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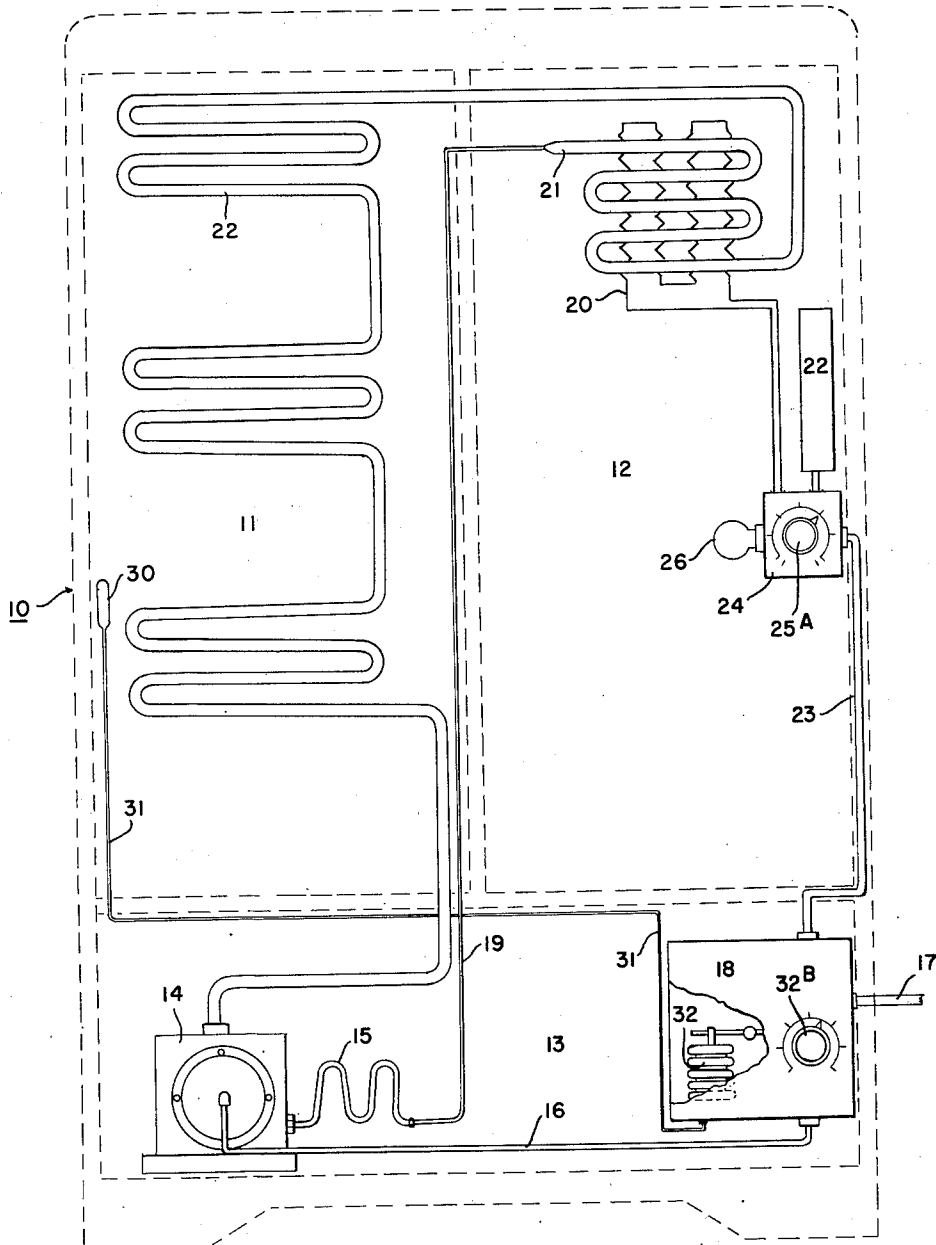
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AUTOMATIC CONTROL SYSTEM FOR COMBINED FREEZER AND COOLER

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2 Sheets-Sheet 1

FIG. 1



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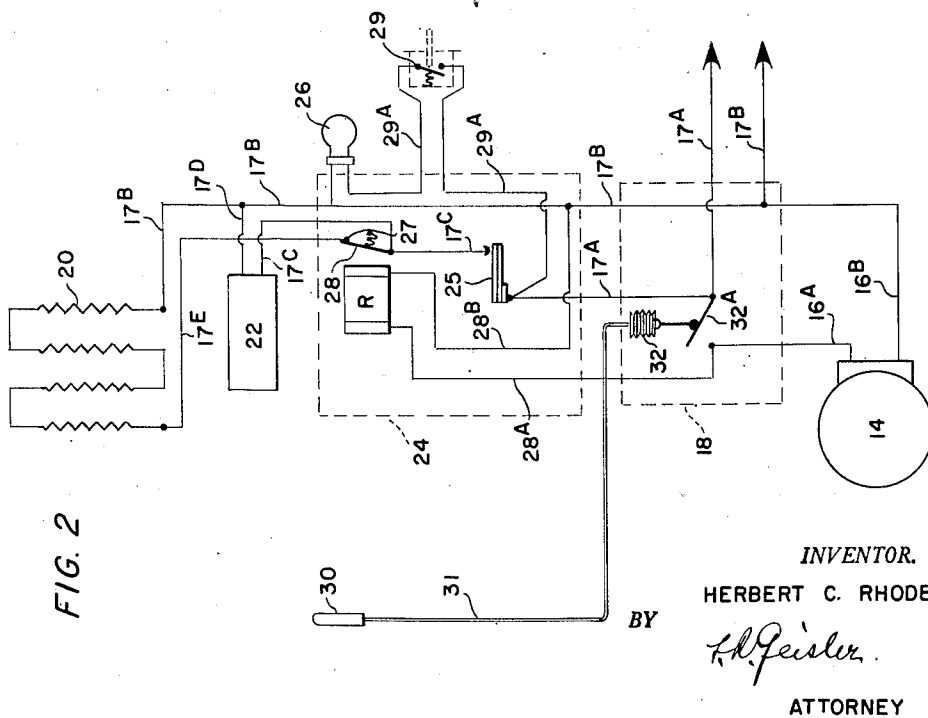
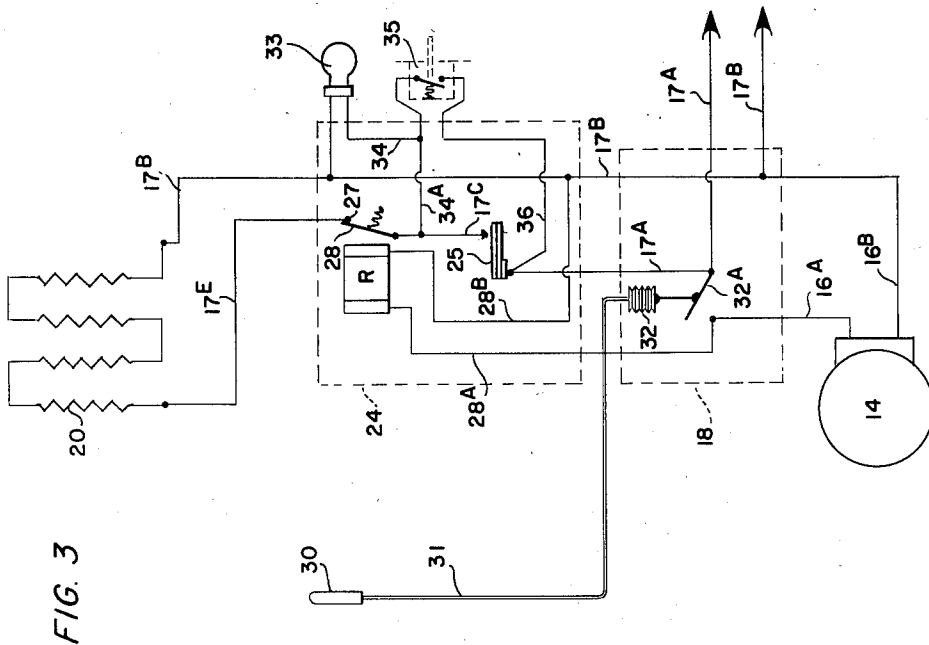
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**AUTOMATIC CONTROL SYSTEM FOR COMBINED  
FREEZER AND COOLER**

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1 Claim. (Cl. 257—3)

The present invention relates to refrigerators which include a cooling compartment for foods or other products to be maintained substantially at a predetermined temperature slightly above freezing and always higher than freezing, and a freezing compartment in which foods or other products are preserved in a temperature always substantially below freezing. This application is a continuation-in-part of my pending application, Serial No. 416,503, filed under date of March 16, 1954, and entitled Temperature Control System for Combined Freezer and Cooler.

The present invention also relates specifically to refrigerators having a cooling compartment and a freezing compartment, both of which are served by a single refrigerant circulating system. In such refrigerators it is necessary to provide suitable means not only for controlling in general the operation of the compressor motor and the single circulating system, but also specifically for preventing the temperature in the cooling compartment from dropping to the freezing level regardless of any excessive operation of the compressor motor and circulation of refrigerant which may become necessary for maintaining the desired below-freezing temperature in the freezing compartment, and it is also necessary to provide means for defrosting the cooling coils in the cooling compartment from time to time to prevent frost and ice from accumulating on these coils to such extent as to interfere with the securing of the desired cooling in the cooling compartment.

The object of the present invention is to provide an improved system wherein such means and the controls for such means will operate entirely automatically.

An additional object is to provide such an automatic control system which will be extremely simple and practical to install and to maintain.

In the following brief description, reference is made to the accompanying drawings in which:

Figure 1 is a diagrammatic view of a refrigerating device and system embodying the present invention;

Figure 2 is a wiring diagram for the same; and

Figure 3 is a similar wiring diagram in which a minor modification is included.

In Figure 1 the refrigerating device, combining a freezer and a cooler, is indicated in general by the reference character 10 and comprises a freezing compartment 11, a cooling compartment 12, and a lower compartment 13 which houses the motor-driven compressor 14, condenser 15 and control switch box 18. The refrigerant, upon operation of the compressor, is delivered from the condenser 15 through the capillary tube 19 to the coils 21 in the cooling compartment 12, and thence to the coils 22 in the refrigerating compartment 11, in the usual manner.

Electric power for operating the entire refrigerating device is delivered over the conductor cable 17 from a suitable outside source (not shown) and power for operating the compressor motor passes to the motor over the

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connected conductor cable 16. An adjustable thermostat control, of familiar construction, is located in the switch box 18 and includes a switch element capable of operation by an expansible bellows 32. Expansion of the bellows 32, to a predetermined amount for which an adjusting control 32B is set, closes the switch element which results in delivery of electric current over the conductor cable 16 to the motor. A bulb 30, located in the freezing compartment 11, is connected with the bellows 32 by the tube 31, and a suitable volatile fluid, which is sealed in the bulb, tube, and bellows, causes expansion of the bellows with a rise in temperature in the freezing compartment 11, in the well-known manner. Thus, whenever the temperature in the freezing compartment 11 reaches a predetermined amount for which the control 32B has been set, the compressor motor will operate and will continue to do so until the circulation of the refrigerant has lowered the temperature in compartment 11, as desired.

Defrosting means, diagrammatically indicated at 20 in Figure 1, is provided for the cooling coils 21 in the cooling compartment 12. A separate warming element, diagrammatically indicated at 22, is provided for the cooling compartment 12. Electric current for the defrosting means and for the warming element is supplied through conductor wires located in a conduit 23.

The passage of electric current to the warming element 22 is controlled by a thermostatic switch of well-known type located in a control box 24 positioned in the cooling compartment 12. This thermostatic switch is manually adjustable by an adjusting control, also of well-known construction, which is indicated at 25A in Figure 1. The arrangement is such that whenever the temperature in the cooling compartment 12 falls below the minimum for which the control 25A has been set, the circuit to the warming element 22 will automatically be closed and will remain closed until the desired temperature rise has occurred in the cooling compartment, whereupon the circuit to the warming element will automatically return to normal open position. Thus the warming element 22 and its thermostatically controlled circuit prevent the temperature in the cooling compartment 12 from falling below the desired minimum for which the control has been set, regardless of any excessive operation of the compressor and the resulting circulation of the refrigerant, even though such excessive circulation and compressor operation may be required for maintaining the low freezing temperature in compartment 11.

The defrosting means 20 is also connected with the circuit to the warming element 22. Such connection would cause the defrosting means to be actuated upon the closing of the circuit to the warming element. However, obviously the defrosting of the cooling coils 21 should never be permitted to take place when the refrigerant is circulating through these coils and thus should never take place when the compressor is operating. Therefore, I provide the branch circuit to the defrosting means with an interrupter relay-operated switch, to be described later, which is energized whenever the compressor motor is in operation, and, when so energized, prevents the closing of the branch circuit to the defrosting means. The result is that the warming element functions whenever the temperature in the cooling compartment 12 drops too low, regardless of whether the compressor is operating or not, and the defrosting means functions whenever the warming element functions except when the compressor is operating. This is an important and novel feature of my invention.

The customary electric light bulb 26, adapted to provide light for the interior of the compartment 12 whenever the door is opened, is preferably mounted on the

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control switch box 24. The circuit to this lamp is closed in the usual manner by a spring-actuated switch operated by the opening of the refrigerator door.

Referring now to the wiring diagram of Figure 2, 17A and 17B indicate the two wires of the conductor 17 over which the electric power is delivered to the entire device from the outside source. The two wires of the conductor cable 16 which lead to the compressor motor 14 are indicated by 16A and 16B, the wire 16B being connected directly to the wire 17B and the wire 16A being connected to the wire 17A through the intermediary of the switch 32A which is operated by the bellows 32 of the thermostatic control assembly previously described and including the bulb 30 located in the freezing compartment.

One terminal of the electric warming element 22 is connected to the branch wire 17C which, in turn, is connected to the wire 17A by the thermostatic switch 25. The other terminal of the warming element 22 is connected by a branch wire 17D to the wire 17B. Thus, whenever the thermostatic switch 25 closes, the warming element 22 will be actuated.

The defrosting means 20 has one terminal connected to the wire 17B and the other terminal connected by the wire 17E to the contact 27, which, in turn, is connected to wire 17C by the switch element 28. The switch element 28 is operated by the relay R and is so arranged that whenever the circuit to the relay R is energized the switch element 27 will open against the force of a closing spring, and thus hold the branch circuit to the defrosting means 20 open. One pole of the relay R is connected by the wire 28A to the wire 17A through the medium of the switch element 32A, and the other pole of the relay R is connected by the wire 28B to the wire 17B. As apparent, the closing of the switch element 32A thus not only causes the compressor motor to operate, but, by energizing the relay R and causing the switch element 28 to open, prevents the branch circuit to the defrosting means 20 from being closed.

The socket for the interior light globe 26 has one terminal connected to the wire 17B and the other terminal connected to the wire 17A by means of the wire 29A and the interposed door switch 29. The switch 29 is the customary door switch in which the door closes against a plunger forcing the switch open against the force of a spring, which spring acts to close the switch whenever the opening of the door releases the plunger and permits the switch to be closed.

The wiring diagram of Figure 3 illustrates a slight modification in my refrigerator assembly in which the light bulb 33 in the cooling compartment serves the double purpose of raising the temperature in the cooling compartment, when the temperature falls below the desired minimum, as well as of providing a light for the compartment whenever the refrigerator door is open. In this modified arrangement, one terminal of the socket for the light bulb 33 is connected to the wire 17B, as before. The other terminal of the light bulb socket is connected to the wire 17A through the wire 34, the wire 34A, the wire 17C, and the thermostatic switch 25. Also this other terminal of the light socket is connected to the wire 17A by the wire 34, the door switch 35, and the wire 36. As will be apparent from Figure 3, the light 33 is turned on as usual by the opening of the refrigerator door and, when so turned on, provides a light for the interior as long as the door remains open, the closing of the door causing the switch 35 to be disconnected. However, whenever the temperature in the cooling compartment falls below the desired minimum the thermostatic switch 25 closes, as previously

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described, and the closing of this switch 25 also closes the circuit to the light bulb 33, whereupon the light bulb remains lighted until the heat from the light bulb has resulted in raising the temperature of the cooling compartment to the extent desired.

The closing of the thermostatic switch 25 will also cause the defrosting means 20 to operate unless the compressor motor happens to be operating, in which case the closing of the circuit to the compressor motor causes the relay R to be energized and the branch circuit to the defrosting means to be interrupted, as already explained.

Thus, in the carrying out of my invention, either the light bulb or a separate warming element may be used for raising the temperature in the cooling compartment. In either case, the defrosting means will operate whenever the temperature in the cooling compartment requires raising unless the refrigerant is being circulated at the same time, and when the refrigerant is being circulated the branch circuit to the defrosting means will always be automatically interrupted. Consequently, when the two thermostatic controls have been set, one for maintaining the desired freezing temperature in the freezing compartment and the other for maintaining the temperature above freezing in the cooling compartment, the entire operation of the system becomes automatic and this automatic operation includes periodic defrosting of the coils in the cooling compartment without any danger of such defrosting occurring while the refrigerant is circulating through the coils.

I claim:

In a combined freezer and cooler of the character described, having a cooling compartment, a freezing compartment, refrigerant coils in said compartments, and a single refrigerant circulation system with a motor-driven compressor for circulating refrigerant successively through the coils of said cooling and freezing compartments, thermostatic means responsive to the temperature in said freezing compartment directly controlling the operation of said motor-driven compressor, whereby to maintain freezing temperature in said freezing compartment at all times, heating means positioned in said cooling compartment at substantial distance from the refrigerant coils in said cooling compartment for raising the temperature of the air in said cooling compartment whenever the operation of said motor-driven compressor causes the temperature in said cooling compartment to fall below a desired minimum, separate thermostatic means responsive to the temperature in said cooling compartment controlling the operation of said heating means, a defrosting heating element located adjacent said refrigerant coils in said cooling compartment, an actuating circuit for said defrosting element, said last mentioned thermostatic means also controlling said defrosting element circuit, whereby the defrosting of said coils in said cooling compartment will occur only when said first mentioned heating means is in operation, and means in said defrosting element circuit between said last mentioned thermostatic means and said defrosting element automatically opening said defrosting element circuit whenever said motor-driven compressor is in operation.

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