

May 25, 1954

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2,679,141

DEFROSTING REFRIGERATING APPARATUS

Filed Sept. 22, 1951

2 Sheets-Sheet 1

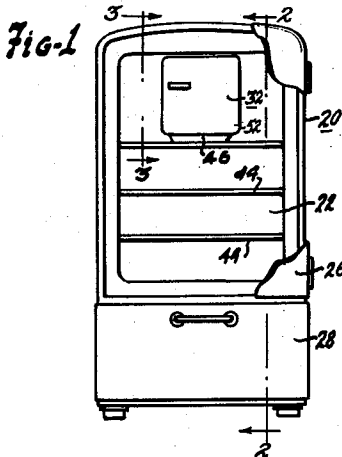
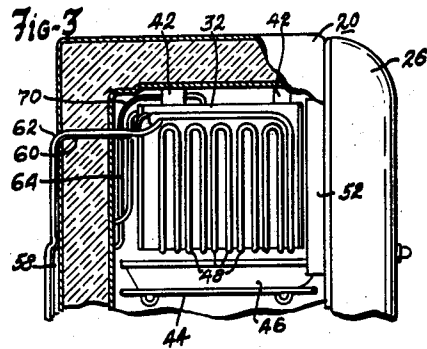
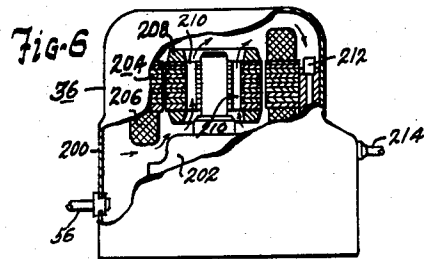
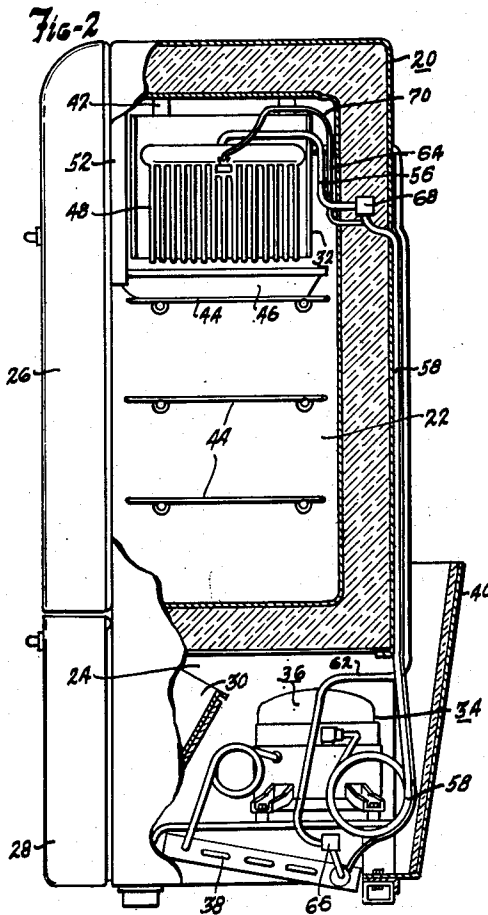
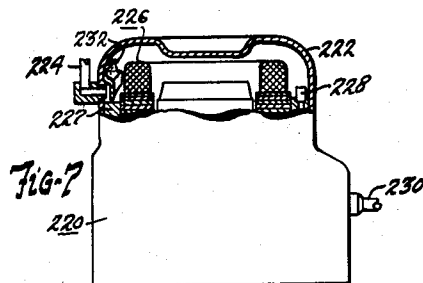
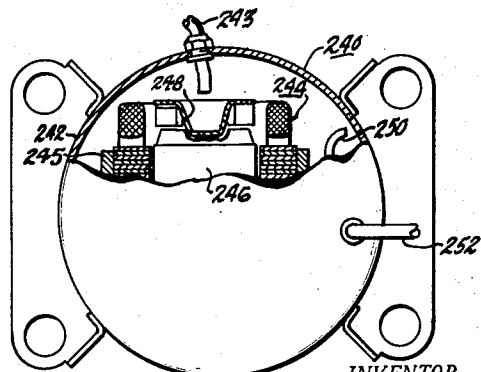


Fig. 8

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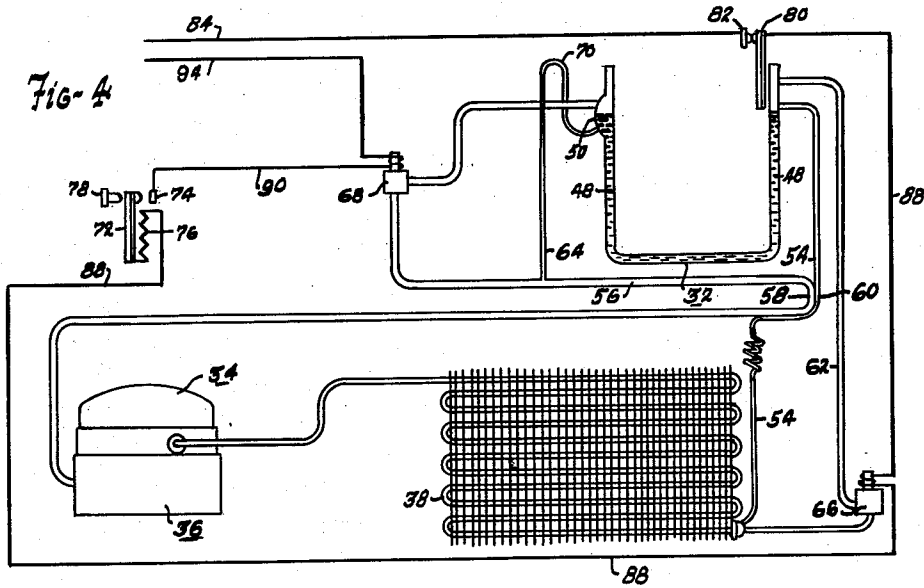
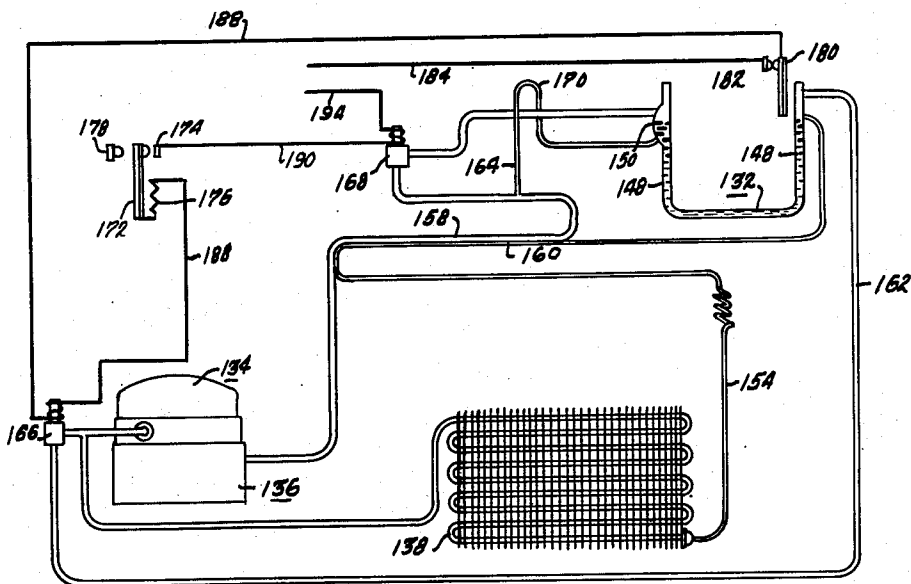
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2 Sheets-Sheet 2



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DEFROSTING REFRIGERATING APPARATUS

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Application September 22, 1951; Serial No. 247,799

13 Claims: (Cl. 62—3)

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This invention relates to refrigerating apparatus and more particularly to the arrangement for defrosting the cooling system thereof.

The present application is a continuation in part of my co-pending applications Serial No. 782,906, filed October 29, 1947, for Refrigerating Apparatus and Serial No. 178,506, filed August 9, 1950, for Refrigerating Apparatus.

One of the objects of the present invention is to provide for refrigerators an improved defrosting system for the rapid defrosting of a refrigerant evaporator together with automatically operable control mechanism for returning the refrigerating system to normal operation.

Another object of my invention is to provide an improved method for defrosting a refrigerating system.

Another object of my invention is to arrange for delivering hot refrigerant gases from the compressor to the evaporator so that the same may be condensed therein and return liquid refrigerant from the evaporator to the motor compressor or heat generating unit wherein it is evaporated and due to the latent heat of evaporation the vapor pressure and temperature in the system including the evaporator is greatly increased when such hot gases are received therein so as to rapidly defrost the evaporator.

Another object of my invention is to by-pass the refrigerant condenser and restricted supply line to the evaporator and send directly the hot gases from the compressor into the evaporator and return liquid refrigerant to the motor compressor unit to evaporate same to increase the pressure and temperature in the system to thereby quickly and effectively defrost the evaporator.

Another object of my invention is to utilize the latent heat of evaporation for defrosting by-passing liquid refrigerant in thermal and/or direct contact with the motor compressor unit and to conduct this latent heat by means of the evaporated refrigerant to the evaporator wherein the refrigerant is condensed and thereby increase the temperature of the evaporator by the latent heat of condensation.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a front view of a refrigerator embodying features of my invention and showing a portion thereof broken away;

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Fig. 2 is a view taken along the line 2—2 of Fig. 1 and showing the door in elevation;

Fig. 3 is a fragmentary view taken along the line 3—3 of Fig. 1;

Fig. 4 is a diagrammatic illustration of the refrigerating and defrosting systems embodying features of my invention;

Fig. 5 is a modification of the systems shown in Fig. 4 and embodying features of my invention;

Fig. 6 is an enlarged view of a motor-compressor unit embodying my invention and showing a portion thereof broken away;

Fig. 7 is a modified form of motor-compressor unit embodying features of my invention; and

Fig. 8 is another modified form of motor-compressor unit embodying features of my invention.

In the drawings, there is shown a household type of refrigerator having a cabinet, designated generally by the numeral 20. The cabinet 20 has a food storage compartment 22 and a machinery compartment 24 below the food storage compartment. Access openings to the compartments 22, 24 are closed at the front of the cabinet by doors 26 and 28 respectively which may be hinged to the cabinet. On its inner side, the machinery compartment door 28 carries a vegetable storage bin 30.

The cooling system for the food storage compartment 22, comprises, in general, a refrigerant evaporator 32 and a refrigerant condensing element 34. Preferably, the refrigerant condensing element 34 comprises, a refrigerant motor compressor, heat generating or refrigerant circulating unit 36 and a refrigerant condenser or heat dissipating element 38. The condensing element 34 is preferably housed in the cabinet machinery compartment 24. This machinery compartment 24 is provided with an opening in the cabinet rear wall communicating with a flue 40 to carry away the heat of condensation and the heat of the motor compressor from compartment 24. The evaporator 32 is preferably suspended from the underside of the cabinet top wall by suitable brackets 42. Below the evaporator 32, a number of food supporting shelves 44 are provided and the uppermost of these shelves 44 may support a removable pan 46 to catch water dripping from the evaporator when the system is being defrosted.

The evaporator 32 may be of the so-called U-shaped type, constructed of a number of metal sheets formed to provide vertical refrigerant passages 48 and to form a refrigerant header 50 in communication with passages 48. An ice making

compartment, formed by the sheet metal evaporator is preferably closed at the front thereof by an interior door 52. The evaporator 32 may, if desired, be constructed like that shown in Patent Number 2,325,706 issued August 3, 1943.

During normal operation of the refrigerator, liquid refrigerant is delivered from the condenser 38 to the evaporator 32 under the control of a small diameter or capillary tube 54. The motor compressor unit 36 is connected to the header 50 above the liquid level therein by a return conduit 56 through which gaseous refrigerant returns to the motor compressor unit. As shown, a portion of the return conduit 56, as at 58, is preferably arranged in heat absorbing relationship with a portion 60 of the supply conduit 54 to cool the refrigerant passing through the latter. Accordingly, refrigeration during normal operation is produced by delivering the correct amount of liquid refrigerant to the evaporator under the control of a small diameter or capillary tube. The liquid evaporates in the evaporator and passes to the compressor which compresses it and delivers same to the condenser wherein it is liquefied and from which it is delivered to the small diameter or capillary tube.

A defrosting system is provided for the refrigerator, including a refrigerant supply conduit 62 and a refrigerant return conduit 64. The refrigerant supply conduit 62 connects the refrigerant condenser 38 to the evaporator 32 and is normally closed to flow therethrough by a control or solenoid valve 66. This refrigerant supply conduit has a relatively large flow capacity compared to the flow capacity of the conduit 64. A second and normally open solenoid valve 68 is provided in the return conduit 56 to control flow therethrough. The defrosting system return conduit 64 is connected to the evaporator below the outlet of the return conduit 56. As shown, the conduit 64 by-passes the valve 68 and connects into the return conduit 56 between the valve and the motor compressor unit 36 or conduit 64 may be a separate return line, if desired. Return conduit 64 has a relatively small flow capacity, compared to the return conduit 56, to effect an increase in pressure in the evaporator 32 when valve 68 is closed on defrosting operation of the evaporator. To insure against drainage of liquid refrigerant from the evaporator during normal operation of the system, I form the return conduit 64 with a loop portion 70 extending above the evaporator outlet connection of the return conduit 56. Thus, when the valve 68 is in open position during normal operation gas is withdrawn from the header 50 to the compressor whereas the liquid in the lower part of the header does not drain through the return conduit 64 because of the loop portion 70 which extends above the liquid level in the evaporator whereas the inlet to the return conduit 64 is positioned in the lower part of the header and below the liquid level therein. In practice I have found that the tube 64 may be approximately 3 feet long by .031 of an inch internal diameter. Drainage of liquid from the evaporator during the defrost period is advantageous in that said liquid flows to the motor compressor unit 36 wherein it is evaporated and this latent heat of evaporation is utilized to increase the vapor pressure and temperature in the system including the evaporating element 32. This is caused by the sensible heat stored in the motor compressor unit and casing, which heat is generated by mechanical friction and additional heat by electrical losses which are effective to

evaporate the liquid which is returned to the motor compressor unit and returned to the evaporator in the form of hot gases which are condensed in the evaporator and the latent heat of condensation provides for rapid defrosting of the evaporating element. Thus, when the system is on defrost, the valve 68 is in closed position and the conduit 64 receives liquid from the lower part of the header and, due to the high pressure in the evaporator, the liquid is conducted or forced back to the motor compressor unit throughout the defrost period. The motor compressor unit may be any of the well known units having a motor and a compressor enclosed in a sealed casing. Such units are well known to those skilled in the art and are used extensively. One of such units may be of the type disclosed and claimed in my Patent No. 2,198,415 dated May 7, 1940.

A control or thermostatic switch 72 is provided to control operation of the solenoid valves 66 and 68. The switch 72, preferably a bi-metal blade, is cooperable with a contact 74 to control operation of the solenoids. A resistance heater 76, in series circuit with the bi-metal blade 72, is energized when the blade is in engagement with its contact 74 and is arranged to influence the bi-metal blade to remain in closed circuit position. Preferably a push-button 78 is provided for manually moving the bi-metal blade into engagement with its cooperating contact 74. A second thermostatic switch or bi-metal blade 80 is provided to control operation of the solenoids 66, 68 and of the heater 76 and is arranged to respond to the temperature of the evaporator 32. This thermostat 80 is in closed circuit position engaging a cooperable contact 82 during normal operation of the refrigerating apparatus. The thermostat contact 82 is connected to a main lead wire 84 and the thermostat blade 80 is connected in series with the solenoid valve coil 66 and with the heater 76 by a lead wire 88. A lead wire 90 connects the thermostat contact 74 in series circuit with the coil of the solenoid valve 68 which in turn is connected to a main lead wire 94.

When it is desired to defrost the evaporator 32, the thermostatic blade 72 is moved manually into engagement with its cooperable contact 74 by means of the push-button 78. This closes the circuit of the solenoids 66, 68 and of the heater 76, since thermostat 80 is closed in response to the low temperature of the evaporator 32. Upon closing of the thermostat 72 the heater 76 is energized and acts to hold the thermostat 72 in closed circuit position. Also, upon closing of the circuit by thermostat 72, the solenoid valve 66 is energized and opens the refrigerant supply line 62 and the other solenoid 68 is energized and closes the refrigerant return line 56. When this occurs, refrigerant flows into the supply conduit 62 and is delivered thereby in gaseous form into the evaporator 32 wherein the refrigerant condenses in this cold region and gives up its heat to raise rapidly the temperature of the evaporator 32. Liquid refrigerant is withdrawn from the evaporator 32 by the motor compressor unit 36 through the return conduit 64 which because of its small flow capacity causes an increase in refrigerant pressure in the evaporator 32. When the temperature of the evaporator 32 has increased to the temperature at which ice and frost have been removed therefrom or to the temperature for which the thermostat has been set, the thermostat 80 opens the circuit of the solenoids

66, 68 and of the heater 76. When this occurs the solenoid 66 returns to closed position and solenoid 68 returns to open position placing the refrigerating apparatus in condition for continuation of normal operation. Also, when the thermostat 88 responds to a predetermined increase in the evaporator temperature, the heater 76 is deenergized, allowing thermostat 72 to return automatically to its normal, open circuit position.

From the foregoing description, it will be noted that I have provided an improved refrigerating apparatus which may be quickly defrosted without shutting down the system and one which automatically returns to normal operation upon completion of the defrosting operation. It will also be noted that on the defrosting operation, the evaporator in effect has the function of a condenser, the heat of condensation quickly raising the temperature of the evaporator to remove ice and frost therefrom. In addition, I have provided a refrigerating apparatus in which the system itself functions in reverse to remove ice from the evaporator. Furthermore my system includes a small flow capacity return line which acts to increase the pressure in the evaporator and decrease the time required to defrost the evaporator; a portion of the defrosting system return conduit being arranged to prevent draining of liquid refrigerant therethrough from the evaporator during normal operation of the system, while the tube during defrosting serves to conduct liquid to the motor compressor unit which evaporates same to increase the vapor pressure in the evaporator due to the latent heat of evaporation.

It will be understood that household refrigerators are controlled in response to change in temperature of the evaporator and accordingly any suitable thermostat control (not shown) now in use, may be used with the above described refrigerator. Therefore, when the present system is placed in condition for defrosting, the usual thermostat control of the system will cause continuous operation until the defrosting is over and the system has again reached normal operating condition. When this occurs, warm refrigerant will be passed directly to the evaporator from the condenser to quickly defrost the evaporator, and liquid refrigerant from the evaporator header will flow through the restrictive passageway 64 to the motor compressor unit. When the evaporator temperature reaches a predetermined temperature, the auxiliary control 88 will interrupt the defrosting condition and allow the normal control to cause the system to return to normal function.

In a modified form shown in Fig. 5, the system is diagrammatically illustrated disclosing a system somewhat like that shown in Fig. 4. However, the modified system shown in Fig. 5 provides for by-passing refrigerant gas leaving the compressor so that it flows directly into the evaporator and not only by-passes the liquid supply and control conduit but also by-passes the condenser. In all other respects the system is the same as that shown in Fig. 4. The system shown in Fig. 5 wherein the gaseous refrigerant flows directly from the compressor to the evaporator has been found to rapidly defrost the evaporator.

In Fig. 5 reference numerals applied are the same as those applied to Fig. 4 with the addition of 100 added to each numeral. Thus the evaporator 132 includes the passages 148 and header 150 and is supplied with refrigerant from the

condenser 138 by a small diameter or capillary tube 154 which controls flow of liquid to the evaporator. Gaseous refrigerant is during normal operation withdrawn from the evaporator 132 by a motor-compressor unit 134 through the vapor return conduit 156, which conduit is controlled by a solenoid valve 160. The vapor return conduit 156 includes a portion 158 which is in heat exchange relation with the conduit 154 and 160. In this embodiment the solenoid valve 160 functions the same as valve 66 in Fig. 4, however, the outlet of the valve 160 allows refrigerant to flow into conduit 162 which flows directly into the evaporator thereby conducting the hot gases from the compressor to the evaporator and by-passing the condenser 138 and control conduit 154. The switch 172 which includes push-button 178, heating element 176 and contact 174, operates the same as the switch 72 in Fig. 4. Likewise the switch 180 with contact 182 functions the same as switch 88 and contact 82 in Fig. 4. Likewise the electric conduits 184 and 188 are connected in series circuit the same as conduits 84 and 88 are connected in the circuit shown in Fig. 4. In other words, the systems disclosed for refrigeration and defrosting are the same in Figs. 4 and 5 with the exception that the solenoid valve which controls the flow of gaseous refrigerant to the evaporator causes the refrigerant to flow immediately from the compressor to the evaporator, by-passing the condenser and capillary supply conduit whereas in Fig. 4 the solenoid valve 66 controls the flow of gaseous refrigerant to the evaporator after the refrigerant passes through the condenser. The description applying to Fig. 4 also applies to that in Fig. 5. It will also be noted that in Fig. 5 a liquid return conduit 164 which is the same as that shown in Fig. 4 designated 64 and serves to conduct liquid from the lower part of the header in the evaporator to the suction or vapor return conduit which conducts the liquid to the compressor where it is evaporated and the vapor pressure increased to increase the pressure and temperature in the evaporator where such evaporated refrigerant is again condensed and re-circulated to thus effectively and quickly defrost the evaporating element.

Likewise the system shown in Fig. 5 may be controlled by the same type of thermostatic control referred to as controlling the system disclosed in Fig. 4 in response to changes of temperature in the refrigerant evaporator disclosed in said system.

In Fig. 6 I have shown an enlarged view of the motor-compressor unit 36 which is a conventional type well known in the art. This unit 36 includes a casing 200 which houses a compressor 202 and motor 204. The motor 204 includes a stator 206 and rotor 208. The rotor 208 is provided with holes or slots 210. Refrigerant returned from the evaporator 32 through conduit 56 enters casing 200 where the refrigerant passes in direct contact with the compressor 202 and motor 204 before passing to the compressor inlet 212 and passes through the slots 210 of the rotor 208 before entering the inlet 212. The compressor 202 has an outlet 214 which leads to the condenser 38. Accordingly any liquid refrigerant which is conducted through conduit 56 into casing 200 comes into direct contact with both the motor and compressor to cause evaporation thereof and since the refrigerant passes through the holes 210 any liquid particles are separated from the gaseous refrigerant by centrifugal force

due to the rotation of the rotor. Thus only gas passes to the compressor inlet 212. This unit 36 may also be used in connection with the system shown in Fig. 5. Further details of this type of motor-compressor unit utilizing a rotor having holes or slots therein may be found in said Patent No. 2,199,415.

In Figs. 7 and 8 I have shown two modified forms of motor-compressor units which may be used in connection with the systems disclosed herein. Under certain operating conditions it may be desirable to use these units.

In Fig. 7 there is shown a motor-compressor unit 220 having a casing 222 provided with an inlet 224 which receives the refrigerant from the evaporator of the refrigerating system. In the casing is shown a motor 226 in the upper portion thereof and a compressor 227 is positioned in the lower part of the casing and is provided with inlet 228 and outlet 230. Refrigerant entering casing 222 comes into contact with baffle 232 which causes liquid to flow into contact with the motor 226, compressor 227 and the inside casing walls to evaporate said liquid due to the heat of the motor and casing which receives heat from both the motor and the compressor. Thus only refrigerant gas enters inlet 228.

In Fig. 8 a motor-compressor unit 240 includes a casing 242 having an inlet 243. Within the casing 242 is a motor 244 having a rotor 246 which carries a cup-shaped fan 248. Below the motor 244 is positioned a compressor 245 having an inlet 250 and an outlet 252. Refrigerant entering the casing 242 moves in the direction of the fan 248 and any liquid refrigerant so entering drops into said fan and due to the rotation of the rotor such liquid is thrown upwardly into contact with the dome portion of casing 242 which causes evaporation of said liquid due to the heat of the casing which receives its heat from both the motor and compressor. Thus only gaseous refrigerant enters inlet 250.

From the foregoing it will be readily apparent that I have provided refrigerating systems such as disclosed in Figs. 4 and 5 wherein refrigerant gases are passed from the compressor into the evaporator wherein such gases are condensed and due to the latent heat of condensation the evaporators of such systems are readily defrosted. Also, it will be noted that liquid refrigerant during the defrost period is drained or caused to flow into the motor compressor casing wherein sensible heat stored is utilized to vaporize the liquid refrigerant to increase the vapor pressure and temperature in the system including the evaporators by the latent heat of evaporation to also aid in rapidly defrosting the refrigerant evaporators so that defrosting takes place so rapidly that frozen foods and the like stored therein do not have an opportunity to warm up to a point which would cause melting thereof.

Furthermore, in systems of this type it is common practice to place the thermal bulb of a thermostat in contact with the surface of an evaporator so that the temperature of the evaporator will actuate the thermostat to open and close the circuit to the motor compressor unit to thereby control the operation of the system in accordance with the temperature of the evaporator. Accordingly, when the defrost switches are actuated to place the systems on defrost operation the thermostat which controls the motor compressor circuit will continue to demand refrigeration and keep the motor compressor circuit closed until the defrost cycle has been com-

pleted and the system has operated sufficiently to lower the temperature in the evaporator to actuate the thermostat to open the motor compressor circuit connections. Such thermostats cause the system to operate during normal operation so as to maintain the temperatures in the evaporator, and in the food storage compartment within predetermined limits.

Although only preferred forms of the invention have been illustrated, and those forms described in detail, it will be apparent to those skilled in the art that various modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

I claim:

1. Refrigerating apparatus comprising a refrigerant condensing element including a motor-compressor unit and an evaporator having a liquid collecting vessel at its outlet, supply means for controlling the flow of liquid refrigerant from the condensing element to said evaporator to maintain the pressure at the discharge of the compressor higher than the pressure in said evaporator during a certain period of operation, conduit means for by-passing said supply means during another period of operation to increase the pressure in said evaporator, and return conduit means arranged to conduct liquid refrigerant from said vessel into direct contact with said motor-compressor unit only when said conduit means is open to by-pass said supply means and cause said increase in pressure in said evaporator.

2. Refrigerating apparatus comprising in combination a refrigerant evaporator having a liquid collecting vessel at its outlet, a refrigerant condensing element for circulating a refrigerating medium into said vessel and through said evaporator, said condensing element having a motor-compressor unit, means for defrosting said evaporator including conduit means for conducting liquid refrigerant from said evaporator into thermal contact with said motor-compressor unit to cause evaporation of said liquid and conduit means for conducting the latent heat of such evaporation by means of the evaporated refrigerant into said evaporator.

3. Refrigerating apparatus comprising a motor-compressor unit, a condenser and an evaporator conducting a level of liquid therein adjacent its outlet, conduit means connecting the evaporator with said motor-compressor unit, supply means connecting said condenser with said evaporator, by-pass means for by-passing said supply means, and said conduit means including an inlet portion below said liquid level and being arranged to conduct liquid refrigerant from said evaporator into direct contact with said motor-compressor unit when said by-pass means is in operation.

4. In a refrigerating apparatus having a refrigerant evaporator having a reservoir containing a quantity of liquid refrigerant at its outlet and a refrigerant condensing element operatively connected by refrigerant supply and return conduits, said element having a motor-compressor unit, a defrosting system for the apparatus comprising, a second refrigerant supply conduit connecting the condensing element to the evaporator, said second refrigerant supply conduit being arranged to deliver gaseous refrigerant to the evaporator, a normally closed valve controlling flow through said second supply conduit, and said return conduit having a portion at least of its inlet positioned on said evaporator below the

liquid level therein at least during defrosting to receive liquid refrigerant from said evaporator when said valve is opened and the pressure in the evaporator is thereby increased and the liquid is conducted into direct contact with said motor-compressor unit to be evaporated thereby and the latent heat of evaporation is conducted to said evaporator.

5. In a refrigerating apparatus having a refrigerant evaporator and a condensing element operatively connected by a refrigerant supply conduit and a refrigerant return conduit, a defrosting control system for the evaporator comprising, a refrigerant supply conduit to deliver gaseous refrigerant from the condensing element to and condense the refrigerant in the evaporator, a normally closed solenoid valve controlling flow through said second refrigerant supply conduit, a normally open solenoid valve controlling flow through said refrigerant return conduit, a thermostat responsive to the temperature of the evaporator controlling operation of said valves, a manually closed thermostatic switch controlling operation of said valves, a resistance heater to influence and hold said thermostatic switch closed and being controlled by said thermostat.

6. In a refrigerating apparatus having a refrigerant evaporator and a condensing element operatively connected by a refrigerant supply conduit and a refrigerant return conduit, a defrosting control system for the evaporator comprising, a refrigerant supply conduit to deliver gaseous refrigerant from the condensing element to and condense the refrigerant in the evaporator, a normally closed solenoid valve controlling flow through said second refrigerant supply conduit, a normally open solenoid valve controlling flow through said refrigerant return conduit, a thermostat responsive to the temperature of the evaporator controlling operation of said valves, a manually closed thermostatic switch controlling operation of said valves, a resistance heater to influence and hold said thermostatic switch closed and being controlled by said thermostat, and a by-pass conduit connected to the evaporator below the return conduit outlet and connected to said return conduit between said normally open valve and said condensing element.

7. In a refrigerating apparatus, a refrigerant evaporator, a refrigerant condenser, a relatively small flow capacity conduit delivering liquid refrigerant from said condenser to said evaporator during normal operation of the system, a relatively large flow capacity conduit connected to deliver refrigerant from said condenser to said evaporator to defrost the evaporator by heat of condensation, a refrigerant compressor operatively connected to said condenser, a refrigerant return conduit delivering refrigerant from said evaporator to said compressor, a normally closed electrically operated valve controlling flow through said relatively large flow capacity conduit, a valve controlling flow through said refrigerant return conduit, a control responsive to a condition of the refrigerant controlling operation of said valves, a thermostatic switch controlling said valves, and a resistance heater arranged to heat and hold said thermostatic switch in closed position and controlled by said control.

8. In a refrigerating apparatus having a refrigerant evaporator and a refrigerant condensing element connected by supply and return conduits, an evaporator defrosting system comprising, a normally opening electrically operated valve controlling flow through said refrigerant

return conduit, a refrigerant supply line of larger flow capacity than the first supply line for delivering refrigerant to the evaporator to defrost the same by the heat of condensation of the refrigerant, a normally closed electrically operated valve controlling flow through said second refrigerant supply conduit, a thermostat responsive to the temperature of the evaporator to control operation of said valves, a manually operable thermostatic switch controlling operation of said valves, and a resistance heater influencing said thermostatic switch and controlled thereby.

9. In refrigeration apparatus, a refrigerant evaporator, a refrigerant condensing element, a relatively small flow capacity refrigerant supply conduit normally delivering liquid refrigerant from said condensing element to said evaporator, a refrigerant return conduit leading from an outlet of the evaporator to said condensing element, a normally open electrically operated valve operable when energized to decrease flow through said refrigerant return conduit, a relatively large flow capacity refrigerant delivering conduit connecting said condensing element and said evaporator for delivering gaseous refrigerant to said evaporator to condense and defrost said evaporator, a normally closed electrically operated valve operable when energized to increase flow through said relatively large flow capacity conduit, a thermostatic switch manually operable to energize said valves, a resistance heater influencing and holding said thermostatic switch closed, a thermostat responsive to the temperature of said evaporator controlling said heater, and a by-pass connecting the evaporator below the return conduit outlet to the condensing element on the other side of the normally open valve from said outlet and having a loop portion above said outlet.

10. In a refrigerating apparatus having a refrigerant evaporator and a refrigerant condensing element operatively connected by refrigerant supply and return conduits, a defrosting control system comprising, a normally open valve controlling flow through the return conduit, a by-pass flow restricting tube from the evaporator around said valve in communication with the condensing element, a refrigerant conducting conduit of larger flow capacity than said by-pass tube and connecting the condensing element and the refrigerant evaporator to deliver relatively warm refrigerant to the latter, a normally closed valve in and controlling flow through said relatively large flow capacity conduit, a thermostatic switch controlling said valves in series circuit therewith, and a second thermostatic switch controlling said valves and said first thermostatic switch in series therewith and responsive to a condition of the refrigerant.

11. In a refrigerating apparatus having a refrigerant evaporator and a refrigerant condensing element operatively connected by refrigerant supply and return conduits, a defrosting control system comprising, a normally open electrically operated valve controlling flow through the return conduit, a by-pass flow restricting tube from the evaporator around said valve in communication with the condensing element, a refrigerant conducting conduit of larger flow capacity than said by-pass tube and connecting the condensing element and the refrigerant evaporator to deliver relatively warm refrigerant to the latter, a normally closed electrically operated valve in and controlling flow through said relatively large flow capacity conduit, a thermostatic switch in series circuit with and controlling said valves,

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a second thermostatic switch in series with and controlling said valves and said first thermostatic switch in response to a condition of the refrigerant, and a resistance heater in series circuit with said thermostatic switches operable to hold said first thermostatic switch in closed position.

12. In a refrigerating apparatus, a refrigerant evaporator, a refrigerant condenser, a relatively small flow capacity conduit delivering liquid refrigerant from said condenser to said evaporator during normal operation of the apparatus, a relatively large flow capacity conduit connecting said condenser and said evaporator, said relatively large flow capacity conduit to deliver refrigerant to said evaporator to defrost the latter by the heat of condensation, a normally closed valve responsive to temperature of the evaporator controlling flow through said relatively large flow capacity conduit, a refrigerant compressor operatively connected to said condenser, a refrigerant return line connecting said evaporator and said compressor, a refrigerant return line of smaller flow capacity than said first mentioned return line conduit connecting said compressor and said evaporator for restricted flow of refrigerant to the compressor during defrosting of the evaporator,

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said second return line being connected to said evaporator anterior to the connection therewith of said first return line, a normally open valve responsive to the temperature of said evaporator controlling flow through said refrigerant return line, and a manually operable control for controlling operation of said valves.

13. A refrigerating system comprising, a refrigerant condensing element, a refrigerant evaporating element, a restricted passage for controlling flow of refrigerant from the condensing element to the evaporating element, an unrestricted passage for conducting evaporated refrigerant from the evaporating element to the condensing element, means for by-passing said restricted passage, means for closing said unrestricted passage, and a continuously open restricted passage from said evaporating element to said condensing element.

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