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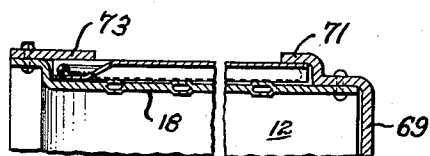
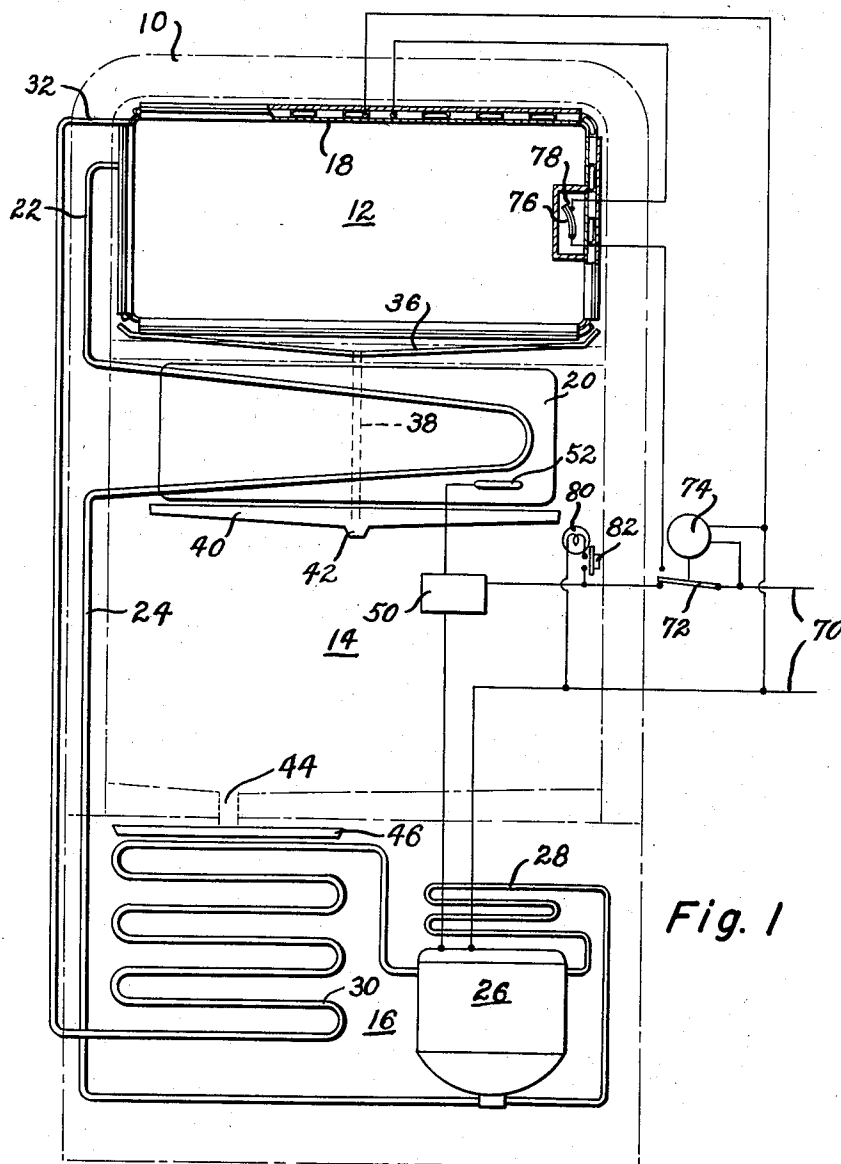
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2,867,093

DEFROSTING ARRANGEMENT FOR REFRIGERATING SYSTEM

Filed Dec. 20, 1955

2 Sheets-Sheet 1



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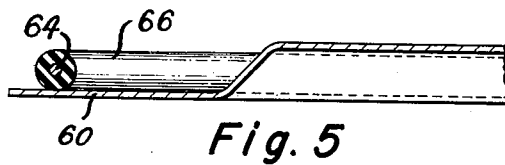
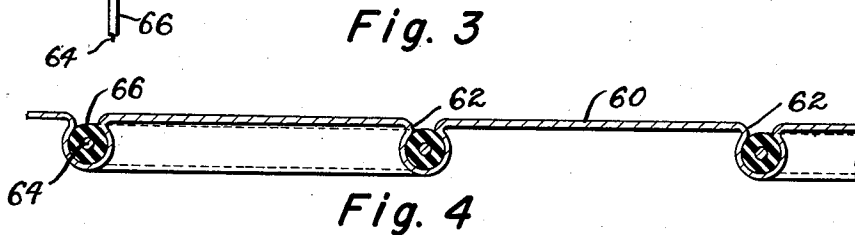
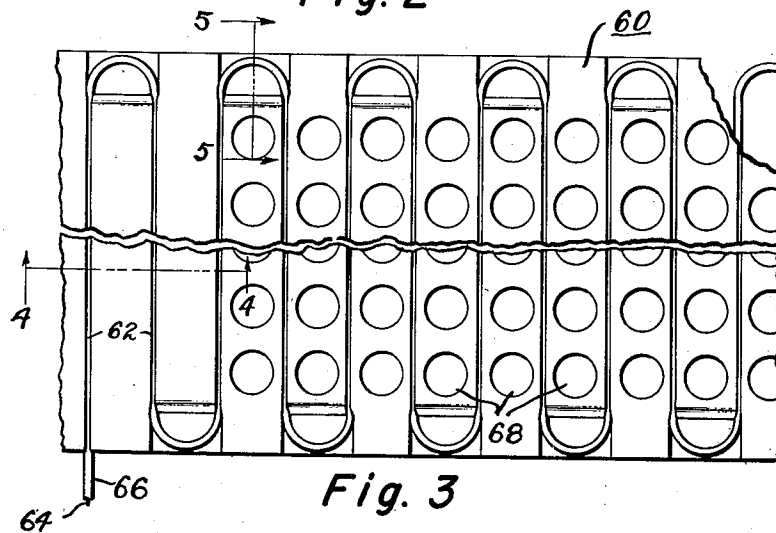
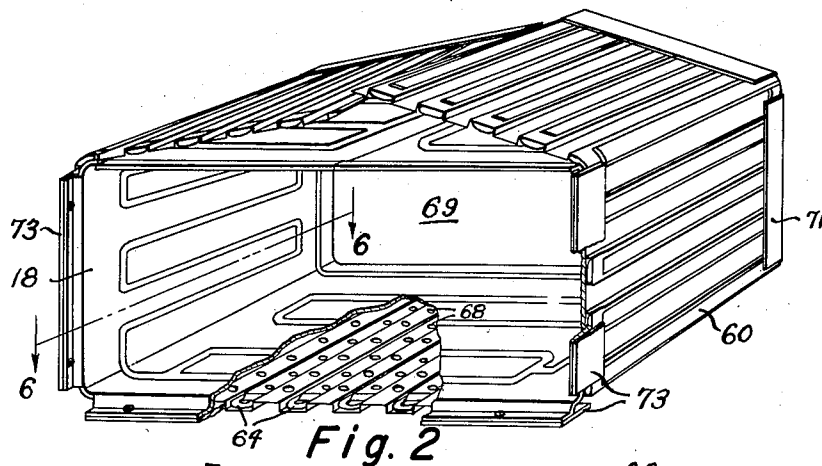
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DEFROSTING ARRANGEMENT FOR REFRIGERATING SYSTEM

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2 Sheets-Sheet 2



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1

2,867,093

DEFROSTING ARRANGEMENT FOR REFRIG- ERATING SYSTEM

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4 Claims. (Cl. 62—152)

This invention relates to refrigerating apparatus and more particularly to an improved arrangement for defrosting the same.

It is an object of this invention to provide an improved arrangement for electrically supplying heat to the evaporator of the frozen food compartment of a refrigerator in such a manner as to avoid localized hot spots.

More particularly, it is an object of this invention to attach a heater element to a relatively thin sheet or strip of metal which distributes the heat uniformly throughout the sheet or strip, and then wrapping the sheet around the exterior of the freezer compartment evaporator.

Still another object of this invention is to provide an improved arrangement for indicating to the user when the refrigerator is being defrosted.

Another object of this invention is to provide an improved control arrangement for the refrigerator and the defrost apparatus.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Figure 1 is a schematic view showing the refrigerant and electrical circuits;

Figure 2 is a perspective view, with parts broken away, showing the construction of the defrost shield and its relationship to the frozen food compartment evaporator;

Figure 3 is a fragmentary developed plan view of the defrost shield;

Figure 4 is a fragmentary sectional view on an enlarged scale taken substantially on line 4—4 of Figure 3;

Figure 5 is a fragmentary sectional view on an enlarged scale taken substantially on line 5—5 of Figure 3; and

Figure 6 is a fragmentary sectional view taken substantially on line 6—6 of Figure 2.

Referring now to the drawing, wherein a preferred embodiment of the invention has been shown, reference numeral 10 generally designates a refrigerator having a frozen food storage compartment 12, an unfrozen food storage compartment 14 and a machinery compartment 16. The refrigerating system includes a first primary evaporator 18 which may be of any conventional construction and which forms the liner for the frozen food storage compartment 12 in accordance with conventional practice. A second primary refrigerant evaporator 20 is mounted in the unfrozen food compartment 14 and is adapted to be connected in unrestricted series refrigerant flow relationship to the outlet of the evaporator 18 by means of the refrigerant line 22.

2

The outlet of the evaporator 20 is connected to the suction line 24 which leads directly to the inlet of a conventional sealed motor-compressor unit 26 located in the machinery compartment 16. The compressor 26 discharges the compressed refrigerant directly into a super heat removing coil 28 which returns the refrigerant to the outer casing of the motor-compressor 26 in accordance with conventional practice. The motor-compressor casing is provided with an outlet which delivers the compressed refrigerant to the condenser 30 wherein the refrigerant is condensed before discharging into the fixed restrictor 32 which conveys the liquid refrigerant to the primary evaporator 18. Systems of this type are more fully described in Wurtz et al. Patent No. 2,672,020, to which reference is made for a more complete disclosure of the refrigerant circuit.

A defrost collecting pan 36 is disposed directly beneath the primary evaporator 18 for collecting the defrost water and for discharging the defrost water through a drain 38 which leads to the condensate collecting trough 40 located beneath the evaporator 20. The trough 40 is provided with means 42 for directing the condensate water onto the back wall of the food storage compartment so as to cause the defrost water to drain down along the back wall of the food storage compartment 14 and eventually enter the drain 44 in the bottom wall of the compartment 14 so as to discharge the condensate water into the vaporizer pan 46 located in thermal exchange relationship with the relatively hot condenser 30, in accordance with usual practice. The apparatus described thus far is intended to represent a conventional modern refrigeration system.

The motor-compressor unit 26 is adapted to be cycled by means of a switch 50 which is controlled by means of a thermostat 52 located on the evaporator 20. The thermostat 52 and the switch 50 are so designed and calibrated that the circuit to the motor-compressor unit 26 will be closed by the switch 50 when the temperature at 52 exceeds 34° and will remain closed until the temperature at 52 drops to -2°, at which time the compressor is stopped until the temperature at 52 again reaches 34. By virtue of this arrangement, the evaporator 20 will automatically defrost itself during each "off" cycle of the compressor, with the result that no auxiliary heat need be applied to the evaporator 20 for defrosting the same, but this is not true of the evaporator 12, which is maintained at temperatures of approximately 0° most of the time, irrespective of whether the motor-compressor unit 26 is energized, due to the characteristics of refrigeration systems of this type, as more fully explained in the above-mentioned patent. The problem of defrosting the frozen food compartment evaporator has been solved by this invention by placing a specially constructed heating shield, or blanket, around the top, bottom and sides of the evaporator 12 in direct intimate contact therewith.

It is recognized that it is old to defrost evaporators by the application of heat thereto but in the prior art type of defrost heaters inadequate provision has been made for uniformly heating all parts of the evaporator in such a manner as to prevent hot spots in certain areas. It has been found that the freezer compartment evaporator 12 can be defrosted very quickly at temperatures lower than formerly considered practical, by using a heater shield such as the shield 60, constructed in accordance with the

showing of Figs. 2 through 5 of the drawing. Figure 2 shows the ends of the heater shield 60 pulled away from the upper surface of the evaporator for purposes of illustration only. This shield consists of a thin sheet or strip of aluminum or the like having a thickness of approximately .012" and having formed therein a plurality of transversely extending heater wire grooves or passages 62 in which an insulated heater wire 64 is placed, as best shown in Fig. 4 of the drawing. The adjacent transversely extending portions of heater wire are arranged fairly close together, with the result that the heat generated by current flowing through the wire 64 will uniformly heat the entire shield 60. The wire 64 is coated by means of insulation 66, which is preferably a polyethylene material, which is not adversely affected by moisture or temperature changes. It will be noted that the shield envelops a major portion of the insulated heater wire so as to facilitate the transfer of heat from the wire to the aluminum shield and so as to hold the wire in place. It will also be noted that the insulated heater wire does not directly contact the surface of the evaporator, with the result that there is less danger of hot spots developing in any one segment of the evaporator. That portion of the shield 60 which underlies the evaporator 18 is provided with water drainage holes 68 which allow the defrost water to flow into the pan 36.

As best shown in Fig. 6 of the drawing, the rear wall 69 of the food compartment 12 is provided with a flange 71 which overlies the rear edge of the shield 60 so as to hold the shield against the evaporator plate 18. Removable clamp elements 73 are bolted or otherwise secured to the front edge of the evaporator plate 18 for holding the heater shield 60 in place.

The power for operating the compressor and the defrost heater is supplied through the main power lines 70 and the energization of the defrost heater is controlled by means of a switch 72 arranged in the circuit, as shown. The switch 72 is a single pole, double throw switch which serves to open the circuit to the motor-compressor unit when the circuit is closed to the defrost heater. This switch 72 is adapted to be operated by means of a timer 74 which opens the circuit to the motor-compressor unit and closes the circuit to the defrost heater periodically, such as once every week, for a predetermined period of time such as fifteen minutes, so as to thereby heat the frozen food storage compartment evaporator 18 to a temperature high enough to melt all of the ice which may have formed thereon during the preceding week.

In the event that the temperature of the evaporator 18 exceeds a predetermined temperature such as 50° before the timer 74 opens the circuit to the heater 64, a thermostat 76 which is arranged in thermal exchange relationship with the evaporator 18 serves to open the circuit at switch 78 located in the heater line, as shown, so as to prevent unnecessary heating of the evaporator 18. The switch 78 recloses when the temperature of the evaporator drops below 35°.

It has been found desirable to provide means for indicating to anyone opening the door to the refrigerator whether or not the refrigerator is being defrosted at the time and in order to accomplish this, the refrigerator light 80 has been arranged in the circuit as shown, so as to be deenergized whenever the switch 72 has opened the circuit to the motor-compressor unit and has closed the circuit to the defrost heater. The light 80 is normally controlled by the door operated switch 82, in accordance with conventional practice, so as to close the circuit to the light 80 whenever the door is opened. By virtue of the above-described control circuit arrangement, it is obvious that this light 80 will remain off whenever the door is opened and the evaporator 18 is being defrosted.

By virtue of the defrost heater construction described herein, it is possible to place the heater wires close together and to operate the heater at a much lower temperature and still obtain rapid and complete defrosting of the

entire refrigerated surface. Insofar as certain aspects of this invention are concerned, one could construct the shield in other shapes and sizes and could arrange the heating wire in other than the serpentine shape shown. Thus, the shield and the heating wire could be so constructed and arranged that the heating wire would extend lengthwise of a long flexible shield which would be wrapped around the outside of the evaporator. The shield in each instance serves as a means for holding the wire and for distributing the heat throughout a much larger area than would otherwise be possible.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. In a refrigerator having a storage compartment for food, an evaporator for refrigerating said food storage compartment, a compressor, a condenser, means for connecting said compressor, condenser, and said evaporator in series refrigerant flow relationship, heater means arranged in thermal exchange relationship with said evaporator for defrosting said evaporator, said heater means comprising flexible means wrapped around said evaporator and a heating element between said flexible means and said evaporator, said heater element being embedded in a groove provided in said flexible means, said flexible means having apertures therein beneath said evaporator for the drainage of defrost water.

2. In a refrigerator having a first storage compartment for frozen food and a second storage compartment for unfrozen food, a first evaporator for refrigerating said frozen food storage compartment, a second evaporator for refrigerating said unfrozen food storage compartment, a compressor, a condenser, means for connecting said compressor, condenser, first and second evaporators in series flow relationship, heater means arranged in thermal exchange relationship with said first evaporator for defrosting said first evaporator, said heater means comprising flexible heat reflecting foil wrapped around said first evaporator and a flexible heating element between said flexible foil and said first evaporator, said heating element being embedded in grooves provided in said foil, said heater being held out of contact with said first evaporator by said foil.

3. Refrigerating apparatus including an above-freezing food compartment and a below-freezing food compartment, a thermal heat transfer barrier between said compartments, a refrigerant liquefying means, a freezing evaporator means in heat exchange relation with said below-freezing compartment and having its inlet connected to an outlet of said liquefying means, a food compartment evaporating means in heat exchange relation with said above-freezing food compartment and having its inlet connected to the outlet of said freezing evaporator means, means for returning evaporated refrigerant from said freezing and food compartment evaporating means to said liquefying means, thermostatic cycling control means having a thermally sensitive element responsive to the temperature of said food compartment evaporating means for starting and stopping said liquefying means and including means for preventing the starting of said liquefying means until the food compartment evaporating means reaches a defrosting temperature above 32° F. and having means for thereafter preventing the stopping of said liquefying means until said food compartment evaporating means is cooled to below-freezing temperatures, said below-freezing compartment having a sufficiently slower heat-leak than said food compartment and said freezing evaporator means having sufficiently greater mass relative to said heat-leak than said food compartment evaporating means that said below-freezing compartment is maintained at substantially constant sub-freezing temperatures during the cycling of said liquefying means, and means for cyclically supplying external

5

heat to said freezing evaporating means so as to defrost the same at less frequent intervals than said food compartment evaporating means is defrosted.

4. In a refrigerator having a storage compartment for food, an evaporator for refrigerating said food storage compartment, a compressor, a condenser, means for connecting said compressor, condenser, and said evaporator in series refrigerant flow relationship, heater means arranged in thermal exchange relationship with said evaporator for defrosting said evaporator, said heater means comprising flexible means wrapped around said evaporator and a heating element between said flexible means and said evaporator, said heater element being embedded

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in a groove provided in said flexible means, said evaporator having flanges overlying the edges of said flexible means so as to hold said flexible means in contact with the outer surface of said evaporator.

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