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DEFROSTABLE EVAPORATOR STRUCTURE

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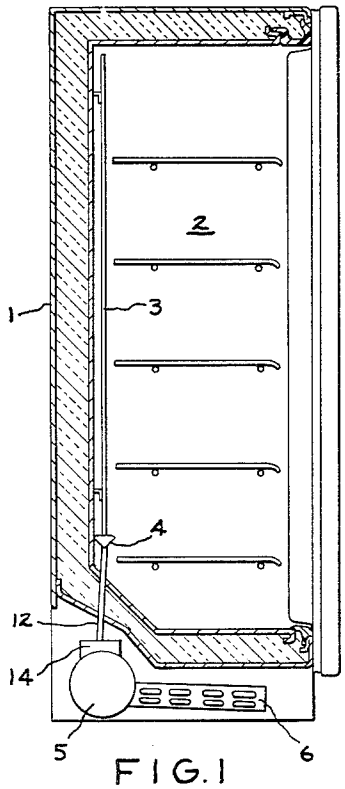


FIG. 1

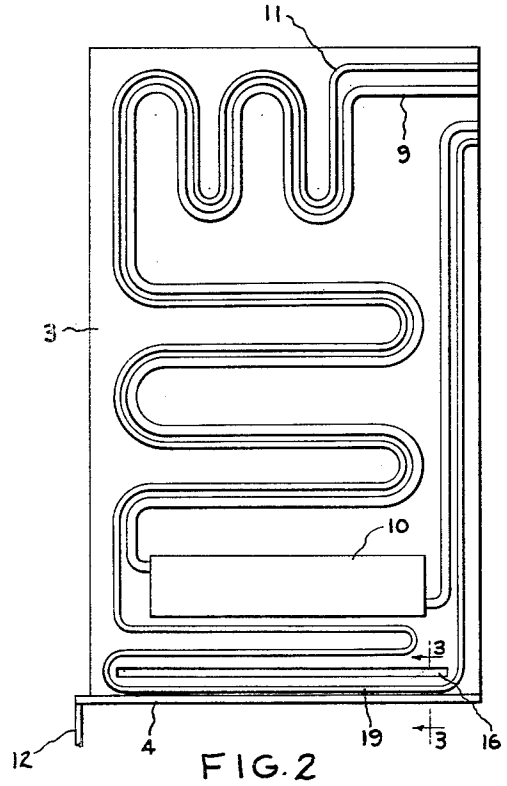


FIG. 2

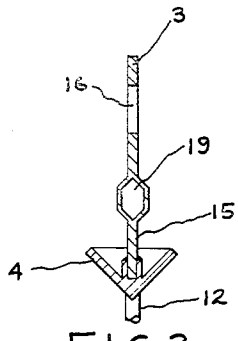


FIG. 3

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DEFROSTABLE EVAPORATOR STRUCTURE

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1 Claim. (Cl. 62—277)

The present invention relates to a defrostable refrigerant evaporator structure and is more particularly concerned with an evaporator structure comprising a vertically arranged tube-in-sheet evaporator having a drain trough connected to the bottom edge of the evaporator and means for maintaining the trough somewhat above the normal operating temperatures of the evaporator during operation of the evaporator.

Since during normal operation thereof, frost tends to collect on the evaporator employed for cooling refrigerant cabinets and the like, it is necessary to remove periodically the insulating frost layer in order to maintain the evaporator at its proper operating efficiency. To remove this layer of frost, it is the usual practice periodically to warm the evaporator to above freezing temperatures in order to melt the frost. Means must then be provided for disposing the melted frost outside the cabinet and for this purpose there is ordinarily associated with the evaporator structure a trough or equivalent receiver for collecting the condensate as it flows from the evaporator. The disposal of this melted frost or condensate from freezer cabinets, that is cabinets designed to operate continuously at below-freezing temperatures, presents a number of problems. A trough supported either by the evaporator structure or on the adjacent walls of the cabinet, which are about the same temperature as the evaporator, is cooled by the supporting means and will normally attain temperatures substantially as low as the evaporator temperatures. As a result, the evaporator heating means are normally required not only to provide heat sufficient to warm the trough to above freezing temperatures during the defrost operation but also to maintain the trough at such temperatures for a period of time sufficient to dispose of all of the condensate which has been received therein during the defrost operation.

It is an object of the present invention to provide a simple and low cost evaporator structure having a defrost water trough supported on an evaporator in such a manner that the trough is maintained at temperatures above the normal operating temperatures of the evaporator.

Another object of the invention is to provide an evaporator structure including a vertically arranged tube-in-sheet evaporator and a drain trough supported by a portion of the evaporator, the evaporator being so constructed that the drain trough is maintained at operating temperatures somewhat above the normal temperatures of the remaining portions of the evaporator.

A more specific object of the invention is to provide an evaporator structure including a vertically arranged tube-in-sheet evaporator including a refrigerant circuit and a hot gas defrost circuit, the evaporator and the defrost circuit being designed to maintain a drain trough connected to the evaporator at relatively frost-free temperatures.

Further objects and advantages of the invention will become apparent as the following description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

In accordance with the present invention, there is provided a defrostable evaporator structure which is particularly useful for the cooling of freezer cabinets and which comprises a vertically arranged tube-in-sheet evaporator and a drain trough connected to the bottom portion of the evaporator for collecting and disposing of defrost water during defrost operation. In order to maintain the trough at temperatures somewhat above the normal operating temperatures for the evaporator, the evaporator is divided into a refrigerant section and a trough section by means of a slot extending substantially the width of the evaporator immediately above the trough. The evaporator also includes a refrigerant circuit above the slot and the hot gas defrost circuit has a portion in heating relationship with the refrigerant circuit and another portion or pass disposed between the trough and the slot for warming the trough during actual defrosting of the evaporator structure.

For a better understanding of the invention reference may be had to the accompanying drawings in which:

Fig. 1 is a side view partially in section of a freezer cabinet including the evaporator structure of the present invention;

Fig. 2 is an enlarged elevational view of the evaporator structure; and

Fig. 3 is a detailed sectional view of the lower portion of the evaporator structure of Fig. 2.

Referring now to Fig. 1 of the drawing there is shown a freezer cabinet 1 including a freezer compartment 2 which is maintained at below freezing temperatures by means of a tube-in-sheet evaporator structure 3. This evaporator extends vertically along one wall of the cabinet and has integrally connected to the bottom edge thereof a trough 4 for collecting defrost water during the defrosting of the evaporator 3. A compressor 5 and a condenser 6 disposed below the storage compartment 2 along with the evaporator 3 form part of a refrigerating system for maintaining the compartment 2 at the desired freezing temperatures.

As is best shown in Figs. 2 and 3, the evaporator 3 is in the form of a plate or sheet having formed therein by any of the well-known methods a plurality of tubular passages. One of these passages generally indicated by the numeral 9 forms a refrigerant circuit which may have as a part thereof an accumulator 10 while the second passage 11 extending generally parallel to the refrigerant circuit 9 and in heat exchange therewith forms a hot gas defrost circuit through which hot compressed refrigerant from the compressor or condenser may be conveyed periodically by conduits (not shown) for the purpose of warming the refrigerant circuit 9 as well as the entire evaporator structure 3 to temperatures at which accumulated frost is melted.

The refrigerant circuit 9 of which the evaporator 3 is a part is so designed that the refrigerant passing through the refrigerant circuit during operation of the compressor 5 maintains the evaporator 3 at below freezing temperatures. At such temperatures, moisture from the air within the compartment 2 tends to collect on the evaporator 3 in the form of a frost layer. As is well known, frost tends to collect on the coldest parts of an evaporator structure, that is, in the case of the illustrated evaporator, on those areas of the evaporator sheet 3 adjacent the refrigerant circuit 9 and accumulator 10. The defrost or hot gas circuit 11 provides means for periodically raising the temperature of the evaporator 3 to above freezing temperatures so that this accumulated frost will melt. The melted frost flows down the two faces of the evaporator 3 and into the trough 4 from which it may be conveniently conveyed by means of a tube 12 out of

the cabinet or compartment **2** into a drain pan **14** which is warmed by the compressor condenser unit for evaporator of the collected condensate.

As is indicated in Fig. 3 of the drawing, the trough **4** is supported directly on the bottom edge **15** of the evaporator **3** and can be secured thereto by spot brazing or the like thereby providing a low cost arrangement for supporting a drain trough in operative relation with an evaporator **1**.

In accordance with the present invention, a slit **16** is provided in the evaporator **3** immediately above the trough **4** for thermally isolating the trough to a substantial extent from the remaining portions of the evaporator structure. This slit **16** which extends substantially the width of the evaporator **3** divides the evaporator structure into an upper refrigerated portion and a lower trough portion so that even though the trough **4** is supported directly on the evaporator **3** and is disposed within the compartment **2**, it nevertheless normally operates at a temperature a few degrees higher than the remaining portions of the evaporator **3** so that not only is there less tendency for frost or moisture to collect on the trough **4** but also any frost which does collect there tends to migrate to the colder portions of the evaporator about the slot **16**. As a result the trough **4** tends to remain frost free due to the air gap provided by the slot **16**.

In order to raise the temperature of the trough **4** to above freezing temperatures during defrost operation, the defrost circuit **11** preferably includes one pass **19** extending across the evaporator between the trough **4** and the slot **16**. The hot gas flowing through this pass **19** quickly raises the temperatures of the trough as well as the drain **12** to temperatures such that the defrost water flowing from the evaporator **3** during the defrost operation remains in liquid form in the trough **4** so that it will readily flow out through the drain **12**.

From the above description it will be seen that there has been provided by the present invention an evaporator structure including a trough integrally connected to a vertical evaporator but isolated by means of the gap **16** against direct refrigeration by the refrigerant circuit. In addition the hot gas defrost circuit including a portion **19** between the slot and the trough maintains the trough at at least the same defrosting temperatures as the remaining portion of the evaporator thus assuring disposal of all of the defrost water during the defrost operation.

While there has been shown and described a particular embodiment of the present invention, it will be understood that the invention is not limited thereto and it is intended by the appended claim to cover all modifications thereof within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

A defrostable evaporator structure comprising a vertically arranged, one-piece, tube-in-sheet evaporator having formed therein a refrigerant circuit and a hot gas defrost circuit separate from said refrigerant circuit, a drain trough integrally connected to the bottom portion of said evaporator, said evaporator having a slot extending substantially the width thereof below said refrigerant circuit and above said trough to partially insulate said trough from said refrigerant circuit whereby said trough normally operated at a temperature a few degrees higher than the portion of said evaporator above said slot, said hot gas defrost circuit including a passage extending between said slot and said trough for warming said trough during defrosting of said evaporator.

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