

Nov. 17, 1942.

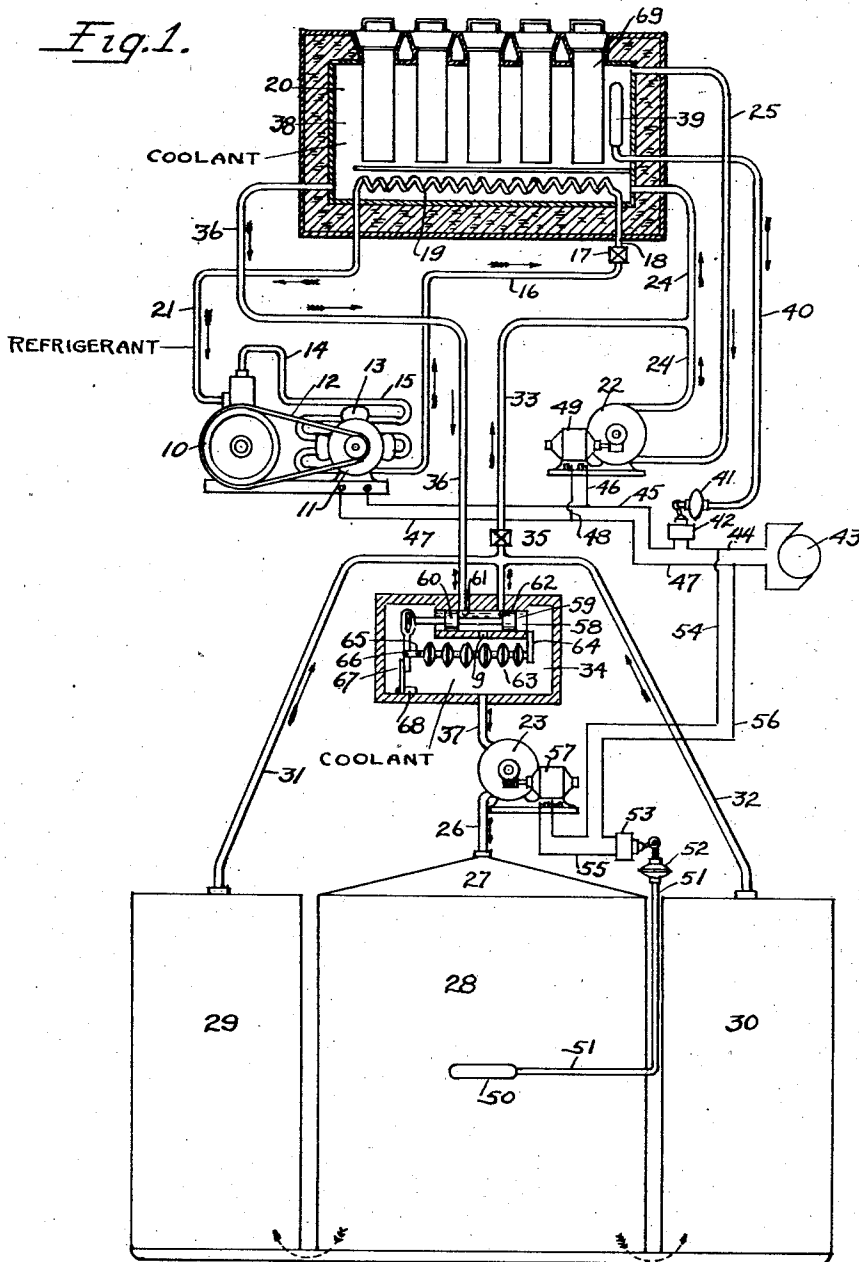
C. D. FATOR

2,301,938

REFRIGERATOR

Filed Aug. 16, 1939

2 Sheets-Sheet 1



Inventor
Charles D. Fator.
By *Samuel R. Fator*
Attorney

Nov. 17, 1942.

C. D. FATOR

2,301,938

REFRIGERATOR

Filed Aug. 16, 1939

2 Sheets-Sheet 2

Fig. 2.

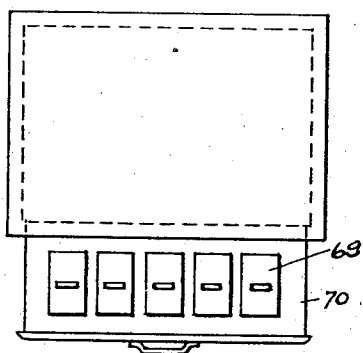


Fig. 7.

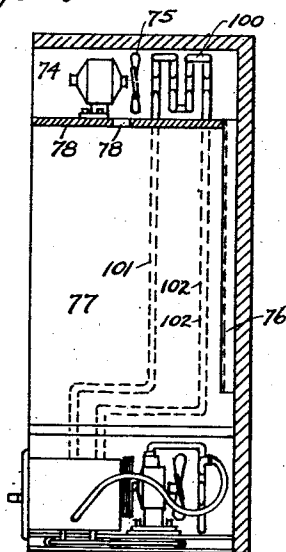


Fig. 3.

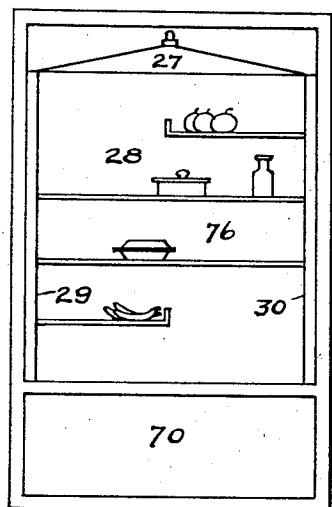


Fig. 5.

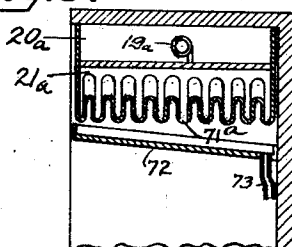


Fig. 8.

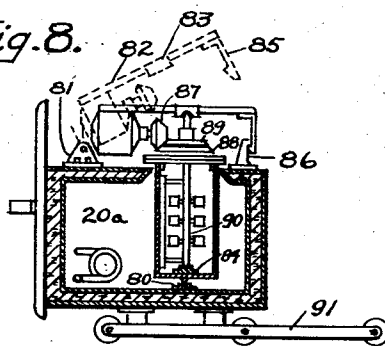


Fig. 4.

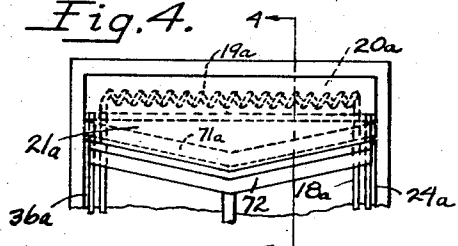
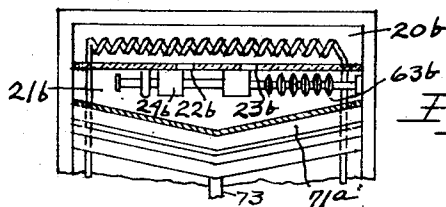


Fig.6.



Inventor
Charles D. Fator.
By Adam Richman
Attorney

UNITED STATES PATENT OFFICE

2,301,938

REFRIGERATOR

Charles D. Fator, San Antonio, Tex.

Application August 16, 1939, Serial No. 290,423

7 Claims. (Cl. 62—95)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

This invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates generally to mechanical refrigerators, but more particularly to improvements in this type of refrigerator with respect to the cooling apparatus and its arrangement therein.

One object of the invention is to provide a mechanical refrigerator in which the food compartment is retained at a practically constant nonfreezing temperature.

Another object of the invention is to prevent contamination of the ice by food odors.

Still another object of the invention is to provide for the convenient relative location of the refrigerating apparatus with respect to the food compartment and ice trays, so as to render all portions of the refrigerator accessible and to provide ample space for both the storage of food and ice cubes.

With these and other objects in view this invention relates to certain novel details of construction, combination and arrangement of parts to be more fully herein described and claimed.

Referring to the figures in which like parts are designated by similar reference characters:

Fig. 1 is a diagrammatic view of the improved refrigerating apparatus;

Fig. 2 is a top plan view of one type of the improved refrigerator;

Fig. 3 is a front elevation of the refrigerator shown in Fig. 2, with the door and freezing tray removed;

Fig. 4 is a front elevation of the upper portion of a modified form of the improved refrigerator having a chilling vessel and a lower corrugated surface beneath the same located at the top of the food compartment;

Fig. 5 is a sectionized view taken on the line 4—4 of Fig. 4;

Fig. 6 is a front elevation of the upper portion of another modified form of the improved refrigerator similar to that shown in Fig. 4, in which a thermo-syphon circulation of the coolant is controlled by a thermostatically operated valve;

Fig. 7 is a partially sectionized side view of a modified form of the refrigerator in which chilled air is circulated through the food compartment;

Fig. 8 is a partially sectionized side elevation of a modified form of freezing tray, provided with a motor-driven ice cream freezer.

In the various types of mechanical refrigerators used in homes at present a chilling unit is placed in the food compartment to maintain a suitable temperature therein. The temperature of such a chilling unit is maintained at from 18 degrees F. to 24 degrees F. which causes any moisture present in the air within the food compartment, that comes into contact with the chilling unit, to freeze and deposit upon it in the form of frost. In a few days sufficient frost will usually collect thereon to partially insulate the chilling unit, thus greatly lowering its cooling efficiency. To restore this efficiency the refrigerating cycle must be temporarily halted to melt this frost from the chilling unit.

For making ice in the present-day mechanical refrigerator space is provided within the food compartment for the location of the chilling unit in which are placed several trays of water for freezing. In this method considerable of the food odor present in the refrigerator is absorbed by the ice, thus impairing its desirability for home consumption. This freezing process is slow, due to the fact that the only contact between the tray and the cooling unit is had on the bottom of the tray.

In the refrigeration principle embodied in the present invention, the usual chilling unit is not located within the food compartment. This compartment is cooled by the circulation therethrough of a chilled brine solution and is automatically retained at a temperature which is never allowed to drop below 33 degrees F. or 1 degree F. above freezing, and thus prevents the accumulation of frost. Removing the usual chilling unit from its usual location within the food compartment also eliminates contamination of the ice by food odors.

In the ice-making unit embodied in this invention, cans containing water to be solidified into ice are immersed directly into a coolant within a cold storage reservoir, which causes more rapid and efficient freezing, and prevents partial insulation by frost as mentioned above.

In considering the diagrammatic layout of the refrigeration apparatus illustrated in Fig. 1, it will be noted that two circulating systems are contained therein; one, a chilling unit utilizing a refrigerant such as ammonia gas, which is condensed by a compressor 10, allowed to expand into a cooling coil 19, and then returned to the compressor, and the other a heat transfer unit for circulating a cooling medium, in which brine is first passed over the chilling coil 19, then pumped through hollow heat absorbing walls sur-

rounding the food chamber, and finally returned to the chilling coil. Thus, the first circulating unit is used for cooling the brine, and the cooled brine is pumped to the food chamber where it absorbs heat and is then returned to be cooled again by the coil of the chilling unit.

The expansion system comprises a compressor 10 which is driven by an electric motor 11, through the transmission belt 12, the motor being provided with a cooling fan 13. The refrigerant is compressed by the compressor 10 and forced through tube 14 into the condenser coil 15, where its temperature from compression is reduced by the fan 13. From the coil 15 the condensed refrigerant is passed through tube 16 to the expansion valve 17 from which it is conducted through tube 18 into the chilling coil 19, located within a freezing chamber or chilling reservoir 20, containing freezing cans 69, and from this coil through tube 21 back to the compressor 10.

The brine circulating system comprises two motor driven circulating pumps, which for convenience may be designated a freezing chamber circulating pump 22, and a food chamber circulating pump 23. The former circulates brine through tube 24 to the freezing chamber 20, and from the freezing chamber back to the pump 22, through the tube 25. The other circulating pump 23 circulates brine from the pump through the tube 26 to the upper and rear wall chilling vessels 27 and 28 of the food compartment, from these to the side wall chilling vessels 29 and 30, and from these latter vessels, through tubes 31 and 32, to tube 33. From tube 33 the brine is pumped either to the mixing chamber 34, or through the check valve 35 and through the tube 24, to the freezing chamber 20, or to both the mixing chamber and the freezing chamber, as will further be described. From the freezing chamber 20 the brine is returned through tube 36 to the mixing chamber 34, and from chamber 34 through tube 37 to the circulating pump 23.

To regulate automatically the temperature of the chilling coil 19 and consequently the coolant 38 within the freezing chamber 20, a thermostat 39 is provided to regulate the compressor motor 11 and the motor of the circulating pump 22. This thermostat 39 which operates on the fluid expansion principle is connected by a tube 40 to an expansible diaphragm control unit 41 which operates a throw switch 42. The switch 42 controls the circuit from the source of power 43 which circuit comprises lead wires 44, 45 and 46, and the return wires 47 and 48, which transmit electrical energy from the source of power 43 to the motors 11 and 49 of the compressor 10 and the circulating pump 22 respectively. The circulating pump 23 which forces the coolant through the chilling vessels 27, 28, 29 and 30, and back through tubes 31 and 32 into the tube 33, as described above, is controlled by a thermostat 50, located within the food compartment and which is similar in design to the thermostat indicated by the numeral 39 located within the freezing chamber. The thermostat 50 is connected by a tube 51 to an expansible diaphragm control unit 52 which operates a throw switch 53. The switch 53 controls a circuit from the source of power 43, comprising lead wires 44 and 54 and return wires 55, 56 and 47 and which transmits electrical energy from the source of power 43 to the motor 57 of the circulating pump 23.

It will be noted from the above description

that the chilled brine from the freezing chamber may be pumped through tube 36 to the mixing chamber 34 and that the warmer brine from the chilling vessels 27, 28, 29 and 30 of the food compartment, may also be pumped, through tubes 31, 32 and 33, to the mixing chamber 34 and to the freezing chamber through tubes 33 and 24.

The mixing chamber comprises a compartment in which is located a spindle valve 58 provided with two pistons 59 and 60 which uncover and close alternately intake ports 61 and 62 at the extremities of the tubes 36 and 33, to allow either the chilled brine passing through tube 36, or the warmer brine passing through the tube 33, or proportional amounts from each tube to enter the chamber 34 through port 9. Brines of different temperatures are mixed within this chamber and the mixture at its resultant temperature is passed through tube 37 to circulating pump 23 and thence through tube 26 into the chilling vessels 27, 28, 29 and 30.

To regulate the temperature of the resultant mixture the spindle valve 58 is controlled by an aneroid cell unit 63 mounted on the support 64. The cell unit 63 operates said valve 58 through a connecting rod 65 and a lever 66 pivotally connected to the spindle at its upper end attached to a flexible member 67 at its lower extremity, the flexible member being mounted on a support 68.

The freezing chamber or cold storage reservoir 20 is required in the refrigerating apparatus although the ice-making feature may not be incorporated therein, since it is in the chamber 20 that heat is absorbed by the evaporator unit from the coolant or brine solution 38, which in turn acts as the vehicle for the transfer of heat from within the food compartment of the refrigerator. The temperature of the coolant is automatically maintained between the limits of 8 to 25 degrees F. If freshly filled freezing cans 69 are placed in the freezing chamber 20, or any warmed coolant delivered into the reservoir 20 through tubes 31, 32 and 33, leading from the chilling vessels 27, 28, 29 and 30, heat will be absorbed therefrom by the coolant within the freezing chamber 20, which in turn will deliver such absorbed heat to the chilling coil 19 of the condenser unit, thus maintaining the desired temperature of the coolant 38.

Assume that the thermostat 50 is set to turn on the coolant circulating pump 23 when the temperature of the food compartment rises to 45 degrees F., and that placing more food in the box has caused the temperature therein to rise to 45 degrees F., immediately pump 23 circulates coolant from the mixing chamber 34 into the chilling vessels 27, 28, 29 and 30, acting to absorb the heat from the food compartment to lower its temperature, and the coolant so circulated will not be any cooler than 33 degrees F. so that no frost will form on the chilling vessels 27, 28, 29 and 30.

The mixing chamber 34 functions automatically to keep the temperature of the coolant entering through tube 26 between 33 and 35 degrees F. by means of the aneroid operated spindle valve 58 described above. Assuming the temperature of the coolant flowing into the mixing chamber 34 reaches a temperature of 33 degrees F. then the aneroid cells 63 collapse to move the spindle valve 58 so as to close port 61 and open port 62 to cut off the flow of cold coolant from the reservoir 20 and to draw in warmer fluid or coolant through tube 33. As the temperature in

the mixing valve chamber 34 rises the aneroid cell block 63 will expand to move the spindle valve 58 to gradually open port 61 to draw in coolant through tube 36 from reservoir 20, which coolant is at a temperature of from 8 to 25 degrees F. and to gradually close port 62. Any coolant drawn through tube 36 from the reservoir 20 is replaced in the reservoir by a like volume passing through tube 33. As soon as the temperature of the food chamber drops to 40 degrees F. the thermostat 50 operates to stop the coolant circulating pump 23, to thus cease the extraction of heat from the food chamber.

The ice-making unit, illustrated in Fig. 1, represents a close miniature reproduction of a large commercial ice plant, with desired modifications to adapt this type of apparatus for use in the ordinary house refrigerator. The compartment or reservoir 20 is insulated with cork or any suitable composition insulating material, which may also be used to insulate the covers of the freezing cans 69. These cans are preferably rectangular in shape and flanged at the top and fit firmly into recesses in the top of the freezing chamber. Due to construction this ice-making unit is likewise frost free.

Throughout the entire construction conducting pipes or tubes, as well as the mixing chamber, are to be adequately insulated against absorption of heat.

Figs. 2 and 3 show the relative location of the refrigerating apparatus with respect to the food compartment in one form of the improved refrigerator. Referring to Fig. 3, it will be noted that the chilling vessels 27, 28, 29 and 30 described above, are located respectively at the top, back and on the side walls of the food compartment and that the ice cans are located in a slidable drawer 70 located beneath the food compartment, as illustrated in Fig. 2. This figure shows the ice cans 69 disposed within the freezing chamber 20 which is mounted on a sliding drawer 70. The drawer 70 is shown in this view as partially withdrawn from the body of the refrigerator. The compressor apparatus is preferably located at the rear of the ice can drawer, as shown in Fig. 7.

Figs. 4 and 5 show a modified form of the refrigerator in which the cooling of the food compartment is effected entirely by a coolant reservoir 20a located in an upper compartment 21a. This coolant reservoir is connected to a mixing chamber (not shown) by the tubes 36a and 24a. Beneath the coolant reservoir 20a and spaced therefrom is located a V-shaped corrugated partition 71a which separates the upper compartment 21a from the food compartment. The corrugated partition 71a furnishes a greater absorption surface to remove heat from the food compartment so that with this type of apparatus it is not necessary to provide coolant vessels on the back and side walls of the refrigerator. Beneath the corrugated partition 71a may be placed a drip pan 72 having an outlet tube 73, as illustrated in Fig. 4.

Fig. 6 shows a modified form of refrigerator in which the cooling of the food compartment is effected entirely by a coolant reservoir 20b located in an upper compartment 21b, and is similar to the construction that is shown in Figs. 4 and 5. In this type of refrigerator it will be noted that the coolant reservoir 20b which is insulated is connected to the compartment 21b by means of the ports 22b and 23b which permit a flow of coolant from one of the communicating chambers to the other, and thus provides a thermo-

syphon circulation of the coolant. The temperature of the coolant in the lower chamber 21b is thermostatically controlled by a slide valve 24b which is operated by an aneroid cell block 63b in a similar manner as the valve 58 illustrated in Fig. 1. In this device the temperature of the fluid in contact with the corrugated partition wall 71a is regulated by the thermostatically controlled slide valve which governs the interchange of warmer and colder fluid between the reservoir 20b and compartment 21b caused by convection currents.

Aneroid cells 63 as illustrated in Fig. 1, or 63b as illustrated in Fig. 6, may be substituted by bi-metallic thermostatic bars or any other form of temperature affected device which will operate the slide valves in accordance with a change in temperature of the coolant within the lower chamber 21b.

The construction shown in Figs. 4, 5 and 6 may also be designed similar to that shown in Fig. 1, wherein ice cans are partially submerged within the coolant in the coolant reservoir.

Fig. 7 shows another modified form of the refrigerator in which a tube 101 from the mixing chamber is connected to the inlet end of a chilling coil or honeycomb radiator 100. The outlet end of the radiator 100 is connected to a tube 102 extending to the mixing chamber (not shown). In this type of refrigerator the radiator 100 is located in advance of a motor driven fan or blower 75 which causes a circulation of air within the refrigerator in the following path: over the chilling coil 100, down the tube 76 leading from the upper chamber 74 to the food compartment 77 and from the food compartment through the opening 78 in the floor 79 of the upper chamber, back to the chilling coil.

Fig. 8 shows a construction in which one of the ice cans is substituted by a motor-driven ice-cream freezer. A circular rotatable freezer can 69a containing the ordinary paddle is submerged in the brine of the freezing chamber 20a and the paddle and can are rotated by the motor which is mounted above the freezing chamber. The motor may be pivotally mounted as shown so that it can be rotated back out of the way to facilitate the removal of the can from the freezing chamber.

In the design illustrated, the ice-cream freezing can is rotatably mounted upon foot-step bearing 80 and the motor which is pivotally mounted on the bracket 81 is provided with an extending arm 82 which is provided with a bearing 83, in which the upper end of the paddle shaft of the freezer is mounted. The lower end of the paddle is rotatably mounted within a foot-step bearing 84 mounted on the floor of the freezing can.

The motor is retained in operative position by the latch member 85 which is mounted on the arm 82 and which engages the bracket member 86. The driving shaft of the motor is connected by the gear 87 to the gears 88 and 89 which are mounted on the top of the freezing can and the paddle shaft 90 respectively.

The drawer 70 is preferably mounted on a roller frame 91 to facilitate withdrawal from its compartment for the removal of ice cans.

Having described my invention, what I claim as new and wish to secure by Letters Patent is:

1. The combination with a refrigerating apparatus including a freezing coil, of a coolant system including a receptacle having walls defining an insulated compartment, adapted to retain said freezing coil, a plurality of narrow inter-

communicating chilling vessels forming interior walls of a storage compartment, a mixing device, and conduits arranged to place the mixing device in communication with said insulated compartment and with said plurality of intercommunicating chilling vessels; said mixing device including a mixing chamber provided with two thermostatically controlled intake ports for selectively admitting coolant from the insulated compartment and the intercommunicating vessels, and an outlet port through which the mixed coolant is conveyed to the chilling vessels at a predetermined temperature.

2. The combination with a refrigerating apparatus including a freezing coil, of a coolant system including a receptacle having walls defining an insulated compartment, adapted to retain said freezing coil, a plurality of narrow intercommunicating chilling vessels forming interior walls of a storage compartment, a mixing device, and conduits arranged to place the mixing device in communication with said insulated compartment and with said plurality of intercommunicating chilling vessels; said mixing device including a mixing chamber provided with two thermostatically controlled intake ports for selectively admitting coolant, at different temperatures, from the insulated compartment and the intercommunicating vessels, and an outlet port connected by a conduit to said chilling vessels, and means including a thermostatically controlled pump adapted to force said coolant to said chilling vessels at a predetermined resultant temperature.

3. The combination with a refrigerating apparatus including a freezing coil, of a coolant system including a receptacle having walls defining an insulated compartment adapted to retain said freezing coil, a plurality of intercommunicating chilling vessels partially surrounding the interior of a storage compartment, a mixing device, and conduits arranged to place the mixing device in communication with said insulated compartment and with said plurality of intercommunicating chilling vessels; said mixing device including a chamber and a temperature controlled valve for selectively admitting the flow of coolant of different temperatures into the mixing chamber, whereby to regulate the heat abstracting effect of said chilling vessels with relation to said food compartment.

4. The combination with a refrigerating apparatus including a freezing coil, of a coolant system including a receptacle having walls defining an insulated compartment adapted to retain said freezing coil, a plurality of intercommunicating chilling vessels forming walls of a storage compartment, a mixing device, and conduits arranged to place the mixing device in communication with said insulated compartment and with said plurality of intercommunicating chilling vessels; said mixing device including a chamber and valve means therein operable to direct the flow of coolant from the insulated compartment through the mixing chamber into said plurality of intercommunicating vessels for return directly to said insulated compartment, said means including additional means for directing some of the returning coolant into said mixing chamber to be mixed with the liquid from said insulated chamber and re-

circulated through said intercommunicating vessels.

5. The combination with a refrigerating apparatus including a freezing coil, of a coolant system including a receptacle having walls defining an insulated compartment adapted to retain said freezing coil, a plurality of intercommunicating chilling vessels forming walls of a food storage compartment, a mixing device, and conduits arranged to place the mixing device in communication with said insulated compartment and with said plurality of intercommunicating chilling vessels; said mixing device including a chamber and valve means therein operable to establish communication between the freezing chamber and chilling vessels whereby to admit warmer and cooler portions of the coolant to said chamber for the purpose of regulating the heat abstracting effect of the chilling vessels upon said food compartment.

6. The combination with a refrigerating apparatus including a freezing coil, of a coolant system including a receptacle having walls defining an insulated compartment adapted to retain said freezing coil, a plurality of intercommunicating chilling vessels forming vessels of a storage compartment, a mixing device, and conduits arranged to place the mixing device in communication with said insulated compartment and with said plurality of intercommunicating chilling vessels, and thermostatically controlled pumps adapted to force coolant through said conduits; said mixing device including a chamber adapted to maintain a predetermined portion of said coolant system within a selected temperature range to regulate the heat abstracting effect of said system upon said storage compartment, said mixing device being provided with a temperature operated valve for interconnecting the mixing chamber with the conduits communicating with the insulated compartment and with the plurality of intercommunicating chilling vessels to selectively admit to said chamber differently temperatured portions of said coolant and to emit coolant therefrom to said intercommunicating chilling vessels at a predetermined resultant temperature.

7. The combination with a refrigerating apparatus contained within a housing having an upper food compartment and a lower drawer and including a freezing coil, of a coolant system including a receptacle having walls defining an insulated compartment located within said drawer and adapted to retain said freezing coil, a plurality of intercommunicating vessels forming interior walls of said food compartment, a mixing device, and conduits arranged to place the mixing device in communication with said insulated compartment and with said plurality of intercommunicating chilling vessels, said mixing device including a chamber, and valve means therein operable to direct the flow of coolant from the insulated compartment through the mixing chamber into said plurality of intercommunicating vessels for return to said insulated compartment, said means including additional means for directing some of the returning coolant into said mixing chamber to be mixed with the liquid from said insulated chamber and recirculated through said intercommunicating vessels.

CHARLES D. FATOR.