

DESCRIPTION

Title of Invention

REFRIGERATOR

5 Technical Field

[0001]

The present disclosure relates to a refrigerator with double doors.

Background Art

[0002]

10 In recent years, the number of refrigerators equipped with, for example, a temperature sensor and a humidity sensor to achieve optimal operation depending on environments where the refrigerators are installed has been increasing. For example, a known refrigerator includes refrigerator compartment doors divided right and left and a heater that is installed in a partition plate between the refrigerator

15 compartment doors to prevent dew formation. The refrigerator increases the energy efficiency by changing energization of the heater at a time ratio depending on the room temperature and humidity around the refrigerator to adjust the surface temperature of the partition plate.

[0003]

20 The partition plate typically employs a structure in which the partition plate is attached to one of the right and left refrigerator compartment doors and hinged to the door in an upper part or a lower part thereof, and turned by a projection of a guide component installed in the upper part of the refrigerator compartment when the refrigerator compartment door is opened or closed.

25 [0004]

To prevent contact between the partition plate and an opening of the refrigerator compartment to smoothly turn the partition plate, the length of the partition plate in the longitudinal direction is shorter than the height of the opening of the refrigerator compartment, and the partition plate is installed so that upper and lower

30 clearances each having a certain size are left between the partition plate and the

opening of the refrigerator compartment. Gasket fins are provided on the upper and lower parts of gaskets of the right and left refrigerator compartment doors to close the upper and lower clearances. In a state where the right and left refrigerator compartment doors are closed, the right and left gasket fins overlap each other, thereby closing the clearances.

[0005]

A heat insulator or the like is not provided in the clearances closed with the gasket fins, and the temperature of the gasket fins hardly increases even when the heater is energized. Thus, the dew formation resistance of the gasket fins is low.

As a method for improving the dew formation resistance of the gasket fins, there is a technique that adjusts a heating amount depending on the position of the partition plate (e.g., refer to Patent Literature 1).

[0006]

In Patent Literature 1, the heating amount is adjusted by varying, in the longitudinal direction, a winding pitch width of a heating wire of a linear heater that is included in a heating body provided on a partition plate. It is possible to easily increase the temperature of the gasket fins and improve the dew formation resistance of the gasket fins by reducing the winding pitch width of the heating wire to increase the heating amount in the upper and lower parts of the partition plate.

Citation List

Patent Literature

[0007]

Patent Literature 1: Japanese Unexamined Patent Application Publication No. 2016-44887

Summary of Invention

Technical Problem

[0008]

For example, an apparatus capable of changing the speed at which a glass fiber core is fed is required to vary the winding pitch width of the heating wire in the longitudinal direction as performed in Patent Literature 1. In addition, a longer

manufacturing time per unit length is required than in the configuration in which the heating wire is wound at equal pitches. Thus, there are problems in that the manufacturing cost is high and the manufacturing efficiency is low.

[0009]

5 The present disclosure has been made to solve the problems as described above, and an object thereof is to provide a refrigerator that improves the manufacturing cost and the manufacturing efficiency while improving dew formation resistance of gasket fins.

Solution to Problem

10 [0010]

 A refrigerator according to an embodiment of the present invention includes: right and left double doors configured to open and close a front opening of a refrigerator compartment; a partition plate attached to one of the right and left double doors rotatably to prevent entry of outside air into the refrigerator compartment; and gaskets provided on the respective double doors, the gaskets being configured to seal part of mating with the partition plate. Clearances are left between an upper end of the partition plate and an upper face of the refrigerator compartment and between a lower end of the partition plate and a lower face of the refrigerator compartment. The partition plate includes a cord-like heater installed inside the partition plate, the cord-like heater including a core and a heating wire wound around the core at equal pitches, the cord-like heater having a pattern formed from an upper part to a lower part in an up-down direction. Each of the gaskets includes gasket fins provided on an upper part and a lower part of the gasket, the gasket fins being configured to close the clearances, and a magnet installed inside the gasket, the magnet extending from the upper part to the lower part in the up-down direction. A pattern width of the cord-like heater in the upper part of the partition plate and a pattern width of the cord-like heater in the lower part of the partition plate are equal to or larger than a distance between outer side faces of the magnets on right and left.

Advantageous Effects of Invention

30 [0011]

According to the refrigerator according to the embodiment of the present invention, the pattern width of the cord-like heater in the upper part of the partition plate and the pattern width of the cord-like heater in the lower part of the partition plate are equal to or larger than the outer side face distance between the outer side faces of the right and left magnets. Thus, the temperature of the upper and lower parts of the magnets easily increases, which makes it possible to also increase the temperature of the gasket fins provided on the upper and lower parts of the gaskets. As a result, it is possible to improve the dew formation resistance of the gasket fins. The cord-like heater includes the core and the heating wire wound around the core at equal pitches, and the winding pitch width of the heating wire is constant in the longitudinal direction. Thus, the manufacturing cost and the manufacturing efficiency can be improved.

Brief Description of Drawings

[0012]

[Fig. 1] Fig. 1 is a schematic front view of a refrigerator according to an embodiment.

[Fig. 2] Fig. 2 is a diagram illustrating a refrigerant circuit of the refrigerator according to the embodiment.

[Fig. 3] Fig. 3 is a connection diagram of refrigerant pipes inside the refrigerator according to the embodiment.

[Fig. 4] Fig. 4 is a connection diagram of refrigerant pipes inside the refrigerator according to a modification of the embodiment.

[Fig. 5] Fig. 5 is a longitudinal sectional view of an upper part of the refrigerator according to the embodiment.

[Fig. 6] Fig. 6 is an exploded view of a partition plate of the refrigerator according to the embodiment.

[Fig. 7] Fig. 7 is a schematic diagram illustrating the cross section of an area around an aluminum foil heater of the partition plate of the refrigerator according to the embodiment and details of a cord-like heater.

[Fig. 8] Fig. 8 is a perspective view of a part B of Fig. 1.

[Fig. 9] Fig. 9 is a sectional view taken from the direction of arrows A-A in Fig. 1.

[Fig. 10] Fig. 10 is a diagram illustrating a pattern of the cord-like heater of the aluminum foil heater installed inside the partition plate in front view of an area around the partition plate of the refrigerator according to the embodiment.

[Fig. 11] Fig. 11 is an enlarged view of a part C of Fig. 10.

[Fig. 12] Fig. 12 is an enlarged view of a part D of Fig. 10.

[Fig. 13] Fig. 13 is an enlarged view of a part E of Fig. 10.

[Fig. 14] Fig. 14 is a plan view of the cross section of an upper part of the partition plate of the refrigerator according to the embodiment.

[Fig. 15] Fig. 15 is a plan view of the cross section of a central part of the partition plate of the refrigerator according to the embodiment.

[Fig. 16] Fig. 16 is a plan view of the cross section of the upper part of the partition plate of the refrigerator according to a modification of the embodiment.

[Fig. 17] Fig. 17 is a plan view of the cross section of the central part of the partition plate of the refrigerator according to the modification of the embodiment.

[Fig. 18] Fig. 18 is a diagram illustrating the pattern of the cord-like heater of the aluminum foil heater installed inside the partition plate in front view of an area around the partition plate of the refrigerator according to a modification of the embodiment.

[Fig. 19] Fig. 19 is an enlarged view of a part C of Fig. 18.

[Fig. 20] Fig. 20 is an enlarged view of a part D of Fig. 18.

[Fig. 21] Fig. 21 is an enlarged view of a part E of Fig. 18.

Description of Embodiments

[0013]

An embodiment will be described hereinafter with reference to the drawings. Note that the embodiment is not limited to details described below. The relationship in size between components in the drawings may differ from that between actual ones.

[0014]

Embodiment.

Fig. 1 is a schematic front view of a refrigerator 100 according to an embodiment.

Hereinbelow, the configuration of the refrigerator 100 according to the present embodiment will be described. In the following description, terms representing directions, such as "upper", "lower", "right", "left", "front", and "back", are appropriately used to facilitate understanding. However, these terms are merely used for description and do not limit the present embodiment. The terms such as "upper", "lower", "right", "left", "front", and "back" used in the present embodiment are based on a front view of the refrigerator 100.

[0015]

As illustrated in Fig. 1, the refrigerator 100 according to the present embodiment includes a plurality of storage compartments. Specifically, the refrigerator 100 includes a refrigerator compartment 1, an ice-making compartment 2, a small freezer compartment 3, a freezer compartment 4, and a vegetable compartment 5. The refrigerator compartment 1 is provided in the uppermost part of the refrigerator 100 and has a front opening that is closed with double doors so that a user can open or close the double doors. The double doors include a refrigerator compartment left door 6 and a refrigerator compartment right door 7. A partition plate 8 is provided between the refrigerator compartment left door 6 and the refrigerator compartment right door 7 to prevent the entry of outside air through between the refrigerator compartment left door 6 and the refrigerator compartment right door 7. Details of the partition plate 8 will be described later.

[0016]

The ice-making compartment 2 and the small freezer compartment 3 are disposed side by side below the refrigerator compartment 1 and pulled out toward a user by pulling drawers (not illustrated). The vegetable compartment 5 is provided in the lowermost part of the refrigerator 100. The freezer compartment 4 is provided above the vegetable compartment 5. The freezer compartment 4 is provided below the ice-making compartment 2 and the small freezer compartment 3 that are disposed

side by side in the right-left direction and above the vegetable compartment 5. The freezer compartment 4 and the vegetable compartment 5 are also configured to be pulled out toward a user by pulling drawers (not illustrated).

[0017]

5 The arrangement of the storage compartments is not limited to the arrangement in the present embodiment and may be any arrangement having a configuration including the double doors and the partition plate 8 provided between the double doors. The refrigerator 100 is equipped with an outside air temperature sensor 9 and an outside air humidity sensor 10. The outside air temperature sensor 9 detects an outside air temperature that is the temperature of air outside the refrigerator 100. The outside air humidity sensor 10 detects an outside air humidity that is the humidity of air outside the refrigerator 100.

[0018]

15 The outside air temperature sensor 9 and the outside air humidity sensor 10 may be installed at any position where the outside air temperature sensor 9 and the outside air humidity sensor 10 can detect the outside air temperature and the outside air humidity, respectively. However, the outside air temperature sensor 9 and the outside air humidity sensor 10 are desirably installed at a position where the outside air temperature sensor 9 and the outside air humidity sensor 10 are not affected by operation of the refrigerator 100, for example, by the temperature of a side face condensing pipe stuck and fixed to the inside of a side face. Thus, the installation position of the outside air temperature sensor 9 and the outside air humidity sensor 10 is preferably inside a hinge cover part 11 that is provided on the upper side of the refrigerator compartment left door 6 because the outside air temperature sensor 9 and the outside air humidity sensor 10 inside the hinge cover part 11 are not affected by heat of, for example, the condensing pipe.

[0019]

30 Fig. 2 is a diagram illustrating a refrigerant circuit 102 of the refrigerator 100 according to the present embodiment. Fig. 3 is a connection diagram of refrigerant pipes inside the refrigerator 100 according to the present embodiment. Fig. 4 is a

connection diagram of refrigerant pipes inside the refrigerator 100 according to a modification of the present embodiment. Arrows in Fig. 2 show the flow of refrigerant. In Figs. 3 and 4, the right front side corresponds to the front side of the refrigerator 100.

5 [0020]

The refrigerator 100 according to the present embodiment includes the refrigerant circuit 102 through which refrigerant circulates. As illustrated in Fig. 2, the refrigerant circuit 102 includes a compressor 12, a machine room condenser 13 of a fin tube type, a left side face condensing pipe 14, a ceiling face condensing pipe 15, a back face condensing pipe 16, a right side face condensing pipe 17, an anti-dew pipe 18, a dryer 19, a capillary tube 20 serving as a pressure reducing device, a cooler 21, a muffler (trap) 22, and a suction pipe 23. The machine room condenser 13, the left side face condensing pipe 14, the ceiling face condensing pipe 15, the back face condensing pipe 16, the right side face condensing pipe 17, and the anti-dew pipe 18 are condensing system pipes.

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[0021]

As illustrated in Fig. 3, the compressor 12, the machine room condenser 13, and the dryer 19 are installed in a machine room 34 that is provided in a lower back part of the refrigerator 100. The ceiling face condensing pipe 15 is connected to the left side face condensing pipe 14 on the left side face and extends to a ceiling face from the left side face condensing pipe 14. The ceiling face condensing pipe 15 may be connected to the right side face condensing pipe 17 on the right side face and extend to the ceiling face from the right side face condensing pipe 17. Although not illustrated, the left side face condensing pipe 14, the ceiling face condensing pipe 15, the back face condensing pipe 16, and the right side face condensing pipe 17 are fixed to an inner face of an outer casing of the refrigerator 100, the outer casing being made of metal, with an aluminum tape.

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[0022]

The refrigerator 100 further includes a machine room cooling fan (not illustrated) that is provided in the machine room 34 and cools the machine room

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condenser 13 and the compressor 12 and an indoor cooling fan (not illustrated) that is provided above the cooler 21 and circulates cold air into the refrigerator 100.

[0023]

Note that two capillary tubes 20 or a plurality of coolers 21 may be installed downstream of the anti-dew pipe 18, that is, downstream of the condensing system pipes. When the two capillary tubes 20 are provided, a three-way valve is installed upstream of the capillary tubes 20. If sufficient condensing capacity can be achieved only by the left side face condensing pipe 14 and the right side face condensing pipe 17, the machine room condenser 13, the ceiling face condensing pipe 15, and the back face condensing pipe 16 may not be provided.

[0024]

As illustrated in Fig. 3, the anti-dew pipe 18 is disposed on a front face flange 70 so as to surround the refrigerator compartment 1, the ice-making compartment 2, the small freezer compartment 3, the freezer compartment 4, and the vegetable compartment 5, that is, each of the storage compartments. The anti-dew pipe 18 is connected, at the lower right back side, to the right side face condensing pipe 17 and connected, at the lower left back side, to the dryer 19 disposed in the machine room 34.

[0025]

In a case where the heat insulating performance between a wall surface of the refrigerator compartment 1 and the outer casing thereof is high, the anti-dew pipe 18 may be disposed on the front face flange 70 so as to surround the storage compartments except the refrigerator compartment 1 as illustrated in Fig. 4. That is, the anti-dew pipe 18 may not be disposed at a position corresponding to the upper, right, and left sides of the refrigerator compartment 1 on the front face flange 70. The case where the heat insulating performance between the wall surface of the refrigerator compartment 1 and the outer casing thereof is high is, for example, a case where the distance between the wall surface of the refrigerator compartment 1 and the outer casing thereof, that is, the heat insulating thickness is large, or a case where a vacuum heat insulator is disposed between the wall surface of the

refrigerator compartment 1 and the outer casing thereof.

[0026]

In the structure illustrated in Fig. 4, the anti-dew pipe 18 is not disposed at the position corresponding to the upper, right, and left sides of the refrigerator compartment 1 on the front face flange 70. Thus, the temperature of the front face flange 70 around the partition plate 8 becomes lower than that in a case where the anti-dew pipe 18 is disposed at the position corresponding to the upper, right, and left sides of the refrigerator compartment 1 on the front face flange 70. However, when the temperature becomes equal to or higher than the above temperature due to the pattern arrangement of the heater inside the partition plate 8, which is described later, the temperature of gasket fins 63, 65 that close a clearance between the upper face of the refrigerator compartment 1 and the partition plate 8 does not decrease. A material cost and a manufacturing cost required to dispose the anti-dew pipe 18 can be reduced by reducing the length of the anti-dew pipe 18.

[0027]

Fig. 5 is a longitudinal sectional view of an upper part of the refrigerator 100 according to the present embodiment. Arrows in Fig. 5 show the flow of air and the size of each arrow shows the magnitude of the volume of air.

As illustrated in Fig. 5, a controller 29 is provided on the back side of the refrigerator 100. The controller 29 includes, for example, dedicated hardware or a central processing unit (CPU, also called a processing unit, an arithmetic unit, a microprocessor, or a processor) that executes a program stored in a memory.

[0028]

A refrigerator compartment temperature sensor 32 for detecting the temperature of the refrigerator compartment 1 (hereinbelow, referred to as the refrigerator compartment temperature) is provided inside the refrigerator compartment 1. The refrigerator compartment temperature sensor 32 may be installed at any position inside the refrigerator compartment 1 where the refrigerator compartment temperature sensor 32 can detect the refrigerator compartment temperature. The controller 29 blows or blocks cold air to the refrigerator compartment 1 by opening or

closing a baffle 85 of a refrigerator compartment damper device 31 on the basis of the refrigerator compartment temperature detected by the refrigerator compartment temperature sensor 32. The refrigerator compartment damper device 31 is provided on a refrigerator compartment air outlet path 24 that is formed on the back side of the refrigerator 100. The refrigerator compartment temperature sensor 32 is used to, for example, control energization of a heater (not illustrated) that is installed for temperature compensation inside the refrigerator compartment 1 and an aluminum foil heater 43 (described later) that is installed inside the partition plate 8.

[0029]

Three pockets 26 are attached to the inside of each of the refrigerator compartment left door 6 and the refrigerator compartment right door 7 and arranged in the height direction. The inside of the refrigerator compartment 1 is partitioned into a plurality of sections by a plurality of shelves 30.

[0030]

A chilled compartment 27 having a temperature (approximately 0 degrees C) lower than the temperature of the refrigerator compartment 1 (approximately 3 degrees C) is provided under the lowermost shelf 30 inside the refrigerator compartment 1. The chilled compartment 27 is provided with a chilled case 28 that stores food. Air outlets 37 to 41 are formed on a back wall of the refrigerator compartment 1 in the respective sections divided by the plurality of shelves 30. Air from the refrigerator compartment air outlet path 24 is blown through the air outlets 37 to 41.

[0031]

Fig. 6 is an exploded view of the partition plate 8 of the refrigerator 100 according to the present embodiment.

As illustrated in Fig. 6, the aluminum foil heater 43 is stuck to the back side of a front metal sheet 42 constituting the front side of the partition plate 8. A meandering pattern is formed on the aluminum foil heater 43 in the longitudinal direction. A front frame-like resin part 44 is attached to the back side of the aluminum foil heater 43 by claws (not illustrated) fitted with claw receivers 57 of the front metal sheet 42. An

upper hinge part 49 is attached to the upper side of a back side resin part 53 constituting the back side of the partition plate 8, and an upper cover part 48 is further fixed thereto from above with a screw 46. A lower hinge part 51 is attached to the lower side of the back side resin part 53, and a lower cover part 50 is further fixed thereto from below with a screw 46. A spring stopper 47 is fixed to the lower hinge part 51 with a screw 46. A spring 52 is attached to the spring stopper 47. The back side resin part 53 in this state is attached to the back side of the front frame-like resin part 44 with a heat insulator 45 interposed therebetween by claws 68 of the front metal sheet 42 fitted with the back side resin part 53.

[0032]

Fig. 7 is a schematic diagram illustrating the cross section of an area around the aluminum foil heater 43 included in the partition plate 8 of the refrigerator 100 according to the present embodiment and details of a cord-like heater 56.

As illustrated in Fig. 7, the aluminum foil heater 43 includes the cord-like heater 56, an aluminum foil 54 that fixes the cord-like heater 56, and a double-faced tape 55. The aluminum foil heater 43 is stuck to the back side of the front metal sheet 42 with the double-faced tape 55. The cord-like heater 56 includes a core 58 such as a glass fiber and a heating wire 59 such as a nichrome wire wound around the core 58 at equal pitches, the core 58 and the heating wire 59 being doubly covered with insulating sheaths 60, 61 such as polyvinyl chloride. In the cord-like heater 56, the heating wire 59 may not be wound around the core 58 at exactly equal pitches, but may be wound around the core 58 at substantially equal pitches. The aluminum foil heater 43 may be stuck to the back side of the front metal sheet 42 with an adhesive instead of the double-faced tape 55.

[0033]

The partition plate 8 is attached to one of the double doors (the refrigerator compartment left door 6 in the present embodiment) by fixing the upper hinge part 49 and the lower hinge part 51 of the partition plate 8 to an inner plate (not illustrated) of the refrigerator compartment left door 6 with, for example, screws. The total length of the partition plate 8 in the vertical direction that is the longitudinal direction is

smaller than the length of the front opening of the refrigerator compartment 1 in the vertical direction, so that clearances are left between the upper end of the partition plate 8 and the front opening of the refrigerator compartment 1 and between the lower end of the partition plate 8 and the front opening of the refrigerator compartment 1.

5 [0034]

For energization of the aluminum foil heater 43, a duty factor arithmetic expression that is previously determined through, for example, a test is programmed in the controller 29. The duty factor represents temporal variation of voltage applied to the aluminum foil heater 43. For example, it is defined that, of 10 seconds as a
10 predetermined time, the aluminum foil heater 43 is energized for 5 seconds and not energized for remaining 5 seconds. The duty factor in this case is 50%. The duty factor for the aluminum foil heater 43 is calculated by the controller 29 on the basis of the outside air temperature, the outside air humidity, and the refrigerator compartment temperature and varies depending on the surrounding environments.

15 [0035]

The duty factor arithmetic expression programmed in the controller 29 is, for example, $\text{duty factor} = a \times \text{outside air humidity} + b$. In the expression, a and b are coefficients determined by a value of $A = \text{outside air temperature} - \text{refrigerator compartment temperature}$ and vary depending on the value of A. The controller 29
20 determines the duty factor for the aluminum foil heater 43 by performing calculation using the duty factor arithmetic expression on the basis of the outside air temperature, the outside air humidity, and the refrigerator compartment temperature respectively detected by the outside air temperature sensor 9, the outside air humidity sensor 10, and the refrigerator compartment temperature sensor 32. With the
25 determined duty factor, no dew forms on the surface of the partition plate 8, the peripheries of the refrigerator compartment left door 6 and the refrigerator compartment right door 7, or the gaskets 62, 64, that is, dew formation resistance of these parts is improved to prevent condensation.

[0036]

30 The duty factor calculated using the duty factor arithmetic expression increases

as the outside air temperature and the outside air humidity increase and increases as the temperature of the refrigerator compartment 1 decreases. The controller 29 energizes the aluminum foil heater 43 with the duty factor determined by the calculation. Thus, the duty factor can be reduced when the outside air temperature and the outside air humidity are low and the refrigerator compartment temperature is high. Therefore, the energy efficiency can be increased.

[0037]

The configuration of the partition plate 8, the method for energizing the aluminum foil heater 43, and the duty factor arithmetic expression are not limited to the details described above. For example, the partition plate 8 may not include the front frame-like resin part 44 and may have any configuration capable of closing the clearances left above and below the partition plate 8 with the gasket fins 63, 65.

[0038]

Next, the structure of the upper part of the partition plate 8 of the refrigerator 100 and the surroundings thereof will be described.

Fig. 8 is a perspective view of a part B of Fig. 1. Fig. 8 illustrates a state where the refrigerator compartment left door 6 is closed and the refrigerator compartment right door 7 is open. A dot-dash line in Fig. 8 shows the outer shape of the gasket fin 65 attached to the refrigerator compartment right door 7 in a state where the refrigerator compartment right door 7 is closed.

[0039]

As illustrated in Fig. 8, the partition plate 8 is attached to the inner plate of the refrigerator compartment left door 6 with the upper hinge part 49 and the lower hinge part 51 rotatably about a vertical axis. Thus, when the refrigerator compartment right door 7 is opened, the position of the partition plate 8 remains unchanged. The gaskets 62, 64 are respectively attached to the refrigerator compartment left door 6 and the refrigerator compartment right door 7. The gaskets 62, 64 seal part of mating with the front face flange 70 around the front opening of the refrigerator compartment 1 and the partition plate 8. The gasket 62 is disposed on an end part of an inner face of the refrigerator compartment left door 6 throughout the entire

circumference thereof. The gasket 64 is disposed on an end part of an inner face of the refrigerator compartment right door 7 throughout the entire circumference thereof. That is, each of the gaskets 62, 64 has a rectangular shape and has an upper horizontal side, a lower horizontal side, a left vertical side, and a right vertical side.

5 In a state where the refrigerator compartment left door 6 and the refrigerator compartment right door 7 are both closed, the right vertical side of the gasket 62 and the left vertical side of the gasket 64 seal part of mating with the partition plate 8, and the other three sides of each of the gaskets 62, 64 seal part of mating with the front face flange 70 of the refrigerator compartment 1.

10 [0040]

The gasket fins 63 are provided on an upper part and a lower part of the right vertical side of the gasket 62. The gasket fins 65 are provided on an upper part and a lower part of the left vertical side of the gasket 64. In the state where the refrigerator compartment left door 6 and the refrigerator compartment right door 7 are
15 both closed, the gasket fins 63, 65 seal part of mating with the partition plate 8 and the front face flange 70 of the refrigerator compartment 1 and close an upper clearance 66 and a lower clearance 67 (refer to Fig. 10 described later).

[0041]

The upper clearance 66 is left between the upper end of the partition plate 8
20 and the upper face of the refrigerator compartment 1. In the state where the refrigerator compartment left door 6 and the refrigerator compartment right door 7 are both closed, the left and right gasket fins 63, 65 overlap each other and close the upper clearance 66. Although only the upper clearance 66 is illustrated in Fig. 8, the lower clearance 67 is left between the lower end of the partition plate 8 and the lower
25 face of the refrigerator compartment 1. Similarly, in the state where the refrigerator compartment left door 6 and the refrigerator compartment right door 7 are both closed, the lower clearance 67 is also closed with the left and right gasket fins 63, 65 overlapping each other.

[0042]

30 The heat insulator 45 or the like is not provided in the upper clearance 66 and

the lower clearance 67 closed with the gasket fins 63, 65. Thus, even when the aluminum foil heater 43 is energized, the temperature of the gasket fins 63, 65 that close the upper clearance 66 and the lower clearance 67 hardly increases compared to the central parts of the gaskets 62, 64. Thus, the dew formation resistance of the gasket fins 63, 65 is lower than that of the central parts of the gaskets 62, 64. In view of this, in a conventional technique, it is necessary to increase the duty factor for the aluminum foil heater 43 inside the partition plate 8 more than necessary so as to prevent dew from forming on the gasket fins 63, 65. As illustrated in Fig. 5, the upper side of the refrigerator compartment 1 typically has large heat leakage 33 from a ceiling 69 of the refrigerator 100. Thus, the volume of air blown through the air outlets 37 to 41 formed on the back wall of the refrigerator compartment 1 is made largest in the uppermost one of the sections divided by the plurality of shelves 30 inside the refrigerator compartment 1. The upper part of the partition plate 8 is more easily cooled than the lower part thereof because the temperature distribution between the divided sections inside the refrigerator compartment 1 is kept within a certain degree of range.

[0043]

The surface temperature of the gasket fins 63, 65 that close the upper clearance 66 is less likely to increase than the surface temperature of the gasket fins 63, 65 that close the lower clearance 67. Thus, the duty factor for the aluminum foil heater 43 is determined on the basis of the surface temperature of the gasket fins 63, 65 that close the upper clearance 66. Since the heat insulator 45 or the like is not provided in the upper clearance 66 closed with the gasket fins 63, 65, the temperature of the gasket fins 63, 65 depends on the temperature of the upper clearance 66. Thus, if the temperature of the upper clearance 66 can be increased, the surface temperature of the gasket fins 63, 65 rises, which makes it possible to reduce the duty factor increased more than necessary and increase the energy efficiency. Thus, the structure of this part will be described in detail below.

[0044]

Fig. 9 is a sectional view taken from the direction of arrows A-A in Fig. 1. In

Fig. 9, the refrigerator compartment left door 6 and the refrigerator compartment right door 7 are not illustrated, and the left side relative to the partition plate 8 is the outside of the refrigerator and the right side relative to the partition plate 8 is the inside of the refrigerator.

[0045]

As illustrated in Fig. 9, a guide part 71 that turns the partition plate 8 is attached to a front lower part of the ceiling 69 of the refrigerator 100. The guide part 71 is provided with a projection 72 projecting downward. The projection 72 works in conjunction with opening and closing of the refrigerator compartment left door 6 and turns the partition plate 8 along the inner plate of the refrigerator compartment left door 6 while being in contact with a groove 73 formed on the upper cover part 48 when the refrigerator compartment left door 6 is opened. When the partition plate 8 turns, the partition plate 8 operates in the following manner through the spring 52 provided on the lower hinge part 51 and the projection 72 provided on the guide part 71. When the refrigerator compartment left door 6 is opened, the partition plate 8 is turned along the inner plate of the refrigerator compartment left door 6 by the projection 72 being in contact with the groove 73 formed on the upper cover part 48. On the other hand, when the refrigerator compartment left door 6 is closed, the partition plate 8 is turned so as to close a clearance between the refrigerator compartment left door 6 and the refrigerator compartment right door 7. In a state where the refrigerator compartment left door 6 and the refrigerator compartment right door 7 are both closed, the left and right gasket fins 63, 65 overlap each other and close the upper clearance 66.

[0046]

An uppermost pattern 74 of the aluminum foil heater 43 inside the partition plate 8 is disposed up to a position where the uppermost pattern 74 overlaps the gasket fins 63, 65 in the height direction. This is to make it easy to increase the temperature of the upper clearance 66 by bringing the uppermost pattern 74 of the aluminum foil heater 43 closest possible to the upper clearance 66. Similarly, a lowermost pattern (not illustrated) of the aluminum foil heater 43 inside the partition

plate 8 is disposed up to a position where the lowermost pattern overlaps the gasket fins 63, 65 in the height direction.

[0047]

Although only the upper clearance 66 is illustrated in Fig. 9, the lower
5 clearance 67 (refer to Fig. 10 described later) between the lower end of the partition
plate 8 and the lower face of the refrigerator compartment 1 is also closed with the left
and right gasket fins 63, 65 overlapping each other as with the upper clearance 66.
However, the lower side of the refrigerator compartment 1 differs from the upper side
thereof in that the guide part 71 and the projection 72 are not provided and the groove
10 73 is not formed on the lower cover part 50.

[0048]

Next, the pattern of the cord-like heater 56 of the aluminum foil heater 43
installed inside the partition plate 8 will be described.

Fig. 10 is a diagram illustrating the pattern of the cord-like heater 56 of the
15 aluminum foil heater 43 installed inside the partition plate 8 in a front view of an area
around the partition plate 8 of the refrigerator 100 according to the present
embodiment. Fig. 11 is an enlarged view of a part C of Fig. 10. Fig. 12 is an
enlarged view of a part D of Fig. 10. Fig. 13 is an enlarged view of a part E of Fig.
10. Fig. 14 is a plan view of the cross section of an upper part 75 of the partition
20 plate 8 of the refrigerator 100 according to the present embodiment. Fig. 15 is a
plan view of the cross section of a central part 76 of the partition plate 8 of the
refrigerator 100 according to the present embodiment. Figs. 10 to 13 are
perspective views of the pattern of the aluminum foil heater 43 through the gaskets
62, 64. Broken lines in Figs. 10 to 13 show magnets 81, 82. Dot-dash lines in Figs.
25 10 to 13 show a center position 86 of the partition plate 8 in the right-left width
direction.

[0049]

The magnets 81, 82 are installed inside the left and right gaskets 62, 64. The
magnets 81, 82 are attracted to the front face flange 70 made of metal when the
30 refrigerator compartment left door 6 and the refrigerator compartment right door 7 are

closed, thereby mate the refrigerator compartment left door 6 and the refrigerator compartment right door 7 closely with the front face flange 70. The magnets 81, 82 have high thermal conductivity.

[0050]

5 In the following description, as illustrated in Fig. 10, the partition plate 8 is divided into three parts, namely, the upper part 75, the central part 76, and a lower part 77 in the vertical direction that is the longitudinal direction. The upper part 75 is a part that mate closely with the gasket fins 63, 65 that close the upper clearance 66. The lower part 77 is a part that mate closely with the gasket fins 63, 65 that close the
10 lower clearance 67. The central part 76 is a part between the upper part 75 and the lower part 77.

[0051]

In the present embodiment, the cord-like heater 56 has a cord-like shape and is formed by winding the heating wire 59 around the core 58 such as a glass fiber at
15 equal pitches so that a heating density is uniform in the longitudinal direction. Thus, the heater pattern needs to be densely routed in a part that mate closely with the gasket fins 63, 65 having high risk of dew formation to increase the heating density on the surface of the partition plate 8. Thus, as illustrated in Figs. 11 and 14, in the upper part 75 of the partition plate 8, the cord-like heater 56 is laid so that a pattern
20 width of the cord-like heater 56 (hereinbelow, referred to as the upper part pattern width a) is equal to or larger than an outer side face distance c between outer side faces of the magnets 81, 82 installed inside the left and right gaskets 62, 64. The outer side faces of the magnets 81, 82 are side faces that do not face each other in the right-left direction. As illustrated in Fig. 13, in the lower part 77 of the partition
25 plate 8, the cord-like heater 56 is laid so that a pattern width of the cord-like heater 56 (hereinbelow, referred to as the lower part pattern width b) is equal to or larger than the outer side face distance c between the outer side faces of the magnets 81, 82 installed inside the left and right gaskets 62, 64.

[0052]

30 The upper part of the refrigerator compartment 1 has a larger air volume and is

thus more easily cooled than the lower part thereof. Thus, the upper part pattern width a of the cord-like heater 56 is preferably larger than the lower part pattern width b. That is, the upper part pattern width a of the cord-like heater 56 > the lower part pattern width b of the cord-like heater 56 $\geq$ the outer side face distance c is preferably satisfied.

[0053]

The magnets 81, 82 installed inside the left and right gaskets 62, 64 are substantially straight in the vertical direction of the refrigerator 100. Thus, the outer side face distance c is constant from top to bottom. In the upper part 75 and the lower part 77 of the partition plate 8, the cord-like heater 56 is laid so that the pattern width of the cord-like heater 56 is equal to or larger than the outer side face distance c between the outer side faces of the magnets 81, 82. This makes it possible to more efficiently heat the magnets 81, 82 themselves in parts that seal part of mating with the upper part 75 and the lower part 77 of the partition plate 8 inside the gaskets 62, 64. Thus, it is possible to further increase the temperature of the magnets 81, 82 in parts of the gaskets 62, 64, the parts facing the cord-like heater 56. Heat conduction inside the magnets 81, 82 having relatively high thermal conductivity increases the temperature of the magnets 81, 82 also in parts of the gaskets 62, 64 above the upper part 75 of the partition plate 8, the parts facing the upper clearance 66. Thus, it is possible to increase the temperature of the gasket fins 63, 65 that close the upper clearance 66.

[0054]

A clearance communicating with the inside of the refrigerator like the clearances above the upper part 75 and below the lower part 77 is not present on the back of the central part 76 of the partition plate 8, that is, heat insulation is performed in the central part 76. Thus, there is less risk of dew formation in the central part 76 than in the upper part 75 and the lower part 77. Thus, to reduce heat entering the inside of the refrigerator, as illustrated in Figs. 12 and 15, in the central part 76 of the partition plate 8, the cord-like heater 56 is laid so that a pattern width of the cord-like heater 56 (hereinbelow, referred to as the central part pattern width d) is equal to or

smaller than an inner side face distance e between inner side faces of the magnets 81, 82 installed inside the left and right gaskets 62, 64. The inner side faces of the magnets 81, 82 are side faces that face each other in the right-left direction. That is, the central part pattern width d of the cord-like heater 56 $\leq$ the inner side face distance e is satisfied.

[0055]

As described above, the magnets 81, 82 installed inside the left and right gaskets 62, 64 are substantially straight in the vertical direction of the refrigerator 100. Thus, the inner side face distance e is constant from top to bottom.

[0056]

As described above, the heating density on the surface of the partition plate 8 in the vertical direction is varied by setting different pattern widths of the cord-like heater 56 between the parts inside the partition plate 8. Specifically, the upper part pattern width a and the lower part pattern width b of the cord-like heater 56 are larger than the central part pattern width d thereof. That is, the upper part pattern width a of the cord-like heater 56 $>$ the lower part pattern width b of the cord-like heater 56 $>$ the central part pattern width d of the cord-like heater 56 is satisfied. This makes the heating density on the surface of the partition plate 8 higher in the upper part 75 and the lower part 77 than in the central part 76.

[0057]

Fig. 16 is a plan view of the cross section of the upper part 75 of the partition plate 8 of the refrigerator 100 according to a modification of the present embodiment. Fig. 17 is a plan view of the cross section of the central part 76 of the partition plate 8 of the refrigerator 100 according to the modification of the present embodiment.

[0058]

In the present embodiment, the pattern width of the cord-like heater 56 includes an insulating sheath thickness. That is, the pattern width of the cord-like heater 56 including the insulating sheath thickness is equal to or larger than the outer side face distance c in the upper part 75 and the lower part 77 of the partition plate 8 as illustrated in Fig. 14 and equal to smaller than the inner side face distance e in the

central part 76 of the partition plate 8 as illustrated in Fig. 15. Including the insulating sheath thickness into the pattern width of the cord-like heater 56 in this manner is effective in heat transfer to the magnets 81, 82 having relatively high thermal conductivity. However, the insulating sheath thickness may not be included in the pattern width of the cord-like heater 56 due to arrangement constraints. That is, even if the pattern width of the cord-like heater 56 is defined as the distance between right and left center lines as illustrated in Figs. 16 and 17, the above effect can be obtained to some extent.

[0059]

Fig. 18 is a diagram illustrating the pattern of the cord-like heater 56 of the aluminum foil heater 43 installed inside the partition plate 8 in front view of an area around the partition plate 8 of the refrigerator 100 according to a modification of the present embodiment. Fig. 19 is an enlarged view of a part C of Fig. 18. Fig. 20 is an enlarged view of a part D of Fig. 18. Fig. 21 is an enlarged view of a part E of Fig. 18. Figs. 18 to 21 are perspective views of the pattern of the aluminum foil heater 43 through the gaskets 62, 64. Broken lines in Figs. 18 to 21 show the magnets 81, 82. Dot-dash lines in Figs. 18 to 21 show the center position 86 of the partition plate 8 in the right-left width direction.

[0060]

Since the pattern width of the cord-like heater 56 is varied inside the partition plate 8, the shape of the aluminum foil 54 that fixes the cord-like heater 56 may be changed following the variation of the pattern width. In this case, as illustrated in Figs. 18 to 21, the width of the aluminum foil 54 is made large in the upper part 75 and the lower part 77 of the partition plate 8 and small in the central part 76 of the partition plate 8. That is, the relationship between the width of an upper part of the aluminum foil 54 (hereinbelow, referred to as the upper part width f), the width of a central part of the aluminum foil 54 (hereinbelow, referred to as the central part width g), and the width of a lower part of the aluminum foil 54 (hereinbelow, referred to as the lower part width h) satisfies the upper part width f of the aluminum foil 54 > the lower part width h of the aluminum foil 54 > the central part width g of the aluminum

foil 54.

[0061]

Similarly, the shape of the front metal sheet 42 may be changed. In this case, as illustrated in Figs. 18 to 21, the width of the front metal sheet 42 is made large in the upper part 75 and the lower part 77 of the partition plate 8 and small in the central part 76 of the partition plate 8. That is, the relationship between the width of an upper part of the front metal sheet 42 (hereinbelow, referred to as the upper part width i), the width of a central part of the front metal sheet 42 (hereinbelow, referred to as the central part width j), and the width of a lower part of the front metal sheet 42 (hereinbelow, referred to as the lower part width k) satisfies the upper part width i of the front metal sheet 42 > the lower part width k of the front metal sheet 42 > the central part width j of the front metal sheet 42.

[0062]

In the parts where the width of the front metal sheet 42 is varied, the entry of heat into the refrigerator is further reduced by reducing, in particular, the central part width j, which further increases the energy efficiency. However, taking adhesion with the gaskets 62, 64 into consideration, the relationship between the central part width j of the front metal sheet 42 and the inner side face distance e between the inner side faces of the magnets 81, 82 in this case satisfies the central part width j of the front metal sheet 42 $\geq$ the inner side face distance e.

[0063]

When heat transfer to the magnets 81, 82 installed inside the left and right gaskets 62, 64 is taken into consideration, the cord-like heater 56, the magnets 81, 82, the aluminum foil 54, and the front metal sheet 42 are desirably disposed so that center positions of the pattern width (a, b, d) of the cord-like heater 56, the distance (c, e) between the magnets 81, 82, the width (f, g, h) of the aluminum foil 54, and the width (i, j, k) of the front metal sheet 42 are aligned with each other because of the following reason. When, in the upper part 75 of the partition plate 8, the cord-like heater 56 is deviated to either right or left with the above relationship satisfied, the length of the cord-like heater 56 in the vertical direction in the part facing the magnets

81, 82 is unchanged. However, in this case, the left part or the right part of the magnets 81, 82 is uselessly heated, which becomes a heat load to the inside of the refrigerator. If the heat load to the inside of the refrigerator increases, cooling energy is consumed, which reduces the energy efficiency.

5 [0064]

As for a boundary position between the upper part 75 and the central part 76 and a boundary position between the central part 76 and the lower part 77 in the partition plate 8, it is considered that the upper part 75 and the lower part 77 of the partition plate 8 require a certain percentage of length to ensure sufficient
10 temperature rise in the magnets 81, 82 installed inside the left and right gaskets 62, 64. Thus, in the length of the partition plate 8 in the vertical direction that is the longitudinal direction, a part that extends downward from the upper end face of the partition plate 8 and has a length of approximately 10% of the total length is defined as the upper part 75, a part that extends upward from the lower end face of the
15 partition plate 8 and has a length of approximately 10% of the total length is defined as the lower part 77, and a part between the upper part 75 and the lower part 77 is defined as the central part 76. However, the length of each of the upper clearance 66 and the lower clearance 67 in the vertical direction has influence on the temperature of the gasket fins 63, 65. For example, if the length of each of the
20 upper clearance 66 and the lower clearance 67 in the vertical direction is long, the temperature of the gasket fins 63, 65 hardly increases without increasing the heating amount. Thus, when the length of each of the upper clearance 66 and the lower clearance 67 in the vertical direction is long, for example, equal to or larger than 5 mm, the percentage of the length of each of the upper part 75 and the lower part 77
25 of the partition plate 8 needs to be slightly larger than the above value. In the present embodiment, the length of each of the upper clearance 66 and the lower clearance 67 in the vertical direction is approximately 2 mm, the cord-like heater 56 is approximately 11.1 W, and the upper part 75 occupies 10% of the total length from the upper end face of the partition plate 8 and the lower part 77 occupies 10% of the
30 total length from the lower end face of the partition plate 8.

[0065]

As described above, the refrigerator 100 according to the present embodiment includes the right and left double doors that open and close the front opening of the refrigerator compartment 1, and the partition plate 8 that is attached to one of the right and left double doors rotatably to prevent the entry of outside air into the refrigerator compartment 1. The refrigerator 100 further includes the gaskets 62, 64 that are provided on the respective right and left double doors and seal part of mating with the partition plate 8. The clearances are left between the upper end of the partition plate 8 and the upper face of the refrigerator compartment 1 and between the lower end of the partition plate 8 and the lower face of the refrigerator compartment 1. The partition plate 8 includes the cord-like heater 56 installed inside thereof, the cord-like heater including the core 58 and the heating wire 59 wound around the core 58 at equal pitches, the cord-like heater having the pattern formed from the upper part 75 to the lower part 77 in the up-down direction. The gaskets 62, 64 include the gasket fins 63, 65 that are provided on the upper part and the lower part thereof and close the clearances, and the magnets 81, 82 installed inside thereof, the magnets 81, 82 extending from the upper part to the lower part in the up-down direction. The pattern width of the cord-like heater 56 in the upper part 75 of the partition plate 8 and the pattern width of the cord-like heater 56 in the lower part 77 of the partition plate 8 are equal to or larger than the outer side face distance c between the outer side faces of the left and right magnets 81, 82.

[0066]

According to the refrigerator 100 according to the present embodiment, the pattern width of the cord-like heater 56 in the upper part 75 of the partition plate 8 and the pattern width of the cord-like heater 56 in the lower part 77 of the partition plate 8 are equal to or larger than the outer side face distance c between the outer side faces of the left and right magnets 81, 82. Thus, the temperature of the upper and lower parts of the magnets 81, 82 easily increases, which makes it possible to also increase the temperature of the gasket fins 63, 65 provided on the upper and lower parts of the gaskets 62, 64. As a result, it is possible to improve the dew formation resistance of

the gasket fins 63, 65. The cord-like heater 56 includes the core 58 and the heating wire 59 wound around the core 58 at equal pitches, and the winding pitch width of the heating wire 59 is constant in the longitudinal direction. Thus, the manufacturing cost and the manufacturing efficiency can be improved.

5 [0067]

In the refrigerator 100 according to the present embodiment, the pattern width of the cord-like heater 56 in the central part 76 between the upper part 75 and the lower part 77 of the partition plate 8 is equal to or smaller than the inner side face distance e between the inner side faces of the left and right magnets 81, 82.

10 [0068]

According to the refrigerator 100 according to the present embodiment, the pattern width of the cord-like heater 56 in the central part 76 of the partition plate 8 is equal to or smaller than the inner side face distance e between the inner side faces of the left and right magnets 81, 82. Thus, it is possible to reduce heat that enters the inside of the refrigerator in the central part 76 of the partition plate 8 where the risk of dew formation is low.

15 [0069]

In the refrigerator 100 according to the present embodiment, the pattern width of the cord-like heater 56 in the upper part 75 of the partition plate 8 is larger than the pattern width of the cord-like heater 56 in the lower part 77 of the partition plate 8.

20 [0070]

According to the refrigerator 100 according to the present embodiment, the pattern width of the cord-like heater 56 in the upper part 75 of the partition plate 8 is larger than the pattern width of the cord-like heater 56 in the lower part 77 of the partition plate 8. Thus, the dew formation resistance of the upper gasket fins 63, 65 can be made higher than that of the lower gasket fins 63, 65. Consequently, even when the upper part of the refrigerator compartment 1 has a larger air volume and is thus more easily cooled than the lower part thereof, dew formation on the gasket fins 63, 65 can be reduced.

Reference Signs List

[0071]

1: refrigerator compartment, 2: ice-making compartment, 3: small freezer
compartment, 4: freezer compartment, 5: vegetable compartment, 6: refrigerator
5 compartment left door, 7: refrigerator compartment right door, 8: partition plate, 9:
outside air temperature sensor, 10: outside air humidity sensor, 11: hinge cover part,
12: compressor, 13: machine room condenser, 14: left side face condensing pipe, 15:
ceiling face condensing pipe, 16: back face condensing pipe, 17: right side face
condensing pipe, 18: anti-dew pipe, 19: dryer, 20: capillary tube, 21: cooler, 22:
10 muffler, 23: suction pipe, 24: refrigerator compartment air outlet path, 26: pocket, 27:
chilled compartment, 28: chilled case, 29: controller, 30: shelf, 31: refrigerator
compartment damper device, 32: refrigerator compartment temperature sensor, 33:
heat leakage, 34: machine room, 37: air outlet, 38: air outlet, 39: air outlet, 40: air
outlet, 41: air outlet, 42: front metal sheet, 43: aluminum foil heater, 44: front frame-
15 like resin part, 45: heat insulator, 46: screw, 47: spring stopper, 48: upper cover part,
49: upper hinge part, 50: lower cover part, 51: lower hinge part, 52: spring, 53: back
side resin part, 54: aluminum foil, 55: double-faced tape, 56: cord-like heater, 57: claw
receiver, 58: core, 59: heating wire, 60: insulating sheath, 61: insulating sheath, 62:
gasket, 63: gasket fin, 64: gasket, 65: gasket fin, 66: upper clearance, 67: lower
20 clearance, 68: claw, 69: ceiling, 70: front face flange, 71: guide part, 72: projection,
73: groove, 74: uppermost part pattern, 75: upper part, 76: central part, 77: lower part,
81: magnet, 82: magnet, 85: baffle, 86: center position, 100: refrigerator, 102:
refrigerant circuit.

CLAIMS

[Claim 1]

A refrigerator comprising:

right and left double doors configured to open and close a front opening of a refrigerator compartment;

a partition plate attached to one of the right and left double doors rotatably to prevent entry of outside air into the refrigerator compartment; and

gaskets provided on the respective right and left double doors, the gaskets being configured to seal part of mating with the partition plate, wherein

clearances are left between an upper end of the partition plate and an upper face of the refrigerator compartment and between a lower end of the partition plate and a lower face of the refrigerator compartment,

the partition plate includes a cord-like heater installed inside the partition plate, the cord-like heater including a core and a heating wire wound around the core at equal pitches, the cord-like heater having a pattern formed from an upper part to a lower part in an up-down direction,

each of the gaskets includes

gasket fins provided on an upper part and a lower part of the gasket, the gasket fins being configured to close the clearances, and

a magnet installed inside the gasket, the magnet extending from the upper part to the lower part in the up-down direction, and

a pattern width of the cord-like heater in the upper part of the partition plate and a pattern width of the cord-like heater in the lower part of the partition plate are equal to or larger than a distance between outer side faces of the magnets on right and left.

[Claim 2]

The refrigerator of claim 1, wherein a pattern width of the cord-like heater in a central part between the upper part and the lower part of the partition plate is equal to or smaller than a distance between inner side faces of the magnets on right and left.

[Claim 3]

The refrigerator of claim 1 or 2, wherein the pattern width of the cord-like heater

in the upper part of the partition plate is larger than the pattern width of the cord-like heater in the lower part of the partition plate.