Sept. 6, 1955 C. A. STICKEL 2,716,865

REFRIGERATING APPARATUS

Filed Sept. 19, 1952 2 Sheets-Sheet 1

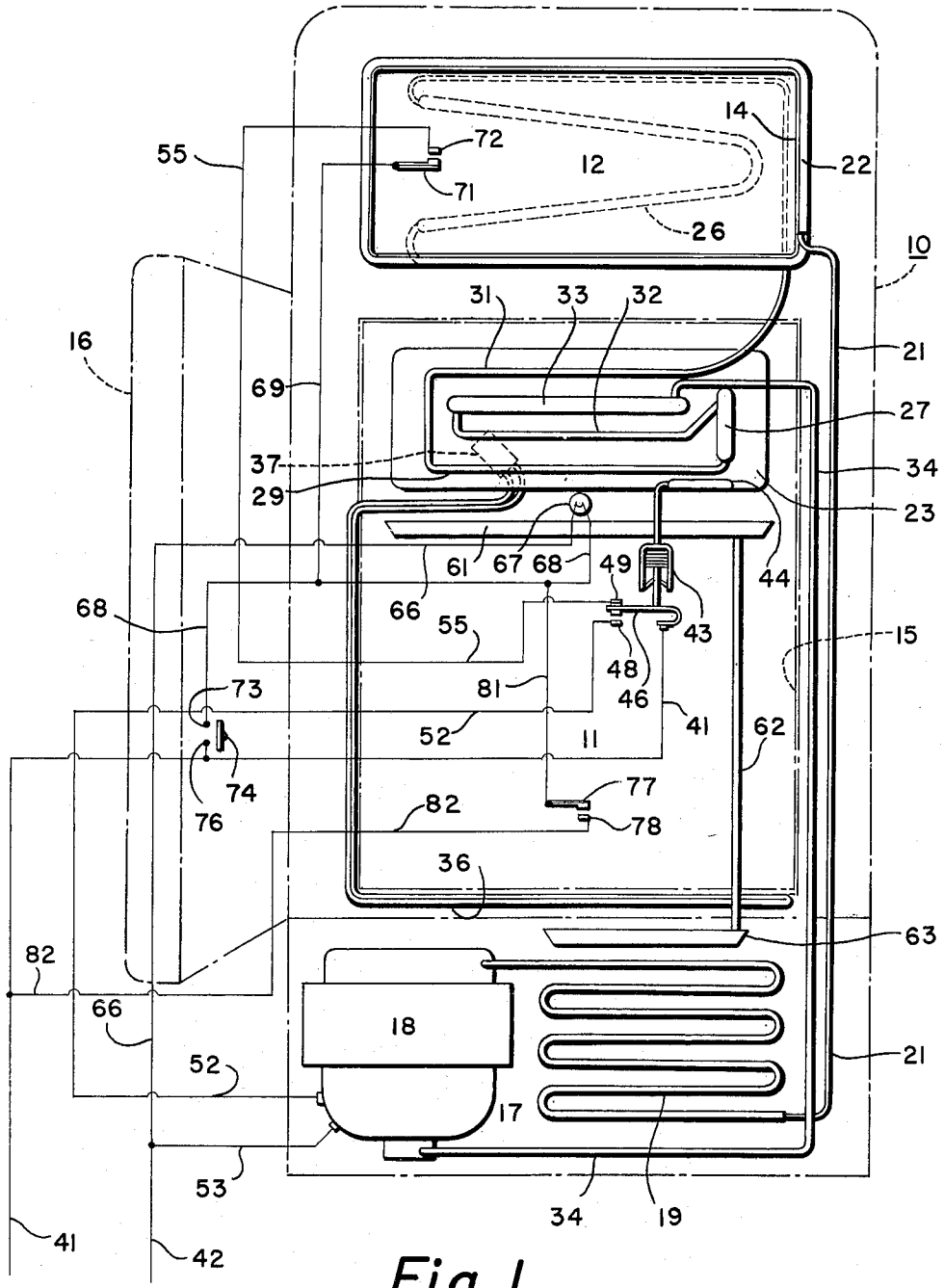


Fig. 1

INVENTOR.
Carl A. Stickel

BY

Willits, Hardman & Tate.

Sept. 6, 1955 C. A. STICKEL 2,716,865

REFRIGERATING APPARATUS

Filed Sept. 19, 1952 2 Sheets-Sheet 2

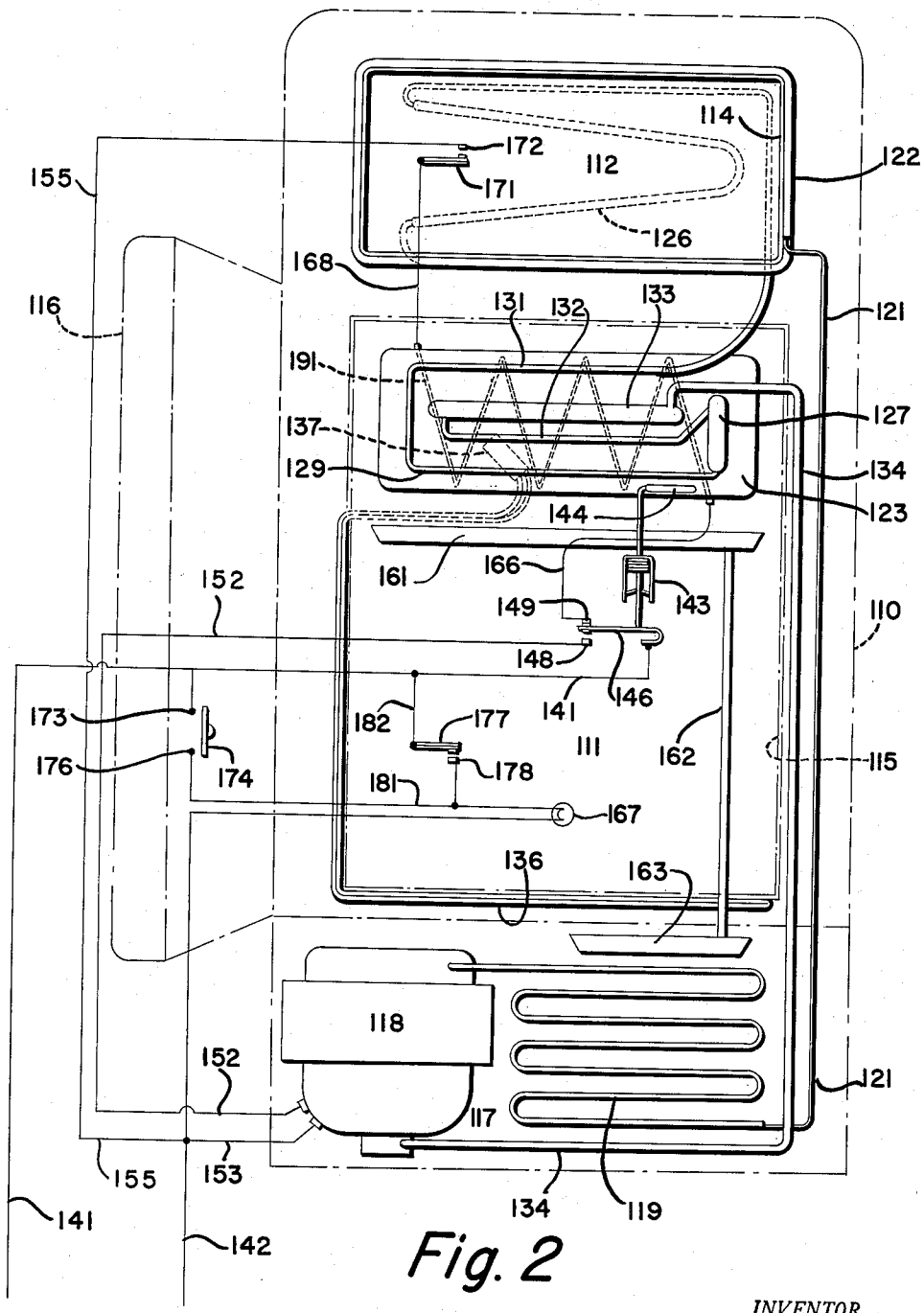


Fig. 2

INVENTOR.
Carl A. Stickel

BY

Willits, Hardman & Fehr.

United States Patent Office 2,716,865 Patented Sept. 6, 1955

2,716,865

REFRIGERATING APPARATUS

Carl A. Stickel, Dayton, Ohio, assignor to General Motors Corporation, Dayton, Ohio, a corporation of Delaware

Application September 19, 1952, Serial No. 310,473

6 Claims. (Cl. 62—4)

This invention relates to refrigeration and particularly to the control of a refrigerating system associated with a refrigerator cabinet.

It is now well known that it is a problem to provide a satisfactory control system for mechanically refrigerated refrigerators, particularly of the household type, which may be manufactured in large quantities, distributed and used throughout areas in this country of widely varying atmospheric conditions. This problem is present because of the fact that a control system must be provided to operate the refrigerating system of a refrigerator in varying atmospheric temperatures ranging below freezing to above 100° F. The advent of household refrigerators having a freezing or frozen food storage compartment separately insulated from a main higher temperatured or unfrozen food storage compartment and the provision of means for periodically defrosting the evaporator of the refrigerating system employed to cool the higher temperatured compartment without materially increasing the temperature of the evaporator employed to cool the frozen food storage compartment has increased the importance of overcoming the aforesaid problem. My invention is particularly directed to a control system for a refrigerator of this type wherein the proper or desired differential temperatures are produced in the two separate compartments thereof irrespective of ambient temperatures exteriorly of the cabinet and wherein defrosting of the evaporator employed to cool the unfrozen food compartment is automatically and periodically carried out.

An object of my invention is to provide an improved refrigerating apparatus of the two-temperature household type.

Another object of my invention is to provide an improved control system for a refrigerator to maintain the desired below freezing temperature in the frozen food compartment thereof while the temperature of the evaporator employed to cool the unfrozen food compartment is caused to vary considerably in temperature for obtaining different results irrespective of ambient temperatures outside the refrigerator cabinet.

Another object of my invention is to provide a control system for a refrigerating system of a two-temperature refrigerator cabinet which will cause refrigeration to be produced in both of the differently temperatured compartments thereof at various ambient temperatures outside the cabinet and to warm the interior of the higher temperatured food compartment should its temperature fall below normal to prevent freezing of perishable food products stored therein.

A further object of my invention is to provide control means for a refrigerating system of the aforesaid type in which a heating means is employed to warm the evaporator utilized for cooling the higher temperatured food compartment so as to quickly remove frost or ice therefrom and to render this heating means effective automatically in a novel manner.

In carrying out the foregoing objects, it is a still further and more specific object of my invention to provide

an improved control arrangement for a refrigerating system wherein three thermostatic means responsive to temperatures at different localities throughout the interior of a refrigerator cabinet cooperate with one another, in an electric circuit to produce certain results in the higher temperatured unfrozen food compartment while at the same time insuring that a below freezing temperature will at all times be maintained in the low temperatured or frozen food compartment.

Further features and advantages of the present invention will become apparent from the following description, reference being had to the accompanying drawings, wherein preferred forms of the invention are clearly shown.

In the drawings:

Figure 1 is a diagrammatic view of a refrigerating apparatus embodying my invention; and

Figure 2 is a view similar to Figure 1 showing a modified form of the present invention.

Referring now to the drawings, for illustrating my invention, I show in Figure 1 thereof a household refrigerator cabinet **10**, generally represented by the dot-dash lines, of the type having a lower cooling or unfrozen food storage compartment **11** and a separate upper freezing or frozen food storage compartment **12** therein. The cabinet outer shell or walls are spaced from metal liners **14** and **15**, forming walls of the compartments **11** and **12** respectively, and any suitable or desirable insulating material is disposed about the liners for insulating the cabinet and insulating the compartments from each other. The cabinet **10** is preferably provided with separate doors for normally closing the food storage compartments and the door **16** for compartment **11** is shown by the dot-dash lines in open position. The outer walls of cabinet **10** depend below compartment **11** and form a machine compartment **17** in the lower portion of the cabinet. Freezing compartment **12** is adapted to be maintained at temperatures low enough to properly preserve frozen foods for long periods of time. Thus the temperature therein is preferably maintained somewhere between —10° F. and 10° F. The main food storage compartment **11** is preferably maintained at temperatures above freezing but low enough to properly refrigerate milk and other perishable unfrozen foods. Temperatures in the neighborhood of 37° to 40° F. are most satisfactory for this purpose.

The refrigerating system used for maintaining the compartments **11** and **12** within the desired temperature ranges employs a conventional motor-compressor unit **18** in which there is an electric motor directly connected to a compressor to be driven thereby. Unit **18** is positioned in the machine compartment **17** and discharges refrigerant into a condenser **19** which is also located in the compartment **17**. The compressed refrigerant entering the condenser **19** is cooled and liquified in any well-known or conventional manner and collects in the lower portion thereof from whence liquid refrigerant flows through a capillary tube type of restrictor **21** which leads from the condenser **19** up to an evaporator **22** disposed in intimate thermal contact with liner **14** for cooling the interior of freezing compartment **12** in accordance with well-known practices. The amount of liquid refrigerant supplied to the evaporator **22** is normally in excess of that required for maintaining the freezing compartment **12** at the desired low temperature with the result that liquid refrigerant spills over from evaporator **22** into a plate-type evaporator **23** which is mounted in the main food compartment **11** and exposed to air therein. In order to reduce the tendency for the refrigerant vapor formed in evaporator **22** from percolating or shoving the liquid refrigerant into evaporator **23**, a disengaging tube **26** has been provided as shown. This tube **26** is attached to the rear wall of the frozen food compartment liner **14** and is preferably

flattened. By virtue of this arrangement the vaporized refrigerant leaving the evaporator 22 will tend to travel upwardly along the uppermost portion of the interior of flattened tube 26 and the liquid refrigerant will flow along the lowermost portion of the interior of tube 26 in its passage to the evaporator 23. The plate evaporator 23 is of such size as to provide adequate refrigeration for cooling food compartment 11 in a 100° or 110° room. To limit the refrigerating effect of the plate evaporator under certain conditions there is provided a vertical liquid refrigerant trapping accumulator 27 between the refrigerant passage 29 which cools the peripheral areas of the plate evaporator 23 and the passage 32 which refrigerates the central area of the plate so that liquid refrigerant will be stored in the accumulator 27 during the operating period to thereby flood the passage 29. Evaporator 23 is in effect a sheet metal plate having refrigerant passages and chambers provided therein as indicated in the drawing. The liquid refrigerant spilling over from evaporator 22 first flows through a passage 31 into passage 29 which leads into the bottom portion of accumulator 27. If the amount of liquid refrigerant supplied to the evaporator 23 is more than enough to fill the passage 29 and accumulator 27, the excess flows through the passage 32 into the lower end of a second accumulator 33 which is arranged as shown. The upper portion of accumulator 33 is connected to the suction line 34 which returns the vaporized refrigerant to the inlet of motor-compressor unit 18. The arrangement of the inlets and outlets of the accumulators 27 and 33 is such that when the compressor stops, the build-up of gas pressure in evaporator 23 will force the liquid refrigerant out of the accumulators 27 and 33 and passages 32, 29 and 31 back into the evaporator 22. The evaporators 22 and 23 are connected in series flow relationship and refrigerant is circulated therethrough in succession respectively.

The present refrigerating apparatus also includes a closed secondary refrigerating system or circuit including a refrigerant evaporating portion or coil 36 arranged in thermal exchange relationship with the outer wall surface of the bottom of liner 15 and a refrigerant condensing portion 37 arranged in thermal contact with the plate evaporator 23 of the primary refrigerating system as is conventional in the art. That portion 36 of the secondary refrigerating system is adapted to cool a ventilated receptacle or drawer (not shown) supported on the bottom wall of liner 15 within compartment 11. Food products such as fruits and vegetables are adapted to be stored and preserved in the ventilated receptacle. This secondary refrigerating system serves the dual purpose of taking heat from the vegetable receptacle and transferring it directly to the evaporator 23 without passing it through the food and air in compartment 11 and also serves the useful purpose of applying heat to the evaporator 23 so as to aid in defrosting the evaporator 23.

A control system is provided for the apparatus disclosed in Figure 1 which is positive and effective to maintain a differential between the temperature of compartment 11 and the temperature of compartment 12 and to defrost evaporator 23 and to insure that the temperature within compartment 11 will not be lowered to a point to cause freezing of perishable foods stored therein. The means in the present invention for defrosting evaporator 23 may be an electric resistance heating element secured in intimate thermal contact with plate evaporator 23 or it may be an electric lamp bulb mounted in close proximity to plate evaporator 23 and employed to both heat this evaporator and illuminate the interior of the food compartment 11 as is shown in Figure 1 of the drawings. The control system for the apparatus disclosed in Figure 1 of the drawings includes a plurality of thermostatic means or switches interposed in an electric circuit for the refrigerating apparatus. The electric circuit comprises power lines 41 and 42 connected to a suitable source of electricity. Power line wire 41 leads to a motor control switch 43 which has an operating bellows and a thermostat bulb 44 connected therewith for actuating the same to move a movable spring contact arm 46 thereof into and out of engagement with stationary contacts 48 and 49. Wire 41 is connected to the movable spring contact arm 46. A wire 52 connected to contact 48 leads to the motor of unit 18 and a wire 53 connects the motor to the other power line wire 42. Switch 43 serves to cause operation of the motor of unit 18 when spring contact arm 46 engages contact 48 in response to the thermostatic bulb 44 reaching a predetermined high temperature such as 36° F. and remains closed until the temperature at bulb 44 reaches a lower temperature such as —2° F. It should be noted that the thermostat bulb 44 is attached directly to the evaporator 23 so that it responds to evaporator temperatures rather than the temperature of air in the food storage compartment 11, as it has been found that the temperature of air in the compartment 11 may be maintained substantially between 37° and 40° F. at all times even though the temperature at the bulb 44 fluctuates over a wide range such as —2° to 36° F. The temperature values herein given are primarily for purpose of illustration and may be varied to suit different requirements.

Plate evaporator 23 is preferably spaced about an inch or so from the rear wall of food compartment 11 directly above a condensate collecting trough 61 which is attached to this rear compartment wall. There is shown a drain pipe 62 for conveying the condensate water, resulting from defrosting evaporator 23 as will hereinafter be described, into a shallow pan 63 located in the machine compartment 17. Heat of the motor-compressor unit 18 and of condenser 19 serves to evaporate the condensate water from pan 63.

The electric circuit of the control system in Figure 1 also includes a wire 66 leading from power line wire 42 to an electric lamp bulb 67 located immediately below the evaporator 23 to both illuminate the interior of compartment 11 and to impart heat to evaporator 23 for warming the same and removing frost or ice therefrom. A wire 68 leads from bulb 67 and is connected to a contact 73 of a door operated switch. A wire 69 branching from wire 68 is attached to a bimetal thermostatic switch 71 mounted in and responsive to the temperature within the freezing or frozen food storage compartment 12. Switch 71 is provided with a stationary contact 72 to which one end of a wire 55 is connected. The other end of wire 55 is attached to the stationary contact 49 of switch 43. The door operated switch includes a spring biased button 74 adapted to be actuated by movement of door 16 of compartment 11. The other contact 76 of the door switch is connected to wire 41. A bimetal or the like thermostatic switch 77, having a stationary contact 78, is located within compartment 11 and is responsive to temperatures therein. This switch 77 is connected to wire 68 by a branch wire 81 and its stationary contact 78 is connected to the power line wire 41 by a branch wire 82.

In the operation of the refrigerating apparatus just described let us assume that the temperatures both in the freezing or frozen food storage compartment 12 and in the unfrozen higher temperatured food storage compartment 11 are satisfactory and that the refrigerator cabinet is located in a 70° or higher room. The door 16 of the refrigerator cabinet 10 is closed thus maintaining the door switch 74 in open position while the other thermostatic means or switches 43, 71 and 77 are in the position shown in Figure 1 of the drawing. The circuit, wires 41, 52, motor-compressor unit 18 and wire 53 leading to wire 42 is deenergized by the contact arm 46 of switch 43 being out of engagement with contact 48. If now a demand for refrigeration is placed upon evaporator 22, such as by inserting products to be frozen into compartment 12, thermostat 71 will be warmed thus causing the same to move into engagement with the contact 72. The circuit completed by closing switch 71 against contact 72 includes

power line wire 41, contact arm 46 of switch 43, contact 49, wire 55, contact 72, switch 71, wire 69, wire 68, lamp 67, wire 66 and back to the other power line wire 42 so as to energize the lamp 67. Thus while the motor of unit 18 is idle lamp 67 is illuminated to impart heat to evaporator 23 to increase its temperature so as to defrost the same whereupon the resulting rise in teemperature of bulb 44 will influence switch 43 to move contact arm 46 away from contact 49 and into engagement with contact 48. It is to be understood that the closing temperature of switch 43 is sufficiently high that the plate evaporator 23 will be cleared of frost or ice before switch arm 46 is actuated. The movement of arm 46 of switch 43 just described opens the circuit to lamp 67 to deenergize the same and closes a circuit leading directly through the motor of unit 18 to start the same. The direct circuit to motor of unit 18 includes power line wire 41, contact arm 46 of switch 43, stationary contact 48, wire 52 through the motor, and back to the other power line wire 42 by way of wire 53. Motor-compressor unit 18 operates to cause the refrigeration demand placed on evaporator 22 to be satisfied whereupon thermostatic switch 71 will move away from contact 72 and thereafter evaporator 23 will be reduced in temperature to cause contact arm 46 of thermostatic switch 43 to move away from contact 48 and to again move into engagement with contact 49. Since the temperature in both compartments 11 and 12 is now satisfied, by the refrigerating system, lamp 67 will not be energized. It is to be noted, however, that any demand for refrigeration in compartment 11, while compartment 12 is at its predetermined low temperature, such as may be caused by placing a quantity of warm food products therein, will increase the temperature of evaporator 23 whereupon thermostatic bulb 44 will actuate switch 43 to cause its contact arm 46 to close against contact 48 to complete the direct circuit to the motor of motor-compressor unit 18 and start the motor. Thus the thermostatic means or switches 43 and 71 function to maintain the proper temperature in the compartments 11 and 12 and to normally provide a predetermined temperature differential therebetween.

Lamp 67, which is utilized to both heat evaporator 23 and illuminate the interior of compartment 11, will be energized independently of the thermostatic switches 43, 71 and 77 by opening door 16 which normally closes compartment 11. For example, should door 16 be opened, the spring biased door switch 74 will be moved into a position to bridge the contacts 73 and 76. This completes a circuit to a lamp 67 through the power line wire 41, switch 74, wire 68, lamp 67 and wire 66 back to the other power line wire 42.

In the average home a refrigerating apparatus of the type disclosed is usually installed in the kitchen where the room temperature normally is 70° or higher and under these conditions the refrigerating apparatus just described will maintain the proper temperature differential between the freezing compartment and the unfrozen food compartment without difficulty. However, some users may locate the refrigerator cabinet on a back porch or in some other location where the temperature ambient to the refrigerator cabinet may be low enough so as not to require much or any at all refrigeration in the higher temperatured unfrozen food compartment 11, but at temperatures too high for properly freezing and preserving the frozen foods stored in the frozen food compartment 12. Thus if the outdoor temperatures fall below 30° F. it is obvious that this temperature is lower than the normal 37° to 40° temperature range which the refrigerating system is designed to maintain in the unfrozen food compartment 11 with the result that the compressor of unit 18 would never need to operate insofar as the compartment 11 is concerned. It is possible that when a refrigerating load is placed on evaporator 22 too much refrigerant may spill over into evaporator 23 and cause its temperature to fall far below its normal low temperature limit. This may also create a near freezing temperature within compartment 11. At such abnormally low temperatures in compartment 11, foods stored therein would become too cold and may freeze and for this reason it is necessary to safeguard against such freezing of perishable food products stored in this compartment. I therefore provide means to add or impart artificial heat to the interior of compartment 11 to prevent such freezing of foods therein when the temperature outside the refrigerator cabinet falls below freezing. Thus the electric circuit in the present disclosure includes the additional thermostatic means or switch 77. In order to compensate for these abnormal conditions described, the refrigerator light or lamp 67 will be energized by switch 77 so as to apply artificial heat to the interior of compartment 11. Switch 77 is set to close at a temperature of 33° F. and upon the air in compartment 11 approaching a near freezing temperature under either of the above described conditions heat will be applied to this compartment. When thermostatic switch 77 closes it completes a circuit through lamp 67 by way of power line wire 41, wire 82, contact 78, branch wire 81, wire 68 and wire 66 to the other power line wire 42. Heat generated by lamp 67 will warm the interior of compartment 11 to a temperature above 33° F. whereafter switch 77 will open to deenergize lamp 67 and cause cessation of the application of artificial heat to this compartment. It will be seen that switch 77 is operable independently of either of the thermostatic switches 43 and 71 and will energize the lamp 67 whenever the temperature becomes too low in the compartment 11.

In Figure 2 of the drawings I show a modified form of my invention wherein heating of the evaporator, utilized to cool the interior of the unfrozen food storage compartment, is more quickly carried out for removing frost or ice therefrom. The electrical circuit for the thermostatic means interposed therein for this modified showing of my invention is slightly different than that disclosed in Figure 1 of the drawings. The main difference between these two showings of the invention being that of providing a tubular sheathed electric heater or the like electrical resistance heating element and mounting the same in intimate thermal contact with the plate evaporator to impart heat directly thereto instead of utilizing a light bulb for heating the same. Reference characters like those employed to describe the various elements of the apparatus shown in Figure 1 but having a "100" prefix will be used to designate the corresponding and additional elements of the apparatus shown in Figure 2 of the drawings. Referring now to Figure 2 a sheathed electric resistance heating element 191 is mounted on and lies along the back of plate evaporator 123 in intimate heat exchange relationship therewith. The lamp 167 in this modified apparatus is employed to illuminate the interior of unfrozen food compartment 111 as well as to add some artificial heat thereto under certain abnormal conditions. The changes in the electrical circuit of this modified showing of my invention over that shown associated with the apparatus disclosed in Figure 1 of the drawings will become apparent to one skilled in the art in view of the following explanation of the operation of the refrigerating apparatus illustrated in Figure 2 of the drawings.

Referring now to Figure 2 let us assume that the refrigerating system associated with the refrigerator 110 has operated to cause evaporator 122 to cool the freezing or frozen food compartment 112 to a temperature of from −10° to 10° F. and to cause the plate evaporator 123 to cool the main or frozen food storage compartment to a temperature of from 37° to 40° F. As before stated the temperature of evaporator 123 is maintained between −2° to 36° F. in order to keep the air in compartment 111 between its range of temperatures aforesaid. The thermostatic means or switches 143, 171, 177 and door operated switch 174 in the electrical circuit associated

with the modified form of apparatus are normally in their respective positions disclosed in Figure 2. Suppose now that a demand for refrigeration is placed on evaporator 122, such as by inserting food products to be frozen into compartment 112, thermostatic means or switch 171 will be warmed and it will move into engagement with the stationary contact 172. The circuit completed by the closing of switch 171 includes power line wire 141, movable spring contact arm 146 of switch 143, contact 149, wire 166, heating element 191, wire 168, switch 171, contact 172 and wire 155 back to the other power line wire 142. This completed circuit energizes heater element 191 to impart heat directly to evaporator 123 for defrosting the same. There is no flow of electric current through the motor windings of motor-compressor unit 118 at this time. As the plate evaporator 123 is heated by element 191 and cleared of frost or ice, the thermostat bulb 144 is warmed to actuate switch 143 and move the spring contact arm 146 thereof away from contact 149 and into engagement with contact 148. This thus deenergizes the heater 191 and closes a direct circuit through unit 118 by way of power line wire 141, spring contact arm 146 of switch 143, contact 148, wire 152, windings of the electric motor of unit 118 and back to power line wire 142 by way of wire 153. The electric motor now drives the compressor to reduce the temperature in compartment 112 and consequently in compartment 111. Once the motor starts operating it will normally continue to operate until the demand for refrigeration in compartment 111, due to warming and defrosting evaporator 123, has been satisfied because it is not until the evaporator 123 has been reduced to its low temperature limit that enough refrigerant has spilled over into this evaporator from evaporator 122 to satisfy the low temperature of evaporator 123 and eventually cause switch 143 to shut off the motor-compressor unit 118. The switches 143 and 171 are actuated independently of one another to thereby insure the maintenance of a desired temperature differential between the frozen food compartment 112 and the unfrozen food compartment 111.

The light bulb or lamp 167 is in this modified form of my invention energized only by closing one of the switches 174 or 177. For example if the unfrozen food compartment door 116 is opened, the spring biased switch 174 will engage and bridge contacts 173 and 176 to thus complete a circuit through the lamp 167 by way of power line wire 141, contacts 173 and 176, wire 181 and back to the other power line wire 142 to thus illuminate the interior of compartment 111. The bimetal thermostatic switch 177 is set to engage contact 178 at about 33° F. Therefore should the temperature within compartment 111 be abnormally lowered to approximate a freezing temperature for reasons hereinbefore described, switch 177 will close to cause energization of lamp 167. The circuit for energizing and causing lamp 167 to heat the interior of compartment 111, even though door switch 174 is open, includes the power line wire 141, wire 182, switch 177, contact 178, lamp 167 and power line wire 142. The lamp 167 will remain illuminated as long as abnormal low temperatures exist in compartment 111 and will therefore generate and dissipate sufficient heat into compartment 111 to prevent freezing of perishable products stored therein. Thus both switches 174 and 177 are adapted to be actuated independently of one another and independently of actuation of either or both of the thermostatic switches 143 and 171.

From the foregoing it should be apparent that I have provided a two-temperature refrigerator cabinet in which the evaporator employed to cool one of the differently refrigerated food storage compartments of the refrigerator is automatically and periodically defrosted without increasing above the desired value the temperature of the freezing or frozen food storage compartment. I have provided a control system for a two-temperature refrigerating apparatus that renders the refrigerating system thereof substantially infallible in automatic operation to maintain separate independent temperatures within the plurality of food storage compartments and to normally maintain a predetermined temperature difference between the compartments irrespective of defrosting of the evaporator employed to cool one of these compartments and irrespective of ambient temperatures outside the refrigerator cabinet. My improved refrigerator is adapted for universal use in that the control system employed therefore permits installation thereof in different localities of atmospheric conditions and in various ambient temperature zones.

While the forms of embodiment of the invention as herein disclosed constitute preferred forms, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. A refrigerating apparatus comprising in combination, a cabinet having an unfrozen food storage compartment and a frozen food storage compartment therein, said compartments being insulated from one another and isolated against flow of air therebetween, a closed refrigerating system associated with said cabinet, said system including a first evaporator for cooling said frozen food compartment, a second frosting and defrosting evaporator for cooling said unfrozen food compartment and a motor and compressor driven thereby for circulating refrigerant in succession through said first evaporator and thence through said second evaporator to produce differential temperatures within said compartments, electric heating means in close thermal relationship with said second evaporator for assisting in defrosting the same, thermostatic means for energizing said heating means and for controlling said motor, said thermostatic means comprising a control means responsive to the temperature of said frozen food compartment for energizing said heating means, said thermostatic means also including a switch responsive to the temperature of said second evaporator for starting and stopping operation of said motor, said switch preventing said control means from energizing said heating means during operation of said motor, and said thermostatic means further including a thermostat within said unfrozen food compartment responsive to a near freezing temperature therein for energizing and deenergizing said heating means.

2. A refrigerating apparatus comprising in combination, a cabinet having an unfrozen food storage compartment and a frozen food storage compartment therein, said compartments being insulated from one another and isolated against flow of air therebetween, a closed refrigerating system associated with said cabinet, said system including a first evaporator for cooling said frozen food compartment, a second frosting and defrosting evaporator for cooling said unfrozen food compartment and a motor and compressor driven thereby for circulating refrigerant in succession through said first evaporator and thence through said second evaporator to produce differential temperatures within said compartments, electric means for heating said unfrozen food compartment to remove frost and ice from said second evaporator, an electric circuit for said motor and said heating means, said circuit including a first thermostatic means responsive to the temperature of said unfrozen food compartment evaporator for starting and stopping said motor, a second thermostatic means responsive to the temperature of said frozen food compartment for energizing said heating means and a third thermostatic means located within said unfrozen food compartment and being responsive to a near freezing temperature of air therein for also energizing said heating means, and said first thermostatic means preventing said second thermostatic means from energizing said heating means during operation of said motor.

3. A refrigerating apparatus comprising in combina-

tion, a cabinet having an unfrozen food storage compartment and a frozen food storage compartment therein, said compartments being insulated from one another and isolated against flow of air therebetween, a closed refrigerating system associated with said cabinet, said system including an evaporator for cooling said frozen food compartment, another evaporator for cooling said unfrozen food compartment and a motor and compressor driven thereby for circulating refrigerant through the evaporators in succession for producing differential temperatures within said compartments, electric means for heating said unfrozen food compartment evaporator to remove frost and ice therefrom, an electric circuit for said motor and said heating means, said circuit including a first thermostatic means responsive to the temperature of said unfrozen food compartment evaporator for starting and stopping said motor, a second thermostatic means responsive to the temperature of said frozen food compartment for energizing and deenergizing said heating means, and a third thermostatic means within said unfrozen food compartment, said third thermostatic means also energizing and deenergizing said heating means independently of said second thermostatic means in response to a near freezing temperature of air in said unfrozen food compartment.

4. A refrigerating apparatus comprising in combination, a cabinet having an unfrozen food storage compartment and a frozen food storage compartment therein, said compartments being insulated from one another and isolated against flow of air therebetween, a closed refrigerating system associated with said cabinet, said system including an evaporator for cooling said frozen food compartment, another evaporator for cooling said unfrozen food compartment and a motor and compressor driven thereby for circulating refrigerant through the evaporators in succession for producing differential temperatures within said compartments, electric means for heating said unfrozen food compartment evaporator to remove frost and ice therefrom, an electric circuit for said motor and said heating means, said circuit including a first thermostatic means responsive to the temperature of said unfrozen food compartment evaporator for starting and stopping said motor, a second thermostatic means responsive to the temperature of said frozen food compartment for energizing and deenergizing said heating means, and a third thermostatic means responsive to a near freezing temperature of air in said unfrozen food compartment for also energizing and deenergizing said heating means independently of said second thermostatic means, and said first thermostatic means opening the circuit to said heating means irrespective of the position of said second thermostatic means when said motor is started.

5. A refrigerating apparatus comprising in combination, a cabinet having an unfrozen food storage compartment and a frozen food storage compartment therein, said compartments being insulated from one another and isolated against flow of air therebetween, a closed refrigerating system associated with said cabinet, said system including an evaporator for cooling said frozen food compartment, another evaporator for cooling said unfrozen food compartment and a motor and compressor driven thereby for circulating refrigerant through the

evaporators in succession for producing differential temperatures within said compartments, electric means for heating said unfrozen food compartment evaporator to remove frost and ice therefrom, an electric circuit for said motor and said heating means, said circuit including a thermostatic means responsive to the temperature of said frozen food compartment for energizing and deenergizing said heating means, another thermostatic means responsive to a near freezing temperature of air in said unfrozen food compartment for also energizing and deenergizing said heating means independently of said first named thermostatic means, and a thermostatically operated snap switch responsive to the temperature of said unfrozen food compartment evaporator for starting and stopping said motor, said snap switch being interposed in the circuit leading to said heating means and deenergizing said heating means when said motor is started irrespective of the position of said first named thermostatic means.

6. A refrigerating apparatus comprising in combination, a cabinet having an unfrozen food storage compartment in the lower portion thereof and a frozen food storage compartment in the upper portion of the cabinet insulated from said unfrozen food compartment, a closed refrigerating system associated with said cabinet, said system including an evaporator for cooling said frozen food compartment, a plate type evaporator disposed in and exposed to air within said unfrozen food compartment and a motor and compressor driven thereby for circulating refrigerant through the evaporators in succession for producing differential temperatures within said compartments, a lamp for both heating and illuminating the interior of said unfrozen food compartment, a door on said cabinet normally closing said unfrozen food compartment, a switch operable by said door, an electric circuit for said motor, said lamp and said switch, said circuit including a first thermostatic means responsive to the temperature of said plate evaporator for starting and stopping said motor, a second thermostatic means responsive to the temperature of said frozen food compartment for energizing said lamp, and a third thermostatic means repsonsive to a near freezing temperature of air in said unfrozen food compartment for also energizing and deenergizing said lamp independently of said second thermostatic means, said switch being effective to energize and deenergize said lamp independently of all of said thermostatic means in response to movements of said door.

References Cited in the file of this patent

UNITED STATES PATENTS

2,202,360	Ullstrand	May 28, 1940
2,229,569	Hoesel	Jan. 21, 1941
2,234,474	Higham	Mar. 11, 1941
2,430,329	Davis	Nov. 4, 1947
2,444,593	Davis	July 6, 1948
2,484,588	Richard	Oct. 11, 1949
2,487,182	Richard	Nov. 8, 1949
2,487,662	McCloy	Nov. 8, 1949
2,488,161	Benson	Nov. 15, 1949
2,541,145	Bader	Feb. 13, 1951
2,573,684	Binder	Nov. 6, 1951
2,627,393	Shell	Feb. 3, 1953