DESCRIPTION

Title of Invention

REFRIGERATOR

Technical Field

[0001]

The present disclosure relates to a refrigerator including a plurality of storage compartments.

Background Art

[0002]

In many existing refrigerators, for each of storage compartments that are partitioned off by a partition wall, an associated single door is provided. However, in some proposed refrigerators, a single door is provided for two separate storage compartments (see, e.g., Patent Literature 1). In a refrigerator disclosed in Patent Literature 1, a single door is provided for two storage compartments that have close temperature zones and are cooled by direct cooling or indirect cooling.

Citation List

Patent Literature

[0003]

Patent Literature 1: Japanese Unexamined Patent Application Publication No. 2011-208806

Summary of Invention

Technical Problem

[0004]

In the refrigerator disclosed in Patent Literature 1, a refrigerator compartment and a storage compartment having a temperature zone close to that of the refrigerator compartment are closed by a single door and a single partition wall. Patent Literature 1 describes that packing on outer peripheral part of the storage compartment is not indispensable. However, Patent Literature 1 does not specify a comparison between the temperatures of storage compartments of the refrigerator. If the temperature of the

lower one of the storage compartments is high and the temperature of the upper one of the storage compartments is low, natural convection between the partition wall and the door occurs and causes heat transfer between the storage compartments. It is therefore hard to control the temperature of each of the storage compartments.

[0005]

The present disclosure is applied to solve the above problem, and relates to a refrigerator in which a single door is provided for at least two storage compartments and which can reduce occurrence of heat transfer between the storage compartments with a simple mechanism.

Solution to Problem

[0006]

A refrigerator according to an embodiment of the present disclosure includes: a housing in which a storage space for storage of material is provided, the housing having an opening that is provided in a front of the housing and is configured to allow the material to be moved into and out of the storage space; a partition wall dividing an interior of the storage space into an upper space and a lower space; and a door provided in front of the storage space and configured to open and close the opening. In the storage space, a plurality of storage compartments are defined by the housing and the partition wall. The plurality of storage compartments include a first storage compartment located above the partition wall and a second storage compartment provided below the partition wall. A temperature of the first storage compartment is set higher than a temperature of the second storage compartment. The door is provided as a single door configured to open and close the first storage compartment and the second storage compartment at the same time, and the door has an upper protrusion and a lower protrusion that protrude from a surface of the door that is adjacent to the storage space. When the door is in a closed state, in the housing, a gap is provided between the partition wall and the door, between the partition wall and the upper protrusion, and between the partition wall and the lower protrusion, the gap causing the first storage compartment and the second storage compartment to communicate with each other. When the door is in the closed state, the upper protrusion is located above the partition wall, with a gap provided between the upper protrusion and the partition

wall. When the door is in the closed state, the lower protrusion is located below the partition wall, with the gap provided between the lower protrusion and the partition wall. The upper protrusion and the lower protrusion extend rightward and leftward as viewed in head-on view, protrude in a depth direction of the housing as viewed in top plan view, and have respective distal end portions that overlap with the partition wall as viewed in top plan view. To the distal end portion of the upper protrusion, packing is attached, the packing being located between the upper protrusion and the partition wall. To the distal end portion of the lower protrusion, lower packing is attached, the lower packing being located between the lower protrusion and the partition wall.

Advantageous Effects of Invention

[0007]

The refrigerator according to the embodiment of the present disclosure includes the first storage compartment provided above the partition wall, and the second storage compartment provided below the partition wall. The temperature of the first storage compartment is set higher than the temperature of the second storage compartment. The door is a single door configured to open and close the first storage compartment and the second storage compartment at the same time, and has the upper protrusion protruding from the surface of the door that is adjacent to the storage space. When the door is in the closed state, the upper protrusion is located above the partition wall, with the gap provided between the upper protrusion and the partition wall, and extends rightward and leftward in the direction of extension of the partition wall as viewed in head-on view, and the distal end side of the upper protrusion in the protruding direction overlaps with the partition wall as viewed in top plan view. Because of provision of the upper protrusion, the refrigerator may increase resistance against cold air that flows between upper and lower storage compartments, thereby reducing transfer of cold air. In the refrigerator, the temperature of a first freezer compartment at an upper position is set higher than the temperature of a second freezer compartment at a lower position. Therefore, between the first freezer compartment and the second freezer compartment, circulation of cold air between the storage compartments that would be caused by natural convection hardly occurs. Thus, even in the case where the refrigerator is a refrigerator that includes a

single door for two storage compartments, that is, for the first freezer compartment and the second freezer compartment, the refrigerator can reduce heat transfer between the storage compartments with temperature setting between the storage compartments and a simple configuration, that is, the presence of the upper protrusion.

Brief Description of Drawings

[0008]

[Fig. 1] Fig. 1 is a front view of a refrigerator according to Embodiment 1.

[Fig. 2] Fig. 2 is a front view of the interior of the refrigerator according to Embodiment 1.

[Fig. 3] Fig. 3 is a vertical sectional schematic view of the refrigerator according to Embodiment 1 that is taken along line A-A in Fig. 1.

[Fig. 4] Fig. 4 is a cross-sectional view of the refrigerator according to Embodiment 1 that is taken along line B-B in Fig. 2, and also schematically illustrates a freezer compartment door.

[Fig. 5] Fig. 5 is a conceptual diagram of a door of the refrigerator according to Embodiment 1 as viewed from the interior side of the refrigerator.

[Fig. 6] Fig. 6 is an enlarged view of part C of the refrigerator according to Embodiment 1 that is illustrated in Fig. 3 in the case where no heater is provided.

[Fig. 7] Fig. 7 is a horizontal cross-sectional view of a first freezer compartment of the refrigerator according to Embodiment 1 that is taken at a position above an upper protrusion.

[Fig. 8] Fig. 8 is a sectional view of the refrigerator according to Embodiment 1 that is taken along line D-D in Fig. 7.

[Fig. 9] Fig. 9 is an enlarged view of the part C of the refrigerator according to Embodiment 1 that is illustrated in Fig. 3 in the case where a heater is provided.

[Fig. 10] Fig. 10 is an enlarged view of the part C of the refrigerator according to Embodiment 1 that is illustrated in Fig. 3 in which a lower packing is provided.

Description of Embodiments

[0009]

Hereinafter, the embodiment of the present disclosure will be described with reference to the drawings. In each of figures including Fig. 1 that will be referred to, components that are the same as or equivalent to those in a previous figure or previous figures are denoted by the same reference signs. The same is true of the entire text of the following description regarding the embodiment. In addition, regarding the embodiment, components that are the same as or equivalent to those in previous

descriptions will be denoted by the same reference signs, and their descriptions may be omitted. The configurations of components described throughout the specification are each merely an example, and their descriptions are not limiting. Even if not particularly described, regarding the embodiment, configurations can be partially combined with each other, as long as such a combination gives rise to no problem.

[0010]

Embodiment 1

Refrigerator 100

Fig. 1 is a front view of a refrigerator 100 according to Embodiment 1. Fig. 2 is a front view of an interior of the refrigerator 100 according to Embodiment 1. In Figs. 1 and 2, a two-headed arrow extending in a lateral direction indicates a left-right direction LR of a housing 10, and a two-headed arrow in an up-down direction indicates an up-down direction UD of the housing 10. The refrigerator 100 includes the housing 10 which forms an outer shell, a partition wall or walls 20 provided in the housing 10, and a door or doors 30 are attached to the housing 10.

[0011]

Housing 10

The housing 10 has a storage space 11 provided to store material. In the front of the housing 10, an opening 12 is provided to allow material to be taken into or out from the storage space 11. For example, the housing 10 includes an outer case which is made of steel plates and forms an outer shell, and an inner case which is made of thin hard resin, such as ABS resin, and located inward of the outer case. A space between the outer case and the inner case is filled with a heat insulating material, such as rigid urethane foam.

[0012]

Partition wall 20

The partition wall or walls 20 each divide the interior of the storage space 11 into upper and lower spaces. The storage space 11 is divided by the partition wall 20 into an upper space and a lower space. The partition wall 20 is a plate-like member. In the storage space 11, the partition wall 20 extends in a depth direction FB (see Fig. 3) of

the interior of the refrigerator 100, and extends in the left-right direction LR of the interior of the refrigerator 100. That is, in the storage space 11, the partition wall 20 extends from an inner wall on the back side of the housing 10 to the opening 12 on the front side of the housing 10.

[0013]

In the storage space 11, a plurality of storage compartments 13 are formed by the housing 10 and the partition wall 20. Regarding the number of partition walls 20, one partition wall 20 may be provided or a plurality of partition walls 20 may be provided. The plurality of storage compartments 13 include a first freezer compartment 14 located above the partition wall 20 and a second freezer compartment 15 located below the partition wall 20.

[0014]

The first freezer compartment 14 is a first one of the plurality of storage compartments 13, and the second freezer compartment 15 is a second one of the plurality of storage compartments 13. The first freezer compartment 14 is provided at a higher position than the second freezer compartment 15. The first freezer compartment 14 and the second freezer compartment 15 are partitioned off by a first partition wall 21 that is one of the partition walls 20.

[0015]

The plurality of storage compartments 13 may include a refrigerator compartment 16 provided above the first freezer compartment 14 and the second freezer compartment 15. The refrigerator compartment 16 is a third one of the plurality of storage compartments 13. The first freezer compartment 14 and the refrigerator compartment 16 are partitioned off by a second partition wall 22 that is one of the partition walls 20. Although the refrigerator 100 as illustrated in Fig. 2 includes three storage compartments 13, it suffices that the refrigerator 100 includes two or more storage compartments 13. The refrigerator 100 includes at least the first freezer compartment 14 which is a first storage compartment and the second freezer compartment 15 which is a second storage compartment.

[0016]

The refrigerator 100 may include a plurality of partition walls 20, the storage space 11 may include a plurality of storage compartments 13 that include the first storage compartment and the second storage compartment and are partitioned off by the plurality of partition walls 20, and the door 30 or doors 30 may be configured to open and close the plurality of storage compartments 13.

[0017]

A heater 80 (see Fig. 3) which will be described below is attached to the first partition wall 21 in such a manner as to finely control the temperature of the first freezer compartment 14. The heater 80 is capable of radiating heat and warming material, such as food. The heater 80 is installed on the first partition wall 21. The temperature of the heater 80 is controlled by a controller 40. With the heater 80 on the first partition wall 21, the refrigerator 100 can finely control the temperature of the first freezer compartment 14 and prevent reversal of the relationship in temperature between the first freezer compartment 14 and the second freezer compartment 15.

[0018]

The controller 40 sets the temperature of the first freezer compartment 14 such that the temperature of the first freezer compartment 14 is higher than that of the second freezer compartment 15. In other words, the controller 40 sets the temperature of the second freezer compartment 15 such that the temperature of the second freezer compartment 15 is lower than that of the first freezer compartment 14. Referring to Fig. 1, the controller 40 is installed at the door 30; however, the installation position of the controller 40 is not limited. The controller 40 may be installed at the housing 10.

[0019]

The controller 40 is, for example, dedicated hardware or a central processing unit (CPU) (also referred to as a processing device, a computing unit, a microprocessor, or a processor) configured to execute a program stored in a memory.

[0020]

The first freezer compartment 14 is controlled by the controller 40 in such a manner as to maintain a supercooled state in which material, such as food, is not frozen even at the freezing point of water or below. The first freezer compartment 14 may be

a supercooling compartment whose temperature is adjusted to fall within a temperature range of the freezing point of water to -15 degrees C. Alternatively, the first freezer compartment 14 may be a cooling compartment whose temperature is controlled to fall within a temperature zone from -5 degrees C to -7 degrees C and material, such as food, is frozen to such a degree that the material can be divided into small portions by a knife or human hand.

[0021]

In the case where the first freezer compartment 14 is the supercooling compartment, the first freezer compartment 14 keeps material which is stored with cold air obtained by cooling by a cooler 51 (see Fig. 3), for at least a certain period of time (for example, five seconds or longer), in a supercooled state where the material is not frozen even at the freezing point of water or below. In the case where the first freezer compartment 14 is the supercooling compartment, a temperature control to change the cooling temperature in stages is performed in the first freezer compartment 14, thereby reducing the probability that cold air will be directly blown onto the material, and thus uniformizing the temperature in the refrigerator 100.

[0022]

The refrigerator 100 freezes material in the first freezer compartment 14 through supercooling. How to use the freezer compartments is thus changed depending on the material to be stored. For example, in the refrigerator 100, food, such as meat, fish, or vegetables, which is to be stored without losing its flavor, can be stored in the first freezer compartment 14, and other kinds of material, such as frozen food, can be stored in the second freezer compartment 15, whereby material can be appropriately stored depending on the user's use.

[0023]

The refrigerator 100 may include a temperature adjusting mechanism, such as the cooler 51 or the heater 80, and the controller 40 which controls the temperature adjusting mechanism. The first freezer compartment 14 may also be used as a cold storage compartment in which material can be made to be in a supercooled state. The temperature adjusting mechanism cools or heats the interior of the refrigerator 100, for

example, with the cooler 51 or the heater 80. In this case, for example, the processing by the controller 40 includes a first step and a second step, and the controller 40 controls the temperature adjusting mechanism in such a manner as to start the second step upon completion of the first step.

[0024]

In the first step, the controller 40 sets the set temperature of the first freezer compartment 14, which is a cold storage compartment, to a lower set temperature θL lower than the freezing point of material, during a first predetermined period T1. After the first predetermined period T1, the controller 40 switches the set temperature to a higher set temperature θH higher than the freezing point and keeps the set temperature at the higher set temperature θH during a second predetermined period T2. After switching the set temperature to the higher set temperature θH, the controller 40 introduces, from the refrigerator compartment 16 or a vegetable compartment (not illustrated), air having a higher temperature than that of air in the first freezer compartment 14 into the first freezer compartment 14, thereby thawing the material. In the second step, the controller 40 re-switches the set temperature to the lower set temperature θL after the second predetermined period T2 and keeps the interior of the first freezer compartment 14 at the lower set temperature θL.

[0025]

Since the first freezer compartment 14 is used as a cold storage compartment capable of causing material to be in a supercooled state, the refrigerator 100 can maintain freshness of food, such as meat or fish, for a longer time than in the refrigerator compartment 16, without freezing the food. The refrigerator 100 can use the first freezer compartment 14 as a freezer compartment or a cold storage compartment, which is selected depending on how long the material should be stored.

[0026]

The refrigerator 100 may include two or more partition walls 20 and two or more divided storage compartments 13. In the refrigerator 100, a larger number of partition walls 20 may be provided in the first freezer compartment 14 or the second freezer compartment 15 to provide a freezer compartment, a supercooling compartment, and a

cold storage compartment. Alternatively, in the refrigerator 100, a larger number of partition walls 20 may be provided in the first freezer compartment 14 or the second freezer compartment 15 to provide three or more storage compartments 13.

[0027]

Door 30

The door 30 is provided in front of the storage space 11 and used to open and close the opening 12 of the housing 10. The doors 30 are a freezer compartment door 31 and a refrigerator compartment door 32. The freezer compartment door 31 and the refrigerator compartment door 32 are rotatably supported by the housing 10.

[0028]

The freezer compartment door 31 is one door 30 which is used to open and close the first freezer compartment 14 which is the first storage compartment and the second freezer compartment 15 which is the second storage compartment, at the same time. That is, the freezer compartment door 31 is the door 30 which is used in common for the first freezer compartment 14 and the second freezer compartment 15 and configured to open and close the opening 12 provided on the front side of the first freezer compartment 14 and the second freezer compartment 15.

[0029]

The refrigerator compartment door 32 is the door 30 which is used to open and close the refrigerator compartment 16 and open and close the opening 12 at the front of the refrigerator compartment 16. In the case where the storage compartments 13 of the refrigerator 100 are used only as freezer compartments, that is, the first freezer compartment 14 and the second freezer compartment 15, the freezer compartment door 31 may be used as the door 30. A detailed structure of the door 30 will be described later on.

[0030]

Internal Configuration of Refrigerator 100

Fig. 3 is a vertical sectional schematic view of the refrigerator 100 according to Embodiment 1 that is taken along line A-A in Fig. 1. Fig. 4 is a cross-sectional view of the refrigerator 100 according to Embodiment 1 that is taken along line B-B in Fig. 2,

and also schematically illustrates the freezer compartment door 31. An arrow in a left-right direction in Fig. 3 and an arrow in a depth direction in Fig. 4 represent the depth direction FB of the housing 10. An internal configuration of the refrigerator 100 will be further described with reference to Figs. 3 and 4. As illustrated in Fig. 3, a cooling compartment 61 is provided on the back side of the interior of the housing 10. The space in the housing 10 is divided by a partition plate 25 into the storage space 11 and the cooling compartment 61.

[0031]

In the cooling compartment 61, the cooler 51 and a fan 52 are provided. In the refrigerator 100, the storage compartment 13 is cooled by air that is cooled by the cooler 51 and sent as cold air by the fan 52 from the cooling compartment 61 into the storage compartment 13. The cooler 51 is provided below the first partition wall 21 between the first freezer compartment 14 and the second freezer compartment 15.

[0032]

The cold air obtained by cooling by the cooler 51 is blown out from the cooling compartment 61 by the fan 52, passes through a first damper 53 and a refrigerator-compartment outlet air passage 62, and is supplied to the refrigerator compartment 16. Also, the cold air obtained by cooling by the cooler 51 is blown out from the cooling compartment 61 by the fan 52, passes through a second damper 54, a first freezer-compartment outlet air passage 63, and a second freezer-compartment outlet air passage 64 (see Fig. 4), and is supplied to the first freezer compartment 14.

[0033]

The first damper 53 and the second damper 54 each include a damper (not illustrated) that is used to open and close an air passage. The controller 40 causes the damper to be opened or closed to adjust the amount of cold air that flows through the air passage. The cold air obtained by cooling by the cooler 51 is sent out by the fan 52, and the temperature of each of the storage compartments 13 is controlled by the opening and closing control of the first damper 53 and the second damper 54.

[0034]

The cold air obtained by cooling by the cooler 51 is blown out from the cooling compartment 61 by the fan 52 and directly supplied to the second freezer compartment 15. The cold air supplied to the refrigerator compartment 16 and the first freezer compartment 14 passes through a refrigerator-compartment return air passage 65, a first freezer-compartment return air passage 66, and a second freezer-compartment return air passage 67 that are provided as illustrated in Fig. 4, and returns to the cooling compartment 61. The refrigerator-compartment return air passage 65 is a passage through which cold air having flowed out of the refrigerator compartment 16 passes. The first freezer-compartment return air passage 66 and the second freezer-compartment return air passage 67 are passages through which cold air having flowed out of the first freezer compartment 14 passes.

[0035]

As illustrated in Fig. 2 and Fig. 4, in the first freezer compartment 14, a first storage case 91 and a second storage case 92 are provided. As illustrated in Fig. 4, the first storage case 91 and the second storage case 92 are laterally arranged side by side in the first freezer compartment 14. In the second freezer compartment 15, a third storage case 95 is provided.

[0036]

The first storage case 91, the second storage case 92, and the third storage case 95 are cases for storing material, such as food. Cases for storing material, such as food, like the first storage case 91, the second storage case 92, and the third storage case 95, may be collectively referred to as storage cases 90. It is preferable that the storage cases 90 be provided in the respective storage compartments 13. For example, a storage case 90 or storage cases 90 may be provided in the refrigerator compartment 16.

[0037]

Preferably, the storage cases 90, such as the first storage case 91, the second storage case 92, and the third storage case 95, should be transparent, because the user can visually identify material in each of the storage cases 90 when opening the freezer compartment door 31. Also, preferably, the front surface of each of the storage

cases 90 should cover the entire door opening of the storage compartment 13 and the storage case 90 should be a case that isolates the inside of the refrigerator 100 from the outside thereof, as seen from the front of the refrigerator 100. In such a manner, preferably, the refrigerator 100 be configured such that each of the storage cases is not pulled out when the door is opened, unlike a pullout door provided with a storage case.

[0038]

A first air outlet 71 is provided as an air outlet for cold air for cooling the first storage case 91, in an upper region of a region located on the right side of the first storage case 91, as seen in a head-on view of the refrigerator 100 or as seen from the front. The first air outlet 71 is an air outlet for cold air in the first freezer-compartment outlet air passage 63.

[0039]

A second air outlet 72 is provided as an air outlet for cold air for cooling the second storage case 92, in an upper region of a region located on the left side of the second storage case 92 as seen in the head-on view of the refrigerator 100 is viewed from the front or as seen from the front. The second air outlet 72 is an air outlet for cold air in the second freezer-compartment outlet air passage 64. The first air outlet 71 and the second air outlet 72 are provided close to central part of the refrigerator 100 in the left-right direction LR of the housing 10.

[0040]

The first storage case 91 has a first air vent 93 for securing a return air passage F1. The return air passage F1 is an air passage for returning cold air blown out of the first air outlet 71 to a first return port 73 that is a cold air return port. The first return port 73 is a cold-air inflow port of the first freezer-compartment return air passage 66. In the first freezer compartment 14, the first return port 73 is provided on a rear side of the first freezer compartment 14 with respect to the first air vent 93.

[0041]

The first air vent 93 is a through hole formed in the first storage case 91. The first air vent 93 is provided on the left side of the first storage case 91 in the left-right direction LR of the housing 10. In the refrigerator 100 according to Embodiment 1, the

first storage case 91 is provided on the left side of the second storage case 92, and the first air vent 93 is provided in a side surface that is located opposite to the second storage case 92.

[0042]

The first air vent 93 is provided closer to the back side than central part of the first storage case 91 in the depth direction FB of the housing 10. The first air vent 93 is provided below the central part of the first storage case 91 in the up-down direction UD of the housing 10.

[0043]

The second storage case 92 has a second air vent 94 for securing a return air passage F2. The return air passage F2 is an air passage for returning cold air blown out of the second air outlet 72 to a second return port 74 that is a cold air return port. The second return port 74 is a cold-air inflow port of the second freezer-compartment return air passage 67. In the first freezer compartment 14, the second return port 74 is provided on the rear side of the first freezer compartment 14 with respect to the second air vent 94.

[0044]

The second air vent 94 is a through hole formed in the second storage case 92. The second air vent 94 is provided on the right side of the second storage case 92 in the left-right direction LR of the housing 10. In the refrigerator 100 according to Embodiment 1, the second storage case 92 is provided on the right side of the first storage case 91, and the second air vent 94 is provided in a side surface that is located opposite to the first storage case 91. That is, the air vent, such as the first air vent 93 or the second air vent 94, is provided in any of side surfaces of the storage case 90 in the left-right direction LR of the housing 10.

[0045]

The second air vent 94 is provided closer to the back side than central part of the second storage case 92 in the depth direction FB of the housing 10. The second air vent 94 is provided below the central part of the second storage case 92 in the up-down direction UD of the housing 10.

[0046]

The flow of cold air that flows in the first freezer compartment 14 will be described with reference to Fig. 4. Cold air that is blown from the first air outlet 71 into the first storage case 91 circulates in the first storage case 91, passes through the first air vent 93 formed in the first storage case 91, and flows into the first return port 73 which communicates with the first freezer-compartment return air passage 66. The return air passage F1 as indicated in Fig. 4 corresponds to the flow of cold air in the first storage case 91.

[0047]

Cold air that is blown from the second air outlet 72 into the second storage case 92 circulates in the second storage case 92, passes through the second air vent 94 formed in the second storage case 92, and flows into the second return port 74 which communicates with the second freezer-compartment return air passage 67. The return air passage F2 as indicated in Fig. 4 corresponds to the flow of cold air in the second storage case 92.

[0048]

In the first freezer compartment 14, the first air outlet 71 and the first air vent 93 are diagonally provided as viewed in head-on view of the first freezer compartment 14, that is, as viewed from the front, thereby enabling cold air to circulate in a wide area. Thus, in the refrigerator 100, it is possible to reduce temperature distribution in the first storage case 91. Similarly, in the first freezer compartment 14, the second air outlet 72 and the second air vent 94 are diagonally provided as viewed in head-on view of the first freezer compartment 14, that is, as viewed from the front, thereby enabling cold air to circulate in a wide area. Thus, in the refrigerator 100, it is possible to reduce temperature distribution in the second storage case 92.

[0049]

In the refrigerator 100, at the rear of the first air vent 93, the first return port 73 is provided to communicate with the first freezer-compartment return air passage 66, whereby cold air from the first storage case 91 linearly flows to the first return port 73. Similarly, in the refrigerator 100, at the rear of the second air vent 94, the second return

port 74 is provided to communicate with the second freezer-compartment return air passage 67, whereby cold air from the second storage case 92 linearly flows to the second return port 74. Therefore, in the refrigerator 100, it is possible to reduce a pressure loss and provide an efficient air passage.

[0050]

As described below, in the refrigerator 100, a space between the first partition wall 21 and the freezer compartment door 31 is not sealed with a gasket, and a gap 70 (see Fig. 3) is provided between the first partition wall 21 and the freezer compartment door 31. In the refrigerator 100, since the first air vent 93 of the first storage case 91 is provided on the back side of the first storage case 91, cold air in the first freezer compartment 14 does not easily flow into the second freezer compartment 15 through the gap 70. Similarly, in the refrigerator 100, since the second air vent 94 of the second storage case 92 is provided on the back side of the second storage case 92, cold air in the first freezer compartment 14 does not easily flow into the second freezer compartment 15.

[0051]

Details of Door 30

Fig. 5 is a conceptual diagram of the doors 30 of the refrigerator 100 according to Embodiment 1 as viewed from the interior side thereof. Details of the doors 30, especially, the details of the freezer compartment door 31, will be described with reference to Fig. 5. The doors 30 are the freezer compartment door 31 and the refrigerator compartment door 32. As described above, only the freezer compartment door 31 may be provided as the door 30.

[0052]

The freezer compartment door 31 has a freezer compartment gasket 33. The freezer compartment gasket 33 is attached to a peripheral edge portion of a back surface of the freezer compartment door 31. When the freezer compartment door 31 is in the closed state, the freezer compartment gasket 33 is in tight contact with and the second partition wall 22 and a peripheral edge portion 12a (see Figs. 2 and 3) which defines the opening 12 of the housing 10.

[0053]

When the freezer compartment gasket 33 is in tight contact with the peripheral edge portion 12a and the second partition wall 22, the gap between the housing 10 and the first freezer compartment 14 and the second freezer compartment 15 is closed, and cold air is prevented from leaking from the refrigerator 100 to the outside thereof through the gap. Also, when the freezer compartment gasket 33 is in tight contact with the peripheral edge portion 12a and the second partition wall 22, the opening 12 for the first freezer compartment 14 and the second freezer compartment 15 is sealed, and the first freezer compartment 14 and the second freezer compartment 15 are each kept as an enclosed space.

[0054]

The refrigerator compartment door 32 has a refrigerator compartment gasket 34. The refrigerator compartment gasket 34 is attached to a peripheral edge portion of the back surface of the refrigerator compartment door 32. When the refrigerator compartment door 32 is in the closed state, the refrigerator compartment gasket 34 is in tight contact with the second partition wall 22 and the peripheral edge portion 12a which defines the opening 12 of the housing 10.

[0055]

When the refrigerator compartment gasket 34 is in tight contact with the peripheral edge portion 12a and the second partition wall 22, the gap between the housing 10 and the refrigerator compartment 16 is closed, and cold air is prevented from leaking from the refrigerator 100 to the outside of the refrigerator 100 through the gap. Also, when the refrigerator compartment gasket 34 is in tight contact with the peripheral edge portion 12a and the second partition wall 22, the opening 12 for the refrigerator compartment 16 is sealed, and the refrigerator compartment 16 is kept as an enclosed space.

[0056]

As illustrated in Figs. 3 and 4, in the storage space 11 in the refrigerator 100, a gasket is not provided between the freezer compartment door 31 and the first partition wall 21 which partitions off the first freezer compartment 14 and the second freezer

compartment 15. That is, in the refrigerator 100, the space between the first partition wall 21 and the freezer compartment door 31 is not sealed by a gasket, and the gap 70 is provided between the first partition wall 21 and the freezer compartment door 31. In the refrigerator 100, the first freezer compartment 14 which is the first storage compartment and the second freezer compartment 15 which is the second storage compartment communicate with each other through the gap 70.

[0057]

The first freezer compartment 14 and the second freezer compartment 15 are partitioned off by the first partition wall 21. However, since the space between the first partition wall 21 and the freezer compartment door 31 is not sealed by a gasket, the first freezer compartment 14 and the second freezer compartment 15 are not completely enclosed, and cold air may circulate between the first freezer compartment 14 and the second freezer compartment 15. However, with respect to the relationship in temperature between the storage compartments 13, the temperature of the first freezer compartment 14 which is located at an upper position is set higher than that of the second freezer compartment 15 which is located at a lower position. Therefore, between the first freezer compartment 14 and the second freezer compartment 15, circulation of cold air between the storage compartments 13 that would occur because of natural convection hardly occurs.

[0058]

Fig. 6 is an enlarged view of part C of the refrigerator 100 according to Embodiment 1 that is illustrated in Fig. 3 in the case where the heater 80 is not provided. The part C is an area where the freezer compartment door 31 and the front edge 21a of the first partition wall 21 face each other. It should be noted that the front edge 21a of the first partition wall 21 is an end portion of the first partition wall 21 that is adjacent to the opening 12 in the depth direction FB of the housing 10. A configuration of the freezer compartment door 31 will be described with reference to Figs. 6 and 5.

[0059]

Upper Protrusion 35

The freezer compartment door 31 has an upper protrusion 35 protruding from a surface of the freezer compartment door 31 that is adjacent to the storage space 11. The upper protrusion 35 is formed at a back surface 31a of the freezer compartment door 31 that is adjacent to the interior of the refrigerator 100, and protrudes in the depth direction FB of the housing 10. That is, the upper protrusion 35 is a raised portion of the back surface 31a of the freezer compartment door 31. When the freezer compartment door 31 is in the closed state, the upper protrusion 35 is located above the first partition wall 21, with a gap 70a interposed between the upper protrusion 35 and the first partition wall 21. The upper protrusion 35 may be resin-molded integrally with the freezer compartment door 31, or may be formed as a separate member from the freezer compartment door 31.

[0060]

The upper protrusion 35 is formed such that when the freezer compartment door 31 is in the closed state, a base portion 35a is located to extend parallel to the direction of extension of the first partition wall 21 in the left-right direction LR of the housing 10. The base portion 35a is a joint portion between the upper protrusion 35 and the back surface 31a of the freezer compartment door 31 and serves as a base. As viewed in head-on view, the first partition wall 21 extends in the left-right direction LR. That is, as viewed in head-on view, the upper protrusion 35 extends laterally in the direction of extension of the first partition wall 21. It should be noted that although it is preferable that the upper protrusion 35 be parallel to the first partition wall 21 as viewed in head-on view, the upper protrusion 35 and the first partition wall 21 does not need to be exactly parallel and it suffices that the upper protrusion 35 and the first partition wall 21 are substantially parallel. The upper protrusion 35 is a rib-like portion at the back surface 31a of the freezer compartment door 31 and is a rectangular columnar portion extending in the left-right direction LR of the housing 10.

[0061]

Lower Protrusion 36

The freezer compartment door 31 has a lower protrusion 36 that protrudes from a surface of the freezer compartment door 31 that is adjacent to the storage space 11.

The lower protrusion 36 is provided at the back surface 31a of the freezer compartment door 31 that is adjacent to the interior of the refrigerator 100 and protrudes in the depth direction FB of the housing 10. That is, the lower protrusion 36 is a raised portion of the back surface 31a of the freezer compartment door 31. When the freezer compartment door 31 is in the closed state, the lower protrusion 36 is located below the first partition wall 21, with a gap 70b interposed between the lower protrusion 36 and the first partition wall 21. The lower protrusion 36 may be resin-molded integrally with the freezer compartment door 31, or may be formed as a separate member from the freezer compartment door 31.

[0062]

The lower protrusion 36 is formed such that when the freezer compartment door 31 is in the closed state, a base portion 36a is located to extend parallel to the direction of extension of the first partition wall 21 in the left-right direction LR of the housing 10. The base portion 36a is a joint portion between the lower protrusion 36 and the back surface 31a of the freezer compartment door 31 and serves as a base. As viewed in head-on view, the lower protrusion 36 extends laterally in the direction of extension of the first partition wall 21. It should be noted that although it is preferable that the lower protrusion 36 be parallel to the first partition wall 21 as viewed in head-on view, the lower protrusion 36 and the first partition wall 21 does not need to be exactly parallel and it suffices that the lower protrusion 36 and the first partition wall 21 are substantially parallel. The lower protrusion 36 is a rib-like portion at the back surface 31a of the freezer compartment door 31 and is a rectangular columnar portion extending in the left-right direction LR of the housing 10.

[0063]

Fig. 7 is a horizontal cross-sectional view of the first freezer compartment 14 of the refrigerator 100 according to Embodiment 1 that is taken at a position above the upper protrusion 35. In Fig. 7, the front edge 21a of the first partition wall 21 which is located below the upper protrusion 35 is indicated by a dotted line. As viewed in a section of the refrigerator 100 in the depth direction, the upper protrusion 35 extends from the back surface 31a of the freezer compartment door 31 in the depth direction FB

to a position where a distal end portion 35b in the protruding direction overlaps with the first partition wall 21. That is, the upper protrusion 35 is formed such that as viewed in top plan view, a distal end side of the upper protrusion 35 in the protruding direction overlaps with the first partition wall 21.

[0064]

Similarly, as illustrated in Fig. 6, the lower protrusion 36 extends from the back surface 31a of the freezer compartment door 31 in the depth direction FB to a position where a distal end portion 36b in the protruding direction overlaps with the first partition wall 21. That is, the lower protrusion 36 is formed such that as viewed in a section of the refrigerator 100 in the depth direction, or as viewed in top plan view, a distal end side of the lower protrusion 36 in the protruding direction overlaps with the first partition wall 21.

[0065]

When the freezer compartment door 31 is in the closed state, the lower surface of the upper protrusion 35 is spaced from the upper surface of the first partition wall 21. Also, when the freezer compartment door 31 is in the closed state, the upper surface of the lower protrusion 36 is spaced from the lower surface of the first partition wall 21. As illustrated in Fig. 6, when the freezer compartment door 31 is in the closed state, the gap 70a is provided between the upper protrusion 35 and the first partition wall 21. In addition, when the freezer compartment door 31 is in the closed state, the gap 70b is provided between the lower protrusion 36 and the first partition wall 21.

[0066]

In the refrigerator 100, when the freezer compartment door 31 is in the closed state, the upper protrusion 35 is located above the first partition wall 21 and the lower protrusion 36 is located below the first partition wall 21, such that the first partition wall 21 is sandwiched between the upper protrusion 35 and the lower protrusion 36 in the up-down direction UD. The upper protrusion 35 and the lower protrusion 36 are raised portions that extend from the back surface 31a of the freezer compartment door 31 in the depth direction FB.

[0067]

In the refrigerator 100, as described above, when the freezer compartment door 31 is in the closed state, in the housing 10, the gap 70 is provided between the first partition wall 21 and the freezer compartment door 31. Also, when the freezer compartment door 31 is in the closed state, in the housing 10, the gap 70a is provided between the first partition wall 21 and the upper protrusion 35. In the refrigerator 100, the first freezer compartment 14 which is the first storage compartment and the second freezer compartment 15 which is the second storage compartment communicate with each other through the gaps 70 and 70a.

[0068]

In the refrigerator 100, as described above, when the freezer compartment door 31 is in the closed state, in the housing 10, the gap 70 is provided between the first partition wall 21 and the freezer compartment door 31. Also, when the freezer compartment door 31 is in the closed state, in the housing 10, the gap 70b is provided between the first partition wall 21 and the lower protrusion 36. In the refrigerator 100, the first freezer compartment 14 which is the first storage compartment and the second freezer compartment 15 which is the second storage compartment communicate with each other through the gaps 70 and 70b.

[0069]

The refrigerator has the upper protrusion 35 and the lower protrusion 36. Thus, when the freezer compartment door 31 is closed, as illustrated in Fig. 6, a gap 70c through which the first freezer compartment 14 and the second freezer compartment 15 communicate with each other is U-shaped in such a manner as to be inclined at 90 degrees as viewed side-on. The gap 70c is a combination of the gaps 70a, 70, and 70b.

[0070]

As illustrated in Figs. 2 and 4, the first storage case 91 and the second storage case 92 are provided in the first freezer compartment 14. Cold air blown from the first air outlet 71 and the second air outlet 72 of the first freezer compartment 14 is partially blown into the first storage case 91 or the second storage case 92. Also, cold air blown from the first air outlet 71 and the second air outlet 72 of the first freezer

compartment 14 partially flows between the bottom of the first storage case 91 or the second storage case 92 and the first partition wall 21, and flows toward the back surface 31a of the freezer compartment door 31.

[0071]

In the refrigerator 100, a space between the freezer compartment door 31 and the first partition wall 21 which is provided between the first freezer compartment 14 and the second freezer compartment 15 is formed as the gap 70c which is U-shaped in such a manner as to be inclined at 90 degrees as viewed side-on. In the refrigerator 100, since cold air that is to pass through the gap 70c needs to pass through bent portions of the gap 70c which is U-shaped in such a manner as to be inclined at 90 degrees, it is possible to reduce the velocity of the cold air which flows through the gap 70c between the freezer compartment door 31 and the first partition wall 21. That is, in the refrigerator 100, in the storage compartments 13 located above and below the first partition wall 21, it is possible to reduce heat transfer between the first freezer compartment 14 and the second freezer compartment 15 which are adjacent to each other, and thus perform temperature controls of the first freezer compartment 14 and the second freezer compartment 15 independent of each other.

[0072]

Packing 42

Fig. 8 is a sectional view of the refrigerator 100 according to Embodiment 1 that is taken along line D-D in Fig. 7. Fig. 8 is an enlarged view illustrating the configuration of front part of the first partition wall 21 and peripheral part thereof. As illustrated in Fig. 8, packing 42 may be attached to the upper protrusion 35 of the freezer compartment door 31. In the upper protrusion 35, a distal end portion 35b thereof in the protruding direction has the packing 42 on the distal end portion 35b thereof in the protruding direction. For example, the packing 42 is molded from resin.

[0073]

As illustrated in Fig. 8, the packing 42 is attached to the distal end portion 35b of the upper protrusion 35. The packing 42 is attached to partially cover an upper surface 35b1, an end surface 35b2, and a lower surface 35b3 of the distal end portion 35b of

the upper protrusion 35. The packing 42 is formed to extend in the left-right direction LR. When the freezer compartment door 31 is in the closed state, the packing 42 is located above the first partition wall 21.

[0074]

The packing 42 has a fixed portion 43, a first fin 44, and a second fin 45. The fixed portion 43 is attached to the distal end portion 35b of the upper protrusion 35. The second fin 45 extends downward from the fixed portion 43. The fixed portion 43 is a member that is C-shaped in a section perpendicular to a longitudinal direction or as viewed side-on. The first fin 44 and the second fin 45 are thin plate-like members. The first fin 44 and the second fin 45 may be collectively referred to as fins 50. The packing 42 has a plurality of fins 50.

[0075]

When the packing 42 is attached to the upper protrusion 35, the first fin 44 and the second fin 45 are located adjacent to the lower surface 35b3 of the upper protrusion 35. Also, when the packing 42 is attached to the upper protrusion 35, the first fin 44 and the second fin 45 are located to extend from the lower surface 35b3 of the upper protrusion 35 toward the upper surface of the first partition wall 21.

[0076]

When the freezer compartment door 31 is in the closed state, the first fin 44 and the second fin 45 are located between the upper protrusion 35 and the first partition wall 21. The first fin 44 and the second fin 45 are provided at different positions of the upper protrusion 35 in the depth direction FB. When the freezer compartment door 31 is in the closed state, the first fin 44 is located adjacent to the back surface 31a of the freezer compartment door 31, and the second fin 45 is located at a deeper position in the first freezer compartment 14 than the first fin 44, in the depth direction FB of the housing 10. That is, the first fin 44 is provided adjacent to the base portion 35a, and the second fin 45 is provided adjacent to the distal end portion 35b. The first fin 44 and the second fin 45 are provided opposite to each other in the depth direction FB.

[0077]

As illustrated in Fig. 8, the first fin 44 and the second fin 45 extend downward, and the first fin 44 is longer than the second fin 45 in the up-down direction. Thus, in the refrigerator 100, the velocity of flow of cold air is reduced by the second fin 45, and cold air does not easily pass between the upper protrusion 35 and the first partition wall 21 because of provision of the first fin 44. The first fin 44 and the second fin 45 may be interchanged.

[0078]

When the freezer compartment door 31 is opened and closed, one or both of the first fin 44 and the second fin 45 may be brought into contact with the first partition wall 21 and be thus bent, the first fin 44 and the second fin 45 may be brought into contact with each other, and an air layer may be formed between the first fin 44 and the second fin 45. One of the plurality of fins 50 may be brought into contact with the upper surface of the first partition wall 21, and the other of the plurality of fins 50 may be brought into contact with the one of the plurality of fins 50 to form an air layer. That is, the first fin 44 may be brought into contact with the upper surface of the first partition wall 21, and the second fin 45 may be brought into contact with the first fin 44 to form an air layer. More specifically, the second fin 45 is longer than the first fin 44 in the up-down direction, and when the freezer compartment door 31 is closed, a distal end portion of the second fin 45 is brought into contact with the upper surface of the first partition wall 21, bent, and moved forward. Then, the distal end portion of the second fin 45 which is moved forward is brought into contact with the distal end portion of the first fin 44 to form an air layer between the second fin 45 and the first fin 44. The air layer formed between the first fin 44 and the second fin 45 improves thermal insulation properties, and a temperature control between the storage compartments 13 is thus effectively performed.

[0079]

If there is a possibility that the packing 42 will be brought into contact with the first partition wall 21 when the freezer compartment door 31 is opened and closed, it is preferable that the first fin 44 and the second fin 45 be made to have different lengths in the up-down direction. In this case, only one fin 50, that is, only one of the first fin 44

and the second fin 45, is brought into contact with the first partition wall 21, whereby the freezer compartment door 31 can be smoothly opened and closed.

[0080]

If the packing 42 will not be brought contact with the first partition wall 21 when the freezer compartment door 31 is opened and closed, the first fin 44 and the second fin 45 may be made to have the same length in the up-down direction. In the case of giving priority to thermal insulation properties, both the first fin 44 and the second fin 45 may be brought into contact with the first partition wall 21 when the freezer compartment door 31 is closed. The packing 42 may have one fin 50, or may have three or more fins 50. That is, the packing 4 may have only one of the first fin 44 and the second fin 45.

[0081]

In the case of attaching the packing 42 to the back surface 31a of the freezer compartment door 31, the packing 42 is attached to the upper protrusion 35 such that a recess of the fixed portion 43 which is C-shaped as viewed side-on is engaged with the distal end portion 35b of the upper protrusion 35. By using the distal end portion 35b of the upper protrusion 35 as a portion to which the packing 42 is attached, it is possible to more easily attach the packing 42 than in a method in which a portion to which the packing 42 is attached is formed on the back surface 31a of the freezer compartment door 31, which is located opposite to the first partition wall 21.

[0082]

The gap 70a between the upper protrusion 35 and the first partition wall 21 is approximately 5 mm. The gap 70b between the lower protrusion 36 and the first partition wall 21 is also approximately 5 mm. In the refrigerator 100, the freezer compartment door 31 may move down because of the weight of the freezer compartment door 31 and as a result, the upper protrusion 35 and the first partition wall 21 may be moved closer to each other. Even in this case, since the packing 42 is provided between the upper protrusion 35 and the first partition wall 21, the packing 42 can reduce damage which would be caused by contact between the upper protrusion 35 and the first partition wall 21 when the freezer compartment door 31 is closed.

[0083]

Fig. 9 is an enlarged view of the part C of the refrigerator 100 according to Embodiment 1 that is illustrated in Fig. 3 in the case where the heater 80 is provided. The heater 80 is provided on the upper surface of the first partition wall 21. In the depth direction FB, an end portion 80a of the heater 80 that is located adjacent to the freezer compartment door 31 is closer to the freezer compartment door 31 than the distal end portion 35b of the upper protrusion 35, and closer to the freezer compartment door 31 than the first fin 44 of the packing 42. That is, in the depth direction FB, the end portion 80a of the heater 80 which is located adjacent to the freezer compartment door 31 is closer to the opening 12 located adjacent to the freezer compartment door 31 than the distal end portion 35b of the upper protrusion 35 and the first fin 44 of the packing 42.

[0084]

Since the heater 80 and the packing 42 are provided as described above, the first fin 44 and the second fin 45 can reduce the velocity of flow of cold air and warm the cold air. Therefore, as compared with the case where such a configuration as described above is not provided, in the refrigerator 100, the difference between the temperature around the first fin 44 and the temperature of the back surface 31a of the freezer compartment door 31 is reduced, thereby preventing occurrence of condensation on the back surface 31a of the freezer compartment door 31.

[0085]

Lower Packing 46

Fig. 10 is an enlarged view of the part C of the refrigerator 100 according to Embodiment 1 that is illustrated in Fig. 3 in the case where a lower packing 46 is provided. In the refrigerator 100, as illustrated in Fig. 10, the lower packing 46 may be attached to the lower protrusion 36 to partially cover the distal end portion 36b of the lower protrusion 36. The lower protrusion 36 has the lower packing 46 at the distal end portion 36b thereof in the protruding direction. For example, the lower packing 46 is molded from resin.

[0086]

The lower packing 46 is attached to partially cover the upper surface, the end face, and the lower surface of the distal end portion 36b of the lower protrusion 36. The lower packing 46 is formed to extend in the left-right direction LR. When the freezer compartment door 31 is in the closed state, the lower packing 46 is located below the first partition wall 21.

[0087]

The lower packing 46 has a lower fixed portion 47 attached to the distal end portion 36b of the lower protrusion 36, a lower first fin 48 and a lower second fin 49 that extend upward from the lower fixed portion 47. The lower fixed portion 47 is a member that is C-shaped in a section perpendicular to the longitudinal direction or as viewed side-on. The lower first fin 48 and the lower second fin 49 are thin plate-like members.

[0088]

When the lower packing 46 is attached to the lower protrusion 36, the lower first fin 48 and the lower second fin 49 are located on the upper surface of the lower protrusion 36 and are also located to extend from the upper surface of the lower protrusion 36 toward the lower surface of the first partition wall 21.

[0089]

When the freezer compartment door 31 is in the closed state, the lower first fin 48 and the lower second fin 49 are located between the lower protrusion 36 and the first partition wall 21. The lower first fin 48 and the lower second fin 49 are provided at different positions at the lower protrusion 36 in the depth direction FB. When the freezer compartment door 31 is in the closed state, the lower first fin 48 is located adjacent to the back surface 31a of the freezer compartment door 31, and the lower second fin 49 is located at a deeper position in the first freezer compartment 14 than the lower first fin 48, in the depth direction FB of the housing 10. That is, the lower first fin 48 is provided adjacent to the base portion 36a, and the lower second fin 49 is provided adjacent to the distal end portion 35b. The lower first fin 48 and the lower second fin 49 are provided opposite to each other in the depth direction FB.

[0090]

As illustrated in Fig. 10, the lower first fin 48 and the lower second fin 49 extend upward, and the lower first fin 48 is longer than the lower second fin 49. The lower first fin 48 and the lower second fin 49 may be interchanged.

[0091]

One or both of the lower first fin 48 and the lower second fin 49 may be brought into contact with the first partition wall 21 and be bent when the freezer compartment door 31 is opened and closed, the lower first fin 48 and the lower second fin 49 may be brought into contact with each other, and an air layer may be provided between the lower first fin 48 and the lower second fin 49. The air layer provided between the lower first fin 48 and the lower second fin 49 improves thermal insulation properties, and a temperature control between the storage compartments 13 is effectively performed.

[0092]

If there is a possibility that the lower packing 46 will be brought into contact with the first partition wall 21 when the freezer compartment door 31 is opened and closed, it is preferable that the lower first fin 48 and the lower second fin 49 have different lengths in the up-down direction, as described above. In the case of adopting such a configuration, it is possible to smoothly open and close the freezer compartment door 31 by bringing only one fin 50, that is, only one of the lower first fin 48 and the lower second fin 49, into contact with the first partition wall 21.

[0093]

In the case where the lower packing 46 is not brought into contact with the first partition wall 21 when the freezer compartment door 31 is opened and closed, the lower first fin 48 and the lower second fin 49 may be formed to have the same length in the up-down direction. Furthermore, in the case of giving priority to thermal insulation properties, both the lower first fin 48 and the lower second fin 49 may be brought into contact with the first partition wall 21 when the freezer compartment door 31 is closed. In addition, the lower packing 46 may have one fin 50, or may have three or more fins 50. That is, the lower packing 46 may have only one of the lower first fin 48 and the lower second fin 49.

[0094]

Regarding attachment of the lower packing 46 to the back surface 31a of the freezer compartment door 31, the lower packing 46 is attached to the lower protrusion 36 such that the recess of the lower fixed portion 47 which is C-shaped as viewed side-on is engaged with the distal end portion 36b of the lower protrusion 36. By using the distal end portion 36b of the lower protrusion 36 as a portion to which the lower packing 46 is attached, it is possible to easily attach the lower packing 46, as compared with the case where a portion to which the lower packing 46 is attached is formed at the back surface 31a of the freezer compartment door 31 which is located opposite to the first partition wall 21.

[0095]

Operation and Advantages of Refrigerator 100

The refrigerator 100 includes the first freezer compartment 14 provided above the first partition wall 21 and the second freezer compartment 15 provided below the first partition wall 21. The temperature of the first freezer compartment 14 is set higher than that of the second freezer compartment 15. The freezer compartment door 31 is a single door configured to open and close the first freezer compartment 14 and the second freezer compartment 15 at the same time. The freezer compartment door 31 has the upper protrusion 35 which protrudes from the surface thereof adjacent to the storage space 11. When the freezer compartment door 31 is in the closed state, the upper protrusion 35 is located above the first partition wall 21, with the gap 70a provided between the upper protrusion 35 and the first partition wall 21. As viewed in head-on view, the upper protrusion 35 extends laterally in the direction of extension of the first partition wall 21. The upper protrusion 35 is formed such that as viewed in top plan view, the distal end side of the upper protrusion 35 in the protruding direction overlaps with the first partition wall 21.

[0096]

In the refrigerator 100, resistance against cold air that flows between upper and lower storage compartments 13 is increased by the upper protrusion 35, thereby reducing movement of the cold air. In the refrigerator 100, the temperature of the first freezer compartment 14 which is located at a higher position than the second freezer

compartment 15 is set higher than that of the second freezer compartment 15. Therefore, between the first freezer compartment 14 and the second freezer compartment 15, circulation of cold air by natural convection between the storage compartments 13 hardly occurs. Thus, even in the case where the refrigerator 100 is a refrigerator that includes a single door for two storage compartments 13, that is, for the first freezer compartment 14 and the second freezer compartment 15, the refrigerator 100 can reduce heat transfer between the storage compartments 13 with temperature setting between the storage compartments 13 and a simple configuration, that is, the presence of the upper protrusions 35.

[0097]

The freezer compartment door 31 is rotatably supported by the housing 10, and in the first freezer compartment 14, one or more storage cases 90 for storing material are provided. In a structure where two storage compartments 13 are opened and closed by the single door 30, cold air in the two storage compartments 13 may flow out of the refrigerator 100, for example, when the user opens the door 30 to take out frozen food, and as a result, energy saving performance may be deteriorated in use of the refrigerator 100. To avoid such a situation, the refrigerator 100 includes one or more storage cases 90 in each of the storage compartments 13, and the freezer compartment door 31 is provided as a pivot door 30.

[0098]

In the refrigerator 100, the storage case or cases 90 for storing food are provided in each of the storage compartments 13 which are partitioned off by the partition wall or walls 20. The storage case or cases 90 are not pulled out when the door 30 is opened. It is thus possible to reduce outflow of cold air from the first freezer compartment 14 and the second freezer compartment 15 to the outside of the refrigerator 100 that occurs when the freezer compartment door 31 is opened and closed, thus improving energy saving performance. In addition, since the storage cases 90 are provided in the storage compartments 13, cold air does not easily flow from the first air outlet 71 or the second air outlet 72 toward the first partition wall 21. It is therefore to further reduce circulation of cold air between the storage compartments 13. Furthermore, in order to

obtain such advantages as described above, it is necessary to prevent the storage cases 90 from being pulled out together with the door 30 when the door 30 is opened. Since the freezer compartment door 31 is a pivot door, the user can see the inside of each of the storage cases 90 which are transparent, when opening the freezer compartment door 31. Therefore, unlike a pullout door that does not enable the user to see the interior of the storage case 90 without pulling out the storage case 90, it is possible to improve energy saving performance while ensuring visibility.

[0099]

In the refrigerator 100, since the interior of the first freezer compartment 14 is partitioned by the storage cases 90 for storing food, air outside the storage cases 90 does not easily touch the food in the storage cases 90. Therefore, even if cold air should circulate between the first freezer compartment 14 and the second freezer compartment 15, in the refrigerator 100, a temperature change would not easily be made and a smell would not easily be transferred in the refrigerator 100.

[0100]

In addition, in the refrigerator 100, since the interior of the first freezer compartment 14 is partitioned by the storage cases 90 for storing food, it is possible to reduce circulation of cold air between the storage compartments 13, and reduce outflow of cold air to the outside of the refrigerator 100 that would occur when the freezer compartment door 31 is opened. Thus, the energy saving performance and cooling quality are improved.

[0101]

The first storage case 91 has the first air vent 93 which is a through hole. The first air vent 93 is provided on the left side of the first storage case 91 in the left-right direction LR of the housing 10. In the depth direction FB of the housing 10, the first air vent 93 is located at a deeper position than the central part of the first storage case 91. In the up-down direction UD of the housing 10, the first air vent 93 is located below the center of the first storage case 91. In the refrigerator 100, since the first air vent 93 is formed in the first storage case 91, it is possible to ensure the return air passage F1 for returning cold air blown out of the first air outlet 71 to the first return port 73 which is a

cold-air return port. In the refrigerator 100, since the return air passage F1 for returning cold air can be ensured in the first freezer compartment 14, it is possible to circulate cold air in a wide area and reduce temperature distribution in the first storage case 91.

[0102]

In the second storage case 92, the second air vent 94 that is a through hole is formed. The second air vent 94 is provided on the right side of the second storage case 92 in the left-right direction LR of the housing 10. In the depth direction FB of the housing 10, the second air vent 94 is provided at a deeper position than the central part of the second storage case 92. In the up-down direction UD of the housing 10, the second air vent 94 is provided below the central part of the second storage case 92. In the refrigerator 100, since the second air vent 94 is formed in the second storage case 92, it is possible to ensure the return air passage F2 for returning cold air blown out of the second air outlet 72 to the second return port 74 which is a return port for cold air. In the refrigerator 100, since the return air passage F1 for returning cold air can be secured in the first freezer compartment 14, it is possible to circulate cold air in a wide area and reduce the range of temperature distribution in the second storage case 92.

[0103]

In the refrigerator 100, a plurality of partition walls 20 may be provided, the storage space 11 may be partitioned into a plurality of storage compartments 13 that include the first storage compartment and the second storage compartment and are partitioned off by the plurality of partition walls 20, and the door 30 may be configured to open and close the plurality of storage compartments 13. Even in the case where the refrigerator 100 is a refrigerator that includes a single door 30 for the plurality of storage compartments 13 including the first freezer compartment 14 and the second freezer compartment 15, it is possible to reduce heat transfer between the storage compartments 13 with temperature setting between the storage compartments 13 and a simple configuration, that is, the presence of the upper protrusions 35.

[0104]

The upper protrusion 35 has the packing 42 on the distal end portion 35b thereof in the protruding direction. The packing 42 has the fixed portion 43 and the thin plate-like fins 50. The fixed portion 43 is attached to the distal end portion 35b of the upper protrusion 35, and the thin plate-like fins 50 extend downward from the fixed portion 43. When the freezer compartment door 31 is in the closed state, the fins 50 are located between the upper protrusion 35 and the first partition wall 21.

[0105]

In the refrigerator 100, it is possible to reduce heat transfer between the storage compartments 13 with temperature setting between the storage compartments 13 and a simple configuration, that is, the presence of the upper protrusions 35. Therefore, in the refrigerator 100, it is not necessary to provide a gasket between the first partition wall 21 and the freezer compartment door 31, and it is possible to control temperature in each of the storage compartments 13 using the packing 42 which is lighter and simpler than a gasket.

[0106]

In the refrigerator 100, a gasket that closes the gap 70 is not provided in front of the first partition wall 21 between the first freezer compartment 14 and the second freezer compartment 15. In the refrigerator 100, however, the packing 42 is provided on part of the upper protrusion 35 to partially close the gap 70c between the first freezer compartment 14 and the second freezer compartment 15. Thus, it is possible to reduce heat transfer between the storage compartments 13 and easily control the temperatures in the storage compartments 13. That is, in the refrigerator 100, it is possible to control the temperature in each of the storage compartments 13 and prevent transfer of the smell of food between the storage compartments 13, without providing a gasket for closing the gap 70.

[0107]

The packing 42 is molded from resin. In the refrigerator 100, as described above, the freezer compartment door 31 may move down because of its weight, and move the upper protrusion 35 closer to the first partition wall 21. Even in this case, since the packing 42 molded from resin is located between the upper protrusion 35 and

the first partition wall 21, it is possible to prevent the upper protrusion 35 from being brought into contact with the first partition wall 21 when the freezer compartment door 31 is closed, or to reduce damage that would be caused by the above contact.

[0108]

The packing 42 has the plurality of fins 50. In the refrigerator 100, the velocity of cold air that passes through the gap 70c is reduced by the plurality of fins 50 and cold air does not easily pass between the upper protrusion 35 and the first partition wall 21 because of the presence of the plurality of fins 50.

[0109]

One of the plurality of fins 50 may be in contact with the upper surface of the first partition wall 21, and the other of the plurality of fins 50 may be in contact with the one of the plurality of fins 50 to form an air layer. The air layer formed between the plurality of fins 50 improves thermal insulation properties, and the temperature control between the storage compartments 13 is more effectively performed.

[0110]

The heater 80 which warms material is provided on the first partition wall 21. In the refrigerator 100, since the heater 80 is provided on the first partition wall 21, it is possible to finely control the temperature of the first freezer compartment 14 and easily maintain the relationship in temperature between the first freezer compartment 14 and the second freezer compartment 15.

[0111]

The temperature zone in the first freezer compartment 14 may be the range of -5 degrees C to -7 degrees C. In the case where the temperature zone in the first freezer compartment 14 is set as the above range, the first freezer compartment 14 can be set as a cooling compartment where material, such as food, is frozen to such a degree that the material can be divided into small portions with a knife or human hands.

[0112]

The temperature zone in the first freezer compartment 14 may be the range of the freezing point of water to -15 degrees C. In the case where the temperature zone in the first freezer compartment 14 is set as the above range, the first freezer

compartment 14 can be set as a supercooling compartment in which material, such as food, can be kept in a supercooled state where the material is not frozen even at the freezing point of water or below.

[0113]

The freezer compartment door 31 has the lower protrusion 36 which protrudes from a surface of the freezer compartment door 31 that is adjacent to the storage space 11. When the freezer compartment door 31 is in the closed state, the lower protrusion 36 is located below the first partition wall 21, with the gap 70b provided between the lower protrusion 36 and the first partition wall 21, and extends rightward and leftward in the direction of extension of the first partition wall 21 as viewed in head-on view. Therefore, even in the case where the refrigerator 100 is a refrigerator that includes a single door for two storage compartments 13, that is, the first freezer compartment 14 and the second freezer compartment 15, it is possible to reduce heat transfer between the storage compartments 13 with temperature setting between the storage compartments 13 and a simple configuration, that is, the presence of the lower protrusion 36.

[0114]

The freezer compartment door 31 has the lower protrusion 36 which protrudes from the surface of the freezer compartment door 31 which is adjacent to the storage space 11. When the freezer compartment door 31 is in the closed state, the lower protrusion 36 is located below the first partition wall 21, with the gap 70b provided between the lower protrusion 36 and the first partition wall 21, and extends rightward and leftward in the direction of extension of the first partition wall 21 as viewed in head-on view. In the refrigerator 100, on the back surface 31a of the freezer compartment door 31, the gap 70c is provided to cause the first freezer compartment 14 and the second freezer compartment 15 to communicate with each other. The gap 70c is defined by the upper protrusion 35 and the lower protrusion 36 of the freezer compartment door 31 and the first partition wall 21 and is U-shaped in such a manner as to be inclined at 90 degrees as viewed side-on. The gap 70c is a passage through which cold air flows. In the refrigerator 100, since the gap 70c configured as described

above is provided, dry air circulates around the first partition wall 21 when the freezer compartment door 31 is in the closed state, thereby reducing occurrence of contact between the first partition wall 21 and humid outside air. Therefore, in the refrigerator 100, it is possible to reduce occurrence of adhesion of condensation to surroundings of the first partition wall 21 or surroundings of the packing 42 and the lower packing 46, which would be caused by cooled outside air.

[0115]

In the refrigerator 100, it is necessary to cause cold air to pass through the gap 70c which is U-shaped as viewed side-on and defined by the upper protrusion 35 and the lower protrusion 36 of the freezer compartment door 31 and the first partition wall 21, and it is possible to reduce the velocity of cold air that flows through the gap 70c between the freezer compartment door 31 and the first partition wall 21. That is, in the refrigerator 100, in the storage compartments 13 which are provided above and below the first partition wall 21, heat transfer between the first freezer compartment 14 and the second freezer compartment 15 which are adjacent to each other is reduced, and thus in the first freezer compartment 14 and the second freezer compartment 15, respective temperature controls are performed independent of each other.

[0116]

The refrigerator 100 includes the cooler 51 which cools the storage space 11. The cooler 51 is provided below the first partition wall 21. Since the cooler 51 is provided below the first partition wall 21 between the first freezer compartment 14 and the second freezer compartment 15, the cooler 51 is separated from the first freezer compartment 14 the temperature of which is higher than that of the second freezer compartment 15, thereby reducing heat conduction from the cooler 51 to the first freezer compartment 14. Also, since the cooler 51 is provided below the first partition wall 21 between the first freezer compartment 14 and the second freezer compartment 15, a heat insulating wall which is provided between the cooling compartment 61 and the storage compartment 13 in the second freezer compartment 15 can be made to have a smaller thickness.

[0117]

The freezer compartment door 31 is a single door configured to open and close the first freezer compartment 14 and the second freezer compartment 15 at the same time. The refrigerator 100 is configured such that the plurality of storage compartments 13 are opened and closed using the single door 30. Thus, the number of doors 30 is smaller than in a configuration in which for storage compartments 13, respective doors 30 are provided. In a recent trend, refrigerators have been made to have a simple design. Therefore, if the number of doors in a refrigerator is reduced, the design of the refrigerator is improved.

[0118]

In the refrigerator 100, in the case where the storage cases 90 are provided right and left as illustrated in Figs. 2 and 4, the first air outlet 71 and the second air outlet 72 are provided close to the central part of the refrigerator 100 in the left-right direction LR, and the first return port 73 and the second return port 74 are provided close to the left and right walls, respectively. In the refrigerator 100, since the air outlets and ports for cold air are provided at such positions as described above, it is possible to reduce the flow of cold air between the storage cases 90. Thus, the refrigerator 100 does not require a partition wall that completely separates the storage cases 90 from each other. In addition, in the refrigerator 100, even in the case where a partition wall is provided to ensure slidableness of the storage cases 90, the partition wall can be made smaller and simpler in structure than a partition wall provided to reduce the flow of cold air. Furthermore, if a rail 96 that enables the storage cases 90 to slide can be attached to the partition wall 20 as illustrated in Fig. 4, it is possible to remove a partition wall component between the storage cases 90 and reduce material and production costs.

[0119]

Embodiment 2

A refrigerator 100 according to Embodiment 2 will be described. Regarding Embodiment 2, components that have the same functions and operations as those in the refrigerator 100 according to Embodiment 1 will be denoted by the same reference signs, and their descriptions will thus be omitted. The following description concerning the refrigerator 100 according to Embodiment 2 is made by referring mainly to the

differences between the refrigerator 100 according to Embodiment 2 and the refrigerator 100 according to Embodiment 1. Configurations not described in the description concerning the refrigerator 100 according to Embodiment 2 are similar to those of the refrigerator 100 according to Embodiment 1. In the description concerning the refrigerator 100 according to Embodiment 2, the configuration of the partition wall 20 is further specifically explained.

[0120]

In some refrigerators, the partition wall 20 is attached to the housing 10 of the refrigerator before urethane filled in the housing 10 is foamed, and cannot be detached from the housing 10 after being attached to the housing 10. In some other refrigerators, part of a partition wall 20 can be detached from the housing; however, even in these refrigerators, it is impossible to detach the entire partition wall 20 from the housing.

[0121]

In the refrigerator 100 according to Embodiment 2, the entire first partition wall 21 that partitions off the first freezer compartment 14 which is the first storage compartment and the second freezer compartment 15 which is the second storage compartment can be detached from the housing. In the refrigerator 100 according to Embodiment 2, the first partition wall 21 is detachably provided in the housing 10.

[0122]

The partition walls 20, which include the first partition wall 21, contain heat insulating materials that are used depending on the temperature settings of storage compartments 13 associated with installation locations of the partition walls 20. The heat insulating materials are each, for example, vacuum heat insulating material or urethane. It is not indispensable that the partition walls 20 contain heat insulating materials that are used depending on the temperature settings of the storage compartments 13 associated with the installation locations of the partition walls 20.

[0123]

Advantages of Refrigerator 100

In existing refrigerators, a cooler 51 and a fan 52 which sends cold air obtained by cooling by the cooler 51 to each of storage compartments 13 are provided at deeper positions than partition walls 20, and air passages, such as a refrigerator-compartment outlet air passage 62, a first freezer-compartment outlet air passage 63, and a second freezer-compartment outlet air passage 64, are provided at deeper positions than the partition walls 20.

[0124]

In such refrigerators as described above, in some cases, it is not possible to put components in the cooler 51, the fan 52, etc., into spaces located at deeper positions than the partition walls 20, because of the presence of the partition walls 20, and as a result, the components cannot be assembled or cannot easily be assembled. Also, in such refrigerators, it may be impossible or hard to form air passages, such as the refrigerator-compartment outlet air passage 62, the first freezer-compartment outlet air passage 63, and the second freezer-compartment outlet air passage 64 at deeper positions than the partition walls 20, because of the presence of the partition walls 20.

[0125]

Even if the components in the cooler 51 and the fan 52 can be assembled at the deeper positions than the partition walls 20, the components need to be divided in order that the components be placed at the deeper positions than the partition walls 20. Consequently, the production cost may be increased. Also, even if air passages, such as the refrigerator-compartment outlet air passage 62, the first freezer-compartment outlet air passage 63, and the second freezer-compartment outlet air passage 64, can be provided at the deeper positions than the partition walls 20, components that define the air passages need to be divided in order that the air passages be provided at the deeper positions than the partition walls 20. Consequently, the production cost may be increased.

[0126]

In the refrigerator 100 according to Embodiment 2, the first partition wall 21 is detachably provided in the housing 10. In the refrigerator 100 according to Embodiment 2, since the first partition wall 21 that partitions off the first freezer

compartment 14 and the second freezer compartment 15 is detachable, the first partition wall 21 can be detached from the housing when components in the cooler 51 or the fan 52 are attached to the interior of the housing 10. Therefore, the first partition wall 21 is detached when the user sets the components in the cooler 51 or the fan 52 in the housing 10, and assembly of the refrigerator 100 is thus facilitated, thereby improving workability. Similarly, the first partition wall 21 is detached when the user makes air passages, such as the refrigerator-compartment outlet air passage 62, the first freezer-compartment outlet air passage 63, and the second freezer-compartment outlet air passage 64, and the formation of the air passages is thus facilitated, thereby improving workability.

[0127]

It is not indispensable that the partition wall 20 contains heat insulating material. In the case where the partition wall 20 does not contain heat insulating material, the number of components provided in the refrigerator 100 can be reduced, thereby reducing material and production costs. Even in the case where the partition wall 20 does not contain heat insulating material, the partition wall 20 can prevent transfer of the smell of food between the storage compartments 13, and it is therefore possible to segment food into small groups and store the small groups in the storage compartments 13.

[0128]

In the case where the first freezer compartment 14 is a freezer compartment in which material freezes through a supercooling compartment, or in the case where the first freezer compartment 14 is a cold storage compartment that keeps material in a supercooled state, preferably, the first partition wall 21 should contain heat insulating material because the first freezer compartment 14 requires fine temperature control. In the refrigerator 100, since the heater 80 and the first partition wall 21 containing heat insulating material are provided, it is possible to easily control temperatures in the storage compartments 13.

[0129]

Embodiment 3

A refrigerator 100 according to Embodiment 3 will be described. Regarding Embodiment 3, components that have the same functions and operations as those in the refrigerators 100 according to Embodiment 1 and Embodiment 2 will be denoted by the same reference signs, and their description will thus be omitted. The description concerning the refrigerator 100 according to Embodiment 3 will be made by referring mainly to the difference between the refrigerator 100 according to Embodiment 3 and the refrigerators 100 according to Embodiments 1 and 2. Components not described in the description concerning the refrigerator 100 according to Embodiment 3 are similar to those in the refrigerators 100 according to Embodiments 1 and 2. In the following description concerning the refrigerator 100 according to Embodiment 3, the configuration of the first partition wall 21 is further specifically described.

[0130]

The first partition wall 21 that partitions off the first freezer compartment 14 and the second freezer compartment 15 is produced and assembled from components, such as resin components, which are not sheet metal. The first partition wall 21 is not provided with a heat radiation pipe for preventing dew condensation. The other configuration of the first partition wall 21 is the same as in the refrigerator 100 according to Embodiment 1 or Embodiment 2.

[0131]

Advantages of Refrigerator 100

In existing refrigerators, when humid outside air flows to the partition wall 20 which has been cooled, dew condensation may occur on the partition wall 20 and surrounding areas of the partition wall 20. Therefore, in some of the refrigerators, a heat radiation pipe that causes heat to transfer to reduce the occurrence of dew condensation may be set on the front side of the partition wall 20.

[0132]

In the refrigerator 100, the gap 70c is provided on the back surface 31a of the freezer compartment door 31 to cause the first freezer compartment 14 and the second freezer compartment 15 to communicate with each other. The gap 70c is defined by the freezer compartment door 31 and the first partition wall 21 and is U-shaped in such

a manner as to be inclined at 90 degrees as viewed side-on. The gap 70c is a passage through which cold air flows. In the refrigerator 100, since the gap 70c having such a configuration as described above is provided, dry air in the refrigerator 100 circulates around the first partition wall 21 when the freezer compartment door 31 is in the closed state, thereby reducing the probability that humid outside air will come into contact with the first partition wall 21. In the refrigerator 100, it is possible to reduce occurrence of dew condensation at the first partition wall 21, or surrounding areas of the packing 42 and the lower packing 46, which is cause by cooled outside air.

[0133]

Therefore, the refrigerator 100 does not require a heat radiation pipe on the front side of the partition wall 20 for preventing occurrence of dew condensation. The first partition wall 21 of the refrigerator 100 is provided with neither a heat radiation pipe that radiates heat to reduce occurrence of dew condensation nor a sheet metal that covers the heat radiation pipe. Therefore, in the refrigerator 100, it is not necessary to install a heat radiation pipe, and the production and material costs can thus be reduced as compared with a refrigerator that requires a heat radiation pipe. Furthermore, since the refrigerator 100 does not include a heat radiation pipe for preventing dew condensation, it is possible to prevent deterioration of energy saving performance which would be caused by transfer of heat from the heat radiation pipe into the interior of the refrigerator 100. The refrigerator 100 can thus improve the energy saving performance than a refrigerator that requires a heat radiation pipe.

[0134]

In a refrigerator including a heat radiation pipe for preventing dew condensation, the front side of a partition wall 20 is formed of a sheet metal component in order to cause the heat radiation pipe to full its function. Furthermore, in the refrigerator including the heat radiation pipe for preventing occurrence of dew condensation, the partition wall 20 is divided into a body portion and a front portion for installation of the heat radiation pipe. In contrast, the first partition wall 21 is not provided with a heat radiation pipe, and can thus be formed of resin. In the refrigerator 100, the entire first partition wall 21 can be molded from resin, and the refrigerator 100 requires a smaller

number of components and lower material and production costs than the refrigerator that requires the heat radiation pipe.

[0135]

Embodiments 1 to 3 can be put into practice in combination. Furthermore, the configurations described regarding each of Embodiments 1 to 3 are each merely an example, and can be combined with a known technique or can be partially omitted or modified without departing from the gist of the present disclosure.

[0136]

For example, in the refrigerator 100 according to Embodiment 1, it is described above that in the first freezer compartment 14, the first storage case 91 and the second storage case 92 are laterally arranged side by side. This description, however, is not limiting. Instead of arrangement of the first storage case 91 and the second storage case 92 in the first freezer compartment 14, the first freezer compartment 14 may be configured as a space separated from the second freezer compartment 15 by the first partition wall 21. Even in such a case, in the refrigerator 100, it is possible to reduce heat transfer between the storage compartments 13 by providing one or both of the upper protrusion 35 and the lower protrusion 36 at the front of the first partition wall 21 between the first freezer compartment 14 and the second freezer compartment 15 and partially closing the gap 70c. In addition, in the refrigerator 100, it is also possible to reduce heat transfer between the storage compartments 13 by providing the packing 42 on the upper protrusion 35 and partially closing the gap 70c with the packing 42.

Reference Signs List

[0137]

10: housing, 11: storage space, 12: opening, 12a: peripheral edge portion, 13: storage compartment, 14: first freezer compartment, 15: second freezer compartment, 16: refrigerator compartment, 20: partition wall, 21: first partition wall, 21a: front edge, 22: second partition wall, 25: partition plate, 30: door, 31: freezer compartment door, 31a: back surface, 32: refrigerator compartment door, 33: freezer compartment gasket, 34: refrigerator compartment gasket, 35: upper protrusion, 35a: base portion, 35b: distal end portion 35b1: upper surface, 35b2: end surface, 35b3: lower surface, 36: lower

protrusion, 36a: base portion, 36b: distal end portion, 40: controller, 42: packing, 43: fixed portion, 44: first fin, 45: second fin, 46: lower packing, 47: lower fixed portion, 48: lower first fin, 49: lower second fin, 50: fin, 51: cooler, 52: fan, 53: first damper, 54: second damper, 61: cooling compartment, 62: refrigerator-compartment outlet air passage, 63: first freezer-compartment outlet air passage, 64: second freezer-compartment outlet air passage, 65: refrigerator-compartment return air passage, 66: first freezer-compartment return air passage, 67: second freezer-compartment return air passage, 70: gap, 70a: gap, 70b: gap, 70c: gap, 71: first air outlet, 72: second air outlet, 73: first return port, 74: second return port, 80: heater, 80a: end portion, 90: storage case, 91: first storage case, 92: second storage case, 93: first air vent, 94: second air vent, 95: third storage case, 96: rail, 100: refrigerator

CLAIMS

[Claim 1]

A refrigerator comprising:

a housing in which a storage space for storage of material is provided, the housing having an opening that is provided in a front of the housing and is configured to allow the material to be moved into and out of the storage space;

a partition wall dividing an interior of the storage space into an upper space and a lower space; and

a door provided in front of the storage space and configured to open and close the opening,

wherein

in the storage space, a plurality of storage compartments are defined by the housing and the partition wall,

the plurality of storage compartments include a first storage compartment located above the partition wall and a second storage compartment provided below the partition wall,

a temperature of the first storage compartment is set higher than a temperature of the second storage compartment,

the door is provided as a single door configured to open and close the first storage compartment and the second storage compartment at the same time, and the door has an upper protrusion and a lower protrusion that protrude from a surface of the door that is adjacent to the storage space,

when the door is in a closed state, in the housing, a gap is provided between the partition wall and the door, between the partition wall and the upper protrusion, and between the partition wall and the lower protrusion, the gap causing the first storage compartment and the second storage compartment to communicate with each other,

when the door is in the closed state, the upper protrusion is located above the partition wall, with a gap provided between the upper protrusion and the partition wall,

when the door is in the closed state, the lower protrusion is located below the partition wall, with the gap provided between the lower protrusion and the partition wall,

the upper protrusion and the lower protrusion extend rightward and leftward as viewed in head-on view, protrude in a depth direction of the housing as viewed in top plan view, and have respective distal end portions that overlap with the partition wall as viewed in top plan view,

to the distal end portion of the upper protrusion, packing is attached, the packing being located between the upper protrusion and the partition wall, and

to the distal end portion of the lower protrusion, lower packing is attached, the lower packing being located between the lower protrusion and the partition wall.

[Claim 2]

The refrigerator of claim 1, wherein the partition wall is detachably provided in the housing.

[Claim 3]

The refrigerator of claim 1 or 2, wherein the door is rotatably supported by the housing, and in the first storage compartment, one or more storage cases configured to store the material are provided.

[Claim 4]

The refrigerator of claim 3, wherein

the storage case has an air vent that is a through hole, and

the air vent is provided in one side of the storage case in a left-right direction of the housing, at a deeper position than central part of the storage case in a depth direction of the housing, and below central part of the storage case in an up-down direction of the housing.

[Claim 5]

The refrigerator of any one of claims 1 to 4, wherein

a plurality of partition walls including the partition wall are provided,

in the storage space, the plurality of storage compartments including the first storage compartment and the second storage compartment and partitioned off by the plurality of partition walls are provided, and

the door is configured to open and close the plurality of storage compartments.

[Claim 6]

The refrigerator of any one of claims 1 to 5, wherein the partition wall is provided with neither a heat radiation pipe configured to radiate heat to reduce occurrence of dew condensation nor a sheet metal covering the heat radiation pipe.

[Claim 7]

The refrigerator of any one of claims 1 to 6, wherein

the packing has a fixed portion that is attached to the distal end portion of the upper protrusion and a thin plate-like fin that extends downward from the fixed portion, and

when the door is in the closed state, the fin is located between the upper protrusion and the partition wall.

[Claim 8]

The refrigerator of any one of claims 1 to 6, wherein

the lower packing has a lower fixed portion and a lower fin, the lower fixed portion being attached to the distal end portion of the lower protrusion, the lower fin being thin and plate-like, and extending upward from the lower fixed portion, and

when the door is in the closed state, the lower fin is located between the lower protrusion and the partition wall.

[Claim 9]

The refrigerator of any one of claims 1 to 7, wherein the packing is molded from resin.

[Claim 10]

The refrigerator of claim 7, wherein the packing has a plurality of fins including the fin.

[Claim 11]

The refrigerator of any one of claim 10, wherein one of the plurality of fins is in contact with an upper surface of the partition wall, and another one of the plurality of fins is in contact with the one of the plurality of fins to form an air layer.

[Claim 12]

The refrigerator of any one of claims 1 to 11, further comprising a heater provided on an upper surface of the partition wall and configured to warm the material.

[Claim 13]

The refrigerator of any one of claims 1 to 12, wherein the first storage compartment has a temperature zone from -5 degrees C to -7 degrees C.

[Claim 14]

The refrigerator of any one of claims 1 to 12, wherein the first storage compartment has a temperature zone from a freezing point of water to -15 degrees C.

[Claim 15]

The refrigerator of any one of claims 1 to 14, further comprising a cooler configured to cool the storage space,

wherein the cooler is provided below the partition wall.

[Claim 16]

The refrigerator of claim 10 or 11, further comprising:

a heater provided on an upper surface of the partition wall and configured to warm the material,

wherein

the plurality of fins include a first fin and a second fin,

when the door is in the closed state, the first fin and the second fin are located between the upper protrusion and the partition wall, and the second fin is located at a deeper position in the first storage compartment than the first fin in a depth direction of the refrigerator as viewed from the opening, and

one of end portions of the heater that is closer to the door than the other is closer to the opening than the distal end portion of the upper protrusion and the first fin in the depth direction of the refrigerator as viewed from the opening.

[Claim 17]

The refrigerator of any one of claims 7, 10, and 11, wherein the fixed portion is C-shaped in a section perpendicular to a longitudinal direction or as viewed side-on.

[Claim 18]

The refrigerator of any one of claims 1 to 17, wherein the gap between the upper protrusion and the partition wall is approximately 5 mm.

[Claim 19]

The refrigerator of any one of claims 1 to 18, wherein the gap between the lower protrusion and the partition wall is approximately 5 mm.