32 for the ice removal, the pivotal force of the lower assembly 32 may be transmitted to the upper ejector 600. For this purpose, the ice maker 30 may further include a connection unit 830 that connects the lower assembly 32 and the upper ejector 600 to each other.

[0061] In one example, when the lower assembly 32 pivots in one direction, the upper ejector 600 may be lowered by the connection unit 830 connected to the lower assembly so that the upper ejecting pin 620 may press the ice. When the lower assembly 32 pivots in an opposite direction, the upper ejector 600 may be raised by the connection unit 830 so as to return to an original position.

[0062] Hereinafter, each of the components constituting the ice maker 30 will be described in more detail.

[0063] The upper cover 100 may include a cover body 110 including a front portion 111 extending in the vertical direction and sidewalls 112 respectively formed on both opposing sides of the front portion 111, an inclined portion 113 disposed in rear of the cover body 110, and a rear portion 114 extending from a rear end of the inclined portion 113. A unit guide 140 as an opening extending in the vertical direction may be formed in the sidewall 112 to guide vertical movement of the upper ejector 600. An air guide 120 including an air guide hole 120h that communicates with the door supply duct hole 25h and receive the cold air may be formed in one side of the cover body 110. The air guide 120 may communicate with a bottom of the water supply 130. The cold air supplied through the air guide 120 may flow along a lower surface of the inclined portion 113 toward the front portion 111. Since the cover body 110, the air guide 120, and the water supply 130 of the upper cover 100 are integrated into an integral body, not only the number of parts may be reduced, but also the occurrence of assembly tolerances may be reduced.

[0064] The upper ejector 600 may be disposed on top of the upper cover 100. The upper ejector 600 may include an upper ejector body 610 extending in one direction and the plurality of upper ejecting pins 620 protruding in a downward direction from the upper ejector body 610. An upper rib 611 extending in one direction may be formed on a top of the upper ejector body 610. An upper ejector guide 640 may be formed on each of both opposing side surfaces of the upper ejector body 610 so that the upper ejector 600 may move up and down along the unit guide 140 of the upper cover 100. Furthermore, a removal prevention protrusion 630 may be disposed on each of both opposing side surfaces of the upper ejector body 610. The removal prevention protrusion 630 may prevent the connection unit 830 from being removed from the upper ejector body 610 while the upper ejector body 610 is coupled to the connection unit 830. One or more pin guides 150 that extend upwardly and are disposed around an inlet guide 230 of the upper tray 200 may be formed on the upper cover 100. The pin guide 150 may guide the upper ejecting pin 620 so as to be correctly inserted into the inlet guide 230.

[0065] The upper tray 200 may be disposed under the upper cover 100. The upper tray 200 may include a plurality of upper chambers 220 extending in the downward direction from upper plate 210. A driving unit support 260 that supports and is coupled to the driving unit 800 may be formed at one side of the upper tray 200. The driving unit support 260 may include a bent portion 261 that extends upwardly and outwardly from one side of the upper plate 210 and a coupling portion 262 that is coupled to the driving unit 800.

[0066] A pair of inserts 805 formed in an upper area of the driving unit 800 so as to protrude toward the coupling portion 262 may be respectively inserted into a pair of receiving holes 262h formed in the coupling portion 262, thereby guiding the driving unit 800 to be easily coupled to the coupling portion 262. A fixing portion 804 may protrude upwardly from a top of the driving unit 800 and include a fixing hole 804h defined therein. The driving unit 800 may be fixed to the coupling portion 262 via a separate fastening member that passes through the fixing hole 804h of the fixing portion 804 and is fastened to a coupling portion 263 formed in an upper area of the coupling portion 262. The driving unit 800 may include a first rotating shaft 801 that provides a driving force to pivot the lower assembly 32 and a second rotating shaft 802 that provides a driving force to pivot a full-ice detection lever 870.

[0067] A pair of coupling portions 240 that extend rearwardly and are bent upwardly may be respectively formed on both opposing sides of a rear portion of the upper plate 210 of the upper tray 200. A pair of coupling holes 240h may be respectively formed in the pair of coupling portions 240. The ice maker 30 may be fixed to the support mechanism 40 via the pair of coupling portions 240 of the upper tray 200. Referring to FIG. 3, the support mechanism 40 includes a support body 41 extending in the vertical direction, and a pair of receiving holes 42 through which the coupling portions 240 of the upper tray 200 may respectively pass rearwardly may be formed in a back surface of the support body 41. For example, when the ice maker 30 is to be mounted on the support mechanism 40, the coupling portion 240 of the upper tray 200 having the bent shape may be inserted into and pass through the receiving hole 42 of the support

mechanism 40 and then the support mechanism 40 may be pushed upwardly. The ice maker 30 may be fixed to the support mechanism 40 via a separate fastening member that passes through the coupling hole 240h of the coupling portion 240 and is fastened to the support mechanism 40.

[0068] A pair of protrusions 280 protruding in a frontward direction may be formed on a front surface of the upper plate 210 of the upper tray 200. The pair of protrusions 280 may secure a spacing of the ice maker 30 from a structure located in front of the ice maker 30. A pair of hinge supporters 270 protruding downwardly and respectively having hinge holes 270h extending in a left-right direction may be respectively disposed on both opposing sides of a lower surface of the upper plate 210 of the upper tray 200. A tray bushing 840 may be coupled to each hinge supporter 270.

[0069] The upper tray 200 may be made of a metal material. For example, the upper tray 200 may being manufactured using a die casting scheme using a metal material and thus be formed to have high rigidity. In this way, the upper tray 200 may be made of a material having high rigidity and thus may minimize deformation of the upper chamber 220, and may also serve as a supporting member supporting the driving unit 800.

[0070] The lower assembly 32 may include a lower tray 400 including a plurality of lower chambers 420, a lower supporter 500 supporting a bottom of the lower tray 400, and a lower cover 300 that fixes the lower tray 400 and the lower supporter 500.

[0071] Referring further to FIG. 20, the lower tray 400 may be made of a soft material such that the lower tray may return to its original shape even after being deformed by an external force. For example, the lower tray 400 may be made of a silicon material. When the lower tray 400 is made of the silicon material, the lower tray 400 may return to its original shape even when the external force is applied to the lower tray 400 such that the lower tray 400 is deformed during the ice-removal process. Therefore, even when the ice making process is repeatedly performed, the spherical ice may be made.

[0072] The lower tray 400 may include the plurality of lower chambers 420. The plurality of lower chambers 420 may be arranged in a plurality of rows. For example, a plurality of first row lower chambers may be arranged along a first row, and a plurality of second row lower chambers may be arranged along a second row.

[0073] An inserted protrusion 440 protruding in a downward direction may be formed between adjacent lower chambers 420. The inserted protrusion 440 may be formed between the first row lower chamber and the second row lower chamber. The inserted protrusion 440 may be formed to extend in an elongate manner in the left-right direction. The inserted protrusion 440 may pass through a slot 540 of the lower supporter 500 in a fastened manner thereto, thereby constituting a fixing structure that fastens the lower tray 400 and the lower supporter 500 to each other. The inserted protrusion 440 may be fastened to the slot 540 of the lower supporter 500 in a hook-coupling scheme, so that the lower tray 400 and the lower supporter 500 may be fastened to each other without a separate fastening member.

[0074] In one example, the lower supporter 500 may include a plurality of chamber receiving portions 520 for respectively accommodating therein the plurality of lower chambers 420 of the lower tray 400. Each chamber receiving portion 520 may be formed in a shape corresponding to a shape of a lower surface of the lower chamber 420. A lower opening 521 may be formed in an inner central area of the chamber receiving portion 520 such that the lower ejector 700 passes through the lower opening 521 during the ice-removal process. Therefore, the lower opening 521 may be formed in each chamber receiving portion 520. The lower surface of the lower chamber 420 of the lower tray 400 may be exposed to the outside through the lower opening 521. The slot 540 extending in the left-right direction may be formed in a central area of the lower supporter 500. The inserted protrusion 440 of the lower tray 400 may be inserted into the slot 540. The slot 540 may be disposed at a position corresponding to the position of the inserted protrusion 440 and may be formed in an opening shape so that the inserted protrusion 440 may be fixedly inserted into the slot 540.

[0075] A front wall 310 extending in a downward direction may constitute a front portion of the lower cover 300, and a rear wall 320 extending in a downward direction may constitute a rear portion thereof. In a lower area of the rear wall 320, a first rear stopping step portion 321 extending in one direction in which the rear wall 320 extends may be formed to protrude inwardly of the lower cover 300 from an inner surface of the rear wall. In an upper area of the rear wall 320, a second rear stopping step portion 322 extending in one direction in which the rear wall 320 extend may be formed to protrude inwardly of the lower cover 300 from the inner surface of the rear wall. When the lower cover 300 is combined with the lower tray 400 and the lower supporter 500, a rear surface of the lower supporter 500 may be fixedly fitted in between the first rear stopping step portion 321 and the second rear stopping step portion 322 in a hooked or caught manner.

[0076] In a lower area of the front wall 310, one or more first front surface stopping step portions 311 may be formed to protrude inwardly of the lower cover 300 from an inner surface of the front wall. In an upper area of the front wall 310, one or more second front surface stopping step portions 312 may be formed to protrude inwardly of the lower cover 300 from the inner surface of the front wall. When the lower cover 300 is combined with the lower tray 400 and the lower supporter 500, a front surface of the lower supporter 500 may be fixedly fitted in between the first front surface stopping step portion 311 and the second front surface stopping step portion 312 in a hooked or caught manner.

[0077] The lower tray 400 and the lower supporter 500

may be combined with each other, and then the lower cover 300 may be assembled with the lower tray 400 and the lower supporter 500 in a swing scheme, such that the lower assembly 32 may be assembled. In assembling the lower cover 300 with the lower tray 400 and the lower supporter 500 in the swing scheme, the rear wall 320 of the lower cover 300 first comes into contact with the lower tray 400 and the lower supporter 500, and then a rear area of each of the lower tray 400 and the lower supporter 500 is pressed into an area between the first rear stopping step portion 321 and the second rear stopping step portion 322 and fixedly fitted in therebetween. Afterwards, the front wall 310 of the lower cover 300 may pivot in a downward direction around the rear wall 320 of the lower cover 300 as a pivot axis, and then, a front area of each of the lower tray 400 and the lower supporter 500 is pressed into an area between the first front surface stopping step portion 311 and the second front surface stopping step portion 312 formed on the front wall 310 of the lower cover 300 and fixedly fitted in therebetween.

[0078] Respective shaft connection portions 811 and 821 of a first link 810 and a second link 820 may pass through both opposing side portions of the lower supporter 500, respectively. A connection shaft 850 extending in one direction may be disposed between the shaft connection portion 811 of the first link 810 and the shaft connection portion 821 of the second link 820 facing each other. A rotational shaft connection portion 813 may be formed on one side of the first link 810 disposed adjacent to the driving unit 800, and may be connected to a rotation protrusion portion 803 formed on the first rotational shaft 801 of the driving unit 800, thereby transmitting the driving force of the driving unit 800 to the lower assembly 32.

[0079] Each of both opposing side portions of the lower supporter 500 may be coupled to each supporter connection hole 832 defined in one side surface of each of the pair of connection units 830. An ejector connection hole 831 coupled to the removal prevention protrusion 630 of the upper ejector 600 may be formed in the other side of each connection unit 830. The removal prevention protrusion 630 of the upper ejector 600 may be connected to the ejector connection hole 831 of the connection unit 830 while being located out of the unit guide 140 of the upper cover 100. When the lower assembly 32 pivots, the pivot force of the lower assembly 32 is transmitted to the upper ejector 600 via the connection unit 830, such that the upper ejector 600 may move up and down along the unit guide 140 of the upper cover 100.

[0080] The first link 810 and the second link 820 may be connected to the lower supporter 500 via a pair of elastic members 860, respectively. For example, the elastic member 860 may be embodied as a coil spring. One end of each of the elastic members 860 may be connected to each of respective spring connection holes 812 and 822 of the first link 810 and the second link 820, while the other end of each of the elastic members 860 may be connected to each of both opposing sides of the lower supporter 500. The elastic members 860 may provide an elastic force to the lower supporter 500 so that a state in which the upper tray 200 and the lower tray 400 are in contact with each other is maintained.

[0081] The lower ejector 700 may be disposed under the lower assembly 32. The lower ejector 700 may press the lower assembly 32 so that the ice closely contacting the lower assembly 32 is removed from the lower assembly 32. The lower ejector 700 may include a lower ejector body 710 and a plurality of lower ejecting pins 720 protruding from the lower ejector body 710. The number of the lower ejecting pins 720 may be equal to the number of the ice chambers 33. The lower ejector 700 may be fixed to the upper assembly 31. However, the present disclosure is not limited thereto, and the lower ejector 700 may be fixed to the support mechanism 40. In the ice-removal process, when the lower assembly 32 pivots toward the lower ejector 700, a lower surface of the lower chamber 420 formed in the lower tray 400 of the lower assembly 32 is pressed and deformed by the lower ejector 700, so that the ice closely contacting the lower chamber 420 may be removed therefrom.

[0082] Each protrusion 750 protruding outwardly may be formed on each of both opposing side surfaces of the lower ejector body 710. Each protrusion 750 may be fixed by a support holder 43 formed on a front surface of the support mechanism 40. Furthermore, a groove 751 may be formed in one side surface of each protrusion 750. A protrusion formed on the support mechanism 40 may be inserted into the groove 751 so that the movement of the lower ejector 700 in the left-right direction may be more strongly restricted. Furthermore, a fastening boss 740 extending from a rear surface of the lower ejector body 710 backwardly may be formed. The fastening boss 740 may be fastened to a coupling hole formed in the support mechanism 40 via a separate fastening member such as a screw. Accordingly, the lower ejector body 710 may be fixed so that the movement in the frontward and backward directions of the lower ejector body 710 is restricted by the support mechanism 40.

[0083] A pair of coupling portions 730, each having a coupling hole 730h defined therein, may be respectively formed on both opposing sides of a top of the lower ejector body 710. A pair of ejector connection portions 290 may be formed on a rear surface of the upper tray 200 and may extend outwardly and be bent so as to respectively cover the coupling portions 730 of the lower ejector body 710. Each ejector connection portion 290 has a coupling hole 290h defined therein. The coupling hole 290h may be coupled to the coupling hole 730h formed in the coupling portion 730 of the lower ejector body 710 via a separate fastening member such as a screw. Accordingly, the lower ejector 700 may be fixed to the upper assembly 31.

[0084] An amount of ices stored in the ice bin 20 may be detected using the full-ice detection lever 870. The full-ice detection lever 870 may include a detection portion 871 that extends in an elongate manner in one direction and is bent at both ends thereof, and a pair of hooks 872

respectively formed at both ends of the bent detection portion 871. The hook 872 formed at one end may be connected to the first rotation shaft 801 of the driving unit 800 and may receive the driving force from the driving unit 800. The hook 872 formed at the other end may be inserted into and caught with a lever receiving portion 121 extending downwardly from the air guide 120 of the upper cover 100. However, the lever receiving portion 121 may be formed as a separate structure from the upper cover 100 rather than being integral with the upper cover 100, and may be mounted on the inner sidewall 27 of the first door 11. Alternatively, a through hole may be defined in the inner sidewall 27 of the first door 11 itself such that the hook 872 may be caught with the through hole.

[0085] Hereinafter, with reference to FIGS. 10 to 12, the upper tray 200 according to the present disclosure will be described in more detail.

[0086] The upper tray 200 may include the upper plate 210 constituting a body thereof. The upper plate 210 may have a rectangular plate shape having a long side and a short side. However, the present disclosure is not limited thereto. The long side of the upper plate 210 may extend in a first direction, and the short side of the upper plate 210 may extend in a second direction. The first direction used in the present disclosure may mean an x-axis direction, and the second direction used in the present disclosure may mean a y-axis direction. Furthermore, the left-right direction of each of the ice maker 30 and the upper tray 200 as described in the present disclosure may mean the first direction and the x-axis direction, a front-back direction as described in the present disclosure may mean the second direction and the y-axis direction, and an up-down or vertical direction may mean a z-axis direction. In addition, a rear position of each of the ice maker 30 and the upper tray 200 described in the present disclosure may mean a position adjacent to a place where the support mechanism 40 is disposed or a place into which the cold air is introduced, while a front position of each of the ice maker 30 and the upper tray 200 described in the present disclosure may mean a position adjacent to a place from the cold air is discharged to the ice bin 20.

[0087] The cold air may be introduced from one side of the upper plate 210 in the first direction. For example, the cold air introduced into the ice maker 30 through the air guide 120 disposed on one side of the upper cover 100 may flow through the cold air flow path formed between the upper cover 100 and the upper plate 210. Therefore, the cold air introduced into the ice maker 30 may flow on and along an upper surface of the upper plate 210 of the upper tray 200. The driving unit support 260 may be formed on the other side of the upper plate 210 in the first direction.

[0088] The plurality of upper chambers 220 arranged in a plurality of rows, each row extending along the first direction, may be formed in the upper plate 210. In the present disclosure, an example in which the upper chambers 220 are arranged in two rows, that is, the first row and the second row are described. However, the present disclosure is not limited thereto and the upper chambers 220 may be arranged in at least three rows. Each of the upper chambers 220 may be formed to extend in the downward direction from the upper plate 210. The upper chambers 220 arranged in the same row may be constructed so that side surfaces thereof contact each other. However, the present disclosure is not limited thereto, and adjacent upper chambers 220 may be spaced from each other by a predetermined spacing.

[0089] For example, the upper chamber 220 may be depressed downwardly relative to the uppermost surface of the upper plate 210. Accordingly, a total volume of the upper tray 200 to be cooled may be reduced, thereby improving the cooling efficiency. An upper surface of the upper chamber 220 may be formed to include a curved surface. Therefore, the upper chamber 220 may be combined with the lower chamber 420 to form a spherical ice chamber, and may have an increased contact surface that may come into contact with the cold air, thereby improving the cooling efficiency. The plurality of upper chambers 220 may be positioned closer to a front end rather than to a rear end of the upper plate 210.

[0090] Each of a plurality of inlet guides 230 may be formed on each of the upper chambers 220 and may communicate with each upper chamber 220 and may extend upwardly of the upper plate 210. Each inlet guide 230 may have a pin inlet opening 230h defined therein into which the upper ejecting pin 620 is inserted. Furthermore, since the inlet guide 230 is formed in a shape extending upwardly in an elongate manner, water may be prevented from flowing into the pin inlet opening 230h of the inlet guide 230 when supplying the water to the ice maker 30. The plurality of inlet guides 230 may include a plurality of first-row inlet guides 230a arranged in the first row and a plurality of second-row inlet guides 230b arranged in the second row. Therefore, the plurality of first-row inlet guides 230a arranged along the first row may be arranged along the first direction, and the plurality of second-row inlet guides 230b arranged along the second row may be arranged along the first direction. An array of the first-row inlet guides 230a and an array of the second-row inlet guides 230b may be arranged along the second direction intersecting the first direction. The first-row inlet guides 230a adjacent to each other may be spaced, by a predetermined distance, from each other. The second-row inlet guides 230b adjacent to each other may be spaced, by the predetermined distance, from each other.

[0091] The plurality of inlet guides 230 may be alternately arranged with each other in a zigzag manner. For example, in a front side view of the upper tray 200, one second-row inlet guide 230b may be disposed between the first-row inlet guides 230a adjacent to each other in the first direction. Similarly, one first-row inlet guide 230a may be disposed between the second-row inlet guides 230b adjacent to each other in the first direction. In this way, the first-row inlet guides 230a and the second-row

inlet guides 230b may be arranged so as to non-overlap each other in the front-back direction, thereby increasing space efficiency.

[0092] One inlet guide 230 among the plurality of inlet guides 230 may include a water-supply guide 231. That is, a partial area of one inlet guide 230 may be cut away so as to be open toward the water supply 130 to form the water-supply guide 231 so that water having flowed through the water supply 130 may flow through the water-supply guide 231 into the ice chamber 33. For example, the water-supply guide 231 may generally include a semi-cylindrical structure, and a supplied-water inlet 232 that generally includes a right square prism shape and is disposed in rear of the semi-cylindrical shape. However, the present disclosure is not limited thereto. Only one of the second-row inlet guides 230b inlet guide may include the water-supply guide 231 including the supplied-water inlet 232. Therefore, one inlet guide 230a including the water-supply guide 231 may be formed to protrude rearwardly beyond other second-row inlet guides 230b arranged in the same first row. The water-supply guide 231 may have an open top and thus may have a water-supply path 231h through which water is supplied.

[0093] As described above, the cold air flowing into the ice maker 30 may flow into one side of the ice maker 30 and be discharged to a position in front of the ice maker 30 through the cold air flow path formed between the upper cover 100 and the upper tray 200. For example, the cold air flowing from the air guide 120 of the upper cover 100 may flow through an area between adjacent ones of the plurality of inlet guides 230 and be discharged to the outside through a cold air discharge spacer 170 formed in a front area and between the upper tray 200 and the upper cover 100. Specifically, the cold air flowing into the ice maker 30 may flow in from a position in rear of the second-row inlet guides 230b, and may flow through an area between adjacent ones of the ones of the second-row inlet guides 230b, and then flow through an area between adjacent ones of the first-row inlet guides 230a and then be discharged to the outside. In this way, the cold air flow path formed between the upper tray 200 and the upper cover 100 may flow through the area between adjacent ones of the second-row inlet guides 230b and the area between adjacent ones of the first-row inlet guides 230a. Therefore, the cold air flowing into the ice maker may be introduced along the first direction and may discharged to the outside along the second direction intersecting the first direction. However, in the present disclosure, the cold air flowing along each of the first direction and the second direction generally means that the cold air flows along the above-mentioned direction, and may not exclude that the cold air may flow in a direction other than the first direction and the second direction.

[0094] Accordingly, a combination of the areas between adjacent ones of the second-row inlet guides 230b and the areas between adjacent ones of the first-row inlet guides 230a may act as a path along which a large amount of cold air may flow, so that the cooling efficiency may be increased in the path along which the large amount of cold air may flow. According to one embodiment of the present disclosure, in order to further improve the cooling efficiency in the path along which a large amount of cold air may flow, one or more cooling fins may be disposed to increase a contact area between the cold air and the upper tray 200.

[0095] For example, each of a plurality of first cooling fins 251 may be disposed between the first-row inlet guides 230a arranged in the first row and the second-row inlet guides 230b arranged in the second row. Each first cooling fin 251 may extend from the first-row inlet guide 230a along the second direction intersecting the first direction in which the inlet guides 230 are arranged. The first cooling fin 251 may be formed integrally with the upper tray 200. The first cooling fin 251 may be disposed between the second-row inlet guides 230b adjacent to each other in the first direction. The first cooling fin 251 may extend rearwardly from a rear surface of the first-row inlet guide 230a. In this way, the first cooling fin 251 is located in the path along which the large amount of cold air may flow, such that the contact area between the cold air and the upper tray 200 may be increased. Furthermore, since the first cooling fin 251 extends along the second direction as the direction in which the cold air flows, the first cooling fin 251 may apply minimized resistance against the cold air flow.

[0096] According to one embodiment of the present disclosure, each of a plurality of second cooling fins 252 may be further disposed between the first-row inlet guides 230a adjacent to each other in order to further increase the cooling efficiency. For example, the second cooling fins 252 and the first cooling fins 251 may be alternately arranged with each other along the first direction. Therefore, the cold air having flowed along and on the first cooling fin 251 disposed between adjacent ones of the second-row inlet guides 230b may flow on and along the second cooling fin 252 disposed between adjacent ones of the first-row inlet guides 230a and then may be discharged to the outside. At least some of the plurality of second cooling fins 252 may extend to the front surface of the second-row inlet guides 230b. The height of the second cooling fin 252 may be smaller than the height of the first cooling fin 251 and may not protrude upwardly beyond the uppermost surface of the upper plate 210 of the upper tray 200. Accordingly, the second cooling fin 252 may increase the contact area between the second cooling fin 252 and the cold air in an area where the cold air flow amount is large while applying minimized resistance to the cold air flow path, thereby improving the cooling efficiency of the upper chamber 220.

[0097] A heating wire receiving groove 250 may be recessed in the upper surface of the upper tray 200 and may extend so as to surround the upper chambers 220. Referring further to FIG. 12, a heating wire 990 may be

received in the heating wire receiving groove 250, thereby facilitating the removal of the ice from the upper chamber 220 during the ice-removal process. The heating wire 990 may be constructed to have a shape corresponding to a shape of the heating wire receiving groove 250 and may be inserted into the heating wire receiving groove 250. The heating wire receiving groove 250 may be formed to be depressed downwardly beyond the uppermost surface of the upper plate 210. Referring further to FIG. 20, the heating wire 990 inserted into the heating wire receiving groove 250 is positioned at a lower vertical level than a vertical level of the uppermost surface of the upper plate 210, thereby reducing the cold air flow resistance caused by the heating wire 990. The heating wire receiving groove 250 may be formed to have at least a portion extending along at least a portion of an outer circumference of each upper chamber 220. Accordingly, the heating wire receiving groove 250 may have at least a portion extending along at least a portion of an outer circumference of each inlet guide 230. The heating wire receiving groove 250 may extend along an inner surface of the water-supply guide 231 in an area thereof corresponding to the water-supply guide 231 of one inlet guide among the inlet guides 230. For example, the heating wire receiving groove 250 may extend to surround an outer circumference of the arrangement of the plurality of inlet guides 230, but may extend along the inner circumference of the water-supply guide 231 in the area thereof corresponding to the water-supply guide 231 of one inlet guide among the inlet guides 230. The water-supply guide 231 of one inlet guide among the inlet guides 230 protrudes further rearwardly beyond the other inlet guides 230 thereof. Thus, when the heating wire receiving groove 250 extends along the outer circumference of the water-supply guide 231 in the area thereof corresponding to the water-supply guide 231 of one inlet guide among the inlet guides 230, the cold air flow resistance in the area may increase. Accordingly, according to the present disclosure, the heating wire receiving groove 250 extends along the inner circumference of the water-supply guide 231 in the area thereof corresponding to the water-supply guide 231 of one inlet guide among the inlet guides 230, such that the cold air flow resistance in the area may be reduced.

[0098] The heating wire receiving groove 250 may be described as follows. Referring to FIG. 11, a virtual center line extending along the first direction of the first-row inlet guides 230a arranged in the first row may be defined as a first-row center line 233a. A virtual center line extending along the first direction of the second-row inlet guides 230b arranged in the second row may be defined as a second-row center line 233b. Furthermore, a portion of a periphery of the first-row inlet guide 230a facing the second-row inlet guide 230b may be defined as an inner periphery of the first-row inlet guide 230a. A portion of a periphery of the second-row inlet guide 230b facing the first-row inlet guide 230a may be defined as an inner periphery of the second-row inlet guide 230b. A portion of the periphery of the first-row inlet guide 230a opposite to the inner periphery of the first-row inlet guide 230a may be defined as an outer periphery of the first-row inlet guide 230a. A portion of a periphery of the second-row inlet guide 230b opposite to the inner periphery of the second-row inlet guide 230b may be defined as an outer periphery of the second-row inlet guide 230b. That is, the periphery of the first-row inlet guide 230a may include the outer and inner periphery opposite to each other around the first-row center line 233a, wherein the inner periphery faces the second-row inlet guide 230b. Moreover, the periphery of the second-row inlet guide 230b may include the outer and inner periphery opposite to each other around the second-row center line 233b, wherein the inner periphery faces the first-row inlet guide 230a.

[0099] In one example, the heating wire receiving groove 250 may be formed to extend along the outer peripheries of the first-row inlet guides 230a based on the first-row center line 233a. However, the present disclosure is not limited thereto, and the heating wire receiving groove 250 may be formed to extend along the inner peripheries of the first-row inlet guides 230a based on the first-row center line 233a. Alternatively, the heating wire receiving groove 250 may extend along the inner peripheries and the outer peripheries of the first-row inlet guides 230a around the first-row center line 233a in an alternate manner with each other. Alternatively, the heating wire receiving groove 250 may extend along the inner peripheries of one or more inlet guides 230 constituting the first-row inlet guides 230a and the outer peripheries of the remaining inlet guides 230 constituting the first-row inlet guides 230a. Alternatively, the heating wire receiving groove 250 may extend along the outer peripheries of one or more inlet guides 230 constituting the first-row inlet guides 230a and the inner peripheries of the remaining inlet guides 230 constituting the first-row inlet guides 230a. That is, the heating wire receiving groove 250 surrounding the plurality of inlet guides 230 constituting the first-row inlet guides 230a may extend along one side of the arrangement of the plurality of inlet guides 230 constituting the first-row inlet guides 230a around the first-row center line 233a. However, the present disclosure is not limited thereto. A portion of the heating wire receiving groove 250 surrounding the plurality of inlet guides 230 constituting the first-row inlet guides 230a may extend along the other side of the arrangement of the plurality of inlet guides 230 constituting the first-row inlet guides 230a around the first-row center line 233a. Based on the plan views as shown in FIG. 11 to FIG. 13, at least a portion of the heating wire receiving groove 250 surrounding the plurality of inlet guides 230 constituting the first-row inlet guides 230a may be located at one side or the other side around the first-row center line 233a.

[0100] Moreover, the heating wire receiving groove 250 may be formed to extend along the outer peripheries of the second-row inlet guides 230b based on the second-row center line 233b. However, the present disclosure is not limited thereto, and the heating wire receiving

groove 250 may be formed to extend along the inner peripheries of the second-row inlet guides 230b based on the second-row center line 233b. Alternatively, the heating wire receiving groove 250 may extend along the inner peripheries and the outer peripheries of the second-row inlet guides 230b around the second-row center line 233b in an alternate manner with each other. Alternatively, the heating wire receiving groove 250 may extend along the inner peripheries of one or more inlet guides 230 constituting the second-row inlet guides 230b and the outer peripheries of the remaining inlet guides 230 constituting the second-row inlet guides 230b. Alternatively, the heating wire receiving groove 250 may extend along the outer peripheries of one or more inlet guides 230 constituting the second-row inlet guides 230b and the inner peripheries of the remaining inlet guides 230 constituting the second-row inlet guides 230b. That is, the heating wire receiving groove 250 surrounding the plurality of inlet guides 230 constituting the second-row inlet guides 230b may extend along one side of the arrangement of the plurality of inlet guides 230 constituting the second-row inlet guides 230b around the second-row center line 233b. However, the present disclosure is not limited thereto. A portion of the heating wire receiving groove 250 surrounding the plurality of inlet guides 230 constituting the second-row inlet guides 230b may extend along the other side of the arrangement of the plurality of inlet guides 230 constituting the second-row inlet guides 230b around the second-row center line 233b. Based on the plan views as shown in FIG. 11 to FIG. 13, at least a portion of the heating wire receiving groove 250 surrounding the plurality of inlet guides 230 constituting the second-row inlet guides 230b may be located at one side or the other side around the second-row center line 233b. For example, a side around the second-row center line 233b at which the heating wire receiving groove 250 is positioned in a portion of an area of the second-row inlet guides 230b corresponding to the water-supply guide 231 may be opposite to a side around the second-row center line 233b at which the heating wire receiving groove 250 is positioned in a portion of an area of the second-row inlet guides 230b non-corresponding to the water-supply guide 231. That is, in the portion of the area of the second-row inlet guides 230b corresponding to the water-supply guide 231, the heating wire receiving groove 250 may be positioned so as to extend along the inner periphery of the second-row inlet guide 230b.

[0101] The heating wire 990 inserted into the heating wire receiving groove 250 may extend along the periphery of the arrangement of the first-row inlet guides 230a and the second-row inlet guides 230b and may have a shape substantially corresponding to a shape of the heating wire receiving groove 250 in the plan view. In the plan view, the shape of the heating wire receiving groove 250 may be identical with the shape of the heating wire 990. Thus, a detailed description thereof will be omitted.

[0102] The heating wire receiving groove 250 may have the depressed shape defined by an outer sidewall 255 and an inner sidewall 254 extending along outer and inner side surfaces of the heating wire receiving groove 250, respectively. Accordingly, one end of the first cooling fin 251 as described above may be connected to the inner sidewall 254, and the other end of the first cooling fin 251 may be connected to the first-row inlet guide 230a. Furthermore, one end of the second cooling fin 252 may be connected to the inner sidewall 254, and the other end of the second cooling fin 252 may be connected to the second-row inlet guide 230b. Furthermore, the second cooling fin 252 may be formed to have a height equal to a height of the inner sidewall, thereby reducing the cold air flow resistance.

[0103] In one example, the upper tray 200 may further include a plurality of depressed patterns 211 respectively formed in rear of the plurality of inlet guides 230. The depressed patterns may be depressed downwardly beyond the upper plate 210. Each depressed pattern 211 may be disposed to overlap with the inlet guide 230 adjacent thereto in the second direction. The depressed pattern 211 may have a shape in which a width decreases as the depressed pattern extends away from the inlet guide 230. For example, as the width of the depressed pattern 211 decreases as the depressed pattern extends toward a side from which the cold air flows into the ice maker 30, a path along which the cold air flows may be controlled only based on the pattern shape of the depressed pattern 211. In this way, the upper tray 200 according to the present disclosure includes the depressed patterns 211 that are respectively formed in rear of the plurality of inlet guides 230 and are depressed downwardly beyond the upper plate 210, so that the volume of the upper tray 200 itself is reduced while increasing the contact area with the cold air, thereby improving the cooling efficiency of the upper chamber 220.

[0104] A first receiving portion 257 depressed downwardly of the upper plate 210 may be formed between adjacent ones of the plurality of inlet guides 230. For example, the first receiving portion 257 may be formed between adjacent second-row inlet guides 230b and adjacent first-row inlet guides 230a. Therefore, a spacing between adjacent ones of the plurality of second-row inlet guides 230b between which the first receiving portion 257 may be larger than a spacing between adjacent ones of other second-row inlet guides 230b between which the first receiving portion 257 is not disposed. Similarly, a spacing between adjacent ones of the plurality of first-row inlet guides 230a between which the first receiving portion 257 may be larger than a spacing between adjacent ones of other first-row inlet guides 230a between which the first receiving portion 257 is not disposed. A sensor may be accommodated in the first receiving portion 257. In one example, a temperature sensor may be accommodated therein. The first receiving portion 257 may be positioned in a biased manner toward one side of the upper plate 210, for example, to a left side.

[0105] A second receiving portion 259 depressed downwardly of the upper plate 210 may be formed in a rear area of the upper plate 210. The second receiving portion 259 may be positioned in a biased manner toward one side of the upper plate 210, for example, the left side. Accordingly, the first receiving portion 257 and the second receiving portion 259 may overlap each other in the front-back direction. The second receiving portion 259 may accommodate therein a first connector 991 and a second connector 992 as a pair of connectors connected to the heating wire 990, and a partial area of each of a first electrical wire 993 and a second electrical wire 994 as a pair of electrical wires. The second receiving portion 259 may have a pair of fixing guides 243 that fix the connectors 991 and 992 and the electrical wires 993 and 994. In addition, a spacing guide 241 may be formed in the depressed pattern 211 located in rear of the second-row inlet guide 230b located at the outermost left side. A pair of electrical wires connected to the heating wire 990 may be spaced from each other via the spacing guide 241 so as not to contact each other.

[0106] Furthermore, a guide wall 242 protruding to have a predetermined height and surrounding at least a portion of the rear area of the upper plate may be formed on a rear end of the upper plate 210. The guide wall 242 may serve to prevent the cold air flowing into the inside of the upper tray 200 from being discharged in the rearward direction. One or more fastening bosses 258 protruding upwardly may be formed between adjacent ones of the plurality of inlet guides 230. For example, a pair of fastening bosses 258 may be respectively formed between the first-row inlet guides 230a and the second-row inlet guides 230b located at the outermost right side and between the first-row inlet guides 230a and the second-row inlet guides 230b located at the outermost left side.

[0107] Referring to FIG. 13, it is shown that the heating wire 990 is seated in the upper tray 200 according to another embodiment. A partial area of the heating wire 990 positioned in a front area of the upper tray 200 may extend along an inner periphery of the arrangement of the first-row inlet guides 230a. For example, in an area overlapping with the first receiving portion 257 in the frontward/backward direction, a portion of the heating wire 990 positioned in the front area thereof may extend along an outer periphery of the arrangement of the first-row inlet guides 230a. In an area not overlapping with the first receiving portion 257 in the frontward/backward direction, a portion of the heating wire 990 positioned in the front area thereof may extend along the inner periphery of the arrangement of of the first-row inlet guides 230a. That is, in an area that does not overlap with the first receiving portion 257 in the frontward/backward direction, a portion of the heating wire 990 located in the front area thereof may extend through the area between the first-row inlet guide 230a and the second-row inlet guide 230b. Further, a portion of the heating wire 990 located in a rear area of the upper tray may extend along an outer periphery of the arrangement of the second-row inlet guides 230b and the water-supply guide 231. In an area where the heating wire 990 extends through an aera between the first-row inlet guide 230a and the second-row inlet guide 230b, the first cooling fin 251 may be removed, or the first cooling fin 251 may include a groove in which a partial area of the fin is removed such that the heating wire is fixedly inserted into the groove of the first cooling fin 251. Accordingly, the heating wire receiving groove 250 of the upper tray 200 into which the heating wire 990 is inserted may be formed in a shape corresponding to a shape of the heating wire 990 as described above. The heating wire cover 900 covering the heating wire 990 may be formed in a shape corresponding to the shape of the heating wire 990 as described above.

[0108] Hereinafter, with reference to FIG. 14 to FIG. 20, the heating wire cover 900 according to the present disclosure will be described in more detail.

[0109] On the upper tray 200, the heating wire cover 900 covering a top of the heating wire 990 to secure the heating wire 990 to the top of the heating wire 990 may be disposed. The heating wire cover 900 may be composed of a flat body 912 and a curved body 911, and may be formed to have a shape similar to a shape of a circumference of an arrangement of the plurality of upper chambers 220. The heating wire cover 900 may be formed to have a structure in which the flat bodies 912 and the curved bodies 911 are arranged alternately with each other. However, the present disclosure is not limited thereto. In a partial area, the heating wire cover 900 may be formed to have an inwardly-concave body 913 inwardly concaved beyond the flat body 912 and the curved body 911 of the heating wire cover 900. For example, referring to FIG. 18, the curved body 911 may be an area extending along a partial area of the outer circumference of the inlet guide 230, the inwardly-concave body 913 may be an area extending along a partial area of an inner circumference of the water-supply guide 231 of one inlet guide among the inlet guides 230, and the flat body 912 may be an area extending along an area between adjacent inlet guides 230. Referring to FIG. 16, the heating wire cover 900 may have a shape including an outwardly-convex body 914 instead of the inwardly-concave body 913. In this case, the outwardly-convex body 914 may be an area extending along a partial area of an outer circumference of the water-supply guide 231. Therefore, the outwardly-convex body 914 may be formed to extend along a partial area of an outer circumference of the water-supply inlet 232 of the water-supply guide 231.

[0110] The heating wire cover 900 may include an upper convex portion 930 protruding upwardly from an upper surface of the heating wire cover body 910 and a lower convex portion 940 protruding downwardly from a lower surface of the heating wire cover body 910. The upper convex portion 930 may extend along the upper surface of the heating wire cover body 910.

[0111] In this case, the upper convex portion 930 may

extend continuously along the circumference of the heating wire cover body 910. However, is not limited thereto, and the upper convex portion 930 may extend discontinuously. For example, referring to FIG. 16, the upper convex portion 930 disposed on the heating wire cover body 910 may include a plurality of upper convex portions. The adjacent upper convex portions 930 may be arranged to be spaced apart by a predetermined distance while a spacer 930h is formed therebetween. When the heating wire cover 900 is seated in the heating wire receiving groove 250 of the upper tray 200, the upper convex portion 930 of the heating wire cover 900 protrudes upwardly beyond the upper plate 210. Therefore, when the upper convex portion 930 is disposed in a flow path of the cold air, the upper convex portion 930 may interfere with the flow of the cold air. Accordingly, the upper convex portion 930 may be not formed on the heating wire cover body 910 but may be removed in an area corresponding to the cold air flow path through which cold air flows, such that the cold air flow interference may be reduced. For example, a discontinuous pattern of the upper convex portion 930 may be formed such that the upper convex portion 930 is formed on an area corresponding to the curved body 911, and the upper convex portion 930 is removed from an area corresponding to the flat body 912. Furthermore, the discontinuous pattern of the upper convex portion 930 may be formed such that when the heating wire cover 900 has been seated on the upper tray 200, the upper convex portion 930 is formed in an area that overlaps the inlet guide 230 adjacent to the heating wire cover 900 in the frontward-backward direction, and the upper convex portion 930 is removed from an area that does not overlap the inlet guide 230 adjacent to the heating wire cover 900 in the frontward-backward direction.

[0112] The lower convex portion 940 may extend along the lower surface of the heating wire cover body 910. In this case, the lower convex portion 940 may extend continuously along the lower surface of the heating wire cover body 910. When the heating wire cover 900 is seated in the heating wire receiving groove 250 of the upper tray 200, the lower convex portion 940 of the heating wire cover 900 is inserted into the heating wire receiving groove 250, such that the lower convex portion 940 may not protrude outwardly beyond the upper plate 210 of the upper tray 200. Therefore, even when the lower convex portion 940 extends continuously, the lower convex portion 940 may not interfere with the flow of the cold air. Furthermore, since the lower convex portion 940 may contact the heating wire 990 to directly press the heating wire 990, it is desirable that the lower convex portion 940 extends continuously so as to apply uniform pressure as much as possible to an entire area of the heating wire 990. In this way, the lower convex portion 940 may apply the uniform pressure as much as possible to the entire area of the heating wire 990, thereby bringing the plurality of upper chambers 220 and the heating wire 990 into being close contact with each other. Accordingly, a heat transfer efficiency at which the heat amount is transferred to the upper chamber 220 from the heating wire 990 may be increased. However, the pattern of the lower convex portion 940 is not limited thereto, and the lower convex portion 940 may extend discontinuously. For example, the lower convex portion 940 may be formed in a discontinuous pattern corresponding to the discontinuous pattern of the upper convex portion 930.

[0113] A width of each of the upper convex portion 930 and the lower convex portion 940 may be smaller than a width of the heating wire cover body 910. Accordingly, when the heating wire cover 900 is seated in the heating wire receiving groove 250, the heating wire cover body 910 is not inserted into the heating wire receiving groove 250 and may act as a seat allowing the heating wire cover 900 to be seated on the upper plate 210. As the heating wire cover body 910 allows the heating wire cover 900 to be seated on the upper plate 210, the lower convex portion 940 may be inserted into the heating wire receiving groove 250, and the upper convex portion 930 may protrude outwardly out of the heating wire receiving groove 250.

[0114] The heating wire cover body 910 may include an inner seat portion 951 extending inwardly, and an outer seat portion 952 extending outwardly such that the heating wire cover body 910 is seated on top of the heating wire receiving groove 250. For example, the upper convex portion 930 may extend along a center line in a width direction of the upper surface of the heating wire cover body 910. However, the present disclosure is not limited thereto, and the upper convex portion 930 may be positioned so as be biased toward one side in the width direction of the heating wire cover body 910 in at least a partial area thereof. For example, when the upper convex portion 930 extends along the center line in the width direction of the upper surface of the heating wire cover body 910, an inner area of the heating wire cover body 910 around the upper convex portion 930 may become the inner seat portion 951, while an outer area of the heating wire cover body 910 around the upper convex portion 930 may become the outer seat portion 952. In addition, when the upper convex portion 930 is positioned so as to be biased toward an outer side in the width direction of the upper surface of the heating wire cover body 910, that is, so as to be in contact with the outer side thereof, an inner area of the heating wire cover body 910 around the upper convex portion 930 may become the inner seat portion 951. Alternatively, when the upper convex portion 930 is positioned so as to be biased toward an inner side in the width direction of the upper surface of the heating wire cover body 910, that is, so as to be in contact with the inner side thereof, an outer area of the heating wire cover body 910 around the upper convex portion 930 may become the outer seat portion 951. Similarly, the lower convex portion 940 may extend along a center line in the width direction of the lower surface of the heating wire cover body 910. However, the present disclosure is not limited thereto, and the lower

convex portion 940 may be positioned so as to be biased toward one side in the width direction of the heating wire cover body 910 in at least a partial area. For example, when the lower convex portion 940 extends along the center line in the width direction of the lower surface of the heating wire cover body 910, an inner area of the heating wire cover body 910 around the lower convex portion 940 may become the inner seat portion 951, while an outer area of the heating wire cover body 910 around the lower convex portion 940 may become the outer seat portion 952. In addition, when the lower convex portion 940 is positioned so as to be biased toward an outer side in the width direction of the lower surface of the heating wire cover body 910, that is, so as to be in contact with the outer side thereof, an inner area of the heating wire cover body 910 around the lower convex portion 940 may become the inner seat portion 951. Alternatively, when the lower convex portion 940 is positioned so as to be biased toward an inner side in the width direction of the lower surface of the heating wire cover body 910, that is, so as to be in contact with the inner side thereof, an outer area of the heating wire cover body 910 around the lower convex portion 940 may become the outer seat portion 951. Therefore, the heating wire cover body 910 may include an area where both the outer seat portion 952 and the inner seat portion 951 are formed. In a partial area of the heating wire cover body 910, the heating wire cover body 910 may include an area where only the inner seat portion 951 or only the outer seat portion 952 is formed. The area of the heating wire cover body 910 where only the inner seat portion 951 is formed may be the front area of the upper tray 200 from which the cold air flows out of the ice maker. Accordingly, even in the front area relatively narrower than the rear area, only the inner seat portion 951 may be seated on the upper plate such that the heating wire cover 900 may be stably seated on the upper plate.

[0115] A shelter 980 having a shape in which a partial area is cut away may be formed on one side of the heating wire cover 900. The shelter 980 may allow the heating wire cover 900 to be fixedly in close contact with an area adjacent to the driving unit support 260 when the heating wire cover 900 is disposed on the upper tray 200, thereby increasing space utilization of the arrangement of structures of the upper tray 200.

[0116] One or more side extensions 920 may be formed that extend outwardly from a side surface of the heating wire cover body 910 of the heating wire cover 900. An extension upper convex portion 921 that extends from the upper convex portion 930 and protrudes upwardly may be formed on an upper surface of the side extension 920. An extension lower convex portion 921 that extends from the lower convex portion 940 and protrudes downwardly may be formed on a lower surface of the side extension 920. The side extension 920 formed in this manner may be temporarily fixed to each of a pair of fixing hooks 281 respectively disposed on both opposing sides of the heating wire receiving groove 250 of the upper tray 200. Therefore, the heating wire cover 900 may be temporarily fixed to the pair of fixing hooks 281 respectively disposed on both opposing sides of the heating wire receiving groove 250 of the upper tray 200, wherein each of the pair of fixing hooks 281 includes a hook stopper 282. However, a position of each of the pair of fixing hooks 281 is not limited thereto, and each of the pair of fixing hooks 281 may be positioned on the upper surface or the lower surface of the heating wire receiving groove 250.

[0117] For example, the fixing hook 281 may be formed to protrude upwardly from the upper plate 210, and may include the hook stopper 282 protruding toward the heating wire cover 900. The fixing hook 281 may be formed to have a vertical level higher than a vertical level of the side extension 920 of the heating wire cover body 910 that has been seated on the heating wire receiving groove 250, and the hook stopper 282 may be formed to overlap the side extension 920 in the vertical direction. The hook stopper 282 may be formed to be spaced apart from the upper plate 210 by a predetermined vertical spacing, so that the side extension 920 of the heating wire cover 900 may be fixedly inserted into the spacing between the hook stopper 282 and the upper plate 210. In the area of the upper plate 210 corresponding to and overlapping the hook stopper 282 in the vertical direction, a hole 283 may be defined, thereby facilitating the insertion of the side extension 920 into the spacing, thereby improving workability during the temporary fixing of the heating wire cover 900.

[0118] According to the present disclosure, the upper tray 200 on which the heating wire cover 900 is seated includes one or more fixing hooks 281 to temporarily fix the heating wire cover 900 thereto. Thus, the heating wire 990 temporarily fixed to the upper tray 200 is prevented from being removed from its correct position during the assembly work of other parts, thereby allowing the heating wire cover 900 to be maintained in a temporarily fixed state before being completely assembled to the upper tray 200. The temporary fixing as used in the present disclosure means that the worker may quickly and easily fix the heating wire cover 900 to the upper tray 200 without using a separate fastening member. The final close contact fixing between the heating wire cover 900 and the upper tray 200 may be additionally performed using an additional structure or an additional assembly step after the temporary fixing assembly step.

[0119] Referring to FIG. 17, the heating wire cover 900 may be disposed on the upper tray 200 so as to cover the heating wire 990 inserted into the heating wire receiving groove 250 of the upper tray 200, and may be temporarily fixed to the fixing hooks 281 formed on the upper tray 200. In this way, the heating wire cover 900 temporarily fixed onto the upper tray 200 may be fixed to the heating wire 990 in a closer contact manner therewith under a pressing portion 160 formed on a lower surface of the upper cover 100.

[0120] Referring to FIG. 21, the upper cover 100 dis-

posed on top of the upper tray 200 may include an upper cover plate 101 corresponding to and overlapping the upper plate 210 of the upper tray 200. A plurality of guide receiving bosses 180 corresponding to and overlapping the inlet guides 230 of the upper tray 200 may be formed on the upper cover plate 101. Referring to FIG. 20, an upper end of the inlet guide 230 may be positioned to be inserted into the guide receiving boss 180. A boss guide 181 may be formed along an outer edge of the upper surface of the guide receiving boss 180. The boss guide 181 may protrude toward a top of the guide receiving boss 180 so as to have a predetermined height. The boss guide 181 may guide the upper end of the inlet guide 230 to be inserted into the guide receiving boss 180. An upper surface of the boss guide 181 and an upper distal end of the inlet guide 230 may be coplanar with each other. In this way, the boss guide 181 protrudes upwardly rather than downwardly of the upper cover 100, the cold air flow path formed between the upper tray 200 and the upper cover 100 is not obstructed by the boss guide 181, such that a sufficient cold air inflow space may be secured.

[0121] Each pressing portion 160 protruding downwardly of the upper cover plate 101 may be disposed adjacent to each guide receiving boss 180. The pressing portion 160 may include a plurality of pressing portions spaced apart from each other by a predetermined distance. The pressing portion 160 presses the upper convex portion 930 of the heating wire cover 900 in a downward direction. Thus, this downwards pressing force may be transferred to the lower convex portion 940 of the heating wire cover 900, so that the lower convex portion 940 may press the heating wire 990 in a downward direction. Accordingly, the pressing portion 160 of the upper cover 100 may cause the heating wire cover 900 to press the heating wire 990 to fix the heating wire 990.

[0122] A plurality of pressing portions 160 may be arranged according to the shape of the heating wire cover 900 and may be spaced apart from each other. In this case, each pressing portion 160 may overlap each inlet guide 230 adjacent thereto in the frontward-backward direction. Accordingly, the pressing portion 160 may be positioned so as not to interfere with the cold air flow in the cold air flow path defined between the adjacent inlet guides 230. Furthermore, an outer diameter of each pressing portion 160 may be smaller than an outer diameter of each inlet guide 230. Accordingly, the pressing portion 160 may have a shape that does not interfere with the cold air flow in the cold air flow path formed between the inlet guides 230 adjacent to each other in the left-right direction.

[0123] According to the present disclosure, the heating wire cover 900 covering the heating wire 990 which is seated in the upper tray 200 may be pressed by the pressing portion 160 of the upper cover 100, so that the upper tray 200 and the heating wire 990 may be brought into close contact with each other. Accordingly, the heat transfer efficiency at which the heat amount from the heating wire 990 is transferred to the upper tray 200 may be increased.

[0124] Furthermore, according to the present disclosure, the lower convex portion 940 protruding downwardly and extending along the heating wire cover body 910 of the heating wire cover 900 presses the heating wire. Thus, the plurality of upper chambers 220 and the heating wire 990 may be brought into close contact with each other, so that the heat amounts respectively applied to the upper chambers 220 from the heating wire 990 may be as uniform as possible. Accordingly, the difference between the times respectively taken for the ices to be respectively removed from the upper chambers 220 may be reduced, and the occurrence of the ice-removal failure in some of the upper chambers 220 may be reduced.

[0125] A fastening hole 163 may be formed in the upper cover plate 101 at a position corresponding to a position of the fastening boss 259 of the upper tray 200. The fastening hole 163 and the fastening boss 258 may be fastened to each other via a fastening member such as a screw, so that the upper cover and the upper tray may be fastened to each other in a close contact manner with each other. Furthermore, a receiving portion guide 161 may be formed on the upper cover plate 101 and at a position corresponding to an outer edge of the first receiving portion 257 of the upper tray 200. The cold air discharge spacer 170 as cut away so as to have a predetermined height may extend along the left-right direction to constitute an area under the front portion 111 of the upper cover 100. Accordingly, in a state in which the upper cover 100 and the upper tray 200 are combined with each other, the cold air discharge spacer 170 through which cold air may be discharged to the outside may be positioned under the front portion of the upper cover 100. In this case, a front guide 182 may be formed along an upper surface of the cold air discharge spacer 170 of the upper cover 100. The front guide 182 is formed to protrude in the frontward direction beyond the cold air discharge spacer 170, and a front distal end of the front guide 182 may be formed to be inclined downwardly.

[0126] Hereinafter, another embodiment of the present disclosure will be described with reference to FIG. 22 and FIG. 23.

[0127] Each pressing portion 160 formed on the lower surface of the upper cover 100 may extend in a downward direction by a length greater than a length by which each pressing portion 160 in FIG. 21 extends.

[0128] In this case, the pressing portion 160 may extend in a downward direction by the greater length so that the pressing portion 160 of the upper cover 100 may directly sufficiently press and fix the heating wire 990.

[0129] For example, a lower end of the pressing portion 160 may be inserted into a portion of an upper area of the heating wire receiving groove 250 formed in the upper tray 200.

[0130] In one example, the pressing portion 160 is formed so that a left-right width thereof decrease as the pressing portion extends downwardly, so that the lower end of the pressing portion 160 may be inserted

into the portion of the upper area of the heating wire receiving groove 250.

[0131] In this case, the left-right width of the pressing portion 160 may be continuously reduced. However, the present disclosure is not limited thereto, and the left-right width of the pressing portion 160 may be discontinuously reduced so as to have a step in a middle area.

[0132] According to another embodiment of the present disclosure, the pressing portion 160 of the upper cover 100 may directly press the heating wire 990 without a separate heating wire cover 900 that fixes the heating wire 990, thereby reducing the number of parts and man-hours related to a separate heating wire fixing member such as a heating wire cover.

[0133] In one example, referring to FIG. 24, still another embodiment of the present disclosure is described, in which the heating wire receiving groove 250 formed in an upper tray 200 may have a heating wire stopper 250a formed therein.

[0134] The heating wire receiving groove 250 may have a sufficient inner groove space in which the heating wire 990 is seated. The heating wire receiving groove 250 may be formed so that a top thereof is open so that the heating wire 990 may be inserted therein.

[0135] In this way, one or more heating wire stoppers 250a may be formed at an upper end of the heating wire receiving groove 250 having the open top.

[0136] For example, the heating wire stopper 250a may be formed from the upper end of the heating wire receiving groove 250, and may extend horizontally to cover a partial area of an upper area of the heating wire receiving groove 250.

[0137] That is, the heating wire stopper 250a may be formed to extend from one side of the heating wire receiving groove 250 so as to cover a portion of the open upper area of the heating wire receiving groove 250, and thus may overlap with the heating wire receiving groove 250 in the vertical direction.

[0138] Therefore, a portion of the upper area of the heating wire receiving groove 250 where the heating wire stopper 250a is formed may have a smaller open area than an open area that a portion of the upper area of the heating wire receiving groove 250 where the heating wire stopper 250a is not formed has.

[0139] In this way, in the upper area of the heating wire receiving groove 250 where the heating wire stopper 250a is partially formed, the heating wire 990 may be inserted into the heating wire receiving groove 250 through the open upper area as not covered with the heating wire stopper 250a.

[0140] In one example, the heating wire stopper 250a may be formed to have a small vertical width so as to have a certain elasticity, that is, may be displaced elastically.

[0141] The heating wire 990 which is inserted and seated in the heating wire receiving groove 250 may be fixedly maintained in the heating wire receiving groove 250 while the upper surface thereof is pressed by the heating wire stopper 250a.

[0142] The heating wire stopper 250a may be formed integrally with the upper tray 200.

[0143] Therefore, the heating wire stopper 250a may be made of a metal material.

[0144] Furthermore, each heating wire stopper 250a may be present in a corresponding manner to each inlet guide 230. However, the present disclosure is not limited thereto, and a plurality of heating wire stoppers 250a may be formed in a corresponding manner to each inlet guide 230.

[0145] In this case, adjacent heating wire stoppers 250a may be spaced apart from each other by a predetermined distance, and accordingly, the heating wire stopper 250a may extend discontinuously.

[0146] Adjacent heating wire stoppers 250a may be arranged to be spaced apart from each other by an equal spacing. However, the present disclosure is not limited thereto, and the adjacent heating wire stoppers 250a may be arranged to be spaced apart from each other by unequal spacings.

[0147] Furthermore, in still another embodiment, in order to improve the fixing force at which the heating wire stopper 250a fixes the heating wire 990, the heating wire stopper 250a may extend continuously along the shape of the heating wire receiving groove 250.

[0148] Accordingly, according to still another embodiment of the present disclosure, the heating wire stopper 250a may directly press the heating wire 990 without a separate heating wire cover 900 that fixes the heating wire 990, thereby reducing the number of parts and man-hours related to a separate heating wire fixing member such as a heating wire cover.

[0149] In one example, referring to FIG. 25, still yet another embodiment of the present disclosure is described, in which a portion of the upper surface of the heating wire 990 may be pressed by the pressing portion 160 of the upper cover 100, and another portion of the upper surface of the heating wire 990 may be pressed by the heating wire stopper 250a formed at the upper tray 200 such that the heating wire 990 may be fixed.

[0150] For example, based on the state where the upper tray 200 and the upper cover 100 are combined with each other, the pressing portions 160 and the heating wire stoppers 250a may be alternately arranged with each other along the heating wire receiving groove 250 and may be spaced from each other by a predetermined distance. However, the present disclosure is not limited thereto.

[0151] The pressing portions 160 and the heating wire stoppers 250a may be alternately arranged with each other in a regular arrangement order. However, the present disclosure is not limited thereto, and the pressing portions 160 and the heating wire stoppers 250a may may be alternately arranged with each other in an irregular arrangement order.

[0152] In this way, the heating wire 990 may be pressed by the pressing portion 160 formed in the upper cover 100 and the heating wire stopper 250a formed in the upper

tray 200. Thus, the heating wire 990 may be pressed by the pressing members respectively formed in the different structures.

[0153] Accordingly, even when the pressing member formed in one structure fails to press the heating wire 990, the heating wire 990 may be pressed by the pressing member formed in another structure, thereby reducing the occurrence of the fixing failure of the heating wire 990.

[0154] In one example, various embodiments of the heating wire cover 900 will be further described below with reference to FIGS. 26 to 28.

[0155] Referring to FIGS. 26 and 27, the heating wire cover 900 may be formed in a form in which the first heating wire cover 901 and the second heating wire cover 902 are separated from each other.

[0156] In an example, referring to FIG. 26, the heating wire cover 900 may be broken into the first heating wire cover 901 as a left cover and the second heating wire cover 902 as a right cover arranged in the left-right direction.

[0157] In this case, the first heating wire cover 901 and the second heating wire cover 902 may be coupled to each other to form a closed loop. However, the present disclosure is not limited thereto.

[0158] In another example, the first heating wire cover 901 and the second heating wire cover 902 may be spaced apart from each other by a predetermined distance while the first heating wire cover 901 and the second heating wire cover 902 may be seated in the heating wire receiving groove 250.

[0159] In this case, the first heating wire cover 901 and the second heating wire cover 902 may be spaced from each other without forming the closed loop while the first heating wire cover 901 and the second heating wire cover 902 are seated in the heating wire receiving groove 250.

[0160] Each of the first heating wire cover 901 and the second heating wire cover 902 may have the side extension 920 including the extension convex portion 921.

[0161] Accordingly, each of the first heating wire cover 901 and the second heating wire cover 902 may be temporarily fixed to each of the pair of fixing hooks 281 respectively disposed on both opposing sides of the heating wire receiving groove 250 of the upper tray 200.

[0162] In another example, referring to FIG. 27, the heating wire cover 900 may be broken into the first heating wire cover 901 as a front cover and the second heating wire cover 902 as a rear cover arranged in the front-back direction.

[0163] In this case, the first heating wire cover 901 and the second heating wire cover 902 may be couped to each other to form a closed loop. However, the present disclosure is not limited thereto.

[0164] In another example, the first heating wire cover 901 and the second heating wire cover 902 may be spaced apart from each other by a predetermined distance while the first heating wire cover 901 and the second heating wire cover 902 are seated in the heating wire receiving groove 250.

[0165] In this case, the first heating wire cover 901 and the second heating wire cover 902 may be spaced from each other without forming the closed loop while the first heating wire cover 901 and the second heating wire cover 902 are seated in the heating wire receiving groove 250.

[0166] Each of the first heating wire cover 901 and the second heating wire cover 902 may have the side extension 920 including the extension convex portion 921.

[0167] Accordingly, each of the first heating wire cover 901 and the second heating wire cover 902 may be temporarily fixed to each of the pair of fixing hooks 281 respectively disposed on both opposing sides of the heating wire receiving groove 250 of the upper tray 200.

[0168] In still another example, referring to FIG. 28, the heating wire cover 900 may be formed to have a cut-away 903 in a partial area thereof such that the heating wire cover 900 is broken.

[0169] For example, the heating wire cover 900 may be formed to have a generally continuous shape. However, the cut-away 903 may be formed in the partial area, so that the entire shape of the heating wire cover 900 may be discontinuous.

[0170] As the heating wire cover 900 includes the cut-away 903 at which the heating wire cover 900 is broken in the partial area, the heating wire cover 900 may have elasticity. Thus, even when a predefined design error occurs in the heating wire cover 900, the heating wire cover 900 may be easily inserted into the heating wire receiving groove 250.

[0171] In one example, the ice maker 30 as described above may include the upper assembly 31 and the lower assembly 32. In this case, the upper assembly 31 may be named as the first assembly 31, and the lower assembly 32 may be named as the second assembly 32.

[0172] Likewise, the upper cover 100 and the upper tray 200 may be named as the first cover 100 and the first tray 200, respectively. The lower cover 300 and the lower tray 400 may be named as the second cover 300 and the second tray 400, respectively. In short, besides the alignment described herein in the FIGs, the two trays 200, 400 may not be aligned in up-down direction or vertical direction and thus can be referred to as the first and the second trays 200, 400. Similarly, albeit optionally, the upper cover 100 and the lower cover 300 may not be aligned in up-down direction or vertical direction and thus can be referred to as the first and the second covers 100, 300. It may be noted that the present disclosure envisages all possible combinations - namely the two trays 200, 400 are aligned in up-down direction but one or more of the two covers 100, 300 is not aligned in up-down direction (one or both covers may be aligned in horizontal direction); the two trays 200, 400 are not aligned in up-down direction (may be aligned in horizontal direction or side by side for example so as to come in contact by horizontal translational motion) but one or both of the two covers 100, 300 may be aligned in up-down direction; the two trays 200, 400 are not aligned in up-down direction (may be aligned in horizontal direction or side by side for

example so as to come in contact by horizontal translational motion) and one or both of the two covers 100, 300 are also not aligned in up-down direction (one or both covers may be aligned in horizontal direction). All other features described in this disclosure may be applied to any of the aforementioned alignment of trays.

[0173] Furthermore, the ice maker 30 may perform the ice-removal process in a pivot scheme in which the second tray 400 pivots around a single axis while the first tray 200 is fixed. However, the present disclosure is not limited thereto.

[0174] In another embodiment, the ice maker 30 may perform the ice-removal process in a scheme in which the first tray 200 or the second tray 400 reciprocates in a linear direction.

[0175] For example, while the first tray 200 is fixed, the second tray 400 may reciprocate in a linear manner vertically. Alternatively, while the second tray 400 is fixed, the first tray 200 may reciprocate in a linear manner vertically. In this way, the ice may be removed from the ice maker.

[0176] That is, the first tray 200 or the second tray 400 may reciprocate in a linear manner vertically.

[0177] Furthermore, in another example, while the first tray 200 is fixed, the second tray 400 may reciprocate in a linear manner horizontally, that is, in the left and right direction or the front and back direction. Alternatively, while the second tray 400 is fixed, the first tray 200 may reciprocate in a linear manner horizontally, that is, in the left and right direction or the front and back direction. In this way, the ice may be removed from the ice maker.

[0178] That is, the first tray 200 or the second tray 400 may reciprocate in a linear manner horizontally.

[0179] The various embodiments of the heating wire cover 900 as described above may be equally applied to the ice maker 30 in which the ice-removal process is performed in a scheme in which the first tray 200 or the second tray 400 reciprocates in a straight direction.

Claims

1. An ice maker comprising:

an upper tray (200) including a plurality of upper chambers (220) and having a heating wire receiving groove (250) defined therein;
a lower tray (400) including a plurality of lower chambers;
a heating wire (990) inserted into the heating wire receiving groove (250);
a heating wire cover (900) seated on the heating wire receiving groove (250) so as to cover the heating wire (990); and
an upper cover (100) disposed on top of the upper tray (200) and including at least one pressing portion (160) pressing the heating wire cover (900).

2. The ice maker of claim 1, wherein the upper tray (200) further includes an upper plate (210), wherein a cold air flow path is defined between the upper cover (100) and the upper tray (200).

3. The ice maker of claim 2, wherein the heating wire receiving groove (250) is depressed in a downward direction beyond an uppermost surface of the upper plate (210).

4. The ice maker of claim 2 or 3, wherein the upper chamber (220) protrudes in a downward direction beyond an uppermost surface of the upper plate (210).

5. The ice maker of any one of claims 2 to 4, wherein the heating wire (990) inserted into the heating wire receiving groove (250) is positioned lower than the uppermost surface of the upper plate (210).

6. The ice maker of any one of the preceding claims, wherein the heating wire receiving groove (250) at least partially extends along at least a partial area of an outer circumference of each of the upper chambers (220).

7. The ice maker of any one of the preceding claims, wherein the upper tray (200) further includes a plurality of inlet guides (230) respectively communicating with the plurality of upper chambers (220) and respectively extending upwardly from the plurality of upper chambers (220),
wherein the heating wire receiving groove (250) at least partially extends along at least a partial area of an outer circumference of each of the plurality of inlet guides (230).

8. The ice maker of claim 7, wherein one of the plurality of inlet guides (230) acts as a water-supply guide (231) constituting a water-supply path (231h),
wherein in an area of the heating wire receiving groove (250) corresponding to the water-supply guide (231), the heating wire receiving groove (250) extends along a portion of an inner circumference of the water-supply guide (231).

9. The ice maker of any one of the preceding claims, wherein the heating wire cover (900) includes:

a heating wire cover body (910) having a closed curve shape and including a hollow space defined therein; and
at least one side extension (920) protruding outwardly from a side surface of the heating wire cover body (910),
wherein the upper tray (200) includes at least one fixing hook (281) fixing the side extension (920).

10. The ice maker of claim 9, wherein the fixing hook (281) is constructed to temporarily or detachably fix the heating wire cover (900) to the heating wire receiving groove (250).

11. The ice maker of any one of the preceding claims, wherein the heating wire cover (900) includes:

a heating wire cover body (910) having a closed curve shape and including a hollow space defined therein;
an upper convex portion (930) protruding upwardly from an upper surface of the heating wire cover body (910) and extending along a shape of the heating wire cover body (910); and
a lower convex portion (940) protruding downwardly from a lower surface of the heating wire cover body (910) and extending along the shape of the heating wire cover body (910),
wherein the heating wire cover body (910) is positioned out of the heating wire receiving groove (250), and the lower convex portion (940) is inserted into the heating wire receiving groove (250).

12. The ice maker of claim 11, wherein the pressing portion (160) presses the upper convex portion (930) in a downward direction, and thus, the lower convex portion (940) presses the heating wire (990) in a downward direction.

13. The ice maker of any one of the preceding claims, wherein the pressing portion (160) protrudes downwardly from a lower surface of the upper cover (100).

14. The ice maker of any one of the preceding claims, wherein the pressing portion (160) includes a plurality of pressing portions,
wherein the pressing portions (160) adjacent to each other are arranged to be spaced apart from each other.

15. A refrigerator comprising:

at least one storage compartment;
at least one door (11, 12) for opening and closing the storage compartment; and
an ice maker (30) mounted into the storage compartment or the door (11, 12),
wherein the ice maker (30) includes:

at least one ice tray (200, 400) including a plurality of chambers (220, 420) and having a heating wire receiving groove (250) defined therein;
a heating wire (990) inserted into the heating wire receiving groove (250);
a heating wire cover (900) seated on the heating wire receiving groove (250) so as to cover the heating wire (990); and
an ice cover disposed on top of the ice tray and including one or more pressing portions (160) pressing the heating wire cover (900).

FIG. 1

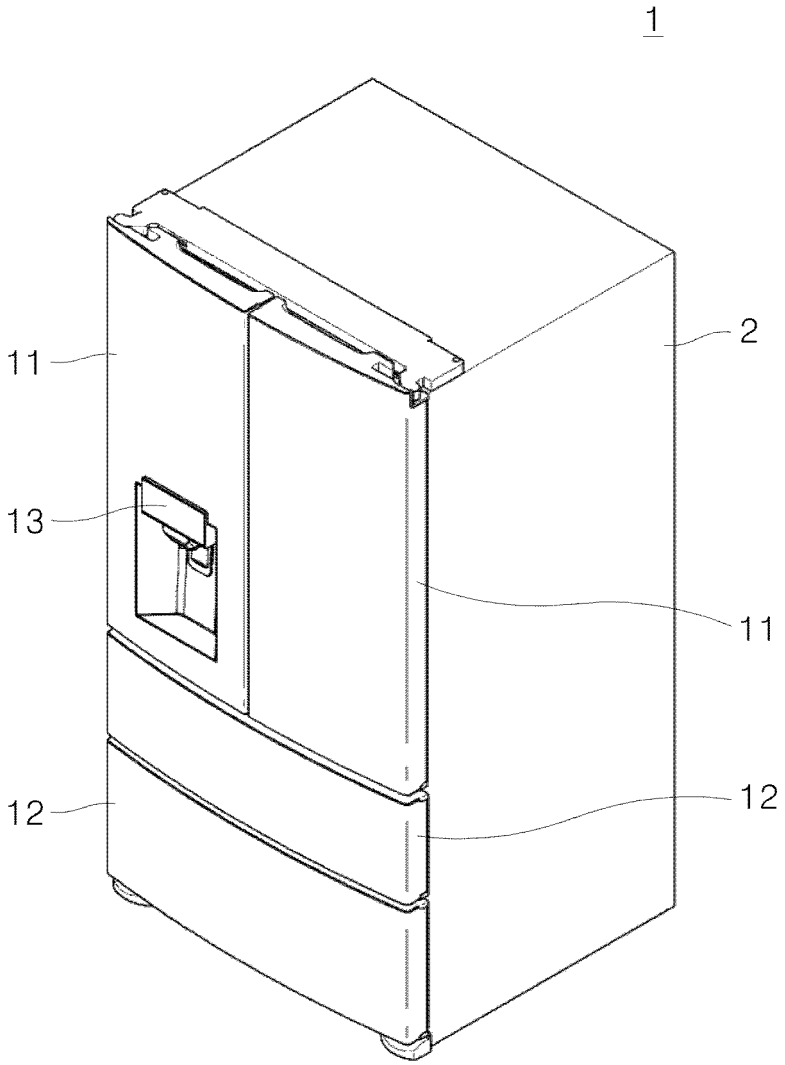


FIG. 2

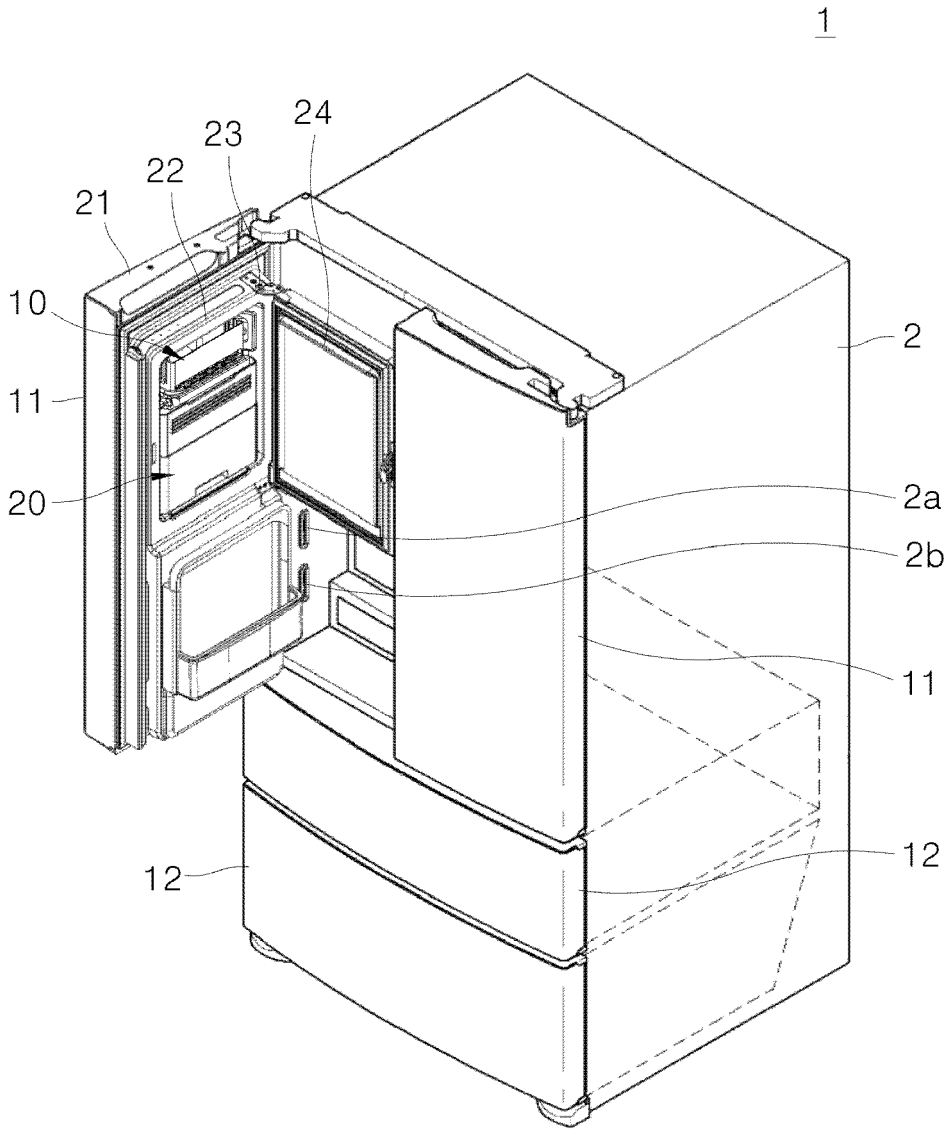


FIG. 3

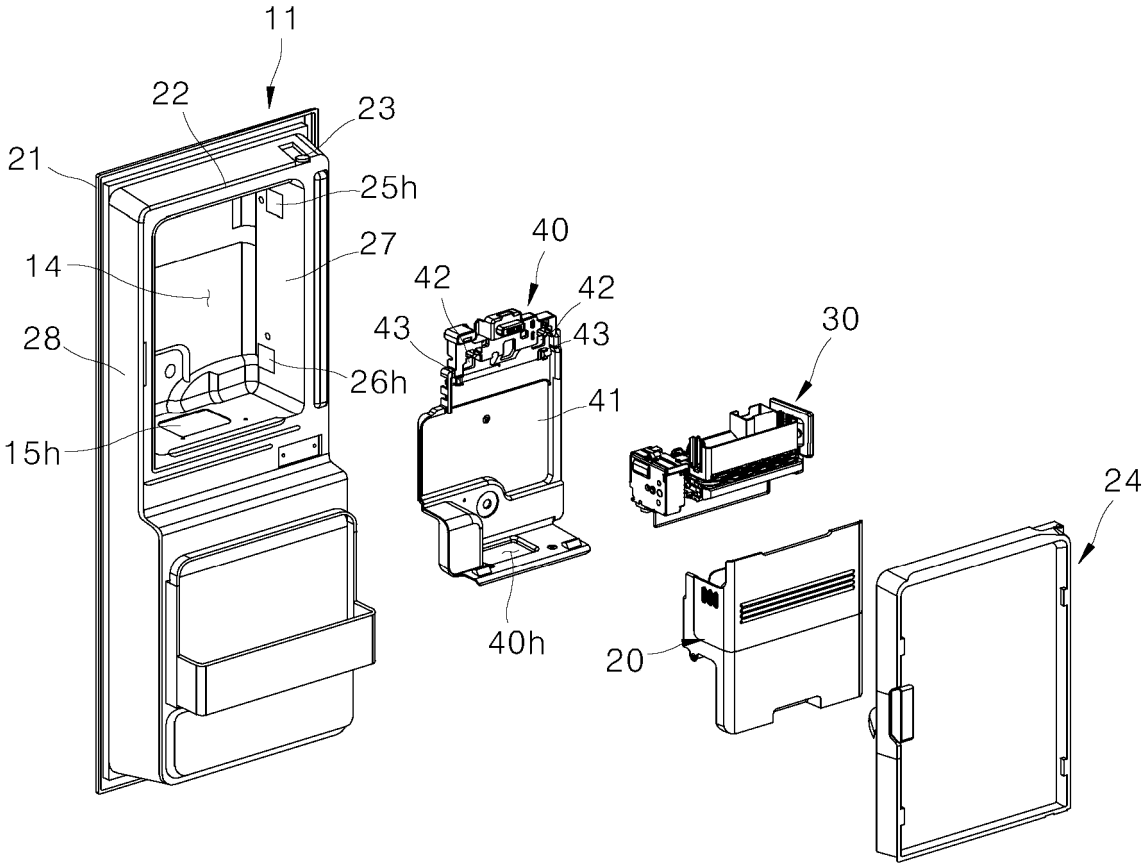


FIG. 4

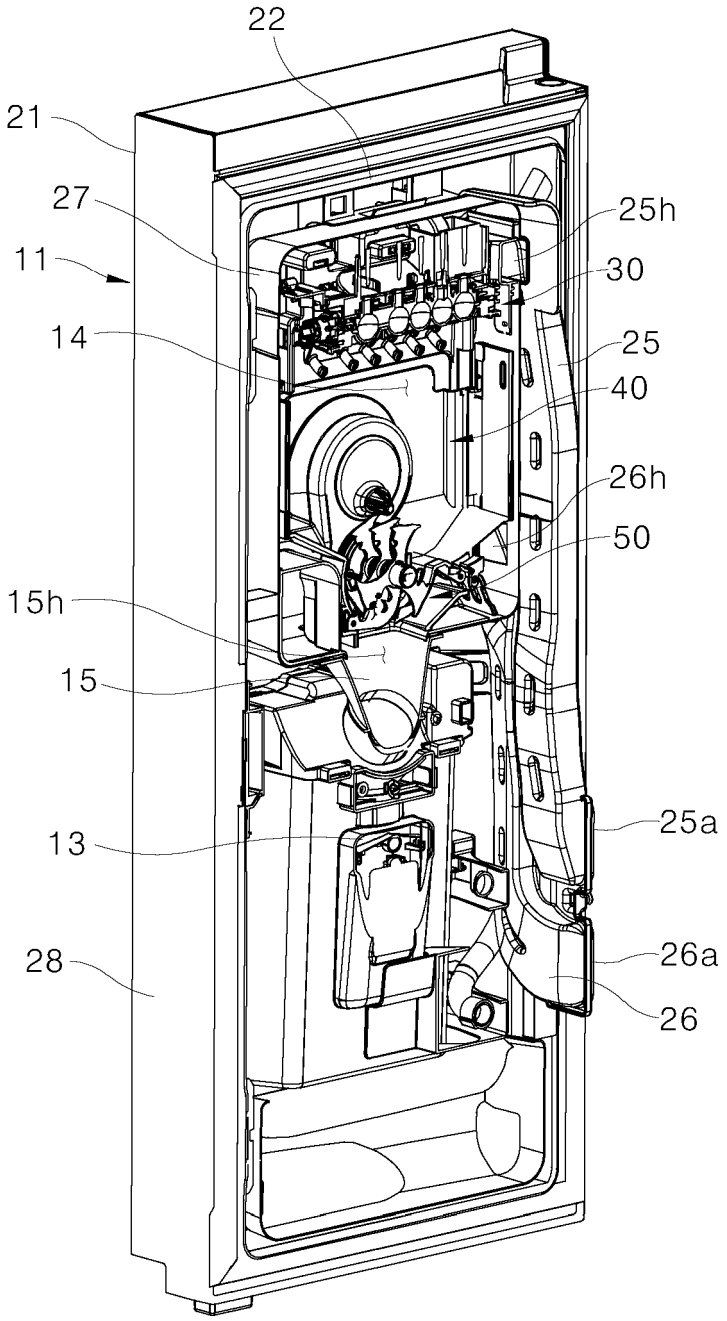


FIG. 5

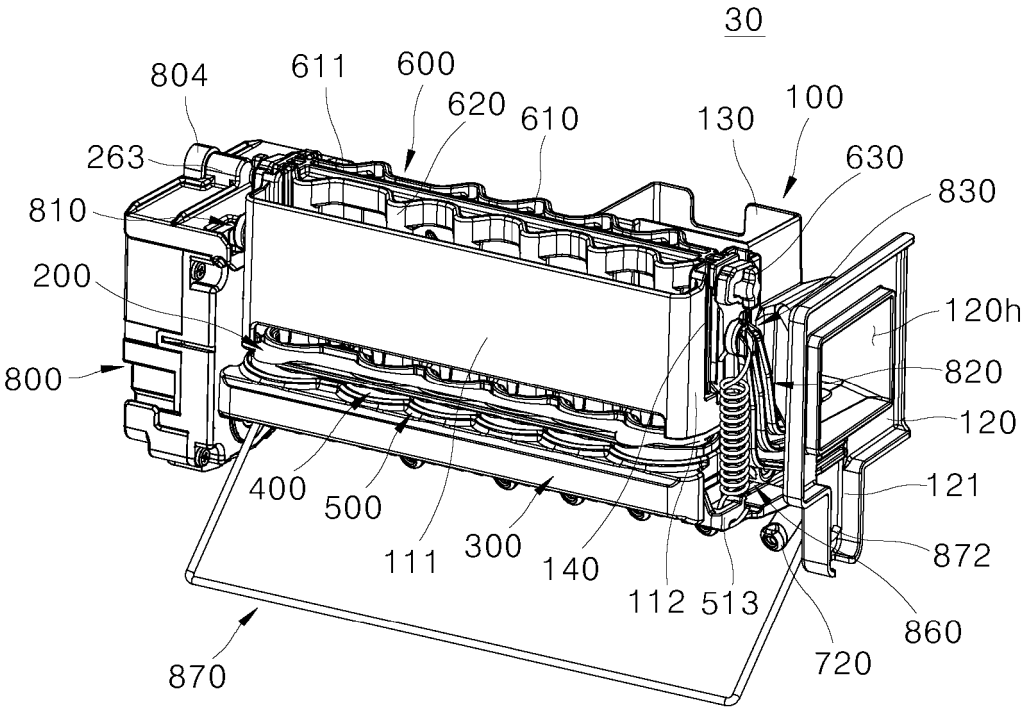

30
804
611
600
620
610
130
100
263
630
830
810
200
120h
800
820
120
400
500
121
111
300
140
872
112
513
860
870
720

FIG. 6

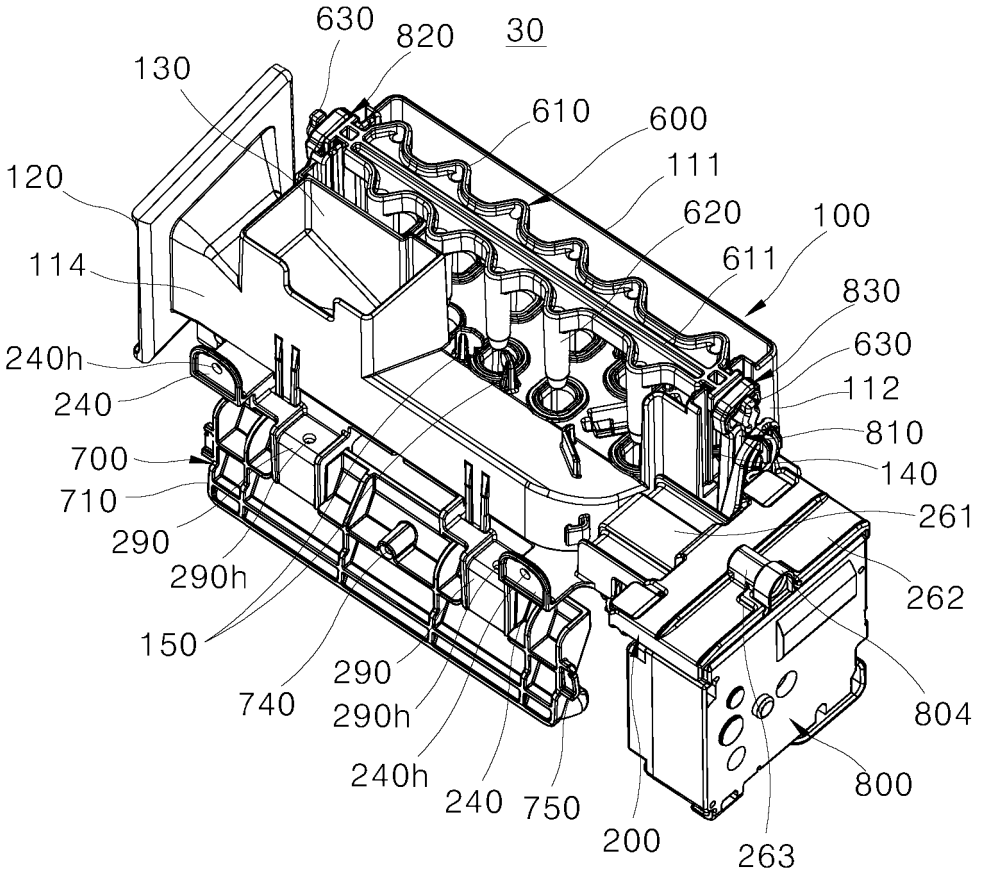

630
820
30
130
610
600
111
120
620
100
114
611
830
240h
630
240
112
700
810
710
140
290
261
290h
262
150
740
290
290h
804
240h
240
750
800
200
263

FIG. 7

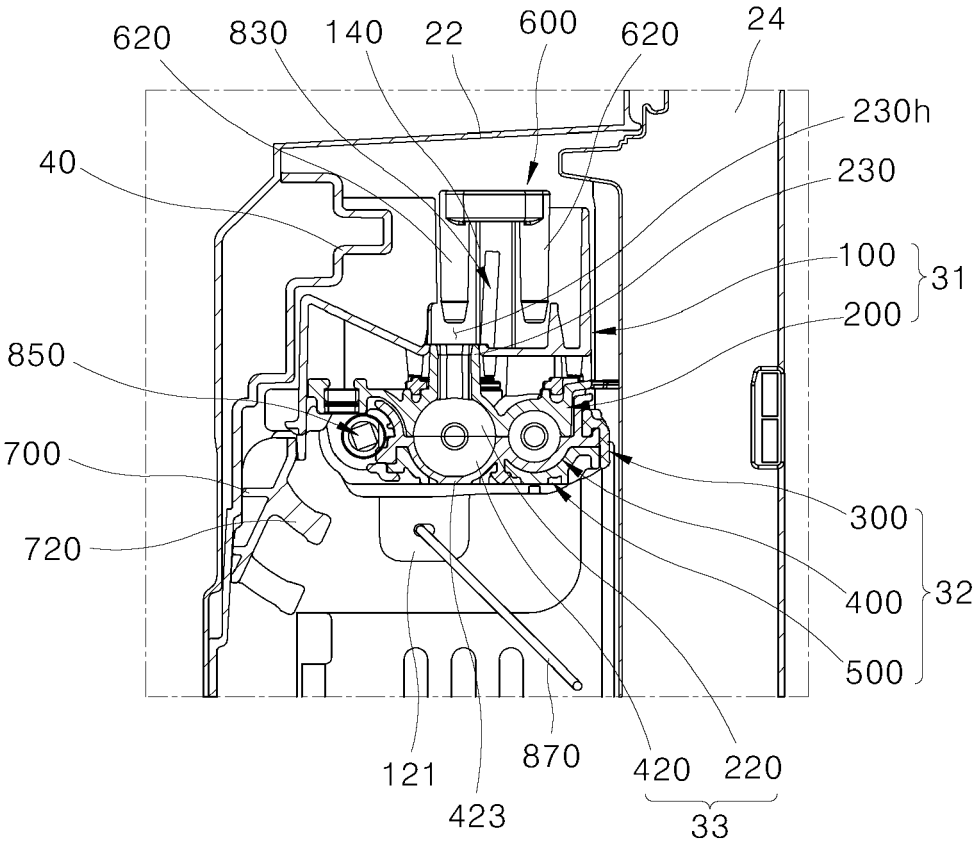

620
830
140
22
600
620
24
230h
40
230
100
31
200
850
700
720
300
400
32
500
121
423
870
420
220
33

FIG. 8

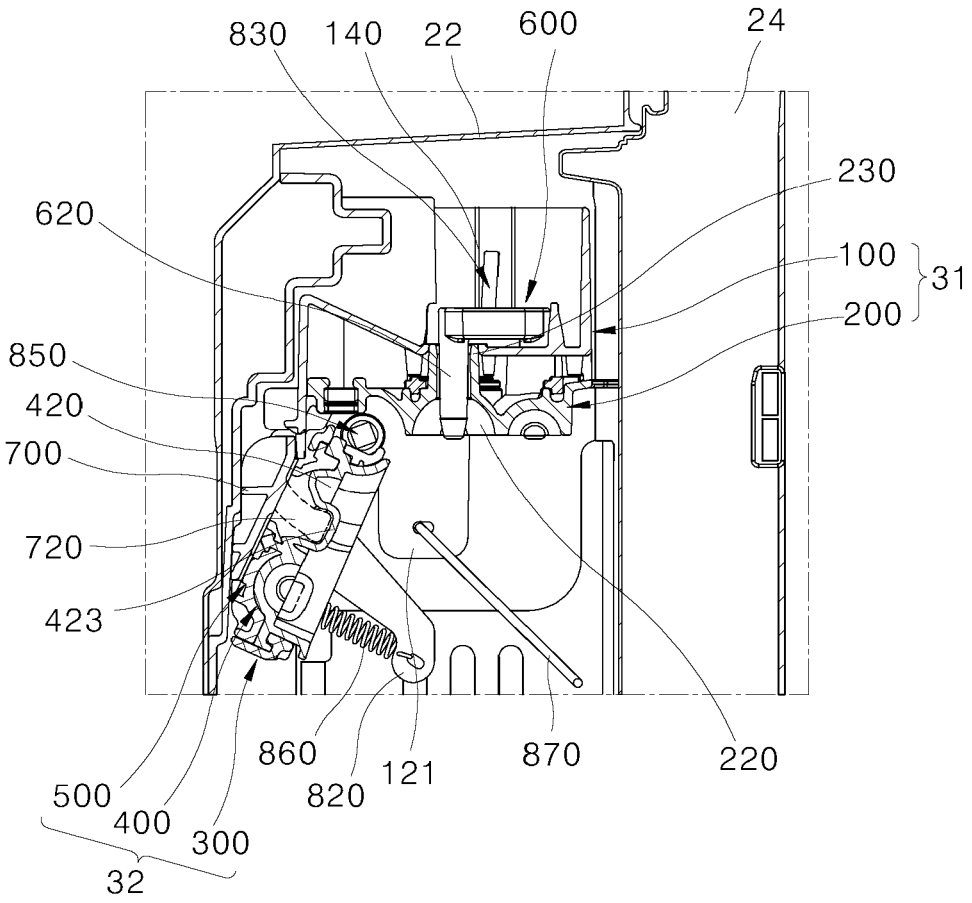

830
140
22
600
24
230
620
100
31
200
850
420
700
720
423
860
121
870
220
500
400
820
300
32

FIG. 9

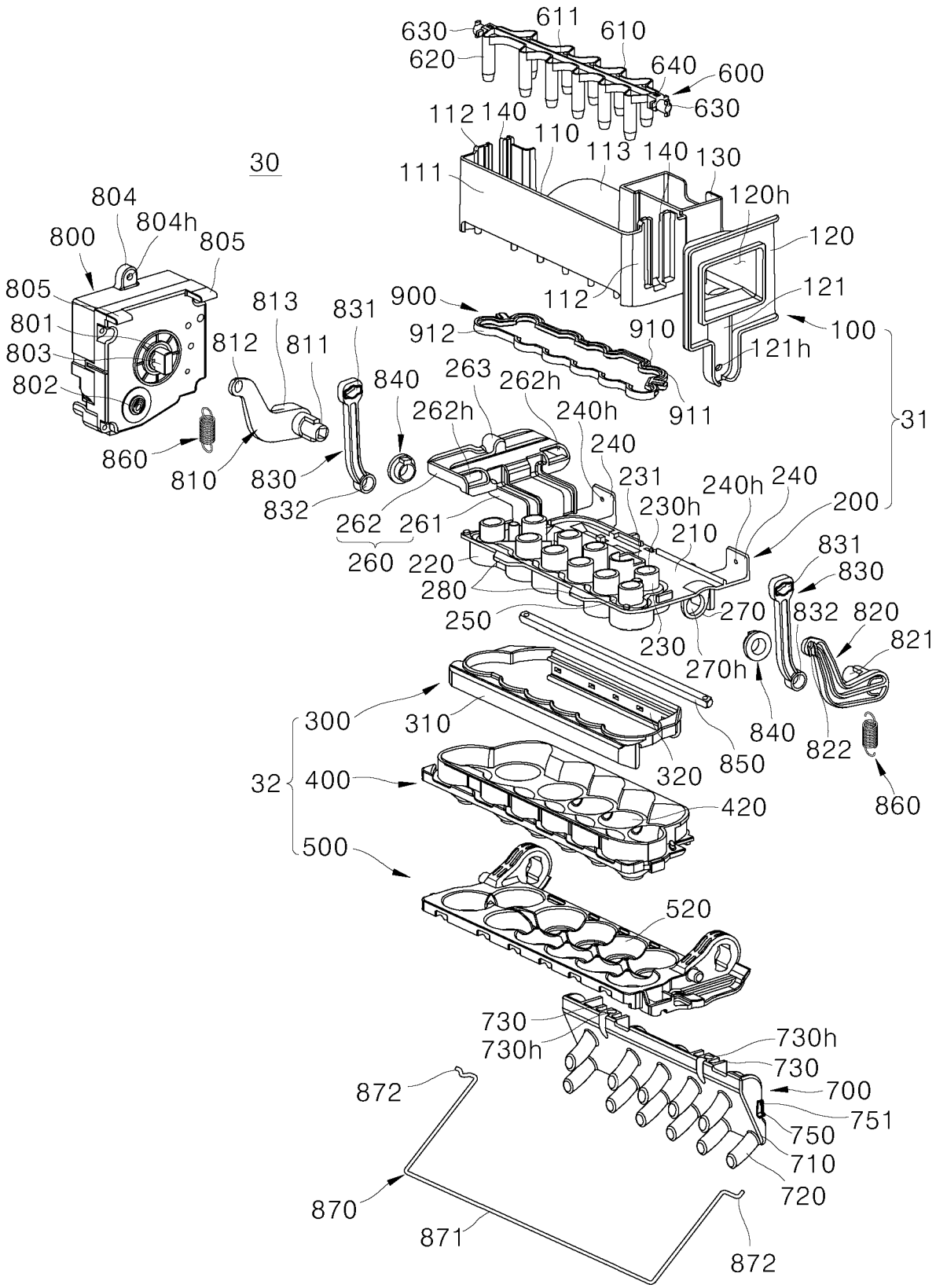

630
620
611
610
640
600
630
112
140
110
113
140
130
111
120h
120
112
121
900
912
910
100
121h
911
31
813
831
812
811
840
263
262h
240h
240
262h
860
810
830
832
262
261
260
231
230h
240h
240
200
210
220
280
250
831
830
270
832
820
821
230
270h
840
822
860
300
310
320
850
32
400
420
500
520
730
730h
730h
730
700
751
750
710
720
872
870
871
872
804
804h
805
800
805
801
803
802

FIG. 10

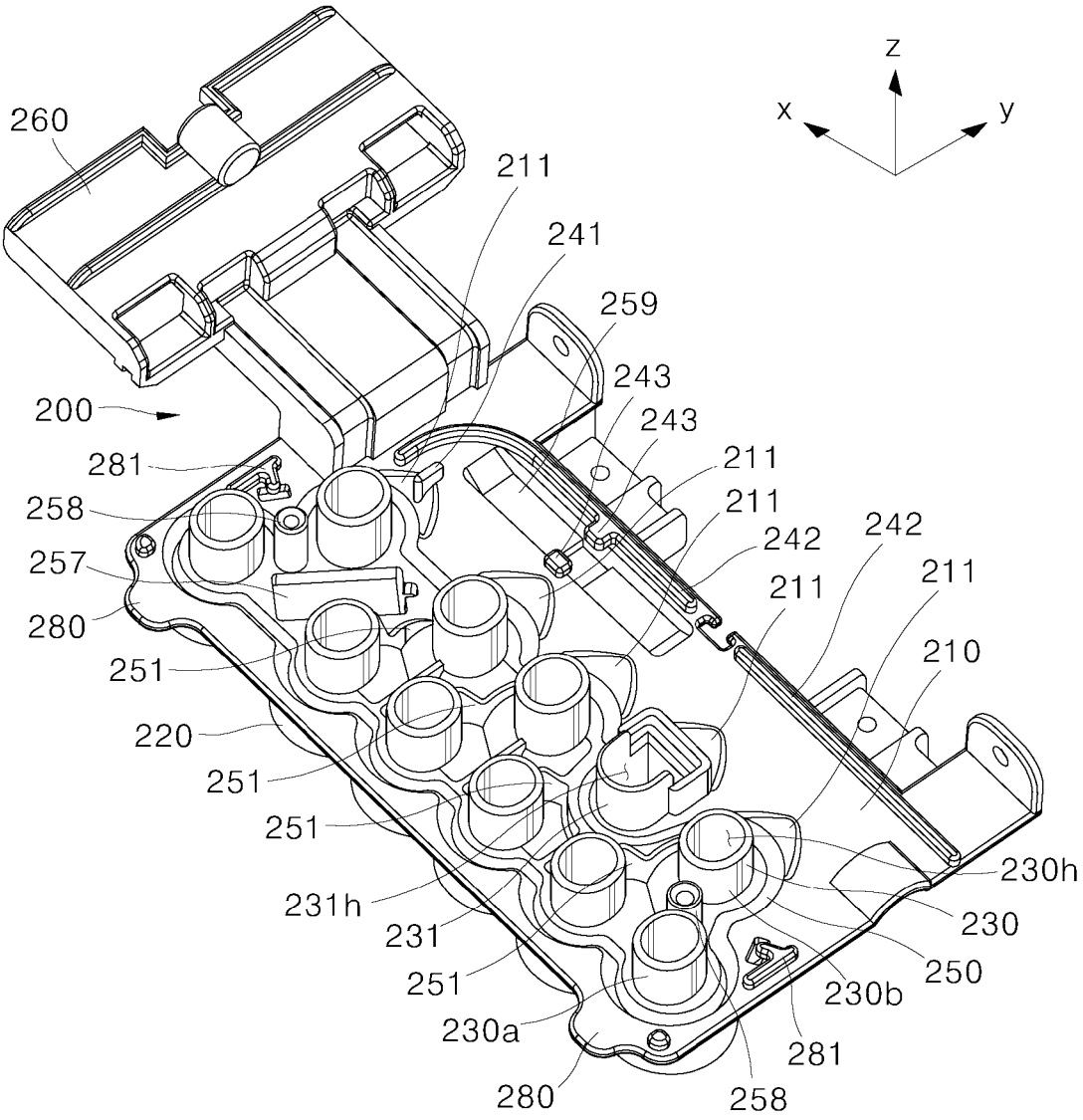

z
x
y
260
211
241
259
243
243
200
281
211
258
211
242
242
257
211
211
280
210
251
220
251
251
230h
231h
230
231
250
251
230b
230a
281
280
258

FIG. 11

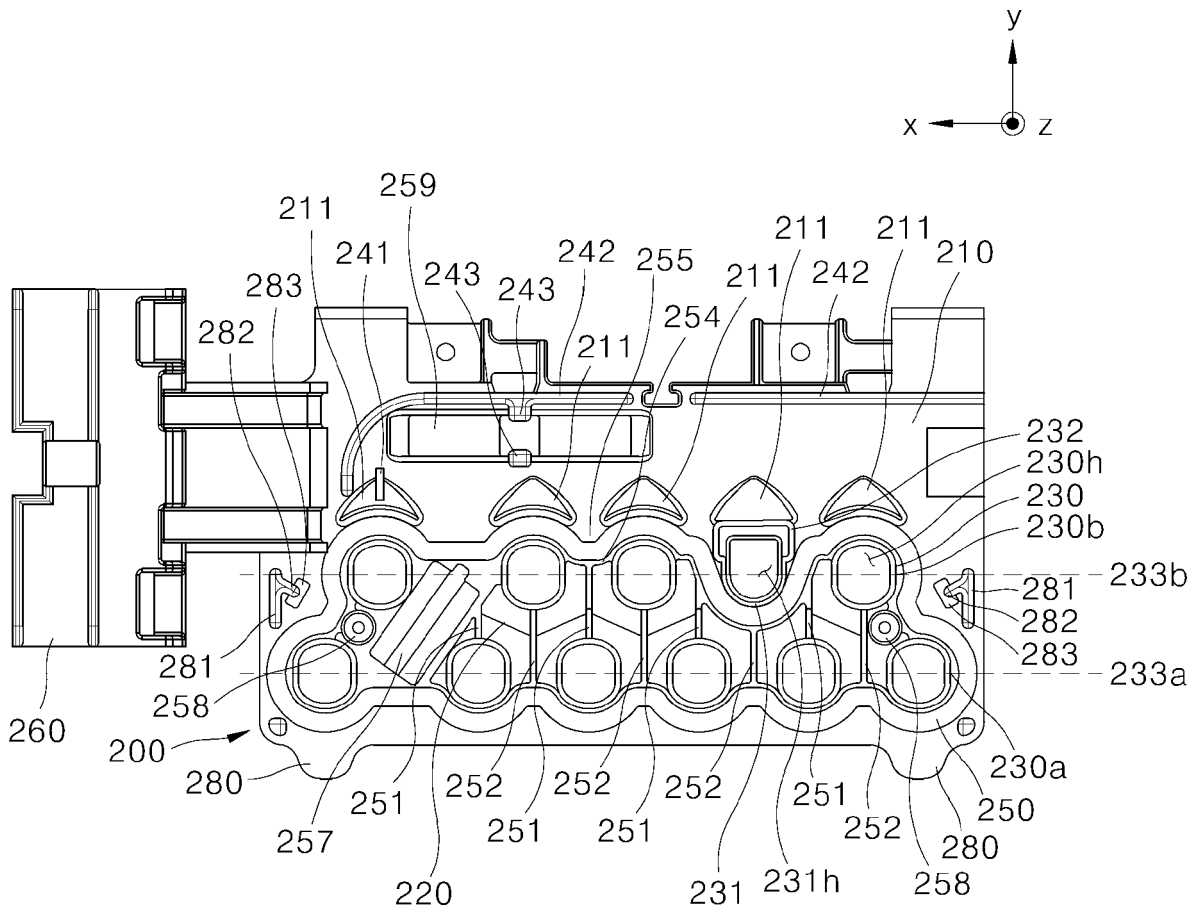

y
x
z
259
211
241
283
243
243
242
255
211
211
211
242
210
282
254
211
232
230h
230
230b
233b
281
282
283
233a
281
258
260
200
280
257
251
220
252
251
252
251
252
251
231
231h
252
258
280
250
230a

FIG. 12

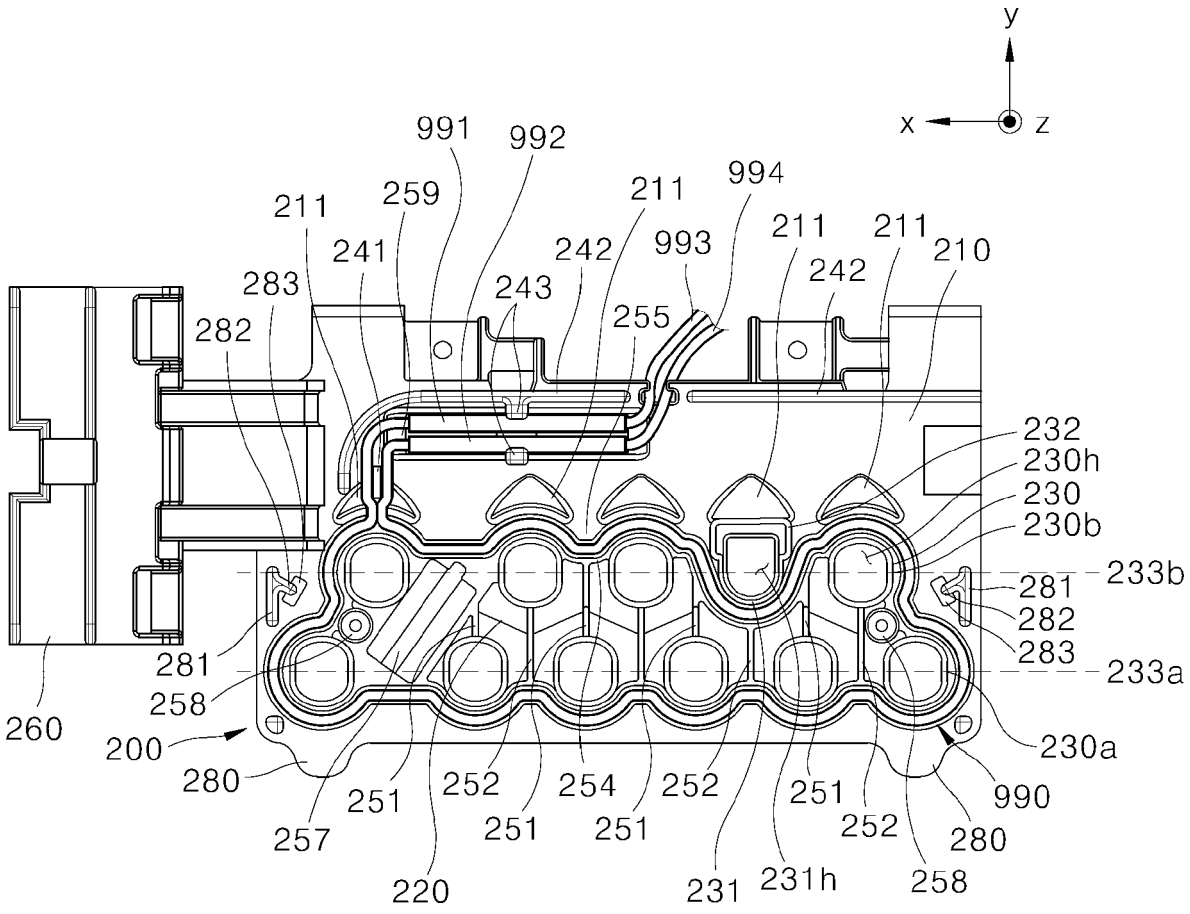

y
x
z
991
992
994
211
259
211
211
211
241
242
993
242
210
283
243
255
282
232
230h
230
230b
233b
281
282
283
233a
281
258
260
200
280
257
251
220
252
251
254
251
252
231
231h
251
252
258
280
990
230a

FIG. 13

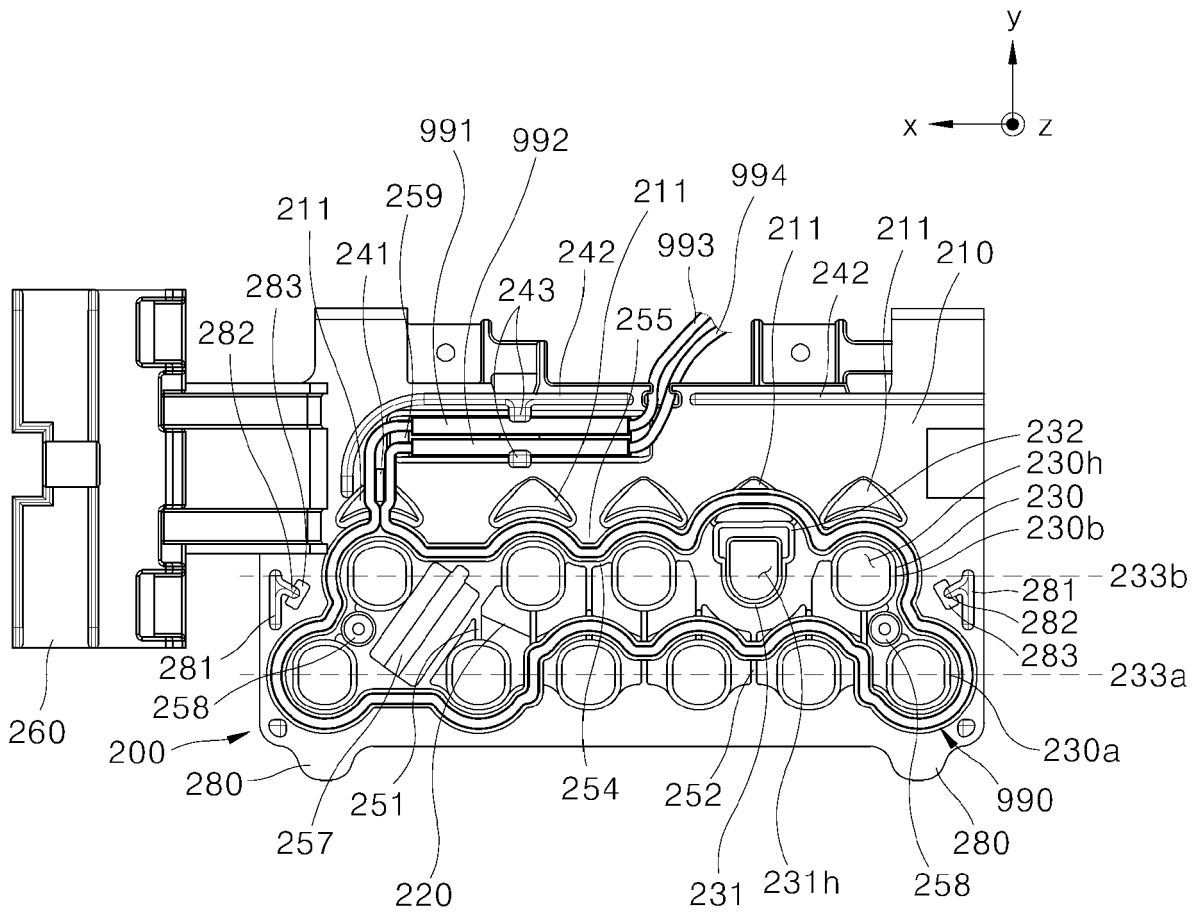

y
x
z
991
992
994
211
259
211
211
211
241
242
993
242
210
283
243
255
282
232
230h
230
230b
233b
281
282
283
233a
281
258
260
200
280
251
254
252
990
230a
257
220
231
231h
258
280

FIG. 14

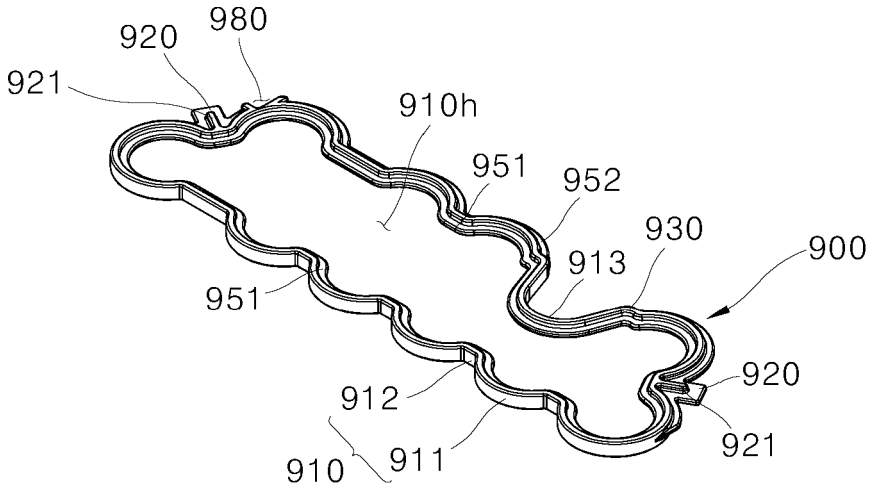

980
920
921
910h
951
952
930
900
913
951
920
912
921
910
911

FIG. 15

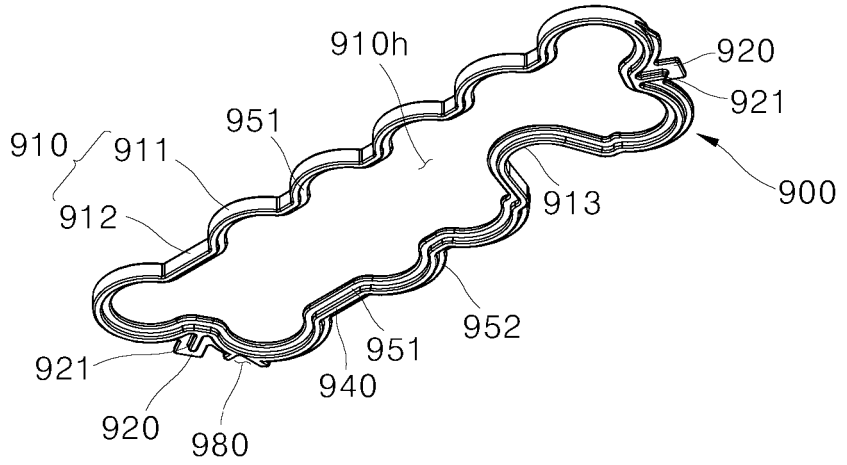

910h
920
921
951
910
911
900
912
913
952
951
921
940
920
980

FIG. 16

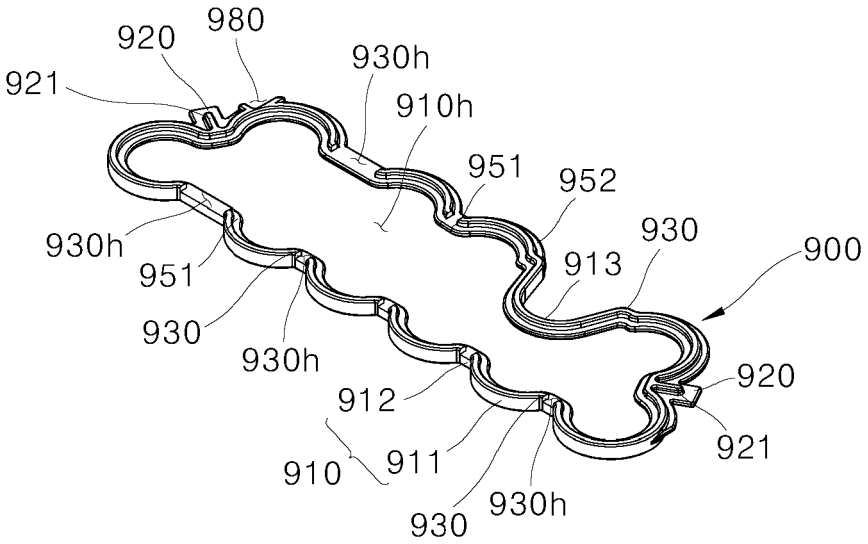

980
920
930h
921
910h
951
952
930
930h
913
900
951
930
930h
920
912
921
910
911
930h
930

FIG. 17

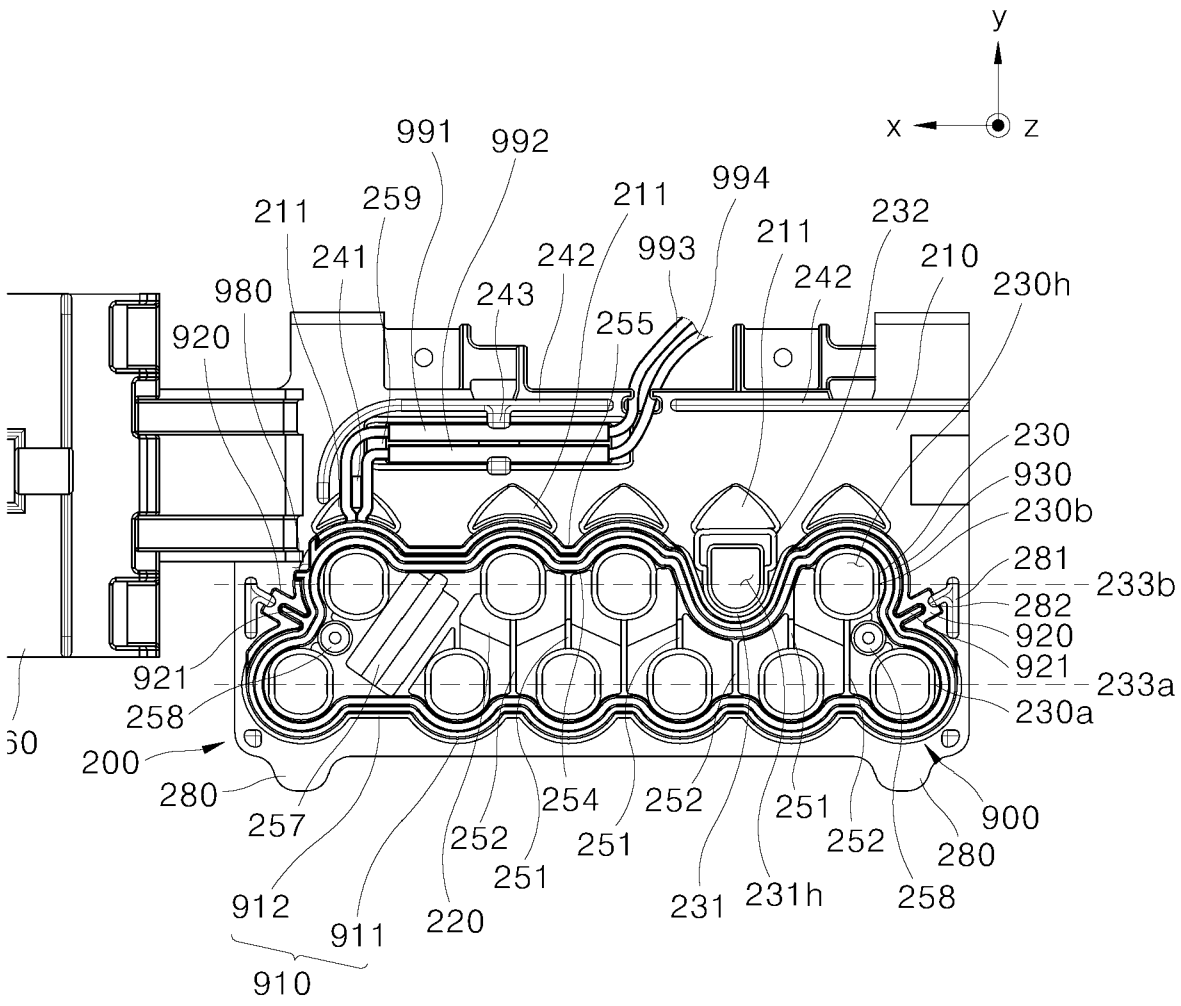

y
x
z
991
992
994
211
259
211
232
211
241
242
993
242
210
980
243
255
230h
920
230
930
230b
281
233b
282
920
921
233a
921
258
230a
200
280
257
254
252
251
252
251
900
252
280
912
911
220
251
231
231h
258
910

FIG. 18

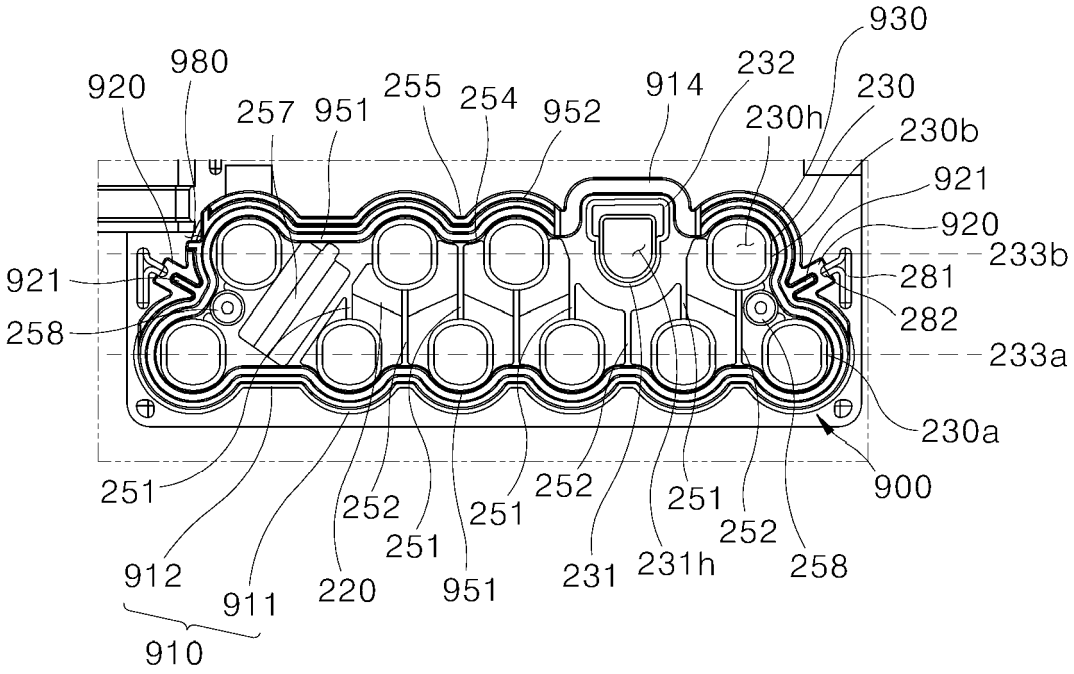

930
980
920
257
951
255
254
952
914
232
230h
230
230b
921
920
233b
921
281
258
282
233a
230a
900
251
252
251
252
251
252
912
911
910
220
951
231
231h
258

FIG. 19

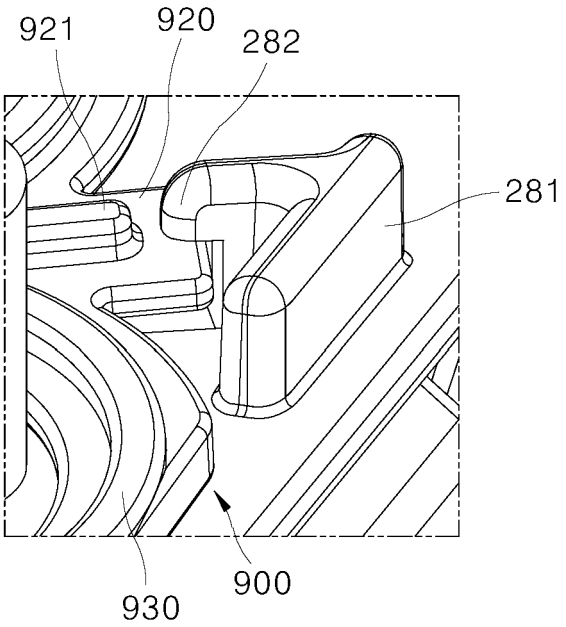

921
920
282
281
930
900

FIG. 20

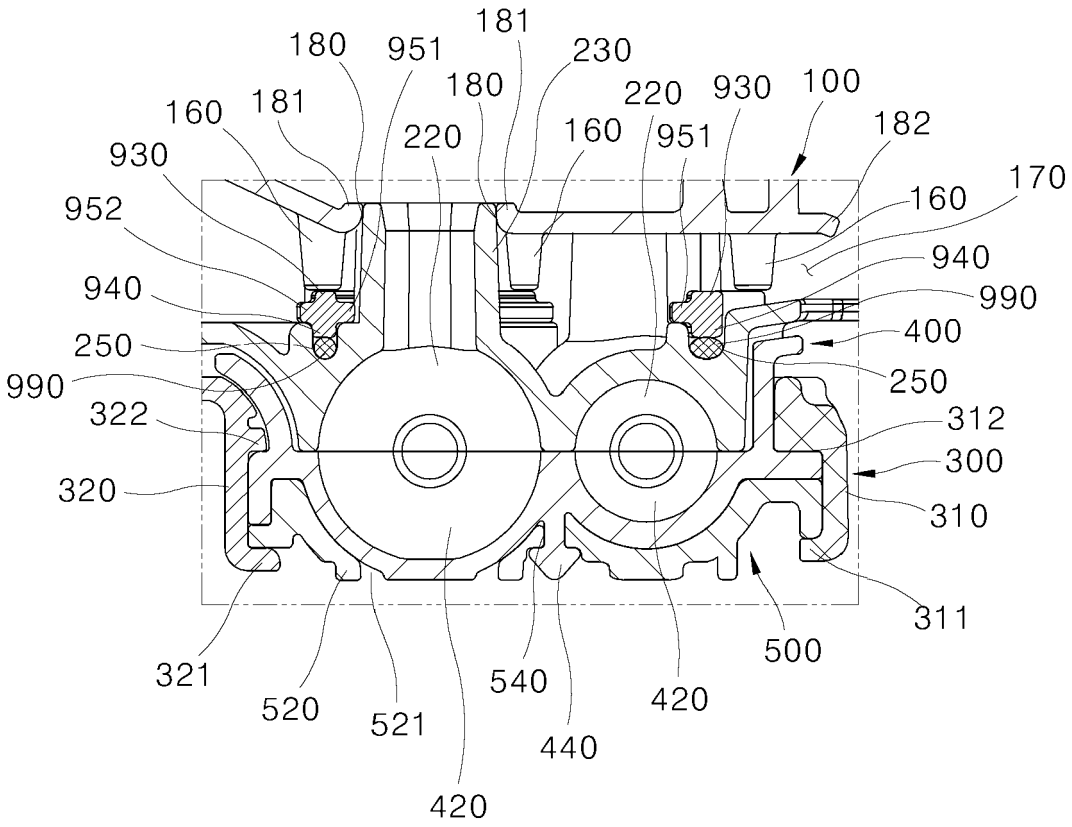

181
180
951
230
180
220
930
100
160
181
220
160
951
182
930
170
160
952
940
940
990
250
400
990
250
322
312
300
320
310
311
500
321
520
521
540
420
440
420

FIG. 21

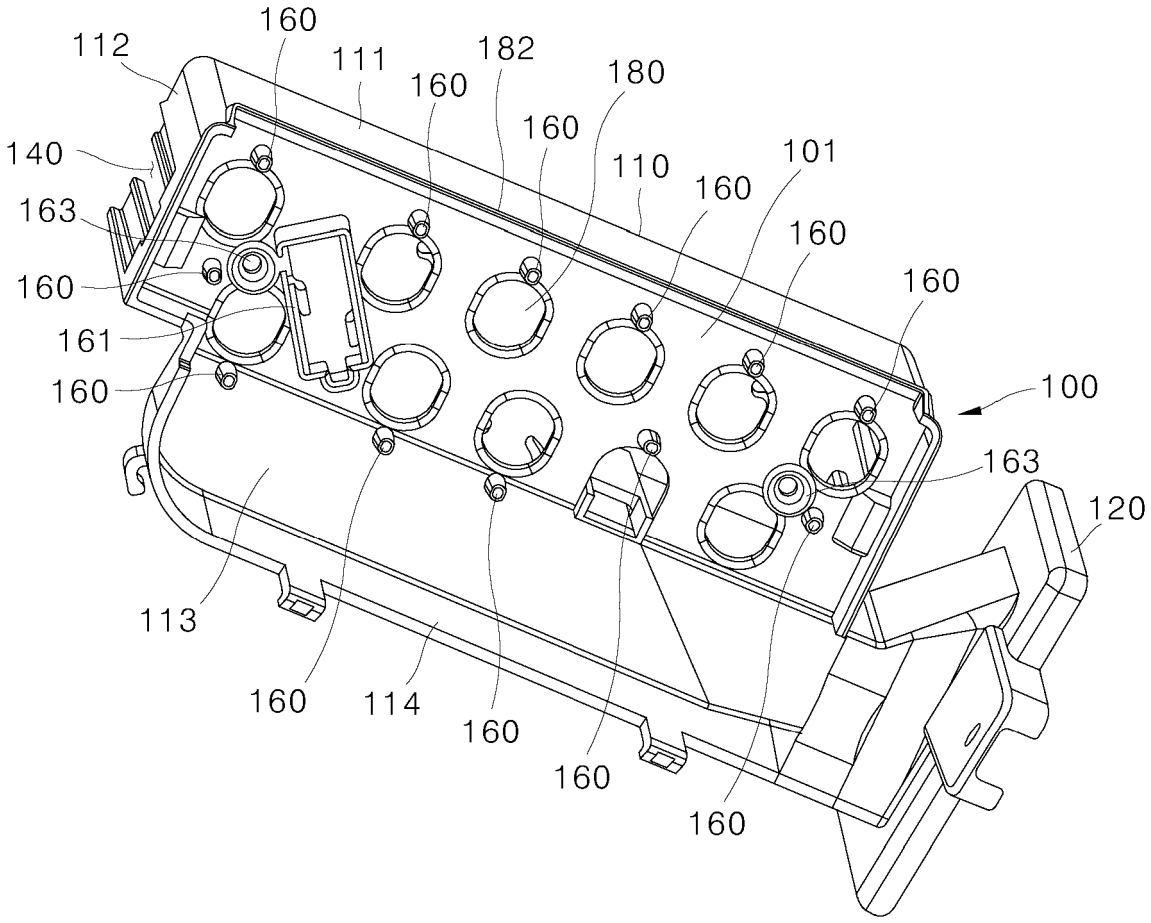

160
112
111
182
180
160
160
140
110
101
160
163
160
160
161
160
100
163
120
113
160
114
160
160
160

FIG. 22

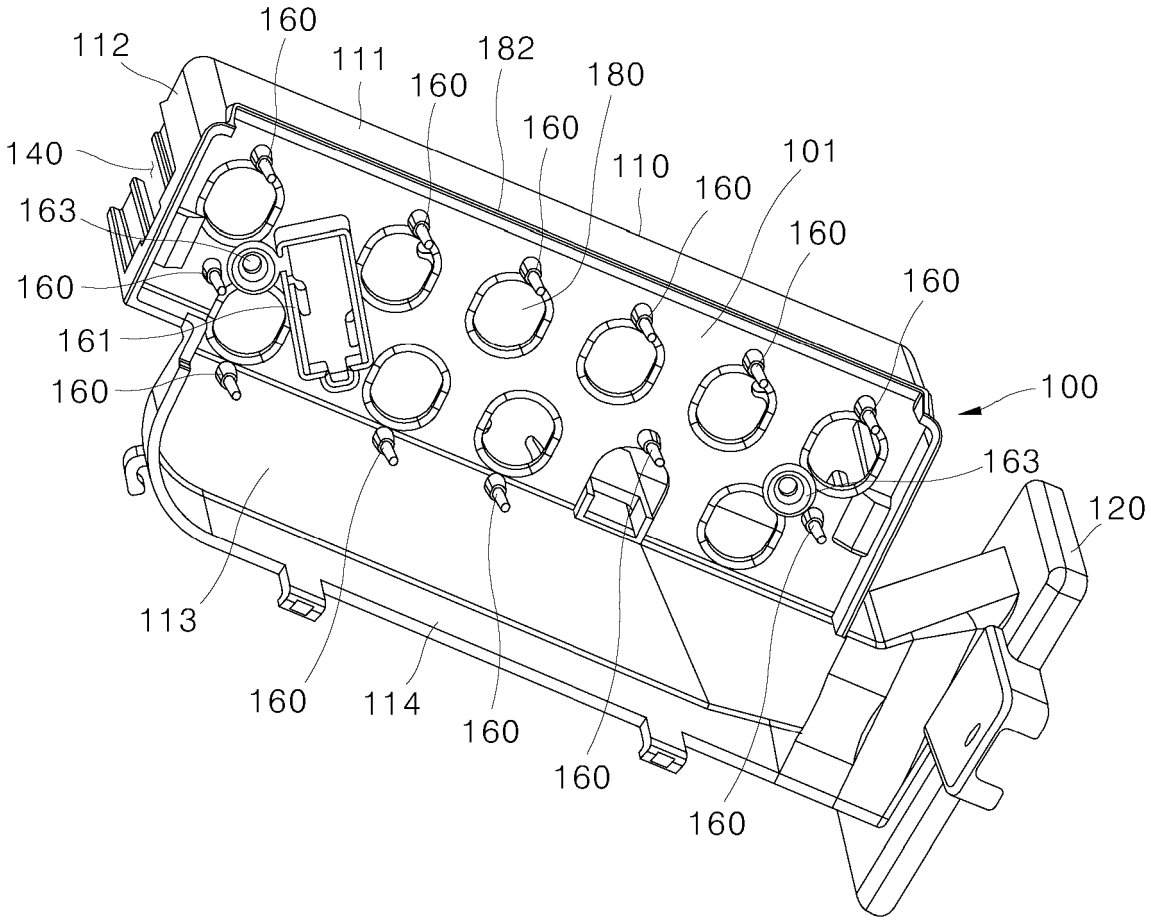

160
112
111
182
160
180
160
140
110
101
163
160
160
160
161
160
100
163
120
113
160
114
160
160
160

FIG. 23

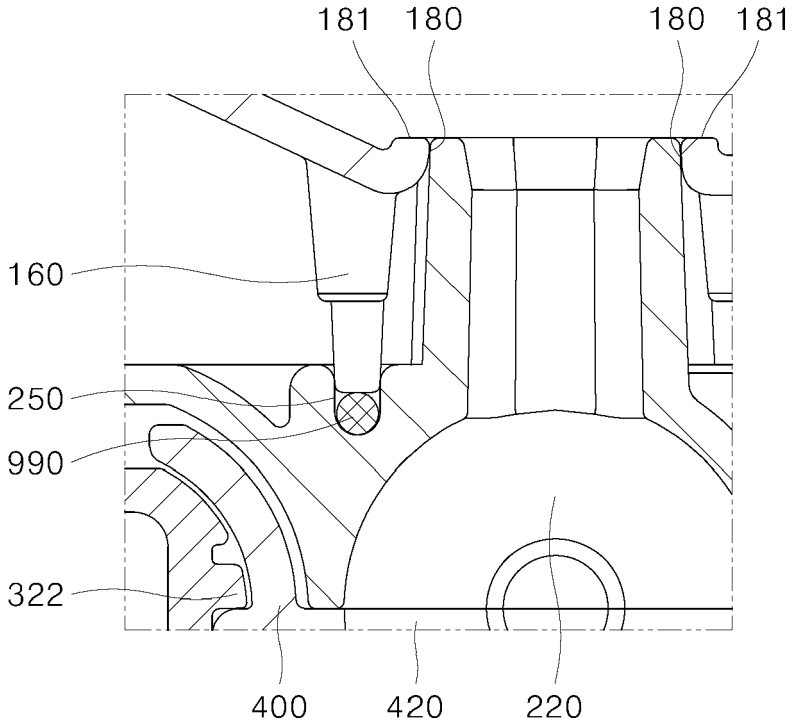


FIG. 24

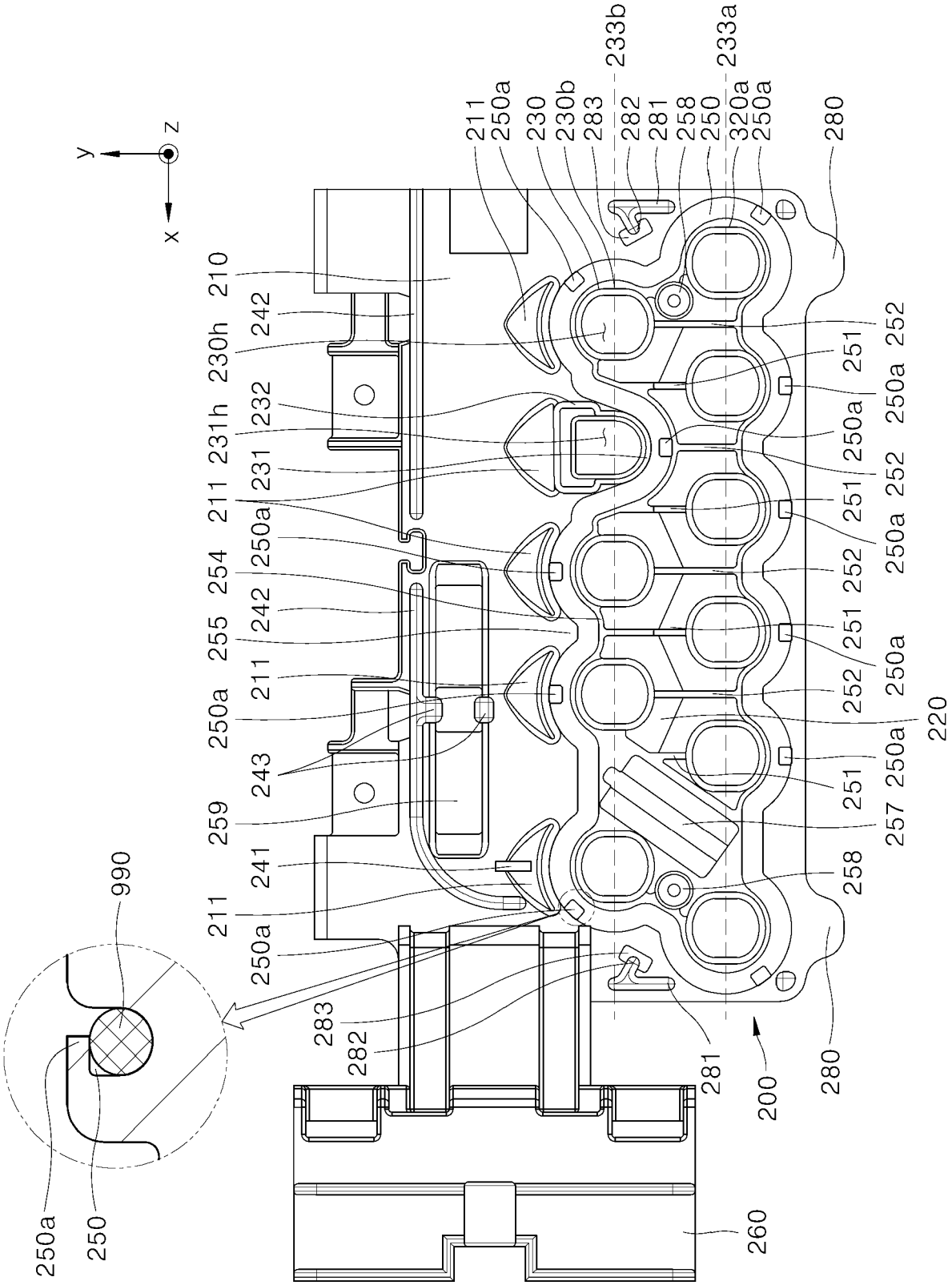

y
z
x
211
250a
230
230b
283
282
281
258
250
320a
250a
280
233b
233a
210
242
230h
232
231h
231
211
250a
254
242
255
211
250a
243
259
241
211
250a
283
282
281
200
280
260
250a
250
990
220
251
252
257

FIG. 25

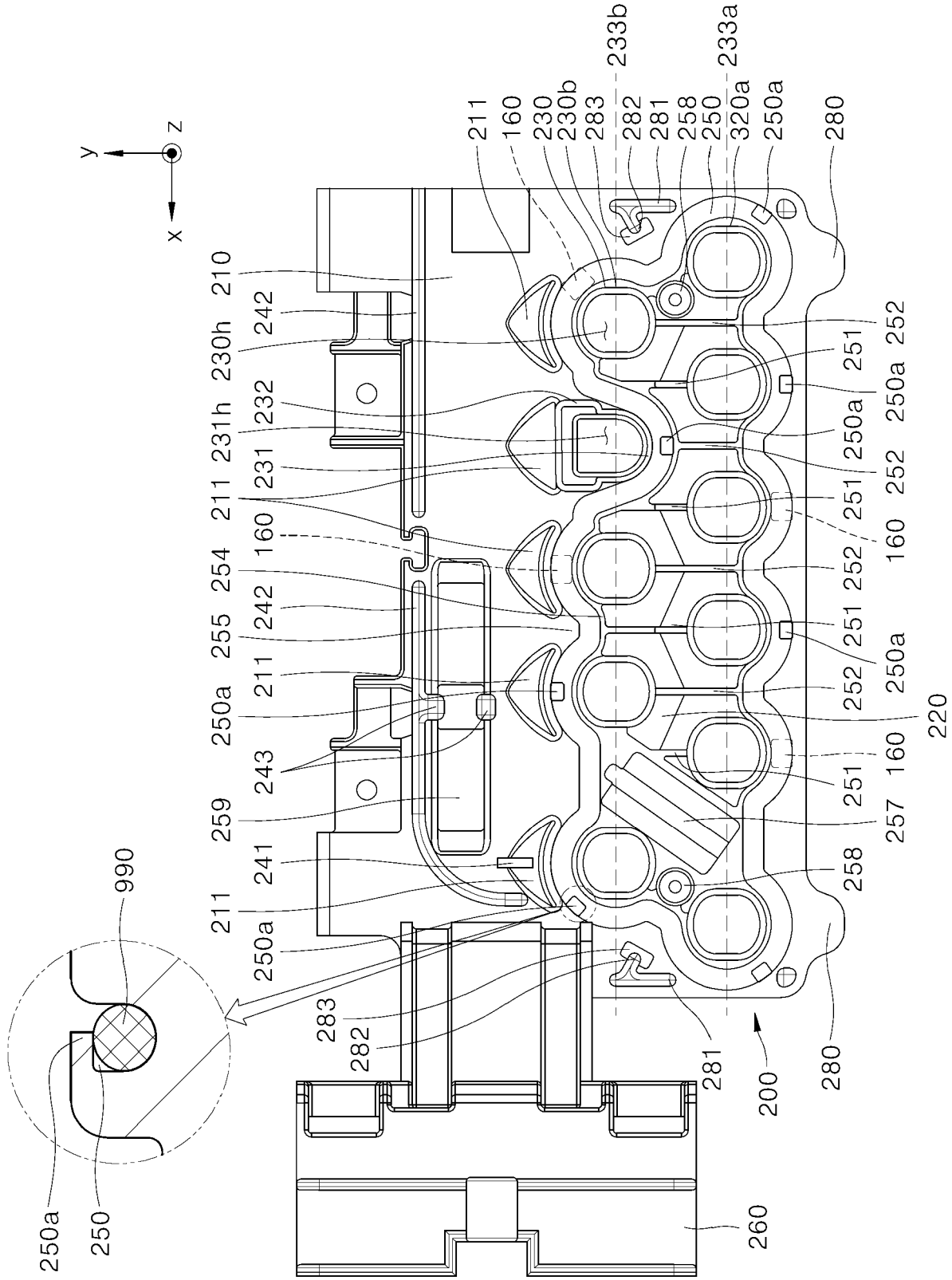

y
z
x
233b
233a
211
160
230
230b
283
282
281
258
250
320a
250a
280
210
242
230h
232
231h
231
254
255
259
241
243
990
250
260
200
220
251
252
257

FIG. 26

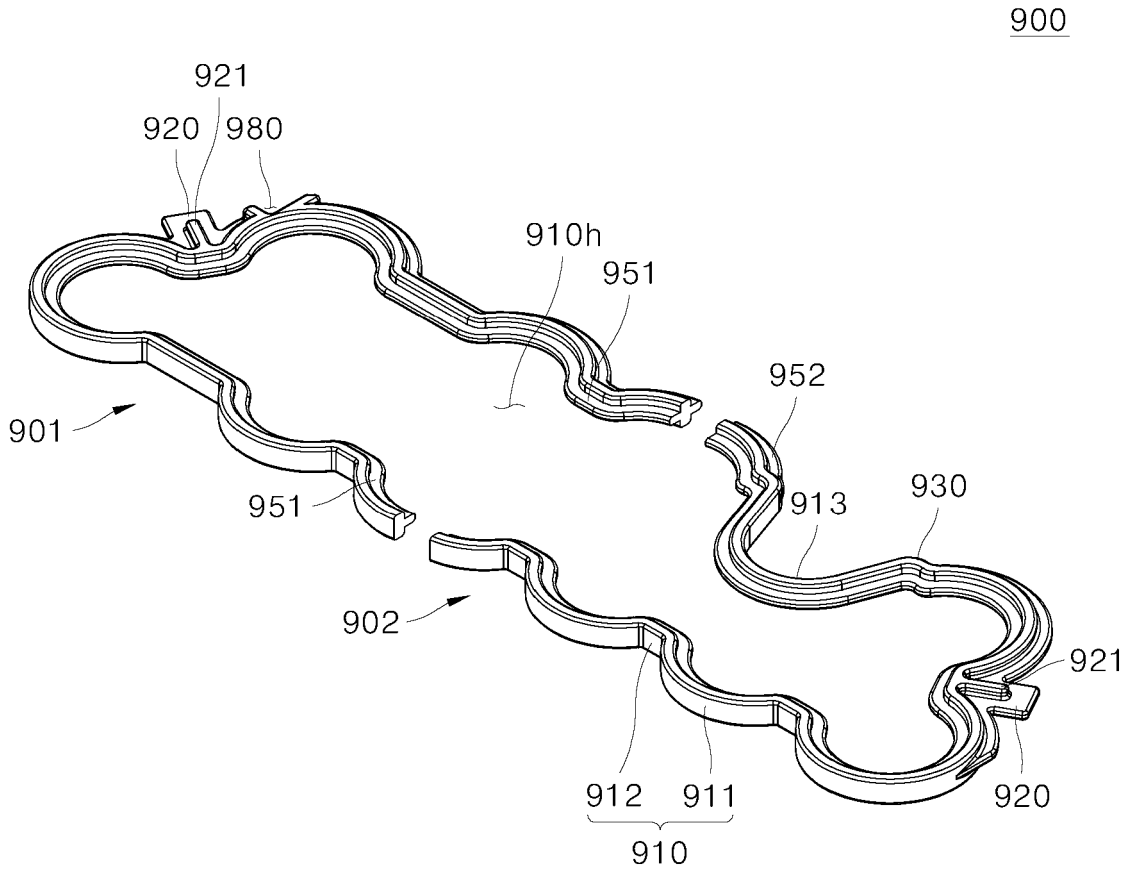

900
921
920
980
910h
951
952
901
951
913
930
902
921
912
911
920
910

FIG. 27

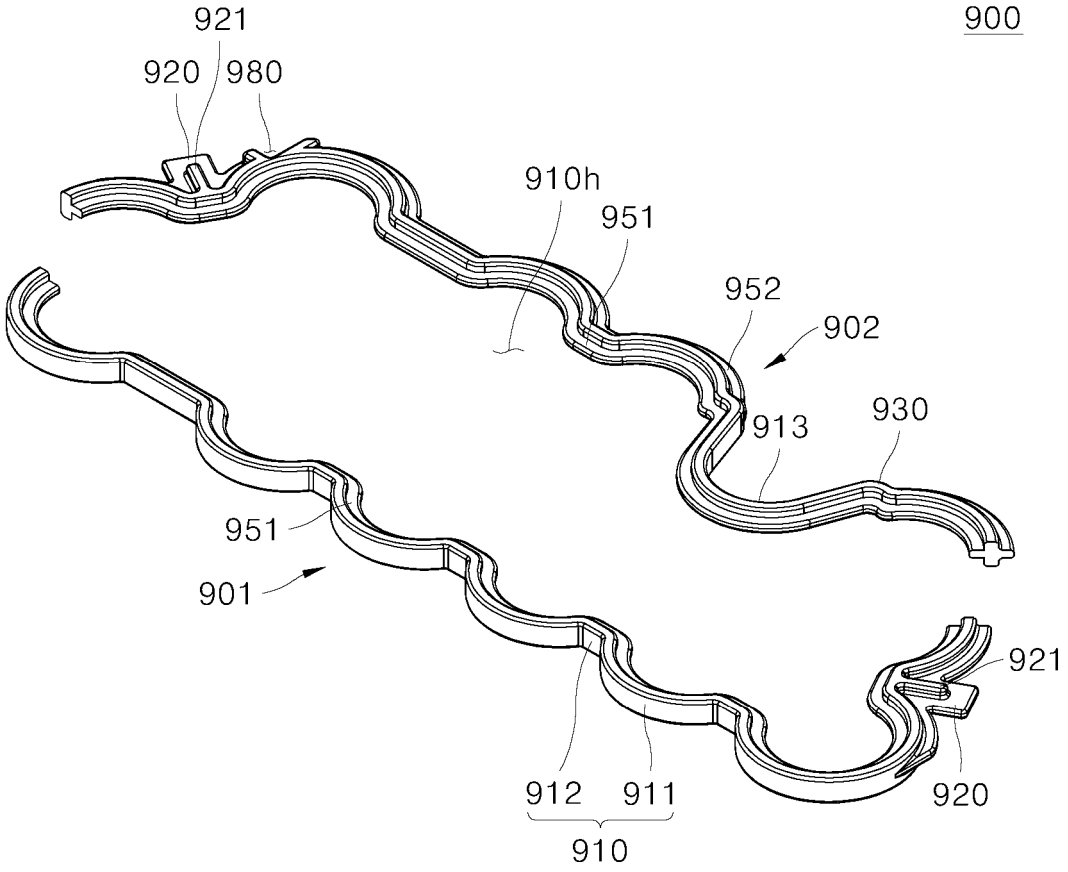
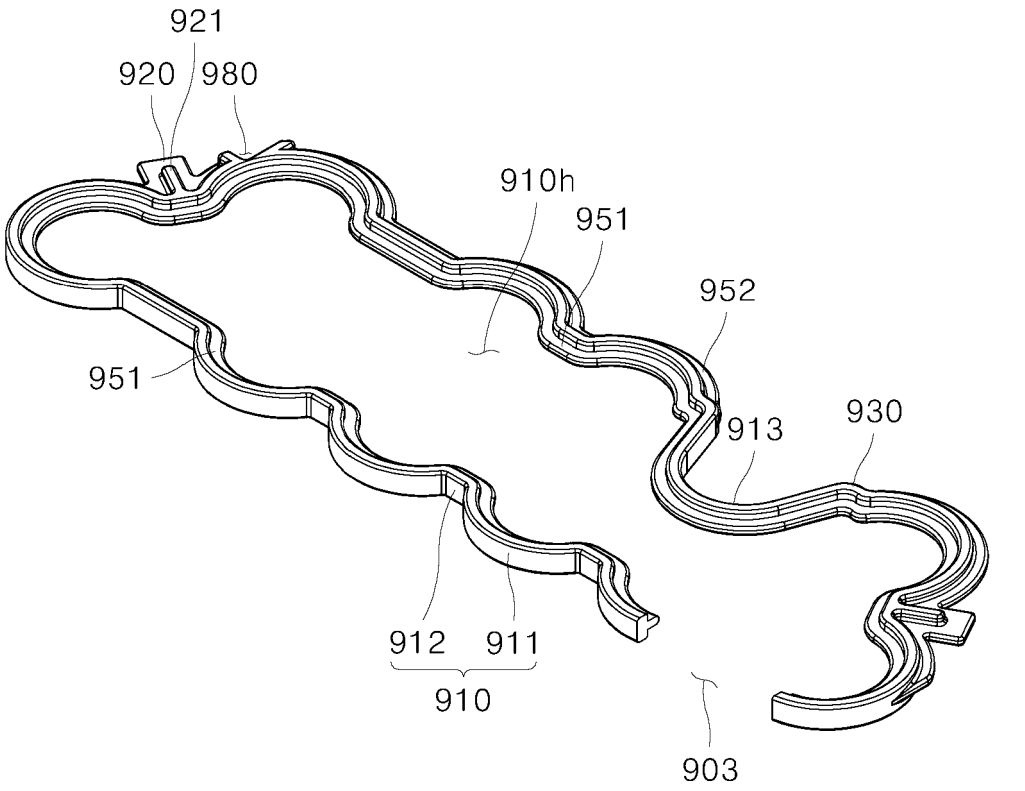

921
900
920
980
910h
951
952
902
913
930
951
901
921
912
911
920
910

FIG. 28



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 24 21 2079

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2020/158404 A1 (KIM YONGHYUN [KR] ET AL) 21 May 2020 (2020-05-21) * figures 2,18-19 * -----	1-15	INV. F25C1/04 F25C1/24 F25C5/08
X	US 2023/026086 A1 (KIM YONGHYUN [KR]) 26 January 2023 (2023-01-26) * figure 10 * -----	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

F25C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	4 March 2025	Canköy, Necdet

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 24 21 2079

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

04-03-2025

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2020158404 A1	21-05-2020	AU 2019378525 A1	24-06-2021
		AU 2023216901 A1	07-09-2023
		AU 2023216908 A1	07-09-2023
		CN 111197892 A	26-05-2020
		CN 115111845 A	27-09-2022
		CN 115111846 A	27-09-2022
		CN 115127279 A	30-09-2022
		CN 115127280 A	30-09-2022
		CN 115143680 A	04-10-2022
		CN 115143681 A	04-10-2022
		EP 3653963 A1	20-05-2020
		EP 4098956 A1	07-12-2022
		US 2020158404 A1	21-05-2020
		US 2024255204 A1	01-08-2024
		WO 2020101369 A1	22-05-2020
US 2023026086 A1	26-01-2023	CN 115682492 A	03-02-2023
		EP 4123243 A1	25-01-2023
		EP 4417903 A2	21-08-2024
		US 2023026086 A1	26-01-2023
		US 2023184477 A1	15-06-2023

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82