Dec. 21, 1965 R. O. CROUCH 3,224,216

REFRIGERATOR DEFROST TRAY

Filed Sept. 3, 1964 2 Sheets-Sheet 1

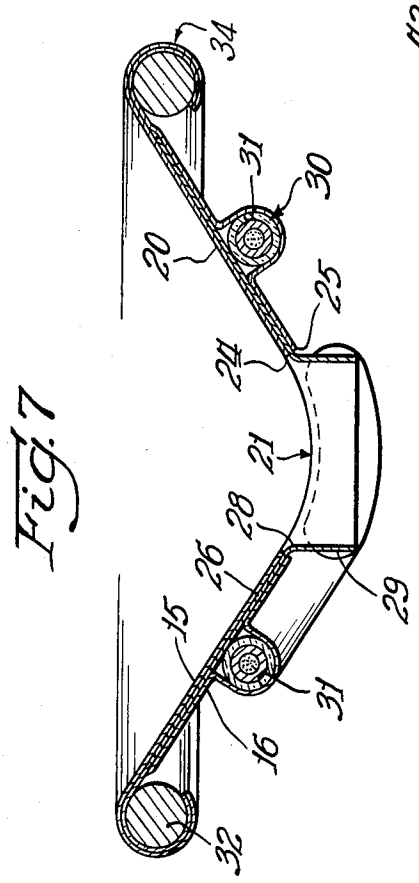

Fig. 7

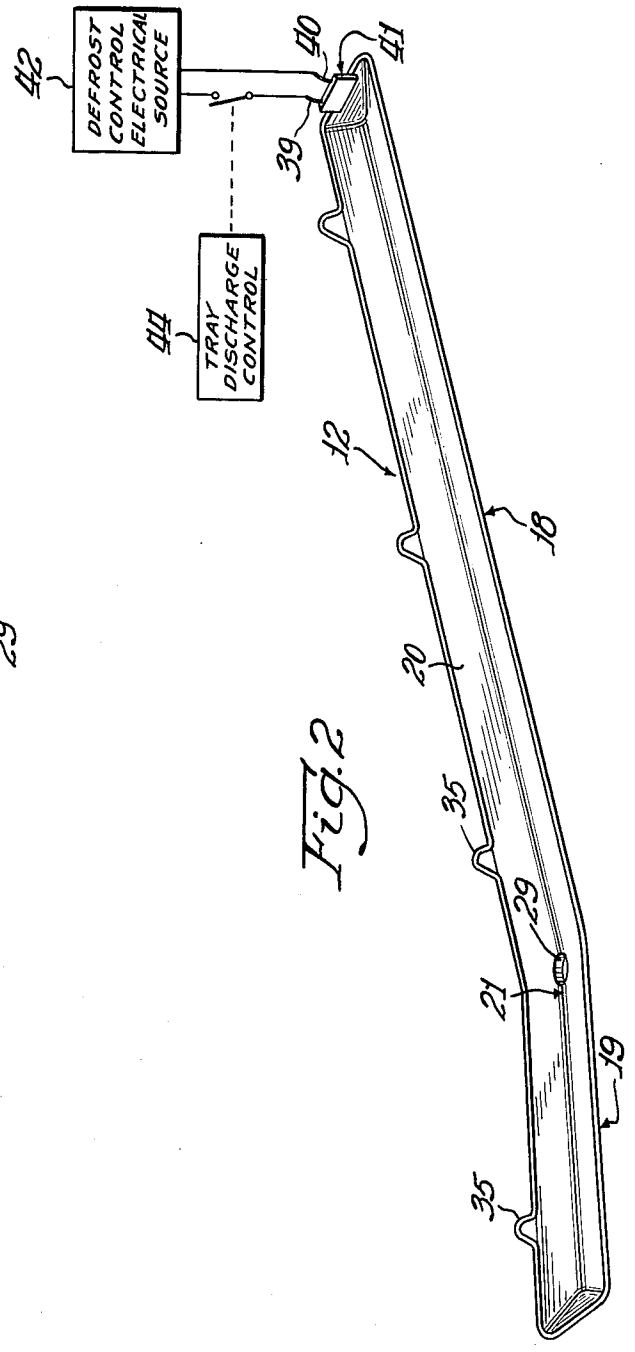

Fig. 2

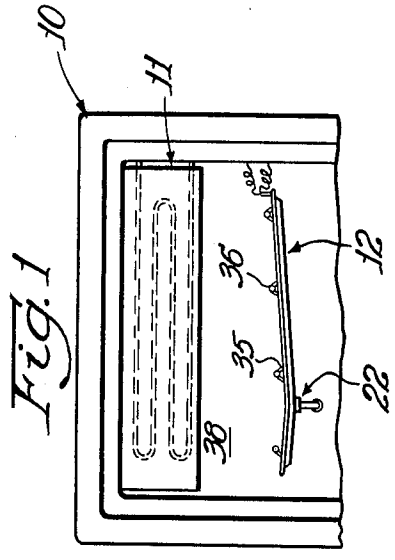

Fig. 1

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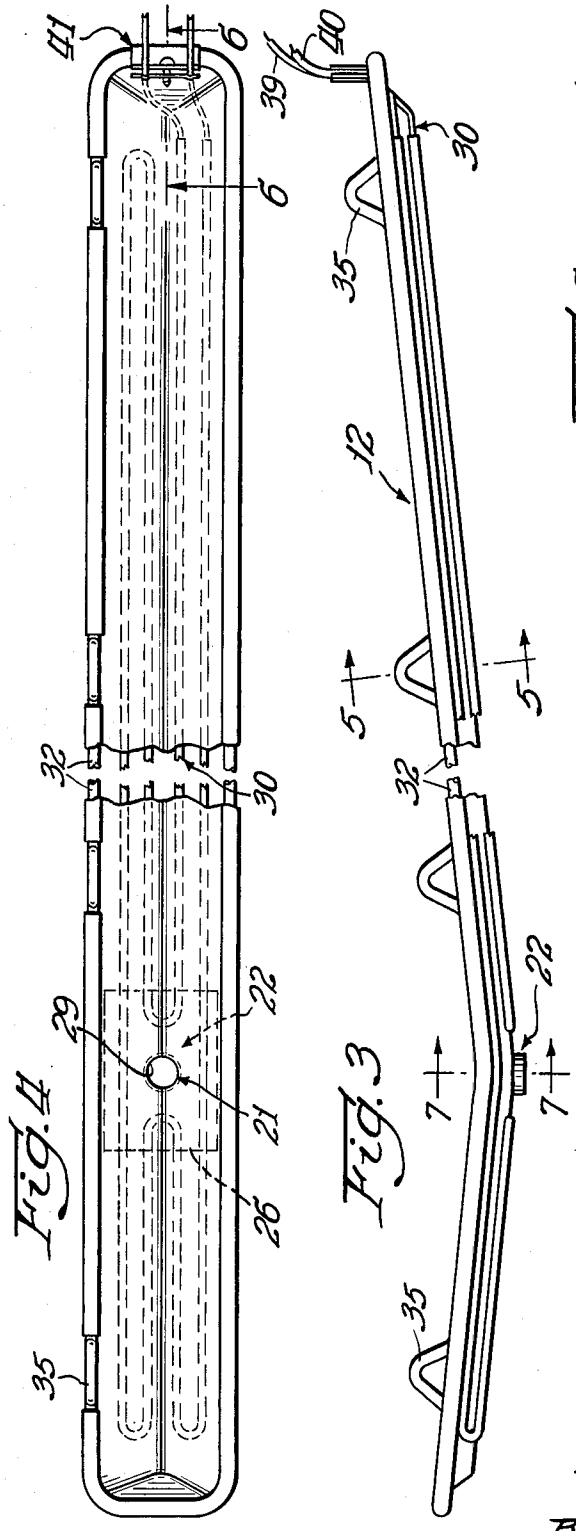

Fig. 4

Fig. 3

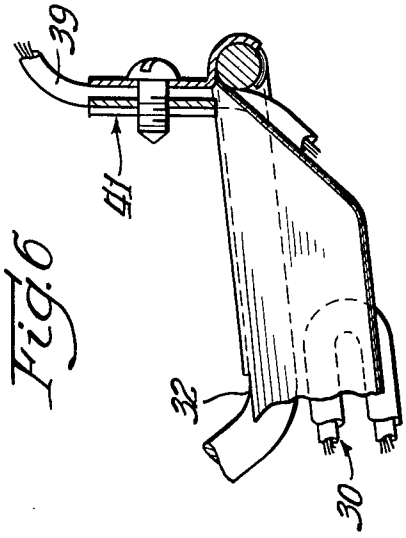

Fig. 6

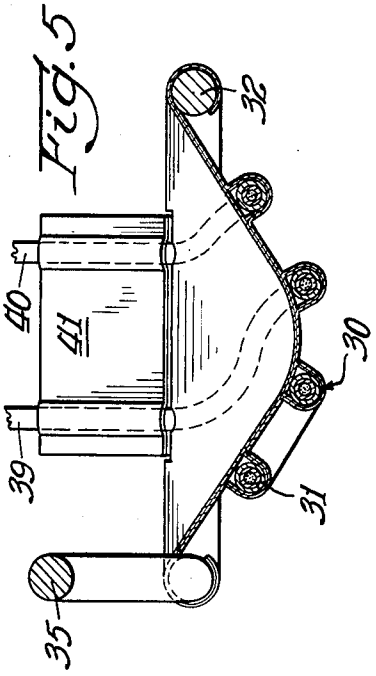

Fig. 5

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REFRIGERATOR DEFROST TRAY

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The present invention relates to refrigerators, freezers and the like and more particularly to structure for defrosting such units.

During customary use of refrigerators, freezers and the like, when the door is opened, warm, relatively moist air enters from outside the unit and concentrates in the upper portion of the cooled enclosure. The moisture condenses as frost and ice on the coldest structure in this part, which oftentimes is the evaporator coils. Periodically, the evaporator coils or other frost collecting structure must be heated just enough to liquefy the frost and ice, so that it can be removed. To catch the melted product, a receptacle is provided. In a refrigerator the receptacle for collecting and conveying the defrost liquid or water is ordinarily positioned in close proximity to the evaporator coils, or coldest part of the refrigerator. Thus, the trough assumes the cold temperature equal to that of the evaporator coils which are below the freezing point of water. In a freezer the ambient temperature of the cooled enclosure is below the freezing point of water, so the trough also is cooled below freezing. Accordingly, the water instead of being carried away, is refrozen.

Auxiliary equipment for heating the receptacle to permit handling of water in a below freezing environment has been developed, however, improvements can be made by decreasing the cost and also by reducing the heat unnecessarily radiated into the cooled storage area. The latter is an important factor where defrosting occurs more frequently, as in the new frost-free refrigerating and freezing units.

It is accordingly an object of the present invention to provide an improved water collecting and conveying structure to remove defrosted ice and frost from interiors of refrigerators, freezers and the like which includes heating means to prevent refreezing of the water while it is being carried away.

It is a more detailed object of the present invention along the lines of the above to provide a trough which is heated yet does not itself radiate heat to a significant degree into the cooled enclosure.

It is an overall object of the present invention to provide an economically manufacturable water collecting and conveying trough having means permitting heating which is easily adapted for installation in standard refrigerators, freezers and the like.

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings in which:

FIG. 1 is a fragmentary elevational section of an upper portion of a refrigerator embodying the present invention;

FIG. 2 is an enlarged perspective of a trough constructed in accordance with the teachings of the present invention;

FIG. 3 is an elevation of the trough of FIG. 2 with a section removed;

FIG. 4 is a plan view of the trough of FIG. 2 with a section removed;

FIG. 5 is a section taken along 5—5 in FIG 3.

FIG. 6 is a section taken along 6—6 in FIG. 4; and

FIG. 7 is an enlarged section taken along 7—7 in FIG. 3.

While the invention will be described in connection with a preferred embodiment, it is understood that I do not intend to limit the invention to that embodiment. On the contrary, I intend to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

Turning to the drawings, there is shown in FIG. 1 a fragmentary elevational top section of a refrigerator **10** having an evaporator coil **11** below which is positioned a receptacle **12** embodying the present invention. The evaporator coil **11** is connected to operative structure (not shown) delivering refrigerant to the coils. As is well known to those skilled in the art, the evaporator coil thereby operates to cool the interior of the refrigerator **10**. Because the evaporator coil **11** is the coldest structure in the refrigerator interior, and because the warm, relatively moist air that enters the refrigerator rises to the top, the moisture in the air condenses on the evaporator coil. Periodically the latter must be heated above the melting point of water to liquefy the frost or ice. This can be done, for example, as is known by those skilled in the art, by an auxiliary heating system (not shown) using as a source of heat, hot gases or electrical energy. During the period of time that the evaporator coil is raised to the temperature which will melt the ice and frost, the remainder of the refrigerator interior is kept cool. Because the receptacle or tray **12** is in close proximity to the evaporator coil **11**, being positioned below the evaporator coil **11** to catch liquid dripping therefrom, the coil structure assumes approximately the same temperature as that of the evaporator, i.e., below the freezing point of water.

In accordance with the present invention the tray **12** is of new and novel construction and is provided with heating means to maintain it at a temperature above the freezing point of water so as to collect and maintain the water in a fluid state. Turning more specifically to FIGS. 2–7, shown in FIG. 7 is an enlarged section of tray **12**. To efficiently utilize heat, while transmitting an insignificant quantity of the same into the refrigerator interior, as herein illustrated, the tray includes an upper or first layer of material **15** and a bottom or second layer of material **16**. The second layer **16** is complementarily shaped for assembly below the first layer to, as is explained in detail subsequently, improve the use of heat furnished to the tray. The layers are formed into a predetermined trough-shape, as herein illustrated, a longitudinally extending trough with respective inclined sections **18, 19**. It is not intended that the invention be limited to a longitudinally-shaped tray, as other shapes performing the water-collecting function can be used. A top surface **20** of the first layer, which is also the upper or top surface of the tray, is formed so as to converge toward a low point **21** to which water, falling on the tray, flows by gravity.

To remove or discharge water collected by the tray **12**, a spout assembly **22** depending from the tray low point is provided. As herein illustrated, the spout assembly **22** is installed to communicate with the water collecting surface **20** through an aperture defined by a pair of aligned openings **24, 25**, provided in respective layers **15, 16** (see FIG. 4, FIG. 7). The spout includes a laterally extending peripheral portion **26** surrounding an upper end **28** of a cylindrical spout portion **29**. As preferably constructed, the lateral portion **26** is sandwiched between the upper and lower layers **15, 16**, surrounding the aperture. It is, of course, possible to have more than one low point to which the water flows and to have the tray surface **20** formed so as to converge to these respective low

points. In that instance, there would be provided openings at these low points to remove the water collected by the tray.

To heat the top layer 15 to a temperature at or above 32 degrees Fahrenheit so that defrost liquid collected is maintained in a fluid state, in the present instance, as best shown in FIG. 4, a heating coil 30 is wound back and forth in a serpentine configuration sandwiched between the respective upper and lower layers 15, 16. The lower layer 16 is provided with a generally semi-circular cross section channel 31 running longitudinally back and forth to enclose the heating coil 30. In the preferred embodiment, the coil is provided with suitable insulation to prevent electrical connection with the conductive foil layers.

One function of the lower layer 16 is to cooperate with the upper layer 15 and trap the heat produced by the coil 30 so that it is transmitted to the upper layer 15 and not radiated into the refrigerator interior. It of course provides support for the heating coil 30. Preferably the upper layer 15 is constructed of heat-conducting material so that heat from the coil 30, or other heating means which can be used, is transmitted to the surface 20 to maintain it at a temperature which keeps water in a fluid or flowing condition. The lower layer 16 is preferably constructed of heat insulative material to assure maximum application of heat to the upper layer. In practice, it has been found that aluminum foil fulfills the requirements for use as both a top layer and a bottom layer. It provides the added advantage of being heat reflective rather than heat radiating so as to trap heat between layers 15, 16 and improve the heat utilizing efficiency of the tray 12.

A feature of the present invention is that the tray 12 can be easily constructed from economically available materials. Using relatively flexible materials, for example aluminum foil, permits easy forming of the tray to predetermined configurations, such as the trough-shape exemplarily shown. However, in certain instances a frame must be provided to give rigidity to the flexible foil material. In the present instance, the wire 32 of the tray has the circumferential edges of the sandwiched together layers 15, 16 wrapped thereabout as shown at 34 (FIG. 7). The wire frame 32 is provided with a plurality of members 35 along the rear portion of the tray, adapted to straddle a plurality of screws 36 projecting from a rear wall 38 of the refrigerator 10. To permit connection of the coil to a source of electrical energy, a pair of terminals 39, 40 are supported at one end of frame 32 by a clip assembly 41. The terminals 39, 40 are connected to an electrical source 42. It is within the scope of the present invention to use other sources of energy to produce heat instead of electricity, for example, hot gases in a gas type refrigerator. Ordinarily, the heating means is energized at the same time as the defrost unit, or a selected time before, to assure that the liquid dripping on the tray is maintained in a fluid state. However, if desired, the defrost liquid can be collected and then periodically melted to remove the same from the refrigerator. In that instance a separate tray liquid discharge control mechanism 44 can be installed to energize the heating means less frequently than the defrost mechanism is operated. Such mechanism can be automatic, for example it can sense the thickness of ice formed on the tray surface and operate the heating means to melt the ice collected. The water in a fluid state would flow to the low point 21 and through the aperture formed by openings 24, 25.

As exemplarily shown, the respective layers 15, 16 of foil material are bonded together using a suitable bonding agent which is both moisture and heat resistant, and where high wattage is used, has good electrical insulation properties. It is understood that the layers could be held together simply by the wrap-around mounting on the wire frame 32 or by other mechanical means and the bonding agent may be dispensed with. Indeed, though as here shown the layers 15, 16 are in juxtaposed relation, they may be assembled with a predetermined space therebetween.

The material used for constructing the tray 12 is preferably highly reflective, for example, aluminum foil, to reduce the amount of heat radiated into the refrigerator or freezer interior. This is of substantial advantage in a frost-free unit where frost or ice are continually defrosted and there is a continual flow of water over the defrost liquid collecting structure.

What is claimed is:

1. A tray adapted to be mounted in the cooling area of a refrigerator, freezer or like unit and collect and remove water during the defrosting of the unit, the combination comprising a top layer of light-weight material having a predetermined trough shape and provided with an upper surface configuration converging toward at least one low point so that water flows over said surface by gravtiy to said low point, a bottom layer of light-weight material complementarily shaped to fit below said top layer, heating means disposed between said top and bottom layers respectively and operative to raise the temperature of said top layer to maintain said defrost water in a fluid state, and means for holding said respective layers together, said top and bottom layers having openings positioned at said low point for removing the water from the tray.

2. A tray as defined in claim 1 wherein a frame is provided positioned adjacent the upper peripheral outline of the tray, said frame being rigid to maintain said flexible layers in the predetermined trough shape.

3. A tray as defined in claim 2 wherein said top and bottom layers are formed of light-weight material such as aluminum foil permitting forming said tray into a predetermined shape and support means for said tray integral with said frame for permitting said tray to be mounted in close proximity to an area being defrosted.

4. A tray as defined in claim 1 wherein control means are included for selectively energizing said heating means in response to sensing means adapted to sense frost accumulation.

5. A tray adapted to be mounted in the cooling area of a refrigerator, freezer or like unit to collect and carry away water during the defrosting of the unit, the combination comprising a top layer of foil having a predetermined trough shape, said top layer having an upper surface converging toward at least one low point so that water flows over said surface by gravity to said low point, a bottom layer of foil, said bottom layer complementarily shaped to fit in juxtaposed relation below said top layer, a heating coil sandwiched between said top and bottom layers respectively and energizable to raise the temperature of said top layer to maintain said defrost water in a fluid state, means for maintaining said respective first and second foil layers bonded together, said layers having a water removal aperture provided at said low point, a spout having laterally extending portions at the upper end thereof installed to communicate with said layer portions surrounding said aperture and a substantially rigid frame for supporting said bonded together first and second foil layers in position to collect defrost water.

6. For use with a refrigerator, freezer or the like, having a cooled interior and structure therein normally collecting frost and requiring defrosting, a tray adapted to catch condensate defrosted from said structure comprising, in combination a first layer of longiudinally extending foil positioned in said refrigerator so that a top surface thereof catches water falling from said structure being defrosted, said foil layer top surface converging to at least one low point to which water falling on said surface flows, a second layer of foil complementarily shaped to fit in juxtaposed relation below said first foil layer, heating means extending the length of said foil layers and sandwiched therebetween, a substantially rigid frame for carrying said first and second layers of foil and said

heating means, means for holding said respective first and second foil layers together, means for mounting said frame in said refrigerator, said layers having at said low point an opening, means communicating with said opening for removing from said refrigerator liquid collected by said upper layer and energizing means coupled to said heating means.

7. For use with a refrigerator, freezer or the like, having a cooled interior and structure therein normally collecting frost and requiring defrosting, a tray adapted to catch water defrosted from said structure comprising, in combination layer of foil defining a water-catching surface converging to a low point, said layer of foil constructed of heat reflective material, a second layer of foil complementarily shaped to fit below said first foil layer, and constructed of heat reflective material, said respective upper and lower layers cooperating to trap heat therebetween, a heating coil wound between said layers of foil, a substantially rigid frame for carrying said first and

second layers of foil and said heating coil, means for mounting said frame in said refrigerator interior to catch water dripping from said frosted structure, said layers provided with openings at said low point, means communicating with said aperture for removing liquid collected by the trough, and electrical means for energizing said heating coils thereby heating said top foil layer surface to at least 32 degrees Fahrenheit.

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