

Oct. 17, 1961

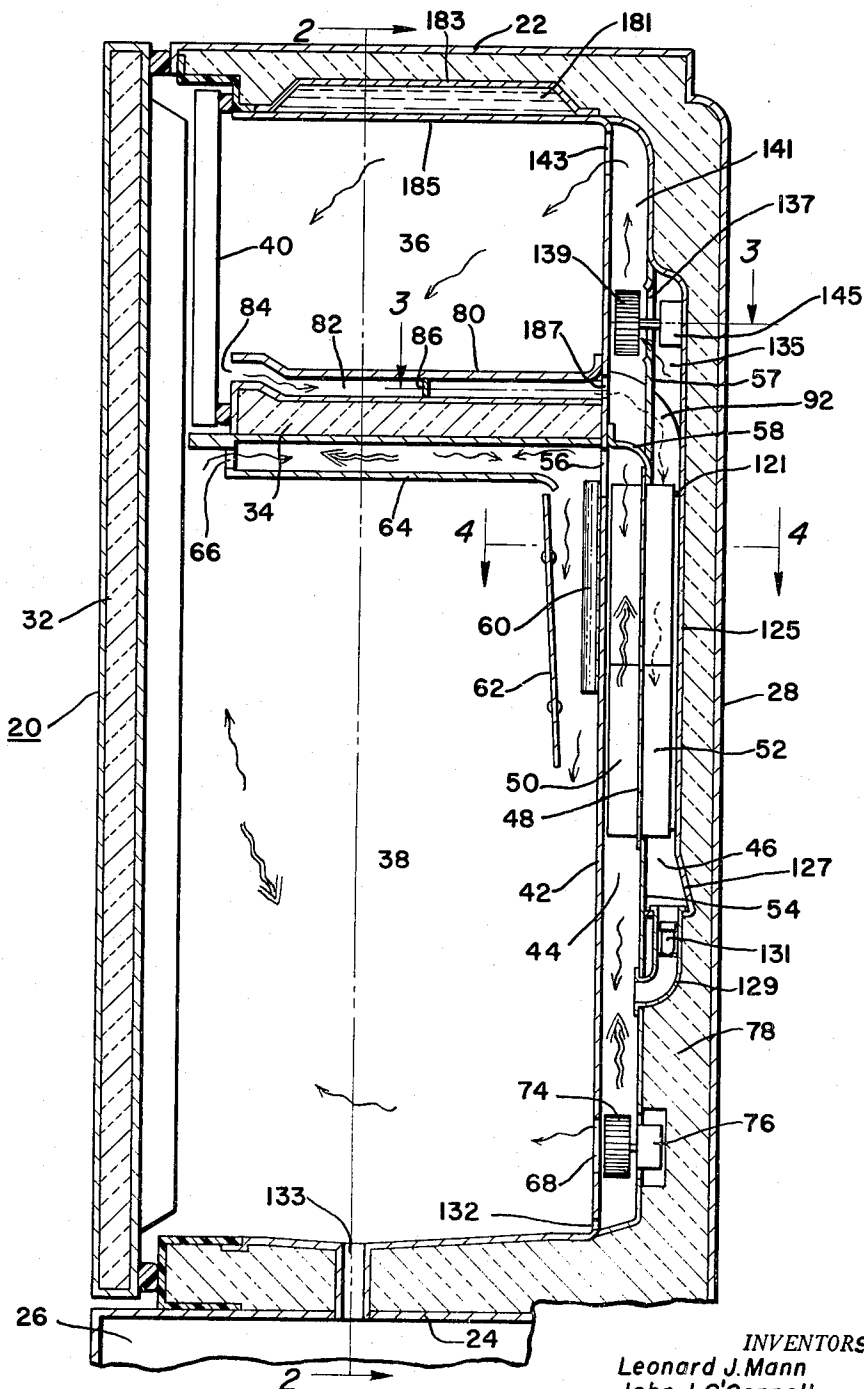
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3,004,401

FORCED AIR COOLED REFRIGERATOR

Filed July 8, 1960

5 Sheets-Sheet 1



Refrigeration Period Circulation

Defrost Period Circulation

Fig. 1

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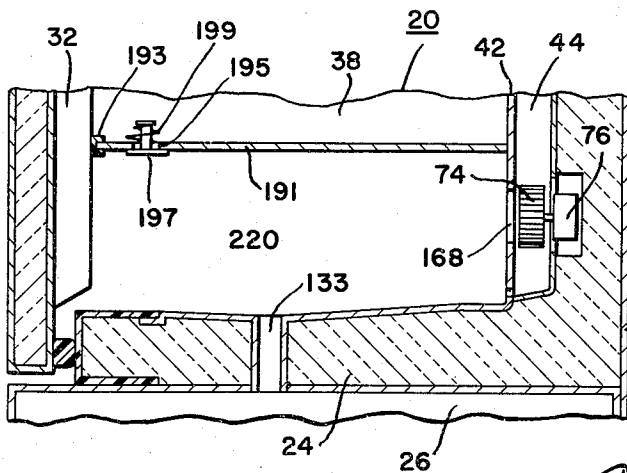
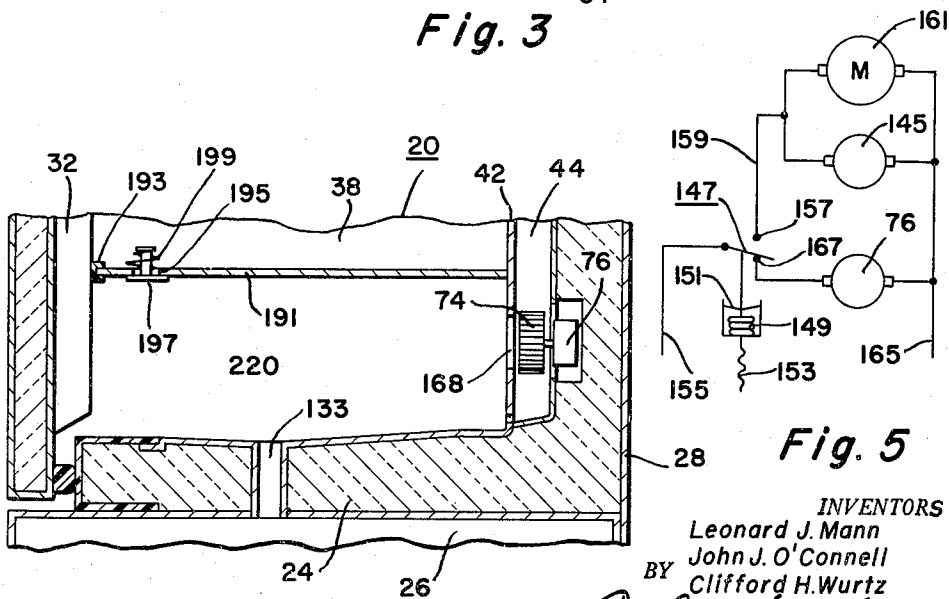
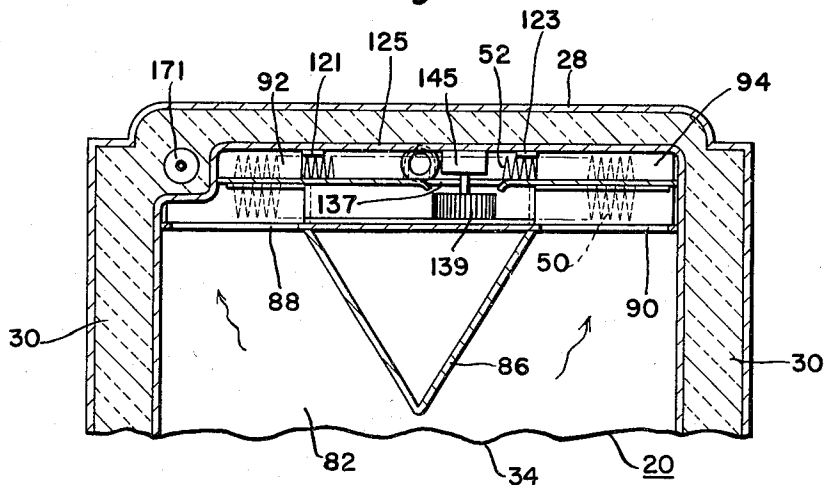
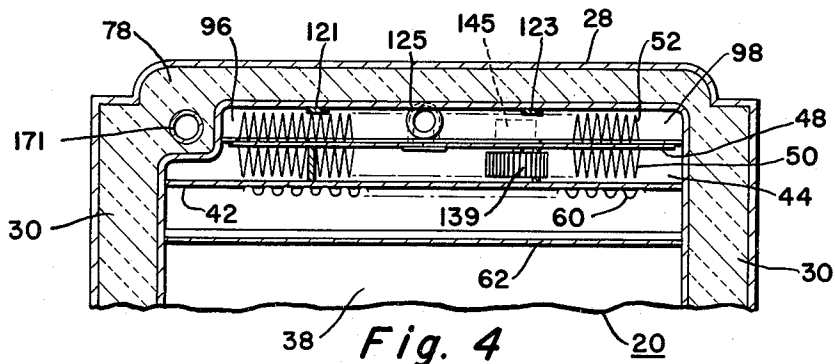


Fig. 6

Fig. 5

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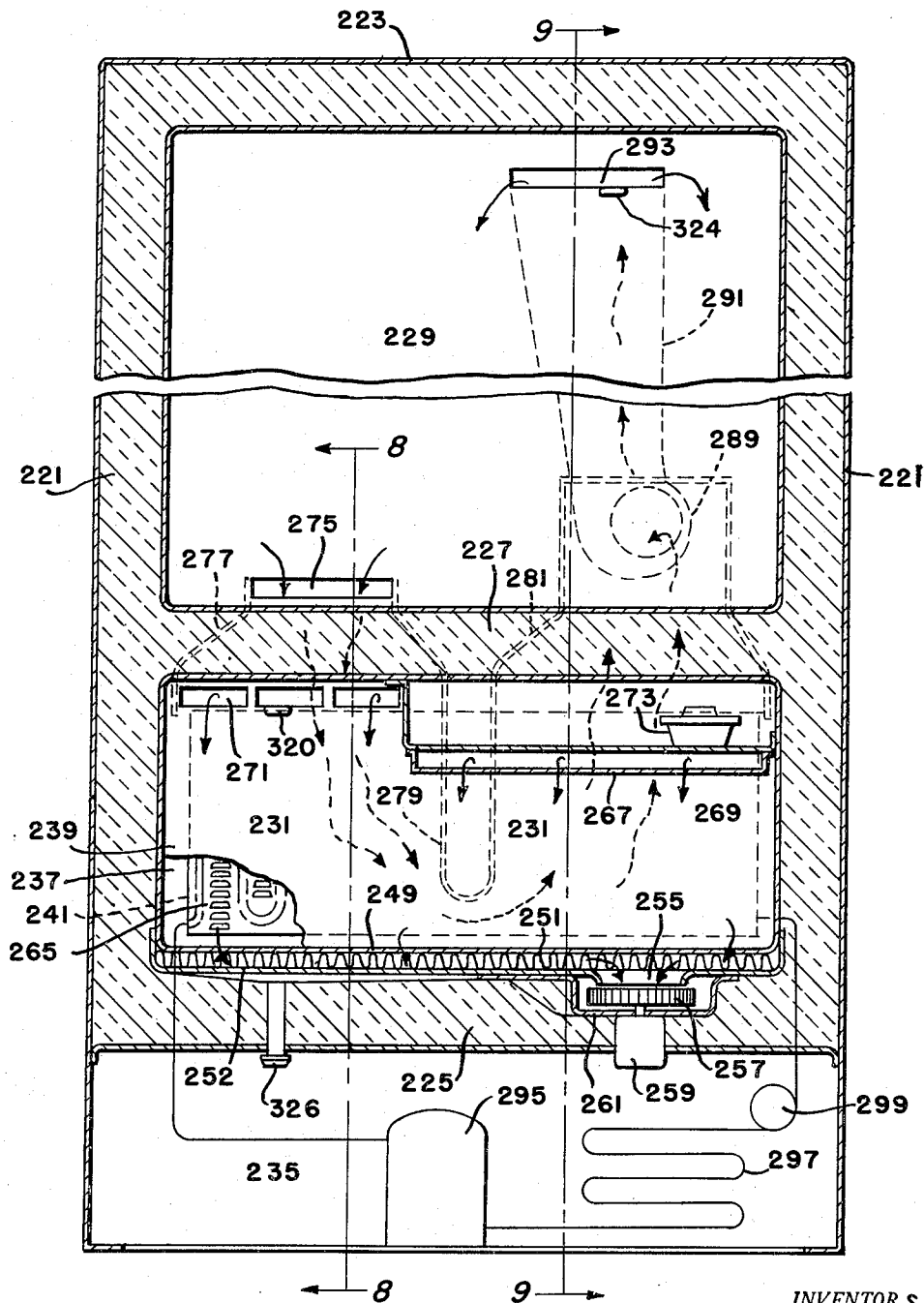


Fig. 7

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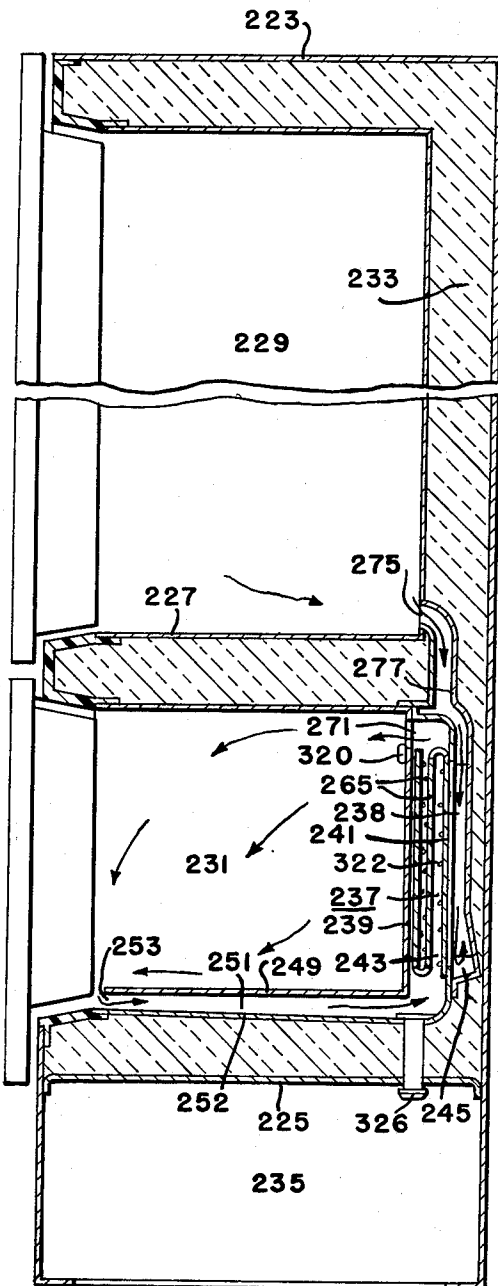


Fig. 8

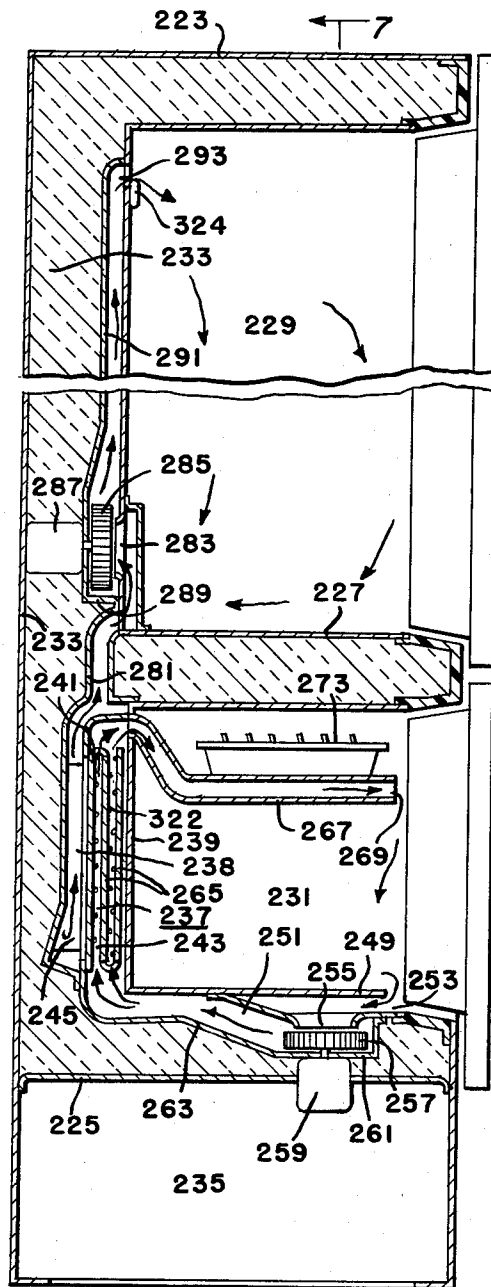


Fig. 9

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FORCED AIR COOLED REFRIGERATOR

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6 Claims. (Cl. 62—156)

This application relates to refrigerating apparatus and more particularly to household refrigerators having frost free above and below freezing storage compartments.

Household refrigerators having frost free storage compartments are commercially successful and provide excellent carefree refrigeration but they are so expensive that the sale is largely limited to those with larger incomes. The models now on the market require two evaporators, two temperature controls and a defrosting control.

It is an object of this invention to provide a household refrigerator having frost free above and below freezing storage compartment which is less complicated and less expensive and provides satisfactory carefree refrigeration.

It is another object of this invention to provide a household refrigerator having above and below freezing frost free storage compartments which requires only a single evaporator and a single thermostatic control and does not require any additional defrosting timer and limiter control.

These and other objects are attained in the form of household refrigerator shown in the drawings in which the below freezing compartment is located in the top of the insulated cabinet and the above freezing compartment is provided beneath. In the rear insulated wall of the cabinet, there is provided an evaporator compartment divided into front and rear compartments by a single plate type evaporator having upright fins on both faces. A finned wall of good heat conducting metal separates the front compartment from the above freezing compartment and is provided with openings at the top and bottom providing a natural convection circulation through the front compartment and the above freezing compartment. This is assisted by vertically oriented zigzag fins on both faces of the evaporator and by zigzag fins on the above freezing compartment side of the conducting metal wall between the above freezing compartment and the evaporator.

This natural convection circulation is further assisted by a false wall extending across the top of the above freezing compartment and a baffle or false wall extending in front of the fins on the rear wall of the above freezing compartment. These two false walls substantially connect with each other and also with the upper opening in the rear wall of the above freezing compartment. To hasten the defrosting, there is provided between the condenser outlet and the evaporator inlet a storage chamber which is located in the insulation space. This storage chamber will receive liquid refrigerant from the evaporator during the idle defrost period.

In a modified form, a separate compartment is formed by providing a heat conducting partition wall above the lower inlet opening in the above freezing compartment. This partition preferably is provided with a one-way check valve so as to normally hold the air in this compartment to prevent circulation during the refrigerating period. This compartment will normally be at a relatively high temperature, such as 60° F., for preserving foods which need not be kept cold. During the idle period, the blower fan will draw air through the one-way valve into this compartment and the air in this compartment will be circulated up through the front evaporator passage so as to exert its heat upon the evaporator to more quickly effect defrosting and to more quickly terminate the idle period.

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The system is controlled by a single pole, double throw thermostatic switch responsive to the temperature of the evaporator. In the warm position, the motor-compressor unit and the upper fan unit are energized to refrigerate the evaporator and to provide circulation between the below freezing compartment and the rear evaporator compartment so as to keep this below freezing compartment at a temperature of between 0° and 5° F. The above freezing compartment is cooled during the refrigerating period by natural convection which circulates from the compartment behind the false wall and baffle in the top wall and in front of the rear wall and into contact with the fins projecting from the rear wall which are cooled from the evaporator behind the rear wall. Some circulation may also take place through the front evaporator compartment entering in at the upper opening and flowing downwardly through the fins of the evaporator and returning through the fan opening at the bottom. This, however, will not take place in the modification shown in FIGURE 6.

When the evaporator has cooled sufficiently, the thermostat will snap to its cold position thereby deenergizing the compressor motor and the upper fan motor and energizing the lower fan. This will stop circulation through the below freezing compartment and the rear evaporator compartment. It will start forced circulation by the lower fan drawing air from the above freezing compartment through the lower opening and discharging the air upwardly through the fins in the front evaporator compartment in contact with the front face of the evaporator and returning the cooled air through the upper opening and above the false wall and behind the baffle at the top of the above freezing compartment.

In a third form, the evaporator compartment is located behind the rear inner wall of the below freezing compartment. Air is drawn by a fan beneath the false bottom wall of the below freezing compartment and discharged through the evaporator in the evaporator compartment and through a hollow ice tray shelf back into the below freezing compartment. The back wall of the evaporator compartment receives the heat from the air circulating in the above freezing compartment and its air circuit. A separate fan and motor controlled by the temperature of the air returned to the below freezing compartment assures adequate circulation and heat transfer. Defrosting is by electric heat.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein preferred embodiments of the present invention are clearly shown.

In the drawings:

FIGURE 1 is a vertical sectional view through a two-compartment refrigerator taken along the line 1—1 of FIGURE 2 embodying one form of our invention;

FIGURE 2 is a sectional view transverse to FIGURE 1 taken along the line 2—2 of FIGURE 1 together with a diagrammatic refrigerating system connected to the evaporator;

FIGURE 3 is a horizontal fragmentary sectional view taken along the line 3—3 of FIGURE 1;

FIGURE 4 is a horizontal fragmentary sectional view taken along the line 4—4 of FIGURE 1;

FIGURE 5 is a wiring diagram;

FIGURE 6 is a fragmentary vertical sectional view of the lower part of a refrigerator showing a modification of the invention;

FIGURE 7 is a front vertical sectional view of another refrigerator embodying another modified form of the invention taken on the line 7—7 of FIGURE 9;

FIGURE 8 is a transverse vertical sectional view taken along the line 8—8 of FIGURE 7; and

FIGURE 9 is a transverse vertical sectional view taken along the line 9—9 of FIGURE 7.

Referring now to the drawings, there is shown an insulated refrigerator cabinet, generally designated by the reference character 20, having an insulated top wall 22, an insulated bottom wall 24 above the machine compartment 26, a rear wall 28 and side walls 30, all insulated. The cabinet is also provided with a single outer insulated door 32 and an insulated horizontal partition wall 34 which separates the upper below freezing compartment 36 from the lower above freezing compartment 38. The below freezing compartment 36 is closed by an inner door 40 which seals this below freezing compartment from the above freezing compartment 38. The rear wall of the above freezing compartment 38 includes a metal liner wall 42 behind which is a thin upright front evaporator compartment 44 divided from the rear evaporator compartment 46 by an imperforate plate-type evaporator 48 provided with a series of vertical zigzag fins 50 bonded to its front face and a series of vertical zigzag fins 52 bonded to its rear face. The plate evaporator connects with a vertical duct wall 54 at the bottom and a vertical duct wall 57 at the top to provide separation between the two compartments. The rear metal wall 42 of the compartment 38 has an upper opening 56 extending across the top connected by a curved wall 58 extending to the upper edge of the evaporator 48 to enclose the top of the front compartment 44.

The rear wall 42 is provided with corrugated vertically oriented fins 60 on its front face which, with the assistance of the baffle 62, provides a natural convection circulation within the compartment 38. Beneath the partition wall 34, there is provided a false wall or baffle 64 having a front opening 66 and a rear exit which connects with the opening 56 as well as with the space behind the upper portion of baffle 62. The wall 42 also has a bottom opening 68. The bottom of the front evaporator compartment 44 is connected by a shroud 70 to the outlet of the scroll 72 of the fan 74 which is driven by the fan motor 76 located in the insulation 78 in the rear wall 28 in alignment with the opening 68. By virtue of this cooling arrangement of the partition wall 34 and the rear wall 42 when the fan 74 is idle, natural convection of air will provide air flow from the above freezing compartment 38 through the opening 66 and through the passage between the false top wall 64 and the partition 34 to the fins 60 behind the baffle 62 and flow downwardly to the bottom of the compartment 38. Some of the air will also pass through the opening 56 into the top of the compartment 44 and flow down through the fins 50 and through the shroud 70 and the scroll 72 and out through the opening 68 into the above freezing compartment 38. However, when the fan 74 is in operation, air will be drawn from the bottom of the compartment 38 through the opening 68 and be discharged by the fan 74 for flow through the scroll 72, the shroud 70 and upwardly through the wide flat upwardly extending front evaporator compartment 44, through the fins 50 and thence through the opening 56 and the passage above the false wall 64, through the opening 66 back into the compartment 38. This fan circulation of air at about 36° F. is used to heat and defrost the evaporator 48 on the off cycle.

The below freezing compartment 36 is provided with a false bottom wall 80 above the insulated partition wall 34 providing a passage 82 having a front entrance 84 extending from side to side across the bottom of the compartment 36. Beneath this false wall 80 is a V-shaped partition wall 86. This V-shaped guiding wall 86 directs the air into the two outlet openings 88 and 90. The outlet opening 88 is connected by a duct 92 with the adjacent side of the top of the rear evaporator compartment 46. A second duct 94 is provided for connecting the opening 90 with the adjacent side passage of the rear duct 46. The rear evaporator compartment is divided into two outer downwardly extending passages 96 and

98 by vertical strips 121 and 123 of elastomeric material which extend between the liner 125 for the rear wall of the rear evaporator compartment 46 and the zigzag fins 52. A central upwardly extending duct is provided in the fins between the strips 121 and 123.

The compartment 46 is closed at the bottom by a wall 127 provided with a drain outlet 129 which drains into the front compartment 44. This drain outlet is provided with float trap 131 for normally keeping the trap closed excepting to allow defrost water to flow through the duct 129. This defrost water will flow to the bottom of the shroud 70 which is drained through an outlet 132 into the drain outlet 133 passing through the bottom wall 24 into the machinery compartment 26 where it may be suitably disposed of. The wall portion 57 extending upwardly from the plate evaporator 48 between the duct portions 92 and 94 and between the strips 121 and 123 provides a duct 135 adjacent the liner 125. This wall 57 is provided with a fan inlet opening 137 providing a connection between the duct 135 and the fan wheel 139 which discharges upwardly through the duct 141 in the rear wall to an upper opening 143 discharging into the below freezing compartment 36. The fan 139 is open at the rear and is driven by the fan motor 145.

A wiring diagram shown in FIGURE 5 includes a double throw thermostatic switch 147 of the single pole type including a bellows actuator 149 and a snap action mechanism 151. The bellows is connected by capillary tubing to a thermostat bulb 153 mounted upon the evaporator 48. One supply conductor 155 connects to a double throw member of the switch 147. Its warm contact 157 is connected by the conductor 159 to the compressor motor 161 provided in the sealed unit 163. The opposite terminal of this motor is connected to the supply conductor 165. Also connected between the conductor 159 and the supply conductor 165 is the upper fan motor 145 which drives the fan 139. The cold contact 167 connects to the fan motor 76 which drives the lower fan 74. It also connects to the supply conductor 165.

The snap action mechanism 151 and the bellows 149 are so designed that upon a temperature of about 35° at the bulb 153, the switch blade 147 will be moved from the contact 167 into engagement with the contact 157. This will cause the operation of the upper fan motor 145 to draw air from the below freezing compartment 36 through the entrance 84, the passageway 82, the duct connectors 92 and 94 for flow down through the outer passages 96 and 98, through the fins 52 in the rear evaporator compartment 46, to the bottom wall 127 and thence the flow of partly cooled air as a result of the contact with the fins and the plate 48 reverses direction and flows upwardly through the central portions of the fins 52 between the strips 121 and 123 into contact with the central portion of the rear face plate evaporator 48 to cool the air to a temperature of between 0° and -5° F. This cold air is drawn upwardly through the duct 135 and through the opening 137 by the fan 139 which discharges the air up through the duct 141 and the opening 143 into the compartment 36.

During this time, the lower fan motor 76 will be de-energized since the switch blade 147 is out of contact with the warm contact 167. However, the above freezing compartment will receive some cooling through the door 40 and the partition wall 34. In addition, cooling will be received by radiation through the front wall 42 of the front evaporator compartment 44 and by convection through the fins 60 which will set up a convection current within the above freezing compartment 38 through the entrance opening 66, the passage above the false wall 64 and the passage behind the baffle 62 in contact with the fins 60 and the wall 42 to provide further cooling for the above freezing compartment. In addition, there will be some flow by natural convection through the opening 56 down through the fins 50 of the front evaporator compart-

ment 44 through the shroud 70 and thence past the fan 74 and through the opening 68 into the above freezing compartment 38. This will provide sufficient cooling for the above freezing compartment during the running period.

During this running period, the compressor motor 161 will be also energized to withdraw evaporated refrigerant from an accumulator 165 provided with an upper outlet at the upper right corner of the plate evaporator 48 connecting with the suction conduit 167 which connects to the inlet of the sealed motor-compressor unit 163. The sealed motor-compressor unit 163 delivers compressed refrigerant from the suction line 167 to the condenser 169 whose outlet connects with the top of the storage chamber 171 located within the insulation 78 in the rear wall. The bottom of this storage chamber 171 is connected by the conduit 173 with the top of the serpentine passage 175 extending downwardly throughout the left and center portions of the plate evaporator 48 and connecting with an upper zigzag portion 177 extending up the right portion of the plate evaporator 48 and thence through a passage 179 connecting with the bottom of the accumulator chamber 165. The liquefying means 163 and 169 liquefies the evaporated refrigerant drawn from the evaporator 48 and forces it through a capillary tube 181 into the storage chamber 171 and thence through the evaporator 48 to cool the evaporator 48 until the evaporator 48 and the thermostat bulb 153 are cooled to -5° F.

When the temperature of -5° F. is reached, the bellows 149 will collapse and move the switch blade 147 away from the contact 157 and into contact with the warm contact 167, thus energizing the lower fan motor 76 and deenergizing the motor 161 of the sealed unit 163 and the upper fan motor 145. This will stop the circulation of air through the upper compartment 36 and stop refrigeration within the plate 48. After the thermostat switch blade 147 moves away from the contact 157, the evaporator 48 warms up and the refrigerant evaporates in the passages 175 and 177. This creates a vapor lift pump effect which carries the liquid refrigerant in the plate evaporator 48 back into the storage chamber 171 and into the accumulator 165. This allows the evaporator 48 to warm up rapidly when the fan motor 76 is energized by the movement of the blade 147 into contact with the contact 167. The fan 74 draws air from the compartment 38 through the opening 68 and discharges it through the scroll 72 and the shroud 70 up through the front evaporator compartment 44 and through the fins 50 over the surface of the evaporator 48 which cools the air and warms the evaporator 48 and the fins 50 and 52 while the cooled air moves upwardly and passes through the opening 56 and the passage above the false wall 64 out through the opening 66 back into the above freezing compartment 38. This provides the above freezing compartment 38 with adequate cooling during the idle period.

This circulation of air heats the evaporator 48 and the fins 50 and 52 so that the evaporator 48 is warmed above freezing and the frost which accumulates on both sides of the evaporator 48 and the fins 50 and 52 during the running period will thereby be defrosted. This frost water will collect in the bottom 127 of the rear evaporator compartment 46 and flows past the upwardly opening float valve 131 through the conduit 129 into the front evaporator compartment 44. This defrost water as well as the defrost water coming off the front face of the evaporator 48 and the fins 50 will fall to the bottom of the front evaporator compartment 44 and flow through the opening 132 across the bottom of the compartment 38 to the drain 133 which carries the defrost water into the machinery compartment 26 for disposal.

To provide adequate refrigeration for the below freezing compartment 36 during the idle period, there may be provided a hold-over or congealing solution 181 provided within a jacket 183 upon the top wall of the compartment 36. This top wall, of course, is provided with a liner

185 of metal which by being in heat transfer with the hold-over 181 adds to the cooling of the compartment 36 during the idle period. By the time that the thermostat bulb 153 reaches the cut-on point of 35° or 36° F., the evaporator 48 and its fins 50 and 52 will be completely defrosted. The bellows 149 will then expand and move the switch blade 147 back into contact with the contact 157 thereby deenergizing the fan motor 76 and energizing the compressor motor 161 and the upper fan motor 145 to start a new operating cycle. The space behind the V-shaped partition 86 may be provided with an opening 187 providing communication with the duct 141 connecting with the opening 143 for cold air circulation therein.

In FIGURE 6, there is shown a modification in which a partition wall 191 of plastic or glass or metal is located above the fan inlet opening 168 and extends between the rear liner wall 42 and the face of the door 32 as well as between the inner surfaces of the side walls 30. This partition wall 191 is provided with a seal 193 at the front for providing a seal at the inner face of the door 32. This partition 191 is provided with an opening 195 normally kept closed by a downwardly opening one-way valve 197 normally spring-pressed upwardly to closed position by a compression type coil spring 199 which, of course, is very weak so it will open on a very light pressure. This partition wall 191, therefore, provides a compartment 220 beneath it and the bottom wall 24 which will be kept at a higher temperature than the remainder of the above freezing compartment 38. For example, this compartment may attain a temperature of 60° F. When the switch blade 147 is moved to its warm position to energize the fan motor 76, the fan 74 will draw warm air from the compartment 220 and discharge this air upwardly through the passage 44 into contact with the fins and the front face of the evaporator 48 to rapidly warm the evaporator 48 and cool the air. The operation of the fan 74 in drawing air from the compartment 220 will also open the valve 197 to draw air from the compartment 38 in order to set up a forced air circulation which will deposit the cold air in the compartment 38 and withdraw the warmer air from the compartment 220 for passage through the front evaporator compartment 44. In this way the evaporator 48 will be heated more rapidly to more rapidly effect the defrosting to reduce the length of the idle period to prevent any undesirable rise in temperature in the compartment 36. The effect of the warm air upon the evaporator 48 will be similar to but more rapid than previously described in moving the refrigerant out of the evaporator into the accumulator 165 and the storage chamber or vessel 171.

In FIGURES 7, 8 and 9, there is provided an insulated refrigerator cabinet having insulated side walls 221, an insulated top wall 223, an insulated bottom wall 225 and an insulated horizontal wall 227 intermediate the top and bottom walls forming an upper above freezing compartment 229 and a lower below freezing compartment 231. The ducts and the evaporator chamber are primarily provided within the rear wall 233. A machine compartment 235 is provided beneath the bottom wall.

The evaporator compartment 237 is provided behind the rear wall 239 of the below freezing compartment 231. This evaporator compartment 237 is divided by a vertically extending impervious plate-type evaporator portion 241 providing a front evaporator compartment 243 and a rear evaporator compartment 245. The front and rear evaporator compartments are sealed from each other by the impervious plate evaporator portion 241. The below freezing compartment 231 is provided with a false bottom wall 249 preferably having zigzag fins 251 and a second bottom wall 252 beneath it and also having an air entrance 253 extending across the front through which air can be drawn from the below freezing compartment. In the bottom wall, there is provided a fan inlet opening 255 beneath which is a centrifugal fan 257 driven by the electric motor 259 extending through the insulation of the bottom wall 225. The blower wheel 257 is sur-

rounded by the discharge scroll 261 which delivers air rearwardly through the discharge duct 263 to the bottom of the front evaporator compartment 243.

This front evaporator compartment 243 includes additional evaporator plate sections 265 preferably formed by folding the single plate. These sections 265 are louvered between their refrigerant passages to permit free air flow in heat transfer with them through the front evaporator compartment 243. The air is cooled to a low temperature by the front surface of the plate evaporator 241 and the additional plate sections 265 as it moves upwardly through the front compartment 243 and is discharged at the top forwardly through a hollow ice tray shelf 267 having a discharge opening 269 at the front for discharging air back into the below freezing compartment 231. The shelf 267 supports the ice trays 273. At the side of the hollow shelf 267 are additional discharge openings 271 which likewise discharge some of the air forwardly from the top of the front evaporator compartment 243 into the below freezing compartment. The hollow ice tray shelf takes up a little more than half the width of the below freezing compartment 231 allowing storage of tall frozen products at the left as viewed in FIGURE 7.

The above freezing compartment 229 is provided with an outlet 275 at the lower rear connected by a downwardly extending duct 277 in the rear wall connecting with the left side of the rear evaporator compartment 245. The rear evaporator compartment is provided with a central vertical U-shaped dividing wall 279 extending part of the way to the bottom of this rear compartment. This rear evaporator compartment 245 may also be provided with fins 238 contacting or bonded to the rear face of the impervious plate evaporator portion 241. A second upwardly extending duct 281 extends upwardly on the opposite side of the rear evaporator compartment 245 and leads to the inlet 283 of a blower wheel 285 driven by the electric motor 287. A discharge scroll 289 surrounds the blower wheel and connects with an upwardly extending duct 291 in the rear wall extending to the discharge opening 293 from which the air is discharged back into the above freezing compartment 229.

In the machinery compartment 235 is a sealed motor-compressor unit 295 having its inlet connected to the outlet of the evaporator 241 and having its outlet connected to the condenser 297 from which refrigerant flows through a capillary restrictor tube 299 to the inlet of the evaporator 241. The operation of the refrigerating system and particularly the sealed motor-compressor unit as well as the fan motor 259 are controlled by a switch controlled in accordance with the temperature of the bulb 320 mounted adjacent the center discharge opening 271 of the front evaporator compartment 243 as shown in FIGURES 7 and 8. This thermostat is set to close and operate the sealed motor-compressor unit 295 and the fan motor 259 at 5° F. and to open to stop the operation of these units at -8° F. These units are also stopped once a day for defrosting during which time the sheathed tubular electric heater 322 in the front evaporator compartment 243 is energized to heat the evaporator 241 to remove the frost which has accumulated. The defrost water escapes through a drain 326.

The upper fan motor 287 is controlled in accordance with the temperature of the thermostat bulb 324 located at the discharge opening 293 to circulate the air from the above freezing compartment 229 through the rear evaporator compartment 237. It closes the circuit to the motor 287 at a temperature of 30° F. and opens the circuit at 23° F. This arrangement keeps the warmer humid air of the above freezing compartment 229 separated from the air of the below freezing compartment 231 which is cold and dry. This separation is provided by the evaporator plate portion 241 which is impervious to the passage of air. This plate portion 241, however, with the aid of the portion 265 cools the air in both evaporator

compartments 243 and 245 to the proper temperature so as to maintain the below freezing compartments 231 at a satisfactory low temperature between 0° and 5° F. and the above freezing compartment 229 at temperatures of about 35° F. The cold air passing through the hollow shelf 267 rapidly freezes the water in the ice trays 273. By keeping the air from the two compartments separated, frosting of the evaporator is minimized and, particularly, excessive frosting at the entrance of the evaporator is prevented so that the air circuit of the below freezing compartment 231 does not become obstructed by frost. The frost therefore is distributed on both sides of the evaporator and is relatively limited in amount so that rapid and complete defrosting is attained.

While the embodiments of the present invention as herein disclosed, constitute preferred forms, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A refrigerator including insulated walls enclosing a below freezing compartment and an above freezing compartment, one of the insulated walls enclosing the above freezing compartment being provided with an evaporator compartment, said insulated walls providing means for thermally isolating said evaporator compartment from said below freezing compartment, a wall of good heat conducting material dividing said evaporator compartment from said above freezing compartment, a substantially impervious plate-type evaporator dividing said evaporator compartment into a first compartment located between said evaporator and said wall of good heat conducting material and into a second compartment located on the opposite side of said evaporator, a refrigerant liquefying means operatively connected to said evaporator, first fan means for circulating air from said above freezing compartment through said first compartment into heat transfer with the adjacent side of said evaporator, and second fan means for circulating air from said below freezing compartment through said second compartment into heat transfer with the opposite face of said evaporator.

2. A refrigerator including insulated walls enclosing a below freezing compartment and an above freezing compartment, one of the insulated walls enclosing the above freezing compartment being provided with an evaporator compartment, a wall of good heat conducting material dividing said evaporator compartment from said above freezing compartment, a substantially impervious evaporator dividing said evaporator compartment into a first compartment located between said evaporator and said wall of good heat conducting material and into a second compartment located on the opposite side of said evaporator, a refrigerant liquefying means operatively connected to said evaporator, first fan means for circulating air from said above freezing compartment through said first compartment into heat transfer with the adjacent side of said evaporator, and second fan means for circulating air from said below freezing compartment through said second compartment into heat transfer with the opposite face of said evaporator, a double throw thermostatic switch means having a warm switch connection connecting with said liquefying means and said first fan means and having a cold position connecting with said second fan means, said wall of good heat conducting material providing for the transfer of heat from said above freezing compartment to said evaporator compartment when said switch means is in the warm switch connection.

3. A refrigerator including insulated walls enclosing a below freezing compartment and an above freezing compartment, one of the insulated walls enclosing the above freezing compartment being provided with an evaporator compartment, a wall of good heat conducting material dividing said evaporator compartment from said above freezing compartment, a substantially impervious evaporator dividing said evaporator compartment into a first

compartment located between said evaporator and said wall of good heat conducting material and into a second compartment located on the opposite side of said evaporator, a refrigerant liquefying means operatively connected to said evaporator, first fan means for circulating air from said above freezing compartment through said first compartment into heat transfer with the adjacent side of said evaporator, and second fan means for circulating air from said below freezing compartment through said second compartment into heat transfer with the opposite face of said evaporator, said second fan means having an inlet in the lower portion of said above freezing compartment, a laterally extending dividing wall extending within said above freezing compartment above said inlet to provide an upper chamber separated from said inlet and a lower chamber in communication with said inlet.

4. A refrigerator including insulated walls enclosing a below freezing compartment and an above freezing compartment, one of the insulated walls enclosing the above freezing compartment being provided with an evaporator compartment, a wall of good heat conducting material dividing said evaporator compartment from said above freezing compartment, a substantially impervious evaporator dividing said evaporator compartment into a first compartment located between said evaporator and said wall of good heat conducting material and into a second compartment located on the opposite side of said evaporator, a refrigerant liquefying means operatively connected to said evaporator, first fan means for circulating air from said above freezing compartment through said first compartment into heat transfer with the adjacent side of said evaporator, and second fan means for circulating air from said below freezing compartment through said second compartment into heat transfer with the opposite face of said evaporator, said second fan means having an inlet in the lower portion of said above freezing compartment, a laterally extending dividing wall extending within said above freezing compartment above said inlet to provide an upper chamber separated from said inlet and a lower chamber in communication with said inlet, said second compartment having an outlet above said laterally extending wall, said laterally extending wall being provided with a one way valve permitting the flow of fluid from the upper chamber to the lower chamber and preventing reverse flow, thermostatic control means responsive to higher temperatures for operating said liquefying means and said first fan means to cool the evaporator and the below freezing compartment and said wall of good heat conducting material and responsive to lower temperatures for preventing operation of said liquefying means and said first fan means and operating said second fan means to circulate air through said upper and lower chambers and said second compartment to defrost the evaporator.

5. A refrigerator including insulated walls enclosing an upper below freezing compartment and a lower above freezing compartment, one of the upright insulated walls of the above freezing compartment being provided with an upright evaporator compartment, a substantially impervious evaporator in the form of a dividing wall dividing said evaporator compartment into an upright first compartment located between the evaporator and the above freezing compartment and a second compartment located between the evaporator and the insulation, an up-

right wall separating said first compartment and said above freezing compartment and having upper and lower openings providing a circulation of air between said first and above freezing compartments by natural gravity, first fan means associated with one of said openings for forcibly circulating air through said first compartment, second fan and duct means for circulating air between said below freezing compartment and said second compartment, refrigerant liquefying means operably connected to said evaporator, and a double throw thermostatic switch means responsive to a higher temperature of said evaporator for energizing said liquefying means and said second fan means and deenergizing said first fan means to cool said below freezing compartment by forced air circulation and said above freezing compartment by natural convection and responsive to a lower temperature of said evaporator for deenergizing said liquefying means and said second fan means to stop refrigeration in said evaporator and forced circulation between said below freezing and second compartments and for energizing said first fan means to forcibly circulate air from said above freezing compartment through said first compartment to rapidly heat and defrost said evaporator and to forcibly cool said above freezing compartment during each idle period.

6. A refrigerator including insulated walls enclosing a below-freezing compartment and an above-freezing compartment, an insulated wall separating said below- and above-freezing compartments, one of the insulated walls being provided with an evaporator compartment containing an evaporator, a refrigerant liquefying means operatively connected to said evaporator, a cycling thermostatic control responsive to the temperature of said evaporator and operating upon a defrosting cycle for controlling said liquefying means, said control including a control device movable from a first position to a second position in response to a rise in said evaporator to defrosting temperatures and movable from the second position to the first position in response to a temperature below that desired to be maintained in the below-freezing compartment, means responsive to the positioning of said control device in said second position for operating said liquefying means and for circulating air from said below-freezing compartment through said evaporator compartment into heat transfer with said evaporator and back to said below-freezing compartment, means responsive to the positioning of said control device in said second position for stopping the operation of said liquefying means and stopping the circulation of air between said below-freezing and evaporator compartments and for circulating air from said above-freezing compartment through said evaporator compartment into heat transfer with said evaporator to defrost said evaporator and back to said above-freezing compartment to cool said above-freezing compartment, and a thermal holdover congealing solution located in heat transfer with said below-freezing compartment and cooled during the operation of said liquefying means for cooling said below-freezing compartment when said control device is positioned in said second position.

References Cited in the file of this patent

UNITED STATES PATENTS

2,866,323

Candor ----- Dec. 30, 1958