

DESCRIPTION

Title of Invention

FREEZER-REFRIGERATOR

Technical Field

5 [0001]

The present invention relates to a freezer-refrigerator provided with a cooler incorporated in a refrigerating cycle and performing cooling.

Background Art

10 [0002]

A cooler of a conventional freezer-refrigerator is comprised of a fin-and-tube type cooler made of a heat transfer pipe through which a refrigerant flows and planar fins fixed in a form penetrated by the heat transfer pipe with an interval from each other in the pipe axis direction of the heat transfer pipe, and a spiral type cooler made of a heat transfer pipe similar to the above and a fin spirally wound around its outer periphery, and a spiral-fin-tube type heat exchanger is arranged on the upstream side of the fin-and-tube type cooler in a wind direction (See Patent Document 1, for example).

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20 Citation List

Patent Literature

[0003]

[Patent Literature 1] Japanese Unexamined Patent Application
Publication No. 2003-313947 (Claims, Figs. 1 to 2)

25

Summary of Invention

Technical Problem

[0004]

However, with the above-described conventional freezer-refrigerator, the spiral-fin-tube type heat exchanger arranged on the upstream side of the fin-and-tube type cooler in the wind direction is extremely expensive as compared with the fin-and-tube type cooler. Recently, energy saving is in demand, but cost reduction is also in demand due to an influence of a lowered selling price at the same time, and use of the spiral-fin-tube type heat exchanger weakens the effect of cost to energy-saving, which makes introduction of mass production difficult.

[0005]

The present invention was made in order to solve the above-described problems and has an object to provide a freezer-refrigerator which is inexpensive and high in heat exchange efficiency.

Solution to Problem

[0006]

A freezer-refrigerator according to the present invention is provided with a first fin-and-tube type cooler having a heat transfer pipe that cools the periphery by an inflowing refrigerant and a plurality of planar fins penetrated by the heat transfer pipe and fixed, and a second fin-and-tube type cooler having a heat transfer pipe that cools the periphery by an inflowing refrigerant and a plurality of planar fins penetrated by the heat transfer pipe and fixed, in which the second fin-and-tube type cooler is smaller in size than the first fin-and-tube type cooler and is arranged on the upstream side of the first fin-and-tube type cooler in an air flow.

Advantageous Effects of Invention

[0007]

In the present invention, since the second fin-and-tube type cooler is arranged on the upstream side of the first fin-and-tube type cooler in the air flow, a frost adhesion spot generated by an operation of the freezer-refrigerator is located mainly on the second fin-and-tube type cooler, whereby frost adhesion amount on the first fin-and-tube type cooler can be lowered. With that, a gap between the planar fins of the first fin-and-tube type cooler is not blocked by frost, deterioration of heat exchange efficiency of the air flow can be suppressed, and an inexpensive freezer-refrigerator can be provided.

Brief Description of Drawings

[0008]

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

[Fig. 2] Fig. 2 is a sectional view of a cut-off side face of the freezer-refrigerator according to Embodiment 1 of the present invention.

[Fig. 3] Fig. 3 is a sectional view illustrating a cooler chamber of the freezer-refrigerator in Fig. 2 in an enlarged manner.

[Fig. 4] Fig. 4 is a sectional view illustrating a cooler chamber of a freezer-refrigerator according to Embodiment 2 of the present invention in an enlarged manner.

[Fig. 5] Fig. 5 is a sectional view illustrating a cooler chamber of a freezer-refrigerator according to Embodiment 3 of the present invention in an enlarged manner.

Description of Embodiments

[0009]

Embodiment 1.

Fig. 1 is a front view of a freezer-refrigerator according to Embodiment 1 of the present invention, Fig. 2 is a sectional view of a cut-off side face of the freezer-refrigerator according to Embodiment 1 of the present invention, and Fig. 3 is a sectional view illustrating a cooler chamber of the freezer-refrigerator in Fig. 2 in an enlarged manner.

In the main body 1 of the freezer-refrigerator in Embodiment 1, a refrigerating chamber 2 is disposed on the uppermost stage, a switching chamber 3 and an ice-making chamber (not shown) are disposed adjacently below that, a vegetable chamber 5 is disposed on the lowermost stage, and a freezing chamber 4 is disposed above that. Arrangement of every chambers disposed in the main body 1 is not limited. On an opening portion of the refrigerating chamber 2, a double-door 6, for example, is mounted. On each opening portion of the switching chamber 3, the ice-making chamber, the freezing chamber 4, and the vegetable chamber 5, drawer-type doors 7, 8, 9, and 10, for example, are disposed. The door 6 of the refrigerating chamber 2 is a double-door, but it may be a single swing door.

[0010]

On the lowermost part on the back face of the main body 1, a compressor 11 is installed. The compressor 11 is a component composing a refrigerating cycle provided in the main body 1 and has a function to compress the refrigerant in the refrigerating cycle. The refrigerant compressed by the compressor 11 is condensed in a condenser (not shown). The refrigerant in the condensed state is decompressed by a capillary (not shown).

[0011]

Above the compressor 11, a cooler chamber 12 is disposed. In the cooler chamber 12, a first fin-and-tube type cooler 13 (hereinafter referred to as a "first cooler 13"), a second fin-and-tube type cooler 14 (hereinafter referred to as a

"second cooler 14"), a cooling fan 15, a radiant heater 16, a heater cover 17, a drain pan 18 having a drain hole 19, a freezing chamber return port 20, and a refrigerating chamber return port 21 are disposed.

[0012]

5 The first cooler 13 comprises a heat transfer pipe 13a and a plurality of planar fins 13b penetrated by the heat transfer pipe 13a and fixed. The second cooler 14, similarly to the above, comprises a heat transfer pipe 14a and a plurality of planar fins 14b penetrated by the heat transfer pipe 14a and fixed. The second cooler 14 is, as shown in Fig. 3, smaller in size than the first cooler
10 13 and is arranged on the upstream side of the first cooler 13 in an air flow. Also, the heat transfer pipe 14a of the second cooler 14 is subjected to surface treatment with high water slip property. For example, the second cooler 14 is coated by a new hydrophobic or hydrophilic substance. This is to decrease held amounts of frost and moisture during defrosting.

15 [0013]

 The first and second coolers 13 and 14 are components composing the refrigerating cycle of the main body 1 and are connected by the same pipeline. The coolers 13 and 14 evaporate the refrigerants decompressed by the above-described capillaries so as to cool the periphery by a heat absorbing function at
20 the evaporation. The cooling fan 15 is disposed above the first and second coolers 13 and 14 and sucks cold air cooled by the first and second coolers 13 and 14 and feeds it to every chambers of the main body 1.

[0014]

 The radiant heater 16 is arranged below the first cooler 13 and melts frost
25 adhering to the first and second coolers 13 and 14. The heater cover 17 is disposed between the first cooler 13 and the radiant heater 16. The heater cover 17 is disposed so that water dripping during defrosting of the first and

second coolers 13 and 14 by the radiant heater 16 does not directly splash thereon. The drain pan 18 is disposed at the bottom part of the cooler chamber 12 and receives drain water dripping from the first and second coolers 13 and 14. The drain water is drained through the drain hole 19 disposed at the bottom part of the drain pan 18.

[0015]

The freezing chamber return port 20 is an air path between the freezing chamber 4 and the cooler chamber 12, and the refrigerating chamber return port 21 is an air path between the refrigerating chamber 2 and the cooler chamber 12. During an operation of the cooling fan 15, cold air flows in a direction from the freezing chamber 4 to the cooler chamber 12. When the operation of the cooling fan 15 is stopped, a convection flow might occur from the cooler chamber 12 to the freezing chamber 4 due to temperature balance of peripheries.

[0016]

In the freezer-refrigerator configured as above, during a cooling operation, cold air cooled by the first and second coolers 13 and 14 is fed into every chambers by the cooling fan 15 and returns into the cooler chamber 12. By means of the circulation of the cold air, frost adhesion amount is larger on the second cooler 14 arranged on the upstream side of the first cooler 13 in the air flow, and frost adhesion amount on the first cooler 13 arranged on the downstream side from the second cooler 14 becomes less.

[0017]

As described above, since the second cooler 14 is arranged on the upstream side of the first cooler 13 in the air flow, the frost adhesion amount is larger on the second cooler 14 than on the first cooler 13. Thus, a gap between the planar fins 13b of the first cooler 13 is no longer blocked by frost, and lowering of heat exchange efficiency of the air flow can be suppressed.

[0018]

Also, during the cooling operation when frost does not adhere, since lowering of heat exchange efficiency of the air flow can be suppressed by adding the second cooler 14, the total heat exchange amount of the first and second coolers 13 and 14 is increased, and a reduction effect of power consumption of the freezer-refrigerator is increased in total. Moreover, since the fin 14b of the second cooler 14 is made in the planar shape, a cost can be reduced than the prior-art case using a spiral fin.

[0019]

Embodiment 2.

Fig. 4 is a sectional view illustrating a cooler chamber of a freezer-refrigerator according to Embodiment 2 of the present invention in an enlarged manner. The same reference numerals are given to the ones similar to those in Embodiment 1.

In Embodiment 2, the second fin-and-tube type cooler 14 (hereinafter referred to as a "second cooler 14") is smaller in size than the first fin-and-tube type cooler 13 (hereinafter referred to as a "first cooler 13") as shown in the figure and is arranged on the upstream side of the first cooler 13 in the air flow. Also, the second cooler 14 is inclined at an angle of 45 degrees to 90 degrees with respect to the planar fin 13b of the first cooler 13. The angle of the second cooler 14 is matched with a direction of cold air flowing from the freezer chamber return port 20 and the refrigerating chamber return port 21 into the cooler chamber 12.

[0020]

As a result, time during which the cold air flowing into the cooler chamber 12 is in contact with the planar fin 14b of the second cooler 14 becomes longer than Embodiment 1. Thus, heat exchange efficiency of the second cooler 14 is

further improved, and an amount of frost adhering to the planar fin 14b of the second cooler 14 is increased, whereby the freezer-refrigerator with excellent energy saving performance can be provided to the market.

[0021]

Embodiment 3.

Fig. 5 is a sectional view illustrating a cooler chamber of a freezer-refrigerator according to Embodiment 3 of the present invention in an enlarged manner. The same reference numerals are given to the ones similar to those in Embodiment 1.

In Embodiment 3, the second fin-and-tube type cooler 14 (hereinafter referred to as a "second cooler 14") is smaller in size than the first fin-and-tube type cooler 13 (hereinafter referred to as a "first cooler 13") as shown in the figure and is arranged on the upstream side of the first cooler 13 in the air flow. Also, the second cooler 14 is inclined at an angle of 45 degrees to 90 degrees with respect to the planar fin 13b of the first cooler 13 in order to match with the direction of the cold air flowing from the freezing chamber return port 20 and the refrigerating chamber return port 21 into the cooler chamber 12.

[0022]

Also, on the basis of the phenomenon that frost adhering to the second cooler 14 can easily grow in a range where the front edge of the planar fin 14b and cold air collide, a front-edge area of the planar fin 14b is enlarged. That is, the shape of the planar fin 14b is made octagonal, for example, so as to promote frost formation, which is an intrinsic feature of the second cooler 14.

As a result, the amount of frost adhering to the octagonal planar fin 14b of the second cooler 14 is further increased, and the freezer-refrigerator with excellent energy saving performance can be provided to the market.

The shape of the planar fin 14b of the second cooler 14 is made octagonal, but this is not limiting. For example, the shape of the planar fin 14b may be elliptical or crescent.

5 Reference Signs List

[0023]

1: main body, 2: refrigerating chamber, 3: switching chamber, 4: freezing chamber, 5: vegetable chamber, 6: double door, 7, 8, 9, 10: drawer-type door, 11: compressor, 12: cooler chamber, 13: first fin-and-tube type cooler, 13a: heat transfer pipe, 13b: planar fin, 14: second fin-and-tube type cooler, 14a: heat transfer pipe, 14b: planar fin, 15: cooling fan, 16: radiant heater, 17: heater cover, 18: drain pan, 19:, drain hole, 20: freezing chamber return port, 21: refrigerating chamber return port

CLAIMS

[Claim 1]

A freezer-refrigerator comprising:

5 a first fin-and-tube type cooler having a heat transfer pipe that cools the periphery by an inflowing refrigerant and a plurality of planar fins penetrated by said heat transfer pipe and fixed; and

a second fin-and-tube type cooler having a heat transfer pipe that cools the periphery by an inflowing refrigerant and a plurality of planar fins penetrated by said heat transfer pipe and fixed, wherein

10 said second fin-and-tube type cooler is smaller in size than said first fin-and-tube type cooler and is arranged on the upstream side of said first fin-and-tube type cooler in an air flow.

[Claim 2]

The freezer-refrigerator of Claim 1, wherein

15 said second fin-and-tube type cooler is inclined at an angle of 45 degrees to 90 degrees with respect to a bottom face of said first fin-and-tube type cooler.

[Claim 3]

The freezer-refrigerator of Claim 1 or 2, wherein

20 the planar fin of said second fin-and-tube type cooler is in a polygonal shape.

[Claim 4]

The freezer-refrigerator of Claim 1 or 2, wherein

the planar fin of said second fin-and-tube type cooler is in an elliptical shape.

[Claim 5]

The freezer-refrigerator of Claim 1 or 2, wherein

the planar fin of said second fin-and-tube type cooler is in a crescent shape.

[Claim 6]

The freezer-refrigerator of any one of Claims 1 to 5, wherein

5 the heat transfer pipe of said second fin-and-tube type cooler is subjected to surface treatment with high water slip property.