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(71) Applicant: **LG Electronics Inc.**
Seoul 150-721 (KR)

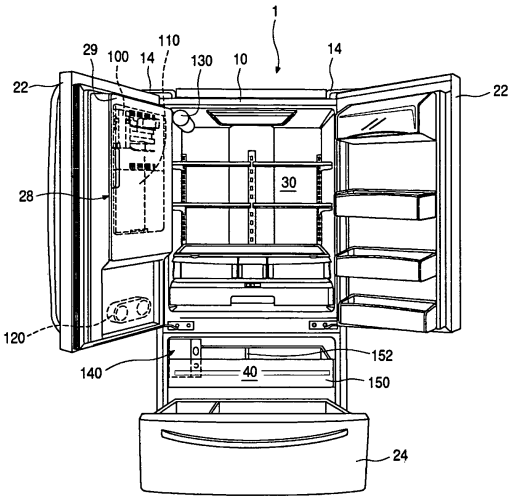
(72) Inventors:
- **KIM, Young-Nam**
  Changwon City
  Gyoungsangnam-do 641-711 (KR)
- **AN, Jong-Wook**
  Changwon City
  Gyoungsangnam-do 641-711 (KR)
- **YANG, Chang-Woan**
  Changwon City
  Gyoungsangnam-do 641-711 (KR)
- **KIM, Seong-Wook**
  Changwon City
  Gyoungsangnam-do 641-711 (KR)

(74) Representative: **Urner, Peter**
Patentanwälte
TER MEER-MÜLLER-STEINMEISTER & PARTNER
Mauerkircherstrasse 45
D-81679 München (DE)

(54) REFRIGERATOR

(57) A refrigerator includes: a cabinet formed with a plurality of storage spaces divided; a first ice maker provided in any one of the plurality of storage spaces; a dispenser provided to a door, through which ice made in the first ice maker is discharged; a second ice maker provided in the storage space different from the storage space where the first ice maker is provided; and a water feeding passage branched such that it is possible to selectively supply water to the first ice maker and the second ice maker from a water supply source.

FIG.2



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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a refrigerator.

BACKGROUND ART

[0002] Generally, a refrigerator is an apparatus for storing foods at a low temperature and is configured to keep foods and drinks frozen or refrigerated according to status of foods for storage.

[0003] An inside of the refrigerator is cooled by cooling-air supplied continuously, and the cooling-air is continuously generated by a heat exchange of refrigerant repeatedly performing a cycle of compression, condensation, expansion and evaporation. Cooling-air supplied to the inside of the refrigerator is uniformly transferred to the inside of the refrigerator by the convection of cooling-air to make it possible to store foods in the inside of the refrigerator at a desired temperature.

[0004] The refrigerator shows a trend toward a large size and mulfunctionality according to variety of user preference and change in dietary life and thus products having various configurations are being released on the market.

[0005] In particular, a refrigerator is provided therein with an ice maker for making ice so as to supply ice. The ice maker has various types according to operation method thereof, and may be installed at various positions of a refrigerator compartment or freezer compartment.

[0006] A refrigerator door is provided with a dispenser for discharging ice made in the ice maker such that a user may obtain ice more easily.

DISCLOSURE OF THE INVENTION

TECHNICAL PROBLEM

[0007] Embodiments provide a refrigerator provided with first and second ice makers disposed at different divided spaces in a cabinet and capable of discharging ice though a dispenser, and water supply passages branched so as to make it possible to supply water to the first and second ice makers, respectively.

[0008] Embodiments of the present invention provide a refrigerator provided with first and second ice makers disposed at different divided spaces in a cabinet and capable of discharging ice though a dispenser, and a controller capable of selectively controlling each of the first and second ice makers according to operation states of the first and second ice makers.

TECHNICAL SOLUTION

[0009] In one embodiment, a refrigerator includes: a cabinet formed with a plurality of storage spaces divided; a first ice maker provided in any one of the plurality of storage spaces; a dispenser provided to a door, through which ice made in the first ice maker is discharged; a second ice maker provided in the storage space different from the storage space where the first ice maker is provided; and a water feeding passage branched such that it is possible to selectively supply water to the first ice maker and the second ice maker from a water supply source.

[0010] In another embodiment, a refrigerator includes: a cabinet having a refrigerator compartment formed at an upper part thereof and a freezer compartment formed at a lower part thereof; a first ice maker provided in the refrigerator compartment; a dispenser provided to a refrigerator compartment door, through which ice made in the first ice maker is discharged; a second ice maker provided in the freezer compartment; an ice container which is provided in the freezer compartment to store ice made in the second ice maker and is accessible by an opening of a freezer compartment door; a water feeding passage branched such that water is supplied toward the first ice maker and the second ice maker, respectively; and a controller electrically connected to the first ice maker and the second ice maker to control operation of each of the first ice maker and the second ice maker.

[0011] In further another embodiment, a refrigerator includes: a cabinet formed with a refrigerator compartment and a freezer compartment; a first ice maker provided in a space for the refrigerator compartment; a dispenser provided to a refrigerator compartment door, through which ice made in the first ice maker is discharged; a second ice maker which is provided in the freezer compartment and is selectively accessible according to opening/closing of a freezer compartment door; a water feeding passage connected to a water supply source outside the refrigerator to supply water to the first ice maker, the second ice maker and the dispenser; and a branch means provided on the water feeding passage to distribute water supplied from the water supply source toward the first ice maker and the second ice maker.

[0012] In still further another embodiment, a refrigerator includes: a cabinet formed with a refrigerator compartment and a freezer compartment; a first ice maker provided in a space for the refrigerator compartment; a dispenser provided to a refrigerator compartment door, through which ice made in the first ice maker is discharged; a water feeding passage guiding water supply to the first ice maker from a water supply source outside the refrigerator; a second ice maker provided in the freezer compartment to make ice with water supplied by a user; and an ice container provided under the second ice maker, in which the ice made in the second ice maker is stored.

ADVANTAGEOUS EFFECTS

[0013] According to the embodiments, the first ice maker and the second ice maker are provided in the re-

spective storage spaces divided in the cabinet such that it is possible to discharge ice through the dispenser or to use ice through the ice container according to ice use environment of the user.

[0014] That is, when a user intends to use a small amount of ice easily, the ice made in the first ice maker is discharged through the dispenser, and when the user intends to use a large amount of ice or to continuously use ice, the ice made in the second ice maker is used through the ice container.

[0015] Therefore, it can be expected that the user can cope with various ice use environments to thus enhance use convenience.

[0016] Also, a controller capable of controlling each of the first ice maker, the second ice maker and the dispenser according to operation states of the first ice maker, the second ice maker and the dispenser is provided so that smooth water supply and effective cooling-air distribution become possible. Therefore, effects capable of enhancing ice making performance, cooling performance and power consumption efficiency can be expected.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

Fig. 1 is is a perspective view of a refrigerator according to an embodiment.

Fig. 2 is a front view of a refrigerator when a door of the refrigerator is opened according to an embodiment.

Fig. 3 is a partial perspective view of an inside of a freezer compartment according to an embodiment.

Fig. 4 is a cross-sectional view of a refrigerator compartment according to an embodiment.

Fig. 5 is a rear view of a refrigerator according to an embodiment.

Fig. 6 is a perspective view schematically illustrating a water feeding passage of a refrigerator according to an embodiment.

Fig. 7 is a block diagram illustrating water flow and control signal flow in a refrigerator according to an embodiment.

Fig. 8 is a block diagram illustrating water flow and control signal flow in a refrigerator according to another embodiment.

Fig. 9 is a front view of a refrigerator when a door of the refrigerator is opened according to another embodiment.

Fig. 10 is a perspective view schematically illustrating a water feeding passage of a refrigerator according to another embodiment.

Fig. 11 is a partial perspective view of a refrigerator of which a freezer compartment door is opened according to another embodiment.

MODE FOR CARRYING OUT THE INVENTION

[0018] Reference will now be made in detail to the embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings. The invention may, however, be embodied in many different forms and should not be construed as being limited to the embodiments set forth herein; rather, that alternate embodiments included in other retrogressive inventions or falling within the spirit and scope of the present disclosure will fully convey the concept of the invention to those skilled in the art.

[0019] While the embodiments describe examples of a bottom freeze type refrigerator for convenience of description and understanding, it will be understood that the present invention may be applied to other types of refrigerators provided with at least two divided storage spaces.

[0020] Fig. 1 is a perspective view of a refrigerator according to an embodiment and Fig. 2 is a front view of a refrigerator when a door of the refrigerator is opened according to an embodiment.

[0021] Referring to Figs. 1 and 2, a refrigerator 1 according to an embodiment is formed by a cabinet 10 provided therein with a storage space, and a door 20 selectively opening/closing an opened front surface of the storage space.

[0022] An inside of the cabinet 10 is divided into an upper compartment and a lower compartment by a barrier or an inner case 12 forming an inside of a storage space to form a refrigerator compartment 30 and a freezer compartment 40 at the upper compartment and the lower compartment, respectively.

[0023] The door 20 is hinge-coupled to the cabinet 10 and installed rotatably, and includes a pair of refrigerator compartment doors 22 selectively opening/closing the refrigerator compartment 30, and a freezer compartment door 24 installed to be opened and closed like a drawer to selectively open/close the freezer compartment 40.

[0024] The refrigerator compartment 30, the freezer compartment 40, the refrigerator compartment doors 22 and the freezer compartment door 24 are provided at insides thereof with accommodating members such as a plurality of shelves, drawers, baskets, etc. such that foods may be accommodated in each of the accommodating members inside the storage space.

[0025] Any one of one pair of the refrigerator compartment doors 22 is provided at a front side thereof with a dispenser 26. The dispenser 26 is configured such that the dispenser 26 may communicate with a first ice maker 100 to be described below and ice and/or drinking water may be discharged at an outside of the refrigerator by a user's manipulation.

[0026] Meanwhile, an ice making compartment 28 may be formed at a rear side of the refrigerator compartment door 22. The ice making compartment 28 is a space where the first ice maker 100 and an ice bank 110 for making and storing ice are accommodated, and may be

formed in an insulator space independent from the inside of the refrigerator compartment .

[0027] In detail, the ice making compartment 28 may be formed by a door liner forming the rear side of the refrigerator compartment door 22 and may be configured such that an inside of the ice making compartment 28 may be opened and closed by an ice making compartment door 29 installed to be openable and closable. An inner side of the ice making compartment 28 communicates with the dispenser 26 such that ice may be discharged through the dispenser 26.

[0028] A cooling-air duct for guiding cooling-air for ice making to the ice making compartment 26 may be provided at one-sided wall of the refrigerator compartment 30. The cooling-air duct may be configured such that the cooling-air duct communicates between the ice making compartment 28 and a heat exchange compartment 50 (see Fig. 4) provided with an evaporator and thus cooling-air may be supplied to the inside of the ice making compartment 28 to maintain subzero temperatures when the refrigerator compartment door 22 is closed.

[0029] Also, the ice making compartment 28 may be provided therein with the first ice maker 100. The first ice maker 100 is to make ice with water supplied through a water feeding passage 200 to be described below, and is configured to be supplied with a predetermined amount of water for ice making, cool the supplied water until the supplied water reaches a set time or set temperature to make ice, automatically separate the made ice and transfer the separated ice to the ice bank 110.

[0030] Also, the first ice maker 100 may be configured such that the first ice maker 100 may sense whether ice stored in the ice bank 110 exceeds a set amount and stop the ice making operation of the first ice maker 100.

[0031] The ice bank 110 is provided at an inside of the ice making compartment 28. The ice bank 110 is configured such that the ice bank 110 may be provided at a lower side of the first ice maker 100 to store ice transferred from the ice maker 100. The ice bank 110 may be configured such that the ice bank 110 may communicate with the dispenser 26 to supply the stored ice toward the dispenser 26 when the dispenser 26 is manipulated.

[0032] Also, the ice bank 110 may be provided therein with an auger which allows ices stored in the ice bank 110 not to stick to each other and to be smoothly transferred to the dispenser 26. In addition, the ice bank 110 may be further provided therein with a crusher crushing the stored ice for discharging pieces of ice.

[0033] A water tank 120 to be described below may be provided at an inner side of the refrigerator compartment door 22. The water tank 120 is to temporarily store water to be supplied to the dispenser 26, and may be provided at a lower side of the refrigerator compartment door 22.

[0034] A water filter 130 is provided at an inner upper surface of the refrigerator compartment 30. The water filter 30 is to filter water supplied toward the dispenser 26, and may be replaceably provided at an inner side of the refrigerator compartment 30.

[0035] Meanwhile, a second ice maker 140 is provided at an upper corner of the freezer compartment 40. The second ice maker 140 is to make ice with water flowing through and supplied from the water feeding passage 200, and may be disposed to be exposed at an inner side of the freezer compartment 40.

[0036] Fig. 3 is a partial perspective view of an inside of a freezer compartment according to an embodiment. Fig. 4 is a cross-sectional view of a freezer compartment taken along line A-A' of Fig. 3 according to an embodiment.

[0037] Referring to Figs. 3 and 4, the second ice maker 140 is to make ice with water supplied through the water feeding passage 200 to be described below, and is configured to be supplied with a predetermined amount of water for ice making, cool the supplied water until the supplied water reaches a set time or set temperature to make ice, automatically separate the made ice and transfer the separated ice to an ice container 150 to be described below.

[0038] Also, the second ice maker 140 may be configured such that the second ice maker 140 may sense whether ice stored in the ice container 150 exceeds a preset amount and stop the ice making operation of the second ice maker 140.

[0039] Meanwhile, a portion of an upper surface of the freezer compartment 40 corresponding to an upper direction of the second ice maker 140 is formed open, and the water feeding passage 200 and electrical wires 162 guided toward the second ice maker 140 through the opened portion are guided into the inner side of the freezer compartment 40.

[0040] A bracket 160 may be installed at the opened portion of the upper surface of the freezer compartment 40. The bracket 160 is formed in a shape corresponding to the opened portion of the upper surface of the freezer compartment so as to shield the opened portion of the upper surface of the freezer compartment. Also, the water feeding passage 200 and the electrical wires 162 penetrate the bracket 160 and are guided toward the second ice maker 140, and the second ice maker 140 may be installed fixedly to the bracket 160.

[0041] The water feeding passage 200 and the electrical wires 162 which are guided toward the second ice maker 140 through the bracket 160 may be exposed to the outside through a passage connecting part 70 formed at the rear surface of the cabinet 10, and may be connected to another water feeding passage 200 and electrical wires 162 at the passage connecting part 70.

[0042] The bracket 160 and the second ice maker 140 are connected to each other by an ice maker holder 170. The ice maker holder 170 is to allow the second ice maker 140 to be installed fixedly to the bracket 160, and is formed such that the second ice maker 140 may be installed spaced from an inner wall of the freezer compartment 40 and the bracket 160.

[0043] Meanwhile, a cooling-air duct 180 for ice making, which communicates with the heat exchange com-

partment 50 provided with the evaporator, may be provided at a sidewall of the freezer compartment 40. A cooling-air discharge hole 182 to which an end portion of the cooling-air duct 180 for ice making is exposed is provided at a sidewall of the freezer compartment 40 adjacent to the second ice maker 140.

[0044] The cooling-air discharge hole 182 is provided for ice making of the second ice maker 140, separately from a main discharge hole 42 provided at the rear wall surface of the freezer compartment 40. Cooling air discharged through the cooling-air discharge hole 182 is directed toward the second ice maker 140 so that ice may be made more rapidly in the inside of the freezer compartment 40.

[0045] The ice container 150 is provided at an inner side of the freezer compartment 40 corresponding to a lower direction of the second ice maker 140. The ice container 150 is a place where ice made in the second ice maker 140 is stored, and may be formed in a typical drawer shape.

[0046] The ice container 150 may be provided to be opened and closed by a rail member provided at the freezer compartment 40, and an inside of the ice container 150 may be divided by a divider 152. The divider 152 may be configured to be movable in the left and right directions such that ice is stored in a portion of the ice container 150 and foods are stored in another portion of the ice container 150.

[0047] The ice container 150 may be formed with a width corresponding to an inner lateral length of the freezer compartment 40, and if necessary, a separate drawer for storage of foods may be provided inside the freezer compartment 40, separately from the ice container 150.

[0048] Fig. 5 is a rear view of a refrigerator according to an embodiment and Fig. 6 is a perspective view schematically illustrating a water feeding passage of a refrigerator according to an embodiment.

[0049] Referring to Figs. 5 and 6, the first ice maker 100, the second ice maker 140 and the dispenser 26 are connected to a water supply source 60 such as a faucet by the water feeding passage 200 shaped in a tube, and are supplied with water for ice making and drinking from the water supply source 60.

[0050] The water feeding passage 200 is configured to include a main passage 210, a first branch passage 220 and a second branch passage 230. The main passage 210, the first branch passage 220 and the second branch passage 230 may be connected to a branch means 240 and thus may communicate with one another.

[0051] In detail, the main passage 210 connects the water supply source 60 such as a faucet to the branch means 240 such that water of the water supply source 60 reaches the refrigerator 1 primarily. An end portion of the main passage 210 may be connected to the branch means 240 at the passage connecting part 70 disposed at the rear surface of the cabinet 10.

[0052] Therefore, when the refrigerator 1 is installed, the main passage 210 may be connected to the branch means 240 at an opened portion of the passage connecting part 70 so that a connecting work between the refrigerator 1 and the water supply source 60 may be performed more easily.

[0053] The first branch passage 220 is formed to extend from the branch means 240 toward the refrigerator compartment door 22 such that water branched from the branch means 240 may be guided to the first ice maker 100 and the dispenser 26 of the refrigerator compartment door 22. The water filter 130 provided in the refrigerator compartment 30 is connected to the first branch passage 220 to filter water flowing through the first branch passage 220.

[0054] The first branch passage 220 is connected to the branch means 240 at the passage connecting part 70, and the first branch passage 220 extends upward along the rear wall of the cabinet 10 and then is inserted into an inside of the cabinet 10 to communicate with the water filter 130.

[0055] The first branch passage 220 extending from the water filter 130 extends along an upper wall of the cabinet 10 and then is guided into the inside of the refrigerator compartment door 22 through a door hinge 14 of the refrigerator compartment door 22.

[0056] The first branch passage 220 guided into the inside of the refrigerator compartment door 22 is again branched into an ice maker-sided passage 222 and a dispenser-sided passage 224 by a first valve 250 at the inside of the refrigerator compartment door 22.

[0057] The first valve 250 is provided to supply water supplied from the first branch passage 220 to the first ice maker 100 and the dispenser 26, respectively, and is configured such that an operation thereof is controlled by a first ice maker controller 310 and a dispenser controller 330 which will be described below.

[0058] The water tank 120 where supplied water is temporarily stored is provided on the dispenser-sided passage 224 extending from the first valve 250 toward the dispenser 26. Therefore, although the flow rate of the first branch passage 220 decreases while the dispenser 26 operates, it becomes possible to drain a set amount of water from the dispenser 26.

[0059] The ice maker-sided passage 222 may extend to the first ice maker 100 to supply water for ice making to the first ice maker 100 according to an operation of the first ice maker 100.

[0060] Meanwhile, the second branch passage 230 is connected to the branch means 240 at the passage connecting part 70. The second branch passage 230, i.e., the water feeding passage 200 illustrated in Fig. 4, may be guided into the inside of a dividing wall dividing the cabinet 10 into the refrigerator compartment 30 and the freezer compartment 40, penetrate the bracket 160 and extend toward the inside of the freezer compartment. An end portion of the second branch passage 230 extending toward the inside of the freezer compartment 40 may be directed toward the second ice maker 140.

[0061] At this time, the dividing wall is a space formed

by an inner case 12 forming the refrigerator compartment 30 and the freezer compartment 40, and a barrier premolded of insulator may be inserted into an inside of the dividing wall or the inside of the dividing wall may be filled with insulator by injecting a foaming solution.

[0062] A second valve 260 may be connected to the second branch passage 230. The second valve 260 may be configured to be controlled by the second ice maker controller 320 to be described below and to thus selectively supply water to the second ice maker 140.

[0063] Meanwhile, the branch means 240 is disposed at the passage connecting part 70 formed at the rear surface of the cabinet 10. The branch means 240 may be formed in a branched tube shape such that water supplied from the water supply source 60 may be supplied to the first branch passage 220 and the second branch passage 230, respectively.

[0064] In the branch means 240, a portion into which the first branch passage 220 is inserted and a portion into which the second branch passage 230 is inserted are different in inner diameter. Therefore, in connecting the branch means 240 to the water feeding passage 200 at the passage connecting part 70, it can be prevented that the first branch passage 220 and the second passage 240 are erroneously assembled.

[0065] For example, one end of the branch means 240 connected to the first branch passage 220 is formed with an inner diameter of 5/16 inches, and another end of the branch means 240 connected to the second branch passage 230 is formed with an inner diameter of 1/4 inches such that the inner diameter of one end of the branch means 240 connected to the first branch passage 220 is larger than that of the other end of the branch means 240 connected to the first branch passage 220. An inner diameter D1 of another end of the branch means 240 connected to the main passage 210 may be the same as an inner diameter D3 of the second branch passage 230.

[0066] Therefore, compared with the second ice maker 140 side, more amount of water may be supplied toward the first ice maker 100 and the dispenser 26, and although water is simultaneously supplied to the first ice maker 100 and the dispenser 26, stable water supply becomes possible.

[0067] Meanwhile, the branch means 240 may be a 3-way valve of which operation is controlled by the first ice maker controller 310, the second ice maker controller 320, or the dispenser controller 330 which will be described below.

[0068] The branch means 240 is connected to the main passage 210, the first branch passage 220 and the second branch passage 230 at the outside of the refrigerator and then is disposed in the passage connecting part 70, and the electrical wires 162 connected to the second ice maker 140 may be connected to an external power in the passage connecting part 70. The passage connecting part 70 is shielded by a connecting part cover 72.

[0069] Fig. 7 is a block diagram illustrating water flow and control signal flow in a refrigerator according to an embodiment.

[0070] Referring to Fig. 7, the first ice maker controller 310, the second ice maker controller 320, and the dispenser controller 330 are provided in the first ice maker 100, the second ice maker 140, and the dispenser 26, respectively.

[0071] In detail, the first ice maker controller 310 is to control operation of the first ice maker 100, and is provided at one-sided portion adjacent to the first ice maker 100 and is electrically connected to the first ice maker 100. The first ice maker controller 310 is also electrically connected to the first valve 250 to control operation of the first valve 250 provided on the first branch passage 220.

[0072] The dispenser controller 330 is to control operation of the dispenser 26, is provided at one-sided portion adjacent to the dispenser 26 and is electrically connected to the dispenser 26. The dispenser controller 330 is also electrically connected to the first valve to control operation of the first valve 250.

[0073] Meanwhile, both of the first ice maker controller 310 and the dispenser controller 330 may be disposed at an inside of the refrigerator compartment door 22, may be formed in a single module if necessary, and may be configured to control all of the first ice maker 100, the dispenser 26 and the first valve 25.

[0074] The second ice maker controller 320 is to control operation of the second ice maker 140, is provided at one-sided portion adjacent to the second ice maker 140 and is electrically connected to the second ice maker 140. The second ice maker controller 320 is also electrically connected to the second valve 260 to control operation of the second valve 260 provided on the second branch passage 230.

[0075] Meanwhile, the first ice maker controller 320, the dispenser controller 330 and the second ice maker controller 320 may be configured to communicate with one another. The first ice maker controller 320, the dispenser controller 330 and the second ice maker controller 320 may exchange operation information of the first ice maker 100, the second ice maker 140 and the dispenser 26 through a wireless communication, and may determine operations of the first ice maker 100, the second ice maker 140 and the dispenser 26 and operations of elements related to these operations through the exchange of the operation information.

[0076] Of course, the first ice maker controller 320, the dispenser controller 330 and the second ice maker controller 320 may be connected by a wiring, and may be connected to one another by extending the electrical wires 162 connected to each of the first ice maker controller 320, the dispenser controller 330 and the second ice maker controller 320 to the passage connecting part 70 or one-sided portion of the refrigerator 1.

[0077] The first ice maker controller 310 and the second ice maker controller 320 may control to preferentially operate any one of the first ice maker 100 and the second ice maker 140 after receiving operation information from

the first ice maker 100 and the second ice maker 140, respectively according to operation state of the first ice maker 100 and the second ice maker 140.

[0078] The first ice maker controller 310 and the second ice maker controller 320 may control water supply to the first ice maker 100 and the second ice maker 140 by controlling operations of the first valve 250 and the second valve 260.

[0079] At this time, the first ice maker controller 310 and the second ice maker controller 320 may determine to give an order of priority operation to the ice maker first starting to operate, and if necessary, may determine to give an order of priority operation to the ice maker inputted by a user's manipulation.

[0080] Of course, when it is determined that supply amount of water is sufficient, all of the first ice maker 100 and the second ice maker 140 may operate and the first valve 250 and the second valve 260 may be controlled to supply water to all of the first ice maker 100 and the second ice maker 140.

[0081] Meanwhile, the first ice maker controller 310 and the second ice maker controller 320 may control to give an order of priority operation such that after any one of the first ice maker 100 and the second ice maker 140 operates until ice is stored in the ice bank 110 or the ice container 150 by a set amount, the other ice maker operates.

[0082] At this time, the first ice maker 100 and the second ice maker 140 may be controlled such that since the ice made in the first ice maker 100 is drawn out to the dispenser 26 by a small amount and use frequency of the first ice maker 100 is high, the first ice maker 100 operates preferentially ahead of the second ice maker 140, and since the ice made in the second ice maker 140 is scooped out from the ice container 150 by a large amount for use but use frequency of the second ice maker 140 is low, the second ice maker 140 operates after full ice making of the ice bank 110 is sensed.

[0083] When the first ice maker 100 operates again, operation of the second ice maker 140 stops and water supply toward the second ice maker 140 stops too. When full ice making is again sensed in the ice bank 110 and operation of the first ice maker 100 stops, the second ice maker 140 may be controlled to operate again.

[0084] Of course, if necessary, the second ice maker 140 may be controlled to operate preferentially, and when the ice container 150 is full with ice, the first ice maker 100 may be controlled to operate.

[0085] Meanwhile, the first ice maker controller 310 and the second ice maker controller 320 may control operations of the first ice maker 100 and the second ice maker 140, respectively according to whether or not the dispenser 26 operates.

[0086] Thus, cooling efficiency drop of the refrigerator compartment or freezer compartment can be prevented and flow rate of water supplied may be maintained constantly by controlling operations of the first ice maker 100, the second ice maker 140, the dispenser 26 and the valves according to the operation state of the first ice maker 100, the second ice maker 140 and the dispenser 26.

[0087] Hereinafter, operation of a refrigerator having the foregoing configuration according to an embodiment will be described with reference to Figs. 1 to 7.

[0088] To supply water to the refrigerator 1, the first branch passage 220, the second branch passage 230 and the main passage 210 are first respectively connected to the branch means 240 disposed in the passage connecting part 70. Next, the main passage 210 is connected to the water supply source 60 such that water of the water supply source 60 may be supplied to the first ice maker 100, the second ice maker 140 and the dispenser 26, respectively.

[0089] In the case where an external power is connected to the passage connecting part 70 or the electrical wire 162 needing to be connected to another electrical wire is disposed, the electrical wire 162 is connected and then the passage connecting part 70 is shielded by the connecting part cover 72.

[0090] Under the above condition, when power is applied, a cooling cycle of the refrigerator operates to cool the refrigerator compartment 30, the freezer compartment 40 and the ice making compartment 28.

[0091] Meanwhile, the first ice maker 100 and the second ice maker 140 are driven by the first ice maker controller 310 and the second ice maker controller 320 according to the order of priority set.

[0092] The order of priority operation of the first ice maker 100 and the second ice maker 140 may be set by a user's external input, and may be controlled such that any one of the first ice maker 100 and the second ice maker 140 may be first driven and then the other may be driven.

[0093] At this time, the first ice maker controller 310 and the second ice maker controller 320 may exchange operation state information with each other to thus control the operation of the first ice maker 100 and the second ice maker 140.

[0094] In detail, water, which flows through the main passage 210 according to an instruction of the first ice maker controller 310 and is supplied through the first branch passage 220, is supplied to the first ice maker 100 along the dispenser-sided passage 224 at the first valve 250.

[0095] When the water supply to the first ice maker 100 is completed, the first ice maker 100 is driven by an instruction of the first ice maker controller 310 so that a concentrative supply of cooling-air toward the first ice maker 100 is performed. After the first ice maker 100 is driven, when it reaches a set time or the temperature of the first ice maker 100 reaches a set temperature, ice making is completed.

[0096] After the ice making is completed, ice is transferred from the first ice maker 100 to the ice bank 110 by an ejector and is stored in the ice bank 110, and then water supply and operation of the first ice maker 100 for

ice making start again.

[0097] The first ice maker 100 stops operation thereof when ice is stored in the ice bank 110 by a set amount. Under the above condition, the state information of the first ice maker 100 is transmitted to the second ice maker controller 320 through the first ice maker controller 310.

[0098] In a state that ice is stored in the ice bank 110, a user may obtain ice by manipulating the dispenser 26 so as to use a small amount of ice easily. That is, the ice stored in the ice bank 110 may be discharged outside the refrigerator through the dispenser 26 by manipulating the dispenser 26.

[0099] Meanwhile, after receiving the operation state information of the first ice maker 100 from the first ice maker controller 310, the second ice maker 140 may determine whether or not to drive the second ice maker 140.

[0100] Water, which flows through the main passage 210 according to an instruction of the second ice maker controller 320 and is supplied through the second branch passage 230, is supplied to the second ice maker 140 along the ice maker-sided passage 222 at the first valve 260.

[0101] When the water supply to the second ice maker 140 is completed, the second ice maker 140 is driven by an instruction of the second ice maker controller 320 so that a concentrative supply of cooling-air toward the second ice maker 140 is performed. After the second ice maker 140 is driven, when it reaches a set time or the temperature of the second ice maker 140 reaches a set temperature, ice making is completed.

[0102] After the ice making is completed, ice is transferred from the second ice maker 140 to the ice container 150 by an ejector and is stored in the ice container 150, and then water supply and operation of the second ice maker 140 for ice making start again.

[0103] The second ice maker 140 stops operation thereof when ice is stored in the ice container 150 by a set amount. Under the above condition, the state information of the first ice maker 100 is transmitted to the first ice maker controller 310 through the second ice maker controller 320.

[0104] When ice is stored in the ice container 150, a user may open the freezer compartment door 24, pull open the ice container 150 and scoop out a required amount of ice for use.

[0105] Meanwhile, if the dispenser 26 is manipulated for draining drinking water, water which flows through the main passage 210 and is supplied through the first branch passage 220 is supplied along the dispenser-sided passage 224 so that a user may drain drinking water from the dispenser 26. At this time, operation information of the dispenser 26 may be also transmitted to the first ice maker controller 310 and the second ice maker controller 320.

[0106] The refrigerator according to the present disclosure may have various embodiments besides the foregoing embodiment, and hereinafter, a refrigerator according to another embodiment will be described with reference to the accompanying drawings.

[0107] Fig. 8 is a block diagram illustrating water flow and control signal flow in a refrigerator according to another embodiment.

[0108] Another embodiment is **characterized in that** a single controller 300 may control the first ice maker 100, the second ice maker 140 and the dispenser 26, and detailed description on the same constitution as that in the foregoing embodiment among the embodiments of the present invention will be omitted and like reference numerals refer to like elements throughout.

[0109] Referring to Fig. 8, a water feeding passage 200 according to another embodiment includes a main passage 210, a first branch passage 220 and a second branch passage 230. The main passage 210, the first branch passage 220 and the second branch passage 230 are connected by a branch means 240 so as to communicate with one another, and are configured to supply water to the first ice maker 100, the dispenser 26 and the second ice maker 140, respectively.

[0110] In detail, the main passage 210 connects the water supply source 60 and the branch means 240 to each other such that water may be supplied from the water supply source 60 to an inside of the refrigerator 1 through the main passage 210.

[0111] The first branch passage 220 is configured to connect the branch means 240 to the first ice maker 100 and the dispenser 26. The water filter 130, the water tank 120 and the first valve 250 are connected to the first branch passage 220, and the first branch passage 220 is configured to be respectively branched into the ice maker-sided passage 252 and the dispenser-sided passage 254 by the first valve 250 and to supply water to the first ice maker 100 and the dispenser 26, respectively.

[0112] The second branch passage 230 connects the branch means 240 and the second ice maker 140 to each other, and may be configured to selectively supply water to the second ice maker 140 by the second valve 260.

[0113] Meanwhile, the first ice maker 100, the second ice maker 140, the dispenser 26, the first valve 250 and the second valve 260 are all connected to a single controller 300. The controller 300 may receive operation state of each element to control operations of the first ice maker 100, the second ice maker 140, the first valve 250 and the second valve 260.

[0114] The controller 300 determines the order of priority operation with respect to the first ice maker 100 and the second ice maker 140 according to operation information of the first ice maker 100 and the second ice maker 140 to operate the first ice maker 100 and the second ice maker 140.

[0115] The controller 300 may be provided in the refrigerator compartment door 22 and may be configured to control other electric components provided on an upper surface of the cabinet 10 to constitute a cooling cycle together.

[0116] Meanwhile, since the determination on the order of priority operation of the first ice maker 100 and the

second ice maker 140 and the operation for taking ice out are the same as those in the foregoing embodiment, detailed description thereof will be omitted.

[0117] The refrigerator according to the present disclosure may have various embodiments besides the foregoing embodiments, and hereinafter, a refrigerator according to another embodiment will be described with reference to the accompanying drawings.

[0118] Fig. 9 is a front view of a refrigerator of which a door is opened according to an embodiment and Fig. 10 is a perspective view schematically illustrating a water feeding passage of a refrigerator according to another embodiment.

[0119] Another embodiment is **characterized in that** a first ice maker is positioned inside the refrigerator and a water feeding passage is designed according to position change of the first ice maker. With respect to the same elements as those in the foregoing embodiment, detailed description thereof will be omitted and like reference numerals refer to like elements throughout.

[0120] Referring to Figs. 9 and 10, a refrigerator 1 according to another embodiment may have an appearance formed by a cabinet 10 and a door 20. An inside of the cabinet 10 is divided into an upper portion and a lower portion defining a refrigerator compartment 30 and a freezer compartment 40, respectively, and the door 20 may be configured to include a pair of freezer compartment doors 22 installed rotatably and a refrigerator compartment door 24 installed to be opened and closed by pulling and pushing the refrigerator compartment door 24.

[0121] An ice making compartment 400 is formed at a left or right upper corner of the refrigerator compartment 30. The ice freezing compartment 400 forms an insulator space separated from the refrigerator compartment 30 and is formed long in forward and backward directions.

[0122] A first ice maker 410 for making ice is provided at an inside of the ice making compartment 400, and an ice bank 420 where ice made in the first ice maker 410 is stored may be provided under the first ice maker 410.

[0123] The ice bank 420 is provided to slide in and out from the ice making compartment 400, and may be configured such that an opened front surface of the ice making compartment 400 is shielded when the ice bank 420 slides in.

[0124] Also, an auger may be provided at an inside of the ice bank 420 to transfer ice stored in the ice bank 420 toward a forward direction such that ice may be taken out in the dispenser 26.

[0125] The dispenser 26 and an ice suit 430 are provided in the refrigerator compartment door 22 shielding the opened front surface of the refrigerator compartment 30 corresponding to a position where the ice making compartment 400 is provided. The ice suit 430 is formed at a rear surface of the refrigerator compartment door 22 such that when the refrigerator compartment door 22 is closed, an inside of the ice making compartment 400 may communicate with the dispenser 26 and thus a transfer of ice made may be guided.

[0126] The water filter 440 is provided at an inner upper surface of the refrigerator compartment 30, and the water tank 440 is provided at an inside of the refrigerator compartment door 22. The water filter 440 and the water tank 440 are connected on a water feeding passage 500 supplying water to the first ice maker 410 and the dispenser 26 from the water supply source.

[0127] Meanwhile, a second ice maker 140 is provided at an upper corner of the freezer compartment 40. The second ice maker 140 is to make ice with water supplied from the water feeding passage 500, and may be disposed to be exposed at an inner side of the freezer compartment 40.

[0128] In detail, the second ice maker 140 is to make ice with water supplied through the water feeding passage 500 to be described below, and is configured to be supplied with a predetermined amount of water for ice making, cool the supplied water until the supplied water reaches a set time or set temperature to make ice, automatically separate the made ice and transfer the separated ice to the ice container 150.

[0129] Also, the second ice maker 140 may be configured such that the second ice maker 140 may sense whether ice stored in the ice container 150 exceeds a preset amount and stop the ice making operation of the second ice maker 140.

[0130] The ice container 150 is provided under the second ice maker 140. The ice container 150 is a place where ice made in the second ice maker 140 is stored, and may be formed in a typical drawer shape.

[0131] The ice container 150 may be provided to be opened and closed by a rail member provided at the freezer compartment 40, and an inside of the ice container 150 may be divided by a divider 152. The divider 152 may be configured to be movable in the left and right directions such that ice is stored in a portion of the ice container 150 and foods are stored in another portion of the ice container 150.

[0132] The ice container 150 may be formed with a width corresponding to an inner lateral length of the freezer compartment 40, and if necessary, a separate drawer for storage of foods may be provided inside the freezer compartment 40, separately from the ice container 150.

[0133] The first ice maker 410, the second ice maker 140 and the dispenser 26 are connected to a water supply source 60 such as a faucet by the water feeding passage 500, and are supplied with water for ice making and drinking from the water supply source 60.

[0134] The wafer feeding passage 500 may be configured to include a main passage 510, a first branch passage 520 and a second branch passage 530, which communicate with one another through the branch means 54. The branch means 540, the main passage 510, the first branch passage 520 and the second branch passage 530 may be connected at the passage connecting part 70.

[0135] The main passage 510 connects the water sup-

ply source 60 and the branch means 540 to allow the water of the water supply source 60 to reach the inside of the refrigerator 1. An end portion of the main passage 510 is connected to the branch means 540 at the passage connecting part 70 disposed at the rear surface of the cabinet 10.

[0136] The first branch passage 520 extends to the first ice maker 410, and the water filter 440 and the water tank 440 may be connected on the first branch passage 520. The first branch passage 520 is branched into an ice maker-sided passage 522 and a dispenser-sided passage 524, respectively at the first valve 550 before the first branch passage 520 is connected to the first ice maker 410.

[0137] The ice maker-sided passage 522 is connected to the first ice maker 410, and the dispenser-sided passage 524 passes through the door hinge 14, is guided to the inside of the refrigerator compartment door 22 and is connected to the dispenser 26.

[0138] The second branch passage 530 extends to the second ice maker 140, and a second valve 560 is provided on the second branch passage 530 to selectively supply water to the second ice maker 140.

[0139] Meanwhile, operations of the first ice maker 410, the second ice maker 140 and the dispenser 26 may be controlled by a controller, and will be the same as those in the foregoing embodiments.

[0140] The refrigerator according to the present disclosure may have various embodiments besides the foregoing embodiments, and hereinafter, a refrigerator according to another embodiment will be described with reference to the accompanying drawings.

[0141] Fig. 11 is a partial perspective view of a refrigerator of which a freezer compartment door is opened according to another embodiment.

[0142] Another embodiment is **characterized in that** the ice maker is not an automatic water feeding and operation type but is supplied with water by a user's direct manipulation. With respect to the same elements as those in the foregoing embodiment, detailed description thereof will be omitted and like reference numerals refer to like elements throughout.

[0143] Referring to Fig. 11, an ice maker 600 is provided at an upper corner of a freezer compartment in a refrigerator according to another embodiment.

[0144] In detail, an installing member 610 for installing the ice maker 600 may be provided at an inner left upper corner of the freezer compartment 40. The installing member 610 may be formed such that the ice maker 600 is inserted from a front side and fixedly installed. The installing member 610 may be provided with a plurality of open surfaces such that cooling-air supplied to the inside of the freezer compartment 40 is smoothly supplied to the ice maker 600.

[0145] The ice maker 600 may be configured to include an ice tray 620 where water is frozen, an ice container 630 where ice is stored, a frame where the ice tray 620 and the ice container 630 are installed, and a tray cover 650 shielding an upper surface of the ice tray 620.

[0146] In detail, the ice tray 620 is rotated by rotation of a manipulation lever 622 and is formed such that ice may be separated from the ice tray 620 due to a distortion of when the ice tray 620 is rotated. The ice tray 620 is configured such that a user may directly separate the ice tray 620 from the frame 640, put water therein and freeze the water put in the ice tray 620.

[0147] The ice tray 620 may include a plurality of ice trays configured to be continuously arranged in a vertical or horizontal direction and be rotated together by the manipulation lever 622 and a combination of gears. Therefore, the ice tray 620 may make and transfer a large amount of ice at one time.

[0148] The ice container 630 is provided to be opened and closed by a sliding system under the ice tray 620, may store ice transferred from the ice tray 620, and forms a space where a large amount of ice made by a plurality of times of ice makings is stored.

[0149] The tray cover 650 is mounted on the frame 640 and may be configured to shield the upper surface of the ice tray 620 and to thus prevent foreign materials from being introduced or prevent water from splashing. The tray cover 650 may be configured to have a plurality of holes which help a smooth introduction of cooling-air.

[0150] Meanwhile, the ice tray 620, the ice container 630 and the tray cover 650 may be configured to be installed at and separated from the installing member 610 in a state that ice tray 620, the ice container 630 and the tray cover 650 are installed in the frame 640.

[0151] Also, instead of the tray cover 650, a water tank may be provided on the ice tray 620, and the water tank may be configured to supply water to the ice tray 620 by opening a valve when the water tank storing water necessary for one-time ice making is installed on the ice tray 620.

[0152] The water tank may store water necessary for multiple-time ice making. In the case of storing water necessary for multiple-time ice making, water for ice making may be supplied by a separate passage which is provided outside the freezer compartment 40 and extends from the water tank to the ice tray 620.

[0153] In the refrigerator 1 having the foregoing configuration according to anther embodiment, in the case of needing a small amount of ice, ice made automatically is discharged through the dispenser 26 and used, and in the case of needing a large amount of ice, a user opens the freezer compartment door 24, pulls open the ice container 630 and scoops out a required amount of ice for use.

[0154] To make ice using the ice maker 600 provided in the freezer compartment 40, a user separates the ice tray 620 and supplies water to the separated ice tray 620, or allows water to be supplied from the water tank to the ice tray 620. After the ice making is completed, the user may rotate the manipulation lever 622 to separate ice from the ice tray 620 and store the separated ice in the ice container 630.

INDUSTRIAL APPLICABILITY

[0155] According to the embodiments, since it is possible to discharge ice through the dispenser and to supply ice from the ice container storing a large amount of ice, use convenience is enhanced and thus the industrial applicability is very high.

Claims

1. A refrigerator comprising:

a cabinet formed with a plurality of storage spaces divided;
a first ice maker provided in any one of the plurality of storage spaces;
a dispenser provided to a door, through which ice made in the first ice maker is discharged;
a second ice maker provided in the storage space different from the storage space where the first ice maker is provided; and
a water feeding passage branched such that it is possible to selectively supply water to the first ice maker and the second ice maker from a water supply source.

2. The refrigerator of claim 1, wherein the first ice maker is provided in a refrigerator compartment and the second ice maker is provided in a freezer compartment under the refrigerator compartment.

3. The refrigerator of claim 1, wherein the refrigerator comprises an ice container which is provided under the second ice maker to store ice and to be pulled open and pushed close.

4. The refrigerator of claim 1, wherein the first ice maker is provided in a refrigerator compartment door and the second ice maker is provided in a freezer compartment under the refrigerator compartment.

5. The refrigerator of claim 4, wherein the first ice maker is provided inside an insulator space formed in the refrigerator compartment door.

6. The refrigerator of claim 4, wherein the second ice maker is installed at an upper surface of the freezer compartment.

7. The refrigerator of claim 4, wherein the freezer compartment further comprises:

a bracket installed at an upper surface of the freezer compartment to guide a portion of the water feeding passage and an electrical wire toward the second ice maker; and
an ice maker holder coupled to the bracket and the second ice maker to fix the ice maker.

8. The refrigerator of claim 4, wherein the freezer compartment further comprises a cooling-air duct for making ice and supplying cooling-air toward the second ice maker.

9. The refrigerator of claim 8, wherein a cooling-air discharge hole in which an opened end of the cooling-air duct for ice making is disposed is further formed at a sidewall of the freezer compartment adjacent to the second ice maker.

10. A refrigerator comprising:

a cabinet having a refrigerator compartment formed at an upper part thereof and a freezer compartment formed at a lower part thereof;
a first ice maker provided in the refrigerator compartment;
a dispenser provided to a refrigerator compartment door, through which ice made in the first ice maker is discharged;
a second ice maker provided in the freezer compartment;
an ice container which is provided in the freezer compartment to store ice made in the second ice maker and is accessible by an opening of a freezer compartment door;
a water feeding passage branched such that water is supplied toward the first ice maker and the second ice maker, respectively; and
a controller electrically connected to the first ice maker and the second ice maker to control operation of each of the first ice maker and the second ice maker.

11. The refrigerator of claim 10, wherein the controller comprises:

a first ice maker controller electrically connected to the first ice maker to control operation of the first ice maker; and
a second ice maker controller electrically connected to the second ice maker to control operation of the second ice maker; and
wherein the first ice maker controller and the second ice maker controller are configured to communicate with each other.

12. The refrigerator of claim 11, wherein the first ice maker controller and the second ice maker controller are configured to communicate wirelessly with each other.

13. The refrigerator of claim 11, wherein the first ice maker controller and the second ice maker controller are provided in the first ice maker and the second ice

maker, respectively.

14. The refrigerator of claim 10, wherein the controller is electrically connected to both of the first ice maker and the second ice maker such that any one of the first ice maker and the second ice maker operates preferentially.

15. The refrigerator of claim 10, wherein the controller controls the first ice maker and the second ice maker such that in a state that operation of any one stops, the other ice maker operates.

16. The refrigerator of claim 10, wherein the controller controls the first ice maker and the second ice maker such that after ice made by the first ice maker is stored in an ice bank provided under the first ice maker by a set amount or more, the second ice maker operates.

17. The refrigerator of claim 10, wherein the controller stops water supply to the first ice maker and the second ice maker when drinking water is discharged through the dispenser.

18. A refrigerator comprising:

a cabinet formed with a refrigerator compartment and a freezer compartment;
a first ice maker provided in a space for the refrigerator compartment;
a dispenser provided to a refrigerator compartment door, through which ice made in the first ice maker is discharged;
a second ice maker which is provided in the freezer compartment and is selectively accessible according to opening/closing of a freezer compartment door;
a water feeding passage connected to a water supply source outside the refrigerator to supply water to the first ice maker, the second ice maker and the dispenser; and
a branch means provided on the water feeding passage to distribute water supplied from the water supply source toward the first ice maker and the second ice maker.

19. The refrigerator of claim 18, wherein the water feeding passage comprises:

a main passage connecting the water supply source and the branch means;
a first branch passage extending from the branch means to the first ice maker; and
a second branch passage extending from the branch means to the second ice maker.

20. The refrigerator of claim 19, wherein a filter and a water tank are connected to the first branch passage.

21. The refrigerator of claim 19, wherein a first valve for selectively supplying water to the first ice maker and the dispenser is provided on the first branch passage, and a second valve for selectively supplying water to the second ice maker is provided on the second branch passage.

22. The refrigerator of claim 19, wherein the branch means comprises a valve making it possible to selectively supply water to the first branch passage or the second branch passage.

23. The refrigerator of claim 19, wherein the branch means has openings into which the first branch passage and the second branch passage are inserted, the openings being different in diameter.

24. The refrigerator of claim 19, wherein the first branch passage has an inner diameter which is greater than that of the second branch passage.

25. The refrigerator of claim 18, wherein the branch means is configured such that at least some of the branch means is exposed at a rear surface of the cabinet.

26. The refrigerator of claim 18, wherein the branch means is configured to be connected to the water feeding passage at an outside of the cabinet.

27. The refrigerator of claim 18, wherein the refrigerator compartment is provided therein with an insulator space which accommodates the first ice maker and is independent from the refrigerator compartment.

FIG.1

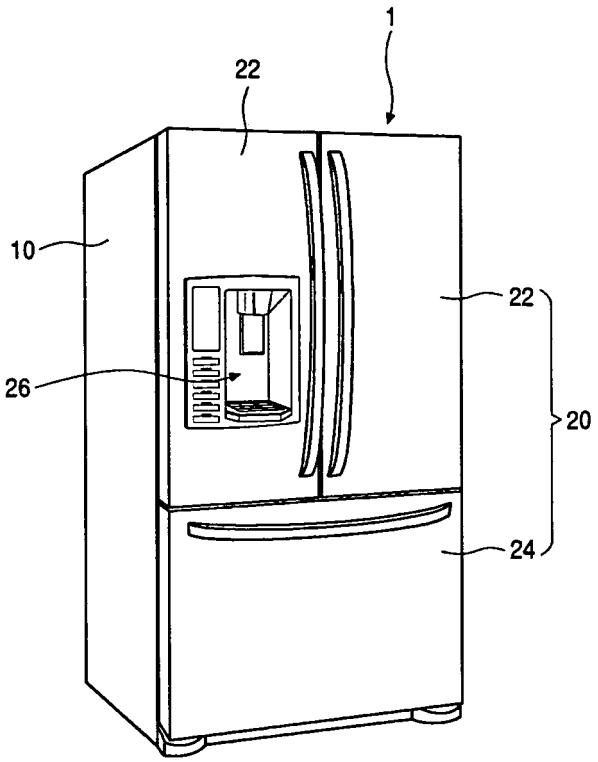


FIG.2

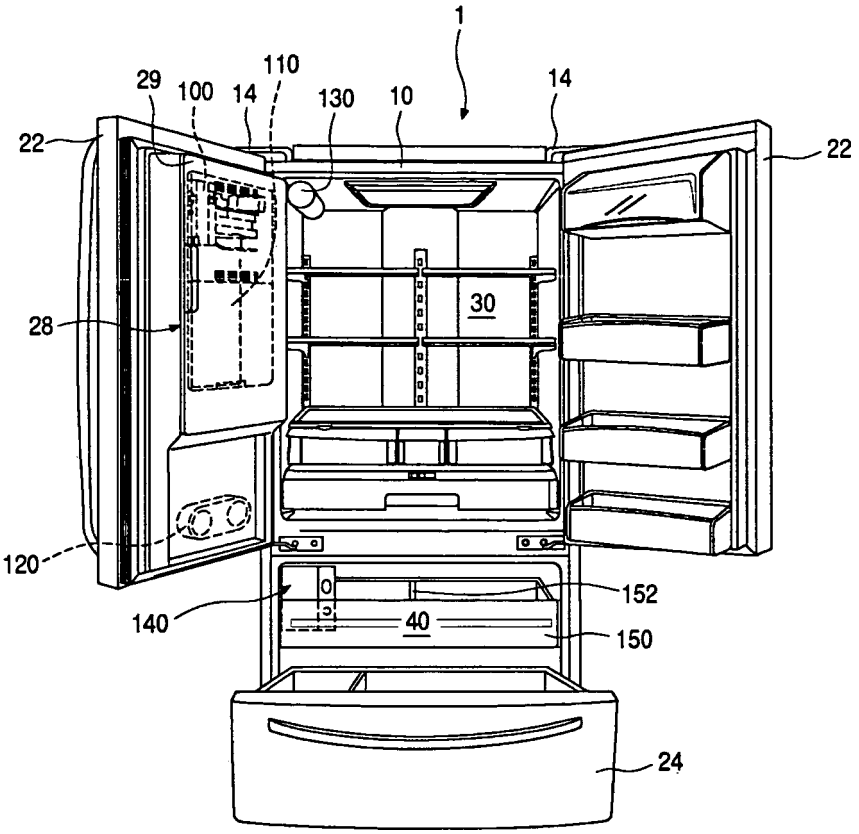


FIG.3

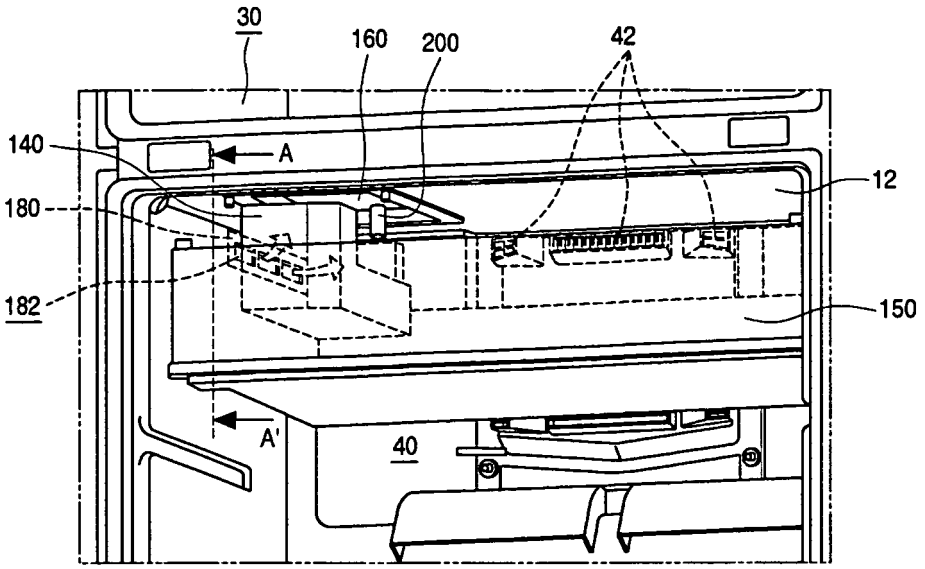


FIG.4

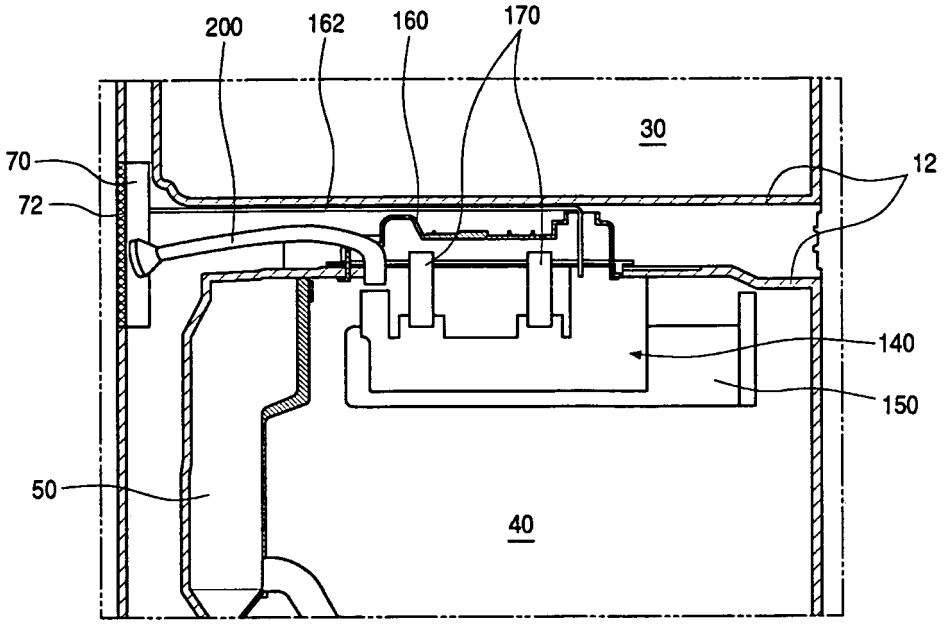


FIG.5

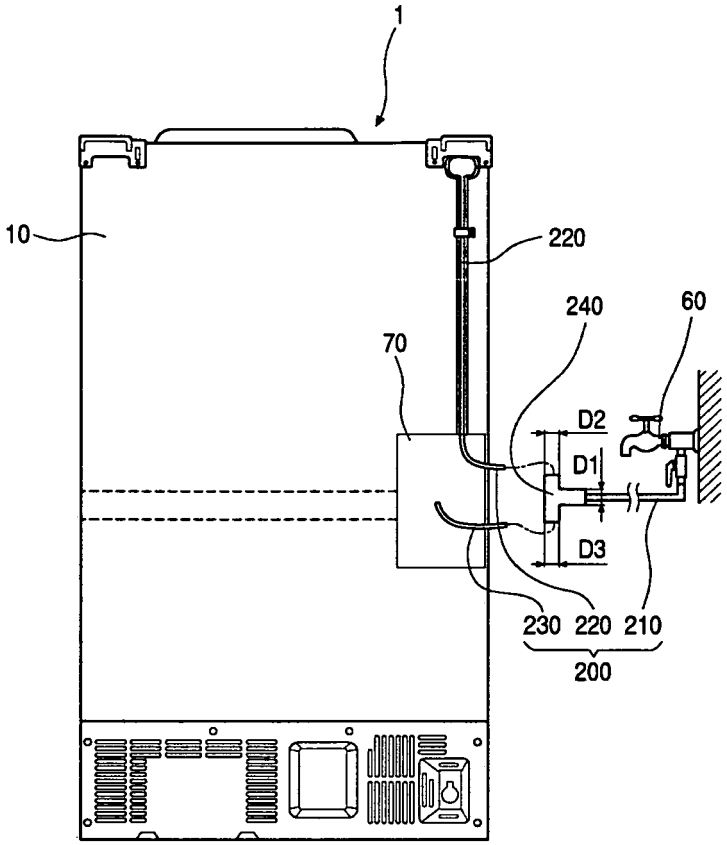


FIG.6

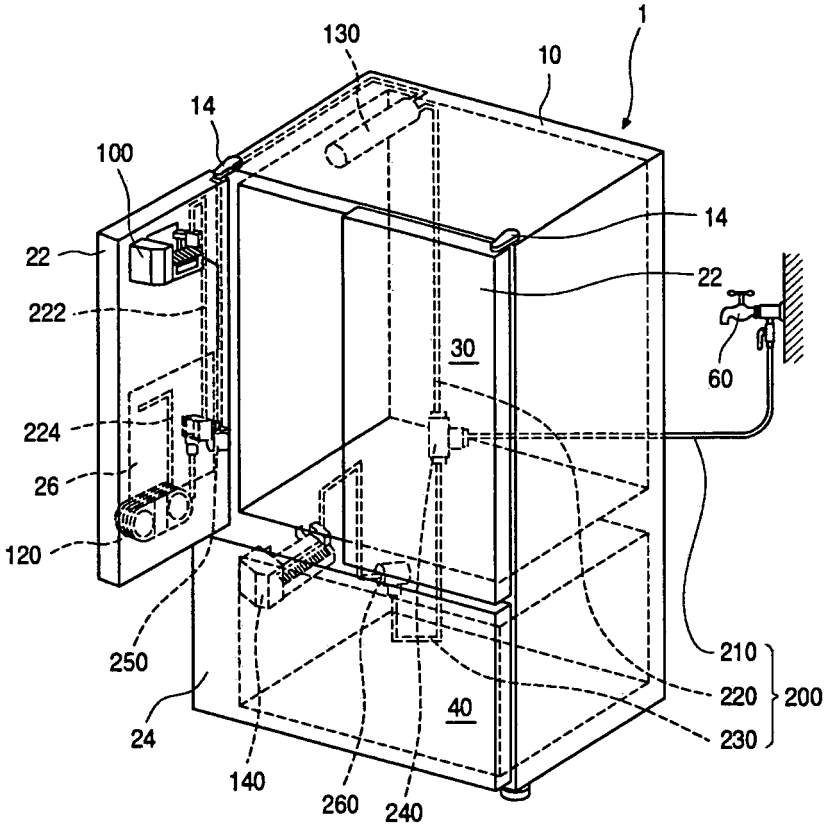

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FIG.7

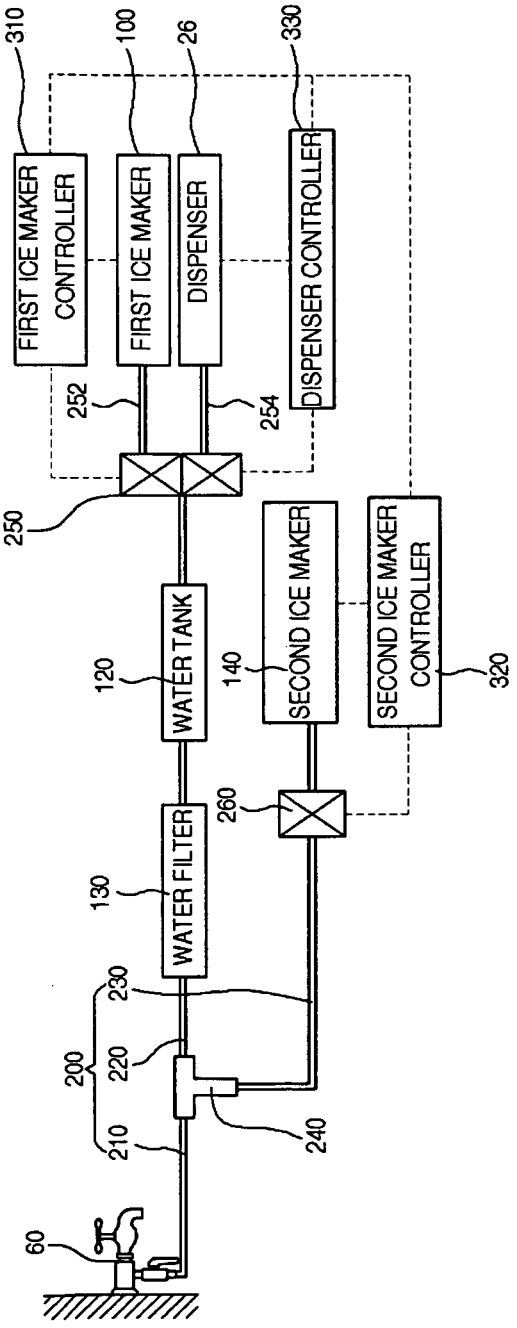

310
100
26
330
FIRST ICE MAKER CONTROLLER
FIRST ICE MAKER
DISPENSER
DISPENSER CONTROLLER
252
254
250
WATER TANK
120
SECOND ICE MAKER
140
SECOND ICE MAKER CONTROLLER
320
260
WATER FILTER
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230
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210
60

FIG.8

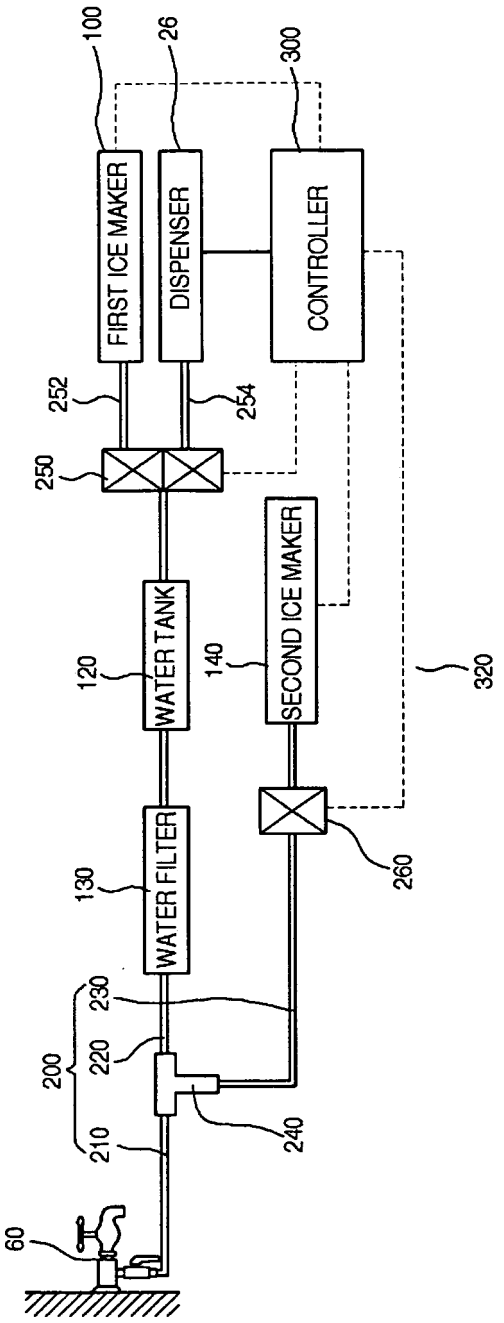

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300
FIRST ICE MAKER
DISPENSER
CONTROLLER
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WATER TANK
SECOND ICE MAKER
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FIG.9

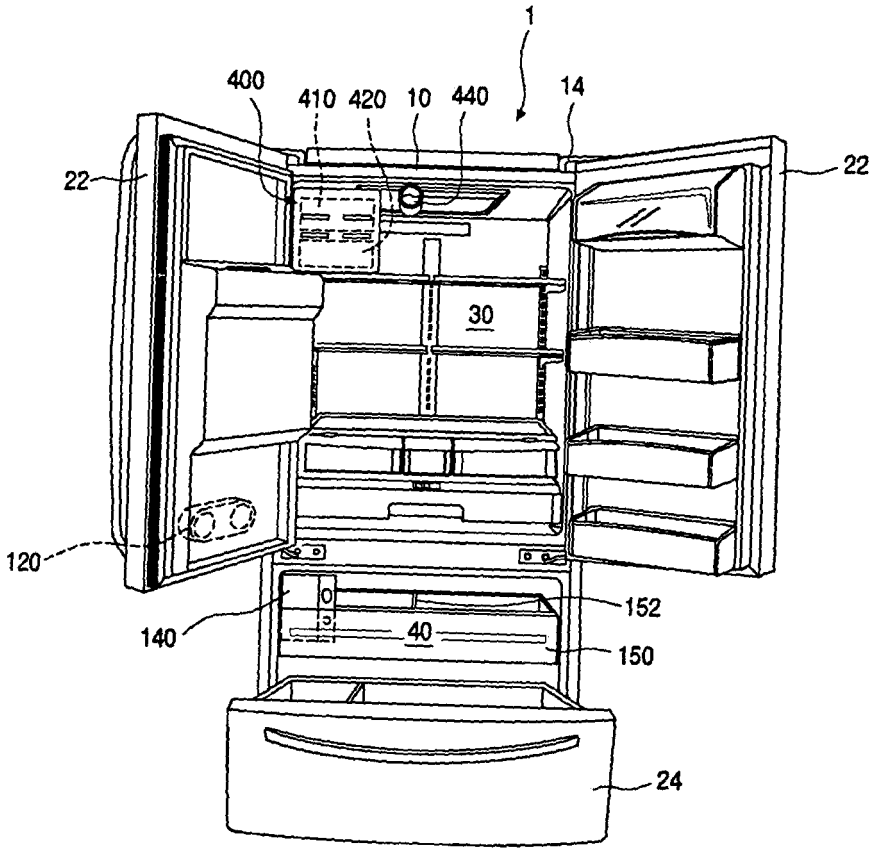


FIG.10

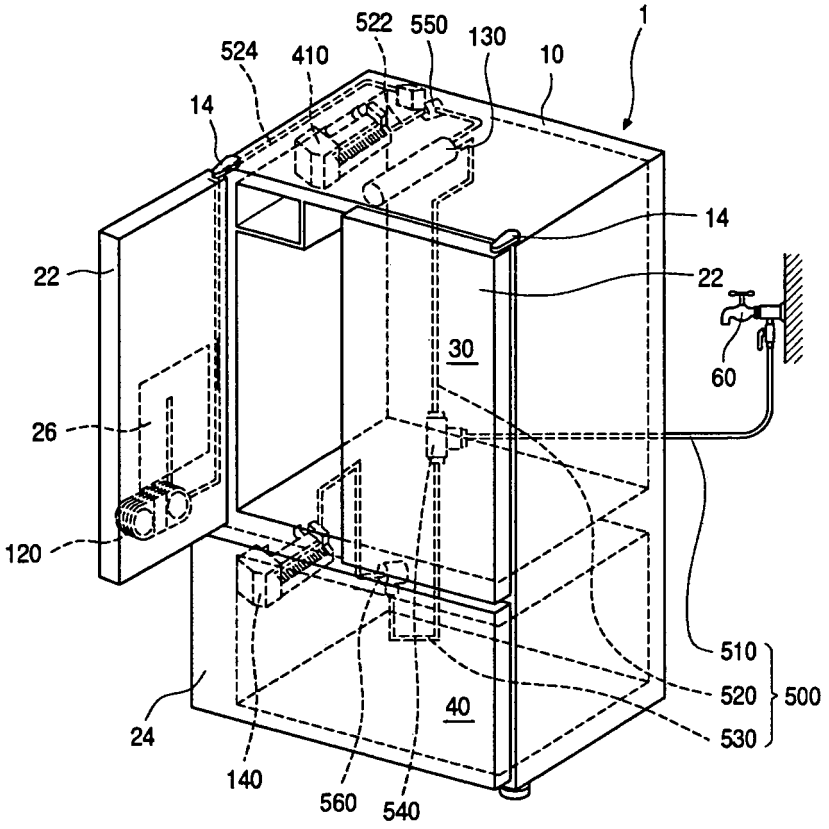
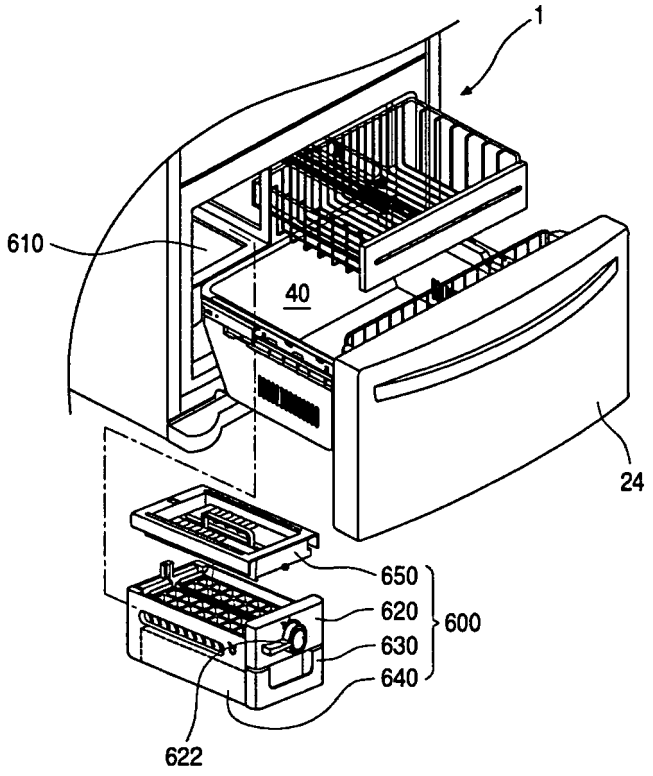

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140
560
540

FIG.11



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2009/003840

A. CLASSIFICATION OF SUBJECT MATTER
F25D 11/00(2006.01)i, F25C 1/24(2006.01)i, F25D 25/00(2006.01)i, F25D 29/00(2006.01)i, F25D 17/08(2006.01)i, F25D 23/02(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)
F25D 11/00; F25C 1/24; F25D 11/02; F25D 25/00

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: a plurality of, ice maker, ice making apparatus, dispenser, refrigerator compartment, freezer compartment

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 10-2008-0112705 A (DAEWOO ELECTRONICS CORPORATION) 26 December 2008 See abstract; claim 1; figure 2	1-27
A	KR 10-2006-0064247 A (LG ELECTRONICS INC.) 13 June 2006 See abstract; claim 1; figure 3	1-27
A	KR 10-2005-0023863 A (LG ELECTRONICS INC.) 10 March 2005 See abstract; claim 1; figure 3	1-27

☐ 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
"E" earlier application or patent but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
08 APRIL 2010 (08.04.2010)	**09 APRIL 2010 (09.04.2010)**

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
Government Complex-Daejeon, 139 Seonsa-ro, Daejeon 302-701, Republic of Korea
Facsimile No. 82-42-472-7140

Authorized officer

Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2009/003840

Patent document cited in search report	Publication date	Patent family member	Publication date
KR 10-2008-0112705 A	26.12.2008	NONE	
KR 10-2006-0064247 A	13.06.2006	NONE	
KR 10-2005-0023863 A	10.03.2005	NONE	

Form PCT/ISA/210 (patent family annex) (July 2009)