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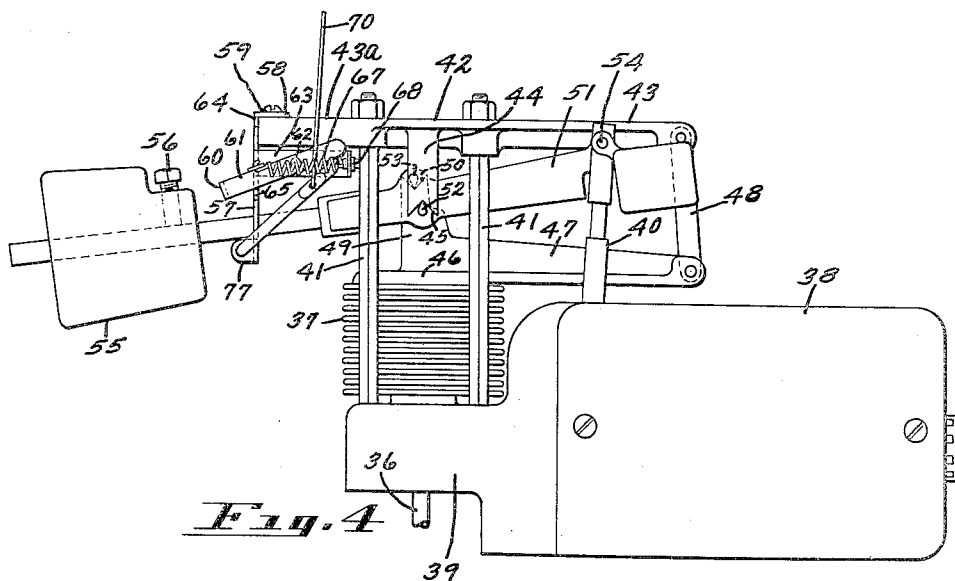
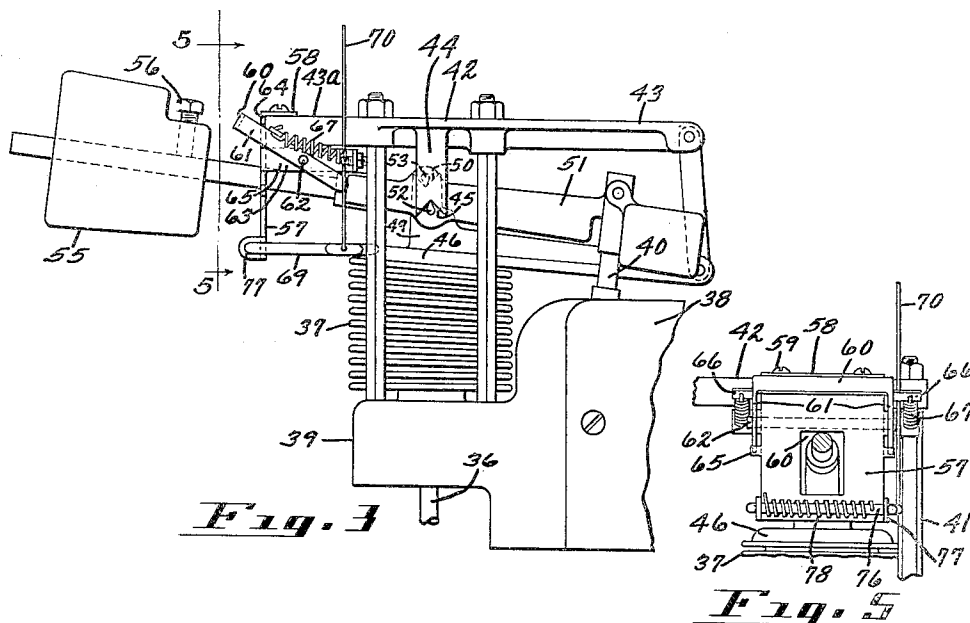
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REFRIGERATING APPARATUS

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

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REFRIGERATING APPARATUS.

Application filed November 15, 1923. Serial No. 875,005.

This invention relates to automatic controlling mechanisms, and more particularly to the control of refrigerant of a refrigerating machine.

One of the objects of the present invention is to provide a refrigerating system in which normally a certain temperature may be obtained and in which the operation thereof may be changed to obtain temporarily a higher temperature. The embodiment is herein illustrated in connection with a refrigerating system in which refrigerant is cyclically circulated and in connection with that type of system it is a further object to vary at will one cycle of the apparatus so as to raise the upper limit of temperature range during that cycle and then restore the succeeding cycles to their normal range.

It is customary to control the operation of household refrigerating machines so that the upper limit of temperature range maintained in the cabinet will be below 32° F.,—say between 10° F. for the lower limit and 28° F. for the upper limit. When operating within this range the expansion unit is likely to become covered with ice and frost because of the moist state of the air surrounding said unit, and become more or less insulated from the air in the cabinet. Under such circumstances it has been the practice to stop the refrigerating apparatus for a period of time long enough to allow the temperature within the cabinet to rise and melt the ice and frost within the expansion unit. By this invention the period of rising temperature in one refrigerating cycle may be prolonged at will and the temperature within the cabinet allowed to rise above the freezing point so as to defrost the expansion unit, and the cycles thereafter be restored automatically so as to maintain the normal temperature range below freezing.

This invention consists in a manually controlled element, which may be denominated a defrosting means, and which may be set to prevent the automatic controlling mechanism from operating during the phase of rising temperature until the temperature in the vicinity of the expanding unit has risen to a predetermined point higher than that at which the controlling mechanism operates in the normal cycles, and to be rendered inoperative automatically when the control-

ling mechanism operates to stop the evaporating or rising temperature period and start the condensing or falling temperature period.

In the accompanying drawings in which like reference characters indicate like parts throughout the several views,

Fig. 1 is a front elevation of a refrigerator cabinet partly broken away to expose parts of a refrigerating apparatus installed in it;

Fig. 2 is a section on the line 2—2 of Fig. 1, illustrating a hand-operated device for setting the defrosting means;

Fig. 3 is a side elevation of so much of an automatic controlling mechanism as is necessary to show the relation of the defrosting means to the other parts of the controlling mechanism, said controlling mechanism being in the position assumed when it has stopped the evaporating period, started the condensing period, and rendered the defrosting means inoperative;

Fig. 4 is an elevation of said controlling mechanism, in the position assumed by it when the condensing period is stopped and the evaporating period begun, with the defrosting device set so as to prolong the evaporating period or period of rising temperature, and

Fig. 5 is a section on the line 5—5 of Fig. 3.

In the drawings the invention is exemplified in a yieldable resistance element combined with a controlling mechanism of the type disclosed in the patent to Bechtold and Mellowes, No. 1,478,421, patented December 25, 1923, and so constructed and disposed as to apply added resistance to the operating member thereof when it approaches the end of its movement toward the position it assumes to start the condensing period and to be rendered inoperative as soon as the condensing period has been started.

In Fig. 1, numeral 20 indicates a refrigerating cabinet, having a compartment 21 in which a refrigerating machine is housed; a cooling compartment 22 containing an expansion unit, and a compartment 23 for the storage of food or other materials to be kept cool. A removable panel-like closure 24 covers the front of the machine compartment, and the usual hinged doors afford ac-

cess to the other compartments. Openings 25 and 26 between the compartment containing the expansion unit and the food compartment provide for the circulation of air through said compartments.

A refrigerating machine unit 27 is shown installed in compartment 21. The unit 27 may be constructed like that disclosed in U. S. patent to Bechtold and Mellowes, #1,276,612, patented August 20, 1918, and need not be described in detail. It will be sufficient to state that the apparatus is of the compressor-condenser-expander circuit type and that the machine unit comprises a compressor (concealed in Fig. 1 behind the closure 24) a prime mover 28 for driving the compressor, and a condenser chamber formed with the compressor casing. The prime mover 28 in this embodiment is an electric motor which is started and stopped by a switch (not shown) operated by the controlling mechanism to be described.

Within the cooling compartment 22, an expanding unit, indicated as a whole by 29, may be sustained by hangers or brackets 30. The expanding unit may comprise the usual expansion tank 31 and expansion coils, not shown in Fig. 1 because they are concealed within a brine tank 32. Ice trays for holding water to be frozen or desserts to be congealed are indicated at 33. Whether the coils of the expanding unit are immersed in a brine tank or exposed directly to air circulating within the cabinet is not material to this invention.

When the compressor is operating, refrigerant in vaporous form is drawn from the expansion tank 31, compressed and condensed, and then pumped to the expansion tank. In Fig. 1, numeral 34 indicates the low pressure or vapor conductor which extends from the upper portion of the tank 31 to the low pressure side of the compressor, and 35 the high pressure or liquid conductor which leads from the high pressure side of the compressor through the condenser to the lower portion of the expansion tank. According to the usual practice, a liquid control valve (not shown) of any approved type, may regulate the discharge of refrigerant from the conductor 35 into expansion tank 31. When motor 28 is started the compressor operates. The motor is stopped and started automatically in response to certain predetermined limits of pressure in a fluid medium, the pressure of which varies in accordance with variations of temperature. The fluid pressure medium referred to may be the refrigerant in the low pressure side of the refrigerant circulating conductors or it may be in a thermostatic tube having one end juxtaposed to or in the immediate vicinity of the expansion unit. In Fig. 1, a thermostatic tube 36 is illustrated, one end of which enters the brine tank 32 so that the pressure of the

fluid confined within the tube is always approximately the pressure of the confined gas or vapor at the temperature of the brine which surrounds the expansion coils. The control mechanism referred to is operated in response to pressure within tube 36, said mechanism starting the compressor when the pressure in said tube is such as results at the upper limit of temperature intended to be reached in the vicinity of the expansion unit and stopping the compressor when the pressure corresponds to that produced by the lower limit of temperature. The pressure in tube 36 is transmitted to the controlling mechanism by a flexible diaphragm consisting of a tubular corrugated bellows 37 which constitutes a part of said controlling mechanism. The bellows acts upon a switch operating member which moves a switch to open or close the circuit of motor 28.

The switch for opening and closing the motor circuit may be a snap switch (not shown) of any suitable type disposed in a switch box 38. The switch box 38 and a platform-like extension 39 thereon constitute a base for supporting the controlling mechanism by which a rod 40 that is connected to the switch may be moved to open and close the switch. From the extension 39 rises a plurality of rigid standards 41, which support a rigid frame 42 that comprises an arm or projection 43 extending over the switch box 38, and a part 43^a that overhangs the platform-like extension 39. A bearing member 44 depends from each edge of frame 42 between two of the supporting standards 41, each bearing member having a V-shaped notch 45 at its lower end. Although Figs. 3 and 4, being side elevations, show only one of these bearing members 44, it will be understood that as one depends from each side of the frame 42, an elevation from the other side would present the same appearance.

There are preferably four of the standards 41. In the space between said standards is the tubular metallic bellows 37, the lower end of which is sealed, fluid tight, to said platform-like extension 39 in any suitable manner, but is provided with an opening communicating with the thermostatic tube 36. The upper end of bellows 37 is sealed to a head 46 from which an arm 47 extends beneath the arm 43 of frame 42 and which is connected to the arm 43 by a link 48. Rising from the head 46 there is a central bearing standard 49 having a V-shaped notch 50 in its upper end the center or apex line of which is parallel with, but displaced laterally from the center or apex lines of the notches 45 in depending bearing member 44. A lever 51, constituting an operating member, is fulcrumed between its ends in the notches 45 by means of knife edged bearings 52 carried by the lever. A knife

edged bearing 53 carried on said lever rests in the notch 50 of the upright member 49 which rises from the bellows head. At its right end,—as viewed in Fig. 4,—lever 51 is pivoted at 54 to the switch moving rod 40 before mentioned. On the other end of lever 51 is an adjustable weight 55 which may be fixed at various points along the arm of lever 51 by means of set screw 56. The weighted arm of lever 51 is preferably guided by a guide member 57, here shown as a bracket having a right angled flange 58 seated on top of the overhanging part 43^a of frame 42 and secured in place by machine screws 59. Said guide member 57 has an elongated slot which serves not only to limit lateral movements of the lever arm, but also to limit the range of oscillation of lever 51 about its fulcrum so that no undue strain may be transmitted to the snap switch after it has been opened or closed. The structure of the switch operating lever, its mount and connection to the bellows are fully disclosed in the patent to Bechtold and Mellowes, No. 1,478,421, patented December 25, 1923.

As thus far described, it will be apparent that if sufficient pressure is admitted to the bellows 37 the latter will expand and cause the lever 51 to move about its fulcrum on bearing members 44, turning the lever so as to raise the weight 55 and depress the rod 40. This closes the switch. Decrease of pressure in bellows 37 will permit the weight 55 to depress the weighted arm of the lever and raise the opposite end, thus lifting rod 40 and finally opening the switch. It will be understood that the switch does not make or break contact in the motor circuit until at or near the limits of movement of lever 51 and rod 40, in the manner characteristic of snap switches.

By adjusting weight 55 toward the end of lever 51, it will be apparent that the switch will open when the pressure in bellows 37 is at a certain predetermined low pressure and the expansion unit at a corresponding temperature, and that by moving weight 55 nearer to the fulcrum the switch will open only when the pressure in the bellows is still lower, corresponding to a lower temperature at the expansion unit; likewise, that the difference between opening and closing pressures and temperatures may be varied by adjusting the weight 55. It will also be apparent that with the adjustable weight alone controlling the range of pressure and temperature between opening and closing of the switch, the pressure that closes the switch cannot be varied without also varying the pressure that opens it, and that with a given setting of the weight 55 the cycles will succeed each other between a substantially definite high and low pressure corresponding to a substantially definite high and low temperature.

By interposing in the latter part of the upward path of movement of the weighted arm of lever 51 an additional resistance, it will be clear that the closing of the switch and starting of the motor will be deferred to a time later than it would be without such interposition. If additional resistance is added to said lever, additional pressure must be built up in the bellows to overcome it and the additional pressure must occur by reason of an increase of temperature at the expansion unit of the refrigerating apparatus. The particular improvement to which this application relates comprises an additional resistance that can be interposed at will in the path of the weighted arm of switch operating lever 51, toward the end of its upward movement and will be automatically disabled as by being removed from the path of movement of said lever as soon as its additional resistance has been once overcome. Thereafter the refrigerating cycles proceed in the normal range.

In the invention as exemplified by the drawings, the additional resistance for prolonging the period of rising temperature of one cycle is provided by a U-shaped lever member 60, the two limbs 61 of which are pivoted, between their ends at 62, to parallel arms 63 extending, one from each edge of guide bracket 57, toward the fulcrum of lever 51. The U-shaped member 60 is limited in its upward and downward movements by stop shoulders 64 and 65, respectively. Attached to an ear 66 on each side of the member 60 is one end of a coiled tension spring 67, the other end of each of which is attached to arm 63 by means of a take-up bolt 68. The springs 67 exert their tension, as will be seen by inspecting the drawings, so that when the member 60 is lowered as indicated in Fig. 4, into the path of movement of lever 51, the spring, exerting its tension in a line below the pivot of member 60, will hold it so until its tension is overcome by the pressure in bellows 37 pushing the lever 51 against it. And when the member 60 has been pushed upward by the pressure in bellows 37 until the pull of the spring is on a line above the pivot of member 60, the spring will hold member 60 in this inoperative position out of the path of lever 51 until it is again reset by hand. The member 60 is intended to be so disposed with relation to the lever 51 and the switch that when, in rising, the weighted arm of lever 51 has pushed upward the resistance member 60 to the point where the spring 67 will snap it away from the lever, the switch will be snapped to closed position, and the compressor will be started. It is readily apparent that the tension of springs 67 can be adjusted by the take-up bolts 68. In this manner, the resistance device can be varied to thus regu-

late the temperature at which the switch is actuated to start the compressor motor when said resistance device is operative.

In order to reset the resistance member 60, that is, to move it from the ineffective position in which it is shown in Fig. 3, to the effective position in which it is shown in Fig. 4, a device is provided that can be operated from the exterior of the cabinet. This device may comprise a resetting lever 69 to which is attached one end of a wire 70, the other end of which is attached to a bar 71 having a handle 72 on the outside of the front wall 20^a of the cabinet. A tubular guide 73 extends through said front wall in which the bar 71 is adapted to slide. That portion of the tubular guide that passes through the wall is threaded and is clamped securely in place by nuts 74. The inner end of said tubular guide 73 is curved downward, as at 75, in order to guide the wire 70 so that an outward pull of the handle 72 may exert an upward pull of the wire at substantially right angles to the power arm of resetting lever 69. Resetting lever 69 may be of U-shape, one limb 76 being pivoted in bearings 77 at the lower end of guide bracket 57 and encircled by a coiled torsion spring 78, so constructed and arranged as to exert its elastic force to keep lever 69 in its down or inactive position and to pull on the wire 70 so as to hold the handle 72 close against one of the nuts 74 at the front of the cabinet. The other limb is so disposed as to engage the extremities of the limbs 61 of resistance member 60 when the handle 72 is pulled outward and lifts lever 69 against the resistance of spring 78. As member 60 is a lever of the first class, upward pressure of lever 69 on the ends of the limbs of said member to the right of the fulcrum pin (as viewed in Fig. 3) will set the member 60 to the position indicated in Fig. 4. In operation, assuming that a temperature range between 10° F. and 28° F. is intended to be maintained at the cooling unit, the controlling mechanism will be so constructed and adjusted that the pressure in the bellows 37 corresponding to the upper limit of temperature desired will cause the lever 51 to operate to close the switch and start the compressor. This terminates the period of rising temperature in the cabinet and begins the period of falling temperature. When the pressure in bellows 37 has fallen to degree corresponding to the lower limit of temperature at the expanding unit, the weight on lever 51 will have moved the lever far enough to open the switch and stop the compressor. This terminates the period of falling temperature. The cycles succeed each other normally over substantially the same range.

Should it now be desired to defrost the

expansion unit, or for any other reason to raise the upper limit of temperature at the expansion unit, the handle 72 may be pulled outward and the resistance member 60 interposed in the path of lever 51 as it moves toward the position in which the switch is closed. When the increasing pressure in bellows 37 due to the rising temperature at the expansion unit has moved the weighted arm of lever 51 into contact with the resistance member 60, the added resistance will check the rise of said weighted arm until additional pressure corresponding to a higher temperature at the expansion unit has been built up in bellows 37 to an extent sufficient to overcome the pressure of the resistance member. When the upward movement of lever 51 has overcome the pressure of the resistance member, the switch will close and spring 67 will snap the member 60 to its ineffective position where it will remain until reset by again pulling out the handle 72. Thereafter the normal cycles will be automatically resumed. The additional resistance may be sufficient to require a pressure in bellows 37 corresponding to a temperature of, say 36° F., so that the ice and frost will be melted from the expansion unit. At any time it is desired to defrost the expansion unit, all that is necessary to do is to pull out the handle 72.

While I have illustrated and described a preferred embodiment of the invention, it is not my intention that the invention shall be limited otherwise than by the appended claims.

What I claim and desire to secure by Letters Patent of the United States is:

1. A refrigerating apparatus, comprising in combination, an evaporator, means for withdrawing refrigerant medium from the evaporator and for condensing said medium and for forcing same into the evaporator, an operating member movable up and down for controlling said means, a device constructed and arranged so as to be responsive to the temperature of the evaporator, said device being adapted to control said operating member, a movable resistance device adapted to be set in the path of upward movement of said operating member, and to be moved by the operating member out of its path in overcoming the resistance, manual means for setting said resistance device, said resistance device comprising means tending to hold it in resisting position until its resistance has been overcome and then to hold it in its ineffective position.

2. A refrigerating system, comprising in combination, an evaporator, a compressor connected therewith, a condenser connected with the evaporator and compressor, mechanism constructed and arranged so as to be responsive to the temperature of the evaporator for starting and stopping the com-

pressor in accordance with upper and lower temperature limits of the evaporator, a resistance device, and means for setting said resistance device manually in position to resist the movement of said mechanism toward the position in which it starts the compressor, said resistance device having associated therewith means for holding it in ineffective position as soon as its resistance has been overcome by said member.

3. A refrigerating system, comprising in combination, an evaporator, a compressor connected therewith, a condenser connected with the evaporator and compressor, mechanism constructed and arranged so as to be responsive to the temperature of the evaporator for starting and stopping the compressor in accordance with upper and lower temperature limits of the evaporator, a resistance device comprising a lever and a spring adapted to hold it either operative or inoperative according to its position, and means for setting said resistance device manually in position to resist the movement of said mechanism toward the position in which it starts the compressor, said resistance device having associated therewith means for holding it in ineffective position as soon as its resistance has been overcome by said member.

4. A refrigerating system, comprising in combination, a cabinet including a cooling chamber, an evaporator within the chamber, a compressor connected with the evaporator, a condenser connected with the evaporator and compressor, mechanism constructed and arranged so as to be responsive to the temperature of the evaporator for starting and stopping the compressor in accordance with the upper and lower temperature limits of the evaporator, a resistance device, and means for setting said resistance device manually in position to resist the movement of said mechanism toward the position in which it starts the compressor, said resistance device having associated therewith means for holding it in ineffective position as soon as its resistance has been overcome by said member, said means including a lever and a device accessible on the exterior of the cabinet for moving the lever into contact with the resistance device for setting the latter.

5. A refrigerating system, comprising in combination, an evaporator, a compressor connected therewith, a condenser connected with the evaporator and compressor, mechanism constructed and arranged so as to be responsive to the temperature of the evaporator for automatically starting and stopping the compressor in accordance with predetermined normal upper and lower temperature limits of the evaporator, and means associated with said mechanism for delaying the operation of said mechanism to start the

compressor, whereby the starting of the compressor is delayed until the temperature of the evaporator rises above said predetermined normal upper limit, said mechanism being adapted to render said means ineffective after a predetermined operation of the mechanism.

6. A refrigerating system comprising, a cooling unit, means for circulating a refrigerant medium through said unit, temperature-responsive means for controlling said first-mentioned means to maintain said unit between predetermined limits of temperature, auxiliary means for temporarily obtaining a higher temperature in the cooling unit including mechanism for temporarily modifying the operation of said first named means, and means for rendering said auxiliary means operative.

7. A refrigerating system comprising, a cooling unit, means for circulating a refrigerant medium through said unit, temperature-responsive means for controlling said first-mentioned means to maintain said unit between predetermined limits of temperature, auxiliary means for temporarily obtaining a higher temperature in the cooling unit including mechanism for temporarily modifying the operation of said first named means, means for varying the effectiveness of said auxiliary means, and means for rendering said auxiliary means operative.

8. A refrigerating system comprising, a cabinet, a cooling unit within the cabinet, means for circulating a refrigerant medium through said unit, temperature-responsive means for controlling said first-mentioned means to maintain said unit between predetermined limits of temperature, auxiliary means for temporarily obtaining a higher temperature in the cooling unit including mechanism for temporarily modifying the operation of said first named means, and means extending through a wall of the cabinet and associated with said auxiliary means for controlling the latter.

9. A refrigerating apparatus comprising, a cooling unit, means for circulating a refrigerant medium through said unit, temperature-responsive apparatus normally controlling the flow of medium whereby to cool said unit to a predetermined temperature, a device for temporarily obtaining a higher temperature in the cooling unit including mechanism for temporarily modifying the circulation of said medium, and provisions operated automatically after a predetermined operation of said device for restoring the system to normal operating condition.

10. A refrigerating apparatus comprising, a cabinet, a cooling unit within the cabinet, means for circulating a refrigerant medium through said unit, temperature-responsive apparatus normally controlling the flow of medium whereby to cool said

unit to a predetermined temperature, a device for temporarily obtaining a higher temperature in the cooling unit including mechanism for temporarily modifying the circulation of said medium, and provisions operated automatically after a predetermined operation of said device for restoring the system to normal operating condition, said device having a portion extending through a wall of the cabinet and operable for rendering said device operative.

11. A refrigerating system comprising, a cooling unit, means for circulating a refrigerating medium through said unit, control means for controlling said first-mentioned means to maintain said unit between predetermined limits of temperature, and means for temporarily obtaining a higher temperature in the cooling unit including mechanism for temporarily modifying the action of said first-mentioned means, and for thereafter automatically restoring the system to the normal control of said control means.

12. A refrigerating system comprising, a cooling unit, means for cyclically circulating a refrigerant medium through said unit, temperature-responsive apparatus for controlling the circulating cycles of said medium

to maintain said unit between predetermined limits of temperature, a device for temporarily obtaining a higher temperature in the cooling unit including mechanism for temporarily modifying the cycles of operation of said means, and provisions operated automatically after a predetermined operation of said device for restoring the system to normal operating condition.

13. A refrigerating system comprising, a cooling unit, means for cyclically circulating a refrigerant medium through said unit, temperature-responsive apparatus for starting the circulating cycle when the temperature of said unit is at a certain value and for stopping said cycle when the temperature of said unit is at a certain value, a device for temporarily obtaining a higher temperature in the cooling unit including mechanism for temporarily delaying the starting of the cycle, and provisions operated automatically after a predetermined operation of said device for restoring the system to normal operating condition.

In testimony whereof I hereto affix my signature.

JESSE G. KING.