

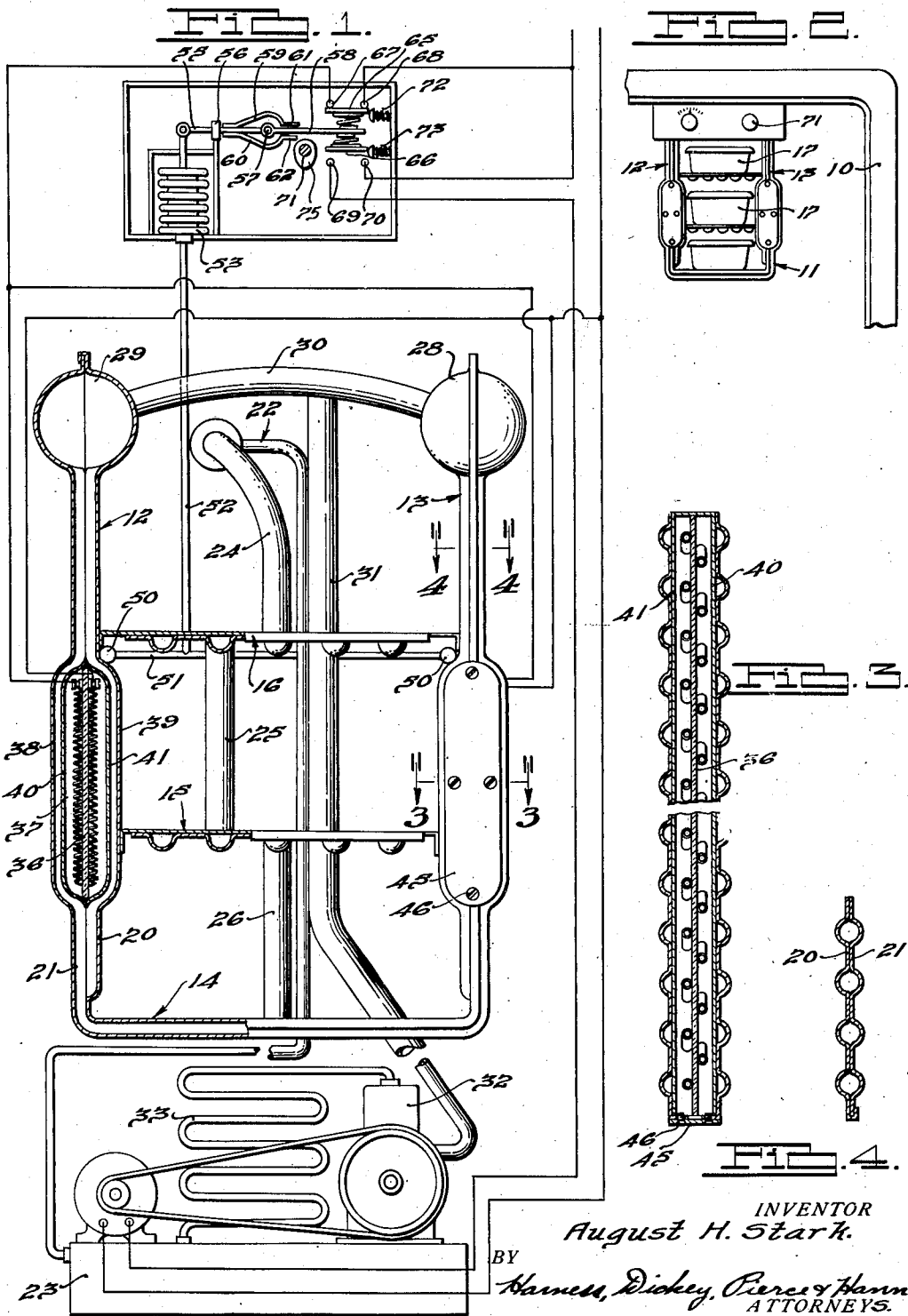
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A. H. STARK

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REFRIGERATOR DEFROSTING

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INVENTOR
August H. Stark.
BY
Harness, Dickey, Pierce & Hann.
ATTORNEYS.

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REFRIGERATOR DEFROSTING

August H. Stark, Perryville, Mo.

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11 Claims. (Cl. 62—1)

The invention relates to refrigerators and it has particular relation to a defrosting device and arrangement.

The application constitutes a continuation in part of my co-pending application for Patent, Serial No. 703,282, filed December 20, 1933.

One object of the invention is to provide an improved defrosting device for refrigerators which will effect defrosting in a very short period of time and without causing any noticeable increase in temperature of the storage compartment of the refrigerator.

Another object of the invention is to provide a defrosting device and arrangement for refrigerators which is designed for particular use in conjunction with sheet metal evaporators.

Another object of the invention is to provide an improved sheet metal evaporator having a heating element embodied therein for defrosting the sides of the evaporator.

Other objects of the invention will become apparent from the following specification, the drawing to which it relates, and from the claims hereinafter set forth.

For a better understanding of the invention, reference may be had to the drawing wherein:

Figure 1 is an elevational view of a refrigerating system embodying an evaporator and defrosting device constructed according to one form of the invention;

Fig. 2 is a fragmentary view illustrating a refrigerator cabinet having an evaporator and defrosting device therein, such as shown by Fig. 1;

Fig. 3 is a cross-sectional view on a larger scale taken substantially along the line 3—3 of Figure 1;

Fig. 4 is a cross-sectional view taken substantially along the line 4—4 of Fig. 1.

Referring to Figure 2, a refrigerator cabinet is indicated at 10 and a depending evaporator in the cabinet is indicated at 11. It will be understood that a door is provided for the cabinet and that the space around the evaporator may be employed for food storage purposes. In general, the type of evaporator shown is of a conventional design and is constructed of sheet metal plates welded or otherwise secured together.

Referring particularly to Figure 1, the evaporator comprises two side walls 12 and 13, a bottom wall 14, and a pair of partitions 15 and 16. The partitions and bottom wall, as shown by Figure 1, may serve as supports for ice trays, indicated at 17. The side walls, bottom, and partitions of the evaporator are constructed by employing sheet metal plates 20 and 21, such as

shown by Figure 4, providing longitudinal recesses in one or both plates, and then welding or otherwise securing the plates together so that the recesses provide refrigerant conducting passageways. Various arrangements and designs of passageways may be used for most efficiently conducting the refrigerant around the sides and through the partitions of the evaporator.

As shown in detail by Fig. 1, the refrigerant may be conducted through a tube 22 leading from a container 23, through a tube 24 to the passageways in the partition 16, then from certain of the passageways in the latter partition to the partition 15 through a second tube 25, and then similarly from the partition 15 to the bottom side of the evaporator through a tube 26. As the refrigerant enters the partitions and bottom wall, it expands in the various passageways and cools. Heat is absorbed from between the partitions and from the storage compartment by the sides, bottom, and side walls of the evaporator, thereby resulting in a lowering of the temperature, as will be readily understood. The refrigerant flows upwardly through the side walls to what may be termed headers 28 and 29 and then discharges through a common connecting pipe 30, which in turn is connected by means of a conduit 31 to the intake side of a refrigerant compressor 32. The tank 23 for the refrigerant under pressure is connected to a condenser 33 that in turn is connected to the discharge side of the compressor.

During operation of a refrigerator of this character, moisture from the air naturally condenses on the sides and bottom of the evaporator and this necessarily results in a lowering of the efficiency of operation. It is quite desirable therefore at times to defrost the evaporator so as to cause removal of the frost. It is furthermore desirable that the defrosting be effected without involving long shut-downs of the refrigerator, as naturally the food storage compartments would become undesirably warm if the refrigerating unit were prevented from operating for too long a period of time. The present invention is designed to accomplish an effective defrosting of the evaporator in a very short period of time and without increasing the temperature of the food storage compartment.

For accomplishing this result, an electric heating element, as shown at 36 in Figure 1, is provided in each side wall of the evaporator and this heating element may comprise a sheet of insulating material having heating coils on opposite sides thereof and the coils themselves may

be covered with insulating material to prevent possible short circuiting through the side walls of the evaporator. A heating element generally of the type employed in electric irons may be used and it should be understood that it is desirable that the insulating material covering the coils should not be of such character or thickness as to undesirably retard the passage of heat therethrough to the metal plates of the evaporator. It seems that mica, for example, is a suitable insulating material for this purpose, as it insulates the electric wires very effectively although it does not undesirably retard the passage of heat therethrough.

Each element is placed in a pocket 37 in the side wall of the evaporator and this pocket may be formed by bulging out one or both sides of the side wall of the evaporator, as indicated at 38 and 39. It should be understood that in providing this pocket, the metal plates that are together above and below the pocket, are separated a substantial distance to form the pocket. Now, in order to still provide for the flow of refrigerant as it would flow in the absence of the pocket, in which case the plates would be together, additional plates 40 and 41 are provided so as to form passageways on each side of the pocket that join the passageways above and below the pocket. Figure 3 illustrates how metal plates 40 and 41 may be employed to form two series of passageways extending around the pocket, and these metal plates may extend entirely to the ends of the side walls and be sealed to the end edges of the main evaporator plates. At the upper and lower ends of the pocket, the plates 40 and 41 may be brought together and also be sealed to the main plates where the latter begin to separate. The front end of the pocket is open for insertion and removal of the heating element, but is adapted to be closed normally by means of a cover plate 45 that may be secured by screws or the like 46 to the edges of the plates.

With the heating element in the pocket, it will be appreciated that all heat from the element must pass outwardly through surfaces of the evaporator that normally become coated with frost. Therefore, before any heat from the element could effect any rise in temperature in the storage compartment outside of the evaporator, it must pass through the frost, and since the frost will absorb heat rapidly, the heat from the element will almost entirely be absorbed by the frost. It could not therefore result in raising the temperature of the food storage compartment before at least melting the frost sufficiently to cause the latter to slide off of the metal plates.

In the practice of the present invention, it is intended that the heating elements be manually turned on, that is, that a manual switch be operated to energize the heating elements, and that simultaneously the compressor motor will be disconnected from the circuit if it is not already disconnected. Then it is intended that as soon as defrosting is essentially completed, the electric circuit through the heating elements will automatically be interrupted approximately at the same time that the compressor motor is again placed in the circuit.

For accomplishing the automatic control bulbs 50 are provided adjacent the heating unit and these bulbs are connected to conduits 51 and 52 and the latter in turn is connected to a syphon bellows 53. It will be understood that the syphon bellows, tubes and bulbs will con-

tain a fluid that suitably expands and contracts with variations in temperatures and therefore that the bellows will contract as the temperature decreases and expand as the temperature increases. The bellows in turn is connected to an arm 55 that passes through an eye 56 which at its other end is pivotally joined, as indicated at 57, to a switch arm 58. Upper and lower sides of the arm 55 are provided with spring elements 59 and 60 that have end portions 61 and 62 spaced from the sides of the arm 58. The switch arm carries switch plates 65 and 66 suitably insulated from the arm and these plates respectively are adapted to close the circuits through the terminals 67 and 68 and the terminals 69 and 70. Closing of the circuit through the terminals 67 and 68 completes a circuit through the heating elements while closing of the circuit through the terminals 69 and 70 completes a circuit through the compressor motor.

Assuming that the temperature of the refrigerator is low and the parts are substantially as shown in Figure 1, with the circuit through the heating elements completed, it will be apparent that as the defrosting proceeds, the frost will slide off of the sides of the evaporator and that the temperature of the refrigerant will increase. Hence, the temperature of the fluid in the bulbs 50 will increase, the bellows 53 will expand, and the arm 55 will pivot clockwise in the eye 56 and as the spring 59 is carried with the arm 55, its end 61 will cause the switch arm 58 to move downwardly so as to break the circuit through the terminals 67 and 68 and to cause the plate 66 to bridge across the terminals 69 and 70, so as to complete the circuit through the motor. Normal operation of the unit then will occur until the temperature is lowered sufficiently to cause the bellows 53 to contract and then the arm 55 will pivot in the other direction and spring element 60 will cause the arm 58 to rise and move the plate 66 away from the terminals 69 and 70. Normally it is intended that during operation of the refrigerator, the plate 65 will not rise sufficiently to bridge the terminals 67 and 68 and therefore the plate 66 will alternately close and open the motor circuit only. For effecting manual closing of the circuit through the heating elements, a manual switch element 71 may be provided that may have a cam element 75 thereon for moving the switch arm 58 upwardly, so as to cause the plate 65 to contact the terminals 67 and 68. Then the circuit through the heating elements is completed, but as soon as the bellows 53 expand sufficiently, the arm 58 is forced downwardly to again effect completion of the motor circuit. Light, spring pressed cam elements 72 and 73 may be provided adjacent the plates 65 and 66 respectively so as to hold the plates in position when moved respectively into bridging relation to the contacts. It will be understood that movement of arm 58 will readily cause the plates to ride over the cam elements.

It will be understood that operation of the manual control 71 is effected by turning the cam element 75 through 180° to move plate 65 into engagement with terminals 67 and 68 and, upon this being done, the cam element is turned further to bring it back to its original position so that it will not interfere with movement of the arm 58 downwardly. The outer end of the element 71 may have a knob for facilitating this operation, as will be readily understood.

The wires to the heating element preferably

extend through the evaporator at the front end thereof and adjacent the cover plate 45 for the pocket, and preferably releasable terminals will be employed so that the heating element may be removed whenever necessary and a new one substituted. The manual switch may be mounted on the plate above the evaporator, which ordinarily is used as a mounting plate for the cold control. A door for covering the front of the evaporator also may be used, as will be readily understood. It may be mentioned that once the cover plate 45 is in place, the pockets for the heating elements are sealed against entry or exit of air and therefore moisture will be prevented from entering the pocket and heated air in the pocket will be prevented from escaping.

It appears that when the heating elements are energized, only a matter of a few minutes will be required to provide sufficient heat to effect separation of the frost from the sides of the evaporator, and then it will slide downwardly off of the evaporator. It is not necessary that the frost be completely melted, but only that the engagement of the frost with the metal plates be loosened substantially to cause the frost to slide off. Therefore, as a matter of fact, very little heat is required to effect this removal of the frost and none whatever would pass into the storage compartment before the frost was removed. It will be appreciated that the temperature of the refrigerant in the evaporator would be rising as the heating element became energized and that the temperature of the fluid in the bellows would be increasing. The design is such that practically as soon as defrosting is essentially completed, the refrigerator unit would be again placed in operation and any heat remaining in the pockets would be removed by the refrigerant flowing through the evaporator.

An arrangement constructed according to the invention would insure defrosting in a very short period of time and furthermore would insure maintenance of the low temperature of the storage compartment. Manifestly, the evaporator can be constructed without much additional expense and in the event either heating element fails to function, a new one could be readily replaced without very much difficulty. Moreover, normal operation of the refrigerator would not be varied unless one decided to defrost the refrigerator, in which case the manual switch would be operated and then, in a very short period of time, the system again would be placed under automatic, normal control.

While the pockets and heating elements are shown as only extending over a limited area of the sides of the evaporator, it will be understood that larger pockets and heating elements may be employed and that a similar pocket might be also provided in the bottom wall of the evaporator.

Although only one form of the invention has been described and illustrated in detail, it will be apparent to those skilled in the art that various modifications may be made without departing from the scope of the appended claims.

What is claimed is:

1. In combination, a compartment to be cooled, a sheet metal, refrigerator evaporator in the compartment and comprising sheet metal plates placed closely together and arranged to provide refrigerant conducting passages between them, and a heating element placed between portions of the plates for defrosting the plate surfaces.

2. In combination, a compartment to be

cooled, a refrigerator evaporator in the compartment and comprising metal plates fastened together in side by side relation, means for conducting refrigerant between the plates, said plates having portions separated to provide a pocket between them, means between the plates for conducting the refrigerant around the pocket and a heating element in the pocket for defrosting the plates.

3. In combination, a compartment to be cooled, a refrigerator evaporator in the compartment and comprising metal plates fastened together in side by side relation, means for conducting refrigerant between the plates, said plates having portions separated to provide a pocket between them, means between the plates for conducting the refrigerant around the pocket, a heating element in the pocket for defrosting the plates, and means including the plates for closing the pocket to air communication with the compartment space around the evaporator.

4. In combination, a compartment to be cooled, a refrigerator evaporator in the compartment, a heating element for defrosting frosting surfaces of the evaporator, and means effecting a complete enclosure of the heating element by frosting surfaces of the evaporator disposed closely around the element so that heat from the element cannot escape except through frosting surfaces of the evaporator that are closely adjacent thereto.

5. In combination, a sheet metal evaporator comprising metal plates sealed together and having refrigerant conducting passages between them so that the surfaces of the plates are cooled by the evaporation of refrigerant passing through the passages, means providing a closed pocket adjacent to and substantially in the plane of the plates, and an electric heating element in the pocket.

6. In combination, a sheet metal evaporator comprising metal plates disposed in side by side, closely adjacent relation and having refrigerant conducting passages between them, means providing a pocket between the plates which is closed to such passages, and an electric heating element in such pocket.

7. In combination, a sheet metal evaporator comprising metal plates disposed in side by side, closely adjacent relation and having refrigerant conducting passages between them, means providing a pocket between the plates which is closed to such passages, and means for providing heat in the interior of the pocket so as to defrost the frosting surfaces of the plates.

8. In combination, a sheet metal evaporator comprising metal plates disposed in side by side, closely adjacent relation and having refrigerant conducting passages between them, means providing a closed pocket between the plates and which is also closed to such passages, and means for heating the interior of the pocket.

9. In combination, a sheet metal evaporator comprising metal plates disposed in side by side, closely adjacent relation and having refrigerant conducting passages between them, a third metal plate between the first plates and providing a pocket between the latter which is closed to such passages, and means for heating the interior of the pocket.

10. In combination, a sheet metal evaporator comprising metal plates disposed in side by side, closely adjacent relation and having refrigerant conducting passages between them, means providing a pocket between the plates which is closed

to such passages, an electric heating element in such pocket, and means providing an opening in the pocket for insertion and removal of the element but enabling closing of the pocket so as to seal the pocket to the atmosphere externally of the pocket.

11. In a refrigerator, the combination of a cooling casing, an evaporator comprising refrigerant conducting loops arranged to cool said casing, and a defrosting device associated with said

loops; certain of said loops being arranged closely around the casing, and the rest of said loops being arranged parallel to the first loops and spaced therefrom to form therewith a space for receiving the defrosting device, said device including an elongated body, heating means positioned in the body, and connections for supplying current to the heating means.

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