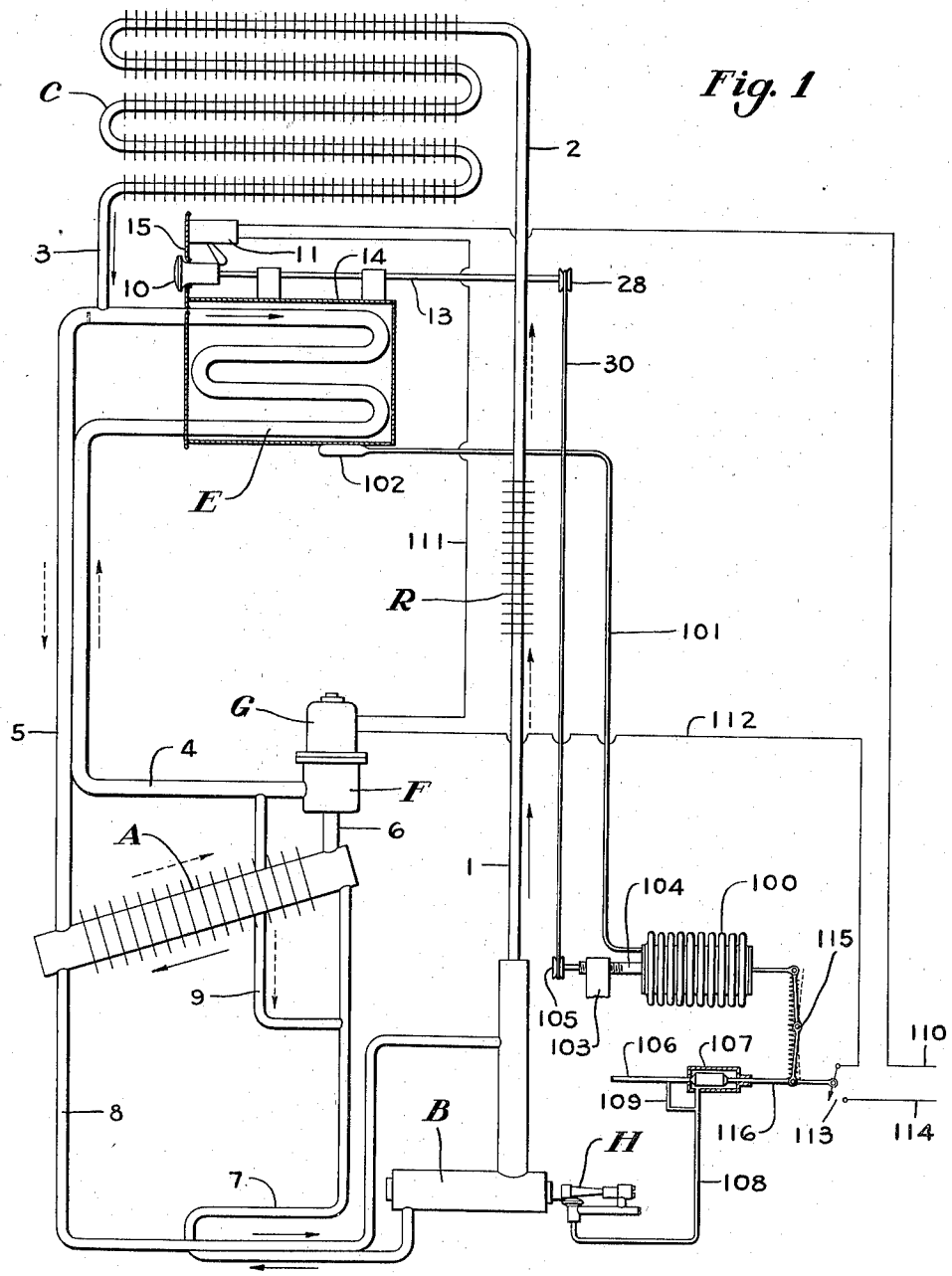
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REFRIGERATION CONTROL

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Fig. 1



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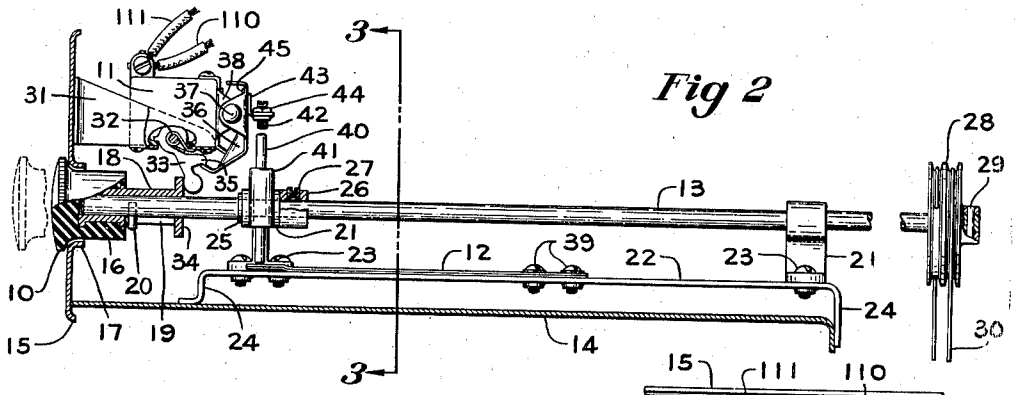


Fig 2

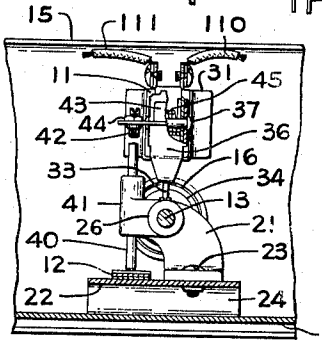


Fig. 3

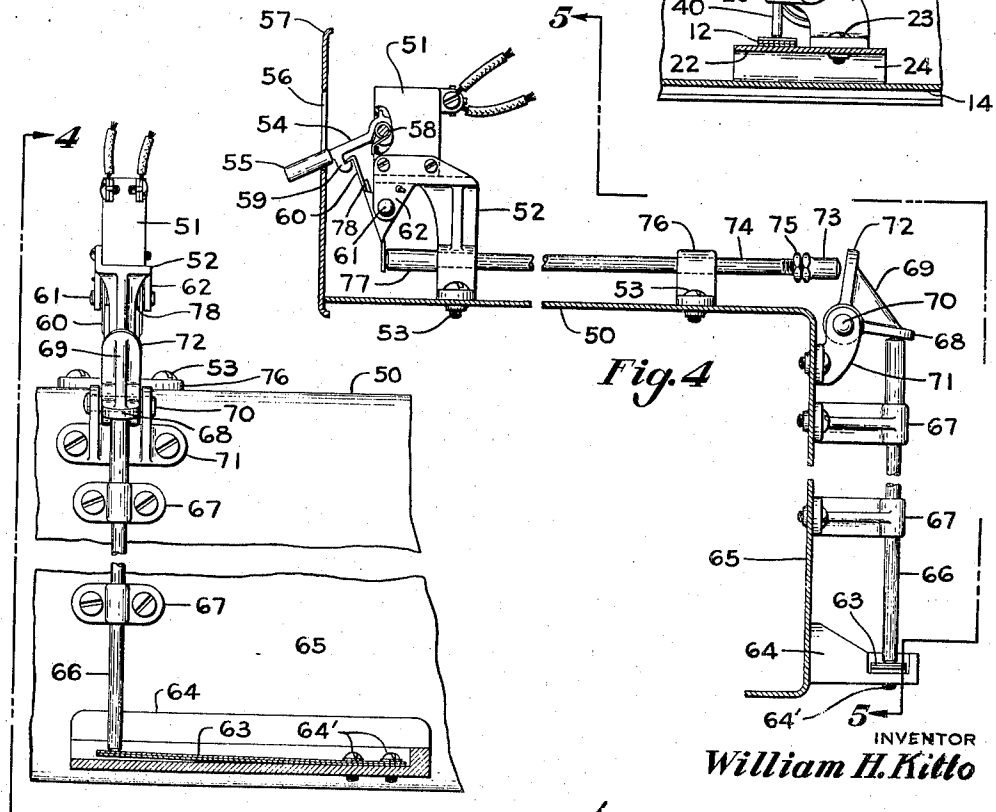


Fig. 4

Fig. 5

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UNITED STATES PATENT OFFICE

2,203,496

REFRIGERATION CONTROL

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Application June 28, 1937, Serial No. 150,690

16 Claims. (Cl. 62—5)

This invention relates to continuous absorption refrigeration systems and more particularly to electrical and mechanical control apparatus for such systems. Continuous absorption refrigerating systems operated by heat and an electrical motor or the like for circulating inert gas therein are well known. It has been proposed to provide such a continuous system with a heater for the boiler operated by gas or the like and to provide an electrical motor for driving a fan or other device for circulating the inert gas between the evaporator and the absorber.

In refrigeration systems of the character above referred to, it is desirable to provide means whereby the temperature range of the apparatus may be varied at will combined with a mechanism whereby the evaporator of the refrigerating apparatus may be defrosted. Defrosting may be accomplished by discontinuing operation of the inert gas circulating fan for a short period of time in order to permit the evaporator to warm up sufficiently to melt accumulated frost therefrom.

It is an object of this invention to provide a control mechanism for a refrigeration system using a gas burner and an electric motor-driven circulating fan for the inert gas of such character that cold control and defrosting are accomplished by suitable manipulation of a single knob.

It is a further object of the invention to provide a refrigerator control mechanism having a control knob positioned adjacent the evaporator, or other suitable point, and operative to adjust remote controlling mechanism.

It is a further object of the invention to provide a refrigerator control mechanism wherein the normal controlling apparatus may be remote from the evaporator and the defrosting controlling apparatus may be positioned on the evaporator.

It is a further object of the invention to provide a controlling mechanism wherein movement of a controlling element in one direction affects cold control and movement in a different direction sets a defrosting mechanism into operation.

It is a further object of the invention to provide a novel defrosting control mechanism for an absorption refrigerating system.

It is a further object of the invention to provide defrosting control mechanism which may be positioned at any desired point without regard to the position of the defrosting release thermostat.

Other objects and advantages resident in the novel arrangement of parts and constructional features will be apparent from the following description taken in connection with the accompanying drawings in which:

Figure 1 is a diagrammatic view of a continuous absorption refrigeration system showing one form of the present invention applied thereto.

Figure 2 is a side view partly in section of one form of the invention applied to the evaporator of a refrigeration system.

Figure 3 is a sectional elevation view of Figure 2 taken along the line 3—3 thereof and looking in the direction of the arrows.

Figure 4 is an elevational view of another form of my invention, taken along the line 4—4 of Figure 5 and looking in the direction of the arrows.

Figure 5 is a rear view of the device of Figure 4 taken along the line 5—5 thereof and looking in the direction of the arrows.

Referring to the drawings in detail and first to Figure 1 thereof, it will be apparent that a continuous absorption refrigerating system is illustrated comprising a boiler B heated by a gas burner H, a rectifier R, a condenser C, an evaporator E, an inert gas circulating fan F driven by a motor G, and an absorber A. These elements are connected by various conduits to form a continuous absorption refrigerating system. The conduit 1 conveys ammonia vapor to the rectifier R wherein entrained water vapor is condensed and returned through conduit 1 to the boiler B. A conduit 2 conveys ammonia vapor from the rectifier to the condenser C wherein it is liquefied and discharged into the evaporator through the conduit 3. An inert gas, such as nitrogen, is circulated by the fan F through conduit 4 to the lower part of the evaporator E wherein the liquid refrigerant evaporates into the inert gas to produce refrigeration. The mixture of inert gas and vaporized refrigerant is discharged from the evaporator into the lower part of the absorber A through the conduit 5. The conduits 4 and 5 are in heat exchange relation as illustrated. In the absorber A the refrigerant vapor contained in the gas mixture discharged thereinto from conduit 5 is absorbed by absorption liquid and the inert gas returns to fan F by way of conduit 6. The weak solution in the boiler is conveyed to the absorber A by way of conduit 7. The strong solution is conveyed from the absorber A to the boiler B through the conduit 8 which is in heat exchange relation with the conduit 7. In order that absorption liquid may be lifted from the level of the boiler to the top of the absorber a portion of the inert gas discharged by the circulating

fan is conveyed by means of conduit 9 to a portion of conduit 7 well below the free surface of the liquid in the boiler and functions to elevate the liquid contained in conduit 7 by gas lift action.

The control mechanism also diagrammatically illustrated in Figure 1 is shown as comprising an evaporator casing top plate 14, a control panel 15, a control knob 10, a defrosting switch 11, a control shaft 13, a drive pulley 28, and a connecting cable 30. The release mechanism for the defrosting switch 11 is not illustrated in Figure 1. These elements and the defrosting release mechanism are described more fully hereinafter in connection with the detail description of Figures 2 and 3. It is sufficient for the present purposes to state that the mechanism just described operates a controlling mechanism normally controlling the gas burner H for the boiler B and the motor G for the fan F. The mechanism normally controlling the motor G and the gas burner H is substantially that illustrated in the co-pending application of Curtis C. Coons, Serial No. 148,424, filed June 16, 1937.

Briefly described, the controlling mechanism for the gas burner H and motor G comprises an expansible bellows 100 connected by conduit 101 to a bulb 102 positioned to be responsive to evaporator temperature. One end of the bellows 100 is carried by an adjusting screw 104 which is threadedly mounted in a rigid support 103. The cable 30 passes around a pulley 105 carried by the screw 104 whereby rotation of knob 10 is transmitted to shaft 104 to shift the position of bellows 100. Bodily movement of bellows 100 changes the temperature range of the control mechanism. Gas is supplied to the burner H through a conduit 106, gas valve 107, and conduit 108. The usual pilot by-pass is provided and is indicated at 109. The drive motor circuit is traced from the line 110, defrosting switch 11, wire 111, motor G, and thence back to the source of supply through wire 112, normal control switch 113, and the line wire 114. The gas valve 107 and control switch 113 are connected together by a rod 116 which is actuated by bellows 100 through a toggle mechanism 115. The gas burner H and motor G are simultaneously placed in and out of operation by the bellows 100 in response to evaporator temperature conditions.

The top plate 14 of the evaporator casing terminates at its forward end rearwardly of the vertically extending control panel 15 which is mounted on the evaporator casing in any suitable manner. The control knob 10 is provided with a rearwardly extending reduced portion 16 which is adapted to rotate and slide freely in a rearwardly flanged opening 17 in the control panel 15. Control knob 10, which may be constructed of hard rubber or other suitable material, embraces a metal collar 18 which is slidably mounted on the end of the control shaft 13. The collar 18 extends rearwardly beyond the reduced portion 16 of the knob 10 and is provided with an elongated slot 19 which embraces a pin 20 rigidly mounted in the shaft 13. By reason of this construction, the shaft 13 is constrained to rotate with knob 10 in all positions thereof but the knob 10 may be moved lengthwise of the shaft 13 without effecting the position of said shaft.

The control shaft 13 is rotatably mounted in spaced bearing supports 21 which are rigidly attached to a supporting bracket 22 by means of screws 23. The supporting bracket 22 is elevated with respect to the top plate 14 of the evaporator by means of downturned end portions 24 which are rigidly attached to the top plate 14 in any suitable manner. Movement of the shaft 13 endwise with respect to the bearing supports 21 is prevented by engagement of an integral collar 25 formed on the shaft 13 against one face of the forward bearing supporting member 21 and a collar 26 which bears against the other face of said bearing support. The collar 26 is maintained in fixed position by a set screw 27.

A pulley member 28 is rigidly mounted on the rear end of the control shaft 13 by means of a pin 29. The pulley 28 receives cable 30 which is adapted to regulate a remote controlling mechanism in the manner explained above.

The remote controlling mechanism operated by cable 30 may be of any suitable character; it may operate only the gas valve control mechanism for a continuous absorption refrigerating system, or it may operate a control mechanism of the type illustrated.

The defrosting switch 11 is rigidly attached to a supporting bracket 31 which is rigidly attached in any suitable manner to the rear wall of the control panel 15. The defrosting switch 11, which is snap acting, is normally urged to the closed circuit position by a torsion spring 32 which operates upon the switch actuating arm 33. The arm 33 is so disposed relative to the metal collar 18 that it is positioned to be abutted by an abutment flange 34 formed integrally with the collar 18. The actuating arm 33 is provided with an offset latching finger 35 which is adapted to be engaged by a latching arm 36. The latching arm 36 is pivotally supported on a pivoting pin 37 mounted in a pair of supporting ears 38 formed on the body of switch 11. A spring 45 is coiled around the pivot pin 37 and is mounted to urge the latching arm 36 in a clockwise direction. By this arrangement the latching arm 36 is engaged with the latching finger 35 to hold the switch in the open circuit position whenever the arm 33 is moved to such position by the abutment flange 34. This is the defrosting position of the apparatus.

Locking engagement between latch finger 35 and latching arm 36 is relieved by the defrosting thermostat 12 which is illustrated as comprising a bimetallic element rigidly mounted on the supporting bracket 22 by means of screws 39. The free end of the defrosting thermostat 12 is positioned to engage the lower end of a rod 40 which is slidably mounted in an offset enlargement 41 formed integrally with the front bearing support 21. The end of the slidable rod 40 remote from defrosting thermostat 12 is adapted to engage an adjusting screw 42 mounted in a lug 43 rigidly attached to the latching arm 36 in any suitable manner. The adjusting screw 42 is held in adjusted position by means of a lock nut 44.

The present invention is not limited to the precise structure illustrated. Various changes may be made in the arrangement illustrated without departing from the spirit of the invention as will be apparent to those skilled in the art.

The above described device operates as follows: Rotation of the knob 10 is transmitted through the control shaft 13 to the pulley 28 and cable 30 to the controlling mechanism whereby the temperature limits of the evaporator are varied as desired. The control knob 10 may have an arrow formed thereon and adapted to cooperate with the usual indicia formed in any suitable manner upon the outer face of the control panel 15.

When it is desired to defrost, the knob 10 is pushed inwardly to the full line position indicated in Figure 2. Inward movement of knob 10 causes the abutment flange 34 to move the switch actuating arm 33 into open circuit position whereupon the latch finger 35 is engaged by the latching arm 36 to lock the switch 11 in open circuit position. The switch 11 remains in open circuit position until the evaporator has reached the defrosting temperature at which time the thermostatic element 12 flexes upwardly, as viewed in Figure 2, and elevates the slidable rod 40 which bears upon the adjusting screw 42 and swings the latching arm 36 counter-clockwise, as viewed in Figure 2, thus releasing the latching engagement between latching finger 35 and latching arm 36. When the actuating arm 33 is unlatched the spring 32 swings said arm in a clockwise direction, as viewed in Figure 2, and snaps the defrosting switch 11 to the closed circuit position. Also, movement of arm 33 in a clockwise direction shifts the control knob 10 to the dotted line position of Figure 2. Due to the fact that knob 10 remains in its innermost position during the defrosting period, it serves to indicate whether the refrigerator is defrosting.

Figures 4 and 5 illustrate a form of my invention in which a defrosting cut-off switch 51 is mounted above the top plate 50 of an evaporator casing. The arrangement is such that the switch may be placed in defrosting position manually from the front portion of the evaporator but is released by a remotely positioned thermostat.

The defrosting switch 51 is rigidly supported from the top plate 50 of the evaporator casing by means of a bracket 52 rigidly attached to the plate 50 by means of screws 53. The defrosting switch 51 is provided with an actuating arm 54 having an insulated handle portion 55 extending through a slot 56 formed in the control panel 57. The actuating arm 54 of the defrosting switch 51 is normally urged to closed circuit position by the torsion spring 58.

The actuating arm 54 is provided with a latch finger 59 which is adapted to be engaged by a latching arm 60 pivotally mounted on a pin 61 carried by downwardly extending lugs 62 formed integrally with the bracket 52.

Latching engagement between the latch finger 59 and the latching arm 60 is released by means of a thermostat 63, shown here as a bimetallic strip, which acts upon arm 60 through the medium of a linkage mechanism to be described hereinafter. In the form of the invention herein illustrated the thermostatic element 63 is rigidly attached at one end to a supporting bracket 64 by means of screws 64'. The bracket 64 is made of material having a very high heat conductivity and is mounted to have good thermal contact with the evaporator casing. The bracket 64 is rigidly mounted on the rear wall 65 of the evaporator in any suitable manner, as by welding.

The free end of the thermostatic element 63 is adapted to underlie the lower end of a rod 66 which is slidably mounted in a pair of supporting brackets 67 rigidly secured to the rear wall 65 of the evaporator in any suitable manner. The upper end of the rod 66 bears upon one arm 68 of a bell crank lever 69 which is pivotally mounted at 70 in a supporting bracket 71 rigidly secured to the rear wall 65 of the evaporator in any suitable manner. The arm 72 of bell crank lever 69 is positioned to bear against an adjustable bearing member 73 which is threadedly mounted on one end of a slidable rod 74 and is held in any adjusted position by a lock nut 75. The slidable rod 74 is supported at its end adjacent the bell crank lever 69 by means of a bearing bracket 76. The end of slidable rod 74 adjacent the defrosting switch 51 is slidably mounted in the supporting bracket 52 and is provided with an enlarged head 77 positioned to engage one end of the latching arm 60. The arm 60 is normally urged against the head 77 by a coiled spring 78 corresponding to the spring 45 described in connection with Figures 2 and 3.

The defrosting switch release mechanism illustrated in Figures 4 and 5 could be applied to the defrosting switch 11 of the control mechanism illustrated in Figure 1.

The defrosting switch 51 is connected to the refrigeration control circuit in any suitable manner.

The operation of this form of the invention is as follows: During normal operation the switch 51 is inoperative and has no effect upon the control mechanism which may be any mechanism adapted to control a continuous absorption refrigeration system such as that illustrated in Figure 1. When it is desired to defrost, the operator moves the actuating arm 54 to the position shown in Figure 4 against the bias of spring 58 until the latching finger 59 and the latching arm 60 have engaged to hold the switch 51 in open circuit position. The switch 51 remains in open circuit position until such time as the evaporator shall have defrosted whereupon thermostatic element 63 flexes upwardly and elevates rod 66 which rocks the bell crank 69 in a counter-clockwise direction and thus shifts the rod 74 toward the control panel 57. Movement of the rod 74 toward the control panel moves the latching arm 60 in a clockwise direction against the bias of the spring 78 and releases the actuating arm 54 to the spring 58 whereupon switch 51 is removed to closed circuit position and the refrigerating apparatus resumes normal operation.

This arrangement is very advantageous in that it permits the defrosting switch to be located above the evaporator at the front portion thereof whereby the actuating arm may extend through an upstanding control panel and thus present a neat and workmanlike evaporator control assembly, but without being unnecessarily hampered by the location of the defrosting thermostat. In certain types of evaporators it is highly desirable that the defrosting thermostat be positioned to be responsive to temperature conditions at the bottom of the evaporator housing. This is due to the fact that the lower part of the evaporator is normally the coldest portion thereof and it is also the portion at which the greatest frost accumulation occurs; hence a complete defrosting is assured before normal operation of the system is resumed.

While I have illustrated and described several embodiments of my invention, it is to be understood that these are to be taken as illustrative only and not in a limiting sense. I do not wish to be limited to the precise structure shown but to include all equivalent variations thereof except as limited by the scope of the appended claims.

I claim:

1. Defrosting apparatus comprising a defrosting switch mounted adjacent an evaporator, means normally urging said switch to closed circuit position, manually operable means for moving said switch to open circuit position, a latch finger on said manually operable means, a pivot-

ally mounted latching arm positioned to engage said latch finger to hold said switch in open circuit position, means normally urging said latching arm to latching position, a thermostat positioned to be responsive to evaporator temperature, and means operative to transmit movement of said thermostat to said latching arm to disengage said latch finger.

2. Absorption refrigerating apparatus including an evaporator, a generator, a source of heat for the generator, an inert gas circulating fan, means operated in response to evaporator temperature conditions for controlling the operation of said source of heat and inert gas circulating fan, normally inoperative means operative to discontinue operation of said inert gas circulating fan to cause defrosting of the evaporator, means connected to said control means and said defrosting means and operative to adjust one of them with a rotary movement and to actuate the other with a translatory movement.

3. Control mechanism for absorption refrigerating apparatus of the type having a gas burner and an inert gas circulating fan comprising in combination, mechanism normally controlling said apparatus, mechanism for effecting abnormal control of said apparatus, and means operatively connected to said mechanisms and operative to exercise independent control over the same.

4. Refrigeration control mechanism comprising a control panel adapted to be mounted upon an evaporator, a knob mounted for translatory and rotary movement in said panel, a remotely positioned control mechanism, means connecting said knob and mechanism whereby rotary movement of said knob adjusts the temperature range of said mechanism, a defrosting device mounted on said panel, means urging said defrosting device into non-defrosting condition, means adapted to lock said defrosting device in defrosting position, means connecting said knob and said defrosting device whereby translatory movement of said knob moves said defrosting device to defrosting position and means for releasing said locking means at the end of a defrosting period.

5. In continuous absorption refrigerating apparatus having a source of heat and a power-driven inert gas circulator the combination of temperature responsive means controlling said source of heat and power-driven circulator, means adapted to render said power-driven circulator inoperative, and means connected to control said temperature responsive means and said second mentioned means independently and selectively.

6. In continuous absorption refrigerating apparatus having a generator, a condenser, an evaporator, an absorber and means connecting said elements to form a continuous absorption refrigerating system using inert gas, the combination of a gas burner adapted to heat said generator, an electrically driven inert gas circulating fan, means responsive to evaporator temperature adapted to control said source of heat and said fan, defrosting means connected to render said electrically driven fan inoperative, manually operated means mounted adjacent said evaporator and connected to adjust said temperature responsive means by rotary movement and to actuate said defrosting means by translatory movement.

7. In combination with the cooling unit of a refrigerating system a defrosting switch mounted adjacent the front portion of said cooling unit, means urging said switch to closed circuit position, means for placing said switch in open circuit position, means for latching said switch in open circuit position, and means for releasing said latching means when the cooling unit has reached a defrosting temperature, said last mentioned means including a thermostat positioned to be responsive to the temperature of that portion of the cooling unit at which the heaviest frost coat accumulates and linkage means for transmitting operative movements of said thermostat to said latching means.

8. Refrigeration control mechanism comprising a normal control mechanism, rotary means adapted to change the temperature range of said normal control mechanism, a defrosting mechanism, means urging said defrosting mechanism to non-defrosting position, means adapted to latch said defrosting mechanism in defrosting position, means adapted to release said latching means, a control knob mounted for independent rotary and slidable movement, means connecting said knob to said rotary means and to said defrosting mechanism whereby rotary movement of said knob affects said normal control mechanism only and slidable movement of said knob affects said defrosting mechanism only, the arrangement being such that said knob indicates whether the machine is defrosting.

9. Refrigeration control mechanism comprising rotatable means adapted to change the temperature range of a normal control mechanism, a defrosting device normally urged to inoperative position, means for latching said defrosting device in operative position, means for releasing said latching means, a control knob mounted for both independent rotatable and slidable movement, the arrangement being such that rotatable movement of said knob affects only said rotatable means and inward movement of said knob causes said defrosting mechanism to be latched in defrosting position, and said defrosting device urges said knob outwardly when said latch means is released.

10. In combination with the cooling unit of a refrigerating system a defrosting switch, means urging said switch to closed circuit position, means for moving said switch to open circuit position, means for latching said switch in open circuit position, and means remotely positioned with respect to said defrosting switch for releasing said latching means when the cooling unit has reached a defrosting temperature, said last mentioned means including a linkage mechanism carried by said cooling unit.

11. In combination, a cooling unit, means for supplying a cooling medium to said cooling unit, adjustable control means for said cooling medium supply means positioned remotely from said cooling unit, a manually settable regulating means mounted on said cooling unit to have independent rotary and slidable movements, a defrosting mechanism mounted on said cooling unit, a defrosting release thermostat mounted on said cooling unit, means for transmitting movement of said defrosting release thermostat to said defrosting mechanism, means for transmitting rotary movement of said regulating means to said control means for adjusting the same, and means for transmitting slidable movement of said regulating means to said defrosting means for operating the same to defrosting position.

12. Control mechanism comprising an adjustable normal control mechanism, a defrosting mechanism, a manually operable regulator, means mounting said regulator for a plurality of independent movements, means for transmit-

ting one of said movements to said normal control mechanism for adjustment thereof independently of other movement of said regulator, and means for transmitting another of said movements of said regulator to said defrosting mechanism to operate the same independently of other movement of said regulator.

13. Refrigerating apparatus comprising a cooling unit, means for supplying a cooling medium to said cooling unit, refrigeration demand responsive means for controlling said cooling medium supply means to maintain said cooling unit between predetermined temperature limits, normally inoperative means for rendering said cooling medium supply means inoperative to defrost said cooling unit, a manually operable regulator mounted for independent rotary and translatory movements, means for transmitting one of said movements of said regulator to said refrigeration demand responsive means for altering the temperature limits of said cooling unit, and means for transmitting the other of said movements of said regulator to said normally inoperative means for rendering the same operative.

14. Refrigerating apparatus comprising a cooling unit, means for supplying a cooling medium to said cooling unit, refrigeration demand responsive means for controlling said cooling medium supply means to maintain said cooling unit between predetermined temperature limits, normally inoperative means for rendering said cooling medium supply means inoperative to defrost said cooling unit, a manually operable regulator mounted for independent rotary and translatory movements, means for transmitting one of said movements of said regulator to said refrigeration demand responsive means for altering the temperature limits of said cooling unit, means for transmitting the other of said movements of said regulator to said normally inoperative means for rendering the same operative, and means for returning said normally inoperative means to inoperative condition at the end of a defrosting period independently of the position of said regulator.

15. Refrigeration control mechanism comprising a regulating knob mounted for independent movement in a plurality of directions, an energy control mechanism, a defrosting control mechanism, thermostatic means for actuating said energy control and defrosting mechanisms, and means connecting said regulating knob to said energy control and defrosting mechanisms for independent actuation by independent movements of said knob.

16. Refrigeration control mechanism comprising a regulator mounted to have a plurality of independent movements, an adjustable normal control mechanism, a defrosting mechanism, means operatively connecting said regulator to said normal control mechanism and to said defrosting mechanism for independent operation by independent movements of said regulator, and means for rendering said defrosting mechanism inoperative independently of said regulator.

WILLIAM H. KITTO.