

DESCRIPTION

Title of Invention

REFRIGERATOR

Technical Field

5 [0001]

The present disclosure relates to a refrigerator, and more particularly, to a defrost water drainage structure and a vacuum heat insulation material disposed between an inner cabinet and an outer cabinet of the refrigerator.

Background Art

10 [0002]

Various refrigerators and refrigeration systems including vacuum heat insulation materials have been proposed. For example, Patent Literature 1 proposes a structure in which vacuum heat insulation materials are provided between an outer cabinet and defrosting pipes disposed in a rigid urethane foam between the outer cabinet and an inner cabinet. The vacuum heat insulation materials thermally insulate storage compartments to reduce the operations of cooling devices and a compressor, so that power consumption is reduced.

[0003]

20 Patent Literature 2 proposes a structure in which a vacuum heat insulation material is provided between an inner cabinet and a defrosting pipe, a pipe, etc., disposed in a rigid urethane foam between an outer cabinet and the inner cabinet. The vacuum heat insulation material thermally insulates defrost water so that the defrost water is prevented from being cooled and frozen due to the influence of the temperature in a storage compartment.

25 Citation List

Patent Literature

[0004]

Patent Literature 1: Japanese Unexamined Patent Application Publication No. 2005-164193

Patent Literature 2: Japanese Unexamined Patent Application Publication No.
2004-101028

Summary of Invention

Technical Problem

5 [0005]

According to the refrigerator of Patent Literature 1, although the storage compartments can be thermally insulated by the vacuum heat insulation materials, defrost water may be cooled and frozen due to the influence of the temperature in the storage compartments.

10 [0006]

According to the refrigerator of Patent Literature 2, the inner cabinet to which the vacuum heat insulation material is fixed has a complex structure to avoid interference with surrounding components, and it is therefore difficult for an adhesive material to hold the vacuum heat insulation material with sufficient tenacity. In addition, a plurality of small vacuum heat insulation materials need to be provided to ensure sufficient heat insulation performance.

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[0007]

The present disclosure has been made to solve the above-described problems, and provides a refrigerator in which freezing of a defrosting pipe can be prevented without sacrificing the overall heat insulation performance and ease of assembling of the refrigerator.

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Solution to Problem

[0008]

A refrigerator according to an embodiment of the present disclosure includes a cabinet body including an inner cabinet in which a storage compartment is formed and an outer cabinet that is provided outside the inner cabinet and that defines an outer frame; a cooling device that generates cold air; a compressor that drives the cooling device; a drain pan in which defrost water generated by the cooling device accumulates; a defrosting pipe through which the defrost water flows to the drain pan; a first vacuum heat insulation material fixed to the outer cabinet; and a second vacuum heat insulation

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material fixed to the inner cabinet. The cooling device, the compressor, and the defrosting pipe are disposed between the inner cabinet and the outer cabinet. The second vacuum heat insulation material is disposed between the inner cabinet and the defrosting pipe and has a dimension less than a dimension of the first vacuum heat insulation material. The refrigerator comprises a defrosting pipe cover that covers at least one of a joining portion between the defrosting pipe and a cooling compartment in which the cooling device is placed and a joining portion between the defrosting pipe and a machine compartment in which the compressor and the drain pan are placed, and a defrosting pipe heater provided on an outer periphery of the defrosting pipe cover. No portion of the defrosting pipe heater overlaps any other portion of the defrosting pipe heater in a direction normal to the defrosting pipe heater.

Advantageous Effects of Invention

[0009]

The refrigerator according to the embodiment of the present disclosure includes the first vacuum heat insulation material fixed to the outer cabinet and the second vacuum heat insulation material fixed to the inner cabinet, and the second vacuum heat insulation material has a dimension less than a dimension of the first vacuum heat insulation material. Accordingly, freezing of the defrosting pipe can be prevented without sacrificing the overall heat insulation performance and ease of assembly of the refrigerator.

Brief Description of Drawings

[0010]

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

[Fig. 2] Fig. 2 is a side sectional view of the refrigerator according to Embodiment 1 of the present disclosure.

[Fig. 3] Fig. 3 is a side sectional view of a refrigerator according to Embodiment 2 of the present disclosure.

[Fig. 4] Fig. 4 is a side sectional view of a region including a freezer compartment of a refrigerator according to Embodiment 3 of the present disclosure.

[Fig. 5] Fig. 5 is a schematic side sectional view of a refrigerator according to Embodiment 4 of the present disclosure.

[Fig. 6] Fig. 6 is an enlarged view of a region including a defrosting pipe of the refrigerator according to Embodiment 4 of the present disclosure.

[Fig. 7] Fig. 7 is a perspective view of a defrosting pipe cover on which a defrosting pipe heater is disposed.

[Fig. 8] Fig. 8 is a development diagram of the defrosting pipe heater.

Description of Embodiments

[0011]

Embodiment 1

5 Fig. 1 is a front view of a refrigerator 1 according to Embodiment 1 of the present disclosure. As illustrated in Fig. 1, the refrigerator 1 has a plurality of drawers, and includes a refrigerator compartment 100, a versatile compartment 200, an ice-making compartment 300, a vegetable compartment 400, and a freezer compartment 500. These compartments are referred to also as storage compartments. The refrigerator
10 compartment 100 has opening-closing doors 11, and is disposed in an uppermost section of the refrigerator 1. The versatile compartment 200 is configured such that a temperature zone thereof can be switched between a freezing temperature zone of around -18 degrees C and a mild freezing temperature zone of around -7 degrees C. The versatile compartment 200 has a drawer 12, and is disposed below the refrigerator
15 compartment 100. The ice-making compartment 300 has a drawer 13, and is disposed next to the versatile compartment 200. The vegetable compartment 400 has a drawer 14, and is disposed below the versatile compartment 200 and the ice-making compartment 300. The freezer compartment 500 has a drawer 15, and is disposed in a lowermost section of the refrigerator 1. The temperatures in the storage
20 compartments may be adjusted by, for example, an operation unit 10. The configuration of the refrigerator 1 may instead be such that the versatile compartment 200 and the ice-making compartment 300 are not provided, and is not particularly limited.

[0012]

25 Fig. 2 is a side sectional view of the refrigerator 1 according to Embodiment 1 of the present disclosure. As illustrated in Fig. 2, the refrigerator 1 includes a cabinet body 50 composed of an inner cabinet 51 in which the storage compartments are formed and an outer cabinet 52 that is provided outside the inner cabinet 51 and that defines an outer frame. A cooling device 17, a compressor 19, and a fan 18 are
30 disposed between the inner cabinet 51 and the outer cabinet 52 in the refrigerator 1.

[0013]

A first vacuum heat insulation material 54 is fixed to the outer cabinet 52, and a second vacuum heat insulation material 55 is fixed to the inner cabinet 51. The space between the inner cabinet 51 and the outer cabinet 52 is filled with a urethane foam 16.

5 The first vacuum heat insulation material 54, the second vacuum heat insulation material 55, and the urethane foam 16 reduce penetration of heat into the storage compartments. The urethane foam 16 may be, for example, a rigid urethane foam.

[0014]

The cooling device 17 generates cold air for cooling the storage compartments.

10 A machine compartment 24 is provided in a region adjacent to the freezer compartment 500 and between the inner cabinet 51 and the outer cabinet 52, and the compressor 19 is placed therein. The cooling device 17 is disposed above the machine compartment 24 in which the compressor 19 is disposed, and is driven by the compressor 19 to generate cold air. The cold air generated by the cooling device 17 is introduced to
15 each storage compartment by the fan 18. The temperature of each storage compartment is detected by a thermistor (not shown) installed in the storage compartment, and is controlled at a preset temperature by adjusting the opening degree of a damper (not shown), the output of the compressor 19, and the amount of air sent by the fan 18. The storage compartments have food shelves 20 and food containers
20 21 to partition the storage spaces therein.

[0015]

A defrosting heater 22, a defrosting pipe 53, and a drain pan 23 are provided between the cooling device 17 and the compressor 19. The defrosting heater 22 is disposed below the cooling device 17 and defrosts the cooling device 17. The
25 defrosting pipe 53, which allows defrost water to pass therethrough, is a pipe that extends from a position below the cooling device 17 to the machine compartment 24. The drain pan 23, in which the defrost water accumulates, is positioned below the defrosting pipe 53 and on the upper surface of the compressor 19, for example. The defrosting pipe 53 may be disposed to connect the cooling device 17 to the drain pan
30 23.

[0016]

The first vacuum heat insulation material 54 on the outer cabinet 52 has a flat shape, and covers rear surfaces of the refrigerator compartment 100, the versatile compartment 200, the ice-making compartment 300, and the vegetable compartment 400. The first vacuum heat insulation material 54 is not disposed between the outer cabinet 52 and the machine compartment 24 that is adjacent to the freezer compartment 500. The first vacuum heat insulation material 54 is bonded to the outer cabinet 52 with, for example, an adhesive.

[0017]

The second vacuum heat insulation material 55 on the inner cabinet 51 is positioned between the freezer compartment 500 and the defrosting pipe 53 and between the freezer compartment 500 and the machine compartment 24. The second vacuum heat insulation material 55 has a dimension less than that of the first vacuum heat insulation material 54, and is partially bent so that the shape thereof follows the shape of the inner cabinet 51. The dimension of the first vacuum heat insulation material 54 or the second vacuum heat insulation material 55 means the lengths in the vertical direction, the left-right direction, and the thickness direction before the second vacuum heat insulation material 55 is bent, or a surface area. The second vacuum heat insulation material 55 is bonded with, for example, an adhesive to the inner cabinet 51, which is formed such that the inner cabinet 51 does not interfere with surrounding components, such as the defrosting pipe 53 and the machine compartment 24.

[0018]

When the refrigerator 1 is in operation and the temperature around the cooling device 17 is reduced, frost may accumulate on the cooling device 17. The defrosting heater 22 melts the frost that has accumulated on the cooling device 17 into defrost water. The defrost water flows through the defrosting pipe 53 disposed between the cooling device 17 and the drain pan 23, and accumulates in the drain pan 23 disposed on the upper surface of the compressor 19. The defrost water is vaporized by heat from the compressor 19, and is discharged through an outlet 25 formed in the machine compartment 24.

[0019]

The defrosting pipe 53 through which the defrost water flows is thermally insulated from the freezer compartment 500, which is at a low temperature, by the second vacuum heat insulation material 55 disposed between the defrosting pipe 53 and the inner cabinet 51. Therefore, the defrost water is not easily cooled due to the influence of the temperature in the freezer compartment 500, and input of heat from the compressor 19 and the outside air to the freezer compartment 500 can be reduced.

[0020]

Since the first vacuum heat insulation material 54 is not disposed between the defrosting pipe 53 and the outer cabinet 52 or between the machine compartment 24 and the outer cabinet 52, the level of heat insulation between the defrosting pipe 53 and the outside air and between the machine compartment 24 and the outside air is low. Therefore, heat from the compressor 19 disposed in the machine compartment 24 can be easily dissipated to the outside of the refrigerator 1, and input of heat from the outside air to the defrosting pipe 53 can be easily increased.

[0021]

The first vacuum heat insulation material 54 can be easily fixed because it has a large dimension and a flat shape, and can be maintained in a state such that sufficient adhesion force is applied thereto because it has a large bonding area. The second vacuum heat insulation material 55 has a dimension less than that of the first vacuum heat insulation material 54, and is therefore lighter than the first vacuum heat insulation material 54. Accordingly, even when the second vacuum heat insulation material 55 cannot be easily disposed in contact with the inner cabinet 51 over a large contact area, separation of the second vacuum heat insulation material 55 due to, for example, aging can be prevented.

[0022]

The above-described refrigerator 1 according to Embodiment 1 includes the first vacuum heat insulation material 54 fixed to the outer cabinet 52 and the second vacuum heat insulation material 55 disposed between the inner cabinet 51 and the defrosting pipe 53 and having a dimension less than that of the first vacuum heat insulation

material 54. Therefore, the first vacuum heat insulation material 54 and the second vacuum heat insulation material 55 can be reliably bonded. In addition, input of heat from the outside air to each storage compartment is reduced. Furthermore, since the first vacuum heat insulation material 54 is not disposed between the defrosting pipe 53 and the outer cabinet 52 or between the machine compartment 24 and the outer cabinet 52, heat generated by the compressor 19 can be efficiently dissipated to the outside of the refrigerator 1. In addition, input of heat from the outside air to the defrosting pipe 53 is increased, so that freezing of the defrost water can be suppressed.

[0023]

In addition, since the second vacuum heat insulation material 55 is positioned between the inner cabinet 51 and the defrosting pipe 53, the defrost water that flows through the defrosting pipe 53 is prevented from being cooled and frozen due to the influence of the temperature of the freezer compartment 500.

[0024]

In addition, since the second vacuum heat insulation material 55 is positioned between the inner cabinet 51 and the machine compartment 24 in which the compressor 19 is disposed, input of heat from the compressor 19 and the outside air to the freezer compartment 500 is reduced, so that power consumption of the refrigerator 1 can be reduced.

[0025]

In addition, since the second vacuum heat insulation material 55, which is smaller than the first vacuum heat insulation material 54, has a bent shape that follows the shape of the machine compartment 24, the contact area between the second vacuum heat insulation material 55 and the inner cabinet 51, which is formed to not interfere with surrounding components, such as the defrosting pipe 53 and the machine compartment 24, can be increased. Accordingly, the adhesion force between the second vacuum heat insulation material 55 and the inner cabinet 51 can be increased, and separation of the second vacuum heat insulation material 55 due to, for example, aging can be prevented. In addition, since it is not necessary to divide the second vacuum heat insulation material 55 into a plurality of pieces, the coverage can be increased to

improve the heat insulation performance, and the ease of handling of the second vacuum heat insulation material 55 is not reduced.

[0026]

The first vacuum heat insulation material 54 is not disposed between the outer cabinet 52 and the compressor 19, and is also not disposed between the outer cabinet 52 and the defrosting pipe 53. Therefore, heat generated by the compressor 19 is efficiently dissipated to the outside of the refrigerator 1, so that power consumption of the refrigerator 1 can be reduced.

[0027]

Embodiment 2

Fig. 3 is a side sectional view of a refrigerator 1 according to Embodiment 2 of the present disclosure. This refrigerator 1 has basically the same structure as that in Embodiment 1, but includes a defrosting pipe 53 and a first vacuum heat insulation material 54 having structures different from those in Embodiment 1.

[0028]

As illustrated in Fig. 3, the defrosting pipe 53 included in the refrigerator 1 according to Embodiment 2 is provided with a defrosting pipe heater 56 on an inner surface thereof. The defrosting pipe heater 56 is energized depending on the operational state of the refrigerator 1 and the ambient environment. The defrosting pipe heater 56 is preferably fixed to the defrosting pipe 53.

[0029]

The first vacuum heat insulation material 54 covers the rear surfaces of the refrigerator compartment 100, the versatile compartment 200, the ice-making compartment 300, and the vegetable compartment 400, and is fixed to the outer cabinet 52 such that the first vacuum heat insulation material 54 extends to a position between the defrosting pipe 53 and the outer cabinet 52. The first vacuum heat insulation material 54 does not cover the machine compartment 24 in which the compressor 19 is disposed.

[0030]

The defrosting heater 22 melts the frost that has accumulated on the cooling device 17 into defrost water, which reaches the defrosting pipe 53. The defrost water flows through the defrosting pipe 53 while receiving heat from the defrosting pipe heater 56 provided on the defrosting pipe 53, and accumulates in the drain pan 23. Then, the defrost water is vaporized by heat from the compressor 19, and is discharged to the outside.

[0031]

Since the defrosting pipe heater 56 is provided, input of heat to the defrosting pipe 53 is increased. Accordingly, even when the temperature of the defrosting pipe 53 is reduced due to cold air from each storage compartment, the defrost water is prevented from being cooled by the defrosting pipe 53 and frozen.

[0032]

The first vacuum heat insulation material 54 is disposed between the defrosting pipe 53 and the outer cabinet 52 so that the defrosting pipe 53 is thermally insulated from the outside air. Therefore, heat from the defrosting pipe heater 56 is efficiently input to the defrost water, and is not easily dissipated to the outside air.

[0033]

According to the above-described refrigerator 1 of Embodiment 2, the defrosting pipe heater 56 is fixed to the defrosting pipe 53, and the first vacuum heat insulation material 54 is disposed between the defrosting pipe 53 and the outer cabinet 52. Therefore, heat from the defrosting pipe heater 56 is not easily dissipated to the outside air, and is efficiently input to the defrost water in the defrosting pipe 53. As a result, power consumption can be reduced.

[0034]

In addition, since the first vacuum heat insulation material 54 is not disposed between the outer cabinet 52 and the compressor 19, heat generated by the compressor 19 can be efficiently dissipated to the outside of the refrigerator 1, so that power consumption of the refrigerator 1 can be reduced.

[0035]

Embodiment 3

Fig. 4 is a side sectional view of a region including a freezer compartment 500 of a refrigerator 1 according to Embodiment 3 of the present disclosure. This refrigerator 1 has basically the same structure as that in Embodiment 1, but includes a second vacuum heat insulation material 55 having a shape different from that in Embodiment 1.

[0036]

As illustrated in Fig. 4, in the refrigerator 1 according to Embodiment 3 of the present disclosure, the second vacuum heat insulation material 55 has a first recess 55a and a second recess 55b formed therein.

[0037]

The first recess 55a is formed in a contact surface of the second vacuum heat insulation material 55 that is in contact with the inner cabinet 51. A projection 51a is formed on a portion of the inner cabinet 51 on which the second vacuum heat insulation material 55 is disposed. The projection 51a and the first recess 55a engage with each other so that the second vacuum heat insulation material 55 is fixed to the inner cabinet 51.

[0038]

The second recess 55b is formed in a surface of the second vacuum heat insulation material 55 that is opposite to the contact surface in contact with the inner cabinet 51. The second recess 55b is provided in a region where the inner cabinet 51 and the machine compartment 24 are close to each other. The first recess 55a and the second recess 55b are spaced from each other so that they do not overlap on a projection plane.

[0039]

The second vacuum heat insulation material 55 extends along the inner cabinet 51 on which the projection 51a is formed. The first recess 55a in the second vacuum heat insulation material 55 and the projection 51a formed on the inner cabinet 51 are engaged with each other to position the second vacuum heat insulation material 55. In this state, the second vacuum heat insulation material 55 and the inner cabinet 51 are bonded together with, for example, an adhesive, and are thereby fixed together.

[0040]

The second vacuum heat insulation material 55 fixed to the inner cabinet 51 is covered with the urethane foam 16 over the surface opposite to the contact surface in contact with the inner cabinet 51. The second recess 55b in the second vacuum heat insulation material 55 serves as a flow passage for the urethane foam 16 so that the flowing properties of the urethane foam 16 are improved. Accordingly, the urethane foam 16 is evenly applied.

[0041]

The structure including the first recess 55a and the second recess 55b according to Embodiment 3 may be employed in combination with the defrosting pipe heater 56 according to Embodiment 2.

[0042]

In the refrigerator 1 according to Embodiment 3, the second vacuum heat insulation material 55 has the first recess 55a in the contact surface thereof that is in contact with the inner cabinet 51. Accordingly, the contact area between the second vacuum heat insulation material 55 and the inner cabinet 51 can be increased. In addition, the first recess 55a may serve as a reference for the position at which the second vacuum heat insulation material 55 is fixed to the inner cabinet 51. Therefore, the second vacuum heat insulation material 55 can be easily positioned in the bonding process, and can be accurately installed in accordance with the designed dimensions.

[0043]

The second vacuum heat insulation material 55 also has the second recess 55b in the surface thereof opposite to the contact surface in contact with the inner cabinet 51. Therefore, the second vacuum heat insulation material 55 and the machine compartment 24 are prevented from interfering with each other or being excessively close to each other in the region where the second vacuum heat insulation material 55 and the machine compartment 24 are close to each other. In addition, a sufficient flow passage for the urethane foam 16 can be provided. Accordingly, the flowing properties and filling properties of the urethane foam 16 are improved, and the thermal effect of the machine compartment 24 on the freezer compartment 500 is reduced so that power consumption can be reduced.

[0044]

The first recess 55a and the second recess 55b are formed at separate positions so that they do not overlap on a projection plane. Therefore, the second vacuum heat insulation material 55 is prevented from becoming excessively thin and unable to provide sufficient thermal insulation. In addition, the second vacuum heat insulation material 55 can be easily attached, and the flowing properties and filling properties of the urethane foam 16 can be improved.

[0045]

In addition, since the projection 51a formed on the inner cabinet 51 is engaged with the first recess 55a formed in the contact surface of the second vacuum heat insulation material 55, the contact surface being in contact with the inner cabinet 51, the second vacuum heat insulation material 55 can be more easily positioned in the bonding process.

[0046]

Embodiment 4

Fig. 5 is a schematic side sectional view of a refrigerator 1 according to Embodiment 4 of the present disclosure. Fig. 6 is an enlarged view of a region including a defrosting pipe 53 included in the refrigerator 1 according to Embodiment 4 of the present disclosure. The refrigerator 1 of Embodiment 4 has basically the same structure as those in Embodiments 1 to 3, but the structure thereof in the region including the defrosting pipe 53 differs from those in Embodiments 1 to 3.

[0047]

As illustrated in Figs. 5 and 6, the refrigerator 1 according to Embodiment 4 of the present disclosure includes a defrosting pipe cover 58 provided on the outer periphery of the defrosting pipe 53 disposed between the first vacuum heat insulation material 54 provided on the outer cabinet 52 and the second vacuum heat insulation material 55 provided on the inner cabinet 51. The defrosting pipe cover 58 is cylindrical, and has a defrosting pipe heater 56 on the outer periphery thereof. The defrosting pipe cover 58 and the defrosting pipe heater 56 are disposed between the first vacuum heat insulation material 54 and the second vacuum heat insulation material 55. The defrosting pipe

cover 58 and the defrosting pipe heater 56 are surrounded by the urethane foam 16 that fills the space between the defrosting pipe 53 and the first vacuum heat insulation material 54 and the space between the defrosting pipe 53 and the second vacuum heat insulation material 55.

5 [0048]

The defrosting pipe cover 58 covers a joining portion 53a at which the defrosting pipe 53 is joined to a cooling compartment 57, which is positioned above the defrosting pipe 53 and in which the cooling device 17 and the defrosting heater 22 are placed. The defrosting pipe cover 58 also covers a joining portion 53b at which the defrosting
10 pipe 53 is joined to the machine compartment 24 positioned below the defrosting pipe 53.

[0049]

Drain water generated in the cooling compartment 57 passes through the defrosting pipe 53 from a lower section of the cooling compartment 57 and accumulates
15 in the drain pan 23 disposed in the machine compartment 24. If the joining portion 53a between the cooling compartment 57 and the defrosting pipe 53 or the joining portion 53b between the defrosting pipe 53 and the machine compartment 24 has a gap, the drain water may leak through the gap. Even in such a case, since the outer surfaces of the joining portion 53a and the joining portion 53b are covered with the defrosting
20 pipe cover 58, the drain water does not enter the urethane foam 16.

[0050]

In Fig. 6, the defrosting pipe cover 58 is composed of a single component that covers the joining portion 53a between the defrosting pipe 53 and the cooling compartment 57 and the joining portion 53b between the defrosting pipe 53 and the
25 machine compartment 24. However, the structure of the defrosting pipe cover 58 is not limited to the illustrated structure. For example, the defrosting pipe cover 58 may instead be composed of two components, which are a component that covers the joining portion 53a between the defrosting pipe 53 and the cooling compartment 57 and a component that covers the joining portion 53b between the defrosting pipe 53 and the
30 machine compartment 24.

[0051]

The defrosting pipe cover 58 may instead be configured to cover only one of the joining portion 53a between the defrosting pipe 53 and the cooling compartment 57 and the joining portion 53b between the defrosting pipe 53 and the machine compartment
5 24. In such a case, the drain water can be prevented from entering the urethane foam 16 from the joining portion 53a or the joining portion 53b.

[0052]

The defrosting pipe cover 58 may be configured to cover both the joining portion 53a and the joining portion 53b. In such a case, the drain water can be more reliably
10 prevented from entering the urethane foam 16.

[0053]

Fig. 7 is a perspective view of the defrosting pipe cover 58 on which the defrosting pipe heater 56 is disposed. Fig. 8 is a development diagram of the defrosting pipe heater 56.
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[0054]

As illustrated in Figs. 7 and 8, the defrosting pipe heater 56 includes a heater wire 56a and a sheet-shaped aluminum plate 56b, and is wrapped around the cylindrical defrosting pipe cover 58. The defrosting pipe heater 56 is disposed such that one surface of the aluminum plate 56b is in contact with the outer peripheral surface of the
20 defrosting pipe cover 58.

[0055]

The heater wire 56a is bent and extends along the other surface of the aluminum plate 56b, that is, the surface that is not in contact with the outer peripheral surface of the defrosting pipe cover 58, over the entire region thereof. No portion of the heater
25 wire 56a overlaps any other portion of the heater wire 56a in a direction normal to the aluminum plate 56b.

[0056]

The aluminum plate 56b is wrapped around the outer peripheral surface of the defrosting pipe cover 58 so that one pair of sides thereof that are opposite to each other extend in the circumferential direction of the defrosting pipe cover 58, and that another
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pair of sides thereof extend in an axial direction of the defrosting pipe cover 58. The dimension of the one pair of sides of the aluminum plate 56b that are opposite to each other is less than the circumference of the defrosting pipe cover 58 by a dimension A shown in Fig. 7. One of the other pair of sides of the aluminum plate 56b does not overlap the other of the other pair of sides of the aluminum plate 56b when the defrosting pipe heater 56 is wrapped around the defrosting pipe cover 58. The dimension A is a dimension of a region in which the one and the other of the other pair of sides of the aluminum plate 56b do not overlap, and is at least greater than zero. Preferably, the dimension A is at least less than half of the circumference of the defrosting pipe cover 58, and is as small as possible.

[0057]

Since the defrosting pipe heater 56 is wrapped around the outer periphery of the defrosting pipe cover 58 as described above, the drain water is blocked by the defrosting pipe cover 58 and prevented from coming into contact with the defrosting pipe heater 56.

[0058]

As described above, the defrosting pipe heater 56 is formed such that the heater wire 56a does not overlap itself and that the aluminum plate 56b does not overlap itself when the defrosting pipe heater 56 is wrapped around the defrosting pipe cover 58.

Accordingly, the defrosting pipe cover 58 does not cause a local temperature increase, and is prevented from being deformed or melted due to heat.

[0059]

The defrosting pipe heater 56 is formed such that the dimension A, which is the difference between the circumference of the defrosting pipe cover 58 and the dimension of the pair of sides of the dimension of the pipe heater 56 that are opposite to each other and that extend in the circumferential direction of the defrosting pipe cover 58, is greater than zero but is as small as possible. Accordingly, the defrosting pipe heater 56 and the defrosting pipe cover 58 are in contact with each other over a large area, and heat can be efficiently input from the defrosting pipe heater 56 to the defrosting pipe cover 58 and the defrosting pipe 53.

[0060]

The defrosting pipe heater 56 is disposed between the first vacuum heat insulation material 54 and the second vacuum heat insulation material 55 together with the defrosting pipe cover 58 and the defrosting pipe 53, so that heat from the defrosting pipe heater 56 is not easily dissipated to the outside. Therefore, heat can be efficiently input from the defrosting pipe heater 56 to the defrosting pipe cover 58 and the defrosting pipe 53. The defrosting pipe heater 56 may instead be structured such that the first vacuum heat insulation material 54 is not disposed between the defrosting pipe heater 56 and the outer cabinet 52. However, when the first vacuum heat insulation material 54 is provided dissipation of heat from the defrosting pipe heater 56 to the outside can be more reliably reduced.

[0061]

According to the above-described refrigerator 1 of Embodiment 4, the joining portion 53a between the cooling compartment 57 and the defrosting pipe 53 and the joining portion 53b between the defrosting pipe 53 and the machine compartment 24 are covered by the defrosting pipe cover 58. Therefore, even when the drain water leaks from the joining portion 53a or the joining portion 53b, the drain water does not enter the urethane foam 16 to cause a degradation of the heat insulation performance, and the urethane foam 16 can be prevented from being deformed due to swelling.

[0062]

In addition, since the defrosting pipe heater 56 is provided on the outer periphery of the defrosting pipe cover 58, even when the drain water leaks from the joining portion 53a or the joining portion 53b, the drain water is blocked by the defrosting pipe cover 58 and prevented from coming into contact with the defrosting pipe heater 56. Therefore, it is not necessary that the defrosting pipe heater 56 be waterproofed, for example, and an inexpensive and safe refrigerator 1 in which freezing of the defrosting pipe 53 is prevented can be proposed.

[0063]

The defrosting pipe cover 58 and the defrosting pipe heater 56 according to Embodiment 4 may be employed in combination with the structures of Embodiments 1 to 3.

Reference Signs List

[0064]

1 refrigerator 10 operation unit 11 opening-closing door 12, 13, 14, 15
drawer 16 urethane foam 17 cooling device 18 fan 19 compressor 20
food shelf 21 food container 22 defrosting heater 23 drain pan 24 machine
compartment 25 outlet 50 cabinet body 51 inner cabinet 51a projection
52 outer cabinet 53 defrosting pipe 53a, 53b joining portion 54 first vacuum
heat insulation material 55 second vacuum heat insulation material 55a first
recess 55b second recess 56 defrosting pipe heater 56a heater wire 56b
aluminum 57 cooling compartment 58 defrosting pipe cover 100 refrigerator
compartment 200 versatile compartment 300 ice-making compartment 400
vegetable compartment 500 freezer compartment material.

CLAIMS

[Claim 1]

A refrigerator comprising:

5 a cabinet body including an inner cabinet in which a storage compartment is formed and an outer cabinet that is provided outside the inner cabinet and that defines an outer frame;

a cooling device that generates cold air;

a compressor that drives the cooling device;

a drain pan in which defrost water generated by the cooling device accumulates;

10 a defrosting pipe through which the defrost water flows to the drain pan;

a first vacuum heat insulation material fixed to the outer cabinet; and

a second vacuum heat insulation material fixed to the inner cabinet,

wherein the cooling device, the compressor, and the defrosting pipe are disposed between the inner cabinet and the outer cabinet, and

15 wherein the second vacuum heat insulation material is disposed between the inner cabinet and the defrosting pipe and has a dimension less than a dimension of the first vacuum heat insulation material, the refrigerator comprising:

20 a defrosting pipe cover that covers at least one of a joining portion between the defrosting pipe and a cooling compartment in which the cooling device is placed and a joining portion between the defrosting pipe and a machine compartment in which the compressor and the drain pan are placed; and

a defrosting pipe heater provided on an outer periphery of the defrosting pipe cover, and

25 wherein no portion of the defrosting pipe heater overlaps any other portion of the defrosting pipe heater in a direction normal to the defrosting pipe heater.

[Claim 2]

The refrigerator of claim 1, wherein the second vacuum heat insulation material is disposed between the inner cabinet and the compressor.

[Claim 3]

The refrigerator of claim 1 or 2, wherein the second vacuum heat insulation material extends along an outer surface of the inner cabinet.

[Claim 4]

5 The refrigerator of any one of claims 1 to 3, wherein the second vacuum heat insulation material has a bent shape that follows a shape of the inner cabinet.

[Claim 5]

The refrigerator of any one of claims 1 to 4, wherein the first vacuum heat insulation material is not disposed between the outer cabinet and the defrosting pipe.

10 [Claim 6]

The refrigerator of any one of claims 1 to 4, further comprising:
a heater fixed to the defrosting pipe,
wherein the first vacuum heat insulation material is disposed between the outer cabinet and the defrosting pipe.

15 [Claim 7]

The refrigerator of any one of claims 1 to 6, wherein the first vacuum heat insulation material is not disposed between the outer cabinet and the compressor.

[Claim 8]

20 The refrigerator of any one of claims 1 to 7, wherein the second vacuum heat insulation material has a first recess in a contact surface thereof that is in contact with the inner cabinet.

[Claim 9]

25 The refrigerator of any one of claims 1 to 8, wherein the second vacuum heat insulation material has a second recess in a surface thereof that is opposite to a contact surface thereof that is in contact with the inner cabinet.

[Claim 10]

30 The refrigerator of any one of claims 1 to 7, wherein the second vacuum heat insulation material has a first recess in a contact surface thereof that is in contact with the inner cabinet and a second recess in a surface thereof that is opposite to the contact surface in contact with the inner cabinet, and

wherein the first recess and the second recess do not overlap on a projection plane.

[Claim 11]

5 The refrigerator of claim 10, wherein the inner cabinet has a projection on a contact surface thereof that is in contact with the second vacuum heat insulation material, and

wherein the first recess and the projection are engaged with each other.