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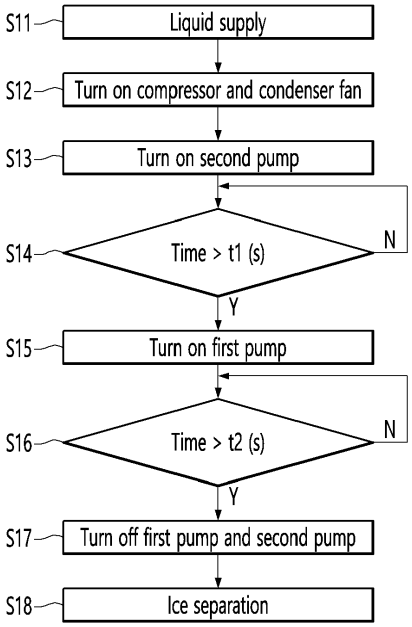
(54) ICEMAKER AND REFRIGERATOR

(57) An icemaker according to the present embodiment may comprise an ice-making unit which is provided in an ice-making chamber and which is for making ice. The icemaker may further comprise: a cooling unit for cooling the ice-making unit; a water supply unit for supplying water to the ice-making unit during ice-making; an ice-removal unit for removing ice from the ice-making unit during ice-removal; and a controller for controlling one or more from among the cooling unit, the water supply unit, and the ice-removal unit.

【Figure 13】



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Description

[Technical Field]

[0001] The present disclosure relates to an ice making device and a refrigerator.

[Background Art]

[0002] In general, a refrigerator is a home appliance for storing food at a low temperature in a storage space that is covered by a refrigerator door. The refrigerator is configured to keep stored food in an optimal state by cooling the inside of the storage space using cold air generated through heat exchange with a refrigerant circulating in a refrigeration cycle.

[0003] The refrigerator may be placed independently in a kitchen or a living room or may be accommodated in a kitchen cabinet.

[0004] The refrigerator is gradually becoming larger and more multi-functional in accordance with the change in dietary life and the trend of higher quality products. Refrigerators including various structures and convenience devices that take user convenience into consideration are being released.

[0005] An automatic ice maker is disclosed in Japanese Registration Patent No. 5687018 that is a prior art document.

[0006] The automatic ice maker includes an ice making chamber for forming ice, an evaporator disposed at an upper side of the ice making chamber, a water tray disposed at a lower side of the ice making chamber and rotatably supported on a support shaft, an ice making water tank assembled at a lower side of the water tray, a supply pump connected to one side of the ice making water tank, a guide member disposed at one side of the ice making water tank and being rotatable, and an ice storage compartment for storing ice.

[0007] In an ice making process, water is supplied from a supply pump while the water tray closes a space of the ice making chamber, and the water supplied to the ice making cell may be cooled by an evaporator.

[0008] In an ice separation process, high-temperature gas is supplied to the evaporator to heat the ice making cell, and at the same time, the water tray is tilted downward, and in a process of tilting the water tray downward, the guide member is rotated to cover an upper side of the water tray.

[0009] As the ice making cell is heated, ice is separated from the ice making cell, falls to an upper side of the guide member, and finally moves to the ice storage compartment.

[0010] However, in the prior art, it only discloses technology for generating one type of ice, and does not disclose technology for generating different types of ice.

[Disclosure]

[Technical Problem]

[0011] The present embodiment provides an ice making device and a refrigerator capable of generating different types of ice.

[0012] Alternatively or additionally, one embodiment provides an ice making device and a refrigerator in which an ice separation can be performed simultaneously on a plurality of trays.

[0013] Alternatively or additionally, one embodiment provides an ice making device and a refrigerator in which different types of ice can be stored separately.

[Technical Solution]

[0014] In one embodiment, an ice making device may include an ice maker provided in an ice making chamber and configured to generate ice. The ice making device may further include a cooler configured to cool the ice maker.

[0015] The ice making device may further include a liquid supplier configured to supply liquid (e.g., water) to the ice maker in an ice making process.

[0016] The ice making device may further include an ice separation assembly configured to separate ice from the ice maker in an ice separation process. The ice making device may further include a controller configured to control at least one of the cooler, the liquid supplier, or the ice separation assembly.

[0017] The ice maker may include a first tray including a first ice making cell. The ice maker may further include a second tray including a second ice making cell.

[0018] A type of ice generated in the first ice making cell may be different from a type of ice generated in the second ice making cell.

[0019] The controller may control an ice making of one tray of the first tray and the second tray to be delayed from an ice making of other tray of the first tray and the second tray.

[0020] An ice making time of the one tray may be less than an ice making time of the other tray.

[0021] The controller may control the liquid supplier so that a liquid supply start time of the one tray is delayed from a liquid supply start time of the other tray.

[0022] The controller may control the liquid supplier so that a liquid supply to the one tray starts when a first reference time elapses after a liquid supply to the other tray starts.

[0023] The controller may control the liquid supplier so that when a second reference time elapses after a liquid supply to the one tray starts, liquid supply to the trays is ended.

[0024] The ice making device may further include a temperature sensor for detecting a temperature of at least one of the first tray or the second tray.

[0025] The controller may control the liquid supplier so

that a liquid supply to the one tray starts when a temperature detected by the temperature sensor is less than a first reference temperature after a liquid supply to the other tray starts.

[0026] The controller may control the liquid supplier so that a liquid supply to the trays stops, when a temperature detected by the temperature sensor is lower than a second reference temperature after a liquid supply to the one tray starts.

[0027] The controller may control the liquid supplier so that a supply amount of liquid per unit time to one tray is less than a supply amount of liquid per unit time to the other tray.

[0028] The controller may control the liquid supplier so that a liquid supply time of the one tray is less than a liquid supply time of the other tray.

[0029] The controller may control the liquid supplier so that a number of times of a liquid supply to the one tray is less than a number of times of a liquid supply to the other tray.

[0030] The controller may control the cooler so that a timing of a supply of a cooling power to the one tray is delayed from a timing of a supply of a cooling power to the other tray.

[0031] The controller may control the cooler so that a supply of a cooling power to the one tray starts when a first reference time elapses after a supply of a cooling power to the other tray starts.

[0032] The controller may control the cooler a supply of a cooling power to the trays stops when a first reference time elapses after a supply of a cooling power to the one tray starts.

[0033] The controller may control the cooler so that a supply amount of a cooling power per unit time to the one tray is less than a supply amount of a cooling power per unit time to the other tray.

[0034] The controller may control the cooler so that a supply time of a cooling power to the one tray is less than a supply time of a cooling power to the other tray.

[0035] The controller may control the cooler so that a number of times of a supply of a cooling power to the one tray is less than a number of times of a supply of a cooling power to the other tray.

[0036] When an ice making of the first tray or the second tray is completed, the controller may operate the ice separation assembly to separate ice from each of the first tray and the second tray.

[0037] In another embodiment, an ice making device may include an ice maker provided in an ice making chamber and configured to generate ice. The ice making device may further include a cooler configured to cool the ice maker. The ice making device may further include a liquid supplier configured to supply liquid to the ice maker in an ice making process. The ice making device may further include an ice separation assembly configured to separate ice from the ice maker in an ice separation process. The ice making device may further include a controller configured to control at least one of the cooler, the liquid supplier, or the ice separation assembly. The ice maker may include a first tray including a first ice making cell. The ice maker may further include a second tray including a second ice making cell.

[0038] A type of ice generated in the first ice making cell may be different from a type of ice generated in the second ice making cell.

[0039] After starting to a supply of a cooling power or starting to a supply of liquid to each of the first tray and the second tray, the controller is configured to control the liquid supplier or the cooler to stop a supply of a cooling power or a supply of liquid of one tray of the first tray and the second tray.

[0040] The controller may operate the ice separation assembly to separate ice from each of the first tray and the second tray when an ice making of other tray of the first tray and the second tray is completed.

[0041] The controller may stop a supply of liquid or a supply of a cooling power of one tray of the first tray and the second tray when a first reference time elapses after an ice making of each of the first and second trays starts.

[0042] The controller may stop a supply of liquid or a supply of a cooling power of the other tray when a second reference time elapses after a supply of liquid or a supply of a cooling power of the one tray is ended.

[0043] The ice making device may further include a temperature sensor for detecting a temperature of at least one of the first tray or the second tray.

[0044] After an ice making of each of the first tray and the second tray starts, if a temperature detected by the temperature sensor is less than a third reference temperature, the controller may stop a supply of liquid or a supply of a cooling power of one tray of the first tray and the second tray.

[0045] After a supply of liquid or a supply of a cooling power of the one tray is ended, if a temperature detected by the temperature sensor is lower than a second reference temperature, a supply of liquid or a supply of a cooling power of the other tray may be ended.

[0046] In further another embodiment, a refrigerator may include a cabinet having a storage chamber. The refrigerator may include a door that opens and closes the storage chamber, and an ice making chamber provided in the door or the cabinet. The refrigerator may further include an ice maker provided in the ice making chamber and configured to generate ice.

[0047] The refrigerator may further include a cooler configured to cool the ice maker. The refrigerator may further include a liquid supplier configured to supply liquid to the ice maker in an ice making process. The refrigerator may further include an ice separation assembly configured to separate ice from the ice maker in an ice separation process. The refrigerator may include a controller configured to control at least one of the cooler, the liquid supplier, or the ice separation assembly.

[0048] The ice maker may include a first tray including a first ice making cell. The ice maker may further include a second tray including a second ice making cell. The

controller may control an ice making of one tray of the first tray and the second tray to be delayed from an ice making of other tray of the first tray and the second tray.

[0049] A type of ice generated in the first ice making cell may be different from a type of ice generated in the second ice making cell.

[Advantageous Effects]

[0050] According to one embodiment, different types of ice can be generated, and thereby user can use various types of ice.

[0051] According to one embodiment, an ice separation process is performed when an ice making is completed in a plurality of trays, so ice in a perfect shape can be generated and a malfunction of an ice separation can be prevented.

[0052] According to one embodiment, since an ice separation process is performed simultaneously on a plurality of trays, an ice separation time can be reduced and a malfunction of an ice separation can be reduced.

[0053] According to one embodiment, if an ice separation time is reduced, a cycle for generating ice for one time may be reduced. If a cycle is reduced, an amount of ice generated per day or for a set time may increase.

[0054] According to one embodiment, since different types of ice can be stored separately, there is an advantage that a user can easily use different types of ice.

[Description of Drawings]

[0055]

FIG. 1 is a perspective view of an ice making device according to the present embodiment.

FIG. 2 is a front view showing a door of an ice making device in an opened state according to the present embodiment.

FIG. 3 is a cross-sectional view showing an inside of an ice making device according to the present embodiment.

FIG. 4 is a diagram showing an inside of an ice making device according to the present embodiment.

FIG. 5 is a diagram showing a liquid supply passage in an ice making device according to the present embodiment.

FIGS. 6 and 7 are perspective views showing liquid being supplied to an ice maker.

FIGS. 8 and 9 are perspective views showing an ice maker and a heat exchanger according to the present embodiment.

FIG. 10 is a diagram showing an arrangement of a first tray and a second tray.

FIG. 11 is a control block diagram of an ice making device of the present invention.

FIG. 12 is a cross-sectional view showing a process of supplying liquid from a liquid supplier to an ice maker during an ice making process.

FIG. 13 is a flowchart for explaining a control method of an ice making device according to a first embodiment of the present invention.

FIG. 14 is a flowchart for explaining a control method of an ice making device according to a second embodiment of the present invention.

FIG. 15 is a flowchart for explaining a control method of an ice making device according to a third embodiment of the present invention.

FIG. 16 is a flowchart for explaining a control method of an ice making device according to a fourth embodiment of the present invention.

FIG. 17 is a control block diagram of an ice making device according to a fifth embodiment of the present invention.

FIG. 18 is a flowchart for explaining a control method of an ice making device according to a fifth embodiment of the present invention.

FIG. 19 is a flowchart for explaining a control method of an ice making device according to a sixth embodiment of the present invention.

FIG. 20 is a flowchart for explaining a control method of an ice making device according to a seventh embodiment of the present invention.

FIG. 21 is a flowchart for explaining a control method of an ice making device according to an eighth embodiment of the present invention.

[Mode for Invention]

[0056] Hereinafter, some embodiments of the present disclosure will be described in detail with reference to the accompanying drawings. It should be noted that when components in the drawings are designated by reference numerals, the same components have the same reference numerals as far as possible even though the components are illustrated in different drawings. Further, in description of embodiments of the present disclosure, when it is determined that detailed descriptions of well-known configurations or functions disturb understanding of the embodiments of the present disclosure, the detailed descriptions will be omitted.

[0057] Also, in the description of the embodiments of the present disclosure, the terms such as first, second, A, B, (a) and (b) may be used. Each of the terms is merely used to distinguish the corresponding component from other components, and does not delimit an essence, an order or a sequence of the corresponding component. It should be understood that when one component is "connected", "coupled", "joined" or "supported" to another component, the former may be directly connected, coupled, jointed or supported to the latter or may be "connected", coupled", "joined" or "supported" to the latter with a third component interposed therebetween.

[0058] The present invention relates to a cooling device. The cooling device may include a refrigerator including at least one refrigerating chamber. The cooling

device may include a freezer including at least one freezing chamber. The freezer may include an ice making device. A component or a control method of the ice making device may be applied to the cooling device. The cooling device may include a storage chamber (e.g., main body) in which an item is stored. The cooling device may include a door that opens and close the storage chamber. The cooling device may include an ice making device. The cooling device may include an ice making chamber. The ice making chamber may be defined as a space in which at least a portion of an ice maker. The ice making chamber may be disposed in the storage chamber and/or the door. The cooling device may include an ice maker. In this specification, an ice making device may include some or all of a tray defining an ice making cell that is a space in which liquid is phase-changed into ice, a cooler for supplying cold to the ice making cell, a liquid supplier for supplying liquid to the ice making cell, and a controller.

[0059] The ice making device may further include an ice separation assembly.

[0060] The tray may include a first tray. The tray may further include a second tray.

[0061] The first tray and the second tray may generate different types of ice.

[0062] The liquid supplier may independently supply liquid to each of the first tray and the second tray.

[0063] The liquid supplier may be configured to simultaneously supply liquid to the first tray and the second tray. Alternatively, the liquid supplier may be movably configured to supply liquid to one of the first tray and the second tray and then supply liquid to other of the first tray and the second tray after change a position of the liquid supplier.

[0064] Alternatively, each of the first tray and the second tray may be configured to be movable, and the first tray may move toward the liquid supplier to receive liquid, and then the second tray may move toward the liquid supplier to receive liquid.

[0065] The cooling device may include a cooler. The cooler is a source that supplies cold and/or heat, and may be referred to as a cold source and/or a heat source. The cooler may include a heat exchanger. The cooler may cool the ice making chamber. Alternatively, the cooler may cool and heat the ice making chamber. The heat exchanger may include at least one of a pipe to supply the cold and/or heat, a refrigerant pipe through which refrigerant flows, an evaporator refrigerant pipe through which refrigerant flows, or a thermoelectric element to supply the cold and/or heat. The evaporator may be located adjacent to or in contact with the tray. Alternatively, cold air cooled by the cooler may be supplied to the tray and liquid is phase-changed into ice in the ice making cell.

[0066] The cooler may cool the first tray. The cooler may cool the second tray. The cooler may cool the first tray and the second tray independently or simultaneously.

[0067] The cooler may optionally include a valve for controlling a flow of refrigerant, a fan for flowing cold air, or a damper for controlling a flow of cold air within the two spaces.

[0068] The controller may adjust a cooling power of the cooler. The cooling power of the cooler may be an output of a thermoelectric element, an amount of cold supplied to the tray, or an output or a frequency of the compressor or an amount of refrigerant flowing into an evaporator. The cold may include at least cold air.

[0069] The ice separation assembly includes at least one of a heater for heating the tray, a pusher for pressing at least a portion of the tray, a refrigerant pipe through which refrigerant flows to heat the tray, a liquid supply assembly for supplying liquid to an outside of the tray, or a driver for moving at least a portion of the tray.

[0070] The ice separation assembly may separate ice from each of the first tray and the second tray independently or simultaneously separate ice from the first tray and the second tray.

[0071] For example, a power of a driver is transmitted simultaneously to the first tray and the second tray, heat from a heater or a refrigerant pipe is transmitted simultaneously to the first tray and the second tray, or liquid is transmitted simultaneously to the first tray and the second tray.

[0072] FIG. 1 is a perspective view of an ice making device according to the present embodiment. FIG. 2 is a front view showing a door of an ice making device in an opened state according to the present embodiment. FIG. 3 is a cross-sectional view showing an inside of an ice making device according to the present embodiment. FIG. 4 is a diagram showing an inside of an ice making device according to the present embodiment.

[0073] Referring to FIGS. 1 to 4, an ice making device 1 of this embodiment may be installed independently to generate ice.

[0074] The ice making device 1 may include a cabinet 10 that forms an external shape. The ice making device 1 may further include a door 20 connected to the cabinet 10.

[0075] The cabinet 10 may include an ice making chamber 12 that generates ice. The cabinet 10 may further include a storage chamber 13 where ice is stored.

[0076] The ice making chamber 12 and the storage chamber 13 may be partitioned by a partition member. The ice making chamber 12 and the storage chamber 13 may be communicated through a communication hole in the partition member. Alternatively, the ice making chamber 12 and the storage chamber 13 may be communicated without a partition member.

[0077] Alternatively, the ice making chamber 12 may include the storage chamber 13, or the storage chamber 13 may include the ice making chamber 12.

[0078] The cabinet 10 may include a front opening 102. The door 20 may open and close the front opening 102. For example, the door 20 may open and close the front opening 102 by rotating.

[0079] When the door 20 opens the front opening 102,

a user can access the storage chamber 13 through the front opening 102. The user can take out ice stored in the storage chamber 13 to an outside through the front opening 102.

[0080] The ice making device 1 may further include an ice maker 40 located in the ice making chamber 12.

[0081] Ice generated in the ice maker 40 may fall from the ice maker 40 and be stored in the storage chamber 13.

[0082] The cabinet 10 may further include an inner case 101 defining the ice making chamber 12. The cabinet 10 may further include an outer case 110 disposed outside the inner case 101.

[0083] Although not shown, an insulating material may be provided between the inner case 101 and the outer case 100.

[0084] The inner case 101 may additionally define the storage chamber 13.

[0085] The ice making chamber 12 may be formed at one side of the inner case 101.

[0086] The ice maker 40 may be located close to a rear wall 101a of the inner case 101. When the ice maker 40 is located close to a rear wall 101a of the inner case 101, usability of the storage chamber 13 can be increased.

[0087] To facilitate a user's access to the storage chamber 13, ice generated by the ice maker 40 may fall in a direction closer to the door 20.

[0088] The cabinet 10 may further include a machine room 18 divided from the storage chamber 13. For example, the machine room 18 may be located at one side of the storage chamber 13.

[0089] Although not limited, a portion of the storage chamber 13 may be located between the ice making chamber 12 and the machine room 18. A volume of the storage chamber 13 may be greater than a volume of the ice making chamber 12 and a volume of the machine room 18.

[0090] The machine room 18 may be placed outside the inner case 101.

[0091] The inner case 101 may include a bottom wall 104 that forms a bottom of the storage chamber 13. The machine room 18 may be located at one side of the bottom wall 104.

[0092] The bottom wall 104 may be provided with a drain hole 105 for discharging liquid.

[0093] A portion of a cooler may be located in the machine room 18. For example, the cooler may be a refrigerant cycle for circulating refrigerant.

[0094] The cooler may include a compressor 183, a condenser 184, an expander (not shown), or a heat exchanger 50. The heat exchanger 50 may be an evaporator through which refrigerant flows. The heat exchanger 50 may be an evaporator through which refrigerant flows.

[0095] In this embodiment, the refrigerant cycle may be capable of switching refrigerant passage using a valve. That is, refrigerant compressed in the compressor 183 may flow directly to the condenser 184 or to the evaporator by switching of refrigerant passage. Although not limited, refrigerant from the compressor 183 may flow to the evaporator during an ice separation process.

[0096] The compressor 183 and the condenser 184 may be located in the machine room 18. The machine room 18 may be provided with a condenser fan 185 to allow air to pass through the condenser 184. For example, the condenser fan 185 may be disposed between the condenser 184 and the compressor 183.

[0097] A front grille 180 in which an air hole 182 is formed may be provided at a front of the cabinet 10. A plurality of air holes 182 may be formed in the front grille 180. The front grille 180 may be located at one side of the front opening 102. When the door 20 closes the front opening 102, the door 20 may cover a portion of the front grille 180.

[0098] The heat exchanger 50 may include refrigerant pipes through which refrigerant flows. At least a portion of the heat exchanger 50 may be located in the ice making chamber 12.

[0099] At least a portion of the heat exchanger 50 may be in contact with the ice maker 40. That is, liquid supplied to the ice maker 40 may be phase-changed into ice by low-temperature refrigerant flowing through the heat exchanger 50. Alternatively, the heat exchanger 50 may be located adjacent to the ice maker 40.

[0100] A cooling type in which the heat exchanger 50 directly contacts the ice maker 40 to generate ice can be referred to as a direct cooling type.

[0101] As another example, air that has heat-exchanged with the heat exchanger 50 is supplied to the ice maker 40, and liquid in the ice maker 40 can be phase-changed into ice by the cooling air. A cooling type of generating ice by supplying cooling air can be called an indirect cooling type or an air cooling type. In a case of the indirect cooling type, it is possible that the heat exchanger 50 is not located in the ice making chamber 12. However, a guide duct that guides cooling air heat-exchanged with the heat exchanger 50 to the ice making chamber 12 may be additionally provided.

[0102] In this embodiment, the ice maker 40 may generate a single type of ice or at least two different types of ice.

[0103] Hereinafter, it will be described as an example that the ice maker 40 generates at least two different types of ice.

[0104] The ice maker may include a tray assembly. The tray assembly may include a tray that defines a space in which an ice making cell is formed. The tray assembly may include a tray case to which the tray is connected and/or coupled and/or joined and/or supported. In this specification, the present invention describes using a tray. However, the present invention may also include embodiments understood by replacing a tray assembly instead of the tray. The tray case may include a first tray case (e.g., tray cover) connected and/or coupled and/or supported and/or jointed to a first portion of the tray. The tray case may include a second tray case (e.g., tray

supporter) connected and/or coupled and/or supported and/or jointed to a second portion of the tray. The ice maker 40 may include a first tray assembly 410 for generating a first type of first ice I1. The ice maker 40 may further include a second tray assembly 450 for generating a second type of second ice I2 different from the first type.

[0105] The first ice I1 and the second ice I2 may differ in one or more of shape, size, transparency, etc.

[0106] Hereinafter, it will be described as an example that the first ice I1 is polygonal ice, and the second ice I2 is spherical ice.

[0107] The storage chamber may include a first storage space 132. The storage chamber may further include a second storage space 134.

[0108] Ice generated in the first tray assembly 410 may be stored in the first storage space 132. Ice generated in the second tray assembly 450 may be stored in the second storage space 134.

[0109] Although not limited, the second storage space 134 may be defined by the ice bin 14. That is, an internal space of the ice bin 14 may serve as the second storage space 134. The ice bin 14 may be fixed or detachably coupled to the inner case 101.

[0110] The ice bin 14 may also be referred to as a partition member that divides the storage chamber 13 into the first storage space 132 and the second storage space 134.

[0111] A volume of the first storage space 132 may be greater than a volume of the second storage space 134. Although not limited, a size of the first ice I1 stored in the first storage space 132 may be smaller than a size of the second ice I2 stored in the second storage space 134.

[0112] A front surface of the ice bin 14 may be arranged to be spaced apart from a rear side of the front opening 102. A bottom surface of the ice bin 14 may be spaced apart from a bottom wall 104 of the storage chamber 13.

[0113] Accordingly, the first ice I1 may be located at one side of the ice bin 14. The first ice I1 may also be located at another side of the ice bin 14. The first ice I1 stored in the first storage space 132 may surround the ice bin 14.

[0114] A bottom wall 104 of the storage chamber 13 may form a floor of the second storage space 134.

[0115] A bottom wall 104 of the storage chamber 13 may be positioned lower than one end 102a of the front opening 102. A bottom surface of the ice bin 14 may be positioned higher than one end 102a of the front opening 102.

[0116] The ice bin 14 may be located adjacent to one surface (left surface in the drawing) of left and right surfaces of the inner case 101. The second tray assembly 450 may be located adjacent to the one surface. Accordingly, ice separated from the second tray assembly 450 may be stored in the second storage space 134 of the ice bin 14. Ice separated from the first tray assembly 410 may be stored in the first storage space 132 outside the second storage space 134.

[0117] When an amount of first ice stored in the first storage space 132 increases, to prevent the first ice from being unintentionally discharged through the front opening 102 when the door 20 is opened, the cabinet 10 may further include an opening cover 16. The opening cover 16 may be rotatably provided to the inner case 101. The opening cover 16 may cover one side of the front opening 102.

[0118] The opening cover 16 can be received in the storage chamber 13 when the door 20 is closed. When the door 20 is opened, other end of the opening cover 16 may be rotated with respect to one end so that the other end protrudes to an outside of the storage chamber 13.

[0119] The opening cover 16 may be elastically supported by, for example, an elastic member (not shown). When the door 20 is opened, the opening cover 16 can be rotated by the elastic member.

[0120] The opening cover 16 may be formed in a convex shape toward the door 20. Accordingly, although not limited, the first ice may be filled in the first storage space 132 up to one end 16a of the opening cover 16.

[0121] When the opening cover 16 is rotated, a portion of the first ice is drawn out of the storage chamber 13 while being located within the convex portion of the opening cover 16, so that a user can easily obtain the first ice.

[0122] Of course, it is also possible to omit the opening cover 16 by varying a height of one end 102a of the front opening 102.

[0123] The cabinet 10 may further include a guide 70 that guides ice separated from the ice maker 40 to the storage chamber 13.

[0124] The guide 70 may be arranged to be spaced apart from the ice maker 40. The guide 70 may guide a first ice I1 separated from the first tray assembly 410. The guide 70 may guide a second ice I2 separated from the second tray assembly 450.

[0125] For example, the guide 70 may include a first guide 710. The guide 70 may further include a second guide 730.

[0126] The first ice I1 separated from the first tray assembly 410 may fall onto the first guide 710. First ice I1 may be moved to the first storage space 132 by the first guide 710.

[0127] The second ice I2 separated from the second tray assembly 450 may fall onto the second guide 730. Second ice I2 may be moved to the second storage space 134 by the second guide 730.

[0128] One end of the ice bin 14 may be positioned adjacent to one end of the second guide 730 so that the second ice I2 is moved to the second storage space 134.

[0129] The ice making device 1 may further include a partition plate 80 to prevent the first ice and the second ice that fall onto the guide 70 from being mixed. The partition plate 80 extends in a vertical direction or in a horizontal direction and may be coupled to the guide 70 or the ice maker 40.

[0130] FIG. 5 is a diagram showing a liquid supply

passage in an ice making device according to the present invention. FIGS. 6 and 7 are perspective views showing liquid being supplied to an ice maker.

[0131] Referring to FIGS. 5 to 7, the ice making device 1 may include a liquid supply passage for guiding liquid supplied from a liquid source 302 to the ice maker 40. The liquid source (e.g., water source) may include a faucet or a liquid tank provided at an inside and/or outside of the ice making device.

[0132] The liquid supply passage may include a first passage 303 connected to the liquid source 302. A liquid supply valve 304 may be provided in the first passage 303. By operating the liquid supply valve 304, a supply of liquid from the liquid source 302 to the ice making device 1 can be controlled. A supply flow rate when liquid is supplied to the ice making device 1 can be controlled by operating the liquid supply valve 304.

[0133] The liquid supply passage may further include a second passage 305 connected to the liquid supply valve 304. The second passage 305 may be connected to a filter 306. For example, the filter 306 may be located in the machine room 18.

[0134] The liquid supply passage may further include a third passage 308 that guides liquid that has passed through the filter 306.

[0135] The cooling device may include a supply component to supply liquid to the ice making device. Alternatively, the supply component may include a liquid supply assembly. The supply component may supply liquid to an ice maker (e.g., tray) from a liquid source (e.g., a faucet or a liquid tank provided at an inside and/or outside of an ice making device). The liquid supply assembly may include a pipe through which the liquid flows. For example, liquid supplied from the liquid supply assembly may be supplied to a liquid supplier, which will be described later. The ice making device 1 may further include a liquid supply assembly 320. The liquid supply assembly 320 may be connected to the third passage 308.

[0136] The liquid supply assembly 320 can supply liquid to the ice maker 40 during a liquid supply process.

[0137] Alternatively, the supply component may include a liquid supplier. The supplier may supply liquid supplied from the liquid supply assembly to an ice maker (e.g., tray). The liquid supplier may include a sub liquid supplier. The sub liquid supplier may include a pipe through which the liquid flows. The sub liquid supplier may include a nozzle. The sub liquid supplier may further include a pump. The sub liquid supplier may include a sub_first liquid supplier. The sub liquid supplier may include a sub_second liquid supplier. The ice making device 1 may further include a liquid supplier 330. The liquid supplier 330 may supply liquid to the ice maker 40 during an ice making process. The liquid supplier 330 can store liquid supplied from the liquid supply assembly 320 and supply liquid to the ice maker 40.

[0138] In this embodiment, the liquid supply assembly 320 may be referred to as a first liquid supply assembly. The liquid supplier 330 may be referred to as a second liquid supply assembly.

[0139] The liquid supply assembly 320 may be located at one side of the ice maker 40. Liquid supplied from the liquid supply assembly 320 may fall onto the ice maker 40.

[0140] The liquid supplier 330 may be located at another side of the ice maker 40.

[0141] The liquid supplier 330 may be spaced apart from the liquid supply assembly 320. The liquid supplier 330 can store liquid supplied from the liquid supply assembly 320 and supply liquid to the ice maker 40.

[0142] In FIGS. 5 to 7, a dotted line shows a flow of liquid supplied from the liquid supply assembly 320, and a solid line shows a flow of liquid supplied from the liquid supplier 330.

[0143] The liquid supplier 330 may include a liquid storage 350 in which liquid is stored. The liquid storage may include a wall to form a space to store the liquid. The ice maker 40 may include one or more through holes 426 through which liquid passes. Liquid supplied from the liquid supply assembly 320 and dropped toward the ice maker 40 may be stored in the liquid storage 350 after passing through the through hole 426. The guide 70 may be provided with a plurality of through holes through which liquid passing through the ice maker 40 passes.

[0144] In a state in which the liquid supply valve 304 is turned on, liquid supplied from the liquid supply assembly 320 falls to one side of the ice maker 40, passes through the ice maker 40, and then may be stored in the liquid storage 350.

[0145] The liquid storage 350 may be provided with a liquid level detector 356 that detects a liquid level. When a liquid level of the liquid storage 350 detected by the liquid level detector 356 reaches a reference liquid level, the liquid supply valve 304 may be turned off.

[0146] In this specification, a process from when the liquid supply valve 304 is turned on to when the liquid supply valve 304 is turned off may be referred to as a liquid supply process. For example, the liquid supply valve 304 may be turned off when a liquid level of the liquid storage 350 detected by the liquid level detector 356 reaches a reference liquid level.

[0147] The liquid supplier 330 may further include liquid pumps 360 and 362 for pumping liquid stored in the liquid storage 350.

[0148] In this embodiment, in an ice making process, liquid stored in the liquid storage 350 may be pumped by the liquid pumps 360 and 362 and supplied to the ice maker 40.

[0149] The liquid pumps 360 and 362 may include a first pump 360. The liquid pumps may further include a second pump 362. When the first pump 360 operates, liquid may be supplied to the first tray assembly 410. When the second pump 362 operates, liquid may be supplied to the second tray assembly 450.

[0150] The first pump 360 and the second pump 362 may operate independently. Pumping capacities of the

first pump 360 and the second pump 362 may be the same or different. A pumping capacity of each of the first pump 360 and the second pump 362 may be variable.

[0151] The liquid supplier 330 may further include first connection pipes 352 and 354 connecting each of the pumps 360 and 362 and the liquid storage 350.

[0152] The first connection pipes 352 and 354 may be connected to the liquid storage 350 at the same or similar height to a bottom of the liquid storage 350.

[0153] The liquid supplier 330 may further include a sub_first liquid supplier 380 for supplying liquid pumped by the first pump 360 to the first tray assembly 410.

[0154] The liquid supplier 330 may further include a sub_second liquid supplier 382 for supplying liquid pumped by the second pump 362 to the second tray assembly 450.

[0155] The sub_first liquid supplier 380 may supply liquid to the first tray assembly 410 from one side of the first tray assembly 410.

[0156] The sub_second liquid supplier 382 may supply liquid to the second tray assembly 450 from one side of the second tray assembly 450.

[0157] The sub_first liquid supplier 380 and the sub_second liquid supplier 382 may be located at one side of the guide 70.

[0158] The liquid supplier 330 may further include second connection pipes 370 and 372 connecting each of the pumps 360 and 362 and each of the sub liquid suppliers 380 and 382.

[0159] Liquid supplied from the sub_first liquid supplier 380 to the first tray assembly 410 may be used to generate ice. Liquid that falls again from the first tray assembly 410 may be stored in the liquid storage 350 after passing through the guide 70.

[0160] Liquid supplied from the sub_second liquid supplier 382 to the second tray assembly 450 may be used to generate ice. Liquid that falls again from the second tray assembly 450 may be stored in the liquid storage 350 after passing through the guide 70.

[0161] A drain pipe 360 may be connected to the liquid storage 350. The drain pipe 360 may extend through the drain hole 105 into the machine room 18. The machine room 18 may be provided with a drain tube 362 connected to the drain pipe 360. The drain tube 362 can finally discharge liquid to an outside of the ice making device 1.

[0162] Hereinafter, the ice maker 40 will be described in detail.

[0163] FIGS. 8 and 9 are perspective views showing an ice maker and a heat exchanger according to the present embodiment.

[0164] FIG. 10 is a diagram showing an arrangement of a first tray and a second tray. FIG. 11 is a control block diagram of an ice making device of the present invention. FIG. 12 is a cross-sectional view showing a process of supplying liquid from a liquid supplier to an ice maker during an ice making process.

[0165] Referring to FIGS. 8 to 12, the heat exchanger 50 may contact the ice maker 40. For example, the heat exchanger 50 may be located at one side of the ice maker 40.

[0166] The ice maker 40 may include a first tray assembly 410 and a second tray assembly 450 as described above.

[0167] The first tray assembly 410 and the second tray assembly 450 may be arranged in a horizontal direction. It is also possible for the first tray assembly 410 and the second tray assembly 450 to be arranged in a vertical direction. The first tray assembly 410 and the second tray assembly 450 may be installed in the cabinet 10 while being connected to each other. That is, the first tray assembly 410 and the second tray assembly 450 can be modularized.

[0168] As another example, the first tray assembly 410 and the second tray assembly 450 may be installed in the cabinet 10 in a separated state. The first tray assembly 410 and the second tray assembly 450 may be positioned close to each other in a horizontal direction.

[0169] The first tray assembly 410 may include a first ice making cell 440.

[0170] In this embodiment, an ice making cell refers to a space where ice is generated. One ice may be generated in one ice making cell.

[0171] The first tray assembly 410 may include a first tray. The first tray may include a first one tray 420. The first tray may further include a first another tray 430 coupled to the first one tray 420.

[0172] For example, the first tray may form a plurality of first ice making cells 440. A plurality of first another trays 430 may be coupled to the first one tray 420.

[0173] The first ice making cell 440 may be defined by one cell or by a plurality of cells. For example, the first ice making cell 440 may include a first one cell 441 and a first another cell 442. Although not limited, the first one cell may be one of a first lower cell and a first upper cell. The first another cell may be another one of the first lower cell and the first upper cell. The first one cell may be one of a first left cell or a first right cell. The first another cell may be another one of the first left cell and the first right cell. Although not limited, it is possible that terms of first one cell and first another cell are opposite to each other.

[0174] The first one cell 441 may be formed by the first one tray 420. The first another cell 442 may be formed by the first another tray 430.

[0175] For example, the first one tray 420 may form a plurality of first one cells 441. Each of the plurality of first another trays 430 may form a first another cell 442.

[0176] Accordingly, when the plurality of first another trays 430 are coupled to a single first one tray 420, a plurality of first ice making cells 440 may be formed.

[0177] The first one tray 420 may include a first opening 423. The first opening 423 communicates with the first one cell 441.

[0178] A number of first openings 423 may be equal to a number of first ice making cells 440.

[0179] The first one cell 441 may form another portion

of an appearance of the first ice. The first another cell 442 may form a portion of an appearance of the first ice.

[0180] After the first another tray 430 is coupled to the first one tray 420, separation of the first another tray 430 from the first one tray 420 may be restricted.

[0181] Liquid supplied from the sub_first liquid supplier 380 may pass through the first opening 423 and be supplied to the first ice making cell 440. Accordingly, the first opening 423 may serve as a liquid supply opening during an ice making process.

[0182] A portion of liquid supplied to the first ice making cell 440 may fall to a lower part of the first tray assembly 410 through the first opening 423. Accordingly, the first opening 423 may serve as a liquid outlet opening during an ice making process.

[0183] Ice generated in the first ice making cell 440 may be separated from the first tray assembly 410 through the first opening 423 in an ice separation process. Accordingly, the first opening 423 may serve as an ice outlet opening during an ice separation process.

[0184] Each of the first one cell 441 and the first another cell 442 may be formed, for example, in a hexahedral shape. A volume of the first another cell 442 and a volume of the first one cell 441 may be the same or different.

[0185] A perimeter (or cross-sectional area) of the first one cell 441 may be greater than a perimeter (or cross-sectional area) of the first another cell 442 so that first ice can be discharged through the first opening 423 after the first ice is generated in the first ice making cell 440.

[0186] That is, during a liquid supply process, an ice making process, or an ice separation process, the first another tray 430 and the first one tray 420 are maintained in a coupled state, so that a shape of the first ice making cell 440 can be maintained.

[0187] The heat exchanger 50 may be in contact with the first another tray 430 so that ice is firstly generated in the first another cell 442.

[0188] The first one tray 420 may include through holes 421 and 425 through which liquid passes.

[0189] The second tray assembly 450 may further include a second tray forming a second ice making cell 451.

[0190] The second tray may be defined by one tray or by a plurality of trays. For example, the second tray may include a second one tray 460 and a second another tray 470. Although not limited, the second one tray may be an upper tray, or a left tray. The second another tray 470 may be a lower tray, or a right tray. It is also possible that terms of the second one tray 460 and the second another tray 470 are opposite to each other.

[0191] The second ice making cell 451 may be defined by one cell or by a plurality of cells. For example, the second ice making cell 451 may include a second one cell 462 and a second another cell 472.

[0192] The second one tray 460 can form the second one cell 462. The second another tray 470 may form the second another cell 472. For example, each of the second one cell 462 and the second another cell 472 may be formed in a hemispherical shape.

[0193] For example, the second tray may form a plurality of second ice making cells 451. Accordingly, the second one tray 460 can form a plurality of second one cells 462. The second another tray 470 can form a plurality of second another cells 472.

[0194] A portion of the first ice making cell 440 may be located at the same height as the second ice making cell 451. For example, at least a portion of the first ice making cell 440 may be arranged to overlap the second ice making cell 451 in a horizontal direction.

[0195] The second ice making cell 451 may be disposed between a rotation center C1 of the second another tray 470 and the first ice making cell 440.

[0196] A height of one end of the first ice making cell 440 and one end of the second ice making cell 451 may be different. For example, one end of the first ice making cell 440 may be positioned lower than one end of the second ice making cell 451.

[0197] A height of the other end of the first ice making cell 440 and the other end of the second ice making cell 451 may be different. For example, the other end of the first ice making cell 440 may be positioned higher than the other end of the second ice making cell 451.

[0198] A contact surface of the second one tray 460 and the second another tray 470 may have a different height from a coupling portion of the first one tray 420 and the first another tray 430. For example, a contact surface of the second one tray 460 and the second another tray 470 may be positioned higher than a coupling portion of the first one tray 420 and the first another tray 430.

[0199] A height of the first ice making cell 440 and a height of the second ice making cell 451 may be different. For example, a height of the first ice making cell 440 may be less than a height of the second ice making cell 451.

[0200] A maximum perimeter of the first ice making cell 440 may be different from a maximum perimeter of the second ice making cell 451. For example, a maximum perimeter of the first ice making cell 440 may be less than a maximum perimeter of the second ice making cell 451.

[0201] A number of first ice making cells 440 may be different from a number of second ice making cells 451. For example, a number of first ice making cells 440 may be greater than a number of second ice making cells 451.

[0202] A volume of the first ice making cell 440 may be different from a volume of the second ice making cell 451. A volume of the first ice making cell 440 may be less than a volume of the second ice making cell 451.

[0203] A sum of volumes of the plurality of first ice making cells 440 may be different from a sum of volumes of the plurality of second ice making cells 451. For example, a sum of volumes of the plurality of first ice making cells 440 may be greater than a sum of volumes of the plurality of second ice making cells 451.

[0204] The second another tray 470 may include a second opening 473.

[0205] A liquid supply process and an ice making process may be performed in a state in which the second one

tray 460 and the second another tray 470 are in contact to form the second ice making cell 451.

[0206] Liquid supplied from the sub_second liquid supplier 382 may pass through the second opening 473 and be supplied to the second ice making cell 451. Accordingly, the second opening 473 may serve as a liquid supply opening during an ice making process.

[0207] A portion of liquid supplied to the second ice making cell 451 may fall to a lower part of the second tray assembly 450 through the second opening 473. Accordingly, the second opening 473 may serve as a liquid outlet opening during an ice making process.

[0208] In an ice separation process, the second another tray 470 may be moved relative to the second one tray 460.

[0209] The first opening 423 and the second opening 473 may be located at different heights. For example, the first opening 423 may be located higher than the second opening 473.

[0210] The second tray assembly 450 may further include a case 452 supporting the second one tray 460.

[0211] A portion of the second one tray 460 may pass through the case 452 from one side. Another portion of the second one tray 460 may be seated on the case 452.

[0212] A driver 690 for moving the second another tray 470 may be installed on the case 452.

[0213] The case 452 may include a circumferential portion 453. The circumferential portion 453 may be provided with a seating end 454. The seating end 454 may be seated on the first tray assembly 410. For example, the seating end 454 may be seated on the first one tray 420.

[0214] A through hole 456 through which liquid passes may be formed in the case 452

[0215] The second tray assembly 450 may further include a supporter 480 supporting the second another tray 470.

[0216] In a state in which the second another tray 470 is seated on the supporter 480, the supporter 480 and the second another tray 470 may be moved together. For example, the supporter 480 may be movably connected to the second one tray 460.

[0217] The supporter 480 may include a supporter opening 482a through which liquid passes. The supporter opening 482a may be aligned with the second opening 473.

[0218] A diameter of the supporter opening 482a may be greater than a diameter of the second opening 473.

[0219] The second tray assembly 450 may further include a pusher 490 for separating ice from the second another tray 470 in an ice separation process. For example, the pusher 490 may be installed on the case 452.

[0220] The pusher 490 may include a pushing column 492. When the second another tray 470 and the supporter 480 are moved in an ice separation process, the pushing column 492 passes through the supporter opening 482a of the supporter 480 to press the second another tray 470. When the second another tray 470 is pressed by the pushing column 492, a shape of the second another tray 470 is deformed and the second ice may be separated from the second another tray 470. To enable deformation of the second another tray 470, the second another tray 470 may be formed of a non-metallic material. In terms of ease of deformation, the second another tray 470 may be formed of a flexible material.

[0221] Meanwhile, the heat exchanger 50 may include a first refrigerant pipe 510 that is in contact with or adjacent to the first tray assembly 410.

[0222] The heat exchanger 50 may further include a second refrigerant pipe 520 located adjacent to or in contact with the second tray assembly 450.

[0223] The first refrigerant pipe 510 and the second refrigerant pipe 520 may be connected in series or in parallel. Hereinafter, it will be described as an example that the first refrigerant pipe 510 and the second refrigerant pipe 520 are connected in series.

[0224] The first refrigerant pipe 510 may include a first inlet pipe 511. The first inlet pipe 511 may be located at one side of the first one tray 420. The first inlet pipe 511 may extend at a position adjacent to the driver 690. The first inlet pipe 511 may extend from one side of the driver 690. That is, the first inlet pipe 511 may extend in a space between the driver 690 and a rear wall 101a of the inner case 101.

[0225] The first refrigerant pipe 510 may further include a first bent pipe 512 extending from the first inlet pipe 511.

[0226] The first refrigerant pipe 510 may further include a first cooling pipe 513 extending from the first bent pipe 512.

[0227] The first cooling pipe 513 may be in contact with one surface the first another tray 430. Accordingly, the first another tray 430 may be cooled by refrigerant flowing through the first cooling pipe 513.

[0228] The first cooling pipe 513 may include a plurality of straight parts 513a. The first cooling pipe 513 may further include a curved shaped connection part 513b connecting ends of two adjacent straight parts 513a.

[0229] The first inlet pipe 511 may be located adjacent to a boundary portion between the first tray assembly 410 and the second tray assembly 450. The first cooling pipe 513 may extend from the boundary portion in a direction away from the second tray assembly 450.

[0230] One straight part may contact one surface of a plurality of first another trays 430.

[0231] A plurality of straight parts 513a may be arranged at substantially the same height.

[0232] The first refrigerant pipe 510 may further include a first connection pipe 514 extending from an end of the first cooling pipe 513. The first connection pipe 514 may extend to be lower in height than the first cooling pipe 513.

[0233] The first refrigerant pipe 510 may further include a second cooling pipe 515 connected to the first connection pipe 514. The second cooling pipe 515 may be located lower than the first cooling pipe 513.

[0234] The second cooling pipe 515 may contact a side surface of the first another tray 430.

[0235] The second cooling pipe 515 may include a plurality of straight parts 515a and 515b. The second cooling pipe 515 may further include a curved shaped connection portion 515c connecting two adjacent straight parts 515a and 515b.

[0236] A plurality of first another trays 430 may be arranged in a plurality of columns and rows.

[0237] Among a plurality of straight parts 515a and 515b, a portion of straight parts 515a may contact one side of the first another tray 430 in one row. Among the plurality of straight parts 515a and 515b, another straight part 515b may contact the first another trays 430 of two adjacent rows, respectively.

[0238] For example, the portion of the straight part 515a may contact a first surface of a first another tray in a first row. For example, another straight part 515b may contact a second surface of a first another tray in a first row and a first surface of a first another tray in a second row.

[0239] The first refrigerant pipe 510 may further include a first discharge pipe 516. The first discharge pipe 516 may extend from an end of the second cooling pipe 515. The first discharge pipe 516 may extend toward the second tray assembly 450. A height of the first discharge pipe 516 may be variable in an extension direction.

[0240] The second refrigerant pipe 520 may receive refrigerant from the first discharge pipe 516. A height of the first discharge pipe 516 may be variable in an extension direction. The second refrigerant pipe 520 may be a pipe formed integrally with the first discharge pipe 516 or may be a pipe coupled to the second discharge pipe 516.

[0241] The second refrigerant pipe 520 may include a second inlet pipe 522 connected to the first discharge pipe 516. The second inlet pipe 522 may be located at an opposite side of the driver 690 in the second tray assembly 450.

[0242] The second refrigerant pipe 520 may further include a third cooling pipe 523. The third cooling pipe 523 may extend from the second inlet pipe 522.

[0243] A portion of the second refrigerant pipe 520 (for example, the third cooling pipe 523) may be positioned higher than one end the second ice making cell 451.

[0244] The third cooling pipe 523 may contact the second one tray 460. Therefore, the second one tray 460 may be cooled by refrigerant flowing through the third cooling pipe 523. For example, the third cooling pipe 523 may contact one surface of the second one tray 460.

[0245] The liquid supply assembly 320 may be positioned higher than the third cooling pipe 523.

[0246] The third cooling pipe 523 may include a plurality of straight parts 523a. The third cooling pipe 523 may further include a curved shaped connection part 523b connecting two adjacent straight parts 523a.

[0247] One or more of a plurality of straight parts 523a may extend in a direction parallel to an arrangement direction of a plurality of second ice making cells 451. A plurality of straight parts 523a may overlap the second ice making cell 451 in a first direction. Some of the plurality of straight parts 523a may overlap the second opening 473 in the first direction. The first direction may be an arrangement direction of the second one cell and the second another cell forming a second ice making cell 451.

[0248] The third cooling pipe 523 may be located higher than the first cooling pipe 513 and the second cooling pipe 515.

[0249] The second refrigerant pipe 520 may further include a second bent pipe 524 extending from an end of the third cooling pipe 523. A portion of the second bent pipe 524 may extend from an end of the third cooling pipe 523 along one side of the driver 690.

[0250] Another portion of the second bent pipe 524 may extend in another direction.

[0251] The second refrigerant pipe 520 may further include a second discharge pipe 525 connected to the second bent pipe 524. At least a portion of the second discharge pipe 525 may extend parallel to the first inlet pipe 511. The second discharge pipe 525 may be located at one side of the driver 690. That is, the second discharge pipe 525 may extend in a space between the driver 690 and a rear wall 101a of the inner case 101.

[0252] At least a portion of the second discharge pipe 525 and the first inlet pipe 511 may be arranged in the first direction.

[0253] At least a portion of the second discharge pipe 525 may overlap the first inlet pipe 511 in the first direction. At least a portion of the second discharge pipe 525 may be located at one side of the first inlet pipe 511.

[0254] Meanwhile, the liquid supply assembly 320 may include a first supplier for supplying liquid to the first tray assembly 410. The liquid supply assembly 320 may include a second supplier for supplying liquid to the second tray assembly 450.

[0255] The second supplier may receive liquid from the first supplier. For example, the second supplier may extend from a point of the first supplier.

[0256] The first supplier may be disposed at one side of the first refrigerant pipe 510, and the second supplier may be disposed at one side of the second refrigerant pipe 520.

[0257] In this embodiment, the liquid supply assembly 320 may supply liquid to the ice maker 40 during a liquid supply process. The liquid supply assembly 320 may supply liquid to the ice maker 40 during an ice separation process.

[0258] When ice making is completed in the ice maker 40, the ice maker 40 may be maintained at a sub-zero temperature. The liquid supply assembly 320 can supply liquid supplied from an external liquid source 302 to the ice maker 40. Since liquid supplied from the external liquid source 302 may be liquid having normal temperature or liquid having a temperature similar to a normal temperature, liquid may be supplied from the liquid supply assembly 320 to the ice maker 40 in an ice separation process to increase a temperature of the ice maker 40.

[0259] The ice making device 1 may further include a

controller 190. The controller 190 may control the liquid supply valve 304 during a liquid supply process.

[0260] The controller 190 may control one or more of the compressor 183 and the condenser fan 185 (or fan driver) in an ice making process.

[0261] The controller 190 may control the first pump 360 and/or the second pump 362 in the ice making process. The controller 190 may independently control the first pump 360 and the second pump 362.

[0262] The controller 190 may control an ice separation assembly in an ice separation process. For example, the ice separation assembly may include one or more of the liquid supply assembly 320 and the refrigerant pipes 510 and 520. The controller 190 may control liquid discharge from the liquid supply assembly 320 by controlling the liquid supply valve 304 in an ice separation process. The controller 190 may control the switching valve to allow high-temperature refrigerant to flow to the refrigerant pipes 510 and 520 in the ice separation process.

[0263] The ice making device 1 may further include a first temperature sensor 191 for detecting a temperature of the first ice making cell 440 or a temperature around the first ice making cell 440.

[0264] The ice making device 1 may further include a second temperature sensor 192 for detecting a temperature of the second ice making cell 451 or a temperature around the second ice making cell 441.

[0265] The controller 190 may determine whether ice making in the first tray assembly 410 is completed based on a temperature detected by the first temperature sensor 191.

[0266] The controller 190 may determine whether ice making in the second tray assembly 450 is completed based on a temperature detected by the second temperature sensor 192.

[0267] Hereinafter, a series of processes by which ice is generated in an ice maker will be described.

[0268] FIG. 13 is a flowchart for explaining a control method of an ice making device according to a first embodiment of the present invention.

[0269] With reference to FIGS. 1 to 13, a process of generating ice in the ice making device 1 will be described.

[0270] A process for generating ice may include a liquid supply process (S11). A process for generating ice may further include an ice making process (S12 to S17). A process for generating ice may further include an ice separation process (S18).

[0271] When the liquid supply process starts (S1), the liquid supply valve 304 is turned on and liquid supplied from an external liquid source 302 flows along the liquid supply passage. The liquid flowing along the liquid supply passage is supplied to the ice maker 40 through the liquid supply assembly 320.

[0272] The liquid supplied to the ice maker 40 falls downward from the ice maker 40 and is stored in the liquid storage 350. When a liquid level of liquid stored in the liquid storage 350 reaches a reference liquid level, the liquid supply valve 304 is turned off and the liquid supply process is completed.

[0273] After the liquid supply process is completed, an ice making process starts.

[0274] In the ice making process, a cooler operates and low-temperature refrigerant may flow into the heat exchanger 50. For example, the compressor 183 and the condenser fan 185 may be turned on (S12). Of course, the condenser fan 185 may also be turned on. Alternatively, the compressor 183 and the condenser fan 185 may be turned on before the ice making process and remain turned on during the ice making process. The valve 188 can be turned off.

[0275] In the ice making process, liquid may be supplied to the ice maker 40 by the liquid supplier 330.

[0276] In this embodiment, an ice making time in the first tray assembly 410 and an ice making time in the second tray assembly may be different.

[0277] In this embodiment, the ice separation assembly may operate to simultaneously separate ice from the first tray assembly 410 and the second tray assembly 450. That is, an ice separation process for the first tray assembly 410 and an ice separation process for the second tray assembly 450 may be performed simultaneously.

[0278] In order for an ice separation process to be performed simultaneously in the two tray assemblies 410 and 450, an ice making completion time in the two tray assemblies must be the same or similar.

[0279] In this embodiment, for example, liquid is firstly supplied to a tray assembly with a longer ice making time, so that an ice making completion time in the two tray assemblies 410 and 450 can be the same or similar.

[0280] Hereinafter, the description will be made assuming that an ice making time in the second tray assembly 450 is greater than an ice making time in the first tray assembly 410.

[0281] The controller 190 may firstly turn on the second pump 362 (S13).

[0282] A difference between an ice making time in the second tray assembly 450 and an ice making time in the first tray assembly 410 may be stored in a memory (not shown).

[0283] An ice making time of the first tray assembly 410 and an ice making time in the second tray assembly 450 may be determined through multiple experiments and stored in the memory.

[0284] Based on a difference in ice making time, a difference in operating time (first reference time) of the first pump 360 and the second pump 362 may be determined.

[0285] When the second pump 362 is turned on, liquid may be supplied to the second tray assembly 450 through the sub_second liquid supplier 382.

[0286] The second liquid supply nozzle 383 may be positioned at one side of the second tray assembly 450. Liquid sprayed from the second liquid supply nozzle 383 may be supplied to the second ice making cell 451 of the

second tray assembly 450.

[0287] Liquid sprayed from the second liquid supply nozzle 383 is supplied into the second ice making cell 451 through a supporter opening 482a of the supporter 480 and a second opening 473 of the second another tray 470.

[0288] Liquid supplied to the second ice making cell 451 flows toward an inner one surface of the second one tray 460. A portion of liquid within the second ice making cell 451 may be frozen by the second refrigerant pipe 520. Unfrozen liquid falls downward again through the second opening 473. Liquid that falls downward through the second opening 473 is stored again in the liquid storage 350.

[0289] The controller 190 may determine whether a first reference time t1 has elapsed after the second pump 362 is turned on (S14).

[0290] As a result of the determination in step S14, if it is determined that a first reference time t1 has elapsed after the second pump 362 is turned on, the controller 190 may turn on the first pump 360 (S15).

[0291] When the first pump 360 operates, liquid may be supplied to the first tray assembly 410 through the sub_first liquid supplier 380.

[0292] The first liquid supply nozzle 381 is disposed at one side of the first tray assembly 410. Liquid sprayed from the first liquid supply nozzle 381 is supplied to a first ice making cell 440 of the first tray assembly 410.

[0293] Liquid sprayed from the first liquid supply nozzle 381 is supplied to the first ice making cell 440 410 through a first opening of the first one tray 420. Liquid supplied to the first ice making cell 440 flows toward one surface of the first another tray 430. A portion of liquid within the first ice making cell 440 is frozen by the first refrigerant pipe 510. Unfrozen liquid falls downward again through the first opening 423. Liquid that falls downward through the first opening 423 is stored in the liquid storage 350 again.

[0294] During the ice making process, ice is generated at one side of the first ice making cell 440 and grows toward another side. As liquid is sprayed into the first ice making cell 440, a portion of the liquid is frozen. In a process of spraying the liquid into the first one tray 420 or the first another tray 430, air bubbles in the liquid may be discharged from the liquid.

[0295] In this embodiment, the second pump 362 operates firstly and when a first reference time has elapsed, the first pump 360 is turned on and the first pump 360 and the second pump 362 are operated together. That is, in the ice making process, a start time of operation (liquid supply start time) of the first pump 360 may be delayed.

[0296] In summary, an ice making start time (or liquid supply start time) in the plurality of tray assemblies 410 and 450 may be different. In the plurality of tray assemblies 410 and 450, a start of an ice making of a tray assembly having a short ice making time may be delayed.

[0297] For example, an ice making may start in the second tray assembly 450 first, and an ice making in the first tray assembly 410 may be delayed.

[0298] In the ice making process, the second ice I2 may grow from a second one tray 460 to cover one side of the second opening 423a of the second another tray 470. In the ice making process, the first ice I1 may grow to an inside of the first one cell 441.

[0299] While performing the ice making process, the controller 190 may determine whether ice making is completed in the tray assembly.

[0300] For example, the controller 190 may determine whether a second reference time t2 has elapsed after the first pump 360 is turned on (S16).

[0301] The second reference time may be substantially the same as an ice making time of the first tray assembly 410. Alternatively, since the second pump 362 operates for a sum of the first and second reference times, a sum of the first and second reference times is equal to an ice making time of the second tray assembly 450.

[0302] That is, the controller 190 may determine whether an ice making is completed based on an ice making time of the first tray assembly 410 or an ice making time of the second tray assembly 450.

[0303] At this time, the second reference time may be determined as a time sufficient to complete a generation of ice in each tray assembly 410 and 450.

[0304] As a result of the determination in step S16, when it is determined that a second reference time t2 has elapsed after the first pump 360 is turned on, the controller 190 determines that an ice making process is completed and turns off the first pump 360 and the second pump 362 (S17).

[0305] When an ice making process is completed, the controller 190 may perform an ice separation process (S18).

[0306] When the ice separation process starts, a flow direction of refrigerant is firstly switched by the switching valve so that high-temperature refrigerant compressed in the compressor 183 may flow to the heat exchanger 50. High-temperature refrigerant flowing into the heat exchanger 50 may be heat exchanged with the ice maker 40. When high-temperature refrigerant flows into the heat exchanger 50, heat may be transferred to the ice maker 40.

[0307] The first ice I1 may be separated from the first tray assembly 410 by the heat transferred to the ice maker 40. When the first ice I1 is separated from the first tray assembly 410, the first ice I1 may fall onto the guide 70. The first ice I1 that fell onto the guide 70 may be stored in the first storage space 132.

[0308] The second ice I2 may be separated from at least a surface of the second one tray 460 by heat transferred to the ice maker 40.

[0309] As time passes, or when a temperature of each tray assembly reaches a set temperature, a flow of high-temperature refrigerant to the heat exchanger 50 may be blocked.

[0310] Next, the driver 690 may operate to separate the second ice I2 from the second tray assembly 450. By operating the driver 690, the second another tray 470

may be moved in a forward direction (clockwise direction with respect to FIG. 12).

[0311] When the second ice I2 is separated from the second one tray 460 and second another tray 470 by high-temperature refrigerant flowing into the heat exchanger 50, the second another tray 470 may be moved while second ice I2 is supported by the second another tray 470. In this case, when the second another tray 470 moves at an angle of approximately 90 degrees, the second ice I2 may fall from the second another tray 470.

[0312] On the other hand, when the second ice I2 has been separated from the second one tray 460 by the high-temperature refrigerant flowing into the heat exchanger 50 but has not yet been separated from the second another tray 470, the pusher 490 presses the second another tray 470 and the second ice I2 may be separated from the second another tray 470 and falls downward while the second another tray 470 moves to an ice separation angle.

[0313] When the second ice I2 is separated from the second tray assembly 450, the second ice I2 may fall onto the guide 70. The second ice I2 that fell onto the guide 70 may be stored in the second storage space 134.

[0314] After the second another tray 470 is moved in the forward direction, the second another tray 470 is moved in a reverse direction (counterclockwise direction in the drawing) by the driver 690 and in contact with the second one tray 460.

[0315] When an ice making start time of the two tray assemblies is the same, if an ice separation process is performed when an ice making is completed in the first tray assembly 410, an ice separation process is performed before an ice making is completed in the second tray assembly 450.

[0316] If an ice separation process is performed at a time of completion of an ice making in the second tray assembly 450, even if an ice separation process is performed in the first tray assembly 410, a malfunction of an ice separation may be occurred due to an excessive ice making in the first tray assembly 410.

[0317] According to this embodiment, an ice separation process is performed when an ice making of the two tray assemblies is completed, so ice in a perfect shape may be generated and a malfunction of an ice separation may be prevented.

[0318] Additionally, since an ice separation process is performed simultaneously in the two tray assemblies, an ice separation time may be reduced and a malfunction of an ice separation may be reduced. If an ice separation time is reduced, a cycle for generating ice for one time may be reduced. If a cycle is reduced, an amount of ice generated per day or for a set time may increase.

[0319] FIG. 14 is a flowchart for explaining a control method of an ice making device according to a second embodiment of the present invention.

[0320] The present embodiment is the same as a first embodiment in other portions, but is different in determining a timing of operating a pump and in determining a completion of an ice making. Accordingly, only characteristic portions of this embodiment will be described.

[0321] Referring to FIG. 14, the liquid supply process is performed (S11), and after the liquid supply process is completed, an ice making process starts. In the ice making process, the cooler operates to allow low-temperature refrigerant to flow into the heat exchanger 50. For example, the compressor 183 and the condenser fan 185 may be turned on (S12).

[0322] The controller 190 may firstly turn on the second pump 362 (S13).

[0323] When the second pump 362 is turned on, liquid is supplied to the second tray assembly 450 through the sub_second liquid supplier 382, and an ice making may start in the second tray assembly 450.

[0324] The controller 190 may determine whether a temperature detected by the second temperature sensor 192 is less than a first reference temperature T1 after the second pump 362 is turned on (S21).

[0325] As a result of the determination in step S21, if it is determined that a temperature detected by the second temperature sensor 192 is less than a first reference temperature T1, the controller 190 turns on the first pump 360 (S22).

[0326] That is, an operating time of the first pump 360 may be determined based on a temperature detected by the second temperature sensor 192. The first reference temperature T1 may be determined in advance based on a difference between an ice making time of the first tray assembly 410 and an ice making time of the second tray assembly 450.

[0327] As another example, the controller 190 determines whether a temperature detected by the first temperature sensor 191 is less than a first reference temperature T1 after the second pump 362 is turned on.

[0328] When the first pump 360 is operated, liquid is supplied to the first tray assembly 410 through the sub_first liquid supplier 380, and an ice making may start in the first tray assembly 410.

[0329] That is, even in this embodiment, a start time of operation of the first pump 360 in the ice making process may be delayed.

[0330] While performing the ice making process, the controller 190 may determine whether an ice making is completed in each tray assembly.

[0331] For example, the controller 190 may determine whether a temperature detected by the second temperature sensor 192 is less than a second reference temperature T2 after the first pump 360 is turned on (S23).

[0332] The second reference temperature T2 is a temperature at which an ice making is sufficiently completed in the second tray assembly 450. When an ice making in the second tray assembly 450 is completed, an ice making in the first tray assembly 410 may also be completed.

[0333] As another example, the controller 190 may determine whether a temperature detected by the first temperature sensor 191 is less than a second reference temperature T2 after the first pump 360 is turned on.

[0334] Although an ice making time of the first tray assembly 410 is less than an ice making time of the second tray assembly 450, an ice making completion time of the two tray assemblies may be the same or similar due to a delay in an ice making start time. Accordingly, when a temperature detected by the first temperature sensor 191 is less than the second reference temperature T2, it may be determined that an ice making in the first tray assembly 410 is completed. An ice making in the second tray assembly 450 will also be completed.

[0335] As a result of the determination in step S22, if it is determined that a temperature detected by the second temperature sensor 192 is less than a second reference temperature T2, the controller 190 determines that an ice making process is completed and then turns off the first pump 360 and the second pump 362 (S17).

[0336] When an ice making process is completed, the controller 190 may perform an ice separation process (S18).

[0337] FIG. 15 is a flowchart for explaining a control method of an ice making device according to a third embodiment of the present invention.

[0338] The present embodiment is the same as a first embodiment and a second embodiment in other portions, but is different in that an ice making start time of a plurality of tray assemblies may be the same and an ice making end time (or liquid supply end time) may be different. Accordingly, only characteristic portions of this embodiment will be described.

[0339] Referring to FIG. 15, the liquid supply process is performed (S11), and after the liquid supply process is completed, an ice making process may starts.

[0340] In the ice making process, the cooler operates to allow low-temperature refrigerant to flow into the heat exchanger 50. For example, the compressor 183 and the condenser fan 185 may be turned on (S12).

[0341] The controller 190 may turn on the first pump 360 and the second pump 362 (S31). That is, an ice making may start simultaneously in the first and second tray assemblies 410 and 450.

[0342] When the first pump 360 is turned on, liquid is supplied to the first tray assembly 410 through the sub_first liquid supplier 380, and an ice making may start in the first tray assembly 410.

[0343] When the second pump 362 is turned on, liquid is supplied to the second tray assembly 450 through the sub_second liquid supplier 382, and an ice making may start in the second tray assembly 450.

[0344] The controller 190 may determine whether a third reference time t3 has elapsed after the first and second pumps 360 and 362 are turned on (S32).

[0345] That is, the controller 190 may determine whether an ice making is completed in the first tray assembly 410 while an ice making process is performed in the two tray assemblies 410 and 450.

[0346] For example, the controller 190 may determine that an ice making in the first tray assembly 410 is completed when a third reference time t3 has elapsed after the first pump 360 is turned on. The third reference time t3 may be referred to as a first end reference time. The third reference time t3 is an ice making time of the first tray assembly 410.

[0347] As a result of the determination in step S21, if it is determined that a third reference time t3 has elapsed after the first and second pumps 360 and 362 are turned on, the controller 190 turns off the first pump 360 (S33).

[0348] That is, the controller 190 may firstly turn off a pump for supplying liquid to a tray assembly where an ice making is completed.

[0349] The controller 190 may determine whether a fourth reference time t4 has elapsed after the first pump 360 is turned off (S34).

[0350] As a result of the determination in step S34, if it is determined that a fourth reference time t4 has elapsed after the first pump 360 is turned off, the controller 190 may turn off the second pump 362 (S35). That is, when the controller 190 determines that an ice making of the second tray assembly 450 is completed, the controller may turn off the second pump 362.

[0351] At this time, a sum of the third reference time t3 and the fourth reference time t4 may be an ice making time of the second tray assembly 450. The fourth reference time t4 may be referred to as a second end reference time.

[0352] When an ice making process is completed, the controller 190 may perform an ice separation process (S18).

[0353] FIG. 16 is a flowchart for explaining a control method of an ice making device according to a fourth embodiment of the present invention.

[0354] The present embodiment is the same as a third embodiment in other portions, but is different in determining a timing of turning off the pump. Accordingly, only characteristic portions of this embodiment will be described.

[0355] Referring to FIG. 16, the liquid supply process is performed (S11), and after the liquid supply process is completed, an ice making process may start.

[0356] In the ice making process, the cooler operates to allow low-temperature refrigerant to flow into the heat exchanger 50. For example, the compressor 183 and the condenser fan 185 may be turned on (S12).

[0357] The controller 190 may turn on the first pump 360 and the second pump 362 (S31). That is, an ice making may start simultaneously in the first and second tray assemblies 410 and 450.

[0358] When the first pump 360 is turned on, liquid is supplied to the first tray assembly 410 through the sub_first liquid supplier 380, and an ice making may start in the first tray assembly 410.

[0359] When the second pump 362 is turned on, liquid is supplied to the second tray assembly 450 through the sub_second liquid supplier 382, and an ice making may start in the second tray assembly 450.

[0360] The controller 190 determines whether a temperature detected by the first temperature sensor 191 is

less than the third reference temperature T3 after the first and second pumps 360 and 362 are turned on (S41).

[0361] The third reference temperature may be referred to as a first end reference temperature for determining completion of an ice making of the first tray assembly.

[0362] The controller 190 may determine that an ice making in the first tray assembly 410 is completed when a temperature detected by the first temperature sensor 191 is less than the third reference temperature T3 after the first and second pumps 360 and 362 are turned on.

[0363] As another example, the controller 190 may determine that an ice making in the first tray assembly 410 is completed when a temperature detected by the second temperature sensor 192 is less than the third reference temperature T3 after the first and second pumps 360 and 362 are turned on.

[0364] That is, the controller 190 may determine whether an ice making is completed in the first tray assembly 410 while an ice making process is performed in the two tray assemblies 410 and 450.

[0365] As a result of the determination in step S41, if it is determined that a temperature detected by the first temperature sensor 191 is less than the third reference temperature T3, the controller 190 turns off the first pump 360 (S42).

[0366] That is, the controller 190 may firstly turn off a pump for supplying liquid to a tray assembly where an ice making is completed.

[0367] The controller 190 may determine whether a temperature detected by the second temperature sensor 192 is less than a second reference temperature T2 after the first pump 360 is turned off (S43).

[0368] The second reference temperature T2 is a temperature at which an ice making is sufficiently completed in the second tray assembly 450.

[0369] If it is determined that a temperature detected by the second temperature sensor 192 is lower than a second reference temperature T2, it may be determined that an ice making in the second tray assembly 450 is completed.

[0370] As a result of the determination in step S43, if it is determined that a temperature detected by the second temperature sensor 192 is less than the second reference temperature T2, the controller 190 turns off the second pump 362 (S44).

[0371] When an ice making process is completed, the controller 190 may perform an ice separation process (S18).

[0372] FIG. 17 is a control block diagram of an ice making device according to a fifth embodiment of the present invention.

[0373] Referring to FIG. 17, in an ice making device of this embodiment, the first refrigerant pipe 510 and the second refrigerant pipe 520 may be connected in parallel.

[0374] An ice making device of this embodiment may further include a first valve 194 and a second valve 195 in addition to the configuration described in FIG. 10. A configuration described in FIG. 10 may be applied equally or similarly to an ice making device of this embodiment.

[0375] The first valve 194 may control a flow of refrigerant into the first refrigerant pipe 510. For example, when the first valve 194 is turned on, refrigerant may flow into the first refrigerant pipe 510. When the first valve 194 is turned off, a flow of refrigerant into the first refrigerant pipe 510 is blocked. When the first valve 194 is turned on, the first valve 194 may control a flow rate of refrigerant flowing into the first refrigerant pipe 510.

[0376] The second valve 195 may control a flow of refrigerant into the second refrigerant pipe 520. For example, when the second valve 195 is turned on, refrigerant may flow into the second refrigerant pipe 520. When the second valve 195 is turned off, a flow of refrigerant into the second refrigerant pipe 520 is blocked. When the second valve 195 is turned on, the second valve 195 may control a flow rate of refrigerant flowing into the second refrigerant pipe 520.

[0377] FIG. 18 is a flowchart for explaining a control method of an ice making device according to a fifth embodiment of the present invention.

[0378] This embodiment also basically explains a method of controlling an ice making device based on a fact that ice making times of a plurality of tray assemblies are different.

[0379] Referring to FIG. 18, a process for generating ice may include a liquid supply process (S11). A process for generating ice may further include an ice making process (S51 to S57). A process for generating ice may further include an ice separation process (S18).

[0380] When the liquid supply process starts (S11), the liquid supply valve 304 is turned on and liquid supplied from an external liquid supply source 302 flows along the liquid supply passage. Liquid flowing along the liquid supply passage is supplied to the ice maker 40 through the liquid supply assembly 320.

[0381] Liquid supplied to the ice maker 40 falls to a lower side of the ice maker 40 and is stored in the liquid storage 350. When a level of liquid stored in the liquid storage 350 reaches a reference level, the liquid supply valve 304 is turned off and the liquid supply process is completed.

[0382] After the liquid supply process is completed, an ice making process starts.

[0383] In the ice making process, the cooler operates to allow low-temperature refrigerant to flow into the heat exchanger 50. In the ice making process, liquid may be supplied to the ice maker 40 by the liquid supplier 330.

[0384] In detail, the controller 190 may firstly turn on the second pump 362 (S51). That is, an ice making in a second tray assembly 450 having a long ice making time may start firstly.

[0385] For example, the controller 190 may turn on the compressor 183 and the condenser fan 185 (S52).

[0386] The controller 190 may turn on the second valve 195 (S53).

[0387] Steps S51 to S53 may be performed sequentially or simultaneously. An order of steps S51 to S53 can be changed.

[0388] When the second valve 195 is turned on, refrigerant flows into the second refrigerant pipe 520 to cool the second tray assembly 450.

[0389] A difference between an ice making time in the second tray assembly 450 and an ice making time in the first tray assembly 410 may be stored in a memory (not shown).

[0390] An ice making time of the first tray assembly 410 and an ice making time of the second tray assembly 450 may be determined through multiple experiments and stored in the memory.

[0391] Based on a difference in ice making time, a difference in operating times (first reference time) of the first pump 360 and the second pump 362 may be determined.

[0392] When the second pump 362 is turned on, liquid is supplied to the second tray assembly 450 through the sub_second liquid supplier 382 to create ice in the second tray assembly 450.

[0393] The controller 190 may determine whether a first reference time t1 has elapsed after the second valve 195 is turned on (S54). Alternatively, the controller 190 may determine whether a first reference time t1 has elapsed after the second pump 362 is turned on.

[0394] As a result of the determination in step S54, if it is determined that a first reference time t1 has elapsed after the second valve 195 is turned on, the controller 190 may turn on the first pump 360 and the first valve (S55).

[0395] When the first pump 360 is turned on, liquid may be supplied to the first tray assembly 410 through the sub_first liquid supplier 380.

[0396] When the first valve 194 is turned on, refrigerant flows into the first refrigerant pipe 510 to cool the first tray assembly 410, ice is generated in the first tray assembly 410.

[0397] While performing the ice making process, the controller 190 may determine whether an ice making is completed in each tray assembly.

[0398] For example, the controller 190 may determine whether a second reference time t2 has elapsed after the first pump 360 or the first valve 194 is turned on (S56).

[0399] The second reference time may be substantially the same as an ice making time of the first tray assembly 410. Alternatively, since the second pump 362 operates for a sum of the first and second reference times, a sum of the first and second reference times is equal to an ice making time of the second tray assembly 450.

[0400] That is, the controller 190 may determine whether an ice making is complete based on an ice making time of the first tray assembly 410 or an ice making time of the second tray assembly 450.

[0401] At this time, the second reference time may be determined as a time sufficient to complete a generation of ice in each of the tray assemblies 410 and 450.

[0402] As a result of the determination in step S56, if it is determined that a second reference time t2 has elapsed after the first pump 360 or the first valve 194 is turned on, the controller 190 determines that an ice making process is completed and may turn off the first pump 360 and the second pump 362 (S57).

[0403] Since high-temperature refrigerant must flow into the refrigerant pipes 510 and 520 in an ice separation process after an ice making, the first valve 194 and the second valve 195 may be maintained in an on state. Alternatively, the first valve 194 and the second valve 195 may be turned on after being turned off.

[0404] When an ice making process is completed, the controller 190 may perform an ice separation process (S18).

[0405] FIG. 19 is a flowchart for explaining a control method of an ice making device according to a sixth embodiment of the present invention.

[0406] The present embodiment is the same as a fifth embodiment in other portions, but is different in determining a timing of operating a pump and in determining a completion of an ice making. Accordingly, only characteristic portions of this embodiment will be described.

[0407] Referring to FIG. 19, a process for generating ice may include a liquid supply process (S11). A process for generating ice may further include an ice making process. A process for generating ice may further include an ice separation process (S18).

[0408] When the liquid supply process starts (S11), the liquid supply valve 304 is turned on and liquid supplied from an external liquid supply source 302 flows along the liquid supply passage. Liquid flowing along the liquid supply passage is supplied to the ice maker 40 through the liquid supply assembly 320.

[0409] Liquid supplied to the ice maker 40 falls to a lower side of the ice maker 40 and is stored in the liquid storage 350. When a level of liquid stored in the liquid storage 350 reaches a reference level, the liquid supply valve 304 is turned off and the liquid supply process is completed.

[0410] After the liquid supply process is completed, an ice making process starts.

[0411] In the ice making process, the cooler operates to allow low-temperature refrigerant to flow into the heat exchanger 50. In the ice making process, liquid may be supplied to the ice maker 40 by the liquid supplier 330.

[0412] In detail, the controller 190 may firstly turn on the second pump 362 (S51). That is, an ice making in a second tray assembly 450 having a long ice making time may start firstly.

[0413] For example, the controller 190 may turn on the compressor 183 and the condenser fan 185 (S52).

[0414] The controller 190 may turn on the second valve 195 (S53).

[0415] Steps S51 to S53 may be performed sequentially or simultaneously. An order of steps S51 to S53 can be changed.

[0416] When the second valve 195 is turned on, refrigerant flows into the second refrigerant pipe 520 to cool

the second tray assembly 450.

[0417] When the second pump 362 is turned on, liquid is supplied to the second tray assembly 450 through the sub_second liquid supplier 382 to generate ice in the second tray assembly 450.

[0418] The controller 190 determines whether a temperature detected by the second temperature sensor 192 is less than a first reference temperature T1 after the second pump 362 or the second valve 195 is turned on (S61) (determination of a starting time of the first pump).

[0419] As a result of the determination in step S61, if it is determined that a temperature detected by the second temperature sensor 192 is less than a first reference temperature T1, the controller 190 may turn on the first pump 360 and the first valve 194 (S62).

[0420] As another example, the controller 190 may determine whether a temperature detected by the first temperature sensor 191 is less than a first reference temperature T1 after the second pump 362 or the second valve 195 is turned on.

[0421] When the first pump 360 is turned on, liquid may be supplied to the first tray assembly 410 through the sub_first liquid supplier 380. When the first valve 194 is turned on, refrigerant flows into the first refrigerant pipe 510 to cool the first tray assembly 410, ice is generated in the first tray assembly 410.

[0422] While performing the ice making process, the controller 190 may determine whether an ice making is completed in each tray assembly.

[0423] For example, the controller 190 determines whether a temperature detected by the second temperature sensor 192 is less than a second reference temperature T2 after the first pump 360 or the first valve 194 is turned on (S63).

[0424] The second reference temperature T2 is a temperature at which an ice making is sufficiently completed in the second tray assembly 450. When an ice making in the second tray assembly 450 is completed, an ice making in the first tray assembly 410 may also be completed.

[0425] As another example, the controller 190 determines whether a temperature detected by the first temperature sensor 191 is less than a second reference temperature T2 after the first pump 360 or the first valve 194 is turned on.

[0426] An ice making time of the first tray assembly 410 is less than an ice making time of the second tray assembly 450, but due to a delay in an ice making start time (or liquid supply start time), an ice making completion time of the two tray assemblies is the same or similar. Accordingly, when a temperature detected by the second temperature sensor 192 is less than a second reference temperature T2, it may be determined that an ice making in the second tray assembly 450 is completed. An ice making in the first tray assembly 410 will also be completed.

[0427] As a result of the determination in step S63, if it is determined that a temperature detected by the second temperature sensor 192 is less than a second reference temperature T2, the controller 190 determines that an ice making process is completed and may turn off the first pump 360 and the second pump 362 (S57).

[0428] Since high-temperature refrigerant must flow into the refrigerant pipes 510 and 520 in an ice separation process after an ice making, the first valve 194 and the second valve 195 may be maintained in an on state. Alternatively, the first valve 194 and the second valve 195 may be turned on after being turned off.

[0429] When an ice making process is completed, the controller 190 may perform an ice separation process (S18).

[0430] FIG. 20 is a flowchart for explaining a control method of an ice making device according to a seventh embodiment of the present invention.

[0431] The present embodiment is the same as a third embodiment in other portions, but is different in that refrigerant flows by two valves. Accordingly, only characteristic portions of this embodiment will be described.

[0432] Referring to FIG. 20, the liquid supply process is performed (S11), and after the liquid supply process is completed, an ice making process may starts.

[0433] The controller 190 may turn on the first pump 360 and the second pump 362 (S71). The controller 190 may turn on the compressor 183 and the condenser fan 185 (S72). In the ice making process, the controller 190 may turn on the first valve 194 and the second valve 195 (S73).

[0434] Accordingly, an ice making may be started simultaneously in the first and second tray assemblies 410 and 450.

[0435] When the first pump 360 is turned on, liquid may be supplied to the first tray assembly 410 through the sub_first liquid supplier 380. When the first valve 194 is turned on, refrigerant flows into the first refrigerant pipe 510 to cool the first tray assembly 410.

[0436] When the second pump 362 is turned on, liquid may be supplied to the second tray assembly 450 through the sub_second liquid supplier 382. When the second valve 195 is turned on, refrigerant flows into the second refrigerant pipe 520 to cool the second tray assembly 450.

[0437] The controller 190 may determine whether a third reference time t3 has elapsed after the first and second pumps 360 and 362 are turned on (S74).

[0438] That is, the controller 190 may determine whether an ice making is completed in the first tray assembly 410 while an ice making process is performed in the two tray assemblies 410 and 450.

[0439] For example, the controller 190 may determine that an ice making in the first tray assembly 410 is completed when a third reference time t3 has elapsed after the first and second pumps 360 and 362 are turned on. The third reference time t3 is an ice making time of the first tray assembly 410.

[0440] As a result of the determination in step S74, if it is determined that a third reference time t3 has elapsed after the first and second pumps 360 and 362 are turned

on, the controller 190 may turn off the first pump 360 and the first valve 194 (S75).

[0441] The controller 190 may determine whether a fourth reference time t4 has elapsed after the first pump 360 or the first valve 194 is turned off (S76).

[0442] As a result of the determination in step S76, if it is determined that a fourth reference time t4 has elapsed after the first pump 360 is turned off, the controller 190 may turns off the second pump 362 and the second valve 195. That is, when the controller 190 determines that an ice making of the second tray assembly 450 is completed, the controller turns off the second pump 362.

[0443] At this time, a sum of the third reference time t3 and the fourth reference time t4 may be an ice making time of the second tray assembly 450.

[0444] When an ice making process is completed, the controller 190 may perform an ice separation process (S18).

[0445] FIG. 21 is a flowchart for explaining a control method of an ice making device according to an eighth embodiment of the present invention.

[0446] The present embodiment is the same as a seventh embodiment in other portions, but is different in determining a timing of turning off a pump. Accordingly, only characteristic portions of this embodiment will be described.

[0447] Referring to FIG. 21, the liquid supply process is performed (S11), and after the liquid supply process is completed, an ice making process may start.

[0448] The controller 190 may turn on the first pump 360 and the second pump 362 (S71). The controller 190 may turn on the compressor 183 and the condenser fan 185 (S72). In the ice making process, the controller 190 may turn on the first valve 194 and the second valve 195 (S73).

[0449] The controller 190 determines whether a temperature detected by the first temperature sensor 191 is less than the third reference temperature T3 after the first and second pumps 360 and 362 are turned on (S81).

[0450] The controller 190 may determine that an ice making is completed in the first tray assembly 410 when a temperature detected by the first temperature sensor 191 is less than the third reference temperature T3 after the first and second pumps 360 and 362 are turned on.

[0451] As another example, the controller 190 may determine that an ice making is completed in the first tray assembly 410 when a temperature detected by the second temperature sensor 191 is less than the third reference temperature T3 after the first and second pumps 360 and 362 are turned on.

[0452] That is, the controller 190 may determine whether an ice making is completed in the first tray assembly 410 while an ice making process is performed in the two tray assemblies 410 and 450.

[0453] As a result of the determination in step S81, if it is determined that a temperature detected by the first temperature sensor 191 is less than the third reference temperature T3 after the first and second pumps 360 and 362 are turned on, the controller 190 turns off the first pump 360 and the first valve 194 (S82).

[0454] The controller 190 determines whether a temperature detected by the second temperature sensor 192 is less than a second reference temperature T2 after the first pump 360 or the first valve 194 is turned off (S83).

[0455] If it is determined that a temperature detected by the second temperature sensor 192 is lower than a second reference temperature T2, it may be determined that an ice making in the second tray assembly 450 is completed.

[0456] As a result of the determination in step S83, if it is determined that a temperature detected by the second temperature sensor 192 is less than the second reference temperature T2, the controller 190 may turn off the second pump 362 and the second valve 194 (S77).

[0457] When an ice making process is completed, the controller 190 may perform an ice separation process (S18).

[0458] In some embodiments, an ice making of a tray having a shorter ice making time may be delayed in a plurality of trays (or tray assemblies). For example, a start of liquid supply to a tray having a shorter ice making time may be delayed.

[0459] In some other embodiments, an end time of liquid supply to a tray having a shorter ice making time in a plurality of trays (or tray assemblies) may be advanced.

[0460] In some other embodiments, cooling of a tray having a shorter ice making time may be delayed in a plurality of trays (or tray assemblies). For example, a start of cooling of a tray having a shorter ice making time may be delayed.

[0461] In some other embodiments, a cooling end time of a tray having a shorter ice making time in a plurality of trays (or tray assemblies) may be advanced.

[0462] As another example, a supply amount of liquid per unit time between a plurality of trays may be different. For example, while a plurality of pumps operates simultaneously, a supply amount of liquid per unit time to the first tray may be less than a supply amount of liquid per unit time to the second tray. In this case, ice making completion times in the first tray and the second tray may be the same or similar. Even when multiple pumps do not operate simultaneously, a supply amount of liquid per unit time to the first tray when the first pump operates is less than a supply amount of liquid per unit time to the second tray when the second pump operates.

[0463] As another example, multiple pumps may operate intermittently. That is, a plurality of pumps may be repeatedly turned on and tuned off. In an ice making process, an on-time times of multiple pumps may be different from each other. Alternatively, in an ice making process, a number of turns on (number of liquid supply times) between multiple pumps may be different from each other.

[0464] For example, an on time of a first pump corresponding to a first tray may be less than an on time of a

second pump corresponding to a second tray. Alternatively, a turn-on number of a first pump corresponding to a first tray may be less than a turn-on number of a second pump corresponding to a second tray.

[0465] As another example, a supply amount of cooling power to the plurality of trays may be different from each other. A supply amount of cooling power may be an amount of cooling power supplied to trays by the cooler.

[0466] For example, a supply amount of cooling power to a first tray may be less than a supply amount of cooling power to a second tray. Alternatively, a number of times of a supply of a cooling power to the first tray may be less than a number of times of a supply of a cooling power to the second tray. Alternatively, a time for supplying cooling power to the first tray may be less than a time for supplying cooling power to the second tray.

[0467] It is also possible to apply technology applied to the ice making device to a refrigerator. That is, the refrigerator may include some or all of the components of the ice making device 1.

[0468] First, the ice maker 40 in the ice making device 1 can be applied to the refrigerator. The refrigerator may include a cabinet having a storage chamber, and a door that opens and closes the storage chamber. An ice making chamber may be provided in the cabinet or the door.

[0469] An ice maker 40 may be provided in the ice making chamber with the same structure or a similar form as the ice maker 40 of this embodiment.

[0470] In this embodiment, the cooler in the ice making device 1 may be replaced with a cooler or a refrigerant cycle that cools the storage chamber of the refrigerator.

[0471] A guide 70, a liquid supply assembly 320, and a liquid supplier 330 provided in the ice making device 1 may also be applied to the refrigerator or may be modified in shape, size, or location to suit characteristics of the refrigerator.

Claims

1. An ice making device comprising:

an ice maker provided in an ice making chamber and configured to generate ice;
a cooler configured to cool the ice maker;
a liquid supplier configured to supply liquid to the ice maker in an ice making process;
an ice separation assembly configured to separate ice from the ice maker in an ice separation process; and
a controller configured to control at least one of the cooler, the liquid supplier, or the ice separation assembly.

2. The ice making device of claim 1,

wherein the ice maker comprises a first tray including a first ice making cell and a second tray including a second ice making cell, and
wherein the controller is configured to control an ice making of one tray of the first tray and the second tray to be delayed from an ice making of other tray of the first tray and the second tray.

3. The ice making device of claim 2,
wherein an ice making time of the one tray is less than an ice making time of the other tray.

4. The ice making device of claim 2,
wherein the controller is configured to control the liquid supplier so that a liquid supply start time of the one tray is delayed from a liquid supply start time of the other tray.

5. The ice making device of claim 4,
wherein the controller is configured to control the liquid supplier so that a liquid supply to the one tray starts when a first reference time elapses after a liquid supply to the other tray starts.

6. The ice making device of claim 5,
wherein the controller is configured to control the liquid supplier so that a liquid supply to the trays is ended when a second reference time elapses after a liquid supply to the one tray starts.

7. The ice making device of claim 5,

further comprising a temperature sensor for detecting a temperature of at least one of the first tray or the second tray, and
wherein the controller is configured to control the liquid supplier so that a liquid supply to the one tray starts when a temperature detected by the temperature sensor is less than a first reference temperature after a liquid supply to the other tray starts.

8. The ice making device of claim 7,
wherein the controller is configured to control the liquid supplier so that a liquid supply to the trays is ended, when a temperature detected by the temperature sensor is lower than a second reference temperature after a liquid supply to the one tray starts.

9. The ice making device of claim 2,
wherein the controller is configured to control the liquid supplier so that a supply amount of liquid per unit time to the one tray is less than a supply amount of liquid per unit time to the other tray.

10. The ice making device of claim 2,
wherein the controller is configured to control the liquid supplier so that a liquid supply time of the one

tray is less than a liquid supply time of the other tray.

11. The ice making device of claim 2,
wherein the controller is configured to control the liquid supplier so that a number of times of a liquid supply to the one tray is less than a number of times of a liquid supply to the other tray.

12. The ice making device of claim 2,
wherein the controller is configured to control the cooler so that a timing of a supply of a cooling power to the one tray is delayed from a timing of a supply of a cooling power to the other tray.

13. The ice making device of claim 12,
wherein the controller is configured to control the cooler so that a supply of a cooling power to the one tray starts when a first reference time elapses after a supply of a cooling power to the other tray starts.

14. The ice making device of claim 13,
wherein the controller is configured to control the cooler so that a supply of a cooling power to the trays stops when a second reference time elapses after a supply of a cooling power to the one tray starts.

15. The ice making device of claim 2,
wherein the controller is configured to control the cooler so that a supply amount of a cooling power per unit time to the one tray is less than a supply amount of a cooling power per unit time to the other tray.

16. The ice making device of claim 2,
wherein the controller is configured to control the cooler so that a supply time of a cooling power to the one tray is less than a supply time of a cooling power to the other tray.

17. The ice making device of claim 2,
wherein the controller is configured to control the cooler so that a number of times of a supply of a cooling power to the one tray is less than a number of times of a supply of a cooling power to the other tray.

18. The ice making device of claim 2,
wherein when an ice making of the first tray or the second tray is completed, the controller is configured to operate the ice separation assembly to separate ice from each of the first tray and the second tray.

19. An ice making device comprising:

an ice maker provided in an ice making chamber and configured to generate ice;
a cooler configured to cool the ice maker;
a liquid supplier configured to supply liquid to the ice maker in an ice making process;
an ice separation assembly configured to separate ice from the ice maker in an ice separation process; and
a controller configured to control at least one of the cooler, the liquid supplier, or the ice separation assembly, wherein the ice maker comprises a first tray including a first ice making cell, and a second tray including a second ice making cell, wherein after starting to a supply of a cooling power or starting to a supply of liquid to each of the first tray and the second tray, the controller is configured to control the liquid supplier or the cooler to stop a supply of a cooling power or a supply of liquid of one tray of the first tray and the second tray.

20. The ice making device of claim 19,
wherein the controller is configured to operate the ice separation assembly to separate ice from each of the first tray and the second tray when an ice making of other tray of the first tray and the second tray is completed.

21. The ice making device of claim 19,
wherein the controller is configured to stop a supply of liquid or a supply of a cooling power of one tray of the first tray and the second tray when a first reference time elapses after an ice making of each of the first and second trays starts.

22. The ice making device of claim 20,
wherein the controller is configured to stop a supply of liquid or a supply of a cooling power of the other tray when a second reference time elapses after a supply of liquid or a supply of a cooling power of the one tray is ended.

23. The ice making device of claim 19,
further comprising a temperature sensor for detecting a temperature of at least one of the first tray or the second tray, wherein after an ice making of each of the first tray and the second tray starts, if a temperature detected by the temperature sensor is less than a third reference temperature, the controller is configured to stop a supply of liquid or a supply of a cooling power of one tray of the first tray and the second tray.

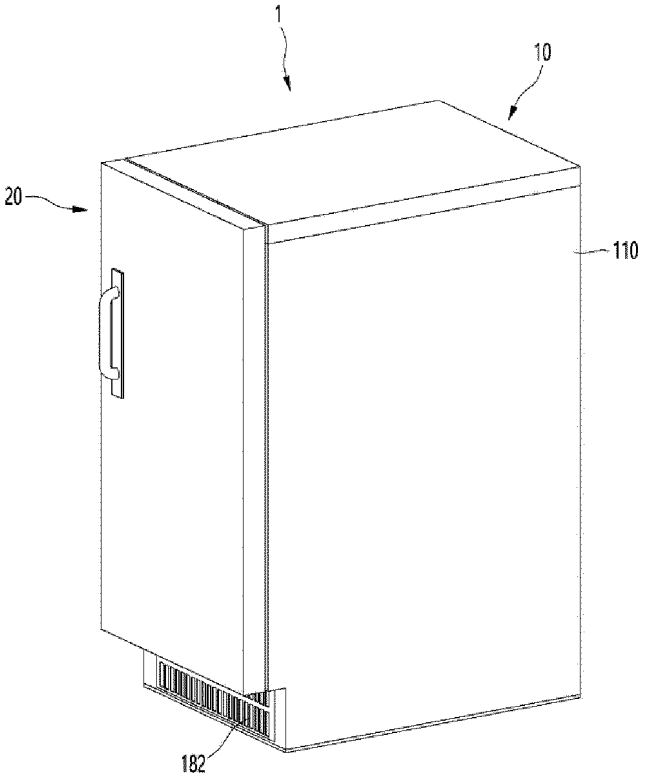
24. The ice making device of claim 23,
wherein after a supply of liquid or a supply of a cooling power of the one tray is ended, if a temperature detected by the temperature sensor is lower than a second reference temperature, a supply of liquid or a supply of a cooling power of the other tray is ended.

25. A refrigerator comprising:

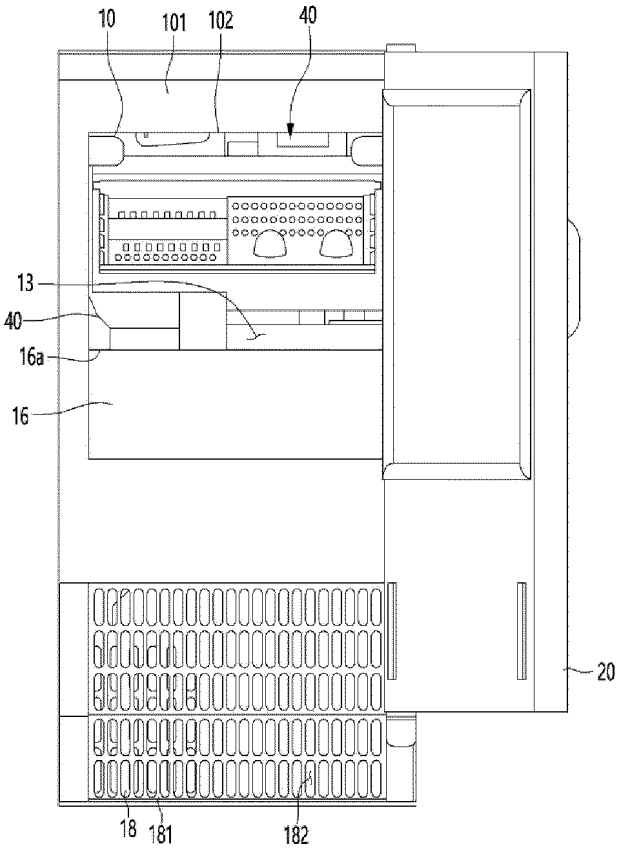
a cabinet having a storage chamber;

a door that opens and closes the storage chamber;
an ice making chamber provided in the door or the cabinet;
an ice maker provided in the ice making chamber and configured to generate ice;
a cooler configured to cool the ice maker;
a liquid supplier configured to supply liquid to the ice maker in an ice making process;
an ice separation assembly configured to separate ice from the ice maker in an ice separation process; and
a controller configured to control at least one of the cooler, the liquid supplier, or the ice separation assembly, wherein the ice maker comprises a first tray including a first ice making cell and a second tray including a second ice making cell, wherein the controller is configured to control an ice making of one tray of the first tray and the second tray to be delayed from an ice making of other tray of the first tray and the second tray.

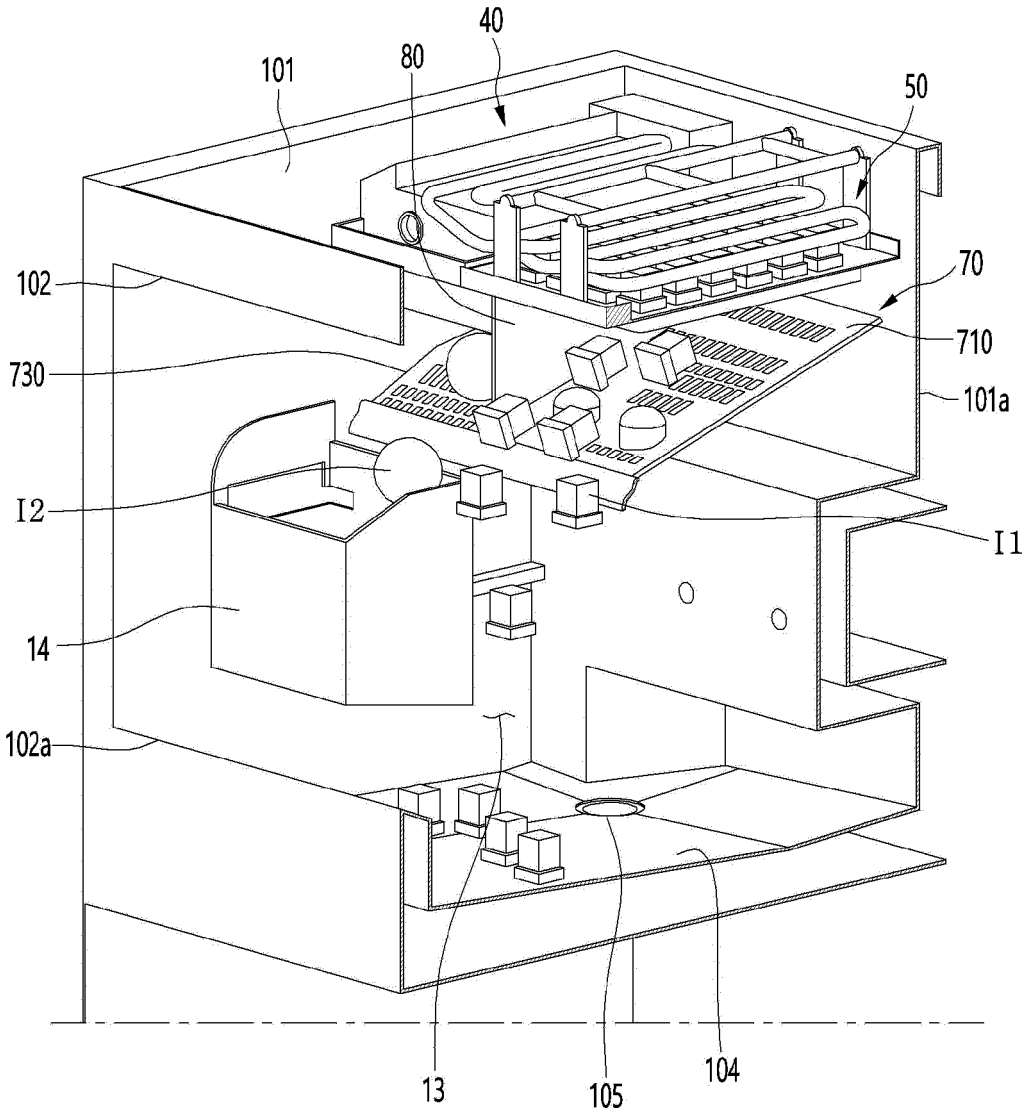
【Figure 1】



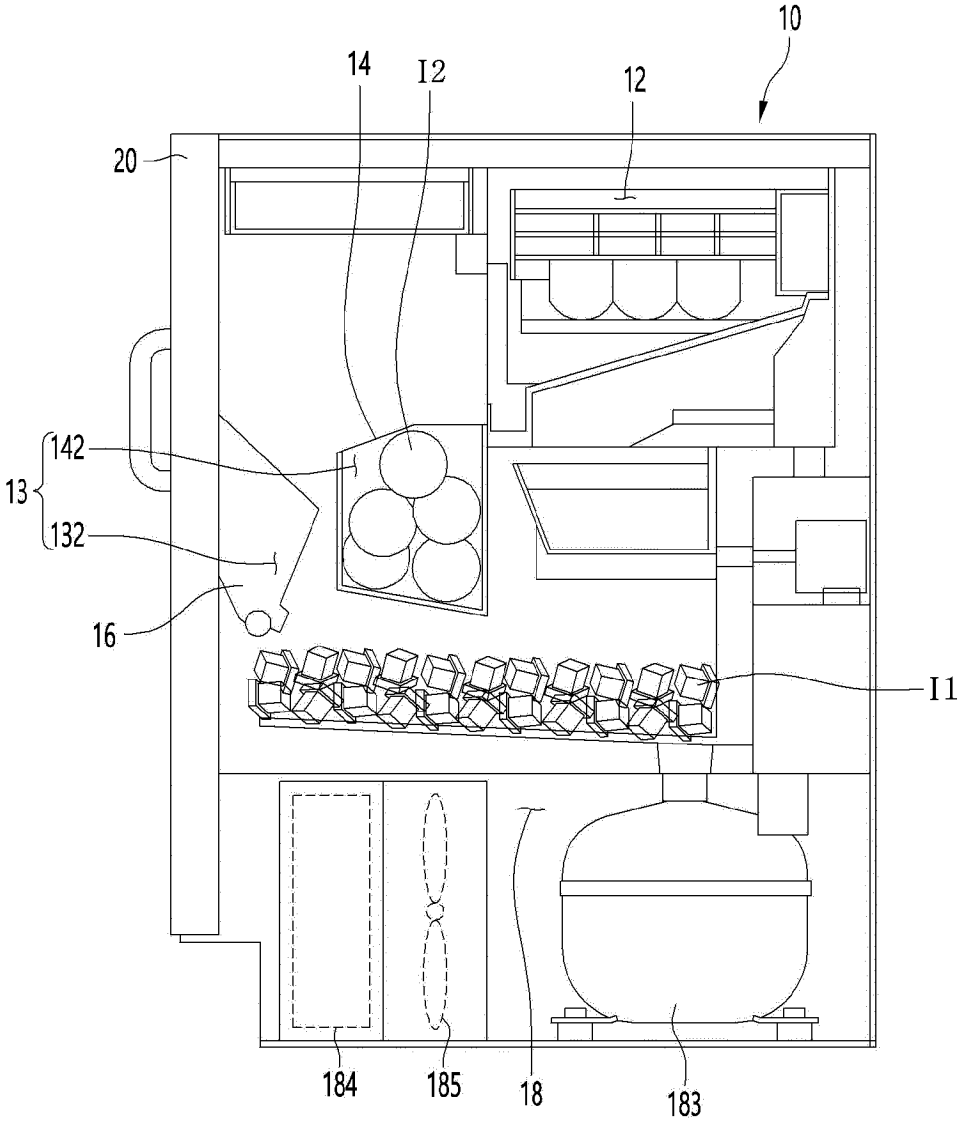
【Figure 2】



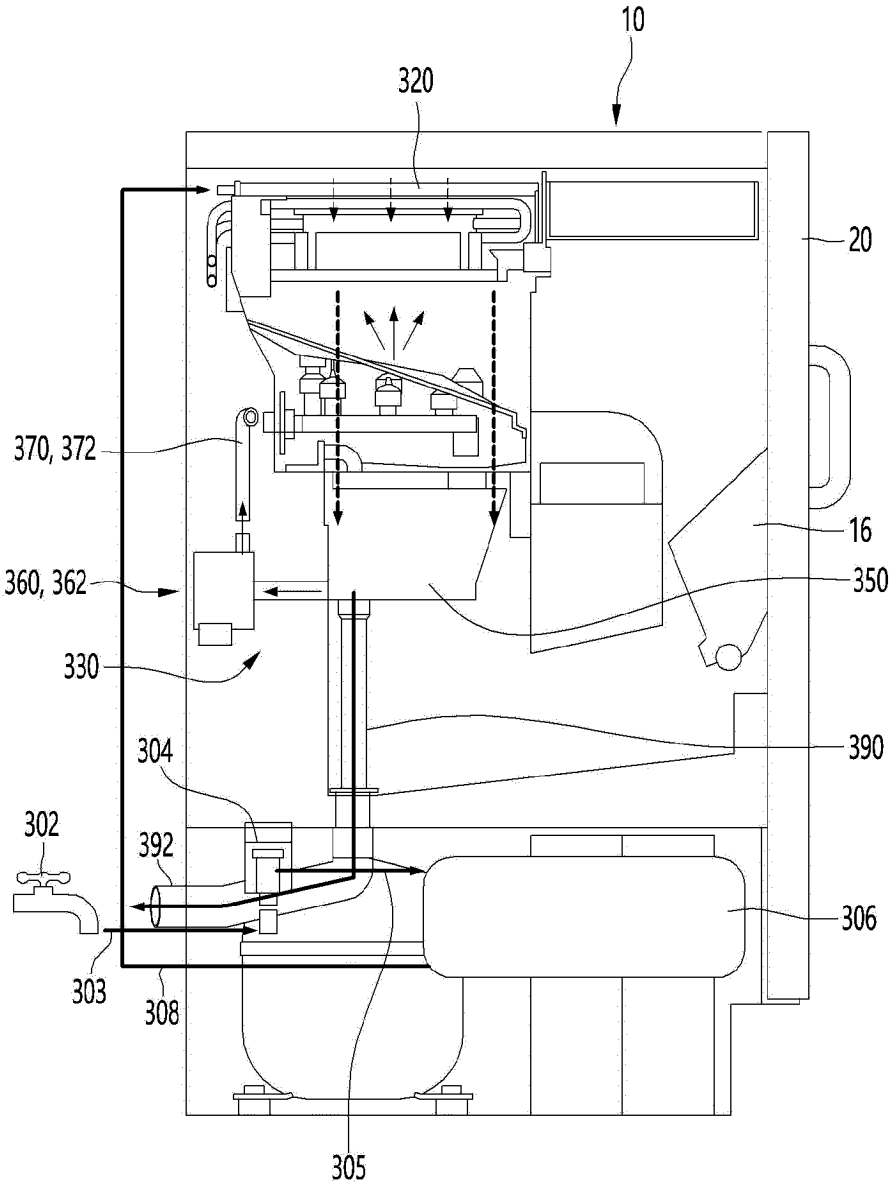
【Figure 3】



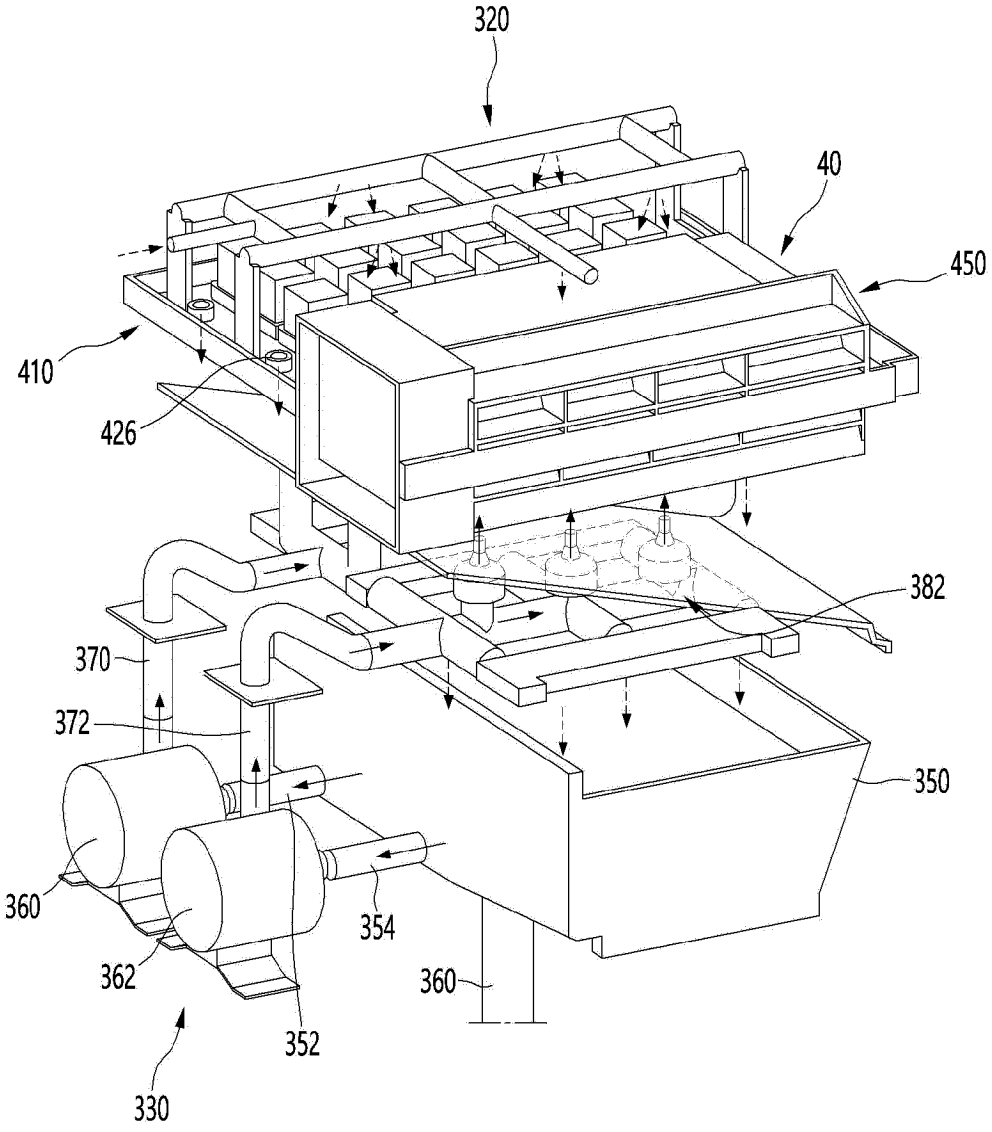
【Figure 4】



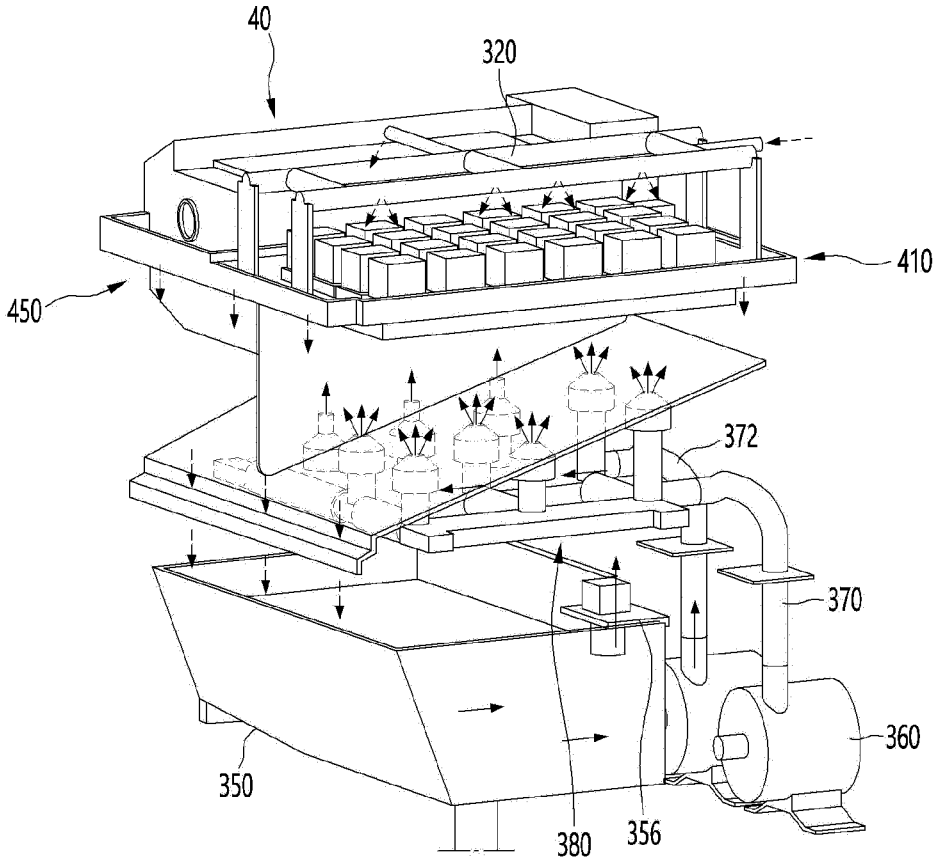
【Figure 5】


10
320
20
370, 372
16
360, 362
350
330
390
304
302
392
306
303
308
305

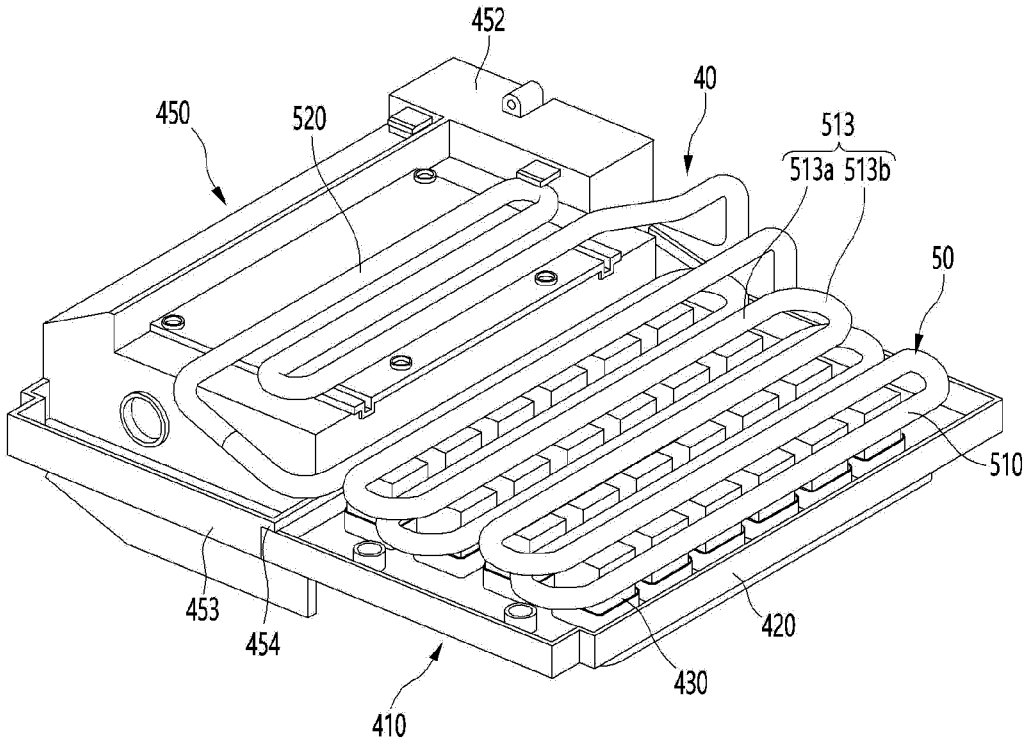
【Figure 6】



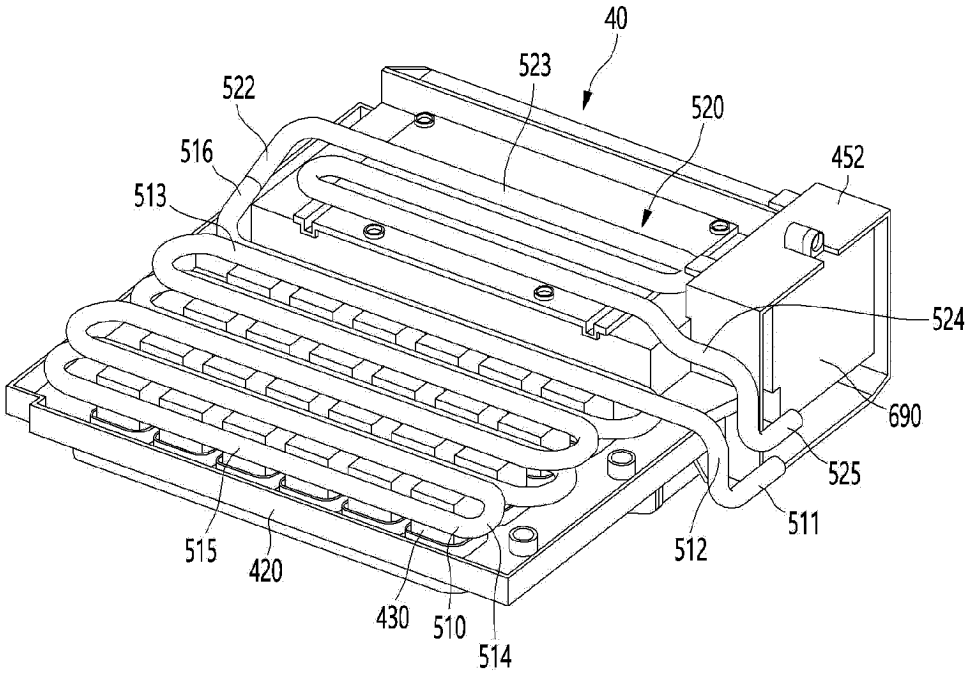
【Figure 7】



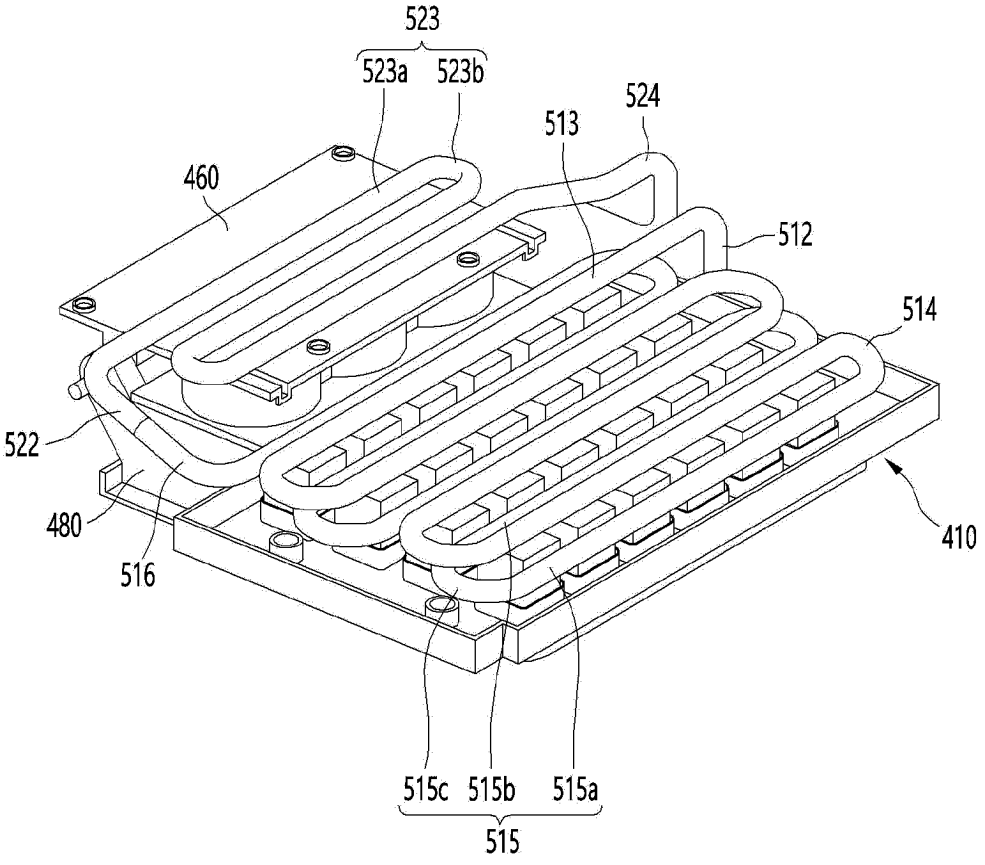
【Figure 8】



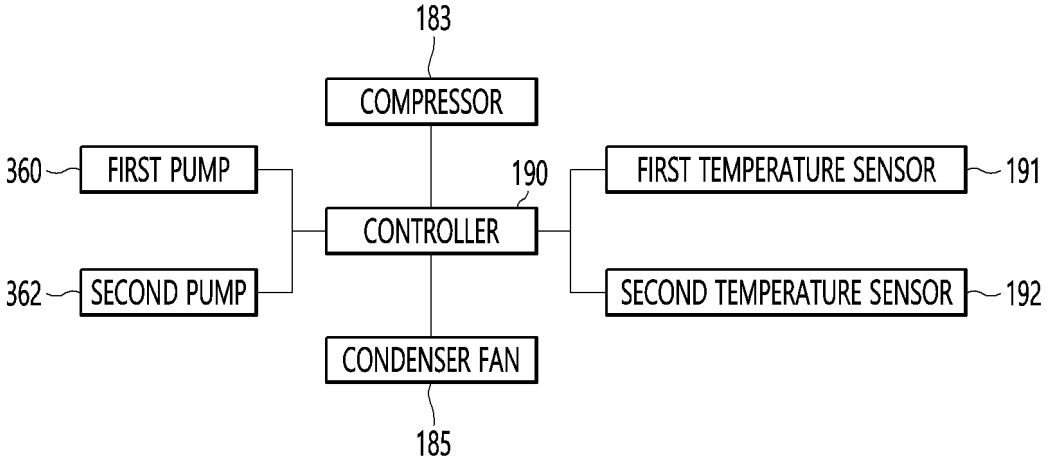
【Figure 9】



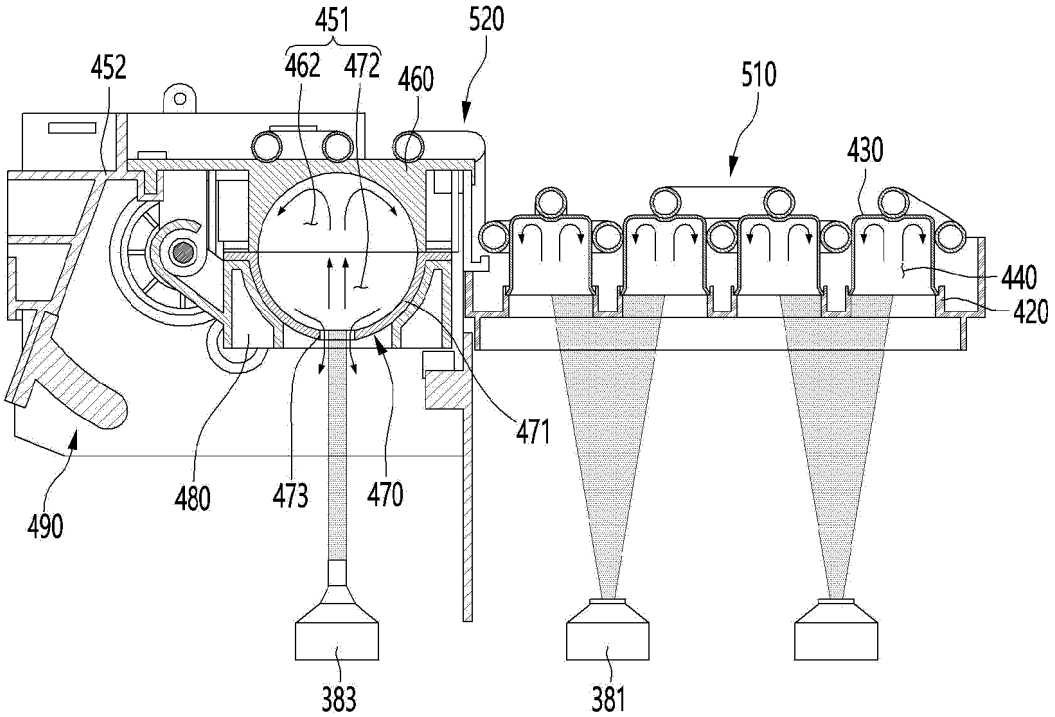
【Figure 10】



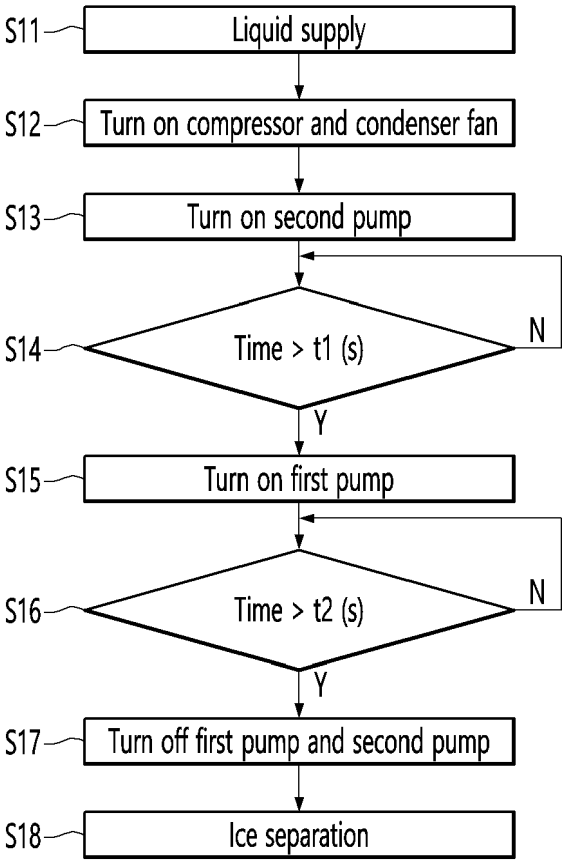
【Figure 11】



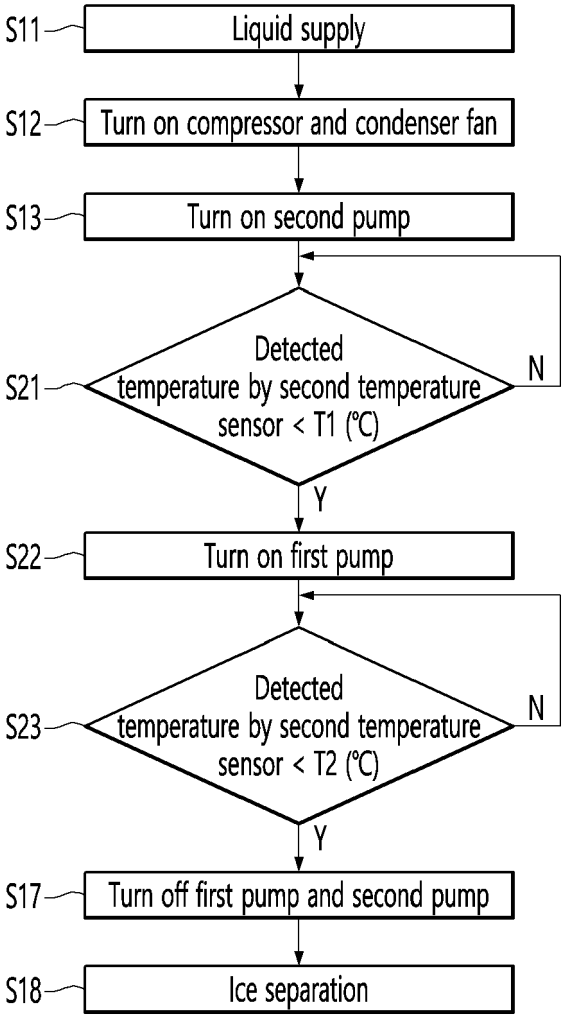
【Figure 12】



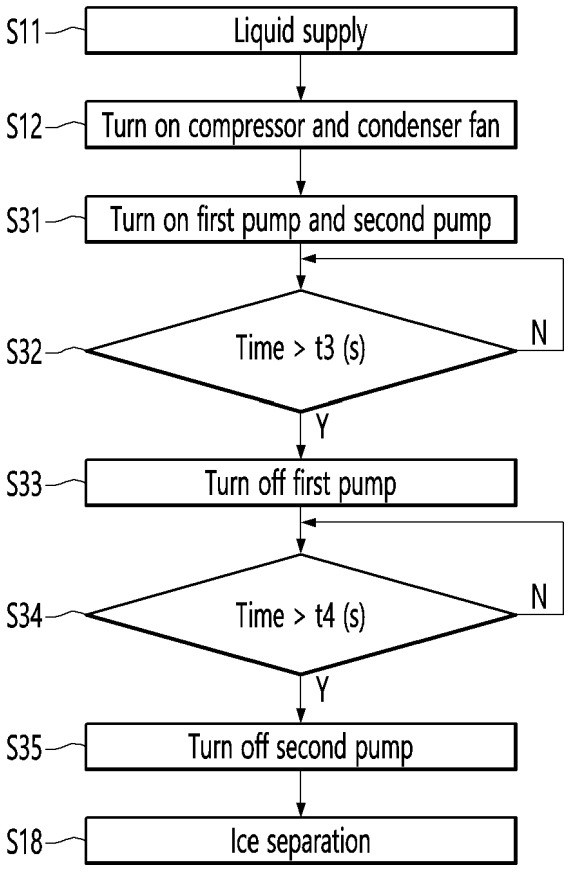
【Figure 13】


S11
Liquid supply
S12
Turn on compressor and condenser fan
S13
Turn on second pump
S14
Time > t1 (s)
N
Y
S15
Turn on first pump
S16
Time > t2 (s)
N
Y
S17
Turn off first pump and second pump
S18
Ice separation

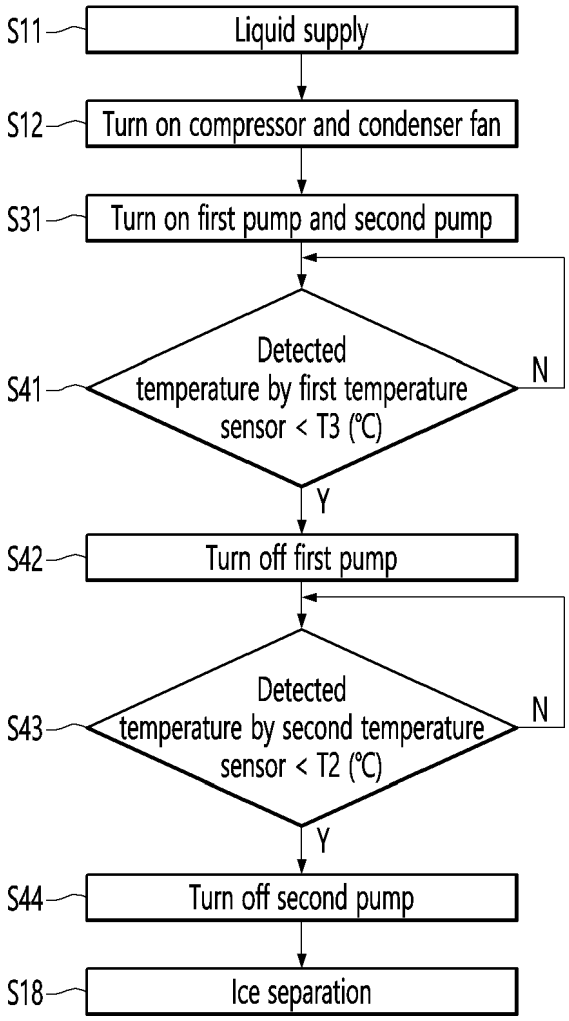
【Figure 14】


S11
Liquid supply
S12
Turn on compressor and condenser fan
S13
Turn on second pump
S21
Detected temperature by second temperature sensor < T1 (℃)
N
Y
S22
Turn on first pump
S23
Detected temperature by second temperature sensor < T2 (℃)
N
Y
S17
Turn off first pump and second pump
S18
Ice separation

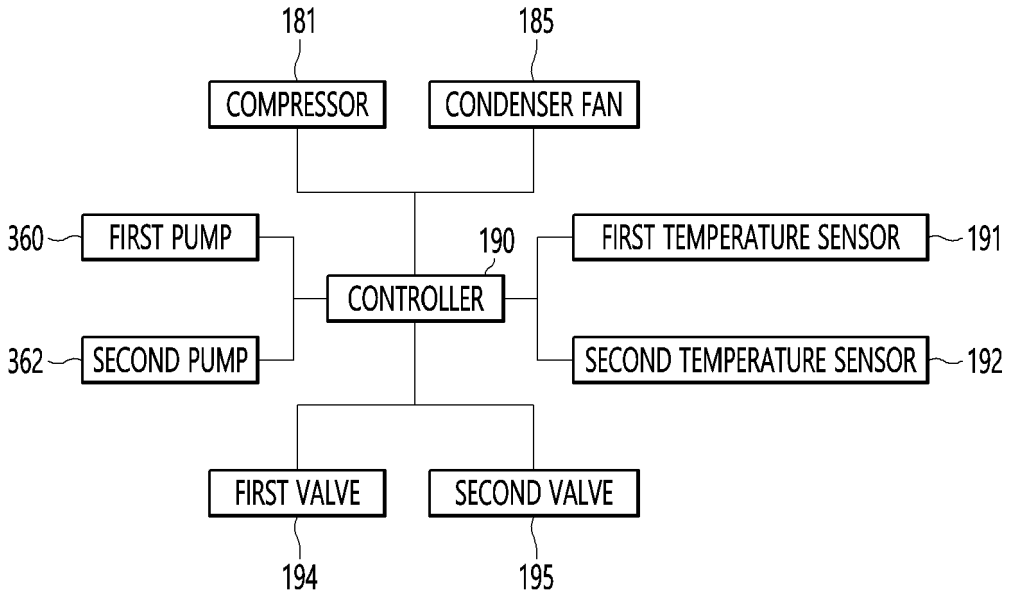
【Figure 15】


S11
Liquid supply
S12
Turn on compressor and condenser fan
S31
Turn on first pump and second pump
S32
Time > t3 (s)
N
Y
S33
Turn off first pump
S34
Time > t4 (s)
N
Y
S35
Turn off second pump
S18
Ice separation

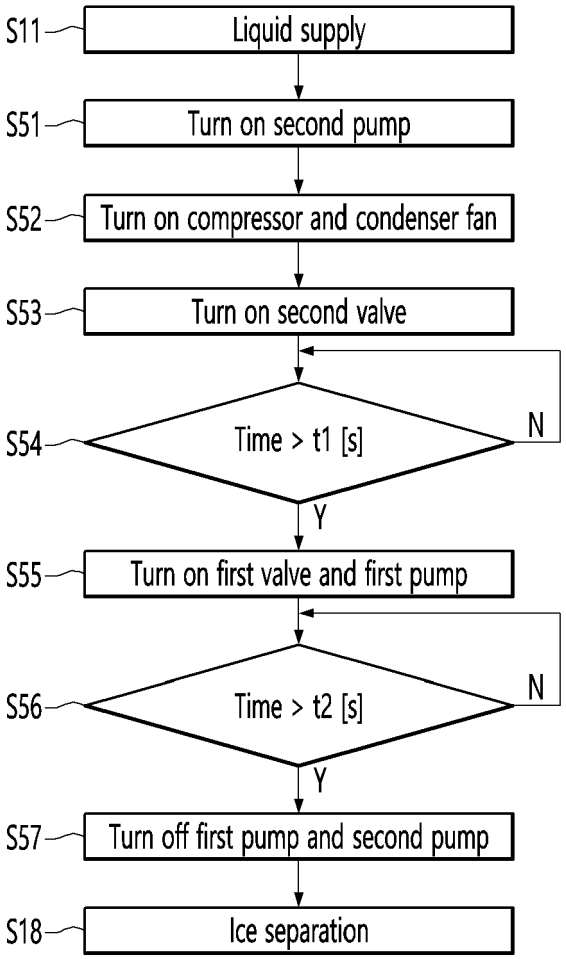
【Figure 16】


S11
Liquid supply
S12
Turn on compressor and condenser fan
S31
Turn on first pump and second pump
S41
Detected temperature by first temperature sensor < T3 (℃)
N
Y
S42
Turn off first pump
S43
Detected temperature by second temperature sensor < T2 (℃)
N
Y
S44
Turn off second pump
S18
Ice separation

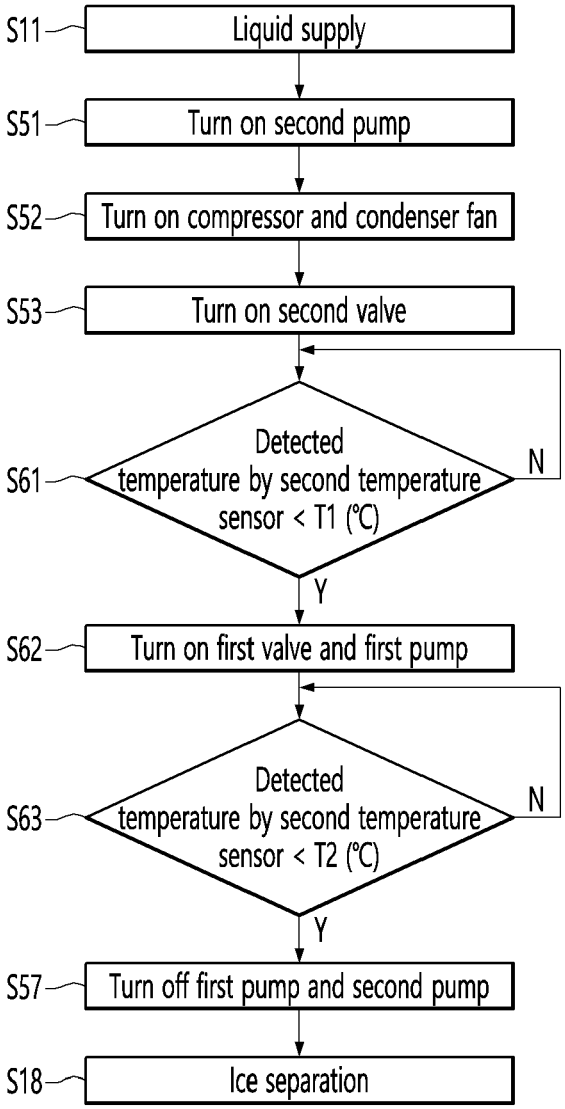
【Figure 17】



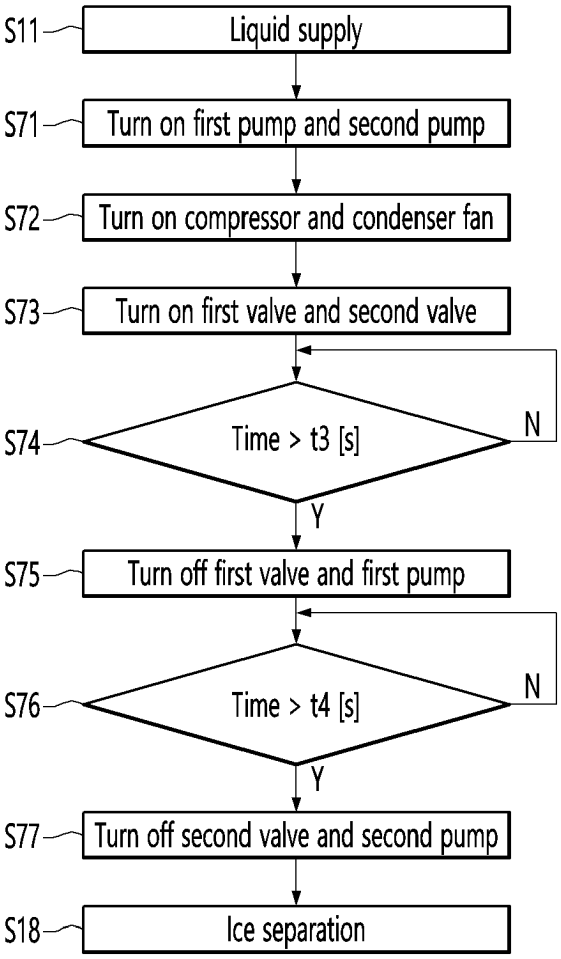
【Figure 18】



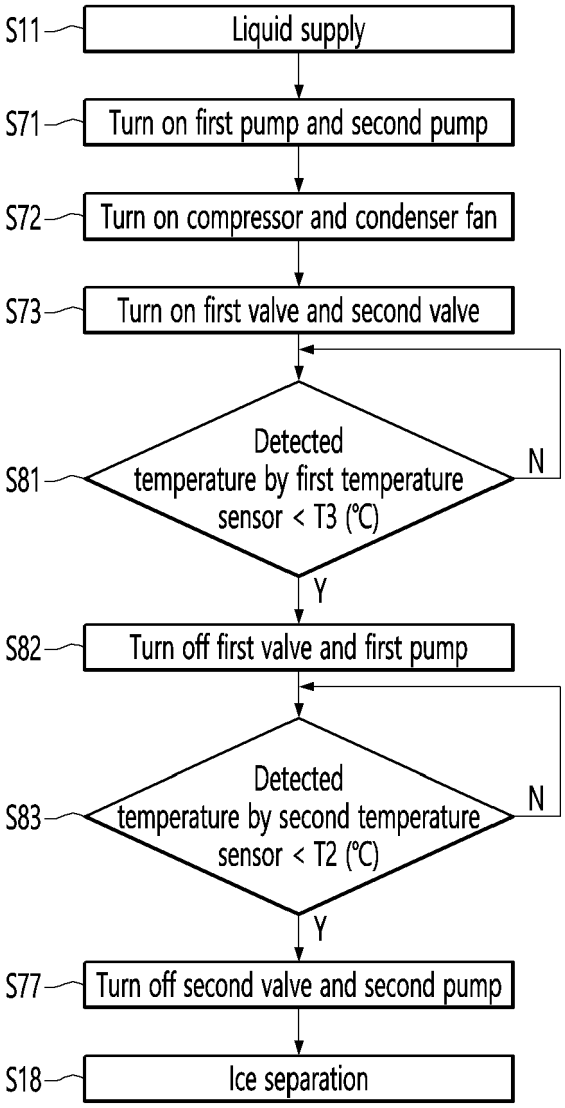
【Figure 19】


S11
Liquid supply
S51
Turn on second pump
S52
Turn on compressor and condenser fan
S53
Turn on second valve
S61
Detected temperature by second temperature sensor < T1 (℃)
N
Y
S62
Turn on first valve and first pump
S63
Detected temperature by second temperature sensor < T2 (℃)
N
Y
S57
Turn off first pump and second pump
S18
Ice separation

【Figure 20】


S11
Liquid supply
S71
Turn on first pump and second pump
S72
Turn on compressor and condenser fan
S73
Turn on first valve and second valve
S74
Time > t3 [s]
N
Y
S75
Turn off first valve and first pump
S76
Time > t4 [s]
N
Y
S77
Turn off second valve and second pump
S18
Ice separation

【Figure 21】


S11
Liquid supply
S71
Turn on first pump and second pump
S72
Turn on compressor and condenser fan
S73
Turn on first valve and second valve
S81
Detected temperature by first temperature sensor < T3 (℃)
N
Y
S82
Turn off first valve and first pump
S83
Detected temperature by second temperature sensor < T2 (℃)
N
Y
S77
Turn off second valve and second pump
S18
Ice separation

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2023/002716

A. CLASSIFICATION OF SUBJECT MATTER

F25C 1/24(2006.01)i; **F25C 1/25**(2018.01)i; **F25C 5/02**(2006.01)i; **F25D 23/04**(2006.01)i; **F25D 23/12**(2006.01)i; **F25D 29/00**(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F25C 1/24(2006.01); F25C 1/10(2006.01); F25C 5/00(2006.01); F25C 5/02(2006.01); F25C 5/18(2006.01); F25C 5/20(2018.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models: IPC as above
Japanese utility models and applications for utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & keywords: 제빙 유닛(ice making unit), 급수(water supply), 냉력(cold power), 트레이(tray), 센서(sensor), 지연(delay), 시간(time)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 10-2018-0080021 A (SAMSUNG ELECTRONICS CO., LTD.) 11 July 2018 (2018-07-11) See paragraphs [0013]-[0016], [0028]-[0029], [0034], [0044], [0053], [0065], [0080], [0083] and [0096] and figures 1 and 3-5.	1-3,12-20,25
Y		4-11,21-24
Y	JP 2007-212133 A (MATSUSHITA REFRIGERATION CO., LTD.) 23 August 2007 (2007-08-23) See paragraphs [0105]-[0106], [0119]-[0123] and [0144]-[0145], claim 3 and figures 1 and 5.	4-11,21-24
A	JP 2002-130883 A (MATSUSHITA REFRIGERATION CO., LTD.) 09 May 2002 (2002-05-09) See paragraphs [0043]-[0050] and figures 2-3.	1-25
A	KR 10-2021-0005799 A (LG ELECTRONICS INC.) 15 January 2021 (2021-01-15) See claim 1 and figure 7.	1-25

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"D" document cited by the applicant in the international application
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 May 2023	**26 May 2023**
Name and mailing address of the ISA/KR **Korean Intellectual Property Office** **Government Complex-Daejeon Building 4, 189 Cheongsa-ro, Seo-gu, Daejeon 35208** Facsimile No. **+82-42-481-8578**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2023/002716

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2018-0347880 A1 (SAMSUNG ELECTRONICS CO., LTD.) 06 December 2018 (2018-12-06) See paragraphs [0090]-[0094] and figures 4-8.	1-25

Form PCT/ISA/210 (second sheet) (July 2022)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2023/002716

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
KR 10-2018-0080021 A	11 July 2018	US 10928114 B2	23 February 2021
		US 2018-0187941 A1	05 July 2018
JP 2007-212133 A	23 August 2007	JP 4492633 B2	30 June 2010
JP 2002-130883 A	09 May 2002	JP 4590713 B2	01 December 2010
KR 10-2021-0005799 A	15 January 2021	AU 2019-352419 A1	27 May 2021
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