A refrigerator is provided. The refrigerator includes a refrigerator main body including a cooling chamber, a door for opening or closing the cooling chamber, an ice making chamber located at the door, a sub-chamber located at the door and spaced from the ice making chamber, the sub-chamber being configured to receive cool air from the cooling chamber, and a cold energy transfer unit configured to transfer energy of cool air of the sub-chamber to the ice making chamber.
FIG. 1
RELATED ART
FIG. 9
REFRIGERATOR HAVING ICE MAKING ROOM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority to Korean Application No. 10-2009-0028532, filed on Apr. 2, 2009, which is herein expressly incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a refrigerator having an ice-making chamber, and more particularly, to a refrigerator having an ice-making chamber in which the use of a cool air duct is reduced, thereby reducing an adverse effect caused by the use of the cool air duct.

[0004] 2. Description of the Related Art

[0005] As is generally known, a refrigerator is a device for refrigerating or cooling food to keep them fresh. Such a refrigerator includes a refrigerator main body formed with a cooling chamber therein, a plurality of doors for opening or closing the cooling chamber, and a refrigeration cycle device for providing cold energy to the cooling chamber.

[0006] The refrigeration cycle device is typically provided with a vapor compression type refrigeration cycle device including a compressor for compressing a refrigerant, a condenser for radiating and condensing the refrigerant, an expansion apparatus for decompressing and expanding the refrigerant, and an evaporator for allowing the refrigerant to absorb and evaporate surrounding latent heat.

[0007] The refrigerator may include various functions in order to enhance user’s convenience and satisfaction. As an example, the refrigerator may include an ice making system (or device) for making ice cubes to provide for the user.

[0008] The ice making system may be configured by including an ice making machine for making ice cubes, and an ice bank positioned at a lower side of the ice making system for storing ice cubes that have been made in the ice making machine.

[0009] The ice making machine may be mounted at an inner side of the door or mounted within a freezing chamber. Furthermore, an ice making machine for accommodating the ice making machine may be formed within the door or freezing chamber.

[0010] FIG. 1 is a perspective view illustrating a refrigerator in the related art. As illustrated in FIG. 1, the refrigerator includes a refrigerator main body 10 formed with a refrigerating chamber 20 and a freezing chamber 30 therein, and a refrigerating chamber door 25 and a freezing chamber door 35 for opening or closing the refrigerating chamber 20 and the freezing chamber 30, respectively.

[0011] The refrigerating chamber 20 is formed at an upper region of the refrigerator main body 10, and the refrigerating chamber door 25 for selectively opening or closing the refrigerating chamber 20 is provided at a front surface of the refrigerating chamber 20. The refrigerator may be also provided with a plurality of refrigerating chamber doors 25.

[0012] A dispenser 40 for taking out water or ice without opening the refrigerating chamber door 25 may be provided at either one of the refrigerating chamber doors 25.

[0013] An ice making chamber 50 for making ice may be formed at an upper region of the refrigerating chamber door 25. Furthermore, an ice making machine for making ice cubes in a predetermined shape, and an ice bank for storing ice cubes that have been made in the ice making machine may be provided within the ice making chamber 50.

[0014] A sidewall cool air duct 60 for providing the cool air of the freezing chamber 30 to the ice making chamber 50 may be provided in the refrigerator main body 10. It may be configured with a pair of sidewall cool air ducts 60, and one of the ducts forms a cool air supply passage 61a for moving the cool air of the freezing chamber 30 to the ice making chamber 50, and the other one forms a cool air return passage 61b for returning the cool air that has passed through the ice making chamber 50.

[0015] However, according to a refrigerator having such an ice making chamber in the related art, the sidewall cool air duct 60 is provided in such a manner that it is buried within a sidewall of the refrigerator main body 10 not to be seen from the outside, and thus dewdrops may be produced on an outer surface of the refrigerator main body 10 by cool air moving along the sidewall cool air duct 60.

[0016] In addition, an electric heater (not shown) for preventing dewdrops from being produced on an outer surface of the refrigerator main body 10 by the sidewall cool air duct 60 may be provided therein, thereby increasing the manufacturing cost, and increasing the power consumption while operating the heater.

[0017] Furthermore, the sidewall cool air duct 60 is formed to connect between the freezing chamber 30 formed at a lower portion of the refrigerator main body 10 and the ice making chamber 50 formed at an upper portion of the refrigerating chamber 20, and thus it has a relatively long length. As a result, it may cause the flow loss of cool air.

[0018] Moreover, in such a refrigerator in the related art, ice is made by using cool air, and thus odor in the air may be absorbed by the ice during the ice making process and its storage.

SUMMARY OF THE INVENTION

[0019] In order to solve the foregoing problem, an object of the present invention is to provide a refrigerator having an ice making chamber capable of removing the use of a sidewall cool air duct.

[0020] Furthermore, another object of the present invention is to provide a refrigerator having an ice making chamber capable of preventing the odor of the air in the cooling chamber from transferring to ice.

[0021] In order to accomplish the foregoing object of the present invention, there is provided a refrigerator having an ice making chamber including a refrigerator main body including a cooling chamber, a door for opening or closing the cooling chamber, an ice making chamber located at the door, a sub-chamber located at the door and spaced from the ice making chamber, the sub-chamber being configured to receive cool air from the cooling chamber, and a cold energy transfer unit configured to transfer energy of cool air of the sub-chamber to the ice making chamber.

[0022] According to another aspect of the present invention, there is provided a refrigerator having a refrigerator main body including a refrigerating chamber and a freezing chamber, a door for opening or closing the refrigerating chamber, an ice making chamber located at the door, a sub-chamber located at the door and spaced from the ice making chamber, the sub-chamber being configured to receive cool air from the freezing chamber, a first cold energy transfer unit
configured to transfer energy of the cool air of the sub-chamber using convection, and a second cold energy transfer unit configured to transfer energy of the first cold energy transfer unit to the ice making chamber using thermal conduction.

Further scope of applicability of the present application will become more apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from the detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

FIG. 1 is a perspective view illustrating a refrigeration in the related art;

FIG. 2 is a perspective view illustrating a refrigerator having an ice making chamber according to an embodiment of the present invention;

FIG. 3 is a longitudinal cross-sectional view of the refrigerator of FIG. 2;

FIG. 4 is a cross-sectional view along the line “IV-IV” of FIG. 3;

FIG. 5 is a view for explaining a process of transferring cold energy to the ice making machine of FIG. 3;

FIG. 6 is a perspective view illustrating a refrigerator having an ice making chamber according to another embodiment of the present invention;

FIG. 7 is a view for explaining an ice making process;

FIG. 8 is a cross-sectional view illustrating a refrigerator having an ice making chamber according to still another embodiment of the present invention;

FIG. 9 is a view for explaining a process of transferring cold energy to the ice making machine of FIG. 8;

FIG. 10 is a perspective view illustrating a refrigerator having an ice making chamber according to still another embodiment of the present invention; and

FIG. 11 is a longitudinal cross-sectional view of the refrigerator of FIG. 10.

DETAILED DESCRIPTION OF THE INVENTION

Hereinafter, exemplary embodiments of a refrigerator having an ice making chamber according to the present invention will be described in detail with reference to the accompanying drawings.

FIG. 2 is a perspective view illustrating a refrigerator having an ice making chamber according to an embodiment of the present invention, FIG. 3 is a longitudinal cross-sectional view of FIG. 2, FIG. 4 is a cross-sectional view along the line “IV-IV” of FIG. 3, and FIG. 5 is a view for explaining a process of transferring cool air to the ice making machine of FIG. 3.

As illustrated in FIG. 2, a refrigerator having an ice making chamber may be configured by including a refrigerator main body 110 formed with a cooling chamber 130, doors 135, 145 for opening or closing the cooling chamber 130, an ice making chamber 190 formed at the cooling chamber 130 or the doors 135, 145, and a cold energy transfer unit 250 configured to transfer cold energy to the ice making chamber 190 by thermal conduction or refrigerant. Here, the cooling chamber 130 is commonly referred to as a freezing chamber 141 and a refrigerating chamber 131. Consequently, it may be possible to remove the use of a conventional sidewall cool air duct for transferring cool air to the ice making chamber 190. Furthermore, ice is not directly brought into contact with cool air, and thus the user does not have to worry about the odor in the air being transferred and absorbed into the ice.

The cooling chamber 130 may be configured with a refrigerating chamber 131 and a freezing chamber 141, which are formed at upper and lower regions of the refrigerator main body 110, respectively. A pair of refrigerating chamber doors 135 for opening or closing the refrigerating chamber 131 is provided at a front surface of the refrigerating chamber 131. The refrigerating chamber doors 135 may be combined with each other in a concurrently movable manner. A freezing chamber door 145 for opening or closing the freezing chamber 141 may be provided at a front surface of the freezing chamber 141. The freezing chamber door 145 may be configured with a draw-type door that can be moved along a front-and-rear direction of the freezing chamber 141.

The ice making chamber 190 may be formed at either one of the refrigerating chamber doors 135. The ice making chamber 190 may be formed in such a manner that a side of the ice making chamber 190 can be opened, and the ice making chamber 190 may be provided with an ice making chamber door 195 for opening or closing an opening of the ice making chamber 190. An ice making machine 210 for making ice (ice cubes) in a predetermined shape and an ice bank 230 for storing ice cubes that have been made in the ice making machine 210 may be provided within the ice making chamber 190. Here, the ice making machine 210 may be configured by including an ice tray 211 having a plurality of cells for forming ice cubes in a predetermined shape, and an ejector 221 for taking out ice cubes that have been formed in the ice tray 211. The ejector 221 may be configured by including a plurality of ejector pins protruded by corresponding to the inside of the each of the cells respectively at a shaft and the circumference of the shaft. When the ejector 221 rotates during the release of ice cubes, the ice cubes that have been made within the cells are pressed by the ejector pins and then taken out of the cells. The ice tray 211 may be formed of a metal member to allow thermal conduction. A side of the ice tray 211 is further provided with a plate-shaped sidewall portion 215. The sidewall portion 215 may be formed of a metal member.

A dispenser 240 for taking ice and/or water may be provided at a lower side of the ice bank 230. The ice bank 230 may be configured by including an ice dispensing device (for example, auger) (not shown) for discharging ice cubes. The ice cubes stored in the ice bank 230 may be taken out to the dispenser 240 by the ice dispensing device when required. As a result, the user can take out ice cubes from the ice bank 230 without opening the refrigerating chamber door 135.

On the other hand, the refrigerator main body 110 may be provided with a refrigeration cycle device 150 for providing cold energy to the freezing chamber 141 and the refrigerating chamber 131. The refrigeration cycle device 150 may be configured with a so-called vapor compression type refrigeration cycle including a compressor 151 for compressing a refrigerant, a condenser 161 for radiating and condens-
ing the refrigerant, an expansion apparatus 171 for depressing and expanding the refrigerant, and an evaporator 181 for allowing the refrigerant to absorb and evaporate surrounding latent heat.

[0044] A machine chamber 120 may be formed at a rear region of the refrigerant main body 110, and the condenser 151, condenser 161, and the expansion apparatus 171 may be disposed in the machine chamber 120. The evaporator 181 may be provided at a rear region of the freezing chamber 141. Furthermore, the evaporator 181 may be disposed in the freezing chamber 141 and the refrigerating chamber 131 respectively. Here, cooling fans 165, 185 for accelerating the flow of air may be provided around the evaporator 181 and the condenser 161 respectively, both constituting the refrigeration cycle device 150. Hereinafter, the exemplary embodiment will be described, for example, where the evaporator 181 is disposed at a rear region of the freezing chamber 141, although the evaporator 181 is not limited to this location.

[0045] The cold energy transfer unit 250 is provided to transfer cold energy that has been produced by the evaporator 181 to the ice making chamber 190, it may be configured to transfer cold energy to the ice making machine 210 by thermal conduction or refrigerant.

[0046] Furthermore, the cold energy transfer unit 250 may be configured by including a first cold energy transfer unit 260 for transferring cold energy, more specifically, cool air, and a second cold energy transfer unit 310 for transferring cold energy by conduction. The second cold energy transfer unit 310 may be configured by including a heat pipe 311. The heat pipe 311 may be configured by including a tubular body 313, and a working fluid 314 sealed within the tubular body 313. The inside of the tubular body 313 may be configured such that the working fluid 314 can be moved by a capillary phenomenon. For example, grooves 315 for generating a capillary phenomenon may be formed at an inner wall surface of the tubular body 313. Furthermore, a mesh structure (not shown) or porous member (not shown) for generating a capillary phenomenon may be provided within the tubular body 313. The working fluid 314 (for example, alcohol, water, mercury, etc.) may be suitably selected based on the used temperature range.

[0047] An end of the heat pipe 311 is disposed to absorb heat from the air in the ice making machine 210, and the other end of the heat pipe 311 is extended downward and disposed at a lower region of the refrigerating chamber door 135. In other words, an end of the heat pipe 311 disposed to be capable of exchanging heat with the ice making machine 210 may be an evaporating unit 312e for allowing working fluid therewithin to absorb and evaporate surrounding heat, and the other end of the heat pipe 311 may be a condensing unit 312b for cooling and condensing the evaporated working fluid 314. The condensing unit 312b may be provided with a plurality of heat transfer fins (heat transfer plates) 316 for increasing the heat-exchanging area.

[0048] The first cold energy transfer unit 260 is provided to transfer heat energy from the heat pipe 311 to the cool air that has been produced by the evaporator 181, which is a second cold energy transfer unit 310, and it may be configured by including a sub-chamber 270 formed at the refrigerating chamber door 135, and a connecting passage 280 for connecting the freezing chamber 141 to the sub-sub-chamber 270. Here, the first cold energy transfer unit 260 may be defined as a "cool air transfer passage” in the aspect of forming a passage in which the cool air of the freezing chamber 141 is transferred to the heat pipe 311.

[0049] The first cold energy transfer unit 260 may be further provided with a duct 291 capable of concentrically ventilating cool air at a side of the evaporator 181 to the connecting passage 280.

[0050] A lower end portion of the heat pipe 311, that is, a condensing unit 312b, is disposed at a lower region of the refrigerating chamber door 135 to transfer heat energy to the cool air in the sub-chamber. An inlet portion 272 and an outlet portion 273 for flowing in and out cool air are formed at a side of the sub-sub-to chamber 270. The inlet portion 272 and the outlet portion 273 may be configured so as to be passed through within a protruding portion 271 protruded from the refrigerating chamber door 135.

[0051] A partition wall 142 is formed between the refrigerating chamber 131 and the freezing chamber 141, and a connecting passage 280 may be formed in order to form a moving path of cool air for connecting the freezing chamber 141 with the sub-sub-chamber 270. Here, it is shown a case in which the duct 291 is disposed at a ceiling of the freezing chamber 141, but it may be configured so as to be disposed with the partition wall 142.

[0052] The connecting passage 280 may be configured by including a cool air outflow passage 282 for providing cool air to the sub-sub-chamber 270, and a cool air inflow passage 283 for returning cool air that has passed the sub-sub-chamber 270. An end of the cool air outflow passage 282 may be connected to an outflow-side end of the duct 291, and the other end thereof may be connected to an inlet portion 272 of the connecting passage 280. An end of the cool air inflow passage 283 of the connecting passage 280 may be connected to the outlet portion 273 of the sub-sub-chamber 270, and the other end of the cool air inflow passage 283 may be disposed at a ceiling of the freezing chamber 141. Here, the other end of the cool air inflow passage 283, that is, a ceiling-side end of the freezing chamber 141 may be defined as a “cool air discharge port” in the aspect of discharging cool air to the freezing chamber 141. As a result, cool air that has passed through the sub-sub-chamber 270 may be directly discharged to the freezing chamber 141.

[0053] An end of the cool air outflow passage 282 of the connecting passage 280 and an end of the cool air inflow passage 283, as illustrated in FIG. 4, are formed at the ground surface of the refrigerating chamber 131. A gasket 293 for preventing cool air from being leaked may be provided between the inlet portion 272 of the sub-sub-chamber 270 and an end of the cool air outflow passage 282 of the connecting passage 280, and between the outlet portion 273 and an end of the cool air inflow passage 283. In this embodiment, it is shown a case in which the gasket 293 is provided in the inlet portion 272 and the outlet portion 273. Here, the first cold energy transfer unit 260 (or cool air transfer passage) may be further provided with a ventilation fan (not shown) for accelerating the flow of cool air. As a result, a relatively low-capacity ventilation fan is driven to move cool air to the sub-chamber 270 and thus the operating frequency (time) of a cooling fan 185 at a side of the relatively high-capacity evaporator 181 is decreased, thereby reducing the power consumption.

[0054] Cool air that has been produced by the evaporator 181 is moved to the connecting passage 280 through the duct 291. The cool air that has moved to the connecting passage 280, more specifically to the cool air outflow passage 282, is
flowed into the sub-chamber 270 through the inlet portion 272. The cool air that has been flowed into the sub-chamber 270 is brought into contact with the condensing unit 312b of the heat pipe 311 and heat is exchanged, and then flowed again into the connecting passage 280, more specifically the cool air inflow passage 283, through the outlet portion 273. The cool air that has flowed into the cool air inflow passage 283 is discharged to the freezing chamber 141.

[0055] On the other hand, working fluid 314 that has been cooled down in the condensing unit 312b of the heat pipe 311 is condensed, and the condensed working fluid 314 is moved to an upper end of the heat pipe 311, e.g., the evaporating unit 312a, along an inner wall surface of the tubular body 313, e.g., the grooves 315, by a capillary phenomenon. The working fluid 314 that has been moved to the evaporating unit 312a absorbs and evaporates surrounding heat, more specifically, heat from the ice making machine 210. As a result, water within each cell of the ice making machine 210 is frozen into ice cubes. Ice cubes are made by repeating a process in which the evaporated working fluid 314 is again moved to the condensing unit 312b to be condensed, and again moved to the evaporating unit 312a to be evaporated. On the other hand, ice cubes that have been made in the ice making machine 210 may be stored within the ice bank 230 through a process of releasing ice cubes, and taken out to the dispenser 240 when required.

[0056] Hereinafter, another embodiment of the present invention will be described with reference to FIGS. 6 and 7.

[0057] FIG. 6 is a perspective view illustrating a refrigerator having an ice making chamber according to another embodiment of the present invention, and FIG. 7 is a view for explaining an ice making process. Hereinafter, for the sake of convenience of explanation, in the drawings, the same or similar portions to those in the foregoing configuration are designated with the same numeral references, and their redundant description will be omitted.

[0058] As illustrated in FIGS. 6 and 7, a refrigerator having an ice making chamber may be configured by including a refrigerating main body 110 formed with a refrigerating chamber 131 and a freezing chamber 141, a refrigerating chamber door 135 and a freezing chamber door 145 for opening or closing the refrigerating chamber 131 and the freezing chamber 141 respectively, an ice making chamber 190 formed at the refrigerating chamber door 135, and a cold energy transfer unit 250 for transferring cold energy to the ice making chamber 190 by thermal conduction or refrigerant.

[0059] The refrigerating chamber 131 and the freezing chamber 141 within the refrigerator main body 110 may be formed to be vertically partitioned by a partition wall 142. A pair of refrigerating chamber doors 135 may be provided in a concurrently movable manner at a front surface of the refrigerating chamber 131, and a freezing chamber door 145 for opening or closing the freezing chamber 141 is while being slid along a front-and-rear direction of the freezing chamber 141 may be provided in the freezing chamber 141.

[0060] The ice making chamber 190 may be formed at either one of the refrigerating chamber doors 135. The ice making chamber 190 may be provided with an opening, and further include an ice making chamber door 195 for opening or closing an opening of the ice making chamber 190.

[0061] An ice making machine 210 for making ice may be provided within the ice making chamber 190, and an ice bank 230 for storing ice cubes that have been made in the ice making machine 210 may be provided at a lower side of the ice making chamber 190.

[0062] The evaporator 181 may be disposed at a rear region of the freezing chamber 141, and a cooling fan 185 may be provided at a side of the 181 to accelerate the flow of cool air.

[0063] The cold energy transfer unit 350 may be configured to transfer heat energy from the air in the ice making chamber 190 to the cool air of the freezing chamber 141 using a refrigerant. Here, the refrigerant of the cold energy transfer unit 350 may be referred to as a “secondary refrigerant” to distinguish from a “primary refrigerant” of the refrigeration cycle.

[0064] The cold energy transfer unit 350 may be configured by including a secondary refrigerant circulating unit (or device) 351 for exchanging heat while circulating the secondary refrigerant.

[0065] The secondary refrigerant circulating unit 351 may be configured by including a first heat exchanger 353 and a secondary heat exchanger 354, disposed to be apart from each other for exchanging heat with the secondary refrigerant and connected to each other by a refrigerant pipe 355 for circulating the secondary refrigerant, a pump 356 disposed between the first heat exchanger 353 and the secondary heat exchanger 354 for pumping the secondary refrigerant. Either one of the first heat exchanger 353 and the second heat exchanger 354 is disposed at the ice making machine 210 to be capable of exchanging heat, and the other one is disposed to be capable of radiating heat energy. In this embodiment, it will be described as an example, a case in which the first heat exchanger 353 is disposed to be capable of exchanging heat at a rear side of the sidewall portion 215 of the ice making machine 210.

[0066] The cold energy transfer unit 350 may be configured by further including a cool air transfer passage 361 for transferring cool air that has been produced by the evaporator 181 to the second heat exchanger 354.

[0067] The cold air transfer passage 361 may be configured by including a sub-chamber 270 formed at the refrigerating chamber door 135, and a connecting passage 280 for connecting the freezing chamber 141 with the sub-chamber 270 to move cold energy, that is, cool air.

[0068] The sub-chamber 270 may be formed at a lower region of the refrigerating chamber door 135, and the second heat exchanger 354 of the secondary refrigerant circulating unit 351 may be disposed within the sub-chamber 270. As a result, cool air that has been produced by the evaporator 181 may be transferred to the secondary refrigerant circulating unit 351. The sub-chamber 270 may be provided with an inlet portion 272 and an outlet portion 273 for flowing in and out cool air.

[0069] The connecting passage 280 may be formed at a partition wall 142 that partitions the refrigerating chamber 131 and the freezing chamber 141.

[0070] The cool air transfer passage may be configured by further including a duct 291 for concentrically moving cool air that has been produced by the evaporator 181 to the connecting passage 280.

[0071] According to the foregoing configuration, cool air that has been produced by the evaporator 181 is moved along the duct 291 of the cool air transfer passage 361, and moved into the sub-chamber 270 through the connecting passage 280 and the inlet portion 272. The cool air that has been heat-exchanged with the second heat exchanger 354 within the
sub-chamber 270 is discharged into the freezing chamber 141 through the outlet portion 273 and the connecting passage 280. [0072] The secondary refrigerant that has been heat-exchanged and cooled down in the second heat exchanger 354 is pumped by the pump 356 and moved to the first heat exchanger 353. The refrigerant that has been moved to the first heat exchanger 353 cools down the ice making machine 210 while exchanging heat with the ice making machine 210. As a result, water of the ice making machine 210 is frozen and made into ice cubes in a predetermined shape. Ice cubes are made by repeating a process in which the refrigerant that has cooled down the ice making machine 210 is again moved to the second heat exchanger 354 to be cooled down and condensed, and then pumped by the pump 356 to be moved to the first heat exchanger 353. Ice cubes that have been made in the ice making machine 210 may be stored within the ice bank 230, and then taken out through the dispenser 240 that is formed at the refrigerating chamber door 135 when required. [0073] Hereinafter, still another embodiment of the present invention will be described with reference to FIGS. 8 and 9. [0074] FIG. 8 is a cross-sectional view illustrating a refrigerator having an ice making chamber according to still another embodiment of the present invention, and FIG. 9 is a view for explaining a process of transferring cool air to the ice making machine of FIG. 8. As illustrated in FIGS. 8 and 9, a refrigerator having an ice making chamber may be configured by including a refrigerator main body 110 formed with a refrigerating chamber 131 and a freezing chamber 141, a refrigerating chamber door 135 and a freezing chamber door 145 for opening or closing the refrigerating chamber 131 and the freezing chamber 141 respectively, an ice making chamber 190 formed at the refrigerating chamber door 135, and a cold energy transfer unit 400 for transferring cold energy to the ice making chamber 190 by thermal conduction or refrigerant. [0075] The refrigerating chamber 131 and the freezing chamber 141 are formed at upper and lower regions of the refrigerator main body 110, respectively, and a refrigerating chamber door 135 and a freezing chamber door 145 are provided at the refrigerating chamber 131 and the freezing chamber 141, respectively. [0076] The ice making chamber 190 may be formed at either one of the refrigerating chamber doors 135, and an ice making machine 210 for making ice cubes in a predetermined shape may be provided within the ice making chamber 190. An ice bank 230 for storing ice cubes that have been made in the ice making machine 210 may be provided at a lower side of the ice making chamber 190. A dispenser 240 for taking out ice cubes without opening the refrigerating chamber door 135 may be provided at a lower side of the ice bank 230. [0077] The cold energy transfer unit 400 may be configured to transfer cold energy by thermal conduction or refrigerant. For example, the cold energy transfer unit 400 may be configured by including a heat pipe 311 or a secondary refrigerant circulating unit 351. For this exemplary embodiment, it will be described as an example, where the cold energy transfer unit 400 is configured to include the heat pipe 311. [0078] The cold energy transfer unit 400 may be configured by further including a cool air transfer passage 410 for transferring the heat energy from the heat pipe 311 to the cool air of the freezing chamber 141. The cool air transfer passage 410 may be configured by including a sub-chamber 270 formed at the refrigerating chamber door 135, and a connecting passage 280 for connecting the freezing chamber 141 with the sub-chamber 270. The lower end of the heat pipe 311 may be disposed in a heat-exchangeable manner within the sub-chamber 270. The lower end of the heat pipe 311, e.g., the condensing unit 312b, may be provided with a plurality of heat transfer fins 316 for increasing the heat-exchanging area. [0079] The connecting passage 280 may be configured by including a cool air outflow passage 282 for moving the cool air of the freezing chamber 141 to the sub-chamber 270, and a cool air inflow passage 283 for returning cool air that has passed the sub-chamber 270 to the freezing chamber 141. [0080] Each side of the cool air outflow passage 282 and the cool air inflow passage 283 is disposed at the ground surface of the refrigerating chamber 131. The cool air outflow passage 282 and the cool air inflow passage 283 are connected to the inlet portion 272 and the outlet portion 273 of the sub-chamber 270 respectively, when the refrigerating chamber door 135 is closed. [0081] The cool air transfer passage may be further provided with a ventilation fan 420 for ventilating cool air to the sub-chamber 270. As a result, the driving frequency and time of a relatively high-capacity cooling fan 185 disposed at a side of the evaporator 181 can be decreased, thereby reducing the power consumption, as well as reducing vibration and/or noise generated when driven. The ventilation fan 420 may be disposed at the cool air outflow passage 282. [0082] According to a such a configuration, during an ice making process, when the rotation of the ventilation fan 420 starts, the cool air of the freezing chamber 141 is passed through the inlet portion 272 of the sub-chamber 270 via the connecting passage 280, more specifically the cool air outflow passage 282, and flowed into the sub-chamber 270. Cool air that has been flowed into the sub-chamber 270 is brought into contact with the condensing unit 312b of the heat pipe 311 and heat is exchanged, and then flowed into the cool air inflow passage 283 of the connecting passage 280 through the outlet portion 273. Cool air that has flowed into the cool air inflow passage 283 is discharged to the freezing chamber 141. Working fluid 314 within the condensing unit 312b of the heat pipe 311 is cooled down and condensed, and then moved to the evaporating unit 312a disposed at an upper side thereof by a capillary phenomenon. The working fluid 314 that has been moved to the evaporating unit 312a repeats a process in which it is heat-exchanged (absorbed) with the ice making machine 210 and evaporated, and then moved to a side of the condensing unit 312b. [0083] Hereinafter, still another embodiment of the present invention will be described with reference to FIGS. 10 and 11. FIG. 10 is a perspective view illustrating a refrigerator having an ice making chamber according to still another embodiment of the present invention, and FIG. 11 is a lateral cross-sectional view of FIG. 10. As illustrated in FIGS. 10 and 11, a refrigerator having an ice making chamber may be configured by including a refrigerator main body 110 formed with a cooling chamber 130, doors 135, 145 for opening or closing the cooling chamber 130, an ice making machine 430 formed at the cooling chamber 130 or the doors 135, 145, and a cold energy transfer unit 450 for transferring cold energy to the ice making machine 430 by thermal conduction or refrigerant. [0084] The refrigerating chamber 131 and the freezing chamber 141 are formed at upper and lower regions of the refrigerator main body 110, respectively, and a refrigerating
chamber door 135 and a freezing chamber door 145 are provided at the refrigerating chamber 131 and the freezing chamber 141, respectively.

[0085] An evaporator 181 may be provided at a rear region of the freezing chamber 141. A cooling fan 185 for accelerating the flow of cool air may be provided at a side of the evaporator 181.

[0086] A dispenser 240 for taking out ice cubes to the outside without opening the refrigerating chamber door 135 may be provided at either one of the refrigerating chamber doors 135.

[0087] An ice making chamber 430 may be formed at an upper region within the refrigerating chamber 131. The ice making chamber 430 may be configured by including a case 431 for forming an ice making chamber 430 wherein to be partitioned from the refrigerating chamber 131, and an ice making chamber door 435 for opening or closing an opening disposed at a front surface of the case 431. As a result, the inside of the ice making chamber 430 is partitioned from the inside of the refrigerating chamber 131, thereby preventing the odor of the air in the cooling chamber from transferring to ice.

[0088] An ice making machine 440 for making ice in a predetermined shape may be provided within the ice making chamber 430. An ice bank 460 for storing ice that has been made in the ice making machine 440 may be provided at a lower side of the ice making machine 440 within the ice making chamber 430.

[0089] The cold energy transfer unit 450 may be configured by including a heat pipe 311 for transferring cool air by conduction.

[0090] An end of the heat pipe 311 may be connected (disposed) to the evaporator 181 in a heat-exchangeable manner, and the other end of the heat pipe 311 may be connected to the ice making machine 440 of the refrigerating chamber 131 in a heat-exchangeable manner. In other words, the condensing unit 312b of the heat pipe 311 is connected to the evaporator 181, and the evaporating unit 312a of the heat pipe 311 is connected to the ice making machine 440. Heat energy may be transferred directly from the ice making machine 440 to the cold air produced by the evaporator 181. As a result, during an ice making process, water and/or ice within the ice making chamber 430 is not brought into contact with outside air, thereby preventing the odor from being transferred and soaked into ice cubes. Here, the heat pipe 311 may be configured to be disposed at an inner wall of the freezing chamber 141 and the refrigerating chamber 131, more specifically at an inner side of the inner case 112c. In other words, prior to a process of forming the refrigerating main body 110, the heat pipe 311 is disposed at an inner side of the inner case 112b and outer case 112a, and a foaming material 112c is foamed, and as a result, it may be configured to be buried between the inner case 112b and the foaming material 112c. Here, both ends of the heat pipe 311, that is, the evaporating unit 312a and/or the condensing unit 312b, may be disposed to be exposed to a side of the ice making machine 440 and the evaporator 181 to perform a heat exchanging process.

[0091] Furthermore, the heat pipe 311 may be disposed at an outer side of the inner case 112b, that is, a side of the freezing chamber 141 and the refrigerating chamber 131, and then an outer wall of the heat pipe 311 may be finished with an insulating material.

[0092] According to such a configuration, working fluid 314 in the condensing unit 312b of the heat pipe 311 is cooled down and condensed by the evaporator 181, and then moved to the evaporating unit 312a by a capillary phenomenon. The working fluid 314 that has been moved to the evaporating unit 312a absorbs and evaporates heat in the ice making machine 440, and the ice making machine 440 is cooled down to form ice. An ice making process is performed by repeating a process in which the working fluid 314 that has been evaporated in the evaporating unit 312a is moved to the condensing unit 312b and then cooled down and condensed, and moved to the evaporating unit 312a again to be evaporated. Ice cubes that have been made and then separated (released) in the ice making machine 440 may be stored within the ice bank 460 at a lower side thereof, and taken out to the outside through the dispenser 240 that is formed at the refrigerating chamber door 135.

[0093] In the foregoing embodiments associated with FIGS. 10 and 11, it is described as an example a case in which an evaporator is provided in the freezing chamber, but the evaporator may be provided in the refrigerating chamber. In this case, a heat pipe may be provided in such a manner that it is connected to the evaporator provided in the refrigerating chamber, and as a result, the length of a cold energy transfer unit, e.g., heat pipe, can be shortened and the configuration can be made simpler.

[0094] As described above, according to an embodiment of the present invention, it is possible to remove the use of a sidewall cool air duct, thereby removing an adverse effect caused by the use of the sidewall cool air duct. In other words, dew drops are not produced on an outer surface of the refrigerating main body, thereby reducing the flow loss of cool air. In addition, a heater is not additionally provided, thereby reducing the manufacturing cost caused by the manufacture and installation of a heater as well as decreasing the power consumption caused by the use of a heater.

[0095] Furthermore, during an ice making process, cool air is not directly brought into contact with water, thereby preventing the odor in the air from transferring to ice.

[0096] Moreover, the cool air transfer section by the air can be reduced, thereby reducing the flow loss of air.

[0097] As described above, preferred embodiments of the present invention are illustrated and described herein with reference to the accompanying drawings. However, the present invention can be implemented in various embodiments without departing from the spirit of the invention, and thus the foregoing embodiments should not be limited to the content of the detailed description.

[0098] Furthermore, the foregoing embodiments should be broadly construed within the scope of the technical spirit defined by the appended claims even though they are not specifically disclosed in the detailed description herein. Moreover, all changes and modifications within the technical scope of the claims and the equivalent scope thereof should be construed to be included in the appended claims.

What is claimed is:

1. A refrigerator, comprising:
   a refrigerating main body including a cooling chamber; a door for opening or closing the cooling chamber; an ice making chamber located at the door; a sub-chamber located at the door and spaced from the ice making chamber, the sub-chamber being configured to receive cool air from the cooling chamber, and a cold energy transfer unit configured to transfer energy of cool air of the sub-chamber to the ice making chamber.
2. The refrigerator of claim 1, wherein the sub-chamber includes a first inlet, the cooling chamber includes a first outlet, the first inlet of the sub-chamber being in communication with the first outlet of the cooling chamber when the door is closed, the first inlet of the sub-chamber not being in communication with the first outlet when the door is open.

3. The refrigerator of claim 2, wherein the sub-chamber includes a first outlet, the cooling chamber includes a first inlet, the first outlet of the sub-chamber being in communication with the first inlet of the cooling chamber when the door is closed, the first outlet of the sub-chamber not being in communication with the first inlet when the door is open.

4. The refrigerator of claim 1, wherein the sub-chamber includes a first outlet, the cooling chamber includes a first inlet, the first outlet of the sub-chamber being in communication with the first inlet of the cooling chamber when the door is closed, the first outlet of the sub-chamber not being in communication with the first inlet when the door is open.

5. The refrigerator of claim 1, wherein the ice making chamber includes an ice maker configured to make ice.

6. The refrigerator of claim 1, wherein the cold energy transfer unit includes a heat pipe extending between the sub-chamber and the ice making chamber.

7. The refrigerator of claim 1, wherein the cold energy transfer unit includes a first cold energy transfer unit located in the sub-chamber and a second cold energy transfer unit extending between the sub-chamber and the ice making chamber.

8. The refrigerator of claim 7, wherein the second cold energy transfer unit includes a heat pipe.

9. The refrigerator of claim 7, wherein the second cold energy transfer unit includes a first heat exchanger located in the sub-chamber, a second heat exchanger located in the ice making chamber, and a liquid circulation path between the first heat exchanger and the second heat exchanger.

10. The refrigerator of claim 9, wherein the second cold energy transfer unit includes a pump to circulate refrigerant flowing in the liquid circulation path.

11. The refrigerator of claim 7, wherein the cooling chamber includes a refrigerating chamber, the first cold energy unit includes an evaporator located beneath the refrigerating chamber, the cool air produced by the evaporator being in communication with the sub-chamber.

12. The refrigerator of claim 1, wherein the cooling chamber includes a refrigerating chamber, the door is a refrigerating chamber door for opening and closing the refrigerating chamber and the ice making chamber is located at the refrigerating chamber door.

13. The refrigerator of claim 12, wherein the cold energy transfer unit includes a heat pipe provided at the refrigerating chamber door.

14. The refrigerator of claim 13, wherein the cooling chamber includes a freezing chamber, and the refrigerator further includes a cold air transfer passage formed in the refrigerating chamber main body to transfer the cool air of the freezing chamber to the sub-chamber.

15. The refrigerator of claim 14, wherein a cool air discharge port for discharging cool air that has passed through the sub-chamber is formed in the freezing chamber.

16. The refrigerator of claim 12, wherein the heat pipe includes at least one heat transfer fin disposed in the sub-chamber.

17. The refrigerator of claim 12, wherein the cold energy transfer unit includes a secondary refrigerant circulating unit to absorb heat from air in the ice making chamber by circulation of a refrigerant.

18. The refrigerator of claim 17, wherein the secondary refrigerant circulating unit includes a first heat exchanger disposed in the ice making chamber, a second heat exchanger connected to the first heat exchanger to circulate a refrigerant, and a pump for circulating the refrigerant through the first and the second heat exchangers.

19. The refrigerator of claim 18, wherein the cooling chamber includes a freezing chamber, and the refrigerator further includes a cool air transfer passage in the refrigerator main body for transferring the cool air of the freezing chamber to the refrigerating chamber door.

20. The refrigerator of claim 19, wherein the cool air transfer passage includes the sub-chamber formed at the refrigerating chamber door and a connecting passage for connecting the sub-chamber with the refrigerating chamber, and the second heat exchanger is disposed within the sub-chamber.

21. The refrigerator of claim 20, wherein a cool air discharge port for discharging cool air that has passed through the sub-chamber is formed in the freezing chamber.

22. The refrigerator of claim 21, wherein the cool air transfer passage includes a fan for accelerating the flow of cool air.

23. A refrigerator, comprising:
   a refrigerator main body including a refrigerating chamber and a freezing chamber,
   a door for opening or closing the refrigerating chamber,
   an ice making chamber located at the door,
   a sub-chamber located at the door and spaced from the ice making chamber, the sub-chamber being configured to receive cool air from the freezing chamber,
   a first cold energy transfer unit configured to transfer energy of the cool air of the sub-chamber using convection;
   and a second cold energy transfer unit configured to transfer energy of the first cold energy transfer unit to the ice making chamber using thermal conduction.

24. The refrigerator of claim 23, further comprising a cool air transfer passage in the refrigerator main body to transfer the cool air of the freezing chamber to the sub-chamber.

25. The refrigerator of claim 24, wherein the cool air transfer passage includes the sub-chamber formed at the refrigerating chamber door and a connecting passage for connecting the sub-chamber with the freezing chamber.

26. The refrigerator of claim 25, wherein the cool air transfer passage includes a fan for accelerating the flow of cool air.

27. The refrigerator of claim 26, wherein the fan is operated only when the ice making chamber is making ice.

28. The refrigerator of claim 23, wherein the second cold energy transfer unit includes a heat pipe to provide thermal conduction.

29. The refrigerator of claim 23, wherein the second cold energy transfer unit includes a secondary refrigerant circulating unit to provide thermal conduction via refrigerant flow.