

DESCRIPTION

[Title of Invention] REFRIGERATOR-FREEZER

[Technical Field]

[0001]

5 The present invention relates to a refrigerator-freezer in which a refrigerator is disposed above a freezer and a circulation fan for inside cooling and a refrigerator-cooling fan which sends cold air to the refrigerator are provided.

[Background Art]

[0002]

10 In large-capacity refrigerator-freezers, particularly, a large-capacity refrigerator-freezer of such a type that a high temperature compartment (i.e., a chilling temperature zone compartment, such as a refrigerator or a vegetable compartment) is disposed above a low temperature compartment (i.e., a refrigeration temperature zone compartment, such as a freezer or an ice-making compartment), a cooler for
15 cooling inside air is placed at the back of the low temperature compartment, and cold air cooled by the cooler is circulated by a circulation fan to cool the inside, it is increasingly difficult to cool the top shelf of the high temperature compartment, which has a large capacity and is positioned high, using a single circulation fan. For this reason, a refrigerator has been proposed which further includes a fan for cooling a
20 high temperature compartment to effectively cool the high temperature compartment (for example, refer to Patent Literature 1).

[Prior Art References]

[Patent Literature]

[0003]

25 [Patent Literature 1] Japanese Patent No. 4667307 (p. 5, Figs. 3 and 4)

[Summary of Invention]

[Technical Problem]

[0004]

30 The refrigerator disclosed in Patent Literature 1 has an air path structure in which the flow of cold air blown from an insidecooling circulation fan positioned in the

vicinity of an outlet of a cooler placed on the rear surface of a low temperature compartment is split into cold air flowing into the low temperature compartment and cold air flowing into the high temperature compartment, the cold air flowing to the high temperature compartment is blown into the high temperature compartment by the high temperature compartment-cooling fan placed on the rear surface of the high temperature compartment.

[0005]

In this structure, however, when the high temperature compartment-cooling fan is driven to rotate upon cooling of the high temperature compartment, cold air supplied to the low temperature compartment is partly supplied to the high temperature compartment in order to cool the high temperature compartment, as illustrated in Fig. 5, so that the quantity of cold air blown into the low temperature compartment is reduced. Disadvantageously, the efficiency of cooling in the low temperature compartment is lowered.

[0006]

The present invention has been made to overcome the above-described disadvantage and an object thereof is to provide a refrigerator-freezer in which the whole of cold air in a cooler compartment is sent to a low temperature compartment and the cold air in the low temperature compartment is sent to a high temperature compartment upon cooling of the high temperature compartment, whereby even in a case in which the high temperature compartment is cooled, there is no possibility that the cooling efficiency in the low temperature compartment would be lowered.

[Solution to Problem]

[0007]

The present invention provides a refrigerator-freezer including a low temperature compartment, a high temperature compartment positioned above the low temperature compartment, a thermal insulating partition wall that separates the low temperature compartment and the high temperature compartment, a cooler compartment positioned at the back of the low temperature compartment, a first fan that sends the whole of cold air in the cooler compartment to the low temperature

compartment, a high-temperature-compartment duct positioned at the back of the high temperature compartment, and a second fan that sends the cold air in the low temperature compartment to the high-temperature-compartment duct.

[Advantageous Effects of Invention]

5 [0008]

According to the present invention, the whole of cold air in the cooler compartment is sent to the low temperature compartment by the first fan. To cool the high temperature compartment, the cold air in the low temperature compartment is sent to the high temperature compartment by the second fan. Advantageously, even
10 in a case of cooling the high temperature compartment, there is no possibility that the cooling efficiency in the low temperature compartment would be lowered.

[Brief Description of Drawings]

[0009]

[Fig. 1] Fig. 1 is a schematic diagram of a refrigerator-freezer according to
15 Embodiment 1 of the present invention, and illustrates a state in which a door of the refrigerator-freezer is detached.

[Fig. 2] Fig. 2 is a sectional view taken along the line A-A in Fig. 1, with some parts being omitted.

[Fig. 3] Fig. 3 is a diagram illustrating a cold air path in the refrigerator-freezer
20 according to the present invention.

[Fig. 4] Fig. 4 is a diagram explaining essential part of a refrigerator-freezer according to Embodiment 2 of the present invention.

[Fig. 5] Fig. 5 is a diagram illustrating a cold air path in a conventional refrigerator-freezer.

25 [Description of Embodiments]

[0010]

[Embodiment 1]

Fig. 1 is a schematic diagram of a refrigerator-freezer according to Embodiment 1 of the present invention, and illustrates a state in which a door of the

refrigerator-freezer is detached. Fig. 2 is a sectional view taken along the line A-A in Fig. 1, with some parts being omitted.

In Figs. 1 and 2, a thermally insulated casing 1 constitutes a refrigerator-freezer body with an open front and includes an outer case 1a made of a steel plate, an inner case 1b which serves as a resin molded component, and a thermal insulator 1c filled in a space between the outer case 1a and the inner case 1b.

[0011]

A thermal insulating partition wall 2 separates a low temperature compartment 3, such as a freezer, and a high temperature compartment 4, such as a refrigerator.

The low temperature compartment 3 is partitioned into two sections by a low-temperature-compartment partition wall 5. The low-temperature-compartment partition wall 5 may be omitted and the low temperature compartment 3 may be a single space. A low-temperature-compartment door 6 opens and closes a front opening of the low temperature compartment 3. A high-temperature-compartment door 7 opens and closes a front opening of the high temperature compartment 4.

[0012]

A low-temperature-compartment back thermal insulating wall 8 is placed at the back of the low temperature compartment 3. A cooler compartment 9 is provided between the low-temperature-compartment back thermal insulating wall 8 and the inner case 1b of the thermally insulation casing 1. A cooler 10 is placed in the cooler compartment 9. An outlet duct 11 permits upper part of the low temperature compartment 3 to communicate with the cooler compartment 9. A return duct 12 permits lower part of the low temperature compartment 3 to communicate with the cooler compartment 9. An inside cooling fan (hereinafter, referred to as a "first fan") 13 is placed in the outlet duct 11.

[0013]

A high-temperature-compartment back thermal insulating wall 14 is placed at the back of the high temperature compartment 4. A high-temperature-compartment duct 15 is provided between the high-temperature-compartment back thermal insulating wall 14 and the inner case 1b of the thermally insulation casing 1.

The thermal insulating partition wall 2 includes a cold air intake duct 16 of which one end opens into the low temperature compartment 3 to form an air inlet 16a, and the other end of the duct opens into the high-temperature-compartment duct 15 to form an air outlet 16b.

[0014]

A high-temperature-compartment cooling fan (hereinafter, referred to as a "second fan") 17 is placed at the air outlet 16b of the cold air intake duct 16 to the high-temperature-compartment duct 15. Referring to Fig. 1, low-temperature-compartment cold air outlets 18 are provided in the low-temperature-compartment back thermal insulating wall 8 and permit the low temperature compartment 3 to communicate with the cooler compartment 9. High-temperature-compartment cold air outlets 19 are arranged in the high-temperature-compartment back thermal insulating wall 14 and permit the high temperature compartment 4 to communicate with the high-temperature-compartment duct 15.

[0015]

A cooling action of the refrigerator-freezer having the above-described structure will be described below.

The whole of air (cold air), cooled by the cooler 10, in the cooler compartment 9 is blown into the low temperature compartment 3 through the outlet duct 11 and the low-temperature-compartment cold air outlets 18 by the first fan 13, so as to cool the inside of the low temperature compartment 3. The air is returned through the return duct 12 to the cooler compartment 9 and is again cooled by the cooler 10.

[0016]

When the inside of the high temperature compartment 4 is cooled, the second fan 17 is driven to rotate. Thus, the cold air in the low temperature compartment 3 is sucked through the air inlet 16a into the cold air intake duct 16 and is sent through the air outlet 16b to the high-temperature-compartment duct 15 and is then blown through the high-temperature-compartment cold air outlets 19 provided in the high-temperature-compartment back thermal insulating wall 14, thus cooling the inside of

the high temperature compartment 4. The air is returned from a high-temperature-compartment return duct (not illustrated) to the cooler compartment 9.

[0017]

As described above, in Embodiment 1, the whole of the lowest temperature cold air cooled in the cooler compartment 9 is sent to the low temperature compartment 3 by the first fan 13, and the cold air is used to cool the low temperature compartment 3, as illustrated in Fig. 3. Furthermore, the cold air, serving as the atmosphere in the low temperature compartment 3, sent through the cold air intake duct 16 is used to cool the high temperature compartment 4. Although this cold air has a higher temperature than the cold air blown directly from the first fan 13, the higher temperature cold air is sufficient to cool the inside of the high temperature compartment 4 at a target temperature.

[0018]

Furthermore, an area close to the air inlet 16a of the cold air intake duct 16 is at a low pressure. Accordingly, placing the air inlet 16a in a position (for example, near the low-temperature-compartment door 6) where the temperature tends to rise in the low temperature compartment 3 enables the cold air blown into the low temperature compartment 3 by the first fan 13 to be drawn to the air inlet 16a of the cold air intake duct 16, thereby making it possible to reduce temperature variations in the low temperature compartment 3.

[0019]

Furthermore, an air path is configured such that the whole of cold air in the cooler compartment 9 is sent to the low temperature compartment 3. Accordingly, the quantity of cold air sent to the low temperature compartment 3 is not reduced during cooling of the high temperature compartment 4. Advantageously, an increase in temperature in the low temperature compartment 3 can be minimized.

[0020]

[Embodiment 2]

Fig. 4 is a diagram explaining principal part of a refrigerator-freezer according to Embodiment 2 of the present invention. The same components as those in Embodiment 1 are designated by the same reference numerals.

According to Embodiment 2, a refrigerator-freezer having the low-temperature-compartment partition wall 5 illustrated in Fig. 1, in the low temperature compartment 3 thereof is presented, wherein cold air in the low temperature compartment 3 is led to the high temperature compartment 4 and a cold air intake duct 20 is provided in the low-temperature-compartment partition wall 5. The cold air intake duct 20 has an air inlet 20a at one end and an air outlet 20b at the other end, the air inlet 20a opening into the low temperature compartment 3, the air outlet 20b extending through the thermal insulating partition wall 2 and opening into the high-temperature-compartment duct 15. The second fan 17 is placed at the air outlet 20b.

[0021]

Embodiment 2 offers substantially the same advantages as those of Embodiment 1. In addition, since the most part of the cold air intake duct 20 is placed in the low-temperature-compartment partition wall 5, the thickness of a thermal insulating layer, serving as the thermal insulating partition wall 2 separating the low temperature compartment 3 and the high temperature compartment 4, is not reduced.

Furthermore, since the sections on both sides of the low-temperature-compartment partition wall 5 in the low temperature compartment 3 are in the same temperature zone, a thermal insulating structure between the sections may be omitted or be very thin. The area of the duct leading to the high temperature compartment 4 can be sufficiently secured without taking account of the influence of the temperature of the inside of the refrigerator-freezer, which is caused by reduction of thermal insulation.

[0022]

Furthermore, although not illustrated, the cold air intake duct 16 according to Embodiment 1 and the cold air intake duct 20 according to Embodiment 2 may be provided in the thermal insulating partition wall 2 and the low-temperature-

compartment partition wall 5, respectively, depending on the temperature distribution in the low temperature compartment 3.

[0023]

[Embodiment 3]

5 According to Embodiment 3, a damper 21 (refer to Fig. 2) which closes and opens an air path is placed upstream of the second fan 17 in the cold air intake duct 16 or 20 positioned in the thermal insulating partition wall 2 or the low-temperature-compartment partition wall 5 in the refrigerator-freezer according to Embodiment 1 or 2.

10 According to Embodiment 3, the flow of cold air from the low temperature compartment 3 to the high temperature compartment 4 can be interrupted with reliability by closing the damper 21. Thus, temperature in the low temperature compartment 3 can be more reliably controlled.

[Explanation of Reference Numerals]

15 [0024]

1: thermally insulation casing, 1a: outer case, 1b: inner case, 1c: thermal insulator, 2: thermal insulating partition wall, 3: low temperature compartment, 4: high temperature compartment, 5: low-temperature-compartment partition wall, 6: low-temperature-compartment door, 7: high-temperature-compartment door, 8: low-temperature-compartment back thermal insulating wall, 9: cooler compartment, 10: cooler, 11: outlet duct, 12: return duct, 13: inside cooling fan (first fan), 14: high-temperature-compartment back thermal insulating wall, 15: high-temperature-compartment duct, 16, 20: cold air intake duc, 16a, 20a: air inlet, 16b, 20b: air outlet, 17: high-temperature-compartment cooling fan (second fan), 18: low-temperature-compartment cold air outlet, 19: high-temperature-compartment cold air outlet, and 21: damper.

CLAIMS

[Claim 1]

A refrigerator-freezer comprising:

a low temperature compartment;

5 a high temperature compartment positioned above the low temperature compartment;

a thermal insulating partition wall that separates the low temperature compartment and the high temperature compartment;

10 a cooler compartment positioned at the back of the low temperature compartment;

a first fan that sends the whole of cold air in the cooler compartment to the low temperature compartment;

a high-temperature-compartment duct positioned at the back of the high temperature compartment; and

15 a second fan that sends the cold air in the low temperature compartment to the high-temperature-compartment duct.

[Claim 2]

The refrigerator-freezer of claim 1, further comprising:

20 a cold air intake duct positioned in the thermal insulating partition wall separating the low temperature compartment and the high temperature compartment, the cold air intake duct having an air inlet that opens into the low temperature compartment and communicating with the high-temperature-compartment duct,

25 wherein the second fan is positioned at an air outlet of the cold air intake duct to the high-temperature-compartment duct.

[Claim 3]

The refrigerator-freezer of claim 1, further comprising:

a low-temperature-compartment partition wall positioned in the low temperature compartment, the low-temperature-compartment partition wall partitioning the low temperature compartment into right and left sections; and

a cold air intake duct positioned in the low-temperature-compartment partition wall, the cold air intake duct having an air inlet that opens into the low temperature compartment and communicating with the high-temperature-compartment duct,

wherein the second fan is positioned at an air outlet of the cold air intake duct to the high-temperature-compartment duct.

[Claim 4]

The refrigerator-freezer of claim 1, wherein the cold air intake duct of claim 2 is positioned in the thermal insulating partition wall, and the cold air intake duct of claim 3 is positioned in the low-temperature-compartment partition, and

wherein the second fan is positioned at an air outlet of each of the cold air intake ducts.

[Claim 5]

A refrigerator-freezer comprising:

a thermally insulation casing including a low temperature compartment, a high temperature compartment, and a thermal insulating partition wall that separates the low temperature compartment and the high temperature compartment, the low temperature compartment being positioned under the thermal insulating partition wall and the high temperature compartment being positioned on the thermal insulating partition wall;

a low-temperature-compartment back thermal insulating wall positioned at the back of the low temperature compartment;

a cooler compartment positioned between the thermally insulation casing and the low-temperature-compartment back thermal insulating wall;

a cooler housed in the cooler compartment;

an outlet duct and a return duct provided in the low-temperature-compartment back thermal insulating wall, the outlet duct and the return duct permitting the low temperature compartment to communicate with the cooler compartment;

a first fan positioned in the outlet duct;

a low-temperature-compartment partition wall that partitions the low temperature compartment into right and left sections;

a high-temperature-compartment duct positioned at the back of the high temperature compartment;

a cold air intake duct positioned in the thermal insulating partition wall or the low-temperature-compartment partition wall, the cold air intake duct having an air inlet at one end and an air outlet at the other end, the air inlet opening into the low temperature compartment, the air outlet opening into the high-temperature-compartment duct; and

a second fan positioned at the air outlet of the cold air intake duct.

[Claim 6]

The refrigerator-freezer of any one of claims 2 to 5, further comprising:

a low-temperature-compartment door provided for the low temperature compartment,

wherein the air inlet of the cold air intake duct is positioned in the vicinity of the low-temperature-compartment door.

[Claim 7]

The refrigerator-freezer of any one of claims 2 to 6, further comprising:

a damper provided in the cold air intake duct at an upstream side of the second fan.