May 22, 1951 L. F. LA PORTE 2,553,657

REFRIGERATOR DEFROSTING METHOD AND APPARATUS

Filed March 6, 1947

Fig. 1.

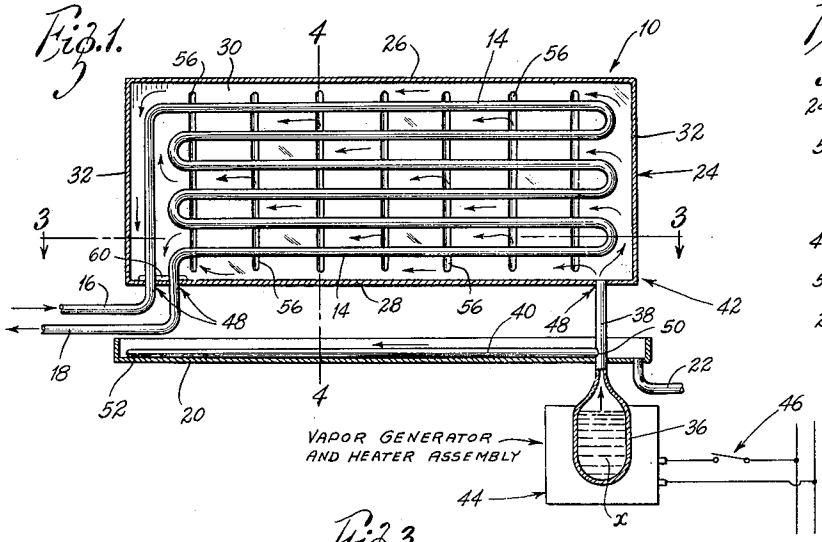


Fig. 2.

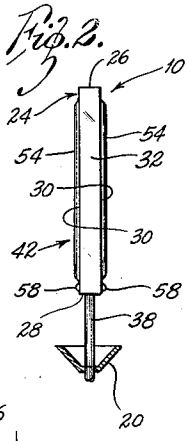


Fig. 3.

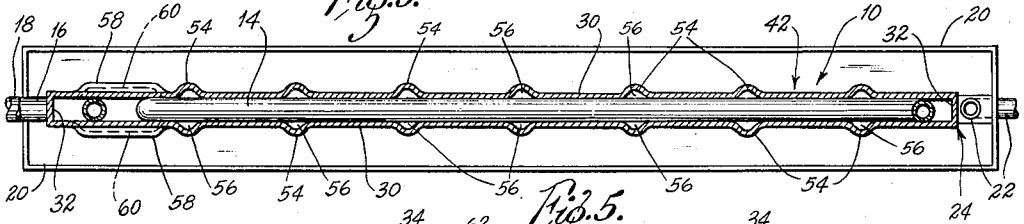


Fig. 4.

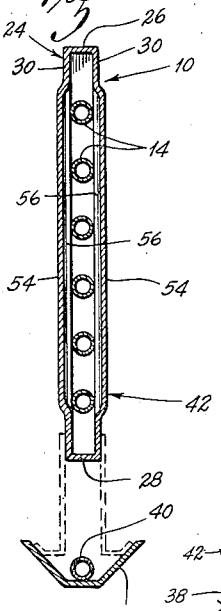


Fig. 5.

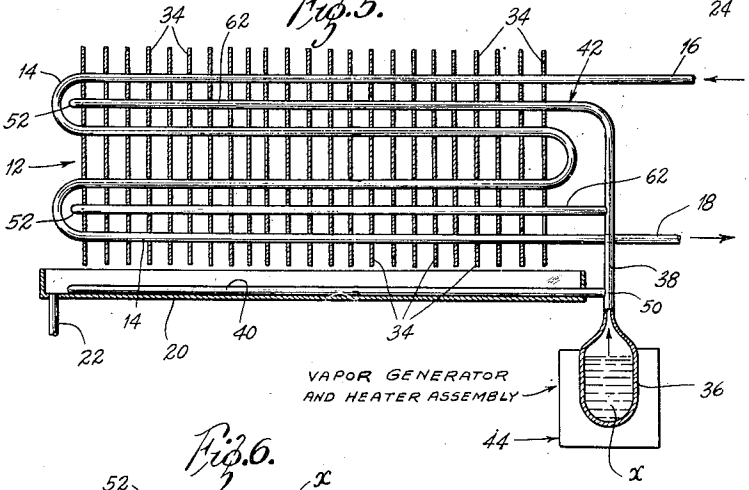


Fig. 6.

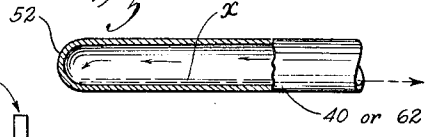
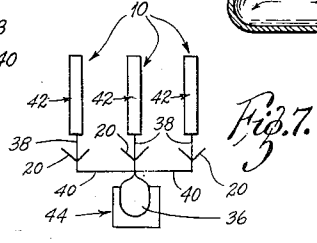


Fig. 7.



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REFRIGERATOR DEFROSTING METHOD AND APPARATUS

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6 Claims. (Cl. 62—126)

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The present invention pertains generally to mechanical refrigeration, and more particularly to the cooling units incorporated in conventional refrigerating mechanisms.

More specifically, the invention relates to a novel method and apparatus for defrosting such cooling units in a simple yet highly efficient manner.

Primarily, the invention has relation to defrosting operations in connection with refrigerator cabinets of the commercial type wherein perishable food is displayed, and wherein a prescribed temperature must be maintained to prevent spoilage. Therefore, the advantages of the invention will be described with this in mind. It is to be understood, however, that the invention has application also to other types of refrigeration, including household refrigerators.

In open food display cabinets, the methods heretofore employed to defrost the coils have been found objectionable for one reason or another. The most commonplace method is to remove the accumulated frost manually with a scraping implement, or to pour water over the unit and allow it to drain off. There are other methods also, such as inserting a heating element or the like, but it is not deemed necessary to elaborate on the disadvantages and inefficiencies of such defrosting operations.

The principal object of the present invention is to provide a method whereby a cooling unit may be quickly and efficiently defrosted, and to provide a simple, inexpensive apparatus whereby the method may be performed when desired.

A further object is to provide a defrosting method and apparatus which may be placed in operation without removing or disturbing the food or other commodities in the cooling compartments.

Other objects are to provide a method and apparatus for defrosting cooling units without appreciably raising the temperature of the space surrounding the units; which is applicable to cooling units of the plate type as well as the fin type; which may be put in operation at will; and which may be incorporated in conventional refrigeration coil assemblies at the time of manufacture, or subsequently.

Included in the invention is the provision of means whereby the drain pan associated with the cooling unit is heated and defrosted simultaneously, obviating the tendency of the drippings to freeze enroute to the drain pipe.

Broadly, the method of defrosting contemplated consists in providing a closed, or airtight

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fluid system of heat-conducting metallic material which, after having been first evacuated and thereafter charged with a predetermined quantity of a selected refrigerant, or volatile liquid, is built into the cooling unit or units in such manner, that branches of the system are adapted to propagate throughout the system the hot vapors generated by a vapor generator included in the system.

The hot gas under pressure dissipates its heat among the cooling unit components and associated drain pan to defrost the same, whereupon it liquefies and returns to the vapor generator by gravity for reheating and consequently, revaporization, to repeat the cycle until the defrosting process is complete.

In other words, the hot vapors emanating from the vapor generator travel upwardly and onwardly along the interior surfaces of the system, give up their heat to those surfaces and thereby having been liquefied, return by gravity to the generator along the same said interior surfaces of the system.

Preferably, the system is built into the coil unit at the outset, with the vapor generator and its heating device located in a compartment of the cabinet other than that in which the cooling unit is situated.

The invention resides in the illustrated arrangement of the various parts which combine to produce the advantages hereinbefore set forth, as well as others which will be apparent or specifically referred to in the description to follow, reference being had also to the accompanying drawing in which the application of my method to both a plate type and a fin type cooling unit is illustrated.

In said drawing, in which some parts are portrayed more or less diagrammatically:

Fig. 1 is a vertical sectional view of a cooling unit of the plate type embodying my invention;

Fig. 2 is an end view thereof with the drain pan in vertical section;

Fig. 3 is a horizontal sectional view taken on line 3—3 of Fig. 1;

Fig. 4 is a vertical sectional view taken on line 4—4 of Fig. 1;

Fig. 5 is a view similar to Fig. 1, of a cooling unit of the fin type;

Fig. 6 is a detail sectional view, partly in elevation, of the extremity of a branch of the system; and

Fig. 7 is a wholly diagrammatic illustration of a plurality of cooling units served by a single vapor generator to defrost them simultaneously.

With reference to Figs. 1 to 4 inclusive a cooling unit of the plate type is indicated as a whole by the numeral 10, while in Fig. 5, a unit of the fin type is similarly indicated by the numeral 12.

Each unit 10 or 12 includes a conventional refrigerant coil 14 having an inlet conduit 16 and an outlet conduit 18, as is understood. Also, disposed beneath each unit is an associated drip or drain pan 20 provided with a suitable drain pipe 22. The drain pan may be of any conventional configuration, and may be supported in proper position by any suitable means, such as by the brackets depending from a part of the unit and suggested by broken lines in Fig. 4, or otherwise.

In accordance with conventional construction, the coil 14 of unit 10 is enclosed in a casing 24 of metal plates which are welded or otherwise secured together to encompass the coil on all sides. Such casing includes a top wall 26, a bottom wall 28, side walls 30, and end walls 32. The coil 14 is in intimate contact with the side walls 30 of the casing throughout, as best seen in Fig. 3, being secured in such position by welding, brazing, or in a similar manner as is understood.

In a unit of this character, the frost due to moisture in the air about the unit 10 forms and accumulates on the outside of the casing 24, the coil 14 being protected therefrom.

On the other hand, the coil 14 of the type of unit 12 portrayed in Fig. 5 is exposed to said moisture, and frost forms and accumulates thereon and on the spaced plates or heat absorbing fins 34 through which the coil passes and which are welded or brazed to the coil in the customary manner.

The detailed description thus far has dealt with structures well known in the refrigeration art. The applicability of the instant invention to them in order to attain its purposes will now be set forth. In its preferred embodiment, the invention includes an airtight or hermetically sealed system containing within itself a predetermined charge of a selected refrigerant.

Said system may be said to comprise four integral components, including a reservoir or bulb portion 36, an upwardly extending conduit 38, a laterally extending branch pipe or conduit 40, and a defrost or container portion generally designated by the numeral 42.

Normally, that is except when defrosting, the refrigerant designated x collects in liquid form in the reservoir or bulb 36, as shown. During defrosting operations, vaporization by the external application of heat causes hot gas under pressure to permeate the system above the liquid level of the refrigerant, as will be seen.

Associated with the reservoir 36, is a suitable heating device preferably of an electric type. It is shown diagrammatically, and indicated by numeral 44. A control switch is indicated at 46. Closing of the switch energizes the heating element to heat the liquid in the reservoir.

Opening and closing of the switch 46 may be manual, or rendered automatic by the inclusion of a suitable control device in the electrical circuit.

With particular reference now to Fig. 1, it is seen that the defrost component 42 of the system comprises the casing 24, from the bottom wall 28 of which the conduit 38 leads to the bulb 36. The lateral branch 40 of the system lies adjacent the bottom of the drain pan.

Obviously, since the system is hermetic, the

openings indicated at 48 through which the inlet and outlet conduits 16 and 18 respectively as well as the conduit 38 pass, are sealed. For the same reason, the branch pipe 40, which opens at one end into the conduit 38, is sealed at 50, and, as particularly shown in Fig. 6, terminates in a closed end 52.

For a reason that will be explained, the side walls 30 of the member 42 are provided with a plurality of spaced corrugations or ribs 54 to provide vertical passageways 56, as shown. Preferably also, each wall 30 is provided with a rib 58 adjacent its lower left hand corner to provide horizontal passageways 60 in that region.

With particular reference now to Fig. 5, it is seen that the defrost component 42 of the system here comprises a pair of spaced laterally extending tubes or branches 62 from which the conduit 38 leads to the bulb 36.

It is understood, of course, that the number of branches 62 employed may be varied. Each said branch, similar to the branch 40, terminates in a closed end 52. As illustrated, the tubes 62 are of sufficient length to extend through the entire battery of fins 34 which are individually welded or brazed thereto.

Although the manner of performing a defrosting operation by the method herein disclosed should be manifest from the foregoing description, and from an inspection of the drawing, a brief resume thereof follows.

Assuming that it is desired to defrost the unit 10, the refrigeration equipment is first shut off, and then the heating element 44 is energized. The heat applied to the bulb 36 exteriorly is quickly transferred to the refrigerant x therein, causing the latter to vaporize. The hot gas under pressure rises and travels along the inner surfaces of the system as indicated by the full line arrows in Figs. 1 and 6. The hot gas thus gives up its heat to the casing 24 and the drain pan 20, simultaneously liquefies, and thereupon returns by gravity to the reservoir 36, traveling along the same inner surfaces of the system.

In other words, the heated refrigerant x in vapor form flows upwardly in contact with the same surfaces along which it, in liquid form, flows downwardly after giving up its heat. This flow in both directions continues as long as heat is applied to the bulb, thereby quickly melting the accumulated frost on the exterior of the unit. The passages 56 and 60 are provided primarily to expedite the return flow, although manifestly, the hot vapors also pass upwardly and laterally therethrough.

Assuming that it is desired to defrost the unit 12, the same procedure is followed, the hot gas giving up its heat to the fins 34 and the drain pan, whereupon it liquefies and returns in that state to the reservoir 36. Since the fins are in intimate contact with the coil 14, some of the heat given up by the hot vapors is conducted to the coil to melt the accumulated frost thereon also.

For defrosting units of the plate type, a calculated quantity of low pressure refrigerant is preferable. For defrosting units of the fin type, a calculated quantity of high pressure refrigerant may be selected. The advantage of the branch 40 in regard to the drain pan has been explained. The broken line arrow appearing in Fig. 6 indicates the direction of the return flow. Obviously, the members 40 and 62 may slope slightly to facilitate the return flow to the reservoir.

As diagrammatically portrayed in Fig. 7, a sin-

gle vapor generator and heater assembly may be installed to service a plurality of units if desired.

It is apparent from the foregoing that a novel defrosting method and apparatus is provided for accomplishing its purpose. While the particular embodiment illustrated and described is considered preferable, it obviously is susceptible of modification without departing from the principles of the invention.

What is claimed is:

1. Apparatus for simultaneously defrosting a cooling unit of the plate type and the drain pan disposed there beneath, said apparatus comprising in combination, a vapor generator and heater assembly, a conduit extending upwardly from the generator, a branch line terminating in a closed end extending laterally from said conduit, a container at the upper end of said conduit and in fluid communication therewith, said generator, conduit, branch, and container forming a unitary integrated hollow system the interior of which after having first been evacuated, has thereupon been charged with a predetermined quantity of selected volatile liquid hermetically sealed within said system.

2. Apparatus for defrosting a cooling unit of the fin type and the drain pan disposed there beneath, said apparatus comprising in combination, a vapor generator and heater assembly, a conduit extending upwardly from the generator, a branch line terminating in a closed end extending laterally from said conduit and in contact with said pan, a container at the upper end of said conduit and in fluid communication therewith, said container comprising one or more tubes extending laterally through the fins and terminating in closed ends, said generator, conduit, branch and container forming a unitary integrated hollow system the interior of which after having first been evacuated, has thereupon been charged with a predetermined quantity of selected volatile liquid hermetically sealed with said system.

3. A hermetically sealed plate type cooling unit and defrosting apparatus including in combination a container of heat-conducting metallic material within which a refrigeration coil assembly is enclosed, a reservoir, a conduit in fluid communication at one end with said container and at the other end with said reservoir, said container, reservoir, and conduit constituting a unitary hollow system within which, after having first been evacuated, is sealed a predetermined charge of a volatile liquid, said liquid normally collecting in said reservoir, and means for applying heat externally to said reservoir to vaporize said liquid.

4. A hermetically sealed plate type cooling unit and defrosting apparatus including in combination, a container of heat-conducting metallic material within which a refrigeration coil assembly is enclosed, a reservoir, a conduit in fluid communication at one end with said container and at the other end with said reservoir, said container, reservoir, and conduit constituting a unitary hollow system within which, after having first been evacuated, is sealed a predetermined charge of a volatile liquid, said liquid normally collecting in said reservoir, means for applying heat externally to said reservoir to vaporize said liquid, and a plurality of spaced vertical corrugations provided in the side walls of the container aforesaid.

5. In a method of defrosting the cooling unit of a refrigeration apparatus including a compressor and having associated therewith an integrated system of hollow components including an upper portion in intimate contact with portions of said unit, and a lower depending portion constituting a reservoir located a selected distance from said unit: the steps of turning off the compressor, and evaporating a predetermined quantity of a volatile liquid hermetically sealed within said system and normally adapted to collect in said reservoir following a defrosting operation by applying heat externally to said reservoir during a defrosting operation, thereby causing said liquid to vaporize and rise within the system, to condense upon entering the cooling unit, and thereupon to return in reliquefied form by gravity to said reservoir for revaporization until the aforesaid application of heat is discontinued.

6. That method of defrosting the cooling unit of a refrigeration apparatus including a compressor and having associated therewith an integrated system of hollow components in fluid communication with one another, said system including upper components in intimate contact with portions of said unit and a lower depending portion constituting a reservoir located remotely from said unit, said reservoir having an electrically operable heating device located in heat transfer relationship thereto, which method is characterized by: the steps of stopping operation of the compressor; energizing said heating device to apply heat externally to said reservoir for evaporating a predetermined quantity of a volatile liquid hermetically sealed within said system and which normally collects in said reservoir following a defrosting operation, thereby causing said liquid to vaporize and rise within the system, to condense upon entering said components of the system which are in contact with said cooling unit, and thereupon to return in reliquefied form by gravity to said reservoir for revaporization; de-energizing said heating device when defrosting is complete.

LOUIS F. LA PORTE.

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