Nov. 12, 1963 A. J. KUHN ETAL 3,110,158

REFRIGERATING APPARATUS INCLUDING DEFROST MEANS

Filed May 29, 1961 2 Sheets-Sheet 1

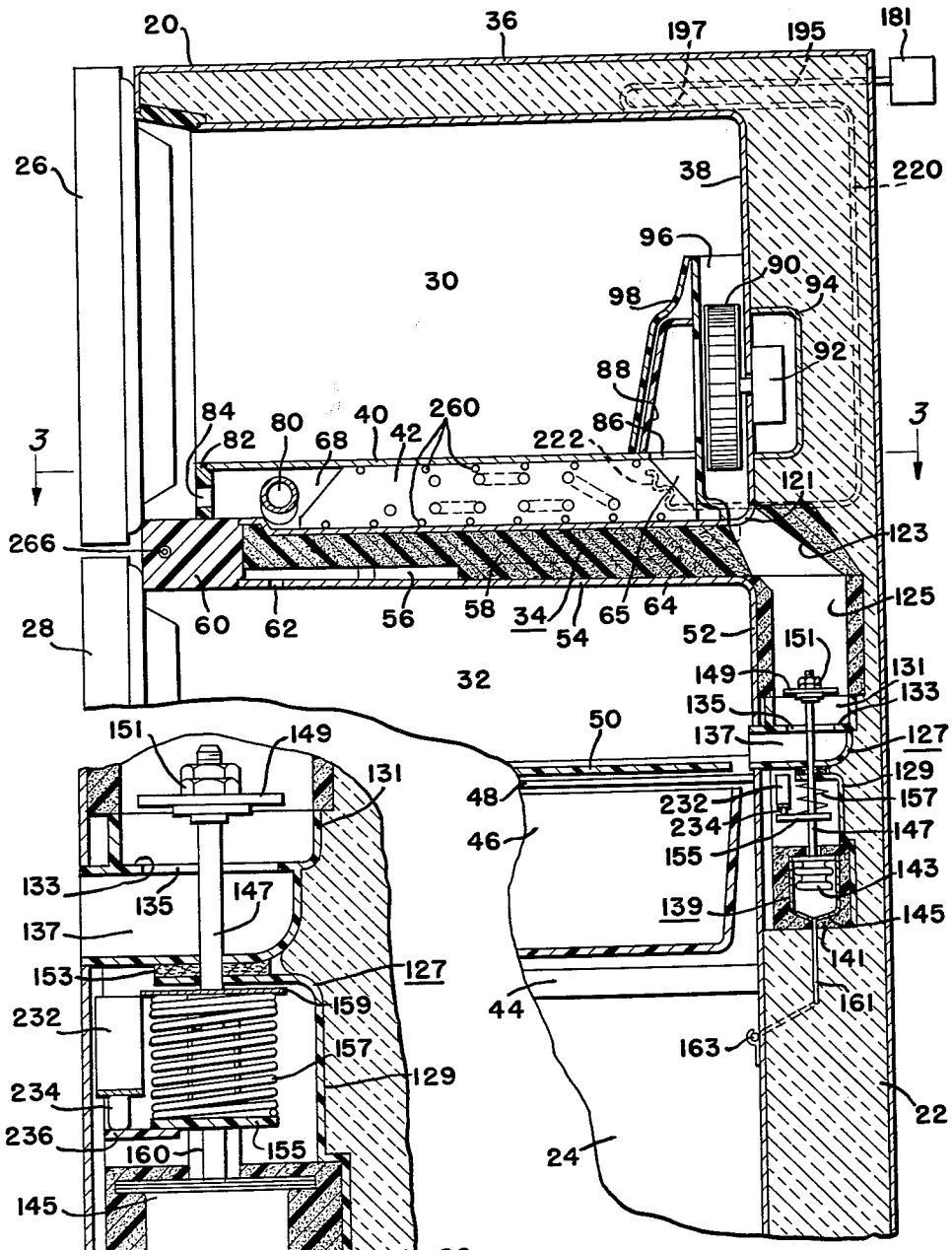


Fig. 1

Fig. 2

INVENTORS
Albert J. Kuhn
John J. O'Connell
BY
Their Attorney

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REFRIGERATING APPARATUS INCLUDING DEFROST MEANS

Filed May 29, 1961 2 Sheets-Sheet 2

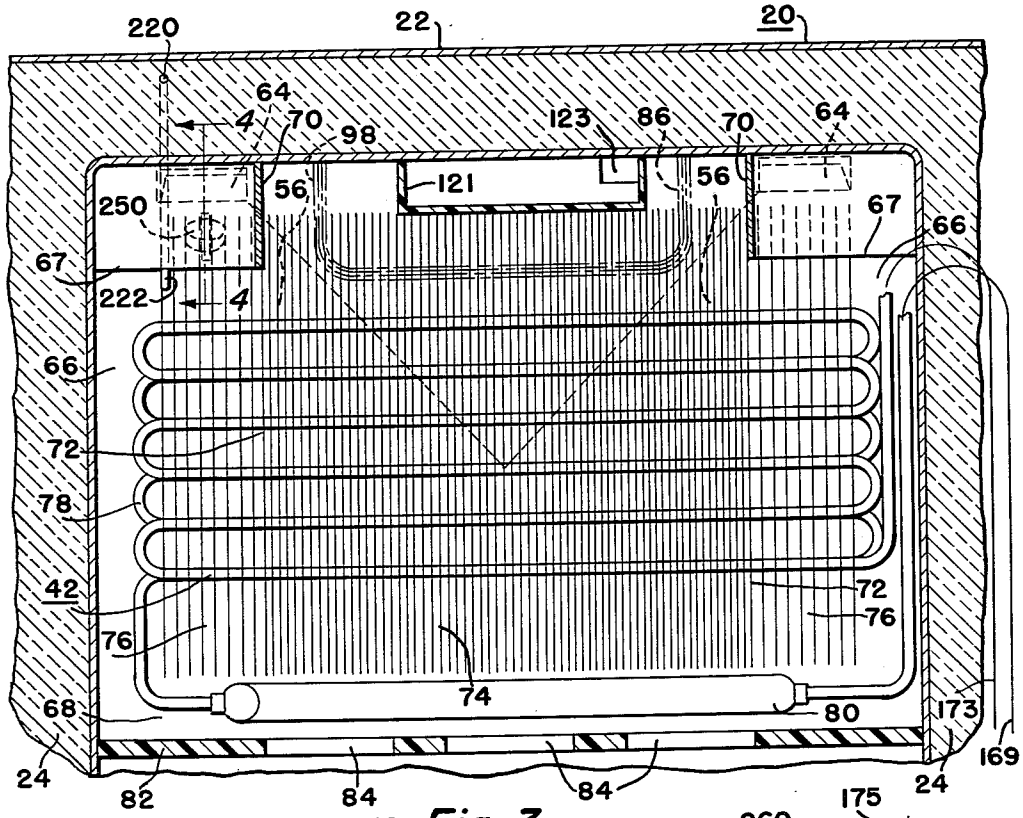


Fig. 3

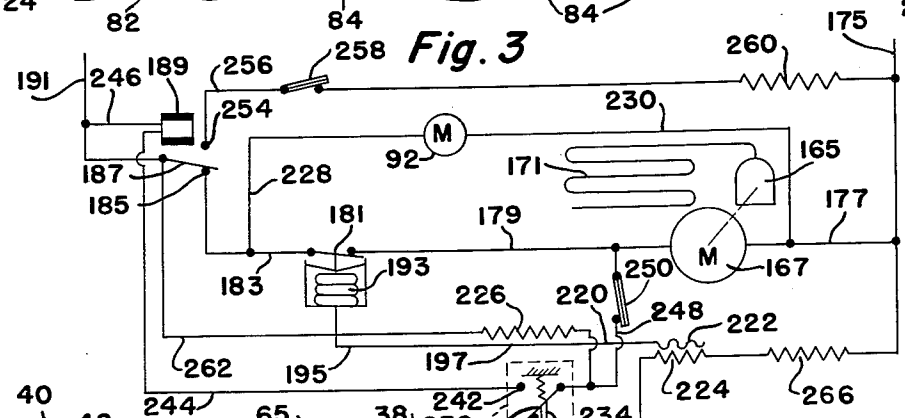


Fig. 5

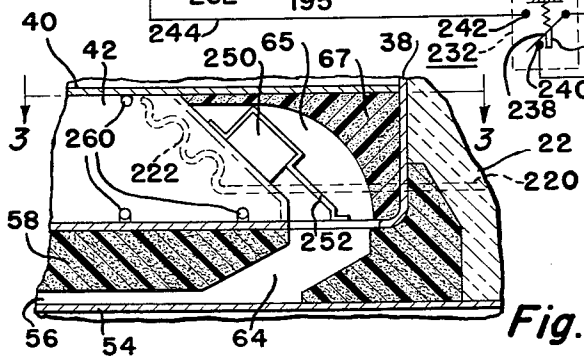


Fig. 4

INVENTORS
Albert J. Kuhn
John J. O'Connell
BY
Carl A. Stickel
Their Attorney

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REFRIGERATING APPARATUS INCLUDING DEFROST MEANS

Albert J. Kuhn and John J. O'Connell, Dayton, Ohio, assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware

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This invention pertains to refrigerating apparatus and more particularly to means for controlling the temperatures of a frost-free two-compartment single evaporator refrigerator and for defrosting the single evaporator.

Since the heat leak for the colder below freezing compartment changes less in proportion than the heat leak for the warmer above freezing compartment, there is a difficulty in maintaining the warmer compartment sufficiently cold for desirable refrigeration while preventing the colder below freezing compartment from becoming too cold under a warm or hot ambient room condition. Also, it is difficult under cold ambient room conditions to keep the colder compartment sufficiently cold while preventing the warmer compartment from becoming too cold and freezing. Heretofore, it has been customary to isolate the compartments and to provide separate evaporators and separate air circulation for each.

Although many devices have been devised for defrosting an evaporator when there is a predetermined build up of frost thereon, none of such devices has achieved any widespread commercial success. Instead, whether needed or not, it has been customary to defrost the evaporator at timed intervals even though this is wasteful and unnecessarily raises the temperature of the compartments an undesirable amount during such defrost periods.

It is an object of this invention to provide a single evaporator two-compartment frost-free refrigerator with a control system which will maintain substantially constant below and above freezing temperatures in the colder and warmer compartments under all expected ambient temperature conditions to be encountered.

It is another object of this invention to provide a control system for a single evaporator two-compartment frost-free refrigerator which will prevent premature termination of the running cycles under low ambient room temperature conditions.

It is another object of this invention to provide a simple economical inexpensive system for defrosting only when the evaporator becomes sufficiently coated with frost that it cannot supply sufficient cold air to keep one of the compartments at a desirable temperature.

It is another object of this invention to provide a simple economical inexpensive system for defrosting only when the means regulating the cooling of one of the compartments moves to a predetermined position substantially indicating the need for defrosting.

It is another object of this invention to provide a simple economical inexpensive system for defrosting only when the air circulating control regulating the cooling of one of the compartments moves to a predetermined position substantially indicating the need for defrosting.

These and other objects are attained in the form shown in the drawings in which the air from the above freezing compartment is first drawn through the widely spaced fins on the edge portions of the evaporator to precool and remove moisture from this warm humid air by the deposit of frost on the fins and tubing. This air is mixed at the front of the evaporator compartment with the colder dry air which is drawn from the frost-free below freezing compartment. The combined air passes rearwardly through the central closely spaced finned section of the evaporator to the inlet of the fan located at the rear of the below freezing compartment. The fan has one upward

outlet discharging directly into the frost-free below freezing compartment and a second downwardly extending outlet extending through passages to the above freezing compartment.

The compressor motor is connected by a single pole, single throw thermostatic switch to the normally closed contact of a single pole, double throw relay connected to one of the supply conductors. The normally open contact of the relay is connected through a safety switch to a defrost heater associated with the evaporator. The fluid motor of the thermostatic switch is provided with a thermosensitive bulb having one portion in contact with the top of the liner of the below freezing compartment and a second portion mounted upon one of the widely spaced fins of the evaporator adjacent the air entrance from the above freezing compartment. A small electric heater is associated with the portion of the bulb on the evaporator and connected normally in parallel with the compressor motor so that it is energized only during the running period of the motor making effective the portion of the bulb in contact with the top of the liner of the below freezing compartment so that it is responsive to the temperature of the below freezing compartment. The switch is set to open at −2° F., thereby assuring the continuance of the operation of the compressor motor until the below freezing compartment has substantially attained a temperature of −2° F. A second small electric heater is associated with the portion of the bulb in contact with the liner of the below freezing compartment. It is connected in shunt with the normally closed contacts of the relay as well as the contacts of the thermostatic switch so that it is energized whenever either or both of these switches are in the open position. This assures that the thermostatic switch will close in response to a predetermined high temperature, such as +11° F. of one of the widely spaced fins of the evaporator. The fan motor which circulates the air through all compartments is connected in shunt with both the thermostatic switch and the compressor motor so that it runs at all times excepting during a defrost period.

The above freezing compartment is maintained at a substantially constant above freezing refrigeration temperature by having therein a thermostat bulb connected to a thermostatically controlled air valve which throttles the flow of air accordingly. As frost builds up upon the widely spaced fins of the evaporator, the air valve opens wider and wider to compensate for the effect of the frost in restricting the circulation and reducing the cooling effect upon the air until the air valve is fully open. This result is taken advantage of to initiate a defrost cycle during the next idle period of the compressor motor. The air valve is provided with a double throw switch normally supplying the energy to the small heater upon the portion of the thermostat bulb in contact with the evaporator. When the air valve is opened fully, the double throw switch associated with it is moved to a position deenergizing the small heater upon the bulb associated with the evaporator and, whenever the thermostatic switch is open, energizing the relay coil to operate the double throw contacts to deenergize the compressor motor and fan motor circuits and to energize the defrost circuit including the defrost heater associated with the evaporator. The defrost period continues without interruption with the electric heater heating the evaporator until, at about a temperature of 50° F., a defrost limiter switch (mounted upon the evaporator at the point where the greatest amount of frost normally collects) opens to deenergize the relay to restore the relay contacts to normal position. Since the thermostatic switch closes during the defrost period, this immediately starts the refrigeration with both the compressor motor and the fan motor being energized simultaneously.

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 embodiment of the present invention is clearly shown.

In the drawings:

FIGURE 1 is a vertical side sectional view through a single evaporator frost-free refrigerator embodying one form of our invention;

FIGURE 2 is an enlarged fragmentary sectional view of FIGURE 1 showing the air valve and associated switch;

FIGURE 3 is a horizontal sectional view taken along the line 3—3 of FIGURE 1;

FIGURE 4 is a fragmentary side vertical sectional view taken along the line 4—4 of FIGURE 3; and

FIGURE 5 is a wiring diagram for the refrigerator shown in the previous figures.

Referring now to the drawings and more particularly to FIGURES 1 and 3, there is shown an insulated refrigerator cabinet 20 provided with an insulated rear wall 22, insulated side walls 24, and insulated top wall 36, upper and lower front doors 26 and 28 enclosing an upper frost-free below freezing compartment 30 and a lower above freezing compartment 32. The bottom insulated wall is not shown. Between the compartments 30 and 32, there is provided an insulated horizontal partition wall 34.

The below freezing compartment 30 is enclosed by a metal liner 38 provided with a metal false bottom wall 40 which rests upon the top of the vertical fins of the refrigerant evaporator 42 which in turn rests upon the bottom of the inner liner 38. The above freezing compartment 32 is provided with a plurality of shelves, such as the shelf 44 and a meat container 46 located above the shelf 44 provided with a lid 48 and a shield 50 located over the lid 48. The above freezing compartment 32 is enclosed within an inner liner 52 having its top wall 54 made largely false by the provisions of the passages 56 in the insulation 58 of the partition wall 34. The top wall 54 of the liner 52 extends forwardly to the mullion 60.

Air from the above freezing compartment 32 passes upwardly through the slots 62 in the front of the partition wall 34. The warm air from the above freezing compartment 32, after passing through these slots 62, flows rearwardly through the passages 56 over the top wall 54 of the liner 52 to the apertures 64 extending upwardly at the rear corners of the insulation 58. This warm air keeps the top wall 54 warm enough to prevent condensation of moisture thereon. The air then passes upwardly through the apertures 64 and through the passages 65 in the corner insulation pieces 67 located in the rear corners of the evaporator compartment 68. This air then flows forwardly through the side passages 66 of the evaporator compartment 68 which are formed between the false bottom metal wall 40 and the bottom of the liner 38. Laterally, these passages are formed by two dividers 70 at the rear which extend forwardly into contact with the vertical fins 72 which divide the evaporator 42 into a closely finned central section 74 and the widely spaced finned edge portions 76. These vertical fins extend from the front to the rear and are provided with bevelled edges also at the front and rear to facilitate defrosting. The fins are mounted upon horizontal serpentine refrigerant coils 78 connecting at their outlet with the accumulator 80 located in front of the evaporator 42 in the front of the evaporator compartment 68.

The dividers 70 and fins 72 also divide the evaporator compartment 68 laterally into the previously mentioned forwardly extending side passages located between the fins 72 and the side edges of the evaporator compartment 68 and into the central passageway extending rearwardly between the fins 72 and embracing the closely spaced fins 74. The space in front of the evaporator 42

in the front of the evaporator compartment 68 provides for the flow of air from the side passages 66 into the central rearwardly extending passageway embracing the fins 74. Between the front edge of the false bottom wall 40 and the mullion 60 is a grille 82 provided with three inlet openings 84 directly in front of the central closely spaced fin section 74 of the evaporator 42. This provides an inlet for the cold dry air from the below freezing compartment 30 into the front space of the evaporator compartment 68 directly in front of the rearwardly extending passage. This cold air mixes with the precooled dried air from the side passages 66 embracing the widely spaced finned portion 76. By this arrangement only cooled and dried air reaches the closely spaced finned portions 74 of the evaporator 42. This arrangement, therefore, provides for a greater deposit of frost on the widely spaced finned portions 76 which are purposely spaced wider so as to accommodate more frost where the temperature differential with the air is greater to achieve a smaller reduction of air flow with an accumulation of frost. Consequently, a lesser amount of frost collects on the front edge of the evaporator 42 and the closely spaced central fin sections 74. The frost is therefore more evenly distributed and not concentrated at any one point of the evaporator. This minimizes clogging of the evaporator and makes it unnecessary to frequently defrost the evaporator.

The rear of the false bottom wall 40 is provided with a centrally located notch 86 covered by the inlet shroud 88 of the centrifugal fan 90 driven by the fan motor 92 located in a recess 94 in the rear wall 22. The fan 90 is provided with an upwardly extending discharge outlet 96 for discharging the greater portion of the cold air drawn from the rear of the evaporator compartment 68 into the below freezing compartment 30. The inlet shroud 88 and the discharge outlet 96 are enclosed within an ornamental cover 98 which prevents the air from the below freezing compartment 30 from contacting and depositing frost upon the cold surface of the inlet shroud 88 and the discharge outlet 96. The fan 90 has a second downwardly extending discharge outlet 121 connecting through the passages 123 and 125 in the insulation pieces in the rear wall 22 with the inlet of an air valve 127.

This air valve 127 includes a plastic body 129 provided with an air inlet 131 connecting with the valve seat 133 enclosing a valve seat opening 135 connecting with discharge chamber 137 formed in the valve body 129. The bottom of the valve body 129 is provided with a fluid motor 139 surrounded by a foam type of insulation 141 within the valve body 129. The fluid motor 139 includes an internal bellows 143 and a container 145. The bottom of the bellows 143 is connected by a valve stem 147 with a valve element 149 located above the valve seat 133. A limited universal mounting 151 is provided for connecting the valve element 149 to the valve stem 147 so as to insure tight seating of the valve 149 upon the seat 133 so as to insure full closing of the valve seat opening 135. A felt seal 153 seals the bottom of the discharge chamber 137 surrounding the valve stem 147. The lower portion of the valve stem 147 connects with the lower spring follower 155 which supports the lower end of the compression type coil spring 157 within the valve body 129. The upper portion of the coil spring 157 is supported by a fixed spring support 159 of inverted U shape, having its lower ends 160 fastened to the container 145 of the fluid motor 139. The bottom of the container 145 of the fluid motor 139 is connected by the capillary tube 161 extending through the insulated rear wall 22 to the thermostat bulb 163 mounted upon the rear wall of the liner 52 of the above freezing compartment 32. The valve 127 is calibrated to be fully closed when the temperature of the bulb 163 is reduced to 34° F. and to be fully open when this temperature reaches 39° F. This air valve 127 throttles

the flow of cold air from the fan 90 so as to prevent the above freezing compartment 32 from falling below freezing temperatures and, particularly, for normally maintaining the temperature thereof between the limits of 34° and 39° F.

The evaporator 42 is provided with liquefied refrigerant from a refrigerant liquefying apparatus which includes a compressor 165 (see FIGURE 5) driven by an electric motor 167 for drawing evaporated refrigerant from the accumulator 80 through the suction line 169 and compressing the refrigerant and forwarding the compressed refrigerant to a condenser 171 where the compressed refrigerant is condensed and forwarded through the capillary tube supply conduit 173 to the inlet of the refrigerant tubing 78 of the evaporator 42. One terminal of the electric motor 167 is connected to the second or right supply conductor 175 through a conductor 177. The opposite terminal of the compressor motor 167 is connected through the conductor 179, the single pole, single throw thermostatic switch 181, the conductor 183 and the normally closed stationary contact 185 and the common movable contact 187 of the double throw relay having an operating coil 189. The common movable contact 187 is connected to the first supply conductor 191. The switch 181 includes a snap acting fluid motor 193 connected to a capillary tube 195 which, as shown in FIGURE 1, has a portion 197 in contact with the top of the liner 38 of the below freezing compartment 30 above the discharge outlet 96 of the fan 90. The capillary tube 195 has a second portion 220 extending to a thermostat bulb portion 222 mounted upon the inside of the left outermost fin of the evaporator 42 adjacent the left rear corner as shown in FIGURES 1, 3 and 4. This is the place at which the warm moist air from the above freezing compartment 32 first contacts the evaporator 42. Consequently, the opening of the door 28, causing an influx of warm moist air from the room, will quickly influence the bulb 222 to close the switch 181 to start the compressor motor 167 so as to maintain the desired temperature within the compartment 32.

It is desirable to operate the compressor motor 167 until the compartment 30 is cooled to −2° F. regardless of the room or ambient temperature. If, due to low ambient room temperature conditions, the amount of air from the above freezing compartment 32 is very small and also relatively cold, there is a possibility that the bulb 222 would become colder than the portion 197 and stop the operation of the compressor motor 167 before the compartment 30 reached a desired temperature of −2° F. This condition might also occur in the event that the bulb portion 222 would become covered with considerable frost. To avoid this, we provide a small electric heater 224 (see FIGURE 5) which is wrapped around or otherwise intimately associated with the bulb portion 222 which is connected in parallel with the compressor motor 167 so that it is energized during each operating period of the motor 167 to prevent the bulb portion 222 from controlling the vapor pressure within the capillary tube 195 during the running period of the motor 167.

Under warm room conditions, the temperature of the below freezing compartment 30 does not rise as rapidly as the temperature within the above freezing compartment 32. Therefore, the bulb portion 197 does not provide a good control for the start of the compressor motor 167. Consequently, to make the switch 181 and the compressor motor 167 responsive to the temperature of the above freezing compartment 32, it is necessary to make the bulb portion 222 active during the off cycle of the compressor motor 167. This is done by providing a second small wattage electric heater 226 connected in shunt with the switch 181 and intimately associated with or wrapped around the portion 197 of the capillary tube 195 which is in contact with the top of the liner 38 of the below freezing compartment 30. This heater 226, when energized by the opening of the switch 181, supplies sufficient heat to the portion 197 so as to make the vapor pressure within the capillary tube 195 and the bellows 193 responsive to the colder temperature of the bulb portion 222 which is in contact with the evaporator 42. For convenience in wiring, these heaters 224 and 226 are interconnected with the controls for the defrosting of the system and the details of the wiring will be described in connection with the defrost system. In the wiring diagram, FIGURE 5, the fan motor 92 is connected by the conductor 228 to the conductor 183 and by the conductor 230 to the conductor 177 so that it is energized whenever the contacts 187 and 185 are engaged. This makes the fan motor 92 operate at all times excepting during the defrost period.

The opening of the doors 26 and 28 and the storage of moist packages within the storage compartments 30 and 32 provide a source of moisture which through the circulation of air migrates to various portions of the evaporator 42. By the arrangement of the precooling widely spaced finned edge portions of the evaporator 42 which precool and remove moisture from the above freezing compartment air, this collection of frost upon the evaporator 42 is substantially evenly distributed so as to minimize the concentration of frost at various points upon the evaporator 42. The rate of deposit of frost, however, varies widely with the amount of opening of the doors, the variations in the humidity of the ambient air and the moisture of the packages in the storage compartments. Consequently, sometimes defrosting is required frequently and sometimes infrequently. Since the timed defrost controls must defrost sufficiently often to take care of the maximum rate of collection of frost, it follows that, under normal or low frost conditions, the defrosting periods are too frequent.

According to our invention, we find it desirable to defrost the evaporator when the evaporator cannot supply sufficient cold air to the above freezing compartment 32 to maintain its desired refrigerating temperature. Since the valve 127 will open wide when the temperature of the above freezing compartment 32 as measured by the bulb 163 is 39° F. or above, we provide in connection with the valve 127 a double throw switch 232 upon the valve body 129 provided with a push button operator 234 which is actuated by a projecting arm upon the bellows spring follower 155 when the valve element 149 reaches the fully open position at 39° F. When the push button 234 is so actuated in a manner similar to a limit switch, it moves the movable contact 238 from its normal position contacting the stationary contact 240 to its defrost position contacting the contact 242. The contact 242 is connected by the conductor 244 to the relay operating coil 189 which in turn is connected by the conductor 246 to the first supply conductor 191. The movable contact 238 of the air valve switch 232 is connected through the conductor 248 and a normally closed defrost limiter switch 250 with the conductor 179 which connects through the motor 167 and the conductor 177 with the second supply conductor 175. The defrost limiter switch 250 is mounted on the bevelled edges of the widely spaced fins at the left rear corner of the evaporator 42 as shown in FIGURES 3 and 4 where the frost normally disappears last. It is supported by the bracket 252. This switch 250 is preferably set to be normally closed and is arranged to close at 22° F. and to open at 50° F.

Since the relay contacts 187, 185 and the thermostatic switch 181 are connected in shunt with the relay coil 189 and the contacts 238, 242 of the air valve switch 232, the closing of the contacts 238 and 242 therefore will not energize the relay coil 189 until the below freezing compartment 30 is cooled sufficiently to open the thermostatic switch 181. Only then the defrost period is begun by energizing the relay coil 189 to move the movable contact 187 into contact with the upper stationary contact 254 to energize the defrost heater circuit through the conductor 256, the safety thermostat switch 258 and the de-

frost heater **260** which connects with the second supply conductor **175**. The defrost heater **260** is preferably of the sheathed tubular type and extends through notches provided in the upper and lower edges of the fins of the evaporator **42** as shown in FIGURES 1 and 4. For simplicity, the defrost heater **260** has been omitted from FIGURE 3. The defrost limiter switch **250** is located at the portion of the evaporator **42** where the most frost accumulates and, therefore, is the last part of the evaporator to defrost. Consequently, when this limiter switch **250** reaches a temperature of 50° F. insuring the completion of the defrosting of the evaporator **42**, it will open to deenergize the operating coil **189** of the relay **187** allowing the movable contact **187** to move from its position in contact with the contact **254** to its normal position in contact with the contact **185**. This will deenergize the defrost heater and reenergize the compressor motor **167** and the fan motor **92**. The refrigeration thus provided will return the air valve **127** and the switch **232** to their normal positions.

At times, the bulb portion **197** will be heated by the heater **226** having one terminal connected by the conductor **262** to the first supply conductor **191**. The second terminal of the heater **226** for the portion **197** connects to the conductor **248** which connects through the limiter switch **250** and the compressor motor **167** and the conductor **177** with the second supply conductor **175**. Since the limiter switch **250** is normally closed, the opening of either the switch **181** or the movement of the contact **187** into contact with the contact **254** will energize the heater **226**. Thus, the heater **226** will be energized during open periods of the switch **181**. In the normal lower position of the switch **232**, the switch **250**, the conductor **248**, the air valve switch contacts **238** and **240**, and the conductor **264** connect the heater **224** in parallel with the compressor motor **167** along with a second heater **266** provided in the mullion **60** to prevent condensation between the doors **26** and **28**. This mullion heater **266** in turn connects to the second supply conductor **175**. Therefore, by virtue of its shunt relation with the switch **181**, the heater **226** is energized whenever the switch **181** is open and, by virtue of its being connected in series with the switch **181**, the heaters **224** and **226** are energized whenever the switch **181** is closed.

Since the evaporator **42** becomes warm during the defrost period, the bulb **222** will be warmed to move the switch **181** to closed position to prepare for the operation of the compressor motor **167** as soon as the defrosting is terminated. As soon as the above freezing compartment **32** is cooled below about 38° F., the switch **232** will return to its normal position with the contact **238** in engagement with the contact **240**. Through this system, the temperature of the above freezing compartment **32** is maintained substantially constant at about 37° F. except when excessive frost begins to accumulate upon the evaporator **42**. The below freezing compartment **30** is maintained at a substantially constant below freezing temperature by the control of the opening of the switch **181** by the portion **197** in contact with the top of the liner **38**. The evaporator **42** is maintained sufficiently cold through the bulb portion **222** in contact with the fin at the left rear corner. The evaporator **42** is defrosted only when required through the use of the switch **232** which is interlocked with the air valve **127**. Furthermore, defrosting cannot be started until after refrigerating requirements have been satisfied. The defrosting and heating of the evaporator **42** is terminated promptly when the frost has disappeared therefrom by the opening of the limiter switch **250** which terminates the heating and deenergizes the relay **189** and the heater **260** and resumes refrigeration by energizing the motors **92** and **167**. By the foregoing construction and arrangement, an improved refrigerator is provided.

While the embodiment of the present invention, as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A refrigerator including insulating means enclosing a below freezing compartment and an above freezing compartment, means forming an evaporator compartment separated from said compartments provided with an evaporator portion, means for circulating air from said below and above freezing compartments through said evaporator compartment in heat transfer with said evaporator portion and returning the cooled air to said below and above freezing compartments, first and second electrical supply conductors, a single pole double throw relay having a movable switch contact connected to said first supply conductor and having two relatively stationary switch contacts, a first electrical circuit including a defrost heater associated with said evaporator portion connecting one of said stationary contacts and said second supply conductor, refrigerant liquefying means operatively connected to said evaporator portion, a second electrical circuit including a first thermostatic switch responsive to the temperature of said evaporator portion and an electrical operating means for said liquefying means connecting the second of said stationary contacts and said second supply conductor, and a third electrical circuit including electrical operating means for said relay and a second switch means responsive to the temperature of said above freezing compartment shunting said movable contact and second stationary contact and said first thermostatic switch and connecting said first supply conductor and said second electrical circuit.

2. A refrigerator including insulating means enclosing a below freezing compartment and an above freezing compartment, means forming an evaporator compartment separated from said compartments provided with an evaporator portion, means for circulating air from said below and above freezing compartments through said evaporator compartment in heat transfer with said evaporator portion and returning the cooled air to said below and above freezing compartments, first and second electrical supply conductors, a single pole double throw relay having a movable switch contact connected to said first supply conductor and having two relatively stationary switch contacts, a first electrical circuit including a defrost heater associated with said evaporator portion connecting one of said stationary contacts and said second supply conductor, refrigerant liquefying means operatively connected to said evaporator portion, a second series electrical circuit including a first thermostatic switch responsive to the temperature of said evaporator portion and opening in response to a low temperature thereof and an electrical operating means for said liquefying means, said second circuit connecting the second of said stationary contacts and said second supply conductor, and a third electrical circuit having connected in series an electrical operating means for said relay and a second switch means responsive to the temperature of said above freezing compartment and a third switch means responsive to the temperature of said evaporator portion, said third circuit shunting said movable contact and second stationary contact and said first thermostatic switch and connecting said first supply conductor and the portion of said second electrical circuit between said first thermostatic switch and said electrical operating means.

3. A refrigerator including insulating means enclosing a below freezing compartment and an above freezing compartment, means forming an evaporator compartment separated from said compartments provided with an evaporator portion, means for circulating air from said below and above freezing compartments through said evaporator compartment in heat transfer with said evaporator portion and returning the cooled air to said below and above freezing compartments, first and second electrical supply conductors, a single pole double throw relay having a movable switch contact connected to said

first supply conductor and having two relatively stationary switch contacts, a first electrical circuit including a defrost heater associated with said evaporator portion connecting one of said stationary contacts and said second supply conductor, refrigerant liquefying means operatively connected to said evaporator portion, a second series electrical circuit including a first thermostatic switch responsive to the temperature of said evaporator portion and opening in response to a low temperature thereof and an electrical operating means for said liquefying means, said second circuit connecting the second of said stationary contacts and said second supply conductor, and a third electrical circuit having connected in series an electrical operating means for said relay and a second switch means responsive to the temperature of said above freezing compartment and a third switch means responsive to the temperature of said evaporator portion, said third circuit shunting said movable contact and second stationary contact and said first thermostatic switch and connecting said first supply conductor and the portion of said second electrical circuit between said first thermostatic switch and said electrical operating means and electrical operating means for said air circulating means connected between the second of said stationary contacts and said second supply conductor.

4. A refrigerator including insulating means enclosing a below freezing compartment and an above freezing compartment, means associated with said insulating means forming evaporator compartment means containing evaporating means, refrigerant liquefying means operatively connected to said evaporating means, means for circulating air from said below and above freezing compartments through said evaporator compartment means in heat transfer with said evaporating means and returning the air in proportions to maintain the respective compartments at below and above freezing refrigeration temperatures, first and second electrical supply conductors, a first electrical circuit including a thermostatic snap acting switch and an electrical operating means for said liquefying means connecting said supply conductors, said thermostatic switch comprising a fluid motor and a thermosensitive means having a first portion in heat transfer with said evaporating means and a second portion in heat transfer with said below freezing compartment, a first electric heater thermally associated with said first portion electrically connected in series with said thermostatic switch, and a second electric heater thermally associated with said second portion electrically connected in shunt with said thermostatic switch.

5. A refrigerator including insulating means enclosing a below freezing compartment and an above freezing compartment, means associated with said insulating means forming evaporator compartment means containing evaporating means, refrigerant liquefying means operatively connected to said evaporating means, means for circulating air from said below and above freezing compartments through said evaporator compartment means in heat transfer with said evaporating means and returning the air in proportions to maintain the respective compartments at below and above freezing refrigeration temperatures, first and second electrical supply conductors, a first electrical circuit including a thermostatic snap acting switch and an electrical operating means for said liquefying means connecting said supply conductors, said thermostatic switch comprising a fluid motor and a thermosensitive means having a first portion in heat transfer with said evaporating means and a second portion in heat transfer with said below freezing compartment, a first electric heater thermally associated with said first portion electrically connected in series with said thermostatic switch, and a second electric heater thermally associated with said second portion electrically connected in shunt with said thermostatic switch and means responsive to a frost condition of said thermostatic means for deenergizing said first heater.

6. A refrigerator including insulating means enclosing a below freezing compartment and an above freezing compartment, means forming an evaporator compartment separated from said compartments provided with an evaporator portion, means for circulating air from said below and above freezing compartments through said evaporator compartment in heat transfer with said evaporator portion and returning the cooled air to said below and above freezing compartments, first and second electrical supply conductors, a first electrical circuit comprising a first thermostatic switch and an electrically operated liquefying means for said evaporator portion electrically connected to said second supply conductor, a second electrical circuit comprising a defrosting means for said evaporator portion electrically connected to said second supply conductor, a double throw relay for alternately connecting said first and second electrical circuits to said first supply conductor, and a third electrical circuit comprising electrical operating means for said relay and a second thermostatic switch responsive to the temperature of one of said compartments connected in electrical shunt with both said relay and said first thermostatic switch.

7. A refrigerator including insulating means enclosing a below freezing compartment and an above freezing compartment, means associated with said insulating means forming evaporator compartment means containing evaporating means, refrigerant liquefying means operatively connected to said evaporating means, means for circulating air from said below and above freezing compartments through said evaporator compartment means in heat transfer with said evaporating means and returning the air in proportions to maintain the respective compartments at below and above freezing refrigeration temperatures, first and second electrical supply conductors, a first electrical circuit comprising a thermostatic switch having a thermosensitive element responsive to the temperature of said evaporating means and an electrically operated liquefying means for said evaporating means connected to said second supply conductor, a second electrical circuit comprising a defrosting means for said evaporating means electrically connected to said second supply conductor, a double throw relay for alternately connecting said first and second electrical circuits to said first supply conductor, an electrical operating means for said relay, a heater for said thermosensitive element, and a double throw switch means responsive to the temperature of one of said compartments for alternately connecting said first circuit to said heater and said electrical operating means for said relay.

8. A refrigerator including insulating means enclosing a below freezing compartment and an above freezing compartment, means associated with said insulating means forming evaporator compartment means containing evaporating means, refrigerant liquefying means operatively connected to said evaporating means, means for circulating air from said below and above freezing compartments through said evaporator compartment means in heat transfer with said evaporating means and returning the air in proportions to maintain the respective compartments at below and above freezing refrigeration temperatures, refrigerant liquefying means operatively connected to said evaporating means, thermostatic control means for said liquefying means having a fluid motor and a thermosensitive means provided with one portion responsive to the temperature of one of said compartments and a second portion responsive to the temperature of said evaporating means, defrosting means for said evaporating means, an electric heater for one of the portions of said thermosensitive means, and a double throw defrost switch arrangement having a normal position for energizing said heater and a defrost position for activating said defrosting means and deenergizing said heater.

9. A refrigerator including insulating means enclosing

a below freezing storage compartment and an above freezing storage compartment insulated from each other, means forming a mixing compartment separated from said storage compartments, an evaporator portion associated with said mixing compartment, means for circulating air from said below and above freezing compartments through said mixing compartment and returning the air to said below and above freezing compartments, a proportioning thermostatic air valve means responsive to and opening in proportion to a rise in temperature above a predetermined temperature of said above freezing compartment for controlling the circulation of air between said above freezing compartment and said mixing compartment, and means responsive to the opening of said air valve means beyond a predetermined point for initiating the defrosting of said evaporator portion.

10. A refrigerator including insulating means enclosing a below freezing storage compartment and an above freezing storage compartment insulated from each other, means forming a mixing compartment separated from said storage compartments, an evaporator portion associated with said mixing compartment, means for circulating air from said below and above freezing compartments through said mixing compartment and returning the air to said below and above freezing compartments, a proportioning thermostatic air valve means responsive to and opening in proportion to a rise in temperature above a predetermined temperature of said above freezing compartment for controlling the circulation of air between said above freezing compartment and said mixing compartment, means responsive to the opening of said air valve means beyond a predetermined point for initiating the defrosting of said evaporator portion, and means for preventing the interruption of the defrosting until said evaporator portion reaches a predetermined temperature.

11. A refrigerator including insulating means enclosing a below freezing compartment and an above freezing

compartment, means forming a mixing compartment separated from said compartments having associated with it an evaporator portion, means for circulating air from said below and above freezing compartments through said mixing compartment and returning the cooled air to said below and above freezing compartments, a proportioning thermostatic air valve means opening proportionately responsive to the rise in temperature of said above freezing compartment above a minimum temperature for increasing the circulation of air between said above freezing compartment and said mixing compartment, and means responsive to a predetermined positioning of said air valves means for initiating the defrosting of said evaporator portion.

12. A refrigerator including insulating means enclosing a below freezing compartment and an above freezing compartment, means forming a mixing compartment separated from said compartments having associated with it an evaporator portion, means for circulating air from said below and above freezing compartments through said mixing compartment and returning the cooled air to said below and above freezing compartments, a proportioning thermostatic air valve responsive to the rise in temperature of said above freezing compartment above a minimum temperature for controlling the circulation of air between said above freezing compartment and said mixing compartment, means responsive to a predetermined positioning of said air valve for initiating the defrosting of said evaporator portion, and means for preventing interruption of the defrosting until said evaporator portion reaches a predetermined temperature above freezing.

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