Jan. 14, 1969 E. D. GIDSEG 3,421,338

SELF-DEFROSTING REFRIGERATORS

Filed Dec. 5, 1966 Sheet 1 of 4

FIG. 1

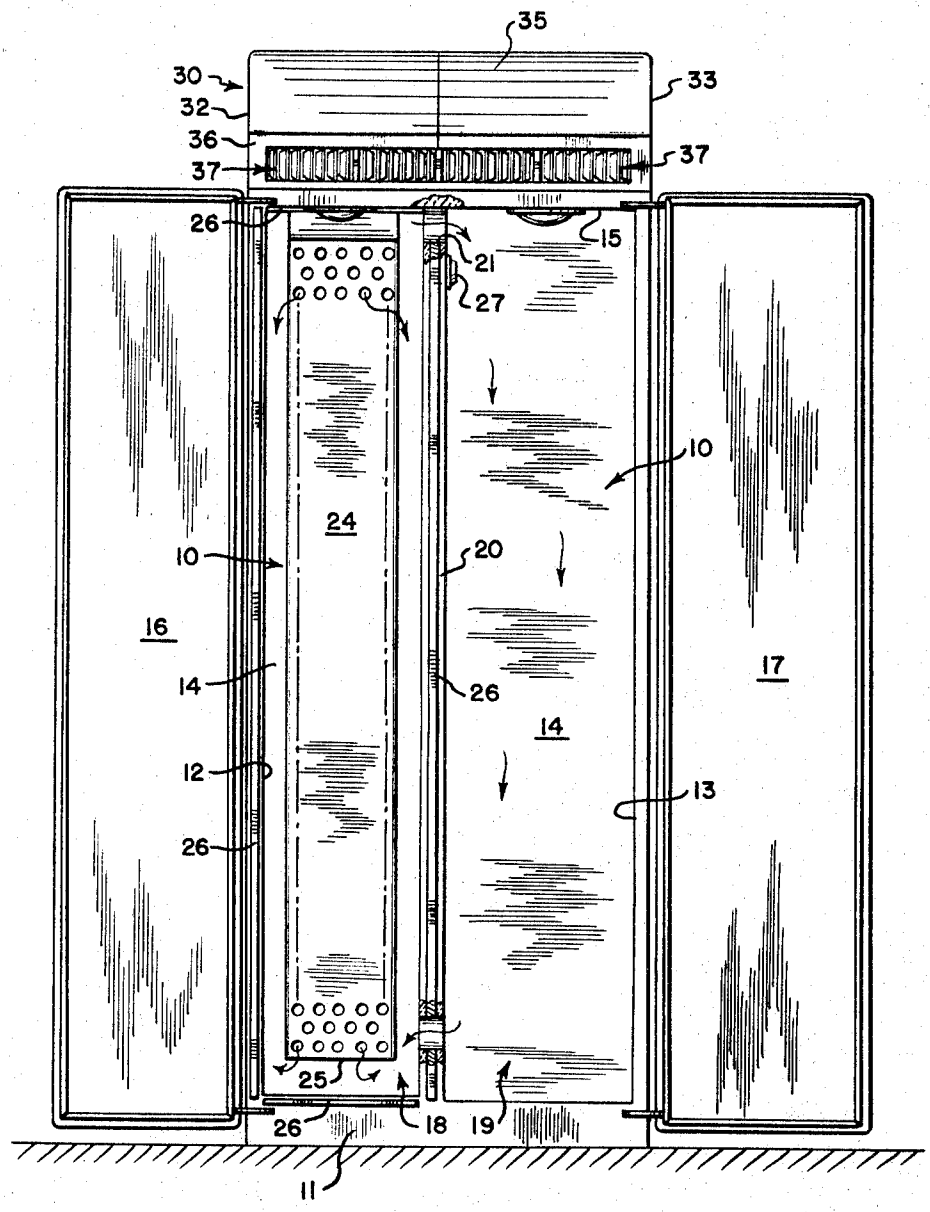

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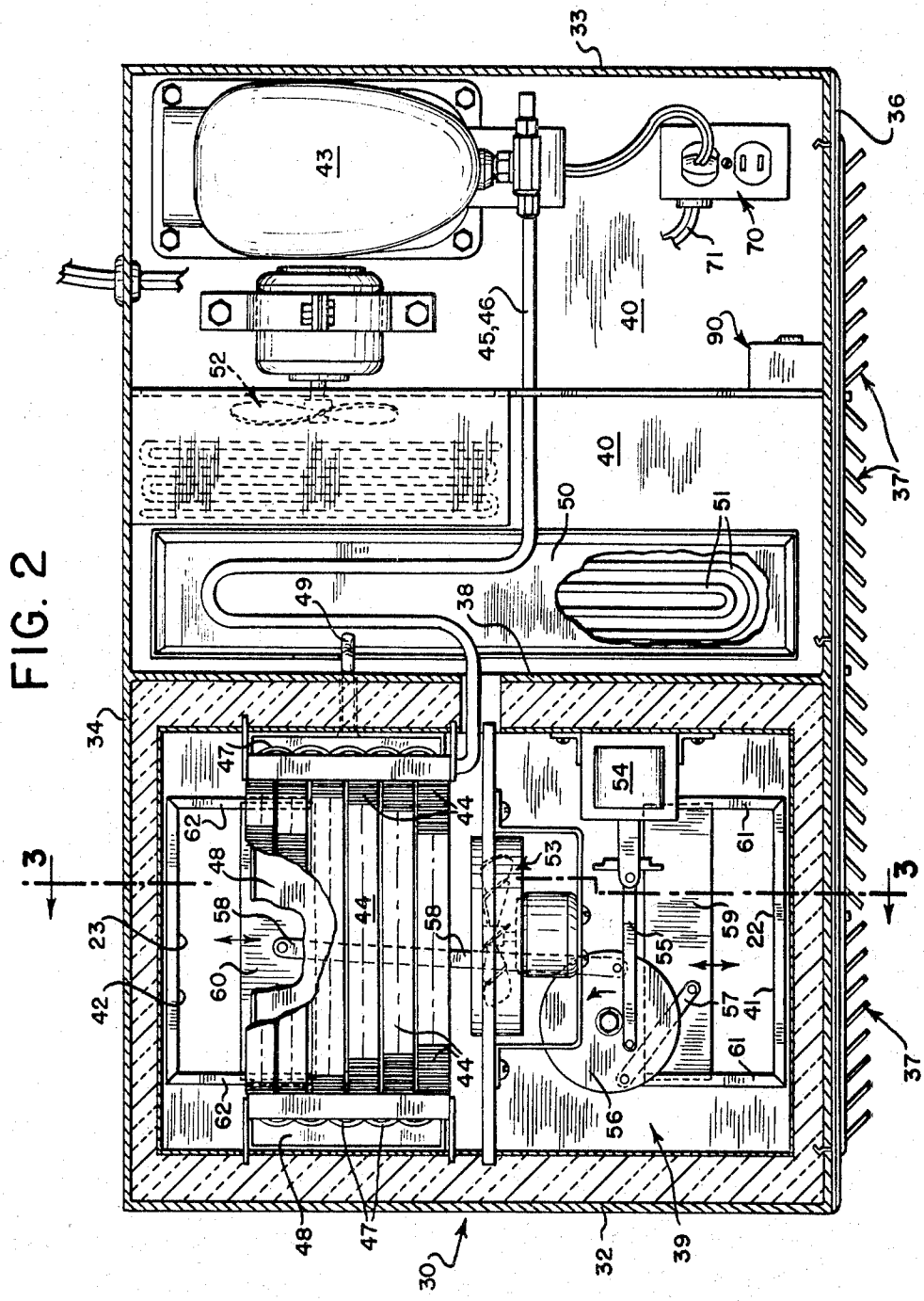
FIG. 2



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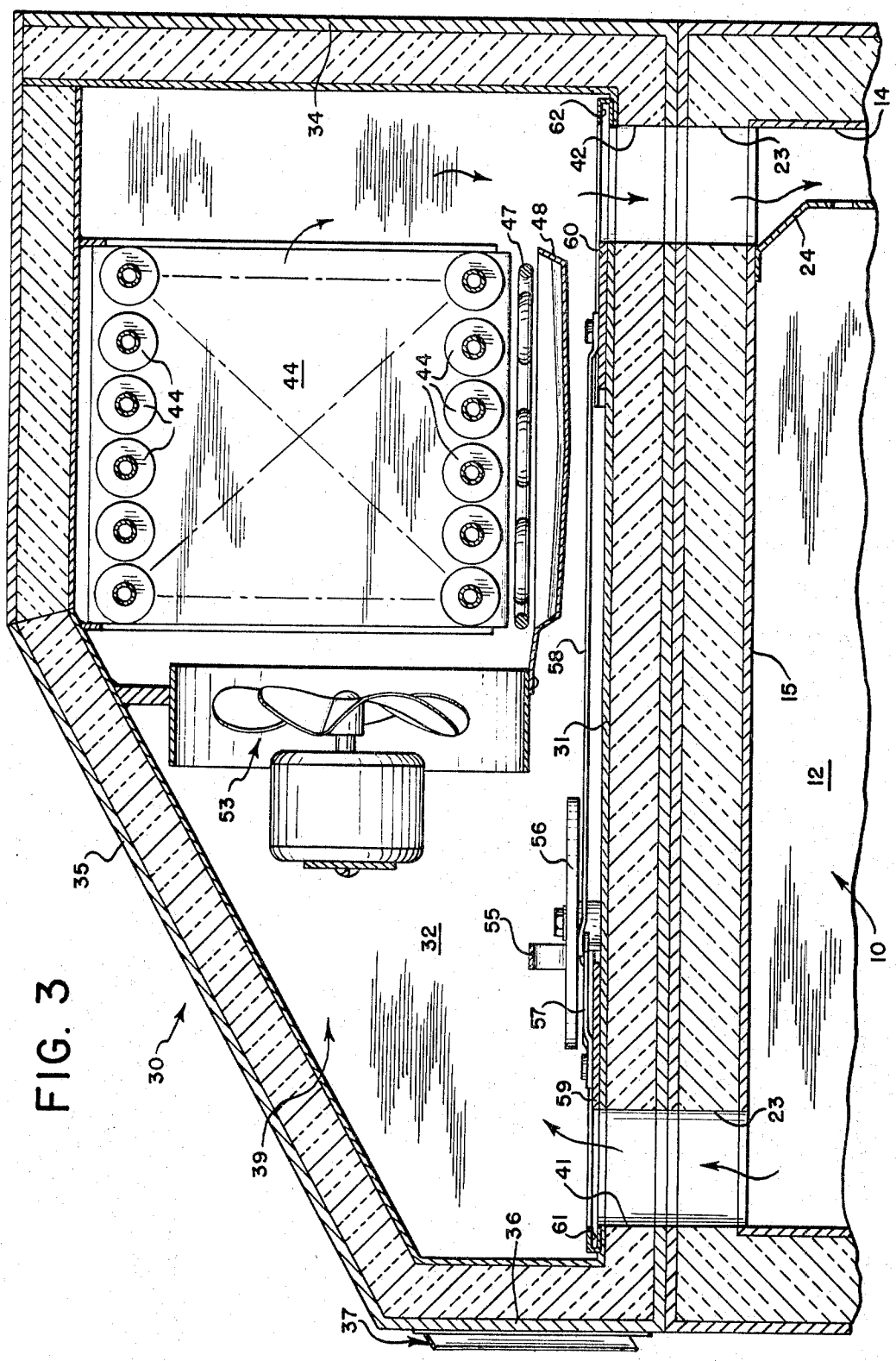
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FIG. 3

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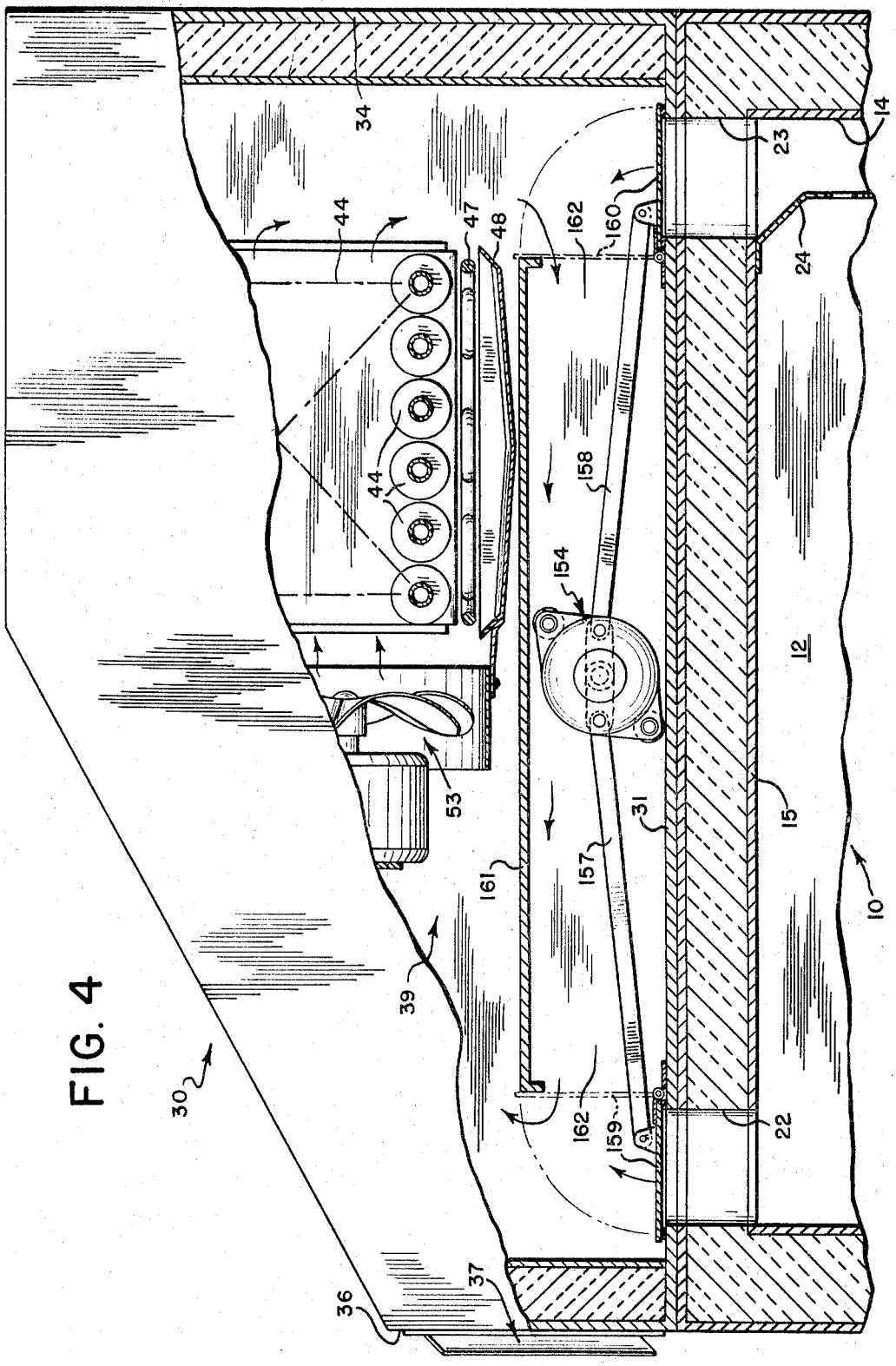

FIG. 4

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3,421,338

SELF-DEFROSTING REFRIGERATORS

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U.S. Cl. 62—155 10 Claims
Int. Cl. F25d *21/06;* F25d *17/04;* F25d *21/14*

ABSTRACT OF THE DISCLOSURE

A self-defrosting refrigerator includes a food storage compartment and a refrigerating compartment adjacent and insulatable from the food storage compartment but inter-connected by first and second passageways. A refrigeration system is mounted within the refrigerating compartment which includes a compressor, a freezer coil, a defroster coil, a blower for circulating frigid air through the passageways to cool the storage compartment during the refrigeration cycle and for circulating hot air through the refrigerating compartment during the defrost cycle, means for sealing the passageways during the defrost cycle and means for collecting and exhausting the melted frost from the refrigerating compartment into the ambient environment.

This invention relates to self-defrosting refrigerators and, more particularly, to a novel refrigerator-freezer constuction in which the refrigeration machinery may be completely insulated from the food storage compartments thereby permitting rapid defrosting of the freezer coils without significantly raising the temperature of the storage compartments. As used herein, the term "refrigerator" is used to denote both refrigerators and freezers as well as refrigerator-freezers.

The self-defrosting refrigerator of the present invention comprises two separate compartments completely insulated from one another except for a pair of passageways therebetween. The first compartment is for the storage of food and the second compartment contains all of the refrigeration machinery including a freezer coil, a defroster coil adjacent the freezer coil, and a blower which circulates cold air across the freezer coil and throughout the food storage compartment by way of the passageways connecting the two compartments and which blower also circulates hot air over the freezer coil during the defrosting cycle. As the defrosting cycle begins, the passageways between the two compartments are sealed while simultaneously creating new passageways within the freezer coil zone for the continuous circulation of heated air within such new passageways so that the heat of defrosting is confined solely to the second compartment. Also included in the system are means for disposing of the melted frost which is collected from the freezer coil during defrosting.

As noted above, the refrigerator of the present invention permits defrosting of the freezer coil in a much shorter time than accomplished by present refrigerators. In the present invention, the freezer coil is located in a compartment separate from the food storage compartment and cooling is accomplished by forced circulation of cold air through passageways which interconnect the two compartments. While the defrosting cycle is in progress, the passageways are closed so that such heat generated during defrosting is not transferred into the storage compartment and the storage compartment temperature remains at a safe level. Furthermore, since defrosting is carried out in a separate insulated compartment, higher temperatures may be employed which, together with forced circulation, thereby substantially decrease the duration of the defrosting cycle. By way of illustration,

although the defrosting cycle of standard home refrigerators may be as much as 17 minutes in duration, the defrosting cycle of the self-defrosting refrigerators of the invention may be complete in 4 minutes or even less. Because there is no need to precisely control temperature at which the defrosting cycle is carried out, for fear of overheating the storage compartment, the thermostatic control for the defroster coil which is found in the prior art is not absolutely required in the refrigerators of the invention. When they are employed, however, such thermostats may be used effectively to permit higher temperatures during defrosting. The elimination of the freezer coil from the interior of the storage compartment yields another advantage in that it makes possible a greater usable storage capacity without altering outside dimensions. The refrigeration system of the invention is more economically manufactured and more efficiently operated because of the savings in the length of copper tubing needed for the freezer coil and because of the reduction of power and heat losses in the system. Finally, because the refrigerator of the present invention is of modular construction it may be serviced more easily since the entire refrigeration compartment may be "un-plugged" from the storage compartment for service and a similar refrigeration compartment installed in place of the first in a few minutes.

A preferred embodiment of the invention is described hereinbelow with reference to the drawings, in which:

FIG. 1 is a front elevation of the refrigerator of the invention with its doors open;

FIG. 2 is a plan view of the refrigeration system with the walls of its compartment removed;

FIG. 3 is a cross-section of the refrigeration compartment mounted atop the storage compartment taken through line 3—3 of FIG. 2; and

FIG. 4 is a partial section similar to FIG. 3 but illustrating an alternate embodiment of the defrosting system.

Referring initially to FIG. 1, the self-defrosting refrigerator-freezer of the invention comprises two major components, namely (a) a food storage compartment **10**, and (b) a refrigerating compartment **30**. The food storage compartment **10** is completely insulated and is of conventional construction in that it has a rectangular base **11**, a pair of parallel vertical side walls **12** and **13**, respectively, a vertical rear wall **14**, a ceiling **15** and a pair of doors **16** and **17** mounted on hinges at the front portions of the vertical side walls **12**, **13**, respectively. The storage compartment **10** is divided into two sections, a freezer section **18** and refrigerator section **19**, by a central wall **20** which extends vertically from the base **11** to the ceiling **15** in a plane parallel to that of the sidewall **12**, **13**. The central wall **20** divides the food storage compartment **10** approximately in half but the exact proportions are a matter of design only. The central wall **20** has an opening **21** near the portion at which it joins the ceiling **15**, which opening **21** allows circulation of air between the freezer section **18** and the refrigerator section **19**. As shown in FIG. 3, the ceiling **15** of the storage compartment **10** has a pair of openings **22** and **23**, located in the freezer section **18** adjacent its forward and rear marginal edges, respectively. A cold air circulating duct **24** is mounted on the rear wall **14** of the freezer section **18** extending vertically downwardly from opening **23** and terminating at the lower portion of the rear wall **14** in an outlet orifice **25**. An electrically heated mullion strip **26** is mounted on the forward marginal edge of the freezer section **18**, the purpose of the strip **26** being to prevent ice from forming on the marginal edges and to ensure an airtight seal between the central wall **20** and the doors **16**, **17**. Also provided in the storage compartment **10** is a temperature regulator

27 of conventional design which is mounted on the central wall 20 in the refrigerator section 19.

As shown best by FIG. 3, the refrigerating compartment 30 is also completely insulated, having a rectangular base 31 of dimensions identical to those of the ceiling 15 of the storage compartment 10, vertical sidewalls 32, 33, a vertical rear wall 34, and a removable top 35. A vertical front wall 36 of the refrigerating compartment 30 has a portion which defines a louvered exhaust grill 37. A vertical bulkhead 38 which extends from the base 31 to the top 34 in a plane parallel to that of the sidewalls 32, 33 and which is supported by the rear wall 34 divides the refrigerating compartment 30 into a first section 39 and a second section 40. The louvered exhaust grill 37 vents the second section 40 only. The base 31 of the refrigerating compartment 30 is provided with two openings 41, 42 which coincide with openings 22, 23 of the storage compartment 10 together defining passageways which allow circulation of air between the first section 39 of the refrigerating compartment 30 and the storage compartment 10.

A conventional electrically powered compressor 43 is mounted in the second section 40 of the refrigerating compartment and a freezer coil 44 is mounted in the first section 39 of the refrigerating compartment 30 as shown best in FIG. 3. Refrigerant supply and return conduits 45, 46 extend from the compressor 43 through bulkhead 38 to the freezer coil 44. An electrically operated defroster coil 47 is located directly beneath the freezer coil 44 and a melted frost collecting pan 48 is mounted directly beneath the defroster coil 47 as shown in FIG. 3. The melted frost collecting pan 48 has a drain opening in its bottom (not shown) to which is connected a drain conduit 49 shown in FIG. 2. The drain conduit 49 extends through the bulkhead 38 into section 40 of the refrigerating compartment 30 and discharges the melted frost into an evaporator pan 50 which is mounted in section 40. Directly beneath the evaporator pan 50 is an evaporator heating coil 51 (which may be either electrical or hot gas type) which vaporizes the melted frost in the evaporator pan 50. A circulating fan 52 directs a stream of air over the evaporating pan 50 to discharge the vaporized melted frost outwardly through the exhaust grill 37. Mounted in section 39 adjacent freezer coil 44 is a suitably supported blower 53 which circulates cold air throughout the storage compartment 10 during the refrigeration cycle and which circulates hot air throughout section 39 of the refrigerating compartment 30 during the defrosting cycle.

A solenoid 54, mounted on base 31 in section 39, acts through link 55, bell crank 56 and links 57, 58 to translate closure members 59, 60 which are slidably mounted in tracks 61 and 62, respectively, on the base 31 of the refrigerating compartment 30 directly over openings 41, 42. The solenoid 54 is shown in its unactuated mode in FIG. 2; when the solenoid 54 is actuated by timer means 90 at the start of the defrosting cycle it causes the closure members 59, 60 to slide into a closed position thereby completing isolating the refrigerating compartment 30 from the storage compartment 10. An alternate embodiment of this system is shown in FIG. 4, in which a rotary solenoid 154 is employed and closure members 159, 160 are pivotally mounted on base 31. In this alternate embodiment, the closure members 159, 160 are opened and closed by the rotary solenoid 154 acting through links 157 and 158, respectively. However, the significant distinction between the embodiment of FIGS. 2 and 3 and the embodiment of FIG. 4 is that the freezer coil 44, heater coil 47 and circulating fan 53 are mounted above a platform 161 which is positioned in section 39 of refrigerating compartment 30 as shown in FIG. 4. The advantage of this construction is that the space between platform 161 and base 31 defines a passageway 162 which allows for greater circulation of air throughout section 39 during the defrosting cycle thereby further decreasing the cycle duration. When the refrigeration cycle is in progress, closure members 159, 160 are pivoted into a vertical position as shown by the broken lines in FIG. 4 and thus prevent any diversion of air into passageway 162.

As noted above, the self-defrosting refrigerator of the invention has two distinct operating cycles, namely a refrigeration cycle and a defrosting cycle.

During the refrigeration cycle, the solenoid 54 or 154 is unactuated; the refrigerating compartment 30 and storage compartment 10 are interconnected through openings 22, 41 and 23, 42. The compressor 43 circulates refrigerant through freezer coil 44 via conduits 45, 46. Blower 53 causes a stream of air to pass across the freezer coil 44, downwardly through openings 42, 23 and duct 24, out of orifice 25, upwardly throughout the freezer section 18 and finally upwardly through openings 22, 41 into the refrigerating compartment 30. A portion of this air flow passes through opening 21 in central wall 20 to cool the refrigerator section 19 of storage compartment 10. Although not shown, a thermostat is positioned at the intake openings to monitor the temperature of the circulating air and to control the rate of defrosting.

Upon initiation of the defrosting cycle by the automatic timer 90, compressor 43 is shut off, defroster coil 47 is actuated and solenoid 54 or 154 is energized, closing closure members 59, 60 or 159, 160 thereby completely sealing the storage compartment 10 from the refrigerating compartment 30. Blower 53 continues to operate, now circulating (i.e., by pushing or pulling) hot air over the freezer coil 44 to melt the frost condensed thereon. The liquified frost collects in pan 48 and is drawn off through conduit 49 and into the evaporator pan 50. The evaporator heating coil 51 evaporates the melted frost and the circulating fan 52 circulates an airstream over the evaporator pan 50 causing the evaporated melted frost to be discharged through the louvered grill 37 into the ambient environment. After a short period, the automatic timer 90 causes the defroster coil 47 to deactivate and the compressor 43 to resume circulation of refrigerant through the freezer coil 44. Blower 53 continues to circulate air throughout section 39 of the refrigeration compartment 30 causing the heat generated during the defrosting cycle to be dissipated rapidly. Shortly afterwards, the solenoid 54 or 154 is deactivated, the closure members 59, 60 or 159, 160 reopen and the refrigeration cycle resumes. Normally, the defrosting cycle may be carried out in less than 5 minutes.

Because of its modular construction the refrigerating compartment 30 may be removed for service as a unit and another similar compartment installed until repairs are completed. Removal of the refrigerating compartment is accomplished by disconnecting from a socket 70 mounted in the refrigerating compartment 30 service lines 71 which lead to the regulator 27 and the heated mullion strip 26 and then sliding the entire refrigerating compartment 30 forwardly and away from the top of the storage compartment 10.

Although the refrigerators shown in the drawings both illustrate a refrigerating unit positioned above the food compartment, the self-defrosting refrigerators of the invention may be constructed with the refrigerator unit positioned below or even adjacent to the food compartment, depending upon which spatial arrangement is desired.

I claim:

1. A self-defrosting refrigerator comprising

(a) a first compartment for the storage of perishable food stuffs;

(b) a second compartment adjacent to and insulatable from the first compartment;

(c) a wall separating the first compartment from the second compartment having first and second openings therein which openings define first and second passageways inter-connecting the first and second compartments; and

(d) a refrigeration system mounted entirely within the second compartment comprising:

(i) a compressor;

(ii) a freezer coil;

(iii) a defroster coil adjacent the freezer coil supplying heat to melt frost from the freezer coil during the defrosting cycle;

(iv) a blower adjacent the freezer coil circulating frigid air through the passageways between the first and second compartments to cool the first compartment during the refrigeration cycle and circulating hot air through the second compartment during the defrosting cycle;

(v) means for sealing the passageways between the first and second compartments during the defrosting cycle; and

(vi) means for collecting and exhausting the melted frost from the second compartment into the ambient environment.

2. A self-defrosting refrigerator in accordance with claim **1**, in which the first and second compartments are of modular construction and separable from one another.

3. A self-defrosting refrigerator in accordance with claim **1**, in which the first compartment has a cold air supply duct extending from the first passageway vertically downwardly along a rear wall of the first compartment and terminating in an orifice at the lower portion of the rear wall.

4. A self-defrosting refrigerator in accordance with claim **3**, in which a vertical central wall divides the first compartment into a freezer section and a refrigerator section which wall has an opening therein to allow circulation of cold air between the freezer section and the refrigerator section.

5. A self-defrosting refrigerator in accordance with claim **4**, in which the vertical central wall has a heated mullion strip mounted on its forward marginal edge preventing the accumulation of frost on the forward marginal edge.

6. A refrigeration system of modular construction comprising an insulated compartment having first and second openings in one wall thereof and having mounted therewithin

(i) a compressor;

(ii) a freezer coil;

(iii) a defroster coil adjacent the freezer coil supplying heat to melt frost from the freezer coil during the defrosting cycle;

(iv) a blower adjacent the freezer coil circulating frigid air through the first and second openings during the refrigeration cycle and circulating hot air through the insulated compartment during the defrosting cycle;

(v) means for sealing the openings during the defrosting cycle; and

(vi) means for collecting and exhausting the melted frost from the insulated compartment into the ambient environment.

7. A refrigeration system in accordance with claim **6** including an automatic timer actuating the defroster coil, sealing means, and exhaust means at the start of the defrosting cycle.

8. A self-defrosting refrigeratiton system in accordance with claim **6**, in which the means sealing the openings during the defrosting cycle comprises

(a) first and second closure members mounted adjacent the first and second openings respectively and translatable to seal the first and second openings;

(b) a closure member actuator energized by the automatic timer; and

(c) a linkage connecting the closure members and the closure member actuator.

9. A self-defrosting refrigeration system in accordance with claim **8**, in which the means for exhausting the melted frost comprises

(a) a melted frost collecting pan mounted beneath the freezer coil;

(b) a heated evaporator pan vaporizing the melted frost;

(c) a conduit carrying the melted frost from the collecting pan to the evaporating pan; and

(d) a circulating fan mounted adjacent the evaporating pan exhausting the vaporized melted frost into the ambient environment.

10. A self-defrosting refrigerator in accordance with claim **6**, in which the insulated compartment has mounted therein a platform defining a passageway between the platform and one wall of the compartment, which passageway facilitates the circulation of hot air throughout the compartment during the defrosting cycle.

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MEYER PERLIN, *Primary Examiner.*

U.S. Cl. X.R.

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