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

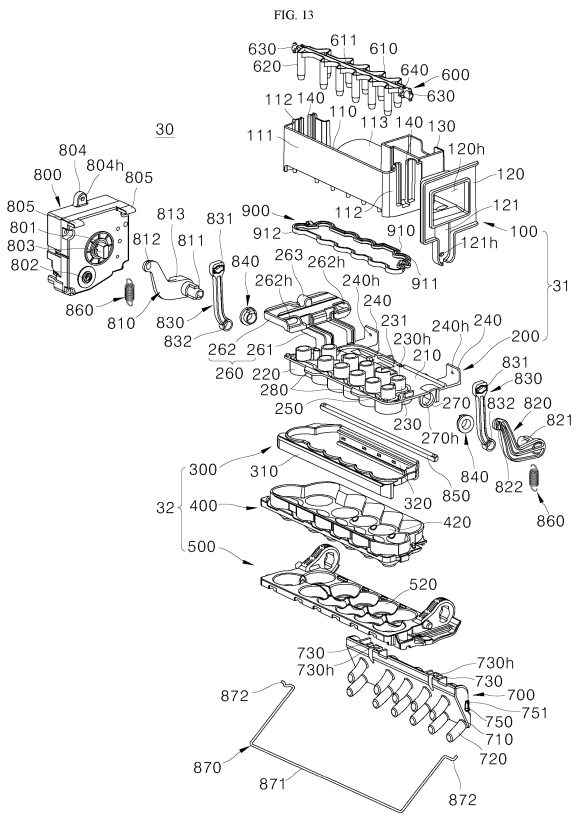
(72) Inventors:
- **CHOI, Soo Young**
08592 Seoul (KR)
- **KIM, Yong Hyun**
08592 Seoul (KR)

(74) Representative: **Vossius & Partner**
Patentanwälte Rechtsanwälte mbB
Siebertstrasse 3
81675 München (DE)

(54) ICE MAKER AND REFRIGERATOR INCLUDING THE SAME

(57) Each of an ice maker and a refrigerator has a fixing structure disposed between lower chambers adjacent to each other and constructed to fasten a lower tray and a lower supporter to each other. Thus, even when an ice chamber is deformed, unintended deformation of structures other than the ice chamber is minimized, and deformation amounts respectively applied to the ice chambers are substantially equal to each other, thereby reducing ice-removal failure.

FIG. 13



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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] 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.

[0006] 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.

[0007] In order to effectively remove ice from the ice chamber during the ice-removal process, a separate mechanism such as an ejector may be used to change a shape of the ice chamber.

[0008] However, when the ice chamber is deformed while the ice tray is not properly fixed, other structures other than the ice chamber that should be deformed may also be deformed.

[0009] When other structures other than the ice chamber that should be deformed are unintendedly deformed, this unintended deformation may cause the ice chamber to be inaccurately deformed during the ice removal process, resulting in ice-removal failure.

[0010] Furthermore, the ice tray may include multiple ice chambers to make multiple ices at once. In this case, when deformation amounts of the ice chambers are not equal to each other, the ice-removal failure may occur.

[0011] Furthermore, the ice tray may be made of a soft material such that the ice tray may be easily deformed. Thus, a fixing structure that may provide the most uniform fixing force to an entire area of the ice tray made of the soft material may be required.

[0012] A separate fastening member such as a screw may be used to secure the ice tray.

[0013] However, when the fastening member is loosened during long-term use of the ice maker, the user recognizes the loosened fastening member together with the removed ice.

SUMMARY

[0014] A purpose of the present disclosure is to provide an ice maker which may reduce unintended deformation of structures other than an ice chamber when the ice chamber of the ice tray is deformed, and a refrigerator including the same.

[0015] Furthermore, a purpose of the present disclosure is to provide an ice maker in which when a plurality of ice chambers of the ice tray are deformed, deformation amounts of the plurality of ice chambers are substantially equal to each other.

[0016] Furthermore, a purpose of the present disclosure is to provide an ice maker having a fixing structure that may provide the most uniform fixing force across an entire area of the ice tray, and a refrigerator including the same.

[0017] Furthermore, a purpose of the present disclosure is to provide an ice maker having a fixing structure that may strongly fix the ice tray without a separate fastening member, and a refrigerator including the same.

[0018] An ice maker according to one embodiment of the present disclosure for achieving the purpose as described above includes an upper tray including a plurality of upper chambers; a lower tray including a plurality of lower chambers; a lower supporter supporting a lower portion of the lower tray; and a lower cover restraining the lower tray and the lower supporter, wherein the lower tray and the lower supporter are fixed to each other using a fixing structure, wherein the fixing structure is disposed between the lower chambers adjacent to each other and is constructed to fasten the lower tray and the lower supporter to each other.

[0019] The fixing structure may include an insertion protrusion formed on the lower tray so as to protrude downwardly of the lower tray; and a slot defined in the lower supporter, wherein the insertion protrusion passes through the slot.

[0020] The plurality of lower chambers may be arranged in a plurality of rows including a first row and a second row, wherein the insertion protrusion may be disposed between the first row and the second row.

[0021] The insertion protrusion may continuously extend along an area between the first row and the second row.

[0022] The insertion protrusion may include a plurality of insertion protrusions arranged along an area between the first row and the second row and spaced from each other.

[0023] The insertion protrusion may extend in a curved manner along an outer circumference of the lower chamber.

[0024] The insertion protrusion may extend along a center line in a width direction of the lower tray.

[0025] The insertion protrusion may include a protrusion body; and a hook portion extending from the protrusion body, wherein a width of the hook portion decreases as the hook portion extends downwardly, such that the

hook portion passes through the slot.

[0026] A width of the protrusion body may be smaller than a largest width of the hook portion.

[0027] Each protrusion rib may be formed at each of both opposing ends in a length direction of the insertion protrusion, wherein each protrusion rib may have a protrusion body and a hook portion extending from the protrusion body, wherein a width of the protrusion body of the rib may be equal to the largest width of the hook portion of the rib.

[0028] The ice maker may further include a lower ejector configured to press a lower surface of the lower chamber during an ice-removal operation, wherein a fastening direction in which the fixing structure fastens the lower tray and the lower supporter to each other may be the same as a direction in which the lower ejector presses the lower chamber.

[0029] The lower tray may be made of a material softer than a material of each of the upper tray, the lower supporter, and the lower cover.

[0030] An ice maker according to one embodiment of the present disclosure for achieving the purpose as described above includes an upper tray including a plurality of upper chambers; a lower tray including a plurality of lower chambers; a lower supporter supporting a lower portion of the lower tray; and a lower cover constructed to press the lower tray and the lower supporter in opposite directions to each other, respectively, thereby restraining the lower tray and the lower supporter.

[0031] The lower cover may be constructed to be assembled to the lower tray and the lower supporter in a swing manner so as to surround a front surface and a rear surface of each of the lower tray and the lower supporter.

[0032] The lower cover may include a front wall including a first front stopping step portion pressing the lower supporter in an upward direction and a second front stopping step portion pressing the lower tray in a downward direction; and a rear wall including a first rear stopping step portion pressing the lower supporter in an upward direction and a second rear stopping step portion pressing the lower tray in a downward direction.

[0033] A size of an area where the first rear stopping step portion contacts the lower supporter may be larger than a size of an area where the first front stopping step portion contacts the lower supporter.

[0034] The first rear stopping step portion may extend further inwardly of the lower supporter beyond the first front stopping step portion.

[0035] The first rear stopping step portion may continuously extend along the plurality of lower chambers arranged in one direction.

[0036] The first front stopping step portion may include a plurality of first front stopping step portions arranged along the plurality of lower chambers arranged in one direction, wherein the plurality of first front stopping step portions may be spaced from each other.

[0037] The second rear stopping step portion may continuously extend along the plurality of lower chambers arranged in one direction.

[0038] The second front stopping step portion may include a plurality of second front stopping step portions arranged along the plurality of lower chambers arranged in one direction, wherein the plurality of second front stopping step portions may be spaced from each other.

[0039] A refrigerator according to one embodiment of the present disclosure for achieving the purpose as described above 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 upper tray including a plurality of upper chambers; a lower tray including a plurality of lower chambers; a lower supporter supporting a lower portion of the lower tray; and a lower cover restraining the lower tray and the lower supporter, wherein the lower tray and the lower supporter are fixed to each other using a fixing structure, wherein the fixing structure is disposed between the lower chambers adjacent to each other and is constructed to fasten the lower tray and the lower supporter to each other.

[0040] The lower cover may be constructed to press the lower tray and the lower supporter in opposite directions to each other, respectively, thereby restraining the lower tray and the lower supporter.

[0041] The lower cover may be constructed to be assembled to the lower tray and the lower supporter in a swing manner so as to surround a front surface and a rear surface of each of the lower tray and the lower supporter.

[0042] Each of the ice maker and the refrigerator according to the present disclosure has the fixing structure disposed between the lower chambers adjacent to each other and constructed to fasten the lower tray and the lower supporter to each other. Thus, even when the ice chamber is deformed, unintended deformation of structures other than the ice chamber may be minimized, and deformation amounts respectively applied to the ice chambers may be substantially equal to each other, thereby reducing the ice-removal failure.

[0043] Furthermore, each of the ice maker and the refrigerator according to the present disclosure has the lower cover that presses the lower tray and the lower supporter in opposite directions to each other, respectively to restrain the lower tray and the lower supporter. Thus, even when the ice chamber is deformed, unintended deformation of structures other than the ice chamber may be minimized, and deformation amounts respectively applied to the ice chambers may be substantially equal to each other, thereby reducing the ice-removal failure.

[0044] Furthermore, the ice maker and refrigerator according to the present disclosure may have the fixing structure which is positioned between the adjacent lower chambers, and fastens the lower tray and the lower supporter to each other. Using the first fixing structure, the lower cover presses the lower tray and the lower supporter in opposite directions, respectively so as to

restrain the lower tray and the lower supporter, thereby applying the most uniform fastening force across the entire area of the ice tray.

[0045] Furthermore, the ice maker and refrigerator according to the present disclosure may have the fixing structure which is positioned between the adjacent lower chambers, and fastens the lower tray and the lower supporter to each other. Using the first fixing structure, the lower cover presses the lower tray and the lower supporter in opposite directions, respectively so as to restrain the lower tray and the lower supporter. Thus, the fixing structure capable of strongly fixing the ice tray without a separate fastening member may be provided.

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 cross-sectional rear view of the door when the ice maker is mounted in the door, and FIG. 5 is a cross-sectional side view of the door when the ice maker is mounted in the door.

FIG. 6 and FIG. 7 are front and rear perspective views of the ice maker, respectively.

FIG. 8 and FIG. 9 are bottom perspective views of the ice maker before and after ice removal, respectively.

FIG. 10 is a rear view of the ice maker when the ice maker is mounted on the support mechanism.

FIG. 11 and FIG. 12 are cross-sectional side views of the ice maker before and after ice removal, respectively.

FIG. 13 is an exploded perspective view of the ice maker.

FIG. 14 and FIG. 15 are perspective views in various directions of the lower cover.

FIGS. 16 to 18 illustrate various embodiments of the lower cover.

FIG. 19 and FIG. 20 are perspective views in various directions of the lower tray.

FIG. 21 is a side view of the lower tray, and FIG. 22 is a side cross-sectional view thereof.

FIGS. 23 to 27 illustrate various embodiments of the lower tray.

FIGS. 28 and 29 are perspective views in various directions of the lower supporter.

FIGS. 30 to 32 illustrate various embodiments of the lower supporter.

FIGS. 33 and 34 are perspective views in various directions of the lower assembly.

FIGS. 35 and 36 are plan and bottom views of the lower assembly, respectively.

FIG. 37 is a perspective view illustrating a scheme in which the lower cover is coupled to the lower tray and the lower supporter.

FIGS. 38 and 39 are perspective views showing cross-sections of the lower cover before and after coupling the lower cover to the to the lower tray and the lower supporter, respectively.

FIG. 40 illustrates a cross-sectional side view of a lower assembly according to another embodiment.

FIG. 41 and FIG. 42 illustrate a fastening structure of a lower tray and a lower supporter according to another embodiment.

FIG. 43 illustrates a fastening structure of a lower tray and a lower supporter according to still another embodiment.

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 13, 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 5, 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 compart-

ment 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. 6 to FIG. 13, 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.

[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 downwardly from the upper plate 210. Each inlet guide 230 having a pin inlet opening 230h defined therein into which each upper ejecting pin 620 is inserted may extend upwardly from each upper chamber 220. 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. 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.

[0066] 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. A heating wire (not shown) is received in the heating wire receiving groove 250, so that the ice may be more easily removed from the upper chamber 220 during the ice-removal process. A heating wire cover 900 may be disposed on a top of the heating wire (not shown). The heating wire cover 900 incudes a heating wire cover body 910 having a closed curve shape and 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 a combination of the plurality of upper chambers 220.

[0067] 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.

[0068] 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.

[0069] 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 and FIG. 10, the support mechanism 40 includes a support body 41 extending in the vertical direction. A coupling body 45 may be formed on a back surface of the support body 41. A pair of receiving holes 42 through which the coupling portions 240 of the upper tray 200 may respectively pass rearwardly may be defined in the coupling body 45. 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. In this case, a guide rib 47 may be formed on an upper end of the

coupling body 45 to guide a boundary surface of an upper area of the coupling portion 240. The ice maker 30 may be fixed to the support mechanism 40 by a separate fastening member that passes through the coupling hole 240h of the coupling portion 240 and is fastened to the coupling body 45.

[0070] 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.

[0071] 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.

[0072] 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.

[0073] A pair of hinge bodies 530 may be disposed on both opposing sides of the lower supporter 500 and may be respectively connected to the pair of hinge supporters 270 of the upper cover 100. A hinge hole 531 of the hinge body 530 may be connected to the hinge hole 270h of the hinge supporter 270. Respective shaft connection portions 811 and 821 of a first link 810 and a second link 820 may pass through the hinge holes 531 of the pair of hinge bodies 530, 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 which are arranged to face each other. A rotation 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 rotating shaft 801 of the driving unit 800, thereby transmitting the driving force of the driving unit 800 to the lower assembly 32.

[0074] A pair of coupling shafts 512 protruding outwardly may be respectively formed on both opposing sides of the lower supporter 500. Each coupling shaft 512 may be coupled to a supporter connection hole 832 defined in one side surface of each of a 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.

[0075] 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 an elastic member coupling portion 513 formed on each of both opposing sides of the lower supporter 500. For example, a catcher groove 514 may be recessed into a bottom of the elastic member coupling portion 513 such that the other end of the elastic member is caught with the catcher groove. 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.

[0076] 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.

[0077] 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 44 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 46 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.

[0078] 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. A pair of ejector connection guides 291 may be disposed on a rear surface of the upper cover 100 and may extend in a downward direction to be positioned in front of an upper area of the lower ejector 700 so as to guide a fixing position of the lower ejector 700.

[0079] 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 opposing ends thereof, and a pair of hooks 872 respectively formed at both opposing 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 through-hole 121h of 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.

[0080] Hereinafter, the lower cover 300, the lower tray 400, and the lower supporter 500 constituting the lower assembly 32 will be described in more detail with reference to FIG. 14 to FIG. 40.

[0081] Referring to FIG. 19 to FIG. 27, 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 under an external force. For example, the lower tray 400 may be made of a silicone material. When the lower tray 400 is made of a silicone material, the lower tray 400 may return to its original shape even when the external force is applied to the lower tray 400 during the ice-removal process such that the lower tray 400 is deformed. Therefore, even when the ice making process is repeatedly performed, the spherical ice may be made.

[0082] The lower tray 400 may include the plurality of lower chambers 420. The lower chambers 420 may be connected to each other via a chamber connection portion 421. Therefore, the plurality of lower chambers 420 connected to each other via the chamber connection portion 421 and the chamber connection portion 42 1 may substantially constitute a significant portion of a body of the lower tray 400.

[0083] The plurality of lower chambers 420 may be arranged in a plurality of rows. Each row extends in the first direction. The plurality of rows may be arranged in the second direction intersecting the first direction. For example, a plurality of first-row lower chambers 420a may be arranged along a first row, and a plurality of second-row lower chambers 420b may be arranged along a second row. The lower chambers 420 arranged in the same row may be arranged so that side surfaces thereof contact each other. However, the present disclosure is not limited thereto, and one lower chamber 420 may be spaced, by a predetermined spacing, from an adjacent lower chamber 420 thereto. The first-row lower chamber 420a and the second-row lower chamber 420b are arranged in the left-right direction corresponding to the long sides of the lower tray 400, respectively. The first-row lower chambers 420a and the second-row lower chambers 420b may be arranged alternatively in in the left-right direction to increase space efficiency. That is, the first-row lower chambers 420a and the second-row lower chambers 420b may be arranged in a zigzag manner in the plan view. In the present disclosure, an example in which the lower chambers 420 are arranged in the first row and the second row is described. However, the present disclosure is not limited thereto, and the rows in which the lower chambers 420 are arranged may further include a third row, a fourth row, etc.

[0084] A pressed portion 423 may be formed on a bottom of each lower chamber 420. The pressed portion 423 may be an area that comes into contact with the lower ejecting pin 720 when the lower tray 400 is deformed by the lower ejector 700. The pressed portion 423 is formed at a center of the lower chamber 420 so that when the lower chamber 420 is deformed by the lower ejecting pin 720, the lower chamber 420 may be deformed as in a uniform manner as possible. Furthermore, the pressed portion 423 is formed in a flat shape having a larger area size in a plan view than an area size thereof in contact with the lower ejecting pin 720. The pressed portion 423 is formed to have a predetermined thickness so as to reduce wear of the bottom of the lower chamber 420 due to repeated deformation thereof.

[0085] Referring to FIG. 16, an insertion protrusion 440 protruding in a downward direction may be formed between adjacent lower chambers 420. The insertion protrusion 440 may be formed between the first-row lower chambers 420a and the second-row lower chambers 420b The insertion protrusion 440 may be formed to extend in an elongate manner in the left-right direction. For example, the insertion protrusion 440 may be formed to extend continuously so as to overlap the plurality of

first-row lower chambers 420a and the plurality of second-row lower chambers 420b in the front-rear direction of the lower tray 400. The insertion protrusion 440 may be inserted into and fastened to a slot 540 of the lower supporter 500 as described below, thereby acting as a fixing structure that fastens the lower tray 400 and the lower supporter 500 to each other. The insertion protrusion 440 may be fastened to the slot 540 of the lower supporter 500 in a hook coupling scheme, thereby allowing the lower tray 400 and the lower supporter 500 to be fastened to each other without a separate fastening member.

[0086] The insertion protrusion 440 may be disposed between lower chambers 420 adjacent to each other in the front-back direction, and may extend in a curved manner along a curved arc of a circumference of the lower chamber 420. As the insertion protrusion 440 extends in the curved manner in this way, a contact area between the lower tray 400 and the lower supporter 500 may be increased, thereby more effectively preventing the lower tray 400 from being removed from the lower supporter 500.

[0087] Furthermore, as the insertion protrusion 440 extends in the curved manner along a curved arc of a circumference of the lower chamber 420, a distance from the insertion protrusion 440 to a center of each lower chamber 420 may be constant as the insertion protrusion 440 extends in the curved manner along the curved arc of the circumference of the lower chamber 420. Accordingly, even when the lower ejector 700 presses the lower chamber 420, each lower chamber 420 may secure a deformation amount thereof such that each lower chamber 420 may be deformed as uniformly as possible without being affected by a shape of the insertion protrusion 440. However, the shape of the insertion protrusion 440 is not limited thereto. In another example, the insertion protrusion 440 may extend in a straight shape while being disposed between the lower chambers 420 adjacent to each other in the front-back direction.

[0088] The insertion protrusion 440 may include a protrusion body 446 extending downwardly so as to pass through the slot 540 of the lower supporter 500, and a hook 441 connected to a bottom of the protrusion body 446. The hook 441 may be formed to have a width that decreases as the hook extends downwardly. Accordingly, the hook 441 of the insertion protrusion 440 may easily pass through the slot 540 of the lower supporter 500. A width of the protrusion body 446 may be smaller than the largest width of the hook 441. For example, at a connection position between the protrusion body 446 and the hook 441, the protrusion body 446 may include a recess 442 that is recessed inwardly beyond a top of the hook 441. The width of the protrusion body 446 may be smaller than the largest width of the hook 441 by the recess 442 formed in the above manner, such that a step portion 445 may be formed at a boundary between the protrusion body 446 and the hook 441. The step portion 445 of the hook 441 formed in this manner may allow the hook 441 having passed through the slot 540 of the lower supporter 500 to be hook-coupled to the slot 540 prevent the lower tray 400 from being detached from the lower supporter.

[0089] In one example, both opposing protrusion ribs 443 extending in the vertical direction may be respectively formed at both opposing ends in a length direction of the insertion protrusion 440. In the area where the protrusion rib 443 is formed, the recess 442 may not be formed in the side surface of the protrusion body 446. Therefore, the protrusion rib 443 may be formed so that the width of the protrusion body 446 and the greatest width of the hook 441 thereof are equal to each other. As both opposing protrusion ribs 443 are formed at both opposing ends in the length direction of the insertion protrusion 440 in this way, the strength of both opposing ends of the insertion protrusion 440 may be reinforced. Further, when the insertion protrusion 440 is inserted into the slot 540 of the lower supporter 500, the workability at which the insertion protrusion 440 is inserted into the slot 540 by a worker may be improved.

[0090] The insertion protrusion 440 as described above may extend generally along a center line passing through a center in a short side of the lower tray 400. As the insertion protrusion 440 extends generally along the center line in this way, a fixing force between the lower tray 400 and the lower supporter 500 in a center area in the front-rear direction of each of the lower tray 400 and the lower supporter 500 may be effectively secured.

[0091] Furthermore, the insertion protrusion 440 is disposed between the lower chambers 420 adjacent to each other in the front-back direction. Thus, even when the lower chamber 420 is deformed by the lower ejector 700, the lower tray 400 may be prevented from being removed from the lower supporter 500 and a uniform deformation amount may be applied to the lower chambers 420.

[0092] A direction in which the fixing structure connecting the lower tray 400 and the lower supporter 500 to each other extends so as to be engaged with the slot of the lower supporter is parallel to a direction in which the lower ejector 700 presses the lower chamber 420. Thus, even when the lower ejector 700 presses the lower chamber 420, the lower tray 400 may be more effectively prevented from being removed from the lower supporter 500.

[0093] In FIG. 23, the example in which the insertion protrusion 440 may be disposed between and extend along an area between the first-row lower chambers 420a and the second-row lower chambers 420b is illustrated. However, the present disclosure is not limited thereto, and the insertion protrusion 440 may be disposed between and extend along an area between the first-row lower chambers 420a that are adjacent to each other in the left-right direction, and/or between the second-row lower chambers 420b that are adjacent to each other in the left-right direction.

[0094] In another example, referring to FIG. 24, the

insertion protrusion 440 may extend discontinuously. That is, the insertion protrusions 440 may be disposed between the first-row lower chambers 420a and the second-row lower chambers 420b and may be arranged so as to be spaced from each other along the left-right direction. For example, the plurality of insertion protrusions 440 may be arranged so as to be spaced apart from each other by a predetermined spacing. Each protrusion rib 443 may be formed at each of both opposing ends of each of the insertion protrusions 440 arranged so as to be spaced apart from each other.

[0095] In still another embodiment, referring to FIG. 25, in addition to the insertion protrusion 440 positioned between the first-row lower chambers 420a and the second-row lower chambers 420b, a lower auxiliary protrusion 444 may be formed on a portion of an outer side surface of each of the first-row lower chamber 420a and/or the second-row lower chamber 420b. The lower auxiliary protrusion 444 may be formed to surround at least a partial area of an outer circumference surface of each of the first-row lower chamber 420a and/or the second-row lower chamber 420b. In this way, the lower auxiliary protrusion 444 additionally extends along a portion of the outer side surface of each of the first-row lower chamber 420a and/or the second-row lower chamber 420b, such that not only the central area between the first-row lower chamber 420a and the second-row lower chamber 420b, but also an outer area out of each of the first-row lower chamber 420a and the second-row lower chamber 420b may be fixed to the lower supporter in a hook coupling manner. Thus, when the lower chambers 420 are deformed, the deformation amounts of the lower chambers 420 may be substantially equal to each other.

[0096] In still yet another embodiment, referring to FIG. 26, the insertion protrusion 440 may be formed between the first-row lower chambers 420a that are adjacent to each other in the left-right direction and between the second-row lower chambers 420b that are adjacent to each other in the left-right direction. In one example, an insertion protrusion 440 formed between the first-row lower chambers 420a that are adjacent to each other in the left-right direction and an insertion protrusion 440 formed between the second-row lower chambers 420b that are adjacent to each other in the left-right direction may be integral with each other and thus may extend continuously. However, the present disclosure is not limited thereto, and an insertion protrusion 440 formed between the first-row lower chambers 420a that are adjacent to each other in the left-right direction and an insertion protrusion 440 formed between the second-row lower chambers 420b that are adjacent to each other in the left-right direction may be separated from each other and may be spaced from each other and thus may extend discontinuously. A predetermined separation space may be formed between the adjacent first-row lower chambers 420a. A predetermined separation space may be formed between the adjacent second-row lower chambers 420b. The insertion protrusion 440 may be formed along the separation space as described above. The insertion protrusions 440 may be arranged in a matrix manner. That is, the insertion protrusions 440 may extend in the row direction in which the plurality of first-row lower chambers 420a are arranged and the row direction in which the plurality of second-row lower chambers 420b are arranged, and in the column direction perpendicular to the row direction. Furthermore, the insertion protrusion 440 may include the plurality of insertion protrusions 440 which may be arranged along the first row in which the plurality of first-row lower chambers 420a are arranged and the second row in which the plurality of second-row lower chambers 420b are arranged. In FIG. 26, an example in which the first-row lower chamber 420a and the second-row lower chamber 420b which are adjacent to each other in the front-back direction are in contact with each other are illustrated. However, the present disclosure is not limited thereto. The first-row lower chamber 420a and the second-row lower chamber 420b which are adjacent to each other in the front-back direction may be arranged to be spaced apart from each other by a predetermined spacing.

[0097] In still yet another embodiment, referring to FIG. 27, the plurality of lower chambers 420 may be grouped into a first group of lower chambers 420c and a second group of lower chambers 420d. The insertion protrusion 440 may be formed in an area between the first and second groups. For example, some of the plurality of first-row lower chamber 420a adjacent to each other and some of the plurality of second-row lower chamber 420b adjacent to each other may be grouped into the first group of the lower chambers 420c. In this case, the lower chambers 420 belonging to the first group of lower chambers 420c may be arranged to contact each other. However, the present disclosure is not limited thereto, and the lower chambers 420 belonging to the first group of lower chambers 420c may be arranged to be spaced apart from each other by a predetermined separation space within the same group. Similarly, some of the plurality of first-row lower chamber 420a adjacent to each other and some of the plurality of second-row lower chamber 420b adjacent to each other may be grouped into the second group of lower chambers 420d. In this case, the lower chambers 420 belonging to the second group lower chamber 420d may be arranged to contact each other. However, the present disclosure is not limited thereto, and the lower chambers 420 belonging to the second group of lower chambers 420d may be arranged to be spaced apart from each other by a predetermined separation space within the same group. The insertion protrusion 440 may extend so as to intersect the direction in which the plurality of first-row lower chambers 420a are arranged and the direction in which the plurality of second-row lower chambers 420b are arranged, that is, may extend in the column direction, that is, in the front-back direction. Further, the insertion protrusion 440 may be disposed between the first group of lower chambers 420c and the second group of lower chambers 420d.

[0098] The lower tray 400 may further include a perimeter wall 410 that protrudes upwardly and extends along a shape of the outer edge of the arrangement of the plurality of lower chambers 420. The perimeter wall 410 may be formed in a shape that surrounds the plurality of lower chambers 420. The perimeter wall 410 may include a first wall 411 having a curved surface and a second wall 412 having a flat surface. For example, the first walls 411 and the second walls 412 may be arranged alternately with each other along a direction in which the perimeter wall 410 extends. The arrangement of the first walls 411 and the second walls 412 may surround the plurality of lower chambers 420. However, the present disclosure is not limited thereto. The first wall 411 may protrude further outwardly beyond the second wall 412. Therefore, the adjacent first walls 411 may be connected to each other via a wall connection portion 413 extending outwardly from an upper end of the second wall 412.

[0099] A portion of the perimeter wall 410 located at the front side of the lower tray 400 may be named a front wall 414, and a portion of the perimeter wall 410 located at the rear side of the lower tray 400 may be named a rear wall 415. For example, the front wall 414 may be a vertical wall extending vertically in an upward direction, and the rear wall 415 may be a curved wall that extends upwardly in a curved manner so as to be away from the lower chamber 420. Furthermore, the uppermost level of the front wall 414 may be higher than the uppermost level of the rear wall 415. For example, a height of the perimeter wall 410 may increases as the perimeter wall 410 extends from a rear surface to a front surface thereof.

[0100] A lower cover plate 430 may be formed so as to extend horizontally outwardly of the perimeter wall 410. A pair of first upper protrusions 431 may be respectively disposed on upper surfaces of both opposing side portions of the perimeter wall 410 so as to protrude upwardly from the lower cover plate 430.

[0101] Furthermore, one or more second upper protrusions 432 protruding in an upward direction from the lower cover plate 430 may be disposed in front of the perimeter wall 410. When a plurality of second upper protrusions 432 are present, the second upper protrusions 432 adjacent to each other may be arranged to be spaced apart from each other by a predetermined distance. For example, each second upper protrusion 432 may be disposed between the lower chambers 420 adjacent to each other in the left-right direction.

[0102] A pair of side limiters 433 protruding in an outward direction from the lower cover plate 430 and extending vertically may be disposed on both opposing sides of the perimeter wall 410. Each side limiter 433 may be disposed between the first upper protrusion 431 and each second upper protrusion 432. The side limiters 433 may limit the movement of the lower tray 400 in the left-right direction, i.e., the horizontal direction in a state in which the lower tray 400 is combined with the lower cover 300 and the lower supporter 500. The side limiter 433 protrudes from a side surface of the lower cover plate 430, and a vertical dimension of the side limiter 433 may be greater than a thickness of the lower cover plate 430. For example, a portion of the side limiter 433 may be positioned at a higher vertical level than a vertical level of the upper surface of the lower cover plate 430, while another portion thereof may be positioned at a lower vertical level than a vertical level of a lower surface of the lower cover plate 430. Therefore, a portion of the side limiter 433 may contact a side surface of the lower cover 300, and another portion thereof may contact a side surface of the lower supporter 500.

[0103] One or more lower protrusions 450 protruding in a downward direction may be disposed on a bottom of a rear area of the lower tray 400. When a plurality of lower protrusions 450 are present, adjacent lower protrusions 450 may be arranged to be spaced apart from each other by a predetermined distance. For example, each lower protrusion 450 may be disposed between the lower chambers 420 adjacent to each other in the left-right direction.

[0104] A lower extension 460 extending in a downward direction may be formed at a rear side of the lower tray 400. The lower extension 460 may be formed to extend in the left-right direction of the lower tray 400. The lower extension 460 may be seated on a step portion 570 of the lower supporter 500 as described below. Therefore, the lower extension 460 may guide a coupling position of the lower tray 400 and the lower supporter 500. Furthermore, a plurality of rear protrusions 461 protruding outwardly may be formed on a rear surface of the lower extension 460. The plurality of rear protrusions 461 may be arranged along the left-right direction of the lower extension 460 while being spaced apart from each other. Each rear protrusion 461 may be positioned in a corresponding manner to each first-row lower chamber 420a. Each rear protrusion 461 may be inserted into each protrusion receiving hole 323 of the lower cover 300 as described below.

[0105] The lower supporter 500 may include a supporter body 523 that supports the lower tray 400. The supporter body 523 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 the lower surface of the lower chamber 420. A lower opening 521 may be formed in an inner center 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. In this case, an outer diameter of the pressed portion 423 located on the lower surface of the lower chamber 420 may be smaller than an inner diameter of the lower opening 521. Accordingly, a spacing 526 may extend along an outer circumference of the

pressed portion 423 and may be defined between the pressed portion 423 and the lower opening 521. As the spacing 526 is formed between the pressed portion 423 and the lower opening 521 in this way, the pressed portion 423 may be uniformly deformed even when the lower ejector 700 pressed and deforms the pressed portion 423.

[0106] A reinforcing body 524 may be formed along a circumference of a lower surface of the lower opening 521. Furthermore, a connection rib 525 may be formed on a lower surface of the lower supporter 500 to connect the adjacent reinforcing bodies 524 to each other to reinforce a strength of the lower supporter.

[0107] The lower supporter 500 may further include a supporter plate 510 extending horizontally from a top of the supporter body 523. The slot 540 extending in an elongate manner in the left-right direction may be defined in a center area in the front-back direction of the supporter plate 510. Thus, the insertion protrusion 440 of the lower tray 400 may be inserted into the slot 540. The hook 441 of the insertion protrusion 440 may pass through the slot 540 such that the protrusion body 446 of the insertion protrusion 440 may be received in the slot 540. Therefore, a width of the slot 540 may be substantially similar to that of the protrusion body 446. The slot 540 may be positioned at a position corresponding to the position of the insertion protrusion 440, and thus may overlap the insertion protrusion 440 vertically, and may be formed in an opening shape so that the insertion protrusion 440 may be fixedly inserted into the opening. At each of both opposing ends in the length direction of the slot 540, a rib slot 541 having a width larger than a width of the slot 540 may be formed. Thus, the protrusion rib 443 of the insertion protrusion 440 may be inserted into the rib slot 541.

[0108] In another embodiment, the slot 540 of the lower supporter 500 as illustrated in FIG. 31 may be formed to have a structure corresponding to a structure of the insertion protrusion 440 of the lower tray 400 as illustrated in FIG. 24. Therefore, the slot 540 of the lower supporter 500 may be divided into slots which may be arranged to be spaced apart from each other by a predetermined distance. That is, the slot 540 may extend discontinuously. Thus, each insertion protrusion 440 may be inserted into each slot 540.

[0109] In still another embodiment, the lower supporter 500 illustrated in FIG. 32 may be formed to have an auxiliary slot 557 extending along a portion of an outer side surface of the chamber receiving portion 520. The auxiliary slot 557 may be formed to surround at least a partial area of an outer circumference surface of the chamber receiving portion 520. The auxiliary slot 557 may be formed to have a structure corresponding to a structure of the lower auxiliary protrusion 444 of the lower tray 400 as illustrated in FIG. 25. Each lower auxiliary protrusion 444 may be inserted into each auxiliary slot 557.

[0110] One or more depressed grooves 555 depressed in a downward direction may be defined in an upper surface of a rear area of the supporter plate 510. When a plurality of depressed grooves 555 are present, adjacent depressed grooves 555 may be arranged to be spaced apart from each other by a predetermined distance. For example, each depressed groove 555 may be disposed between the chamber receiving portions 520 adjacent to each other in the left-right direction. When the lower tray 400 is combined with the lower supporter 500, the lower protrusion 450 of the lower supporter 500 may be fixedly inserted into the depressed groove 555 of the supporter plate 510. Therefore, the depressed groove 555 may have a shape corresponding to that of the lower protrusion 450 and be disposed at a position corresponding to a position of the lower protrusion 450 and thus may overlap with the lower protrusion 450 vertically.

[0111] One or more stopping step receiving grooves 550 may be formed in a lower surface of a front area of the lower supporter 500. When the stopping step receiving groove 550 includes a plurality of stopping step receiving grooves, the adjacent stopping step receiving grooves 550 may be arranged to be spaced apart by a predetermined distance. For example, each stopping step receiving groove 550 may be positioned at a position corresponding to a position of a center of each chamber receiving portion 520, and that is, may overlap the center of each chamber receiving portion 520 in the front-back direction. The stopping step receiving groove 550 may be upwardly recessed in the lower surface of the front area of the supporter plate 510 having a predetermined thickness. A first front stopping step portion 311 of the lower cover 300 which will be described later may be hooked and engaged with the stopping step receiving groove 550 of the lower supporter 500.

[0112] A pair of hinge bodies 530 which protrude rearwardly and respectively include hinge holes 531 passing therethrough may be respectively disposed on both opposing sides in the left-right direction of the lower supporter 500. Both opposing sides of the lower supporter 500 may be respectively finished with both opposing outer walls 511. A pair of coupling shafts 512 may be respectively disposed on both opposing outer walls 511 so as to protrude outwardly therefrom. Further, a pair of elastic member coupling portions 513 may be respectively disposed on both opposing outer walls 511 so as to protrude outwardly therefrom. Furthermore, a pair of side protrusions 560 may be respectively disposed on lower ends of both opposing outer walls 511 so as to protrude outwardly therefrom.

[0113] The step portion 570 may be formed on the rear surface of the lower supporter 500 so as to support the lower extension 460 of the lower tray 400 thereon. The step portion 570 may be formed to extend in the left-right direction of the lower supporter 500 so as to have a shape corresponding to a shape of the lower extension 460 of the lower supporter 500. A vertical level of an upper end of the step portion 570 may be lower than a vertical level of an upper end of the supporter plate 510, so that a step

may be formed on the rear area of the supporter plate 510.

[0114] In one example, the lower cover 300 may include a lower cover plate 303 for fixing the lower tray 400 and the lower supporter 500. A portion of the lower tray 400 may contact a lower surface of the lower cover plate 303 such that that the lower tray is fixed to the lower cover plate. A hollow 305 may be defined in the lower cover plate 303. A partial area including the lower chamber 420 of the lower tray 400 may pass through the hollow 305 and may be exposed to the outside therethrough. For example, when the lower tray 400 is fixed to the lower cover plate 303 while the lower tray 400 is positioned under the lower plate 211, a portion of the lower tray 400 may protrude upwardly beyond the lower cover plate 303 through the hollow 305.

[0115] The lower cover 300 may further include an inner wall 340 surrounding a portion of the lower tray 400 passing through the lower cover plate 303. The inner wall 340 may be formed in a shape that surrounds the lower chamber 420 and extends along a shape of a portion of a circumference of the lower chamber 420 of the lower tray 400.

[0116] A front wall 310 extending in a downward direction may be formed on a front surface of the lower cover plate 303, a rear wall 320 extending in a downward direction may be formed on a rear surface thereof, and a pair of side walls 330 may be formed between the front wall 310 and the rear wall 320. Each curved finishing wall 319 that surrounds each of corners of the lower tray 400 and the lower supporter 500 may be disposed between the front wall 310 and each side wall 330.

[0117] The side wall 330 may be formed as a short side having a length smaller than a length of each of the rear wall 320 and the front wall 310, while each of the rear wall 320 and the front wall 310 may be formed as a long side having a relatively larger length than the length of the side wall 330. Furthermore, the rear wall 320 may be relatively shorter in length than the front wall 310. However, the present disclosure is not limited thereto.

[0118] A first rear stopping step portion 321 may be formed on a lower area of an inner surface of the rear wall 320 and may extend in one direction in which the rear wall 320 extends. A second rear stopping step portion 322 may be formed on an upper area of the inner surface of the rear wall 320 and may extend in one direction in which the rear wall 320 extends. Each of the first rear stopping step portion 321 and the second rear stopping step portion 322 may be formed to protrude inwardly of the lower cover 300. The first rear stopping step portion 321 may be formed to protrude further inwardly beyond the second rear stopping step portion 322.

[0119] The first rear stopping step portion 321 may be formed to be bent inwardly of the lower cover 300 from a lower end of the rear wall 320 which extends in a downward direction. An upper surface of a distal end of the first rear stopping step portion 321 may be a curved surface, so that when the lower cover is coupled to the lower supporter 500 as described later, coupling and contacting therebetween may be facilitated. The first rear stopping step portion 321 may be in contact with a lower surface of the lower supporter 500.

[0120] The second rear stopping step portion 322 is formed on the upper area of the rear wall 320 extending in the downward direction. However, a position of the second rear stopping step portion 322 is not limited to the uppermost end of the rear wall 320. For example, the second rear stopping step portion 322 may be positioned so as to be spaced apart from the uppermost end of the rear wall 320 by a predetermined distance in the downward direction. However, the second rear stopping step portion 322 may be located on an upper area in the vertical direction of the rear wall 320. Both opposing ends of the second rear stopping step portion 322 may be connected to the inner wall 340 extending downwardly of the lower cover plate 303. Accordingly, even when a strong load is applied to the second rear stopping step portion 322, the deformation of the rear wall 320 may be minimized. The second rear stopping step portion 322 and the rear wall 320 may support an outer surface of the rear wall 415 of the lower tray 400.

[0121] A plurality of protrusion receiving holes 323 may be formed in the rear wall 320. For example, the plurality of protrusion receiving holes 323 may be arranged in one direction and may be positioned between the first rear stopping step portion 321 and the second rear stopping step portion 322. The protrusion receiving holes 323 may be formed so as to extend through the lower cover 300 in the front-rear direction. Each rear protrusion 461 of the lower tray 400 may be fixedly inserted into each protrusion receiving hole 323.

[0122] One or more first front stopping step portions 311 may be formed to protrude from a lower area of an inner surface of the front wall 310 inwardly of the lower cover 300. When the lower cover 300 is coupled to the lower tray 400 and the lower supporter 500, the first front stopping step portion 311 may be inserted into and may be fixedly hook-coupled to or engaged with the stopping step receiving groove 550 of the lower supporter 500. When a plurality of first front stopping step portions 311 are present, the adjacent first front stopping step portions 311 may be arranged to be spaced apart from each other by a predetermined distance. For example, each first front stopping step portion 311 may be positioned in a corresponding manner to each lower chamber 420, and that overlap therewith in the front-back direction.

[0123] One or more second front stopping step portions 312 may be formed to protrude from an upper area of the inner surface of the front wall 310 inwardly of the lower cover 300. The second front stopping step portion 312 may be formed to extend in one direction along the left-right direction of the front wall 310. However, the present disclosure is not limited thereto, and the second front stopping step portion 312 may include a plurality of second front stopping step portions 312. When the plurality of second front stopping step portions 312 are pre-

sent, the second front stopping step portions 312 adjacent to each other may be arranged to be spaced apart from each other by a predetermined distance. For example, each second front stopping step portion 312 may be positioned on top of the first front stopping step portion 311 and may positionally correspond to each first front stopping step portion 311 and thus overlap therewith vertically.

[0124] Between the front wall 310 and the inner wall 340 of the lower cover 300, a receiving portion 313 may be formed. When the lower cover 300 covers the lower tray 400 and the lower supporter 500, the receiving portion 313 may surround and accommodate the front area of each of the lower tray 400 and the lower supporter 500. A depression 314 may be formed in the receiving portion 313 of the lower cover 300, such that the second upper protrusion 432 formed on the front surface of the lower tray 400 is seated in the depression 314. The depression 314 may be formed in a shape corresponding to that of the second upper protrusion 432 and may be disposed at a corresponding position to a position of the second upper protrusion 432. Therefore, the depression 341 may include a plurality of depressions. Each depression 341 may be disposed between the lower chambers 420 that are adjacent to each other in the left-right direction.

[0125] A pair of first receiving grooves 331 may be respectively formed in lower areas of both opposing side walls 330 of the lower cover 300. The first receiving groove 331 may be formed in a recessed shape in an upward direction to have a predetermined recess space. The first upper protrusion 431 of the lower tray 400 may be fixedly inserted into the first receiving groove 331. Therefore, the first receiving groove 331 may be formed in a corresponding shape to a shape of the first upper protrusion 431.

[0126] The lower cover 300 may be formed as an integral closed curved frame including the hollow 305 defined therein. However, the present disclosure is not limited thereto, and the lower cover 300 may be formed in separate structures which may be assembled with each other. For example, referring to FIG. 16, each of the front wall 310 and the rear wall 320 of the lower cover 300 may be divided in left and right portions constituting a first lower cover 301 and a second lower cover 302, respectively. In this way, the first lower cover 301 and the second lower cover 302 that are separated from each other may be coupled to each other via a fastening portion 350 such as a hook and thus may be assembled into a single lower cover 300. Furthermore, referring to FIG. 17 as another example, each of both opposing side walls 330 of the lower cover 300 may be divided into front and rear portions constituting a first lower cover 301 and a second lower cover 302, respectively. In this way, the first lower cover 301 and the second lower cover 302 which are separated from each other may be coupled to each other via a fastening portion 350 such as a hook and thus may be assembled into a single lower cover 300.

[0127] The lower assembly 32 may be assembled by first coupling the lower tray 400 and the lower supporter 500 to each other, and then coupling the lower cover 300 to the lower tray 400 and the lower supporter 500 in a swing scheme. When 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 may first come into contact with the lower tray 400 and the lower supporter 500, and then the rear area of each of the lower tray 400 and the lower supporter 500 may be pressed into an area between the first rear stopping step portion 321 and the second rear stopping step portion 322 and may be engaged therewith. Afterwards, the front wall 310 of the lower cover 300 may pivot in a downward direction using the rear wall 320 of the lower cover 300 as a pivot axis, and then the front area of each of the lower tray 400 and the lower supporter 500 may be pressed into an area between the first front stopping step portion 311 and the second front stopping step portion 312 formed on the front wall 310 of the lower cover 300 and may be engaged therewith.

[0128] The lower cover 300 assembled into the lower assembly 32 may surround the front surface and the rear surface of each of the lower tray 400 and the lower supporter 500, and may press the lower tray 400 and the lower supporter 500 in opposite directions, respectively. so that the lower tray 400 and the lower supporter 500 may be restrained. That is, the front wall 310 of the lower cover 300 may include the first front stopping step portion 311 pressing the lower supporter 500 upwardly and the second front stopping step portion 312 pressing the lower tray 400 downwardly. The rear wall 320 of the lower cover 300 may include the first rear stopping step portion 321 pressing the lower supporter 500 upwardly and the second rear stopping step portion 322 pressing the lower tray 400 downwardly.

[0129] Specifically, the first front stopping step portion 311 and the second front stopping step portion 312 of the lower cover 300 may press the lower surface of the supporter plate 510 of the lower supporter 500 and the upper surface of the lower cover plate 430 of the lower tray 400, respectively. Furthermore, the first rear stopping step portion 321 and the second rear stopping step portion 322 of the lower cover 300 may press the lower surface of the step portion 570 of the lower supporter 500 and the upper surface of the lower extension 460 of the lower tray 400, respectively.

[0130] The lower cover 300 presses both the front and rear surfaces of each of the lower tray 400 and the lower supporter 500. However, it is preferable that a supporting force of a portion thereof that provides the pivot axis during the assembly be greater. For example, after the lower cover 300 has been assembled into the lower assembly, the deformation of the lower cover 300 should be minimized so that the hook coupling or fitting coupling of the lower cover 300 is not easily released. Therefore, the rear wall 320 of the lower cover 300 may be subjected to minimized deformation so as to maintain a strong

coupling force thereof. The front wall 310 of the lower cover 300 may be deformed relatively in a larger amount than the deformation amount of the rear wall 320 so that the front wall 310 may be easily couped to the lower tray and the lower supporter in the swing scheme. That is, the hook coupling achieved using the front wall 310 of the lower cover 300 may be achieved using the plastic deformation of the lower cover 300 or a deformation amount below a deformation amount at which the lower cover 300 is broken. The fitting coupling achieved using the rear wall 320 of the lower cover 300 may be achieved using strong fixation and support using substantially non-deformation.

[0131] An area where the first rear stopping step portion 321 contacts the lower supporter 500 may be larger than an area where the first front stopping step portion 311 contacts the lower supporter 500. Further, the first rear stopping step portion 321 may extend inwardly of the lower supporter 500 beyond the first front stopping step portion 311. Accordingly, the rear wall 320 on which the first rear stopping step portion 321 has been formed may be deformed in a relatively smaller amount than the deformation amount of the front wall 310 on which the first front stopping step portion 311 has been formed.

[0132] The first rear stopping step portion 321 may extend continuously along the arrangement of the plurality of lower chambers 420 arranged in one direction. However, the present disclosure is not limited thereto. For example, referring to FIG. 18, the first rear stopping step portion 321 may extend discontinuously. That is, the first rear stopping step portion 321 may be divided into a plurality of first rear stopping step sub-portions 321 arranged along the plurality of lower chambers 420 arranged in one direction and spaced from each other. The second rear stopping step portion 322 may extend continuously along the arrangement of the plurality of lower chambers 420 arranged in one direction. However, the present disclosure is not limited thereto. For example, referring to FIG. 14, the second rear stopping step portion 322 may extend discontinuously. That is, the second rear stopping step portion 322 may be divided into a plurality of second rear stopping step sub-portions 322 arranged along the plurality of lower chambers 420 arranged in one direction and spaced from each other. Even when each of the first rear stopping step portion 321 and the second rear stopping step portion 322 extends discontinuously, the area where the first rear stopping step portion 321 comes into contact with the lower supporter 500 may be larger than the area where the first front stopping step portion 311 comes into contact with the lower supporter 500.

[0133] The lower assembly 32 as described above may be configured such that the pivot direction in which the lower cover 300 is assembled into the lower assembly 32, and the vertical direction in which the lower tray 400 receives the force from the lower ejector 700 during the ice removal after the lower cover 300 has been assembled into the lower assembly may be different from each other. Thus, a strength for maintaining the workability and the fastening force for the assembly into the lower assembly may be secured.

[0134] In one example, after the lower assembly 32 has been assembled, a partial area of the perimeter wall 410 of the lower tray 400 may be formed to protrude upwardly beyond the inner wall 340 of the lower cover 300. In this case, the uppermost end of the perimeter wall 410 of the lower tray 400 may further protrude upwardly so as to be spaced from the uppermost end of the inner wall 340 of the lower cover 300 by a predetermined distance. When a spacing between the top of the perimeter wall 410 of the lower tray 400 and the top of the inner wall 340 of the lower cover 300 is defined, the lower tray 400 made of the soft material may be prevented from folding or rolling during the assembly process.

[0135] FIG. 40 illustrates another embodiment in which the lower tray 400 and the lower supporter 500 are coupled to each other. For example, an insertion protrusion 580 protruding upwardly may be formed on a center area in the front-back direction of the lower supporter 500. A protrusion receiving groove 470 into which the insertion protrusion 580 of the lower supporter 500 may be inserted may be formed in a bottom of the lower tray 400 and at a position corresponding to a position of the insertion protrusion 580. Accordingly, the lower supporter 500 and the lower cover 300 may be coupled to each other in a hook coupling manner. In this way, the lower tray 400 and the lower supporter 500 may be fixed to each other via the fixing structure that may be disposed between the lower chambers 420 adjacent to each other in the front-back direction and may fasten the lower tray 400 and the lower supporter 500 to each other.

[0136] Hereinafter, another embodiment of the present disclosure will be described with reference to FIG. 41 and FIG. 42.

[0137] One or more auxiliary insertion protrusions 448 may be additionally formed on a lower surface of each lower chamber 420 so as to protrude outwardly.

[0138] In FIG. 41 and FIG. 42, an example in which one auxiliary insertion protrusion 448 is formed on each lower chamber 420 is shown. However, the present disclosure is not limited thereto, and a plurality of auxiliary insertion protrusions 448 may be formed on each lower chamber 420.

[0139] The auxiliary insertion protrusion 448 may be formed in a protrusion shape that protrudes outwardly from the lower surface of the lower chamber 420 formed in a hemispherical shape.

[0140] In this case, the auxiliary insertion protrusion 448 may be formed to have a hook shape so as to be hook-coupled to the lower supporter 500.

[0141] In one example, the auxiliary insertion protrusion 448 may be formed in a similar shape to a shape of the insertion protrusion 440 including the protrusion body 446, the hook 441, the recess 442, and the step portion 445.

[0142] The auxiliary insertion protrusion 448 may have

a hook shape and a size that is smaller than a size of the insertion protrusion 440.

[0143] While the insertion protrusion 440 extends in the downward direction in a perpendicular manner to a horizontal surface, the auxiliary insertion protrusion 448 may extend in an inclined manner so as to extend away from the insertion protrusion 440.

[0144] For example, each auxiliary insertion protrusion 448 may extend downwardly and outwardly rather than inwardly of the lower tray 400.

[0145] Therefore, the auxiliary insertion protrusion 448 may extend outwardly and downwardly in a diagonal direction.

[0146] In this case, each auxiliary insertion protrusion 448 may be formed on an outer portion of the lower surface of each lower chamber 420 located far away from the insertion protrusion 440 disposed between the first-row lower chambers 420a and the second-row lower chambers 420b.

[0147] In this way, the direction in which the auxiliary insertion protrusion 448 extends does not coincide with the direction in which the insertion protrusion 440 extends. Thus, the lower tray 400 and the lower supporter 500 may be hook-coupled to each other in the diagonal direction or the inclined direction as well as the perpendicular direction to the horizontal surface, thereby allowing the lower tray 400 and the lower supporter 500 to be fastened to each other under a stronger fastening force.

[0148] The lower supporter 500 may be formed to have an auxiliary slot 548 into which the auxiliary insertion protrusion 448 is inserted.

[0149] The auxiliary insertion protrusion 448 having a hook portion may pass through the auxiliary slot 548 such that the hook portion is located out of the auxiliary slot 548, such that the lower tray and the lower supporter may be coupled to each other in a hook coupling scheme.

[0150] The lower tray 400 and the lower supporter 500 may be coupled to each other in the hook coupling scheme using the auxiliary insertion protrusion 448 formed on the lower chamber 420 and the auxiliary slot 548 formed in the lower supporter 500.

[0151] For example, the auxiliary insertion protrusion 448 may have a male structure, and the auxiliary slot 548 may have a female structure.

[0152] In this way, the lower chamber 420 may be fastened to the lower supporter 500 in the hook coupling scheme using the auxiliary insertion protrusion 448 and the auxiliary slot 548 being engaged with each other. Thus, deformation of the lower chamber 420 that may occur after the lower ejector 700 presses the pressed portion 423 of the lower chamber 420 to remove the ice from the lower chamber 420 may be prevented.

[0153] That is, after the lower ejector 700 presses the pressed portion 423 of the lower chamber 420 to remove the ice from the lower chamber 420, the lower chamber 420 should return to its original hemispherical shape. However, in an abnormal situation, the lower chamber 420 may not return to its original hemispherical shape.

[0154] However, according to an embodiment of the present disclosure, the coupling structure, that is, the auxiliary insertion protrusion 448 that is coupled to the lower supporter 500 is formed on the lower chamber 420 itself, so that even when the lower ejector 700 presses the pressed portion 423 of the lower chamber 420, a state in which the lower chamber 420 and the lower supporter 500 are in close contact with each other may be maintained.

[0155] Hereinafter, still another embodiment of the present disclosure will be described with reference to FIG. 43.

[0156] The insertion protrusion 580 protruding upwardly may be formed in the center area in the width direction of the lower supporter 500. The protrusion receiving groove 470 into which the insertion protrusion 580 of the lower supporter 500 may be inserted may be formed in the bottom of the lower tray 400 at a position corresponding to a position of the insertion protrusion 580.

[0157] Accordingly, the lower supporter 500 and the lower tray 400 may be hook-coupled to each other. In this way, the lower tray 400 and the lower supporter 500 may be fixed to each other using the fixing structure that is disposed between the lower chambers 420 adjacent to each other in the front-back direction and fastens the lower tray 400 and the lower supporter 500 to each other.

[0158] For example, the insertion protrusion 580 may have a male structure, and the protrusion receiving groove 470 may have a female structure.

[0159] In this case, one or more auxiliary insertion protrusions 448 that protrude outwardly and downwardly may be additionally formed on the lower surface of each lower chamber 420.

[0160] Furthermore, the lower supporter 500 may have the auxiliary slot 548 receiving therein the auxiliary insertion protrusion 448.

[0161] The auxiliary insertion protrusion 448 having a hook portion may pass through the auxiliary slot 548 such that the hook portion is located out of the auxiliary slot 548, such that the lower tray and the lower supporter may be coupled to each other in a hook coupling scheme.

[0162] The lower tray 400 and the lower supporter 500 may be coupled to each other in the hook coupling scheme using the auxiliary insertion protrusion 448 formed on the lower chamber 420 and the auxiliary slot 548 formed in the lower supporter 500.

[0163] For example, the auxiliary insertion protrusion 448 may have a male structure and the auxiliary slot 548 may have a female structure.

[0164] The auxiliary insertion protrusion 448 and the auxiliary slot 548 formed in FIG. 43 are the same as those as described in FIG. 42. Thus, any redundant descriptions thereof will be omitted.

[0165] In this regard, based on the state in which the lower tray 400 and the lower supporter 500 have been coupled to each other, the insertion protrusion 440 extends in the downward direction in a perpendicular man-

ner to a horizontal surface, while the auxiliary insertion protrusion 448 may extend in an inclined manner so as to extend away from the insertion protrusion 440.

[0166] In one example, each auxiliary insertion protrusion 448 may extend downwardly and outwardly rather than inwardly of the lower tray 400.

[0167] Therefore, the auxiliary insertion protrusion 448 may extend outwardly and downwardly in a diagonal direction. In this case, each auxiliary insertion protrusion 448 may be formed on an outer portion of the lower surface of each lower chamber 420 located far away from the insertion protrusion 440 disposed between the first-row lower chambers 420a and the second-row lower chambers 420b.

[0168] In this way, the direction in which the auxiliary insertion protrusion 448 extends does not coincide with the direction in which the insertion protrusion 440 extends. Thus, the lower tray 400 and the lower supporter 500 may be hook-coupled to each other in the diagonal direction or the inclined direction as well as the perpendicular direction to the horizontal surface, thereby allowing the lower tray 400 and the lower supporter 500 to be fastened to each other under a stronger fastening force.

[0169] In this way, the lower chamber 420 may be fastened to the lower supporter 500 in the hook coupling scheme using the auxiliary insertion protrusion 448 and the auxiliary slot 548 being engaged with each other. Thus, deformation of the lower chamber 420 that may occur after the lower ejector 700 presses the pressed portion 423 of the lower chamber 420 to remove the ice from the lower chamber 420 may be prevented.

[0170] Furthermore, according to still another embodiment of the present disclosure, male and female coupling structures of the lower tray 400 and the lower supporter 500 in the central area in the front-back direction may be different from male and female coupling structures of the lower tray 400 and the lower supporter 500 in an outer area in the front-back direction.

[0171] Specifically, in the central area, the insertion protrusion 580 of the lower supporter 500 may have a male structure, while the protrusion receiving groove 470 of a female structure into which the insertion protrusion 58 is inserted may be formed in the lower tray 400.

[0172] Conversely, in the outer area, the auxiliary insertion protrusion 448 of the lower tray 400 may have a male structure, and the auxiliary slot 548 of the lower supporter 500 may have a female structure.

[0173] According to still another embodiment, the lower tray 400 and the lower supporter 500 may be fastened to each other so that the male and female coupling structures of the lower tray 400 and the lower supporter 500 in the central area in the front-back direction are opposite to the male and female coupling structures of the lower tray 400 and the lower supporter 500 in the outer area in the front-back direction. Thus, the directions in which the fastening forces act in the center area and the outer area are opposite to each other, such that the lower tray 400 and the lower supporter 500 may be more firmly fastened to each other.

[0174] 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.

[0175] 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.

[0176] 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.

[0177] 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.

[0178] In one 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.

[0179] That is, the first tray 200 or the second tray 400 may reciprocate in a linear manner vertically.

[0180] 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.

[0181] That is, the first tray 200 or the second tray 400 may may reciprocate in a linear manner horizontally.

[0182] 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 including a plurality of upper chambers;

a lower tray including a plurality of lower chambers;

a lower supporter supporting a lower portion of the lower tray; and

a lower cover restraining the lower tray and the lower supporter,

wherein the lower tray and the lower supporter

are fixed to each other by a fixing structure, wherein the fixing structure is disposed between the lower chambers adjacent to each other and is constructed to fasten the lower tray and the lower supporter to each other.

2. The ice maker of claim 1, wherein the fixing structure includes:

an insertion protrusion formed on the lower tray so as to protrude downwardly of the lower tray; and
a slot defined in the lower supporter, wherein the insertion protrusion passes through the slot.

3. The ice maker of claim 1, or 2, wherein the plurality of lower chambers are arranged in a plurality of rows including a first row and a second row,
wherein the insertion protrusion is disposed between the first row and the second row.

4. The ice maker of claim 3, wherein the insertion protrusion continuously extends along an area between the first row and the second row.

5. The ice maker of claim 3, or 4, wherein the insertion protrusion includes a plurality of insertion protrusions arranged along an area between the first row and the second row and spaced from each other.

6. The ice maker of claim 2, 3, or 4, wherein the insertion protrusion extends in a curved manner along an outer circumference of the lower chamber.

7. The ice maker of any one of claims 2 to 6, wherein the insertion protrusion extends along a center line in a width direction of the lower tray.

8. The ice maker of any one of claims 2 to 7, wherein the insertion protrusion includes:

a protrusion body; and
a hook portion extending from the protrusion body, wherein a width of the hook portion decreases as the hook portion extends downwardly, such that the hook portion passes through the slot.

9. The ice maker of claim 8, wherein a width of the protrusion body is smaller than a largest width of the hook portion.

10. The ice maker of claim 9, wherein each protrusion rib is formed at each of both opposing ends in a length direction of the insertion protrusion,
wherein each protrusion rib has a protrusion body and a hook portion extending from the protrusion body, wherein a width of the protrusion body of the rib is equal to the largest width of the hook portion of the rib.

11. The ice maker of any one of claims 1 to 10, wherein the ice maker further comprises a lower ejector configured to press a lower surface of the lower chamber during an ice-removal operation,
wherein a fastening direction in which the fixing structure fastens the lower tray and the lower supporter to each other is the same as a direction in which the lower ejector presses the lower surface of lower chamber.

12. The ice maker of any one of claims 1 to 11, wherein the lower tray is made of a material softer than a material of each of the upper tray, the lower supporter, and the lower cover.

13. A refrigerator comprising:

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 upper tray including a plurality of upper chambers;
a lower tray including a plurality of lower chambers;
a lower supporter supporting a lower portion of the lower tray; and
a lower cover restraining the lower tray and the lower supporter,

wherein the lower tray and the lower supporter are fixed to each other using a fixing structure, wherein the fixing structure is disposed between the lower chambers adjacent to each other and is constructed to fasten the lower tray and the lower supporter to each other.

14. The refrigerator of claim 13, wherein the lower cover is constructed to press the lower tray and the lower supporter in opposite directions to each other, respectively, thereby restraining the lower tray and the lower supporter.

15. The refrigerator of claim 13, or 14, wherein the lower cover is constructed to be assembled to the lower tray and the lower supporter in a swing manner so as to surround a front surface and a rear surface of each of the lower tray and the lower supporter.

FIG. 1

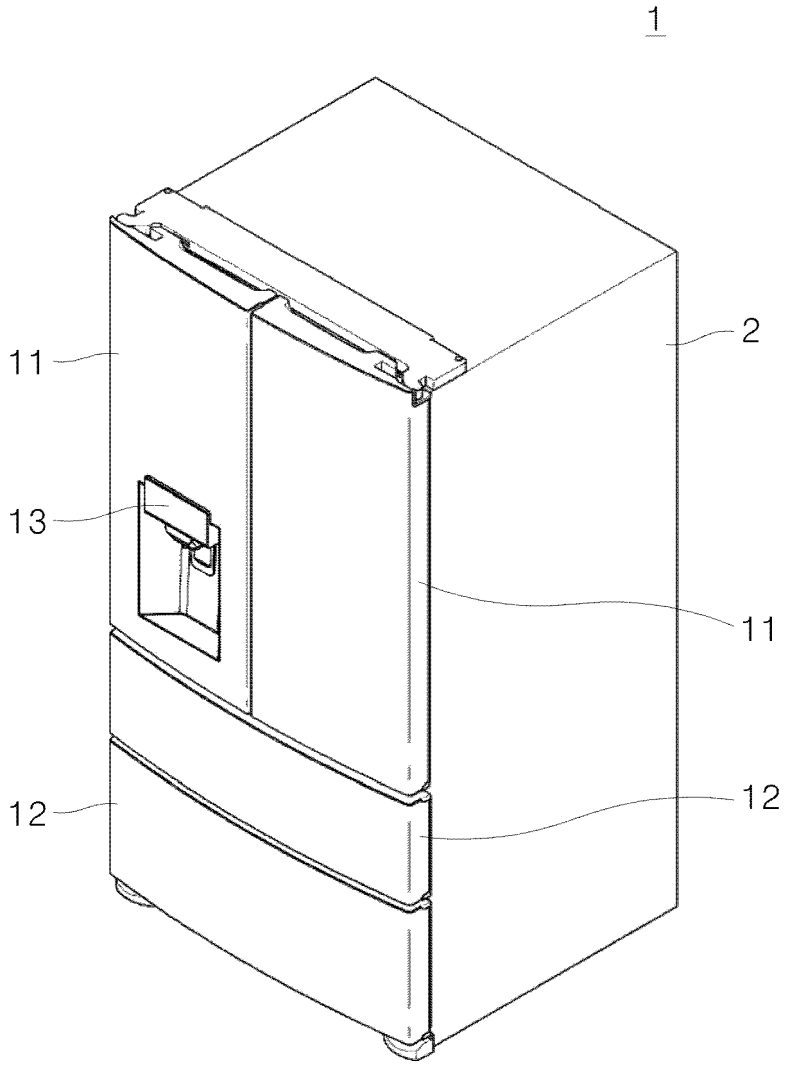

FIG. 2

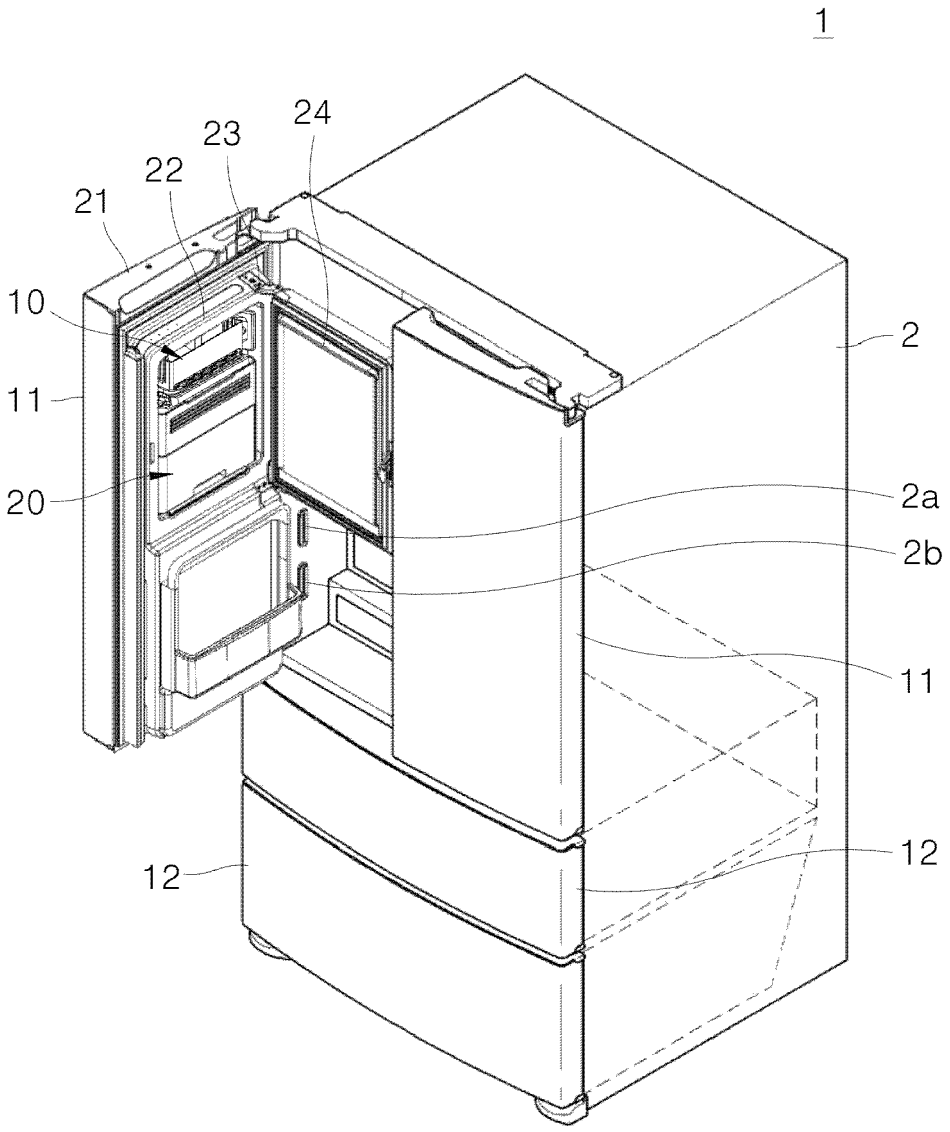

FIG. 3

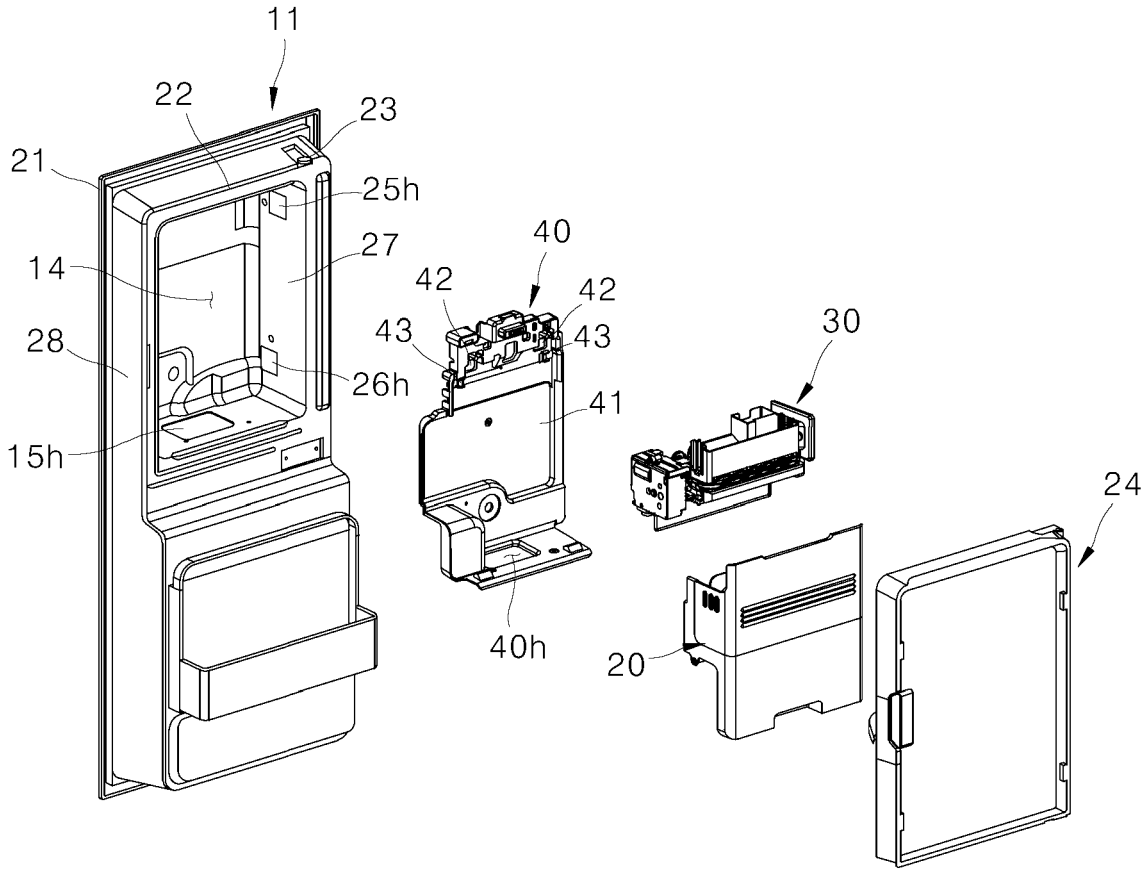

FIG. 4

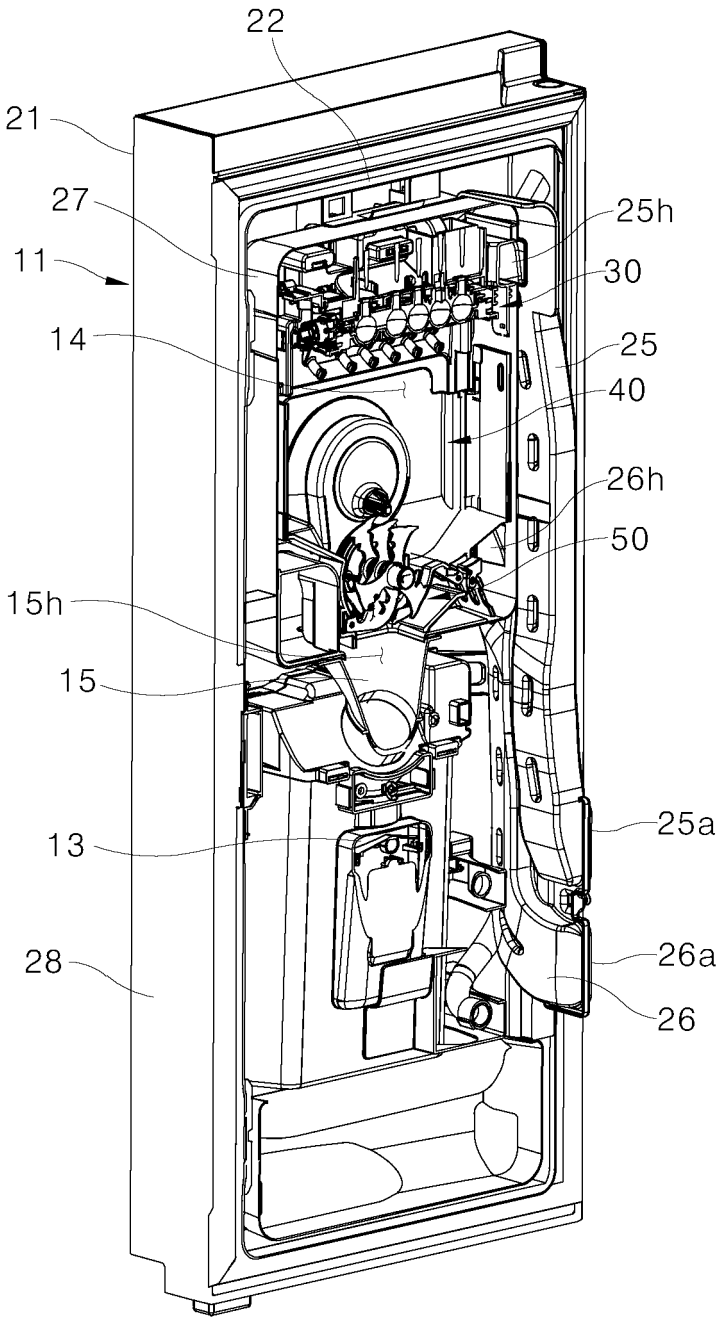

FIG. 5

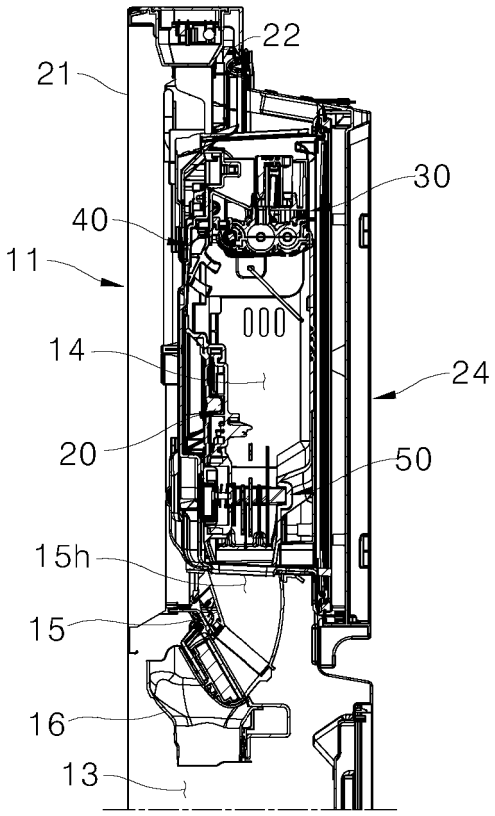
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FIG. 6

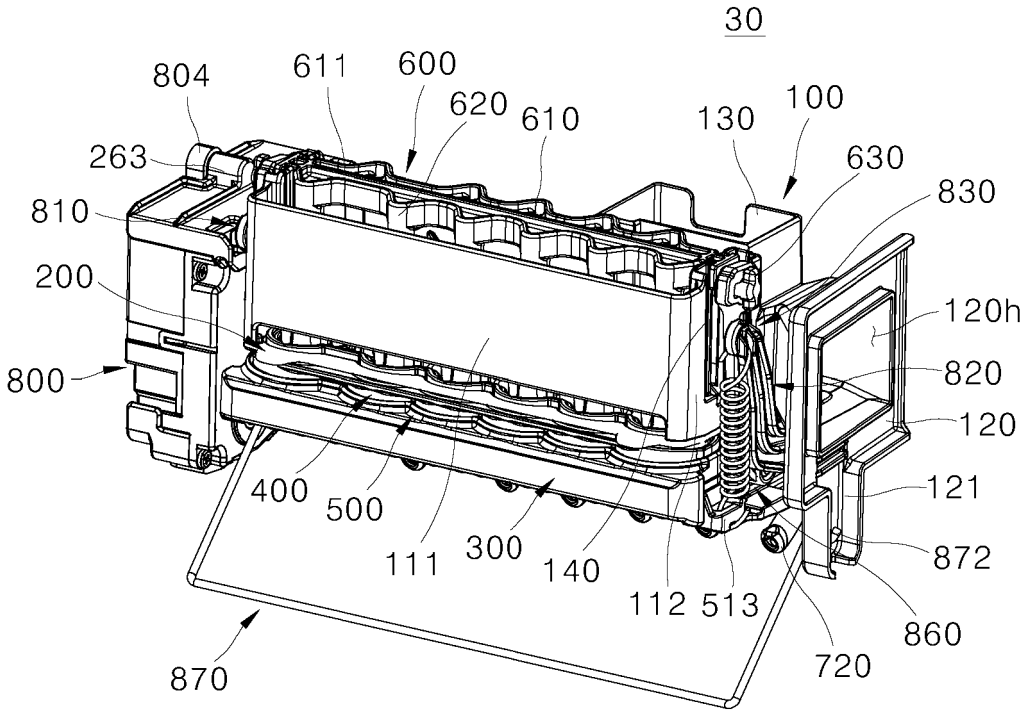
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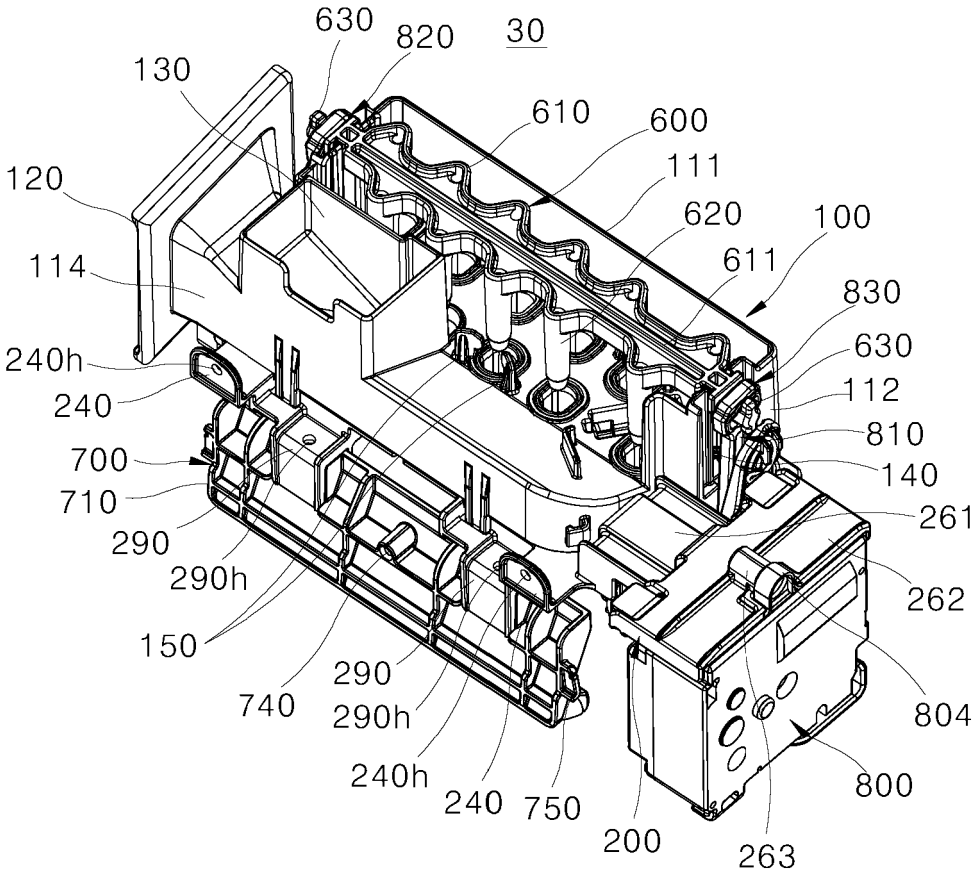
FIG. 7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263

FIG. 8

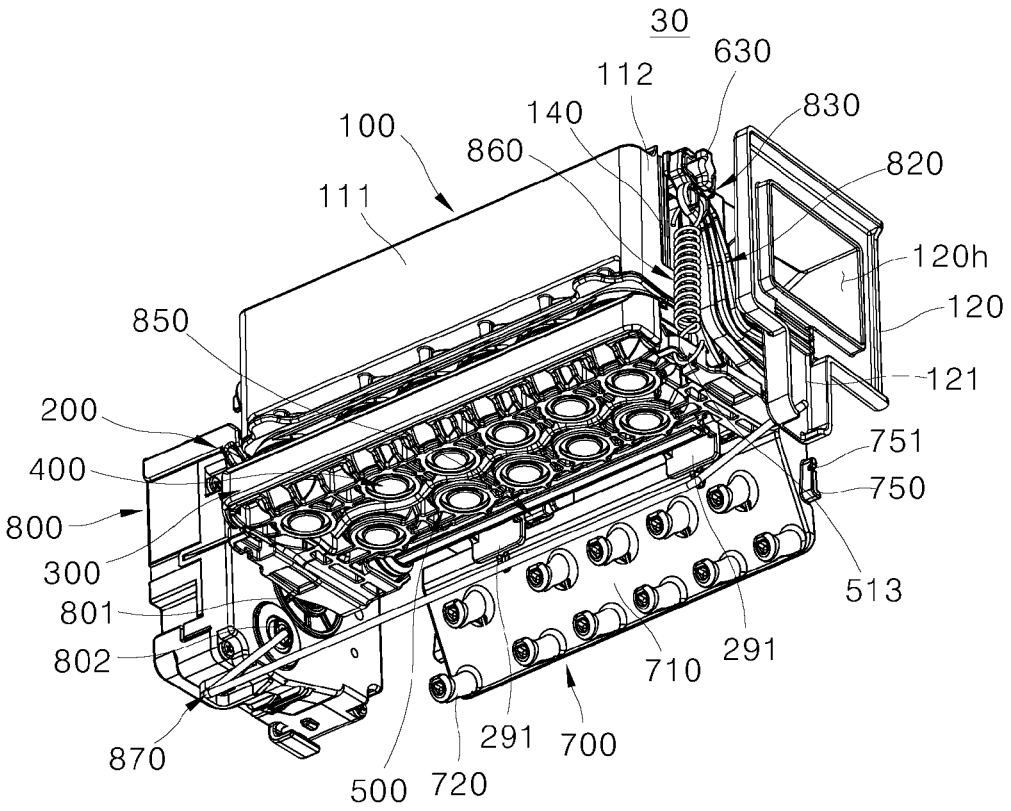

FIG. 9

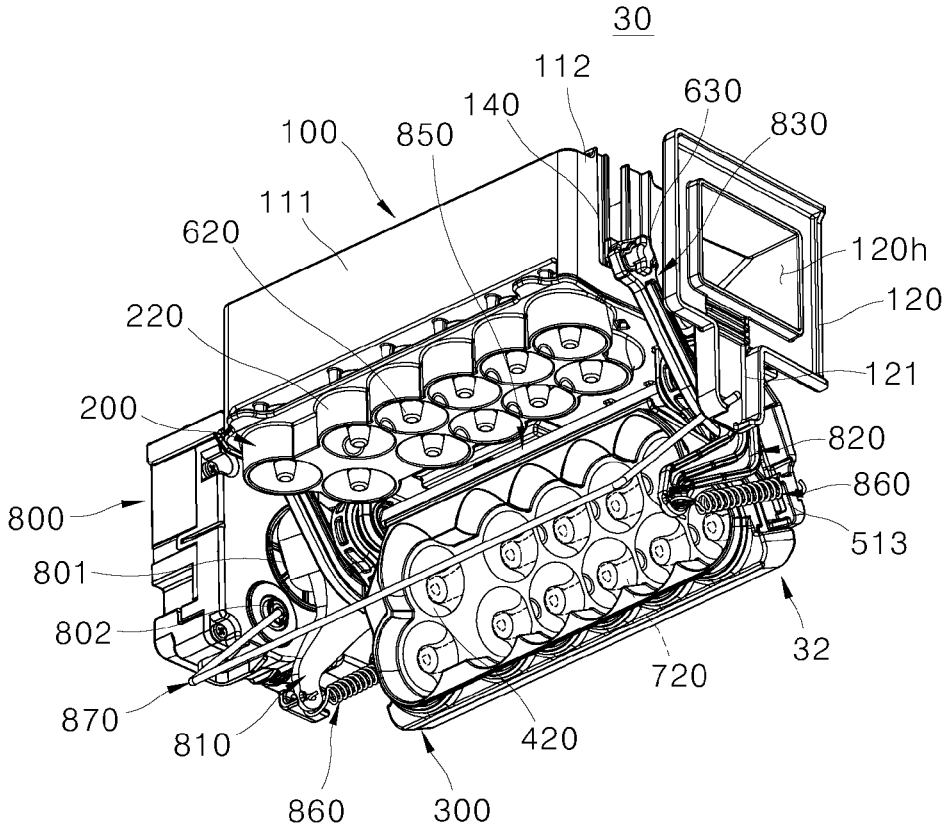

FIG. 10

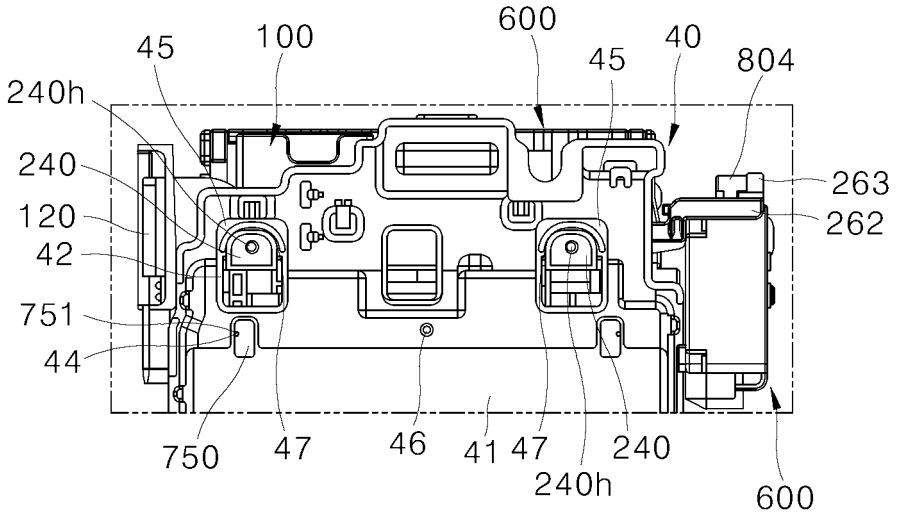
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FIG. 11

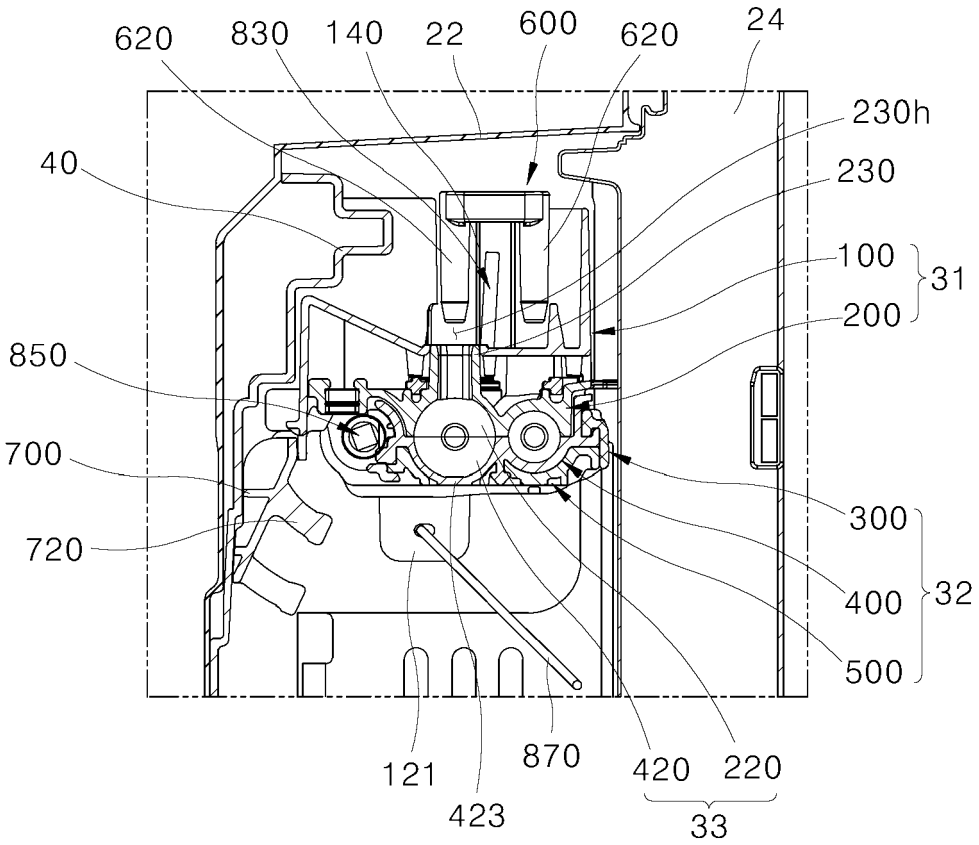
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FIG. 12

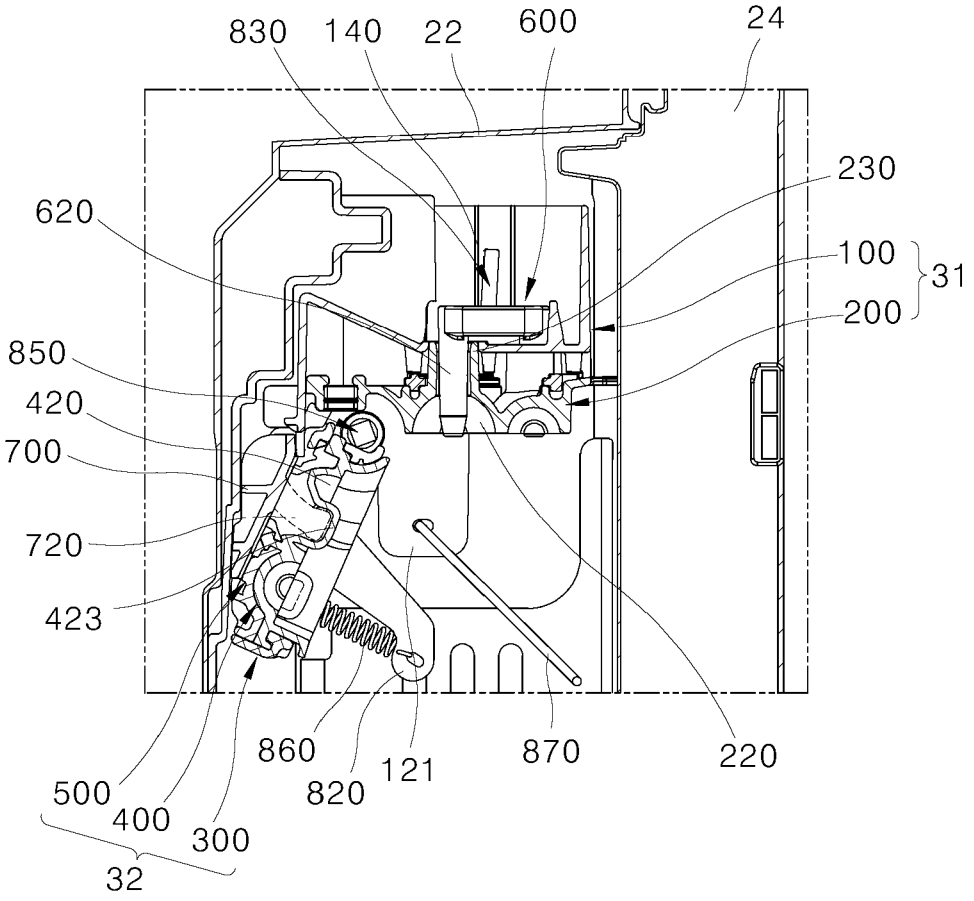
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FIG. 13

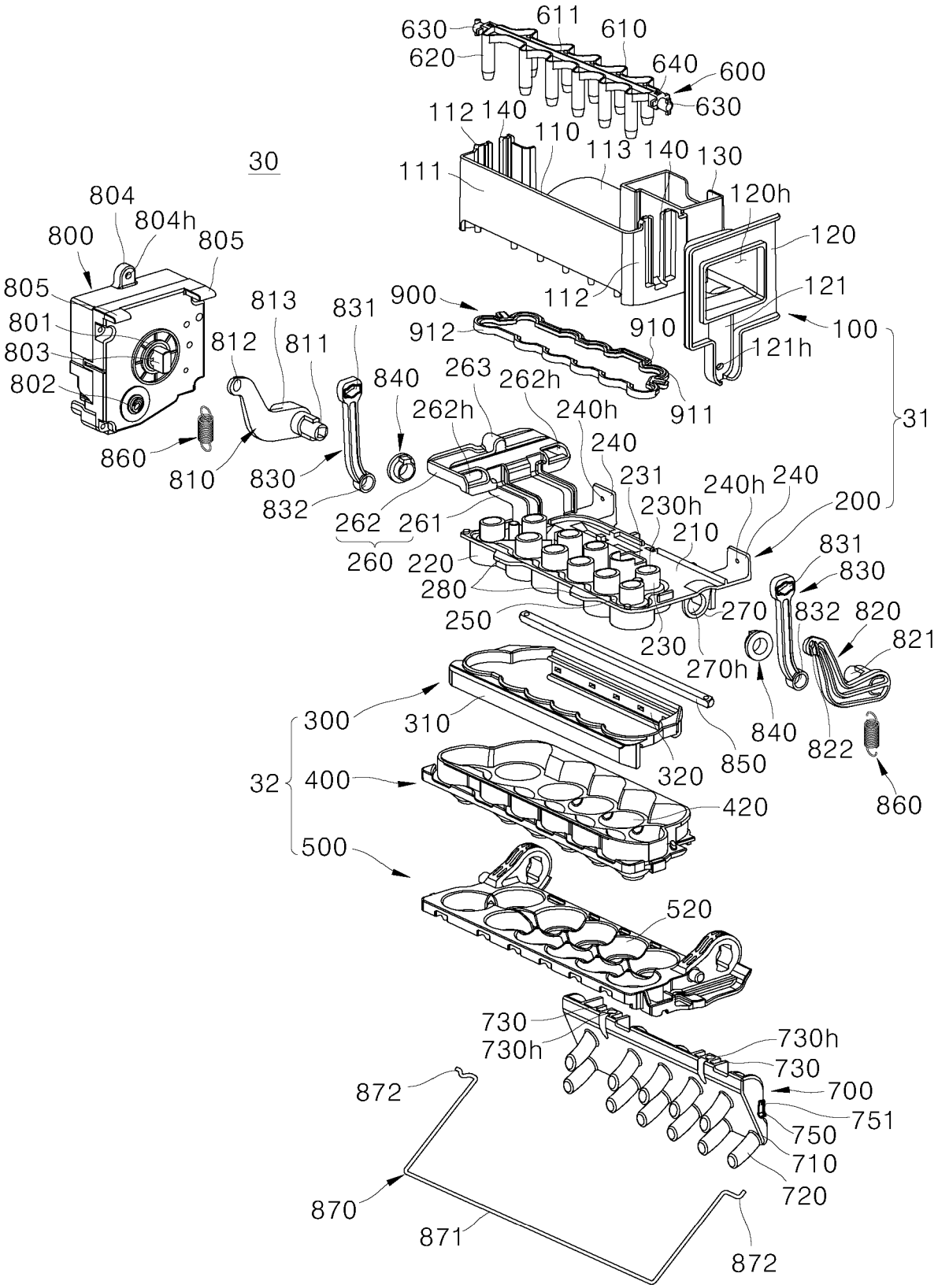
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FIG. 14

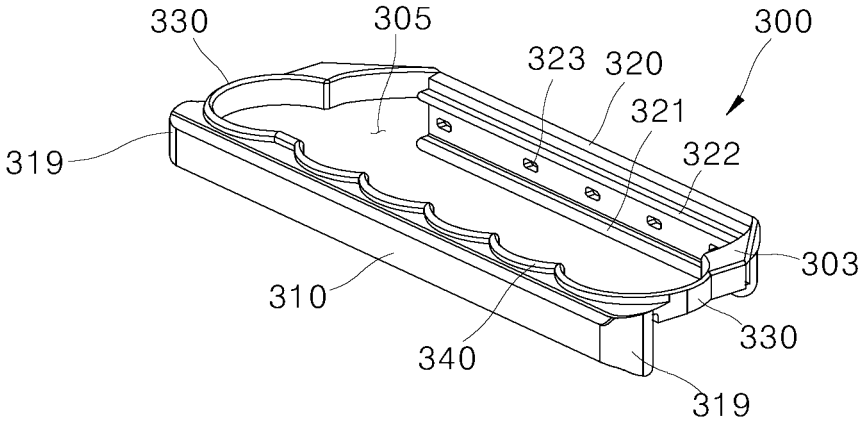
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FIG. 15

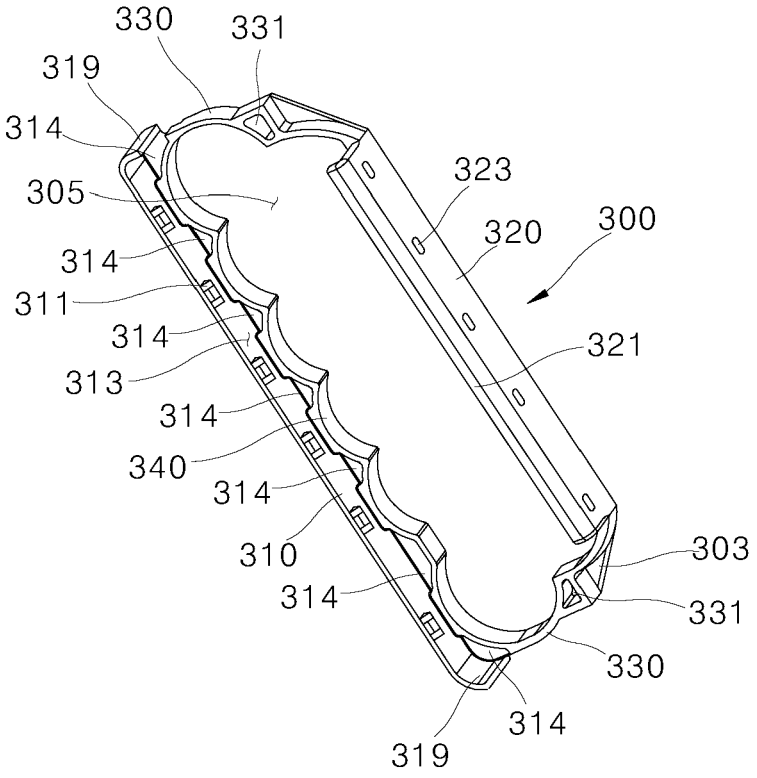
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FIG. 16

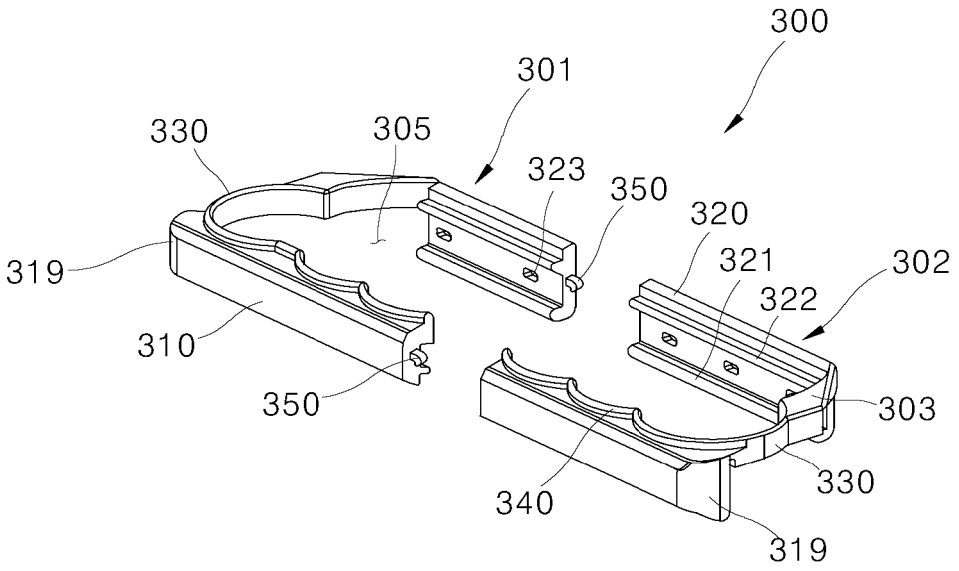
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FIG. 17

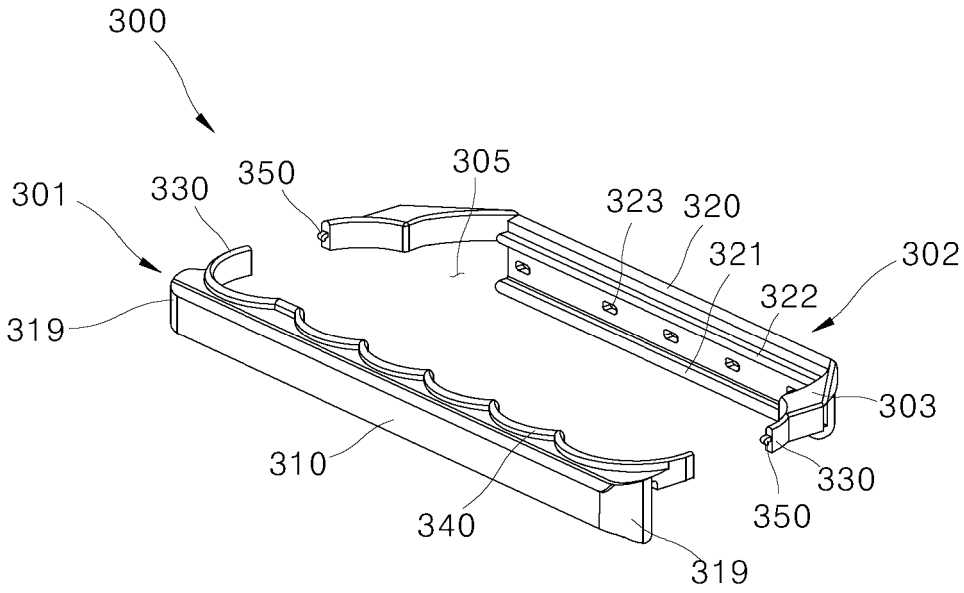
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FIG. 18

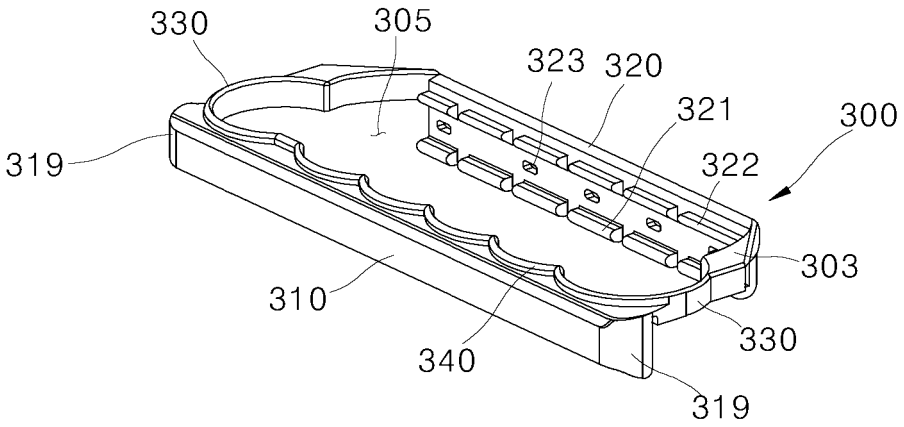
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FIG. 19

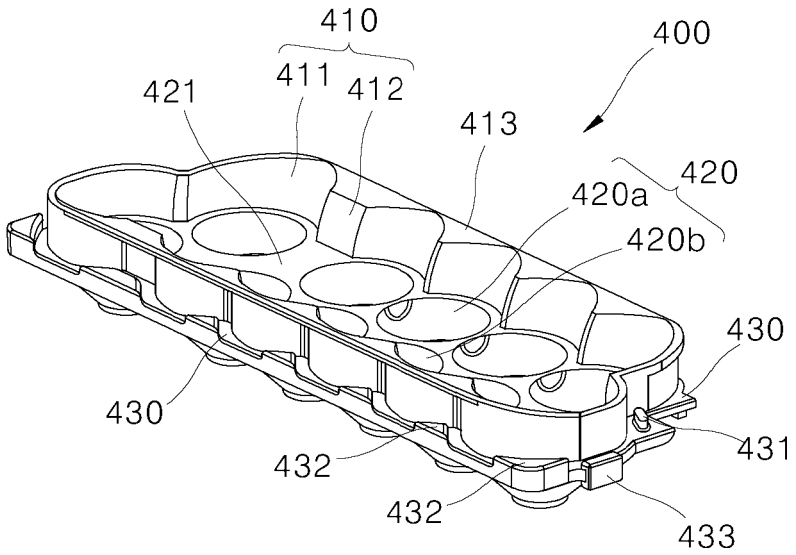
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FIG. 20

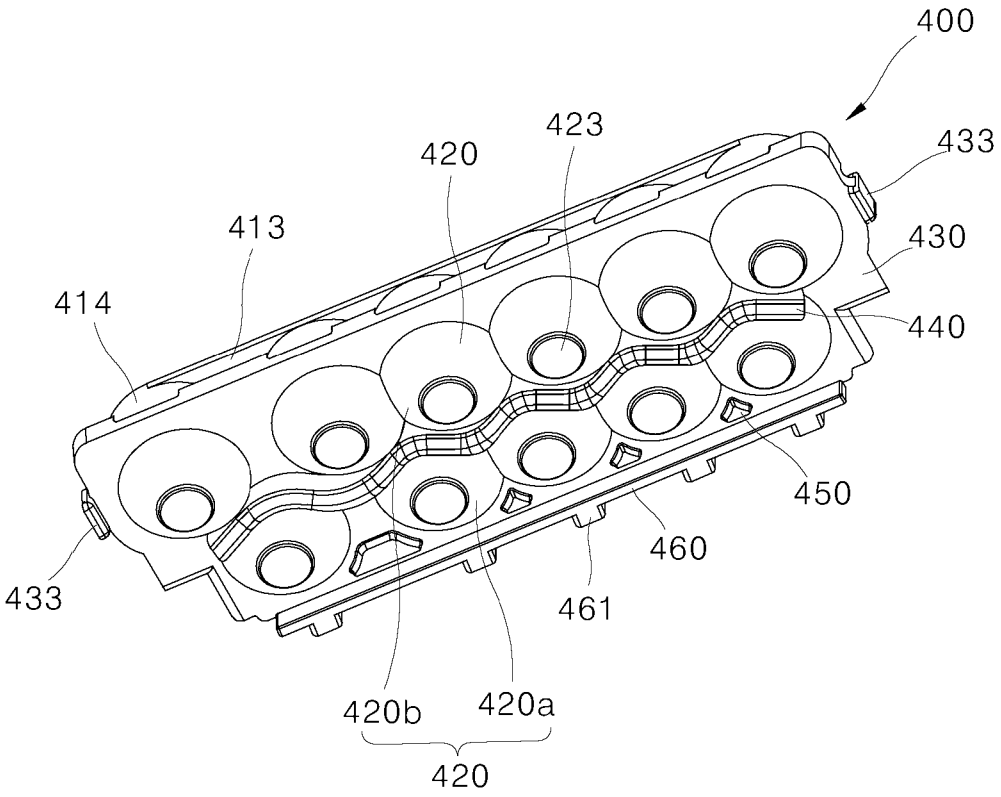
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FIG. 21

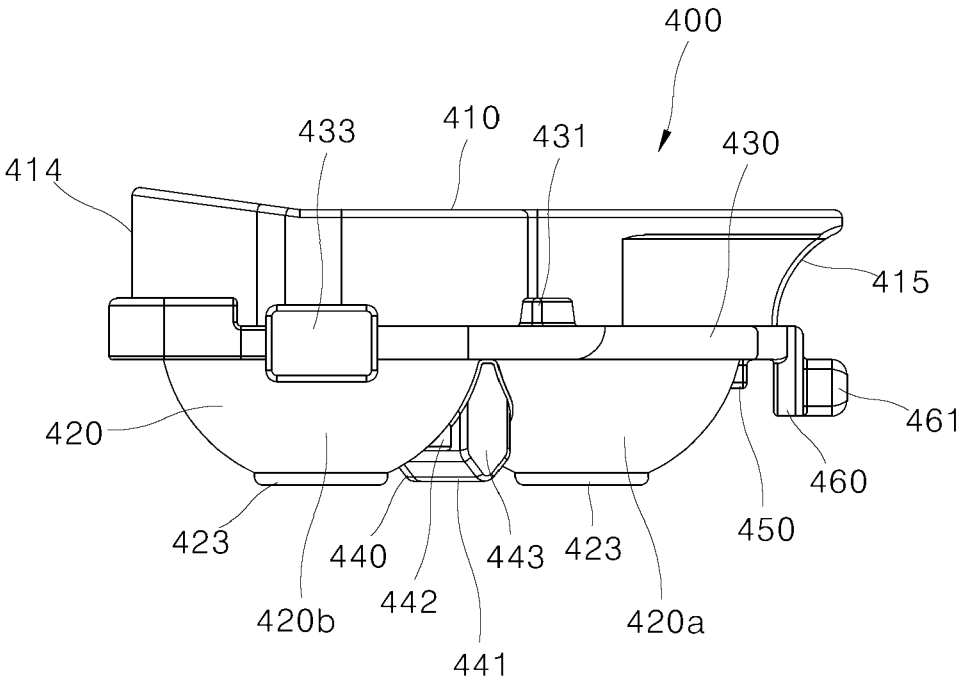
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FIG. 22

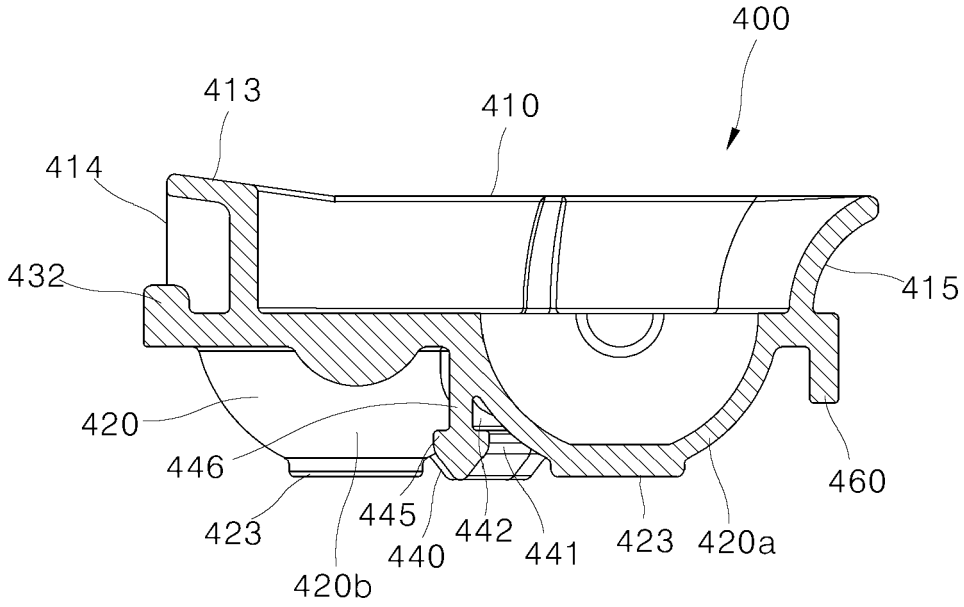
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FIG. 23

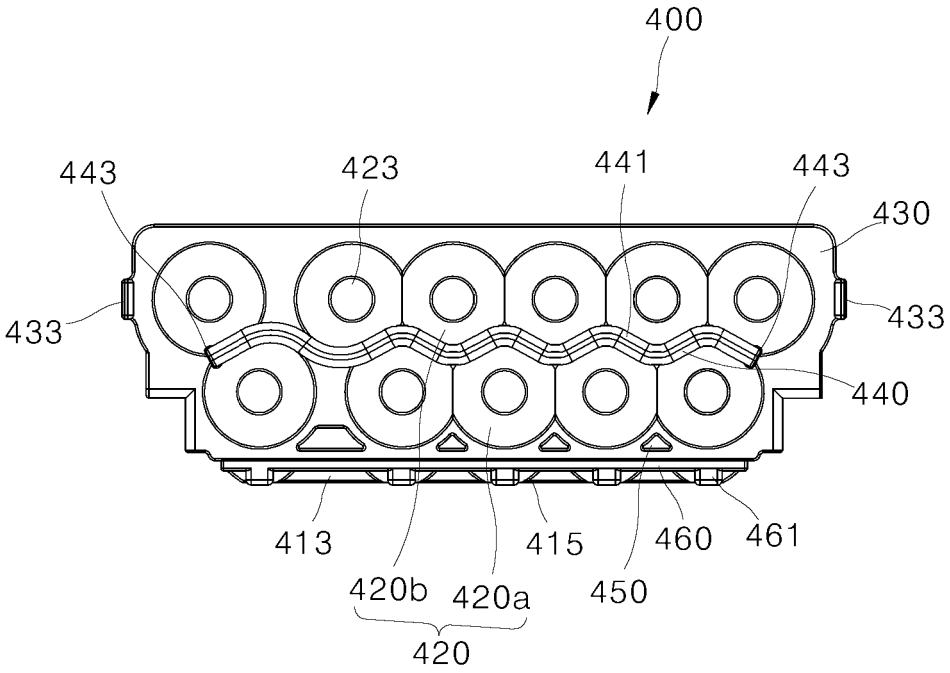
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FIG. 24

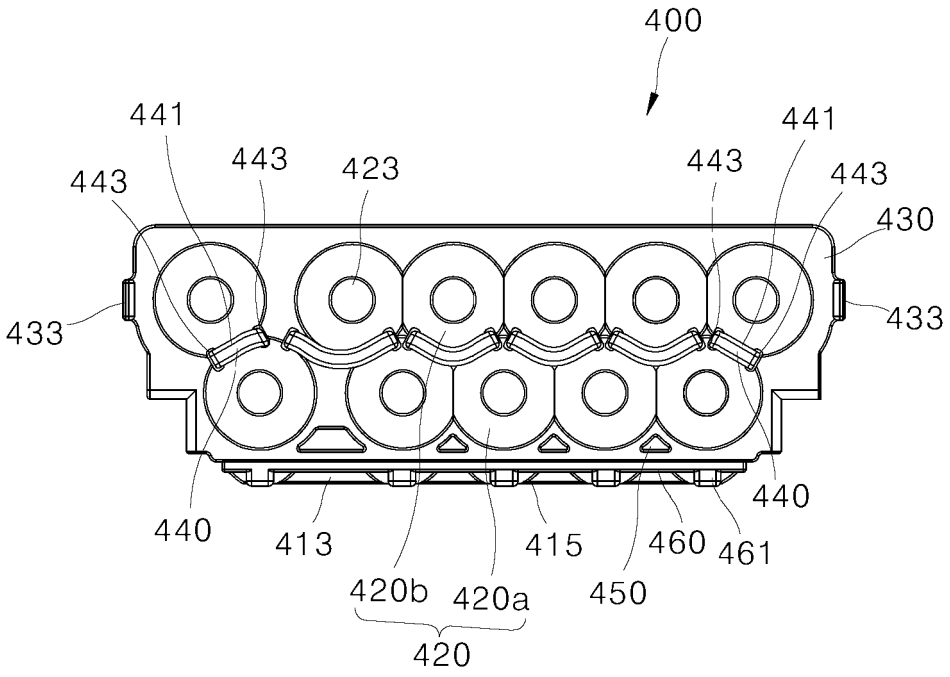
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FIG. 25

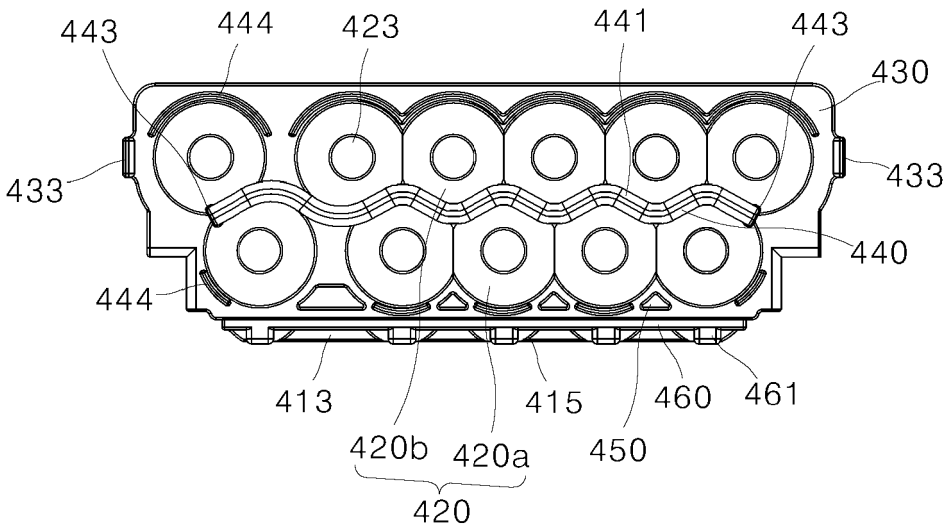
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FIG. 26

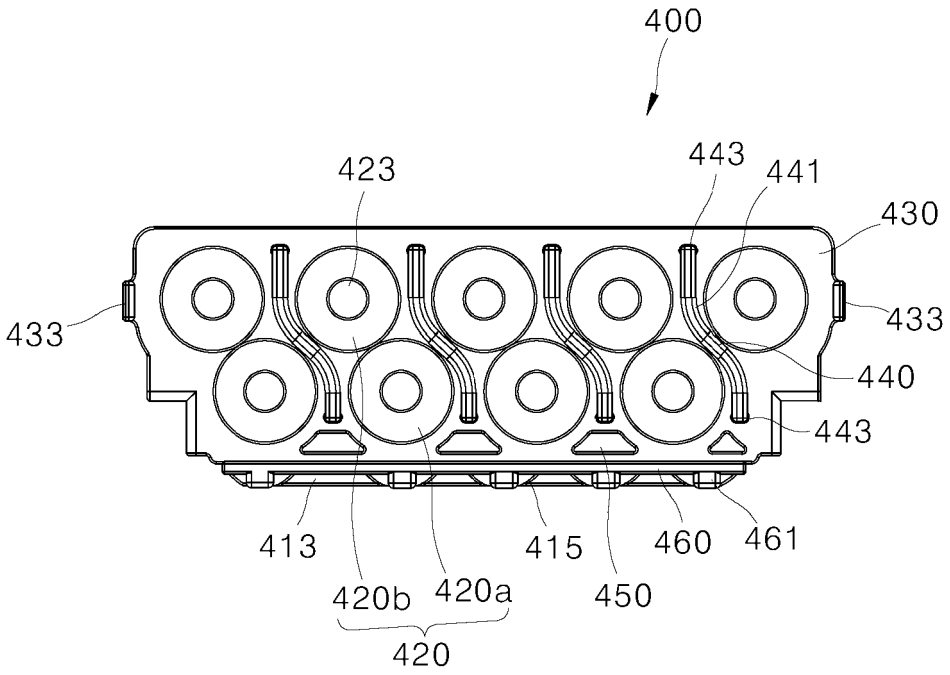
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FIG. 27

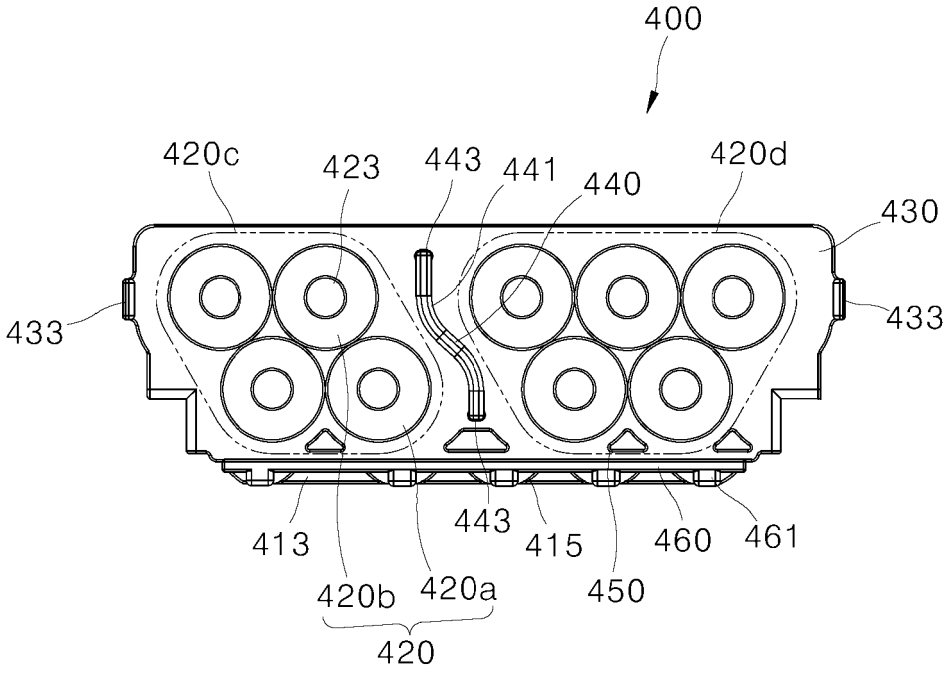
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FIG. 28

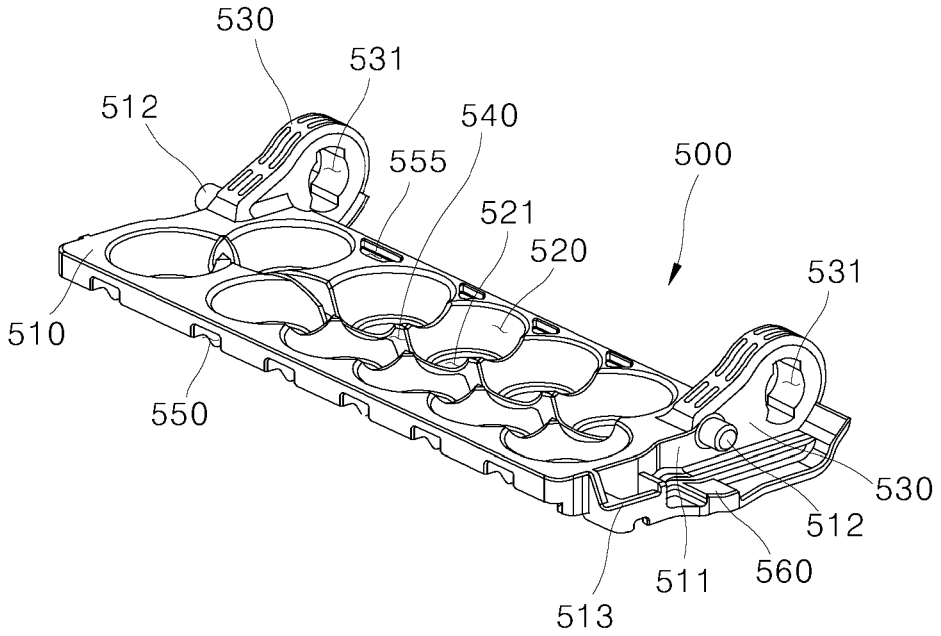
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FIG. 29

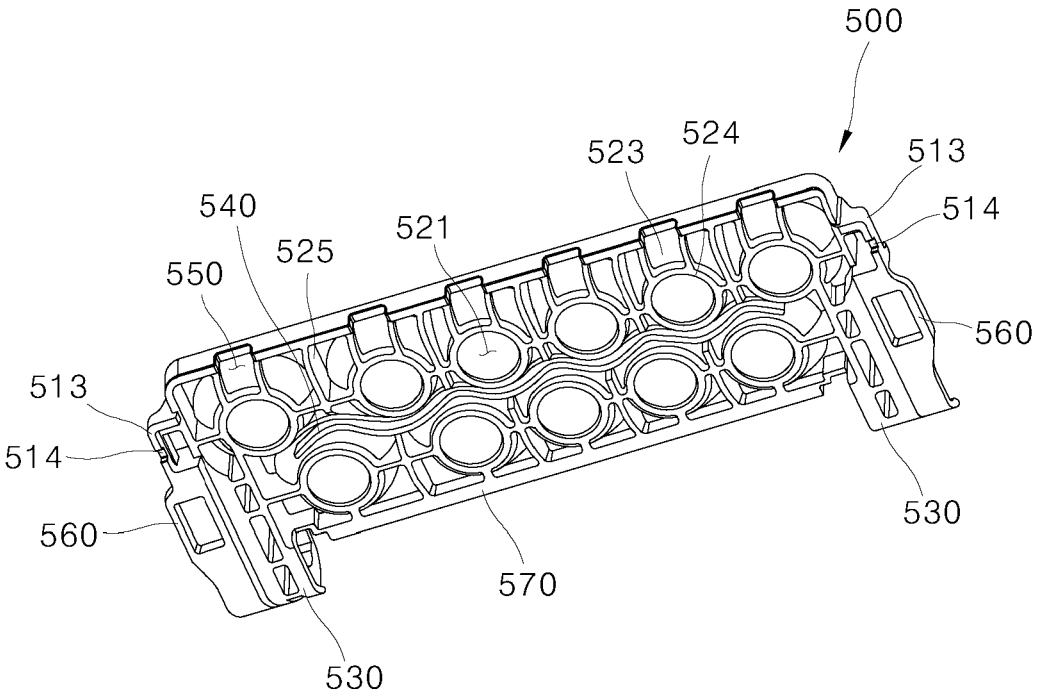
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FIG. 30

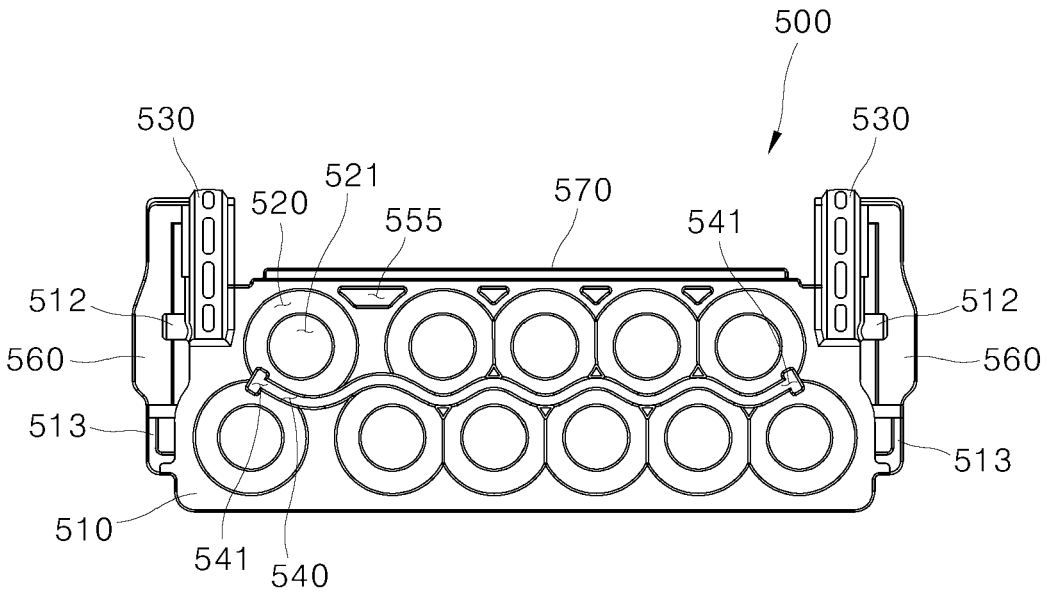
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FIG. 31

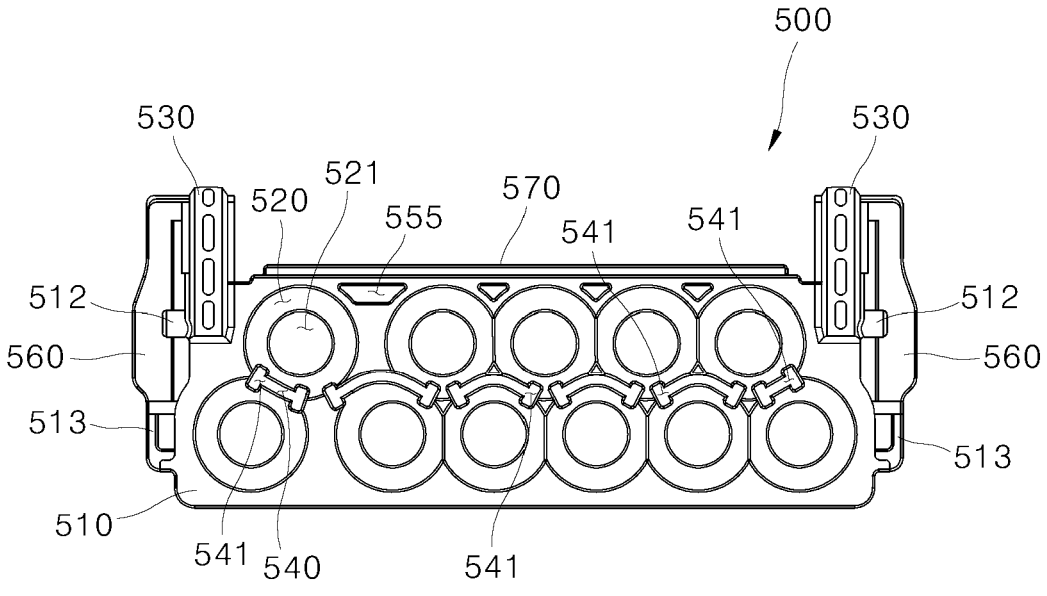
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FIG. 32

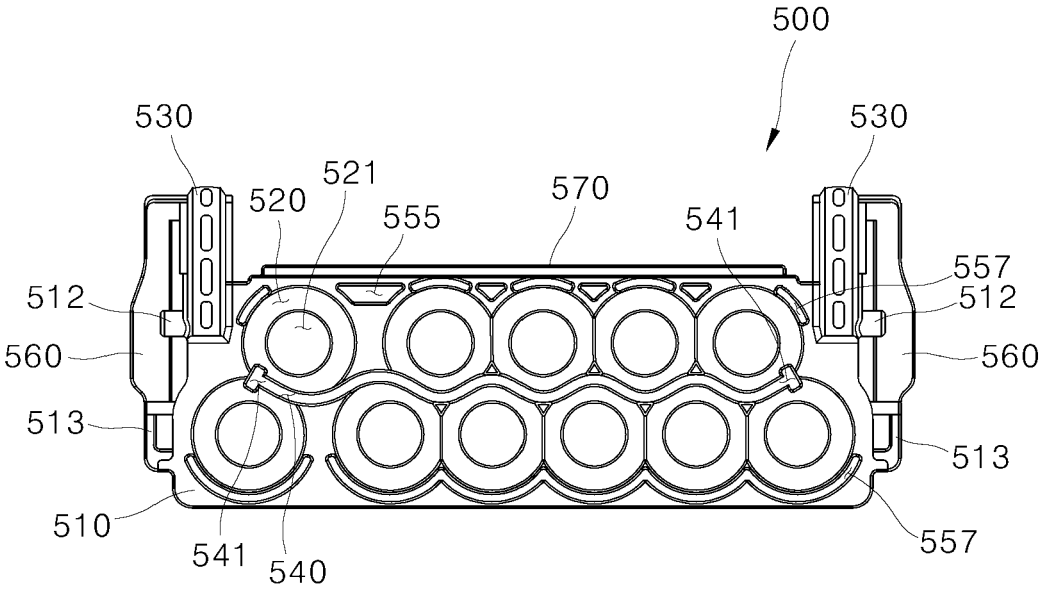
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FIG. 33

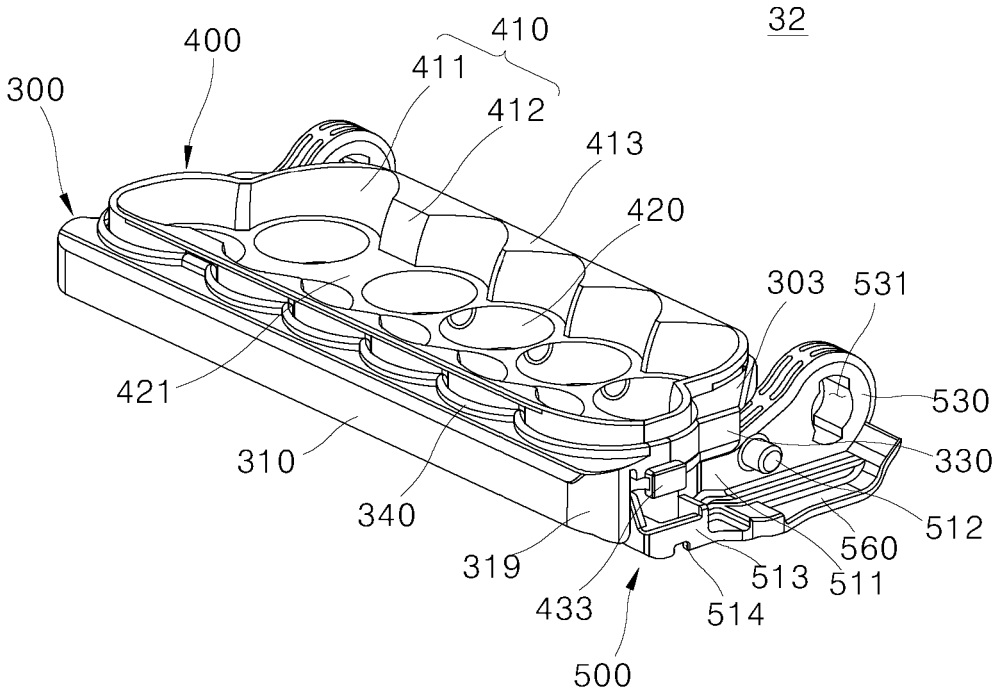
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FIG. 34

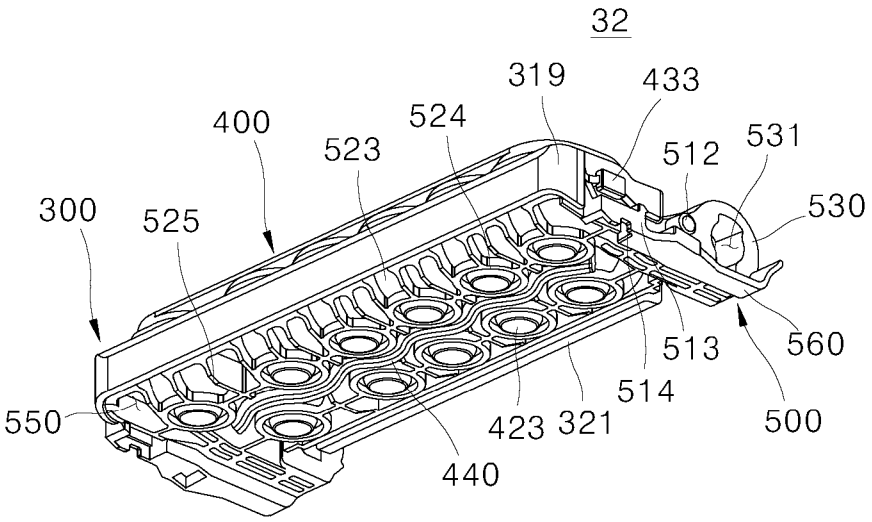
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FIG. 35

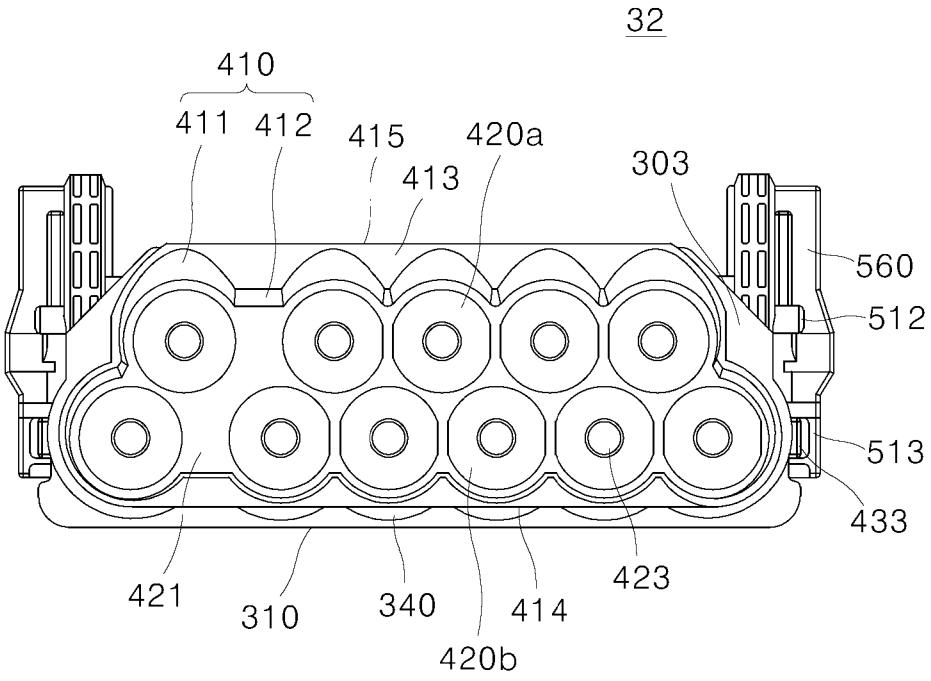
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FIG. 36

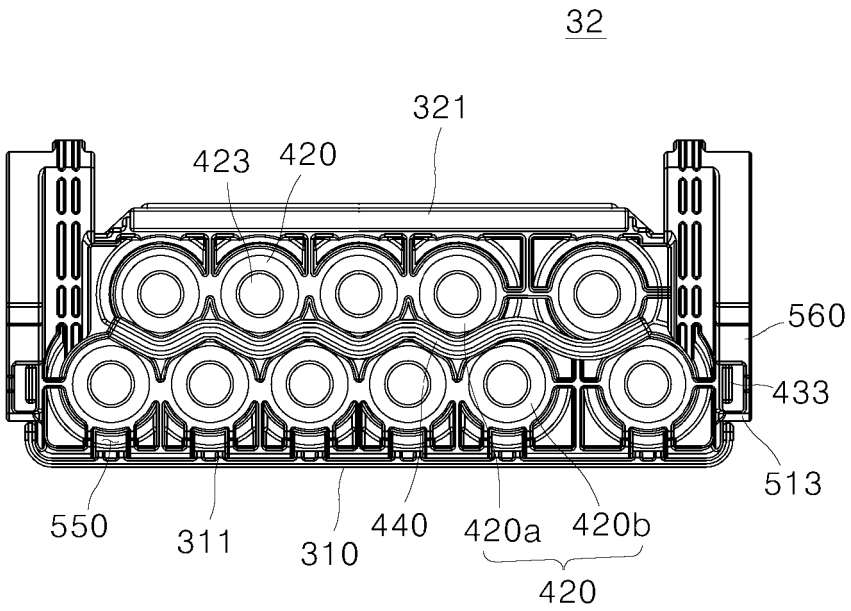
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FIG. 37

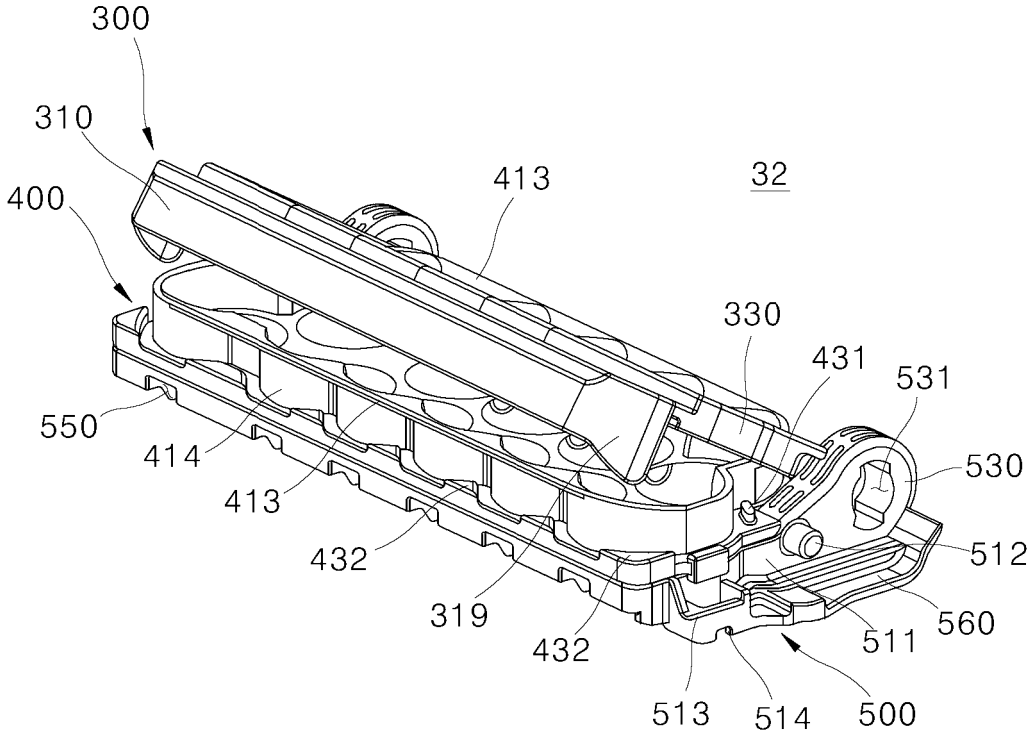
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FIG. 38

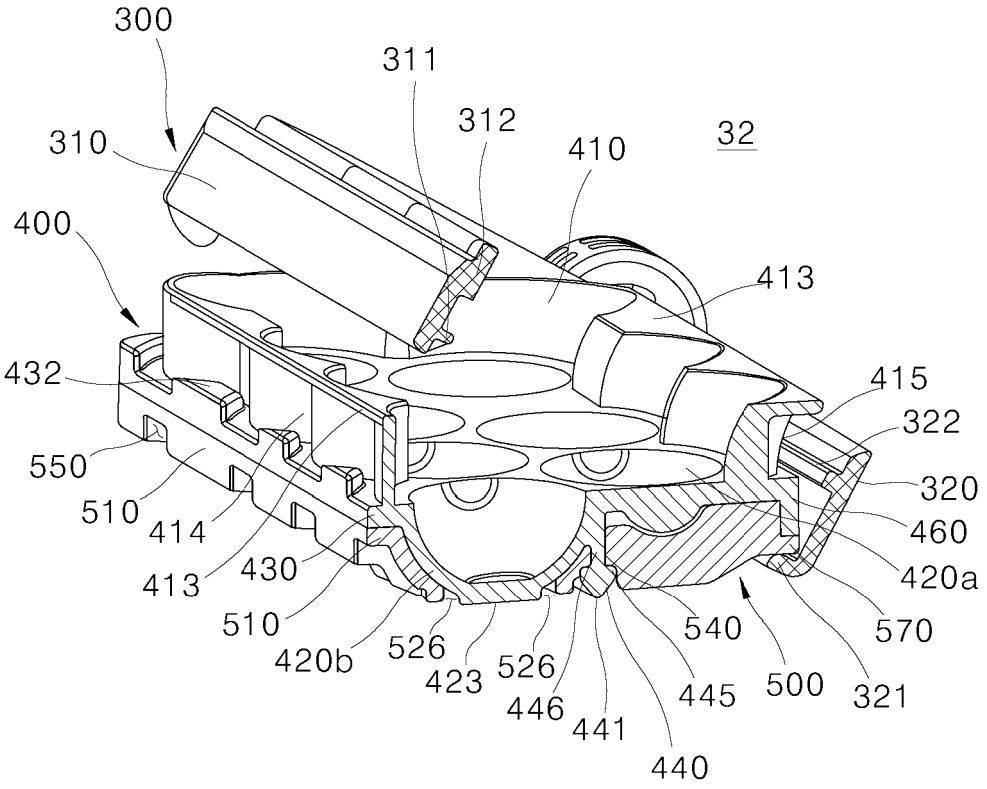
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FIG. 39

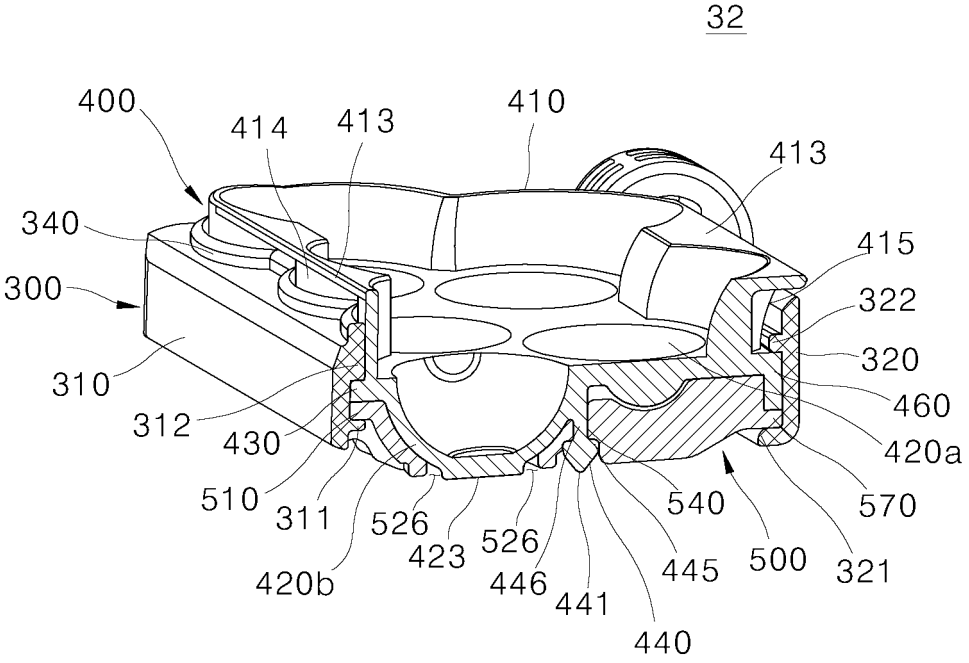
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FIG. 40

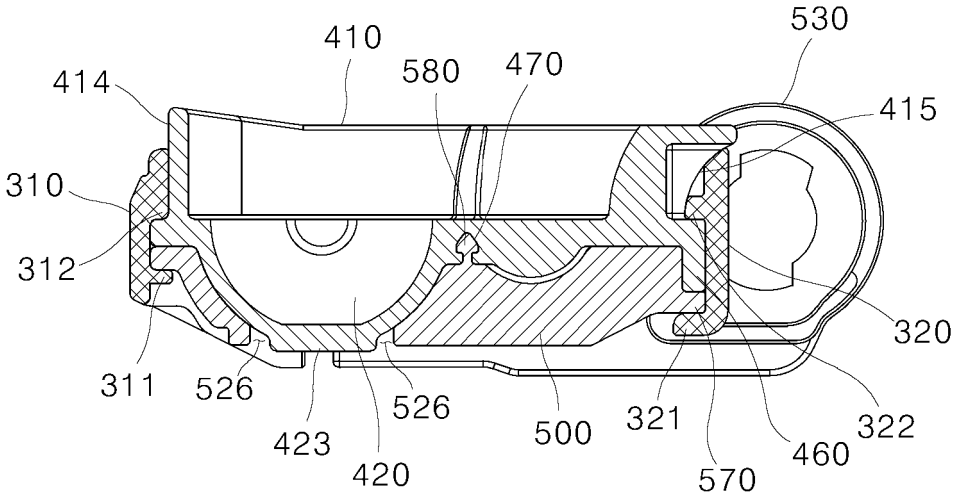
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FIG. 41

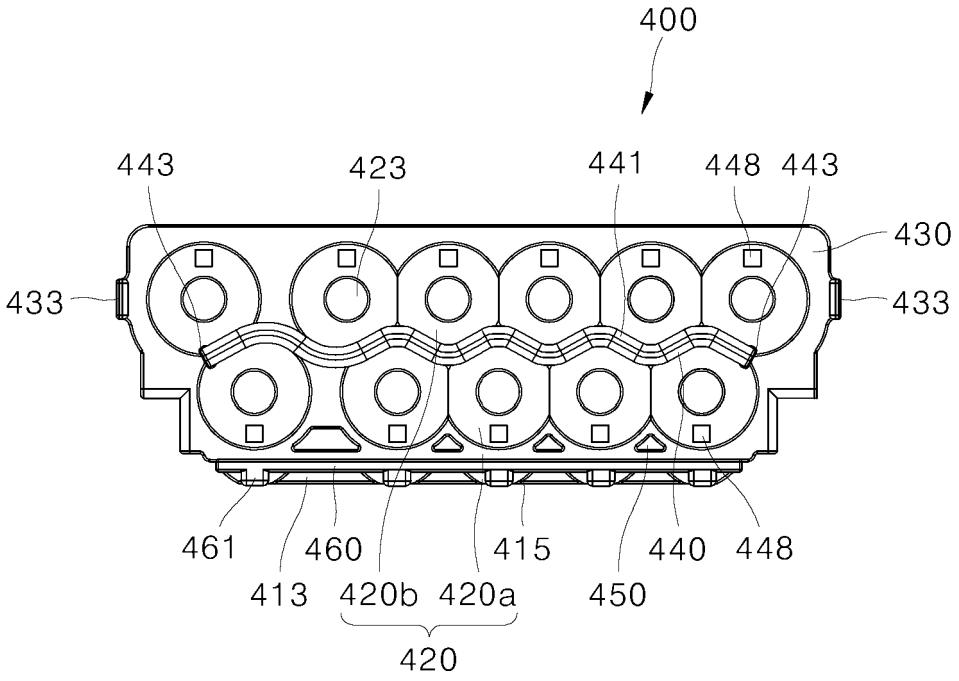
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FIG. 42

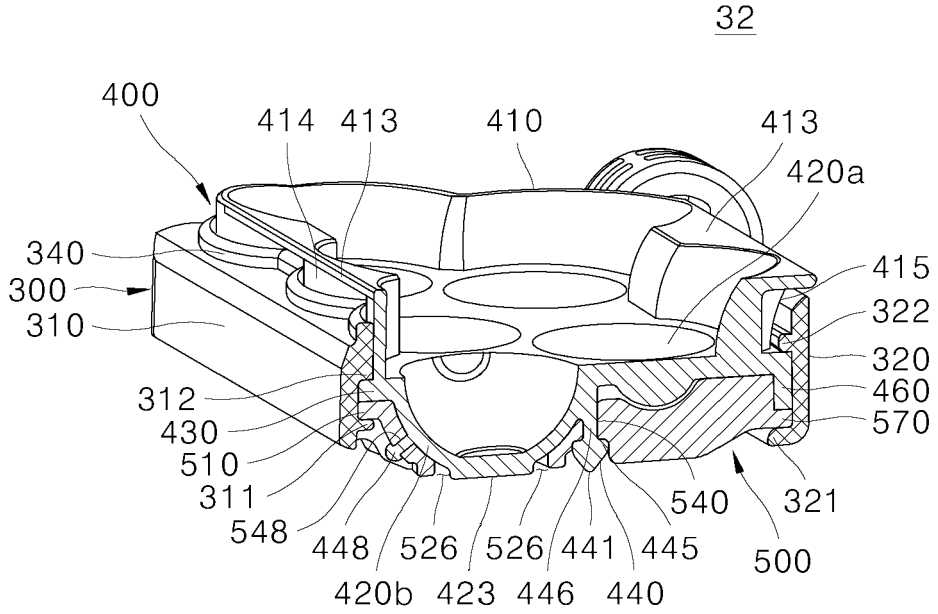
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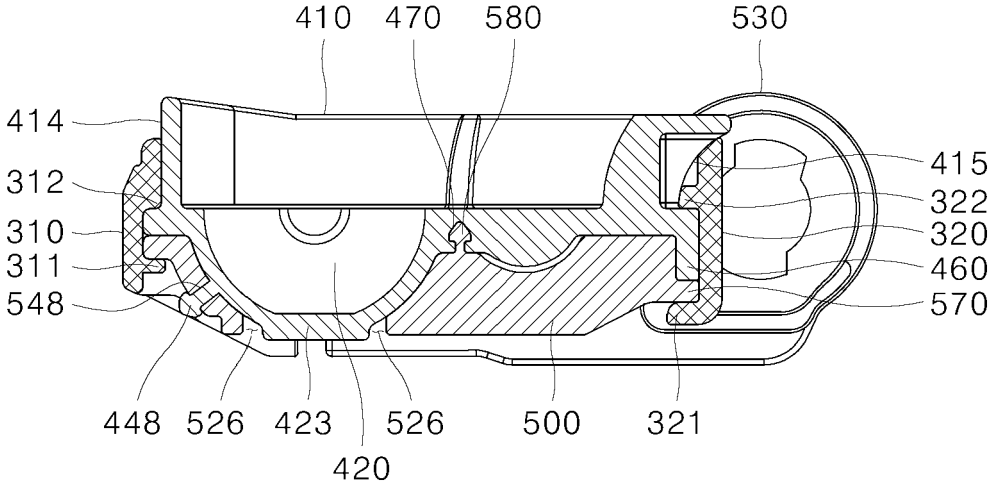
FIG. 43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EUROPEAN SEARCH REPORT

Application Number
EP 24 20 5175

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 A	EP 2 568 235 B1 (LG ELECTRONICS INC [KR]) 7 November 2018 (2018-11-07) * figures 1-6 * * paragraphs [0060], [0061] *	1-8, 11-15 9,10	INV. F25C1/24
X A	US 2020/158403 A1 (HONG JINIL [KR] ET AL) 21 May 2020 (2020-05-21) * figures 1-34 * * paragraphs [0231], [0232] *	1-8, 11-15 9,10	
X,P	WO 2024/151097 A1 (LG ELECTRONICS INC [KR]) 18 July 2024 (2024-07-18) * figures 1-23 *	1,13	
X,P A,P	WO 2024/150998 A2 (LG ELECTRONICS INC [KR]) 18 July 2024 (2024-07-18) * figures 1-36 *	1-8, 11-15 9,10	

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	26 February 2025	Dezso, Gabor

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26-02-2025

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WO 2024150998 A2	18-07-2024	NONE	

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