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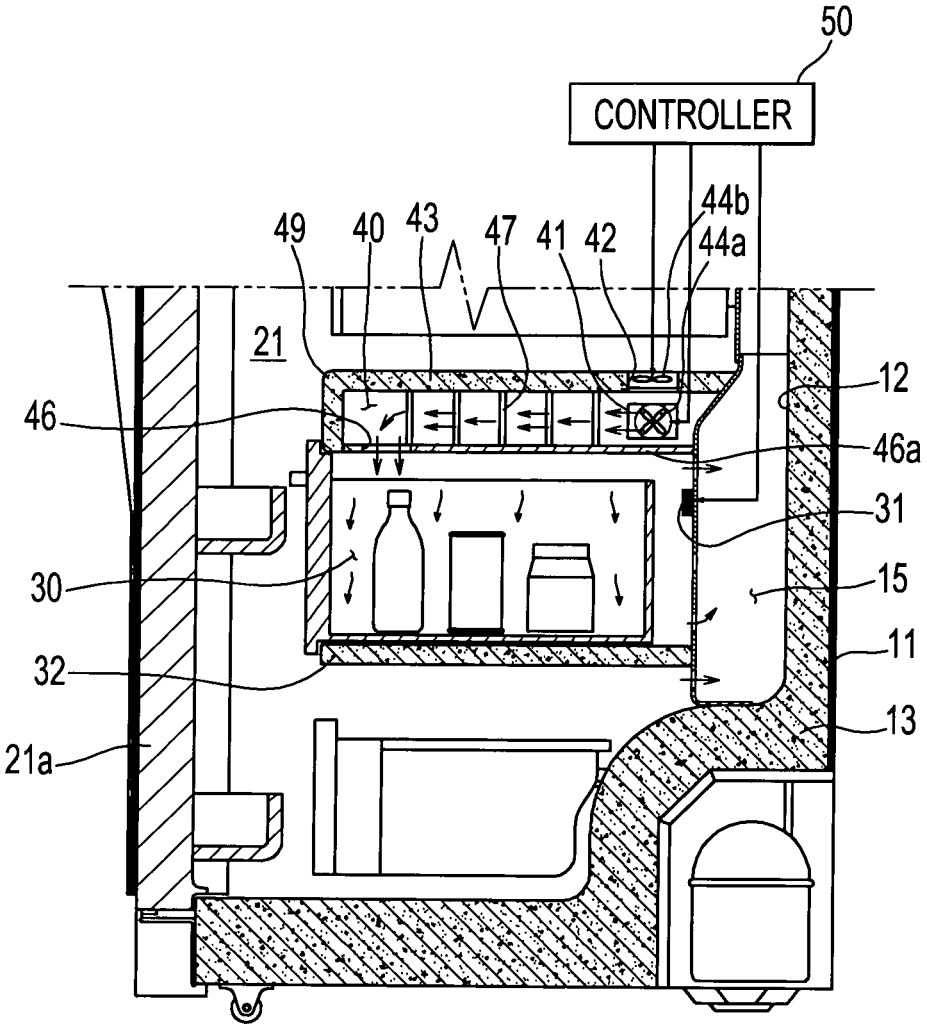
(54) **Refrigerator and method for producing supercooled liquid**

(57) A refrigerator for supercooling beverage into supercooled liquid and a method of producing the supercooled liquid using the same. The refrigerator includes a mixing room (40) provided in a main body (10) to mix chilled air from a freezer compartment (22) and a refrigerator compartment (21) with each other and having a first suction port (41) for suctioning the freezer compartment chilled air and a second suction port (42) for suction the refrigerator compartment chilled air, and a supercooling compartment (30) provided in the main body (10) to be directly or indirectly refrigerated by the chilled air mixed in the mixing room (40). The mixing room (40) and the supercooling compartment (30) may be provided either in the refrigerator compartment (21) or in the freezer compartment (22), or in an independent refrigerator compartment to form an independent refrigerating room separated from the freezer compartment (22).

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FIG. 3


50
CONTROLLER
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44b
44a
21
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46
46a
31
30
15
11
32
13
21a

Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of Korean Patent Application No. 2006-4207, filed on January 14, 2006, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates to a refrigerator, and more particularly, to a refrigerator for supercooling beverage and a method of producing a supercooled liquid using the same.

2. Description of the Related Art

[0003] Although a beverage is generally changed to a solid phase when its temperature is under its freezing point temperature at standard atmospheric pressure, occasionally, the beverage is not changed into the solid phase but is maintained in the supercooled state. As such, if liquid is not frozen even when it is below the freezing point and remains in the supercooled state it is in what is known in thermodynamics as a metastable state. Since the supercooled liquid in the metastable state is neither unstable nor stable, when there is ambient perturbation, the supercooled beverage undergoes a phase transition to the solid state. Thus, when either a supercooled beverage is poured into a cool cup or a shock or vibration is applied to the supercooled beverage, the beverage that is not completely frozen and not completely melted can be provided to a consumer. Hereinafter, the beverage whose phase is changed into the solid phase by applying an external force to the supercooled beverage is referred to slush.

[0004] In connection with this, Japanese Laid-Open Patent Publication No. 2003-214753 discloses a supercooling apparatus installed in a main body of a refrigerator such that temperature of a compartment for accommodating food is uniform and food is refrigerated. The conventional supercooling apparatus includes a chilled air supply duct and a chilled air suction duct, respectively installed to sidewalls of the compartment, and a connection duct installed to an upper wall of the compartment to connect the chilled air supply duct to the chilled air suction duct. In the conventional supercooling apparatus, since the chilled air is continuously circulated through a path formed by the chilled air supply duct, the compartment, the chilled air suction duct, and the connection duct, temperature distribution of the compartment is uniformly maintained.

[0005] Although it is important to maintain a uniform temperature distribution of the compartment for the supercooling of the beverage, like the conventional supercooling apparatus, it is more important that, in order to maintain a beverage in a supercooled state and to provide a good slush to customers, temperature distribution with respect to time of the compartment for accommodating the beverage must be maintained as uniform as possible. In other words, if, although average temperature of the compartment is uniformly maintained, the temperature of the compartment varies over a large range as time passes, when the temperature of the compartment is at the lowest point, since the beverage in the supercooled state is frozen, the slush cannot be made.

[0006] As a method of controlling a range of temperature variation with respect to time of the compartment using the conventional supercooling apparatus, there is a method of adjusting temperature of the chilled air generated by an evaporator. In other words, when a temperature required to supercool the beverage is - (minus) 5 degrees centigrade, the temperature of the chilled air generated by the evaporator is slightly lower.

[0007] However, the method of refrigerating the compartment by generating the chilled air for supercooling the beverage is not effective for the following reason. A conventional refrigerator includes a freezer compartment and a refrigerator compartment. When providing a compartment for supercooling to the conventional refrigerator, the installation of the additional evaporator for supercooling the beverage is not effective in view of structure and costs.

[0008] Thus, a solution is required that is capable of generating and supplying chilled air suitable for supercooling a beverage utilizing the structure and features of the conventional refrigerator as they are.

SUMMARY OF THE INVENTION

[0009] The present invention has been made in view of the above-mentioned problems, and an aspect of the invention is to provide a refrigerator for properly mixing chilled air supplied from a freezer compartment and a refrigerator compartment to generate chilled air suitable for supercooling a beverage and a method of producing a supercooled liquid using the refrigerator.

[0010] In accordance with the aspect, the present invention provides a refrigerator including a main body having a freezer compartment and a refrigerator compartment, a mixing room provided in the main body to suction and mix chilled air from the freezer compartment and the refrigerator compartment with each other, a supercooling compartment provided in the main body to be refrigerated by the chilled air mixed in the mixing room, and a controller for controlling suction quantities of freezer compartment chilled air and refrigerator compartment chilled air suctioned into the mixing room.

[0011] The mixing room may include a first suction port communicating with the freezer compartment to suction the freezer compartment chilled air, a second suction port communicating with the refrigerator compartment to suction the refrigerator compartment chilled air, and a chilled

air supply port through which the chilled air mixed in the mixing room is supplied into the supercooling compartment.

[0012] In the first suction port and the second suction port, blower fans are installed to suction the chilled air.

[0013] The mixing room further includes a mixing device by which the chilled air suctioned through the first suction port and the second suction port is mixed with each other when traveling to the chilled air supply port and attains an equilibrium state.

[0014] The mixing device includes a mixing passage formed between the suction ports and the chilled air supply port, and the mixing passage is formed in the serpentine shape by at least one passage forming plate.

[0015] The mixing device may further include a fan rotated in the mixing room to accelerate the mixing of the chilled air.

[0016] The supercooling compartment includes a temperature sensor installed therein, and the controller compares a temperature measured by the temperature sensor with a set temperature of the supercooling compartment to control the blower fans such that a suction quantity of the freezer compartment chilled air and a suction quantity of the refrigerator compartment chilled air are adjusted.

[0017] The mixing room and the supercooling compartment may be provided in the freezer compartment or in the refrigerator compartment.

[0018] Moreover, the main body further includes an independent refrigerator compartment separated from the freezer compartment and the refrigerator compartment and having a separate refrigerating room, and the mixing room and the supercooling compartment are provided in the independent refrigerator compartment.

[0019] The mixing room and the supercooling compartment may be disposed adjacent to each other. Moreover, the mixing room is spaced apart from the supercooling compartment and further includes a connector duct provided between the mixing room and the supercooling compartment to connect the mixing room to the supercooling compartment.

[0020] The supercooling compartment is disposed in the mixing room. In this case, the supercooling compartment further includes a chilled air introducing port communicating with the mixing room to receive the chilled air mixed in the mixing room, and the chilled air introducing port is installed with a damper for opening and closing the chilled air introducing port.

[0021] The refrigerator further includes a casing for separating the mixing room from the supercooling compartment, wherein the casing is made of material of a high heat capacity.

[0022] The mixing room and the supercooling compartment may further include insulators for preventing temperature variation affects due to the temperature of the refrigerator compartment and of the freezer compartment.

[0023] In accordance with another aspect, the present invention provides a refrigerator including a main body having a refrigerator compartment and an evaporator for generating chilled air, a mixing room provided in the main body to suction and mix the chilled air from the refrigerator compartment and the evaporator with each other, a supercooling compartment provided in the main body to be refrigerated by the chilled air mixed in the mixing room, and a controller for controlling suction quantities of refrigerator compartment chilled air and evaporator chilled air suctioned into the mixing room.

[0024] In accordance with another aspect, the present invention provides a method of producing a supercooled liquid utilizing a refrigerator including a refrigerator compartment and a freezer compartment, including suctioning chilled air from the freezer compartment and the refrigerator compartment and mixing the chilled air in a mixing room, and blowing the chilled air mixed in the mixing room into a supercooling compartment.

[0025] The method further includes adjusting a suction quantity of freezer compartment chilled air and a suction quantity of refrigerator compartment chilled air suctioned into the mixing room such that a temperature of the supercooling compartment is maintained at a set temperature.

[0026] The supercooling compartment may include a chilled air supply port through which the chilled air mixed in the mixing room is supplied and a damper for opening and closing the chilled air supply port, and the method may further include closing the damper and indirectly refrigerating the supercooling compartment using the chilled air in the mixing room.

[0027] In accordance with another aspect, the present invention provides a method of producing a supercooled liquid utilizing a refrigerator including a refrigerator compartment and a freezer compartment, including suctioning the chilled air from the refrigerator compartment and the evaporator and mixing the chilled air with each other in a mixing room, and blowing the chilled air mixed in the mixing room into a supercooling compartment.

[0028] Additional aspects and/or advantages of the invention will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] These and/or other aspects and advantages of the invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings in which:

FIG. 1 is a front view illustrating a refrigerator according a first embodiment of the present invention;

FIG. 2 is a front sectional view of the refrigerator in FIG. 1;

FIG. 3 is a sectional view taken along the line I-I in FIG. 1;

FIGS. 4A and 4B are views illustrating a mixing device provided in a mixing room as shown in FIG. 3;

FIG. 5 is a side sectional view illustrating a part of a refrigerator according to a second embodiment of the present invention;

FIG. 6 is a side sectional view illustrating a part of a refrigerator according to a third embodiment of the present invention;

FIG. 7 is a side sectional view illustrating a part of a refrigerator according to a fourth embodiment of the present invention; and

FIG. 8 is a side sectional view illustrating a part of a refrigerator according to a fifth embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0030] Reference will now be made in detail to the embodiments of the present invention, examples of which are illustrated in the accompanying drawings. FIG. 1 is a front view illustrating a refrigerator according a first preferred embodiment of the present invention, FIG. 2 is a front sectional view of the refrigerator in FIG. 1, and FIG. 3 is a sectional view taken along the line I-I in FIG. 1.

[0031] As shown in FIGS. 1 to 3, the refrigerator according to the first embodiment of the present invention includes a main body 10 having an open front side. The main body 10 includes an outer shell 11 for forming an outer appearance and an inner shell 12 spaced apart from the outer shell 11 to form a compartment for accommodating food. Between the outer and the inner shells 11 and 12, an insulator 13 is formed to prevent chilled air from being dissipated.

[0032] The compartment 20 is divided into right and left sides by an intermediate partition 14, wherein the right side serves as a refrigerator compartment 21 for refrigerating food and the left side serves as a freezer compartment 22 for freezing food. In the rear side of the compartment 20, a chilled air generating room 15 is provided to generate chilled air to be supplied to the compartment 20. The chilled air generating room 15 includes an evaporator (not shown) for performing heat-exchange between the evaporator and ambient air to generate the chilled air.

In the vicinity of the evaporator, a circulation fan (not shown) is installed to supply the chilled air into the compartment 20.

[0033] In the front sides of the refrigerator compartment 21 and the freezer compartment 22, a refrigerator compartment door 21a and a freezer compartment door 22a are hinged to open and close the refrigerator compartment 21 and the freezer compartment 22, respectively. Each of the doors 21 a and 22a is provided with shelves 16 for accommodating food.

[0034] The refrigerator according to the first embodiment of the present invention includes a supercooling compartment 30 provided in the refrigerator compartment 21 to refrigerate a beverage below a freezing point and to produce a supercooled liquid.

[0035] The lowest temperature in which the beverage can be supercooled (hereinafter referred to a 'limit supercooling temperature') is determined by various variables such as type of the beverage, material or a size of a container for containing the beverage, and the like. However, when the types of the containers usually used are restricted to only a few, then material, size and other variables with minimal effect (for example, refrigerating speed) are neglected, experimental data are statistically processed so that supercooling temperatures suitable for the types of the beverages can be determined. For example, as a result of repetitive experiments with 200 ml of water contained in a glass container, if an average limit supercooling temperature is - (minus) 9 degrees centigrade, it is possible to define a temperature equal to or slightly higher than the same as a set temperature of the supercooling compartment 30. The experiments are performed while changing the types of the beverages as described above, the set temperature T of the supercooling compartment 30 is about - (minus) 5 degrees centigrade to - (minus) 12 degrees centigrade. Since the temperature range is between the temperature (-(minus) 18 degrees centigrade to - (minus) 21 degrees centigrade) of the freezer compartment 22 and temperature (3 degrees centigrade to 5 degrees centigrade) of the refrigerator compartment 21, chilled air in the freezer compartment and chilled air in the refrigerator compartment are properly mixed with each other to make chilled air used to supercool the beverage.

[0036] Thus, the refrigerator according to the first embodiment of the present invention includes a mixing room 40 provided in the refrigerator compartment 21 to suction chilled air respectively from the freezer compartment 22 and the refrigerator compartment 21 and to mix the same to make chilled air to be supplied into the supercooling compartment 30, and a controller 50 for controlling the suction quantity of the chilled air suctioned from the freezer compartment and the refrigerator compartment into the mixing room 40 to maintain the temperature of the supercooling compartment 30 at the set temperature.

[0037] The mixing room 40 includes first and second suction ports 41 and 42 for suctioning the freezer compartment chilled air and the refrigerator compartment chilled air from the freezer compartment 22 and the refrigerator compartment 21, respectively. As shown in FIGS. 2 and 3, in a case of providing the mixing room 40 and the supercooling compartment 30 in the refrigerator compartment 21, the first suction port 41 penetrates the intermediate partition 14 to communicate with the freezer

compartment 22, and the second suction port 42 penetrates a side of a partition 43 for separating the mixing room 40 from the refrigerator compartment 21 to communicate with the refrigerator compartment 21. In the first and the second suction ports 41 and 42, are installed blower fans 44a and 44b for supplying suction force necessary for suctioning the freezer compartment chilled air and the refrigerator compartment chilled air, and flaps 45 for opening and closing the first and the second suction ports 41 and 42 according to whether the blower fans 44a and 44b are driven or not.

[0038] The mixing room 40 is disposed adjacent to the supercooling compartment 30 and is separated by a partition 46a. The chilled air mixed in the mixing room 40 is directly blown into the supercooling compartment 30. To this end, the mixing room 40 includes a chilled air supply port 46 formed in the partition 46a.

[0039] The mixing room 40 may include a mixing device 47 for mixing the chilled air suctioned through the first and the second suction ports 41 and 42 while traveling in an equilibrium state. The mixing device 47, as shown in FIG. 4A, may include the first suction port 41 and a mixing passage 47a formed between the second suction port 42 and the chilled air supply port 46. FIG. 4A is a plan view illustrating the mixing passage formed in the mixing room as shown in FIG. 3. The mixing passage 47a is formed in a serpentine shape by at least one passage forming plate 47b. Moreover, the mixing device, as shown in FIG. 4B, may include a fan 47c installed to rotate in the mixing room 40 to accelerate the mixing of the chilled air. The fan 47c is installed in the mixing room 40 without a driving device such as a motor and is rotated by receiving a force from a stream of the chilled air suctioned into the mixing room 40, causing the acceleration of the mixing of the chilled air.

[0040] The supercooling compartment 30 includes a supercooling temperature sensor 31 installed to measure temperature of the supercooling compartment 30, and the controller 50 compares the temperature measured by the supercooling temperature sensor 31 with the set temperature of the supercooling compartment 30 and controls the blower fans 44a and 44b according to the compared result to adjust the suctioning quantity of the freezer compartment chilled air and the refrigerator compartment chilled air. For example, if the set temperature of the supercooling compartment 30 is - (minus) 7 degrees centigrade and the measured temperature of the supercooling temperature sensor 31 is - (minus) 5 degrees centigrade, the controller 50 controls the blower fans 44a and 44b to increase a suction ratio of the freezer compartment chilled air such that temperature of the mixture of the chilled air lowers to - (minus) 7 degrees centigrade. As shown in FIGS. 4A and 4B, a mixing temperature sensor 48 may be installed in the mixing room 40, and in this case, the mixing temperature sensor 48 is installed around the chilled air supply port 46 to measure the temperature of the mixture of the chilled air being supplied into the supercooling compartment 30.

[0041] Meanwhile, the mixing room 40 and the supercooling compartment 30 include insulators 49 and 32 for separating the refrigerator compartment 21 from the mixing room 40 and the supercooling compartment 30 to prevent heat transfer therebetween and the internal temperature of the freezer compartment 22 from being affected by the temperature of the refrigerator compartment 21.

[0042] In relation to the aspect of the present invention, operation of the refrigerator according to the first preferred embodiment of the present invention will be described as follows. When a set temperature of the supercooling compartment 30 is determined according to types of food to be supercooled, the blower fans 44a and 44b are driven such that the freezer compartment chilled air is introduced into the mixing room 40 through the first suction port 41 from the freezer compartment 22 and the refrigerator compartment chilled air is introduced into the mixing room 40 through the second suction port 42 from the refrigerator compartment 21. The freezer compartment chilled air and the refrigerator compartment chilled air suctioned into the mixing room 40 undergo heat exchange while passing through the mixing passage 47a to be in the equilibrium state, and are supplied into the supercooling compartment 30 through the chilled air supply port 46 to supercool the beverage in the supercooling compartment 30.

[0043] At that time, the supercooling temperature sensor 31 installed in the supercooling compartment 30 measures the temperature of the supercooling compartment 30. Data on the measured temperature are transmitted to the controller 50, and the controller 50 compares the temperature measured by the supercooling temperature sensor 31 with the set temperature of the supercooling compartment 30 and controls the blower fans 44a and 44b according to the result of the comparison. Then, the suction quantities of the freezer compartment chilled air and the refrigerator compartment chilled air are adjusted so that temperature of the chilled air mixed in the mixing room 40 approaches the set temperature, and as a result the supercooling compartment 30 can be maintained at the set temperature.

[0044] Although FIG. 3 shows an example that the mixing room 40 and the supercooling compartment 30 are installed in the refrigerator compartment 21, the mixing room 40 and the supercooling compartment 30 may be disposed in the freezer compartment 22. However, in this case, the second suction port for suctioning the refrigerator compartment chilled air penetrates the intermediate partition and communicates with the refrigerator compartment.

[0045] FIG. 5 is a side sectional view illustrating a part of a refrigerator according to a second embodiment of the present invention. Although in the embodiment of FIG. 3 the supercooling compartment 30 is disposed adjacent to the mixing room 40, in this embodiment, a supercooling compartment 60 is disposed in a mixing room 70. Hereinafter, a case of disposing the supercooling

compartment 60 and the mixing room 70 in the freezer compartment 22 will be described.

[0046] As shown in FIG. 5, the refrigerator according to the second embodiment of the present invention includes the mixing room 70, disposed in the freezer compartment 22, to suction the chilled air from the freezer compartment 22 and the refrigerator compartment 21 respectively and to mix them, and the supercooling compartment 60 disposed in the mixing room 70 and separated from the mixing room 70 by a casing 61.

[0047] Like the embodiment of FIG. 3, the mixing room 70 includes a first and a second suction ports 71 and 72 communicated with the freezer compartment 22 and the refrigerator compartment 21, wherein blower fans 73a and 73b and flaps are installed in the first and the second suction ports 71 and 72, respectively.

[0048] The supercooling compartment 60 includes a chilled air introducing port 63 communicating with the mixing room 70 to directly receive the chilled air from the mixing room 70, and a damper 64 for opening and closing the chilled air introducing port 63. When opening the damper 64, the chilled air is directly supplied into the supercooling compartment 60 from the mixing room 70, and when closing the damper 64, the chilled air in the mixing room 70 around the supercooling compartment 60 refrigerates the supercooling compartment 60 via indirect heat transfer such as conduction, radiation, or the like. When refrigerating the supercooling compartment 60 through the indirect heat transfer, it is possible to prevent local or rapid temperature change of the supercooling compartment 60 that would occur when the chilled air is directly supplied into the supercooling compartment 60. Moreover, since the chilled air in the mixing room 70 surrounding the supercooling compartment 60 mitigates the supercooling compartment 70 being affected from the freezer compartment 22 with low temperature, the supercooling compartment 60 can maintain a stable temperature more precisely. At that time, since when the casing 61 of the supercooling compartment 60 is made of material of large heat capacity the casing 61 serves a buffer against the temperature change, the rapid temperature change of the supercooling compartment 60, from the effect of ambient temperature around the supercooling compartment 60, is further mitigated.

[0049] A supercooling temperature sensor 62 is installed in the supercooling compartment 60. When the damper 64 is closed, the controller 50 may adjust the suction quantities of the freezer compartment and the refrigerator compartment such that the temperature t measured by the supercooling temperature sensor 62 satisfies the following formula with respect to the set temperature T of the supercooling compartment 60.

$$T-2 \le t \le T+2$$

[0050] When the damper 64 is closed and the supercooling compartment 60 is indirectly refrigerated, it is difficult to maintain the temperature t of the supercooling compartment 60 at the set temperature T. However, when the temperature measured in the supercooling compartment 60 is too low in comparison to the set temperature, the beverage in the supercooling compartment 60 may possibly be frozen, and to the contrary, when the temperature measured in the supercooling compartment 60 is too high, the supercooling of the beverage is hard to achieve so that it is also difficult to change the supercooled beverage into slush when a user makes slush from the supercooled beverage. Thus, by taking this point into consideration, the controller 50 controls the blower fans 73a and 73b and adjusts a mixing ratio of the chilled air such that difference between the temperature t measured in the supercooling compartment 60 and the set temperature T is maintained within 2 degrees centigrade. For example, when the temperature of the supercooling compartment 60 measured by the supercooling temperature sensor 62 is - (minus) 4 degrees centigrade and the set temperature is - (minus) 7 degrees centigrade, the controller 50 increases the suction quantity of the freezer compartment chilled air to further refrigerate the supercooling compartment 60.

[0051] Meanwhile, in order to prevent the mixing room 70 from being affected from the temperature of the freezer compartment 22, the mixing room 70 includes an insulator 75 for separating the mixing room 70 from the freezer compartment 22 to preventing heat transfer between the freezer compartment 22 and the mixing room 70. The mixing room 70 further includes a chilled air discharge port 76 for circulating the chilled air therein toward the chilled air generating room 15. The chilled air discharge port 76 may be installed with a damper 77 for opening and closing the chilled air discharge port 76.

[0052] Operation of the refrigerator according to the second embodiment of the present invention will be described as follows. When the set temperature T is determined according to types of beverage to be supercooled, the blower fans 73a and 73b are driven so that the freezer compartment chilled air is introduced into the mixing room 70 through the first suction port 71 from the freezer compartment 22, and the refrigerator compartment chilled air is introduced into the mixing room 70 through the second suction port 42 from the refrigerator compartment 21. The freezer compartment chilled air and the refrigerator compartment chilled air suctioned into the mixing room 70 undergo heat exchange in the mixing room 70 to be in the equilibrium state, and are supplied into the supercooling compartment 60 through the chilled air supply port 63. The temperature control when the damper 64 is opened is identical to that of the embodiment as shown in FIG. 2. In other words, the controller 50 controls the blower fans 73a and 73b such that the temperature of the supercooling compartment 60 measured by the supercooling temperature sensor 62 can be maintained at the set temperature T.

[0053] After supply of the mixture of the chilled air to

the supercooling compartment 60 for a predetermined time, the damper 64 is closed to indirectly refrigerate the supercooling compartment 60. At that time, the supercooling temperature sensor 62 installed in the supercooling compartment 60 measures the temperature of the supercooling compartment 60. Data on the measured temperature is transmitted to the controller 50, and the controller 50 compares the temperature measured by the supercooling temperature sensor 62 with the set temperature of the supercooling compartment 60 and controls the blower fans 44a and 44b, when the difference between the supercooling compartment temperature t and the set temperature T is greater than 2 degrees centigrade, such that the mixing ratio of the chilled air can be changed. Then, the temperature of the mixing room 70 is changed so that the temperature of the supercooling compartment 60 can be maintained at a temperature required to maintain the beverage in the supercooled state.

[0054] Although FIG. 5 shows an example that the mixing room 70 and the supercooling compartment 60 are installed in the freezer compartment 22, the mixing room 70 and the supercooling compartment 60 may be disposed in the refrigerator compartment 21.

[0055] FIG. 6 is a side sectional view illustrating a part of a refrigerator according to a third embodiment of the present invention. The embodiment in FIG. 6 is basically similar to the embodiment in FIG. 3, but it is different from the embodiment in FIG. 3 in that the mixing room 40 is spaced apart from the supercooling compartment 30. Hereinafter, the same reference numerals are assigned to the same components and only aspects peculiar to this embodiment will be described.

[0056] As shown in FIG. 6, the mixing room 40 having the first suction port 41 and the second suction port 42 is spaced apart from the supercooling compartment 30 and is disposed in the rear side 21 b of the refrigerator compartment. The mixing room 40 may be disposed higher than the supercooling compartment 30 such that the chilled air mixed in the mixing room 40 can be smoothly supplied into the supercooling compartment 30.

[0057] The mixing room 40 and the supercooling compartment 30 are connected to each other by a connector duct 80 provided therebetween such that the chilled air in the mixing room 40 can be supplied into the supercooling compartment 30. An end of the connector duct 80 communicates with the mixing room 40 via a chilled air discharge port 81 formed in the lower side of the mixing room 40 and the opposite end thereof communicates with the supercooling compartment 30 via a chilled air introducing port 82 formed in the upper side of the supercooling compartment 30. The connector duct 80 may be disposed along the sidewall 21c (See FIG. 1) of the refrigerator compartment 21 oriented toward the intermediate partition 14.

[0058] Since operation of the refrigerator according to this preferred embodiment is similar to that of the refrigerator as shown in FIG. 2, its description is omitted.

[0059] FIG. 7 is a side sectional view illustrating a part of a refrigerator according to a fourth embodiment of the present invention. In this embodiment, the supercooling compartment 30 and the mixing room 40 are provided not in the freezer compartment 22 or the refrigerator compartment 21, but independently provided in an independent refrigerator compartment 90. Hereinafter, similar components to those in the embodiment as shown in FIG. 3 will not be described. The same components as those of the embodiment in FIG. 3 are assigned with the same reference numerals and only aspects peculiar to this embodiment will be described.

[0060] As shown in FIG. 7, the refrigerator according to this embodiment of the present invention includes the independent refrigerator compartment 90 separated from the freezer compartment 22 (See FIG. 2) and the refrigerator compartment 21 and having a separate accommodating room. The independent refrigerator compartment 90 is provided in the lower refrigerator compartment 21 and includes a door 90a for opening and closing the independent refrigerator compartment 90.

[0061] The independent refrigerator compartment 90 is partitioned into an upper side and a lower side by a horizontal partition 91 and is independent from the refrigerator compartment 21. The independent refrigerator compartment 90 is partitioned into a left side and a right side by the intermediate partition 14 (See FIG. 2) and is separated from the freezer compartment 22. Although FIG. 7 does not illustrate the freezer compartment and the intermediate partition, the position of the independent refrigerator compartment 90 can be understood by referring FIGS. 1 and 2.

[0062] The independent refrigerator compartment 90 includes the mixing room 40 having the first suction port 41 penetrating the intermediate partition 14 and communicating with the freezer compartment 22 and the second suction port 42 penetrating the horizontal partition 91 and communicating with the refrigerator compartment 21, and the supercooling compartment 30 for directly receiving the chilled air from the mixing room 40 to supercool the beverage.

[0063] Since the above structure and operation are identical to those of the refrigerator in FIG. 3, its description is omitted. In this embodiment, although the independent refrigerator compartment 90 disposed in the lower side of the refrigerator compartment 21 has been described, the independent refrigerator compartment 90 can be disposed in the lower side of the freezer compartment 22.

[0064] As such, when the mixing room 40 and the supercooling compartment are provided in the independent refrigerator compartment 90, since the mixing room 40 and the supercooling compartment 30 are less affected from the temperature of the freezer compartment 22 or the refrigerator compartment 21, the temperature of the supercooling compartment 30 is more easily controlled.

[0065] FIG. 8 is a side sectional view illustrating a part of a refrigerator according to a fifth embodiment of the present invention. In this embodiment, a refrigerator for

mixing the refrigerator compartment chilled air with the chilled air from the chilled air generating room 15 is described, not the refrigerator compartment chilled air with the freezer compartment chilled air. Hereinafter, the same reference numerals as those in FIG. 3 are assigned to the same components, and only aspects peculiar to of this preferred embodiment will be described.

[0066] As shown in FIG. 8, a mixing room 40' is provided in the main body 10 to suction and mix the chilled air from the refrigerator compartment 21 and an evaporator 15a in the chilled air generating room 15 with each other. The mixing room 40' includes a first suction port 41' provided in the rear side 21 b of the refrigerator compartment to suction the chilled air generated by the evaporator 15a and to communicate with the chilled air generating room 15, and a second suction port 42' communicated with the refrigerator compartment 21 to suction the chilled air from the refrigerator compartment 21. The first suction port 41' may be disposed in the upper side of the evaporator 15a. The first and the second suction ports 41' and 42' are installed with blower fans 44a' and 44b' for supplying suction force required to suction the chilled air from the chilled air generating room 15 and the refrigerator compartment 21.

[0067] Since operation of the refrigerator according to this embodiment is similar to that of the refrigerator as shown in FIG. 2 except for using the chilled air from the evaporator instead of the freezer compartment chilled air, its description is omitted.

[0068] Meanwhile, the aspects as shown in FIGS. 3 to 7 (for example, the mixing passage, positions of the mixing room and the supercooling compartment, the relation between the mixing room and the supercooling compartment, and the damper) can all be applied to this embodiment.

[0069] As described above, the refrigerator according to the present invention generates suitable chilled air for supercooling beverage by properly mixing freezer compartment chilled air with the refrigerator chilled air so that the supercooling compartment can be implemented without seriously changing the structure of the conventional refrigerator.

[0070] Moreover, since the supercooling compartment is refrigerated by the chilled air having temperature approximately the same as the set temperature of the supercooling compartment, the temperature of the supercooling compartment does not change rapidly and the beverage can be stably supercooled.

[0071] Although a few embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in this embodiment without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

Claims

1. A refrigerator comprising:

a main body having a freezer compartment and a refrigerator compartment;
a mixing room provided in the main body to suction and mix chilled air from the freezer compartment and the refrigerator compartment with each other;
a supercooling compartment provided in the main body to be refrigerated by the chilled air mixed in the mixing room; and
a controller for controlling a quantity of a freezer compartment chilled air and a refrigerator compartment chilled air suctioned into the mixing room.

2. The refrigerator according to claim 1, wherein the mixing room comprises:

a first suction port communicated with the freezer compartment to suction the freezer compartment chilled air;
a second suction port communicated with the refrigerator compartment to suction the refrigerator compartment chilled air; and
a chilled air supply port through which the chilled air mixed in the mixing room is supplied into the supercooling compartment.

3. The refrigerator according to claim 2, wherein in the first suction port and the second suction port, blower fans are installed to suction the chilled air

4. The refrigerator according to claim 2, wherein the mixing room further comprises a mixing device by which the chilled air suctioned through the first suction port and the second suction port is mixed with each other when traveling to the chilled air supply port and attains an equilibrium state.

5. The refrigerator according to claim 4, wherein the mixing device comprises a mixing passage formed between the suction ports and the chilled air supply port.

6. The refrigerator according to claim 5, wherein the mixing passage is formed in a serpentine shape by at least one passage forming plate.

7. The refrigerator according to claim 4, wherein the mixing device further includes a fan rotated in the mixing room to accelerate the mixing of the chilled air.

8. The refrigerator according to claim 3, wherein the supercooling compartment includes a temperature

sensor installed therein, and the controller compares a temperature measured by the temperature sensor with a set temperature of the supercooling compartment to control the blower fans such that a suction quantity of the freezer compartment chilled air and a suction quantity of the refrigerator compartment chilled air are adjusted.

9. The refrigerator according to claim 1, wherein the mixing room and the supercooling compartment are provided in the freezer compartment or in the refrigerator compartment.

10. The refrigerator according to claim 1, wherein the main body further comprises an independent refrigerator compartment separated from the freezer compartment and the refrigerator compartment and having a separate refrigerating room, and the mixing room and the supercooling compartment are provided in the independent refrigerator compartment.

11. The refrigerator according to claim 1, wherein the mixing room and the supercooling compartment are disposed adjacent to each other.

12. The refrigerator according to claim 1, wherein the mixing room is spaced apart from the supercooling compartment and further comprises a connector duct provided between the mixing room and the supercooling compartment to connect the mixing room to the supercooling compartment.

13. The refrigerator according to claim 1, wherein the supercooling compartment is disposed in the mixing room.

14. The refrigerator according to claim 13, wherein the supercooling compartment further comprises a chilled air introducing port communicated with the mixing room to receive the chilled air mixed in the mixing room, and the chilled air introducing port is installed with a damper for opening and closing the chilled air introducing port.

15. The refrigerator according to claim 1, further comprising a casing for separating the mixing room from the supercooling compartment, wherein the casing is made of material of a high heat capacity.

16. The refrigerator according to claim 1, wherein the mixing room and the supercooling compartment further comprise insulators for preventing affect due to temperature of the refrigerator compartment and of the freezer compartment.

17. A refrigerator comprising:

a main body having a refrigerator compartment and an evaporator for generating chilled air;
a mixing room provided in the main body to suction and mix the chilled air from the refrigerator compartment and the evaporator with each other;
a supercooling compartment provided in the main body to be refrigerated by the chilled air mixed in the mixing room; and
a controller for controlling suction quantities of a refrigerator compartment chilled air and an evaporator chilled air suctioned into the mixing room.

18. A method of producing a supercooled liquid utilizing a refrigerator comprising a refrigerator compartment and a freezer compartment, the method comprising:

suctioning chilled air from the freezer compartment and the refrigerator compartment and mixing the chilled air in a mixing room; and
blowing the chilled air mixed in the mixing room into a supercooling compartment.

19. The method of producing a supercooled liquid according to claim 18, further comprising adjusting a suction quantity of a freezer compartment chilled air and a suction quantity of a refrigerator compartment chilled air suctioned into the mixing room such that a temperature of the supercooling compartment is maintained at a set temperature.

20. The method of producing a supercooled liquid according to claim 18, wherein the supercooling compartment comprises:

a chilled air supply port through which the chilled air mixed in the mixing room is supplied; and
a damper for opening and closing the chilled air supply port.

21. The method of producing a supercooled liquid according to claim 20, further comprising closing the damper and indirectly refrigerating the supercooling compartment using the chilled air in the mixing room.

22. A method of producing a supercooled liquid utilizing a refrigerator comprising a refrigerator compartment and an evaporator for generating chilled air, the method comprising:

suctioning the chilled air from the refrigerator compartment and the evaporator and mixing the chilled air with each other in a mixing room; and
blowing the chilled air mixed in the mixing room into a supercooling compartment.

FIG. 1

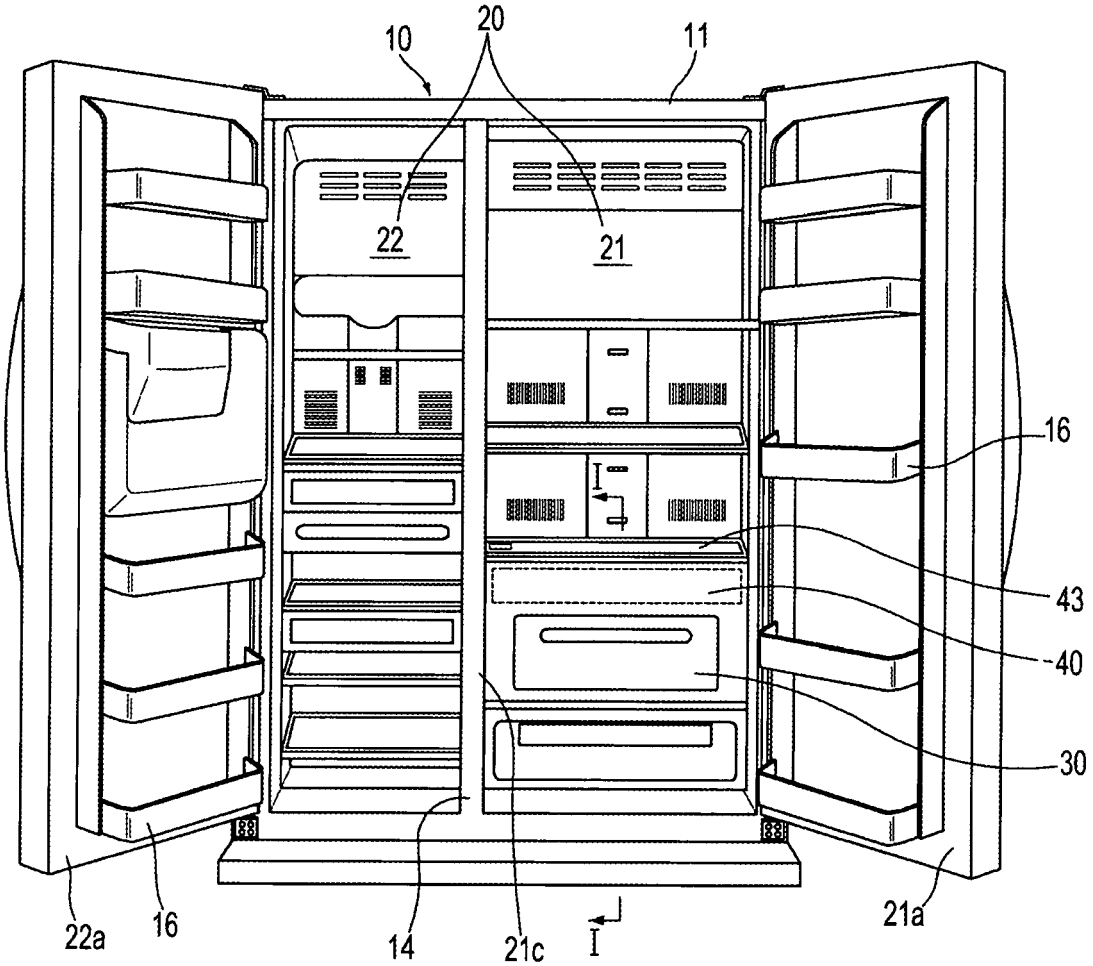


FIG. 2

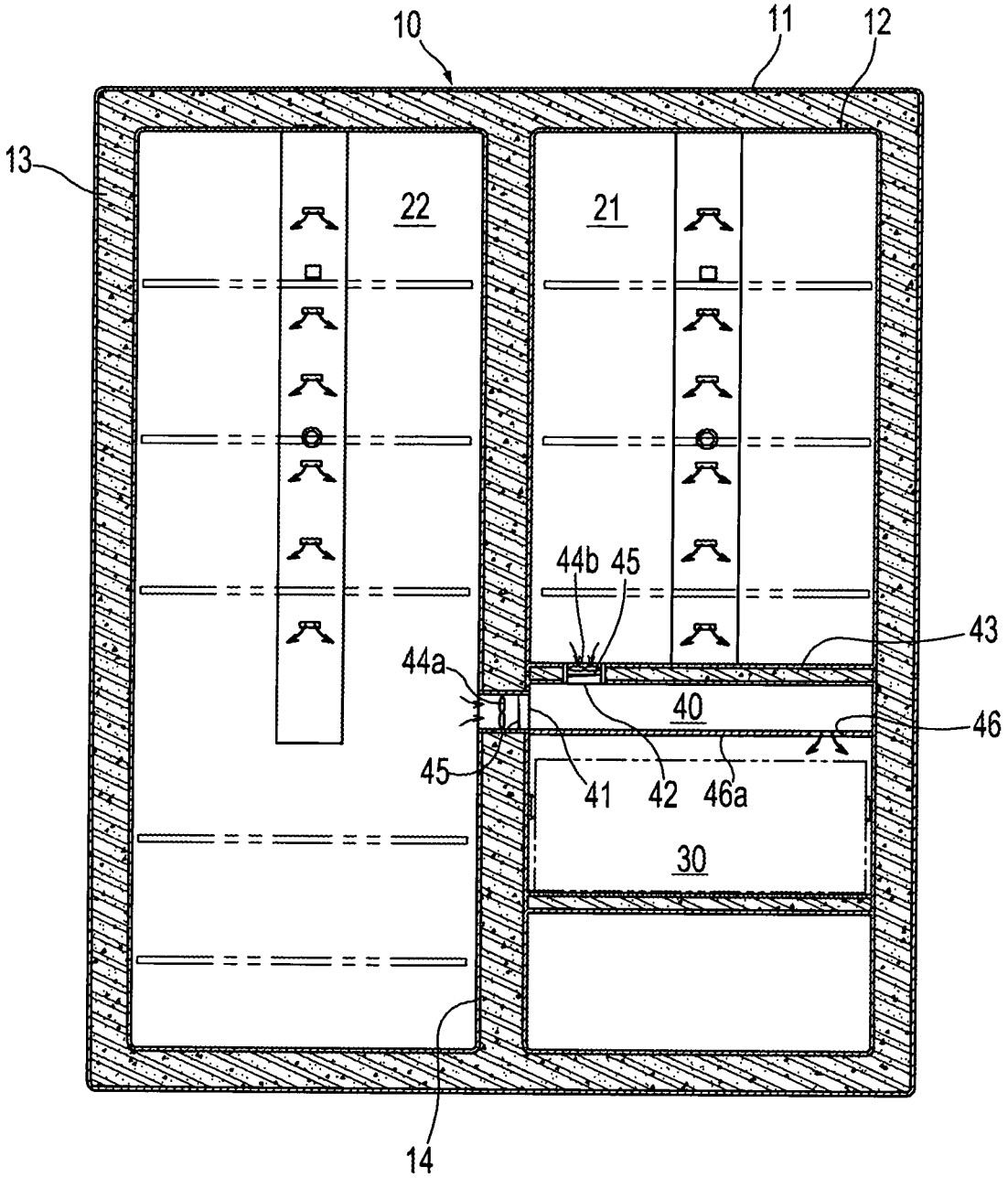


FIG. 3

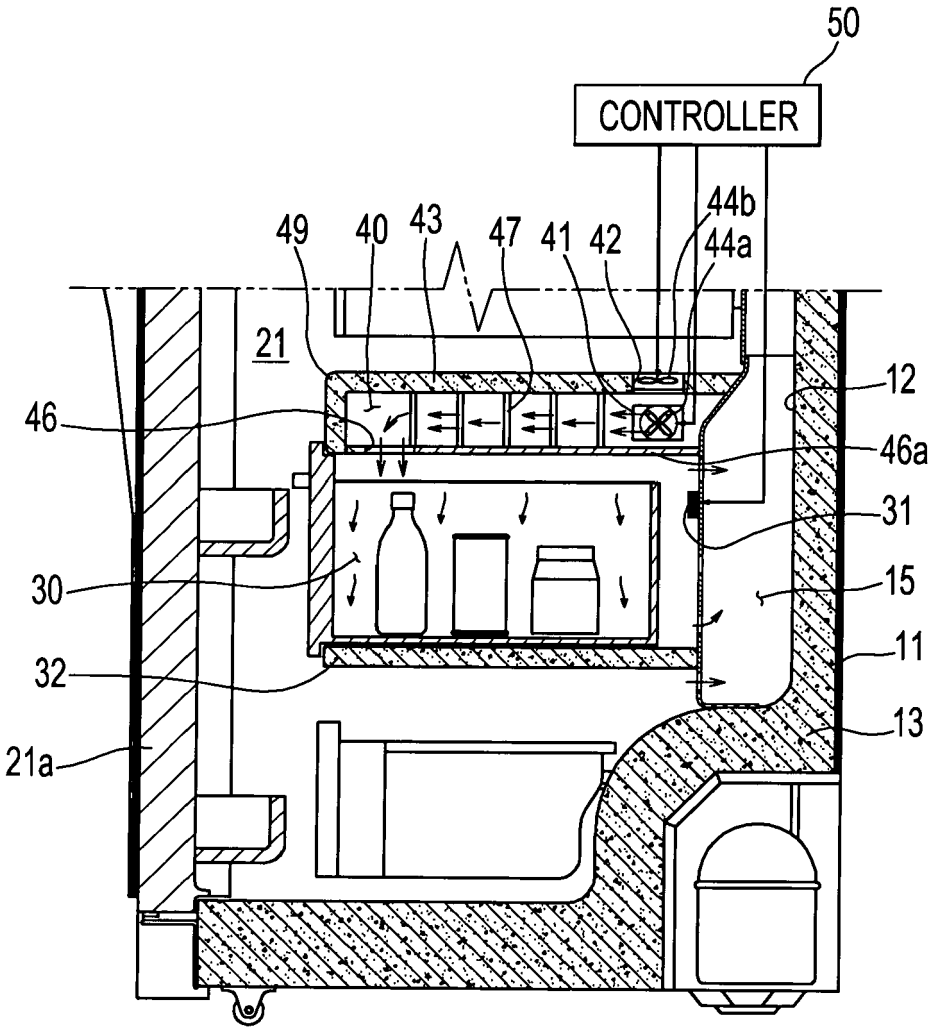

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49
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43
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41
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44b
44a
21
12
46
46a
31
30
15
11
32
13
21a

FIG. 4A

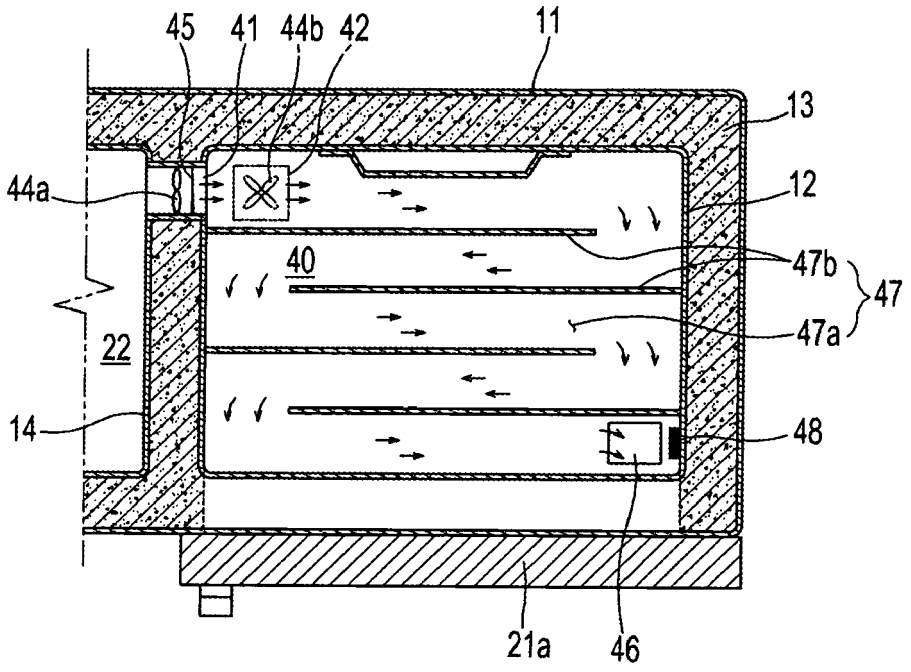


FIG. 4B

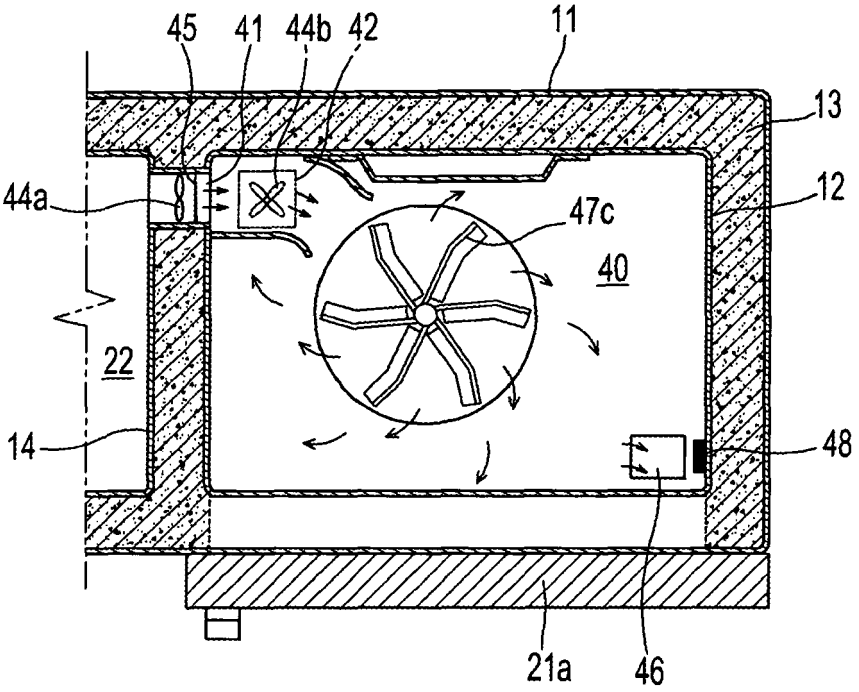


FIG. 5

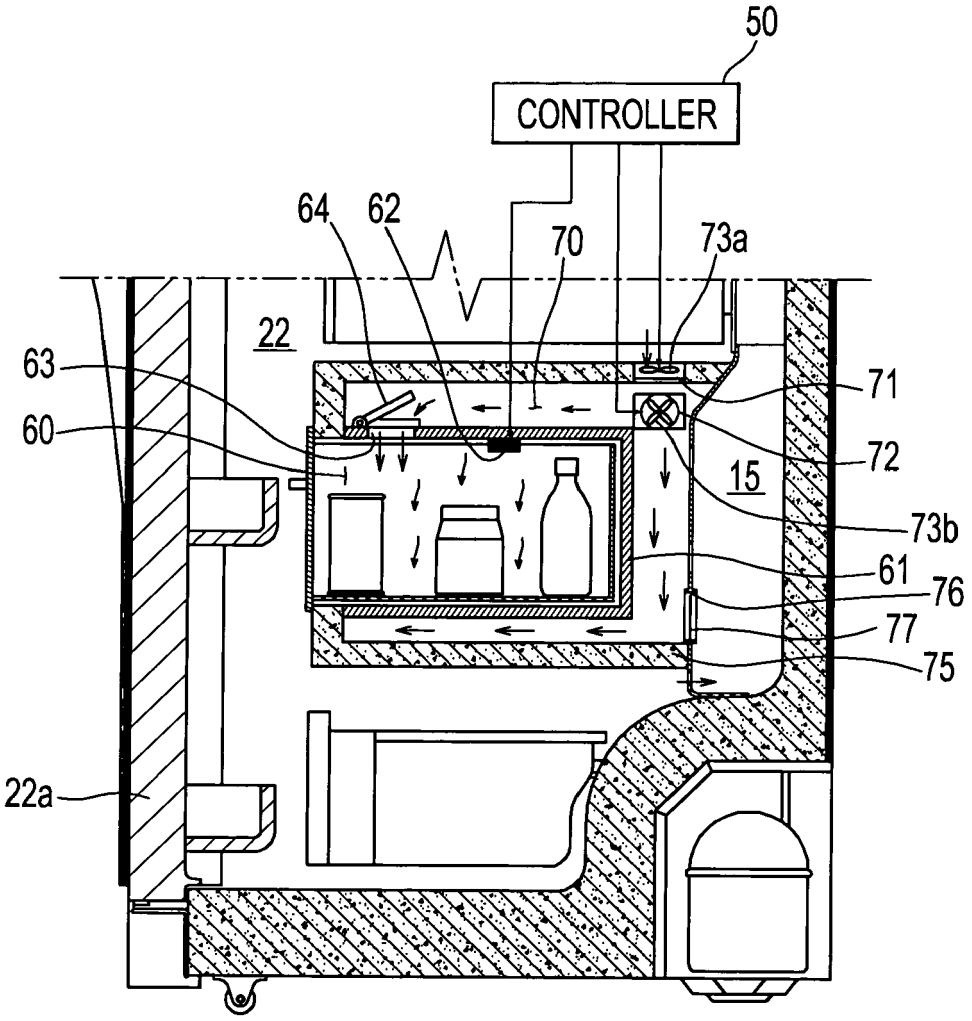


FIG. 6

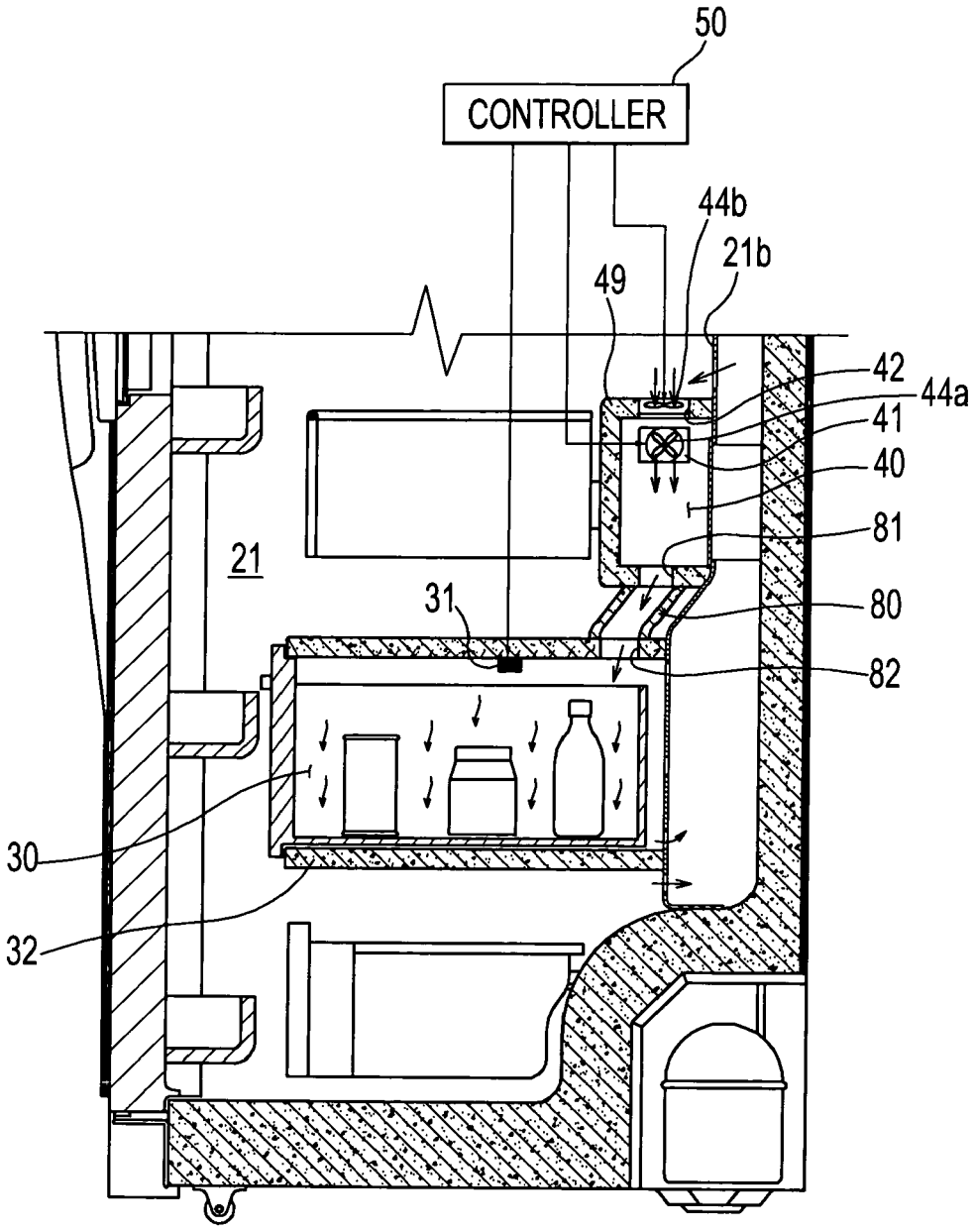


FIG. 7

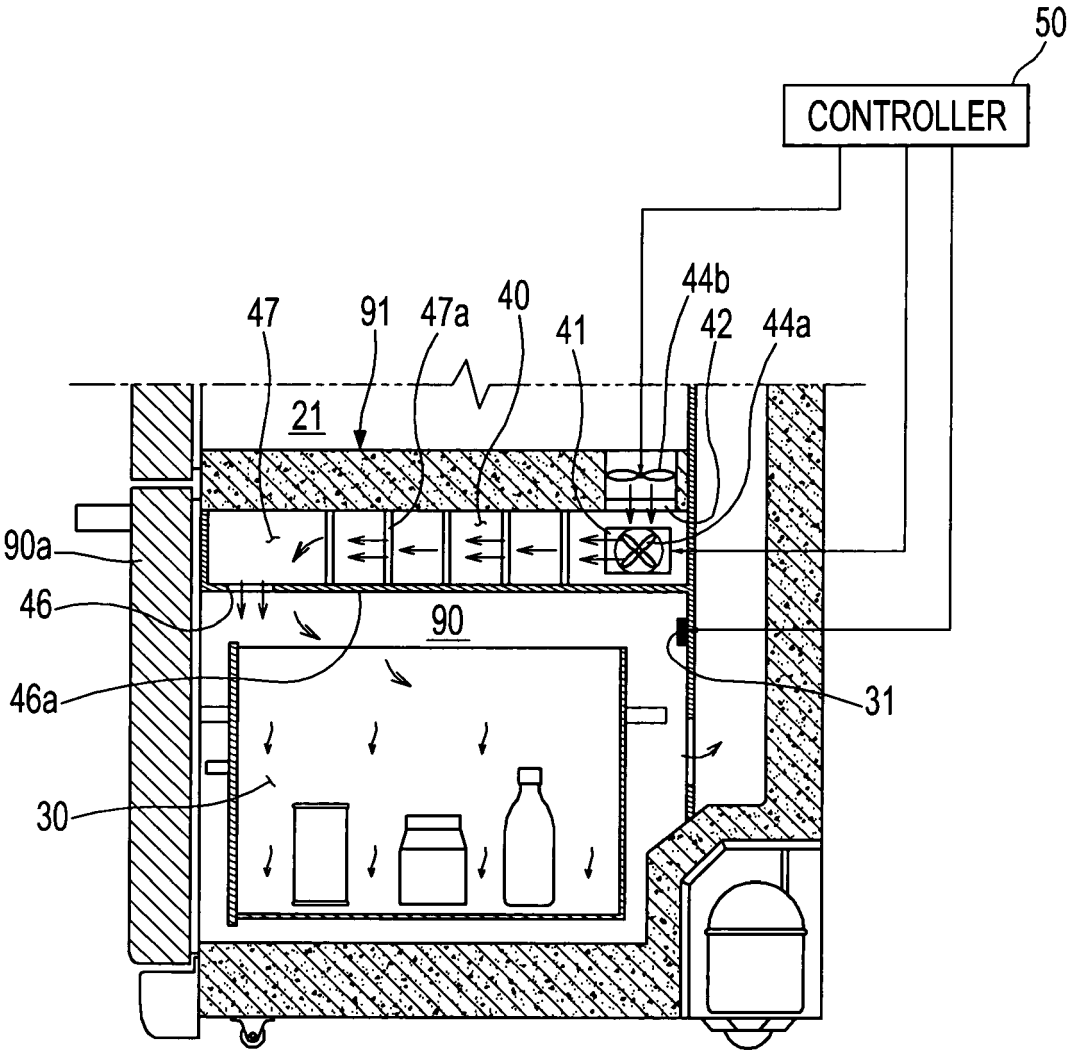
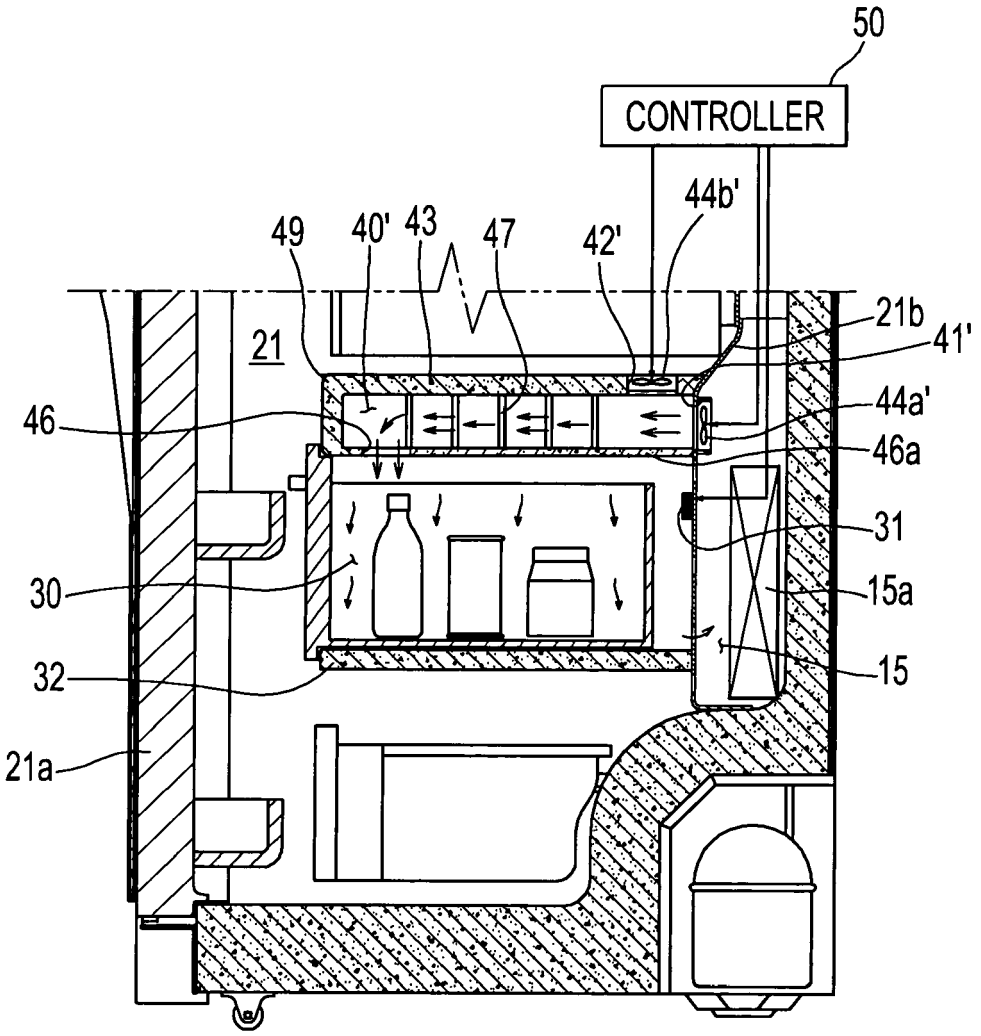


FIG. 8


50
CONTROLLER
44b'
49
40'
43
47
42'
21b
41'
21
44a'
46
46a
31
30
15a
32
15
21a

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Patent documents cited in the description

- KR 20064207 **[0001]**
- JP 2003214753 A **[0004]**