

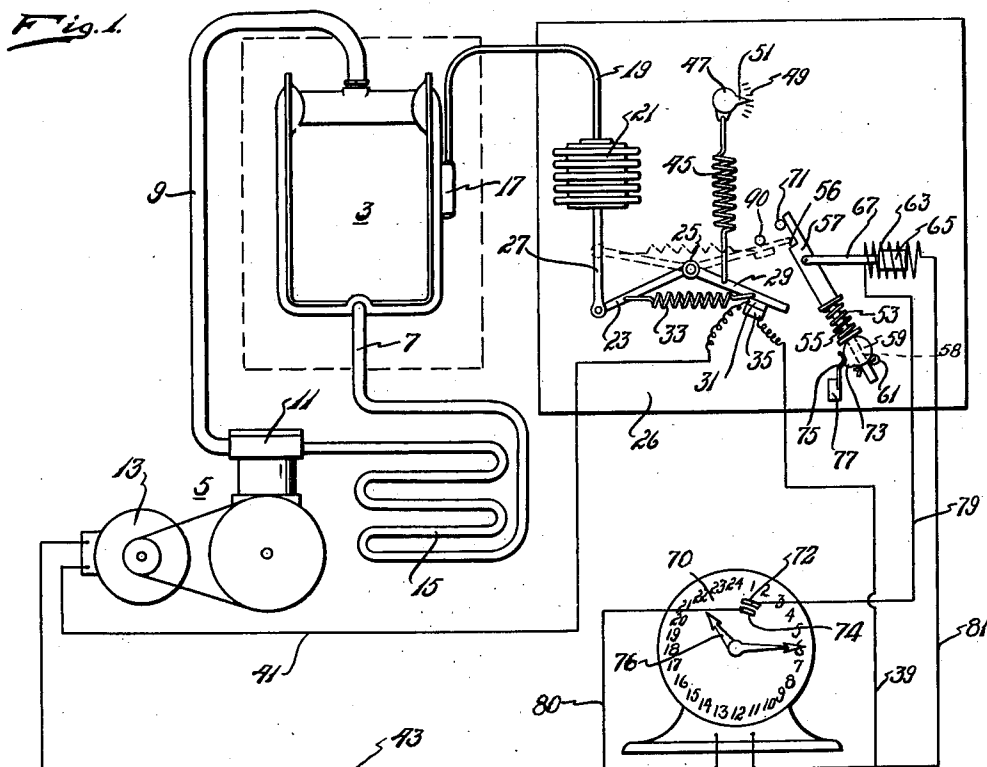
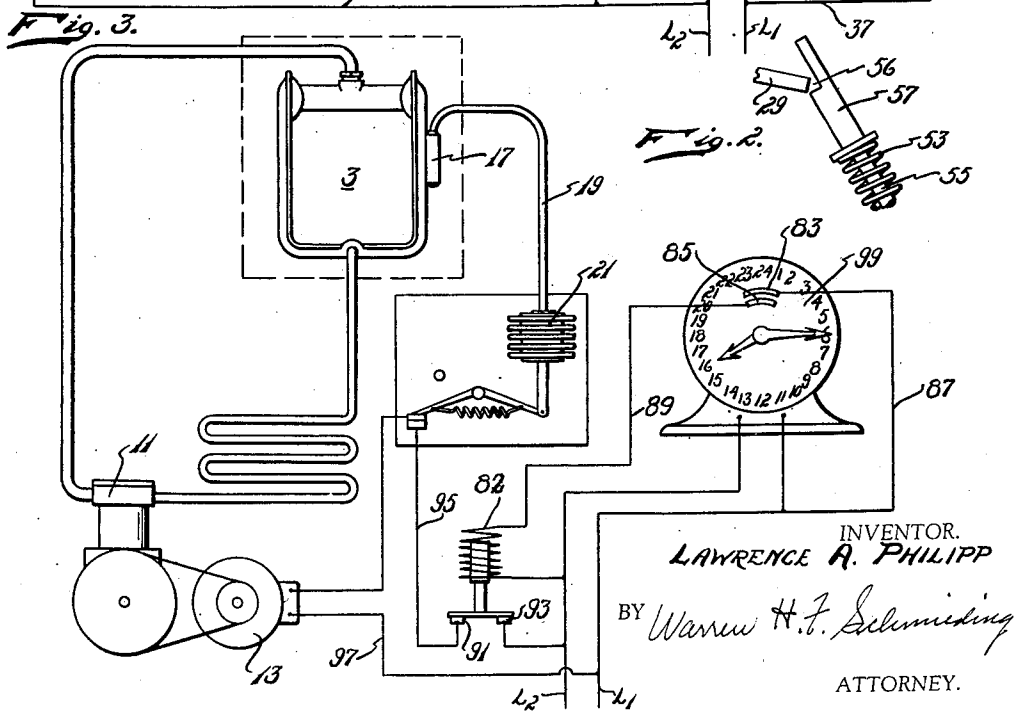
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REFRIGERATING APPARATUS

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REFRIGERATING APPARATUS

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My invention pertains to an automatic temperature control for refrigerating systems and more particularly to automatic means for periodically varying the temperature of the cooling unit to obtain temporarily a different temperature than that normally maintained.

It is an object of my invention to provide a refrigerating system comprising control means for normally maintaining a cooling unit within a predetermined temperature range and associated time measuring means for periodically varying the control means to temporarily establish a temperature differing from the normal temperature.

It is a further object of my invention to provide an automatic refrigerating system with an automatic defroster for periodically varying the range of temperatures normally maintained by the thermostatic control device sufficiently to melt the ice and frost which has accumulated on the cooler unit during the normal operation thereof.

It is also an object of my invention to provide an automatic refrigerating system with a time measuring device arranged to periodically modify the operation of the temperature control to provide periodic defrosting at a time when it will not interfere with the normal use of the refrigerating system.

Another object of my invention is to provide an automatic control for refrigerating systems comprising an electric time measuring device co-operatively disposed with reference to a temperature responsive control whereby the operation of the refrigerating system is conjointly regulated thereby.

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 diagrammatic view representing a refrigerating system arranged in accordance with one form of my invention;

Fig. 2 is a detailed view thereof illustrating the arrangement for restoring the modifying means to unset position when the thermostatic switch operates; and

Fig. 3 is a diagrammatic view representing an automatic refrigerating system provided with another embodiment of my automatic defrosting means.

Referring more particularly to Fig. 1 of the drawing the apparatus comprises a cooling unit

3 through which refrigerant is circulated by suitable refrigerant circulating means. As shown the cooling unit 3 may be an evaporator for vaporizing a volatile refrigerant which is supplied thereto from a compressor-condenser unit 5 through a refrigerant supply conduit 7 and a suction conduit 9 connected therebetween.

The compressor unit 5 may comprise a refrigerant compressor 11 driven by a suitable electric motor 13 for drawing the refrigerant vapor through the suction line 9 from the evaporator 3, compressing it, condensing it, in a suitable condenser 15, and returning it through the refrigerant supply line 7 to the evaporator. A fan (not shown) may be provided adjacent the condenser 15 for circulating the air therethrough in the usual manner to expedite the process of dispersing the latent heat of vaporization from the compressed refrigerant for condensing it to a liquid.

In order to automatically maintain a predetermined temperature in the cooling unit 3 a temperature responsive control device is provided for automatically starting the motor 13 whenever the temperature rises to a predetermined value for introducing liquid refrigerant into the evaporator 3 to lower its temperature. A suitable thermal control device for this purpose may comprise a thermobulb 17 which is disposed adjacent the cooling unit and is filled with an expansible fluid, or a vaporizable liquid, which will expand or vaporize in accordance with the varying temperature to which it is subjected. The thermal bulb 17 is connected through a suitable conduit 19 to an expansible metal bellows 21 for applying the varying pressures set up within the thermobulb to actuate a control device.

As shown the control device actuated by the pressures set up in the thermobulb may comprise a snap acting switch consisting of a lever arm 23 which is pivoted upon a stationary pin 25 at one end with the other end connected through a suitable link 27 to the head of the metal bellows 21. The pivot pin 25 may be secured to a switch panel 26 which serves as a base for supporting the bellows 21 and accessories. A contact lever 29 is also pivoted at one end upon the same stationary pin 25 and carries an electrical contact member 31 which is mounted thereon in suitable insulated relation. A toggle spring 33 is tensioned between the two pivoted levers 23 and 29. In the position shown the toggle spring 33 tends to pull the contact lever 29 downwardly which movement is limited by a stationary contact member 35 which is mounted

on the switch panel and also serves as a back stop. In this position the engaged contact members 31 and 35 complete the energizing circuit for the electrical compressor driven motor 13 thereby causing it to operate the compressor 11 and supply refrigerant to the cooling unit. The motor energizing circuit may be traced from the service line L1 thence by way of conductors 37 and 39, contacts 35 and 31 and thence by a conductor 41 to one side of the motor 13. The other side of the motor is connected to the other line L2 through a suitable conductor 43.

When the continued operation of the compressor causes the temperature of the fluid within the thermal bulb 17 to be lowered sufficiently, the metal bellows 21, is contracted and pulls the actuator lever 23 up into alignment with the contact lever 29 whence the tension of the toggle spring 33 is directed to pull the contact lever 29 upwardly instead of downwardly. As the contact lever 29 moves upwardly the tension of the toggle spring 33 becomes still more effective to accelerate the movement and the lever is snapped upwardly with a sudden movement bringing it sharply into engagement with a stationary stop 90 which limits its upward movement. This operation separates the electrical contacts 31 and 35 thereby stopping the compressor 11.

As the cooling unit 3 no longer receives liquid refrigerant from the condenser its temperature rises and the thermo bulb 17 supplies a gradually increasing pressure to the metal bellows 21. This causes the bellows 21 to expand and lower the interconnected end of the pivoted lever 23 until a position is reached where the tension of the toggle spring is directed to pull the contact arm 29 downwardly. As soon as this position is reached the contact arm 29 is snapped suddenly to its lowermost position, as shown, thereby bringing the electrical contact members 31 and 35 into conductive engagement and restarting the compressor motor. This cycle of operation is repeated thus operating the compressor 11 intermittently to maintain the temperature adjacent cooling unit 3 in predetermined limits.

In order to provide for conveniently adjusting the temperature operating characteristics of the control device, an adjustable biasing means is associated with the toggle switch which comprises a tension spring 45 connected between the contact lever 29 and a manually rotatable adjusting member 47 mounted on the panel 26. The spring 45 tends to bias the contact arm 29 upwardly and thereby opposes the action of the flexible bellows 21 as it expands to snap the switch downwardly.

By turning the rotatable member 47 to pull up the adjacent end of the tension spring 45 and increase the tension it applies to the contact lever 29 the temperature range within which the switch will operate may be raised. A stationary scale 49 is preferably mounted adjacent a pointer 51 projecting from the rotatable member 47 to facilitate the adjustment of the switch to procure the desired temperature operating characteristics.

In order to provide for modifying the normal adjusted operation of the device by a predetermined increment, an auxiliary biasing spring 53 is provided which is a compression spring concentrically disposed on a slidable rodlike element 55. The rod 55 carries a latch 57 on one end and slides freely through a guide aperture 59 in a guide post 59. The auxiliary biasing spring normally tends to slide the latch away from the guide post 57 and its movement in this direction is limited by a cotter pin 61 in the outer end of the

slide rod 55. The slide rod 55 is preferably square or non-circular in cross section to prevent rotation in the corresponding guide aperture in the guide post 59. The guide post 59 is rotatably secured in the switch panel 26 whereby the slide rod 55 may be rotated to move the latch 57 toward the end of the contact lever 29.

In order to provide cooperative engagement between the end of the contact lever 29 and the latch 57, the latch is provided with a notch 56 which slides snugly over the end of the contact lever. For moving the latch 57 to latching position under the end of the contact lever 29 when it is elevated, I provide a solenoid 63 which may be energized in a suitable manner, as will be subsequently set forth. Electromagnetic actuator means associated with the solenoid 63 comprises an armature member 65 therefor which is connected through a suitable connecting rod 67 with the latch member.

When the winding of the solenoid 63 is energized it sets up an electromagnetic field thereby drawing in the armature member 65 which through the connecting rod 67 exerts a thrust upon the latch member 57 turning it toward the contact lever 29 whence the notch 56 in the latch 57 engages the end of the contact lever 29 in close fitting relation immediately, or as soon as it is elevated. The end of the latch member is extended sufficiently to engage a stop pin 71 for limiting its movement toward the contact lever. A cam 73 on the side of the rotatable guide post 59 passes under a stiff flat holding spring 75 supported from a bracket 77 on the panel 26 to hold the guide post in either the set or unset position.

In its latched position the latch applies the tension of the auxiliary biasing spring 53, as a predetermined increment, to aid the tension applied by the adjustable biasing spring 45 thereby raising the temperature limits required to actuate the contact lever 29 to circuit closing position. By properly selecting the auxiliary biasing spring 53 a modified temperature operation is obtained which causes the cooling unit temperature to rise sufficiently to completely melt off the accumulated ice and frost before the switch closes to start the compressor motor.

After the temperature modifying latch 57 has been set, the next operation of the switch restores it to its unset position. As clearly shown in Fig. 2, as the contact lever 29 rotates downwardly the end thereof assumes a position where the lower edge of the end of the contact lever 29 is turned away from the surface of the notch 56. After this position is attained, the latch member 57 is snapped quickly away from the end of the contact lever 29 by the tension stored in the auxiliary biasing spring 53 thereby restoring the modifying means to unset position and restoring normal operation of the thermal switch.

In order to automatically defrost the cooling unit at regular intervals and at times so selected that the normal use of the refrigerating system will not be adversely interrupted, I prefer to energize the winding of the latch solenoid 63 by means of a time measuring device. Such a device may comprise a suitable clock mechanism which may be either mechanical or electrical, but I prefer to utilize an electric clock mechanism 70 which may be energized for continuous operation by connecting it permanently to the service lines L1 and L2 from which the compressor motor is intermittently energized.

Contact means 72 and 74 are provided on the

clock 70 to be closed periodically, as once in each 24 hour period, although a period such as once in 48 hours or any other desired period may be arranged by mounting the electrical contact members adjacent a suitable element of the clock. As shown a 24 hour clock is provided, and the contacts 72 and 74 are disposed adjacent one of the movable hands 76 of the clock for conductive engagement thereby. One side of the latch solenoid 63 is connected by a conductor 79 through the clock operated contacts 72, 74 and thence through a suitable conductor 80 to the conductor 43 and thence to the service line L2. The other side of the solenoid 63 is connected directly to the other service line L2 through conductors 81 and 37 whereby the solenoid 63 will be energized through the clock actuated contacts to modify the normal temperature control and defrost the cooling unit of the refrigerator.

By selecting a suitable time for the defrosting operation as for example at 12 o'clock at night, or at one or two o'clock in the morning the refrigerator is automatically defrosted at a time when its normal utility is not seriously interrupted. Furthermore, by defrosting regularly at frequent intervals only a small quantity of frost and ice accumulates on the cooling unit. Consequently the defrosting period is not necessarily extended over a very long period of time and the operating efficiency of the refrigerator is but very slightly affected either by the accumulation of the frost and ice, or the operation of defrosting.

In accordance with another embodiment of my invention a delicate clock operated contact is utilized for defrosting any automatic refrigerator. This is accomplished by providing a relay, or an electromagnetic switch, the electromagnetic winding 82 of which is energized through clock controlled contacts 83 and 85 through a series circuit from the service line L1, conductor 87, through the clock contacts, thence by a conductor 89 to the relay winding 82 and to the other line conductor L2. The thermostatically controlled circuit of the refrigerator which is to be automatically defrosted extends through back contacts 91 and 93 on the relay which close the refrigerator circuits 95 and 97 for normal operation when the relay winding 81 is unenergized. When the relay winding 82 is energized, its armature pulls up thereby opening its back contacts 91 and 93 and thus interrupting the energizing circuit of the refrigerator.

By providing contacts 83 and 85 of suitable length adjacent the hands or other elements of the electric clock mechanism 99 the relay winding is energized thereby interrupting the normal operation of the refrigerator compressor for a period of time, sufficient to provide for defrosting the cooling unit.

It will be seen that I have provided an automatic defrosting refrigerator system which is of simplified construction and which automatically defrosts the refrigerator periodically, thereby maintaining the amount of accumulated ice and frost at a minimum and preserving the maximum efficiency of the refrigerator at all times with a minimum of interference with the normal utility of the system.

Aside from the specific embodiments of the invention herein shown and described, it will be understood that numerous details of the construction may be altered or omitted without departing from the spirit and scope of the invention as disclosed and claimed, and that I do not

desire to limit the invention to the exact constructions herein set forth.

I claim as my invention:

1. In combination in a refrigerating system, a cooling unit, means for circulating a refrigerant therethrough, a thermostatic control for operating said refrigerant circulating means, electromagnetic means for modifying the operation of said thermostatic control, and a time measuring device for periodically rendering said electromagnetic means operative.

2. In combination in a refrigerating system, a cooling unit, means for circulating a refrigerant therethrough, an electrical circuit for operating said refrigerant circulating means, a temperature responsive means for normally controlling the circuit, an electro-magnetic means disposed to modify said temperature means for cooperatively controlling the circuit with the temperature means, and a time-measuring device for periodically rendering said electro-magnetic means operative.

3. In combination in a refrigerating system, a cooling unit, means for circulating refrigerating medium through said unit and operable to maintain said unit normally between predetermined temperature limits, an electric circuit for said first means, electromagnetically operated means for controlling the electric circuit for causing a different temperature in the cooling unit, and a time measuring device for periodically rendering said electromagnetically operative means operable.

4. In combination in a refrigerating system a cooling unit, means for circulating a refrigerant therethrough, an electrical circuit for actuating said circulating means, a thermostatic switch for controlling said circuit and said refrigerant circulating means to maintain a normal temperature range, an electromagnetic switch having its circuit controlling contacts connected to said circuit to render said thermostatic switch ineffective, and a time measuring device for periodically rendering said electromagnetic switch operative to cause an abnormal temperature condition.

5. In combination in a refrigerating system, a cooling unit, means for circulating refrigerant therethrough, an electrical circuit for actuating said circulating means, a thermostatic switch for controlling said circuit and said refrigerant circulating means to maintain a normal temperature range, an electromagnetic switch having back contacts connected in series relation with the thermostatic switch; an electrical time measuring device for periodically rendering said electromagnetic switch operable to cause an abnormal temperature condition.

6. In combination a cooling unit, means for circulating a refrigerant therethrough, a thermostatic switch responsive to temperature conditions maintained by said cooling unit for actuating said refrigerant circulating means to maintain a normal range of temperatures, modifying means adapted to be set for varying the operating characteristics of said thermostatic switch to establish an abnormal temperature condition, an electromagnet for moving said modifying means to set position, means actuated by the operation of said thermostatic switch in response to said abnormal temperature condition for restoring said modifying means to unset position, and a time measuring device for periodically rendering said electromagnet operative.

7. In combination a cooling unit, means for circulating a refrigerant therethrough, a thermo-

static switch responsive to temperature conditions maintained by said cooling unit for actuating said refrigerant circulating means to maintain a normal range of temperatures, modifying means adapted to be set for raising the temperature response characteristic of said thermostatic switch to establish an abnormally high temperature condition in said cooling unit to melt the accumulated ice and frost therefrom, an electromagnet for moving said modifying means to set position, a time measuring device for periodically rendering said electromagnet operative, and means actuated by the operation of said thermostatic switch in response to said abnormally high temperature condition for restoring said modifying means to unset position.

8. In combination in a refrigerating system, a cooling unit, means for circulating refrigerant therethrough, an electrical circuit for controlling said refrigerant circulating means, temperature responsive regulating means in said circuit for regulating the operation of said circulating means, adjustable means for modifying the operating characteristics of said regulating means, means for varying the operating characteristics

of said regulating means by a predetermined step comprising electromagnetic actuating means, and time measuring means for rendering said electromagnetic means operative.

9. A refrigerating system controller comprising a thermostatic switch, manually adjustable means for modifying the operating characteristics of said switch, means for modifying the operating characteristics of said switch by a predetermined step and electromagnetic means for setting the same, said second means being associated with said switch for automatic resetting in response to a single modifying operation of the switch.

10. A refrigerating system controller comprising a thermostatic switch, means for modifying the operating characteristics of said switch and electromagnetic means for setting the same, said means being associated with said switch for automatic resetting in response to a single modifying operation of the switch, and time measuring means for rendering said electromagnetic means operative.

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