Oct. 30, 1934. E. G. GAYNOR 1,979,103

AUTOMATIC CONTROL FOR REFRIGERATORS, ETC

Filed Dec. 19, 1931 2 Sheets-Sheet 1

Fig. 1.

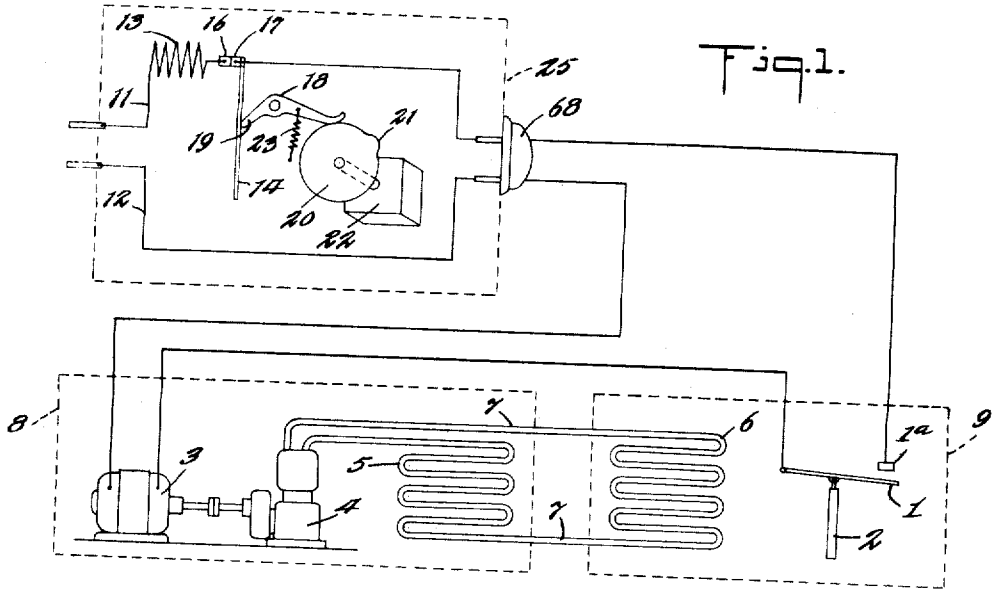


Fig. 2.

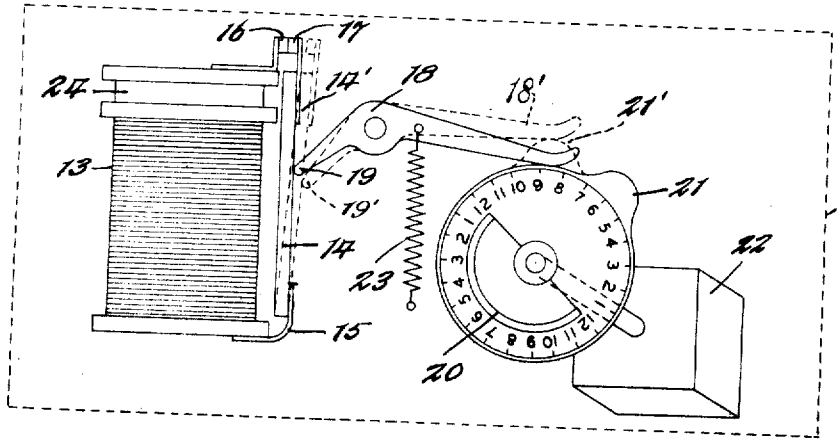


Fig. 3.

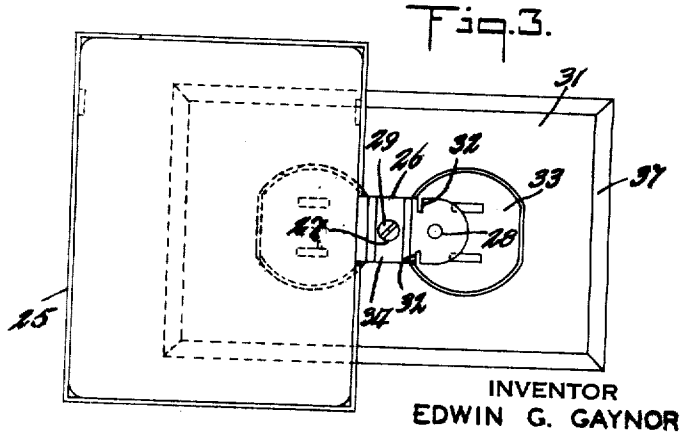
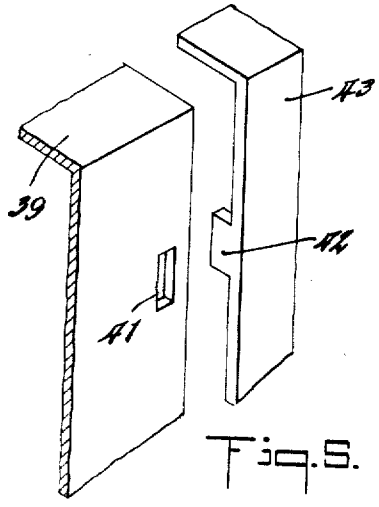


Fig. 5.



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AUTOMATIC CONTROL FOR REFRIGERATORS, ETC

Filed Dec. 19, 1931 2 Sheets-Sheet 2

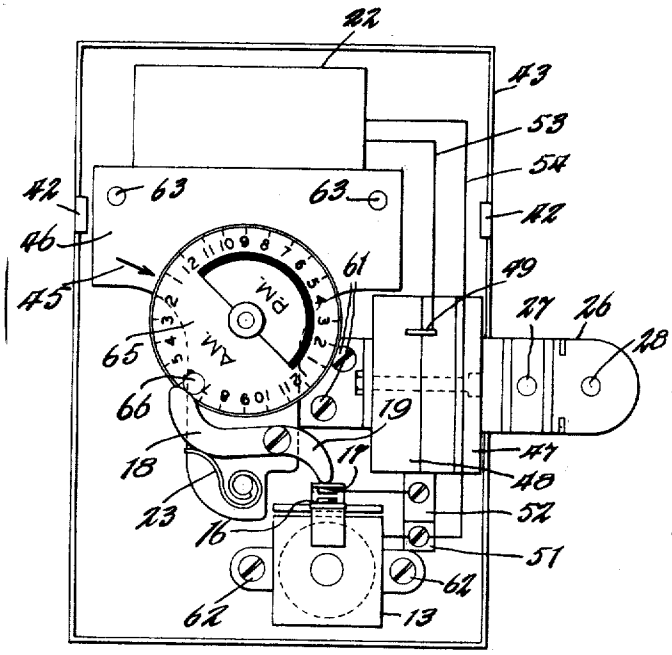


Fig. 6

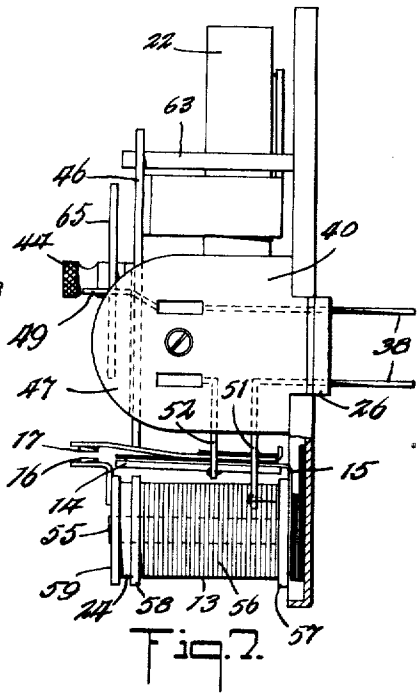


Fig. 7.

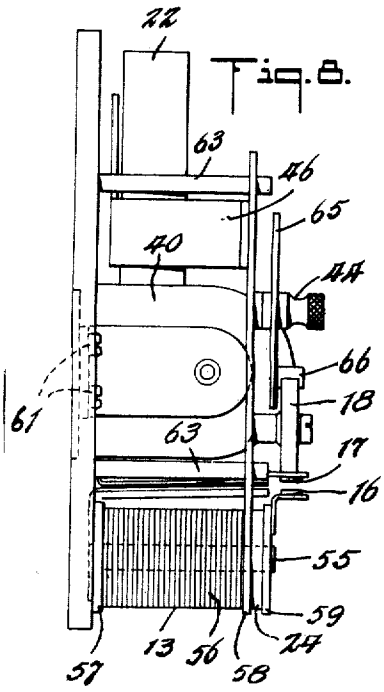
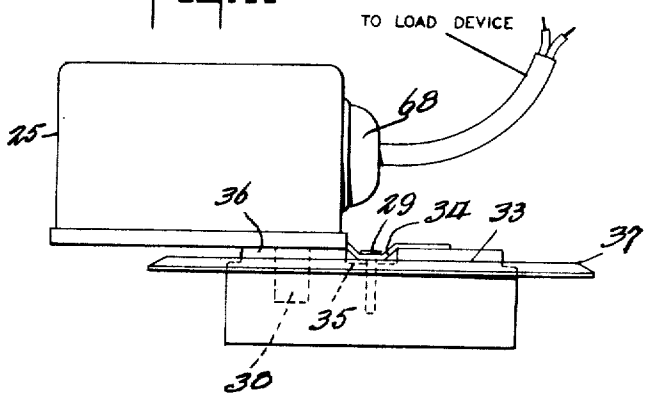


Fig. 8.

Fig. 4.



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UNITED STATES PATENT OFFICE

1,979,103

AUTOMATIC CONTROL FOR REFRIGERATORS, ETC.

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Application December 19, 1931, Serial No. 582,081

20 Claims. (Cl. 62—4)

This invention relates to refrigerator control systems, particularly to systems adapted to supplement the normal control means, and has for its principal object to provide a defrosting system wherein the actual duration of a selected defrosting interval is automatically varied in accordance with the requirements of the refrigerator, instead of being arbitrarily fixed for a definite period of time, as in the usual defrosting device.

Another object of the invention is to provide a simple, efficient and economical defroster which may be applied as a unit to existing refrigerators without otherwise changing their construction.

A still further object is to provide a rugged and comparatively inexpensive self-contained device that can be plugged manually into the customary service outlet and is adapted to receive the usual conductor plug leading from the refrigerator, and which will operate without further attention.

Still another object is to provide a means of permanently mounting the defroster unit on the service outlet.

In refrigerators cooled by a refrigerant passing through a metal coil or other cooling unit, which absorbs heat from the surrounding air, dew forms on the cooling coil when it is in operation. In refrigerators with ice drawers, water is present on the sides and bottom of the drawers and drawer frame, due to water splashing over when the drawers are inserted in the frame. If the refrigerant is cold enough, the dew and water will freeze and in time coat the coil and drawer with ice. Since ice is a poor conductor of heat, it impedes the transfer of heat from the surrounding air to the coil, and consequently lowers the efficiency of the refrigerator. When the coil is coated with ice, the refrigerant has to be worked at a higher intensity, or for a longer time, or both, to achieve the same drop in temperature in the media to be cooled, as is obtained without the ice coating.

The ice may be removed by shutting off the refrigerant, in which case it will gradually melt from the heat in the surrounding media. This is the method heretofore advised and commonly used in household and small commercial refrigerators. Again, the ice may be removed by reversing the action of the cooling coil and making it radiate heat outwardly to melt the ice. This latter method is commonly used in commercial cold storage plants.

My invention provides a defroster which may be used in all types of domestic and commercial intermittently acting refrigerators, cold storage plants and the like, and which performs automatically and with due regard to particular thermal requirements the manual operation referred to above.

Heretofore, automatic operation has been performed by time switches, which open a circuit, dead or alive, at a certain time, and in like manner, close it at the end of a fixed interval. Such switches are comparatively expensive, and require comparatively powerful clock movements to operate switches sufficiently rugged and strong to open circuits carrying motors under load or receiving initial starting inrushes.

According to the present invention, a cut-out, combining both mechanical and electro-magnetic action, opens a dead motor circuit during a fixed and periodic interval, thereby preventing circulation of the refrigerant for that interval. Preferably, this condition occurs daily, and at any desirable time, and is of sufficient average duration to defrost the coils, keep the ice drawers and the drawer frame reasonably free of ice, and yet not long enough to allow the refrigerator temperature to rise too high or the ice cubes to melt.

Referring now to the drawings, Fig. 1 is a diagrammatic representation of an embodiment of the invention,

Fig. 2 is an elevational view of the defrosting unit,

Fig. 3 is a side view of the defroster unit inserted in a duplex service outlet,

Fig. 4 is a plan view of the defrosting unit inserted in a duplex service outlet,

Fig. 5 is an elevational view showing a side and the base disconnected from each other,

Fig. 6 is a side view of the defroster unit with the cover removed,

Fig. 7 is an elevational view of the cut-out and current tap, and

Fig. 8 is an elevational view of the frame structure of the defrosting unit.

In the drawings, the switch 1 and contact 1a are of the type usually employed in domestic refrigerators, and are operated by any suitable control such as the thermostat 2. The switch 1 is operated intermittently, that is, periodically or aperiodically, and serves to operate the motor 3 which actuates the compressor 4 and controls the circulation of cooling fluid through condenser 5, cooling unit or coil 6, and connecting pipes 7. Preferably, the motor, compressor and condenser are located in a compartment 8, and the cooling coil, thermostat and switch are located in a compartment 9.

The conductors 11 and 12 are connected to any

suitable source of current, such as the house current. In series with the conductor 11, is a cut-out 13, having an armature 14 and armature spring 15. Contacts 16 and 17 are supported by the upper face of the cut-out and the armature respectively. A pivoted follower 18, has an arm 19 normally pressing against armature 14, closing contacts 16 and 17. A rotatable cam 20, or a wheel carrying a cam, and having an extending portion 21, is rotated by a clock, motor or other periodic device 22, the cam preferably making one revolution in twenty-four hours.

When the intermittently operated switch 1 is closed it completes a circuit from conductor 12, motor 3, switch 1 and contact 1*a*, contacts 17 and 16, energized cut-out 13, to return conductor 11, and the motor 3 will cause a circulation of the cooling fluid through the cooling unit 6.

As the cam 20 rotates, and when extending portion 21 comes in contact with the follower 18, as shown by 21′ and 18′, the follower is lifted against the action of spring 23 and arm 19 is drawn away from armature 14. However, cut-out 13 remains energized, armature 14 remains attracted and the cooling fluid will continue to circulate.

If switch 1 opens while the extending portion 21 is in contact with the follower 18, or if the switch is open when the extending portion first contacts with the follower, the motor 3 will be inoperative and armature spring 15 will cause armature 14 to separate contacts 16 and 17, as shown by 14′, so that while the follower is raised, the closing of switch 1 will not complete the circuit. In this case, the circuit will again be completed only when switch 1 is closed and when the extending portion 21 is no longer in contact with the follower.

It is therefore obvious that defrosting will be effected only when switch 1 is open and when extending portion 21 raises the follower, and will depend on the length of the extending portion. The length of time that the extending portion raises the follower will be hereinafter referred to as the defrosting interval.

This defrosting interval is fixed, but as the cut-out is free to open the circuit only when switch 1 is open and the motor is dead, it follows that defrosting may not occur during the entire defrosting interval. If the motor is running during the entire defrosting interval, as for example if the refrigerator is set for extra cold, defrosting will not be effected. If the refrigerator is unduly warm, defrosting will be unnecessary. A defrosting interval is therefore selected which is an approximation of all possible conditions and which gives average defrosting. This defrosting interval is selected as the result of experience and preferably the length of the extending portion 21 should be such as to give a defrosting interval of about 1½ hours.

Defrosting according to this invention allows the small amount of ice formed on the cooling unit, drawers, and drawer frame to vaporize into the surrounding air, thereby eliminating the need of a drip pan, and allowing more space for the food products.

Should alternating current be used, shading coil 24 and the pressure of arm 19 against armature 14 tend to reduce the alternating current hum to which the cut-out is subjected.

The cut-out and cam with its operating mechanism may be built in the refrigerator, or may be enclosed in a housing 25 of metal or other material and mounted on a service outlet plate. Housing 25 has a tab 26 integral with the base in which are two holes 27 and 28 spaced so that hole 27 may engage the plate holding screw 29 of a duplex service outlet 31, and hole 28 the plate holding screw of a single service outlet (not shown). The tab is slotted at 32 so as to allow the unused portion of the tab to be broken off when the duplex mounting is used. If the unused portion of the tab were not removed, access to the unused outlet 33 would be prevented. The tab has an offset 34 which permits the tab to conform to the depression 35 between the female members 33 and 36 of the outlet. The offset 34 permits the holding screw 29 to force and hold the outlet plate 37 firmly against the wall, thereby improving the general appearance.

The housing is provided with two metallic pins 38 similar to those projecting from the ordinary attachment plug cap and with a service outlet or current tap 40 adapted to receive the plug cap at the end of the refrigerator cord.

Immediately preceding or after the defroster unit is plugged into the service outlet, the cover of the defroster may be removed by pressing the sides 39, thereby releasing the mortises 41, from the bent tenons 42 of the base 43, exposing the defroster mechanism, and permitting adjustment of the rotatable cam 20 so that defrosting will take place at any desired time of the day or night, but preferably at midnight.

The cam 20 is graduated along its edge into twenty-four parts, corresponding to a. m. and p. m. hours. The cam 20 is adapted to be rotated by knurled knob 44, permitting any desired number to be placed opposite pointer 45, which is etched in frame 46, or raised therefrom by any suitable means. To control the time of defrosting, the number on the cam corresponding to the time of day, is brought opposite pointer 45. For example, if the defrosting unit is inserted in the service outlet at 3 p. m., the cam 20 is rotated by knob 44 until 3 p. m. on the cam is opposite pointer 45, and defrosting will occur at midnight.

Another important feature of the above arrangement resides in the ability to control the time of defrosting, even though the house current has failed or the refrigerator has not been in use for a considerable period of time. When the house current resumes its flow, or when it is again desired to place the refrigerator in operation, the cover of the defrosting unit is removed and the cam is rotated as described above.

According to the preferred form of my invention, the current tap or service outlet 40 of the defroster unit comprises two cast insulating blocks 47 and 48 (Fig. 6 and Fig. 7), between which is sandwiched a blade 49 extending from about ¾″ below the blocks to about ⅜″ above the blocks. To this blade is attached a resilient member, not shown, to receive a blade of a plug. A second blade 51 is bent to project to the left of the blocks, and a similar blade 52 carries a resilient member, not shown, to receive the other blade of a plug. From blade 49, a lead 53 runs to the periodic device 22 and a second lead 54 runs from periodic device 22 to blade 51. Between the periodic device and the cam 20 is the conventional train of gears.

The cut-out comprises a core 55, a winding 56 of about 110 turns of .047″ copper wire, a lower pole piece 57, an intermediate pole piece 58, a copper washer or shading coil 24, an upper pole

piece 59, contacts 16 and 17, armature 14, armature spring 15 and the necessary insulation.

The action of the shading coil is as follows: That portion of the flux incident to a half cycle of alternating current which does not follow the shortest path from the core 55 through the pole piece 58, armature 14 and pole piece 57, but which goes from the core 55, through pole piece 59, causes a current to be set up in the shading coil 24, which current is out of phase with the line. This current sets up a flux, whose circuit is the upper portion of the core, pole piece 59, armature 14, and pole piece 58. I have found that under certain conditions, this flux is sufficient to hold the armature during that period of the current cycle when the flux in the greater magnetic circuit has practically vanished. These certain conditions are that the armature rest against the pole piece 59, that the pole piece 58 be from .001" to .005" from the adjacent surface of the armature, and that an adjustable distance be provided between the armature and the pole piece 57. I allow for this adjustment between the armature and pole piece 57 by suspending the armature on the armature spring 15, which is clamped between the pole piece 57 and the cut-out support. A feeler is inserted between the pole piece 57 and armature 14, and the three are squeezed while the cut-out is clamped firmly to its support.

The unit construction of the device is a feature that provides ease of assembly and low cost. In assembling the unit, the current tap 40, a unit by itself is bolted into holes in the base 43, by means of bolts 61. The cut-out, also a complete unit, is bolted lightly into holes in the base by means of bolts 62. Alternating current of from one-fourth to four times the amount which the coil 56 will be expected to handle is then run through the coil, and the feeler, which substantially prevents A. C. hum, is then selected. The feeler is then squeezed between the pole piece 57 and armature 14 and the cut-out is securely bolted.

The periodic device 22 and follower 18 are a unit and are slipped over three supporting posts 63 and held in position by means of soft rubber bushings between the frame 46 and the posts 63, according to regular clock practice.

It is, of course, obvious that the metallic pins and the service outlet may be conveniently spaced on either the face or any side of the housing and that the housing need not be mounted on the service outlet plate, but may be placed in any convenient position and connected to the house service outlet by means of an extension cord.

It is also obvious that the cam 20 may be rotated at any desirable speed and may contain more than one extending portion, and instead of an extending portion 21, a circular disc 65 with a cam 66 (Fig. 6 and Fig. 8) may be used, in which case the follower 18 will not rest upon the disc, but will periodically rest upon the cam 66.

It is also obvious that a notched wheel may be substituted for the cam, or wheel carrying the cam.

It will be evident that the invention is capable of various modifications and adaptations without departing from the scope and spirit of the invention as defined in the appended claims.

The invention claimed is:

1. In combination, a refrigerator having a cooling unit, an electrical circuit including a motor for supplying refrigerant to said unit, a pair of switches in said circuit, temperature controlled means for opening and closing one of said switches to provide "off" and "on" periods of refrigeration, time controlled means for opening and closing the second switch to provide a defrosting interval, and means for preventing said second switch from opening when the first switch is closed.

2. In combination, a refrigerator having a cooling unit, an electrical circuit including a motor for supplying refrigerant to said unit, a thermostatically operated switch for opening and closing said circuit to provide "off" and "on" periods of refrigeration, a cut-out having an energizing winding, an armature and a cooperating contact in circuit with said motor, and a periodically operated device normally acting on said armature in a direction to close said contact and adapted when operated to release said armature and permit it to open said contact when said circuit is opened by said switch.

3. In combination, a refrigerator having a cooling unit, an electrical circuit including a motor for supplying refrigerant to said unit, a thermostatically operated switch for opening and closing said circuit to provide "off" and "on" periods of refrigeration, a cut-out having an energizing winding, an armature and a cooperating contact in circuit with said motor, an actuating member acting on said armature in a direction to close said contact, and a rotatable cam having means for periodically releasing said actuating member from said armature to permit said armature to open said contact when said circuit is broken by said switch.

4. In combination, a refrigerator having a cooling unit, an electrical circuit including a motor for supplying refrigerant to said unit, a thermostatically operated switch for opening and closing said circuit to provide "off" and "on" periods of refrigeration, a cut-out having an energizing winding, an armature and a cooperating contact in circuit with said motor, an actuating member acting on said armature in a direction to close said contact, a rotatable cam having means for periodically releasing said actuating member from said armature to permit said armature to open said contact when said circuit is broken by said switch, means for rotating said cam during a definite time cycle, and means for adjusting said cam to vary the time of operation of said actuating member.

5. An automatic refrigerator comprising a cooling unit, means normally controlling the circulation of a refrigerant in said unit, means for limiting the operation of said normal control means for a selected period, and means responsive to an operative condition of said normal control means for limiting the duration of said period.

6. An automatic refrigerator comprising a cooling unit, means normally controlling the circulation of a refrigerant in said unit, means for limiting the operation of said normal control means for a selected period, and means responsive to an operative condition of said normal control means at the beginning of said selected period for limiting the duration of said period.

7. An automatic refrigerator comprising a cooling unit, thermally actuated means for controlling the flow of a refrigerant in said unit, a chronometric device for limiting the operation of said thermally actuated means for a selected period, and means determined by the length of the period selected and by an operative condition of

said thermally actuated means for limiting the duration of said period.

8. An automatic refrigerator comprising a cooling unit, means normally controlling the circulation of a refrigerant in said unit, means for limiting the operation of said normal control means for a selected period, and means for limiting the duration of the period selected.

9. An automatic refrigerator comprising a cooling unit, means normally controlling the circulation of a refrigerant in said unit, means for limiting the operation of said normal control means during a selected period, and means for limiting the operation of said limiting means.

10. An automatic refrigerator comprising a cooling unit, means normally controlling the circulation of a refrigerant in said unit, means for limiting the operation of said normal control means during a selected period, and means for delaying the operation of said limiting means.

11. An automatic refrigerator comprising a cooling unit, means normally controlling the circulation of a refrigerant in said unit, means for limiting the operation of said normal control means during a selected period, and means responsive to an operative condition of said normal control means for rendering said limiting means ineffective.

12. An automatic refrigerator comprising a cooling unit, means normally controlling the circulation of a refrigerant in said unit, a device for limiting the operation of said normal control means for a selected period, means for delaying the operation of said limiting device and means for restoring the control of said cooling unit to said normal control means at the end of said period.

13. The combination with a refrigerator comprising a cooling unit and having a motor and a temperature responsive switch normally controlling the circulation of a refrigerant in said unit, of means rendering said normal control means temporarily ineffective, said means comprising a second switch in circuit with said motor and said first mentioned switch, time controlled means for opening and closing said second switch and means holding said second switch closed when said first switch is closed.

14. The combination with a refrigerator comprising a cooling unit and having a motor and a temperature responsive switch normally controlling the circulation of a refrigerant in said unit, of means rendering said normal control means temporarily ineffective, said means comprising a second switch, biased to open, in circuit with said motor and said first mentioned switch, time controlled means for opening and closing said second switch, and a cutout for holding said second switch closed when said first switch is closed.

15. The combination with a refrigerator comprising a cooling unit and having a motor and a temperature responsive switch normally controlling the circulation of a refrigerant in said unit, of means rendering said normal control means temporarily ineffective, said means comprising a second switch having contacts in circuit with said motor and said first mentioned switch, an armature for biasing one of said contacts, time controlled means for opening and closing said second switch, and a cutout for holding said second switch closed when said first switch is closed.

16. The combination with a refrigerator comprising a cooling unit and having a motor and a temperature responsive switch normally controlling the circulation of a refrigerant in said unit, of means rendering said normal control means temporarily ineffective, said means comprising a second switch having contacts in circuit with said motor and said first mentioned switch, an armature for biasing one of said contacts, a follower associated with said armature, time controlled means for opening and closing said second switch, and a cutout for holding said second switch closed when said first switch is closed.

17. The combination with a refrigerator comprising a cooling unit and having a motor and a temperature responsive switch normally controlling the circulation of a refrigerant in said unit, of means rendering said normal control means temporarily ineffective, said means comprising a second switch having contacts in series with said motor and said first mentioned switch, an armature for biasing one of said contacts, a follower associated with said armature, a time controlled cam associated with said follower, and a cutout for holding said second switch closed when said first switch is closed.

18. The combination with a refrigerator comprising a cooling unit and having a motor and a temperature responsive switch normally controlling the circulation of a refrigerant in said unit, of means rendering said normal control means temporarily ineffective, said means comprising a cut-out having an energizing winding, an armature and a cooperating contact adapted to be connected in series with said motor and temperature responsive switch, and a time controlled device acting on said armature in a direction to close said contact and adapted to release said armature and permit it to open said contact when said winding is deenergized.

19. The combination with a refrigerator comprising a cooling unit and having a motor and a temperature responsive switch normally controlling the circulation of a refrigerant in said unit, of means rendering said normal control means temporarily ineffective, said means comprising a cut-out having an energizing winding, an armature and a cooperating contact adapted to be connected in series with said motor and temperature responsive switch, an actuating member acting on said armature in a direction to close said contact, and a rotatable cam having means for periodically releasing said actuating member from said armature to permit said armature to open said contact when said winding is deenergized.

20. The combination with a refrigerator comprising a cooling unit and having a motor and a temperature responsive switch normally controlling the circulation of a refrigerant in said unit, of means rendering said normal control means prising a cooling unit and having a motor and a cut-out having an energizing winding, an armature and a cooperating contact adapted to be connected in series with said motor and temperature responsive switch, an actuating member acting on said armature in a direction to close said contact, a rotatable cam having means for periodically releasing said actuating member from said armature to permit said armature to open said contact when said winding is deenergized, means for rotating said cam during a definite time cycle, and means for adjusting said cam to vary the time of operation of said actuating member.

EDWIN G. GAYNOR.

CERTIFICATE OF CORRECTION.

Patent No. 1,979,103. October 30, 1934.

EDWIN G. GAYNOR.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, line 135, claim 20, strike out the syllable and words "prising a cooling unit and having a motor and" and insert the words temporarily ineffective, said means comprising; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 12th day of February, A. D. 1935.

(Seal)

Leslie Frazer
Acting Commissioner of Patents.