

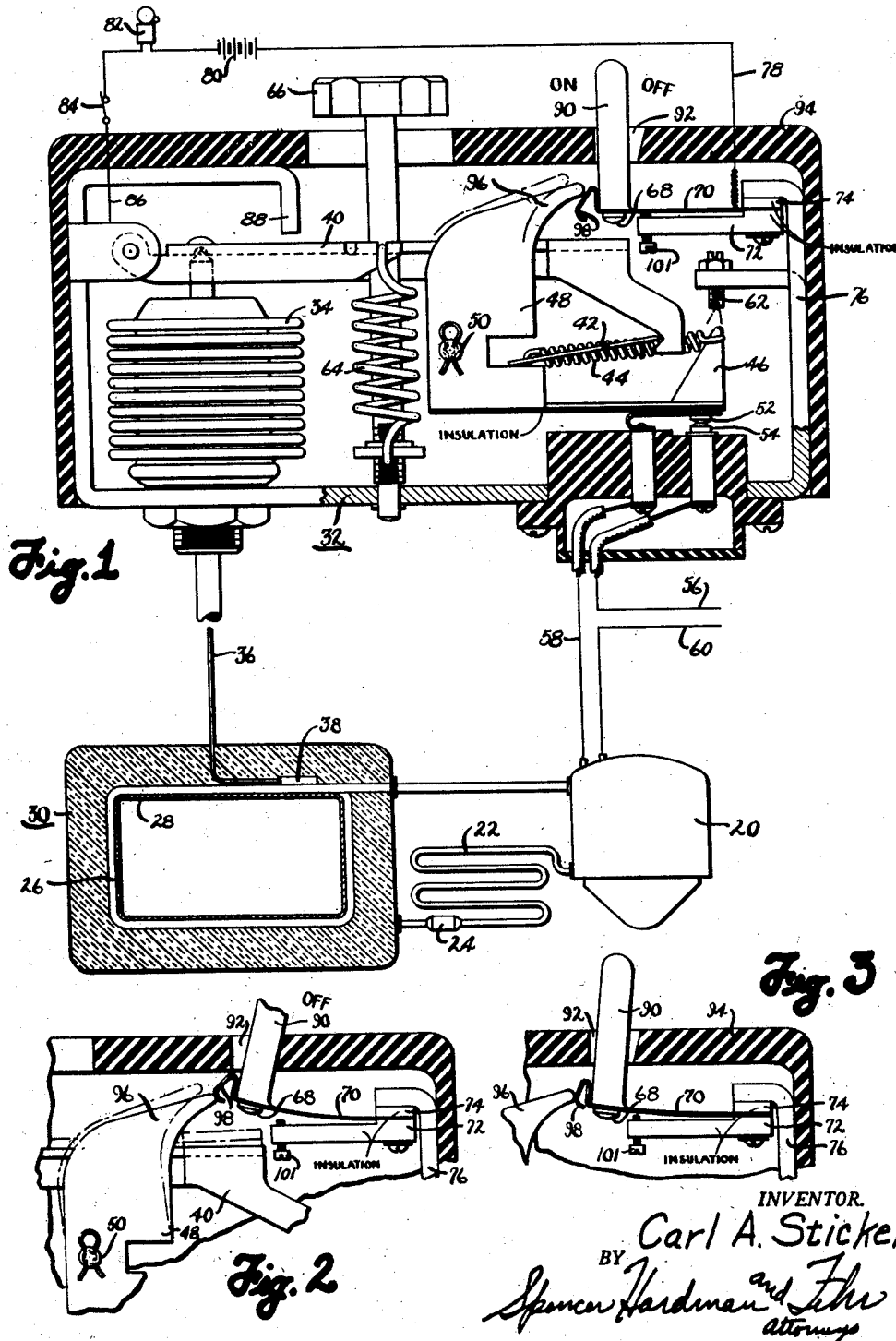
Jan. 9, 1951

C. A. STICKEL
REFRIGERATOR ALARM SYSTEM

2,537,431

Filed Nov. 19, 1946

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

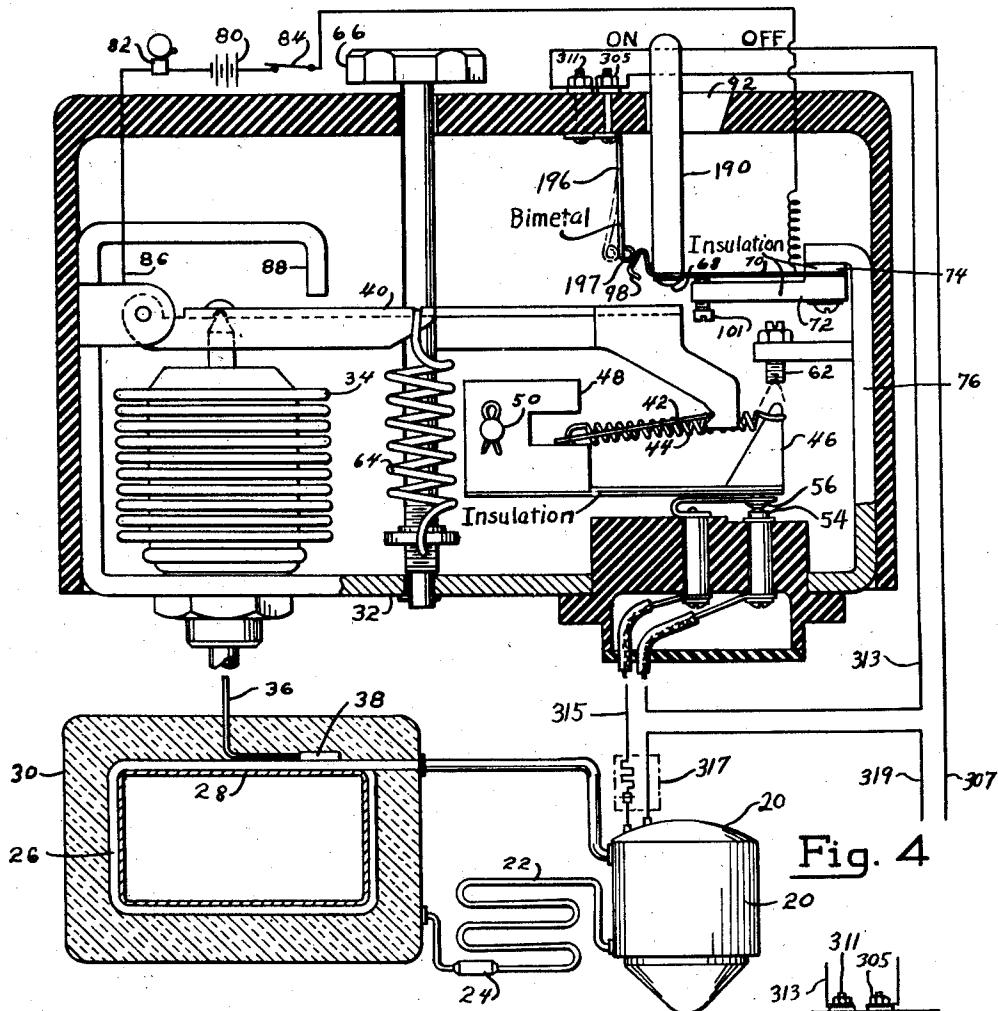


Fig. 4

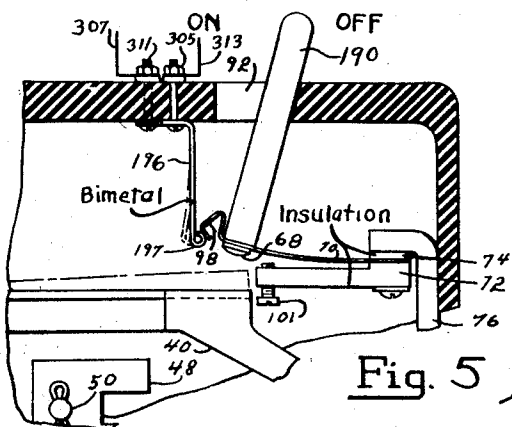


Fig. 5

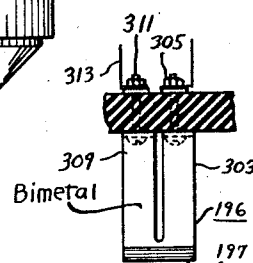


Fig. 6

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UNITED STATES PATENT OFFICE

2,537,431

REFRIGERATOR ALARM SYSTEM

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Application November 19, 1946, Serial No. 710,733

23 Claims. (Cl. 177-311)

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This application is a continuation in part of my copending application S. N. 504,527, filed October 1, 1943, now abandoned.

This invention relates to temperature and/or pressure control devices by which the temperature and/or pressures in any room, compartment, space or system is maintained below or above a certain limit and in which a signal or some other suitable indication is given automatically in case the temperature and/or pressure exceeds the desired limit. Such control device may be used, for example, for refrigerating apparatus, for heating systems, and for pressure systems.

I have chosen to illustrate my invention as applied to a refrigerating system for ice cream and frozen food cabinets wherein it is necessary to prevent the cabinet from warming to such an extent that the frozen products melt. Such cabinets have been provided with signaling devices of various types. The Riley Patent 2,092,085, for example, shows a form of control and signaling device for refrigerators wherein a warning light is lighted whenever the temperature of the cabinet exceeds a certain limit.

It has been found that with such an arrangement either during the initial operation of such apparatus or whenever such apparatus is filled with an unusually large amount of food that the temperature of such cabinet will rise above the desired temperature limit and the signal light will light and remain lighted for comparatively long periods of time until the refrigerating system has operated long enough to cool the contents of the cabinet to the proper temperature. During all of this time the refrigerating system is operating properly and there is no need to call a serviceman. This situation is even more disturbing where an audible device, such as a bell is used as a signaling means. In such a case the bell might ring for periods of nine to ten hours, which would be so disturbing as to preclude the use of an audible signaling device. This also may be sufficient to exhaust the battery power supply normally used to provide a source of power independent of the electrical power supply, since the failure of power supply would be one of the causes for a temperature rise above normal. To disconnect the battery with an ordinary manually operated switch is undesirable since if the switch were opened to prevent operation of the signaling device it is likely that people would forget to reclose the switch.

It is therefore an object of my invention to provide a control for a temperature and/or pres-

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sure controlled signaling device which will render the signaling device inoperative under certain initial conditions under which the proper temperature and/or pressure is not maintained and thereafter be restored automatically to its normal effectiveness upon the restoration of normal conditions.

It is another object of my invention to provide a cycling temperature and/or pressure control with a signaling device which may be manually rendered ineffective and which will remain so until the end of a cycle, after which its effectiveness will be restored automatically.

It is also an object of my invention to provide a signaling system for temperature and/or pressure controls in which audible devices may be used satisfactorily.

It is another object of my invention to provide a control device with an additional control switch which at any time may be rendered ineffective but be rendered effective upon a prescribed operation of the control device.

It is another object of my invention to provide a control for an electrically operated system with a signaling device which may be manually rendered ineffective and will remain so until the supply of electrical energy to the system is interrupted after which its effectiveness will be restored automatically.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a view partly in section of a control for a frozen food refrigerating system provided with a signaling system embodying one form of my invention;

Fig. 2 is a fragmentary sectional view similar to Fig. 1 showing the signaling control held in an ineffective position, while the refrigeration control is in one phase of its operation;

Fig. 3 is a fragmentary sectional view illustrating the moving of the signaling control from one position to another;

Fig. 4 is a view partly in section, of a control for a frozen food refrigerating system provided with a signaling system embodying another form of my invention;

Fig. 5 is a fragmentary sectional view similar to Fig. 4 showing the signaling control held in an ineffective position while electric energy is being supplied to the system; and

Fig. 6 is a fragmentary sectional view showing the detent.

Referring now to the drawings, there is shown in Fig. 1 a sealed motor-compressor unit 20 which delivers compressed refrigerant to a condenser 22 where the refrigerant liquefies and is forwarded under the control of a liquid control device or restrictor 24 to an evaporator 26 which surrounds the frozen storage compartment 28 of a frozen storage cabinet 30. The operation of the refrigerating system is controlled by a refrigerator control 32 which includes a metal bellows 34 connected by capillary tubing 36 to a bulb 38 or similar device which is positioned in heat exchange relation with the walls of the frozen storage compartment 28 and the evaporator 26. The bellows 34 operates a primary lever 40 provided at one end with a double toggle type of snap-acting mechanism including a secondary lever 42 and a toggle spring 44 which connects to a post 46 of the control lever 48. The control lever 48 is pivoted upon a pin 50 and controls the control device proper which in this case is a set of switch contacts 52 and 54.

The switch contact 54 is provided at the top of the conductor post which is connected to one of the supply conductors 56 while the switch contact 52 is mounted upon the end of a spring fastened to another conductor post which is connected by the conductor 58 to the sealed motor-compressor unit 20 which in turn is connected to the other supply conductor 60. The spring which holds the contact 52 is tensioned so that in its unstressed condition it carries the contact 52 away from the contact 54, so that when the control lever 48 is turned in a counter-clockwise direction placing the post 46 in contact with the differential adjusting screw 62, the contacts 52 and 54 will be separated.

The position of the set-screw 62 determines the temperature and/or pressure differential between the opening and closing of the switch contacts 52 and 54. The temperature at which the opening and closing takes place is determined by the range spring 64 which may have its tension adjusted by the range adjusting screw and knob 66 in order to change the temperature at which the switch 52 and 54 is opened and closed. The bulb 38 is charged with a volatile liquid which will create a vapor pressure within the bellows in proportion to the temperature of the bulb 38 and the compartment 28. As an alternative the bulb 38 may be filled with an absorbent such as activated charcoal and the bulb and bellows filled with a gas which may be absorbed and evolved by the charcoal in accordance with changes of temperature in the bulb 38 and the compartment 28. By this arrangement, the movement of the primary lever 40 is a function of temperature.

This function has been taken advantage of to provide a signaling control by placing a signaling contact 68 in a position wherein it will be contacted by the primary lever 40 when the temperature of the frozen storage compartment 28 reaches a prescribed value. This contact 68 is supported at the end of a thin spring metal strip 70 which is tensioned so that it will normally remain in a straight position against the set-screw 101. It is anchored in an insulating support between the insulating member 72 and an insulating spacer 74 which are connected to the frame 76 of the control 32. The strip 70 is connected in the signaling circuit by the conductor 78 which connects to a set of dry cell batteries 80 or other suitable power source which in turn is connected

to some suitable signaling device 82 such as a bell or a buzzer. The signaling device 82 is connected in series with a manual switch 84 which in turn is connected by the conductor 86 to the frame 76 of the control 32 which connects to the primary lever 40. The manual switch 84 may be omitted if desired to reduce the cost of the signalling circuit.

Although the bulb is not placed directly in the compartment 28 it will reflect the temperature of compartment 28 even though the refrigerating system is operating, since it is placed at the discharge end of the evaporator 26 wherein the temperature of compartment 28 will be reflected in the temperature of the vapor leaving the evaporator 26. It will therefore be seen that even though the switch contacts 52 and 54 are closed and the refrigerating system is in the proper order and operating properly, that when considerable quantities of warm food are placed into the compartment 28 to be frozen, the temperature of the compartment 28 will rise above the maximum desired temperature of the cabinet which may be 5° or 10° F. Under such conditions the primary lever 40 will move against its stop 88 and it would also contact the contact 68 to close the alarm circuit. The signaling device 82 would commence to operate providing an audible warning which would continue until the compartment 28 was reduced below 5° or 10° F. To keep the cost of such systems within the means of the average buyer the condensing unit is small and this temperature level may not be reached for a considerable time and the ringing of a bell or even the lighting of a light for that period would be objectionable.

Therefore upon the end of the strip 70 I have provided a small operating lever 90 which extends through a slot 92 in the outer case 94 of the control. This slot 92 limits the movement of the lever 90. The case 94 may be provided with legends "On" and "Off." The moving of the lever 90 to the "off" position raises the contact 68 away from the primary lever 40 when the primary lever 40 is in its uppermost position against the stop 88 illustrated by dot-dash lines in Fig. 2. In order to hold the contact 68 in this position during the time the refrigerating system is operating to reduce the food storage compartment down to its proper level, under such conditions I provide an extension 96 upon the control lever 48 in the form of a nose and I provide a spring latch or detent 98 upon the end of the spring strip 70 so that when the control lever 48 is in the closed circuit position the spring latch or detent 98 may be brought past the nose 96 as shown in Fig. 3 and will rest on top of the nose 96 as shown in Fig. 2 in order to hold the contact 68 out of the path of the primary lever 40. This will hold the lever 90 and the contact 68 in its "off" or inoperative position as shown in Fig. 2 as long as the switch contacts 52 and 54 remain closed to continue operation of the refrigerating system.

When the refrigerating system finally brings the frozen storage compartment 28 down to its proper temperature the primary lever 40 will be lowered sufficiently that the secondary lever 42 will be brought below the center line of the spring 44 and the control lever 48 will snap in a counterclockwise direction to a position placing the post 46 against the differential set-screw 62 as shown in dot-dash lines. This will stop the refrigerating system. The nose 96 being a part of the control lever 48 will be similarly moved as illustrated in dot-dash lines, so that it will move

away from the latch or detent 98 allowing the spring strip 70 to spring back to the position shown in Fig. 1 against the adjusting screw 101 provided upon the end of the insulating member 72. The adjusting screw 101 may be adjusted to raise or lower the position of the contact 68 so as to raise or lower the temperature at which the contact 68 is contacted by the primary lever 40 to open and close the alarm circuit. While I prefer that the spring latch 98 be resilient as shown, so that it may pass the nose 96 without moving the nose 96 it may be made rigid, if desired, in which case it will force the nose 96 to retract a sufficient distance against the tension of the toggle spring 44 to permit its movement in either direction. The surfaces of spring latch or detent 98 which contact the nose 96, are beveled so that they present a resilient V projection pointed toward the nose 96 which may be forcibly cammed past the nose 96 in either direction and yet will be supported by the nose 96 as shown in Fig. 2.

Through this control whenever the frozen storage cabinet is loaded with warm food the bellows 31 will expand and the primary lever 40 will rise and move the control lever 48 to the full line position as shown in Fig. 1, closing the contacts 52 and 54 and causing the operation of the refrigerating system. The signal alarm circuit in a short time, will be closed by the continued expansion of the bellows 34 to place the primary lever 40 into contact with the contact 68. At any time after the switch contacts 52 and 54 are closed the lever 90 may be pushed to the right as viewed in Fig. 1, to raise the contact 68 out of the path of the primary lever 40 and to place the detent 98 on top of the nose 96 as shown in Fig. 2. This will open the alarm circuit and prevent or stop the operation of the alarm 82. The contact 68 and the lever 90 will be held in this position until the compartment 28 is brought down to its proper cut-off temperature at which temperature the switch contacts 52, 54 will be opened and the refrigerating system stopped.

In the opening of the contacts 52, 54 the spring 64 will pull the primary lever 40 downwardly causing the snap-acting mechanism to trip the control lever 48 to the open circuit position carrying the nose 96 away from the detent 98 to place the alarm contact 68 in position, as shown in Fig. 1 to perform its normal function of giving a warning whenever the temperature of the compartment 28, as reflected by the position of the primary lever 40, reaches the prescribed limit carrying the primary lever 40 into contact with the contact 68 to close the alarm circuit and ring the bell 82.

In the second modification disclosed in Figs. 4, 5 and 6 the refrigerating system as well as the following parts of the control system, such as the bellows, primary lever, the double toggle snap-acting lever and spring, the range spring and its adjusting screw and knob, the strip 70, the contact 68, the nose 96, the adjusting screw 101, as well as the alarm circuit, are the same as the first modification and have the same reference characters. The second modification differs from the first modification in that instead of the restoration of the alarm contact 68 to its normal effective position being dependent upon the opening of the switch contacts 52 and 54 as in Figs. 1 to 3, the second form shown in Figs. 4 to 6 makes the restoration electrically responsive to allow the alarm contact 68 to return to its normal effective

position whenever the motor circuit of the refrigerating apparatus is deenergized.

Referring now more particularly to Fig. 4, there is shown a U-shaped bimetal holding member 196 having its lower end 197 curled upwardly so that when in the heated position shown, it will hold the detent 98 as shown in Fig. 5, when the lever 190 is moved to the "off" position. The U-shaped bimetal member 196 replaces the nose 96 which is omitted from the control member 148 in the second modification. This U-shaped bimetal member 196 has its rear leg 303 connected by the bolt 305 to the supply conductor 307. The front leg 309 is connected by the bolt 311 to the conductor 313 which connects to the stationary contact 54. The movable contact 56 is connected by the conductor 315 with the normally closed thermal overload protector 317 which opens the circuit of the motor-compressor unit 20 under any overload condition to prevent damage to the motor windings. The motor-compressor unit 20 is connected to the other side of the electrical supply source by the conductor 319.

The bimetal 196 is so constructed that it quickly assumes the full line position shown in Figs. 4 and 5 when heated by the motor current. The thickness of the bimetal is exaggerated in the drawings. Should the motor circuit of the sealed motor-compressor unit 20 be interrupted for any reason whatsoever, the bimetal 196 will bow to the left to the dot-dash line positions shown in Figs. 4 and 5. If the lever 190 has been in the "off" or latched position, the bowing of the bimetal 196 to the dot-dash line position will release the detent 98 and allow the strip 70 and the contact 68 to move to its normal effective position with the strip 70 against the stop screw 101.

Thus in this form, should the connection with the source of power supply be broken, such as for example, by the accidental removal of the plug connection, or perhaps by the tripping of the overload 317, or by failure of the power supply, or by the opening of the contacts 54 and 56, the signal alarm will be restored to its normal effective condition. Should the temperature of the compartment 28 be above the maximum desired temperature the signal alarm circuit will be energized, since the primary lever will rise sufficiently to make contact with the contact 68 to give the warning that the temperature is not being maintained. Thus in this second modification the signal alarm is returned to effective condition, not only when the contacts 54 and 56 open, but also whenever the electrical circuit is deenergized for any reason whatsoever.

While I have illustrated my alarm control as applied to a refrigerating system, since the primary lever 40 is both temperature responsive and pressure responsive due to the pressure within the bulb, it may be applied to other pressure and temperature applications by connecting the bellows to the source of pressure or to the temperature condition which is to be controlled. The contacts 52, 54 may be used to control the means for changing the temperature or pressure to maintain the desired limit.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, 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. In combination, a first means to be kept

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within desired temperature limits, a temperature changing means for maintaining the first means within said temperature limits, a cyclically operable control means for said temperature changing means having a predetermined differential providing operating and idle periods corresponding to said temperature limits, a signaling device, means for rendering effective said signaling device when one of said temperature limits is exceeded, and releasable means controlled by said cyclically operable means for preventing the signaling device from being rendered effective only until the termination of one of said periods of operation of the temperature changing means.

2. In combination, a cabinet to be kept below a desired temperature, a refrigerating system for cooling said cabinet, a cyclically operable control means providing operating and idle periods of said refrigerating system for maintaining said cabinet below said temperature, a signaling device, means for operating said signaling device when said temperature is exceeded, and settable releasable means for preventing the operation of said signaling device during any one of said operating periods until the termination of said period only.

3. A first control comprising a control device operable to first and second control positions, an actuating means for operating said first control device to and from said first and second positions, a second control device operated by said actuating means to first and second control positions, an electrical circuit connected to said second control device, manually settable means for deenergizing said electrical circuit, and means responsive to the operation of said first control device from one position to another for releasing said settable means.

4. A control comprising a first control device operable to first and second control positions, an actuating means for operating said first control device to and from said first and second positions, a second control device operated by said actuating means to first and second control positions, manually settable means cooperating with said first control device for holding said second control device in one of its positions when said first control device is in one of its positions, said first control device being provided with means for releasing said settable means coincidentally to its operation from one control position to another.

5. A control comprising a first control device operable to first and second control positions, an actuating means for operating said first control device to and from said first and second positions, a second control device in the form of switch contact means operated by said actuating means to open and closed positions, manually settable means cooperating with said first control device for holding said switch contact means in one of said positions when said first control device is in one of its positions regardless of the movement of said actuating means, said first control device being provided with means for releasing said manually settable means coincidentally to its operation from one control position to another.

6. A first control comprising a control device operable to and from first and second control positions, an actuating means for said first control device, a snap-acting means for connecting said actuating means and said control device, a second control device in the form of a switch contact means operable to one control position upon

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abnormal movement of the actuating means and to a second position upon normal movement of the actuating means, a manually operable means for operating said switch contact means to an inoperative position, said control device being provided with means effective in one of said control positions only for holding said switch contact means in said inoperative position and for releasing said switch contact means coincidentally to the operation of said control device to another control position.

7. A control comprising a control device operable to first and second positions, an actuating means for operating said control device to and from said first and second positions, a switch means operated by said actuating means to closed and open positions, manually settable latching means for holding said switch means in the open position, and means responsive to the operation of said control device from one position to another for releasing said settable latching means.

8. A control comprising a fluid motor, a first control device connected to and operated by said fluid motor to first and second control positions, a second control device operated by said fluid motor to first and second control positions, a detent connected to and moved by said fluid motor to first and second positions coincidentally to the operation of said first control device, said second control device being provided with a manually settable latching means cooperating with said detent when in one of its positions for holding the second control device in one of its positions and for preventing normal operation of the second control device until said detent is moved from said one position.

9. A control including a control means operable to and from first and second control positions, an actuating means for said control means, snap-acting means for controlling the operation of said actuating means and said control means, a control device operated to a first position by said actuating means upon movement to an abnormal position and operable to a second position upon all normal movements of said actuating means, a manually settable device for preventing the operation of said control device to its first position, and means responsive to an operation of one of said means for releasing said manually settable means to restore the normal control of said control device.

10. In combination, a first means to be kept within desired temperature limits, a temperature changing means for maintaining the first means within said temperature limits, control means for starting and stopping the operation of the temperature changing means providing operating and idle periods, a signaling device, means for rendering said signaling device effective to give a warning signal when one of said temperature limits is exceeded, means for rendering said signaling device ineffective regardless of temperature conditions for one of said periods including means responsive to the termination of said one period for restoring said signaling device to potential effectiveness for giving a warning should one of the temperature limits be exceeded.

11. In combination, an electrically powered means to be kept within desired limits, means for supplying said first means with electrical energy, control means for interrupting and completing the supply of electric energy to said electrically powered means to provide idle and operating periods, a signaling device, means for rendering said

signaling device effective to give a warning signal when one of said limits is exceeded, means for rendering said signaling device ineffective for one of said periods only including means operable coincidentally to the interruption of the supply of electric energy for restoring said signaling device to normal potential effectiveness to give a warning should one of the limits be exceeded.

12. A control comprising a fluid motor means, a first movable device connected to and operated by said fluid motor means to first and second operating positions, a second movable device having two physical positions, said second device in the first of said physical positions being operated by said fluid motor means to first and second control positions, a detent means for holding said second device in the second physical position for preventing its operation to its second control position, said detent means including means operable coincidentally to the operation of said first device from its first operating position to its second operating position for releasing said second device, said second control device including a biasing arrangement for biasing it from the second physical position to the first physical position.

13. In combination, a first means to be kept within desired temperature limits, a temperature changing means for maintaining the first means within said temperature limits, a cyclically operable control means for said temperature changing means having a predetermined differential providing operating and idle periods corresponding to said temperature limits, a signaling device, means for rendering effective said signaling device when one of said temperature limits is exceeded, settable means for preventing the signaling device from being rendered effective, and means responsive to the next succeeding cycling operation of the control means for releasing said settable means.

14. In combination, a cabinet to be kept below a desired temperature, a refrigerating system for cooling said cabinet, control means for starting and stopping the operation of said refrigerating system providing operating and idle periods, a signaling device, means for operating said signaling device when said temperature is exceeded, and settable releasable means for preventing the operation of said signaling device during one of said periods until the termination of said period only.

15. In combination, a cabinet to be kept below a desired temperature, a refrigerating system for cooling said cabinet, control means for starting and stopping the operation of said refrigerating system providing operating and idle periods, a signaling device, means for operating said signaling device when said temperature is exceeded, and settable releasable means for preventing the operation of said signaling device during one of said periods until the termination of said period only, including means operable coincidentally to the stopping of said refrigerating system for restoring the signaling device to its normal potential effectiveness to give a warning should one of the limits be exceeded.

16. A control comprising a fluid motor, a first control device connected to and operated by said fluid motor to first and second control positions, a second control device operated by said fluid motor to first and second control positions, an electrically controlled detent movable to first and second positions, said second control device being provided with a manually settable latching means cooperating with said detent when in one

of said positions for holding and preventing normal operation of said second control device in one of its positions, said first control device being provided with electrical control means electrically connected to said detent for controlling said detent to release said second control device.

17. A control comprising a first control device operable to first and second positions, a second control means operable to first and second positions, settable holding means for holding said second control means in the first position, and means responsive to the operation of said first control device from one position to another for releasing said settable holding means.

18. A control comprising a first control device operable to first and second positions, a second control device operable to first and second positions, said second control device including means for biasing it from the second position to the first position, means for operating said first and second control devices to and from their first and second positions, settable holding means for holding said second control device in its first position to prevent it from being operated to its second position, and means responsive to the operation of the first control device from one position to another for releasing the settable holding means.

19. A control comprising a first movable device operable to first and second operating positions, a second movable device having first and second physical positions, means for operating said second movable device when in the first physical position to first and second control positions, settable holding means for holding said second device in said second physical position for preventing its operation to its second control position, said holding means including means operable coincidentally to the operation of the first movable device from its first operating position to its second operating position for releasing said second movable device.

20. A control comprising a first movable device operable to first and second operating positions, a second movable device having first and second physical positions, means for operating said second movable device when in the first physical position to first and second control positions, settable holding means for holding said second device in said second physical position for preventing its operation to its second control position, said holding means including means operable coincidentally to the operation of the first movable device from its first operating position to its second operating position for releasing said second movable device, said second movable device including a biasing arrangement for biasing it from the second physical position to the first physical position.

21. In combination, a first means to be kept within desired temperature limits, a temperature changing means for maintaining the first means within said temperature limits, a cyclically operable control means for said temperature changing means having a predetermined differential providing operating and idle periods corresponding to said temperature limits, a signaling device, means for rendering effective said signaling device when one of said temperature limits is exceeded, settable means having an ineffective position in which it is inoperative to affect the operation of the signaling device and an effective position for preventing the signaling device from being rendered effective, and means responsive to the next succeeding cycling operation of

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the control means for causing the movement of the settable means from the effective to the ineffective position.

22. A control comprising a first control device operable to first and second positions, a second control means operable to first and second positions, settable means having an ineffective position in which it is inoperative to affect the operation of the second control means and an effective position for holding the second control means in the first position, and means responsive to the operation of said first control device from one position to another for causing the movement of the settable means from the effective position to its ineffective position.

23. A control comprising a first movable device operable to first and second operating positions, a second movable device having first and second physical positions, means for operating said second movable device when in the first physical position to first and second control positions, settable means having an ineffective position in which it is inoperative to affect the operation of the second movable device and an

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effective position for holding said second device in said second physical position for preventing its operation to its second control position, said settable means including means operable coincidentally to the operation of the first movable device from its first operating position to its second operating position for causing the movement of the settable means from the effective position to its ineffective position.

CARL A. STICKEL

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2,447,893	Bauman -----	Aug. 24, 1948
2,447,894	Bauman -----	Aug. 24, 1948
2,447,895	Bauman -----	Aug. 24, 1948

Certificate of Correction

Patent No. 2,537,431

January 9, 1951

CARL A. STICKEL

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 7, lines 27 and 69, respectively, for the words "first control comprising a control" read *control comprising a first control*;

and that the said Letters Patent should be read as corrected above, so that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 27th day of February, A. D. 1951.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.

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