

Nov. 12, 1957

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2,812,642

REFRIGERATING APPARATUS

Filed Aug. 9, 1955

4 Sheets-Sheet 1

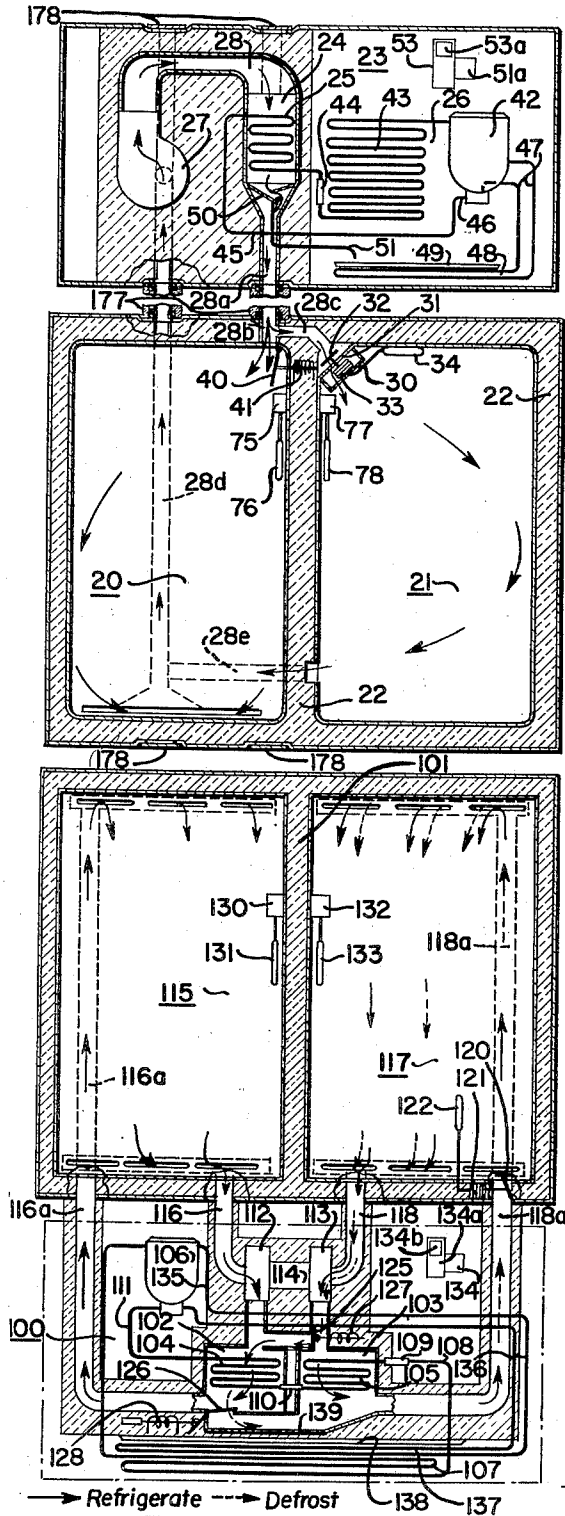


Fig. 1

Fig. 2

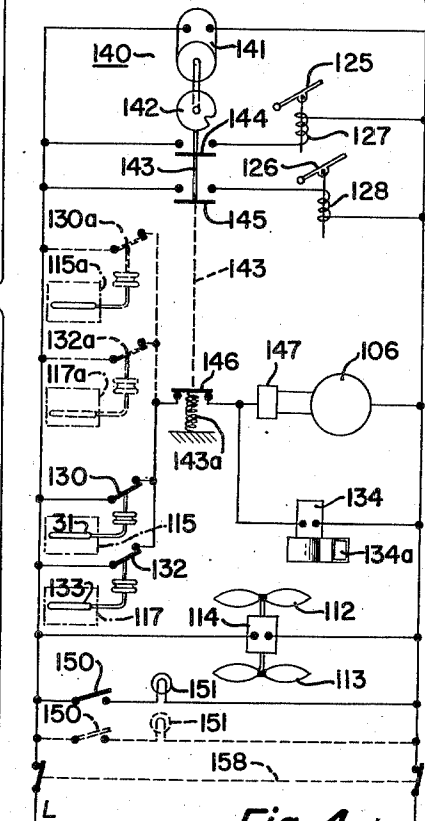
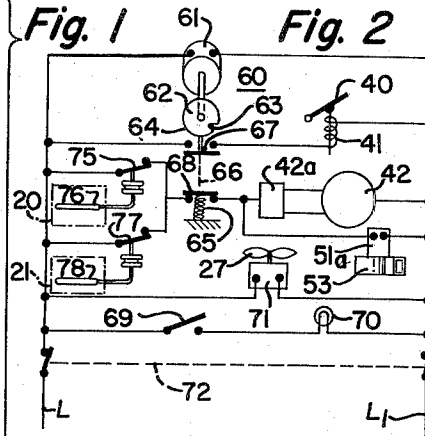


Fig. 3

Fig. 4

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4 Sheets-Sheet 2

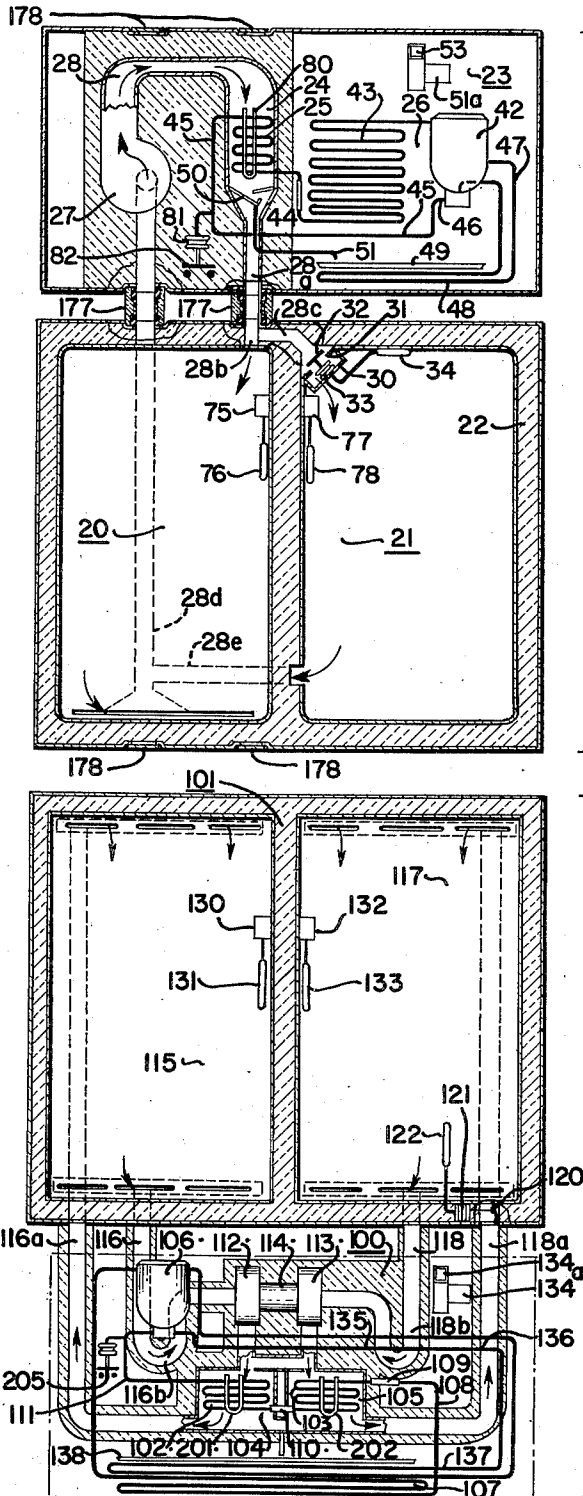


Fig. 5

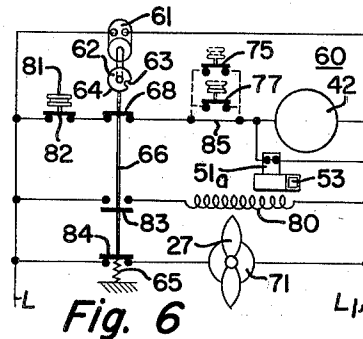


Fig. 6

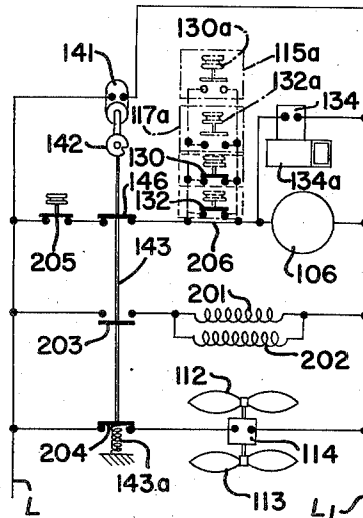


Fig. 8

Fig. 7

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4 Sheets-Sheet 3

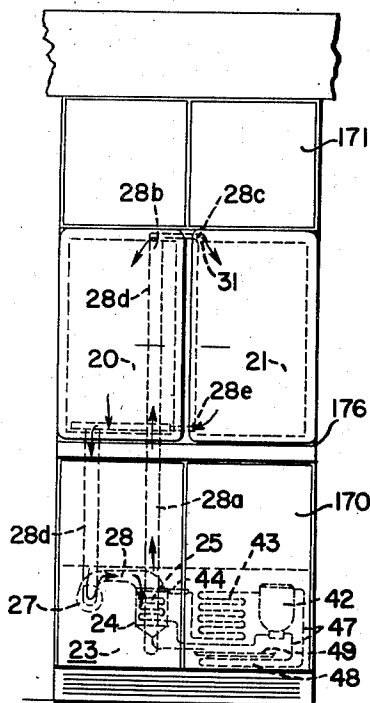


Fig. 12

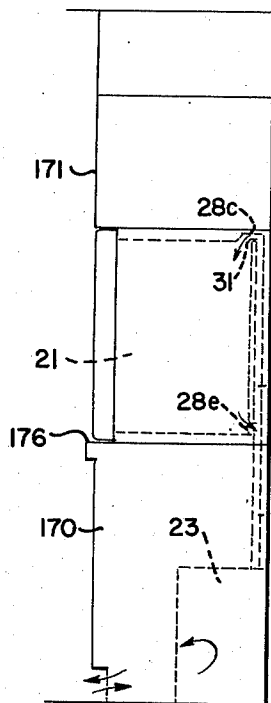


Fig. 13

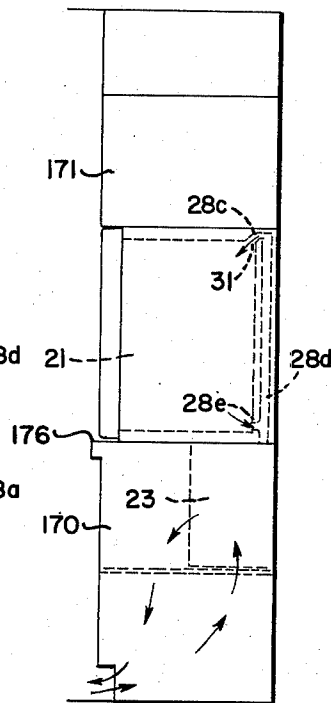


Fig. 14

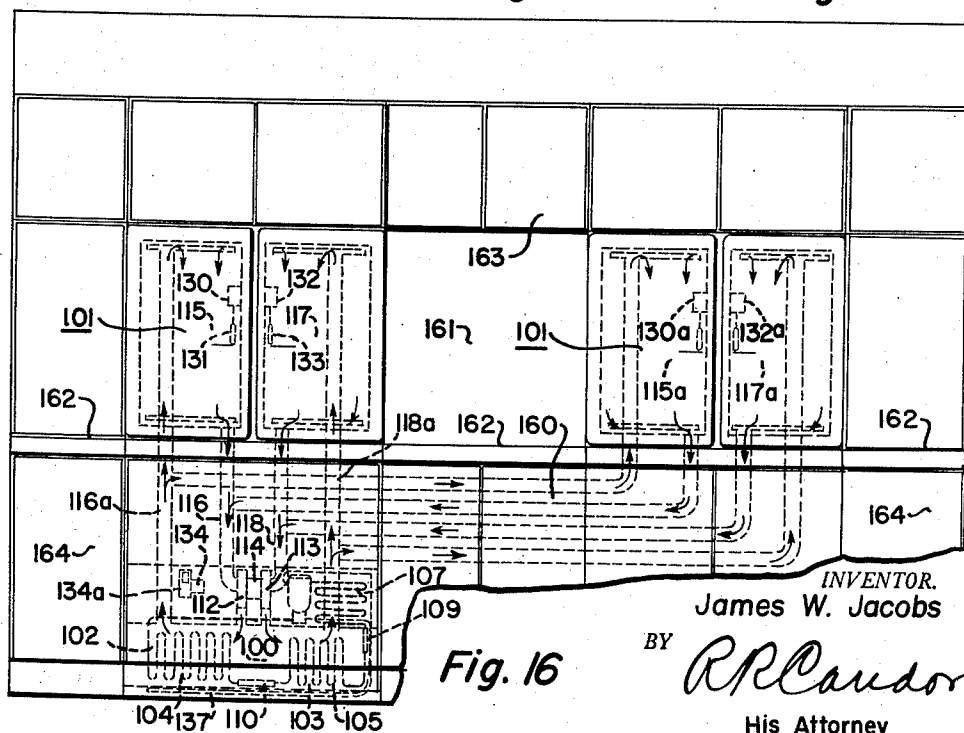


Fig. 16

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4 Sheets-Sheet 4

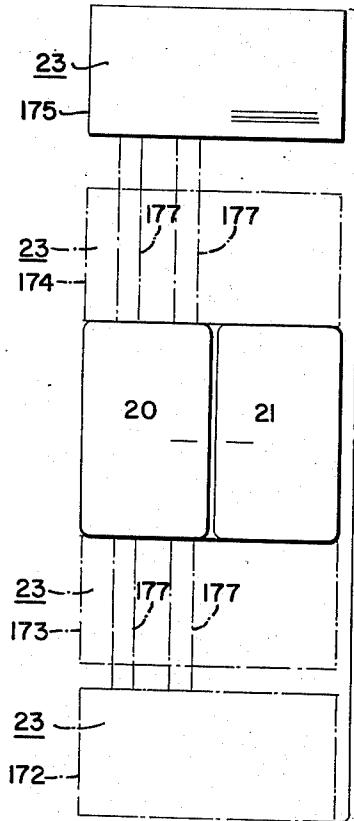


Fig. 9

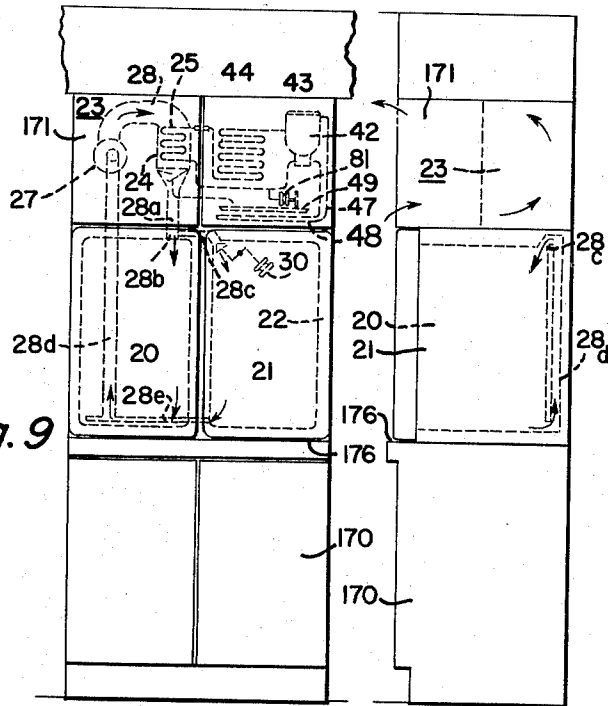


Fig. 10

Fig. 11

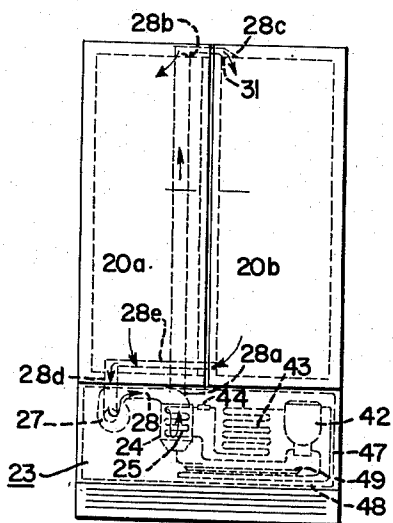


Fig. 15

Fig. 17

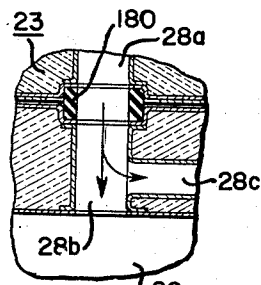


Fig. 18

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## REFRIGERATING APPARATUS

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Application August 9, 1955, Serial No. 527,377

16 Claims. (Cl. 62—4)

This invention relates to refrigerating apparatus and more particularly to a two-temperature two-compartment food refrigerator in which frost does not accumulate in either of the food compartments, or on the food in said compartments.

Two-temperature refrigerators usually have been provided in which one of the compartments has a below freezing temperature and the other compartment has an above freezing temperature. Various means have been provided for defrosting the evaporators of these compartments. Sometimes the below freezing compartment is defrosted by removing the food, and by scraping the accumulated frost within the compartment at long intervals of time. In other refrigerators, the evaporator is defrosted after short intervals of time by the application of heat electrically or with "hot gas," but the defrosting operation tends to melt the frozen foods in the compartment, because of the proximity to the food of the warmed evaporator or of the heating medium used in defrosting the evaporator. According to this invention, however, frost or condensation is never accumulated in either of the compartments or on the food therein, and the defrosting operation takes place in an enclosure materially removed from the food compartments, so that the defrosting operation does not materially raise the normal refrigerating temperatures in either of the compartments, and no frost accumulates on the food.

Accordingly, an object of this invention is to provide a refrigerator having a below freezing compartment, an above freezing compartment, an air cooling enclosure removed from said compartments, air circulating means, a refrigerant evaporator and a refrigerant liquefier so constructed and arranged that all of the frost or condensation occurs on the evaporator and in the air cooling enclosure which is relatively distant from the refrigerating compartments and the food therein, together with means for defrosting the evaporator in such a manner that the refrigerating compartments or the food therein are not materially raised from their normal refrigerating temperatures.

Another object of this invention is to provide an air cooling unit which can be combined in a plurality of ways with one or more food refrigerating units, each having above and below freezing temperature compartments, in such a manner that frost or condensation does not accumulate in such compartments.

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

In the drawings:

Figure 1 is a diagrammatic vertical cross-section of one embodiment of my invention.

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Figure 2 is a wiring diagram for the refrigerating apparatus shown in Figure 1.

Figure 3 is a view similar to Figure 1, but showing a modification.

Figure 4 is a wiring diagram for the apparatus shown in Figure 3.

Figure 5 is a view similar to Figure 1, showing a modified defrosting means.

Figure 6 is a wiring diagram for the apparatus of Figure 5.

Figure 7 is a view similar to Figure 3 showing a modified defrosting means.

Figure 8 is a wiring diagram for the apparatus of Figure 7.

Figure 9 is a diagrammatic representation showing how the refrigerating compartments and the air cooling unit may be related in various positions on a kitchen cabinet or the like.

Figure 10 is a view, somewhat similar to Figure 9, but showing one position of the air cooling unit.

Figure 11 is a transverse elevation of Figure 10.

Figure 12 is a view similar to Figure 10, but showing the cooling unit in a different position.

Figure 13 is a transverse elevation of Figure 12.

Figure 14 is a view similar to Figure 13, but showing the air cooling unit in a slightly different position.

Figure 15 is a view showing the air cooling unit with a slightly larger set of refrigerating compartments.

Figure 16 is a view showing how a plurality of refrigerating units and a plurality of air cooling units of the character shown in Figures 3 and 17 may be used in a kitchen cabinet type of installation.

Figure 17 is an enlarged cross-section of a duct connection to be used in a construction such as shown in Figure 9, and others.

Figure 18 is an enlarged cross-section of a duct connection to be used in a construction such as shown in Figure 10, and others.

In Figures 1 and 2, a below freezing compartment 20 and a refrigerating above freezing compartment 21 are enclosed by an insulated cabinet construction 22. These form a food refrigerating unit which is to be used in conjunction with an air cooling unit 23, which includes an air cooling enclosure 24, a refrigerant evaporator 25 and a refrigerant liquefier 26 in refrigerant circulating relationship and with the evaporator 25 in thermal exchange with the air cooling enclosure 24. Air circulating means 27, in the form of a motor driven blower or fan, is provided for circulating air through the air cooling enclosure 24. Conduit means 28, 28a, 28b, 28c, 28d and 28e cooperate with the air circulating means 27 to circulate air from the air cooling enclosure 24 in parallel into the below freezing compartment 20 and the above freezing compartment 21 and back to said air cooling enclosure 24.

A thermostatic air controller 30 regulates the flow of air through the above freezing compartment 21 in response to temperatures in said compartment. This may take the form of an aperture 31 opened and closed by a valve or baffle 32 which is operated by bellows 33 and a thermostatic bulb 34. The aperture 31 is restricted more and more as the temperature in the compartment 21 falls, and vice versa, to maintain the temperature in compartment 21 substantially at the desired above freezing temperature by regulation of the air flow through said compartment.

A solenoid operated air controller 40 is provided for

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regulating the flow of air through the below freezing compartment 20. When the solenoid 41 is energized, the controller 40 stops or reduces the air circulation through compartment 20, and when the solenoid 41 is deenergized the circulation through compartment 20 is increased or restored. The air controller 40 stops or reduces air flow through said compartment 20 during the defrosting period and restores or increases air circulation during the refrigerating period.

The refrigerant liquefier 26 may take the form of a motor compressor unit 42 which discharges compressed refrigerant to the condenser 43, which discharges liquefied refrigerant through the valve or restrictor 44 to the evaporator 25. The evaporated refrigerant returns through the conduit 45 to the inlet 46 of the compressor. The motor compressor unit 42 may be provided with a heat dissipator including branch hot gas circulator pipes 47 which have a portion 48 below the water evaporating pan 49. When the evaporator 25 is defrosted, the water falls into the collecting baffle 50 and drains through the pipe 51 into the pan 49, where it is evaporated by the heat created in the auxiliary heat dissipator 47, 48.

Air may be circulated into and out of the compartment containing the compressor 42 and condenser 43 by means of a blower 53 driven by a motor 51a. The blower may draw air into the compartment through an air inlet and discharge it through an air outlet 53a.

Referring to Figure 2, a timer 60 has a motor 61 and a cam 62 rotated thereby to provide a defrost period corresponding to notch 63 and a refrigerating period corresponding to the smooth circumference 64. The cam 62 controls the refrigerant liquefier 26 (and particularly the motor compressor unit 42), and solenoid operated air controller 40, 41. The timer stops the operation of the motor compressor 42 and causes the solenoid operated air controller 40 to reduce or stop air circulation through compartment 20 during the defrost period corresponding to notch 63. The timer permits operation of said motor compressor unit 42 and causes said solenoid operated air controller 40, 41 to increase or restore air circulation through compartment 20 during the refrigerating period corresponding to smooth circumference 64. To this end, a compression spring 65 is provided to move the linkage 66 upwardly against the cam 62. The switch 67 is open during the refrigerating period and is closed during the defrost period, while the switch 68 is closed during the refrigerating period and is open during the defrost period. The motor compressor unit may be provided with the usual starting relay 42a. The switch 69 is a door switch which energizes the illuminating lamp 70 when the door is open. If desired, two such switches 69 and lamps 70 may be provided for each compartment 20 and 21. The air circulating means or blower 27 is operated by motor 71 which is across the lines L and L<sub>1</sub>, as long as the refrigerator is plugged in or its line switch 72 is closed to energize lines L and L<sub>1</sub>.

If desired, a below freezing thermostatic switch 75 is responsive to temperatures in the below freezing compartment 20 through the medium of thermostatic bulb 76. An above freezing thermostatic switch 77 is responsive to temperatures in the above freezing compartment 21 through the medium of bulb 78. The switches 75 and 77 control the operation of the refrigerant liquefier 26, or its motor compressor unit 42, to stop operation of the liquefier when both of the compartments 20 and 21 are below their respective predetermined low temperatures and to permit operation of the refrigerant liquefier when either of said compartments 20 or 21 are above the said respective predetermined low temperatures, as indicated in the wiring diagram in Figure 2.

Referring to Figures 5 and 6, all of the elements of these figures are substantially the same as in Figures 1 and 2, wherever they have been indicated by the same reference numerals. However, the solenoid operated air

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controller 40, 41 has been omitted, and in lieu thereof an electric heater 80 has been placed in thermal exchange with the evaporator 25. A low pressure switch 81 is connected to the low side, such as the conduit 45, so that the switch 82 is opened when the refrigerant pressure on the low side falls below a predetermined limit, and the switch 82 is closed when the refrigerant pressure on the low side rises to an upper predetermined limit. The operation of the electric heater 80 is accomplished by the switch 83 which is closed during the defrost period of the timer and is open during the refrigerating period of the timer. The blower 27 is stopped by the timer switch 84 during the defrost period, so no heat is transferred at that time to the food compartments.

The switches 75 and 77 may be omitted or may be retained, as indicated by the dotted lines in Figure 6. The switches 75 and 77 of Figures 1 and 2 and the low pressure switch 82 of Figures 5 and 6 may be used interchangeably for each other in either Figures 1 and 2 or 5 and 6. If switches 75 and 77 are used in Figures 5 and 6, the line 85 is removed, so that the current to the motor compressor unit 42 has to pass through either or both of the switches 75 and 77. When switches 75 and 77 are used in Figures 5 and 6, the low pressure switch 82 may be omitted or retained, as desired.

Referring now to Figures 3 and 4, the refrigerator includes an air cooling unit 100 and a food refrigerating unit 101. The air cooling unit includes a first (or relatively cold) air cooling enclosure 102 and a second (or relatively warm) air cooling enclosure 103, and a refrigerant evaporator having sections 104 and 105 respectively in thermal exchange with enclosures 102 and 103. A refrigerant liquefier is provided in refrigerant circulating relationship with the evaporator 104, 105 and includes a motor compressor unit 106 discharging compressed refrigerant into the condenser 107 from whence liquefied refrigerant flows through the line 108, through the restrictor or valve 109 to the warmer evaporator section 105, from whence the refrigerant flows through a second restrictor 110 to the colder section 104 of the evaporator and from whence the refrigerant flows through the conduit 111 back to the compressor 106. Air circulating means may take the form of blowers 112 and 113 operated by the motor 114. The blower 112 circulates air through the below freezing compartment 115 and through the first air cooling enclosure 102 by means of the conduits 116 and 116a. The blower 113 circulates air through the above freezing compartment 117 by means of the conduits 118 and 118a and through the second air cooling enclosure 103.

A thermostatic air controller 120 is provided in conduit 118a with a bellows 121 and a bulb 122 to regulate the flow through the above freezing compartment 117 in response to temperature in said above freezing compartment 117. The controller tends to throttle the flow of air as the temperature in the compartment falls, and vice versa, to maintain the temperature in the compartment substantially at the desired temperature. A solenoid operated controller includes the valves 125 and 126 operated by the solenoids 127 and 128 respectively to regulate the flow of air through the below freezing compartment 115, to reduce or stop the circulation of air during the defrost period and to increase or restore the circulation of air during the refrigerating period. The valve 125 opens the connection between compartment 117 and compartment 102, and leaves the opening to compartment 103 partially open. During the defrost period, the air circulates to and from compartment 117 and enclosures 102 and 103, as indicated by the dotted arrows, to defrost the evaporator 104 and 105 by heat from compartment 117, at which time the compressor is idle.

A below freezing thermostatic switch 130 is provided with a thermostatic bulb 131, and an above freezing thermostatic switch 132 is provided with a thermostatic bulb 133 to control the operation of the refrigerant liquefier in

such a manner as to stop operation when both of the compartments 115 and 117 are below their respective predetermined low temperatures and to permit operation of said refrigerant liquefier when either of the temperatures in said compartments are above their respective predetermined low temperatures.

The motor compressor unit 106 is provided with auxiliary hot gas conduits 135 and 136 which lead to a pan warming coil 137 below the water evaporating pan 138 which receives the condensate and frost melted water guided by the baffles 139 from the evaporator sections 104 and 105.

A motor 134 and blower 134a having an outlet 134b are provided for circulating air in and out of compressor or condenser compartment similarly to motor 51a and blower 53. Other figures disclose motors 51a or 134 and blowers 53 and 134a which operate to circulate air into and out of the compressor or condenser compartment in the same manner.

Referring to Figure 4, a timer 140 has a timer motor 141 and a cam 142 operated thereby having a defrost notch substantially as previously described with respect to Figure 2. The cam 142 operates the linkage 143, which is pressed upwardly by spring 143a, to open switch 146 and close the switches 145 and 144 during the defrost periods and vice versa during the refrigeration period substantially in the same manner as in Figure 2. The thermostatic switches 130 and 132 are in parallel-series with the switch 146 and the motor compressor 106, which includes the starting relay 147. The blowers 112 and 113 and motor 114 are across the lines L and L<sub>1</sub>, and operate as long as the refrigerator is plugged in, or its line switch 158 is closed.

If the air cooling unit 100 is connected to more than the two compartments 115 and 117, as hereafter described concerning Figure 16, such additional compartments may be provided with switches 130a and 132a, so that the compressor 106 can operate as long as any of these compartments require refrigeration but cannot operate if all of the compartments are refrigerated below their respective low temperatures. One or more door switches 150 control the illuminating lamps 151 in as many compartments as is desired.

In Figures 7 and 8, the operation is substantially the same as in Figures 3 and 4, and similar numerals have been used to designate similar elements, except that the solenoid operated controller valves 125 and 126 of Figures 3 and 4 have been omitted. They have been replaced by electric heaters 201 and 202 in thermal exchange with evaporator sections 104 and 105. They are energized during the defrost period and deenergized during the refrigerating period by switch 203. The conduits 116 and 118 have been provided with heat trapping loops 116b and 118b to prevent air convection during defrosting. The blowers 112, 113 and motor 114 are stopped during the defrost period by timer switch 204. A low pressure switch 205 may be connected to the low side of the refrigerating system, at line 111 for example, which operates as described with respect to switch 82 of Figures 5 and 6, and which may be used interchangeably with or additionally to the switches 130 and 132 in either of the modifications shown in Figures 3 and 4 or 7 and 8. In Figure 8, the line 206 is to be omitted if thermostatic switches 130 and 132 are added to, or substituted for, low pressure switch 205. If additional refrigerating compartments 115a and 117a are connected to the refrigerating systems of either Figures 3 and 4 or Figures 7 and 8, and as shown in Figure 16, then additional switches 130a and 132a may be added as shown in phantom lines in Figures 4 and 8.

The air cooling unit 100 may be installed in a kitchen cabinet-like construction as shown in Figure 16 in which the compartments 115 and 117 are substantially as shown in Figures 3 or 7 and located above the counter-top 162 while the compartments 115a and 117a are additional

compartments which are connected by the conduit constructions 160 for parallel air circulation. The compartments 115, 115a, 117 and 117a may occupy the usual space 161 between the kitchen cabinet table top 162 and the upper cabinets 163 usually provided in the kitchen. The lower cabinets 164 may be the usual lower kitchen cabinets and the air cooling unit 100 may occupy some or all of one or more of such lower cabinets. If desired, the cooling unit may occupy one or more of the upper kitchen cabinets 163 instead.

Referring to Figures 9 through 14, the constructions shown in Figures 1, 3 and 5 may be used in conjunction with the usual kitchen cabinets. The lower kitchen cabinets 170 are spaced from the usual upper kitchen cabinets 171. The air cooling unit 23 may be placed in or below the lower kitchen cabinets 170 in either of the positions 172 or 173 (Figure 9) or in or above the upper kitchen cabinets in the upper positions 174 or 175 of Figure 9. The refrigerating compartments 20 and 21 may be placed immediately above the top of the counter-top 176 and below the bottom of the upper cabinets 171 in any of the positions shown in Figures 10 through 14. The air cooling unit 23 may be placed in any of the dotted line positions designated by the numeral 23 in such figures.

In Figure 15, the air cooling unit 23 may be used with enlarged refrigerated compartments 20a and 20b, but operated substantially as shown in Figures 1 and 5. In all embodiments, the cooling unit may be placed above or below the compartments, and the conduit constructions are varied by causing the conduits to leave the bottom of the refrigerated compartments and the top of the air cooling compartment or vice versa, as indicated.

In all of the modifications of Figures 9 through 16, controls similar to those of Figures 1 through 8 are provided, as desired.

The air cooling units 23, 100, etc., in all of the embodiments, may be connected to the refrigerating compartments 20, 21, 115, 117, etc., by the conduit connectors are shown in Figures 17 and 18. The air cooling units may have air outlets 28a, etc. either at the bottom or the top or both. If outlets are provided at both the bottom and top, the one not used may be plugged by a resilient cap 178, as indicated in Figures 1 and 5. The same is true of the inlets and outlets in the refrigerating units. If the air cooling units are immediately adjacent the refrigerating compartments, the inlets 28b, 28c, etc. of the latter may be joined by resilient sleeves 180, as shown in Figure 18. If they are separated, they can be joined by conduits 177, etc., and the juncture point may be sealed by resilient sleeves 181, as shown in Figure 17.

In the operation of the embodiment of Figures 1 and 2, the refrigerating system 25, 26 operates as long as energized by its controls as indicated in Figure 2 while the timer cam utilizes surface 64. When the timer 61, 62 reaches the defrost period of notch 63 (once a day for example), switch 67 is closed and switch 68 is opened. This causes air to circulate only through compartment 21 and enclosure 24 and through conduits 28e, 28d, 28, 28a, 28b, 28c (but not into compartment 20) to transfer heat to the evaporator 25 from compartment 21 sufficiently to defrost the evaporator while the refrigeration system is stopped. Thereafter, the timer resumes the full line operation of Figure 2 so that both compartments receive refrigerated air at a temperature sufficient to lower compartment 20 to the desired below freezing temperature and to lower compartment 21 to an above freezing temperature suitable for refrigerating unfrozen foods. Since the evaporator 25 operates at a lower temperature than prevails in either compartment 20 or 21, all frosting takes place on evaporator 25, and no frost or condensation is ever deposited in compartments 20 or 21 or the food in them. Foods in compartments 20 and 21 are not warmed during defrosting because air circulation through compartment 20 is stopped by solenoid valve 40,

and the air flowing through compartment 21 is sufficiently cold to prevent warming of that compartment.

In Figures 5 and 6, the operation is substantially the same as in Figures 1 and 2, except that all air circulation is stopped during the defrost period by the opening of switch 84 while switch 83 is closed and switch 68 is opened to energize heater 80 and stop motor compressor 42. Under these conditions, the evaporator 25 is defrosted without warming the compartments 20 and 21, and refrigeration is resumed after the defrost period is terminated, by the passing of notch 63.

In the operation of the modification shown in Figures 3 and 4, refrigerated air is circulated between compartment 115 and enclosure 102 and between compartment 117 and enclosure 103. The air currents are cooled by the evaporator sections 104 and 105 to the proper temperatures to maintain proper low temperature limits in the respective compartments 115 and 117. During the defrost period, switches 144 and 145 are closed while switch 146 is opened. Air then circulates between compartment 117 and enclosures 102 and 103 to transfer heat to evaporator sections 104 and 105 and defrost them.

In Figures 7 and 8, the operation is the same as in Figures 3 and 4 except that air circulation is completely stopped and heaters 201 and 202 are energized during the defrost period.

In all the foregoing embodiments, the defrost water is evaporated in the respective pans 49 and 138.

In the modifications of Figures 9 through 16, the operation is the same as previously described with respect to the corresponding Figures 1 through 8, with obvious modification or addition, as shown.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted as may come within the scope of the claims which follow.

What is claimed is as follows:

1. In combination: a below freezing compartment; a refrigerating above freezing compartment; an air cooling enclosure; air circulating means; conduit means cooperating with said air circulating means to circulate air from said air cooling enclosure in parallel into said below freezing and above freezing compartments and back to said air cooling enclosure; a thermostatic air controller regulating the flow of air through said above freezing compartment in response to temperatures in said above freezing compartment; a solenoid operated air controller regulating the flow of air through said below freezing compartment; a refrigerant evaporator and a refrigerant liquefier in refrigerant circulating relationship and with said evaporator in thermal exchange with said air cooling enclosure; and a timer having a defrost period and a refrigerating period and controlling said refrigerant liquefier and solenoid operated air controller to stop operation of said refrigerant liquefier and to cause said solenoid operated air controller to reduce air circulation during said defrost period and to permit operation of said refrigerant liquefier and to cause said solenoid operated air controller to increase air circulation during said refrigerating period.

2. In combination: a below freezing compartment; a refrigerating above freezing compartment; an air cooling enclosure; air circulating means; conduit means cooperating with said air circulating means to circulate air from said air cooling enclosure in parallel into said below freezing and above freezing compartments and back to said air cooling enclosure; a thermostatic air controller regulating the flow of air through said above freezing compartment in response to temperatures in said above freezing compartment; a solenoid operated air controller regulating the flow of air through said below freezing compartment; a refrigerant evaporator and a refrigerant liquefier in refrigerant circulating relationship with said evaporator in thermal exchange with said air cooling enclosure; a below freezing thermostatic switch responsive to temperatures in said below freezing com-

partment and an above freezing thermostatic switch responsive to temperatures in said above freezing compartment controlling the operation of said refrigerant liquefier to stop operation of said refrigerant liquefier when both of said compartments are below their respective predetermined low temperatures and to permit operation of said refrigerant liquefier when either of said compartments are above said respective predetermined low temperatures.

3. In combination: a below freezing compartment; a refrigerating above freezing compartment; an air cooling enclosure; air circulating means; conduit means cooperating with said air circulating means to circulate air from said air cooling enclosure in parallel into said below freezing and above freezing compartments and back to said air cooling enclosure; a thermostatic air controller regulating the flow of air through said above freezing compartment in response to temperatures in said above freezing compartment; a refrigerant evaporator and a refrigerant liquefier in refrigerant circulating relationship with said evaporator in thermal exchange with said air cooling enclosure; electric heating means in thermal exchange with said evaporator; and a timer having a defrost period and a refrigerating period and controlling said refrigerant liquefier and said electric heating means to stop operation of said refrigerant liquefier and air circulating means and to energize said electric heating means during said defrost period and to permit operation of said refrigerant liquefier and air circulating means and to deenergize said electric heating means during said refrigerating period.

4. In combination: a below freezing compartment; a refrigerating above freezing compartment; an air cooling enclosure; air circulating means; conduit means cooperating with said air circulating means to circulate air from said air cooling enclosure in parallel into said below freezing and above freezing compartments and back to said air cooling enclosure; a thermostatic air controller regulating the flow of air through said above freezing compartment in response to temperatures in said above freezing compartment; a refrigerant evaporator and a refrigerant liquefier in refrigerant circulating relationship with said evaporator in thermal exchange with said air cooling enclosure; electric heating means in thermal exchange with said evaporator; a below freezing thermostatic switch responsive to temperatures in said below freezing compartment and an above freezing thermostatic switch responsive to temperatures in said above freezing compartment controlling the operation of said refrigerant liquefier to stop operation of said refrigerant liquefier when both of said compartments are below their respective predetermined low temperatures and to permit operation of said refrigerant liquefier when either of said compartments are above said respective predetermined low temperatures.

5. In combination: an air cooling unit including an air cooling enclosure, a refrigerant evaporator and a refrigerant liquefier in refrigerant circulating relationship and with said evaporator in thermal exchange with said cooling enclosure, and air circulating means for circulating air through said air cooling enclosure; a food refrigerating unit including a below freezing compartment and a refrigerating above freezing compartment; conduit means cooperating with said air circulating means to circulate air from said air cooling enclosure in parallel into said below freezing and above freezing compartments and back to said air cooling enclosure; a thermostatic air controller regulating the flow of air through said above freezing compartment in response to temperatures in said above freezing compartment; a solenoid operated air controller regulating the flow of air through said below freezing compartment; and a timer having a defrost period and a refrigerating period and controlling said refrigerant liquefier and solenoid operated controller to stop operation of said refrigerant liquefier

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11. In combination: a below freezing compartment; a refrigerating above freezing compartment; a first air cooling enclosure for said below freezing compartment; a second air cooling enclosure for said above freezing compartment; air circulating means; conduit means cooperating with said air circulating means to circulate air from said first air cooling enclosure into said below freezing compartment and back to said first air cooling enclosure and from said second air cooling enclosure into said above freezing compartment and back to said second air cooling enclosure; a thermostatic air controller regulating the flow of air through said above freezing compartment in response to temperatures in said above freezing compartment; a refrigerant evaporator and a refrigerant

11. In combination: a below freezing compartment; a refrigerating above freezing compartment; a first air cooling enclosure for said below freezing compartment; a second air cooling enclosure for said above freezing compartment; air circulating means; conduit means cooperating with said air circulating means to circulate air from said first air cooling enclosure into said below freezing compartment and back to said first air cooling enclosure and from said second air cooling enclosure into said above freezing compartment and back to said second air cooling enclosure; a thermostatic air controller regulating the flow of air through said above freezing compartment in response to temperatures in said above freezing compartment; a refrigerant evaporator and a refrigerant

8. In combination: an air cooling unit including an air cooling enclosure, a refrigerant evaporator and a refrigerant liquefier in refrigerant circulating relationship and with said evaporator in thermal exchange with said cooling enclosure, and air circulating means for circulating air through said air cooling enclosure; a food refrigerating unit including a below freezing compartment and a refrigerating above freezing compartment; conduit means cooperating with said air circulating means to circulate air from said air cooling enclosure in parallel into said below freezing and above freezing compartments and back to said air cooling enclosure; a thermostatic air controller regulating the flow of air through said above freezing compartment in response to temperatures in said above freezing compartment; electric heating means in thermal exchange with said evaporator; a below freezing thermostatic switch responsive to temperatures in said below freezing compartment and an above freezing thermostatic switch responsive to temperatures in said above freezing compartment controlling the operation of said refrigerant

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liquefier in refrigerant circulating relationship, said evaporator having a colder section in thermal exchange with said first air cooling enclosure and having a warmer section in thermal exchange with said second air cooling enclosure; electric heating means in thermal exchange with said evaporator; a below freezing thermostatic switch responsive to temperatures in said below freezing compartment and an above freezing thermostatic switch responsive to temperatures in said above freezing compartment controlling the operation of said refrigerant liquefier to stop operation of said refrigerant liquefier when both of said compartments are below their respective predetermined low temperatures and to permit operation of said refrigerant liquefier when either of said compartments are above said respective predetermined low temperatures.

12. In combination: an air cooling unit including a first air cooling enclosure and a second air cooling enclosure, a refrigerant evaporator and a refrigerant liquefier in refrigerant circulating relationship with said evaporator having a colder section in thermal exchange with said first air cooling enclosure and having a warmer section in thermal exchange with said second air cooling enclosure, and air circulating means for circulating air through said air cooling enclosures; a food refrigerating unit including a below freezing compartment and a refrigerating above freezing compartment; conduit means cooperating with said air cooling means to circulate air from said first air cooling enclosure into said below freezing compartment and back to said first air cooling enclosure and from said second air cooling enclosure into said above freezing compartment and back to said second air cooling enclosure; a thermostatic air controller regulating the flow of air through said above freezing compartment in response to temperatures in said above freezing compartment; a solenoid operated controller regulating the flow of air through said below freezing compartment; and a timer having a defrost period and a refrigerating period and controlling said refrigerant liquefier and solenoid operated air controller to stop operation of said refrigerant liquefier and to cause said solenoid operated air controller to reduce air circulation during said defrost period and to permit operation of said refrigerant liquefier and to cause said solenoid operated air controller to increase air circulation during said refrigerating period.

13. In combination: an air cooling unit including a first air cooling enclosure and a second air cooling enclosure, a refrigerant evaporator and a refrigerant liquefier in refrigerant circulating relationship with said evaporator having a colder section in thermal exchange with said first air cooling enclosure and having a warmer section in thermal exchange with said second air cooling enclosure, and air circulating means for circulating air through said air cooling enclosures; a food refrigerating unit including a below freezing compartment and a refrigerating above freezing compartment; conduit means cooperating with said air cooling means to circulate air from said first air cooling enclosure into said below freezing compartment and back to said first air cooling enclosure and from said second air cooling enclosure into said above freezing compartment and back to said second air cooling enclosure; a thermostatic air controller regulating the flow of air through said above freezing compartment in response to temperatures in said above freezing compartment; electric heating means in thermal exchange with said evaporator and a timer having a defrost period and a refrigerating period and controlling said refrigerant liquefier and said electric heating means to stop operation of said refrigerant liquefier and air circulating means and to energize said electric heating means during said defrost period and to permit operation of said refrigerant liquefier and air circulating means and to deenergize said electric heating means during said refrigerating period.

14. In combination: an air cooling unit including a first air cooling enclosure and a second air cooling enclosure, a refrigerant evaporator and a refrigerant lique-

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fier in refrigerant circulating relationship with said evaporator having a colder section in thermal exchange with said first air cooling enclosure and having a warmer section in thermal exchange with said second air cooling enclosure, and air circulating means for circulating air through said air cooling enclosures; a food refrigerating unit including a below freezing compartment and a refrigerating above freezing compartment; conduit means cooperating with said air cooling means to circulate air from said first air cooling enclosure into said below freezing compartment and back to said first air cooling enclosure and from said second air cooling enclosure into said above freezing compartment and back to said second air cooling enclosure; a thermostatic air controller regulating the flow of air through said above freezing compartment in response to temperatures in said above freezing compartment; a solenoid operated controller regulating the flow of air through said below freezing compartment; a below freezing thermostatic switch responsive to temperatures in said below freezing compartment and an above freezing thermostatic switch responsive to temperatures in said above freezing compartment controlling the operation of said refrigerant liquefier to stop operation of said refrigerant liquefier when both of said compartments are below their respective predetermined low temperatures and to permit operation of said refrigerant liquefier when either of said compartments are above said respective predetermined low temperatures.

15. In combination: an air cooling unit including a first air cooling enclosure and a second air cooling enclosure, a refrigerant evaporator and a refrigerant liquefier in refrigerant circulating relationship with said evaporator having a colder section in thermal exchange with said first air cooling enclosure and having a warmer section in thermal exchange with said second air cooling enclosure, and air circulating means for circulating air through said air cooling enclosures; a food refrigerating unit including a below freezing compartment and a refrigerating above freezing compartment; conduit means cooperating with said air cooling means to circulate air from said first air cooling enclosure into said below freezing compartment and back to said first air cooling enclosure and from said second air cooling enclosure into said above freezing compartment and back to said second air cooling enclosure; a thermostatic air controller regulating the flow of air through said above freezing compartment in response to temperatures in said above freezing compartment; electric heating means in thermal exchange with said evaporator and a timer having a below freezing thermostatic switch responsive to temperatures in said below freezing compartment and an above freezing thermostatic switch responsive to temperatures in said above freezing compartment controlling the operation of said refrigerant liquefier to stop operation of said refrigerant liquefier when both of said compartments are below their respective predetermined low temperatures and to permit operation of said refrigerant liquefier when either of said compartments are above said respective predetermined low temperatures.

16. In a multiple section refrigeration unit, the combination: a first self-contained cabinet; a second self-contained cabinet; a below freezing compartment in said first cabinet; a refrigerating above freezing compartment in said first cabinet; an air cooling enclosure in said second cabinet; air circulating means; conduit means cooperating with said air circulating means to circulate air from said air cooling enclosure in parallel into said below freezing and above freezing compartments and back to said air cooling enclosure; a thermostatic air controller regulating the flow of air through said above freezing compartment in response to temperatures in said above freezing compartment; a refrigerant evaporator and a refrigerant liquefier in refrigerant circulating relationship and with said evaporator in thermal exchange with said air cooling enclosure; and a timer having a defrost period

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and a refrigerating period and controlling said refrigerant  
 liquefier to stop operation of said refrigerant liquefier and  
 to reduce air circulation during said defrost period and to  
 permit operation of said refrigerant liquefier and to cause  
 increased air circulation during said refrigerating period. 5

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