which a sectional area decreases and a central position of a cross section approaches the rear face side in a downstream direction, and the drain passage is integrally formed from the inlet to the outlet.

Advantageous Effects of Invention

[0009]

According to the refrigerator of the embodiment of the present invention, the inner diameter of the drain passage from the inlet to the outlet decreases, while the central position thereof approaches the rear face side of the refrigerator, so that in the thermal insulation wall between the cooler compartment and the machine compartment, a region in a forward direction from the drain passage is ensured to be wide, and a vacuum thermal insulator can be installed in the ensured region. Hence in the refrigerator, the thermal insulation performance can be enhanced by an area for installation of the vacuum thermal insulator being increased. Further, with the drain passage being integrally formed from the inlet to the outlet, permeation of moisture from the drain passage into the thermal insulator can be reduced, thereby lowering the establishment that the drain passage is blocked. As thus described, in the refrigerator, it is possible to improve drainage probabilities while maintaining thermal insulation properties.

Brief Description of Drawings

[0010]

[Fig. 1] Fig. 1 is an external perspective view illustrating a refrigerator according to Embodiment 1 of the present invention.

[Fig. 2] Fig. 2 is a schematic view illustrating a refrigerant circuit and an air cycle passage of the refrigerator according to Embodiment 1 of the present invention.

[Fig. 3] Fig. 3 is a side sectional view illustrating the refrigerator according to Embodiment 1 of the present invention.

[Fig. 4] Fig. 4 is a schematic configuration view of a machine compartment on the rear face of the refrigerator according to Embodiment 1 of the present invention.

[Fig. 5] Fig. 5 is a partial sectional view illustrating a configuration of a thermal insulation box body according to Embodiment 1 of the present invention.

compartment, a part of the foamed thermal insulator adjacent to the outer shell of the front face of the ice-making compartment 3, and other portions. A discharge port of the return air passage 30b of the ice-making compartment 3 merges in the vicinity of a return inlet 74 for cool air from the freezer compartment 6. For avoiding a pressure drop due to the merge, the return inlet 74 from the freezer compartment 6 may be formed in the vicinity of the discharge port for the cool air from the ice-making compartment 3, to have a dimension not smaller than a lateral width of the return air passage 30b of the ice-making compartment 3. Note that the return air passage 30b of the ice-making compartment 3 may be directly returned into the cooler compartment 27 in a position above the return inlet 74 for cool air from the freezer compartment 6.

[0036]

Fig. 16 is an explanatory view illustrating a blow air passage of the versatile compartment and a return air passage of the versatile compartment of the refrigerator according to Embodiment 1 of the present invention. (a) is a partial front view of the refrigerator 1 when the door is removed, and (b) is a partial side sectional view of the refrigerator 1.

[0037]

As illustrated in Fig. 16, a blow air passage 29c for the cool air to the temperature versatile compartment 4 is formed by connecting a plurality of air passages, through each of which a cooled air passes after being discharged from the air-sending device 15 installed above the cooler 14. The plurality of air passages are an air passage in the foamed thermal insulator above the cooler compartment 27, an air passage molded in the foamed thermal insulator installed on the rear face side of the temperature versatile compartment 4, and other air passages. Note that the air volume control device 18b (cf. Fig. 3) that regulates an amount of cool air supplied to the temperature versatile compartment 4 is installed, for example, in the middle of the blow air passage 29c of the temperature versatile compartment 4. Further, the return air passage 30c of the versatile compartment is made up of a cool-air return inlet arbitrarily installed on the rear-face wall of the temperature versatile

of heat from the vegetable compartment 5 to another storage compartment, or transfer of cooling energy from another storage compartment, the cooler compartment 27, or other places, to the vegetable compartment 5. In addition, entry of heat from the outside of the refrigerator 1 into the vegetable compartment 5 is prevented.

[0045]

On the other hand, when the covering ratio of the vacuum thermal insulator is set to be large, the average temperature of the vegetable compartment 5 tends to be lowered. For this reason, the refrigerator 1 may have a configuration to hold the temperature inside the vegetable compartment 5.

[0046]

Fig. 24 is a schematic view illustrating placement of a thermal heater of the vegetable compartment according to Embodiment 1 of the present invention. Fig. 24 illustrates an example where a thermal heater 46 using electric resistance is installed to keep the temperature inside the vegetable compartment 5 when necessary. The thermal heater 46 is installed in an arbitrary position on the floor face, the rear face, the left-side face, and the right-side face of the vegetable compartment 5, particularly at a point where the temperature inside the vegetable compartment 5 is relatively low, and with an arbitrary capacity of 3 W or greater, and about 10 W, for example. The thermal heater 46 is energized at a duty factor on the time basis (a ratio of energization time to reference time) according to an outside air temperature and the temperature inside the vegetable compartment 5.

[0047]

Fig. 25 is a schematic view illustrating placement of the heat rejection pipe of the vegetable compartment according to Embodiment 1 of the present invention. Fig. 26 is a schematic view illustrating the relation of connection between the heat rejection pipe of the vegetable compartment and the refrigerant circuit according to Embodiment 1 of the present invention. Fig. 25 illustrates a configuration in which a heat rejection pipe 47 is disposed, in place of the above thermal heater 46, inside the urethane foamed member 23a in each of the right and left side walls of the vegetable

outside the region covered with the metal tray 89 in the drip tray 80 may be covered with a metal tape or other materials.

[0065]

The metal tray 89 is formed along the water receiver 81 and the upstream portion 82a to have a substantially identical shape as the shape of the inlet 83 of the drain passage 82, and promotes conduction of heat generated from the passage heater 85 installed inside the thermal insulator 34c.

[0066]

Melt water having been generated by the defrosting unit 67 melting a part of frost and dropped from the cooler 14 into the water receiver 81 of the drip tray 80 is guided to the inlet 83 of the drain passage 82 by the inclination of the water receiver 81. The melt water guided to the inlet 83 flows into the drain passage 82, is further melted by the passage heater 85 while passing through the upstream portion 82a, and flows into the downstream portion 82b having a smaller inner diameter. With no junction being provided in the drain passage 82, the melt water passing therethrough is discharged into the machine compartment 90 from the outlet 84 protruding into the machine compartment 90, without permeating into the thermal insulation wall 99.

[0067]

Fig. 32 is a rear view illustrating a configuration of the inside of the machine compartment according to Embodiment 1 of the present invention. In the machine compartment 90, a water tray (drain pan 91) is installed to receive moisture discharged from the outlet 84 of the drain passage 82 into the machine compartment 90, and a heating pipe 92 is installed in the drain pan 91. The heating pipe 92 is formed of, for example, a refrigerant tube through which high-temperature refrigerant flows.

[0068]

The melt water having passed through the drain passage 82 is discharged from the outlet 84 into the drain pan 91 of the machine compartment 90 and stored in the drain pan 91. The melt water stored in the drain pan 91 is urged to evaporate by the heating pipe 92 and cooling air that cools the air-cooled condenser 9, the compressor

a rectangle, or a shape in combination of a half oval and a rectangle, and the back side of the inlet 183 almost reaches the backmost portion of the water receiving face. The outlet 184 is, for example, formed in a shape which cross-section is substantially circular. As illustrated in Fig. 34, on the inlet 183 side of the drain passage 182 (hereinafter referred to as an upstream portion 182a), the sectional area decreases and the front position of the cross section approaches the rear face side in the downstream direction. On the outlet 184 side, the drain passage 182 (hereinafter referred to as a downstream portion 182b) is formed in a tubular shape having a substantially constant inner diameter and having a length such that the drain passage 182 protrudes into the machine compartment 90. The drain passage 182 is integrally formed from the inlet 183 to the outlet 184, and the cross section of the upstream portion 182a changes from the cross-sectional shape of the inlet 183 to the circular shape of the downstream portion 182b.

[0081]

In Embodiment 2, the downstream portion 182b of the drain passage 182 is formed to be inclined from a direction along the rear face of the refrigerator 1 (e.g., perpendicularly downward direction) to the rear face side. That is, the position of the downstream portion 182b shifts closer to the back of the refrigerator 1 when being closer to the outlet 184. An angle forming the downstream portion 182b is set to be an angle at which the moldability of the drain passage 182 and the ease for discharge of melt water are not impaired, or no foreign matters are accumulated. For example, it may be configured such that the inclination angle of the outlet 184 has an angle of depression (angle θ) equal to or larger than 7 degrees relative to a depth horizontal direction of the refrigerator 1, the angle being an angle at which a droplet falls under its own weight. In addition, the upper limit of the angle of depression (angle θ) may, for example, be set to smaller than 90 degrees so that the flow of the melt water from the upstream portion 182a of the drain passage 182 is not prevented.

[0082]

As described above, in Embodiment 2, in the same manner as in Embodiment 1, the drain passage 182 is formed such that the inner diameter is reduced and the

central position approaches the rear face of the refrigerator 1 from the inlet 183 to the outlet 184, and the drain passage 182 is integrally formed from the inlet 183 to the outlet 184. Therefore, in the same manner as in Embodiment 1, in the refrigerator 1, it is possible to avoid the blockage of the drain passage 182 while ensuring the thermal insulation performance of the thermal insulation wall 99, and to prevent occurrence of a water leakage in the refrigerator or other problems.

[0083]

Moreover, the inclination angle of the outlet 184 of the drain passage 182 has an angle of depression (angle θ) equal to or larger than 7 degrees relative to the depth horizontal direction. Hence the outlet 184 of the drain passage 182 is formed facing the rear face of the refrigerator 1 and a region in which the vacuum thermal insulator can thus be installed in the thermal insulation wall 99 is ensured to be wide, and in the refrigerator, it is possible to increase the area covered with the vacuum thermal insulator and enhance the thermal insulation performance.

[0084]

Note that the embodiment of the present invention is not limited to the above embodiments, and various changes can be made. For example, in Embodiment 1, the heater that generates heat by energization has been used as the defrosting unit 67, but it may be configured such that frost is melted using high-temperature refrigerant in place of the heater.

Reference Signs List

[0085]

1 refrigerator 2 refrigerator compartment 3 ice-making compartment 4 temperature versatile compartment 5 vegetable compartment 6 freezer compartment 7 refrigerant circuit 8 compressor 9 air-cooled condenser 10 heat rejection pipe 11 dew condensation preventive pipe 12 dryer 13 decompression device 14 cooler 14a lower end 15 air-sending device 16 (16a, 16b, 16c, 16d) temperature sensor 17 control board 18 (18a, 18b, 18c) air volume control device 19 thermal insulation box body 19a wall portion 21 outer box 22 inner box

CLAIMS

[Claim 1]

A refrigerator comprising:

a thermal insulation box body including an inner box, an outer box, and a thermal insulator installed in a space between the inner box and the outer box;

a machine compartment that is formed by a lower portion of a rear face of the thermal insulation box body recessing inward and in which a compressor is disposed;

a cooler compartment that is formed in the thermal insulation box body above the machine compartment and in which a cooler that generates cool air is disposed;

a water receiver provided below the cooler in the cooler compartment and receiving water from the cooler;

a drain passage having an inlet provided at the water receiver, passing through a thermal insulation wall interposed between the cooler compartment and the machine compartment to cause the cooler compartment and the machine compartment to communicate with each other, and having an outlet protruding into the machine compartment; and

a passage heater provided on the inlet side of the drain passage,

wherein a cross-sectional shape of the inlet of the drain passage is an elliptical or oval shape, the drain passage on the inlet side has a shape in which a sectional area decreases and a central position of a cross section approaches the rear face side in a downstream direction, and

the drain passage is integrally formed from the inlet to the outlet.

[Claim 2]

The refrigerator of claim 1, wherein the drain passage has a wall face vertically extending on the rear face side or a part of the rear face side in a plan view.

[Claim 3]

The refrigerator of claim 1, wherein an inclination angle of the outlet of the drain passage is an angle of depression equal to or larger than 7 degrees relative to a depth horizontal direction.

[Claim 4]

The refrigerator of any one of claims 1 to 3, wherein the drain passage is integrally formed with the water receiver.

[Claim 5]

The refrigerator of any one of claims 1 to 4, further comprising a defrosting unit melting frost on the cooler with a heater or high-temperature refrigerant.

[Claim 6]

The refrigerator of any one of claims 1 to 5, further comprising a water tray installed below the outlet in the machine compartment,

wherein a heating pipe is disposed inside the water tray.

[Claim 7]

The refrigerator of any one of claims 1 to 6, further comprising a first storage compartment formed in the thermal insulation box body,

wherein the water receiver and the drain passage are formed by extending a floor face of the first storage compartment to the cooler compartment, and are disposed in positions lower than the floor face.

[Claim 8]

The refrigerator of claim 7, further comprising a second storage compartment formed below the first storage compartment and in front of the machine compartment, and set to a temperature lower than that of the first storage compartment,

wherein the thermal insulation wall is a bottom wall of the first storage compartment and a wall portion forming the machine compartment of the thermal insulation box body.