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DEFROSTING HEATER IN REFRIGERATOR

This invention relates to the water-proof structure of a defrosting heater for a refrigerator or a freezing chamber.

5 A conventional defrosting heater, disclosed for instance by Unexamined Japanese Utility Model Publication Hei-4-20990, will be described with reference to FIGS. 7 and 8. FIG. 7 is a sectional front view of the conventional defrosting heater for a refrigerator, and FIG. 8 is an enlarged section view of its essential components thereof
10 shown in the encircled region A of FIG. 7.

In FIGS. 7 and 8, reference numeral 1 designates a cooling air circulating fan provided on the back of the refrigerator; 2, a cooler provided below the fan 1; 3, a cylindrical heat-resisting glass pipe which is laid
15 horizontal near the lower edge of the cooler 2; 4, a heating wire of iron-chromium alloy coiled inside the glass pipe 3; 5, lead wires connected to both ends of the heating wire 4; 6, heat-resisting terminals which support the lead wires 5 for connection of the latter 5 to the heating wire 4; and 7,
20 disks (only one disk shown) which are provided at both ends of the glass pipe 3 to close the latter 3 at both ends, and support the terminals 6, respectively. Further in FIGS. 7 and 8, reference numeral 8 designates silicon rubber caps which seal the glass pipe at both ends, hold the disks 7
25 against the end faces of the glass pipe 3, and support the lead wires 5 from outside, respectively; 9, a defrosting heater including the heating wire 4 of iron-chromium alloy coiled inside the glass pipe 3; 10, the two ends of the heating wire 4; and 11, straight lead wire through which the
30 ends 10 of the heating wire 4 are connected to the terminals 6, respectively.

The operation of the conventional defrosting heater thus constructed will be described.



The cooling air, which is produced by the heat exchanging action of the cooler 2, is supplied into the refrigerator to cool and preserve the contents such as food in it. On the other hand, the air passing through the cooler 2, being dehumidified, gradually forms frosts on the cooler 2. The frosts thus formed obstructs the flow of air around the cooler 2. Therefore, every predetermined period of time, the defrosting heater 9 provided below the cooler 2 is operated to melt the frosts, so that the refrigerator is maintained high in cooling characteristic at all times.

However, the conventional defrosting heater designed as described above suffers from the following difficulties: The frosts formed on the cooler are molten into water by the heat generated by the defrosting heater, and the water may fall, in the form of water droplets, onto the cap or the lead wire. In this case, the water droplets are led to the outer end of the cap, through which the lead wire is extended, so that a capillary phenomenon occurs with the water droplets; that is, the water droplets are allowed to go through the small gap between the cap and the lead wire into the defrosting heater. As a result, the defrosting heater becomes poor in electrical insulation, or the metal parts such as the heating wire and the lead wires are corroded, and at worst broken; that is, the refrigerator is lowered in reliability - more specifically, it is lowered in safety, and reduced in service life.

This difficulty may be eliminated by completely closing the gap between the cap and the lead wire at each end of the glass pipe; that is, by completely isolating the inside of the glass pipe from the outside air. However, the method provides another problem: when current is applied to the defrosting heater, the pressure in the glass pipe is abruptly increased by the heat generated by the heating wire to burst the glass pipe or remove the cap or caps from the glass pipe.



Accordingly, an object of this invention is to eliminate the above-described difficulties accompanying a conventional defrosting heater for a refrigerator. More specifically, an object of the invention is to provide a defrosting heater for a refrigerator which is free from difficulties that, even when water formed by defrosting drips on the caps, lead wires or the like of the defrosting heater, the defrosting heater is lowered in electrical insulation or corroded, and that, when current is applied to the defrosting heater, the latter is not safe - for instance the glass pipe is burst or the cap or caps are removed from the glass pipe.

The foregoing object of the invention has been achieved by the provision of a defrosting heater for a refrigerator in which the lead wires of the heater are inserted into water-proof and heat-resisting tubes, and first end portions of the tubes are put on the caps of the heater in such a manner that they are fixedly held in full contact with the caps, respectively. Furthermore, in the defrosting heater, the remaining end portions of the tubes have water dripping means and air flow means.

Even when water formed by defrosting drips on the cap or the water-proof tube, the water droplets will never go into the defrosting heater, because the gap between the cap and the lead wire is covered with the water-proof tube. When the water droplets fall on the lead wire, the water dripping means provided at the remaining end portion of the tube functions to allow the water droplets to drop as they are; that is, the water will never flow into the defrosting heater. On the other hand, the air which is expanded by the heat generated by the heating wire upon application of current to the defrosting heater is allowed to flow out through the remaining end portions of the water-proof tubes.



First Embodiment

A first embodiment of this invention will be described with reference to FIGS. 1 through 4. FIG. 1 is front a sectional front view of a defrosting heater for a refrigerator, which constitutes a first embodiment of the invention. FIG. 2 is an enlarged sectional view of its essential components shown in the encircled region A of FIG. 1. FIG. 3 is an enlarged sectional view of its essential components shown in the encircled region B of FIG. 1. FIG. 4 is an enlarged sectional view showing the folded parts C and D of a heat-resisting tube of the defrosting heater. In FIGS. 1 through 4, parts corresponding functionally to those which have been described with reference to FIGS. 7 and 8 (the prior art) are therefore designated by the same reference numerals or characters.

In FIGS. 1 and 2, reference numeral 3 designates a heat-resisting glass pipe which is provided near the lower end of the cooler 2 in such a manner that it is laid horizontal; 4, a heating wire of iron-chromium alloy coiled inside the glass pipe 3; 10, the ends (only one end shown) of the coiled heating wire; 11, straight heating wires (only one straight heating wire shown); 5, lead wires (only one lead wire shown) used to supply current through terminals 6 to the heating wires 11 and 4; 6, the aforementioned terminals through which the lead wires 5 are connected to the straight heating wires 11, respectively; and 16, a silicon rubber tube which cover each lead wire 5. One end portion of the silicon rubber tube 16 is connected to the cap 8 with first fixing means 17 such as a fastener in such a manner that the one end portion is in full contact with the outer cylindrical wall of the cap 8. The other end portion of the tube 16 is folded as indicated at D in FIG. 1 so that it is opened downwardly.

Further in FIGS. 1 and 2, reference numeral 18 designates second fixing means such as a fastener which ties the lead wire 5 and the tube 16 together between the folded



part C of the tube and the folded part E of the lead wire 5; 19, a first air flow gap formed between the tube 16 and the lead wire 5 (hereinafter referred to as "a first gap 19", when applicable); and 20, a second air flow gap formed
5 between the lead wire 5 and the cap 8 (hereinafter referred to as "a second gap 20", when applicable).

The operation of the first embodiment thus constructed will be described.

When current is applied to the defrosting heater 9,
10 the heating wire 4 generates heat to melt the frosts on the cooler 2 into water, which is discharged through a draining mechanism (not shown). The water may drip on the cap 8 of the defrosting heater 9; however, it never goes into the first gap, because the tube 16 covers the cap 8 in such a
15 manner that its inner surface is sealingly in contact with the whole outer cylindrical surface of the cap 8. In the case where the water drips on the lead wire 5 or the tube 16 or the second fixing means 18 shown in the encircled region B of FIG. 1 (i.e., in FIG. 3) the water droplets may flow down
20 to the folded part E of the lead wire 5 by their own weight and fall therefrom, or they, flowing down the tube 16, may come near the encircled region A of FIG. 1. However, in those cases, the water droplets will never go into the second gap 20 between the lead wire 5 and the cap 8, because as was
25 described before, the tube 16 sealingly covers the whole outer cylindrical surface of the cap 8 with the fixing means 17. On the other hand, the heating wire 4 generates heat. The heat thus generated heats the air in the glass pipe 3 as well, so that the air is abruptly increased in volume and in
30 temperature; however, the air thus heated is allowed to flow out through the second gap 20 and the first gap 19.

Second Embodiment

In the first embodiment, the water dripping structure as shown in the region B of FIG. 1 is so designed that the
35 end portion of the tube 16 is so held that it is opened



downwardly whereby no water droplets move to the first gap
19. However, as shown in FIGS. 5 and 6, the end portion of
the tube may be so held that it is opened upwardly. FIG. 5
is an enlarged diagram showing a part of another example of
the defrosting heater, which constitutes a second embodiment
of the invention, in correspondence to the encircled region B
of FIG. 1. Fig. 6 shows a cross sectional view of the
example of Fig. 5. In this case, the end portion of the tube
is covered with a water-resistant bag 20, and then the bag
20, the lead wire 5, and the tube 6 are fixed with the second
fixing means 18. The second embodiment thus constructed has
the same effects as the first embodiment.

In the above-described embodiments, the tube 16 is
sealingly put on the cap 8 with the first fixing means 17
mounted on the tube 16; however, the invention is not limited
thereto or thereby. For instance, the tube 16 may be
connected to the cap by using an adhesive agent in such a
manner that the inner cylindrical surface of the former is
sealingly in contact with the whole outer cylindrical surface
of the latter.

As is apparent from the above description, when water
formed by defrosting drips on the defrosting heater or the
lead wires thereof, the water droplets are positively
prevented from flowing into the defrosting heater.

Therefore, the defrosting heater of the invention is high in
electrical insulation, and its metal parts such as the
heating wire are prevented from corrosion. That is, the
defrosting heater according to the invention is considerably
high in reliability.

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CLAIMS

1. A defrosting heater for a refrigerator which is arranged below a cooler, and which comprises:

an insulated cylindrical pipe which is sealed with insulating caps at both ends;

a heating wire coiled inside said insulated cylindrical pipe which, when energized by electric current, generates heat to melt frosts;

heat-resisting lead wires connected to both ends of said heating wire in such a manner that the connecting points thereof are located in said insulating caps, respectively, said lead wires being extended through through-holes formed in said insulating caps, respectively,

CHARACTERIZED in that

said lead wires are covered with heat-resisting and water-resistant tubes in such a manner that the cylindrical inner surfaces of end portions of said tubes, which portions are on the side of said insulated cylindrical pipe, are in full contact with said caps, respectively.

2. A defrosting heater as claimed in claim 1, CHARACTERIZED in that

said end portions of said heat-resisting and water-resistant tubes are put on said insulating caps, respectively, and are then tightened against said insulating caps with fixing means, so that the cylindrical inner surfaces of said end portions of said tubes are fixedly held in full contact with the outer cylindrical surface of said insulated pipe.

3. A defrosting heater as claimed in claim 1, CHARACTERIZED in that





said end portions of said heat-resisting and water-resistant tubes are put on said insulating caps, respectively, and

5 with an adhesive agent applied to the inner cylindrical surface of said end portions thus put on and at least part of the outer surfaces of said insulating caps, the cylindrical inner surfaces of said end portions of said tubes are fixedly held in full contact with the outer cylindrical surface of said insulated pipe.

10 4. A defrosting heater as claimed in any one of the preceding claims,

CHARACTERIZED in that

15 the remaining end portions of said heat-resisting and water-resistant tubes are fixed in such a manner that the openings of said remaining end portions are faced downwardly, and

a gap is formed between each of said tubes and said lead wire therein.

20 5. A defrosting heater as claimed in claim 1, 2 or 3,

CHARACTERIZED in that

25 the remaining end portion of each of said heat-resisting and water-resistant tubes is fixed in such a manner that the opening of said remaining end portion is faced upwardly, and covered with a water-resistant bag from above, and

a gap is formed between each of said tubes and said lead wire therein, while an air-flow means is formed between the gap and the outside air.



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6. A defrosting heater for a refrigerator substantially as described with reference to Figures 1 to 4 or Figures 5 and 6 of the drawings.

