

DESCRIPTION

Title of Invention

REFRIGERATOR

5 Technical Field

[0001]

The present disclosure relates to a refrigerator including a chilled compartment and a versatile compartment.

Background Art

10 [0002]

An example of a known refrigerator includes a chilled compartment and a versatile compartment. The chilled compartment is set to a temperature in a temperature zone higher than a temperature zone of a freezer compartment and lower than a temperature zone of a refrigerator compartment, and the versatile compartment can be set to various temperature zones by a user (see, for example, Patent Literature 1). In general, food can be stored for a longer period of time as the temperature decreases. However, when food is stored in a temperature zone of the freezer compartment, moisture in the food freezes and causes breakage of cell walls in the food, often resulting in deterioration of the taste of the food. The chilled compartment may be provided to increase the food storage period and reduce deterioration of the food. Patent Literature 1, for example, describes a chilled compartment set to about -3 degrees C. Various temperature zones have been proposed as temperature zones to which the versatile compartment can be set. According to Patent Literature 1, for example, a user can select from freezer (-15 degrees C), partial (-8 degrees C), chilled (-3 degrees C), refrigerator (3 degrees C), and vegetable (8 degrees C) temperature zones.

Citation List

Patent Literature

[0003]

Patent Literature 1: Japanese Unexamined Patent Application Publication No.
2007-327709

Summary of Invention

Technical Problem

5 [0004]

It is known that when frozen food, such as meat or fish, is thawed in the chilled compartment, the food can be thawed without greatly damaging its taste because the frozen moisture in the food is thawed gradually. The chilled compartment may also be used with the temperature therein set to around 0 degrees C so that the moisture in food does not freeze and that the food can be stored for a longer period of time compared to when the food is stored in a general refrigerator compartment. The versatile compartment has been proposed to be used for soft freezing in which the temperature is set to about -7 degrees C. To utilize the characteristics of the temperature zones to which the chilled compartment and the versatile compartment can be set, stored food may be moved between the chilled compartment and the versatile compartment. For example, food stored in the chilled compartment may be moved to the versatile compartment to store the food for a longer period of time, or food stored in the versatile compartment may be thawed in the chilled compartment.

15 [0005]

20 In the refrigerator described in Patent Literature 1, the chilled compartment is disposed in the refrigerator compartment. The versatile compartment is disposed below the refrigerator compartment. The refrigerator compartment and the versatile compartment have different doors that can be opened and closed. Therefore, when a stored item is to be moved between the chilled compartment and the versatile compartment, each of the doors of the refrigerator compartment and the versatile compartment needs to be opened and closed, and the stored item needs to be moved in an up-down direction. Thus, the user cannot easily move the stored item between the chilled compartment and the versatile compartment.

25 [0006]

The present disclosure has been made in light of the above-described circumstances, and provides a refrigerator in which a stored item can be easily moved between a chilled compartment and a versatile compartment.

Solution to Problem

5 [0007]

A refrigerator according to an embodiment of the present disclosure includes: a chilled compartment whose temperature is capable of being set in a range from a first upper limit to a first lower limit; a versatile compartment whose temperature is capable of being set in a range from a second upper limit to a second lower limit, the second upper limit being higher than the first upper limit, the second lower limit being lower than the first lower limit; a cooler configured to generate cool air; a cooler compartment accommodating the cooler; and a versatile-compartment flow passage connecting the cooler compartment and the versatile compartment to each other and allowing the cool air generated by the cooler to flow therethrough. The chilled compartment and the versatile compartment are arranged next to each other in a horizontal direction. The chilled compartment and the versatile compartment are covered by one door capable of being opened and closed.

Advantageous Effects of Invention

[0008]

20 In the refrigerator according to the embodiment of the present disclosure, the chilled compartment and the versatile compartment are arranged next to each other in the horizontal direction. In addition, the chilled compartment and the versatile compartment are covered by one door capable of being opened and closed. Therefore, a stored item can be moved between the chilled compartment and the versatile compartment simply by opening the one door and moving the stored item in the horizontal direction. Thus, the stored item can be easily moved between the chilled compartment and the versatile compartment.

Brief Description of Drawings

[0009]

[Fig. 1] Fig. 1 is a schematic perspective view illustrating the appearance of a refrigerator according to Embodiment 1 when doors are closed.

[Fig. 2] Fig. 2 is a schematic perspective view illustrating the interior of the refrigerator according to Embodiment 1 when the doors are open.

5 [Fig. 3] Fig. 3 is a schematic sectional view taken at part A in Fig. 2.

[Fig. 4] Fig. 4 is a schematic diagram illustrating flows of cool air in the refrigerator according to Embodiment 1.

[Fig. 5] Fig. 5 is a schematic diagram illustrating flows of cool air toward a cooler compartment in the refrigerator according to Embodiment 1.

10 [Fig. 6] Fig. 6 is a schematic diagram illustrating a heater disposed in a chilled compartment of the refrigerator according to Embodiment 1.

[Fig. 7] Fig. 7 is a schematic diagram illustrating doors of a refrigerator according to Modification 1 of Embodiment 1.

15 [Fig. 8] Fig. 8 is a schematic diagram illustrating drawer panels of a refrigerator according to Modification 2 of Embodiment 1.

[Fig. 9] Fig. 9 is a schematic diagram illustrating flows of cool air in a refrigerator according to Embodiment 2.

[Fig. 10] Fig. 10 is a flowchart of an example of an operation of a chilled-compartment damper in the refrigerator according to Embodiment 2.

20 [Fig. 11] Fig. 11 is a schematic diagram illustrating a first-ventilation-opening damper and a second-ventilation-opening damper in a chilled compartment of a refrigerator according to Embodiment 3.

[Fig. 12] Fig. 12 is a schematic diagram illustrating flows of cool air in a refrigerator according to Embodiment 4.

25 [Fig. 13] Fig. 13 is a schematic diagram illustrating flows of cool air toward a cooler compartment in the refrigerator according to Embodiment 4.

[Fig. 14] Fig. 14 is a schematic diagram of an automatic ice maker and a water tank of a refrigerator according to Embodiment 5.

Description of Embodiments

30 [0010]

Refrigerators according to the present disclosure will now be described with reference to the drawings. The present disclosure is not limited to embodiments described below, and various modifications are possible without departing from the spirit of the present disclosure. In addition, the present disclosure includes all possible combinations of the structures in the embodiments described below. The refrigerators illustrated in the drawings are examples, and the illustrated refrigerators are not intended to limit the refrigerators according to the present disclosure.

[0011]

In the following description, terms representing directions (for example "up", "down", "right", "left", "front", "rear", etc.) are used as appropriate to facilitate understanding. However, these terms are used for the purpose of description, and are not intended to limit the present disclosure. In the drawings, elements denoted by the same reference signs are the same or corresponding elements, and this applies throughout this specification.

[0012]

In the drawings, the relative dimensional relationships, shapes, etc., of the components may differ from the actual ones. In addition, in the drawings, the X direction is the left-right direction of the refrigerator, and extends leftward as shown by the arrow thereof. The Y direction is the front-rear direction of the refrigerator, and extends rearward as shown by the arrow thereof. The Z direction is the up-down direction of the refrigerator, and extends upward as shown by the arrow thereof.

[0013]

Embodiment 1

(Configuration of Refrigerator 100)

Fig. 1 is a schematic perspective view illustrating the appearance of a refrigerator 100 according to Embodiment 1 when doors 2a, 2b, and 2c are closed. Fig. 2 is a schematic perspective view illustrating the interior of the refrigerator 100 according to Embodiment 1 when the doors 2a, 2b, and 2c are open. As illustrated in Fig. 1, the refrigerator 100 includes a box-shaped housing 1. The housing 1 has doors 2a, 2b, and 2c on the front. In the following description, the doors 2a, 2b, and 2c will be

referred to simply as "doors 2" when it is not necessary to distinguish between them.
The term "doors 2" is to be interpreted as one or more doors 2.

[0014]

As illustrated in Fig. 2, the doors 2 are swing doors. The housing 1 is provided
5 with hinges 5a, 5b, 5c, 5d, and 5e that support the doors 2 and allow the doors 2 to
swing about a vertical axis. The hinges 5a to 5e may be provided at either the left or
right end of the housing 1. The doors 2 of the refrigerator 100 are not limited to swing
doors, and may be drawer panels. Alternatively, the doors 2 may include one or more
swing doors and one or more drawer panels.

[0015]

As illustrated in Fig. 2, the inner space of the housing 1 is partitioned into a
refrigerator compartment 31, a chilled compartment 32, a versatile compartment 33, and
a freezer compartment 34. The door 2a covers the refrigerator compartment 31 such
that the door 2a can be opened and closed. The door 2b covers the chilled
15 compartment 32 and the versatile compartment 33 such that the door 2b can be opened
and closed. The door 2c covers the freezer compartment 34 such that the door 2c can
be opened and closed. In this specification, the spaces into which the inner space of
the housing 1 is partitioned are referred to as storage compartments. The storage
compartments include the refrigerator compartment 31, the chilled compartment 32, the
20 versatile compartment 33, and the freezer compartment 34. The term "storage
compartments" is to be interpreted as one or more storage compartments.

[0016]

A refrigerator-compartment partition wall 7 extending in a horizontal direction is
provided at the bottom of the refrigerator compartment 31. The refrigerator
25 compartment 31 includes shelves 11 and a refrigerator-compartment case 12, which is
a drawer case. Although Fig. 3 shows a plurality of shelves 11, the shelves 11 may be
omitted. The number of shelves 11 is not limited.

[0017]

The chilled compartment 32 and the versatile compartment 33 are disposed
30 below the refrigerator-compartment partition wall 7 and arranged next to each other in a

horizontal direction. As described above, the chilled compartment 32 and the versatile compartment 33 are covered by one door 2b that can be opened and closed. The chilled compartment 32 and the versatile compartment 33 are separated from each other by a first partition wall 8 extending in the up-down direction. The first partition wall 8 has a first ventilation opening 8a. As illustrated in Fig. 2, the first ventilation opening 8a is disposed in a lower front portion of the first partition wall 8. The chilled compartment 32 and the versatile compartment 33 communicate with each other through the first ventilation opening 8a.

[0018]

The chilled compartment 32 can be set to a chilled temperature zone, which is a range from a first lower limit to a first upper limit. The first lower limit and the first upper limit of the chilled temperature zone are, for example, about -3 degrees C and about 3 degrees C, respectively. The versatile compartment 33 can be set to a temperature in the range from a freezer temperature zone, which is a second lower limit, to a refrigerator temperature zone, which is a second upper limit. The freezer temperature zone is, for example, a temperature zone of -17 degrees C or less. The refrigerator temperature zone is, for example, a temperature zone of 3 degrees C to 10 degrees C. Therefore, the versatile compartment 33 can be set to a temperature lower than the temperature in the chilled compartment 32. The versatile compartment 33 can also be set to a temperature higher than the temperature in the chilled compartment 32.

[0019]

The chilled compartment 32 includes a chilled-compartment case 13, which is a drawer case. The versatile compartment 33 includes a versatile-compartment case 14, which is also a drawer case. By opening the door 2b and pulling the chilled-compartment case 13 and the versatile-compartment case 14 outward, stored items can be easily accessed, and therefore can be easily moved between the chilled compartment 32 and the versatile compartment 33.

[0020]

A second partition wall 9 extending in a horizontal direction is provided at the bottom of the chilled compartment 32 and the versatile compartment 33. The freezer

compartment 34 is disposed below the second partition wall 9. A portion of the second partition wall 9 that separates the chilled compartment 32 and the freezer compartment 34 from each other has a second ventilation opening 9a. The chilled compartment 32 and the freezer compartment 34 communicate with each other through the second ventilation opening 9a. The freezer compartment 34 includes a first freezer-compartment case 15, which is a drawer case, and a second freezer-compartment case 16, which is also a drawer case. An item can be easily stored and removed by pulling the first freezer-compartment case 15 and the second freezer-compartment case 16 outward.

[0021]

In the following description, the refrigerator-compartment case 12, the chilled-compartment case 13, the versatile-compartment case 14, the first freezer-compartment case 15, and the second freezer-compartment case 16 will be referred to simply as "drawer cases" when it is not necessary to distinguish between them. The term "drawer cases" is to be interpreted as one or more drawer cases. The shelves 11 and the drawer cases are provided to partition the inner spaces of the storage compartments. The shelves 11 and the drawer cases also serve to facilitate movement, storage, and removal of items. Items stored in deepest regions of the drawer cases can be checked by pulling the drawer cases outward. Therefore, the possibility that the items stored in deep regions will be left unused can be reduced. The number of drawer cases included in each storage compartment is not limited. Storage compartments having no drawer cases may be provided. Storage compartments other than the refrigerator compartment 31 may include the shelves 11.

[0022]

Fig. 3 is a schematic sectional view taken at part A in Fig. 2. Fig. 3 illustrates a cross section of the refrigerator 100 in the up-down direction taken along a plane passing through the versatile compartment 33. As illustrated in Fig. 3, a refrigerator-compartment outlet panel 24 is provided at the rear of the refrigerator compartment 31. A versatile-compartment outlet panel 25 is provided at the rear of the versatile compartment 33. A fan grille 26 is provided at the rear of the freezer compartment 34.

[0023]

In the following description, the refrigerator-compartment outlet panel 24, the versatile-compartment outlet panel 25, and the fan grille 26 are referred to simply as "rear panels" when it is not necessary to distinguish between them. The term "rear panels" is to be interpreted as one or more rear panels.

[0024]

A cooler compartment 21 accommodating a cooler 21a and a fan 22 is provided between the fan grille 26 and a rear surface of the housing 1. The fan 22 is disposed above the cooler 21a. A damper 27 is provided above the cooler compartment 21 and between the second partition wall 9 and the rear surface of the housing 1. The damper 27 may be either a twin damper or a single damper. Cool air generated by the cooler 21a is accelerated by the fan 22, passes through the damper 27 in an open state, and is supplied to the refrigerator compartment 31 and the versatile compartment 33. The freezer compartment 34 receives the cool air that does not pass through the damper 27.

[0025]

The refrigerator 100 includes a machine compartment 52 in a lower rear region thereof. The machine compartment 52 accommodates a compressor 23, an air-cooled condenser, a drier, and a pressure reducing device. The compressor 23, the air-cooled condenser, the drier, and the pressure reducing device are connected to a refrigerant circuit together with a heat radiation pipe to constitute a refrigeration cycle. The heat radiation pipe is disposed in an urethane portion of the housing 1 and around the storage compartments. The air-cooled condenser, the heat radiation pipe, the drier, and the pressure reducing device are not illustrated.

[0026]

Refrigerant discharged from the compressor 23 rejects heat and condenses in the air-cooled condenser and the heat radiation pipe. The refrigerant that has passed through the air-cooled condenser and the heat radiation pipe flows through the drier and the pressure reducing device, and is supplied to the cooler 21a. The refrigerant is evaporated in the cooler 21a, exchanges heat with air circulated in the refrigerator 100 by the fan 22, and then flows out of the cooler 21a. Then, the refrigerant flows through

a suction pipe, is increased in temperature while exchanging heat with the pressure reducing device, and returns to the compressor 23. The air that has exchanged heat with the refrigerant in the cooler 21a is cooled and supplied to the storage compartments by the fan 22. Thus, air circulation paths are formed in the refrigerator 100.

[0027]

A controller 51 that controls the refrigerator 100 is provided at an upper rear corner of the housing 1. The controller 51 is composed of, for example, dedicated hardware or a CPU that executes programs stored in a memory. The CPU is also referred to as a central processing unit, a central processing device, a processing device, a computing device, a microprocessor, a microcomputer, or a processor.

[0028]

(Flows of Cool Air in Refrigerator 100)

Flows of cool air in the refrigerator 100 will now be described with reference to Figs. 4 and 5. Fig. 4 is a schematic diagram illustrating flows of cool air in the refrigerator 100 according to Embodiment 1. In Fig. 4, the arrows in the refrigerator 100 show the flows of cool air. Fig. 5 is a schematic diagram illustrating flows of cool air toward the cooler compartment 21 in the refrigerator 100 according to Embodiment 1.

[0029]

As illustrated in Fig. 4, the cooler compartment 21 and the refrigerator compartment 31 are connected to each other by a refrigerator-compartment flow passage 500. The refrigerator-compartment outlet panel 24 has refrigerator-compartment air outlets 40a. The refrigerator compartment 31 communicates with the refrigerator-compartment flow passage 500 through the refrigerator-compartment air outlets 40a in the refrigerator-compartment outlet panel 24. Although more than one refrigerator-compartment air outlets 40a are provided in Fig. 4, there may be only one refrigerator-compartment air outlet 40a.

[0030]

The cooler compartment 21 and the versatile compartment 33 are connected to each other by a versatile-compartment flow passage 510. The versatile-compartment outlet panel 25 has a versatile-compartment air outlet 40c. The versatile compartment 33 communicates with the versatile-compartment flow passage 510 through the versatile-compartment air outlet 40c in the versatile-compartment outlet panel 25.

[0031]

The cooler compartment 21 and the freezer compartment 34 are connected to each other by a freezer-compartment flow passage 520. The fan grille 26 has a freezer-compartment air outlet 40d. The freezer compartment 34 communicates with the freezer-compartment flow passage 520 through the freezer-compartment air outlet 40d in the fan grille 26.

[0032]

As described above, the cool air generated by the cooler 21a is accelerated by the fan 22 and supplied to the refrigerator compartment 31, the versatile compartment 33, and the freezer compartment 34. As illustrated in Fig. 4, the cool air that has passed through the damper 27 is divided into refrigerator-compartment supply cool air 61 that flows through the refrigerator-compartment flow passage 500 and versatile-compartment supply cool air 63 that flows through the versatile-compartment flow passage 510. The refrigerator-compartment supply cool air 61 flows through the refrigerator-compartment flow passage 500 and is supplied to the refrigerator compartment 31 through the refrigerator-compartment air outlets 40a. Items stored in the refrigerator compartment 31 are cooled by the refrigerator-compartment supply cool air 61 supplied to the refrigerator compartment 31 through the refrigerator-compartment air outlets 40a.

[0033]

The versatile-compartment supply cool air 63 flows through the versatile-compartment flow passage 510 and is supplied to the versatile compartment 33 through the versatile-compartment air outlet 40c. Items stored in the versatile compartment 33 are cooled by the versatile-compartment supply cool air 63 supplied to the versatile compartment 33 through the versatile-compartment air outlet 40c.

[0034]

The cool air generated by the cooler 21a is supplied to the freezer compartment 34 without passing through the damper 27. As illustrated in Fig. 4, the cool air generated by the cooler 21a flows through the freezer-compartment flow passage 520 as freezer-compartment supply cool air 64, and is supplied to the freezer compartment 34 through the freezer-compartment air outlet 40d. Items stored in the freezer compartment 34 are cooled by the freezer-compartment supply cool air 64 supplied to the freezer compartment 34 through the freezer-compartment air outlet 40d.

[0035]

Flows of cool air that enters the chilled compartment 32 will now be described. As illustrated in Fig. 5, the cooler compartment 21 and the chilled compartment 32 are connected to each other by a chilled-compartment return flow passage 530. The chilled compartment 32 has a chilled-compartment return port 42b. The chilled compartment 32 and the chilled-compartment return flow passage 530 communicate with each other through the chilled-compartment return port 42b. The chilled compartment 32 and the versatile compartment 33 communicate with each other through the first ventilation opening 8a in the first partition wall 8. Therefore, the versatile-compartment supply cool air 63 supplied to the versatile compartment 33 is sucked by the negative pressure in the chilled-compartment return flow passage 530 and supplied to the chilled compartment 32 as chilled-compartment supply cool air 62a.

[0036]

The chilled compartment 32 and the freezer compartment 34 communicate with each other through the second ventilation opening 9a in the second partition wall 9. Therefore, the freezer-compartment supply cool air 64 supplied to the freezer compartment 34 is sucked by the negative pressure in the chilled-compartment return flow passage 530 and supplied to the chilled compartment 32 as chilled-compartment supply cool air 62b. Thus, the chilled-compartment supply cool air 62a is supplied to the chilled compartment 32 from the versatile compartment 33, and the chilled-compartment supply cool air 62b is supplied to the chilled compartment 32 from the freezer compartment 34.

[0037]

As illustrated in Fig. 5, the chilled-compartment return port 42b is disposed at a position diagonal to the first ventilation opening 8a and the second ventilation opening 9a. Therefore, the chilled-compartment supply cool air 62a and the chilled-compartment supply cool air 62b supplied to the chilled compartment 32 are sucked by the negative pressure in the chilled-compartment return flow passage 530 and enter the chilled-compartment return flow passage 530 through the chilled-compartment return port 42b. Items stored in the chilled compartment 32 are cooled by the chilled-compartment supply cool air 62a flowing from the first ventilation opening 8a toward the chilled-compartment return port 42b and the chilled-compartment supply cool air 62b flowing from the second ventilation opening 9a toward the chilled-compartment return port 42b. Since the chilled-compartment return port 42b is disposed at a position diagonal to the first ventilation opening 8a and the second ventilation opening 9a, a flow of cool air that travels substantially along a diagonal line of the chilled compartment 32 is generated, and the uniformity of the temperature distribution in the chilled compartment 32 is improved. The chilled-compartment supply cool air 62a and the chilled-compartment supply cool air 62b that have flowed into the chilled-compartment return flow passage 530 return to the cooler compartment 21 through the chilled-compartment return flow passage 530 as chilled-compartment return cool air 202.

[0038]

As illustrated in Fig. 5, the refrigerator compartment 31 and the cooler compartment 21 are connected to each other by a refrigerator-compartment return flow passage 540. The refrigerator-compartment supply cool air 61 supplied to the refrigerator compartment 31 flows into the refrigerator-compartment return flow passage 540 through a refrigerator-compartment return port (not illustrated). The refrigerator-compartment supply cool air 61 that has flowed into the refrigerator-compartment return flow passage 540 returns to the cooler compartment 21 through the refrigerator-compartment return flow passage 540 as refrigerator-compartment return cool air 201.

[0039]

As described above, the versatile-compartment supply cool air 63 generated by the cooler 21a and supplied to the versatile compartment 33 and the freezer-compartment supply cool air 64 generated by the cooler 21a and supplied to the freezer compartment 34 are supplied to the chilled compartment 32 as the chilled-compartment supply cool air 62a and the chilled-compartment supply cool air 62b, respectively, and then return to the cooler compartment 21 through the chilled-compartment return flow passage 530 as the chilled-compartment return cool air 202. The refrigerator-compartment supply cool air 61 generated by the cooler 21a and supplied to the refrigerator compartment 31 returns to the cooler compartment 21 through the refrigerator-compartment return flow passage 540 as the refrigerator-compartment return cool air 201. Thus, the passage of the cool air supplied to the refrigerator compartment 31 and the passage of the cool air supplied to the chilled compartment 32 are separated from each other. The refrigerator compartment 31 is set to a relatively high temperature zone, and items stored therein generally emit strong odors. Since the passage of the cool air supplied to the refrigerator compartment 31 and the passage of the cool air supplied to the chilled compartment 32 are separated from each other, transfer of odors of the stored items between the refrigerator compartment 31 and the chilled compartment 32 can be reduced.

[0040]

In the description in this specification, the cool air generated by the cooler 21a is referred to by different names with different reference signs, that is, as the refrigerator-compartment supply cool air 61, the chilled-compartment supply cool air 62a, the chilled-compartment supply cool air 62b, the versatile-compartment supply cool air 63, the freezer-compartment supply cool air 64, the refrigerator-compartment return cool air 201, and the chilled-compartment return cool air 202 to distinguish them from each other for convenience. Each of the refrigerator-compartment supply cool air 61, the chilled-compartment supply cool air 62a, the chilled-compartment supply cool air 62b, the versatile-compartment supply cool air 63, the freezer-compartment supply cool air 64, the refrigerator-compartment return cool air 201, and the chilled-compartment return cool air 202 may be referred to simply as "cool air". The term "cool air" may also refer

to all of the refrigerator-compartment supply cool air 61, the chilled-compartment supply cool air 62a, the chilled-compartment supply cool air 62b, the versatile-compartment supply cool air 63, the freezer-compartment supply cool air 64, the refrigerator-compartment return cool air 201, and the chilled-compartment return cool air 202.

5 [0041]

As described above, in Embodiment 1, the chilled compartment 32 receives the chilled-compartment supply cool air 62a that has passed through the versatile compartment 33 and the chilled-compartment supply cool air 62b that has passed through the freezer compartment 34. Since each of the chilled-compartment supply cool air 62a and the chilled-compartment supply cool air 62b is the cool air that has cooled the items stored in the versatile compartment 33 or the items stored in the freezer compartment 34, the temperature thereof is higher than the temperature of the cool air generated by the cooler 21a. In other words, the temperatures of the chilled-compartment supply cool air 62a and the chilled-compartment supply cool air 62b are close to a target temperature for maintaining the chilled compartment 32 at a set temperature. Therefore, when comparing the case where the chilled-compartment supply cool air 62a and the chilled-compartment supply cool air 62b are supplied to the chilled compartment 32 and the case where the cool air generated by the cooler 21a is directly supplied to the chilled compartment 32, the chilled compartment 32 is more slowly cooled in the case where the chilled-compartment supply cool air 62a and the chilled-compartment supply cool air 62b are supplied. Therefore, temperature hunting in the chilled compartment 32 is reduced, and adverse effects of temperature variations on the items stored in the chilled compartment 32 are reduced accordingly.

15 [0042]

In Embodiment 1, the cool air generated by the cooler 21a is not directly supplied to the chilled compartment 32. Therefore, the cool air is not strongly blown into the chilled compartment 32 by the fan 22. Since the cool air is not directly supplied from the cooler compartment 21, the chilled compartment 32 does not have an air outlet through which the cool air generated by the cooler 21a is supplied. Therefore, the

chilled compartment 32 does not receive cool air that is excessively cool relative to the set temperature, and the items stored in the chilled compartment 32 do not freeze.

[0043]

The flow rate and the temperature of the cool air supplied to the chilled compartment 32 are not greatly influenced by the rotation speed of the fan 22 and the open/closed state of the damper 27. Therefore, the chilled compartment 32 does not receive excessively cool air generated by the cooler 21a, and the occurrence of significant temperature hunting in the chilled compartment 32 can be reduced. When significant temperature hunting occurs while the set temperature of the chilled compartment 32 is around 0 degrees C, the temperature in the chilled compartment 32 fluctuates between the temperature zones above and below 0 degrees C, and the stored items are adversely affected. In the chilled compartment 32 according to Embodiment 1, the occurrence of such temperature hunting is reduced, so that adverse effects of temperature variations on the stored items are reduced. Therefore, damage to the stored items can be prevented and, when the stored items are food, loss of flavor in the food can be prevented.

[0044]

(Damper 27)

The operation of the damper 27 will now be described with reference to Fig. 4. As illustrated in Fig. 4, the refrigerator compartment 31, the chilled compartment 32, the versatile compartment 33, and the freezer compartment 34 are respectively provided with a refrigerator-compartment temperature sensor 41a, a chilled-compartment temperature sensor 41b, a versatile-compartment temperature sensor 41c, and a freezer-compartment temperature sensor 41d. In the following description, the refrigerator-compartment temperature sensor 41a, the chilled-compartment temperature sensor 41b, the versatile-compartment temperature sensor 41c, and the freezer-compartment temperature sensor 41d will be referred to simply as "temperature sensors 41" when it is not necessary to distinguish between them. The term "temperature sensors 41" is to be interpreted as one or more temperature sensors 41.

[0045]

The temperatures in the storage compartments are sensed by the temperature sensors 41. The controller 51 receives the temperatures sensed by the temperature sensors 41, and transmits a signal to the damper 27 to control the open/closed state of the damper 27. When the open/closed state of the damper 27 changes, the flow rate of the cool air that passes through the damper 27 changes accordingly. Since the cool air can be delivered to the storage compartments at appropriate flow rates, the storage compartments can be maintained at set temperatures. The temperature sensors 41 are, for example, thermistors.

[0046]

When the refrigerator includes a plurality of dampers, manufacturing costs may be increased, and the flow passage structure may become complex. In Embodiment 1, the chilled compartment 32 is not required to have a dedicated damper. Therefore, manufacturing costs are not increased, and the flow passage structure does not become complex.

[0047]

(Heater 50)

A heater 50 will now be described with reference to Fig. 6. Fig. 6 is a schematic diagram illustrating the heater 50 for the chilled compartment 32 of the refrigerator 100 according to Embodiment 1. As illustrated in Fig. 6, the floor surfaces of the chilled compartment 32 and the versatile compartment 33 are defined by the second partition wall 9. The heater 50 is provided inside a portion of the second partition wall 9 corresponding to the floor surface of the chilled compartment 32. The heater 50 generates heat when energized. The controller 51 controls the energization of the heater 50.

[0048]

When the versatile compartment 33 is set to a low temperature, for example, -10 degrees C, the chilled compartment 32 may be excessively cooled relative to the set temperature of the chilled compartment 32. Also when the freezer compartment 34 is set to a low temperature, for example, -20 degrees C, the chilled compartment may be excessively cooled relative to the set temperature of the chilled compartment 32. Also

when the versatile compartment 33 stores only a small amount of items, the flow rate of the chilled-compartment supply cool air 62a supplied from the versatile compartment 33 to the chilled compartment 32 is increased, and accordingly the chilled compartment 32 may be excessively cooled relative to the set temperature thereof. Also when the freezer compartment 34 stores only a small amount of items, the flow rate of the chilled-compartment supply cool air 62b supplied from the freezer compartment 34 to the chilled compartment 32 is increased, and accordingly the chilled compartment 32 may be excessively cooled relative to the set temperature thereof.

[0049]

When the chilled compartment 32 is excessively cooled relative to the set temperature of the chilled compartment 32, the temperature in the chilled compartment 32 is lower than the set temperature. As described above, the controller 51 receives the temperature in the chilled compartment 32 sensed by the chilled-compartment temperature sensor 41b. When the temperature in the chilled compartment 32 sensed by the chilled-compartment temperature sensor 41b is lower than the set temperature, the controller 51 energizes the heater 50 so that the heater 50 generates heat. The heater 50 generates heat so that the temperature of the air in the chilled compartment 32 is increased to the set temperature of the chilled compartment 32.

[0050]

In the above description, the refrigerator 100 is a bottom freezer refrigerator in which the refrigerator compartment 31 is disposed above the chilled compartment 32 and the versatile compartment 33 with the refrigerator-compartment partition wall 7 disposed therebetween and in which the freezer compartment 34 is disposed below the chilled compartment 32 and the versatile compartment 33 with the second partition wall 9 disposed therebetween. However, the refrigerator according to Embodiment 1 is not limited to a bottom freezer refrigerator, and the freezer compartment 34 may be disposed above the chilled compartment 32 and the versatile compartment 33. The refrigerator may be any refrigerator in which the chilled compartment 32 and the versatile compartment 33 are arranged in a horizontal direction and are covered by one door 2b that can be opened and closed. The storage compartments are not limited to

the refrigerator compartment 31, the chilled compartment 32, the versatile compartment 33, and the freezer compartment 34. Other storage compartments, such as an ice-making compartment and a vegetable compartment, may be provided.

[0051]

5 The refrigerator 100 according to Embodiment 1 includes the chilled compartment 32, the versatile compartment 33, the cooler 21a, the cooler compartment 21, and the versatile-compartment flow passage 510. The temperature of the chilled compartment 32 can be set in the range from the first upper limit to the first lower limit. The temperature of the versatile compartment 33 can be set in the range from the second upper limit to the second lower limit. The second upper limit is higher than the first upper limit, and the second lower limit is lower than the first lower limit. The cooler 21a generates cool air. The cooler compartment 21 accommodates the cooler 21a. The versatile-compartment flow passage 510 connects the cooler compartment 21 and the versatile compartment 33 to each other and allows the cool air generated by the cooler 21a to flow therethrough. The chilled compartment 32 and the versatile compartment 33 are arranged next to each other in a horizontal direction. The chilled compartment 32 and the versatile compartment 33 are covered by one door 2b capable of being opened and closed.

[0052]

20 According to the above-described configuration, the chilled compartment 32 and the versatile compartment 33 are covered by one door 2b that can be opened and closed. The chilled compartment 32 and the versatile compartment 33 can be used by opening and closing the door 2b once. Therefore, the stored items can be easily moved between the chilled compartment 32 and the versatile compartment 33. Thus, the usability of the refrigerator 100 is improved.

[0053]

30 The refrigerator 100 according to Embodiment 1 includes the first partition wall 8 and the chilled-compartment return flow passage 530. The first partition wall 8 separates the chilled compartment 32 and the versatile compartment 33 from each other. The chilled-compartment return flow passage 530 connects the cooler

compartment 21 and the chilled compartment 32 to each other and allows the chilled-compartment return cool air 202 flowing out of the chilled compartment 32 to flow therethrough. The first partition wall 8 has the first ventilation opening 8a providing communication between the chilled compartment 32 and the versatile compartment 33.

5 The cool air flows into the versatile compartment 33 through the versatile-compartment flow passage 510. The cool air flows into the chilled compartment 32 from the versatile compartment 33 through the first ventilation opening 8a. The cool air in the chilled compartment 32 flows into the cooler compartment 21 through the chilled-compartment return flow passage 530.

10 [0054]

According to the above-described configuration, the chilled compartment 32 adjoins the versatile compartment 33 with the first partition wall 8 disposed therebetween. Therefore, the effect of cooling the chilled compartment 32 is influenced by heat conduction from the versatile compartment 33 through the first partition wall 8. As a result, compared to a configuration in which the chilled compartment 32 is disposed in the refrigerator compartment 31 at the bottom of the refrigerator compartment 31, the cooling effect due to heat conduction from the versatile compartment 33 is increased. Thus, the inner space of the chilled compartment 32 according to the above-described configuration can be more efficiently cooled than the inner space of the chilled compartment 32 disposed at the bottom of the refrigerator compartment 31. Because the inner space of the chilled compartment 32 can be efficiently cooled, the chilled compartment 32 can be cooled by the cool air that has passed through the versatile compartment 33. In other words, the chilled compartment 32 can be efficiently cooled by reusing the cool air used to cool the versatile compartment 33.

25 [0055]

Since the chilled-compartment supply cool air 62a that has passed through the versatile compartment 33 is supplied to the chilled compartment 32, the chilled compartment 32 is slowly cooled. Therefore, temperature hunting in the chilled

compartment 32 is reduced, so that adverse effects on the items stored in the chilled compartment 32 can be reduced.

[0056]

The refrigerator 100 according to Embodiment 1 includes the freezer compartment 34, the first partition wall 8, the second partition wall 9, the chilled-compartment return flow passage 530, and the freezer-compartment flow passage 520. The first partition wall 8 separates the chilled compartment 32 and the versatile compartment 33 from each other. The second partition wall 9 separates the chilled compartment 32 and the freezer compartment 34 from each other. The chilled-compartment return flow passage 530 connects the cooler compartment 21 and the chilled compartment 32 to each other and allows the cool air flowing out of the chilled compartment 32 to flow therethrough. The freezer-compartment flow passage 520 connects the cooler compartment 21 and the freezer compartment 34 to each other and allows the cool air generated by the cooler 21a to flow therethrough. The temperature in the freezer compartment 34 can be set to a temperature lower than the second lower limit for the versatile compartment 33. The first partition wall 8 has the first ventilation opening 8a providing communication between the chilled compartment 32 and the versatile compartment 33. The second partition wall 9 has the second ventilation opening 9a providing communication between the chilled compartment 32 and the freezer compartment 34. The cool air flows into the versatile compartment 33 through the versatile-compartment flow passage 510. The cool air flows into the freezer compartment 34 through the freezer-compartment flow passage 520. The cool air flows into the chilled compartment 32 from the versatile compartment 33 through the first ventilation opening 8a and from the freezer compartment 34 through the second ventilation opening 9a. The cool air in the chilled compartment 32 flows into the cooler compartment 21 through the chilled-compartment return flow passage 530.

[0057]

According to the above-described configuration, the chilled compartment 32 adjoins the versatile compartment 33 with the first partition wall 8 disposed therebetween. The chilled compartment 32 also adjoins the freezer compartment 34

with the second partition wall 9 disposed therebetween. Therefore, the effect of cooling the chilled compartment 32 is influenced by heat conduction from the versatile compartment 33 through the first partition wall 8 and heat conduction from the freezer compartment 34 through the second partition wall 9. As a result, compared to a configuration in which the chilled compartment 32 is disposed in the refrigerator compartment 31 at the bottom of the refrigerator compartment 31, the cooling effect due to heat conduction from the versatile compartment 33 and the freezer compartment 34 is increased. Thus, the inner space of the chilled compartment 32 according to the above-described configuration can be more efficiently cooled than the inner space of the chilled compartment 32 disposed at the bottom of the refrigerator compartment 31. According to the above-described configuration, because the inner space of the chilled compartment 32 can be efficiently cooled, the chilled compartment 32 can be cooled by the cool air that has passed through the versatile compartment 33 and the cool air that has passed through the freezer compartment 34. In other words, the chilled compartment 32 can be efficiently cooled by reusing the cool air used to cool the versatile compartment 33 and the cool air used to cool the freezer compartment 34. [0058]

A flow passage configuration is formed to enable the chilled-compartment supply cool air 62a that has passed through the versatile compartment 33 and the chilled-compartment supply cool air 62b that has passed through the freezer compartment 34 to be supplied to the chilled compartment 32, so that the chilled compartment 32 is slowly cooled. Therefore, temperature hunting in the chilled compartment 32 is reduced, so that adverse effects of temperature variations on the items stored in the chilled compartment 32 can be reduced.

[0059]

(Modification 1 of Doors 2)

Fig. 7 is a schematic diagram illustrating doors 2 of a refrigerator 100 according to Modification 1 of Embodiment 1. As illustrated in Fig. 7, the housing 1 has a door 2a and a door 2b on the front. The chilled compartment 32, the versatile compartment 33, and the freezer compartment 34 are covered by the door 2b that can be opened and

closed. According to this configuration, the chilled compartment 32, the versatile compartment 33, and the freezer compartment 34 can be used by opening and closing the door 2b once. Therefore, the stored items can be easily moved between the chilled compartment 32, the versatile compartment 33, and the freezer compartment 34.

[0060]

(Modification 2 of Doors 2)

Fig. 8 is a schematic diagram illustrating drawer panels of a refrigerator 100 according to Modification 2 of Embodiment 1. In Modification 2, a door 2b and a door 2c are drawer panels. As illustrated in Fig. 8, the door 2b is a drawer panel that can be moved in the front-rear direction along rails provided on wall surfaces of the chilled compartment 32 and the versatile compartment 33. Although not illustrated, the door 2c is a drawer panel that can be moved in the front-rear direction along rails provided on wall surfaces of the freezer compartment 34.

[0061]

(Drawer Panels 2b and 2c)

Although not illustrated in detail, a left wall surface of the chilled compartment 32 and a right wall surface of the versatile compartment 33 are provided with first rails extending along the depth. First frames supported by the first rails are attached to a surface of the door 2b facing the chilled compartment 32 and the versatile compartment 33. Left and right side surfaces of the first partition wall 8 that separates the chilled compartment 32 and the versatile compartment 33 from each other are provided with second rails extending along the depth. Second frames supported by the second rails are attached to the surface of the door 2b facing the chilled compartment 32 and the versatile compartment 33 in a central region of the surface. The first frames and the second frames slide along the corresponding ones of the first rails and the second rails to move in the front-rear direction. The chilled-compartment case 13 and the versatile-compartment case 14 are fitted to corresponding ones of the frames, and are therefore capable of being pulled out of the chilled compartment 32 and the versatile compartment 33 as the door 2b, which is a drawer panel, slides in the front-rear direction.

[0062]

According to the above-described configuration, the door 2b of the chilled compartment 32 and the versatile compartment 33, the chilled-compartment case 13, and the versatile-compartment case 14 are integrated together. Therefore, all of the items stored in the chilled-compartment case 13 and the versatile-compartment case 14 can be checked by opening the door 2b. In addition, the stored items can be moved between the chilled compartment 32 and the versatile compartment 33 simply by opening the door 2b. Therefore, the stored items can be moved between the chilled compartment 32 and the versatile compartment 33 while checking all of the items stored in the chilled compartment 32 and the versatile compartment 33 simply by opening the door 2b. Thus, the usability of the refrigerator 100 is improved.

[0063]

Embodiment 2

Fig. 9 is a schematic diagram illustrating flows of cool air in a refrigerator 100 according to Embodiment 2. The refrigerator 100 according to Embodiment 2 described herein differs from the refrigerator 100 according to Embodiment 1 in that the chilled compartment 32 communicates with the refrigerator-compartment flow passage 500. In the following description, elements that are the same as those in Embodiment 1 described above are denoted by the same reference signs, and description thereof will be omitted.

[0064]

As illustrated in Fig. 9, the chilled compartment 32 has a chilled-compartment air outlet 40b that communicates with the refrigerator-compartment flow passage 500. The chilled-compartment air outlet 40b is provided with a chilled-compartment damper 401 capable of opening and closing the chilled-compartment air outlet 40b. When the chilled-compartment damper 401 is in an open state, the refrigerator-compartment flow passage 500 and the chilled compartment 32 communicate with each other. Accordingly, the refrigerator-compartment supply cool air 61 flowing through the refrigerator-compartment flow passage 500 flows into the chilled compartment 32 through the chilled-compartment air outlet 40b as chilled-compartment supply cool air

62c. The controller 51 controls the open/closed state of the chilled-compartment damper 401. The opening degree of the chilled-compartment damper 401 may be adjustable, and the flow rate of the chilled-compartment supply cool air 62c may be adjusted by adjusting the opening degree of the chilled-compartment damper 401.

[0065]

The chilled-compartment supply cool air 62c supplied to the chilled compartment 32 returns to the cooler compartment 21 through the chilled-compartment return flow passage 530 together with the chilled-compartment supply cool air 62a and the chilled-compartment supply cool air 62b as the chilled-compartment return cool air 202. The chilled-compartment return cool air 202 is described in Embodiment 1, and description thereof is thus omitted herein. A portion of the refrigerator-compartment supply cool air 61 flowing through the refrigerator-compartment flow passage 500 that has not been supplied to the chilled compartment 32 as the chilled-compartment supply cool air 62c is supplied to the refrigerator compartment 31. The refrigerator-compartment supply cool air 61 supplied to the refrigerator compartment 31 is described in Embodiment 1, and description thereof is thus omitted herein.

[0066]

(Chilled-Compartment Damper 401)

When the set temperature of the versatile compartment 33 is in the refrigerator temperature zone or close to the refrigerator temperature zone, the temperature of the chilled-compartment supply cool air 62a supplied from the versatile compartment 33 to the chilled compartment 32 may be equal to the set temperature of the chilled compartment 32 or higher than the set temperature of the chilled compartment 32. The controller 51 receives the temperature in the chilled compartment 32 sensed by the chilled-compartment temperature sensor 41b. When the controller 51 determines that the temperature in the chilled compartment 32 is higher than the set temperature, the controller 51 sets the chilled-compartment damper 401 to an open state. When the controller 51 determines that the temperature in the chilled compartment 32 is lower than or equal to the set temperature, the controller 51 sets the chilled-compartment damper 401 to a closed state.

[0067]

Fig. 10 is a flowchart of an example of an operation of the chilled-compartment damper 401 in the refrigerator 100 according to Embodiment 2. The controller 51 receives the temperature in the chilled compartment 32 sensed by the chilled-compartment temperature sensor 41b (step ST1). Next, the controller 51 compares the received temperature in the chilled compartment 32 and the set temperature, and determines whether or not the temperature in the chilled compartment 32 is lower than or equal to the set temperature (step ST2). When the temperature in the chilled compartment 32 is lower than or equal to the set temperature (YES in step ST2), the controller 51 sets the chilled-compartment damper 401 to the closed state (step ST3), and ends the process. When the temperature in the chilled compartment 32 is higher than the set temperature in step ST2 (NO in step ST2), the controller 51 sets the chilled-compartment damper 401 to the open state (step ST4). After that, the controller 51 returns to step ST1.

[0068]

According to Embodiment 2, when the chilled-compartment damper 401 is in the open state, the chilled compartment 32 receives the chilled-compartment supply cool air 62c supplied from the refrigerator-compartment flow passage 500 in addition to the chilled-compartment supply cool air 62a supplied from the versatile compartment 33 and the chilled-compartment supply cool air 62b supplied from the freezer compartment 34. Therefore, the flow rate of the cool air supplied to the chilled compartment 32 can be increased while temperature hunting in the chilled compartment 32 is reduced compared to when the cool air generated by the cooler 21a is supplied directly to the chilled compartment 32. Therefore, the chilled compartment 32 can be maintained at the set temperature while adverse effects on the items stored in the chilled compartment 32 are reduced.

[0069]

The refrigerator 100 according to Embodiment 2 includes the refrigerator compartment 31, the refrigerator-compartment flow passage 500, the chilled-compartment air outlet 40b, and the temperature sensor 41b. The refrigerator-

compartment flow passage 500 connects the cooler compartment 21 and the refrigerator compartment 31 to each other and allows the cool air generated by the cooler 21a to flow therethrough. The chilled-compartment air outlet 40b is provided in the chilled compartment 32 and provides communication between the refrigerator-compartment flow passage 500 and the chilled compartment 32. The temperature sensor 41b is provided in the chilled compartment 32. The chilled-compartment air outlet 40b is provided with the chilled-compartment damper 401 capable of opening and closing the chilled-compartment air outlet 40b. The chilled-compartment damper 401 opens and closes based on the temperature sensed by the temperature sensor 41b and the set temperature of the chilled compartment 32.

[0070]

According to the above-described configuration, the refrigerator-compartment supply cool air 61 at a relatively low temperature that flows through the refrigerator-compartment flow passage 500 can be supplied to the chilled compartment 32 through the chilled-compartment air outlet 40b as the chilled-compartment supply cool air 62c. When the temperature in the chilled compartment 32 is higher than the set temperature, the chilled-compartment supply cool air 62c can be supplied to the chilled compartment 32. Therefore, the versatile compartment 33 can be set to a temperature in the refrigerator temperature zone or a temperature zone close to the refrigerator temperature zone without considering the influence on the temperature in the chilled compartment 32. In other words, the temperature to which the versatile compartment 33 can be set can be selected from a wider range, and accordingly the usability of the refrigerator 100 is increased.

[0071]

In the refrigerator 100 according to Embodiment 2, the chilled-compartment damper 401 is set to the open state when the temperature sensed by the temperature sensor 41b is higher than the set temperature of the chilled compartment 32, and the cool air flowing through the refrigerator-compartment flow passage 500 flows into the chilled compartment 32 through the chilled-compartment air outlet 40b.

[0072]

According to the above-described configuration, when the temperature in the chilled compartment 32 is higher than the set temperature, the chilled-compartment damper 401 is set to the open state so that the cool air at a relatively low temperature flowing through the refrigerator-compartment flow passage 500 is supplied to the chilled compartment 32. Therefore, the inner space of the chilled compartment 32 can be rapidly cooled so that the temperature therein approaches the set temperature. Therefore, even when the temperature in the chilled compartment 32 is temporarily higher than the set temperature, adverse effects on the items stored in the chilled compartment 32 can be reduced.

[0073]

Embodiment 3

Fig. 11 is a schematic diagram illustrating a first-ventilation-opening damper 8b and a second-ventilation-opening damper 9b in a chilled compartment 32 of a refrigerator 100 according to Embodiment 3. The refrigerator 100 according to Embodiment 3 described herein differs from the refrigerators 100 according to Embodiment 1 and Embodiment 2 in that the first ventilation opening 8a is provided with the first-ventilation-opening damper 8b and that the second ventilation opening 9a is provided with the second-ventilation-opening damper 9b. In the following description, elements that are the same as those in Embodiments 1 and 2 described above are denoted by the same reference signs, and description thereof will be omitted.

[0074]

(First-Ventilation-Opening Damper 8b and Second-Ventilation-Opening Damper 9b)

The first-ventilation-opening damper 8b is capable of opening and closing the first ventilation opening 8a. When the first-ventilation-opening damper 8b is in an open state, the chilled-compartment supply cool air 62a flows into the chilled compartment 32. The opening degree of the first-ventilation-opening damper 8b may be adjustable in multiple steps, and the flow rate of the chilled-compartment supply cool air 62a may be adjusted by adjusting the opening degree of the first-ventilation-opening damper 8b.

[0075]

The second-ventilation-opening damper 9b is capable of opening and closing the second ventilation opening 9a. When the second-ventilation-opening damper 9b is in an open state, the chilled-compartment supply cool air 62b flows into the chilled compartment 32. The opening degree of the second-ventilation-opening damper 9b may be adjustable in multiple steps, and the flow rate of the chilled-compartment supply cool air 62b may be adjusted by adjusting the opening degree of the second-ventilation-opening damper 9b.

[0076]

The controller 51 controls the open/closed state of the first-ventilation-opening damper 8b and the open/closed state of the second-ventilation-opening damper 9b. As described in Embodiment 1, the chilled compartment 32 may be excessively cooled relative to the set temperature. The controller 51 receives the temperature sensed by the chilled-compartment temperature sensor 41b. When the controller 51 determines that the temperature in the chilled compartment 32 is lower than or equal to the set temperature, the controller 51 sets at least one of the first-ventilation-opening damper 8b and the second-ventilation-opening damper 9b to a closed state. When the controller 51 determines that the temperature in the chilled compartment 32 is higher than the set temperature, the controller 51 sets each of the first-ventilation-opening damper 8b and the second-ventilation-opening damper 9b to the open state.

[0077]

The flow rate of the chilled-compartment supply cool air 62a that flows into the chilled compartment 32 can be reduced by setting the first-ventilation-opening damper 8b to the closed state. The flow rate of the chilled-compartment supply cool air 62b that flows into the chilled compartment 32 can be reduced by setting the second-ventilation-opening damper 9b to the closed state. Therefore, cooling of the chilled compartment 32 to a temperature below the set temperature can be suppressed, and adverse effects of temperature reduction on the items stored in the chilled compartment 32 can be reduced. It is not necessary that both the first-ventilation-opening damper 8b and the second-ventilation-opening damper 9b be provided. The configuration may

be such that only one of the first-ventilation-opening damper 8b and the second-ventilation-opening damper 9b is provided.

[0078]

The refrigerator 100 according to Embodiment 3 includes the temperature sensor 41b provided in the chilled compartment 32. The first ventilation opening 8a is provided with the first-ventilation-opening damper 8b capable of opening and closing the first ventilation opening 8a. The first-ventilation-opening damper 8b opens and closes based on the temperature sensed by the temperature sensor 41b and the set temperature of the chilled compartment 32.

[0079]

According to the above-described configuration, the first-ventilation-opening damper 8b opens and closes based on the temperature in the chilled compartment 32 and the set temperature of the chilled compartment 32, so that the temperature in the chilled compartment 32 can be easily maintained at the set temperature. Therefore, items can be stored in the chilled compartment 32 at a more appropriate temperature, and adverse effects on the stored items can be reduced.

[0080]

In the refrigerator 100 according to Embodiment 3, the first-ventilation-opening damper 8b is set to the closed state when the temperature sensed by the temperature sensor 41b is lower than the set temperature of the chilled compartment 32.

[0081]

According to the above-described configuration, when the first-ventilation-opening damper 8b is set to the closed state, the chilled-compartment supply cool air 62a is not supplied to the chilled compartment 32. In other words, the chilled compartment 32 is not cooled by the chilled-compartment supply cool air 62a. Therefore, temperature reduction in the chilled compartment 32 can be suppressed, so that the occurrence of freezing of the items stored in the chilled compartment 32 can be reduced.

[0082]

The refrigerator 100 according to Embodiment 3 includes the temperature sensor 41b provided in the chilled compartment 32. The first ventilation opening 8a is

provided with the first-ventilation-opening damper 8b capable of opening and closing the first ventilation opening 8a, and the second ventilation opening 9a is provided with the second-ventilation-opening damper 9b capable of opening and closing the second ventilation opening 9a. At least one of the first-ventilation-opening damper 8b and the second-ventilation-opening damper 9b opens and closes based on the temperature sensed by the temperature sensor 41b and the set temperature of the chilled compartment 32.

[0083]

According to the above-described configuration, the open/closed state of the first-ventilation-opening damper 8b and the open/closed state of the second-ventilation-opening damper 9b can be controlled based on the temperature in the chilled compartment 32. Therefore, the flow rate of the cool air supplied to the chilled compartment 32 can be adjusted by the combination of the open/closed states of the first-ventilation-opening damper 8b and the second-ventilation-opening damper 9b.

Since the flow rate of the cool air supplied to the chilled compartment 32 can be easily adjusted, the temperature in the chilled compartment 32 can be easily maintained at the set temperature. In addition, temperature hunting in the chilled compartment 32 can be reduced. Therefore, items can be stored in the chilled compartment 32 at a more appropriate temperature, and adverse effects on the stored items can be reduced.

[0084]

In the refrigerator 100 according to Embodiment 3, at least one of the first-ventilation-opening damper 8b and the second-ventilation-opening damper 9b is set to the closed state when the temperature sensed by the temperature sensor 41b is lower than the set temperature of the chilled compartment 32.

[0085]

According to the above-described configuration, when the first-ventilation-opening damper 8b is set to the closed state, the chilled-compartment supply cool air 62a is not supplied to the chilled compartment 32. When the second-ventilation-opening damper 9b is set to the closed state, the chilled-compartment supply cool air 62b is not supplied to the chilled compartment 32. In other words, the chilled compartment 32 is not

cooled by the chilled-compartment supply cool air 62a and the chilled-compartment supply cool air 62b. Therefore, temperature reduction in the chilled compartment 32 can be suppressed, so that the occurrence of freezing of the items stored in the chilled compartment 32 can be reduced. It can be determined whether to set the first-ventilation-opening damper 8b to the closed state, to set the second-ventilation-opening damper 9b to the closed state, or to set both the first-ventilation-opening damper 8b and the second-ventilation-opening damper 9b to the closed state based on the temperature in the chilled compartment 32. Since the way to adjust the flow rate of the cool air supplied to the chilled compartment 32 can be selected from a wider range of options, the temperature in the chilled compartment 32 can be more easily brought closer to the set temperature. Since the flow rate of the cool air supplied to the chilled compartment 32 can be easily adjusted, the temperature in the chilled compartment 32 can be easily maintained at the set temperature. In addition, temperature hunting in the chilled compartment 32 can be reduced. Therefore, items can be stored in the chilled compartment 32 at a more appropriate temperature, and adverse effects on the stored items can be reduced.

[0086]

Embodiment 4

Fig. 12 is a schematic diagram illustrating flows of cool air in a refrigerator 100 according to Embodiment 4. Fig. 13 is a schematic diagram illustrating flows of cool air toward a cooler compartment 21 in the refrigerator 100 according to Embodiment 4. The refrigerator 100 according to Embodiment 4 described herein differs from the refrigerators 100 according to Embodiments 1 to 3 in that the cooler 21a includes a first cooler 21aL and a second cooler 21aR and that the cooler compartment 21 is provided with a dividing wall 28.

[0087]

(Cooler 21a)

As illustrated in Figs. 12 and 13, the cooler 21a includes the first cooler 21aL and the second cooler 21aR. Figs. 12 and 13 illustrate an example in which the cooler compartment 21 is provided with the dividing wall 28 that divides the cooler 21a into the

first cooler 21aL and the second cooler 21aR. The position at which the dividing wall 28 divides the cooler 21a into the first cooler 21aL and the second cooler 21aR is determined by the ratio between the amount of cool air required in storage compartments to which cool air generated by the first cooler 21aL is supplied and the amount of cool air required in storage compartments to which cool air generated by the second cooler 21aR is supplied. The first cooler 21aL and the second cooler 21aR may have separate structures through which the refrigerant flows in parallel. Alternatively, the cooler 21a may be sectioned into the first cooler 21aL and the second cooler 21aR by the dividing wall 28. The first cooler 21aL and the second cooler 21aR may have any structure as long as the cool air generated by the first cooler 21aL and the cool air generated by the second cooler 21aR are independently supplied.

[0088]

The dividing wall 28 extends from a rear surface of the fan grille 26 to the housing 1 in the cooler compartment 21. The dividing wall 28 passes through a gap between refrigerant pipes of the cooler 21a to divide the cooler 21a into the first cooler 21aL and the second cooler 21aR. Thus, the dividing wall 28 is disposed in the space between the fan grille 26 and the housing 1 to partition the cooler compartment 21 into a left space in which the first cooler 21aL is positioned and a right space in which the second cooler 21aR is positioned. In the cooler compartment 21, the cool air is impeded from flowing between the right space and the left space divided from each other by the dividing wall 28.

[0089]

As illustrated in Fig. 12, the cool air generated by the first cooler 21aL is supplied to the refrigerator compartment 31 as the refrigerator-compartment supply cool air 61. The cool air generated by the second cooler 21aR is supplied to the versatile compartment 33 and the freezer compartment 34 as the versatile-compartment supply cool air 63 and the freezer-compartment supply cool air 64. The refrigerator-compartment supply cool air 61, the versatile-compartment supply cool air 63, and the freezer-compartment supply cool air 64 are supplied to the refrigerator compartment 31, the chilled compartment 32, the versatile compartment 33, and the freezer compartment

34. Flows of the cool air to the refrigerator compartment 31, the chilled compartment 32, the versatile compartment 33, and the freezer compartment 34 are similar to those in Embodiment 1, and description thereof is thus omitted herein.

[0090]

5 As illustrated in Fig. 13, the refrigerator-compartment supply cool air 61 supplied to the refrigerator compartment 31 flows into the refrigerator-compartment return flow passage 540 through a refrigerator-compartment return port (not illustrated). The refrigerator-compartment supply cool air 61 that has flowed into the refrigerator-compartment return flow passage 540 returns to the left space of the cooler compartment 21, in which the first cooler 21aL is disposed, through the refrigerator-compartment return flow passage 540 as the refrigerator-compartment return cool air 201.

[0091]

15 As described above in Embodiment 1, the versatile-compartment supply cool air 63 supplied to the versatile compartment 33 and the freezer-compartment supply cool air 64 supplied to the freezer compartment 34 are supplied to the chilled compartment 32 as the chilled-compartment supply cool air 62a and the chilled-compartment supply cool air 62b, respectively, and then return to the right space of the cooler compartment 21, in which the second cooler 21aR is disposed, through the chilled-compartment return flow passage 530 as the chilled-compartment return cool air 202.

[0092]

20 In Embodiment 4, the cool air generated by the first cooler 21aL cools the items stored in the refrigerator compartment 31 as the refrigerator-compartment supply cool air 61, and then returns to the first cooler 21aL as the refrigerator-compartment return cool air 201. The cool air generated by the second cooler 21aR cools the versatile compartment 33, the freezer compartment 34, and the chilled compartment 32, and returns to the second cooler 21aR as the chilled-compartment return cool air 202. Thus, the cool air supplied to the refrigerator compartment 31 is separated from the cool air supplied to the chilled compartment 32, the versatile compartment 33, and the freezer compartment 34. Therefore, the cool air supplied to the refrigerator

25

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compartment 31 is not mixed with the cool air supplied to the chilled compartment 32, the versatile compartment 33, and the freezer compartment 34. Therefore, transfer of odors from the items stored in the refrigerator compartment 31 to the items stored in the chilled compartment 32, the versatile compartment 33, and the freezer compartment 34 can be suppressed. Although not illustrated, a pipe route for the refrigerant in the first cooler 21aL and a pipe route for the refrigerant in the second cooler 21aR may be divided from each other. By dividing the pipe routes for the refrigerant and controlling the first cooler 21aL and the second cooler 21aR individually, energy efficiency can be improved.

[0093]

The refrigerator 100 according to Embodiment 4 includes the refrigerator compartment 31 and the refrigerator-compartment flow passage 500 connecting the cooler compartment 21 and the refrigerator compartment 31 to each other. The cooler 21a includes the first cooler 21aL and the second cooler 21aR. The cooler compartment 21 is provided with the dividing wall 28 separating the first cooler 21aL and the second cooler 21aR from each other. Cool air generated by the first cooler 21aL flows into the refrigerator compartment 31 through the refrigerator-compartment flow passage 500. Cool air generated by the second cooler 21aR flows into the versatile compartment 33 through the versatile-compartment flow passage 510.

[0094]

According to the above-described configuration, the cool air supplied to the refrigerator compartment 31 does not mix with the cool air supplied to the versatile compartment 33. Therefore, transfer of odors between the items stored in the refrigerator compartment 31 and the items stored in the versatile compartment 33 can be suppressed.

[0095]

The refrigerator 100 according to Embodiment 4 includes the refrigerator compartment 31 and the refrigerator-compartment flow passage 500 connecting the cooler compartment 21 and the refrigerator compartment 31 to each other. The cooler 21a includes the first cooler 21aL and the second cooler 21aR. The cooler

compartment 21 is provided with the dividing wall 28 separating the first cooler 21aL and the second cooler 21aR from each other. Cool air generated by the first cooler 21aL flows into the refrigerator compartment 31 through the refrigerator-compartment flow passage 500. Cool air generated by the second cooler 21aR is divided into the versatile-compartment supply cool air 63 and the freezer-compartment supply cool air 64. The versatile-compartment supply cool air 63 flows through the versatile-compartment flow passage 510 and into the versatile compartment 33. The freezer-compartment supply cool air 64 flows through the freezer-compartment flow passage 520 and into the freezer compartment 34.

[0096]

According to the above-described configuration, the cool air supplied to the refrigerator compartment 31 does not mix with the cool air supplied to the versatile compartment 33 and the freezer compartment 34. Therefore, transfer of odors between the items stored in the refrigerator compartment 31 and the items stored in the versatile compartment 33 and the freezer compartment 34 can be suppressed.

[0097]

Embodiment 5

(Automatic Ice Maker 601)

Fig. 14 is a schematic diagram illustrating an automatic ice maker 601 and a water tank 602 included in a refrigerator 100 according to Embodiment 5. The refrigerator 100 according to Embodiment 5 described herein differs from the refrigerators 100 according to Embodiments 1 to 4 in having an ice-making function. In the following description, elements that are the same as those in Embodiments 1 to 4 described above are denoted by the same reference signs, and description thereof will be omitted.

[0098]

As illustrated in Fig. 14, the refrigerator 100 according to Embodiment 5 includes the automatic ice maker 601 and the water tank 602 storing water to be supplied to the automatic ice maker 601. The automatic ice maker 601 is disposed in the freezer compartment 34. After completion of ice-making is confirmed, ice chips made by the

automatic ice maker 601 are released and stored in an ice storage space (not illustrated) provided in the first freezer-compartment case 15.

[0099]

A portion of the refrigerator-compartment partition wall 7 corresponding to the ceiling surface of the chilled compartment 32 has a recess 602a facing the refrigerator compartment 31. The water tank 602 is placed in the recess 602a in the refrigerator-compartment partition wall 7. The chilled compartment 32 is set to a temperature higher than the temperature of the freezer compartment 34. Therefore, compared to a configuration in which the water tank 602 is placed on a ceiling surface of the freezer compartment 34, the water tank 602 and water in the water tank 602 are less likely to freeze. Since the water tank 602 and water in the water tank 602 are not likely to freeze, it is not necessary to provide means for preventing the water tank 602 and water in the water tank 602 from freezing. Means for preventing the water tank 602 and water in the water tank 602 from freezing is, for example, a heater for the water tank 602.

[0100]

The refrigerator 100 according to Embodiment 5 includes the refrigerator compartment 31, the refrigerator-compartment partition wall 7, the automatic ice maker 601, and the water tank 602. The refrigerator compartment 31 is provided above the chilled compartment 32. The refrigerator-compartment partition wall 7 is provided between the refrigerator compartment 31 and the chilled compartment 32. The water tank 602 is configured to store water to be used in the automatic ice maker 601. The refrigerator-compartment partition wall 7 has a recess 602a facing in a direction from the chilled compartment 32 toward the refrigerator compartment 31, and the water tank 602 is placed in the recess 602a.

[0101]

According to the above-described configuration, the water tank 602 is disposed in the refrigerator-compartment partition wall 7 positioned between the refrigerator compartment 31 and the chilled compartment 32. The refrigerator compartment 31 and the chilled compartment 32 are storage compartments having relatively high set

temperatures. Therefore, the possibility that the water tank 602 and water stored in the water tank 602 will freeze can be reduced.

[0102]

Although Embodiments 1 to 5 have been described, the refrigerator 100 is not limited to Embodiments 1 to 5 described above, and various modifications and applications are possible without departing from the gist. For example, the refrigerator 100 may be configured such that the chilled compartment 32 is disposed in a right region and the versatile compartment 33 is disposed in a left region. In addition, Embodiments 1 to 5 may be combined with each other without adversely affecting the functions or structures of Embodiments 1 to 5.

Reference Signs List

[0103]

1: housing, 2: door, 2a: door, 2b: door, 2c: door, 5a: hinge, 5b: hinge, 5c: hinge, 5d: hinge, 5e: hinge, 7: refrigerator-compartment partition wall, 8: first partition wall, 8a: first ventilation opening, 8b: first-ventilation-opening damper, 9: second partition wall, 9a: second ventilation opening, 9b: second-ventilation-opening damper, 11: shelf, 12: refrigerator-compartment case, 13: chilled-compartment case, 14: versatile-compartment case, 15: first freezer-compartment case, 16: second freezer-compartment case, 21: cooler compartment, 21a: cooler, 21aL: first cooler, 21aR: second cooler, 22: fan, 23: compressor, 24: refrigerator-compartment outlet panel, 25: versatile-compartment outlet panel, 26: fan grille, 27: damper, 28: dividing wall, 31: refrigerator compartment, 32: chilled compartment, 33: versatile compartment, 34: freezer compartment, 40a: refrigerator-compartment air outlet, 40b: chilled-compartment air outlet, 40c: versatile-compartment air outlet, 40d: freezer-compartment air outlet, 41: temperature sensor, 41a: refrigerator-compartment temperature sensor, 41b: chilled-compartment temperature sensor, 41c: versatile-compartment temperature sensor, 41d: freezer-compartment temperature sensor, 42b: chilled-compartment return port, 50: heater, 51: controller, 52: machine compartment, 61: refrigerator-compartment supply cool air, 62a: chilled-compartment supply cool air, 62b: chilled-compartment supply cool air, 62c: chilled-compartment supply cool air, 63: versatile-compartment supply cool air,

64: freezer-compartment supply cool air, 100: refrigerator, 201: refrigerator-
compartment return cool air, 202: chilled-compartment return cool air, 401: chilled-
compartment damper, 500: refrigerator-compartment flow passage, 510: versatile-
compartment flow passage, 520: freezer-compartment flow passage, 530: chilled-
5 compartment return flow passage, 540: refrigerator-compartment return flow passage,
601: automatic ice maker, 602: water tank, 602a: recess.

CLAIMS

[Claim 1]

A refrigerator comprising:

a chilled compartment whose temperature is capable of being set in a range from
5 a first upper limit to a first lower limit;

a versatile compartment whose temperature is capable of being set in a range
from a second upper limit to a second lower limit, the second upper limit being higher
than the first upper limit, the second lower limit being lower than the first lower limit;

a cooler configured to generate cool air;

10 a cooler compartment accommodating the cooler; and

a versatile-compartment flow passage connecting the cooler compartment and
the versatile compartment to each other and allowing the cool air generated by the
cooler to flow therethrough,

wherein the chilled compartment and the versatile compartment are arranged
15 next to each other in a horizontal direction, and

wherein the chilled compartment and the versatile compartment are covered by
one door capable of being opened and closed.

[Claim 2]

The refrigerator of claim 1, further comprising:

20 a first partition wall separating the chilled compartment and the versatile
compartment from each other; and

a chilled-compartment return flow passage connecting the cooler compartment
and the chilled compartment to each other and allowing the cool air flowing out of the
chilled compartment to flow therethrough,

25 wherein the first partition wall has a first ventilation opening providing
communication between the chilled compartment and the versatile compartment,

wherein the cool air flows into the versatile compartment through the versatile-
compartment flow passage,

wherein the cool air flows into the chilled compartment from the versatile
30 compartment through the first ventilation opening, and

wherein the cool air in the chilled compartment flows into the cooler compartment through the chilled-compartment return flow passage.

[Claim 3]

The refrigerator of claim 2, further comprising:

- 5 a temperature sensor provided in the chilled compartment,
wherein the first ventilation opening is provided with a first-ventilation-opening damper capable of opening and closing the first ventilation opening, and
wherein the first-ventilation-opening damper opens and closes based on a temperature sensed by the temperature sensor and a set temperature of the chilled
10 compartment.

[Claim 4]

The refrigerator of claim 3, wherein the first-ventilation-opening damper is set to a closed state when the temperature sensed by the temperature sensor is lower than the set temperature of the chilled compartment.

15 [Claim 5]

The refrigerator of any one of claims 1 to 4, further comprising:

a refrigerator compartment; and

a refrigerator-compartment flow passage connecting the cooler compartment and the refrigerator compartment to each other,

- 20 wherein the cooler includes a first cooler and a second cooler,
wherein the cooler compartment is provided with a dividing wall separating the first cooler and the second cooler from each other,

wherein cool air generated by the first cooler flows into the refrigerator compartment through the refrigerator-compartment flow passage, and

- 25 wherein cool air generated by the second cooler flows into the versatile compartment through the versatile-compartment flow passage.

[Claim 6]

The refrigerator of claim 1, further comprising:

a freezer compartment;

a first partition wall separating the chilled compartment and the versatile compartment from each other;

a second partition wall separating the chilled compartment and the freezer compartment from each other;

5 a chilled-compartment return flow passage connecting the cooler compartment and the chilled compartment to each other and allowing the cool air flowing out of the chilled compartment to flow therethrough; and

a freezer-compartment flow passage connecting the cooler compartment and the freezer compartment to each other and allowing the cool air generated by the cooler to
10 flow therethrough,

wherein a temperature in the freezer compartment is capable of being set to a temperature lower than the second lower limit for the versatile compartment,

wherein the first partition wall has a first ventilation opening providing communication between the chilled compartment and the versatile compartment,

15 wherein the second partition wall has a second ventilation opening providing communication between the chilled compartment and the freezer compartment,

wherein the cool air flows into the versatile compartment through the versatile-compartment flow passage,

wherein the cool air flows into the freezer compartment through the freezer-compartment flow passage,
20

wherein the cool air flows into the chilled compartment from the versatile compartment through the first ventilation opening and from the freezer compartment through the second ventilation opening, and

wherein the cool air in the chilled compartment flows into the cooler compartment
25 through the chilled-compartment return flow passage.

[Claim 7]

The refrigerator of claim 6, wherein the freezer compartment is covered by the one door.

[Claim 8]

30 The refrigerator of claim 6 or 7, further comprising:

a temperature sensor provided in the chilled compartment,
wherein the first ventilation opening is provided with a first-ventilation-opening damper capable of opening and closing the first ventilation opening,
wherein the second ventilation opening is provided with a second-ventilation-opening damper capable of opening and closing the second ventilation opening, and
wherein at least one of the first-ventilation-opening damper and the second-ventilation-opening damper opens and closes based on a temperature sensed by the temperature sensor and a set temperature of the chilled compartment.

[Claim 9]

The refrigerator of claim 8, wherein at least one of the first-ventilation-opening damper and the second-ventilation-opening damper is set to a closed state when the temperature sensed by the temperature sensor is lower than the set temperature of the chilled compartment.

[Claim 10]

The refrigerator of any one of claims 6 to 9, further comprising;
a refrigerator compartment; and
a refrigerator-compartment flow passage connecting the cooler compartment and the refrigerator compartment to each other,
wherein the cooler includes a first cooler and a second cooler,
wherein the cooler compartment is provided with a dividing wall separating the first cooler and the second cooler from each other,
wherein cool air generated by the first cooler flows into the refrigerator compartment through the refrigerator-compartment flow passage, and
wherein cool air generated by the second cooler is divided into versatile-compartment supply cool air and freezer-compartment supply cool air, the versatile-compartment supply cool air flowing through the versatile-compartment flow passage and into the versatile compartment, the freezer-compartment supply cool air flowing through the freezer-compartment flow passage and into the freezer compartment.

[Claim 11]

The refrigerator of any one of claims 1 to 4 and 6 to 9, further comprising:

a refrigerator compartment;

a refrigerator-compartment flow passage connecting the cooler compartment and the refrigerator compartment to each other and allowing the cool air generated by the cooler to flow therethrough;

5 a chilled-compartment air outlet provided in the chilled compartment and providing communication between the refrigerator-compartment flow passage and the chilled compartment; and

a temperature sensor provided in the chilled compartment,

10 wherein the chilled-compartment air outlet is provided with a chilled-compartment damper capable of opening and closing the chilled-compartment air outlet, and

wherein the chilled-compartment damper opens and closes based on a temperature sensed by the temperature sensor and a set temperature of the chilled compartment.

[Claim 12]

15 The refrigerator of claim 11, wherein the chilled-compartment damper is set to an open state when the temperature sensed by the temperature sensor is higher than the set temperature of the chilled compartment, and

wherein the cool air flowing through the refrigerator-compartment flow passage flows into the chilled compartment through the chilled-compartment air outlet.

20 [Claim 13]

The refrigerator of any one of claims 1 to 12, further comprising:

a refrigerator compartment provided above the chilled compartment;

a refrigerator-compartment partition wall provided between the refrigerator compartment and the chilled compartment;

25 an automatic ice maker; and

a water tank configured to store water to be used in the automatic ice maker,

wherein the refrigerator-compartment partition wall has a recess facing in a direction from the chilled compartment toward the refrigerator compartment, and

wherein the water tank is placed in the recess.

30 [Claim 14]

The refrigerator of any one of claims 1 to 13, wherein the one door is a swing door or a drawer panel.