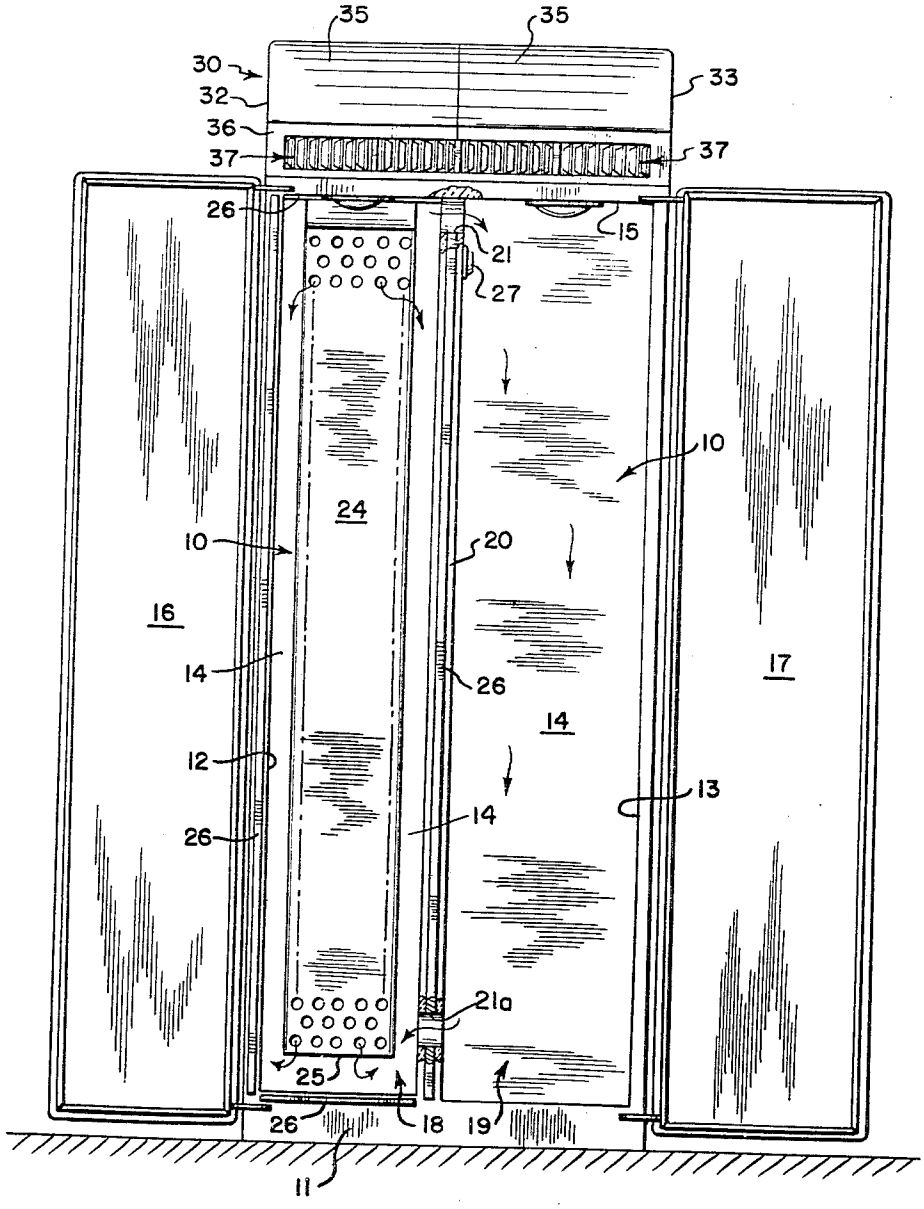
Dec. 30, 1969 E. D. GIDSEG 3,486,347

SELF-DEFROSTING REFRIGERATOR

Filed Dec. 27, 1968 6 Sheets-Sheet 1

FIG. 1



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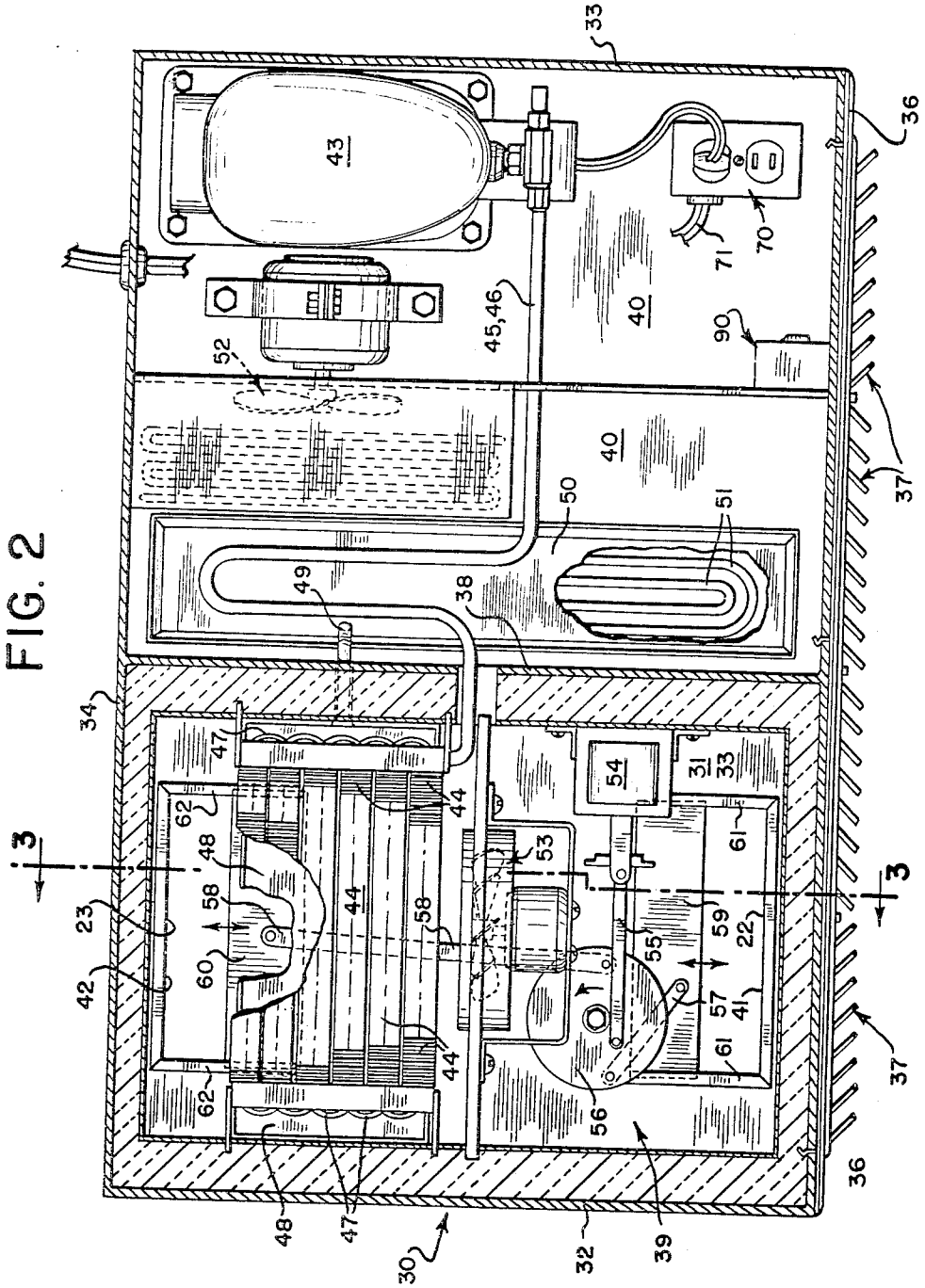
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SELF-DEFROSTING REFRIGERATOR

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FIG. 2



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SELF-DEFROSTING REFRIGERATOR

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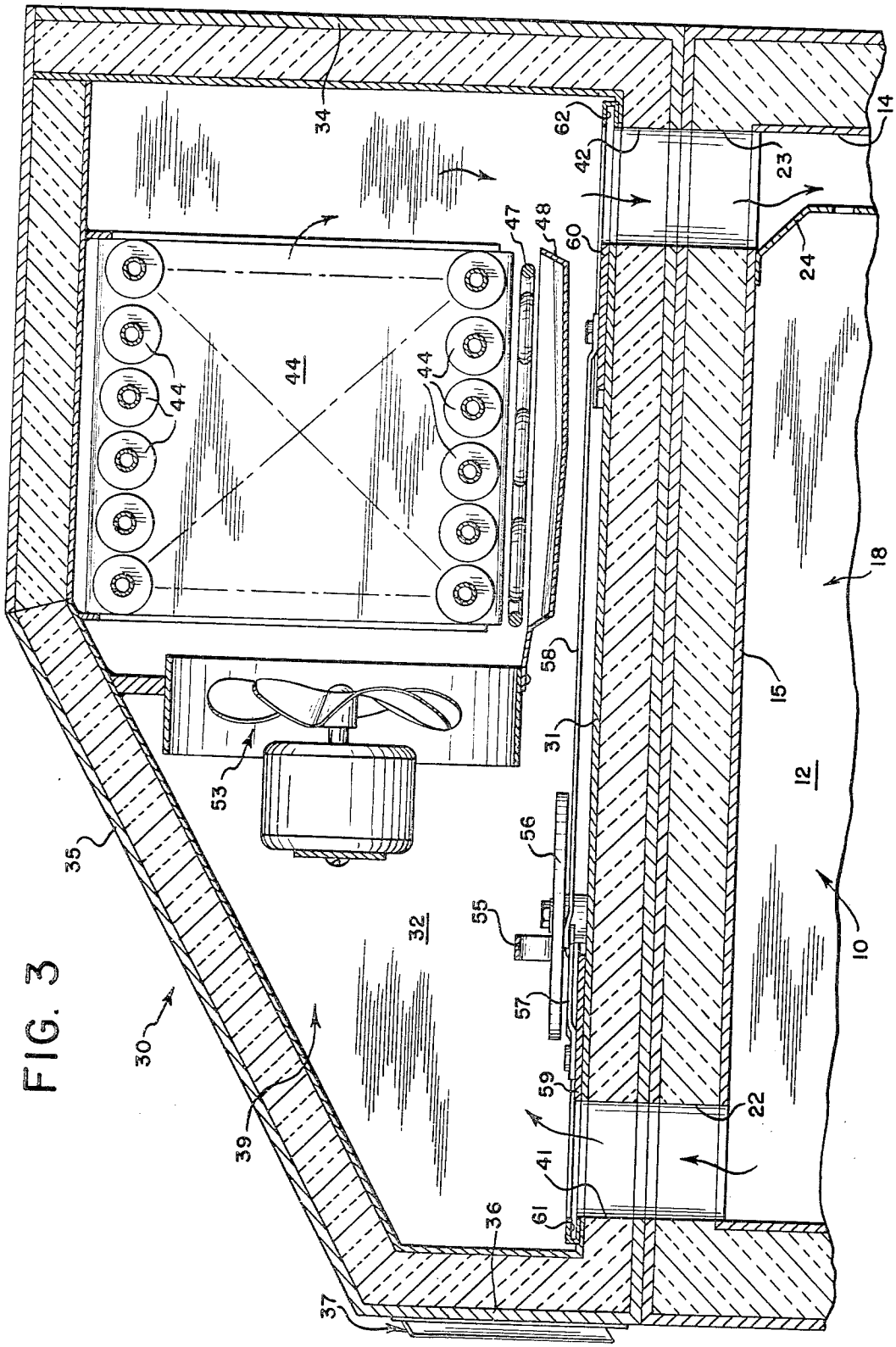


FIG. 3

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SELF-DEFROSTING REFRIGERATOR

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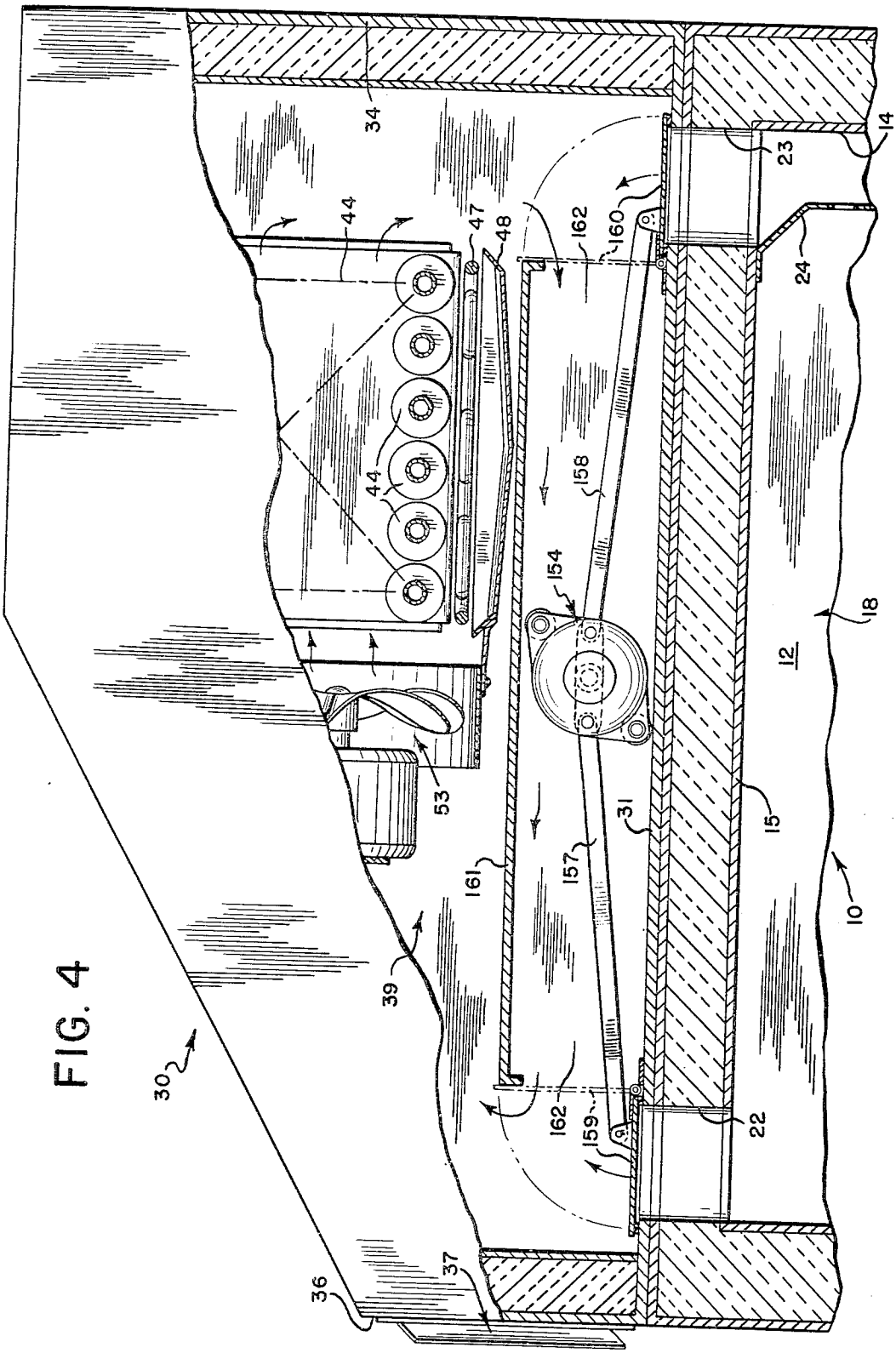


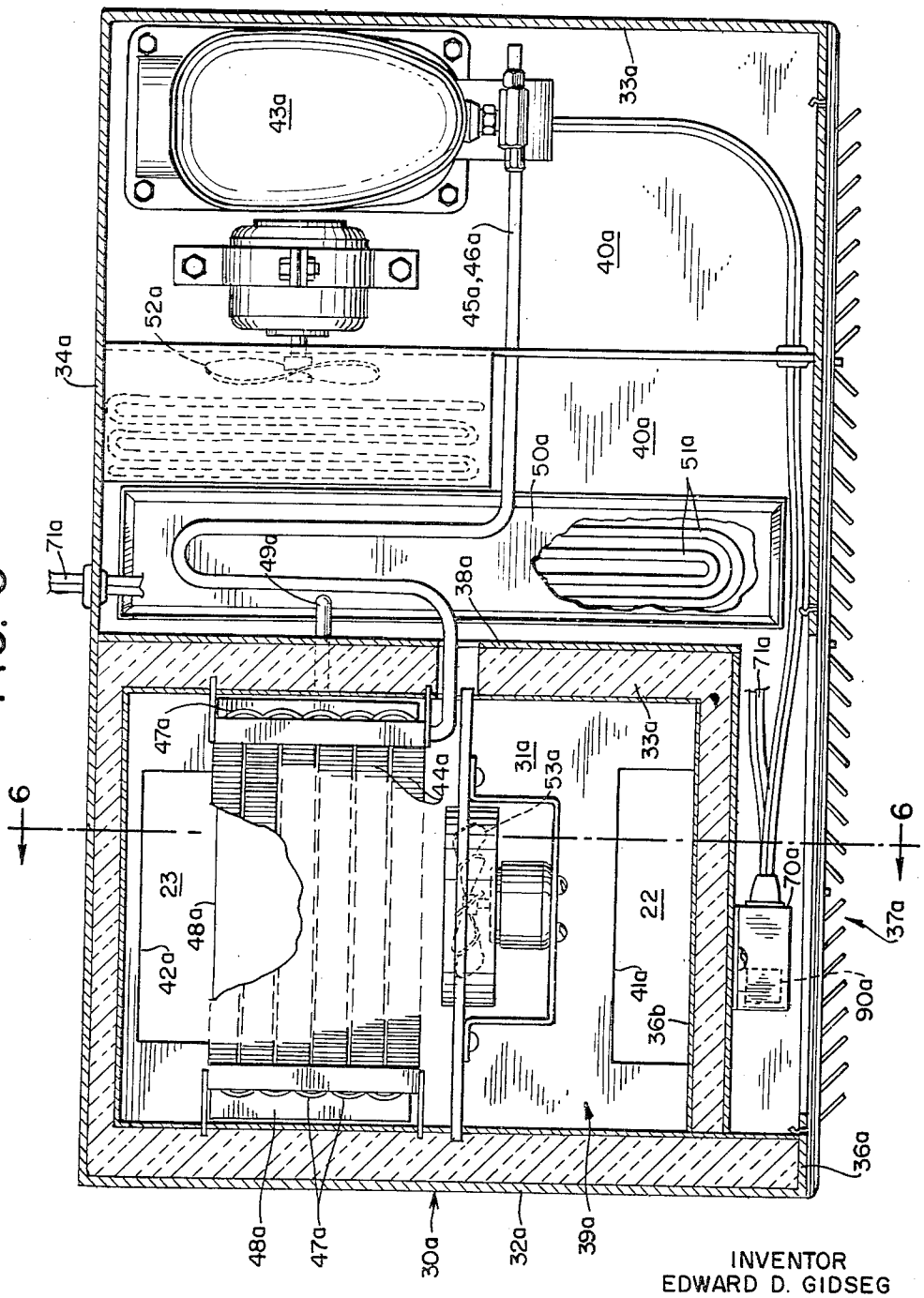
FIG. 4

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SELF-DEFROSTING REFRIGERATOR

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FIG. 5



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SELF-DEFROSTING REFRIGERATOR

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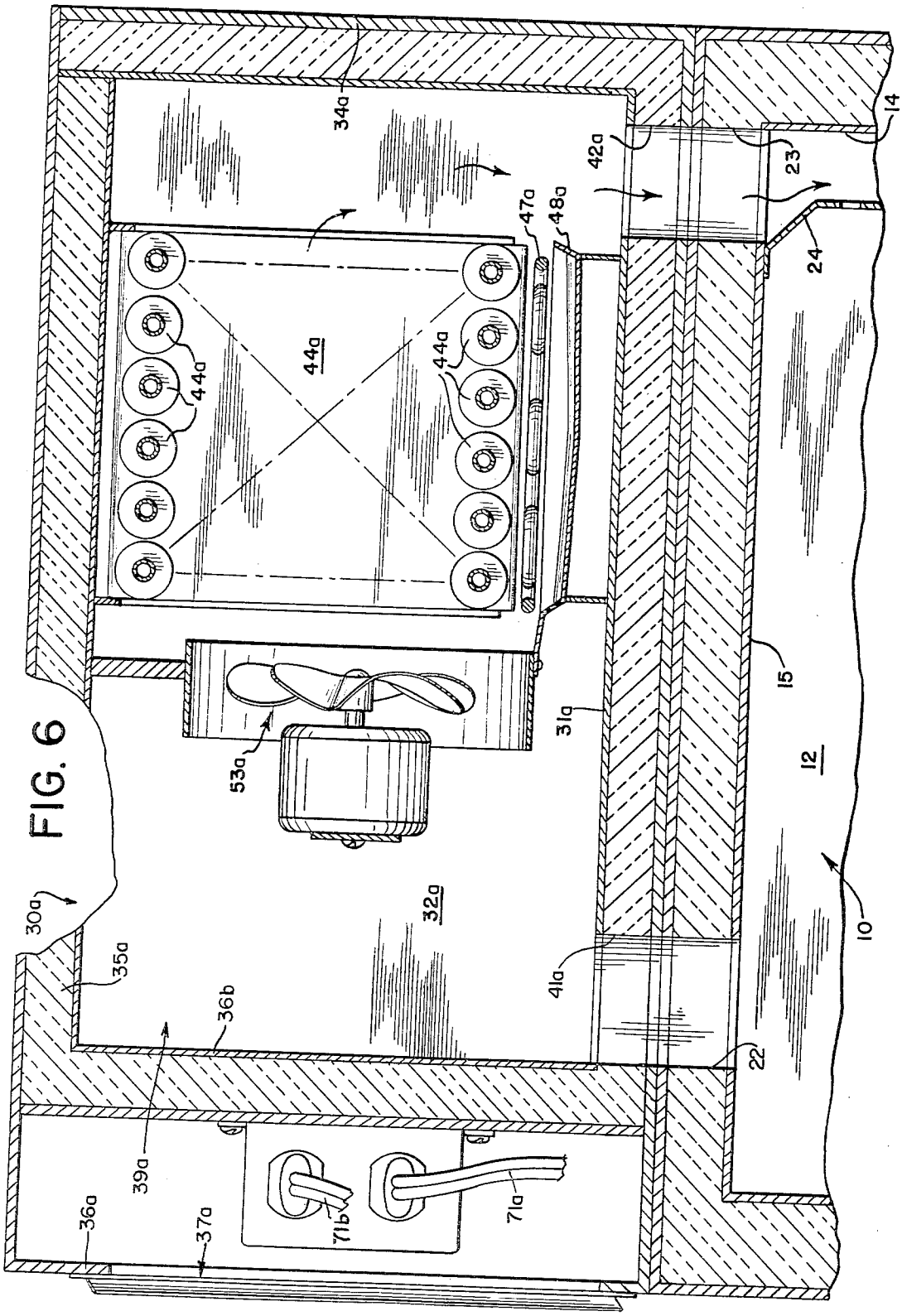


FIG. 6

United States Patent Office 3,486,347
Patented Dec. 30, 1969

3,486,347

SELF-DEFROSTING REFRIGERATOR

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Continuation-in-part of application Ser. No. 599,039, Dec. 5, 1966. This application Dec. 27, 1968, Ser. No. 787,361

Int. Cl. F25d *21/06*

U.S. Cl. 62—155 6 Claims

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 interconnected 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 means for collecting and exhausting the melted frost from the refrigerating compartment into the ambient environment.

CROSS-REFERENCE TO RELATED APPLICATION

The present application is a continuation-in-part of copending application, Ser. No. 599,039, filed Dec. 5, 1966 now U.S. Patent No. 3,421,338.

BACKGROUND OF THE INVENTION

This invention relates to self-defrosting refrigerators and, more particularly to a novel refrigerator-freezer construction in which the refrigeration system is completely separated from the food storage compartments thereby permitting rapid defrosting of the freezer coils and easy accessibility for servicing mechanical equipment. As used herein, the term "refrigerator" is used to denote both refrigerators and freezers as well as refrigerator-freezers.

SUMMARY OF THE INVENTION

The self-defrosting refrigerator of the present invention comprises a food storage compartment divided by a central wall into a freezer section and a refrigerator section. The central wall includes a first opening to permit circulation of chilled air from the freezer section into the refrigerator section and a second opening to permit return circulation of chilled air from the refrigerator section into the freezer section. A refrigerating compartment is adjacent to the food storage compartment, the respective compartments being separated by a wall having first and second openings therein which define first and second passageways interconnecting the compartments. A refrigeration system mounted entirely within the refrigerating compartment comprises a compressor, a freezer coil, a defroster coil adjacent the freezer coil supplying heat to melt frost from the freezer coil during a defrosting cycle, a blower adjacent the freezer coil circulating frigid air through the passageways between the first and second compartments and through the first and second openings in the central wall of the first compartment during the refrigeration cycle to cool the freezer section and the refrigeration section, and means for collecting and exhausting the melted frost into the ambient environment.

Although the passageways between the two compartments remain open during the defrosting cycle the differential density between the cold air in the food storage compartment and the warmer air in the refrigerating compartment inhibits any heat transfer by natural convection which would otherwise tend to raise the temperature in the food storage compartment. Additionally, the elimination of the freezer coil and the remainder of the refrigeration system from the interior of the storage compartment yields an 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.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIG. 2 is a plan view of a first embodiment 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;

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

FIG. 5 is a plan view of a second embodiment of the refrigeration system with the walls of its compartment removed; and

FIG. 6 is a cross-section of the refrigeration compartment mounted atop the storage compartment taken through line 6—6 of FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring initially to FIG. 1, a first embodiment of 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 a 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 a first opening **21** near the portion at which it joins the ceiling **15**, which opening **21** allows circulation of chilled air from the freezer section **18** to the refrigerator section **19**. A second opening **21***a* in the central wall **20** allows the return circulation of chilled air from the refrigerator section **19** to the freezer section **18**. 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 **35** 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 compartments **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 condiuts **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** and is recirculated through opening **21***a* into the freezer section prior to being returned to the refrigerating compartment **30** for rechilling. 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 trough 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.**

Referring now to FIGS. 5 and 6, a second embodiment of the present refrigerating includes a food storage compartment which is substantially identical to the compartment **10** of the first embodiment and therefore the reference characters used to describe the food storage compartment **10** shall also be employed in the dscription of the second embodiment.

The refrigerating compartment **20***a* of the second embodiment, shown best by FIG. 6, is completely insulated, having a rectangular base **31***a* of dimensions identical to those of the ceiling **15** of the storage compartment **10,**

vertical sidewalls 32*a*, 33*a*, a vertical rear wall 34*a*, and a removable top 35*a*. A vertical front wall 36*a* of the refrigerating compartment 30*a* has a portion which defines a louvered exhaust grill 37*a* and a vertical front wall 36*b* which is spaced inwardly from wall 36*a* completes the insulation of the refrigeration compartment 30*a*. A vertical bulkhead 38*a* which extends from the base 31*a* to the top 35*a* in a plane parallel to that of the sidewalls 32*a*, 33*a* and which is supported by the rear wall 34*a* divides the refrigerating compartment 30*a* into a first section 39*a* and a second section 40*a*. The louvered exhaust grill 37*a* is operative across its entire length but vents the second section 40*a* only. The base 31*a* of the refrigerating compartment 30*a* is provided with two openings 41*a*, 42*a* which coincide with openings 22, 23 of the storage 10 compartment together defining passageways which allow circulation of air between the first section 39*a* of the refrigerating compartment 30*a* and the storage compartment 10.

A conventional electrically powered compressor 43*a* is mounted in the second section 40*a* of the refrigerating compartment 30*a* and a freezer coil 44*a* is mounted in the first section 39*a* of the refrigerating compartment 30*a* as shown best in FIG. 6. Refrigerant supply and return conduits 45*a*, 46*a* extend from the compressor 43*a* through bulkhead 38*a* to the freezer coil 44*a*. An electrically operated defroster coil 47*a* is located directly beneath the freezer coil 44*a* and a melted frost collecting pan 48*a* is mounted directly beneath the defroster coil 47*a*. The melted frost collecting pan 48*a* has a drain opening in its bottom (not shown) to which is connected a drain conduit 49*a* shown in FIG. 5. The drain conduit 49*a* extends through the bulkhead 38*a* into section 40*a* of the refrigerating compartment 30*a* and discharges the melted frost into an evaporator pan 50*a* which is mounted in section 40*a*. Directly beneatth the evaporator pan 50*a* is an evaporator heating coil 51*a* (which may be either electrical or hot gas type) which vaporizes the melted frost in the evaporator pan 50*a*. A circulating fan 52*a* directs a stream of air over the evaporating pan 50*a* to discharge the vaporized melted frost outwardly through the exhaust grill 37*a*. Mounted in section 39*a* adjacent freezer coil 44*a* is a suitably supported blower 53*a* which circulates cold air through the passageways between the storage compartment 10 and the refrigerating compartment 30*a* and through the first and second openings 21, 21*a*, in the central wall 20 of the storage compartment 10 during the refrigeration cycle.

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 compressor 43*a* circulates refrigerant through freezer coil 44*a* via conduits 45*a*, 46*a*. Blower 53*a* causes a stream of air to pass across the freezer coil 44*a*, downwardly through openings 42*a*, 23 and duct 24, out of orifice 25, upwardly throughout the freezer section 18 and finally upwardly through opening 22, 41*a* to return into section 39*a* of the refrigerating compartment 30*a*. A portion of this air flow passes through opening 21 in central wall 20 to cool the refrigerator section 19 of storage compartment 10 and is recirculated through opening 21*a* into the freezer section prior to being returned to the refrigerating compartment 30*a* for rechilling. Although not shown, a thermostat is positioned in a junction box 70*a* at the intake opening 22, 41*a* to monitor the temperature of the circulating air and to control the operation of the compressor 43*a*.

Upon initiation of the defrosting cycle by an automatic timer 90*a* also mounted in junction box 70*a*, compressor 43*a* is shut off, defroster coil 47, is actuated and blower 53*a* is deactivated to prevent circulation of hot air into the storage compartment 10. The liquified frost collects in pan 48*a* and is drawn off through conduit 49*a* and into the evaporator pan 50*a*. After a short period, the automatic timer 90*a* causes the defroster coil 47*a* to deactivate and the compressor 43*a* to resume circulation of refrigerant through the freezer coil 44*a*. The evaporator heating coil 51*a* evaporates the melted frost and the circulating fan 52 circulates an airstream over the evaporator pan 50*a* causing the evaporated melted frost to be discharged through the louvered grill 37*a* into the ambient environment. Blower 53*a* again begins to circulate air throughout section 39*a* of the refrigeration compartment 30*a* and storage compartment 10 as the refrigeration cycle resumes.

Because of its modulator construction the refrigerating compartment 30*a* 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 first socket in the junction box 70*a* which is mounted outside section 39*a* of the refrigerating compartment 30*a* on vertical wall 36*b* service line 71*a* which leads to the source of electrical power, thereafter disconnecting from a second socket in the junction box 70*a* service line 71*b* which leads to the heated mullion strip 26 and other electrical equipment and then sliding the entire refrigerating compartment 30*a* 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 embodiment is employed and the spatial arrangement desired.

I claim:

1. A self-defrosting refrigerator comprising:

(a) a first compartment for the storage of perishable foodstuffs including a central wall dividing the first compartment into a freezer section and a refrigerator section, the central wall having a first opening to permit the circulation of chilled air from the freezer section to the refrigerator section and a second opening to permit the return circulation of chilled air from the refrigerator section to the freezer section;

(b) a second compartment adjacent to 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 unobstructed passageways interconnecting the freezer section of the first compartment with the second compartment; 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 a defrosting cycle;

(iv) a blower adjacent the freezer coil cooling the freezer section and the refrigerator section during the refrigeration cycle by circulating frigid air through the passageways between the freezer section of the first compartment and the second compartment, a portion of the frigid air being further circulated from the freezer section to the refrigerator section through the first opening in the central wall of the first compartment and being returned to the freezer section through the second opening in the central wall; and

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

2. A self-defrosting refrigerator according to claim 1 wherein the first and second compartments are of modular construction and separable from one another.

3. A self-defrosting refrigerator according to claim 1 further including a cold air supply duct extending from the first passageway vertically downwardly along a rear wall of the freezer section of the first compartment and terminating at the lower portion of the rear wall.

4. A self-defrosting refrigerator according to claim 1 further including a heated mullion strip mounted on a forward marginal edge of the central wall preventing the accumulation of frost on the forward marginal edge.

5. A self-defrosting refrigeration system according to claim 1 further including an automatic timer actuating the defroster coil and exhaust means and deactivating the blower at the start of the defrosting cycle.

6. A self-defrosting refrigeration system according to claim 1 wherein 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.

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MEYER PERLIN, Primary Examiner

U.S. Cl. X.R.

62—187, 276, 291