March 10, 1936. E. HEITMAN 2,033,828

REFRIGERATING APPARATUS

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Fig. 1.

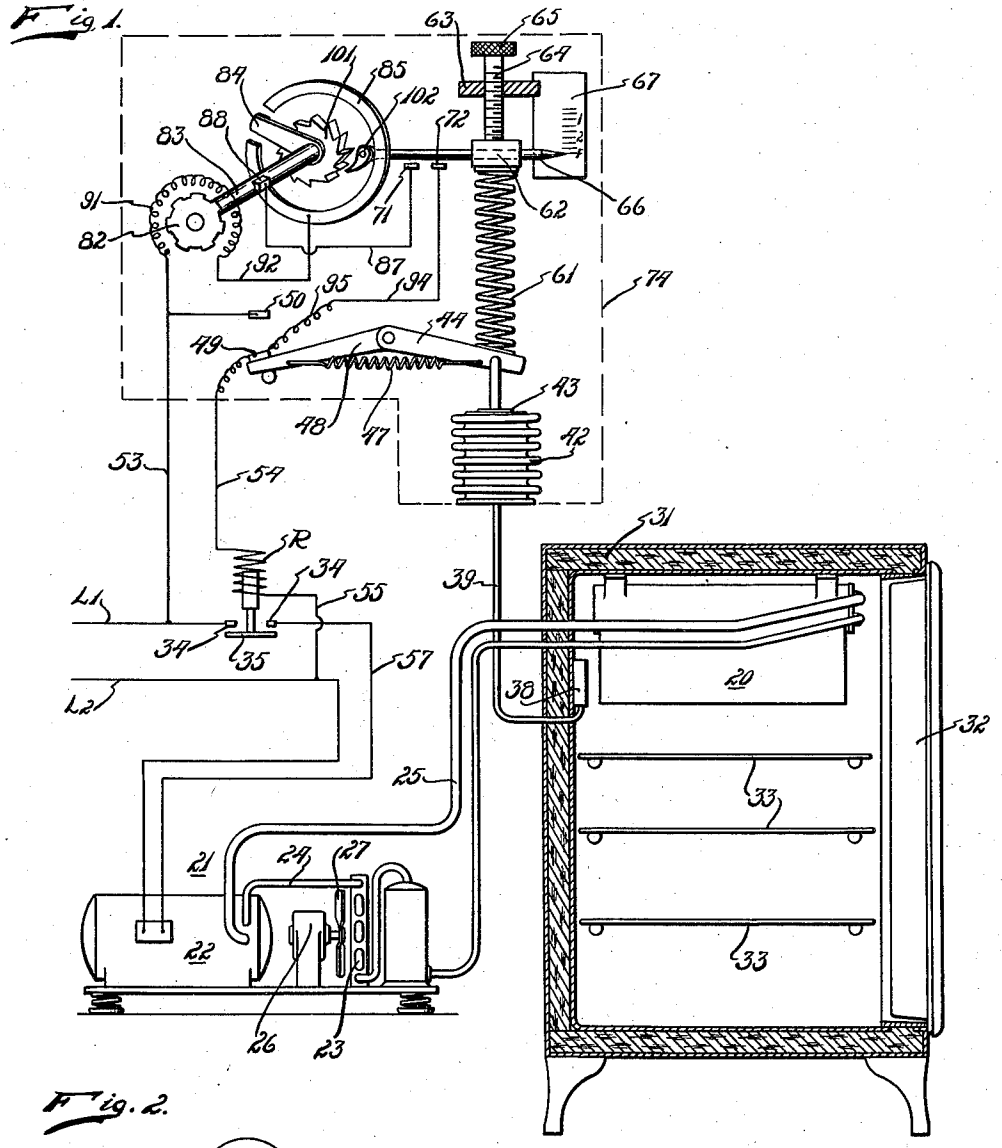
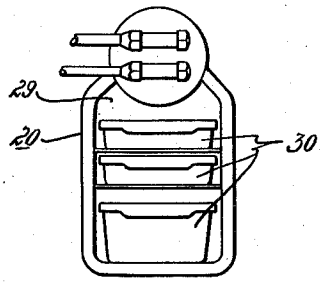


Fig. 2.



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REFRIGERATING APPARATUS

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10 Claims. (Cl. 62—4)

The present invention relates to refrigerating systems and more particularly to means for controlling the temperature of the cooling unit or element of the system.

Refrigerating systems are operated so that normally a desired temperature is maintained and it is often desirable to temporarily maintain a modified temperature of the cooling unit, as per example, for quickly freezing or congealing substances or for removing the ice formed on the cooling unit due to the condensation and freezing thereof of the moisture from the air circulating thereover.

One of the objects of the present invention is to provide a refrigerating system in which the cooling unit is maintained normally at a desired temperature and to provide mechanism which when placed into operation causes a modification of the temperature of the cooling unit and to further control the system so as to prevent after a predetermined time the continuous operation of the modified operation.

In carrying out the above object it is a further object of the present invention to provide a timing mechanism which will cause the continuance of a modified refrigeration cycle a predetermined time after the modified cycle is brought into effect.

The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments, when read in conjunction with the accompanying drawing, in which:

Fig. 1 is a view partly sectional and partly diagrammatic showing a refrigerator cabinet and system arranged in accordance with my invention; and

Fig. 2 is an end elevational view of an evaporator unit.

For the purpose of illustrating one form I have chosen to illustrate the invention as employed in a refrigerating system in which there is obtained temporarily a lower than normal temperature, but my invention may be advantageously utilized either in a system in which it is desirable to at times modify the operation thereof to obtain a temperature lower than normally or to temporarily obtain a temperature higher than normally for defrosting the cooling unit or both.

My invention is applicable to any type of refrigerating system employing a cooling unit and a circulating refrigerant and in the present invention the system is shown as a compressor condenser expander type employing an evaporator 20, a compressor and condenser unit 21 including a compressor and a driving motor enclosed in a unitary casing 22, and a condenser 23 operatively connected to the compressor through suitable conduit means 24. The compressor 22 draws refrigerant vapor from the evaporator 20 through a conduit 25 and transmits it under pressure through the conduit 24 into the condenser 23 where its latent heat of vaporization is dissipated in the usual manner. For the purpose of expediting the dissipation of heat from the condenser 23 air may be drawn therethrough by a fan 27 driven by a suitable electric motor 26 or other motive means. The evaporator unit 20 encloses a freezing chamber 29 and is mounted within a heat insulating cabinet 31 which is closed by a heat insulating door 32 in the usual manner.

The evaporator 20 is mounted in the upper portion of the food storage compartment enclosed by the cabinet and suitable shelves 33 are provided thereunder for supporting food substances which are to be stored at a low temperature to retard decomposition. The chamber enclosed by the evaporator 20 may be utilized for freezing ice cubes, desserts and the like in trays 30.

The compressor motor 22 is energized from the alternating current service mains L1 and L2 through the contactors 34, 35 of a relay R which is energized automatically in accordance with the temperature conditions adjacent the evaporator. The temperature responsive device for controlling the relay comprises a thermo bulb 38 which is mounted adjacent the evaporator and contains an expansible or vaporizable fluid. A tube 39 extends from the bulb 38 to an expansible metal bellows 42 which is distended or contracted in accordance with the pressure variations in the bulb. The head 43 of the expansible bellows is connected to one end of a pivoted lever arm 44 of a toggle switch, of well known construction. When the expansion of the bellows moves the end of the lever beyond a predetermined point, a toggle spring 47 snaps a second pivoted lever 48 upwardly and throws a movable contact 49 against a stationary contact 50 thereby energizing the relay R. The relay energizing circuit may be traced from one of the main line conductors, L1, of the alternating current service line through a conductor 53 to the stationary contact 50 of the thermostatic switch, thence through the movable contact member 49, through a conductor 54 to the relay winding R, thence by way of a conductor 55 to the other main line conductor L2.

As the relay R pulls up, its contactors 34, 35 complete the motor energizing circuit which may be traced from the main line conductor L1 through a conductor 57 to the motor 22 the other terminal of which is connected directly to the other main line conductor L2. If a large motor is used a suitable starting device may be provided in the well known manner. In operation the expansible bellows 42 moves in accordance with temperature conditions within the cabinet,

and when the temperature rises above a predetermined value the thermal switch snaps up and starts the motor compressor unit.

When the compressor has operated sufficiently to lower the temperature of the evaporator unit a predetermined amount, the thermal switch snaps down and stops the motor. Thus the motor compressor unit is operated intermittently to normally maintain the temperature of the cooling unit between predetermined temperature limits.

In order to provide for adjustably shifting the normal temperature range to be automatically maintained, a compression spring 61 is interposed between the movable end of the toggle switch lever arm 44 and a stationary stop 62. The stop 62 is adjustably supported on one end of a screw threaded shaft 63 which screws through a suitable threaded aperture in a stationary bracket 64. The other end of the shaft 64 may carry a knurled knob 65, and the stop 62 may carry a pointer 66 adjacent a stationary scale 67 to facilitate adjusting for the desired temperature. The scale 67 may have numerical designations to indicate the various temperature ranges of adjusted operation and a special designation such as F may be provided to indicate the lowest temperature to which the control may be set for quick freezing. As the knob 65 is turned to select the desired range of temperatures to be maintained the tension on the compression spring 61 is varied, and the operation of the thermal switch automatically controls the compressor unit to maintain the desired temperatures.

In order to provide for freezing in the shortest possible time, when the controller is adjusted to its extreme position at "F", a pair of suitably insulated contact members 71 and 72 are stationarily mounted in such a position that they will be bridged by the pointer 66, or any other electrically conductive member associated therewith. This shunts the thermal switch and the compressor unit runs continuously. The thermal control switch and the associated elements are preferably mounted upon a suitable supporting structure or panel board 74 as indicated by the dotted lines.

In order to open the shunt circuit after a predetermined time a small electric motor is provided which is preferably a self starting synchronous motor similar to those commonly used in electric clocks. The rotor 82 of the synchronous motor is mechanically connected through a suitable shaft 83 to drive a brush 84 over an arcuate shaped stationary contact member 85. The time interval required to drive the brush 84 around the arcuate contact 85 is so selected, as by interposing suitable gearing, that the continuous running of the compressor for such a time after the evaporator has been cooled to temperature F will freeze the contents of the freezing chamber and will not cause freezing in the storage compartment.

Electrical connections are provided whereby one of the stationary contacts 71 adjacent the pointer 66 is connected to the rotating brush 84 through a conductor 87 and suitable conductive means 88 such as a brush slidably engaging the shaft or a flexible pig tail connection. The stationary winding 91 of the synchronous motor, diagrammatically represented adjacent the rotor, is permanently connected through a conductor 92 to the arcuate shaped contact 85 and on the other side to the conductor 53 and the stationary contact 50 of the thermal switch. The other stationary contact member 72 adjacent the pointer is connected to the movable contact member 49 of the thermal switch through a suitable conductor 94 which may comprise a flexible portion 95 adjacent the movable contact member.

When the rotatable brush 84 engages the arcuate contact 85 and the pointer member 66 bridges the stationary contacts 71 and 72, a shunt circuit is completed around the contacts 49 and 50 of the thermal switch. The shunt circuit may be traced from the line conductor L1 by way of the conductor 53 to the synchronous motor winding 91, thence through the conductor 92 to the arcuate contact member 85, to the rotatable brush 84, thence by way of the conductor 87 to the stationary contacts 71 and 72 which are bridged by the pointer member 66 and by way of the conductor 94 to the movable contact 49 of the thermal switch. This circuit constitutes a shunt around the contacts of the thermal switch and continuously energizes the relay winding R which is connected by conductors 54 and 55 between the movable contact 49 on the thermal switch and the other main line conductor L2. Hence, the compressor motor runs continuously irrespective of whether the thermal switch contacts 49 and 50 are open or closed.

As soon as the contacts 49 and 50 of the thermal switch open when the fast freezing setting has been made and it is desired to have a prolonged freezing cycle, the current from the relay R continues through the shunt circuit and simultaneously energizes the winding 91 of the self starting synchronous motor. When the synchronous motor has driven the brush 84 around to the open portion of the arcuate contact 85, the shunt circuit is broken. This operation de-energizes the relay R and stops the compressor motor in time to avoid freezing the food storage compartment.

The resetting of the timing device is accomplished automatically each time the temperature adjuster 65 and 66 is actuated to the "F" position. This is accomplished by means of a ratchet wheel 101 on the shaft 83 with the rotatable brush 84 which is stepped around by means of a pawl 102 on the pointer member 66. The brush 84 and the ratchet wheel 101 are preferably secured together rigidly and to the shaft 83 through a friction slip connection. When adjusting the pointer 66 to the intermediate temperature positions the pawl 102 is carried out of range of the ratchet wheel 101 and the rotatable brush 84 remains in the open portion between the ends of the arcuate contact member 85. It will be readily understood that shunting contacts 71 and 72 may also be mounted to cooperate with the pointer member 66 at other adjusted positions to vary the operation of the system as desired.

It will be seen that I have provided a simple and safe quick freezing control for refrigerating systems which may be set to cause freezing in the shortest possible time without danger of excessive freezing.

While it is necessary for the purpose of illustration to describe the several disclosed forms of my invention in detail, it will be apparent that the invention is not so limited, and that other forms and applications thereof are embraced within the scope of the appended claims.

I claim as my invention:

1. A refrigerating system comprising in combination a cooling unit, means for circulating refrigerant medium through said cooling unit to

maintain said cooling unit normally between predetermined temperature limits, means for modifying the operation of the first mentioned means so as to maintain a different temperature of the cooling unit, and means rendered operable when said modifying means is actuated for discontinuing the modified operation of the first mentioned means after a predetermined time interval of modified operation.

2. A refrigerating system comprising in combination a cooling unit, means for circulating refrigerant medium through said cooling unit, control means for actuating said first mentioned means to maintain said cooling unit normally between predetermined temperature limits, modifying means for rendering said control means inoperative, and means rendered operable when said modifying means is actuated for restoring said control means to operative control after a predetermined time interval of modified operation.

3. A refrigerating system comprising in combination a cooling unit, means for circulating refrigerant medium through said cooling unit, an electric motor for driving said means, electrical control means for controlling the operation of said motor in accordance with the temperature of said cooling unit to maintain predetermined normal temperature conditions therein, means for modifying the operation of said control means to maintain a different temperature range in said cooling unit, and means rendered operable when said modifying means is actuated for discontinuing the modified operation after a predetermined time interval.

4. In combination a storage compartment, a freezing chamber, a cooling unit for cooling said compartment and said chamber, means for circulating refrigerant medium through said cooling unit to maintain said cooling unit normally between predetermined temperature limits, means for modifying the operation of the first mentioned means to establish a quick freezing temperature in said chamber, and means rendered operable when said modifying means is actuated for discontinuing the modified operation of the first mentioned means after a predetermined time interval of modified operation to avoid freezing in the storage compartment.

5. In combination a storage compartment, a freezing chamber, a refrigerant evaporator for cooling said storage compartment and said freezing chamber, a refrigerant compressor-condenser unit operatively interconnected to said evaporator, control means for actuating said unit in accordance with temperature conditions, modifying means whereby the operation of said control means may be varied to maintain different temperature conditions, and means for restoring said control means to normal control after a predetermined time interval of modified operation.

6. In combination a food storage compartment, a refrigerant evaporator therein enclosing a freezing chamber, a compressor-condenser unit operatively interconnected with said evaporator, a control device for operating said unit to maintain normal temperature conditions in said compartment, manually adjustable means for adjusting said thermostatic control device to vary the normal temperatures maintained in said compartment as desired, associated means actuated by movement of said adjustable means to an extreme adjusted position for operating said unit continuously to cause quick freezing in the freezing chamber and means rendered operative by movement of said adjustable means to its extreme position for interrupting the continuous operation of the unit before freezing is caused in the storage compartment.

7. In combination a food storage compartment, a refrigerant evaporator therein enclosing a freezing chamber, a compressor-condenser unit operatively interconnected with said evaporator, an electric motor for operating said unit, a thermostatic switch for controlling said motor in accordance with the temperature in said compartment, adjustable means for adjusting said switch to maintain various temperatures in said compartment as desired, means associated therewith for completing a shunt circuit around the contacts of said thermostatic switch for quick freezing in the freezing chamber, and means rendered operative by said first means for opening the short circuit before freezing is caused in the food storage compartment.

8. In combination a food storage compartment a refrigerant evaporator enclosing a freezing chamber therein, a compressor-condenser unit operatively interconnected with said evaporator, an electric motor for operating said unit, a thermostatic switch for controlling said motor in accordance with the temperature conditions in said compartment, adjustable means for adjusting said switch to maintain various temperatures in said compartment as desired, contact means adjacent the extreme adjustable position of said adjustable means for completing a shunt circuit around the contacts of said thermostatic switch to actuate said motor continuously and a time switch in said shunt circuit to stop said motor before the temperature in said food compartment is decreased sufficiently to freeze the contents thereof.

9. A refrigerating system comprising in combination a cooling unit, means for circulating refrigerant medium through said cooling unit, an alternating current electric motor for driving said means, control means for controlling the energization of said motor from the alternating current service mains in accordance with the temperature of said cooling unit to maintain a predetermined temperature, modifying means for modifying the operation of said control means to maintain a different temperature condition, a self-starting synchronous motor, an energizing circuit completed therefor when said modifying means is actuated, and means actuated by said synchronous motor for discontinuing the modified operation after a predetermined time interval.

10. A refrigerating system comprising in combination a cooling unit, means for circulating refrigerant medium through said cooling unit, an alternating current electric motor for driving said means, control means for controlling the energization of said motor from the alternating current service mains in accordance with the temperature of said cooling unit to maintain a predetermined temperature, said control means comprising a thermostatic switch, shunting means for closing a shunt circuit around said switch to cause a modified operation, a self-starting synchronous motor in said shunt circuit, and means actuated by said synchronous motor for opening said shunt circuit after a predetermined time.

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