Aug. 19, 1952 M. W. GARLAND 2,607,202

MEANS FOR DEFROSTING COOLING COILS

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FIG. 1

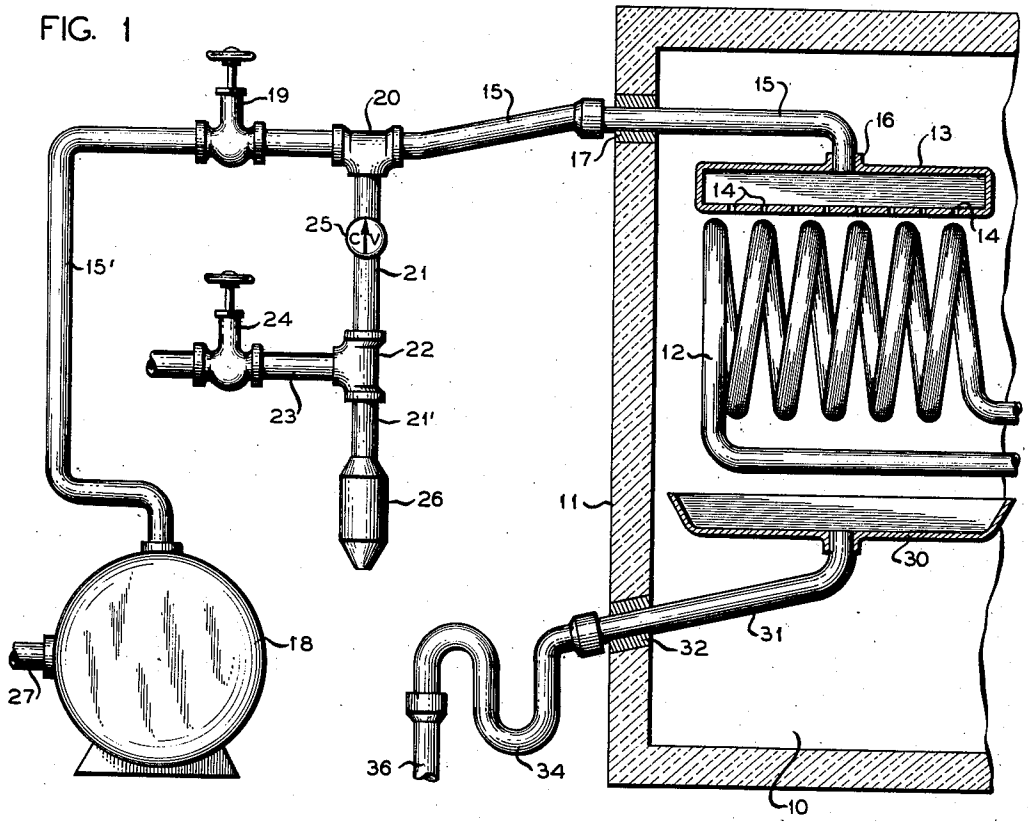
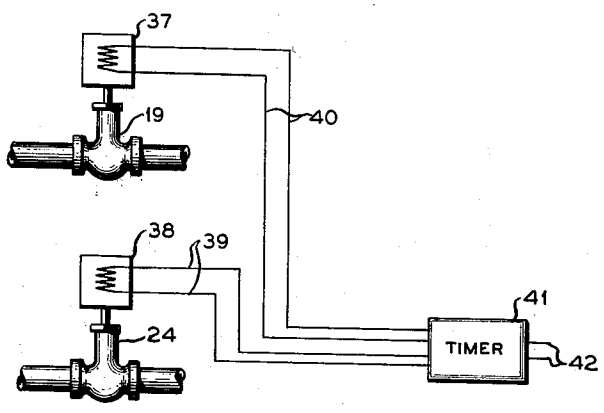


FIG. 2



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MEANS FOR DEFROSTING COOLING COILS

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6 Claims. (Cl. 62—103)

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This invention relates to refrigeration and more particularly to the periodic removal of frost which accumulates on the cooling unit which is usually in the form of a coil located in a refrigerated compartment.

When air in a refrigerated compartment is cooled below its dew point the moisture of the air is deposited on the cooling unit in the form of frost. This frost is a relatively good heat insulating medium and if allowed to accumulate and remain on the coils materially impairs the efficiency of the cooling unit.

To maintain the efficiency of the refrigeration system it is necessary to remove the accumulated frost in as short a time as possible in order to maintain a relatively low temperature in the compartment and preclude the necessity of recooling the same from an elevated temperature after completion of the defrosting operation.

Numerous systems have been devised for accomplishing the defrosting operation, among which are the provision of a heated body adjacent the cooling unit, the passage of warm air or gas over the cooling unit, and the shutting down of the refrigeration system in order to allow the frost to melt. These attempts to solve the defrosting problem have presented disadvantages, the most serious of which is the relatively long defrosting cycle and the excessive raising of the temperature within the refrigerated compartment. Attempts have also been made to solve the defrosting problem by spraying a relatively warm fluid such as water over the cooling unit to melt the frost accumulated thereon. This method has the advantage of melting the frost in a relatively short time without materially raising the temperature in the refrigerated compartment but there are also very serious disadvantages connected with this method as it has been heretofore employed.

For conveying the water to the coils and distributing it thereover a spray head is ordinarily utilized, which is provided with a plurality of relatively small spray openings. At the completion of the defrosting operation all liquid must be removed from the spray head and from the pipe for conveying liquid thereto in order to prevent its freezing and subsequently clogging for the next operation. Attempts have been made to meet this problem by the provision of a self-draining liquid supply conduit which is normally open to the atmosphere. In leaving the conduit open to the atmosphere several undesirable consequences occur such as the likelihood of passage of refrigerated air from or warm air to the compartment, in addition to the likelihood of contamination of the refrigerated space by means of the open connection.

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Furthermore, in an air unit in which fans are positioned over the coils to promote the circulation of air during normal cooling operation the fan draws warm air from the outside into the refrigerated space through the normally open conduit.

Accordingly, it is an object of the present invention to provide a defrosting system for utilizing a first relatively warm fluid such as water for the defrosting operation and for utilizing a second fluid for positively removing all of the first fluid remaining in the supply conduit and spray head after the completion of the defrosting operation.

A further object of the invention is to provide a defrosting system utilizing a relatively warm fluid such as water to remove the frost from a cooling unit and in which means is provided for effectively preventing the escape of cold air from the interior of the refrigerated compartment and for preventing the influx of warm air thereto after the defrosting operation is completed and for preventing the entrance of contaminating substances.

It is a further object of the invention to provide an automatic defrosting system utilizing relatively warm fluid such as water to remove the frost from the cooling unit, the defrosting cycle being initiated and automatically controlled by electrical timing devices or by means responsive to the accumulation of frost on the cooling unit.

Further objects and advantages of the invention will become apparent from the following description taken in conjunction with the drawings wherein:

Fig. 1 is a diagrammatic view illustrating the defrosting system of this invention applied to a conventional refrigerated compartment and with certain parts in section for greater clarity;

Fig. 2, a schematic diagram of an electrical control circuit for the defrosting system of Fig. 1.

With continued reference to the drawing, there is shown in Fig. 1 a refrigeration compartment 10 provided with conventional insulated walls 11, a cooling unit or evaporator 12 of any desired form being disposed within the compartment. The compartment 10 may be of any desired size and shape and cooling unit 12 of course is proportionately arranged in accordance with the requirements of the particular compartment to be refrigerated.

Immediately above the cooling unit 12 is located

a spray head 13 having a plurality of relatively small apertures 14 in the lower surface thereof, there being a sufficient number of these apertures arranged in a manner to supply a relatively warm fluid such as water over the entire surface of the cooling unit or coil 12. A fluid supply conduit 15 is connected by a joint 16 to the spray head 13, this conduit extending through a wall of the compartment 10, there being provided a suitable sealing means 17 in the wall of the compartment to prevent the leakage of air around the conduit 15.

The conduit 15 is connected by a conduit 15' to a tank 18 of a second fluid such as compressed dry air, a valve 19 being positioned in the line 15' between the tank and the spray head 13. Between the valve and the spray head, a T fitting 20 connects the pipes 15 and 15' to a conduit 21 which is connected to a conduit 21' by a T fitting 22. The T fitting 22 is connected to a conduit 23 of a water supply line and has a valve 24 for regulating the supply of water. The conduit 21 has a check valve 25 for closing the pipe so that the pipe 15 will not communicate with the atmosphere through the conduits 21 and 21'. The conduit 21' has an automatic drain valve 26 of the type which will permit a small amount of liquid to drain therethrough, as may occur in the event of the valve 24 not providing a perfect seal, but closes on the application of pressure from the water flowing through valve 24 under normal conditions of operation. The tank 18 may have the supply of air replenished by suitable means such as a compressor or source of supply through a pipe 27 connected thereto.

In order to remove the defrosting liquid and the water resulting from the melting frost from the compartment 10 a drip pan 30 is located beneath the cooling unit 12. The drip pan is provided with a drain 31 extending exteriorly of the compartment through a suitable sealing means 32 in one of the walls thereof. Connected to the outer end of the drain is a conventional U-shaped trap 34, the opposite end of which may discharge to the atmosphere or be connected to a sewer pipe 36. The trap 34 operating in a well known manner seals the drain 31 against the passage of gas under normal pressures in either direction and also prevents the entry of other contaminating substances into the compartment 10. Liquid supply conduit 15 and drain 31 may be formed of a relatively poor heat conducting material in order to restrict the flow of heat therethrough and maintain the efficiency of the system.

In the operation of the system described above, and assuming an accumulation of frost on the cooling coil 12 sufficient to require removal thereof, valve 24 in the water line is opened, the valve 19 in the air line remaining closed, thus permitting the water to flow through conduit 21, opening check valve 25, and conduit 15 to the spray head. At the same time the water entering conduit 21' closes the valve 26 to prevent the passage of water therethrough. Upon reaching the spray head 13 the liquid is discharged therefrom through the apertures 14 in a spray covering the outer surface of cooling unit 12. Due to the relatively high temperature of the liquid frost present on the surface of the cooling unit 12 is thereby melted. The defrosting liquid as well as the liquid resulting from the melted frost is collected in the drip pan 30 and drains therefrom through drain 31 and trap 34 to the atmosphere or sewer pipe 36 as the case may be.

Upon completion of the removal of frost from the cooling unit 12 the water valve 24 is closed, permitting check valve 25 to close, and the valve 19 in the air line is opened to permit air under pressure in the tank 18 to pass through the conduits 15 and 15', driving any water remaining in the pipe and the spray head 13 out through the spray head, thus clearing the pipe, the spray head, and the apertures 14 therein of any liquid which remains after the defrosting operation. Since the air is compressed and dry it is obvious that the supply pipe head and sprays will be completely freed of water. After the water removing operation the valve 19 is closed; the storage tank 18 may be replenished with air as required.

In many installations it is desirable that the operation of the defrosting system be entirely automatic and accordingly there is illustrated in Fig. 2 an electrical control circuit which may be utilized in conjunction with the apparatus shown in Fig. 1 and described above for performing the defrosting operation at predetermined intervals. This may be accomplished by merely presetting a conventional timer for the desired cycle of operations within a predetermined period of time.

In the control system, the valves 19 and 24 are provided with operating solenoids 37 and 38 respectively, these solenoids being connected by suitable leads 39 and 40 to a conventional timer 41 for which power is supplied through lines 42. Where an electrically operated fan or blower is employed for circulating air over the coils during normal operation, the timer may control the operation of such fan by conventional switch means. Similarly, the refrigerant supply or return may be controlled by the timer if desired.

The operation of the control system illustrated in Fig. 2 is initiated by the timer 41 to open and close the valves 19 and 24 at predetermined intervals. The invention also contemplates the use of the valve actuating timing means shown in Patent No. 2,480,346, issued August 30, 1949 to M. B. Watts.

It will thus be seen that by the above described control circuit a relatively simple efficient means has been provided whereby the refrigerating equipment may be defrosted at predetermined intervals, the defrosting cycle being predetermined in accordance with the time required for such operation.

In certain refrigeration installations means is provided usually in the form of an electrically driven fan for circulating air within the refrigerated compartment and over the cooling unit to more efficiently cool the compartment and in installations such as these the motor for driving the circulating fan and the power supply therefor may be conveniently utilized as a control means for a defrosting system such as that shown in Fig. 1 and described above.

It is therefore apparent that by this invention there has been provided a relatively simple, inexpensive defrosting system which readily lends itself to manual operation and control, to completely automatic control based on a predetermined cycle of operation, and a predetermined period of time between cycles of operation and which may also be conveniently controlled by the degree of accumulation of frost on the cooling unit as shown in the Watts Patent 2,480,346. This defrosting system completely and rapidly removes the accumulated frost from the cooling unit while maintaining relatively low temperature in the refrigeration compartment. At the completion of the defrosting operation all of the

liquid used to accomplish the defrosting is removed from the system thereby precluding the possibility of the system's being clogged by the subsequent formation of ice. Furthermore, the system is effectively closed after the defrosting operation in order to prevent the possibility of contamination of the compartment by the influx of gas or other substance as well as to prevent the passage of air into or from the compartment, lowering its efficiency.

It will be obvious to those skilled in the art that various changes may be made in the invention without departing from the spirit and scope thereof and therefore the invention is not limited by that which is shown in the drawings and described in the specification but only as indicated in the appended claims.

What is claimed is:

1. A refrigeration system comprising a refrigeration compartment, a cooling unit disposed in said compartment, a defrosting system for removing accumulated frost from said cooling unit, said defrosting system comprising a spray head disposed above said cooling unit, a drip pan disposed beneath said cooling unit, a drain connected to said drip pan and extending exteriorly of said compartment, a liquid trap in said drain, a supply conduit connected to said supply head and extending exteriorly of said compartment, said supply conduit being connected to a source of dry compressed air, an auxiliary conduit connected to said supply conduit and connected to a source of liquid, a first valve in said supply conduit between the source of air and the auxiliary conduit connection, a second valve in said auxiliary conduit for controlling the supply of liquid and a check valve in said auxiliary conduit for preventing the flow of gases therethrough, a drain valve connected between the second valve and the check valve, said drain valve being adapted to permit a relatively small flow of liquid under low pressure through it but to prevent the passage of liquid through it under normal operating pressure, whereby upon closing of the first valve in the supply conduit and opening of the second valve in the auxiliary line the liquid may flow through the check valve into the spray head and be sprayed over the cooling unit thus melting the frost accumulated thereon, the liquid and melted frost being collected in the drip pan and removed from the compartment through the drain, and whereby upon closing the second valve in the auxiliary conduit and opening of the valve in the supply conduit, the check valve will close and dry compressed air may pass through the supply conduit and the spray head thus removing all of the liquid therefrom.

2. In a defrosting system for a refrigeration system having a compartment and a cooling unit with drainage means therefor, a defrosting system comprising conduit means for directing fluid to said cooling unit to melt accumulated frost, first and second means for directing first and second fluids respectively to said conduit means, said first fluid being adapted to melt frost from said cooling unit, individual control means for said first and second directing means, and valve means connected into said first directing means, said valve means permitting fluid under low pressure to discharge from the first directing means.

3. In a defrosting system having a compartment and a cooling unit therein, fluid directing means for spraying a first fluid of relatively high temperature over said cooling unit to melt frost accumulated thereon, a first conduit connected to the fluid directing means, a first fluid supply means connected to the first conduit, a first valve in said first fluid supply means for controlling flow therethrough, a second valve connected into said first fluid supply means between said first valve and said first conduit, said second valve permitting fluid under low pressure reaching it to discharge from the first fluid supply means, a third valve in said first fluid supply means between said second valve and said first conduit, said third valve permitting flow therethrough toward the first conduit and preventing flow in the reverse direction, a second fluid supply means connected to the first conduit, and valve means in the second fluid supply means.

4. The structure of claim 3, and electrical control means for operating the first valve in said first fluid supply means and the valve means in said second fluid supply means.

5. In a defrosting system having a compartment and a cooling unit therein, fluid directing means, a first fluid supply means connected to the fluid directing means for spraying a first fluid of relatively high temperature over said cooling unit to melt frost accumulated thereon, valve means in the first fluid supply means for controlling flow therethrough, auxiliary means in the first fluid supply means for positively preventing leakage through the valve means from reaching the fluid directing means, a second fluid supply means connected to the fluid directing means, and valve means in the second fluid supply means for controlling flow therethrough.

6. The method of defrosting apparatus in a refrigeration compartment comprising supplying a first fluid of relatively high temperature to directing means positioned to distribute fluid over the apparatus to remove frost from the apparatus, the fluid passing from the directing means onto the apparatus, discontinuing the flow of said first fluid when sufficient frost has been removed from the apparatus, and supplying a second fluid to the directing means to remove any first fluid remaining therefrom, said second fluid passing through the directing means and into the compartment.

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