

DESCRIPTION

Title of Invention

REFRIGERATOR

Technical Field

5 [0001]

The present invention relates to a refrigerator in which plural storage compartments differing in temperature zone are arranged in a user-friendly manner.

Background Art

[0002]

10 To date, as for refrigerators, a configuration is known in which plural tiers of storage compartments differing in temperature zone are formed by partitioning an interior of a refrigerator body, i.e., an outer shell, in a vertical direction using partition plates like a refrigerator disclosed in Patent Literature 1, for example. The storage compartments are partitioned by partition plates into a refrigerator, a first freezer
15 compartment, a vegetable compartment, and a second freezer compartment in order from the top taking user-friendliness into consideration. Also, in the refrigerator, an evaporator chamber is placed on the back side of the storage compartments to house a cooler configured to generate cold air and a fan configured to supply the cold air generated by the cooler to the storage compartments. In the refrigerator of Patent
20 Literature 1, an evaporator chamber is placed such that it bridges across a vegetable compartment and a freezer compartment.

Citation List

Patent Literature

[0003]

25 Patent Literature 1: Japanese Patent No. 3212954

Summary of Invention

Technical Problem

[0004]

30 In the case of the refrigerator disclosed in Patent Literature 1, since the evaporator chamber is placed such that it bridges across the freezer compartment

and the vegetable compartment differing in temperature zone, storage capacity of the freezer compartment and the vegetable compartment decreases by an amount equivalent to an increase in the space of the evaporator chamber. Also, with the refrigerator, in order to prevent the cold air in the evaporator chamber from moving to the vegetable compartment, it is necessary to increase the thickness of a partition wall partitioning between the evaporator chamber and vegetable compartment, thereby to ensure heat insulation. However, if the thickness of the partition wall is increased, the storage volume of the vegetable compartment is reduced, which may result in poor user-friendliness.

[0005]

The present invention has been made to solve the above problems and an object thereof is to provide a refrigerator configured such that even though plural tiers of storage compartments differing in temperature zone are arranged in a user-friendly way, large storage capacity can be secured for the storage compartments by efficiently insulating an evaporator chamber and the storage compartments from each other.

Solution to Problem

[0006]

A refrigerator according to an embodiment of the present invention comprises: a refrigerator body that is open on a front side and in which an inside space surrounded by an inner box and an outer box is filled with an insulating material; partition plates configured to partition an interior of the refrigerator body, thereby to form a plurality of tiers of storage compartments along a vertical direction; a compressor configured to compress refrigerant; a cooler installed in the refrigerator body and configured to generate cold air; a fan installed in the refrigerator body and configured to supply the cold air generated by the cooler to the storage compartments, wherein an evaporator chamber configured to house the cooler and the fan is formed between vertically adjacent ones of the partition plates on a back side of one of the plurality of tiers of storage compartments.

Advantageous Effects of Invention

[0007]

With the refrigerator according to an embodiment of the present invention, since the evaporator chamber configured to house the cooler and the fan is provided between vertically adjacent ones of the partition plates on the back side of one of the plurality of tiers of storage compartments, storage capacity of the storage compartment can be increased by an amount for which space of the evaporator chamber can be reduced. Also, with the refrigerator according to an embodiment of the present invention, since the evaporator chamber is placed on the back side of the freezer storage compartment, there is no need to provide a partition wall configured to partition between the refrigerator storage compartment and the evaporator chamber as with existing refrigerators. Thus, the refrigerator according to an embodiment of the present invention allows the evaporator chamber and the storage compartments to be insulated from each other efficiently, thereby omitting provision of a partition wall configured to partition the refrigerator storage compartment and the evaporator chamber, and allows the storage capacity of the storage compartments to be increased accordingly.

Brief Description of Drawings

[0008]

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

[Fig. 2] Fig. 2 is a sectional view taken along line A-A in Fig. 1.

[Fig. 3] Fig. 3 is an enlarged sectional view schematically showing a variation of an upper freezer storage compartment of the refrigerator according to Embodiment 1 of the present invention.

[Fig. 4] Fig. 4 is an enlarged sectional view schematically showing a variation of an evaporator chamber of the refrigerator according to Embodiment 1 of the present invention.

[Fig. 5] Fig. 5 is a sectional view showing an internal structure of a conventional refrigerator.

[Fig. 6] Fig. 6 is a sectional view showing an internal structure of a refrigerator

according to Embodiment 2 of the present invention.

[Fig. 7] Fig. 7 is a sectional view showing an internal structure of a refrigerator according to Embodiment 3 of the present invention.

Description of Embodiments

[0009]

Embodiments of the present invention will be described below with reference to the drawings. Note that, in the drawings, same or equivalent parts are denoted by the same reference numerals and description thereof will be omitted or simplified as appropriate. Also, shapes, sizes, arrangement, and other attributes of the components described in the drawings can be changed as appropriate within the scope of the present invention.

[0010]

Embodiment 1

Fig. 1 is a front view of a refrigerator according to Embodiment 1 of the present invention. Fig. 2 is a sectional view taken along line A-A in Fig. 1. Fig. 3 is an enlarged sectional view schematically showing a variation of an upper freezer storage compartment of the refrigerator according to Embodiment 1 of the present invention. Fig. 4 is an enlarged sectional view schematically showing a variation of an evaporator chamber of the refrigerator according to Embodiment 1 of the present invention.

[0011]

As shown in Figs. 1 and 2, a refrigerator 100 according to Embodiment 1 includes a refrigerator body 1 provided with an opening in a front face and provided with plural tiers of storage compartments formed by partitioning an interior using plural partition plates 10, 11, and 12. A space is formed in the refrigerator body 1 by hermetical sealing by an inner box 13 made of a resin constituting an inner side of the refrigerator 100 and an outer box 14 made of a steel sheet constituting an outer side of the refrigerator 100. Although detailed illustrations in the drawings are omitted, the inside space enclosed by the inner box 13 and the outer box 14 is filled with a heat insulating foam such as a polyurethane foam, with a vacuum heat insulating

material installed therein.

[0012]

The plural tiers of storage compartments include a freezer storage compartment whose internal temperature is set to a first set temperature lower than 0 degrees C or to a second set temperature lower than 0 degrees C, and a refrigerator storage compartment whose internal temperature is set to a third set temperature (e.g., 0 degrees C or above) higher than the first set temperature and the second set temperature or a fourth set temperature (e.g., 0 degrees C or above) higher than the first set temperature and the second set temperature. Specifically, the storage compartments are made up of a refrigerator compartment 2, an upper freezer storage compartment 3, a vegetable compartment 5, and a lower freezer storage compartment 6 in order from the top. Note that the vegetable compartment 5 corresponds to a first refrigerator storage compartment according to the present invention and the refrigerator compartment 2 corresponds to a second refrigerator storage compartment according to the present invention. The upper freezer storage compartment 3 is made up of a freezer compartment 4a and an ice storage compartment 4b arranged side by side as shown in Fig. 1. In the case of the refrigerator 100 of Embodiment 1, the refrigerator compartment 2 and the vegetable compartment 5 are refrigerator storage compartments and the upper freezer storage compartment 3 and the lower freezer storage compartment 6 are freezer storage compartments. The storage compartments are distinguished by the settable temperature zone (set temperature range) and, for example, the refrigerator compartment 2 can be set to approximately 3 degrees C, the upper freezer storage compartment 3 and lower freezer storage compartment 6 can be set to approximately -12 to -18 degrees C, and the vegetable compartment 5 can be set to approximately 5 degrees C. Note that different temperature zones may be made available to the freezer compartment 4a and ice storage compartment 4b of the upper freezer storage compartment 3.

[0013]

Note that a rotary refrigerator compartment right door 20a and a refrigerator

compartment left door 20b are attached to a front opening of the refrigerator compartment 2 such that a user can open and close. Also, a drawer-type freezer compartment door 30 is attached to a front opening of the freezer compartment 4a such that a user can open and close and a drawer-type ice storage compartment door 40 is attached to a front opening of the ice storage compartment 4b such that a user can open and close. Furthermore, a drawer-type vegetable compartment door 50 is attached to a front opening of the vegetable compartment 5 such that a user can open and close and a lower freezer storage compartment door 60 is attached to a front opening of the lower freezer storage compartment 6 such that a user can open and close. A gasket is attached to each door along an inner peripheral edge to prevent indoor cold air from flowing outside. Also, the set temperatures of the respective storage compartments are not limited to those described above and may be set or changed as appropriate depending on the installation location and the contents.

[0014]

A storage case 31 for use to store food is installed in the freezer compartment 4a of the upper freezer storage compartment 3. The freezer compartment 4a stores foods used relatively frequently such as frozen foods for packed lunch or ice cream. An evaporator chamber 7 is provided behind the upper freezer storage compartment 3 by being partitioned by a partition wall 15. A cooler 70 configured to generate cold air of around -20 to -30 degrees C and a fan 71 configured to supply the cold air to the individual compartments are housed in the evaporator chamber 7 by being arranged one above the other. The evaporator chamber 7 and the individual storage compartments are communicated with each other through air flow paths 9a to 9d provided for use to send the cold air generated in the evaporator chamber 7 to the individual storage compartments. The evaporator chamber 7 and the upper freezer storage compartment 3 are partitioned from the refrigerator compartment 2 by the partition plate 10 and from the vegetable compartment 5 by the partition plate 11.

[0015]

Note that, as shown in Fig. 3, the refrigerator 100 of Embodiment 1 may be

configured such that storage space of the upper freezer storage compartment 3 will be increased by increasing the height of the upper freezer storage compartment 3. In that case, if two tiers of cases 32 and 33 are provided in the freezer compartment 4a of the upper freezer storage compartment 3, a user can keep contents tidy and, as a result, user-friendliness is remarkably improved. In installing the two tiers of cases 32 and 33 one on top of the other in the freezer compartment 4a, if different temperature adjustment ranges are provided to the top and bottom cases, for example, by setting the case 32 on the top side to a soft freezing zone of approximately -7 degrees C and setting the case 33 on the bottom side to an all-out freezing zone of approximately -18 degrees C, use of the refrigerator 100 in line with daily habits of a user can be further ensured.

[0016]

Also, as shown in Fig. 4, the refrigerator 100 of Embodiment 1 may be configured such that the cooler 70 and the fan 71 will be placed left and right by increasing the width of the upper freezer storage compartment 3. Compared to the configuration in which the cooler 70 and the fan 71 are arranged one above the other, this configuration permits the use of a tall and larger cooler 70, and thereby makes it possible to improve cooling capacity and provide a user-friendly configuration.

[0017]

The vegetable compartment 5 is placed at a location where a user can take in and out vegetables without the need of stooping down. A storage case 51 for use to store vegetables and other similar foodstuffs is installed also in the vegetable compartment 5. The refrigerator compartment 2 and upper freezer storage compartment 3 are placed right above the vegetable compartment 5. That is, in the refrigerator 100, frequently-used storage compartments differing in temperature zone are placed at locations where the user can use them without the need of stooping down, and consequently a user-friendly layout is provided.

[0018]

A storage case 61 capable of storing food is installed in the lower freezer storage compartment 6. The lower freezer storage compartment 6 is provided to

store, for example, a stock of food materials such as meat or fish for a long term.

That is, the refrigerator 100, which allows foods differing in intended use to be stored separately in the upper freezer storage compartment 3 and the lower freezer storage compartment 6, realizes user-friendliness.

[0019]

As with typical refrigerators, the refrigerator 100 of Embodiment 1 is configured to supply cold air generated by a refrigerant cycle using a compressor 80 to the individual storage compartments through the respective air flow paths 9a to 9d, thereby to cool the individual storage compartments. The compressor 80 is installed in a machine chamber 8 provided behind the lower freezer storage compartment 6 near a bottom of the refrigerator 100. The machine chamber 8 is provided outside the refrigerator body 1 and partitioned from the lower freezer storage compartment 6 by a partition wall 16. High-temperature, high-pressure refrigerant gas compressed by the compressor 80 becomes high-pressure liquid refrigerant by being cooled by a non-illustrated condenser, and becomes low-pressure, two-phase refrigerant by being further decompressed by a non-illustrated decompressor (usually a capillary tube). As the storage compartments of the refrigerator 100 are cooled by the cooler 70 (evaporator), the low-pressure, two-phase refrigerant becomes low-pressure gas refrigerant and returns to the compressor 80. The refrigerant cycle described above is repeated in the refrigerator 100.

[0020]

Fig. 5 is a sectional view showing an internal structure of an existing refrigerator. As shown in Fig. 5, also in the conventional refrigerator 100A, storage compartments are made up of a refrigerator compartment 2, an upper freezer storage compartment 3, a vegetable compartment 5, and a lower freezer storage compartment 6 in order from the top. An evaporator chamber 7 is placed bridging across the upper freezer storage compartment 3 and the vegetable compartment 5. A partition wall 15 is provided between the evaporator chamber 7 and the upper freezer storage compartment 3. Also, a partition wall 17 is provided between the evaporator chamber 7 and the vegetable compartment 5. In the refrigerator 100A,

because the evaporator chamber 7 set to -20 to -30 degrees C is provided behind the vegetable compartment 5 set to 5 degrees C, it is necessary to increase the thickness of the partition wall 17 partitioning the evaporator chamber 7 and the vegetable compartment 5, thereby to ensure heat insulation such that the cold air in the evaporator chamber 7 is prevented from moving to the vegetable compartment 5. However, if the thickness of the partition wall 17 is increased, the storage volume of the vegetable compartment 5 is reduced, deteriorating user-friendliness.

[0021]

The refrigerator 100 according to Embodiment 1 of the present invention includes a freezer storage compartment (the upper freezer storage compartment 3) whose internal temperature is set to a first set temperature lower than 0 degrees C, a freezer storage compartment (the lower freezer storage compartment 6) whose internal temperature is set to a second set temperature lower than 0 degrees C, and a refrigerator storage compartment (the vegetable compartment 5) whose internal temperature is set to a third set temperature higher than the first set temperature and the second set temperature. Besides, in the refrigerator 100, since the evaporator chamber 7 configured to house the cooler 70 and the fan 71 is formed between the vertically adjacent partition plates 10 and 11 on the back side of the upper freezer storage compartment 3, which is the storage compartment on one of the tiers, space of the evaporator chamber 7 can be reduced and the storage capacity of the storage compartment can be increased accordingly. Also, with the refrigerator 100, since the evaporator chamber 7 is placed on the back side of the upper freezer storage compartment 3, there is no need to provide a partition wall configured to partition between the refrigerator storage compartment and the evaporator chamber as with existing refrigerators. Thus, the refrigerator 100 allows the evaporator chamber 7 and storage compartments to be insulated from each other efficiently, thereby omitting a partition wall 17 configured to partition between the refrigerator storage compartment and evaporator chamber 7, and allows the storage capacity of the storage compartments to be increased accordingly.

[0022]

Note that although in the illustrated refrigerator 100 of Embodiment 1, the evaporator chamber 7 is formed between the vertically adjacent partition plates 10 and 11 on the back side of the upper freezer storage compartment 3, this is not restrictive. The evaporator chamber 7 may be formed between vertically adjacent partition plates on the back side of the lower freezer storage compartment 6. Also, although it is preferable to provide the evaporator chamber 7 on the back side of a freezer storage compartment, it is sufficient that the evaporator chamber 7 is formed between vertically adjacent partition plates on the back side of one of the plural tiers of storage compartments. That is, the evaporator chamber 7 may be provided on the back side of the vegetable compartment 5 or the refrigerator compartment 2. In that case, however, it is necessary to increase the thickness of the partition wall partitioning between the evaporator chamber 7 and the vegetable compartment 5 or the refrigerator compartment 2, and thereby to ensure heat insulation.

[0023]

Embodiment 2

Next, a refrigerator 101 according to Embodiment 2 of the present invention will be described with reference to Fig. 6. Fig. 6 is a sectional view showing an internal structure of the refrigerator according to Embodiment 2 of the present invention. Note that the same components as those of the refrigerator described in Embodiment 1 are denoted by the same reference numerals as the corresponding components of Embodiment 1, and description thereof will be omitted as appropriate.

[0024]

As shown in Fig. 6, in the refrigerator 101 of Embodiment 2, as with the refrigerator 100 according to Embodiment 1, plural tiers of storage compartments formed by partitioning using plural partition plates 10, 11, and 12 are made up of a refrigerator compartment 2, an upper freezer storage compartment 3, a vegetable compartment 5, and a lower freezer storage compartment 6 in order from the top. An evaporator chamber 7 is provided behind the upper freezer storage compartment 3 by partitioning by a partition wall 15. A cooler 70 and a fan 71 are housed one above the other in the evaporator chamber 7. Also, a compressor 80 configured to

compress refrigerant is installed behind the lower freezer storage compartment 6.

[0025]

The compressor 80 is housed in a machine chamber 8 provided behind the lower freezer storage compartment 6 placed on the lowermost tier. The machine chamber 8 is demarcated by a partition wall 16 erected between a lower surface of the partition plate 12 and a bottom face of the lower freezer storage compartment 6, the partition plate 12 partitioning the lower freezer storage compartment 6 and the vegetable compartment 5. Together with the lower freezer storage compartment 6, the machine chamber 8 is divided from the vegetable compartment 5 by the partition plate 12 partitioning between the lower freezer storage compartment 6 and vegetable compartment 5.

[0026]

Now, suppose that an upper end of the partition wall 16 partitioning between the machine chamber 8 and the lower freezer storage compartment 6 does not reach the lower surface of the partition plate 12, for example, as with the refrigerator 100 of Embodiment 1 shown in Fig. 2, a partition plate demarcating a top face of the machine chamber 8 is placed inside the lower freezer storage compartment 6, creating a useless space incapable of storing food or other products.

[0027]

Since the refrigerator 101 of Embodiment 2 is structured such that the machine chamber 8 is demarcated by the partition wall 16 erected between the undersurface of the partition plate 12 and the bottom face of the storage compartment placed on the lowermost tier (the lower freezer storage compartment 6), the partition plate 12 partitioning an upper part of the storage compartment placed on the lowermost tier (lower freezer storage compartment 6), an internal space of the refrigerator body 1 can be used as a food storage space without waste.

[0028]

Note that the refrigerator 101 of Embodiment 2 is not limited to a configuration in which the machine chamber 8 and the vegetable compartment 5 are partitioned from each other by the partition plate 12. The machine chamber 8 and the vegetable

compartment 5 may be partitioned from each other by a partition plate, which is different from the partition plate 12. In that case, a top face of the partition plate which is different from the partition plate 12 is to be installed almost flush with a top face of the partition plate 12.

[0029]

Also, as for the illustrated refrigerator 101 of Embodiment 2, although an explanation is made taking as an example a case in which the storage compartment placed on the lowermost tier is the lower freezer storage compartment 6, this is not restrictive. The refrigerator 101 of Embodiment 2 may be configured such that a refrigerator storage compartment will be placed on the lowermost tier, with the machine chamber 8 being placed behind the refrigerator storage compartment to house the compressor 80.

[0030]

Embodiment 3

Next, a refrigerator according to Embodiment 3 of the present invention will be described with reference to Fig. 7. Fig. 7 is a sectional view showing an internal structure of the refrigerator according to Embodiment 3 of the present invention. Note that the same components as those of the refrigerator described in Embodiment 1 are denoted by the same reference numerals as the corresponding components of Embodiment 1, and description thereof will be omitted as appropriate.

[0031]

As shown in Fig. 7, in the refrigerator 102 of Embodiment 3, as with the refrigerator 100 according to Embodiment 1, plural tiers of storage compartments formed by being partitioned from one another using plural partition plates 10, 11, and 12 are made up of a refrigerator compartment 2, an upper freezer storage compartment 3, a vegetable compartment 5, and a lower freezer storage compartment 6 in order from the top. An evaporator chamber 7 is provided behind the upper freezer storage compartment 3 by partitioning by a partition wall 15. A cooler 70 and a fan 71 are housed one above the other in the evaporator chamber 7.

[0032]

The refrigerator 102 is characterized in that a compressor 80 configured to compress refrigerant is installed behind the refrigerator compartment 2 placed on the uppermost tier. The compressor 80 is housed in a machine chamber 8 provided behind the refrigerator compartment 2. The refrigerator compartment 2, which is cooled, for example, at an internal temperature of around 3 degrees C, is less prone to being affected by the compressor 80 than other storage compartments. Consequently, the refrigerator 102 can provide sufficient heat insulation even if a partition wall 18 partitioning the machine chamber 8 demarcated to house the compressor 80 from the refrigerator compartment 2 is reduced in thickness, and thus the storage capacity of the storage compartments can be increased by an amount for which the thickness of the partition wall 18 can be reduced.

[0033]

Note that although the illustrated refrigerator 102 of Embodiment 3 has been described by taking as an example a case in which the storage compartment placed on the uppermost tier is the refrigerator compartment 2, this is not restrictive. The refrigerator 102 of Embodiment 3 may be configured such that the storage compartment placed on the uppermost tier is a freezer storage compartment, with the machine chamber 8 being placed behind the freezer storage compartment to house the compressor 80.

[0034]

Whereas the present invention has been described above by referring to embodiments, the present invention is not limited to the configurations of the embodiments described above. For example, whereas the plural storage compartments are made up of the refrigerator compartment 2, the upper freezer storage compartment 3, the vegetable compartment 5, and the lower freezer storage compartment 6 in order from the top, another configuration may be used. In short, it should be added that, just for the record, various modifications, applied uses, and utilization made by so-called those skilled in the art as needed are also included in the scope (technical scope) of the present invention.

Reference Signs List

[0035]

1 refrigerator body 2 refrigerator compartment 3 upper freezer
storage compartment 4a freezer compartment 4b ice storage
compartment 5 vegetable compartment 6 lower freezer storage
5 compartment 7 evaporator chamber 8 machine chamber 9a, 9b, 9c, 9d
air flow path 10, 11, 12 partition plate 13 inner box 14 outer box 15,
16, 17, 18 partition wall 20a refrigerator compartment right door 20b
refrigerator compartment left door 30 freezer compartment door 31 storage
case 32, 33 case 40 ice storage compartment door 50 vegetable
10 compartment door 51 storage case 60 lower freezer storage compartment door 61
storage case 70 cooler 71 fan 80 compressor 100, 101, 102, 100A
refrigerator

CLAIMS

[Claim 1]

A refrigerator comprising:

a refrigerator body that is open on a front side and in which an inside space
5 surrounded by an inner box and an outer box is filled with an insulating material;

partition plates configured to partition an interior of the refrigerator body and
thereby to form a plurality of tiers of storage compartments along a vertical direction;

a compressor configured to compress refrigerant;

a cooler installed in the refrigerator body and configured to generate cold air;

10 and

a fan installed in the refrigerator body and configured to supply the cold air
generated by the cooler to the storage compartments, wherein

an evaporator chamber configured to house the cooler and the fan is formed
between vertically adjacent ones of the partition plates on a back side of one of the
15 plurality of tiers of storage compartments.

[Claim 2]

The refrigerator of claim 1, wherein:

the plurality of tiers of storage compartments include:

an upper freezer storage compartment, an internal temperature of which
20 is set to a first set temperature lower than 0 degrees C;

a lower freezer storage compartment, an internal temperature of which is
set to a second set temperature lower than 0 degrees C;

a first refrigerator storage compartment, an internal temperature of which
is set to a third set temperature higher than the first set temperature and the second
25 set temperature, the first refrigerator storage compartment being sandwiched
between the upper freezer storage compartment and the lower freezer storage
compartment;

the evaporator chamber is formed between vertically adjacent ones of the
partition plates on a back side of the upper freezer storage compartment or the lower
30 freezer storage compartment.

[Claim 3]

The refrigerator of claim 1 or 2, wherein:

the compressor is housed in a machine chamber provided behind a lowermost storage compartment of the plurality of tiers of storage compartments; and

5 the machine chamber is demarcated by a partition wall erected between a lower surface of a partition plate partitioning an upper part of the lowermost storage compartment and a bottom face of the lowermost storage compartment.

[Claim 4]

10 The refrigerator of claim 1 or 2, wherein the compressor is housed in a machine chamber provided behind an uppermost storage compartment of the plurality of tiers of storage compartments.

[Claim 5]

The refrigerator of claim 4, wherein:

15 a second refrigerator storage compartment, an internal temperature of which is set to a fourth set temperature higher than a first set temperature lower than 0 degrees C and a second set temperature lower than 0 degrees C is placed on an uppermost tier of the plurality of tiers of storage compartments; and

the compressor is housed in the machine chamber provided behind the second refrigerator storage compartment.

20