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REFRIGERATING METHOD AND APPARATUS

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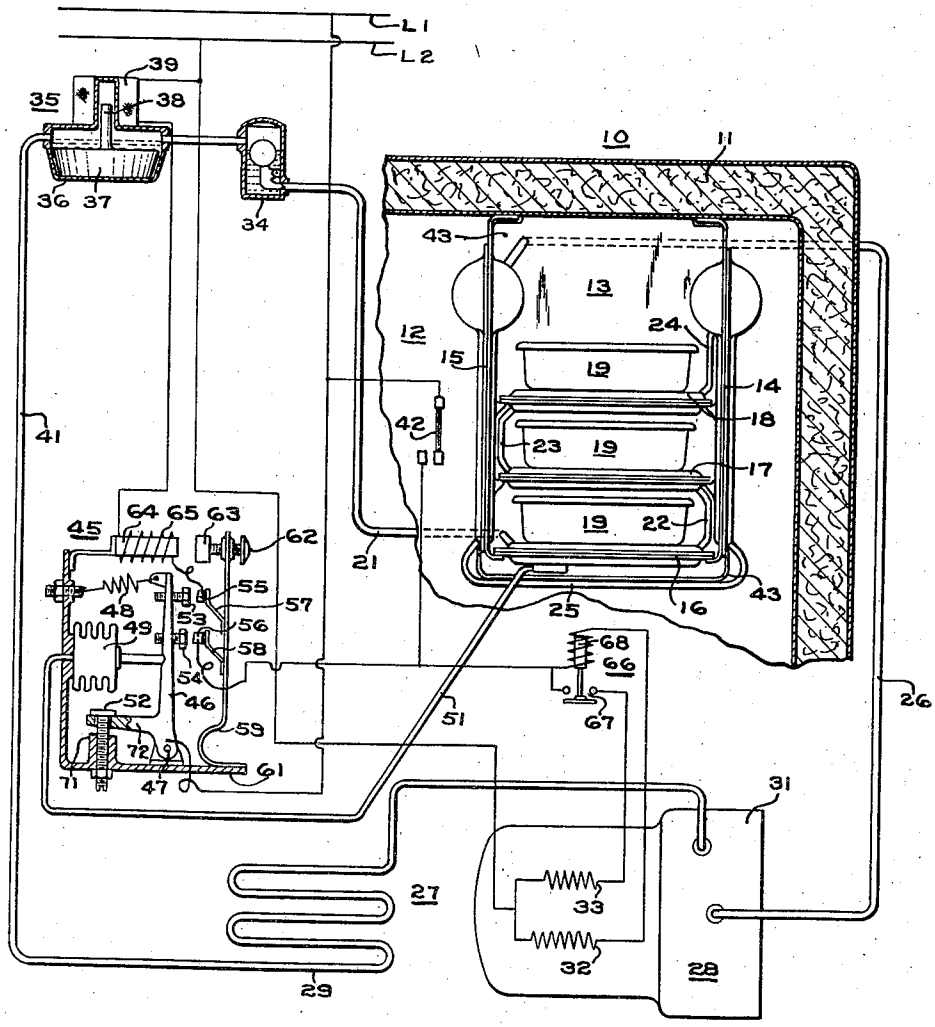


FIG. 1.

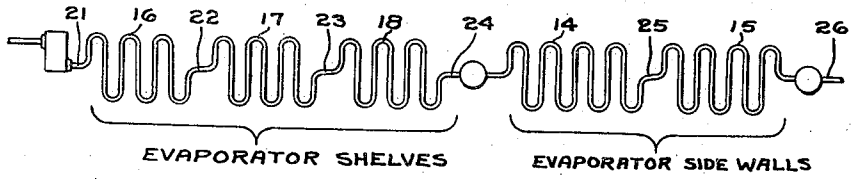


FIG. 2.

WITNESSES:

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REFRIGERATING METHOD AND APPARATUS

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16 Claims. (Cl. 62—4)

My invention relates to a method and apparatus for controlling the operation of refrigerating machines having relatively high and low temperature cooling elements and it has for an object to provide an improved method and apparatus of this kind.

A further object of my invention is to normally operate an evaporator element of a refrigerator at a predetermined mean temperature and to effect, at will, the operation of a second evaporator element at a lower temperature.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawing, forming a part of this application, in which:

Fig. 1 is a diagram of a refrigerating machine having my improved control apparatus applied thereto; and,

Fig. 2 is a diagrammatic representation of the elements of the evaporator and connections therebetween.

In practicing my invention, a refrigerator having refrigerant condensing means and first and second evaporator elements is employed for cooling food products stored in the refrigerator and for congealing desserts or freezing water or other fluids.

Evaporation of refrigerant in one or the other of the evaporators is controlled by a control device adjustable to first or second positions. In the first position of the control device, refrigerant is evaporated in one evaporator for cooling the air in the refrigerator chamber under control of a thermostat arranged in the chamber. This evaporator is, therefore, maintained at a predetermined mean temperature for cooling the air in the chamber.

The control device may be moved to a second position, whereupon evaporation is effected in the other evaporator, at relatively low pressure and temperature. This evaporator is effective for quick freezing purposes or for congealing desserts. In this position of the device, the thermostat is ineffective to control the evaporation of refrigerant in the evaporator. Means may be provided for returning the control device to its first position, which means is operated, preferably, in response to the temperature of the low temperature evaporator. A suitable adjustment may be provided for the control device whereby the temperature of the low temperature evaporator at which the device is actuated may be varied. The adjustment preferably includes a position wherein the temperature responsive means is ineffective to return the control device to its first position, so that evaporation of refrigerant continues in the low temperature evaporator until the device is manually moved to its first position.

My improved control apparatus is applicable to various forms of two temperature refrigerators such as, for example, the refrigerating apparatus disclosed and claimed in my copending application, Serial No. 15,003, filed April 6, 1935, and assigned to the Westinghouse Electric & Manufacturing Company. In the present application, I have disclosed a similar refrigerating system which employs a novel evaporator structure having wall members in heat exchanging relation with the air in refrigerator chamber and shelves for supporting water freezing trays arranged within the walls. The wall members constitute a relatively high temperature evaporator element and the shelves define a low temperature evaporator element. A system having an evaporator structure of this type is disclosed and claimed, in my copending application, Serial No. 81,088, filed May 21, 1936, and assigned to the Westinghouse Electric & Manufacturing Company.

Referring specifically to the drawing for a detailed description of the invention, a refrigerator cabinet of the domestic type is shown generally at 10 and includes insulated wall members 11 for defining a chamber 12 for the storage and cooling of food products. An evaporator structure 13 is arranged within the chamber 12 and includes wall members 14 and 15 and shelves 16, 17, and 18, the latter supporting trays 19 in which water or other fluids may be frozen or congealed. It will be understood that the walls and shelves of the evaporator 13 are hollow or include passages in which refrigerant is evaporated for cooling the same.

Liquid refrigerant enters the lower shelf 16 by means of a conduit 21 and passes in series through the shelves 16, 17, and 18. Connecting conduits 22 and 23 are arranged respectively between the shelves 16 and 17 and between shelves 17 and 18 for conducting refrigerant thereto. A conduit 24 connects the shelf 18 and side wall 14, the latter being connected to the wall 15 by a conduit 25, as shown. Vaporized refrigerant is conveyed from the wall member 15 through a conduit 26, so that it will be apparent that the flow of refrigerant through the evaporator 13 is in series through shelves 16, 17, and 18 and the walls 14 and 15 in the order named. This is illustrated diagrammatically in Fig. 2.

A refrigerant condensing unit, shown generally at 27, and preferably of the compression type,

includes a motor-compressor mechanism 28 and a condenser 29. As the type of compressor employed forms no part of my invention, I have not shown it in detail, but it is to be understood that the compressor and its driving motor are arranged within the sealed casing 31. The running and starting windings of the motor are shown diagrammatically at 32 and 33, respectively.

A conventional float valve 34 for regulating the flow of condensed refrigerant to the evaporator is connected in the conduit 21, and a device 35 that operates to vary, in effect, the refrigerant charge, is disposed between the valve 34 and the condenser 29. The latter device includes a casing having a chamber 36 therein and a movable element 37 for varying the liquid storage capacity of the chamber 36, said element 37 being raised or lowered by a solenoid including a core 38 and a winding 39. The chamber 36 receives refrigerant from the condenser 29 through a conduit 41.

When the element 37 is in its first, or lower position, it occupies the chamber 36 and prevents the collection of condensed refrigerant therein, and, therefore, substantially all of the refrigerant in the system is circulated by the compressor mechanism 28. Raising the element 37 to a second position reduces the effective charge of refrigerant in the system, as condensed refrigerant gathers in the chamber 36 and does not circulate through the evaporator. The effective charge of refrigerant is, therefore, reduced in an amount equivalent to the amount of liquid which was displaced by element 37 when in the first or lower position.

The purpose of varying the effective charge of refrigerant is to change the operation of the system, so that in the first position of the device 35, cooling of the air in the chamber 12 to a desirable temperature is effected and in the second position of the device, quick freezing of liquids at a low temperature is obtained without materially reducing the temperature of the air in the chamber 12. In the first position of the device, refrigerant fills the shelves and a substantial portion of the evaporator walls 14 and 15. This represents the normal operating position and, as described hereinafter, the compressor mechanism 28 is controlled by a thermostat 42 for maintaining the air within the chamber 12 at a desired temperature.

The temperature at which the evaporator operates is preferably as high as practicable, and sufficiently low for effectively cooling the air in the refrigerator chamber 12 and for maintaining the liquid in the trays 19 in a frozen condition, if desired. By maintaining the temperature of the evaporator at a relatively high value, excessive dehumidification of the air in the chamber 12 is avoided.

In the second or quick freezing position of the device 35, liquid refrigerant is present in the shelves 16, 17, and 18 only, due to the reduced amount of refrigerant in the system that is effective for evaporation. The walls 14 and 15 contain refrigerant which has been vaporized in the shelves, which refrigerant is superheated by the walls. The walls are, of course, cooled in a very small amount, the heat abstracted therefrom being only the sensible heat absorbed by the vaporized refrigerant as superheat.

In accordance with my invention, operation of the compressor mechanism 28 is initiated or continued as the device 35 is actuated to its second position and is terminated only when the temperature of the shelves is depressed to the desired value, at which time the device is returned to its first position. It is to be understood that the shelves 16, 17, and 18 are so disposed that they are shielded by the walls 14 and 15 so that they are contacted by only a small amount of the air circulating in the chamber 12, and therefore, are not effective to cool the air to any substantial degree. Shields 43 may be carried by the evaporator 13 at its bottom, rear and front sides for inhibiting air in the chamber 12 from circulating over the cold shelves.

In accordance with my invention, the device 35 and the condensing unit 27 are preferably controlled by a mechanism generally shown at 45. The latter includes a lever 46 pivoted at 47 and biased in counterclockwise direction by a tension spring 48 and in clockwise direction by a bellows 49. The bellows 49 communicates with a closed tube 51 which is secured in heat exchanging relation with one of the shelves 16 of of the evaporator 13. The tube 51 contains a volatile fluid and defines with the bellows 49 a thermostat of the expansible gas type. Movement of the lever 46 by the bellows 49 is limited by a stop 52, which may be adjustable as shown. A pair of electrically connected contacts 53 and 54 are carried by the lever 46 and are connected to a conductor L_1 of an electrical circuit.

The mechanism 45 includes a pair of contacts 55 and 56 insulated from each other and carried by flexible members 57 and 58, respectively. The members 57 and 58 are carried by a spring support 59 fixed to a stationary member at 61 and carrying, at its upper end a manually operated push button 62. The latter is threaded in the support 59 and includes an armature 63, forming a part of a magnet, shown at 64. The latter may be energized by a suitable winding 65 which is electrically connected to the solenoid 39 in such manner that they are simultaneously energized and deenergized. As shown, the solenoid 39 and winding 65 are series connected between a conductor L_2 of the electrical supply circuit and the contact 55.

The running and starting windings 32 and 33 of the compressor motor are connected to the conductor L_2 and to a conventional starting relay 66. The latter includes a switch 67 for controlling energization of starting winding 33 and a solenoid 68 for actuating the switch 67 and connected to the running winding 32 in series relation. During starting, the relatively high starting current in the solenoid 68 effects closing of the switch 67 and energization of the starting winding 33. As the starting current is depressed due to the acceleration of the motor, the solenoid is ineffective to hold the switch 67 closed and the starting winding 33 is deenergized. As the operation of starting relays of this type is well known, no further description is deemed necessary.

The motor winding 32 is connected to the conductor L_1 by parallel circuits, the first of which includes the thermostat 42 and the second of which includes the contacts 56 and 54, and lever 46, the latter being connected to conductor L_1.

Operation

The refrigerating system disclosed operates on the well-known compressor-condenser-expander cycle. Gaseous refrigerant is withdrawn from the evaporator structure 13 through conduit 26 by the compression mechanism 28 and is com-

pressed to a suitable pressure for condensation in the condenser 29. Heat is abstracted from the condenser in any well known manner for condensing the compressed refrigerant. Liquid refrigerant passes through the conduit 41 and device 35 to the float valve 34, which regulates the delivery of the refrigerant to the evaporator 13 through the conduit 21. Vaporization of the refrigerant in the evaporator 13 at relatively low pressure is effected, whereby heat is abstracted therefrom. The portion or portions of the evaporator in which vaporization is effected depends upon the position of the device 35 as described heretofore.

During normal operation for cooling the air in the chamber 13, the apparatus is in the position shown in the drawing. The device 35 is deenergized and the element 37 occupies the chamber 36 so that liquid refrigerant occupies the shelves 16, 17, and 18 and a substantial portion of the walls 14 and 15. The compressor mechanism 28 is under control of the thermostat 42. As the temperature within the chamber 12 increases, the thermostat 42 closes and completes a circuit including conductor L_1, thermostat 42, relay solenoid 68, motor winding 32 to the conductor L_2 so that the compresor 28 operates to circulate refrigerant in the system. Evaporation is effected in the shelves 16, 17, and 18 and walls 14 and 15 whereby the chamber 12 is cooled and the congealed substance in the trays 19 may be preserved. As the temperature within the chamber 12 is depressed to a predetermined value, the thermostat 42 opens and operation of the compressor 28 is terminated.

When it is desired to depress the temperature of the shelves, as when water is to be frozen or dessert congealed, the button 62 of the mechanism 45 is pressed. This operation effects closing of contacts 53 and 55 and establishes a circuit including conductor L_1, lever 46, contact 53 and 55, winding 65, solenoid 39 to conductor L_2. Energization of magnet 64 attracts the armature 63 to the core and holds the button 62 and the member 55 in this position. Engagement of the contacts 54 and 56 establishes a shunt circuit around the thermostat 42 and effects operation of the compressor mechanism 28, regardless of whether thermostat 42 is closed or not. As the solenoid 39 is energized, the element 37 is raised and liquid refrigerant fills the chamber 36 so that the effective charge of refrigerant is reduced. Therefore, refrigerant substantially fills the shelves 16 to 18, inclusive, and is vaporized therein, the vaporous refrigerant passing through the walls 14 and 15 to the suction conduit 26.

The temperature of the shelves 16 to 18 is depressed to a relatively low value for effecting the congelation of the substance in the trays without materially reducing the temperature in the chamber 12. As the temperature of the shelves is depressed to a predetermined value, the bellows 49 contracts and the lever 46 is moved by the spring 48 a distance sufficient to effect opening of the contacts 53 and 55. Accordingly, the magnet 64 is deenergized and the spring member 59 moves to the right. Opening of contacts 53 and 55 deenergizes solenoid 39, permitting the element 37 to drop to its lower position and thereby displace the refrigerant in chamber 36, which refrigerant passes to the float 34 and eventually to the evaporator walls 14 and 15. Opening of the contacts 54 and 56 deenergizes the shunt circuit around the thermostat 42 so that control of energization of the motor winding 32 is returned to the thermostat 42.

The temperature of the shelves at which the bellows 49 operate to open the contacts 53 and 55 may be varied by rotating the button 62, which rotation effects a change in the distance between the armature 63 and the magnet core. Increasing this distance causes added movement to the left of the armature 63 when it is pushed toward the magnet core. Additional deflection of the contact supports 57 and 58 results as their respective contacts 55 and 56 engage contacts 53 and 54 and, therefore, the bellows must be contracted further by a reduced temperature of the shelves to effect opening of the contacts 53 and 55.

Preferably, the button 62 includes a position wherein the bellows 49 is ineffective to open the contacts 53—55. Opening of the contacts may, however, be effected manually by pulling the button and armature 63 from the magnet 64. This operation may be obtained by providing a stop 71 which is engaged by an extension 72 on the lever 46. By adjusting the armature to its extreme position wherein the armature 63 is farthest removed from the magnet 64, maximum deflection of the contact supports 57 and 58 is effected when the button 62 is pressed. In this position, the spring 48 is ineffective to move the lever 46 and contact 53 a distance sufficient to disengage the contact 53 from contact 55 due to the engagement of the stop 71 and the lever extension 72. Continuous operation of the compressor 28 is effected in this position and operation thereof is terminated only by manually pulling the armature 63 away from the magnet core and thereby disengaging contacts 55 and 56 from the contacts 53 and 54.

I have shown my improved control apparatus applied to a refrigerating system employing high and low temperature evaporating elements wherein the effective charge of the refrigerant in the system is varied for controlling evaporation in one of the elements, but it is to be understood that it may be applied to other forms of refrigerating systems having a plurality of evaporating elements which are operated at different temperatures and which may or may not be disposed in the same cooling chamber.

I have shown an embodiment of my improved control system wherein the compressor mechanism is controlled at times by a thermostat which is responsive to the temperature of the air in the chamber cooled by one of the evaporator elements, but it will be understood that the thermostat may be disposed otherwise and may be made responsive to other temperatures prevailing in the chamber in any known manner.

From the foregoing, it will be apparent that I have provided an improved control system for refrigerating apparatus, having a refrigerant condensing unit and a plurality of evaporators, in which the condensing unit is operated to supply refrigerant for vaporization in one of the evaporators under control of a thermostat at one time, and in which the condensing unit may be started independently of the thermostat at another time to supply refrigerant for vaporization in a second evaporator, the operation of said condensing unit being returned for control by said thermostat and for supplying refrigerant to said one evaporator in response to a predetermined temperature of the second evaporator, or at the will of the operator.

While I have shown my invention in but one

form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

What I claim is:

1. In refrigerating apparatus, the combination of a cabinet structure, a low temperature and a higher temperature evaporator disposed within said cabinet structure, refrigerant condensing means, means for conveying condensed refrigerant to said evaporators, temperature responsive means arranged within the cabinet for controlling the operation of the refrigerant condensing means, a device normally disposed in a first position in which refrigerant is delivered for vaporization in the higher temperature evaporator and in which position the temperature responsive means is effective for controlling the refrigerant condensing means; said device being movable manually to a second position in which refrigerant is delivered for vaporization in the low temperature evaporator and in which position the refrigerant condensing means is operated independently of the temperature responsive means, and means responsive to a predetermined temperature of the low temperature evaporator for actuating said device to its first position.

2. In refrigerating apparatus, the combination of a cabinet structure, a low temperature and a higher temperature evaporator disposed within said cabinet structure, refrigerant condensing means, means for conveying condensed refrigerant to said evaporators, a device movable to first and second positions in which positions refrigerant is delivered for vaporization in the high and low temperature evaporators, respectively, temperature responsive means arranged within the cabinet for initiating and terminating operation of the refrigerant condensing means when said device is in its first position, means for controlling said device and having first and second positions, corresponding to the first and second positions of said device, means for manually actuating the control means to its second position and for initiating operation of the refrigerant condensing means independently of said temperature responsive means, and means responsive to the temperature of the low temperature evaporator for actuating the control means to its first position and for returning control of the refrigerant condensing means to said first-mentioned temperature responsive means.

3. In refrigerating apparatus, the combination of a cabinet structure, a low temperature and a higher temperature evaporator disposed within said cabinet structure, refrigerant condensing means, means for conveying condensed refrigerant to said evaporators, temperature responsive means arranged within the cabinet for controlling the operation of the refrigerant condensing means, a device normally disposed in a first position in which refrigerant is delivered for vaporization in the higher temperature evaporator and in which position the temperature responsive means is effective for controlling the refrigerant condensing means; said device being movable manually to a second position in which refrigerant is delivered for vaporization in the low temperature evaporator and in which position the refrigerant condensing means is operated independently of the temperature responsive means; means responsive to a predetermined temperature of the low temperature evaporator for actuating said device to its first position, and means movable to a plurality of selective positions for adjusting said last-mentioned temperature responsive means, whereby the temperature of the low temperature evaporator to which the temperature responsive means responds to adjust said device is varied.

4. The combination as claimed in claim 3 wherein said adjustable means includes a position in which the last-mentioned temperature responsive means is rendered ineffective to actuate the control device to its first position.

5. In refrigerating apparatus, the combination of a cabinet, a relatively high temperature evaporator for cooling the air within the cabinet, a relatively low temperature evaporator for congealing fluids, means for condensing refrigerant and for translating it to said evaporators, a device movable to a first position for delivering condensed refrigerant to the high and low temperature evaporators and movable to a second position for delivering condensed refrigerant to the low temperature evaporator only, temperature responsive means disposed within the cabinet for controlling the operation of the refrigerant condensing means when said device is in its first position. means for moving said device to its second position and for initiating operation of the refrigerant condensing means independently of the temperature responsive means, and means responsive to the temperature of the low temperature evaporator for moving said device to its first position.

6. In refrigerating apparatus, the combination of a cabinet structure, a low temperature and a higher temperature evaporator arranged within said cabinet structure, means for condensing vaporous refrigerant and for translating it to said evaporators, a device for controlling the flow of condensed refrigerant and movable to first and second positions; said device when disposed in its first position, delivering condensed refrigerant to the high and low temperature evaporators and, when disposed in its second position, delivering condensed refrigerant to the low temperature evaporator only; means responsive to temperatures prevailing within the cabinet for initiating and terminating operation of the refrigerant condensing means when said device is in its first position, means for manually adjusting the device to its second position and for operating the refrigerant condensing means independently of the temperature responsive means and means responsive to a predetermined temperature of the low temperature evaporator for moving said device to its first position and for returning control of the refrigerant condensing means to said first-mentioned temperature responsive means.

7. In refrigerating apparatus, the combination of a cabinet structure, a low temperature and a higher temperature evaporator arranged within said cabinet structure, means for condensing vaporous refrigerant and for translating it to said evaporators, a device for controlling the flow of condensed refrigerant and movable to first and second positions; said device, when disposed in its first position, delivering condensed refrigerant to the high and low temperature evaporators and, when disposed in its second position, delivering condensed refrigerant to the low temperature evaporator only; means responsive to temperatures prevailing within the cabinet for initiating and terminating operation of the re-

frigerant condensing means when said device is in its first position and means for moving the device to its second position for operating the refrigerant condensing means independently of the temperature responsive means and for moving said device to its first position for returning control of the refrigerant condensing means to said first-mentioned temperature responsive means.

8. In refrigerating apparatus, the combination of a cabinet structure, an evaporator arranged within said cabinet structure, said evaporator having wall members for cooling the air in said cabinet and constituting a high temperature evaporator element, said evaporator including shelves arranged within the wall members for receiving fluids to be congealed and constituting a low temperature evaporator element, means for condensing refrigerant and for translating it serially through said shelves and said wall members, temperature responsive means disposed within the cabinet for controlling the operation of the refrigerant condensing means, a device for varying the effective charge of refrigerant in the apparatus and movable to a first position in which condenser refrigerant fills said shelves and a portion of the wall members, said device being movable to a second position in which condensed refrigerant is delivered to the shelves only, means manually operated at will for actuating said device to its second position and for operating the refrigerant condensing means independently of the temperature responsive means, means responsive to a predetermined temperature of a shelf for actuating the device to its first position and for returning control of the refrigerant condensing means to the first-mentioned temperature responsive means and means adjustable to a plurality of selective positions for varying the temperature of the shelves to which said temperature responsive means responds to actuate said device; said adjustable means including a position in which the temperature responsive means is ineffective to return the device to its first position or to return control of the refrigerant condensing means to the first-mentioned temperature responsive means.

9. In refrigeration apparatus, the combination of a low temperature evaporator, a higher temperature evaporator, refrigerant condensing means, means for conveying condensed refrigerant to said evaporators, temperature responsive means affected by said higher temperature evaporator for controlling the operation of the refrigerant condensing means, a device normally disposed in a first position in which refrigerant is delivered for vaporization in the higher temperature evaporator and in which position the temperature responsive means is effective for controlling the refrigerant condensing means; said device being movable manually to a second position in which the refrigerant is delivered for vaporization in the low temperature evaporator and in which position the refrigerant condensing means is operated independently of the temperature responsive means, and means responsive to a predetermined temperature of the low temperature evaporator for actuating said device to its first position.

10. In refrigerating apparatus, the combination of a structure having a zone to be refrigerated, an evaporator having a first portion for cooling the air in the zone and a second portion isolated from said zone, means for circulating refrigerant through the evaporator, temperature responsive means for controlling the operation of the circulating means whereby the air in said zone is maintained at a predetermined mean value, auxiliary means for effecting operation of the circulating means independently of the temperature responsive means whereby the temperature of the second evaporator portion is depressed to a relatively low value and means for reestablishing control of the circulating means by the temperature responsive means subsequent to an operation of the circulating means which was effected by said auxiliary means.

11. In refrigerating apparatus, the combination of a structure having a zone to be refrigerated, an evaporator having a first portion for cooling the air in the zone, a container for fluid to be congealed, said evaporator having a second portion in heat transfer relation with the container, means for circulating refrigerant through the evaporator, temperature responsive means for controlling the operation of the circulating means whereby the air in said zone is maintained at a predetermined mean value, means manually operable at will for effecting operation of the circulating means independently of the temperature responsive means whereby the temperature of the second evaporator portion is depressed to a relatively low value for rapid congealation of the fluid in the container and means responsive to the temperature of the second evaporator portion for reestablishing control of the circulating means by said temperature responsive means subsequent to an operation of the circulating means which was effected by said manually operated means.

12. In refrigerating apparatus, the combination of a cabinet structure, a low temperature and a higher temperature evaporator disposed within said cabinet structure, refrigerant condensing means, means for conveying condensed refrigerant to said evaporators, temperature responsive means arranged within the cabinet for controlling the operation of the refrigerant condensing means, means normally effecting refrigeration in the higher temperature evaporator, at which time the temperature responsive means controls the refrigerant condensing means, said last means being manually adjustable to effect refrigeration of the low temperature evaporator, at which time the refrigerant condensing means is operated independently of said temperature responsive means, and means responsive to a predetermined temperature of the low temperature evaporator for again effecting refrigeration of the higher temperature evaporator under the control of the temperature responsive means.

13. In refrigerating apparatus, the combination of a cabinet structure, a low temperature and a higher temperature evaporator disposed within said cabinet structure, refrigerant condensing means, means for conveying condensed refrigerant to said evaporators, temperature responsive means arranged within the cabinet for controlling the operation of the refrigerant condensing means, a mechanism for normally effecting refrigeration in the higher temperature evaporator, at which time the temperature responsive means controls the refrigerant condensing means, means for adjusting the mechanism for effecting refrigeration of the low temperature evaporator, at which time the temperature responsive means is ineffective to control the refrigerant condensing means, and means for conditioning said mechanism so that refrigeration is again effected in the higher temperature evaporator, when the demand for refrigeration of the low temperature evaporator has been satisfied.

14. In refrigerating apparatus, the combination of means defining a zone to be cooled, an evaporator structure including wall members disposed in heat transfer relation with the air in said zone and defining a cooling chamber therebetween, said structure including a shelf disposed within said cooling chamber and isolated from the air in the zone, said wall members and shelf having respective spaces therein for refrigerant, means for circulating refrigerant through the evaporator structure and adjustable to a first condition for supplying condensed refrigerant to the spaces of the walls and shelf for vaporization and to a second condition for supplying refrigerant to the shelf space only, means responsive to the temperature of the air in said zone for controlling the operation of the circulating means during periods when the latter is in said first condition, means for effecting operation of the circulating means independently of the temperature responsive means when the circulating means is in said second condition, and means responsive to a predetermined low temperature of the shelf for adjusting the circulating means to its first condition and for returning control of the same to said first-mentioned temperature responsive means.

15. In refrigerating apparatus, the combination of a cabinet structure, an evaporator disposed within the cabinet structure and having wall members for cooling the air within the cabinet structure, said wall members defining a cooling chamber therebetween, a shelf disposed within the cooling chamber, said wall members and shelf having respective passages for refrigerant, means for condensing refrigerant and for translating it to the evaporator so that it flows into the shelf passage until filled and thence into the passages of the walls, a device for varying the effective charge of refrigerant in the apparatus and normally disposed in a first position in which condensed refrigerant substantially fills the shelf passages and a portion of the passages of the walls, said device being movable to a second position in which condensed refrigerant is delivered to the passages of the shelf only, temperature responsive means disposed within the cabinet for controlling the operation of the refrigerant condensing means during periods when said device is normally disposed in its first position, means for periodically actuating said device to its second position and for operating the refrigerating condensing means independently of said temperature responsive means, and means responsive to a predetermined low temperature of the shelf for returning the device to its first position and for returning control of the refrigerant condensing means to said first-mentioned temperature responsive means.

16. The method of operating refrigerating apparatus having an evaporator including wall members disposed for cooling air in a space to be refrigerated and a shelf disposed between the wall members for supporting substances to be congealed, which method comprises normally supplying condensed refrigerant to both the shelf and the wall members for vaporization at relatively high pressure, controlling the supply of refrigerant in response to the temperature within said space, supplying refrigerant to the shelf for vaporization at relatively low pressure independently of the temperature of said space and establishing the said normal supply of refrigerant to both the shelf and the walls under control of the temperature within the space in response to a predetermined low temperature produced by the shelf.

LESLIE B. M. BUCHANAN.

CERTIFICATE OF CORRECTION.

Patent No. 2,133,952. October 25, 1938.

LESLIE B. M. BUCHANAN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, first column, line 25, claim 8, for the word "condenser" read condensed; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 13th day of December, A. D. 1938.

Henry Van Arsdale

(Seal) Acting Commissioner of Patents.