

DESCRIPTION

Refrigerator

5 Technical Field

The present invention relates to a refrigerator, and more particularly to a refrigerator containing a cooling accumulation.

10 Background Art

A conventional refrigerator designed to cool in the refrigerator also during stop of operation of a compressor for refrigeration cycle is disclosed in Japanese Utility Model Laid-open Publication 63-217174. The constitution of this
15 conventional refrigerator is shown in Fig. 5 through Fig. 8. Fig. 5 is a sectional view of an insulating device for composing the refrigerator, Fig. 6 is a longitudinal sectional view of the refrigerator incorporating the insulating device shown in Fig. 5, Fig. 7 is a sectional view along A-A of Fig. 6, and
20 Fig. 8 is a specific gravity characteristic diagram of water.

In Fig. 6 and Fig. 7, the refrigerator comprises a box main body 105 of refrigerator, a freezing compartment 113, a refrigerating compartment 114, a freezing compartment door 106, a refrigerating compartment door 107, a partition wall 108, an
25 evaporator 109, a blower 110, a partition board 111, a fan guard

112, rack holders 113a of freezing compartment, and rack holders 114a of refrigerating compartment. An insulating device 101 is disposed so as to be drawn in and out on the rack holders 113a of the freezing compartment 113.

5 In Fig. 5, the insulating device 101 includes an upper container 101a, a lower container 101b, a peripheral flange 101c at the junction of the upper container 101a and lower container 101b, and container bases 101e. The inside of the insulating device 101 is filled with a cooling accumulation
10 101d. The upper container 101a forms a recessed central flat portion 101f, and the entire central flat portion 101f is pressed and formed like a bowl. As the cooling accumulation 101d, a material not to be frozen in the freezing compartment is used. A bowl-shaped tray 102 for containing food is placed
15 on the central flat portion 101f of the upper container 101a. Tray bases 102a are formed in the bottom of the tray 102. The recess (dent) of the central flat portion 101f of the insulating device 101 is filled with water 104. The water 104 is used for increasing the heat transfer quantity between the
20 central flat portion 101f and tray 102. The specific gravity characteristic diagram of water is shown in Fig. 8. Food 103 is contained in the tray 102.

 In such constitution, when freezing quickly the food 103 by using the insulating device 101, the flange 101c of the
25 insulating device 101 is placed on the rack holders 113a of the

refrigerating compartment 113, and the cooling accumulation
101d charged in the freezing compartment 113 is lowered in
temperature. The food 103 is placed on the insulating device
101 lowered in temperature. Thus, the food 103 is frozen
5 quickly.

By injecting water 104 between the insulating device
101 and tray 102, the tray 102 can be cooled from outside
through the cooled water 104. Therefore, the food 103 in the
tray 102 is cooled efficiently. That is, the water 104
10 contacting with the insulating device 101 is cooled, and the
tray 102 is cooled by the cooled water 104.

In such conventional constitution, however, since the
tray 102 is shaped like bowl, it was difficult to take out the
food. Moreover, when the door 106 is opened or the tray 102 is
15 drawn out, the insulating device 101 may drop out of the rack
holders 113f.

The invention solve the problems of the prior art, and
presents a refrigerator having various effects including
excellent cold reserve capacity, prevention of risk of dropping
20 of rack, excellent controllability of rack, and prevention of
sharp rise of temperature in freezing compartment in case of
power failure.

Disclosure of the Invention

25 The refrigerator of the invention comprises a box body

for storing food in low temperature state, cooling means for cooling the inside of the box body, a rail unit placed inside of the box body, a rack having a hollow portion, being disposed slidably along the rail unit, and a cooling accumulation placed
5 in the hollow portion of the rack. The rack has a first fitting portion in a desired position thereof, the rail portion has a second fitting portion at a position fitting with the first fitting portion, the first fitting portion is fitted with the second fitting portion when the rack is placed on the rail unit,
10 and the rack is fixed to the rail unit by this fitting. In this constitution, the low temperature reserving capacity of food is superior, drop rack or other risk is prevented, the controllability of rack is excellent, and sudden rise of temperature inside of the box body in the event of power
15 failure or cut-off of power supply to the refrigerator can be prevented. Still more, when taking out the food, if the rack is drawn out forward, dropping of rack can be prevented.

In the constitution, preferably, the rail unit is placed at a lateral side to the opening of the box body, a
20 support unit is formed in an inner part of the inside of the box body, the support unit is formed at a position so that the inner part of the rack may contact with the inner part of the box body when the rack is placed on the rail unit, and the rack is supported by the rail unit and the support unit. In this
25 constitution, the hollow rack filled with cooling accumulation

is fixed to the rail unit stably and securely.

In the constitution, preferably, a cold air duct for blowing a cold air generated by the cooling means into the box body is formed in an inner part of the inside of the box body, the inner part of the rack forms a slope for generating convection of the cold air from the cold air duct, and the cold air released from the cold air duct flows in convection within the box body through the slope of the rack. In this constitution, cold air flows in convection beneath the rack, and frosting in the lower part of the rack can be prevented.

In the constitution, preferably, the rack has an injection port for filling the hollow portion with the cooling accumulation. In this constitution, a good-looking rack can be presented without impeding sliding of the rack.

In the constitution, preferably, a guide portion for the ease of filling when filling with the cooling accumulation is formed inside of the hollow portion of the rack, and the guide is shaped to have a slope becoming narrower in the direction of the injection port. In this constitution, the flowability is enhanced when injecting the cooling accumulation of high viscosity, and the filling time can be shortened.

In the constitution, preferably, a vegetable compartment for storing vegetable is placed in the box body, and the rack is placed at a position for covering the vegetable compartment. In this constitution, temperature rise of food in

the vegetable compartment can be prevented in the event of power failure.

In the constitution, preferably, the rack is formed of a plastic material. In this constitution, the rack of a
5 complicated shape can be manufactured easily, so that an inexpensive refrigerator can be presented.

In the constitution, preferably, the box body has a freezing compartment in its box body, and the rail unit and the rack are placed inside of the freezing compartment.
10 In this constitution, the freezing capacity of food is superior, dropping of rack or other risk is prevented, the controllability of the rack is excellent, and sudden rise of temperature in the freezing compartment in the event of power failure can be prevented. Moreover, when taking out the food,
15 if the rack is drawn out, dropping of the rack can be prevented.

In the constitution, preferably, the box body has a refrigerating compartment in its box body, and the rail and the rack are placed inside of the refrigerating compartment. In this constitution, the refrigerating capacity of food is
20 superior, dropping of rack or other risk is prevented, the controllability of the rack is excellent, and sudden rise of temperature in the refrigerating compartment in the event of power failure can be prevented. Moreover, when taking out the food, if the rack is drawn out, dropping of the rack can be
25 prevented.

In the constitution, preferably, the box body has a freezing compartment and refrigerating compartment in its box body, the rail unit and the rack are placed inside of the freezing compartment, a second rail unit is further placed
5 inside of the refrigerating compartment, the second rail unit has a third fitting portion in the same shape as the second fitting portion, the rack can be placed by moving to the second rail, and the first fitting portion is fitted and fixed in the third fitting portion when the rack is placed in the second
10 rail. In this constitution, the freezing capacity of food is superior, dropping of rack or other risk is prevented, the controllability of the rack is excellent, and when taking out the food, if the rack is drawn out, dropping of the rack can be prevented. Moreover, in the event of power failure, the rack
15 containing the cooling accumulation in the freezing compartment can be moved and placed in the refrigerating compartment, so that sudden rise of temperature in the refrigerating compartment can be prevented.

In the constitution, preferably, the box body has a
20 freezing compartment and a refrigerating compartment in its box body, the refrigerating compartment has a vegetable compartment for storing vegetables, the rail unit and the rack are placed inside of the freezing compartment, a second rail unit is placed at position for covering the vegetable compartment
25 inside of the refrigerating compartment, the second rail

unit has a third fitting portion in the same shape as the second fitting portion, the rack can be placed by moving to the rail, and the first fitting portion is fitted and fixed in the third fitting portion when the rack is placed on the second
5 rail to cover the vegetable compartment. In this constitution, the freezing capacity of food is superior, dropping of rack or other risk is prevented, the controllability of the rack is excellent, and when taking out the food, if the rack is drawn out, dropping of the rack can be prevented. Moreover, in the
10 event of power failure, the rack containing the cooling accumulation in the freezing compartment can be moved and placed at a position for covering the vegetable compartment, so that sudden rise of temperature in the vegetable compartment can be prevented.

15 In the constitution, preferably, further comprising a third rail unit placed in the inside of the box body, a second rack having a second hollow portion, being placed slidably along the third rail unit, and a second cooling accumulation placed in the second hollow portion of the second rack. The
20 second rack has a fourth fitting portion, the third rail unit has a fifth fitting portion at a position fitting with the first fitting portion, the fourth fitting portion is fitted with the fifth fitting portion when the second rack is placed in the third rail unit, and the second rack is fixed to the
25 third rail unit by this fitting. In this constitution, since

plural racks filled with cooling accumulation are placed in the box body, the effect for preventing sudden rise of temperature in the box in the event of power failure is much greater.

5 Brief Description of the Drawings

Fig. 1 is a perspective view of essential parts of a refrigerator showing an embodiment of the invention.

Fig. 2 is a sectional view of a refrigerator showing an embodiment of the invention.

10 Fig. 3 is a partial sectional view of a refrigerator showing an embodiment of the invention.

Fig. 4 is a perspective view of a rack showing an embodiment of the invention.

15 Fig. 5 is a sectional view of an insulating device of a conventional refrigerator.

Fig. 6 is a longitudinal sectional view of a refrigerator incorporating the insulating device shown in Fig. 5.

Fig. 7 is a sectional view along A-A of Fig. 6.

20 Fig. 8 is a specific gravity characteristic diagram of water showing a prior art.

Best Mode for Carrying Out the Invention

Embodiments of refrigerator of the invention are described below. A perspective view of essential parts of a refrigerator showing an embodiment of the invention is given in

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Fig. 1. A sectional view of the refrigerator shown in Fig. 1 is given in Fig. 2. A magnified sectional view of the portion for composing the cooling accumulation of an embodiment according to the invention is shown in Fig. 3. A perspective view of
5 an embodiment of the rack according to the invention is shown in Fig. 4.

Embodiment 1

In Fig. 1 through Fig. 4, the refrigerator comprises a freezing compartment 13, and a refrigerating compartment 14
10 placed at the lower side of the freezing compartment 13. The freezing compartment 13 and refrigerating compartment 14 are composed in a box body 5. A door 6 of the freezing compartment is provided at the front side of the freezing compartment 13. A door 7 of the refrigerating compartment is provided at the
15 front side of the refrigerating compartment 14. A partition board 11 is placed at the inner side of the freezing compartment 13, and at the inner side of this partition board 11, an evaporator 9 and a blower 10 are installed as cooling means. A fan guard 12 is disposed at the front side of the blower 10.
20 A dust 23 for blowing out cold air is formed in the fan guard 12. An inner box 15 is placed in the freezing compartment 13. This inner box 15 may be also placed at the inner side of the box body 5. At desired right and left positions of the inner box 15, a pair of rails 16 are installed. A hollow rack 17 is
25 placed slidably along the rail unit 16. That is, the hollow

rack 17 is placed slidably above or beneath the rail unit 16.
Or, the hollow rack 17 is placed slidably between the rails 16.
A cooling accumulation 18 is filling the hollow portion of the
hollow rack 17. A first fitting portion 19 of a protruding
5 shape is formed at a desired position of the hollow rack 17.
A second fitting portion 20 of a dent shape is formed at a
desired position of the rail unit 16. The first fitting
portion 19 and second fitting portion 20 have shapes to be
fitted with each other. By mutual fitting of the first
10 fitting portion 19 and second fitting portion 20, the rack 17
is fixed in the rail unit 16. Food is put on the hollow rack
17.

Alternatively, the hollow rack 17 filled with the
cooling accumulation 18 and the rail unit 16 may be also
15 disposed at plural positions in the freezing compartment 13.
The first fitting portion 19 and second fitting portion 20 may
be also disposed at plural positions in the rack 17 and rail
unit 16. The first fitting portion 19 may have a dent shape
and the second fitting portion 20 may have a protruding shape.
20 Preferably, the second fitting portion 20 is placed near the
center of the rail unit 16.

In the embodiment, the temperature of the freezing
compartment can be set at about -20°C . Accordingly, as the
cooling accumulation, a material having a melting temperature
25 of -10°C to -20°C is used. For example, using a cooling

accumulation having a melting temperature of -11°C , it is used in a state cooled to -20°C in the freezing compartment. As such cooling accumulation, for example, a mixture containing principal ingredients of aqueous solution, natural high
5 polymer (polysaccharides) as gelating agent, paraoxy benzoic acid or 2-brom-2-nitropropane-1,3-diol as preservative, and inorganic acid as freezing mixture may be used as the cooling accumulation.

In this constitution, the food is directly put on the
10 hollow rack 17 filled with the cooling accumulation 18, so that freezing may be maintained efficiently. Moreover, since the first fitting portion 19 of the hollow rack 17 and the second fitting portion 20 of the rail unit 16 are mutually fitted and fixed, when the door 6 is opened, or when the stored food is
15 taken out from the rack 17, the hollow rack 17 is prevented from being dropped out of the rail unit 16. Still more, in the event of power failure, sudden rise of temperature in the freezing compartment can be prevented.

Embodiment 2

20 In the refrigerator explained in embodiment 1, furthermore, an inner box 35 is provided in the refrigerating compartment 14, and a pair of second rails 36 having the same shape as the rails 16 are formed at specified right and left positions of the inner box 35. At a specified position of this
25 second rail unit 36, a third fitting portion 40 having the same

shape as the second fitting portion 20 is formed. In this embodiment, the second rail unit 36 is placed at the upper side of a vegetable container 22 as vegetable storing means disposed in the refrigerating compartment 14. The hollow rack 5 17 containing the cooling accumulation 18 placed in the freezing compartment 13 can be moved and placed on this second rail unit 36.

In this constitution, in the event of power failure, the hollow rack 17 filled with the cooling accumulation 18 10 placed in the freezing compartment 13 can be moved to the second rail unit 36 of the refrigerating compartment 14. By moving and placing the hollow rack 17 filled with the cooling accumulation 18 into the refrigerating compartment 14, sudden rise of temperature in the refrigerating compartment 14 can be 15 prevented. In particularly, it is preferred to move and place the hollow rack 17 filled with the cooling accumulation 18 at a position for covering the vegetable container 22, and in this constitution, therefore, sudden rise of temperature in the vegetable container can be prevented. The vegetable container 20 22 may be also composed as a vegetable compartment.

In this constitution, meanwhile, other hollow rack filled with cooling accumulation may be preliminarily placed in the refrigerating compartment 14 or on the vegetable container. In the event of power failure, the rack placed in the freezing 25 compartment may be replaced with other rack placed in the

refrigerating compartment. Or, an ordinary rack not containing cooling accumulation may be preliminarily installed in the refrigerating compartment. In this case, in the event of power failure, the rack containing the cooling accumulation placed in the freezing compartment and the rack not containing cooling accumulation placed in the refrigerating compartment may be replaced.

Embodiment 3

In the refrigerator explained in embodiment 2, a support unit 21 of a protruding shape is formed at a position for supporting the rear portion of the hollow rack 17, at the inner side of the inner box 35 of the refrigerating compartment 14. In this constitution, the rack 17 can be securely moved from the freezing compartment 13 and placed in the refrigerating compartment 14. Such support unit 21 may be also formed in the inner part of the freezing compartment 13. In this constitution, the rack can be securely and stably fixed in the freezing compartment.

Embodiment 4

As shown in Fig. 3, in the lower surface of the inner part of the hollow rack 17, a slope 24 having an inclination to be smaller in thickness gradually toward the inner part is formed. More preferably, a duct 23 for blowing out the cold air formed in the fan duct 12 is located at position confronting the slope 24 of this hollow rack 17. In this constitution,

the cold air can efficiently flow into the lower part of the rack 17, and deposit of frost on the lower surface of the rack 17 is prevented, and it is possible to remove the depositing frost by sublimation.

5 Embodiment 5

As shown in Fig. 4, an injection port 25 for injecting the cooling accumulation is formed in the inner part of the hollow rack 17. In this constitution, the injection port 25 does not contact with the inner box or impede the sliding
10 performance of the rack 17, and so that the rack of excellent looking or appearance may be obtained.

Embodiment 6

As shown in Fig. 4, in the hollow portion of the hollow rack 17, a guide 26 having an inclination so as to be smaller 1
15 in the width in the direction of the injection port 25 side is placed. More preferably, plural guides 26 are formed. In this constitution, when injecting the cooling accumulation of high viscosity into the hollow portion of the hollow rack 17, it is possible to improve the flowability of the cooling
20 accumulation, and the filling work of the cooling accumulation having high viscosity may be easier. Moreover, preferably, the upper surface and lower surface of the guide 26 may contact or join the hollow inner surface of the rack 17. In this constitution, the mechanical strength of the rack 17 is
25 enhanced.

Embodiment 7

In the foregoing embodiments 1 to 6, preferably, the hollow rack 17 is formed of a plastic material. In this constitution, it is easy to manufacture the rack 17 of complicated shape, and the rack having a specified shape can be fabricated at low cost. It is more preferable to use such as plastic material that the inside of the hollow portion may be visible. In this constitution, the state of the cooling accumulation 18 charged in the hollow rack 17 can be observed, so that the degree of accumulation of cooling can be known.

In the invention, the cooling accumulation is not particularly limited, but a material suited to the desired freezing temperature or refrigerating temperature may be used. In order to keep the freezing capacity or refrigerating capacity, it is preferred to use the cooling accumulation in a state cooled to a temperature lower than the melting temperature by about -5°C or to about -15°C . Therefore, when the temperature in the freezing compartment is desired to be about -20°C , it is preferred to use the cooling accumulation having a melting temperature of about -5°C to about -15°C . For example, as the cooling accumulation, an aqueous solution containing gelating agent, preservative, freezing mixture, expansion preventive in freezing, and others is used. As the cooling accumulation, a material not to be frozen in the freezing compartment may be also used, but in this case the cold

insulating effect corresponding to the melting latent heat is slightly impaired. Other examples of cooling accumulation include chemical materials containing polyethylene glycol, polypropylene glycol, polyalkylene glycol, polyvinyl alcohol
5 and others. Or, mixture of these chemical materials with water or alcohol may be used. A mixture of hydrophilic polymer or water absorbing polymer and water may be used. Yet, mixture of these materials and inorganic material may be used. The components for composing such cooling accumulations are
10 preferred to be substances having no adverse effects on the human body.

Industrial Applicability

The refrigerator of the invention can store the food by
15 putting directly on the hollow rack containing cooling accumulation, so that the food can be frozen and stored efficiently. It is also possible to prevent dropping of the rack filled with the cooling accumulation. Moreover, in the event of power failure, sudden rise of temperature of the food
20 and in the freezing compartment can be prevented.

In the event of power failure, still more, the rack containing the cooling accumulation can be moved from the freezing compartment and placed in the refrigerating compartment, so that the temperature rise time of the food in the
25 vegetable container can be extended.

Moreover, as the cold air blown out from the duct for blowing out the cold air is controlled by the slope in the hollow rack, the frost in the lower part of the hollow rack is removed by sublimation, and frosting of the hollow rack can be prevented.

5 Since the injection port is provided near the rear part of the hollow rack, when the hollow rack slides on the rail unit, the injection port does not contact with the inner box, so that a good-looking hollow rack can be presented.

10 Furthermore, having a guide toward the injection port side in the hollow portion of the hollow rack, the flowability is enhanced when injecting the cooling accumulation into the hollow rack, and the injection time of the cooling accumulation is shortened, and therefore the rack containing the cooling
15 accumulation can be presented at a lower cost.

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CLAIMS

1. A refrigerator comprising:
a box body for storing food in low temperature state,
cooling means for cooling the inside of said box body,
5 a rail unit placed inside of said box body,
a rack having a hollow portion, being disposed slidably
along said rail unit, and
a cooling accumulation placed in said hollow portion of
said rack,
10 wherein said rack has a first fitting portion in a
desired position thereof, said rail portion has a second
fitting portion at a position fitting with said first fitting
portion, said first fitting portion is fitted with said second
fitting portion when said rack is placed on said rail unit, and
15 said rack is fixed to said rail unit by this fitting.
2. A refrigerator of claim 1, wherein said rail unit
is placed at a lateral side to the opening of said box body, a
support unit is formed in an inner part of said inside of said
box body, said support unit is formed at a position so that the
20 inner part of said rack may contact with the inner part of said
box body when said rack is placed on the rail unit, and said
rack is supported by said rail unit and said support unit.
3. A refrigerator of claim 1, wherein a cold air duct
for blowing a cold air generated by said cooling means into
25 said box body is formed in an inner part of said inside of said



box body, the inner part of the rack forms a slope for generating convection of said cold air from said cold air duct, and said cold air released from said cold air duct flows in convection within said box body through said slope of said rack.

5 4. A refrigerator of claim 1, wherein said rack has an injection port for filling said hollow portion with said cooling accumulation.

 5. A refrigerator of claim 4, wherein a guide portion for the ease of filling when filling with said cooling
10 accumulation is formed inside of said hollow portion of said rack, and said guide is shaped to have a slope becoming narrower in the direction of said injection port.

 6. A refrigerator of claim 1, wherein a vegetable compartment for storing vegetable is placed in said box body,
15 and said rack is placed at a position for covering said vegetable compartment.

 7. A refrigerator of claim 1, wherein said rack is formed of a plastic material.

 8. A refrigerator of claim 1, wherein said rack is
20 transparent so that said cooling accumulation placed in said hollow portion may be visible.

 9. A refrigerator of claim 1, wherein said box body has a freezing compartment in its box body, and said rail unit and said rack are placed inside of said freezing compartment.

25 10. A refrigerator of claim 1, wherein said box body



has a refrigerating compartment in its box body, and said rail and said rack are placed inside of said refrigerating compartment.

11. A refrigerator of claim 1, wherein said box body
5 has a freezing compartment and refrigerating compartment in its box body, said rail unit and said rack are placed inside of said freezing compartment, a second rail unit is further placed inside of said refrigerating compartment, said second rail unit
10 has a third fitting portion in the same shape as said second fitting portion, said rack can be placed by moving to said second rail, and said first fitting portion is fitted and fixed in said third fitting portion when said rack is placed in said second rail.

12. A refrigerator of claim 1, further comprising a
15 third rail unit placed in said inside of said box body, a second rack having a second hollow portion, being placed slidably along said third rail unit, and a second cooling accumulation placed in said second hollow portion of said second rack, wherein said second rack has a fourth fitting
20 portion, said third rail unit has a fifth fitting portion at a position fitting with said first fitting portion, said fourth fitting portion is fitted with said fifth fitting portion when said second rack is placed in said third rail unit, and said second rack is fixed to said third rail unit by this fitting.

25 13. A refrigerator of claim 1, wherein said box body



has a freezing compartment and a refrigerating compartment in said box body, the refrigerating compartment has a vegetable compartment for storing vegetables, said rail unit and said rack are placed inside of said freezing compartment, a second
5 rail unit is placed at position for covering said vegetable compartment inside of said refrigerating compartment, said second rail unit has a third fitting portion in the same shape as said second fitting portion, said rack can be placed by moving to said rail, and said first fitting portion is fitted
10 and fixed in said third fitting portion when said rack is placed on said second rail to cover said vegetable compartment.

14. A refrigerator of claim 1, wherein said box body has a freezing compartment and a refrigerating compartment in said box body, said rail unit is placed inside of said freezing
15 compartment, a third rail unit is further placed in said inside of said freezing compartment, a second rack having a second hollow portion is placed slidably along said third rail unit, a second cooling accumulation is placed in said second hollow portion of said second rack, said second rack has
20 a fourth fitting portion, said third rail portion has a fifth fitting portion at a position fitted with said first fitting portion, said fourth fitting portion is fitted with said fifth fitting portion when said second rack is placed on said third rail unit, and said second rail is fixed to said third rail
25 unit by this fitting, said rail unit and said rack are placed



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inside of said freezing compartment, a second rail unit is further placed inside of said refrigerating compartment, said second rail unit has a third fitting portion in the same shape as said second fitting portion, said rack can be placed in said
5 second rail, and said first fitting portion is fitted and fixed to said third fitting portion when said rack is placed in said second rail.