Dec. 31, 1935. M. H. LOUGHRIDGE 2,025,760

REFRIGERATOR

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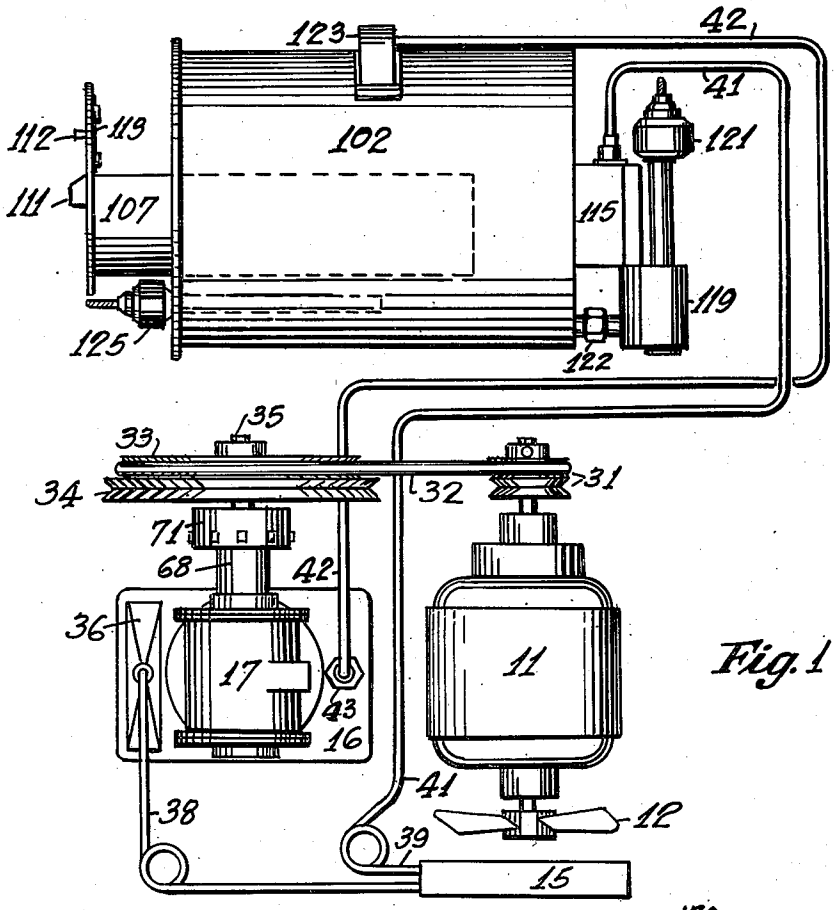


Fig. 1

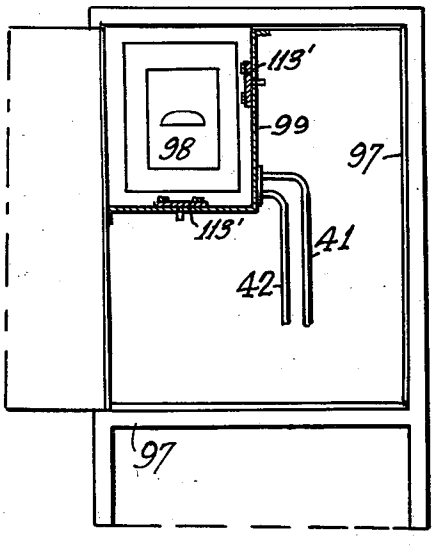


Fig. 3

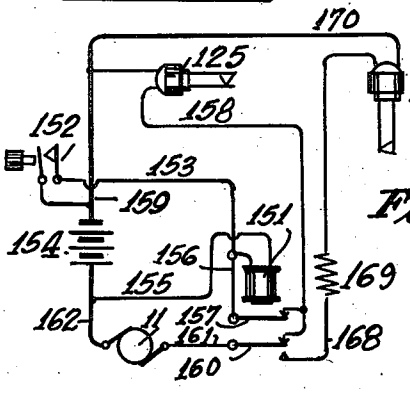


Fig. 2

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Fig. 4.

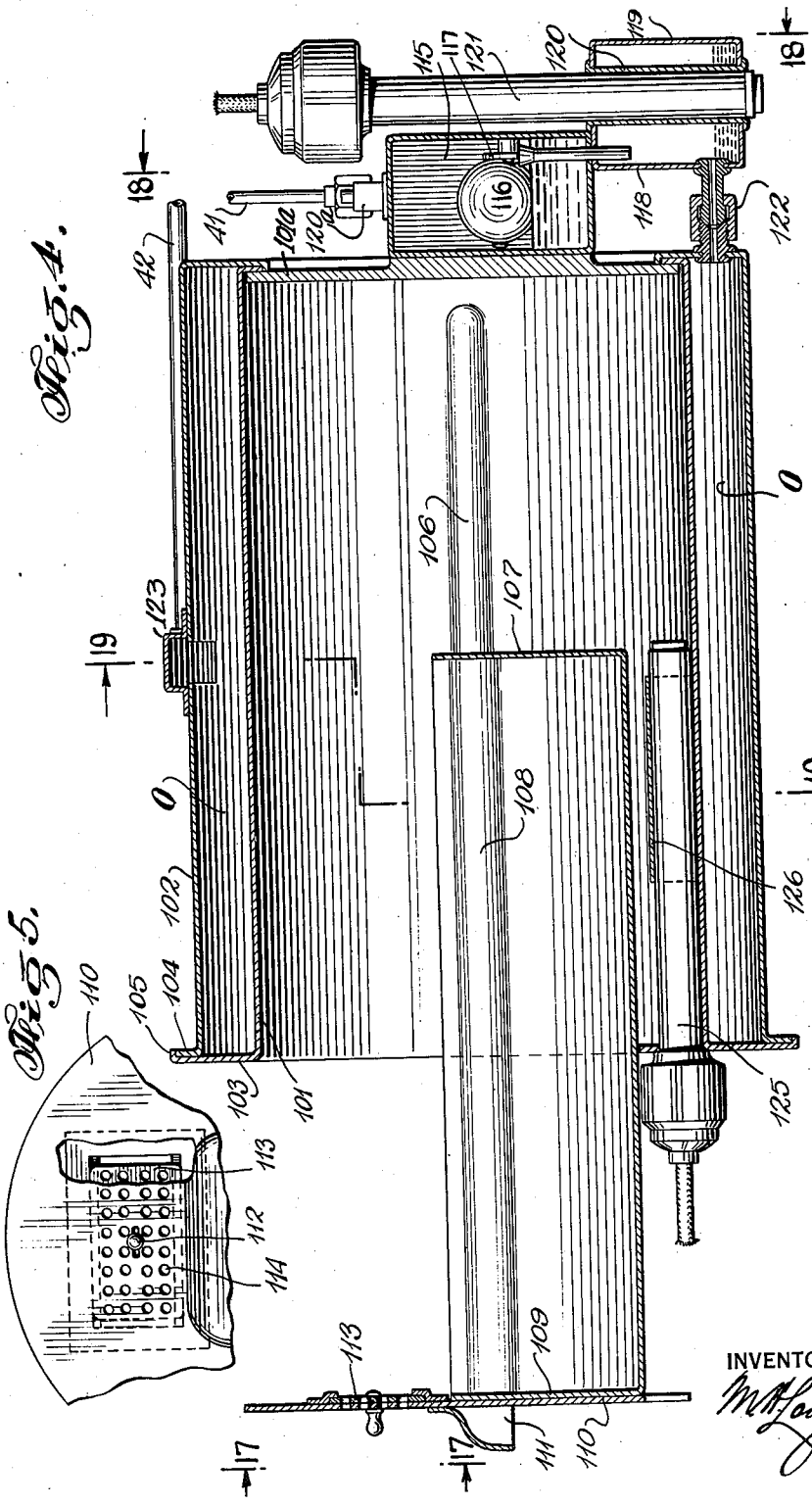


Fig. 5.

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Fig. 6.

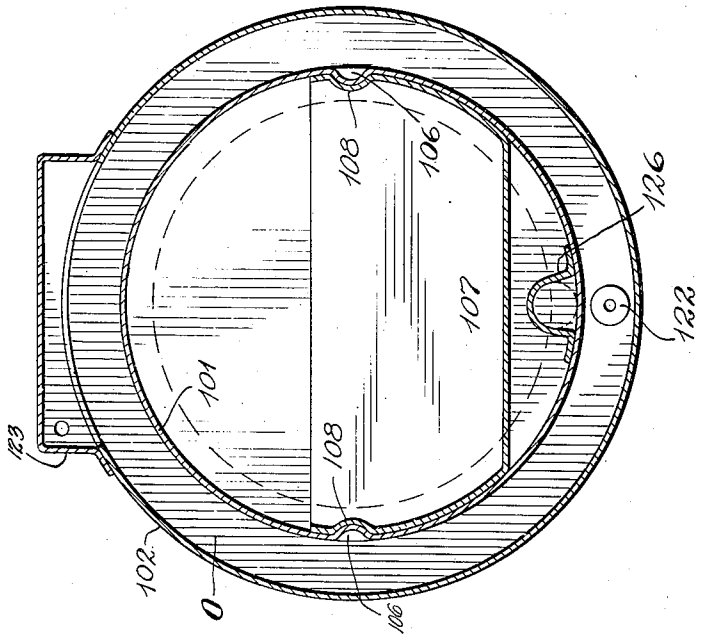
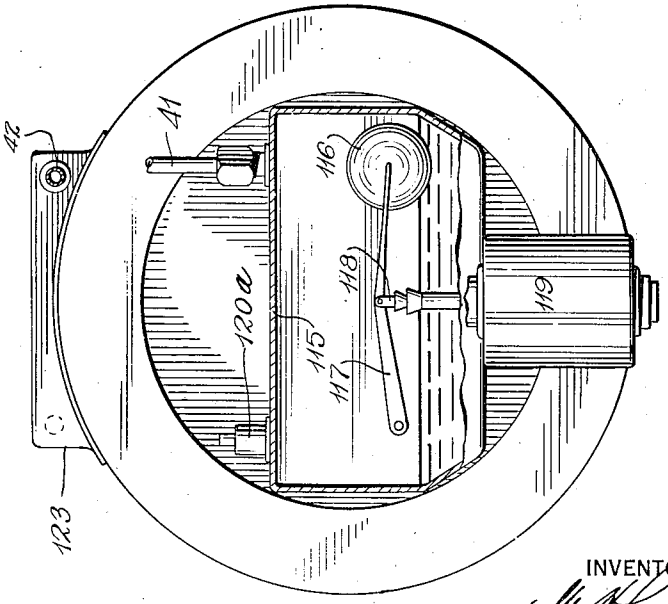


Fig. 7.



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UNITED STATES PATENT OFFICE

2,025,760

REFRIGERATOR

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Application December 26, 1929, Serial No. 416,363

31 Claims. (Cl. 62—4)

This invention relates to refrigerators and particularly to the small, self-contained refrigerator unit that is used in restaurants, homes and offices and has for an object to provide an automatic control for the refrigerator by a pair of thermostats set to operate at different temperatures with electrically controlled means for selecting the operation by said thermostats; another object is to provide a pair of ventilators for an enclosure for the evaporator which regulates the draft around the evaporator, and another object is to locate the thermostats with reference to the evaporator so that they are subject to different temperatures in the operation of the system. A practical application of the invention resides in an evaporator designed to make ice cubes in a system normally controlled by one thermostat, but which may be changed over, by the operation of a push button, to the control by a second thermostat, set to operate at a lower temperature, and thus intensify the operation of the system when ice cubes are wanted. Other objects of the invention will appear from the following specification, in connection with the accompanying drawings, in which;

Fig. 1 is a diagram of the motor, compressor and evaporator with connections;

Fig. 2 is a diagram of the electrical connections for the control system;

Fig. 3 is a view of the inside of a refrigerator showing the ventilated enclosure for the evaporator;

Fig. 4 is a sectional elevation of a cylindrical form of evaporator, and float valve that may be used with this invention;

Fig. 5 is a detail of a form of ventilator that is used in connection with the evaporator;

Fig. 6 is an end view of the evaporator from the rear showing the float valve associated therewith in section;

Fig. 7 is a transverse sectional elevation of the evaporator on line 19—19, Fig. 4.

The present invention is shown applied to small refrigerator units such as are used in household refrigerators and in electric water coolers and contains certain novel features, all of which may be embodied in the single machine or these features may be applied individually as desired.

The form of apparatus illustrated in the drawings to show my invention comprises the usual "high side" having an electric motor, belt connected to a rotary form of compressor, with connections passing through a condenser, cooled by a fan driven by the motor, and leading to the evaporator, or "low side". The evaporator, as shown, is a hollow cylindrical, sheet metal shell with a float valve at one end and a drawer at the other end passing into the interior of the cylinder and in which water may be frozen into ice cubes. One of the controlling thermostats is placed in the cylinder with the ice cube drawer and the other is placed outside the cylinder.

A receptacle is provided in connection with the float valve for the thermostat controlling the operation of the motor. This enables the thermostat to be placed in the most effective position.

The system herein disclosed is arranged to provide refrigeration with different degrees of intensity and is so controlled that it may be changed over from operating under one system of control to the other until a pre-determined degree of refrigeration has been reached when the system automatically changes back again to its former condition.

The system is regulated by the use of a pair of thermostats, one of which is arranged to control the system under normal operation and the other is arranged to control the system under accelerated operation. A change-over relay is provided for changing over the control of the motor from one of these thermostats to the other. In practice, the operation of a push button energizes this relay and secures accelerated operation until the circuit is interrupted by the thermostat, thereafter the relay is deenergized and the system continues to operate at a normal rate until the push button is again operated.

The cooling effect may be concentrated in the evaporator to speed up the freezing of the ice cubes by enclosing the evaporator in the cooling chamber and regulating the draft by adjustable regulators to which the evaporator is exposed. Shutting off the draft will accelerate the freezing.

In the drawings, 11 is the electric motor upon the shaft of which the fan 12 is mounted to direct an air current through the condenser 15.

The compressor 17 is driven by the motor 11 through the driving pulley 31, belt 32 and pulley 33, mounted on shaft 35 of the compressor. A pair of different sized belt pulleys 33 and 34 are provided on the shaft 35 with a view to obtaining a change in the operating speed of the compressor. A variation in speed of the compressor may be desirable as, for instance, where an increase in the volume of the circulating medium in the system is desired.

The base 16 is provided at one end with an outlet, as indicated at 36 and to which the outlet pipe 38 is connected. The pipe 38 leads to the

condenser 15 and from the condenser through pipe 39 and by pipe 41 connects to the evaporator 102 hereinafter described.

The pipe 42 leading from the evaporator connects to valve 43, and to the base 16. The valve 43 comprises a valve member (not shown) which closes the pipe 42 when any back pressure develops in the compressor.

The evaporator as shown in Fig. 4 is made from tubing having an inner member 101 and an outer member 102 enclosing the space indicated by *o*. The inner tube 101 is flanged outwardly at 103 at one end and is flanged inwardly at the opposite end and the outer tube 102 is flanged outwardly at 104 to engage the flange 103 of the inner tube and is flanged inwardly at the opposite end. These flanges are brought into abutting relation as shown and the outer flange 103 is turned over at the edge 105 to make a seating for the flange 104. This holds the tubing in alignment and facilitates the operation of welding. The inner tube is preferably provided with a pair of diametrically opposed inwardly projecting ridges 106 which give rigidity to the tubing and provide a slide for the drawer 107 which has corresponding ridges 108 to engage the ridges 106. This drawer is provided with an end 109 to which the end plate 110 is secured with the handle 111. For ventilating purposes the slide 113 is provided in the end plate 110 and operated by the knob 112 whereby the ventilating apertures 114 may be opened or closed as desired.

In the particular system used to illustrate this invention a float valve is used for regulating a discharge of gas to the evaporator. The float valve is mounted on the end plate 101*a* and comprises the tank 115 with the float 116 connected through lever 117 with the valve 118 Fig. 6, leading to the thermostat chamber 119 and by the nipple 122 to the evaporator chamber *o*. The refrigerant delivered to pipe 41 under pressure from the condenser 15 is delivered to the tank 115 and through the float valve and chamber 119 to the evaporator *o* and from the evaporator through the header connection 123 placed on top of the cylinder to pipe 42 and back to the intake side of the compressor. The float valve is provided with an outlet at 120*a* for testing purposes.

The thermostat chamber 119 is provided with an open ended tube 120 for receiving the stem 121 of the thermostat as shown. This places the thermostat in the position to be influenced at the point of expansion of the refrigerant through valve 118; the chamber 119 it will be noted is a continuation of chamber *o*. A second thermostat is provided at 125, held in place by the cleat 126 below the drawer 107 against the inside of the evaporator. Normally the thermostat 121 controls the operation of the system but if it should be desired to accelerate the extent of the refrigeration, such as in making ice cubes or cooling food stuffs placed in the drawer 107 and having considerable latent heat, the system can be changed over from being controlled by thermostat 121 to be controlled by thermostat 125. It should be noted that variations in the operation of the machine can be obtained by thermostats adjusted to operate under different temperature conditions and located in any convenient position in the cooling chamber. It is also possible to accelerate or retard the extent of the refrigeration by regulating the ventilation of the evaporator as indicated in Fig. 3, in which 97 is the cooling chamber, 98 is the evaporator and 99 is an enclosure or baffle plate for the evaporator. This baffle plate is provided with ventilators at the top and bottom 113′ similar to Fig. 5 by which the draft to the evaporator can be retarded when it is desired to cool articles placed within the evaporator rapidly. One, or both of the thermostats may be enclosed with the evaporator by 99.

One arrangement for operating the system described is shown in Fig. 2 and includes a means whereby the operation of the system may be temporarily accelerated by the operation of a push button.

This comprises a control relay 151 operated by the push button 152 through wire 153, battery 154 and wire 155. When the push button is closed the relay is energized and a stick circuit is thereby established through wire 156, contact 157 in the energized position, wire 158, thermostat 125 and wire 159 to battery 154, thus relay 151 will remain energized until the circuit is interrupted by the thermostat 125. When the control relay 151 is energized the circuit of motor 11 is established through wire 161, contact 160, wire 158, thermostat 125, wire 159, battery 154 and wire 162 to motor 11. This places the motor under the control of thermostat 125.

As soon as the temperature has been lowered to cause thermostat 125 to open its circuit, the relay 151 is thereby deenergized and it cannot again be energized until the push button 152 is operated. In the deenergized position of relay 151 the motor 11 is controlled by a circuit including wire 161, contact 160 in the deenergized position, wire 168, resistance 169, thermostat 121, wire 170, wire 159, battery 154, and wire 162 to the motor 11.

The system herein described may be applied and operated, as shown, or its component parts may be separately used in other systems of refrigeration which is the intent and purpose of the invention.

This is the normal condition of the system and places the motor 11 under the control of thermostat 121 and the resistance 169 so that the speed of the motor may be decreased below the speed obtained when controlled by thermostat 125. By this arrangement it will be noted that the mechanism can be initiated for a predetermined degree of refrigeration and when this refrigeration has been reached the system is automatically changed over to operate under normal conditions.

The present invention includes a system with one evaporator in a cooling chamber through which a refrigerant is circulated, a pair of thermostats operative at different temperatures selectively controlling, one at a time, the flow of the refrigerant so that the chamber is cooled under the control of one thermostat to a greater degree than when under the control of the other thermostat.

The thermostats do not control the system by superimposing the control of the lower operating thermostat upon the higher operating thermostat, but instead, they control the system one only at a time, the thermostat which is not controlling being out of circuit and ineffective in influencing the system. Thus, any defects, such as a short circuit, that might arise in one of the thermostats cannot influence the system when operating under the other thermostat.

The change over between the high and low operating thermostats is obtained electrically, by an electric relay which selectively controls the circuits so as to bring one or other of the thermostats into control and to disconnect the non-

controlling thermostat from the system. This relay is remotely controlled by a push button which may be placed in any convenient location, inside or outside the cooling chamber. The energy necessary to operate the relay and change over the system is very small and is easily controlled.

The relay which selectively controls the circuit of the thermostats may also be located outside the cooling chamber and remote therefrom as its operation is entirely electric and it does not have to be connected in any way with the circulating system. This relay is known as a "stick" relay because it controls its own circuit at 157 so that once it is energized by the pick-up circuit, through the push button and the push button is released to open the pick-up circuit, the holding circuit through 157 is established until interrupted by the thermostat 125. When the holding circuit is thus interrupted, the relay is deenergized and it cannot again be energized by 125 until it is first energized by the push button in the pick-up circuit. This provides a simple and comparatively inexpensive method of controlling the system by different temperatures in the cooling chamber, subject to manual selection.

It should be noted that as shown in Fig. 5, the evaporator is a hollow container provided with a closure and that a controlling thermostat is located in this container and the second controlling thermostat is located outside the container. A much lower temperature is usually obtained inside the evaporator than prevails outside the evaporator. This difference in temperature may be used to obtain a difference in control where the thermostats operate at substantially the same temperature.

The mechanism described operates with a refrigerant comprising a mixture of ethyl chloride and oil and the apparatus is shown constructed with particular reference to the use of this refrigerant; it should be understood, however, that when a different refrigerant is used the apparatus may be varied to suit these different conditions without departing from the intent and spirit of the present invention which is intended to include a full range of equivalents in the refrigeration industry.

Having thus described my invention, I claim:

1. A refrigerating system comprising a compressor, a motor operatively connected with said compressor, a condenser and an evaporator connected in a circulating system with said compressor and a pair of thermostats associated with said evaporator and means for connecting either of said thermostats and disconnecting the other at a time for controlling the circuit of said motor under different temperature conditions.

2. A refrigerating system comprising a compressor, a motor operatively connected with said compressor, a condenser and an evaporator connected in a circulating system with said compressor, a pair of thermostats associated with said evaporator and operative at different times and an electrically operated device for selectively controlling the circuit of said motor by either of said thermostats.

3. A refrigerator system comprising a compressor, a motor operatively connected with said compressor, a condenser and an evaporator connected in a circulating system with said compressor, a pair of thermostats operating at different temperatures, means for opening and closing the circuit of said motor by one only of said thermostats at a time and automatic electric means for changing the system to control the motor by the other thermostat.

4. A refrigerating system comprising a compressor, a motor operatively connected with said compressor, a condenser and an evaporator connected in a circulating system with said compressor, means controlling said motor to operate said system at a normal rate and electrically operated means manually initiated for accelerating the operating of said system until a predetermined condition is reached and for automatically resuming normal operation when this predetermined condition is reached.

5. A refrigerating system comprising a compressor, a motor operatively connected with said compressor, a condenser and an evaporator connected in a circulating system with said compressor, a thermostat controlling said motor to operate said system at a normal rate and a second thermostat controlling the circuit of said motor until a predetermined condition is reached the circuit controlled by the second thermostat containing means for accelerating the speed of the motor.

6. In a refrigerator, the combination of a compressor, a motor for operating said compressor, an evaporator, means connecting said compressor with said evaporator for the circulation of a refrigerant medium therein, a thermostat controlling said motor, a drawer in said evaporator and a receptacle for said thermostat between said drawer and said evaporator.

7. In a refrigerator, the combination of a compressor unit, a motor operatively connected with said compressor, an evaporator, means connecting said compressor with said evaporator for the circulation of a refrigerating medium therein, said evaporator comprising a hollow open ended vessel, a removable end plate fitted to said open end and a control valve for the refrigerating medium, supported by said end plate.

8. In a refrigerator, the combination of a compressor, a motor for operating said compressor, an evaporator, means connecting said compressor with said evaporator for the circulation of a refrigerant therein, a thermostat located within said evaporator and a second thermostat located outside said evaporator, said thermostats controlling said motor.

9. In a refrigerator, the combination of a compressor, a motor for operating said compressor, an evaporator, means connecting said compressor with said evaporator for the circulation of a refrigerant therein, a tube extending into said evaporator, a thermostat located in said tube and means for controlling said motor by said thermostat.

10. A refrigerator system comprising a compressor, a motor operatively connected with said compressor, a condenser and an evaporator connected in a circulating system with said compressor, a pair of thermostats operating at different temperatures, a stick relay selectively controlling said motor by said thermostats and a circuit for said stick relay controlled by one of said thermostats.

11. A refrigerator system comprising a compressor, a motor operatively connected with said compressor, a condenser and an evaporator connected in a circulating system with said compressor, a pair of thermostats operating at different temperatures, means for setting said system for control solely by either of said thermostats at a time and means for automatically changing the system for control.

12. A refrigerator system comprising a compressor, a motor operatively connected with said compressor, a condenser and an evaporator connected in a circulating system with said compressor, between the thermostats an electrically operated device for setting said system for operating under a predetermined temperature control and for automatically removing said predetermined temperature control and changing the system for another condition of control.

13. A refrigerator system comprising a compressor, a motor operatively connected with said compressor, a condenser and an evaporator connected in a circulating system with said compressor, a cooling chamber for said evaporator, means responsive to different temperatures in said cooling chamber controlling said motor and electrically operated means manually set for changing the temperature of said control.

14. A refrigerator system comprising a compressor, a motor operatively connected with said compressor, a condenser and an evaporator connected in a circulating system with said compressor, thermostatic means including an electrically controlled relay for controlling the circuit of said motor and a push button controlling the circuit of said relay for varying said thermostatic means to control said motor at different temperatures.

15. A refrigerator system comprising a compressor, a motor operatively connected with said compressor, a condenser and an evaporator connected in a circulating system with said compressor, thermostatic means for controlling the circuit of said motor and an electrically operated relay for varying said thermostatic means to control said motor at different temperatures.

16. A refrigerator system comprising a compressor, a motor operatively connected with said compressor, a condenser and an evaporator connected in a circulating system with said compressor, thermostatic means controlling said motor, a relay, an electric circuit controlling said relay associated with said thermostatic means, said relay in one position controlling said means to control said motor at one temperature and in another position controlling said means to control said motor at another temperature and a manually operated switch controlling said electric circuit.

17. A refrigerator system comprising an evaporator, means for circulating a refrigerant in said evaporator, a pair of thermostats controlling said means, an electrically operated relay selectively making one only of said thermostats effective at a time, a cooling chamber with an enclosure for said evaporator and an adjustable ventilator for said enclosure.

18. A refrigerator system comprising an evaporator, means for circulating a refrigerant in said evaporator, a thermostat controlling said means, a cooling chamber with an enclosure for said evaporator and a plurality of spaced adjustable ventilators, said ventilators located at right angles to each other in the walls of said enclosure.

19. Refrigerating apparatus comprising in combination, a single cooling unit, means for circulating a refrigerating medium thru said unit, means for automatically controlling the circulating means to maintain, normally, a predetermined mean temperature of the cooling unit, means for controlling the circulating means to maintain a different temperature of the cooling unit, said controlling means including an electrically operated device selectively operated by the temperature of the cooling unit to discontinue the mean temperature control and to establish control by said different temperature.

20. Refrigerating apparatus comprising in combination, a cooling unit, electrically operated means for circulating a refrigerating medium thru said unit, means for automatically controlling the circuit of said circulating means to maintain, normally, a predetermined mean temperature of the cooling unit, an electrically operated device, manually set for controlling the circuit of said circulating means for a different temperature of the cooling unit and means for automatically controlling the circuit of said electric control means for restoring said controlling means for normal operation.

21. Refrigerating apparatus comprising in combination, a cooling unit, means for circulating a refrigerating medium thru said unit, means for automatically controlling the circulating means to maintain, normally, a predetermined mean temperature of the cooling unit, an electrically operated device, manually set, for controlling the circulating means for a different temperature of the cooling unit and means controlling the circuit of said electrically controlled means for automatically restoring the controlling means for normal operation.

22. Refrigerating apparatus comprising in combination, a cooling unit, means for circulating a refrigerating medium thru said unit, means for automatically controlling the circulating means to maintain, normally, a predetermined mean temperature of the cooling unit, an electrically operated device for controlling the circulating system to effect a lower temperature than said predetermined mean temperature and means controlling the circuit of said electrical control means for restoring said controlling means for normal operation automatically, after said lower temperature has been reached.

23. Refrigerating apparatus comprising in combination, a cooling unit, means for circulating a refrigerating medium thru said unit, controlling means controlling said circulating means, effective at a plurality of different temperatures, an electrically operated device for changing over said controlling means to make one of said temperature controls only effective at a time and means for automatically operating said change over device.

24. Refrigerating apparatus comprising in combination, a cooling unit, means for circulating a refrigerating medium thru said unit, controlling means controlling said circulating means, effective at a plurality of different temperatures, an electrically operated relay for selectively changing over said controlling means between said temperatures and means automatically controlling said relay by said controlling means.

25. Refrigerating apparatus comprising in combination, a cooling unit, means for circulating a refrigerating medium thru said unit, a plurality of thermostats, each effective at different temperatures, controlling said circulating means and an electrically operated device for automatically changing over the control from one of said thermostats to the other thermostat.

26. Refrigerating apparatus comprising in combination, a cooling unit, means for circulating a refrigerating medium thru said unit, a plurality of thermostats, each effective at different temperatures, controlling said circulating means, manual means for setting said control to operate

only by one of said thermostats and an electrically operated device for changing said control to another thermostat.

27. Refrigerating apparatus comprising in combination, a cooling unit, means for circulating a refrigerating medium thru said unit, a plurality of thermostats, each effective at different temperatures, controlling said circulating means, a relay selectively making effective one only of said thermostats at a time, the circuit of said relay being controlled by one of said thermostats.

28. A refrigerator system comprising an evaporator, means for circulating a refrigerant in said evaporator, a thermostat controlling said system and a chamber with a nozzle for expanding said refrigerant before entering said evaporator, said thermostat being operatively connected with said chamber.

29. In a refrigerator, an evaporator, means for circulating a refrigerant in said evaporator, and a plurality of thermostatic means controlling said circulating means, one of said thermostatic means being located within said evaporator and the other located outside said evaporator.

30. A refrigerator system comprising an evaporator, means for circulating a refrigerant in said evaporator, a thermostat controlling said means, a cooling chamber, an enclosure in said cooling chamber for said evaporator and said thermostat, a pair of ventilators located one above the other in the walls of said enclosure and means for adjusting the opening of one of said ventilators.

31. A refrigerator system comprising an evaporator, means for circulating a refrigerant in said evaporator, a thermostat responsive to heat controlling said means, a cooling chamber, an enclosure in said cooling chamber for said thermostat, a pair of ventilators located one above the other in the walls of said enclosure and means for adjusting the opening of one of said ventilators.

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