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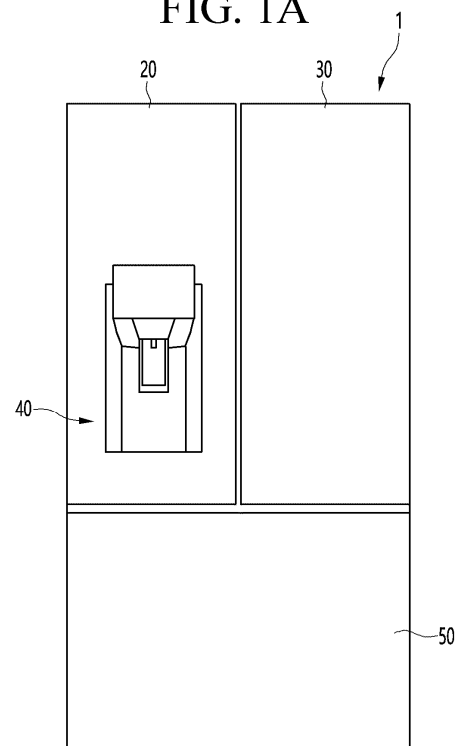
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(54) **REFRIGERATOR**

(57) A refrigerator includes an ice-making body having a circumferential portion configured to receive water, a blade configured to contact ice formed on the circumferential portion and separate the ice from the circumferential portion, and an ice-compression assembly configured to compress ice having a first size scraped from the circumferential portion by the blade and form the ice into a second size larger than the first size.

FIG. 1A



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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a refrigerator.

BACKGROUND

[0002] A refrigerator is an appliance that may store food at a low temperature in an internal storage space shielded by a door. The refrigerator cools the inside of the storage space by using cold air, thereby keeping stored food in a refrigerated state or a frozen state.

[0003] In some cases, an ice maker for making ice is provided in a freezing space of the refrigerator. For example, the ice maker receives water supplied from a water supply source or a water tank in a tray, and then cools the water to generate ice. The ice generated by the ice maker may be stored in an ice bin. The user may open a freezing space door, approach the ice bin, and take out the ice of the ice bin.

[0004] In some cases, where ice is formed hard, a child, an elderly person, or a consumer having weak teeth may feel discomfort when chewing the ice.

SUMMARY

[0005] The present application describes apparatus and method configured to generate chewable ice having reduced hardness.

[0006] The present application describes a refrigerator capable of manufacturing ice having strength to an extent that a consumer may chew and eat.

[0007] The present application describes a refrigerator capable of providing a tray including a peripheral surface in which ice is generated, and cooling water supplied to the peripheral surface to manufacture thin ice (ice in a first state or first state ice).

[0008] The present application describes a refrigerator capable of providing a blade on one side of the tray to separate the thin ice from the peripheral surface and manufacture powdered ice (ice in a second state or second state ice).

[0009] The present application describes a refrigerator capable of compressing the powdered ice to manufacture molded ice (ice in a third state or third state ice) having a predetermined strength.

[0010] In some implementations, a refrigerator in which the inner diameter of the cylinder narrows along the direction of ice movement, thereby allowing compression to occur along with the movement of the ice.

[0011] In some implementations, a refrigerator in which a heater is installed in the cylinder, thereby partially melting powdered ice and crushed ice delivered to the cylinder, and refreezing the melted ice to form a single lump of molded ice.

[0012] In some implementations, a refrigerator in which a greater amount of heat is supplied to a front

region adjacent to the inlet of the cylinder and a lesser amount of heat is supplied to a rear region adjacent to the outlet, thereby enabling ice delivered to the cylinder to melt in the front region and then refreeze in the rear region.

[0013] In some implementations, a refrigerator in which the cylinder is preheated before the ice is delivered to the cylinder, thereby allowing a portion of the ice delivered to the cylinder to melt and then refreeze simultaneously with its delivery, thereby compressing the ice into molded ice of a suitable chewable strength. In some implementations, a refrigerator with improved energy-saving performance by heating the cylinder when ice is transported to the cylinder, allowing some of the ice transported to the cylinder to move within the cylinder, melting and then refreezing.

[0014] In some implementations, a refrigerator that provides a temperature sensor capable of detecting the temperature of the cylinder and that can turn a heater on/off or adjust its output based on the value detected by the temperature sensor.

[0015] In some implementations, a refrigerator that can turn a heater on/off or adjust its output based on various factors, including the internal temperature, whether the door is open, changes in cooling capacity, whether a defrost operation is in progress, and whether the ice is full.

[0016] In some implementations, a refrigerator that can resolve the blockage of the cylinder by compressed ice during the process of compressing ice using a heater.

[0017] In some implementations, a refrigerator that incorporates a replaceable discharge pipe at the rear end of the cylinder, allowing the strength and size of the formed ice to be adjusted based on the material and size of the discharge pipe. In some implementations, a refrigerator in which the discharge pipe is formed of an elastic material with elasticity, thereby compressing ice radially and also in the direction of ice transport (axial direction).

[0018] In some implementations, a refrigerator capable of producing ice that maintains its molded shape for a long time by increasing the compressive strength of powdered ice.

[0019] In some implementations, a refrigerator in which ice, which has been first compressed while passing through a cylinder, passes through the cylinder's discharge port and then flows into a discharge pipe for a second compression.

[0020] In some implementations, a refrigerator in which ice, which has been secondarily compressed by a piston while flowing into the discharge pipe and moving, exits through an outlet formed smaller than the inner diameter of the discharge pipe, expanding the outlet. Due to a force that prevents the outlet from expanding, the ice is thirdly compressed, allowing it to exit the discharge pipe in a more solid state.

[0021] In some implementations, a refrigerator in which a temperature sensor can be installed on the out-

side of the cylinder. In some implementations, a refrigerator in which a cylinder can be attached to an external fixing part.

[0022] In some implementations, a refrigerator capable of cooling water present on the peripheral surface of the tray by providing a cold air supply device that supplies cold air to the tray.

[0023] In some implementations, a refrigerator in which the tray is made of a material with high thermal conductivity, for example, metal, so that the tray can be quickly cooled by the supplied cold air.

[0024] In some implementations, a refrigerator in which at least one of a protrusion and a recess is formed on the peripheral surface of the tray to improve ice-making performance, and in which at least one of the protrusion and the recess can be provided with a space or surface for ice formation.

[0025] In some implementations, a refrigerator in which a through-hole is formed in the tray to increase the cooling area of the tray, and in which a cold air path is formed in the through-hole. In some implementations, a refrigerator having a water storage tank, and arranging a tray so that at least a portion of the tray is contained in the water storage tank, so that water can be smoothly supplied to the periphery of the tray.

[0026] In some implementations, a refrigerator includes a tray having a peripheral surface (or peripheral wall) through which water is supplied, a blade that scrapes ice formed on the peripheral surface while in contact with the ice formed on the peripheral surface, and a compression assembly that compresses ice of a first size separated from the peripheral surface by the blade into a second size larger than the first size.

[0027] The compression assembly may include a cylinder into which ice separated from the peripheral surface is introduced, and a piston that reciprocates under the action of a motor and compresses the ice introduced into the cylinder.

[0028] The refrigerator may include a heater installed in the compression assembly to provide heat to at least a portion of the compression assembly.

[0029] The heater may be installed in the cylinder.

[0030] The heater may be formed in a linear shape and may be spirally wound around the outer surface of the cylinder.

[0031] The heater may be formed such that the distance between the coils of the heater coils varies in at least some sections along the longitudinal direction of the cylinder. The heater may be formed such that the winding spacing on one side adjacent to the cylinder's inlet is greater than the winding spacing on the other side adjacent to the cylinder's outlet.

[0032] The heater may be formed such that the heat per unit area is different at least in some sections along the cylinder's length.

[0033] The heater may be formed such that the heat per unit area supplied to one side adjacent to the cylinder's inlet is greater than the heat per unit area supplied to

the other side adjacent to the cylinder's outlet.

[0034] The heater may be controlled to turn on at least one step before the ice to be compressed is transported to the cylinder.

[0035] The heater may be controlled to turn on at least one step after the ice to be compressed is transported to the cylinder.

[0036] The cylinder may be provided with a temperature sensor on its outer surface that detects the outer surface temperature of the cylinder. When the temperature of the cylinder detected by the temperature sensor drops below a preset target temperature while the heater is off, the heater may be controlled to turn on.

[0037] When the temperature of the cylinder detected by the temperature sensor reaches a preset target temperature while the heater is on, the heater may be controlled to turn off.

[0038] The output of the heater may be controlled to vary depending on the operating conditions of the refrigerant cycle and the surrounding environment for maintaining the storage temperature. For example, the surrounding environment may include a temperature or a change of the temperature in a place where the refrigerator is installed.

[0039] When the cooling capacity of the refrigerant cycle increases, the output of the heater may be controlled to increase, and when the cooling capacity of the refrigerant cycle decreases, the output of the heater may be controlled to decrease.

[0040] The cylinder may include an inlet through which ice separated from the circumferential surface flows, an outlet through which compressed ice within the cylinder flows, and a compression space formed between the inlet and the outlet, in which ice flowing into the inlet flows toward the outlet and is compressed. The compression space of the cylinder may be formed such that its diameter gradually decreases toward the discharge port in at least some sections.

[0041] The cylinder may be made of a metal material that facilitates heat transfer.

[0042] The cylinder may have a sensor mounting portion formed on the outer surface thereof, into which a temperature sensor is mounted.

[0043] The sensor mounting portion may have a sensor mounting groove formed vertically open to accommodate the temperature sensor.

[0044] The cylinder may include a discharge pipe coupled to the discharge port side of the cylinder, through which ice discharged from the discharge port is further compressed and then discharged.

[0045] The discharge pipe may be made of an elastic material having flexibility.

[0046] The discharge pipe may have one end open to form a connection portion connected to the discharge port, and the connection portion may be hollow and may be coupled to surround the circumferential surface of the cylinder in which the discharge port is formed.

[0047] One outer surface of the cylinder, surrounded

by the connection portion, may have a groove formed concavely to a predetermined depth and extending along the circumferential direction. The connecting portion may have a protrusion formed on the inner surface that protrudes inwardly and extends along the inner surface, and the protrusion may be inserted into the groove.

[0048] A ring-shaped sealing member may be inserted into the groove.

[0049] The discharge pipe may include a discharge portion having one end extending from the connecting portion and an outlet formed on the other end through which compressed ice is discharged.

[0050] The discharge portion may include a first section whose inner diameter gradually decreases from one end connected to the connecting portion to the other end where the outlet is formed.

[0051] The discharge portion may include a second section defining the outlet and having a constant inner diameter.

[0052] The diameter of the second section may be formed to be smaller than the diameter of the first section.

[0053] The diameter of the second section may be formed to be smaller than the diameter of the discharge port of the cylinder.

[0054] The cylinder may have at least one extension portion extending outward from one end where the inlet port is formed, and the extension portion may have at least one coupling hole formed therein. The refrigerator may include a cold-air duct arranged to supply cold air toward the peripheral surface of the tray. However, a liquid other than water may be supplied to the peripheral surface.

[0055] The cold-air duct may include a portion extending in a tangential direction of the tray or in a direction corresponding thereto.

[0056] The refrigerator may include a bracket forming a receiving space for the tray, and the cold-air duct may be coupled to the bracket at an angle.

[0057] The peripheral surface of the tray may include a portion extending in a rounded manner.

[0058] The peripheral surface of the tray may include a portion having an arc shape.

[0059] The peripheral surface of the tray may include a portion having a circular shape.

[0060] The tray may include a drum.

[0061] With respect to the tray, a cold-air duct may be provided on one side of the tray, and a guide wall may be provided on the other side of the tray to guide cold air toward the peripheral surface of the tray. One side of the tray provided with the cold-air duct and the other side of the tray provided with the guide wall may form opposite sides with respect to the center of the tray. Therefore, the cold air can flow smoothly along the peripheral surface of the tray.

[0062] The refrigerator may include a first blade provided on one side of the tray and configured to separate ice (first-state ice) formed on the peripheral surface from the tray.

[0063] One side of the tray provided with the cold-air duct and the other side of the tray provided with the first blade may form opposite sides with respect to the center of the tray. Therefore, the first blade can prevent resistance to the cold air flow.

[0064] The refrigerator may include a reservoir for supplying water to the tray, and the reservoir may be arranged opposite a cold air path supplied to the peripheral surface of the tray through a cold-air duct.

[0065] With respect to the center of the tray, the cold air path from the cold-air duct toward the peripheral surface of the tray and the reservoir may be arranged on opposite sides. Accordingly, cold air introduced through the cold-air duct can directly affect the water reservoir, preventing freezing of the water in the water reservoir.

[0066] The water reservoir may be positioned below the tray relative to the direction of gravity, and the cold air path may be positioned above the tray.

[0067] The refrigerator may include a bracket having a wall supporting the water reservoir, and the bracket may include a portion positioned in a space between the peripheral surface of the tray and the water reservoir. The portion of the bracket may prevent cold air from being supplied to the water reservoir.

[0068] The refrigerator may include a bracket forming a receiving space for the tray, and the bracket may form an opening through which ice separated from the tray may move.

[0069] The opening may be formed on the opposite side of the cold-air duct relative to the tray, so that cold air supplied to the tray may diffuse through the opening.

[0070] The opening may be defined as a space between a guide wall guiding cold air to the peripheral surface of the tray and a wall of the bracket to which a first blade is coupled. Based on the direction of cold air flow supplied from the cold-air duct, the downstream cross-sectional area of the cold-air duct is formed to be smaller than the upstream cross-sectional area, so that cold air can be supplied in a concentrated manner along the peripheral surface of the tray.

[0071] The tray is constructed of a material with high thermal conductivity, such as metal, and can be rapidly cooled by the cold air.

[0072] At least one of a protrusion and a recess is formed on the peripheral surface of the tray, and a space or surface for ice formation is provided in at least one of the protrusion and the recess, thereby improving ice-making performance and enabling ice formed on the peripheral surface to be separated by a blade.

[0073] Due to the configuration of the recess and the protrusion, the thickness of the ice formed in the recess is formed to be greater than that of the ice formed in the protrusion. When ice is separated by the blade, the ice formed in the recess is separated relative to the protrusion, facilitating discharge as powdered ice.

[0074] The recess and the protrusion may be arranged axially on the peripheral surface. The recesses and protrusions may be formed in multiple numbers, and the

recesses and protrusions may be arranged alternately.

[0075] The tray may be provided to be rotatable.

[0076] The tray may include a shaft coupling portion provided at the center of the tray and coupled to a shaft, a first tray portion forming the circumferential surface, and a second tray portion extending radially to connect the shaft coupling portion and the first tray portion.

[0077] The second tray portion may be provided in multiple numbers.

[0078] The first tray portion may include an outer circumferential surface forming the circumferential surface and an inner circumferential surface facing the shaft coupling portion.

[0079] The tray may include a through-hole through which cold air passes to increase the cooling area of the tray.

[0080] The through-hole may be formed to penetrate the tray in the axial direction.

[0081] The shaft coupling portion, the first tray portion, and the second tray portion may define the through-hole.

[0082] In some implementations, since ice having strength to an extent that a consumer may chew and eat may be manufactured, consumer satisfaction may increase.

[0083] In some implementations, by providing a tray including a peripheral surface in which ice is generated, and cooling water supplied to the peripheral surface, thin ice (ice in a first state) may be manufactured.

[0084] In some implementations, by providing a blade on one side of the tray to separate the thin ice from the peripheral surface, powdered ice (ice in a second state) may be manufactured.

[0085] In some implementations, by compressing the powdered ice, molded ice (ice in a third state) having a predetermined strength may be manufactured.

[0086] In some implementations, the inner diameter of the cylinder is formed to narrow along the direction of ice movement, allowing compression to occur along with the ice movement.

[0087] In some implementations, a heater is installed in the cylinder, allowing some of the powdered ice and crushed ice delivered to the cylinder to melt, and the melted ice to refreeze, forming a single lump of molded ice.

[0088] In some implementations, a greater amount of heat is supplied to the front region adjacent to the inlet of the cylinder, and a lesser amount of heat is supplied to the rear region adjacent to the outlet. This allows the ice delivered to the cylinder to melt in the front region and then refreeze in the rear region.

[0089] In some implementations, the cylinder is preheated before the ice is delivered to the cylinder, allowing a portion of the ice delivered to the cylinder to melt and then refreeze simultaneously with the delivery, thereby compressing the ice into molded ice of a suitable chewable strength. In some implementations, energy efficiency may be improved by heating the cylinder when ice is transported to it, allowing some of the ice trans-

ported to the cylinder to move inside the cylinder, melting and then refreezing.

[0090] In some implementations, a temperature sensor capable of detecting the temperature of the cylinder, and can control the heater on/off or adjust its output based on the value detected by the temperature sensor.

[0091] In some implementations, the heater is controlled to be on/off or adjust its output based on various factors, including the internal temperature, whether the door is open, changes in cooling capacity, whether the defrost operation is in progress, and whether the ice is full.

[0092] In some implementations, the ice maker has the advantage of resolving the cylinder blockage caused by compressed ice during the process of compressing ice inside the cylinder through the heater.

[0093] In some implementations, the refrigerator may include a replaceable discharge pipe at the rear end of the cylinder, allowing the strength and size of the formed ice to be adjusted based on the material and size of the discharge pipe.

[0094] In some implementations, the discharge pipe is formed of an elastic material with elasticity, thereby compressing ice radially and also in the direction of ice transport (axial direction).

[0095] In some implementations, the refrigerator can produce ice that maintains its molded shape for a long time by increasing the compressive strength of powdered ice.

[0096] In some implementations, ice that has been first compressed while passing through a cylinder passes through the cylinder's discharge port and then flows into the discharge pipe for a second compression.

[0097] In some implementations, ice that has been secondarily compressed by a piston while moving through the discharge pipe expands as it exits through an outlet formed smaller than the inner diameter of the discharge pipe. Due to the force resisting expansion of the outlet, it undergoes a third compression, allowing it to exit the discharge pipe in a more solid state.

[0098] In some implementations, the refrigerator facilitates the installation of a temperature sensor on the outside of the cylinder.

[0099] In some implementations, the refrigerator facilitates the easier attachment of the cylinder to external fixing components., a cold air supply device that supplies cold air to the tray can be provided to cool water present on the peripheral surface of the tray.

[0100] In some implementations, the tray is constructed of a material with high thermal conductivity, such as a metal material, so that the tray can be quickly cooled by the supplied cold air.

[0101] In some implementations, at least one of a protrusion and a recess is formed on the peripheral surface of the tray to improve the ice-making performance of the tray, and a space or surface for ice formation is provided in at least one of the protrusion and the recess, thereby improving the ice-making performance of the

tray.

[0102] In some implementations, a through-hole is formed in the tray, and a cold air path is formed in the through-hole, thereby increasing the cooling area of the tray.

[0103] In some implementations, a water reservoir is provided, and the tray is arranged so that at least a portion of the tray is contained in the water reservoir, thereby ensuring a smooth supply of water to the peripheral surface of the tray. In some implementations, a bracket for supporting a reservoir, and the bracket includes a wall extending toward a space between a periphery of a tray and the reservoir, thereby restricting the supply of cold air to the reservoir and thus preventing water stored in the reservoir from freezing.

BRIEF DESCRIPTION OF THE DRAWINGS

[0104]

FIG. 1A is a front view showing an example of a refrigerator, and FIG. 1B is a view showing an example state in which one door of the refrigerator is separated.

FIG. 2A is a perspective view showing an example of a front of a first refrigerating space door, and FIG. 2B is a perspective view showing an example of a rear of the first refrigerating space door.

FIG. 3A is a view showing an example state in which a basket and a filter are separated from the first refrigerating space door, and FIG. 3B is a view showing an example state in which an ice-making space door and a cover member are separated from the first refrigerating space door.

FIG. 4 is a perspective view showing an example of an ice maker disposed inside an ice-making space in an example state in which the ice-making space door is separated from the first refrigerating space door.

FIG. 5 is a view showing an example configuration of an ice maker and a door duct.

FIG. 6 is a front perspective view showing an example configuration of an ice maker and an ice-making space bracket.

FIG. 7 is a rear perspective view showing an example configuration of an ice maker and an ice-making space bracket.

FIG. 8 is an exploded perspective view showing an example configuration of an ice maker and an ice-making space bracket.

FIG. 9 is an exploded perspective view showing an example configuration of an ice-making part of an ice maker.

FIG. 10 is an exploded perspective view showing an example configuration of a tray assembly and a reservoir.

FIG. 11A is a view showing an example state when the tray assembly is at a first position.

FIG. 11B is a view showing an example state when

the tray assembly is at a second position.

FIG. 12 is an exploded perspective view showing an example configuration of a compression assembly of an ice maker.

FIG. 13 is a perspective view showing an example configuration of a transfer pipe and a gear device.

FIG. 14 is a plan view showing an example configuration of a transfer pipe and a gear device.

FIG. 15A is a view showing an example state in which a piston is at a first position and ice de-iced from a tray assembly falls into a transfer pipe.

FIG. 15B is a view showing an example state in which a piston moves to a second position and ice of a transfer pipe is compressed by the piston.

FIG. 15C is a view showing an example state in which a piston moves to a third position and a transfer guide device supplies ice to the transfer pipe.

FIG. 15D is a view showing an example state in which a piston returns to a first position and the transfer guide device moves to an original position.

FIG. 16 is a plan view showing an example configuration of an ice-making part of an ice maker.

FIG. 17 is a left side view showing an example configuration of the ice-making part of the ice maker.

FIG. 18 is a right side view showing an example configuration of the ice-making part of the ice maker.

FIG. 19 is a front view showing an example configuration of the ice-making part of the ice maker.

FIG. 20 is a left perspective view showing an example configuration of a cold-air duct.

FIG. 21 is a bottom perspective view showing an example configuration of the cold-air duct.

FIG. 22 is a view showing a partial configuration of the ice-making part.

FIG. 23 is a view showing an example state in which a tray assembly and a reservoir are removed from FIG. 22.

FIG. 24 is a cross-sectional view taken along line 24-24 of FIG. 8.

FIG. 25 is a cross-sectional view taken along line 25-25 of FIG. 8.

FIG. 26 is a view showing an example state in which cold air is supplied from a refrigerating space door to an ice-making chamber and cold air in the ice-making chamber is returned to an outside of the refrigerating space door.

FIG. 27 is a view showing an example configuration of an ice-making part.

FIG. 28 is a view showing an example configuration of an ice-making part.

FIG. 29 is a view showing an example configuration of an ice-making part.

FIG. 30 is a side view showing an example state in which a cylinder and a discharge pipe are coupled.

FIG. 31 is a longitudinal cross-sectional view of FIG. 30.

FIG. 32 is a rear perspective view showing an example state in which a cylinder and a discharge pipe

are coupled.

FIG. 33 is a perspective view showing an example state in which a cylinder and a discharge pipe are coupled.

FIG. 34 is a side view of a cylinder.

FIG. 35 is a rear perspective view of a cylinder. FIG. 36 is a perspective view of a cylinder.

FIG. 37 is a cross-sectional view showing an example state in which a cylinder and a discharge pipe are coupled.

FIGS. 38 to 42 are side views showing an example state in which a heater and a temperature sensor are installed at various locations in a cylinder.

DETAILED DESCRIPTION

[0105] Hereinafter, some implementations of the present disclosure will be described in detail through example drawings. In adding reference numerals to components in each drawing, it should be noted that the same components are given the same numerals as much as possible even if displayed on different drawings. In addition, in describing implementations of the present disclosure, if it is determined that a detailed description of a related known configuration or function interferes with understanding of the implementations of the present disclosure, the detailed description thereof will be omitted.

[0106] FIG. 1A is a front view showing an example of a refrigerator, FIG. 1B is a view showing an example state in which one door of the refrigerator is separated, FIG. 2A is a perspective view viewed from a front of a first refrigerating space door, and FIG. 2B is a perspective view viewed from a rear of the first refrigerating space door.

[0107] FIG. 3A is a view showing an example state in which a basket and a filter are separated from the first refrigerating space door, and FIG. 3B is a view showing an example state in which an ice-making space door and a cover member are separated from the first refrigerating space door.

[0108] Referring to FIGS. 1A to 3A, in some implementations, a refrigerator 1 may include a cabinet 10. The cabinet 10 may include a storage space. The refrigerator 1 may further include a door opening and closing the storage space. The door may be rotatably or movably connected to the cabinet 10.

[0109] The storage space may include a refrigerating space 18. The storage space may selectively or additionally include a freezing space 19. For example, FIG. 1B illustrates that the storage space includes the refrigerating space 18 and the freezing space 19. The refrigerating space 18 and the freezing space 19 may be partitioned by a partition wall.

[0110] The door may include refrigerating space doors 20 and 30 opening and closing the refrigerating space 18. The refrigerating space 18 may be opened and closed by one or more refrigerating space doors 20 and 30. The door may include a freezing space door 50 opening and

closing the freezing space 19. The freezing space 19 may be opened and closed by one or more freezing space doors 50.

[0111] Hereinafter, an example in which the refrigerating space 18 is opened and closed by a first refrigerating space door 20 and a second refrigerating space door 30 will be described.

[0112] At least one of the first refrigerating space door 20 and the second refrigerating space door 30 may include a dispenser 40 for discharging water and/or ice. Of course, depending on a type of refrigerator, it is also possible that the freezing space door 50 includes the dispenser 40.

[0113] At least one of the first refrigerating space door 20 and the second refrigerating space door 30 may include one or more ice makers 100.

[0114] Hereinafter, an example in which the ice maker 100 is provided in the first refrigerating space door 20 will be described. In some examples, it is also possible that an ice maker is provided in the second refrigerating space door 30 or the freezing space door 50. In this case, the dispenser 40 and the ice maker may be provided in the same door. Alternatively, an additional ice maker may also be provided in the refrigerating space 18 or the freezing space 19.

[0115] FIG. 1B illustratively shows that the refrigerator 1 is a bottom freezer type refrigerator, but unlike this, it is noted that the idea of the present disclosure may be equally applied to a side-by-side type refrigerator or a top-mount type refrigerator. In the case of the side-by-side type or the top-mount type refrigerator, a freezing space door may include an ice maker and a dispenser, or a refrigerating space door may include an ice maker and a dispenser.

[0116] The dispenser 40 may be located on a front surface of the first refrigerating space door 20. A part of the dispenser 40 is recessed rearward to provide a space in which a container may be located.

[0117] The dispenser 40 may discharge ice generated by the ice maker 100. At least a part of the ice maker 100 may be positioned higher than the dispenser 40.

[0118] The first refrigerating space door 20 may include an outer case 21. The outer case 21 may form a front appearance. The first refrigerating space door 20 may include a door liner 70. The door liner 70 may be directly or indirectly connected to the outer case 21. The door liner 70 may open and close the refrigerating space 18.

[0119] In a state in which the outer case 21 and the door liner 70 are connected, an insulating space may be formed between the outer case 21 and the door liner 70. An insulating material may be provided in the insulating space. The insulating material may be formed by curing a foaming liquid injected from the outside. Alternatively, a vacuum insulating body may be provided in the insulating space. It is also possible that the insulating material and the vacuum insulating body are provided together in the insulating space.

[0120] The refrigerator 1 may include an ice-making space 25 providing a space in which ice is generated. The ice-making space 25 may, for example, be provided in the first refrigerating space door 20. The ice maker 100 may be located in the ice-making space 25. For example, the door liner 70 may form the ice-making space 25. The ice-making space 25 may be formed as one surface of the door liner 70 is recessed toward the outer case 21.

[0121] The first refrigerating space door 20 may further include an ice bin 500 in which ice generated by the ice maker 100 is stored. The ice stored in the ice bin 500 may be discharged to the dispenser 40. The ice bin 500 may be accommodated in the ice-making space 25 together with the ice maker 100. The ice bin 500 may be located below the ice maker 100.

[0122] For example, cold air generated by a cooler may be supplied to the ice-making space 25. That is, the cooler may be configured to supply cold air to the ice-making space 25. Alternatively, the cooler may be configured to operate to supply cold air to the ice-making space 25. In this manner, the ice-making space 25 may be cooled by an indirect cooling method using cold air. In some examples, the ice-making space 25 may be cooled by a direct cooling method using cold air. In some implementations, the ice-making space 25 may be cooled by a direct cooling method, e.g., using a refrigerant pipe. In some examples, an ice-making body may be disposed in the ice-making space 25 and configured to receive water, where the ice-making body can be cooled directly or indirectly by a cooling medium such as refrigerant or cooled air. For instance, the cooling medium may contact the ice-making body and be configured to transfer heat from the ice-making body to thereby freeze water received in the ice-making body into ice.

[0123] The cooler may be configured to cool the ice-making space 25 by including at least one of a refrigerant cycle and a thermoelectric element. For example, cold air for cooling of the freezing space 19 may be supplied to the ice-making space 25.

[0124] The refrigerator 1 may further include a supply flow path 16 guiding cold air of the freezing space 19 or cold air of a space in which an evaporator generating cold air for cooling of the freezing space 19 is located, to the first refrigerating space door 20. The refrigerator 1 may include a discharge flow path 17 guiding cold air discharged from the first refrigerating space door 20 to the freezing space 19 or the space in which the evaporator is located. The supply flow path 16 and the discharge flow path 17 may be provided in the cabinet 10. Cold air circulating through the supply flow path 16 and the discharge flow path 17 may flow by a fan, for example, disposed in the freezing space 19 or the space in which the evaporator is located.

[0125] A first opening 16a forming an end portion of the supply flow path 16 may be formed in an inner wall of the refrigerating space 18. Cold air of the supply flow path 16 may be discharged from the supply flow path 16 through the first opening 16a. A second opening 17a forming an

end portion of the discharge flow path 17 may be formed in the inner wall of the refrigerating space 18. Cold air of the supply flow path 16 may flow into the discharge flow path 17 through the second opening 17a. The first opening 16a and the second opening 17a may be formed in one inner wall among a plurality of inner walls of the refrigerating space 18.

[0126] The first refrigerating space door 20 may include a cold-air inlet 75. When the first refrigerating space door 20 is closed, the cold-air inlet 75 may communicate with the supply flow path 16 through the first opening 16a. The first refrigerating space door 20 may include a cold-air outlet 76. When the first refrigerating space door 20 is closed, the cold-air outlet 76 may communicate with the discharge flow path 17 through the second opening 17a.

[0127] The cold-air inlet 75 may be formed on one side surface of the door liner 70. Although not limited, the one side surface of the door liner 70 is a surface facing an inner wall of the refrigerating space 18 in which the supply flow path 16 is located when the first refrigerating space door 20 is closed. The cold-air outlet 76 may be formed on the one side surface of the door liner 70. Although not limited, the one side surface of the door liner 70 is a surface facing an inner wall of the refrigerating space 18 in which the discharge flow path 17 is located when the first refrigerating space door 20 is closed.

[0128] The one side surface of the door liner 70 may include a first side surface portion 72 and a second side surface portion 74 having different widths in a front-rear direction. A width in the front-rear direction of the second side surface portion 74 may be formed greater than a width of the first side surface portion 72. At least one of the cold-air inlet 75 and the cold-air outlet 76 may be formed in the second side surface portion 74 of the door liner 70. The second side surface portion 74 may protrude further toward the refrigerating space 18 than the first side surface portion 72.

[0129] The first refrigerating space door 20 may include an ice-making space door 60 opening and closing the ice-making space 25. The ice-making space door 60 may be an insulating door in which an insulating material is provided inside. The ice-making space door 60 may be rotatably connected to the first refrigerating space door 20 by a hinge.

[0130] A first basket 62 capable of storing food may be provided in the ice-making space door 60. It is possible that a second basket 65 is provided in the first refrigerating space door 20. For example, the second basket 65 may be located below the first basket 62. A length in the front-rear direction of the second basket 65 may be shorter than a length in the front-rear direction of the first basket 62. The second basket 65 may overlap the dispenser 40 in the front-rear direction.

[0131] A component space 63 accommodating components may be formed in the first refrigerating space door 20. In the component space 63, at least one of a valve 68 adjusting flow of water, a filter, and a water tank 69 storing water may be accommodated. The component

space 63 may be formed by the door liner 70. Alternatively, the component space 63 may be formed by a separate wall connected to the door liner 70. The first refrigerating space door 20 may include a cover member 64 covering the component space 63. A holder 67 to which the filter is coupled may be provided in the component space 63.

[0132] The cover member 64 may include an opening 63. Through the opening 63, the filter may be coupled to the holder 67. The second basket 65 may cover the opening 63. When the second basket 65 is separated, the opening 63 may be exposed. The holder 67 may be exposed through the opening 63.

[0133] FIG. 4 is a perspective view showing an example of an ice maker disposed inside an ice-making space in a state in which an ice-making space door is separated from a first refrigerating space door, and FIG. 5 is a view showing configurations of an ice maker and a cold-air circulation duct to the ice maker.

[0134] Referring to FIGS. 4 and 5, a refrigerating space door 20 may include an ice-making space 25 accommodating an ice maker 100. The refrigerating space door 20 may include a plurality of walls 80 defining the ice-making space 25.

[0135] The plurality of walls may constitute at least a part of the door liner 70.

[0136] The plurality of walls may include a lower wall 80a defining a lower portion of the ice-making space 25, an upper wall 80b defining an upper portion of the ice-making space 25, and two side walls 81 defining both side portions of the ice-making space 25. The plurality of walls may further include a front wall 80c defining a front surface of the ice-making space 25.

[0137] The lower wall 80a may include a take-out portion 84 for taking out ice stored in the ice bin 500 to the dispenser 40.

[0138] The ice maker 100 may be located between the upper wall 80b and the ice bin 500. For example, the ice maker 100 may be disposed adjacent to the upper wall 80b.

[0139] A first duct 90 connected to the cold-air inlet 75 to supply cold air to the ice-making space 25 may be provided in the side wall 81. For example, the first duct 90 is embedded in the side wall 81 and may not be exposed to the ice-making space 25. The first duct 90 may extend upward from the cold-air inlet 75 to an upper portion of the refrigerating space door 20 in which the ice maker 100 is located. The first duct 90 can be referred to as a door duct.

[0140] The first duct 90 includes a duct discharge portion 91 discharging cold air, and cold air discharged from the duct discharge portion 91 may flow into a cold-air duct 400 of the ice maker 100.

[0141] A supply portion 82 guiding cold air to the cold-air duct 400 may be formed in the side wall 81. The duct discharge portion 91 is connected to the supply portion 82, and the cold-air duct 400 may be connected to the duct discharge portion 91 through the supply portion 82.

[0142] A return portion 83 for sending cold air of the ice-

making space 25 to the cold-air outlet 76 may be formed in the side wall 81. For example, the return portion 83 may be formed at a height at which the ice bin 500 is located.

[0143] A second duct 95 may be connected to the return portion 83. The second duct 95 may include a duct inlet portion 96 introducing cold air discharged through the return portion 83. The duct inlet portion 96 may be directly or indirectly connected to the return portion 83. For example, the second duct 95 is embedded in the side wall 81 and may not be exposed to the ice-making space 25. The second duct 95 extends downward from the return portion 83 to a lower portion of the refrigerating space door 20, and may be connected to the cold-air outlet 76.

[0144] The ice maker 100 may include an ice-making part 200 performing an operation of receiving water, cooling the water in a tray assembly 240, and de-icing cooled ice. However, a liquid other than water may be supplied to the tray assembly 240.

[0145] The ice maker 100 may include a compression part 300 configured to transfer ice de-iced from the tray assembly 240 and recombine or compress transferred ice to manufacture ice in the third state. The ice in the third state may be ice having a predetermined thickness. The ice in the third state may have, for example, a cylindrical or polygonal column shape corresponding to an inner surface shape of a cylinder 360 or a discharge pipe 370 to be described later.

[0146] The ice maker 100 may include a cold-air duct 400 supplying cold air to the ice-making part 200. The cold-air duct 400 may be understood as being disposed between the side wall 81 and the tray assembly 240 to be described later.

[0147] Hereinafter, a detailed configuration of the ice maker 100 will be described with reference to drawings.

[0148] FIG. 6 is a front perspective view showing an example configuration of an ice maker and an ice-making space bracket, FIG. 7 is a rear perspective view showing an example configuration of the ice maker and the ice-making space bracket, and FIG. 8 is an exploded perspective view showing an example configuration of the ice maker and the ice-making space bracket.

[0149] Referring to FIGS. 6 to 8, an ice maker 100 may be installed in the ice-making space 25 of the refrigerating space door 20. The refrigerating space door 20 may include an ice-making space plate 85 forming at least a part of the wall 80 of the ice-making space 25. The ice-making space plate 85 may include the lower wall 80a and the front wall 80c.

[0150] The ice maker 100 may be supported by the front wall 80c of the ice-making space 25. The ice maker 100 may be coupled to the front wall 80c by a wall coupling portion 329. A plurality of wall coupling portions 329 may be provided on both sides of the ice maker 100. For example, the wall coupling portion 329 may be understood as a fastening device provided in the compression part 300.

[0151] The ice maker 100 is supported on an upper

portion of the front wall 80c, and the ice bin 500 may be located below the ice maker 100. The refrigerating space door 20 may include a take-out motor to provide driving force to discharge ice stored in the ice bin 500 to the dispenser 40.

[0152] The wall 80 of the ice-making space 25 may include a motor accommodating portion 86 surrounding the take-out motor. The take-out motor is connected to a gear assembly located in front of the front wall 80c, and when the gear assembly operates by driving of the take-out motor, an auger of the ice bin 500 operates so that ice may be taken out. The front wall 80c may include a through portion 87 through which a shaft connecting the gear assembly and the ice bin 500 passes. Ice discharged from the ice bin 500 may be discharged to the dispenser 40 through the take-out portion 84 of the lower wall 80a.

[0153] The ice maker 100 may include an ice-making part 200 including a first motor 210. The first motor 210 may be named an "ice-making motor" providing driving force to move a tray assembly 240 in order to move the tray assembly 240.

[0154] The ice-making part 200 may include ice-making brackets 220 and 230 forming a cold-air flow path. A cold-air duct 400 is connected to one side of the ice-making brackets 220 and 230, and cold air supplied through the cold-air duct 400 may flow through a cold-air flow path formed inside the ice-making brackets 220 and 230. The cold-air duct 400 may be defined as a "first cold-air duct", and the ice-making brackets 220 and 230 may also be defined as a "second cold-air duct".

[0155] The first motor 210 may be connected to the ice-making brackets 220 and 230.

[0156] The ice-making brackets 220 and 230 may include a first bracket 220 forming an accommodating space of the tray assembly 240. The cold-air duct 400 is connected to the first bracket 220, and cold air supplied through the cold-air duct 400 may flow into the accommodating space. The cold-air duct 400 may include an inlet portion 420 connected to the supply portion 82 of the side wall 81.

[0157] The ice-making brackets 220 and 230 may include a second bracket 230 connected to the first bracket 220 and forming a cold-air flow path together with the first bracket 220. For example, one side portion of the first bracket 220 is opened, and the opened one side portion may be covered by the second bracket 230 so that a cold-air flow path may be formed therein.

[0158] The second bracket 230 may form an accommodating space in which a gear assembly 235 and 236 interworking by driving of the first motor 210 is accommodated.

[0159] The first bracket 220 and the second bracket 230 may be connected in a front-rear direction. The first motor 210 is connected to one side of the second bracket 230, and the gear assembly 235 and 236 may interwork by driving of the first motor 210. For example, the first motor 210 and the second bracket 230 may be disposed

in the front-rear direction.

[0160] The ice-making space plate 85 may include a support wall 85a for supporting the ice-making part 200. The support wall 85a constitutes an upper portion of the ice-making space plate 85, and the ice-making part 200 may be supported on an upper portion of the ice-making space plate 85 through the support wall 85a.

[0161] The ice-making brackets 220 and 230 may include a plate coupling portion 229 supported by the ice-making space plate 85. For example, the plate coupling portion 229 is provided in the first bracket 220 and may be coupled to a coupling hole 88 formed in the support wall 85a.

[0162] For example, the plate coupling portion 229 may include a rib protruding from the first bracket 220. However, unlike this, the plate coupling portion 229 provided in the ice-making brackets 220 and 230 may be provided in various forms, for example, a boss or a fastening hole to which a fastening member is coupled. Correspondingly, the coupling hole 88 of the ice-making space plate 85 may also be provided in a form of a rib or a boss.

[0163] A plurality of plate coupling portions 229 may be provided at a plurality of points of the ice-making brackets 220 and 230.

[0164] The ice-making part 200 may include a reservoir 250 storing water. The reservoir 250 may supply water to the tray assembly 240.

[0165] The first bracket 220 may include a communication portion 221b guiding a water supply pipe 120 (see FIG. 11A) to supply water to the reservoir 250. The communication portion 221b may be formed on a surface of the first bracket 220 facing the front wall 80c.

[0166] For example, the water supply pipe 120 is inserted into the communication portion 221b, and at least a part of the water supply pipe 120 may extend into the ice-making brackets 220 and 230.

[0167] The ice maker 100 may include a compression part 300 including a second motor 310. The second motor 310 may be named a "compression motor" providing driving force to move a piston 335 (see FIG. 12) for compressing or recombining ice. In some examples, the compression part 300 may be referred to as an ice-compressing assembly or ice-compression assembly.

[0168] The compression part 300 may include a first bracket 320 connected to the second motor 310. The first bracket 320 may support parts constituting the compression part 300.

[0169] The compression part 300 may include a discharge port 328 for discharging ice manufactured in the ice maker 100 to the ice bin 500. For example, the discharge port 328 is formed on a lower surface of the first bracket 320, and ice discharged through the discharge port 328 may fall into the ice bin 500.

[0170] The compression part 300 may include a cylinder 360 defining a movement space of ice (powdered ice) generated in the ice-making part 200. Ice introduced into the cylinder 360 may be compressed or recombined by a

reciprocating piston 335 into ice molded ice having a predetermined volume. The ice described herein may include frozen ice fragments or powder produced by mechanically separating a frozen ice body from the ice-making body and subsequently compressing the fragments or powder into a shaped ice piece. The ice fragments or powdered ice may have a water content and density suitable for the subsequent ice compressing or shaping operations described herein.

[0171] The compression part 300 may include a transfer pipe 340 provided at an inlet side of the cylinder 360 and configured to transfer ice (powdered ice) discharged from the ice-making part 200 to the cylinder 360. A space for accommodating the powdered ice is formed inside the transfer pipe 340, and the powdered ice may move into the cylinder 360. In some examples, the compression part 300 includes a transfer passage or duct, and the transfer pipe 340 is an example of the transfer passage or duct.

[0172] The compression part 300 may include a discharge pipe 370 provided at an outlet side of the cylinder 360 and providing a predetermined resistance so that ice present in the cylinder 360 is compressed or recombined.

[0173] For example, to provide the resistance, the discharge pipe 370 may be formed such that a cross-sectional area decreases based on a direction in which ice moves.

[0174] The discharge pipe 370 may be made of an elastically deformable material, for example, a silicone material, to provide the resistance.

[0175] An outlet of the discharge pipe 370 is opened, and molded ice compressed or recombined while passing through the discharge pipe 370 may be discharged through the opened outlet of the discharge pipe 370.

[0176] FIG. 30 is a side view illustrating an example state in which a cylinder and a discharge pipe are coupled.

[0177] FIG. 31 is a longitudinal sectional view of FIG. 30.

[0178] FIG. 32 is a rear perspective view illustrating an example state in which the cylinder and the discharge pipe are coupled.

[0179] FIG. 33 is a perspective view illustrating an example state in which the cylinder and the discharge pipe are coupled.

[0180] Referring to FIGS. 30 to 33, the compression part 300 is provided at the outlet of the cylinder 360. The compression part 300 may include a discharge pipe 370 that provides a predetermined resistance to compress ice present in the cylinder 360.

[0181] The cylinder 360 and the discharge pipe 370 may have a circular cross-section in at least a portion of the section.

[0182] The cylinder 360 and the discharge pipe 370 may have a cylindrical shape in at least a portion of the section or a conical shape.

[0183] For example, to provide the resistance, the discharge pipe 370 may be formed with a smaller

cross-sectional area relative to the direction in which the ice moves. The discharge pipe 370 may be made of an elastically deformable material, such as silicone.

[0184] The discharge pipe 370 may be formed of a flexible material.

[0185] The discharge pipe 370 can compress compressed ice in the radial direction and also in the direction of ice transport (axial direction).

[0186] When powdered ice flows into the discharge pipe 370 and the piston 335 compresses it, the discharge pipe 370 deforms. In some examples, the force that prevents the shape of the discharge pipe 370 from being deformed can further compress the powdered ice passing through the discharge pipe 370.

[0187] In some examples, the cylinder 360 may be formed of a material with high thermal conductivity. The cylinder 360 may be formed of a metal material.

[0188] For example, the cylinder 360 may be formed of aluminum.

[0189] The cylinder 360 and the discharge pipe 370 may be formed integrally. The cylinder 360 and the discharge pipe 370 can be detachably coupled.

[0190] At this time, the cylinder 360 and the discharge pipe 370 can be coupled to each other through a separate coupling means.

[0191] The cylinder 360 has an open inlet 361 on one side through which powdered ice flows in, and an open outlet 362 on the other side through which compressed molded ice flows out.

[0192] In some examples, a compression space 363 is formed inside the cylinder 360, defining a space where powdered ice flowing into the inlet 361 moves toward the outlet 362 and is compressed.

[0193] One side of the compression space 363 may be connected to the inlet 361, and the other side may be connected to the outlet 362. In some examples, the cylinder 360 may be formed with a uniform diameter throughout the entire section, based on the direction of movement of the powdered ice.

[0194] In some examples, the diameter of the cylinder 360 may vary in some sections, based on the direction of movement of the powdered ice.

[0195] In some examples, the diameter of the cylinder 360 may vary throughout the entire section, based on the direction of movement of the powdered ice.

[0196] For example, the inner diameter of the cylinder 360 may be varied to gradually decrease from one side to the other along at least some sections along the direction of movement of the powdered ice.

[0197] Accordingly, the diameter of the compression space 363 of the cylinder 360 may be varied to gradually decrease from one side to the other, at least in some sections.

[0198] That is, the diameter of the compression space 363 may decrease from one side, where the inlet 361 is formed, to the other side, where the outlet 362 is formed.

[0199] The diameter of the inlet 361 may be formed larger than the diameter of the outlet 362.

[0200] Referring to FIG. 30, the diameter (d1) of the compression space 363 at a first point adjacent to the inlet 361 rather than the outlet 362 may be formed larger than the diameter (d2) of the compression space 363 at a second point adjacent to the outlet 362 rather than the inlet 361. (i.e., $d1 > d2$)

[0201] In addition, the diameter of the compression space 363 of the cylinder 360 may be varied so that the diameter gradually decreases from one side to the other in some sections, and may remain constant in the remaining sections.

[0202] For example, a decreasing section may be formed, where the diameter of the compression space 363 decreases along the direction of movement of the powdered ice from one side of the inlet 361 to the other side. After this decreasing section, a maintenance section may be formed, where the diameter of the compression space 363 remains constant until the outlet 362.

[0203] As described above, if the diameter of the compression space 363 of the cylinder 360 is formed to decrease in a concave manner, the cross-sectional area of the compression space 363 decreases from the inlet 361 to the outlet 362. Consequently, the compression of the powdered ice moving through the compression space 363 is more reliably achieved, allowing for the formation of solid, molded ice.

[0204] In some examples, if the diameter of the inlet 361 is formed larger than that of the outlet 362, the powdered ice can move into the cylinder 360. A discharge pipe 370 is formed on the other side of the cylinder 360 having the outlet 362.

[0205] Ice, which is first compressed in the cylinder 360 and then discharged through the outlet 362, flows into the discharge pipe 370, is further compressed, and then discharged.

[0206] The discharge pipe 370 has a connecting portion 371 formed on one side, which is connected to the outlet 362 of the cylinder 360.

[0207] The connecting portion 371 is hollow and open at both ends.

[0208] The connecting portion 371 may be formed to surround the other end of the cylinder 360 having the outlet 362.

[0209] That is, the other end of the cylinder 360 having the outlet 362 may be fitted and secured to the connecting portion 371. The above-mentioned connecting portion 371 is made of an elastic material and can be secured while covering the outer side of the outlet 362 of the cylinder 360 by the elastic restoring force of the connecting portion 371 itself.

[0210] At this time, the other end of the cylinder 360 (the right end as shown in FIG. 30) into which the connecting portion 371 is fitted and connected can be formed so that its outer diameter remains constant so that the entire area can be in close contact with the connecting portion 371.

[0211] FIG. 34 is a side view of a cylinder.

[0212] FIG. 35 is a rear perspective view of the cylinder.

[0213] FIG. 36 is a perspective view of the cylinder.

[0214] FIG. 37 is a cross-sectional view illustrating an example state in which the cylinder and the discharge pipe are coupled.

5 **[0215]** Referring to FIGS. 34 to 37, the other end of the cylinder 360 (the right end as seen from FIG. 31) may have a groove 364 formed inwardly on the outer surface of the cylinder, recessed to a predetermined depth and extending along the circumference.

10 **[0216]** In addition, the connecting portion 371 may have a protrusion 3711 formed protruding from the inner surface and extending along the inner surface.

[0217] Referring to FIGS. 31 and 37, the protrusion 3711 and the groove 364 may form a rectangular cross-section. As another example, the protrusion 3711 and the groove 364 may form a cross-section with at least a portion of a curve.

[0218] In some examples, when the protrusion 3711 of the connecting portion 371 is fitted into the groove 364 of the cylinder 360, the bonding strength between the cylinder 360 and the discharge pipe 370 can be enhanced. In some examples, during the ice compression process, the discharge pipe 370 can remain connected to the cylinder 360 without being separated.

25 **[0219]** In some examples, a groove 364 may be formed on the outer surface of the cylinder 360 to a predetermined depth, extending inwardly along the circumference, and a sealing member may be inserted into the groove.

30 **[0220]** For example, the sealing member may be an O-ring. The sealing member may be formed so that a portion is fitted into the groove 364 and another portion protrudes outward from the cylinder 360.

35 **[0221]** When the connecting portion 371 of the discharge pipe 370 is fitted into the other end of the cylinder 360, a portion of the sealing member is fitted into the groove 364. The other portion of the sealing member may contact the inner surface of the connecting portion 371, while pressing against the inner surface of the connecting portion 371.

40 **[0222]** Therefore, the bonding strength between the cylinder 360 and the discharge pipe 370 can be enhanced by the configuration of the sealing member. In some examples, during the ice compression process, the discharge pipe 370 can remain connected without being separated from the cylinder 360. As a variation, instead of forming a separate groove 364 on the outer surface of the cylinder 360, a sealing member may be inserted into the connecting portion 371 of the discharge pipe 370 and the other end of the cylinder 360.

50 **[0223]** In some examples, a separate fixing ring, etc., may be used to press the discharge pipe 370 along the circumferential direction on the outer surface of the discharge pipe 370 to secure it to the cylinder 360. Additionally, various fixing means may be additionally provided as long as they can secure the discharge pipe 370 to the cylinder 360.

[0224] In some examples, the discharge pipe 370 ex-

tends from the connecting portion 371 in the direction in which ice is discharged, and a discharge portion 372 is formed through which compressed ice is discharged.

[0225] One end of the discharge portion 372 is connected to the connecting portion 371, and an open outlet 373 is formed on the other end.

[0226] That is, the outlet 373 of the discharge pipe 370 is open, and the molded ice that is compressed or recombined while passing through the discharge pipe 370 can be discharged through the outlet 373 of the open discharge pipe 370.

[0227] The discharge portion 372 may be formed such that its inner diameter gradually decreases from one side connected to the connecting portion 371 to the other side where the outlet 373 is formed, and may form a first section 3721 that is formed in an inclined manner.

[0228] In addition, the discharge portion 372 may be formed such that a second section 3722 extends from the first section 3721, defines the outlet 373, and has a constant inner diameter. As described above, if the inner diameter of the first section 3721 of the discharge portion 372 is gradually reduced toward the outlet 373, the powdered ice moving through the first section 3721 of the discharge portion 372 is more reliably compressed, resulting in the formation of solid molded ice.

[0229] The solidly compressed molded ice passes through the second section 3722, is formed to a constant diameter, and is then discharged out of the discharge pipe 370 through the outlet 373.

[0230] The diameter of the second section 3722 may be smaller than that of the first section 3721.

[0231] Referring to FIG. 37, the inner diameter (D1) of the outlet 362 of the cylinder 360 may be larger than the inner diameter (D2) of the outlet 373 of the discharge pipe 370. That is, the diameter of the second section 3722 may be formed smaller than the inner diameter (D1) of the outlet 362 of the cylinder 360.

[0232] In some examples, in the case of the discharge portion 372 of the discharge pipe 370, the inner diameter of one end (the right side as shown in FIG. 37) may be formed identical to the inner diameter of the outlet 362 of the cylinder 360, and the inner diameter of the other end (the left side as shown in FIG. 37) may be formed identical to the inner diameter of the outlet 373.

[0233] In some examples, the inner diameter of the outlet 362 may gradually decrease from one end (the right side as shown in FIG. 37) to the other end (the left side as shown in FIG. 37) to form the second section 3722.

[0234] After passing through the outlet 362 of the cylinder 360, the ice flowing into the discharge pipe 370 is initially compressed. This ice can be further compressed by a piston 335 in the discharge pipe 370.

[0235] The ice compressed a second time by the piston 335 in the discharge pipe 370 may exit through the outlet 373, which is formed smaller than the inner diameter (D1) of the discharge pipe 370.

[0236] The secondarily compressed ice then exits the

outlet 373, which is formed smaller than the inner diameter (D1) of the discharge pipe 370, expanding the outlet 373. Due to the force that prevents the outlet 373 from expanding, the ice is compressed a third time, exiting the discharge pipe 370 in a harder state.

[0237] Additionally, the cylinder 360 may be formed with a sensor mounting portion 365 on the outer surface where a temperature sensor is mounted.

[0238] The sensor mounting portion 365 may be formed integrally with the cylinder 360.

[0239] The sensor mounting portion 365 may be formed as a separate member from the cylinder 360 or may be integrally coupled to the cylinder 360.

[0240] The temperature sensor may be installed to detect at least one of the temperature of the cylinder 360, the temperature surrounding the cylinder 360, and the temperature inside the cylinder 360.

[0241] Additionally, the sensor mounting portion 365 may be formed with a sensor mounting groove 3651 into which the temperature sensor is installed.

[0242] For example, the sensor mounting portion 365 and the sensor mounting groove 3651 may extend vertically. Additionally, a step 3611 formed concavely outwardly along the circumference of the inlet 361 may be formed at one end of the cylinder 360 having the inlet 361.

[0243] In some examples, at least one extension portion 366 protruding outward from the outer surface may be formed at one end of the cylinder 360 having the inlet 361.

[0244] At least one coupling hole 3661 may be formed in the extension portion 366.

[0245] A plurality of extensions 366 may be formed on the outer surface of one end of the cylinder 360.

[0246] The extension portion 366 may extend obliquely from the upper side of the outer surface of the cylinder 360 to both sides.

[0247] The extension portion 366 may extend downward from the lower side of the outer surface of the cylinder 360. The extension portion 366 may be formed to secure the cylinder 360 to another component.

[0248] In some examples, the discharge pipe 370 made of an elastic material can be applied to various locations in various ice makers where ice is discharged.

[0249] For example, it can be applied to various types of known ice makers, with or without an auger.

[0250] In some examples, it can be applied to various ice makers that have a piston and a cylinder to compress ice within the cylinder.

[0251] It can also be applied to ice makers that directly produce small powdered ice or separately supply small powdered ice and then compact the powdered ice to store or supply larger-sized molded ice.

[0252] In some examples, during the process of introducing powdered ice into the cylinder 360 and compressing it with the piston 335 to produce molded ice, heat may be supplied to compact the ice more firmly.

[0253] If compression is performed without applying heat to the cylinder, the ice will not clump together well,

resulting in ice that breaks apart and thus lacks the characteristics of nugget ice, which is formed from powdered ice in a single mass.

[0254] In some examples, if ice freezes inside the cylinder and clogs it, heat may be supplied to the cylinder to clear the clog.

[0255] If the cylinder is not cleared of ice clogging, ice making becomes impossible and damage to components such as the piston and cylinder may occur.

[0256] The present disclosure addresses this issue by attaching a heater to the cylinder, allowing ice to be produced with a consistent strength.

[0257] Specifically, a heater is added to the exterior of the cylinder, slightly melting the surface of the ice in contact with the inner surface of the cylinder, and then refreezing, resulting in ice that retains its shape while maintaining a chewable strength.

[0258] In some examples, if the cylinder becomes clogged by compressed ice during the ice compression process, the heater can be used to clear the clog. In detail, the problem of cylinder clogging can be solved by adding a heater to the outside of the cylinder, slightly melting the surface of the compressed ice formed inside the cylinder, and then pushing out the compressed ice.

[0259] FIGS. 38 to 42 are side views illustrating a cylinder, with heaters and temperature sensors installed at various locations.

[0260] In detail, FIG. 38 is a side view illustrating a cylinder with heaters spaced at different intervals along the length of the cylinder and a temperature sensor installed on the discharge side. FIG. 39 is a side view illustrating a cylinder with a heater installed on the inlet side and a temperature sensor installed on the discharge side. FIG. 40 is a side view illustrating a cylinder with heaters installed on the inlet side and the center side and a temperature sensor installed on the discharge side. FIG. 41 is a side view illustrating a cylinder with a heater installed on the inlet side and a temperature sensor installed on the center side. FIG. 42 is a side view illustrating a cylinder with a heater installed on the discharge side and a temperature sensor installed on the inlet side.

[0261] Hereinafter, the configuration of the cylinder 360 and the heater 390 will be described in more detail with reference to FIGS. 38 to 42, with reference to the drawings. In some examples, the heater 390 is installed in the cylinder 360 and supplies heat to the cylinder 360, so it can be called a "cylinder heater."

[0262] The cylinder 360 may have various shapes, but for example, it may be formed in a cylindrical shape.

[0263] Here, the inner or outer diameter of the cylinder 360 may vary along at least a portion of the axial direction (longitudinal direction).

[0264] For example, the inner or outer diameter of the cylinder 360 may be formed to decrease along at least a portion of the ice transport direction.

[0265] The heater 390 may be provided in various forms.

[0266] For example, the heater 390 may be provided in a linear configuration. The heater 390 may be provided as a cord heater.

[0267] As another example, the heater 390 may be provided as a surface heater. In some examples, the heater 390 may be configured in various implementations within the range of converting electrical energy into thermal energy and supplying heat to the cylinder 360.

[0268] If the heater 390 is configured in a linear form, it may be installed on the outer surface of the cylinder 360.

[0269] The heater 390 may be installed in a coiled manner on the outer surface of the cylinder 360.

[0270] The heater 390 may be configured in a linear form and may be spirally wound around the outer surface of the cylinder 360. For example, the heater 390 may be a linear or line heater that is wound around the cylinder in a spiral shape. The heater 390 has a linear shape in a plan view of the cylinder 360.

[0271] The heater 390 may be installed to wrap around the outer surface of the cylinder 360 multiple times.

[0272] The heater 390 may be spirally wound around the outer surface of the cylinder 360.

[0273] In some examples, the heater 390 may be wound in a diagonal shape when viewed from the side of the cylinder 360. Additionally, the heater 390 may be provided as a single unit, or as two or more units.

[0274] In some examples, when multiple heaters 390 are provided, the heaters 390 may be controlled collectively or individually.

[0275] The heater 390 may be wound around the outer surface of the cylinder 360 and then secured to the outer surface of the cylinder 360 while being covered with aluminum tape or the like.

[0276] The heater 390 may be embedded within the cylinder 360 so as not to be exposed to the outer or inner surface of the cylinder 360, or may be installed on the inner surface of the cylinder 360.

[0277] The cylinder 360 may be formed of a thermally conductive material.

[0278] For example, the cylinder 360 may be formed of a metal material such as aluminum. In some examples, a wire is connected to the heater 390, and the heater 390 is turned on and off by a separate control unit. The output of the heater 390 and the on/off time of the heater 390 can be controlled.

[0279] A discharge pipe 370 may be formed at the outlet of the cylinder 360.

[0280] The discharge pipe 370 may be made of a non-metallic material.

[0281] In this case, the heater 390 may not be provided in the discharge pipe 370, but only in the cylinder 360.

[0282] In some examples, some portions of the cylinder 360 may be made of a metallic material, while others may be made of a non-metallic material.

[0283] The heater 390 may only be provided in the metallic portion of the cylinder 360.

[0284] For example, the cylinder 360 may be made of aluminum, which has high thermal conductivity and high

strength.

[0285] Referring to FIG. 40, when the heater 390 is wound around the outer surface of the cylinder 360, the spacing between the heaters 390 can be maintained constant.

[0286] Referring to FIG. 40, when the heater 390 is wound around the outer surface of the cylinder 360, the heater 390 can be wound around the entire section of the cylinder 360.

[0287] In some examples, when the heater 390 is wound around the outer surface of the cylinder 360, the heater 390 can be wound around only a portion of the cylinder 360.

[0288] Referring to FIGS. 39 and 41, the heater 390 can be wound around only one side adjacent to the inlet 361 of the cylinder 360. Referring to FIG. 42, the heater 390 may be wound only on the other side adjacent to the outlet 362 of the cylinder 360.

[0289] As another example, the heater 390 may be wound only on the central portion located between the inlet 361 and the outlet 362 of the cylinder 360.

[0290] When the heater 390 is wound on the outer surface of the cylinder 360, the spacing between the heaters 390 may vary for each section.

[0291] The heater 390 may be wound at different intervals along the length of the cylinder 360 at least in some sections.

[0292] The heater 390 may be formed so that the spacing between the windings on the other side adjacent to the outlet 362 of the cylinder 360 is greater than the spacing between the windings on the other side adjacent to the inlet 361 of the cylinder 360. Referring to FIG. 38, the heater 390 may be wound with a first gap (d3) on one side adjacent to the inlet 361 of the cylinder 360 and with a second gap (d4) on the other side adjacent to the outlet 362 of the cylinder 360.

[0293] Here, the second gap (d4) may be formed larger than the first gap (d3).

[0294] That is, the heater 390 may be wound with a higher density on one side adjacent to the inlet 361 of the cylinder 360 and with a lower density on the other side adjacent to the outlet 362 of the cylinder 360.

[0295] In this case, when power is supplied to the heater 390, a greater amount of heat is supplied to the inlet 361, thereby increasing the temperature of the inlet 361. In some examples, by supplying a relatively smaller amount of heat to the outlet 362, the temperature of the outlet 362 may rise slightly less.

[0296] In some examples, the heater 390 may be configured such that the heat per unit area varies at least in some sections along the length of the cylinder 360.

[0297] The heater 390 may be configured such that the heat per unit area supplied to one side of the cylinder 360 adjacent to the inlet 361 is greater than the heat per unit area supplied to the other side of the cylinder 360 adjacent to the outlet 362.

[0298] In some examples, when the heater 390 is wound around the outer surface of the cylinder 360,

the output of the heater 390 may vary across sections. For example, the heater 390 may output heat at a first intensity on one side adjacent to the inlet 361 of the cylinder 360, and at a second intensity on the other side adjacent to the outlet 362 of the cylinder 360.

[0299] Here, the first intensity may be formed to be greater than the second intensity.

[0300] That is, the heater 390 may output heat at a higher intensity on one side adjacent to the inlet 361 of the cylinder 360, thereby supplying a high amount of heat, and may output heat at a lower intensity on the other side adjacent to the outlet 362 of the cylinder 360, thereby supplying a low amount of heat.

[0301] In this case, when power is supplied to the heater 390, a greater amount of heat is supplied to the inlet 361, thereby further increasing the temperature on the inlet 361 side. In some examples, by supplying a relatively smaller amount of heat to the outlet 362, the temperature of the outlet 362 may rise slightly less.

[0302] As another example, if a heater 390 is provided or not, a water flow path can be formed inside the cylinder 360, supplying water to the ice inside the cylinder 360. The supplied water can melt the ice inside the cylinder 360 and then refreeze, forming solid ice.

[0303] In some examples, the heater 390 can be turned on/off at set intervals, or its output can be controlled.

[0304] The heater 390 can be turned on/off or its output can be controlled by an external factor.

[0305] For example, the external factor may be the cylinder temperature.

[0306] If the cylinder 360 is equipped with a temperature sensor, the heater can be controlled based on the cylinder temperature, thereby maintaining a constant cylinder temperature.

[0307] Additionally, if the cylinder is not equipped with a temperature sensor, the heater itself can be controlled.

[0308] However, if the temperature of the cylinder 360 rises excessively, the compressive force of the piston 335 may increase.

[0309] Specifically, if the temperature of the cylinder 360 rises excessively, the ice within the cylinder 360 will melt excessively. In some examples, if the excessively melted ice refreezes, pores will no longer form between the powdered ice, resulting in hard, molded ice, similar to regular ice. In some examples, the compressive force of the piston 335 may increase.

[0310] In some examples, if the temperature of the cylinder 360 rises excessively, the ice within the cylinder 360 will melt excessively, reducing the amount of ice compressed by the piston. In some examples, as the piston remains within the cylinder for an extended period of time, the compressive force of the piston 335 may increase. In some examples, the optimal temperature range of the cylinder 360 may be set so that the compression force of the piston 335 is within an appropriate range while creating molded ice having a strength suitable for user chewing.

[0311] Referring to FIGS. 38 to 42, a temperature

sensor 368 is installed on the inside or outside of the cylinder 360.

[0312] For example, the temperature sensor 368 is accommodated and installed in a sensor mounting groove 3651 of a sensor mounting portion 365 formed on the outer surface of the cylinder 360.

[0313] The temperature sensor 368 can detect the temperature outside the cylinder 360.

[0314] The heater 390 can be turned on/off or its output controlled based on the temperature value detected by the temperature sensor 368.

[0315] For example, if the temperature of the cylinder 360 or the temperature surrounding the cylinder 360 detected by the temperature sensor 368 is lower than a preset reference temperature, the control unit can control the heater 390 to turn on or increase its output. As another example, if the temperature of the cylinder 360 or the temperature surrounding the cylinder 360 detected by the temperature sensor 368 is higher than a preset reference temperature, the control unit may control the heater 390 to be turned off or the output of the heater 390 to be reduced.

[0316] Referring to FIG. 41, the temperature sensor 368 may be formed at the center of the cylinder 360 along its length.

[0317] In some examples, referring to FIG. 42, the temperature sensor 368 may be formed on one side adjacent to the inlet 361 along the length of the cylinder 360.

[0318] In some examples, referring to FIGS. 38 to 40, the temperature sensor 368 may be formed on the other side adjacent to the outlet 362 along the length of the cylinder 360.

[0319] In some examples, the temperature sensor 368 may be installed at a location that does not overlap the heater 390. For example, as illustrated in FIG. 39, the heater 390 is formed on one side of the cylinder 360 adjacent to the inlet 361 along the longitudinal direction. The temperature sensor 368 may be formed at the center of the cylinder 360 along the longitudinal direction or on the other side adjacent to the outlet 362.

[0320] As another example, as illustrated in FIG. 42, the heater 390 is formed adjacent to the outlet 362 along the longitudinal direction of the cylinder 360. The temperature sensor 368 may be formed at the center of the cylinder 360 along the longitudinal direction or on the other side adjacent to the outlet 362.

[0321] As another example, as illustrated in FIG. 41, the heater 390 is formed at the center of the cylinder 360 along the longitudinal direction. The temperature sensor 368 may be formed on one side adjacent to the inlet 361 or the other side adjacent to the outlet 362 of the cylinder 360, excluding the center, along the longitudinal direction of the cylinder.

[0322] In some examples, the heater 390 may be installed with different densities along the longitudinal direction of the cylinder 360.

[0323] In some examples, the heater 390 may be in-

stalled with a variable density along the longitudinal direction of the cylinder 360.

[0324] In some examples, the heater 390 may be installed with a density that increases or decreases along the longitudinal direction of the cylinder 360.

[0325] In some examples, the cylinder 360 may be divided into a region with a relatively high heater density of the heater 390 and a region with a low heater density of the heater 390, and the temperature sensor 368 may be installed in the region with a low heater density of the heater 390. For example, based on the longitudinal center of the cylinder 360, the heater 390 may be formed with a high density in the area adjacent to the inlet 361, and with a relatively low density or no heater 390 in the area adjacent to the outlet 362.

[0326] The temperature sensor 368 may be installed at a location adjacent to the outlet 362 where the heater 390 density is low.

[0327] The temperature sensor 368 may measure the temperature of the outer surface of the cylinder 360 from the outlet 362.

[0328] As a variation, the temperature sensor 368 may also measure the temperature of the outer surface of the discharge pipe from the discharge pipe side. Accordingly, some ice may be melted in the front portion of the cylinder 360, where the heater 390 density is high, and melted ice may be refrozen in the back portion of the cylinder 360, where the heater 390 density is low or where the heater 390 is not formed, thereby creating molded ice.

[0329] As another example, with respect to the longitudinal center of the cylinder 360, the heater 390 density may be low in the area adjacent to the inlet 361, and the heater 390 density may be relatively high in the area adjacent to the outlet 362.

[0330] The temperature sensor 368 may be installed adjacent to the inlet 361, where the heater 390 density is low.

[0331] The temperature sensor 368 may measure the temperature of the outer surface of the cylinder 360 from the inlet 361 side. As described above, if the heater 390 density is formed relatively high in the area adjacent to the outlet 362, some of the ice at the end of the cylinder 360 will melt. In some examples, when the piston 335 compresses the ice inside the cylinder, the compression force of the piston 335 may be reduced.

[0332] In the present disclosure, the powdered ice or ice cubes introduced into the cylinder 360 may be partially melted in the front of the cylinder 360 adjacent to the inlet 361 to create a lump of molded ice. In some examples, in the rear of the cylinder 360 adjacent to the outlet 362, the melted ice may be refrozen, thereby forming the powdered ice or ice cubes into a single lump.

[0333] Therefore, the heater 390 is configured to provide a greater amount of heat to the front of the cylinder 360 adjacent to the inlet 361. In some examples, a heater 390 can be configured to provide relatively less heat or no heat at the rear of the cylinder 360 adjacent to the outlet 362.

[0334] The following describes a method for controlling the heater.

[0335] Before the powdered ice is transferred to the cylinder 360, the heater 390 is controlled to turn on at a preset stage, allowing the cylinder 360 to be preheated.

[0336] In the preheated state, if the temperature of the cylinder 360 reaches a set temperature or higher, powdered ice can be transferred into the cylinder 360.

[0337] Because the temperature of the cylinder 360 has increased, some of the powdered ice transferred into the cylinder 360 that contacts the inner wall of the cylinder 360 or is adjacent to the inner wall of the cylinder 360 may melt.

[0338] At this time, the output of the heater 390 can be controlled to vary step-by-step. The output of the heater 390 may be controlled to increase.

[0339] The output of the heater 390 may be controlled to increase and then decrease.

[0340] The output of the heater 390 may be controlled to decrease.

[0341] The output of the heater 390 may be controlled to vary depending on the position of the powdered ice moving toward the cylinder 360.

[0342] For example, the heater 390 may be controlled to output a first amount of heat when the powdered ice moving toward the cylinder 360 is at a first position.

[0343] In some examples, the heater 390 may be controlled to output a second amount of heat greater than the first amount of heat when the powdered ice moving toward the cylinder 360 is at a second position located behind the first position (closer to the cylinder) based on the direction of movement.

[0344] Additionally, the heater 390 may be controlled to output a heat amount less than the first heat amount when the powdered ice moving toward the cylinder 360 is at a second position located behind the first position (closer to the cylinder) relative to the direction of movement.

[0345] The output of the heater 390 may be controlled to vary over time.

[0346] In this case, the output of the heater 390 may be controlled to vary in stages over time.

[0347] In some examples, before the powdered ice is transferred to the cylinder, the cylinder may be preheated to improve heating efficiency.

[0348] That is, the heater may be controlled to turn on at least one of the stages before the powdered ice is transferred to the cylinder.

[0349] First, the heater 390 may be controlled to turn on while the tray 241 is rotating. For example, the heater 390 may be controlled to turn on when the first peripheral surface (242a) of the tray 241 comes into contact with water in the reservoir 250.

[0350] In some examples, the heater 390 may be controlled to turn on when water is supplied to the peripheral surface of the tray 241.

[0351] In some examples, the heater 390 may be controlled to turn on when the tray 241 is stationary.

[0352] That is, the heater 390 may be controlled to turn on when the rotation of the tray 241 is stopped and ice is formed on the peripheral surface of the tray 241.

[0353] In some examples, the heater 390 may be controlled to turn on when ice formed on the peripheral surface of the tray 241 is separated from the tray 241 or after the ice has been separated. That is, the heater 390 may be controlled to turn on when ice generated on the periphery of the tray 241 is separated from the tray 241 by the first blade 280.

[0354] In some examples, the heater 390 may be controlled to turn on when ice generated on the periphery of the tray 241 is moving after being separated from the tray 241.

[0355] For example, the heater 390 may be controlled to turn on when ice (powdered ice) separated from the tray 241 is received in the transfer pipe (340) before being transported to the cylinder 360.

[0356] In some examples, when ice (powdered ice) separated from the tray 241 is received in the transfer pipe (340) before being transported to the cylinder 360, and the lever 350 operates to transport the powdered ice toward the cylinder 360, the heater 390 may be controlled to turn on. In some examples, after the powdered ice is transferred to the cylinder 360, the heater 390 may be controlled to turn on, thereby increasing the temperature of the cylinder 360.

[0357] In addition, as the temperature of the cylinder 360 increases, some of the powdered ice within the cylinder 360 that comes into contact with the inner wall of the cylinder 360 or is adjacent to the inner wall of the cylinder 360 may melt.

[0358] At this time, the output of the heater 390 may be controlled to vary stepwise.

[0359] The output of the heater 390 may be controlled to increase.

[0360] The output of the heater 390 may be controlled to increase and then decrease.

[0361] The output of the heater 390 may be controlled to decrease.

[0362] In some examples, the heater 390 may be turned on/off or its output may be controlled to vary depending on the temperature of the cylinder 360.

[0363] The temperature sensor 368 detects the temperature of the cylinder 360.

[0364] The temperature of the cylinder 360 detected by the temperature sensor 368 is input to the control unit, and the heater 390 may be turned on/off or its output may be controlled to vary so that the temperature of the cylinder 360 remains constant.

[0365] For example, if the temperature of the cylinder 360 detected by the temperature sensor 368 is lower than a preset reference temperature, the heater 390 may be turned off and its output may be reduced. Additionally, if the temperature of the cylinder 360 detected by the temperature sensor 368 is higher than a preset reference temperature, the heater 390 may be controlled to turn on or its output may be controlled to increase.

[0366] In some implementations, the heater 390 may be controlled to turn on/off, or its output may be controlled to vary, depending on the temperature of any portion of the refrigerator 1, such as the internal temperature, the door temperature, or the evaporator temperature.

[0367] In this case, the temperature sensor 368 may be omitted.

[0368] For example, the heater 390 may be controlled to turn on/off, or its output may be controlled to vary, depending on the temperature of the ice-making space 25.

[0369] In some examples, the output of the heater 390 according to the temperature of the ice-making space 25 may be mapped in advance and stored in the control unit, and then the output of the heater 390 may be controlled to vary in real time according to the temperature of the ice-making space 25. Additionally, to increase energy efficiency, the cylinder 360 can be heated only when necessary.

[0370] The heater 390 can be controlled to turn on after ice is transported to the cylinder 360.

[0371] First, the heater 390 can be controlled to turn on when ice is transported to the cylinder 360 and the ice inside the cylinder 360 is compressed.

[0372] For example, the heater 390 can be controlled to turn on when the piston 335 operates and the ice inside the cylinder 360 is compressed.

[0373] That is, the heater 390 can be controlled to turn on when the piston 335 operates.

[0374] For reference, the differences in the formed ice produced depending on the output of the cylinder heater are as follows.

[0375] First, as the output of the heater 390 increases, the cylinder temperature rises.

[0376] And as the cylinder temperature increases, ice in contact with the inner surface of the cylinder melts more quickly. In some examples, a greater amount of ice inside the cylinder melts.

[0377] As the amount of melted ice inside the cylinder increases, the density of the refrozen molded ice increases, reducing the diameter of the molded ice. In some examples, the greater the amount of melted ice inside the cylinder, the more solid molded ice with a transparent surface can be produced.

[0378] In some examples, if the cylinder temperature is maintained low, the ice inside the cylinder may not melt, or if it does melt, only a small portion of it will melt.

[0379] In some examples, because refreezing does not occur inside the cylinder, the density decreases. This results in ice that is difficult to compress even when compressed inside the cylinder and breaks apart after compression.

[0380] Such ice breaks when discharged from the discharge pipe and has difficulty maintaining its shape.

[0381] Therefore, the cylinder temperature may be maintained within an appropriate temperature range to produce molded ice of appropriate strength.

[0382] According to the present disclosure, ice is made

in the tray 241, the made ice is separated from the tray surface, and the separated powdered ice or ice cubes are transported. The process of compressed, molded ice being discharged after the transported powdered ice or ice cubes are compressed within the cylinder can be defined as one ice-making cycle.

[0383] In some examples, when the Nth ice-making cycle is completed, the N+1th ice-making cycle begins.

[0384] The output of the heater 390 can be maintained constant during the ice-making cycle.

[0385] In some examples, the temperature of the cylinder 360 can be maintained constant during the ice-making cycle.

[0386] In some examples, the output of the heater 390 can be controlled to vary during the ice-making cycle.

[0387] First, the heater 390 is controlled to be turned on/off during the ice-making cycle, and when ice is transported to the cylinder 360, the heater 390 can be controlled to turn on.

[0388] For example, when the heater 390 is turned on, the output of the heater 390 can be controlled to increase gradually. At this time, the graph of the heater 390 output change over time may draw an upward line.

[0389] According to this, the ice-making and ice-breaking efficiency of the molded ice can be improved.

[0390] As another example, when the heater 390 is turned on, the output of the heater 390 can be controlled to gradually increase and then decrease. At this time, the graph of the heater 390 output change over time may draw an upward parabolic curve.

[0391] According to this, the ice-making and ice-breaking efficiency of the molded ice can be improved, while also improving energy efficiency.

[0392] In some examples, the heater 390 is controlled to turn on and off during the ice-making cycle. Before the ice is transported to the cylinder 360, the heater 390 can be turned on first, allowing the cylinder 360 to preheat.

[0393] For example, when the heater 390 is turned on, the output of the heater 390 can be controlled to gradually decrease. At this time, the graph of the heater 390 output change over time may be a downward curve.

[0394] Accordingly, powdered ice or ice cubes are transported into the cylinder while the cylinder temperature is preheated, thereby improving the ice-making and breaking efficiency of the molded ice, while also improving energy efficiency.

[0395] As another example, when the heater 390 is turned on, its output may be controlled to gradually decrease and then increase. At this time, the graph of the heater 390 output change over time may be a downward convex parabola.

[0396] Accordingly, powdered ice or ice cubes are transported into the cylinder while the cylinder temperature is preheated, thereby improving the ice-making and breaking efficiency of the molded ice within the cylinder, while also improving energy efficiency. In some examples, as the heater output decreases and then increases, the efficiency of the molded ice can be further improved.

[0397] In some examples, the heater 390 output may be controlled to vary depending on the operation of the piston 335. For example, when the piston 335 operates to compress ice inside the cylinder 360, the output of the heater 390 may be controlled to increase.

[0398] As another example, when the piston 335 is in the standby position, the output of the heater 390 may be controlled to be maintained or decreased.

[0399] The output of the heater 390 may be controlled to vary in conjunction with the movement position of the piston 335, the stroke distance of the piston 335, the movement position of the lever 350, the rotational position of the tray 241, and the operation of peripheral components.

[0400] In some examples, when the temperature of the cylinder 360 measured by the temperature sensor 368 reaches a preset reference temperature while the heater 390 is turned on, the heater 390 may be controlled to turn off.

[0401] In some examples, when the elapsed time after the heater 390 is turned on reaches the reference time, the heater 390 may be controlled to turn off. Additionally, the heater 390 can be controlled to vary its output depending on various factors.

[0402] Here, varying the heater output includes switching the heater from an on state to an off state or from an off state to an on state.

[0403] The heater 390 can also be controlled to vary its output depending on changes in cooling capacity.

[0404] The cooling capacity can refer to compressor output, the opening rate of the damper that controls the flow of cold air, the opening rate of the refrigerant valve, fan output, etc. In some examples, if the cooling capacity increases, the output of the heater 390 can be controlled to increase, and if the cooling capacity decreases, the output of the heater 390 can also be controlled to decrease.

[0405] In some examples, the heater 390 output can be controlled to vary if the target temperature of the freezing space 19 changes due to changes in the notch of the freezing space 19. That is, if the target temperature of the freezing space 19 decreases, the output of the heater 390 can be controlled to increase. If the target temperature of the freezing space 19 increases, the output of the heater 390 can be controlled to decrease.

[0406] In some examples, in a refrigerator that lowers the temperatures of the freezing space 19 and the refrigerating space 18 using one compressor and two evaporators, the output of the heater 390 can be controlled to vary as the target temperature of the refrigerating space 18 changes due to changes in the notch of the refrigerating space 18.

[0407] That is, if the target temperature of the refrigerating space 18 decreases, the output of the heater 390 can be controlled to increase. If the target temperature of the refrigerating space 18 increases, the output of the heater 390 can be controlled to decrease.

[0408] In some examples, the output of the heater 390

can be controlled to vary as the room temperature (RT) of the space in which the refrigerator is installed changes. That is, if the room temperature (RT) of the space where the refrigerator is installed decreases, the output of the heater 390 is controlled to decrease. If the room temperature (RT) of the space where the refrigerator is installed increases, the output of the heater 390 is also controlled to increase.

[0409] In some examples, the output of the heater 390 can be controlled to vary depending on whether the refrigerator door is opened.

[0410] The "refrigerator door" may refer to the freezer door or the refrigerator door.

[0411] Generally, when the refrigerator door is opened, the internal temperature increases.

[0412] Therefore, if the opening of the refrigerator door is detected, the output of the heater 390 can be controlled to decrease.

[0413] In some examples, if the room temperature (RT) of the space where the refrigerator is installed is lower than the internal temperature, the internal temperature may actually decrease when the refrigerator door is opened.

[0414] In this case, if the opening of the refrigerator door is detected, the output of the heater 390 can be controlled to increase.

[0415] In addition, when the door load response operation is performed after the refrigerator door is opened and the cooling capacity increases, the output of the heater 390 is controlled to increase. In addition, when the door load response operation is terminated and the cooling capacity decreases, the output of the heater 390 can also be controlled to decrease.

[0416] In addition, before the defrosting operation begins, if the cooling capacity increases while lowering the internal temperature in advance so that the internal temperature does not increase during the defrosting operation, the output of the heater 390 can be controlled to increase.

[0417] In some examples, when cooling capacity decreases due to deep cooling, the heater 390 output can be controlled to decrease. When cooling capacity increases due to the end of the defrost operation, the heater 390 output can be controlled to increase.

[0418] In some examples, when the refrigerator is initially powered on, the heater 390 output can be controlled to increase.

[0419] In some examples, when a full ice level is detected, the heater 390 output can be controlled to decrease. When the full ice level detection is canceled, the heater 390 output can be controlled to increase.

[0420] In situations where ice is not produced for reasons other than a full ice level, the heater 390 output can be controlled to decrease. When ice production resumes, the heater 390 output can be controlled to increase.

[0421] The compression part 300 may include a cutter wall 380 disposed at a position spaced apart from the outlet of the discharge pipe 370 by a predetermined

distance and interfering with molded ice discharged through the discharge pipe 370. The cutter wall 380 is supported by the first bracket 320 and may be disposed adjacent to an upper side of the discharge port 328.

[0422] The cutter wall 380 includes an inclined surface facing the discharge pipe 370, and molded ice discharged from the discharge pipe 370 may be cut while interfering with the inclined surface. Then, the cut ice may fall into the ice bin 500 through the discharge port 328.

[0423] FIG. 9 is an exploded perspective view showing an example configuration of an ice-making part of an ice maker, FIG. 10 is an exploded perspective view showing an example configuration of a tray assembly and a reservoir, FIG. 11A is a view showing an example state when a tray assembly is at a first position, and FIG. 11B is a view showing an example state when the tray assembly is at a second position.

[0424] First, referring to FIGS. 9 and 10, the ice-making part 200 may include a tray assembly 240 forming an ice-making space.

[0425] The tray assembly 240 may include a tray 241 receiving water to perform ice-making. The tray 241 may be provided to be movable by receiving power from the first motor 210. For example, the tray 241 may be provided to be rotatable.

[0426] The tray 241 may include peripheral surfaces 242a and 242b forming a water storage space. The peripheral surfaces 242a and 242b may be understood as including a cell for ice generation.

[0427] For example, the tray 241 may have a drum shape having a peripheral surface. The peripheral surface may form an outer circumferential surface of the drum. That is, the peripheral surfaces 242a and 242b may be understood as extending in a circumferential direction to form the outer circumferential surface of the tray 241.

[0428] In another aspect, the tray 241 may have a disk shape or a plate shape including both side walls and a peripheral surface. In some examples, the tray 241 may be referred to as an ice-making body or a rotating body having a disk shape, a plate shape, a fan shape, an arc shape, a cylindrical shape, etc.

[0429] The peripheral surfaces 242a and 242b may include a first peripheral surface 242a forming a water storage space. The first peripheral surface 242a may form at least a part of the outer circumferential surface of the tray 241. When the first peripheral surface 242a is at a position facing the reservoir 250, the first peripheral surface 242a may include a surface contacting water stored in the reservoir 250. In some examples, the first peripheral surface 242a may be referred to as a circumferential portion or a peripheral portion of the ice-making body (e.g., tray 241) configured to receive water.

[0430] The first peripheral surface 242a may be disposed adjacent to the first blade 280 so that ice generated on the first peripheral surface 242a contacts the first blade 280.

[0431] The first peripheral surface 242a may include at

least one of a first part defining a recessed portion and a second part defining a protruding portion so as to increase a contact area of water cooling area. The first part may include a recess 241a, and the second part may include a protrusion 241b.

[0432] When a recessed portion of the first peripheral surface 242a is viewed as a reference position, it may be understood that the first peripheral surface 242a includes the protrusion 241b, and when a protruding portion of the first peripheral surface 242a is viewed as a reference position, it may be understood that the first peripheral surface 242a includes the recess 241a.

[0433] Due to configurations of the recess 241a and the protrusion 241b, the first peripheral surface 242a may be understood as including an uneven structure.

[0434] A plurality of recesses 241a and a plurality of protrusions 241b may each be provided. The plurality of recesses 241a (see FIG. 17) and the plurality of protrusions 241b (see FIG. 17) may have a structure in which they are alternately arranged. The recesses 241a may be recessed relative to the protrusions 241b. In some examples, the recesses 241a are defined at the peripheral surfaces 242a such that the protrusions 241b are formed between the recesses 241a. In some examples, the protrusions 241b are disposed at the peripheral surfaces 242a such that the recesses 241a are formed between the protrusions 241b.

[0435] The peripheral surfaces 242a and 242b may include a second peripheral surface 242b. When the second peripheral surface 242b is at a position facing the reservoir 250, the second peripheral surface 242b may include a surface that does not contact water stored in the reservoir 250.

[0436] The second peripheral surface 242b may be disposed relatively far away from the first blade 280 so that ice generated on the second peripheral surface 242b does not contact the first blade 280.

[0437] A center distance from a center of the tray 241 to the second peripheral surface 242b, that is, a radius distance of the second peripheral surface 242b, may be formed less than a center distance from the center of the tray 241 to the first peripheral surface 242a, that is, a radius distance of the first peripheral surface 242a. For example, the second peripheral surface 242b may have a shape cut from an edge of the first peripheral surface 242a in a direction toward the center of the tray 241.

[0438] When the first peripheral surface 242a is at a position to be frozen by contacting cold air, the second peripheral surface 242b is disposed to face the reservoir 250. At this time, since the second peripheral surface 242b does not contact water of the reservoir 250, the reservoir 250 may not be cooled by the tray 241 forming a low temperature. Accordingly, freezing of water stored in the reservoir 250 may be prevented.

[0439] At least one first peripheral surface 242a may be provided. For example, a plurality of first peripheral surfaces 242a are provided, and the second peripheral surface 242b may be disposed between the plurality of

first peripheral surfaces 242a based on the circumferential direction of the tray 241.

[0440] At least one second peripheral surface 242b may be provided. For example, a plurality of second peripheral surfaces 242b are provided, and the first peripheral surface 242a may be disposed between the plurality of second peripheral surfaces 242b based on the circumferential direction of the tray 241.

[0441] The tray 241 may include side walls 244 also referred to as side surfaces. The side wall 244 may include a portion extending in a radial direction of the tray 241.

[0442] A plurality of side walls 244, for example, two side walls 244, may be provided to form both side surfaces of the tray 241. The two side walls 244 may be disposed spaced apart in an axial direction of the first motor 210. The peripheral surfaces 242a and 242b may be formed between the two side walls 244.

[0443] The tray 241 may include an inner circumferential wall 244a connected to the side wall 244. The inner circumferential wall 244a is understood to form an inner circumferential surface of the tray 241, and may include a surface opposite to the peripheral surfaces 242a and 242b with respect to the side wall 244.

[0444] A bar 249 is coupled to the tray 241 as a "central shaft" of the tray 241. The bar 249 may have a non-circular shape.

[0445] The bar 249 may be disposed to pass through a central portion or a rotational center portion of the tray 241. The central portion of the tray 241 includes a central bracket 243, and the central bracket 243 may have a shape surrounding at least a part of the bar 249.

[0446] The bar 249 is coupled to gear assemblies 235 and 236, and may rotate in interworking with the gear assemblies 235 and 236. For example, the bar 249 may be integrally formed with the gear assemblies 235 and 236, or may be provided to be separable.

[0447] Another example is proposed. The bar 249 is removed, and a central shaft protruding from the gear assemblies 235 and 236 may be directly coupled to the central bracket 243 of the tray 241.

[0448] The tray 241 may include extension walls 243a extending from the central bracket 243 toward the side walls 244. The extension wall 243a may, for example, extend in a radial direction from the central bracket 243.

[0449] A plurality of extension walls 243a are provided, and the plurality of extension walls 243a may be disposed spaced apart from each other in a circumferential direction.

[0450] Directions will be defined. Throughout the specification, an "axial direction" means a direction in which a shaft of the first motor 210 or the second motor 310 extends, and a "radial direction" means a direction of a radius crossing the axial direction.

[0451] The tray 241 may form tray holes 245 (tray openings). The tray hole 245 may be understood as a hole penetrating in the axial direction of the tray 241. Through the tray hole 245, cold air flows so that a cooling

area of the tray 241 may increase.

[0452] The tray hole 245 may be understood as a space defined by the central bracket 243, the plurality of extension walls 243a, and the inner circumferential wall 244a. A plurality of tray holes 245 are formed, and the plurality of tray holes 245 may be disposed in a circumferential direction of the tray 241.

[0453] The tray assembly 240 may include tray covers 246 and 247 connected to the tray 241. The tray covers 246 and 247 may be provided on both side walls 244 of the tray 241.

[0454] The tray covers 246 and 247 are disposed to cover at least one side of the tray 241 and may function to prevent water of the reservoir 250 from flowing into the tray holes 245 of the tray 241.

[0455] The tray covers 246 and 247 may be made of a material having low thermal conductivity so that generation of ice is limited. For example, the material having low thermal conductivity may include a non-metal material. A plastic material may be proposed as an example of the non-metal material.

[0456] The tray cover 246 and 247 may include a first tray cover 246 provided on one side wall 244 of the tray 241. The first tray cover 246 may include a first cover wall 246a covering the one side wall 244 of the tray 241. A radial length or width of the first cover wall 246a may be formed greater than a radial length or width of the side wall 244 of the tray 241 so as to prevent water from flowing into the tray hole 245 of the tray 241.

[0457] The first tray cover 246 may include a first through hole 246b through which the central bracket 243 of the tray 241 passes. The first through hole 246b may be axially aligned with the central bracket 243 of the tray 241.

[0458] The first tray cover 246 may include a first extension wall 246c extending from the first through hole 246b toward the first cover wall 246a. The first extension wall 246c may extend in a radial direction to cover the extension walls 243a of the tray 241. The first extension wall 246c may be provided in a plurality corresponding to the extension walls 243a.

[0459] The first tray cover 246 may include a first inner circumferential wall 246d connected to the first cover wall 246a. The first inner circumferential wall 246d may be understood to form an inner circumferential surface of the first tray cover 246.

[0460] The first tray cover 246 may include a first cover fastening portion 246e protruding from the first inner circumferential wall 246d. The first cover fastening portion 246e may include a boss, and a predetermined fastening member may pass through the boss and be fastened to a second cover fastening portion 247e of the second tray cover 247. However, the shape of the first cover fastening portion 246e is not limited thereto, and as long as it may be coupled to the second cover fastening portion 247e, it may also be provided in a shape of a rib or a locking protrusion.

[0461] The first tray cover 246 may include a first

communication hole 246f communicating with the tray hole 245 of the tray 241. Cold air may pass through the through hole 245 via the first communication hole 246f.

[0462] The tray covers 246 and 247 may include a second tray cover 247 provided at the other side wall 244 of the tray 241. The second tray cover 247 may include the second cover wall 247a covering the other side wall 244 of the tray 241. In order to prevent water from flowing into the tray hole 245 of the tray 241, a radial length of the second cover wall 247a may be formed to be greater than a radial length of the side wall 244 of the tray 241.

[0463] An example configuration of the second tray cover 247 may be substantially similar to that of the first tray cover 246. The second tray cover 247 may include a second through hole 247b having an example configuration corresponding to the first through hole 246b of the first tray cover 246.

[0464] The second tray cover 247 may include a second extension wall 247c corresponding to the first extension wall 246c of the first tray cover 246.

[0465] The second tray cover 247 may include a second inner circumferential wall 247d corresponding to the first inner circumferential wall 246d of the first tray cover 246.

[0466] The second tray cover 247 may include a second cover fastening portion 247e corresponding to the first cover fastening portion 246e of the first tray cover 246.

[0467] The second tray cover 247 may include a second communication portion 247f communicating with the tray hole 245 of the tray 241. Cold air may pass through the second communication portion 247f via the first communication hole 246f and the tray hole 245.

[0468] In another aspect, the first tray cover 246 and the second tray cover 247 may be understood as one component of a "tray" in a broad sense. In this case, the tray assembly 240 may be referred to as a "tray", the tray 241 may be referred to as a "tray part", and the first and second tray covers 246 and 247 may constitute a part of the tray assembly 240.

[0469] In some implementations, the first and second tray covers 246 and 247 are not provided, and the tray assembly 240 may be configured to include only the tray 241.

[0470] The ice-making part 200 may include the first bracket 220 forming a first accommodating space 220a for the tray assembly 240.

[0471] The first bracket 220 may include a first wall 221 supported by the ice-making space plate 85. The first wall 221 may be understood as a wall shielding at least a portion of one side surface of the tray assembly 240.

[0472] In another aspect, the first wall 221 may be disposed to support the tray 241. The first wall 221 may include an insertion hole 221a into which at least a portion of the tray 241 is inserted to support the tray 241. For example, the central bracket 243 of the tray 241 may be rotatably inserted into the insertion hole 221a.

[0473] The first wall 221 may include communication portion 221b guiding the water supply pipe 120. The water supply pipe 120 is inserted into the communication portion 221b, and at least a part of the water supply pipe 120 may be located in the first accommodating space 220a.

[0474] The first wall 221 may form at least a portion of a wall guiding flow of cold air introduced through the cold-air duct 400.

[0475] The ice-making part 200 may include a second wall 222 connected to the first wall 221. The second wall 222 is connected to an end portion of the first wall 221, for example, an upper end portion, and may protrude in a direction toward the first motor 210. The second wall 222 may form an upper end portion of the ice-making part 200.

[0476] The ice-making part 200 may include a third wall 223 connected to the first wall 221. The third wall 223 is connected to an end portion of the first wall 221, for example, a lower end portion, and may protrude in a direction toward the first motor 210. The third wall 223 may form a lower end portion of the ice-making part 200.

[0477] The ice-making part 200 may include a fourth wall 224 and a fifth wall 225 connected to the third wall 223. The fourth wall 224 is connected to one side of the third wall 223, and the fifth wall 225 may be connected to the other side of the third wall 223. For example, the fourth wall 224 and the fifth wall 225 may protrude at both ends of the third wall 223. In some examples, any one of the first to fifth walls that contacts the reservoir may be referred to as a supporting wall. For example, the third wall 223 may be a supporting wall that supports a bottom of the reservoir 250, and the fourth wall 224 and the fifth wall 225 may be extending walls protruding from the supporting wall.

[0478] The ice-making part 200 may include a second accommodating space 220b in which the reservoir 250 is placed. The second accommodating space 220b may be understood as a space defined by the third wall 223, the fourth wall 224, and the fifth wall 225. The second accommodating space 220b may be formed below the first accommodating space 220a.

[0479] The reservoir 250 may include a case having a predetermined capacity, and a heater 255 provided in a wall of the case and providing heat so that water stored in the reservoir 250 is not frozen. The heater 255 may be named a "reservoir heater".

[0480] The ice-making part 200 may include a water supply guide wall 224a guiding water supplied from the water supply pipe 120 to the reservoir 250. The water supply guide wall 224a may form at least a portion of the fourth wall 224.

[0481] The water supply guide wall 224a may be located adjacent to a discharge portion of the water supply pipe 120, and may include an inclined surface guiding a flow of water discharged from the water supply pipe 120. The inclined surface of the water supply guide wall 224a may extend to be inclined with respect to a direction from

the communication portion 221b toward the reservoir 250.

[0482] Water discharged from the water supply pipe 120 falls onto the inclined surface, and the fallen water flows downward at a low speed along the inclined surface and may flow into the reservoir 250.

[0483] The ice-making part 200 may include a first blade 280 contacting ice made to separate ice made in the tray 241. The first blade 280 may be located adjacent to a rotation path of the tray 241. In particular, the first blade 280 may be located adjacent to the first peripheral surface 242a when the tray 241 rotates.

[0484] The first blade 280 may be provided in the fifth wall 225. For example, the reservoir 250 is disposed on an inner surface of the fifth wall 225, and the first blade 280 may be coupled to a surface of the fifth wall 225.

[0485] The ice-making part 200 may include a second blade 285 contacting frozen ice to separate frozen ice from the tray assembly 240.

[0486] The second blade 285 may be located adjacent to both side walls of the tray assembly 240 so as to scrape frozen ice on both side walls, that is, the first cover wall 246a and the second cover wall 247a.

[0487] A plurality of second blades 285 may be provided, and one second blade 285 may be provided in the first wall 221. Another second blade 285 may be provided in an outer wall of the second bracket 230, for example, an outer wall of the gear bracket 231.

[0488] The first blade 280 and the second blade 285 may be disposed at positions spaced apart from each other, for example, disposed opposite to each other based on a center of the tray assembly 240. With this configuration, it may be possible to prevent a cold-air flow path formed in the ice-making part 200 from being interfered with by the first and second blades 280 and 285.

[0489] In detail, cold air introduced through the cold-air duct 400 flows from an area in which the second blade 285 is located to an opposite area in which the first blade 280 is located based on the center of the tray assembly 240. If the first and second blades 280 and 285 are disposed in one side area based on the center of the tray assembly 240, there is a problem in that these blades act as flow-path resistance. In some implementations, by disposing the first and second blades 280 and 285 on both sides of the tray assembly 240, an effect of reducing resistance of cold-air flow may appear.

[0490] While the tray assembly 240 rotates, frozen ice contacting the second blade 285 is separated from the tray assembly 240, and the separated ice may flow into the reservoir 250.

[0491] So that ice separated by the second blade 285 may flow into the reservoir 250, the second blade 285 may be disposed at a position adjacent to the reservoir 250. For example, based on a height direction with respect to a ground supporting the refrigerator, the reservoir 250 is disposed below the tray assembly 240 and the second blade 285 may be disposed at a position lower than a center of the tray assembly 240.

[0492] In another aspect, the second blade 285 may be disposed at a position overlapped in an up-down direction with respect to an opened upper end of the reservoir 250. The opened upper end of the reservoir 250 may be understood as an end portion into which water flows.

[0493] A cold-air flow path through which cold air introduced from the cold-air duct 400 flows may be formed inside the first bracket 220. At least a portion of the cold-air flow path may be formed in the first accommodating space 220a.

[0494] The first bracket 220 may include a first opening 224b to which the cold-air duct 400 is coupled and which forms a cold-air inlet portion. The first opening 224b may be formed in a fourth wall 224 also referred to as a side wall of the first bracket 220. For example, the first opening 224b may be formed on a side on which the water supply guide wall 224a is provided, and may be located above the water supply guide wall 224a.

[0495] The first opening 224b and the reservoir 250 may be located opposite to each other based on the center of the tray 241. For example, the first opening 224b may be formed at a position higher than the center of the tray 241, and the reservoir 250 may be disposed at a position lower than the center of the tray 241. With such an example configuration, it may be possible to prevent cold air introduced through the first opening 224b from directly flowing into the reservoir 250.

[0496] The ice-making part 200 may include a guide wall 226 disposed to guide cold air to the peripheral surfaces 242a and 242b of the tray 241. The guide wall 226 is provided in the first wall 221 and may be formed to be rounded corresponding to a curvature of the peripheral surfaces 242a and 242b.

[0497] A first portion of the guide wall 226 may be connected to the first wall 221, and a second portion may be connected to the second wall 222.

[0498] The guide wall 226 and the first opening 224b may be located opposite to each other based on the center of the tray 241. Accordingly, since air supplied to an outer circumferential surface peripheral surface of the tray 241 through the first opening 224b is guided by the guide wall 226 located opposite to the first opening 224b, it may be possible to form cold-air flow path along the outer circumferential surface peripheral surface of the tray 241.

[0499] A space between the guide wall 226 and the first blade 280 forms a second opening 227 (see FIG. 17) through which powdered ice separated from the tray 241 is discharged, and cold air guided by the guide wall 226 may be diffused to the ice-making space 25 through the second opening 227.

[0500] The ice-making part 200 may include gear assemblies 235 and 236 interworking with the first motor 210. The gear assemblies 235 and 236 may include a driving gear 235 connected to the first motor 210 and a driven gear 236 interworking with the driving gear 235.

[0501] The number of gear teeth of the driving gear 235 is formed less than the number of gear teeth of the driven

gear 236, so that the gear assemblies 235 and 236 may constitute a reduction gear. Accordingly, torque for rotating the tray assembly 240 may increase.

[0502] The ice-making part 200 may include the second bracket 230 accommodating the gear assemblies 235 and 236. The second bracket 230 may shield an opened one side of the first bracket 220 to form a cold-air flow path within the ice-making brackets 220 and 230.

[0503] The second bracket 230 may include the gear bracket 231 supporting the gear assemblies 235 and 236. The gear bracket 231 includes a bracket wall 231a covering the opened one side of the first bracket 220, and the bracket wall 231a may form at least one surface of the cold-air flow path.

[0504] The gear assemblies 235 and 236 may be rotatably supported by the bracket wall 231a. A hole to which a shaft of the first motor 210 is connected is formed in a first center portion 235a of the driving gear 235, and the shaft of the first motor 210 may be supported by the bracket wall 231a through the hole.

[0505] The bar 249 may be connected to a second center portion 236a of the driven gear 236 through the bracket wall 231a. A hole to which the bar 249 is connected is formed in the second center portion 236a of the driven gear 236, and the bar 249 may be supported by the bracket wall 231a through the hole.

[0506] The first center portion 235a and the second center portion 236a may each include a bracket forming a hole.

[0507] The second bracket 230 may include a gear cover 232 connected to the gear bracket 231. The gear cover 232 may shield an opened one side of the gear bracket 231. The gear bracket 231 and the gear cover 232 may constitute a "gear housing".

[0508] For example, the gear cover 232 may be fastened to the gear bracket 231. The gear bracket 231 may include a first fastening portion 231b fastened to the gear cover 232, and the gear cover 232 may include a second fastening portion 232a fastened to the first fastening portion 231b. A predetermined fastening member may be coupled to the first fastening portion 231b and the second fastening portion 232a.

[0509] The gear bracket 231 may include a first coupling portion 231c fastened to the first bracket 220. The first bracket 220 may include a second coupling portion 222a fastened to the first coupling portion 231c. A predetermined fastening member may be coupled to the first coupling portion 231c and the second coupling portion 222a.

[0510] The gear cover 232 may be coupled to the first motor 210. The first motor 210 includes a fastening rib 215, and the gear cover 232 may include a fastening boss 237 coupled to the fastening rib 215. A predetermined fastening member may pass through the fastening rib 215 and be coupled to the fastening boss 237.

[0511] The gear cover 232 may include a first through portion 232b through which the shaft of the first motor 210 passes. The shaft of the first motor 210 may be coupled to

the first center portion 235a of the driving gear 235 through the first through portion 232b. The first center portion 235a of the driving gear 235 may be rotatably supported by the first through portion 232b.

[0512] The gear cover 232 may include a second through portion 232c by which the second center portion 236a of the driven gear 236 is supported. The second center portion 236a of the driven gear 236 may be rotatably supported by the second through portion 232c.

[0513] When the first motor 210 rotates, the driving gear 235 and the driven gear 236 interwork, and the bar 249 connected to the driven gear 236 may rotate. According to rotation of the bar 249, the tray assembly 240 may rotate.

[0514] The operation of the tray assembly 240 will be described with reference to FIGS. 11a and 11b. FIG. 11A illustrates an example state in which the tray assembly 240 is at an ice-making position (a first position), and FIG. 11B illustrates an example state in which the tray assembly 240 is at a water-supply position (a second position).

[0515] Referring to FIG. 11A, based on driving of the first motor 210, the tray assembly 240 may be at the ice-making position. At the ice-making position, a first peripheral surface 242a of the tray 241 may not be immersed in the reservoir 250 and may be located in a first accommodation space 220a of the first bracket 220. For example, as illustrated in FIG. 11A, two first peripheral surfaces 242a may be located on both upper sides of the reservoir 250.

[0516] At the ice-making position, water supplied to the first peripheral surface 242a may be cooled by cold air supplied through the cold-air duct 400 and may undergo a phase change into thin ice. A state of ice cooled on the first peripheral surface 242a may be referred to as a first state or first state ice. The ice in the first state may be formed to a predetermined height on surfaces of a recess 241a and a protrusion 241b provided on the first peripheral surface 242a. The ice in the first state may be understood as ice having a thin layer thickness.

[0517] When a predetermined time elapses at the ice-making position, the first motor 210 may be driven so that the tray assembly 240 rotates. For example, as illustrated in FIG. 11A, the tray assembly 240 may rotate counter-clockwise.

[0518] During rotation of the tray assembly 240, when the first peripheral surface 242a is at a position where the first blade 280 is provided, the first blade 280 may contact ice formed on the first peripheral surface 242a. In the contact process, the ice may be separated from the first peripheral surface 242a and may be de-iced.

[0519] The de-iced ice may be introduced into the compression part 300, in particular into the transfer pipe 340. The de-iced ice may have a shape of powdered ice, and such a state of ice may be referred to as a second state or second state ice.

[0520] The de-icing process may be performed during a section in which the tray 241 makes one rotation (a 360-degree rotation), so that ice formed on the two first

peripheral surfaces 242a may be separated by the first blade 280.

[0521] In some examples, in this process, the first peripheral surface 242a on which de-icing has been completed may further rotate and pass the water-supply position as illustrated in FIG. 11B. While passing the water-supply position, water may be supplied to the first peripheral surface 242a.

[0522] In detail, the tray assembly 240 rotates counter-clockwise from the position of FIG. 11A, de-icing is performed on the first peripheral surface 242a, and the tray assembly 240 moves to the position of FIG. 11B. At this time, the first peripheral surface 242a is immersed in or contacted with water of the reservoir 250. Water that contacts the first peripheral surface 242a may remain on the first peripheral surface 242a due to surface tension.

[0523] Such a water-supply operation may be performed until water is supplied to the two first peripheral surfaces 242a. That is, when the tray assembly 240 makes one rotation from the position of FIG. 11A, the de-icing operation and the water-supply operation may be performed.

[0524] FIG. 12 is an exploded perspective view illustrating an example configuration of the compression assembly of the ice maker, FIG. 13 is a perspective view illustrating an example configuration of the transfer pipe and a gear device, FIG. 14 is a plan view illustrating an example configuration of the transfer pipe and the gear device, FIG. 15A is a view illustrating an example state in which the piston is at a first position and de-iced ice from the tray assembly falls into the transfer pipe, and FIG. 15B is a view illustrating an example state in which the piston moves to a second position and ice in the transfer pipe is compressed by the piston.

[0525] First, referring to FIGS. 12 to 14, the ice maker 100 may include a compression part 300 for compressing or recombining ice (powdered ice, ice in the second state) de-iced from the ice-making part 200.

[0526] The compression part 300 may include a second motor 310 for providing driving force. The second motor 310 may include a motor shaft 312.

[0527] The compression part 300 may include a pinion gear 315 coupled to the motor shaft 312 and rotating according to driving of the second motor 310. The pinion gear 315 may include a shaft coupling portion 314 coupled to the motor shaft 312.

[0528] The compression part 300 may include a rack gear 330 interworking with the pinion gear 315. The rack gear 330 may include a bar-shaped rack body 331 and a first gear 332 formed on the rack body 331 and interworking with the pinion gear 315.

[0529] The rack gear 330 may include a rail 334 guiding movement of the rack gear 330. For example, the rail 334 may be provided at a lower end portion of the rack body 331. The rail 334 may move along a rail groove 324a provided in a fastening wall 324 of the first bracket 320.

[0530] The compression part 300 may include a piston

335 that moves together with the rack gear 330. The piston 335 may include a portion extending in a direction corresponding to an extension direction of the rack gear 330, and may be provided to be capable of reciprocating motion. The piston 335 may move only up to an inlet side of the cylinder 360, or at least a portion of the piston 335 may move so as to be inserted into the cylinder 360.

[0531] For example, the piston 335 may have a substantially cylindrical shape corresponding to an internal shape of a second part 342 of the transfer pipe 340.

[0532] The compression part 300 may include a coupling bracket 336 provided at one side of the piston 335 and coupling the piston 335 and the rack gear 330. The coupling bracket 336 may be coupled to the rack body 331. The coupling bracket 336 may include a rack fastening portion 336a, and the rack body 331 may include a bracket fastening portion 331a. A predetermined fastening member may couple the rack fastening portion 336a and the bracket fastening portion 331a.

[0533] The compression part 300 may include a transfer pipe 340 forming an accommodation space 341a for ice in the second state powdered ice. The transfer pipe 340 may be disposed at an inlet side of the cylinder 360.

[0534] The transfer pipe 340 may include a first part 341 having the accommodation space 341a. The first part 341 may form an opening so that the ice in the second state may be introduced.

[0535] The transfer pipe 340 may include a second part 342 having an internal space communicating with the accommodation space 341a. The piston 335 may be inserted into the second part 342.

[0536] The second part 342 may have an inner diameter slightly larger than an outer diameter of the piston 335 so that the piston 335 may reciprocate in an inserted state. For example, the second part 342 may have a hollow cylindrical shape.

[0537] The second part 342 may be positioned below the transfer pipe 340 with respect to a gravity direction. Ice introduced into the first part 341 may move downward by the gravity and may be introduced into the internal space of the second part 342. The piston 335 may reciprocate in the internal space of the second part 342.

[0538] The transfer pipe 340 may be supported by the first bracket 320. The transfer pipe 340 may include a fastening portion 343 provided at the first part 341. The fastening portion 343 may be coupled to a transfer pipe fastening portion 321d of the first bracket 320 by a predetermined fastening member. By fastening the fastening portion 343 and the transfer pipe fastening portion 321d, an upper portion of the transfer pipe 340 may be stably supported by the first bracket 320.

[0539] A plurality of fastening portions 343 may be provided, and the plurality of fastening portions 343 may be provided at upper and lower portions of the transfer pipe 340. In FIG. 13, fastening portions 343a, 343b, and 343c are illustrated.

[0540] The transfer pipe 340 may include a protrusion 344, and the first bracket 320 may include a protrusion

groove 321e accommodating the protrusion 344. The protrusion 344 may be provided at a lower position than the fastening portion 343, for example at the second part 342. After the protrusion 344 is inserted into the protrusion groove 321e for temporary assembly, the fastening portion 343 may be fastened to the transfer pipe fastening portion 321d.

[0541] The compression part 300 may include a lever 350 movably provided to guide movement of ice in the transfer pipe 340. For example, the lever 350 may be rotatably provided. The lever 350 may be referred to as a transfer guide device.

[0542] The lever 350 may include a rotation bar 351 forming a rotational center of the lever 350. The rotation bar 351 may be rotatably inserted into a bar support portion 345 of the transfer pipe 340. The bar support portion 345 may protrude from the first part 341 and may have a rib shape having a recessed groove into which the rotation bar 351 is fitted.

[0543] The lever 350 may include a plate 352 extending from the rotation bar 351. The plate 352 may be provided at a central portion of the rotation bar 351. The plate 352 may rotate about the rotation bar 351 so as to move into the transfer pipe 340.

[0544] The transfer pipe 340 may form an opening 341b through which the plate 352 passes. The plate 352 may move into or out of the transfer pipe 340 through the opening 341b.

[0545] The transfer pipe 340 may include a stopper 347 provided outside the opening 341b. The stopper 347 may have a shape bent along at least a portion of a circumference of the plate 352. The stopper 347 may limit a movement distance of the plate 352 when the plate 352 moves outward from the transfer pipe 340. The plate 352 may move outward only to a position interfering with the stopper 347.

[0546] The plate 352 may include a rounded portion 352a extending with a predetermined curvature. A curved direction of the rounded portion 352a may correspond to a direction facing downward inside the transfer pipe 340.

[0547] By the rounded portion 352a, ice present inside the transfer pipe 340 may be pressed downward. Accordingly, ice present in the first part 341 may be moved to the second part 342 by the lever 350.

[0548] A hole 354 may be formed in the rounded portion 352a. The hole 354 is for preventing a situation in which ice introduced into the transfer pipe 340 is blocked by the rounded portion 352a and movement toward a lower portion of the transfer pipe 340 is restricted. Ice may move to a lower side of the rounded portion 352a through the hole 354.

[0549] The compression part 300 may include a spring 358 providing a restoring force to the lever 350. The spring 358 may be provided at one end among both ends of the rotation bar 351. For example, the spring 358 may include a torsion spring.

[0550] The spring 358 may provide a restoring force so

that the lever 350 returns to the outside of the transfer pipe 340 when the linkage with the second gear 333 is released while the lever 350 has moved to the inside of the transfer pipe 340 through linkage with the second gear 333.

[0551] A spring support portion 351a may be provided on the rotation bar 351, and one side of the spring 358 may be supported by the spring support portion 351a.

[0552] The spring support portion 351a may protrude in a direction intersecting an extension direction of the rotation bar 351 at a position adjacent to both ends of the rotation bar 351. The restoring force of the spring 358 may be transmitted to the lever 350 through the spring support portion 351a.

[0553] The compression part 300 may include a third gear 355 transmitting power to the lever 350. The third gear 355 may be connected to the other end of the rotation bar 351. The other end may be understood as an end opposite to the one end at which the spring 358 is provided.

[0554] The third gear 355 may engage with the second gear 333 provided on the rack gear 330. The second gear 333 may be positioned laterally of the first gear 332. The first gear 332 and the second gear 333 may be axially arranged on an upper surface of the rack body 331.

[0555] The first gear 332 may be configured to have gear teeth for a predetermined length in a direction from a first end toward a second end of the rack body 331, that is, toward the cylinder 360. The second gear 333 may be configured to have gear teeth for a predetermined length in a direction from the second end toward the first end of the rack body 331. The number of gear teeth of the second gear 333 may be less than the number of gear teeth of the first gear 332.

[0556] The compression part 300 may include the cylinder 360 disposed at an outlet side of the transfer pipe 340. Ice collected at a lower portion of the transfer pipe 340 may be moved into the cylinder 360 by the piston 335.

[0557] The cylinder 360 may also be understood as constituting a portion of a transfer pipe in a broad sense in that it guides movement of ice. Accordingly, the transfer pipe 340 may be referred to as a first transfer pipe, and the cylinder 360 may be referred to as a second transfer pipe.

[0558] The compression part 300 may include a discharge pipe 370 provided at an outlet side of the cylinder 360 and providing a force for compressing or recombining ice transferred in the cylinder 360. For example, the discharge pipe 370 may be configured so that a cross-sectional area decreases in a direction in which ice is discharged.

[0559] The discharge pipe 370 may be formed of an elastically deformable material to provide resistance in a direction opposite to a transfer direction of ice. For example, the discharge pipe 370 may be formed of silicone.

[0560] Since the piston 335 presses one side of ice present in the cylinder 360 and resistance is provided on

the other side by the discharge pipe 370, compression or recombination of powdered ice may be achieved. Compressed powdered ice may be formed into ice having a predetermined shape (third state, molded ice) and may be discharged through a discharge portion of the discharge pipe 370.

[0561] The molded ice discharged from the discharge portion may interfere with a cutter wall 380 spaced apart from the discharge pipe 370 by a set distance, and in this process the molded ice may be cut. A distance between the discharge pipe 370 and the cutter wall 380 may be determined according to an ice size desired by a consumer. The cut molded ice may be introduced into an ice bin 500 through a discharge port 328 of the first bracket 320.

[0562] The compression part 300 may include compression brackets 320 and 327 for supporting the plurality of components described above.

[0563] The compression brackets 320 and 327 may include the first bracket 320 forming a first through-hole 321a through which the motor shaft 312 of the second motor 310 passes. The first bracket 320 may include a first wall 321 extending so as to face the ice-making space plate 85. For example, the first wall 321 may form a vertical wall extending in a vertical direction. The first through-hole 321a may be formed in the first wall 321.

[0564] The first bracket 320 may include a second wall 322 forming the discharge port 328. The second wall 322 may be connected to a lower end of the first bracket 320 and may extend in a direction away from the ice-making space plate 85. For example, the second wall 322 may form a horizontal wall extending in a horizontal direction.

[0565] The compression brackets 320 and 327 may include the second bracket 327 coupled to the first bracket 320. A space in which the rack gear 330 and the piston 335 are positioned may be formed between the first bracket 320 and the second bracket 327.

[0566] The first wall 321 may include a plurality of fastening portions.

[0567] The plurality of fastening portions may include a first fastening portion 321b coupled to a first fastening portion 328a of the second bracket 327. The first fastening portion 321b may protrude from the first wall 321 and may include a boss to which a fastening member is coupled. The first fastening portion 328a of the second bracket 327 may include a hole into which the fastening member is inserted.

[0568] The plurality of fastening portions may include a second fastening portion 321c coupled to a second fastening portion 328b of the second bracket 327. The second fastening portion 321c may be formed in a fastening wall 324 provided at a position spaced apart from the first wall 321 in a direction toward the second bracket 327. For example, the second fastening portions 328b and 321c may include holes. A predetermined fastening member may be fastened to the second fastening portions 328b and 321c.

[0569] An upper surface of the fastening wall 324 may

include a guide surface guiding sliding of the coupling bracket 336. Since the coupling bracket 336 is supported on the guide surface, stable reciprocating motion of the rack gear 330 and the piston 335 may be achieved. Of course, the coupling bracket 336 may be disposed to be slightly spaced apart from the upper surface of the fastening wall 324.

[0570] The fastening wall 324 may include the rail groove 324a guiding movement of the rail 334 of the rack gear 330. The rail groove 324a may be formed on a surface of the fastening wall 324 facing the rack gear 330 among a plurality of surfaces defining the fastening wall 324. At least a portion of the rail 334 may be fitted into the rail groove 324a, and the rail 334 may move along the rail groove 324a.

[0571] The second bracket 327 may include a bracket wall 327a covering at least a portion of the rack gear 330 and the piston 335. The bracket wall 327a may include a second through-hole 327b in which a central portion 315a of the pinion gear 315 is rotatably supported. For example, the central portion 315a may be inserted into the second through-hole 327b.

[0572] Next, a process in which powdered ice generated in the ice-making part 200 and supplied to the compression part 300 is compressed will be described with reference to FIGS. 15A to 15B.

[0573] A position of the piston 335 illustrated in FIG. 15A is defined as a first position. At the first position, the second motor 310 is in a stopped state, and the first motor 210 of the ice-making part 200 is driven so that powdered ice I1 may be supplied into the transfer pipe 340. The state of FIG. 15A may be maintained for a first predetermined time.

[0574] After the first predetermined time elapses, when the second motor 310 is driven in a forward direction, the piston 335 moves in a direction toward the cylinder 360 by engagement of the pinion gear 315 and the first gear 332 (forward movement of the piston), and in this process, as illustrated in FIG. 15B, powdered ice collected in a lower portion of the transfer pipe 340, that is, in the second part 342, is moved into the cylinder 360.

[0575] In FIG. 15B, the piston 335 is illustrated as moving only up to an inlet side of the cylinder 360. However, unlike this illustration, at least a portion of the piston 335 may be inserted into the cylinder 360. A position of the piston 335 in FIG. 15B is defined as a second position.

[0576] In the state of FIG. 15B, when the second motor 310 is driven in a reverse direction, the piston 335 may move in a direction away from the cylinder 360 (rearward movement of the piston). The rack gear 330 moves together with the piston 335, and at an end of movement of the rack gear 330, the second gear 333 may engage with the third gear 355. Accordingly, the third gear 355 rotates clockwise based on FIG. 15C, and thus the lever 350 rotates clockwise about the rotation bar 351.

[0577] When the lever 350 rotates, the plate 352 and the rounded portion 352a move into the accommodation

space 341a of the transfer pipe 340 and transfer powdered ice present in the transfer pipe 340. For example, ice present in an upper portion of the transfer pipe 340, that is, in the first part 341, may be pressed downward and moved toward a lower portion of the transfer pipe 340, that is, toward the second part 342. A position of the piston 335 in FIG. 15C is defined as a third position.

[0578] In the state of FIG. 15C, when the second motor 310 is driven in the forward direction, the piston 335 may move in a direction toward the cylinder 360. When the rack gear 330 moves for movement of the piston 335, engagement between the second gear 333 and the third gear 355 is released, and by restoring force of the spring 358, the lever 350 moves to an upright position as illustrated in FIG. 15A. Then, the piston 335 may return to the first position.

[0579] By repeating the processes of FIGS. 15A to 15D, powdered ice may undergo compression or recombination within an internal space of the cylinder 360 and may be manufactured into molded ice I2, that is, ice in a third state or third state ice (see FIG. 15B). When pressure for the ice to pass through the discharge pipe 370 is applied to the molded ice I2 by the piston 335, the molded ice I2 may be discharged through the discharge pipe 370. In some examples, the third state ice may be heated before being discharged from discharge pipe 370 and generate fourth state ice. In some examples, the temperature of ice may sequentially increase from the first state ice to the fourth state ice based on the locations of ice. For example, the first state ice on the ice-making body may have a first temperature, and the second state ice separated from the ice-making body may have a second temperature higher than or equal to the first temperature. The third state ice molded into shape at an inlet side of the cylinder has a third temperature higher than or equal to the second temperature, and the fourth state ice at an outlet side of the cylinder may have a fourth temperature higher than the third temperature.

[0580] Ice discharged from the discharge pipe 370 interferes with the cutter wall 380 and is cut to a predetermined size, and the cut ice may be introduced into the ice bin 500.

[0581] FIG. 16 is a plan view illustrating an example configuration of an ice-making part of an ice maker, FIG. 17 is a left side view illustrating the configuration of the ice-making part of the ice maker, FIG. 18 is a right side view illustrating the configuration of the ice-making part of the ice maker, and FIG. 19 is a front view illustrating the configuration of the ice-making part of the ice maker.

[0582] First, referring to FIG. 16, an ice-making part 200 may include a cold-air duct 400 that supplies cold air into an inner space of an ice-making brackets 220 and 230. The inner space of the ice-making brackets 220 and 230 may form a cold air flow path.

[0583] The cold-air duct 400 may be connected to a first duct 90, and may be disposed in a space between the first duct 90 and a first bracket 220.

[0584] The cold-air duct 400 may include an inlet por-

tion 420 through which cold air is introduced. The inlet portion 420 may be connected to an end of the first duct 90.

[0585] The cold-air duct 400 may include an outlet portion 430 that discharges cold air into the cold air flow path. The outlet portion 430 may be connected to a first opening 224b of the first bracket 220, and the cold air discharged from the outlet portion 430 may be introduced into the inside of the first bracket 220 through the first opening 224b.

[0586] The inlet portion 420 may be formed at one end of the cold-air duct 400, and the outlet portion 430 may be formed at the other end of the cold-air duct 400. The one end and the other end may form ends facing each other.

[0587] The cold-air duct 400 may include a duct body 440 that extends from the inlet portion 420 toward the outlet portion 430 and guides a flow of the cold air. The inlet portion 420 and the outlet portion 430 may be formed at both ends of the duct body 440.

[0588] The duct body 440 may be configured such that a width or a flow cross-sectional area of the duct body 440 changes with reference to a flow direction of the cold air. For example, the duct body 440 may have a downstream-side width W2 smaller than an upstream-side width W1 with reference to the cold air flow.

[0589] In other words, a downstream-side flow cross-sectional area of the duct body 440 may be smaller than an upstream-side flow cross-sectional area. With such an example configuration, a flow velocity of the cold air introduced through the inlet portion 420 may increase and the cold air may be readily supplied into the inner space of the ice-making brackets 220 and 230.

[0590] A width or a flow cross-sectional area of the inlet portion 420 may be formed to be greater than a width or a flow cross-sectional area of the outlet portion 430.

[0591] In order for the width or the flow cross-sectional area of the duct body 440 to change, a side surface of the duct body 440 may be formed to be inclined by a first angle $\theta 1$ with respect to a virtual first extension line $\ell 1$. The first extension line $\ell 1$ may be understood as a horizontal extension line extending from one side surface of the first bracket 220 toward the other side surface thereof.

[0592] Referring to FIG. 19, the duct body 440 may extend upwardly inclined by a second angle $\theta 2$ with respect to a virtual second extension line $\ell 2$ and may be connected to the first opening 224b, so as to supply cold air to a circumferential surface 242a and 242b of the tray 241, in particular, to an upper-side circumferential surface 242a and 242b of the tray 241. In some examples, the circumferential surface 242a may be referred to as a circumferential portion or a peripheral portion of the ice-making body (e.g., tray 241) configured to receiver water.

[0593] The second extension line $\ell 2$ may be understood as a horizontal extension line extending from one side surface of the first bracket 220 toward the other side surface thereof. For example, the second extension line

ℓ2 may be a horizontal extension line passing through the inlet portion 420. In FIG. 19, the second extension line ℓ2 is illustrated as passing through a lower end of the inlet portion 420, but the second extension line ℓ2 may be defined to pass not only through the lower end but also through a central portion or an upper end of the inlet portion 420.

[0594] The duct body 440 may extend to be inclined with respect to the first duct 90.

[0595] A cold air flow path formed along the circumferential surface 242a and 242b may be defined between an upper portion of the tray 241 and a second wall 222 of the first bracket 220, and due to the inclined shape of the duct body 440, cold air may be supplied into the cold air flow path while being prevented from flowing toward a reservoir 250 located below the tray 241. Accordingly, freezing of the reservoir 250 due to cold air may be prevented.

[0596] Referring to FIGS. 17 and 18, both end portions of the ice-making brackets 220 and 230 may form openings through which cold air passes. The first opening 224b connected to the outlet portion 430 of the cold-air duct 400 may be formed at one end of the ice-making brackets 220 and 230. A second opening 227 may be formed at the other end of the ice-making brackets 220 and 230.

[0597] The first opening 224b may be an opening for cold air inflow, and the second opening 227 may be understood as an opening for cold air discharge. The second opening 227 may function as an opening through which ice separated from the tray 241 is discharged.

[0598] The first opening 224b may be formed at one side surface of the first bracket 220, and at least a portion of the circumferential surface 242a and 242b of the tray 241, in particular, at least a portion of a first circumferential surface 242a, may be disposed to face the first opening 224b.

[0599] That is, the circumferential surface 242a and 242b of the tray 241 may be exposed to the outside of the first bracket 220 through the first opening 224b. From another viewpoint, the circumferential surface 242a and 242b may be understood as being disposed to face the outside of the ice maker through the cold-air duct 400. With such an example configuration, cold air introduced through the cold-air duct 400 may be supplied to the circumferential surface 242a and 242b through the first opening 224b. In addition, ice separated from the first circumferential surface 242a by the first blade 280 may be discharged to the outside of the first bracket 220 through the second opening 227.

[0600] The second opening 227 may be formed at the other side surface of the first bracket 220. The other side surface of the second bracket 230 may be opposite to the one side surface on which the first opening 224b is formed. That is, the one side surface and the other side surface of the second bracket 230 may be disposed to face each other. The cold air introduced through the first opening 224b may cool the tray 241 while passing the circumferential surface 242a and 242b of the tray 241,

and may be discharged through the second opening 227.

[0601] The second opening 227 may be defined as a space between a guide wall 226 provided at one side portion of the first bracket 220 and the first blade 280. The guide wall 226 may be formed to be rounded corresponding to a curvature of the first circumferential surface 242a of the tray 241, and may guide cold air flowing along a second wall 222 of the first bracket 220 toward the first circumferential surface 242a.

[0602] In other words, the second opening 227 may be understood as a space between the guide wall 226 and a fifth wall 225 to which the first blade 280 is mounted.

[0603] The first blade 280 may include a blade body 281 mounted to the fifth wall 225 and a tip 283 provided at an end of the blade body 281. The tip 283 may have a shape in which a cross-sectional area of an end portion of the tip 283 becomes smaller so as to scrape off ice formed on the first circumferential surface 242a.

[0604] For example, a plurality of recesses 241a and a plurality of protrusions 241b may be alternately arranged in an axial direction on the first circumferential surface 242a. A plurality of tips 283 may be provided to be spaced apart in the axial direction such that at least a portion of each tip 283 may be inserted into the plurality of recesses 241a.

[0605] An end portion of the blade body 281 may include a flat surface so as to scrape off ice formed on the protrusions 241b.

[0606] Ice formed on the first circumferential surface 242a may be separated by the first blade 280, and the separated ice may be discharged through the second opening 227, and the discharged ice may be introduced into a compression part 300.

[0607] The first bracket 220 may include a first receiving space 220a in which the tray assembly 240 is received. An axial width of the first receiving space 220a may be formed to be greater than an axial width of the tray assembly 240.

[0608] A cold air flow path through which cold air flows may be formed between an outer wall of the tray assembly 240 and a wall of the ice-making brackets 220 and 230.

[0609] For example, the first tray cover 246 of the tray assembly 240 and a gear bracket 231 may be spaced apart from each other by a first distance S1, and a first side flow path may be formed in a space spaced apart by the first distance.

[0610] The second tray cover 247 of the tray assembly 240 and a first wall 221 of the first bracket 220 may be spaced apart from each other by a second distance S2, and a second side flow path may be formed in a space spaced apart by the second distance. As described above, since cold air supplied through the first and second side flow paths may cool a side wall of the tray assembly 240, cooling of the tray 241 may be rapidly performed and ice-making performance may be improved.

[0611] The tray 241 may be formed of a material having

a high thermal conductivity so as to be cooled. For example, the tray 241 may be formed of a metal material. As an example of the metal material, steel or aluminum may be proposed.

[0612] FIG. 20 is a left perspective view illustrating an example configuration of a cold-air duct, and FIG. 21 is a bottom perspective view illustrating the configuration of the cold-air duct.

[0613] Referring to FIGS. 20 and 21, the cold-air duct 400 may be disposed between a side wall 81 of an ice-making chamber 25 and the tray assembly 240. From another viewpoint, the cold-air duct 400 may be disposed between the side wall 81 of the ice-making chamber 25 and the ice-making brackets 220 and 230, in particular, the first bracket 220.

[0614] The cold-air duct 400 may include a duct bracket 410 connected to the side wall 81 of the ice-making chamber 25, and a duct body 440 extending from the duct bracket 410 and forming a cold air flow path therein.

[0615] The duct bracket 410 may include a fastening hole 415 fastened to the side wall 81. A predetermined fastening member may be coupled to the side wall 81 through the fastening hole 415. The duct bracket 410 may be disposed to surround the inlet portion 420 of the cold-air duct 400.

[0616] The first duct 90 (see FIG. 5) may be embedded in the side wall 81, and a duct outlet 91 formed at an end of the first duct 90 may be coupled to the side wall 81. Cold air flowing through the first duct 90 may be discharged through the duct outlet 91 and may be introduced into the duct body 440 through the inlet portion 420.

[0617] The duct body 440 may include a plurality of walls 441 to 444. For example, the plurality of walls may include a first wall 441 forming one side wall of the duct body 440, a second wall 442 forming a bottom wall, a third wall 443 forming the other side wall, and a fourth wall 444 forming a top wall. A flow path through which cold air passes may be formed inside the first to fourth walls 441 to 444.

[0618] The inlet portion 420 may be formed at one end of the duct body 440, and the outlet portion 430 may be formed at the other end thereof. The duct body 440 may extend obliquely from the inlet portion 420 toward the outlet portion 430.

[0619] Since the first duct 90 guides a flow of cold air by extending upward from a lower portion of a first refrigerator space door 20, the cold-air duct 400 may extend upwardly inclined toward a lateral side of the ice-maker so as to smoothly guide cold air from an upper end of the first duct 90 to an ice maker 100. For this, the second wall 442 and the fourth wall 444 may extend upwardly inclined from the inlet portion 420 toward the outlet portion 430.

[0620] FIG. 22 is a view illustrating a partial configuration of the ice-making part, FIG. 23 is a view illustrating an example state in which the tray assembly and the reservoir are removed from FIG. 22, FIG. 24 is a cross-sectional view taken along line 24-24 of FIG. 8, FIG. 25 is a cross-sectional view taken along line 25-25 of FIG. 8, and

FIG. 26 is a view illustrating an example state in which cold air is supplied from the refrigerator space door to the ice-making chamber and cold air of the ice-making chamber is returned to the outside of the refrigerator space door,.

[0621] Referring to FIGS. 22 to 26, the cold-air duct 400 may be coupled to the first bracket 220. For example, the outlet portion 430 of the cold-air duct 400 may be disposed to be connected to the opening 224b of the first bracket 220.

[0622] An outer circumferential surface of the tray assembly 240 may be disposed to face the opening 224b. The cold-air duct 400 may be coupled to the first bracket 220 such that cold air introduced through the opening 224b is supplied to the outer circumferential surface of the tray assembly 240.

[0623] A distance from the opening 224b to the outer circumferential surface of the tray assembly 240 may be formed to be smaller than a distance from the opening 224b to the reservoir 250. Accordingly, cold air introduced through the opening 224b may flow toward the outer circumferential surface of the tray assembly 240, and direct flow toward the reservoir 250 may be prevented.

[0624] When an extension line $\ell 3$ corresponding to a direction in which the cold-air duct 400 extends from the side wall 81 of the ice-making chamber 25 to the ice-making brackets 220 and 230 is defined, the extension line $\ell 3$ may be formed to be tangent to an extension line $\ell 4$ of the circumferential surface 242a and 242b of the tray 241 or to form a direction corresponding thereto. Accordingly, cold air discharged from the cold-air duct 400 may be readily supplied in a direction toward the circumferential surface 242a and 242b of the tray 241.

[0625] When a radial extension line ℓc passing through a center of the tray 241 is defined, the extension line ℓc may extend to bisect the tray 241. For example, the extension line ℓc may be understood as a radial extension line passing through a bar 249 of the tray assembly 240.

[0626] With reference to the extension line ℓc , the first opening 224b and the second opening 227 of the ice-making brackets 220 and 230 may be disposed opposite to each other. Accordingly, cold air introduced through the first opening 224b may be discharged through the second opening 227 after passing along the circumferential surface of the tray 241.

[0627] With reference to the extension line ℓc , the cold-air duct 400 and the guide wall 226 may be disposed opposite to each other. The guide wall 226 may be spaced apart from an outer circumference of the tray 241 by a predetermined distance, and may include a portion extending in a circumferential direction so as to guide a cold air flow in an outer circumferential direction of the tray 241.

[0628] With such an example configuration, cold air flowing toward the circumferential surface 242a and 242b of the tray 241 may maintain a flow along the circumferential surface 242a and 242b by the guide wall 226.

Further, cold air may flow via the guide wall 226 to a lower portion of the tray 241 where the first blade 280 is located.

[0629] With reference to the extension line ℓc , the cold-air duct 400 and the first blade 280 may be disposed opposite to each other. With reference to the cold air flow, the first blade 280 may be disposed on a downstream side of the guide wall 226.

[0630] The cold-air duct 400 may be disposed such that cold air is supplied along the circumferential surface 242a and 242b of the tray 241 corresponding to a rotation direction of the tray 241. As cold air is supplied along the circumferential surface 242a and 242b, a portion of the circumferential surface located on an upstream side of the cold air may remain in a water state, while ice may gradually be generated on another portion of the circumferential surface located on a downstream side of the cold air.

[0631] After the tray 241 is cooled for a predetermined time at an ice-making position of FIG. 24, the tray 241 may rotate, for example, in a counterclockwise direction, and in this process, ice sufficiently formed on the first circumferential surface 242a by cold air may be separated by the first blade 280.

[0632] Further, as the tray 241 continues to rotate, ice on the opposite first circumferential surface 242a may be additionally cooled and then may be separated by the first blade 280. With such an example configuration and operation, ice-making performance may be improved.

[0633] With reference to the extension line ℓc , the first blade 280 and the second blade 285 may be disposed opposite to each other. A blade bracket 221c to which the second blade 285 is mounted may be provided on the first wall 221 of the first bracket 220. The blade bracket 221c may protrude from the first wall 221 toward one side wall of the tray assembly 240.

[0634] The second blade 285 may be additionally provided between the other side wall of the tray assembly 240 and an outer wall of the gear bracket 231.

[0635] Since the first and second blades 280 and 285 are disposed opposite to each other with respect to the center of the tray 241, rotational resistance of the tray 241 due to the first and second blades 280 and 285 may be distributed, and rotation performance of the tray 241 may be improved. Further, obstruction of the cold air flow path formed on an outer circumferential side of the tray 241 by the first and second blades 280 and 285 may be prevented.

[0636] With respect to the center of the tray 241, the cold-air duct 400 and the reservoir 250 may be disposed opposite to each other. For example, the cold-air duct 400 may be located above the center of the tray 241, and the reservoir 250 may be located below the center of the tray 241. Accordingly, cold air supplied through the cold-air duct 400 may be supplied to the circumferential surface 242a and 242b located above the center of the tray 241, and supply to the reservoir 250 may be prevented. Accordingly, freezing of the reservoir 250 may be prevented.

[0637] A cold air flow path may be formed between

both side walls of the tray assembly 240 and the ice-making brackets 220 and 230. A first side-wall flow path 238a may be formed between the gear bracket 231 and one side wall of the tray assembly 240, and a second side-wall flow path 238b may be formed between the first wall 221 of the first bracket 220 and the other side wall of the tray assembly 240. By the first and second side-wall flow paths 238a and 238b, cooling performance of the tray 241 may be improved.

[0638] FIG. 27 is a view illustrating an example configuration of an ice-making part.

[0639] In some implementations, referring to FIG. 27, a tray assembly 240a may include a circumferential surface 1242a and 1242b. The circumferential surface 1242a and 1242b may include a first circumferential surface 1242a that receives water to form ice, and a second circumferential surface 1242b that extends from the first circumferential surface 1242a and has a center distance shorter than a center distance of the first circumferential surface 1242a.

[0640] When the first circumferential surface 1242a is disposed to face the reservoir 250, the first circumferential surface 1242a may be disposed to be immersed in or contacted with water stored in the reservoir 250. In some examples, when the second circumferential surface 1242b is disposed to face the reservoir 250, the second circumferential surface 1242b may be disposed not to be immersed in or contacted with water stored in the reservoir 250.

[0641] When passing around the first blade 280, the first circumferential surface 1242a may be disposed adjacent to the first blade 280 so that the first blade 280 contacts ice on the first circumferential surface 1242a. In some examples, when passing around the first blade 280, the second circumferential surface 1242b may be located at a position spaced apart from the first blade 280 so that the first blade 280 does not interfere with the second circumferential surface 1242b.

[0642] An area of the first circumferential surface 1242a may be formed to be greater than an area of the second circumferential surface 1242b.

[0643] In some implementations, the first and second circumferential surfaces 1242a and 1242b are provided in a single pair and includes a first circumferential surface having an area greater than that of the first circumferential surface of the previous examples. Accordingly, an ice-making amount in the present example may be greater than that in the previous example.

[0644] An extension direction of the cold-air duct 400 may be tangent to the first circumferential surface 1242a or form a direction corresponding thereto so that cold air supplied from the cold-air duct 400 may be directly supplied to the first circumferential surface 1242a. Other configurations of the ice maker may be the same as those described in the previous example.

[0645] FIG. 28 is a view illustrating an example configuration of an ice-making part.

[0646] In some implementations, referring to FIG. 28, a

tray assembly 240b may include a circumferential surface 2242. For example, water may be supplied to an entire area of the circumferential surface 2242 and ice may be generated.

[0647] The ice-making part may be characterized in that the reservoir 250 and a heater 255 are removed, and water is directly supplied to the circumferential surface 2242 through a water supply pipe 120a. In order to prevent water supplied from the water supply pipe 120a from being discharged to a lower side of the tray assembly 240b, an amount of water supplied through the water supply pipe 120a may be small.

[0648] The water supply pipe 120a may be disposed to supply water toward an upper end of the tray assembly 240b. For example, a discharge portion of the water supply pipe 120a may be formed at a position slightly higher than the upper end of the tray assembly 240b.

[0649] The water supply pipe 120a may extend into the inner space of the ice-making brackets 220 and 230 by passing through the second wall 222 of the first bracket 220.

[0650] Water supplied to the upper end of the tray assembly 240b may spread toward a lower end of the tray assembly 240b along the circumferential surface 2242 by gravity. Since an amount of water flowing along the circumferential surface 2242 is small, the water may slowly spread along the circumferential surface 2242 and separation from the circumferential surface 2242 may be prevented.

[0651] A cold-air duct 400a supplying cold air may be connected to a lateral side of the ice-making brackets 220 and 230. The cold-air duct 400a may be disposed at approximately a height of the center C of the tray assembly 240b, and cold air discharged from the cold-air duct 400a may cool the circumferential surface 2242 located at the center height of the tray assembly 240b.

[0652] Further, cold air may cool water present on the circumferential surface 2242 while flowing toward the upper end and the lower end of the tray assembly 240b.

[0653] FIG. 29 is a view illustrating an example configuration of an ice-making part.

[0654] In some implementations, referring to FIG. 29, an example configuration of a tray assembly 240c may be the same as the above-described configuration of the tray assembly 240.

[0655] A reservoir 250 may be disposed at one side of the tray assembly 240, for example, at a lower side. A vertical direction will be defined. The vertical direction may be defined based on a ground on which the refrigerator 1 or the cabinet 10 is placed. For example, the refrigerator 1 or the cabinet 10 may be understood as being placed above the ground. The vertical direction may correspond to a gravity direction. Such definition regarding directions may be applied throughout the specification in the same manner.

[0656] Since the reservoir 250 is disposed below the tray assembly 240, ice separated from a side wall 244 of the tray assembly 240 may fall into the reservoir 250.

[0657] A cold-air duct 400b supplying cold air may be connected to a lateral side of the ice-making brackets 220 and 230. The cold-air duct 400b may be disposed at a position higher than approximately the center C of the tray assembly 240c, and cold air discharged from the cold-air duct 400b may flow adjacent to an upper end of the tray assembly 240c. For example, cold air may be supplied to a circumferential surface formed at the upper end of the tray assembly 240c.

[0658] That is, the reservoir 250 may be disposed at one side of the tray assembly 240c, and the cold-air duct 400b may be disposed to supply cold air toward the other side opposite to the one side of the tray assembly 240c.

[0659] With such an example configuration, since the cold-air duct 400b is spaced apart from the reservoir 250 relatively far, cold air discharged from the cold-air duct 400b may be prevented from being directly supplied to the reservoir 250. Accordingly, freezing of water in the reservoir 250 may be prevented.

[0660] In some implementations, it has been described that the ice maker 100 is mounted to the refrigerator space door 20. However, the ice maker 100 may alternatively be mounted to a freezing space door 50 or disposed inside a freezing space 19.

Claims

1. A refrigerator comprising:

a cabinet that defines a storage space;
a door configured to open and close at least a portion of the cabinet;
an ice-making body rotatably provided at the cabinet or the door, the ice-making body having a circumferential portion configured to receive water and to generate ice;
an ice-making bracket configured to accommodate the ice-making body, the ice-making bracket defining a flow path of cooled air for cooling the ice-making body;
a blade configured to contact the ice on the circumferential portion of the ice-making body and to separate the ice from the circumferential portion of the ice-making body; and
an ice-compression assembly configured (i) to compress first size ice that has a first size and is separated from the circumferential portion of the ice-making body by the blade and (ii) to generate second size ice having a second size from the first size ice, the second size being larger than the first size.

2. The refrigerator of claim 1, wherein the ice-compression assembly comprises:

a cylinder configured to receive the first size ice separated from the circumferential portion; and

- a piston configured to reciprocate with respect to the cylinder and to compress the first size ice introduced into the cylinder; and
a motor configured to drive the piston.
3. The refrigerator of claim 2, wherein the cylinder defines:
- an inlet configured to receive the first size ice separated from the circumferential portion of the ice-making body;
an outlet configured to discharge the ice compressed within the cylinder; and
a compression space between the inlet and the outlet, the piston being configured to compress and move the ice introduced through the inlet toward the outlet.
4. The refrigerator of claim 3, further comprising a discharge pipe coupled to the outlet of the cylinder and configured to receive the ice discharged from the outlet of the cylinder, the discharge pipe being configured to additionally compress and discharge the ice received from the outlet of the cylinder.
5. The refrigerator of claim 4, wherein the discharge pipe comprises a connection portion that defines an opening at one side of the discharge pipe and that is connected to the outlet of the cylinder, the connection portion having a hollow shape, and wherein the connection portion is coupled to and surrounds an outer circumferential portion of the cylinder that defines the outlet.
6. The refrigerator of claim 5, wherein the discharge pipe further comprises a discharge portion that extends from the connection portion and that defines a discharge outlet at an opposite side of the connection portion, the discharge outlet being configured to discharge compressed ice.
7. The refrigerator of claim 6, wherein the discharge portion comprises a first section having a first side connected to the connection portion, and wherein an inner diameter of the first section decreases from the first side toward a second side where the discharge outlet is defined.
8. The refrigerator of claim 7, wherein the discharge portion further comprises a second section defining the discharge outlet, and
- wherein an inner diameter of the second section is constant, and
wherein the inner diameter of the second section is less than or equal to the inner diameter of the first section, and
wherein the inner diameter of the second section
- is less than an inner diameter of the outlet of the cylinder.
9. The refrigerator of claim 3, further comprising a heater disposed at the ice-compression assembly and configured to provide heat to at least a portion of the ice-compression assembly.
10. The refrigerator of claim 9, wherein the heater comprises a linear heater that is spirally wound around an outer surface of the cylinder.
11. The refrigerator of claim 10, wherein a winding interval of the heater at first side adjacent to the inlet of the cylinder is less than a winding interval at a second side adjacent to the outlet of the cylinder.
12. The refrigerator of claim 10, wherein the heater is configured to provide (i) a first amount of heat per unit area to a first portion of the cylinder adjacent to the inlet of the cylinder and (ii) a second amount of heat to a second portion of the cylinder adjacent to the outlet of the cylinder, the first amount of heat being greater than the second amount of heat.
13. The refrigerator of claim 9, wherein the heater is controlled to be turned on during at least one of (i) a first stage before the ice is transferred to the cylinder or (ii) a second stage after the ice is transferred to the cylinder.
14. The refrigerator of claim 9, further comprising a temperature sensor disposed at an outer surface of the cylinder and configured to sense a temperature of the outer surface of the cylinder, and wherein the heater is configured to:
- be turned on from an off-state based on the temperature sensed by the temperature sensor being less than a preset target temperature; and
be turned off from an on-state based on the temperature sensed by the temperature sensor being greater than or equal to the preset target temperature.
15. The refrigerator of claim 9, further comprising a temperature sensor disposed at an outer surface of the cylinder and configured to sense a temperature of the outer surface of the cylinder, and
- wherein the refrigerator is configured to perform a refrigerant cycle to maintain a temperature of the storage space,
wherein the heater is configured to be controlled to vary an output based on operating conditions of the refrigerant cycle and based on a surrounding environmental condition outside the refrigerator.

FIG. 1A

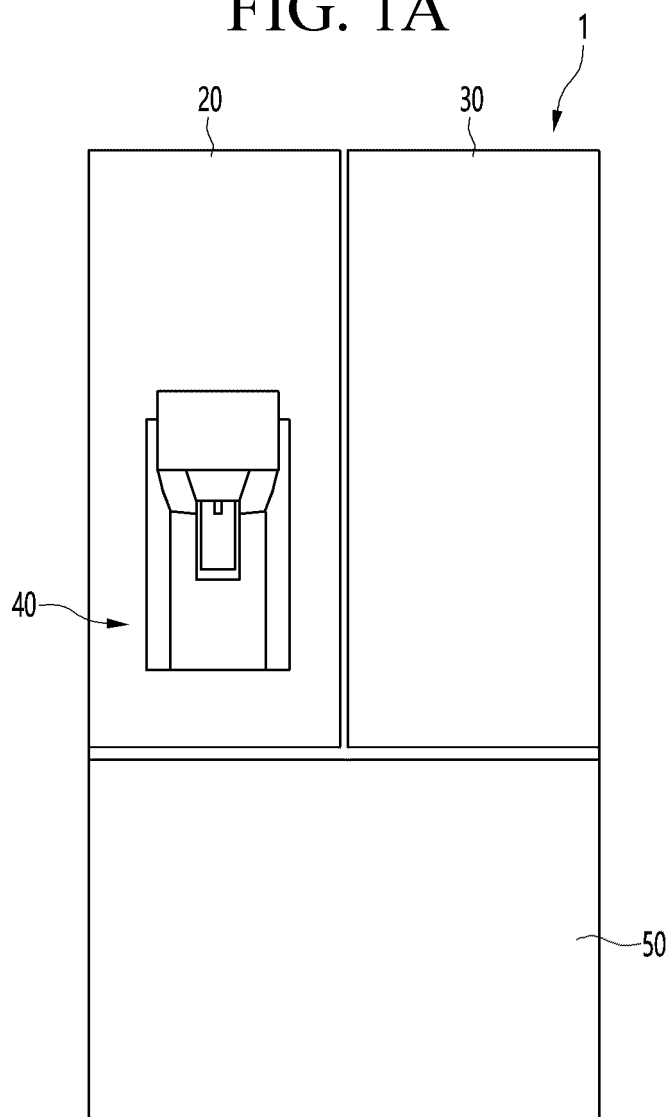


FIG. 1B

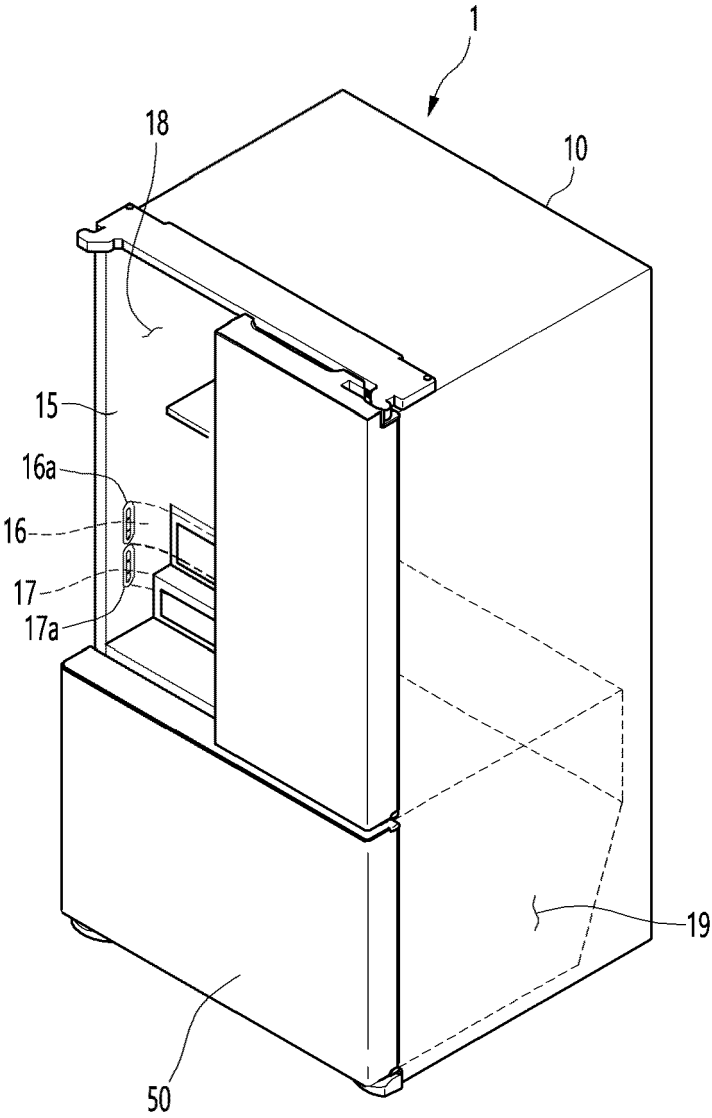


FIG. 2A

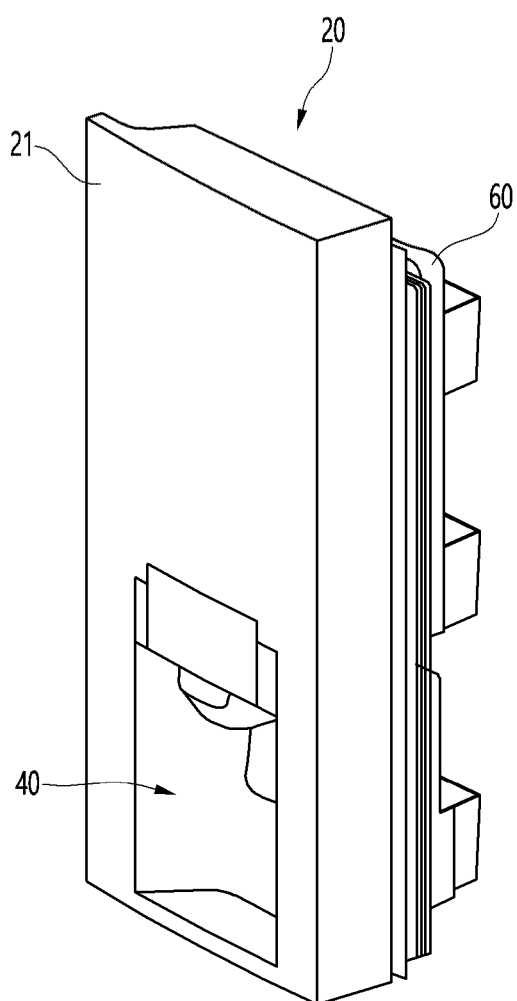


FIG. 2B

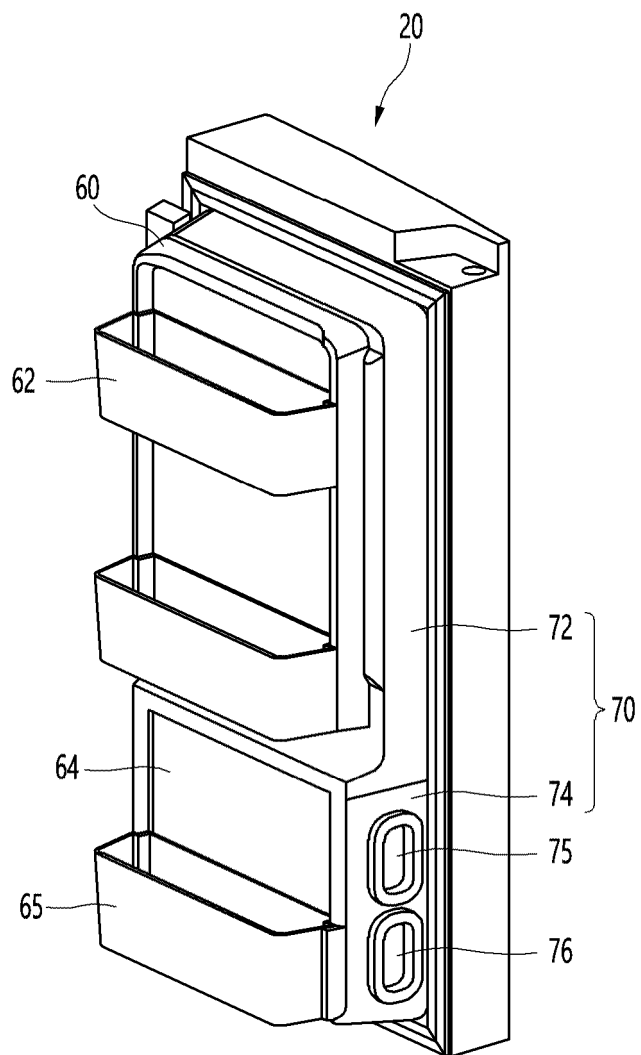


FIG. 3A

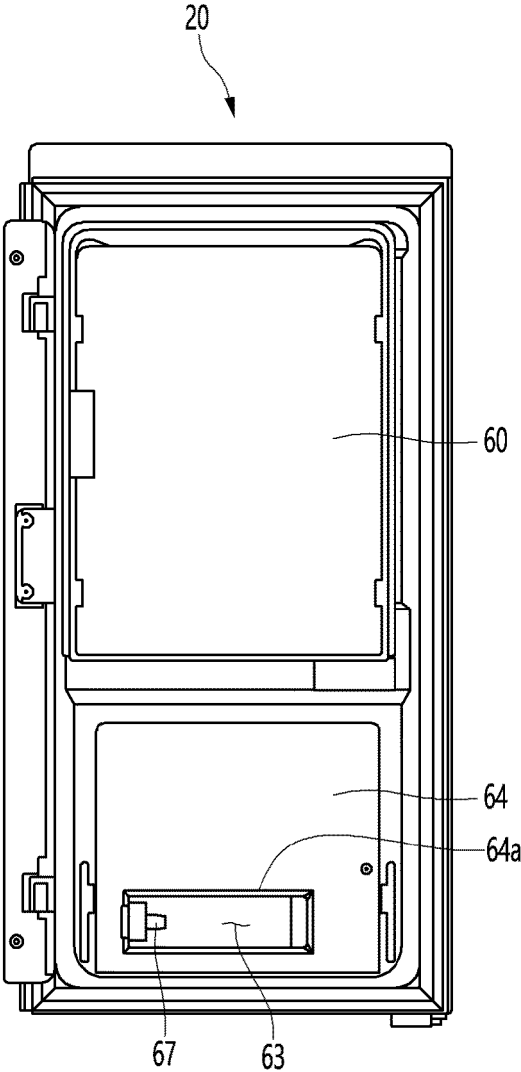


FIG. 3B

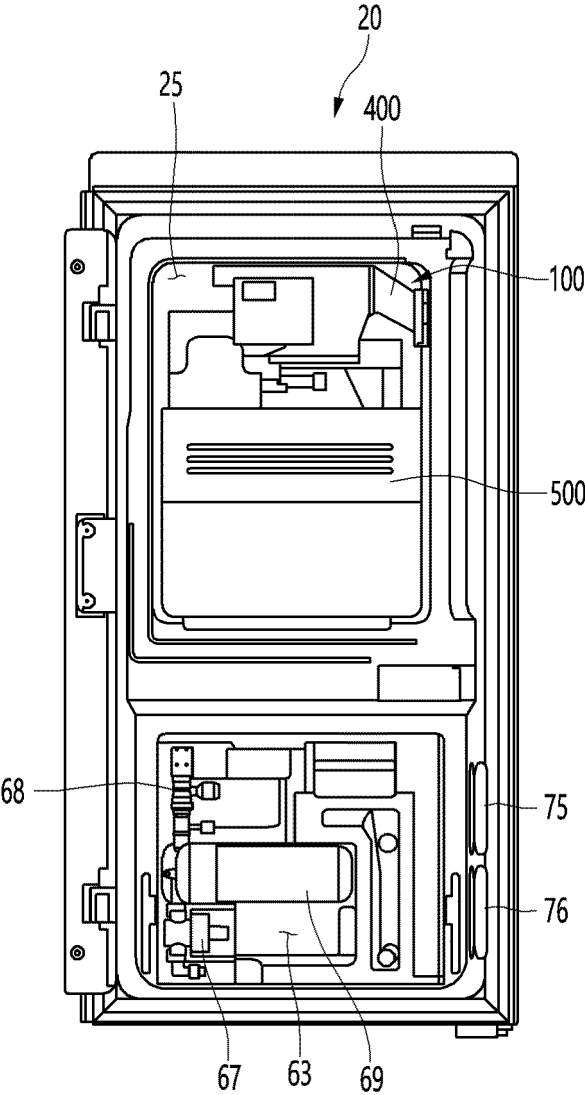


FIG. 4

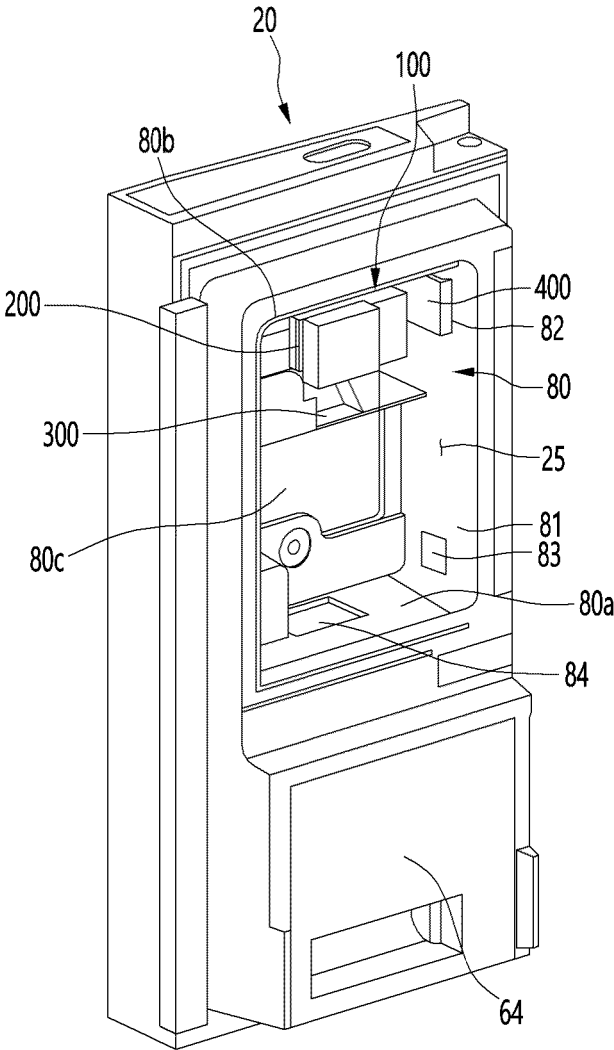


FIG. 5

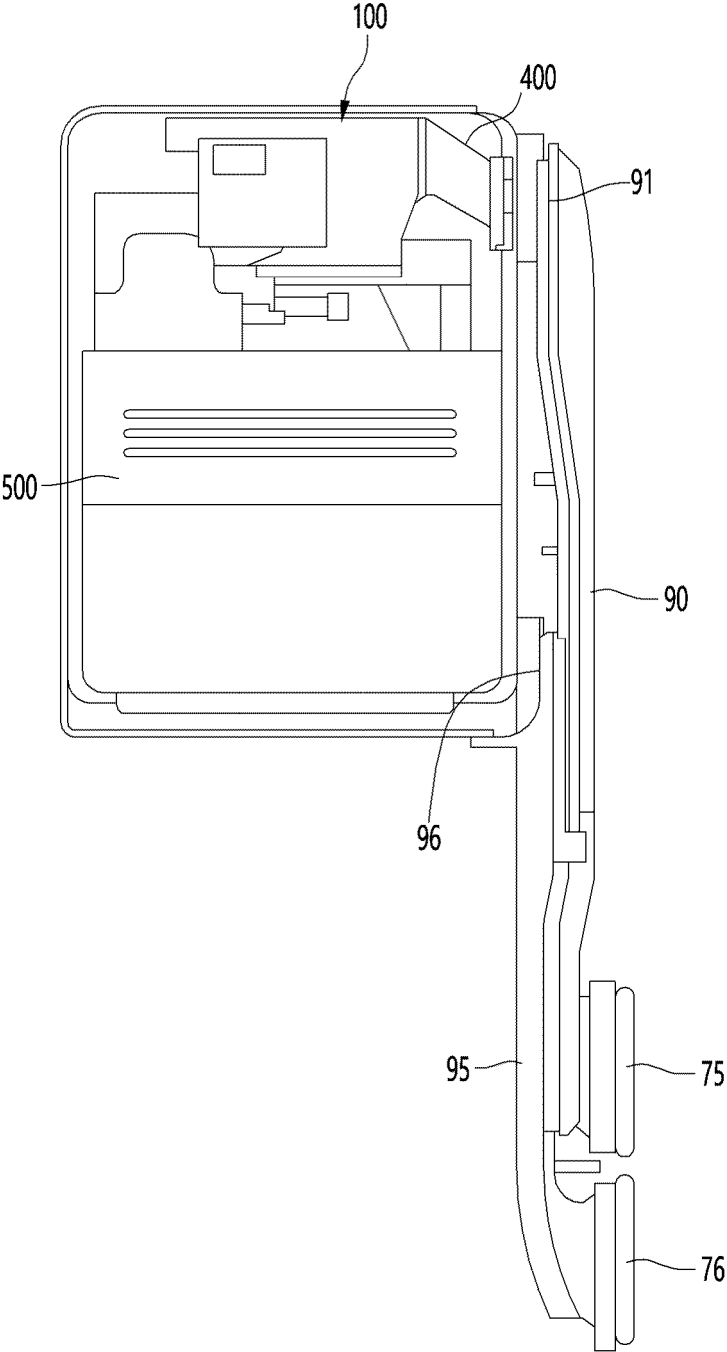


FIG. 6

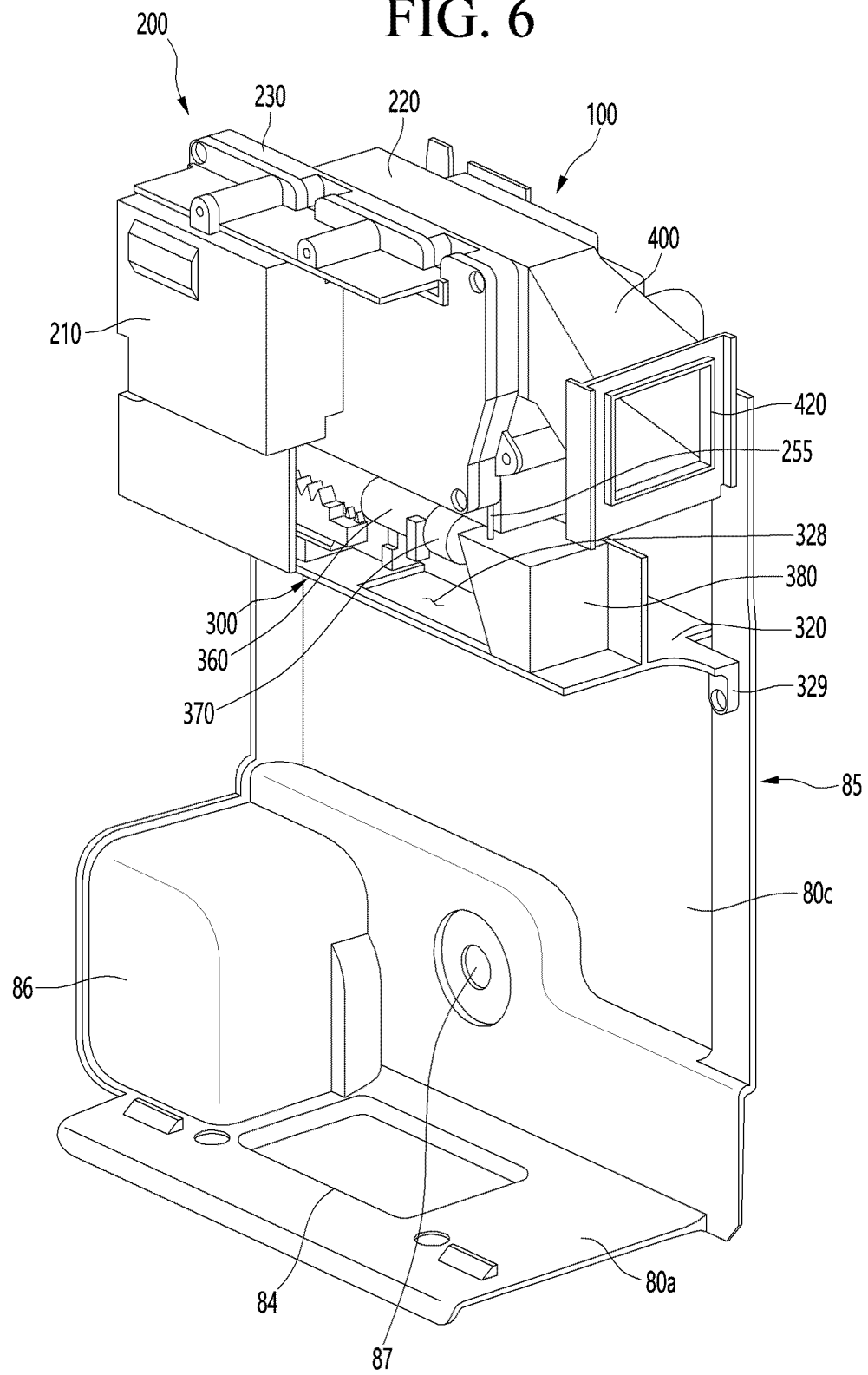


FIG. 7

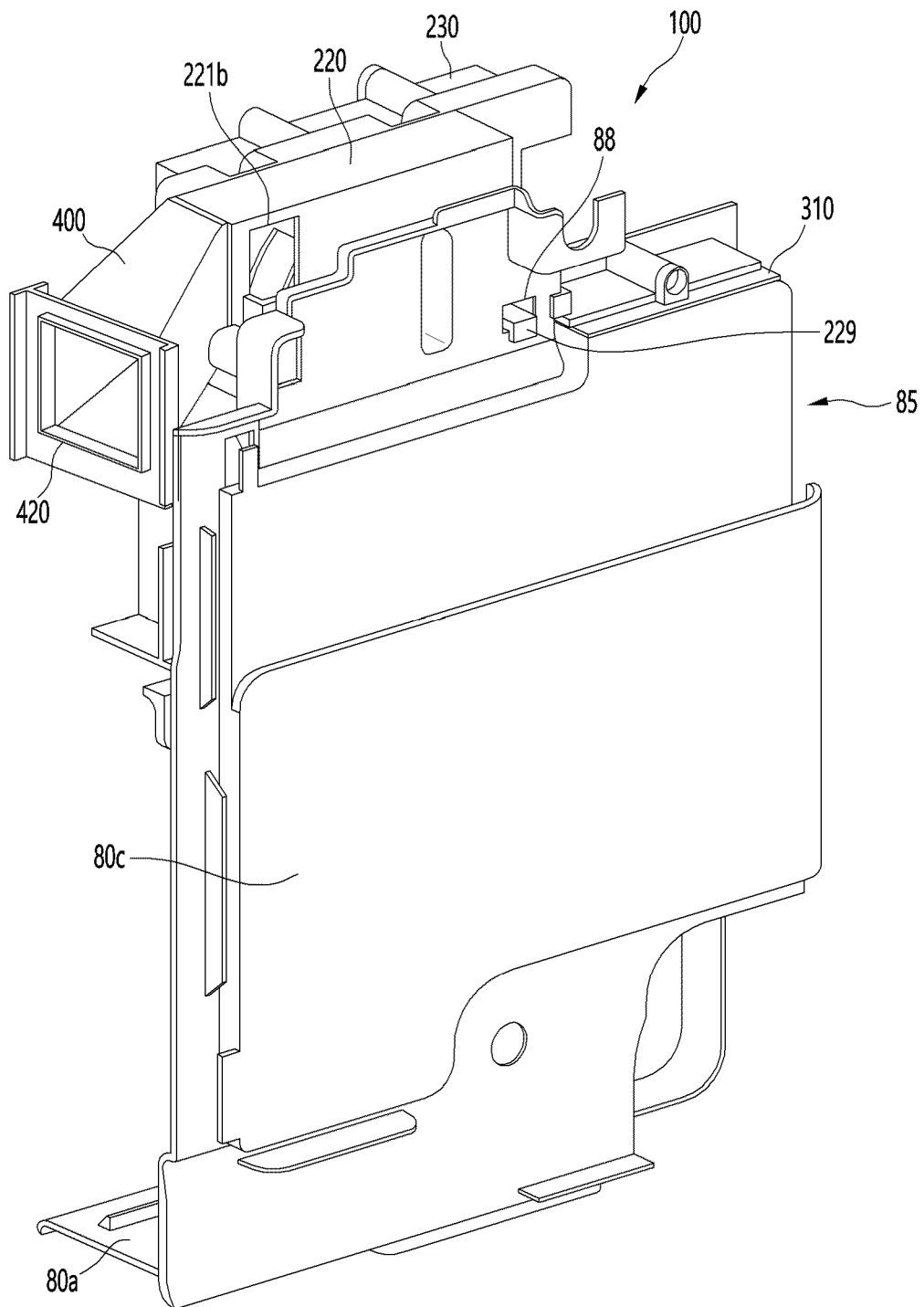


FIG. 8

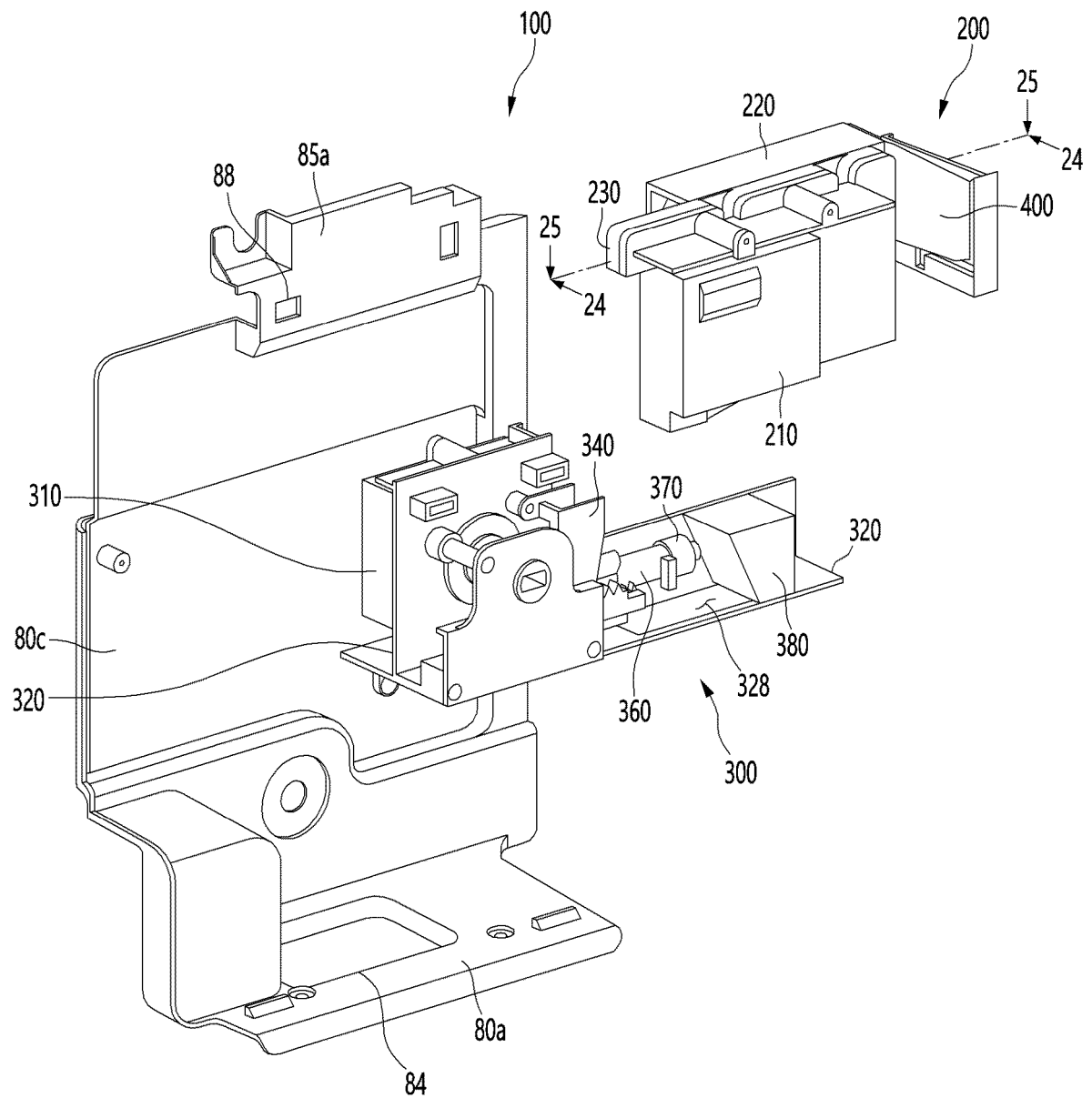


FIG. 9

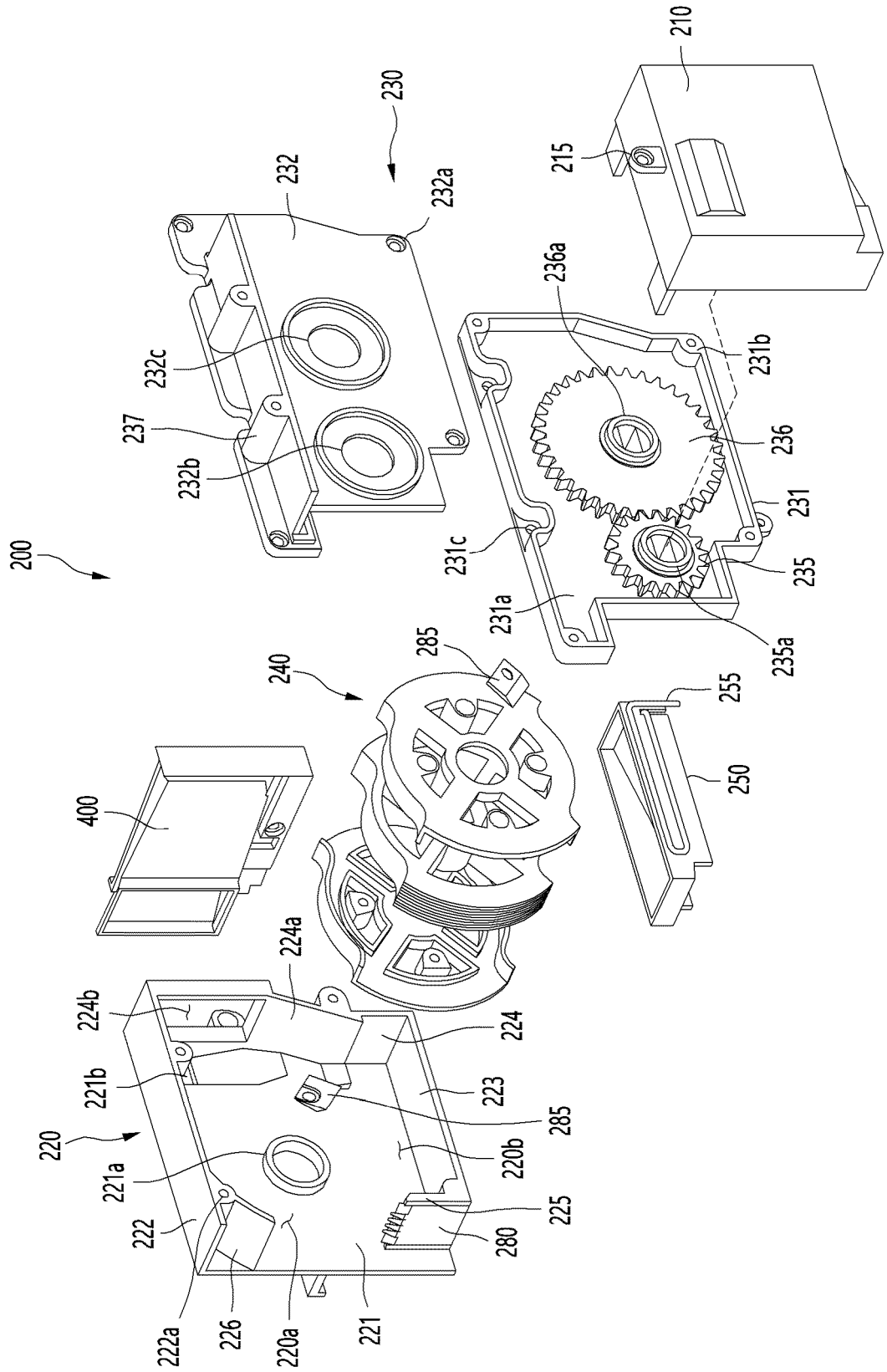


FIG. 10

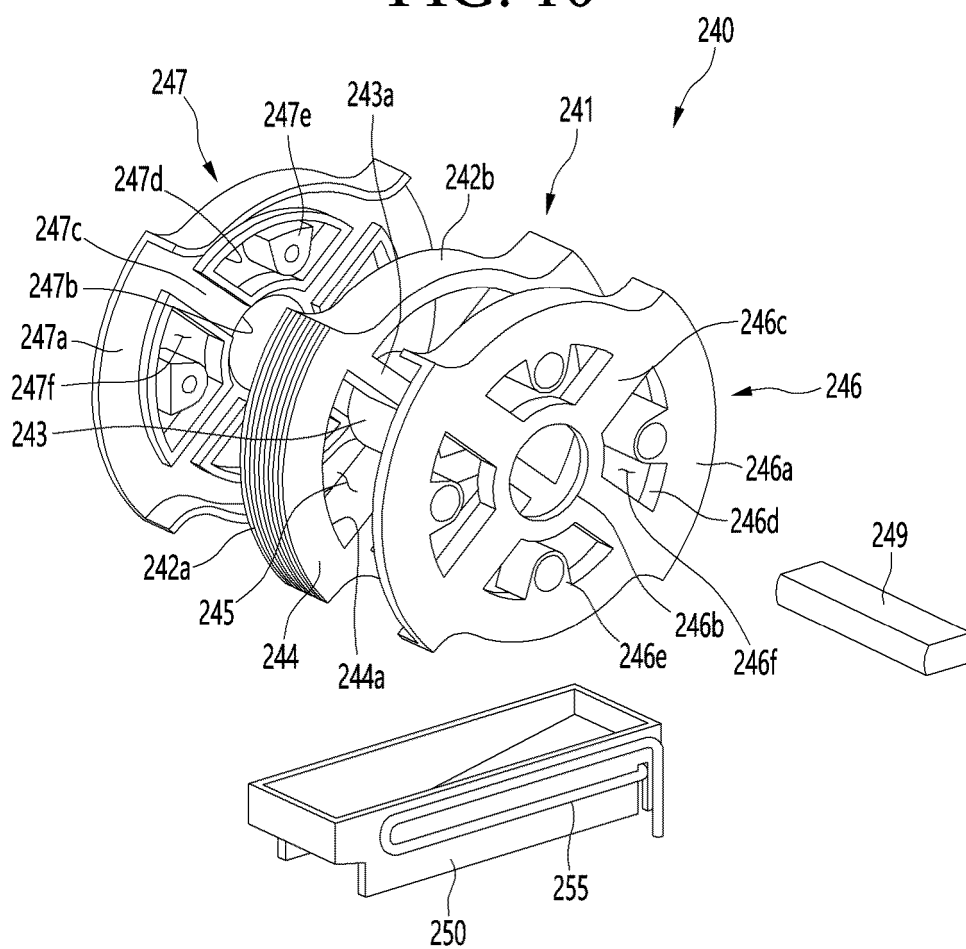


FIG. 11A

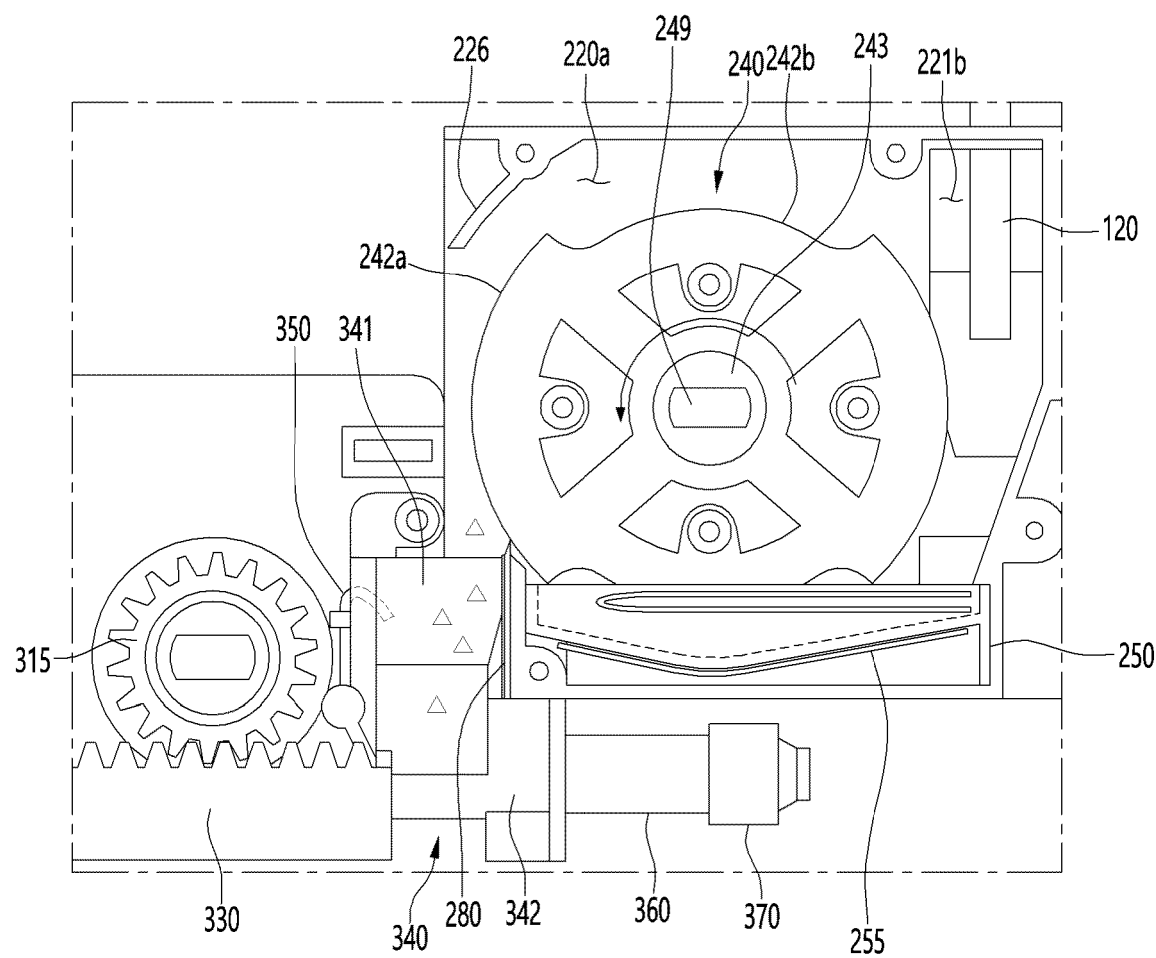


FIG. 11B

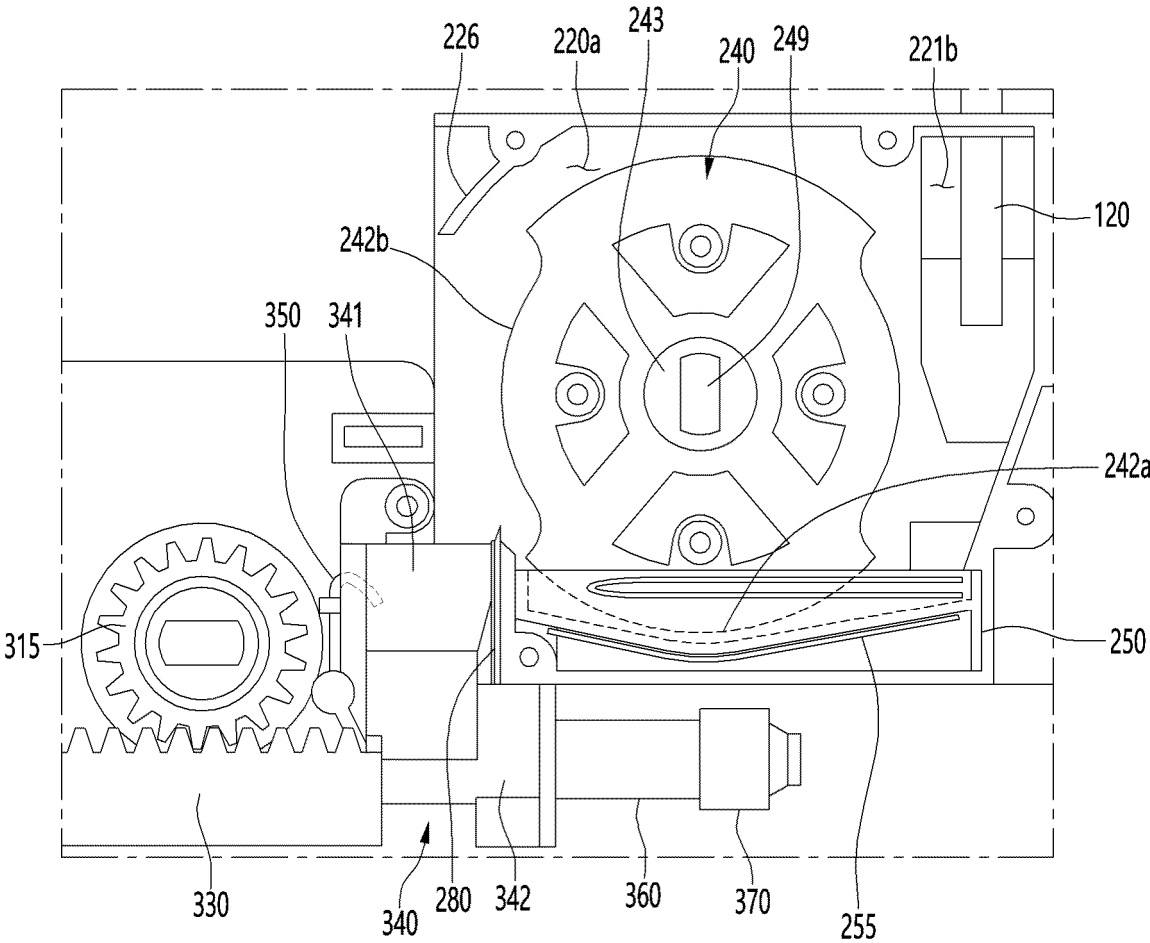


FIG. 12

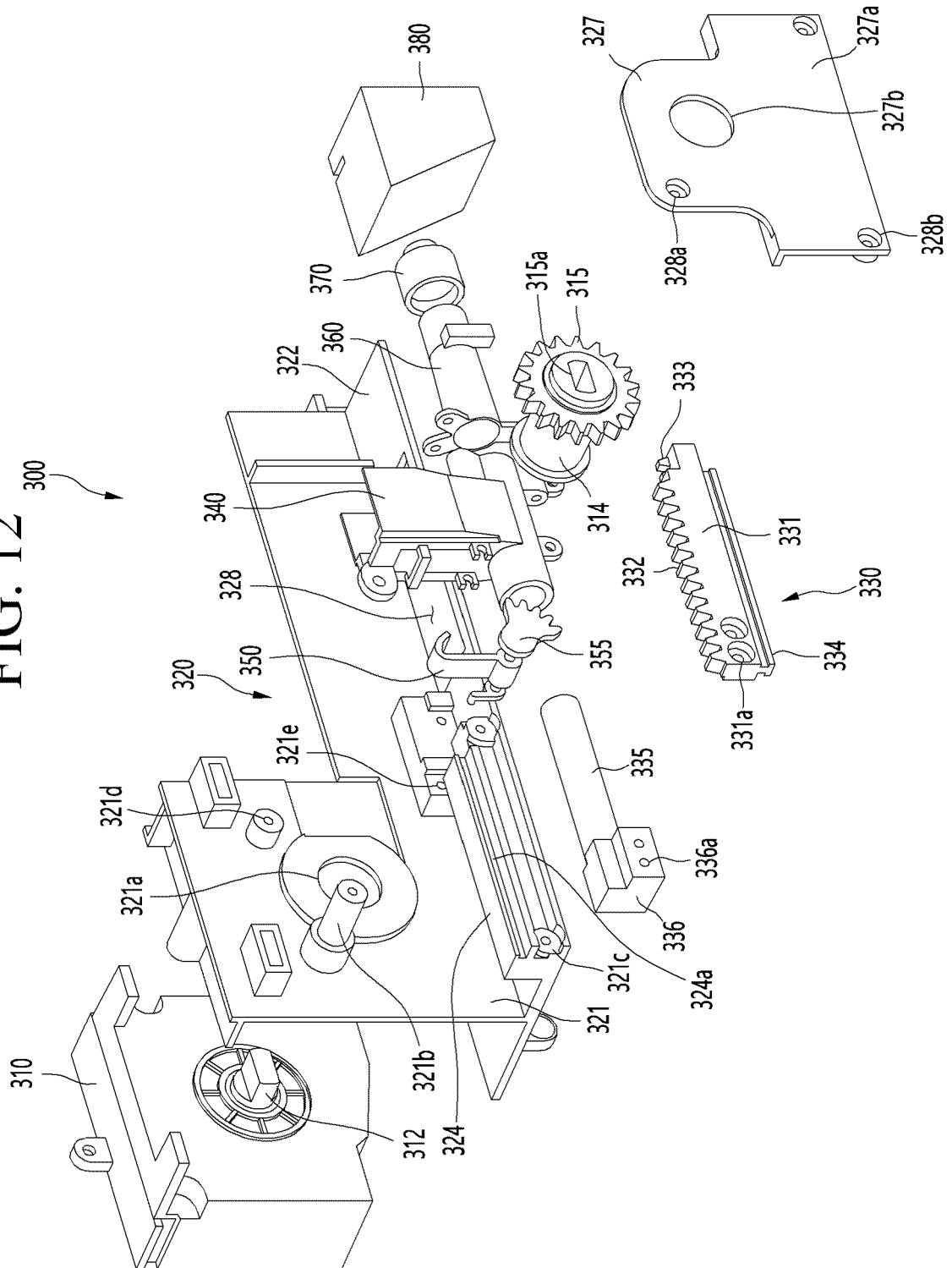


FIG. 13

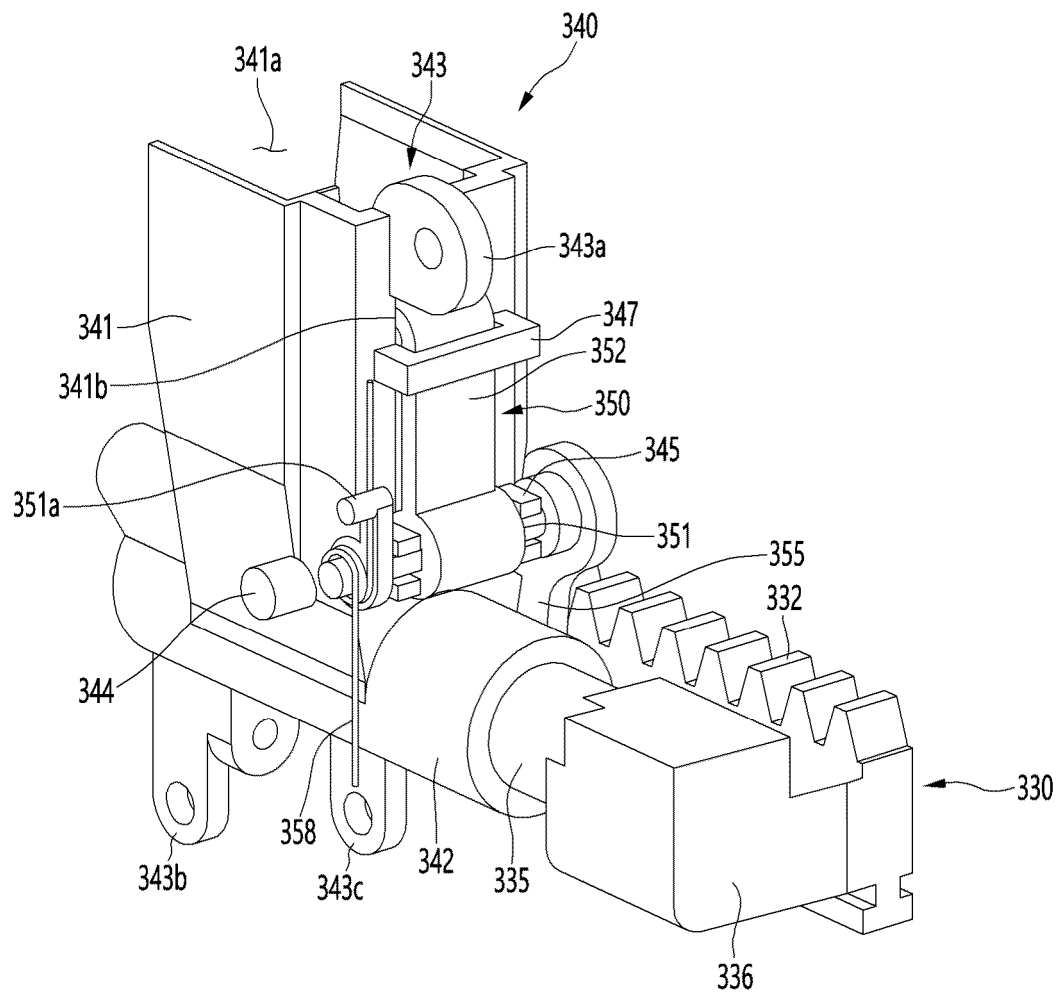


FIG. 14

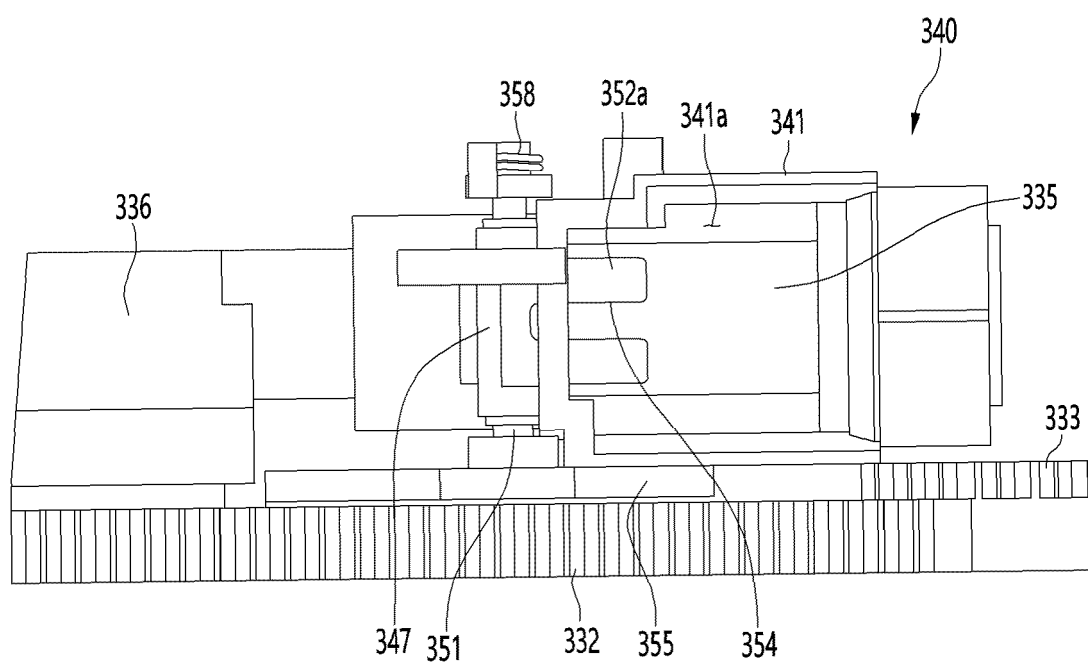


FIG. 15A

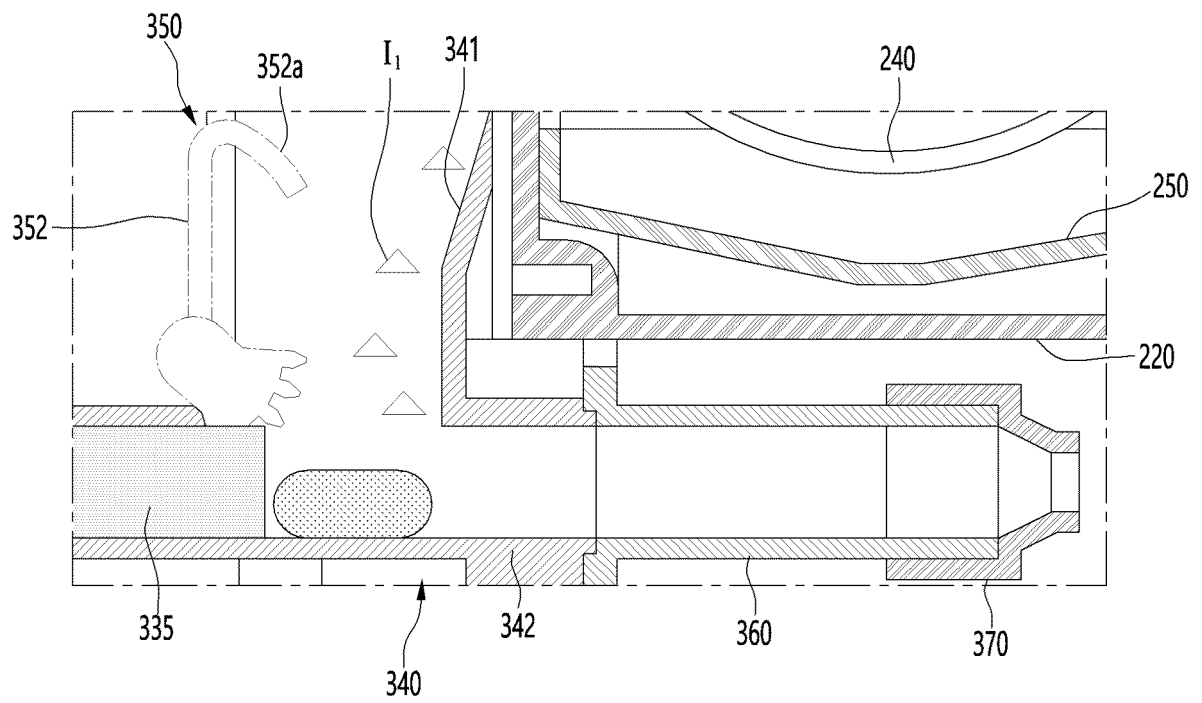


FIG. 15B

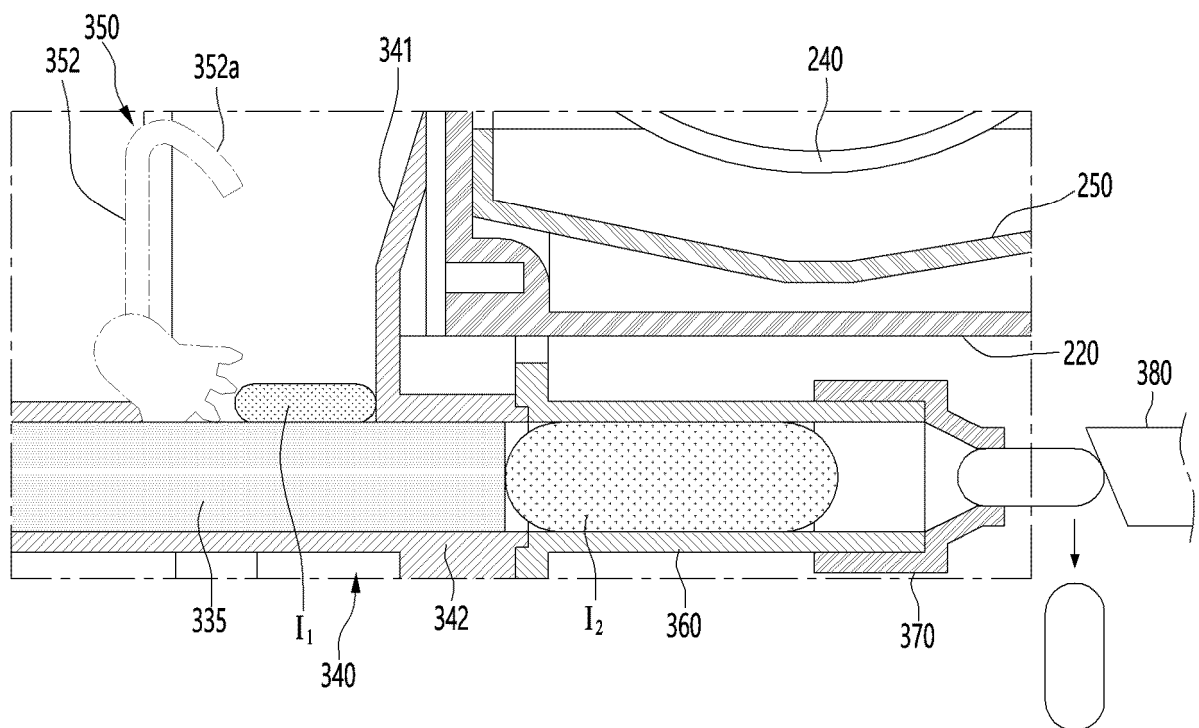


FIG. 15C

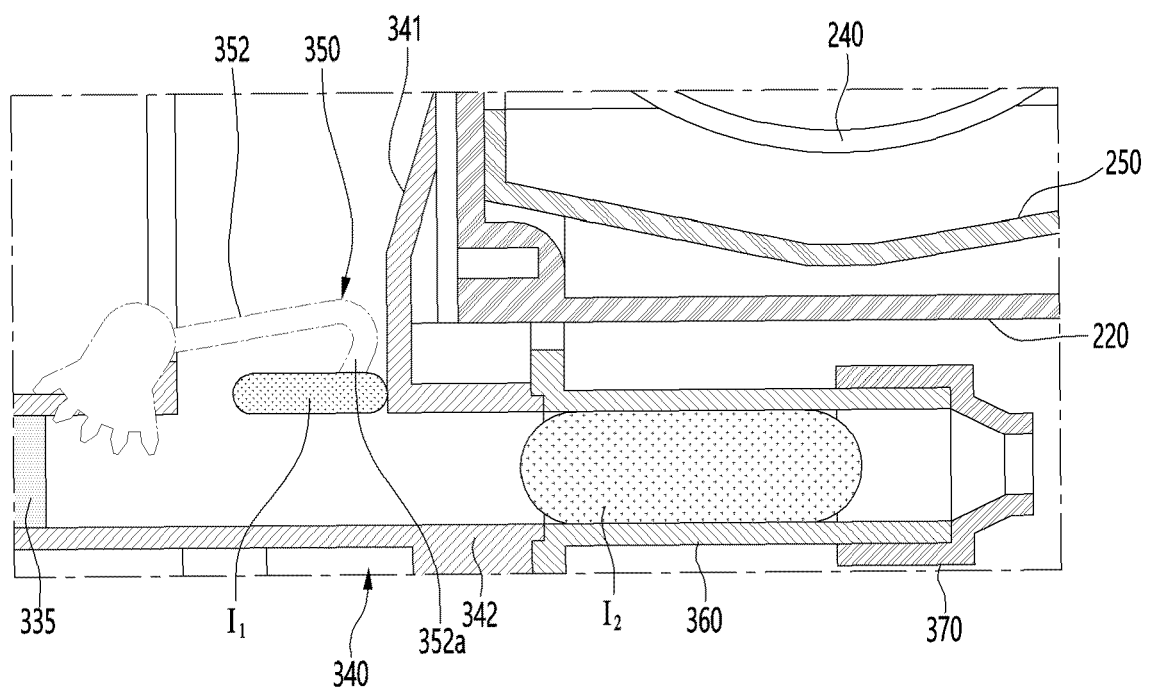


FIG. 15D

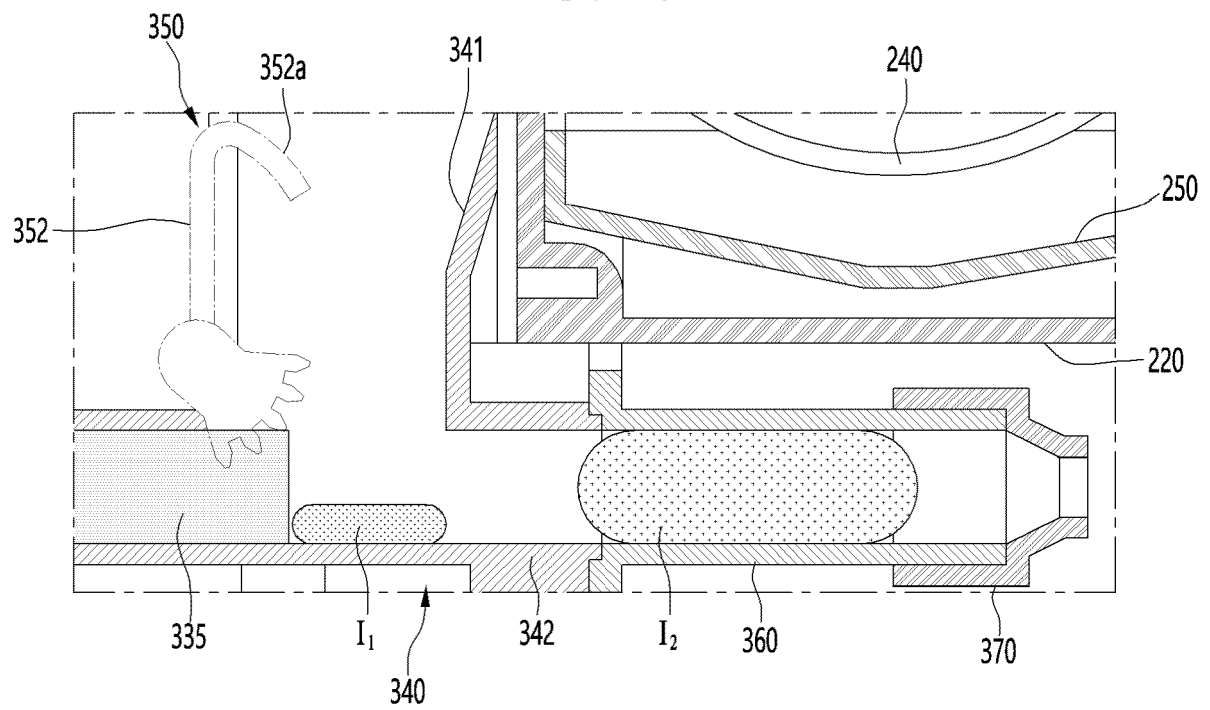


FIG. 16

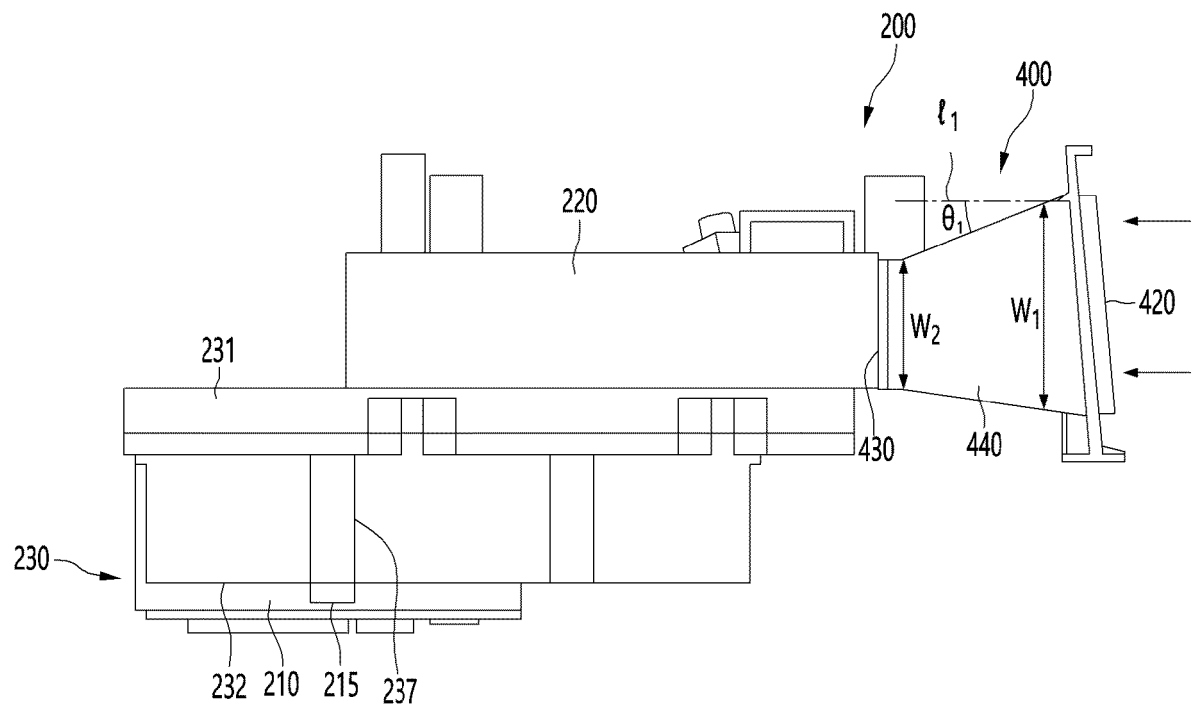


FIG. 17

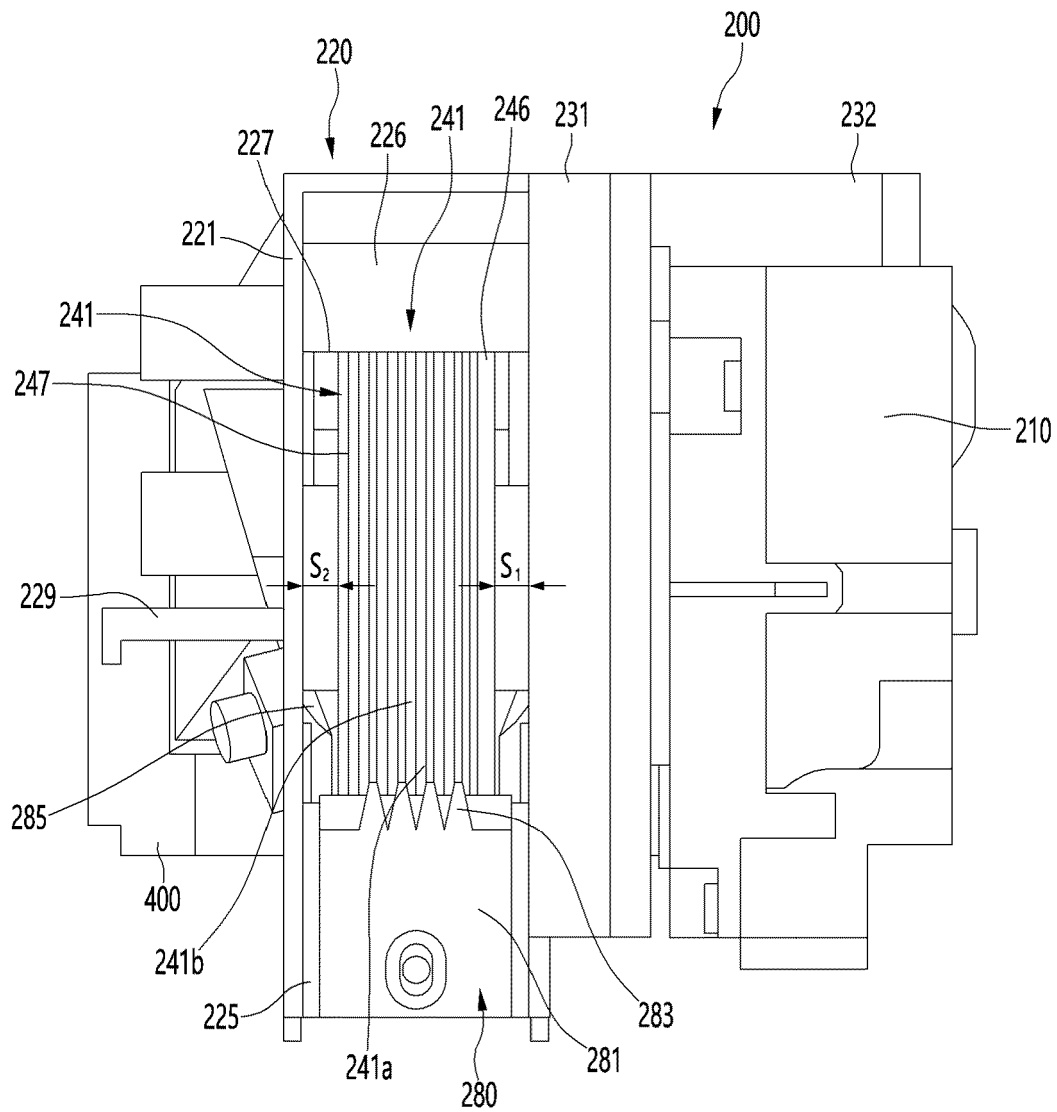


FIG. 18

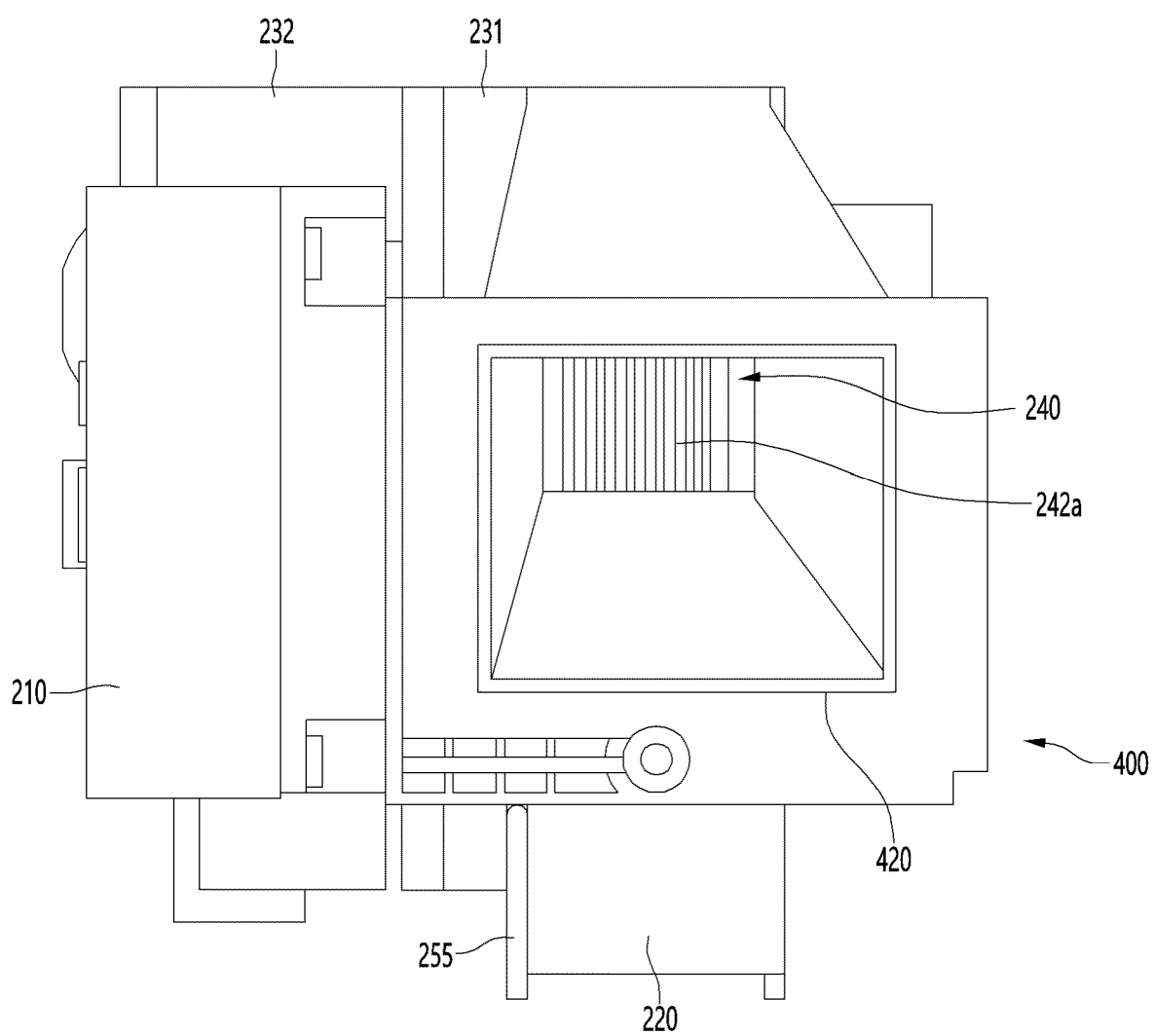


FIG. 19

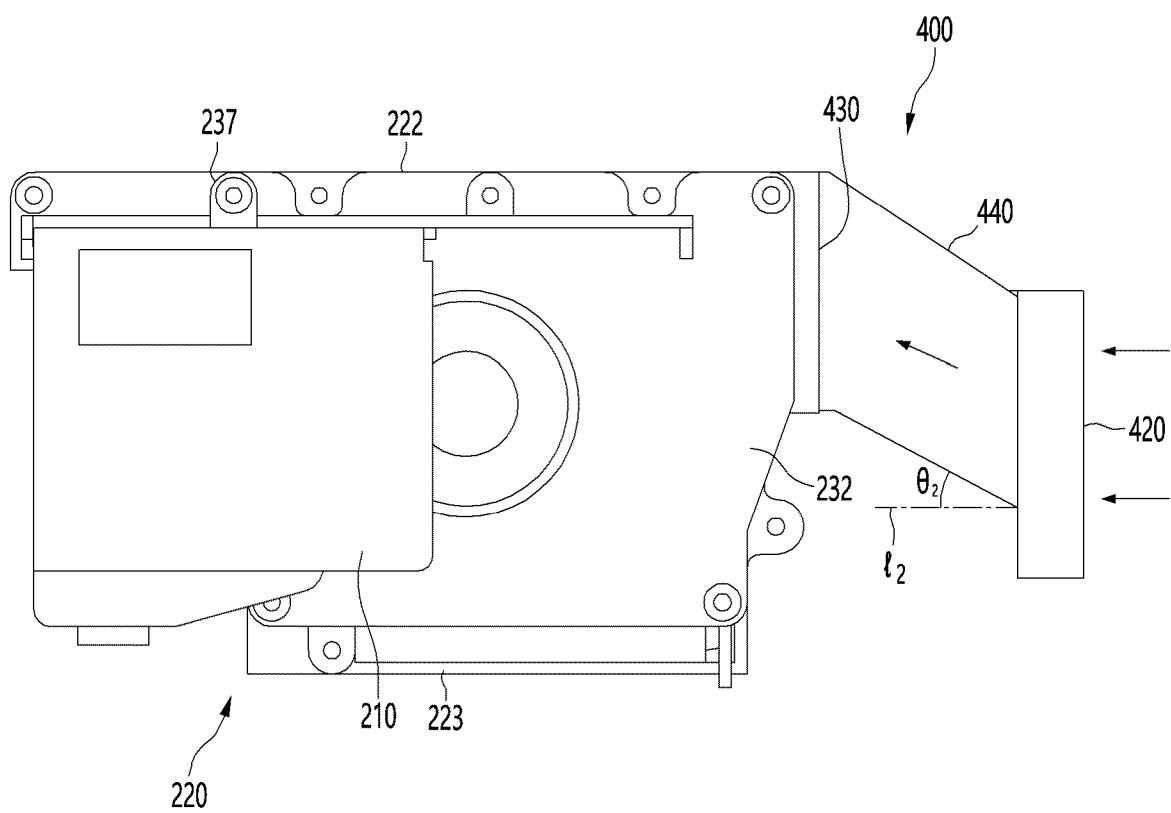


FIG. 20

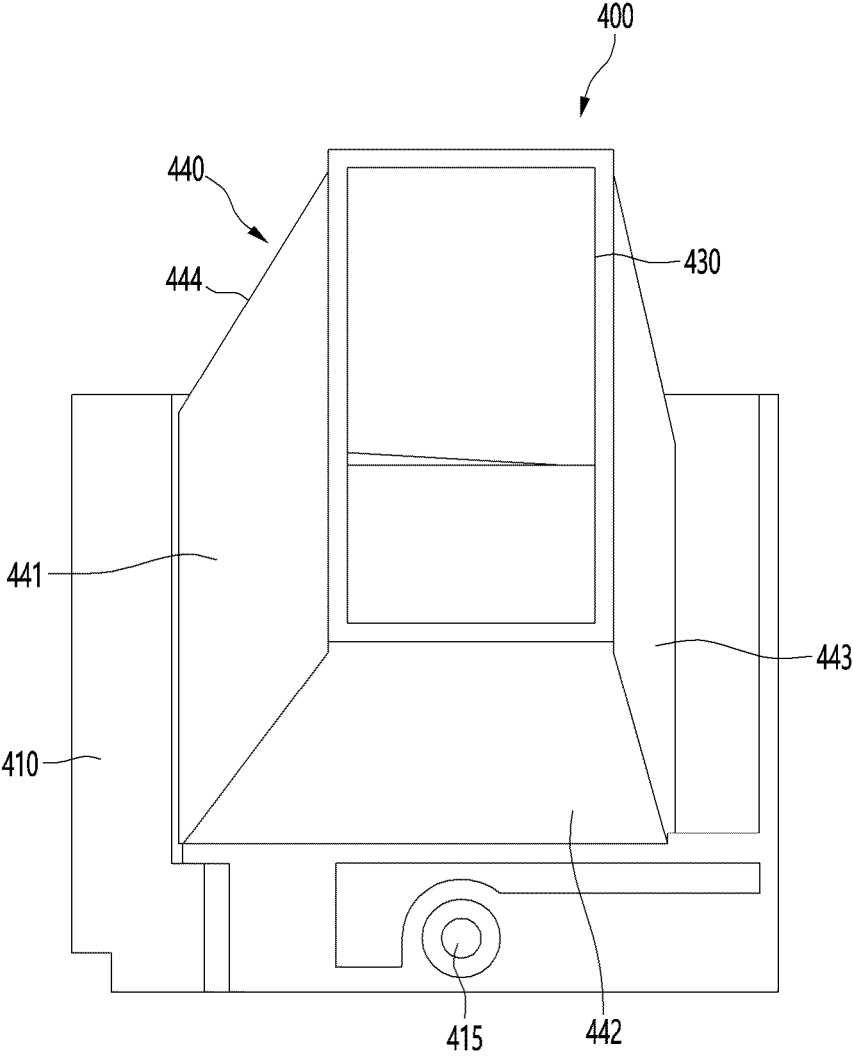


FIG. 21

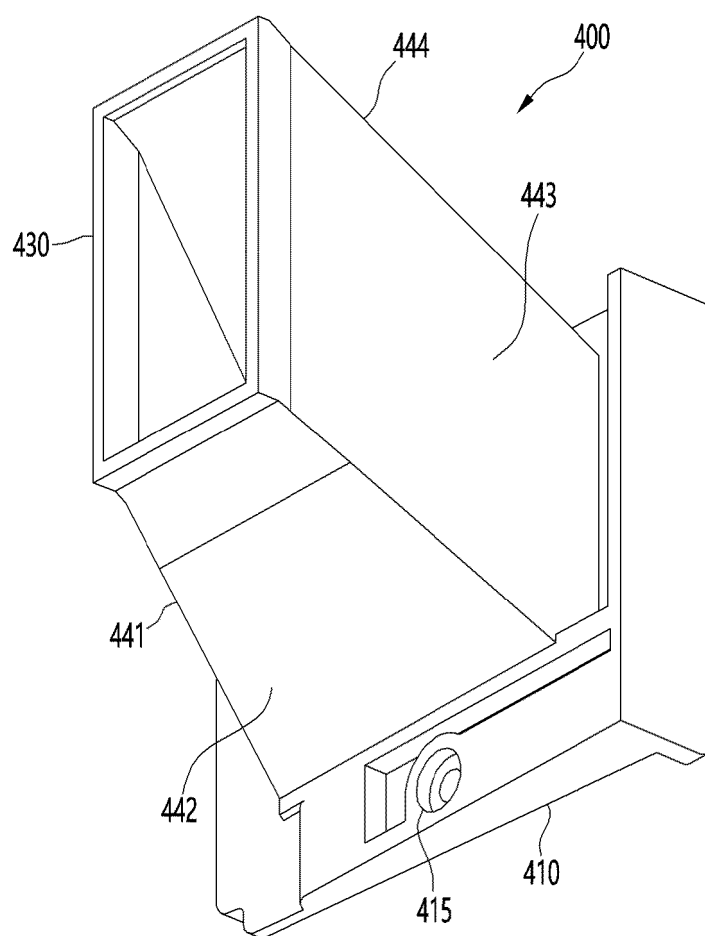


FIG. 22

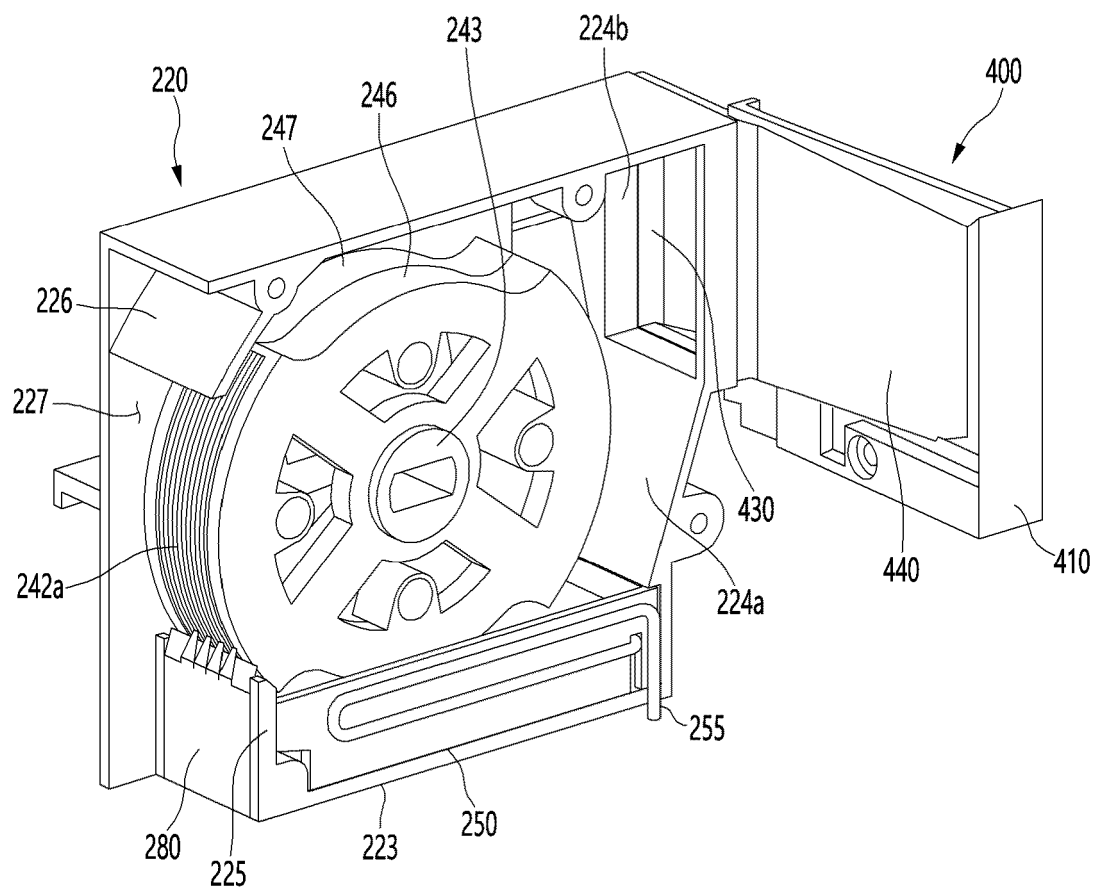


FIG. 23

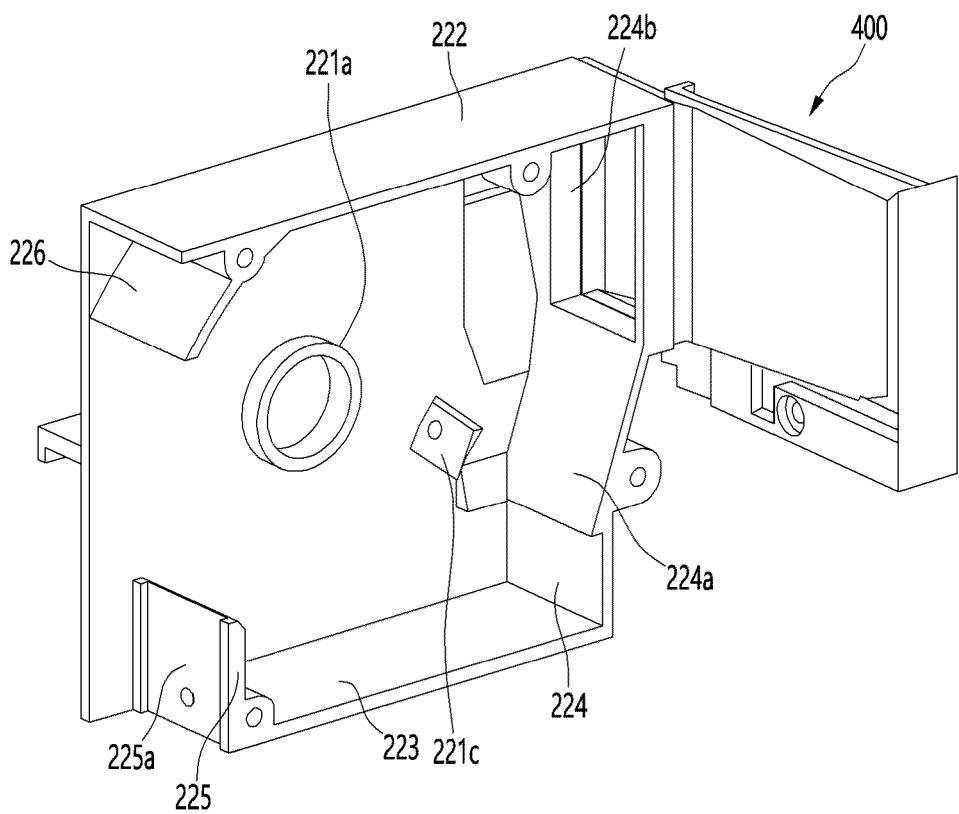


FIG. 24

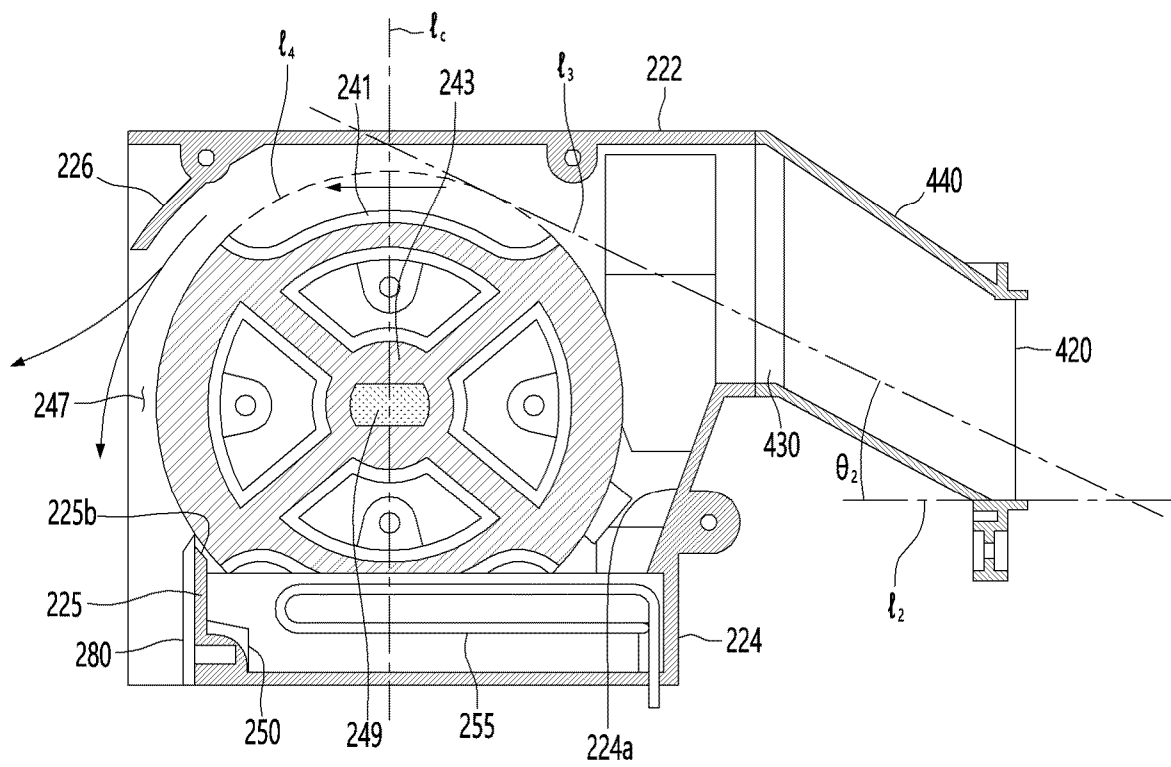


FIG. 25

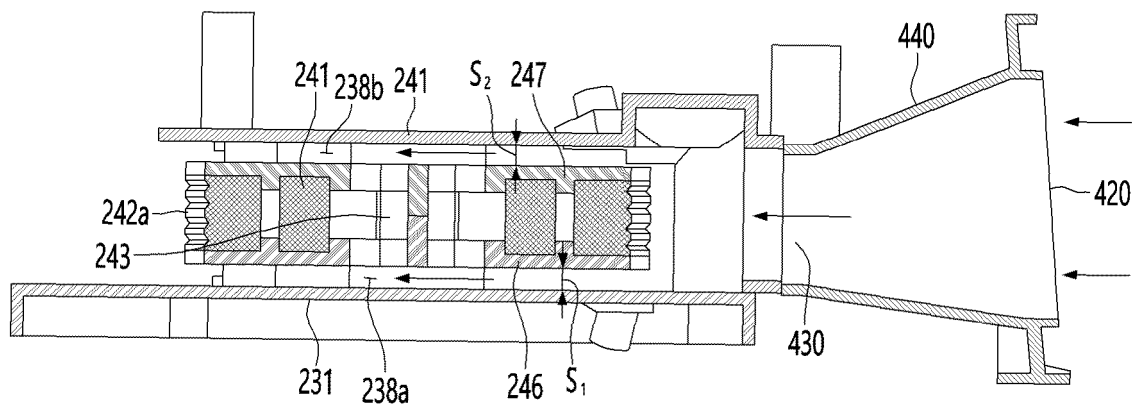


FIG. 26

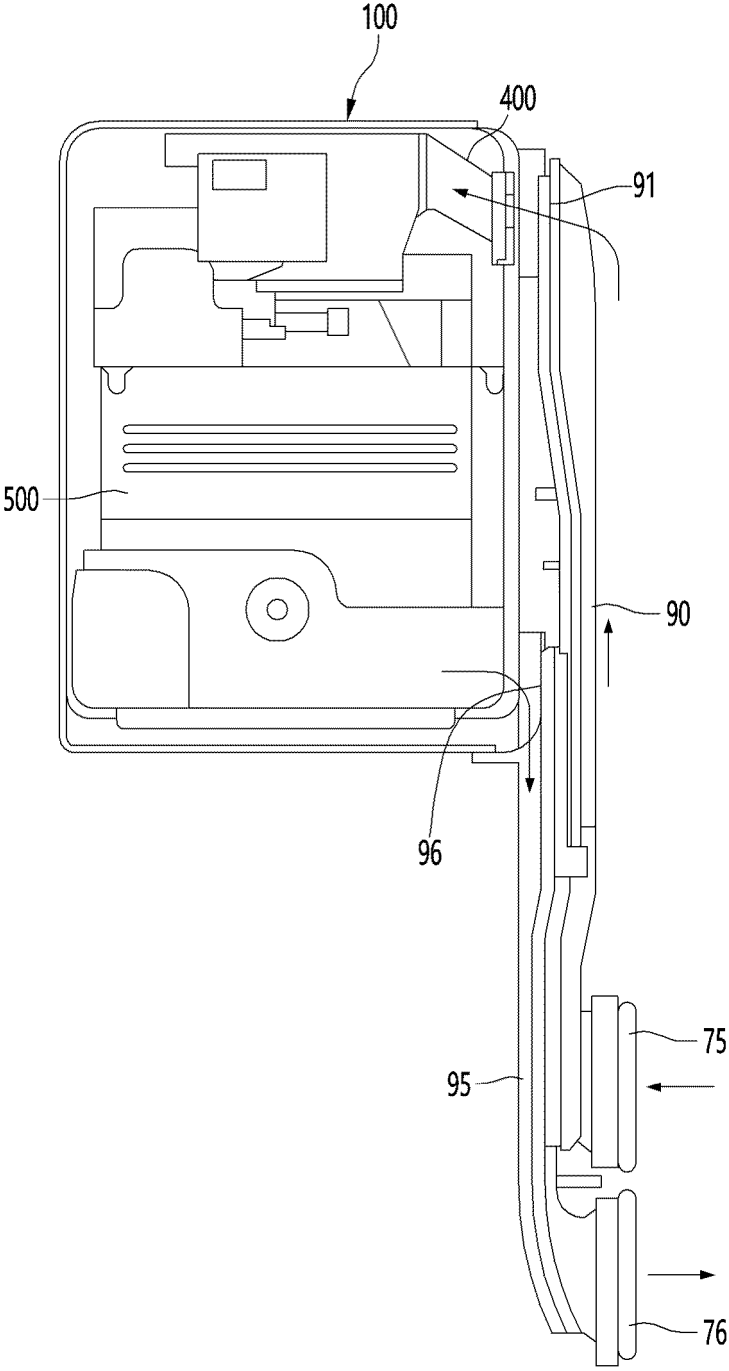


FIG. 27

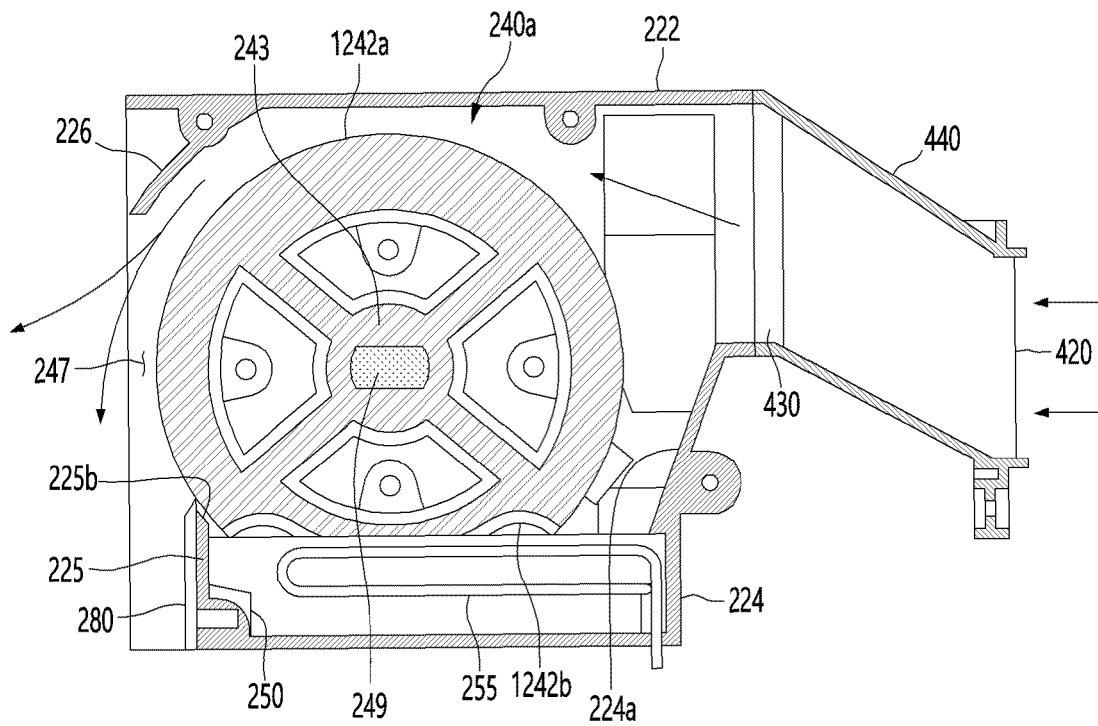


FIG. 28

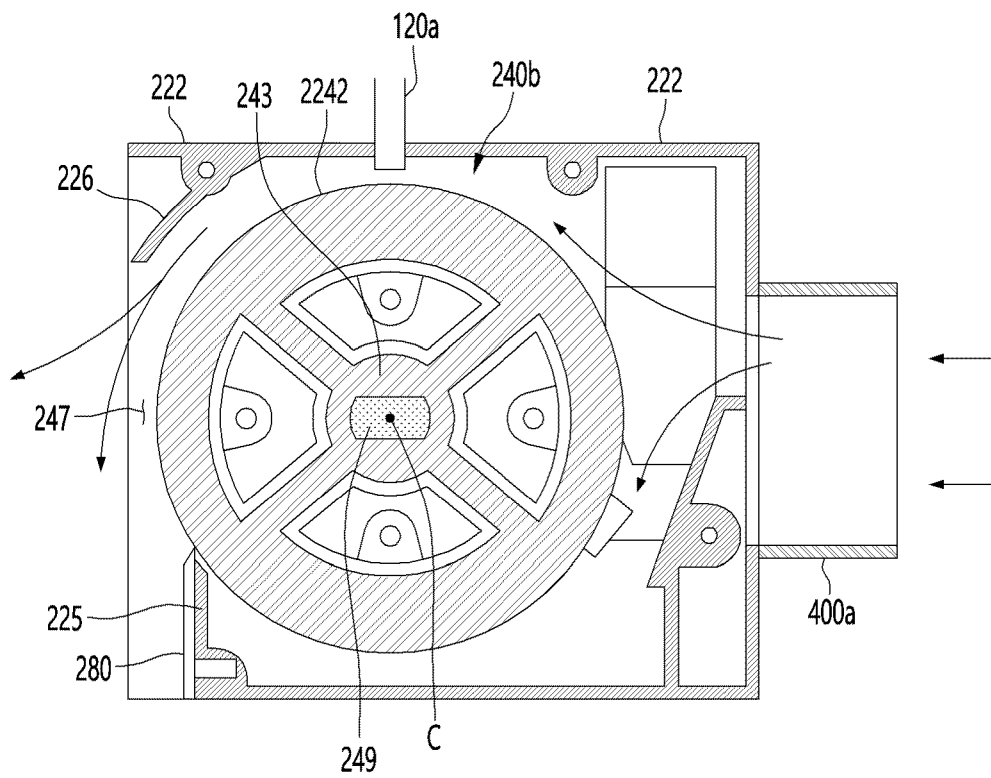


FIG. 29

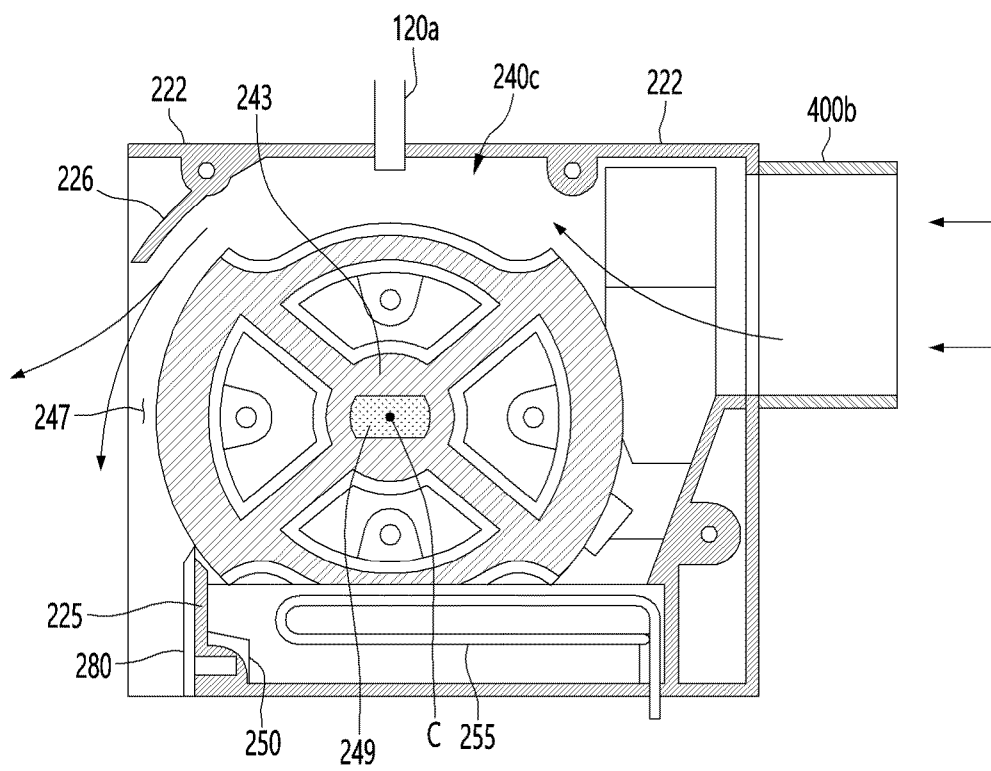


FIG. 32

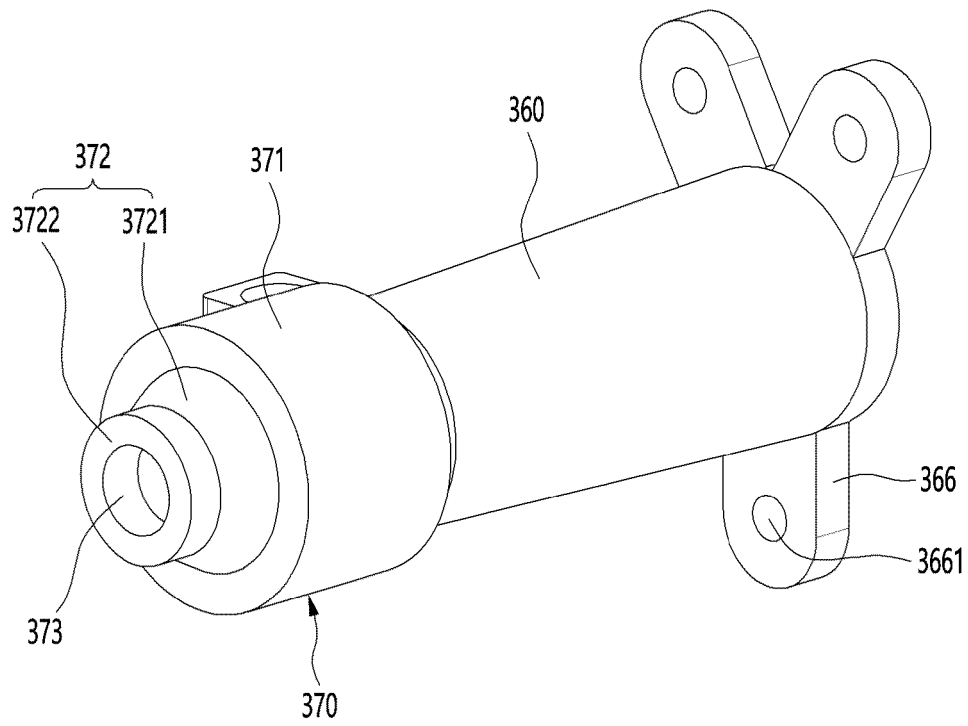


FIG. 33

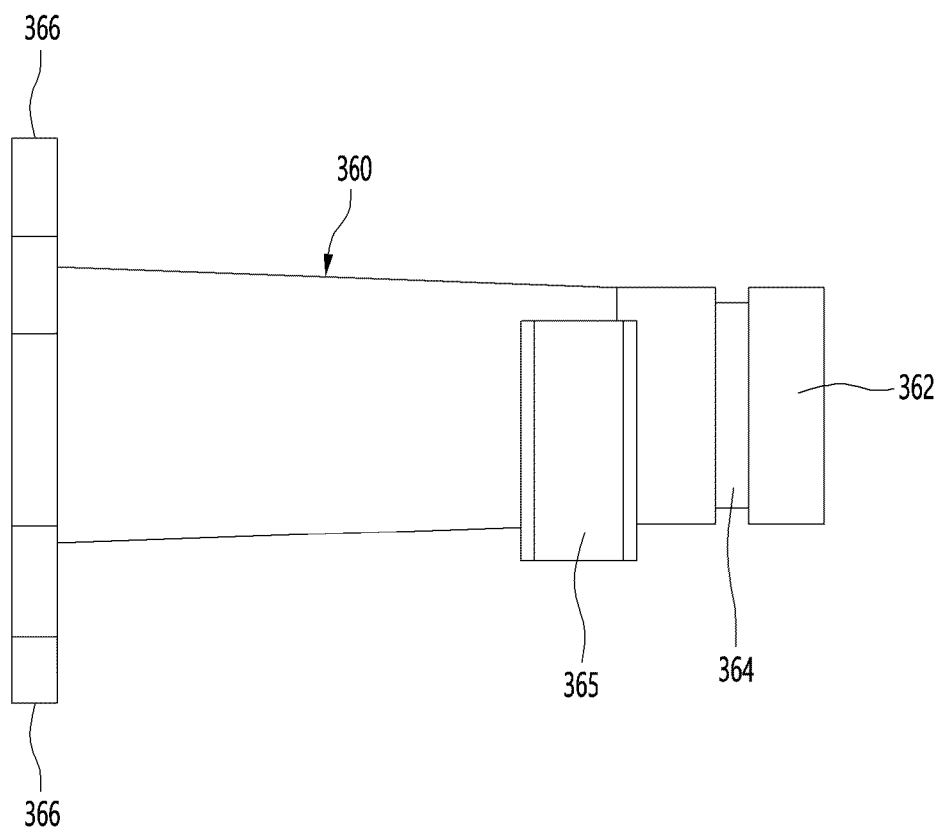


FIG. 34

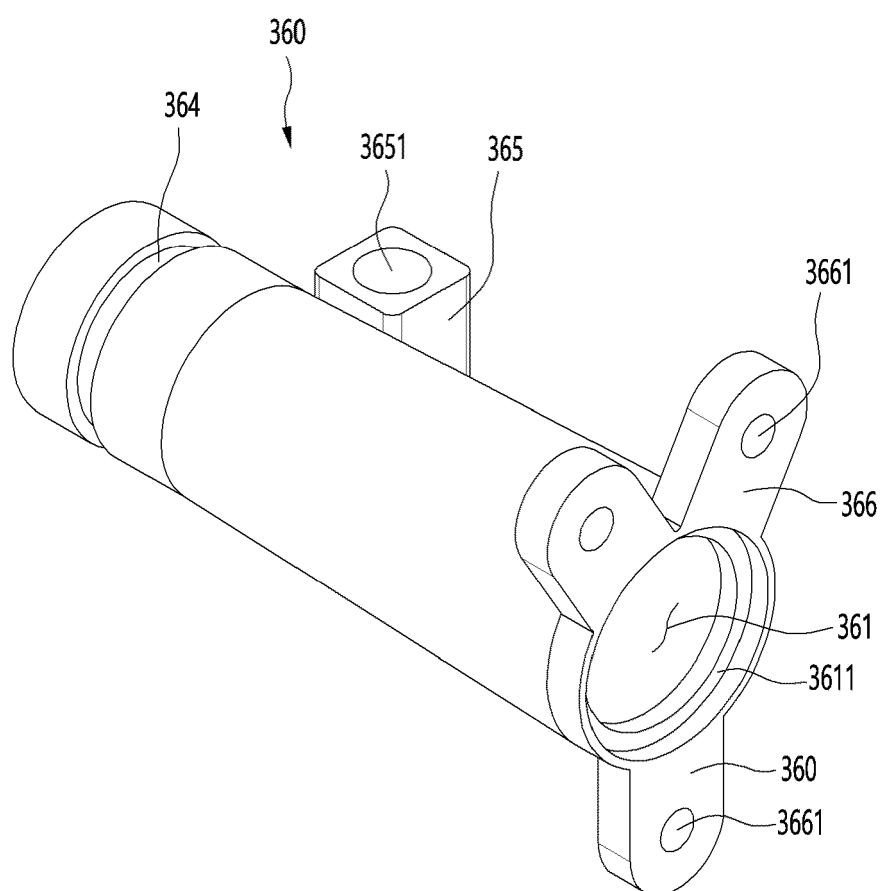


FIG. 35

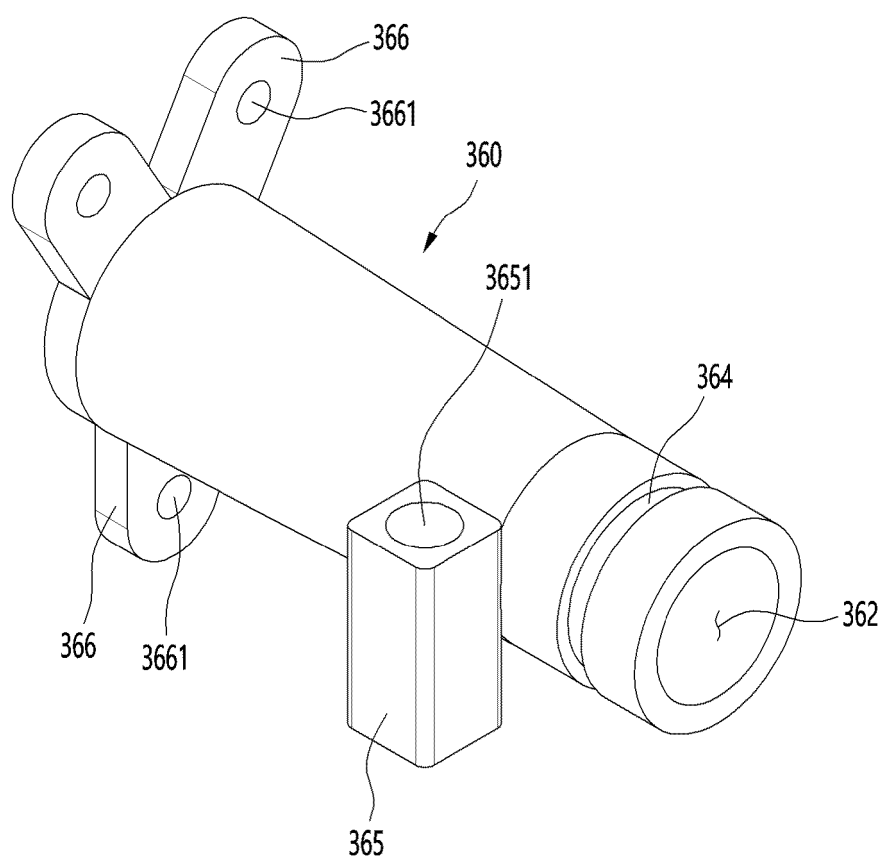


FIG. 36

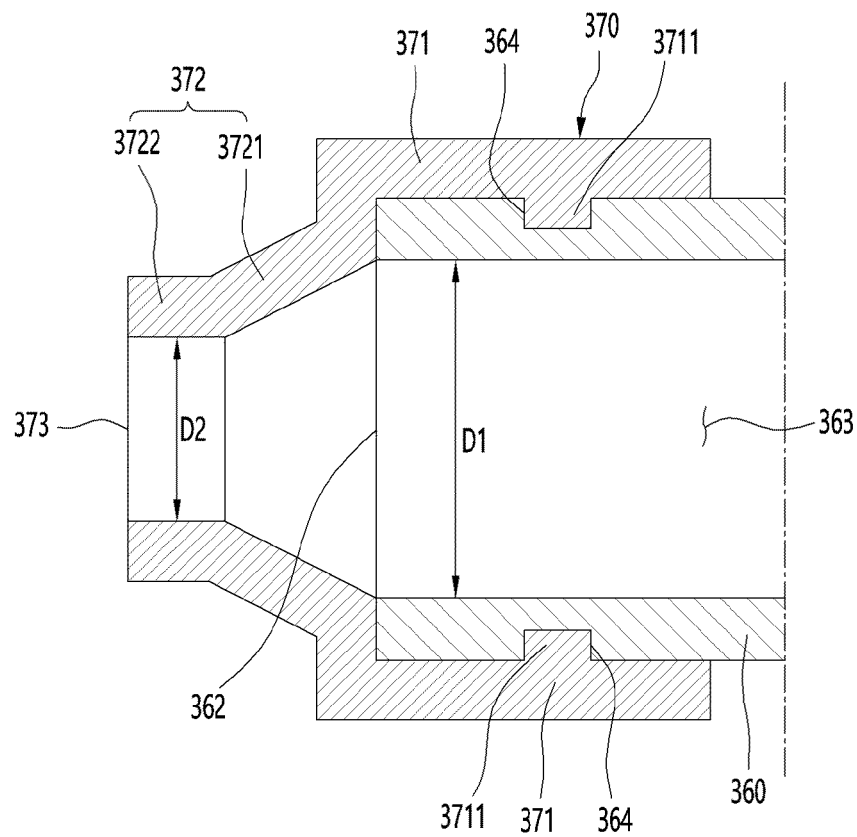


FIG. 37

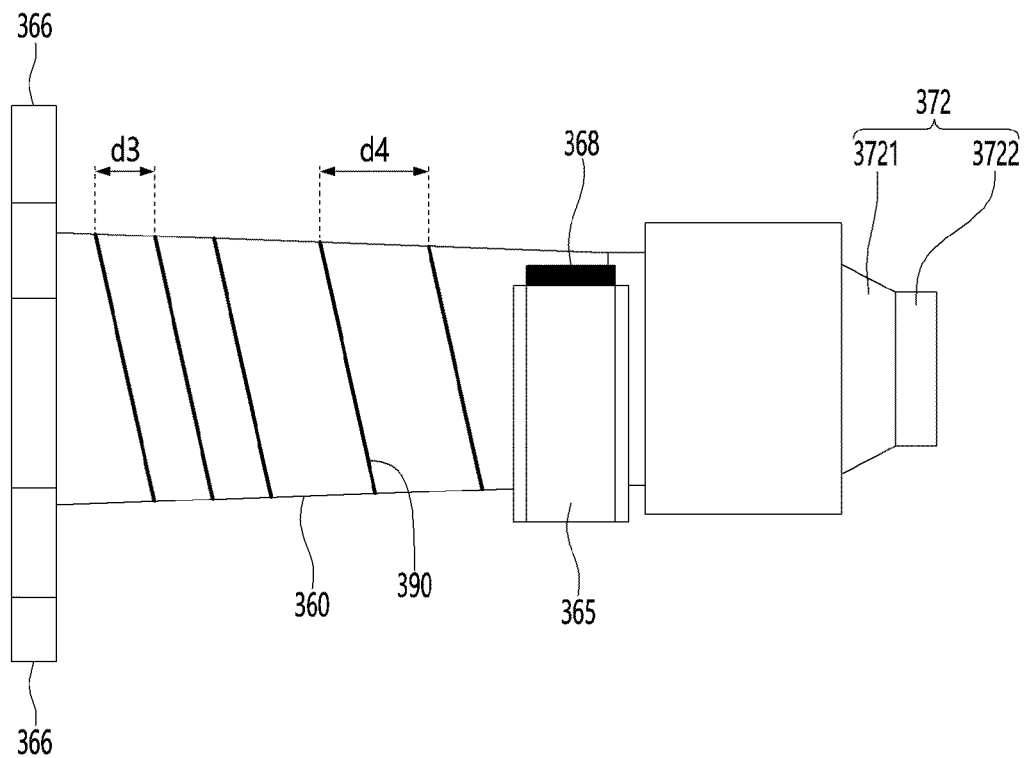


FIG. 38

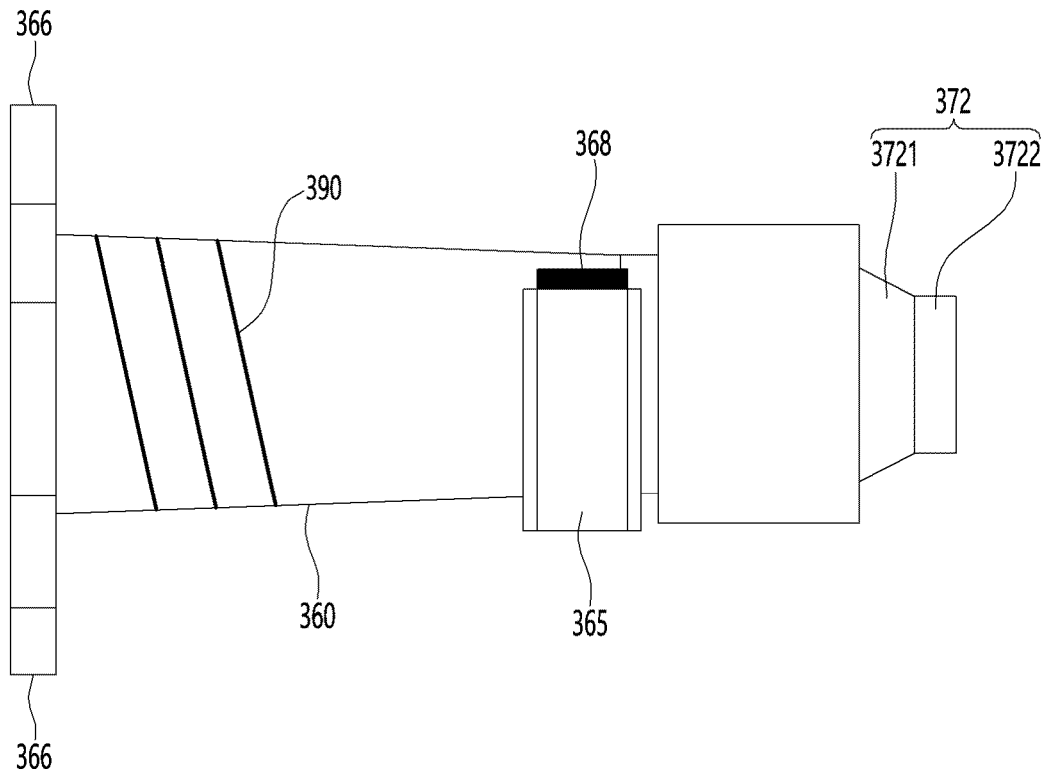


FIG. 39

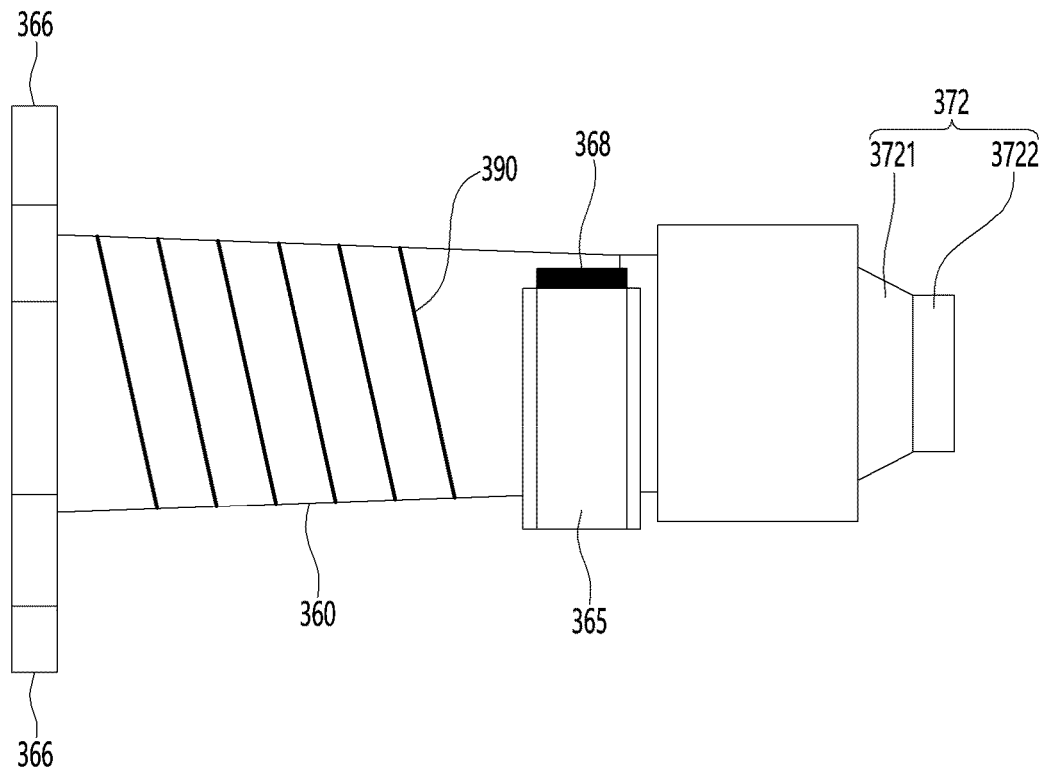


FIG. 40

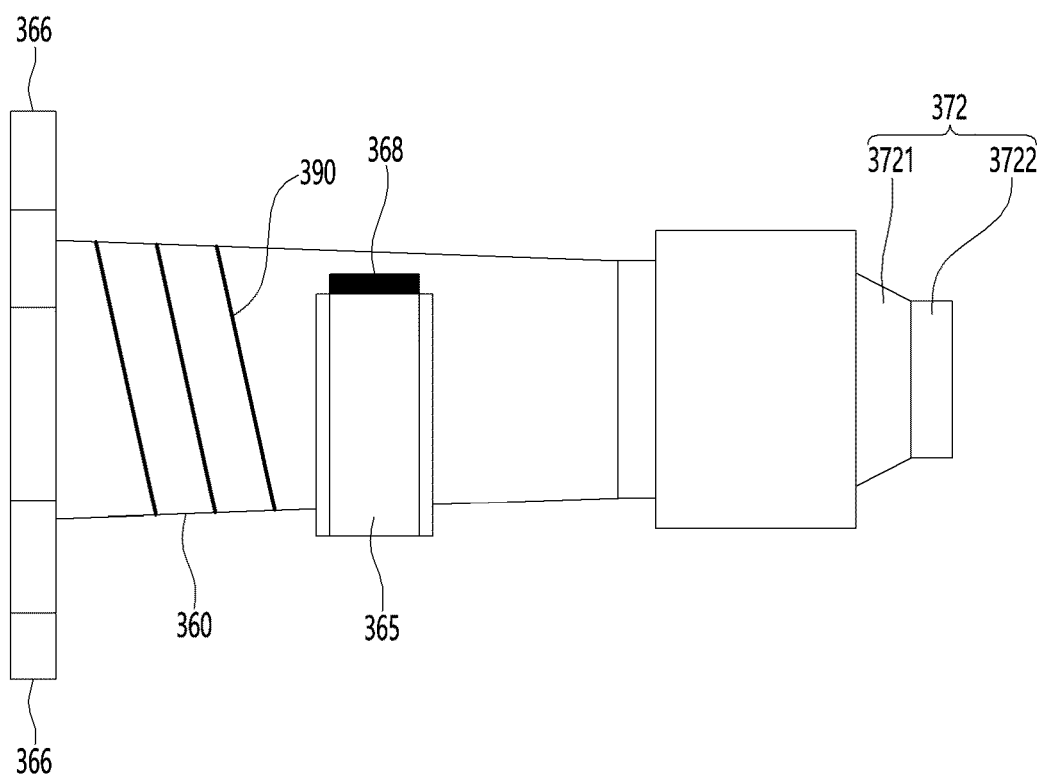
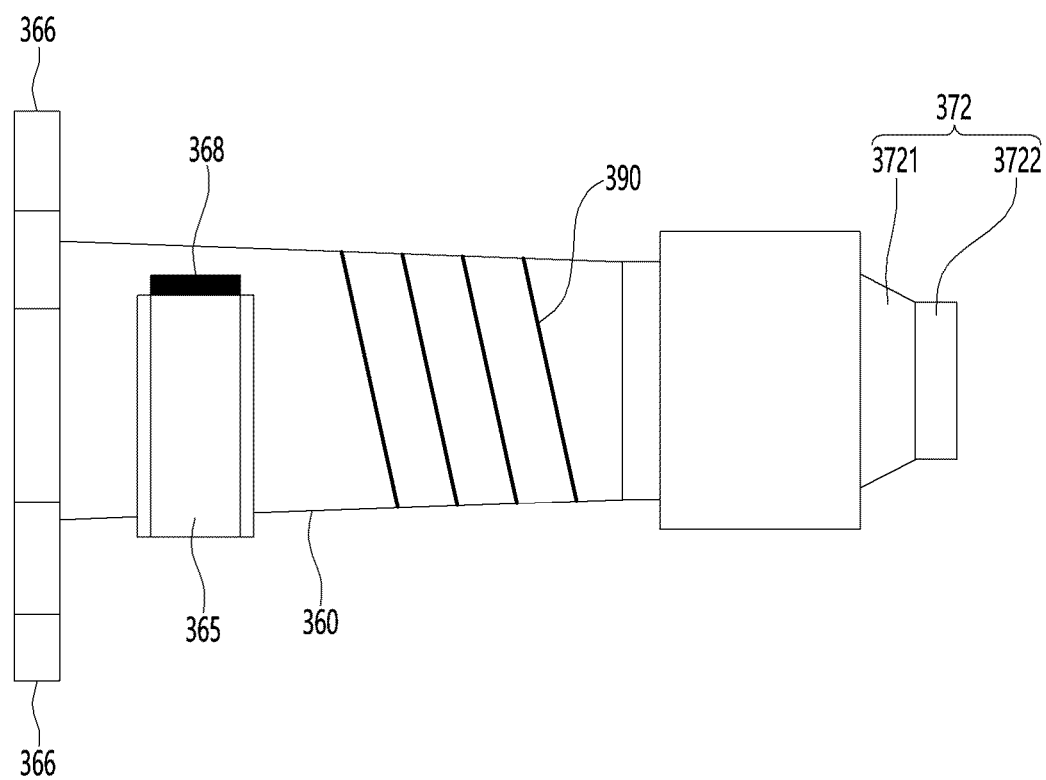


FIG. 41





EUROPEAN SEARCH REPORT

Application Number

EP 26 16 9202

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 2010/319366 A1 (KIM SEONG-JAE [KR] ET AL) 23 December 2010 (2010-12-23) * paragraph [0038] - paragraph [0067]; figures 1-11 *	1-15	INV. F25C5/04 F25C5/06 F25C5/08 F25C5/14 F25C5/20 F25D23/02
Y	US 2011/146324 A1 (LEE SEUNG MOK [KR] ET AL) 23 June 2011 (2011-06-23) * paragraph [0060] - paragraph [0175]; figures 1-19 *	1-15	
Y	WO 2024/155005 A1 (LG ELECTRONICS INC [KR]) 25 July 2024 (2024-07-25) * paragraph [0123] - paragraph [0150]; figures 1-19 *	1-15	
A	US 12 000 642 B2 (ELECTROLUX HOME PROD INC [US]) 4 June 2024 (2024-06-04) * column 1, line 36 - column 2, line 44; figures 1-10 *	1	
Y	CN 1 202 962 A (JOSEF HOBELSBERGER [DE]) 23 December 1998 (1998-12-23) * page 10, last paragraph - page 11, last paragraph; figures 1-9 *	4-8	TECHNICAL FIELDS SEARCHED (IPC) F25C F25D
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		14 July 2026	Kolev, Ivelin
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

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EP 26 16 9202

5

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