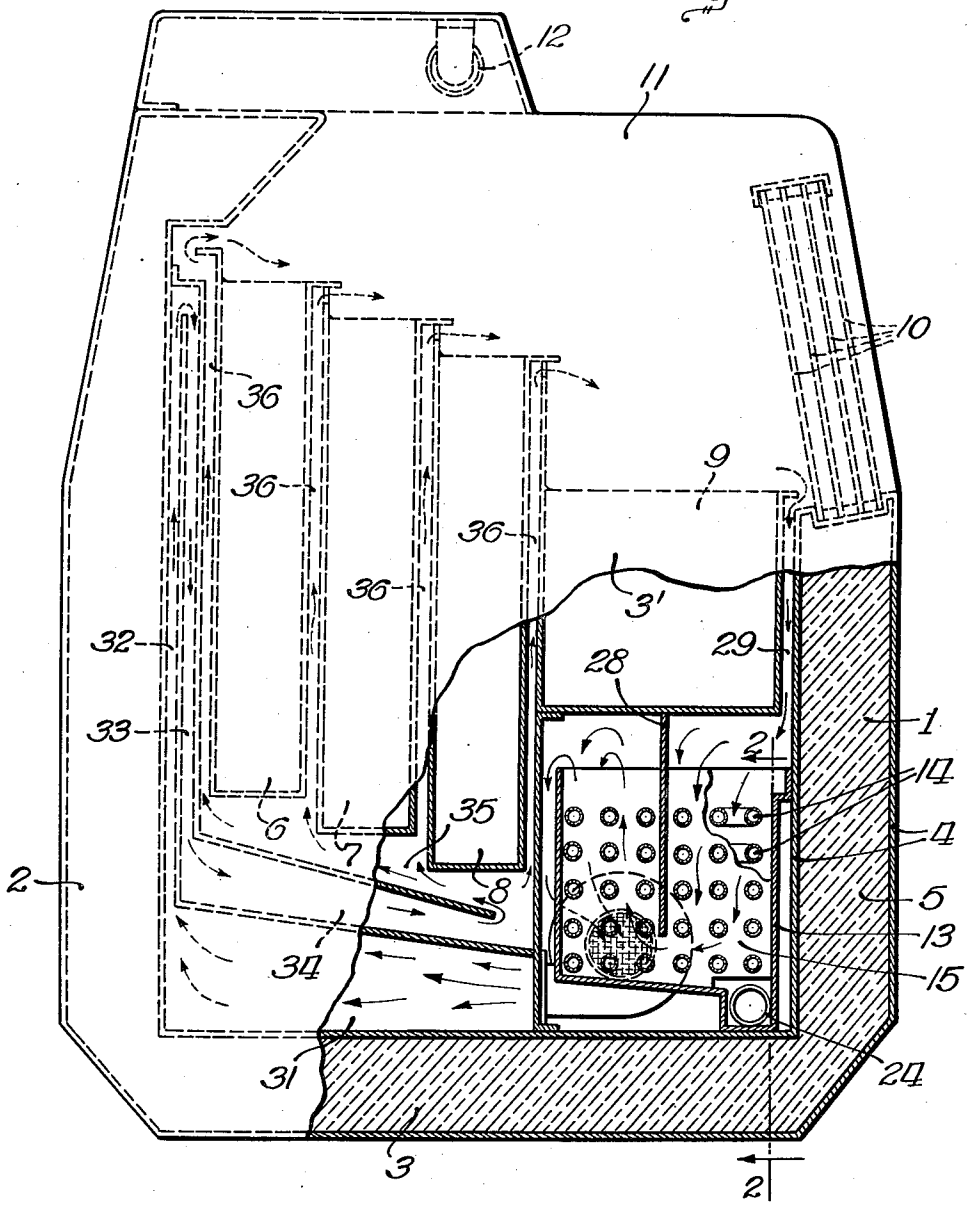
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Fig. 1.



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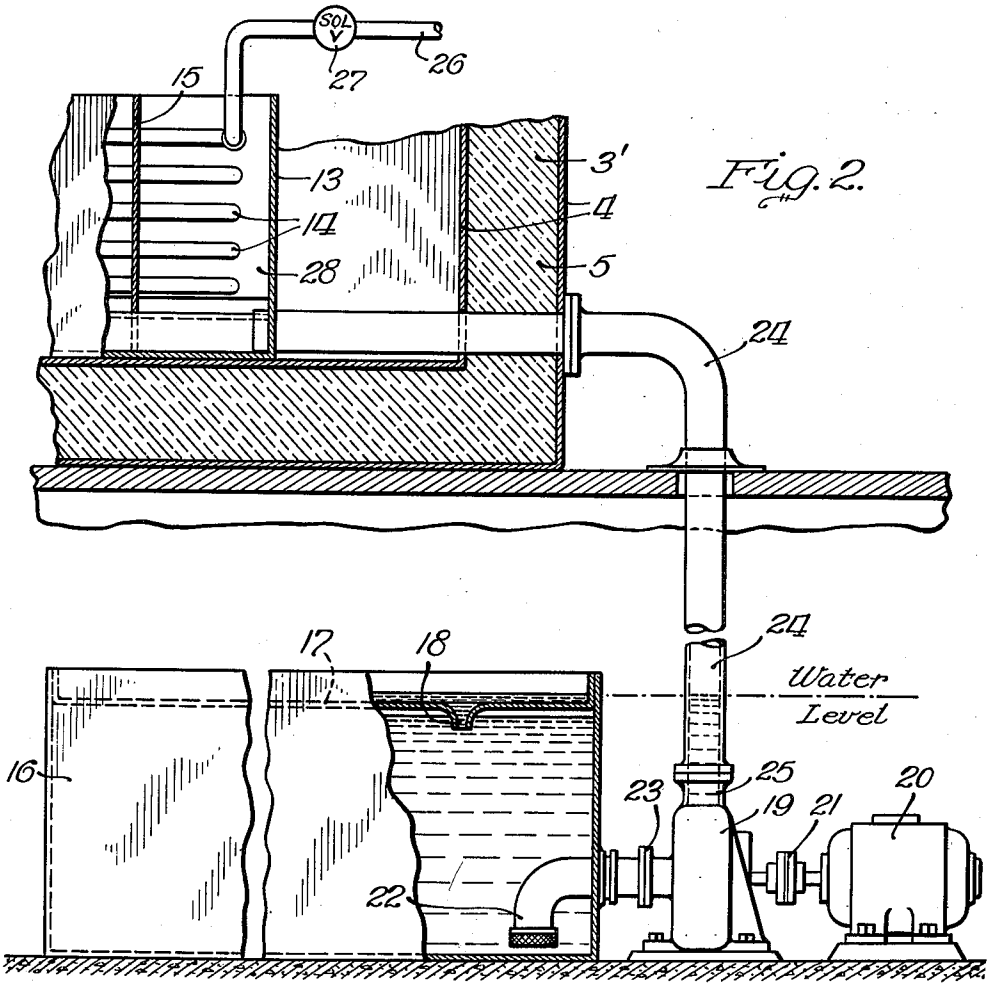


Fig. 2.

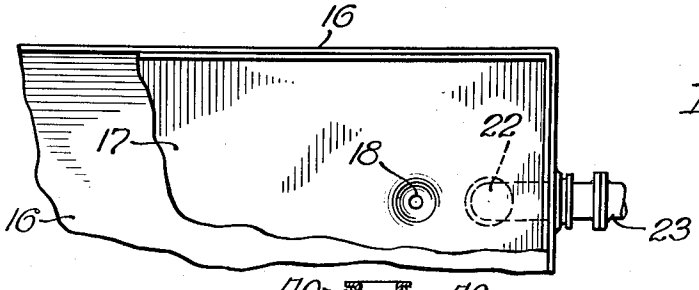


Fig. 3.

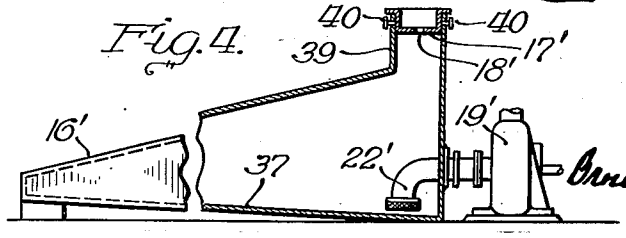


Fig. 4.

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Application November 26, 1948, Serial No. 62,143

5 Claims. (Cl. 62—101)

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This invention relates, in general, to refrigeration systems, and has particular relation to an improved defroster for defrosting the coils or heat transfer surfaces of such systems.

While we have shown and shall describe the invention in connection with a particular tube and fin coil, it is to be understood that the heat transfer surfaces may be of any other suitable or preferred form.

So far, there have been various general defrosting schemes, for example, by applying heat internally of the coil by high pressure vapor generated by extraneous heat or obtained from the high side of the refrigeration system; also by positioning a spray-head to spray water over the frost-accumulating surfaces.

The first scheme above-mentioned has the objection of requiring the use of pressures and temperatures which are frequently higher than those for which the coils, expansion valves, floats, control diaphragms and the like are designed. Where vapor is generated by an electric heating element, there is the possibility of rupture or serious damage.

The second scheme above-mentioned takes more time to defrost than does the defroster of the present invention, and is more expensive and complicated than the defroster according to the present invention. The use of a spray-head above the frost-accumulating surfaces in conjunction with a drip pan below such surfaces presents a device that can be fitted into certain types of refrigerators only with difficulty, if at all.

One of the main objects of the present invention is to provide simple, highly effective, and low cost means for defrosting the coil or other frost accumulating surfaces without overlying spray heads and underlying drip pans and the like; also without applying heat internally of the coil by high pressure vapor or the like.

Another object of the invention is to provide a defroster of the character described having various features of novelty and advantages, and characterized by its simplicity in construction, its economy in manufacture and installation, its effectiveness in use and ability to defrost more quickly, and its adaptability to be fitted into various types of refrigerators, refrigerated display cases and the like.

Further objects and advantages of the invention will appear from the following detailed description, taken in connection with the accompanying drawings which illustrate the construction and operation of illustrative forms of devices embodying the present invention.

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In the drawings:

Figure 1 is a view partly in vertical section and partly in elevation showing the coil or heat transfer device in position within a low temperature insulated space or refrigerator compartment;

Figure 2 is a fragmentary sectional view taken substantially on the line 2—2 of Figure 1 and showing a water storage tank and supply system for the defroster;

Figure 3 is a fragmentary top plan view of the water storage tank shown in Figure 2; and

Figure 4 is a more or less schematic view on reduced scale showing another form of liquid storage tank.

Referring now to the drawings, we have shown for purposes of illustration a refrigerated display case having vertical front and back walls 1 and 2, a bottom wall 3, and end walls 3'. The walls are heat insulated, for example, by forming them of inner and outer metallic shells 4 with suitable insulating material 5 filling the space therebetween.

The refrigerated display case, shown in general in Figure 1, is of the type more fully disclosed and claimed in our copending application Serial No. 62,144, filed November 26, 1948. It is to be understood that the present invention may be used with other forms of refrigeration apparatus as suitable or desired.

Suffice it for purposes of the present description to state that the display case illustrated in Figure 1 has cans or containers 6, 7, and 8, for holding vertically stacked packages of frozen food or the like, a compartment 9, a front wall 10 comprising a plurality of spaced transparent sheets, an opening at 11 through which the contents of the case are accessible for removal from the case, and a fluorescent light at 12.

A chamber 13 for the heat transfer device is disposed within the refrigerated space, and the coil, evaporator, or other heat transfer device is disposed within the chamber 13. The heat transfer device is shown of the tube and fin type comprising the coiled tube or tubes 14 and fins 15. The tubes 14 provide the primary cooling surfaces, and fins 15 provide secondary cooling surfaces, as well known in the art. Other forms of coil or heat transfer devices may be employed within the scope of the present invention.

Outside the refrigerated space and at a level below the level of the coil chamber 13 there is a storage tank 16 for the water or other defrosting liquid. A rust preventer or other inhibitor may be added to the defrosting liquid if and as desired. The top of the liquid storage tank 16 is closed

by a top wall 17 having a restricted opening 18 through which any excess liquid that flows back into the storage tank as a result of defrosting may rise onto the top of the wall 17. In the form of storage tank illustrated in Figure 2, the top wall 17 is of large area for spreading any liquid rising through the restricted opening 18 over a large area for evaporation. The liquid storage tank is substantially closed against evaporation of its contents except for any negligible amount of thinly spread liquid on top of the top wall 17.

For the purpose of transferring the defrosting liquid from the tank 16 into the coil chamber 13, we provide a pump 19 driven, for example, by an electric motor 20 through a suitable driving connection 21. An inlet conduit 22 has a downturned inner end opening into the bottom of the tank 16. This conduit 22 leads to the inlet 23 of the pump 19. A conduit 24 leads from the outlet 25 of the pump 19 into the bottom portion of the coil chamber 13. The refrigerant tube 26 for delivering refrigerant to the coil 14 is preferably provided as shown more or less diagrammatically in Figure 2, with a solenoid valve 27 for controlling the refrigerant flow. If this valve 27 is closed during defrosting, the defrosting of the coil is hastened. The closing and opening of the valve 27 may be by timed action as well understood in the art, or otherwise as desired.

The pump 19 selected for illustration is a centrifugal pump of a character which, when shut off, will permit the liquid transferred from tank 16 to coil chamber 13 for defrosting purposes to flow back through the pump by gravity from the coil chamber 13 and into the storage tank 16. When the pump 19 is in operation it delivers the defrosting liquid from tank 16 into coil chamber 13 and prevents the flow of liquid back from the coil chamber 13 to the tank 16.

To defrost the coil with the apparatus illustrated, the pump 19 is started and runs as long as it is desired to permit the defrosting period to take place. It pumps the water or other liquid from the tank 16 up into the coil chamber 13 to a level submerging the frost accumulating surfaces of the coil. In one illustrated apparatus embodying the present invention it is possible to put the liquid to the desired level in the coil chamber 13 in about one-half a minute. We then let the defrosting liquid remain at the desired level within the coil chamber 13 for about another half a minute; the pump remaining in operation during this time to prevent the flow of liquid back from the coil chamber 13 to the tank 16 through the pump.

After completion of the defrosting operation, the above recited times being merely illustrative, the pump 19 may shut off. The liquid then flows by gravity from the coil chamber 13 through conduit 24, pump 19, and conduit 22, back into the tank 16. Any excess liquid that flows back into the storage tank 16 as a result of defrosting may rise through the restricted opening 18 and spread thinly over a large area on the top wall 17 for evaporation. With the illustrated form of apparatus mentioned above, it takes about one-half a minute to get all of the liquid back from the coil chamber 13 into the tank 16. An additional grace period of about one-half a minute may be allowed for all of the liquid to get from the coil chamber 13 back to the tank 16.

Within the broader aspects of the present invention, the water which is supplied into the coil chamber 13 to a level submerging the frost accumulating surfaces of the coil may come from any service or municipal main direct to the coil chamber 13 without using a water storage tank and pump as shown and described. In such case, the means for maintaining the water in the coil chamber 13 at a level submerging the frost accumulating surfaces of the coil and for preventing draining of the water from the coil chamber during the defrosting period may be in the form of a suitable valve in the conduit leading to the coil chamber, or other suitable means may be employed for this purpose. Where a valve is employed, it may be opened following the defrosting period to permit the liquid to drain from the coil chamber.

In either case, the water is allowed to remain in the coil chamber until all frost is removed from the coil. The particular time is not per se of the essence of the invention and may, therefore, vary. Where a water storage tank is employed, it is disposed outside the refrigerated space where it is surrounded by relatively warm air, for example, at room or ground temperature. If desired, the water or other defrosting liquid in the storage tank 16 can be heated, for example, by a unit heater or by hot gas from the compressor of the refrigeration system, or otherwise as desired.

In the system shown and described, the motor 20 may be controlled by a timer, with contacts on the timer which may be adjusted for sequence timing to defrost once a day or at less or more frequent intervals. Such contacts are well known in the art and, per se, form no part of the present invention. In order to simplify the drawings and the description, they have not, therefore, been illustrated.

In the form of case shown in Figure 1, a vertical plate or baffle 28 extends downwardly into the coil chamber 13 intermediate the sides thereof. While, per se, the same forms no part of the present invention, air is drawn downwardly through the space 29 into one side of the coil chamber 13 and passes beneath baffle 28, up through the opposite side of the coil chamber, and around the coil chamber to the inlet of a blower 30. The blower discharges the refrigerated air rearwardly through space 31, upwardly through a back space 32, and downwardly through a space 33 into space 34, from where it flows forwardly and passes into space 35 underlying the package containers 6, 7 and 8. From the space 35 the refrigerated air passes upwardly through the spaces 36 between and rearwardly and forwardly of the package containers. The refrigerated air flows forwardly over the top packages from openings at the upper ends of the spaces 36 and, with a slight amount of spillage, passes back through the space 29 and is recirculated as described.

In the modification shown on reduced scale and more or less schematically in Figure 4, the water storage tank 16' has a bottom 37 inclined downwardly toward one end. The inlet conduit 22' opens from the deeper end of the tank 16' and the top wall 38 of this tank has an upstanding tubular part 39 of reduced cross sectional area above the inlet end of the conduit 22'. The top wall 17' in this case is in the form of a peripherally flanged member removably secured in place in the upstanding tubular part 39, for example, by screws 40. The removability of the member 17', positioned as described, permits cleaning the tank adjacent the inlet conduit 22'.

The top wall 17' has a restricted opening 18'

through which any excess liquid that flows back into the storage tank, as the result of defrosting, may rise onto the top of wall 17' as in the preceding embodiment of the invention. The member 17' presents a small area over which the excess liquid will spread on top of the wall 17', and therefore tilting of the case is not so important because then we are working with a small rise and small volume. Failure to fill the coil chamber to the desired level due to tilting of the case is thus avoided.

The embodiments of the invention shown in the drawings are for illustrative purposes only, and it is to be expressly understood that said drawings and the accompanying specification are not to be construed as a definition of the limits or scope of the invention, reference being had to the appended claims for that purpose.

We claim:

1. In combination with a refrigerated space, a chamber within said space, a heat transfer device in said chamber, said device having frost accumulating surfaces, and means for supplying defrosting liquid into said chamber to a level submerging the frost accumulating surfaces of said heat transfer device to defrost same and for removing the defrosting liquid from said chamber after defrosting, the means for supplying defrosting liquid into said chamber comprising a pump having a conduit leading from said pump into said chamber, said pump being a centrifugal pump disposed at a level below the level of said chamber and of a character which when shut off will permit the liquid to flow back through it by gravity from the chamber, and when in operation will prevent such flow of liquid back from the chamber.

2. In combination with a refrigerated space, a chamber within said space, a heat transfer device in said chamber, said device having frost accumulating surfaces, a liquid storage tank outside said refrigerated space, a pump, an inlet conduit leading from the interior of said liquid storage tank to the inlet of said pump, an outlet conduit leading from the outlet of said pump into the bottom portion of said chamber for transferring defrosting liquid from said liquid storage tank into said chamber to a level submerging the frost accumulating surfaces of said heat transfer device to defrost same, the bottom portion of the wall of said chamber being imperforate except for a conduit opening through said wall in proximity to the bottom of the chamber for supplying defrosting liquid from said storage tank into said chamber, and a pump in said conduit for transferring liquid from said storage tank into said chamber, said pump being of a character which, when shut off, will permit the liquid to flow back through it by gravity to the storage tank, and, when in operation, will prevent the flow of liquid back to said storage tank from said chamber.

3. In combination with a refrigerated space, a chamber within said space, a heat transfer device in said chamber, said device having frost accumulating surfaces, a liquid storage tank outside said refrigerated space, a conduit leading from said liquid storage tank into said chamber, a pump in said conduit for delivering defrosting liquid from said storage tank into said chamber through said conduit, said pump being of a character which when shut off will permit the liquid to flow back through it by gravity to the storage tank, and when in operation will prevent the flow of liquid back to said storage tank from said chamber, and a top wall closing the top of the liquid storage tank and having a restricted opening through which any excess liquid that flows back into the storage tank as a result of defrosting may rise onto the top of said top wall, said liquid storage tank being substantially closed against evaporation of its contents except for negligible amount of liquid on top of said top wall.

4. Apparatus according to claim 3 wherein the bottom of the liquid storage tank is inclined downwardly toward one end with said conduit opening from the deeper end of said tank and the top wall is in the form of a flanged member of reduced area removably secured in a portion of reduced horizontal area upstanding from the top of said tank above the position from which said conduit opens from said tank.

5. Apparatus according to claim 3 wherein the top wall of the liquid storage tank is of large area for spreading any liquid rising through the restricted opening in said top wall over a large area.

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