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DEFROSTING SYSTEM

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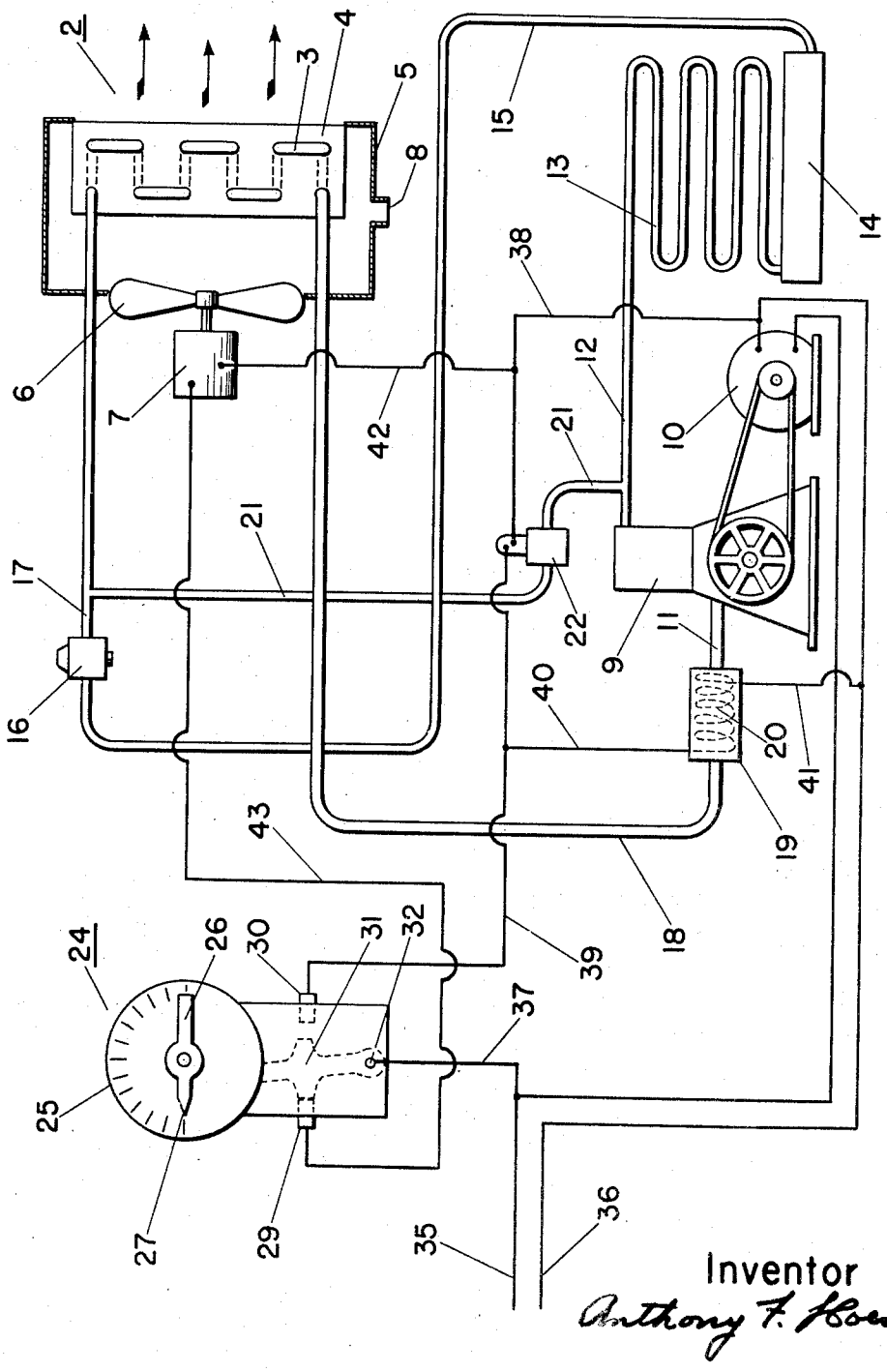

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DEFROSTING SYSTEM

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4 Claims. (Cl. 62—115)

The present invention relates to hot gas defrosting of cooling units which are utilized to cool compartments to temperatures below 32° F.

More specifically the invention contemplates the use of the refrigerant compressor hot gas discharge in order to supply sufficient heat to the cooling unit in order to defrost the same. It also contemplates the use of means whereby the time functioning of such defrosting system is under the adjustable control of manually operated time switch means, whereby the operator may manually initiate the various necessary functions, for the defrosting, by merely flipping a switch handle to a given time designation previously determined as being sufficient to complete the defrosting cycle. Upon the elapse of the given time, the refrigeration system then automatically resumes its previous normal operation.

While the use of hot compressor discharge gas, for defrosting, is rather old in the art, all previous systems necessitated manual attendance to start and stop the various necessary functions in a somewhat given sequence, and then after the lapse of sufficient time, to then reverse the previous operations so that the system would then be in normal function.

An object, of the invention, is to provide an improved system of semi-automatic hot gas defrosting of low temperature cooling units.

Another object, of the invention, is to provide means for vaporizing, before entrance into the compressor, of the returned refrigerant fluid, which is condensed in the cooling unit due to its surrender of heat thereto.

Other objects, of the invention, will be more fully disclosed in the following specification and claims:

In the drawing, the figure is a diagrammatic elevational view of a refrigerating system embodying the invention.

Referring to the drawing, a cooling unit **2**, comprised of a nested volatile refrigerant conduit circuit **3** upon which fins **4** are mounted in heat transfer relationship, is situated within a casing **5** through which, and over the exterior surfaces of the cooling unit **2**, a fan **6**, driven by the motor **7**, forces an air circulation as indicated by the arrows.

The casing **5** has a drain **8**, usually connected to a sewer, to get rid of the defrosted moisture during the defrosting period.

The refrigerant compressor **9** is driven by means of the motor **10** and evacuates refrigerant fluid, in vapor phase, from the conduit **11**. The compressed vapor is forced into the discharge conduit **12** from whence it enters a condenser **13**, wherein, during normal functioning, it surrenders its heat and becomes condensed to its liquid phase. The liquid receiver **14** receives this liquid, which is then led by means of the liquid conduit **15** to an expansion valve **16** which tends, during normal operation, to feed refrigerant fluid, under reduced pressure, to the refrigerant inlet conduit **17** connected to the conduit circuit **3**. A suction conduit **18** serves to lead the refrigerant fluid from the outlet of the conduit circuit **3**.

Interposed, between the suction conduit **18** and the conduit **11**, is a hollow casing **19** containing an electrical heating element **20**, whose function will be described later.

The discharge conduit **12** and the refrigerant inlet conduit **17** are connected by means of the bypass conduit **21** in the circuit of which is placed a solenoid valve **22**.

The above comprises the refrigerant circulation system.

An electric timing switch **24**, of which there are numerous suitable types commercially available at present and so well known, in the art, that in the present instance it is presumed sufficient to represent the same diagrammatically and with proper functional description, comprises a casing **25** containing clock mechanism, not shown, which is wound up by means of the timing handle **26** being moved in a clockwise direction so that the pointer **27** stops at some particular predetermined point of the graduated face, which is usually graduated in minutes of operation.

The timing handle **26** is shown in the stopped position. Assume it to be moved to say the 5 minute graduation, then the timing handle gradually moves counterclockwise so that at the lapse of 5 minutes the timing handle **26** is again in its present stopped position.

Included within the casing **25** is a single pole double throw switch comprised of stationary contacts **29** and **30** and a contact arm **31** oscillating, about the fulcrum **32**, to establish an electrical circuit with either contact **29** or **30** depending upon the position of the timing handle **26**.

Whenever the timing handle **26** is moved to "on" position, clockwise, the contact arm **31** swings to the right and establishes contact with the stationary contact **30**. This contact persists until the timing handle **26** returns to "off" position, as shown, at which time the contact

arm 31 then swings to the left and establishes contact with the stationary contact 29, as shown.

The electrical conduits 35 and 36, leading to a suitable source of electrical energy, connect to the compressor motor 10. The electrical conduit 37 connects conduit 35 with the fulcrum 32 of the contact arm 31 which is in electrical circuit therewith.

An electrical conduit 38 connects with the conduit 36 and one side of the coil circuit in the solenoid valve 22. The other side of the coil circuit, of the solenoid valve 22, is connected to the stationary contact 30 by means of the electrical conduit 39.

The electrical heating element 20 is connected to the electrical conduits 36 and 39 by means of the conduits 40 and 41 respectively.

The fan motor 7 connects to electrical conduit 38 by means of the conduit 42, and also connects to the stationary contact 29 by means of the conduit 43.

The above comprises the electrical wiring system.

With the timing handle 26 in the "off" position, as shown, the compressor motor 10 and the fan motor 7 are in operation. The solenoid valve 22 is in closed position and the electrical heating element 20 is deenergized.

During the operation of the compressor 9 and the normal circulation of refrigerant within the refrigerant conduit circuit 3, there will occur a progressive accumulation of frost upon the exterior surfaces of the conduit 3 and the fins 4 mounted thereon. After a sufficient accumulation of frost, it will then become necessary to defrost these surfaces.

The operator now moves the timing handle 26, in a clockwise direction, for some predetermined time lapse. The contact arm 31 now swings to make contact with the stationary contact 30. The fan motor 7 now stops and the electrical circuit is now established in both the electrical heating element 20, which now heats up, and the solenoid valve 22, which now opens.

The compressor 9, being still in operation, discharges hot compressed refrigerant vapor into the discharge conduit 12. Since the solenoid valve 22 is open, the hot compressed vapor passes through the conduits 21 and 17 to the conduit circuit 3 in which it surrenders heat, thereby sufficiently elevating the temperature of the conduit 3 and fins 4 to defrost the same.

During this stage, the pressures in the conduit 3 become much greater than the normal, therefore no refrigerant liquid is fed through the expansion valve 16, but the hot vapor condenses within the conduit 3 and eventually passes into the suction conduit 18 in liquid phase.

It is obvious that, if liquid refrigerant passes into the compressor 9 which is conceded to be bad practice, it will among other deleterious results, naturally result in a reduced amount of work and the temperature of the discharge, to the discharge conduit 12, will be such that it will be incapable of being an efficient defrosting agent.

Since the returned refrigerant fluid is under the influence of the heat generated by the electrical heating element 20, any returning refrigerant liquid will thereby become vaporized and the temperature of the fluid, passing through the conduit 11 and into the compressor 9, will be substantially the same as that passing during normal operation. This ensures the compressor discharge fluid as being of such temperature as will do efficient defrosting.

After the proper time lapse, depending upon the original positioning of the timing handle 26, the timing handle is automatically returned to its original position, as shown, and the contact arm 31 swings to and makes contact with the stationary contact 29. The circuit, in the conduit 43, is reestablished and the fan motor 7 again starts. The circuit, in the conduit 39 is broken, thereby closing the solenoid valve 22 and deenergizing the electrical heating element 20.

The system is now in normal operation until such time as it is desired to again defrost the cooling unit. At such time, all the operator needs to do is flip the timing handle 26 to its proper time position, without giving any part of the system any further attention, since it will always automatically restore to normal function after the defrosting time lapse.

From the above, it will be noted that I have provided a defrosting system which operates with a minimum of attention and which tends to maintain a constant temperature of discharge fluid leading from the compressor.

While the drawing and specification show a particular embodiment of the invention, it is understood that various modifications may be employed without departing from the spirit and scope of the invention which is to be limited only to the claims hereto appended.

I claim:

1. The method of defrosting a cooling unit upon the exterior surfaces of which a progressive frost accumulation occurs during the circulation of a volatile refrigerant therethrough by means of a compressor normally evacuating refrigerant vapor from said cooling unit and discharging the compressed vapor into a condenser wherein it surrenders heat and becomes liquified prior to again normally entering said cooling unit, which comprises periodically conducting the discharge of said compressor, prior to its liquefaction in said condenser, to the cooling unit wherein it tends to surrender heat, for the defrosting function, and becomes liquified and then reheating the liquid refrigerant, issuing from said cooling unit, in order to vaporize the same before its entrance into said compressor, the said heated vapor being at substantially the same pressure as that obtaining within the cooling unit.

2. The method of defrosting a cooling unit upon the exterior surfaces of which a progressive frost accumulation occurs during the circulation of a volatile refrigerant therethrough by means of a compressor normally evacuating refrigerant vapor from said cooling unit and discharging the compressed vapor into a condenser wherein it surrenders heat and becomes liquefied prior to again normally entering said cooling unit, which comprises periodically conducting the discharge of said compressor, prior to its liquefaction in said condenser, to the cooling unit wherein it tends to surrender heat, for the defrosting function, and becomes liquefied and then reheating the liquid refrigerant, issuing from said cooling unit, in order to vaporize the same before its entrance into said compressor.

3. In a mechanical refrigerating system having a cooling unit normally discharging refrigerant vapor into a suction line conduit connected to the inlet of a compressor normally discharging compressed vapor into a conduit connecting the compressor with a condenser from which a refrigerant liquid conduit leads to a refrigerant pressure reducing means normally dis-

charging into a refrigerant inlet conduit of the cooling unit, over the exterior surfaces of which an air circulation is maintained by a motor driven fan and upon which exterior surfaces a frost progressively accumulates, the combination of a by-pass conduit connected to said compressor discharge, and ahead of said condenser, and also connected to the refrigerant inlet between the said refrigerant pressure reducing means and the cooling unit, a normally closed solenoid valve in said by-pass conduit, electrical heating means disposed in heat transfer relationship with the refrigerant passing through the suction line conduit and normally de-energized, an electrical time switch normally maintaining a current supply to the fan motor, manually operated means to set said time switch for a given time lapse during which the current supply to said fan motor is interrupted, and during which time lapse the time switch energizes the solenoid valve to open position allowing the compressor discharge fluid to enter the inlet of said cooling unit, said time switch, during said time lapse, also energizing said electrical heating means.

4. In a mechanical refrigerating system having a cooling unit normally discharging refrigerant vapor into a suction line conduit connected to the inlet of a compressor normally discharging compressed vapor into a conduit connecting the compressor with a condenser from which a refrigerant liquid conduit leads to a refrigerant pressure reducing means normally discharging into a refrigerant inlet conduit of the cooling unit, over the exterior surfaces of which an air circulation is maintained by a motor driven fan and upon which exterior surfaces a frost progressively accumulates, the combination of a by-pass conduit connected to said compressor discharge, and ahead of said condenser, and also connected to the refrigerant inlet between the said refrigerant pressure reducing means and the cooling unit, a normally closed solenoid valve in said by-pass conduit, electrical heating means disposed in heat transfer relationship with the refrigerant passing through the suction line conduit and normally de-energized, an electrical time switch normally maintaining a current supply to the fan motor, manually operated means to set said time switch for a given time lapse during which the current supply to said fan motor is interrupted, and during which time lapse the time switch energizes the solenoid valve to open position allowing the compressor discharge fluid to enter the inlet of said cooling unit, said time switch, during said time lapse, also energizing said electrical heating means, and the said time switch automatically reestablishing said fan motor current circuit and de-energizing said solenoid valve and said electrical heating means after the time lapse.

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