Oct. 23, 1956 R. E. WALLENBROCK ET AL 2,767,558

AIR BLAST REFRIGERATED CABINET

Filed March 30, 1955

4 Sheets-Sheet 1

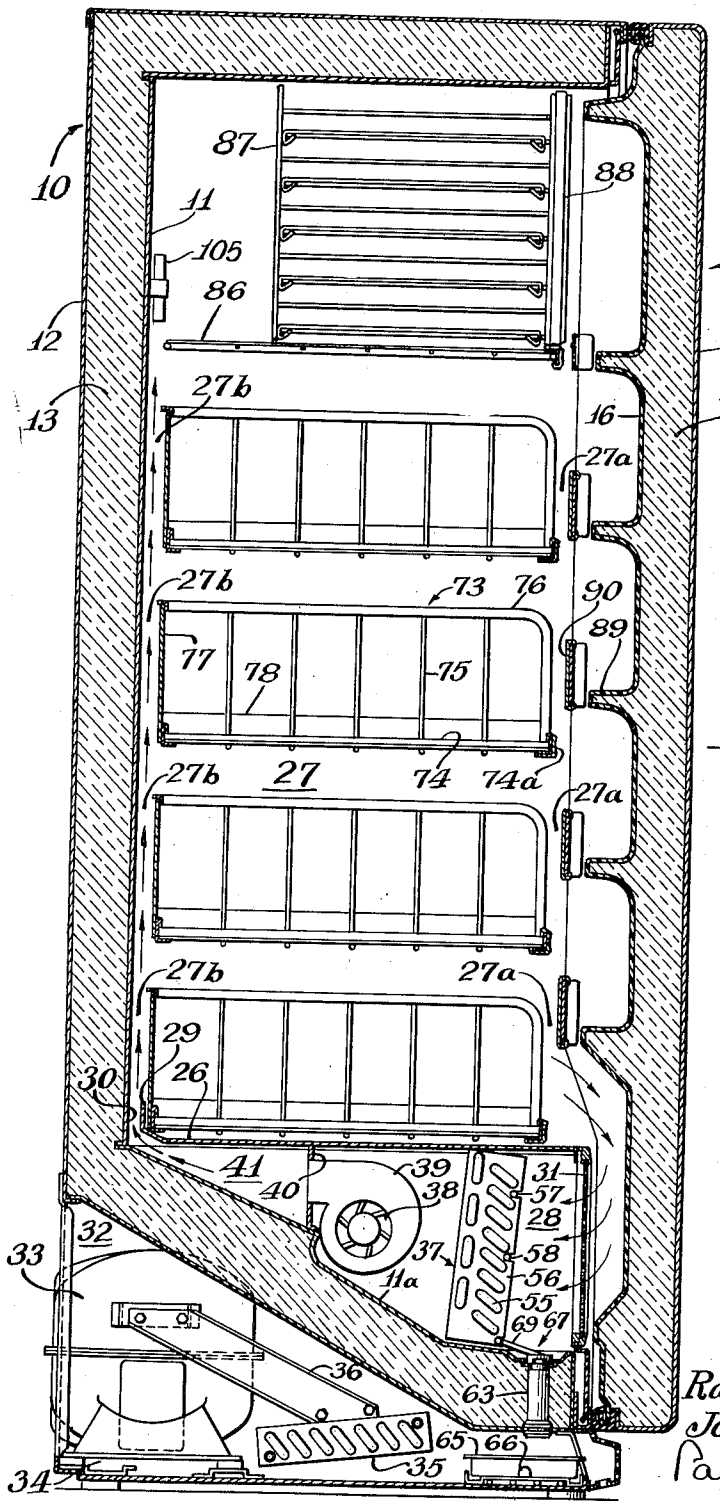

FIG. 1.

FIG. 13.

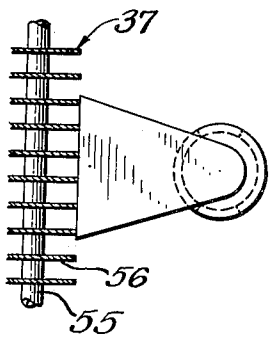

FIG. 12.

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4 Sheets-Sheet 2

FIG. 2.

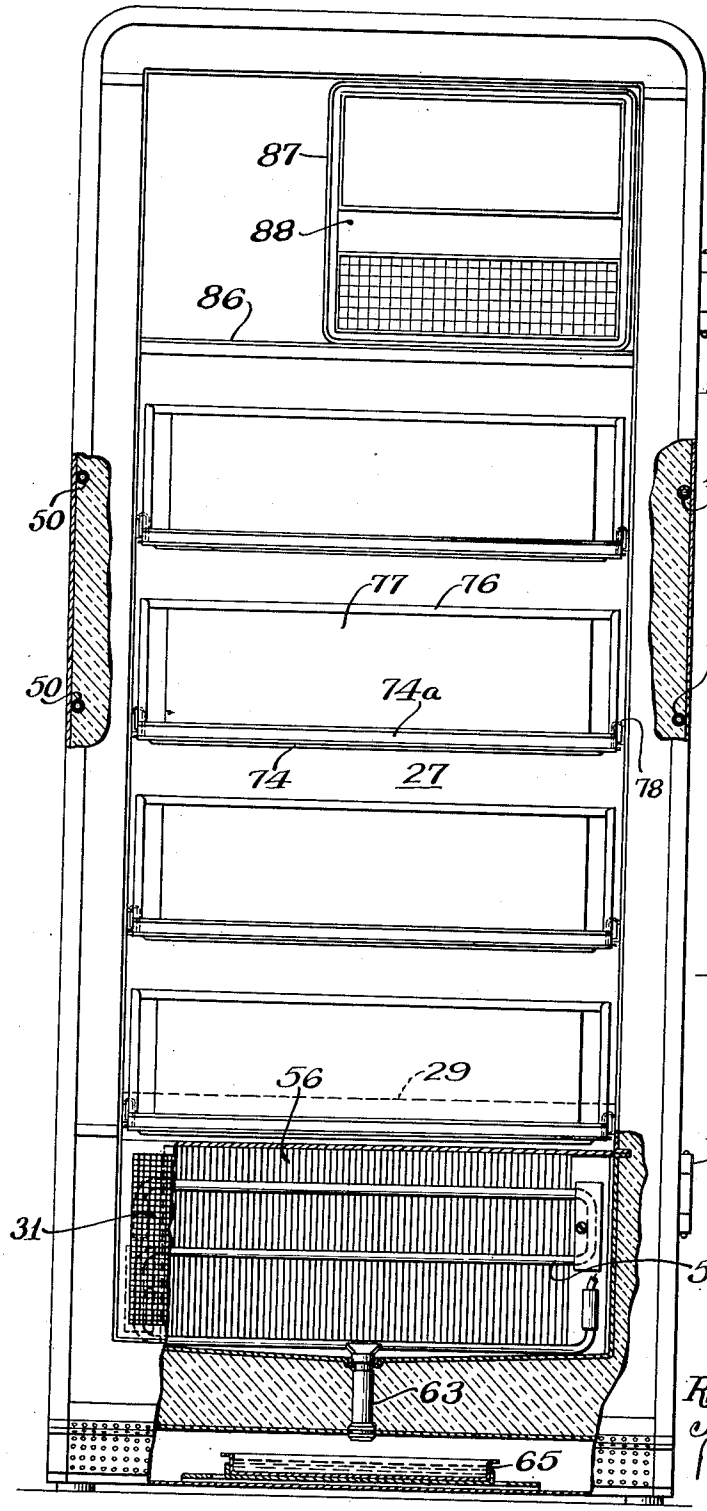


FIG. 3.

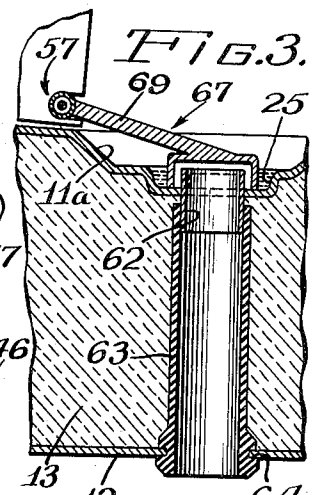


FIG. 4.

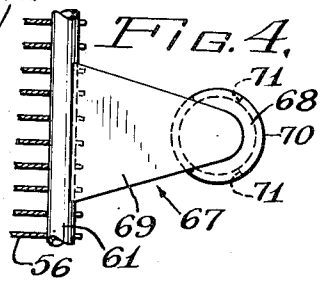
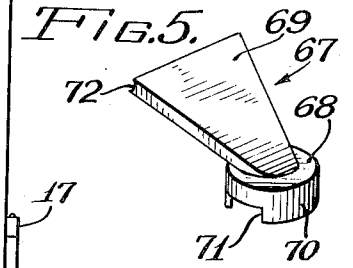


FIG. 5.



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AIR BLAST REFRIGERATED CABINET

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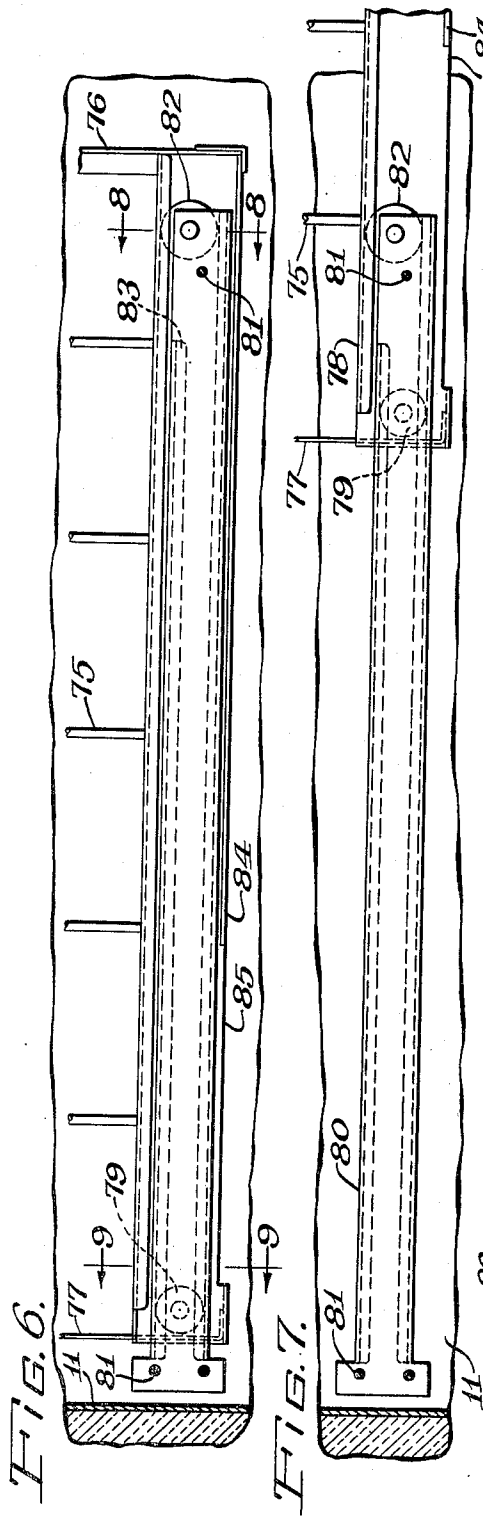

FIG. 6.

FIG. 7.

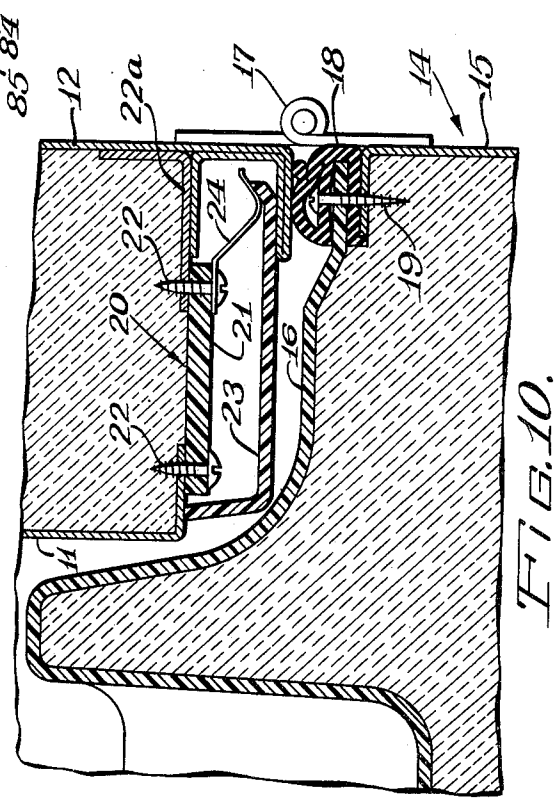

FIG. 10.

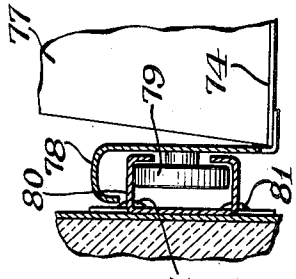

FIG. 9.

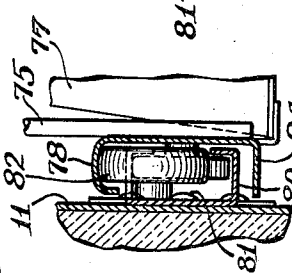

FIG. 8.

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AIR BLAST REFRIGERATED CABINET

Filed March 30, 1955

4 Sheets-Sheet 4

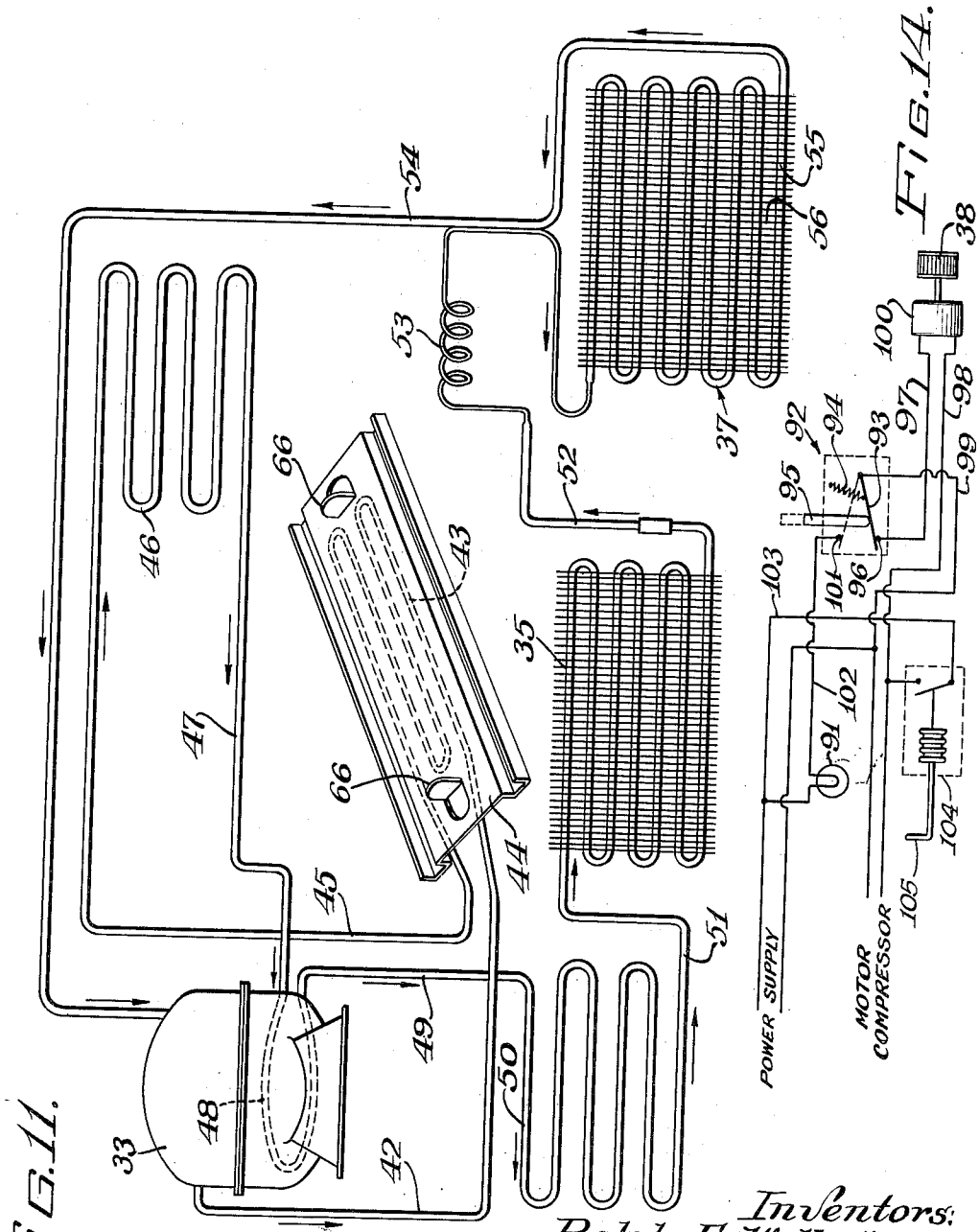

FIG. 11.

FIG. 14.

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United States Patent Office

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AIR BLAST REFRIGERATED CABINET

Ralph E. Wallenbrock and John S. Palmer, Evansville, Ind., assignors, by mesne assignments, to Whirlpool-Seeger Corporation, a corporation of Delaware

Application March 30, 1955, Serial No. 497,977

15 Claims. (Cl. 62—117.25)

This invention relates generally to refrigerated cabinets, but is more particularly directed to a cabinet of this character that utilizes forced air circulation therewithin to accomplish a cooling of the contents thereof.

In the conventional vertically arranged domestic or household mechanically refrigerated cabinet a refrigerant evaporator cooling element is usually disposed in a portion of the food storage area and the food items which it is desired be maintained at the lowest temperatures are generally positioned in closest proximity thereto for cooling purposes. Other portions of the food storage area generally contain shelves upon which are stored other food articles and this storage area is frequently referred to as the food storage compartment. The natural affinity of warm air particles for cold surfaces quite naturally sets up convection currents of air within the food storage area which operate to bring the warmer air particles within the cabinet into contact with the colder surfaces of the evaporator thereby reducing the temperature of all the air contained within the food storage area. In this manner the temperatures of the food articles in the food storage compartment are reduced and the heat thus removed is transferred by way of the refrigerant and the refrigerant-carrying conduits to a condenser for dissipation to the outside atmosphere in accordance with well understood principles of refrigeration.

Although this type of refrigerated cabinet which is commonly referred to as an upright chest is universally accepted and widely used it is a well known fact that it is not entirely suitable for all the different purposes for which it is presently employed. One of the most serious objections thereto results from the fact that there is usually an appreciable temperature gradient or variation between different points within the food storage compartment thus creating some confusion as to the best or proper location in which to store particular food items therewithin. In addition, a refrigerated cabinet of this character does not have, because of its primary dependence upon the natural convection of air currents plus only a limited amount of secondary heat conduction along its interior walls, the flexibility or cooling efficiency desired in order to effect a proper cooling of all the contents thereof. Furthermore, the natural tendency of refrigerated cabinets of this character to accumulate large deposits of frost in the vicinity of the colder surfaces in the food storage area, thus requiring frequent removal or defrosting with possible loss or damage to the contents during such removal operations, represents a continuing source of annoyance and objection to the user thereof. It is a feature of the proposed invention, therefore, to describe a refrigerated cabinet which intentionally deviates considerably, in structural arrangement, from that of the present unsatisfactory and inefficient conventional cabinets, and which, in so doing provides a cabinet that overcomes the disadvantageous features and characteristics of such prior cabinets, and which, furthermore, is highly adaptable for the storing and cooling of foodstuffs.

One of the principal objects of the present invention is

to provide an upright refrigerated cabinet wherein a substantially uniform temperature is maintained throughout its food storage area and where there is no appreciable deposit or accumulation of frost formation within the food storage compartment thereof.

Another principal object is to provide a refrigerated cabinet having improved flexibility and cooling efficiency in the cooling of food items placed therewithin.

An important object of the instant invention resides in the provision of a refrigerated cabinet utilizing forced air circulation to provide for air-blast cooling of the contents thereof.

Another important object is to provide a simplified and removable air duct or flue arrangement for a refrigerated cabinet employing air-blast cooling.

Another object is to provide an improved condensate collecting and disposal arrangement for a refrigerated cabinet employing forced air circulation.

A further object is to provide an improved electric heater defroster for an evaporator cooling element in an air-blast refrigerated cabinet.

A still further object is to provide a refrigerated cabinet wherein an evaporator cooling element is remotely disposed from the food storage area and wherein air circulation means are operative for directing air into intimate heat exchange relation with said evaporator and thereafter with the interior and contents of the food storage area of the cabinet.

Another object is to provide in an air-blast type of refrigerated cabinet an improved condensate collecting and disposal means wherein a portion of the condensate collected operates to provide a positive air and gas seal or trap which restricts the admission into the food storage area of extraneous matters or air particles from outside the cabinet, and which additionally restricts leakage of air from inside the cabinet to the outside thereof.

A yet still further object is to provide an air-blast type of refrigerated cabinet wherein a wall of each, of one or more, individual basket-like food storage containers cooperates with the walls of a food storage compartment to provide an air duct or air flue for guiding air particles through said compartment after said particles have been cooled by being passed into intimate thermal contact with a refrigerant evaporator cooling element.

Further objects and advantages of the invention will become apparent as the following description proceeds, and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, reference may be had to the accompanying drawings in which:

Figure 1 is a vertical sectional side view of the proposed cabinet but having portions of the components thereof shown in elevation;

Figure 2 is a front elevational view of the cabinet illustrated in Figure 1 but shown with the lower portion thereof partially cut-away and with the cabinet closure door removed;

Figure 3 is an enlarged sectional detail of the condensate drain cap and tube structure;

Figure 4 is a top plan view of the drain cap shown in engaged relation with a portion of a defrost heater coil positioned in the refrigerant evaporator;

Figure 5 is a perspective view of the drain cap for the condensate drainage tube;

Figure 6 is a side elevational view of the sliding track mechanism for the basket-like food receptacles;

Figure 7 is a view similar to Figure 6 but shown with the food basket in an extended position;

Figure 8 is a partial sectional view taken on line 8—8 of Figure 6;

Figure 9 is a partial sectional view taken on line 9—9 of Figure 6;

Figure 10 is an enlarged sectional view showing portions of the cabinet door and the cabinet breaker strip assembly;

Figure 11 is a schematic diagram showing the refrigerant circuit and the refrigerant-carrying conduits thereof;

Figure 12 is a view similar to Figure 4 but showing the drain cap directly engaging portions of the evaporator instead of a defrost heater element;

Figure 13 is an enlarged sectional detail of the electric heater defrost element; and

Figure 14 is a schematic wiring diagram of the control circuits for the refrigeration apparatus.

Referring now to the drawings it will be noted that the preferred embodiment, selected for illustrating the teachings of the present invention, includes a cabinet, generally indicated by the reference numeral **10**, which is fashioned with an inner shell or liner **11** having a front access opening therein and a similarly conformed outer shell or liner **12** spaced therefrom by suitable heat insulating material **13**. A somewhat similarly fashioned front door or closure member **14** may include an outer liner or panel **15** and an inner panel or pan **16**, with suitable heat insulating material **13** therebetween, that is hingedly mounted on cabinet **10** by suitable means such as the hinges **17**. The marginal edges of the outer and inner panels **15** and **16**, respectively, of said door, may be fastened together by means of a conventional resilient gasket sealing member **18** which, in turn, may be removably attached to the inwardly turned marginal edge of the outer panel **15** by suitable securing means such as the screws **19**. The marginal edges of the inner and outer liners **11** and **12**, of the cabinet, may be, respectively, inwardly turned and Yoder-rolled, as indicated, and bridged with a breaker strip assembly such as is indicated generally by the reference numeral **20**. Such breaker strip assembly may include a rigid inner member **21**, of low-heat conducting material such as "Masonite" or a reinforced polyester plastic which is affixed to the marginal edges of the respective liners by suitable means such as the screws **22** and an angle bracket **22***a*, and an outer or covering strip **23** of any suitable well-known plastic material such as polystyrene which may be held in place by a resilient member such as the spring clip **24**. It will be understood, of course, that the door **14** will be provided with a suitable latching and handle mechanism but since these elements form no particular part of the present invention they have been omitted from the drawings.

The bottom wall or floor of the cabinet, preferably, is inclined and the bottom wall or floor portion **11***a* of the inner liner **11** may be further formed as a depressed and stepped area with a sump-like recess or well **25** having an opening therein at the bottom thereof. A horizontal partition or baffle-like wall member **26**, extending from the front almost to the rear of the cabinet, serves to divide the interior or enclosed area of the cabinet inner liner into a food storage compartment **27** and an adjoining air-cooling compartment **28**. The rear marginal edge **29** of said partition is upwardly turned and spaced from the rear wall of the liner **11** to provide an air passage in the form of an elongated opening **30** which extends from one side of said inner liner to the other, while a perforated member or screen **31** may be used to provide an open-type front wall or grille-like closure over a front access opening of said air cooling compartment **28**.

Since the floor or bottom wall of the cabinet is inclined there is provided a convenient compartmented area **32** therebeneath which may be utilized as a machinery compartment for a portion of the refrigeration apparatus. A conventional hermetic-type motor-compressor unit **33** is supportably positioned within said latter compartment, by suitable means such as the support brackets **34**, and a static condenser **35** may be suspendedly supported from said motor-compressor by suitable brackets such as shown by the reference numeral **36**. A generally conventional tube and finned-type of refrigerant evaporator **37** is positioned with the air cooling compartment **28** along with a suitable air circulating or air-moving means. Such air circulating means may include a conventional axial air inlet centrifugal blower **38** mounted in a shrouded scroll-like housing or casing **39** and driven by an electric motor **100** disposed adjacent thereto in compartment **28**. A vertically disposed wall **40** which provides a rear wall for the air cooling compartment **28** additionally functions to provide a baffle or partition which tends to direct or channel the air in said cooling compartment into the axial inlet of said blower. The shrouded scroll **39** exhausts through an opening in said baffle wall **40** into a converging duct or flue-like air passageway **41** which communicates with the elongated opening or air passageway **30**. Thus air admitted through the perforated front wall or grille member **31** is first cooled by passing through and into intimate heat exchange relation with the evaporator **37** and thereafter is circulated by the blower fan **38** into the duct or flue **41** from whence it emerges by way of air passageway **30** into the food storage compartment **27**.

The refrigeration apparatus, which is shown schematically in Figure 11, includes a motor-compressor **33** which discharges by way of a refrigerant-carrying conduit **42** into a condensate evaporating loop portion or coil **43** fixedly secured to the underneath surface of a platform-like hot plate member **44**, while the outlet of said coil is connected by a conduit **45** to a dri-wall condenser coil **46** which is suitably secured in good thermal contact to the inner surface of the right side wall of the cabinet outer line **12**. The opposite end of coil **46** is connected by conduit **47** to a loop or coil **48** immersed in the oil reservoir portion of said motor-compressor unit and this coil, in turn, is connected by conduit **49** to a dri-wall condenser coil **50** which is mounted in good thermal contact to the inner surface of the opposite or left side wall of the cabinet outer liner **12**. The outlet of coil **50** is connected by conduit **51** to the static condenser **35**, positioned in the apparatus compartment **32**, and the discharge side of this latter condenser is connected by conduit **52** to a capillary tube **53** which discharges into the evaporator **37** that, in turn, is connected by the suction line conduit **54** to the motor-compressor **33** to complete the refrigeration circuit or system. It will be understood, of course, that the above refrigeration apparatus will be charged with a suitable refrigerant and the system will be operated in accordance with the generally understood principles of refrigeration.

The evaporator **37** which, preferably, is of the tube and fin-type is generally fashioned with a serpentine-shaped refrigerant-carrying coil **55** circumscribed by a plurality of spaced-apart fins **56** and the unit is positioned so as to be in intimate thermal contact with the inclined floor **11***a* of the cabinet inner liner member **11**. An electric heater element **57** may, if desired, be buried in the evaporator for purposes of defrosting the unit at prescribed intervals. This heater element which is generally serpentine-shaped may be positioned in slot-like openings **58** (Figure 1) provided in the fins and dimensioned to receive said element in a tight frictionally engaging relationship. Such heating element, which may be any one of several such elements generally available on the commercial markets, usually is fashioned with a centrally disposed electrical resistance wire **59** surrounded by electrical insulating material **60**, in turn, covered with a suitable metallic skin-like covering or sheath **61**. The opposite ends of the resistance wire, of said element, are adapted for connection to a suitable source of electrical energy (not shown) which, in turn, may be automatically controlled for energizing said element at prescribed time

intervals, in accordance with practises that are presently well understood in the art. Since devices for effecting this automatic operation are somewhat conventional and well known no illustration or description of the details thereof was felt necessary. Of course other well-known defrosting devices may also be used without departing from the teachings hereof and the present invention is likewise applicable where defrosting is accomplished by the use of hot gases that are passed through the evaporator, as well as in cabinets where the defrosting is manually accomplished without the aid of auxiliary or supplementary devices.

The well or reservoir **25** in the floor of the cabinet receives a drain pipe or conduit **62**, which is tightly secured in an opening in the bottom thereof by any suitable or well-known means, and this pipe extends some distance into the well **25** so as to provide a trap-like gas or air seal as will presently be understood. Telescopingly fitted over the opposite end of the drain pipe **62** is another pipe or conduit **63** which extends through the insulation **13** and through an opening in the outer shell **12** into the machinery compartment **32**. An annular groove or grommet-like channel **64** in said latter pipe is adapted to aid in fixedly positioning and sealing said pipe or tube in place. The conduit **63** is fashioned, preferably, of a suitable low-heat conducting resilient material, such as rubber or any one of the well-known vinyl or polyethylene plastics adaptable for such purposes, and thus will not function to conduct any appreciable amount of heat from one liner of the cabinet to the other. With the conduits **62** and **63** arranged as proposed there is provided a good moisture seal where each of said conduits pass through the respective inner and outer liners thereby substantially prohibiting the ingress of moisture into the insulation material **13**. Positioned directly beneath the open end of the tube **63**, in the compartment **32**, is the condensate evaporating coil **43** and its associated hot plate member **44** which is adapted to support a relatively shallow condensate collecting and evaporating pan **65**. Upwardly extending fingers or tab members **66**, preferably punched out of the plate **44**, may be provided for purposes of positioning or holding the pan **65** in place on said plate.

The inner end or the end of conduit or drain pipe **62** which extends in an upstanding rim-like or flange fashion into the moisture collecting well or reservoir **25** is covered with a drain cover member, indicated generally by the reference numeral **67**, and thus when a suitable quantity of liquid has collected in the well **25** the cover cooperates therewith to provide the trap-like positive gas and air seal previously mentioned. This cover, which is fashioned of a suitable high-heat conducting material such as one of the zinc die casting metals or the like, includes a dome-like cap portion **68** dimensioned to fit loosely over the end portion of the pipe **62**, and an outwardly flaring arm portion **69** fashioned integral therewith. A depending circular flange portion **70** of said cap is provided with a plurality of recesses or slot-like openings **71** (only two of which are shown) while the outer edge of the arm **69** is concavely recessed or grooved as indicated at **72**. The radius of curvature of this concavature is selected, preferably, to conform to that of the metallic sheath **61** of the heater element **57** thus providing for the maximum of physical and thermal contact surface when used with said heater element. When an electric heater element is not employed for defrosting purposes the edge of said flaring arm need not be concavely recessed as then the arm would directly engage the edges of the fins **56**, of the evaporator **37**, as shown in Figure 12.

As the evaporator **37** is defrosted, by whatever means preferred, the moisture or condensate draining therefrom will flow down the inclined floor **11***a* of the cabinet inner liner and be collected in the well or reservoir **25**. The openings **71**—**71** in the drain pipe covering cap **68** will, of course, permit the liquid to rise in the well **25** inside said cap as well as outside thereof until it reaches the inwardly extending flange-like edge or rim of pipe **62** whence it will overflow said edge and drain into the pan **65** where it will be evaporated by the heat of coil **43**. Upon cessation of the defrosting operation the liquid remaining in the well **25** will continue to provide a highly effective trap or seal to prevent the ingress of air, gas or any other extraneous matter from the outside by way of the drain tubes **62** and **63**, as well as to prevent air from inside the cabinet leading out through these drain pipes. Eventually, of course, upon resumption of the refrigeration cycle the liquid remaining in said well will freeze, as may also any moisture that remains on the floor of the cabinet inner liner, thus enhancing the sealing effect of the trap formed by said liquid. Upon any subsequent defrosting of the evaporator **37**, however, the heat therefrom, which is transmitted by way of the flaring arm **69** to the cap **68**, will become operative to melt the frozen liquid in the well **25** and thus permit resumption of flow of liquid condensate through the conduits **62** and **63** to the pan **65**. Since the evaporator **37** is also in good thermal contact with the floor **11***a* of said inner liner any ice formations thereon will likewise be melted by the heat from the defrost operation.

Since the food containers, of which four principal ones are shown, are identical in construction only one such unit will be described in detail. Each container, indicated generally by the reference numeral **73**, is of the open-wire or basket-type of construction so as to facilitate the circulation of cooled air into intimate heat exchange relation with the contents therewithin, and is slidably mounted so that it may be rolled out to gain easy access to the contents thereof. The basket is fashioned with a floor or bottom wall **74** of spaced and crossed wire rods or the like with a transversely extending front trim or handle member **74***a*, and opposite side walls **75**—**75** of vertically disposed horizontally spaced wire-like rod elements the ends of which are fixedly secured by any suitable means to a reinforcing rim or edging rail member **76** while the opposite ends of said rim are suitably secured to the floor **74**. An imperforate rear wall member **77** has the top end edge thereof suitably affixed to the rim **76** while the bottom or lower end edge thereof is suitably secured to the floor **74** of said basket. A generally **Z**-shaped sliding rail or track member **78** is fixedly secured by suitable means to each side wall of the basket and a roller element **79** is rotatably mounted thereon proximate the inwardly extending end of each of said slide track members. A cooperating channel or track member **80** of generally **C**-shape is secured, by suitable means such as the rivets shown at **81**, to each side wall of the cabinet inner liner and a roller element **82** is rotatably mounted therein proximate the outwardly extending end thereof. The roller element **79**, on the track **78**, is positioned to ride within the channel **80** and the diameter thereof is dimensioned slightly smaller than the inner spacing of the opposite arms of said channel, while the roller element **82**, of the channel track **80**, is adapted to ride beneath the upper arm of the track **78** and thus carry a large portion of the weight of said food receptacle. A break **83** in the forward end of the upper arm of the channel **80** permits the roller element to be removed therefrom when the basket is fully extended. A lower horizontally extending arm **84**, on the track **78**, serves to prevent the food basket from being accidentally tilted upwardly, while a break **85**, in said arm **84** proximate the inwardly extending end portion of the track **78**, is adapted to cooperate with the break **83**, in the channel **80**, to effect removal of the food basket from the cabinet when desired.

The embodiment of the cabinet shown herein provides for a shelf **86** of the open-wire type which may be disposed, as illustrated, at the upper portion of the food storage compartment **27**. If desired an open-type rack **87** having a door or covering member **88** thereon may be positioned on the shelf **86** for purposes of supporting

smaller articles of food or articles which do not require the ready accessibility of many of the other articles in the cabinet. It will be understood, however, that this shelf and rack may be replaced with another food basket receptacle, such as shown at **73**, without deviating from any of the teachings of the present invention.

The inner door pan or panel **16**, which is fashioned of a suitable and well-known material such as a polystyrene plastic or a laminated phenolic resin is formed, preferably, so as to provide integrally molded and forwardly projecting shelf members **89** that are spaced vertically one from another a distance that coordinates with the spacing of the food baskets **73**. A combination trim and food retainer member **90** positioned across the front of each shelf may function as a decorative element as well as a retainer for the food articles positioned on these door shelves. The inner door pan **16** is so spaced from the basket receptacles that when the basket receptacles and door shelves are completely filled with food articles there will still be a spacing that may function as a vertical duct-like flue **27***a* between the baskets and the door through which air may pass in its journey to or from the air cooling compartment **28**.

In the embodiment selected for illustrating a preferred concept of the present invention the air circulating means is arranged so that air after being cooled by its passage into heat exchange relation with the evaporator **37**, in the air cooling compartment **28**, is discharged by the blower **38** into the flue **41** from where it passes by way of the elongated opening **30** into the food storage compartment **27**. In said food storage compartment the individual rear wall members **77**, of the food baskets **73**, operate to provide a discontinuous baffle which cooperates with the rear and a portion of each side wall, of the inner liner **11**, to provide a duct-like air passage or flue **27***b* which directs the cooled air upwardly into the compartment **27**. Of course, a certain portion of such air will pass out through each of the openings formed by the vertical spacing between successive basket rear wall baffle members **77** and flow down over the contents of the baskets. The air that remains at the top of said rear wall air passageway will, of course, flow over the open shelf **86** and rack **87** and the contents thereof and thereafter will flow back down through said food compartment to the lower portion thereof. When the baskets **73** are pretty well filled with food articles the cooled air after brushing over said articles will flow down past the front thereof in the flue-like air passage space **27***a* provided between said baskets and the door **14**. At the lower end of this passage **27***a* the air flows through the perforated grille-like front wall **31** of the air cooling compartment **28** where it is again brought into heat exchange relation with the evaporator **37**. As the air passes into heat exchange relation with the evaporator **37** moisture is removed therefrom and deposited in the form of frost on the surfaces of said evaporator and from there it is subsequently removed by a defrosting operation of the evaporator. Although the preferred embodiment of the proposed cabinet shows the path of flow of air currents as being from the evaporator up the rear wall and down the front wall of the cabinet it will be appreciated that such direction of air flow might be reversed and a good cooling effect obtained without deviating from the concepts of the present invention.

If desired, an interior illuminating lighting device **91** may be suitably positioned in the cabinet so as to light the interior thereof upon opening the door. A plunger-type switch **92** mounted so as to be actuable by the door **14** may be employed to turn the light on and off as the door is opened and closed. The switch **92**, preferably, is of the single-pole double-throw type having an arm **93** that is biased to one position by a spring such as **94** and is actuated by a plunger **95**. This switch may be so arranged that when the door **14** is in a closed position the switch arm **93** engages the contact **96** and completes the electrical circuit through conductors **97**, **98** and **99** to the blower wheel motor **100**. When the door is opened the arm **93** disengages contact **96** and opens the blower motor circuit and then subsequently engages the contact **101** and closes the circuit to the lighting device **91** through conductors **99**, **102** and **103**.

In operation the refrigeration apparatus functions in conventional fashion and the thermostatically controlled switch **104** operates according to the demands of the food storage compartment **27**, to cycle the refrigeration apparatus and thus fulfill these requirements. The feeler bulb **105** for this latter switch may be positioned, as is well understood, in any particular location whose temperature it is desired be used for controlling the operation of the refrigeration system. In the instant application it is preferred that such control be positioned proximate the upper portion and at the rear of the inner liner, as this is the storage space which tends to become warm first when the compressor unit is off, although such preference should not be considered as limiting the present invention. If desired a clip may be provided or the control bulb may be positioned in a well in order to provide for intimate contact between the bulb and the liner.

The electrical switch **92** is arranged, preferably, so that the thermostatically controlled switch **104** may control both the motor-compressor **33** and the blower motor **100** while the door **14** is closed, but upon opening of the door the blower fan motor **100** is stopped although the refrigeration apparatus will be allowed to continue if the demands for refrigeration require such operation. Although it may be otherwise desired it is usually preferred that the blower motor **100** not be operated while the door **14** of the cabinet is open and the arrangement described herein assures that this blower fan will cease operation when the door is opened.

From the foregoing it should now be apparent that a novel and improved air-blast type upright refrigerated cabinet has been shown and described, and it is to be understood that changes may be made in the construction without departing from the spirit of the invention or the scope thereof as defined in the appended claims.

What is claimed is:

1. A refrigerated cabinet, comprising: spaced apart inner and outer shells fashioned to define a plurality of compartments having an access opening in each; a closure member hingedly mounted on the cabinet and arranged to cover said access openings; refrigeration apparatus operative for cooling the interior of the cabinet; said apparatus including an evaporator cooling element and air circulating means disposed in one of said compartments; a first air communicating means between said compartments; a plurality of separately fashioned food storage receptacles having a wall of each thereof imperforate and being disposed in vertically spaced relation in the other of said compartments; said receptacles being further arranged so that all their imperforate walls are vertically positioned and disposed in substantially the same plane to provide a baffle-like wall having horizontally extending openings therein; said baffle-like wall being spaced from said inner shell and cooperating therewith to form air duct means extending from said first air communicating means inwardly into the other of said compartments; and having said closure member spaced from the access opening of the said one compartment to provide a second air communicating means between said compartments which cooperates with said first air communicating means to effect the flow of air, forced by said air circulating means into intimate heat exchange relation with said evaporator cooling element, successively in a continuous circuit between and through each of said compartments.

2. A refrigerated cabinet, comprising: spaced apart inner and outer shells fashioned to define a plurality of compartments having an access opening in each; a closure member hingedly mounted on the cabinet and arranged

to cover said access openings; refrigeration apparatus operative for cooling the interior of the cabinet; said apparatus including an evaporator cooling element and air circulating means disposed in one of said compartments; a first air communicating means between said compartments; a plurality of food storage receptacles having a wall of each thereof imperforate and being disposed in vertically spaced relation in the other of said compartments; said receptacles being further arranged so that all their imperforate walls are vertically positioned and disposed in substantially the same plane to provide a baffle-like wall having a plurality, equal to one less than the number of said receptacles, of vertically spaced and horizontally extending openings therein; said baffle-like wall being spaced from said inner shell and disposed to cooperate therewith to form air duct means extending inwardly into the other of said compartments from said first air communicating means; and said closure member being spaced from the access opening of the said one compartment to provide a second air communicating means between said compartments which cooperates with said first air communicating means to effect the flow of air, forced by said air circulating means into intimate thermal contact with said evaporator cooling element, successively in a continuous circuit between and through each of said compartments.

3. A refrigerated cabinet, comprising: spaced apart inner and outer shells fashioned to define adjacent food storage and cooling compartments with an access opening for each compartment; a closure member hingedly mounted on the cabinet and arranged to cover the access opening of each of said compartments; refrigeration apparatus operative for cooling the interiors of said compartments; said apparatus including an evaporator cooling element and air circulating means disposed in said cooling compartment; an air passageway opening into both of said compartments; a plurality of food storage receptacles slidably disposed in vertical spaced relation in said food storage compartment; each of said receptacles being fashioned of open-wire construction with the rear vertical wall thereof formed of imperforate material; said receptacles being further disposed so that in their fully inserted position in said compartments their imperforate walls provide a discontinuous baffle that cooperates with said inner shell to provide an air duct extending along a rear wall of said compartment; and having said closure member formed with a portion that is spaced from the access openings of said compartments so as to provide an air communicating means between compartments which is adapted to cooperate with said air passageway in providing for the flow of air, forced by said air circulating means into intimate thermal contact with said evaporator cooling element, successively in a continuous circuit between and through each of said compartments.

4. In a refrigerated cabinet the combination, comprising: spaced apart inner and outer shells arranged to define a space divided by a wall-like partition member into a food storage compartment and an air-cooling compartment; refrigeration apparatus operative to cool said compartments including, a refrigerant evaporator cooling element, air circulating means, and refrigerant-carrying conduits; heating means for defrosting said evaporator cooling element; said evaporator cooling element and said air circulating means being disposed remote from said food storage compartment; a plurality of food receptacles providing air baffle means, and having said air baffle means cooperative with said inner shell to provide an air duct within said food storage compartment; moisture evaporating means including a liquid container disposed in intimate thermal contact with a portion of one of said refrigerant-carrying conduits; means for conveying moisture from said evaporator cooling element to said liquid container including, a moisture collecting member disposed beneath said evaporator cooling element, and a drain pipe opening into said moisture collecting member and discharging into said liquid container; and a cap member positioned over one end of said drain pipe, and having a portion thereof extending into intimate heat exchange relation with said evaporator cooling element whereby heat from the evaporator during defrosting thereof is effective for melting ice formations developed around the opening of said moisture collecting member.

5. In a refrigerated cabinet the combination, comprising: spaced apart inner and outer shells arranged to define a space divided by a wall-like partition member into a food storage compartment and an air-cooling compartment; refrigeration apparatus operative to cool said compartments including, a refrigerant evaporator cooling element, air circulating means, and refrigerant-carrying conduits; heating means for defrosting said evaporator cooling element; said evaporator cooling element and said air circulating means being disposed in said air-cooling compartment; a plurality of food receptacles providing air baffle means, and having said air baffle means cooperative with said inner shell to provide an air duct within said food storage compartment; moisture evaporating means including a liquid container disposed in intimate thermal contact with a portion of one of said refrigerant-carrying conduits; moisture drainage means including, a drain member disposed beneath said evaporator cooling element and having an opening therein, an upstanding flange-like wall adjoining said opening, and a drain pipe extending from said opening and discharging into said liquid container; and a highly heat-conductive cap member positioned over the flanged opening of said drain member, and having a portion thereof that extends into good thermal exchange relationship with said evaporator cooling element whereby heat from the evaporator during defrosting thereof is effective for melting ice formations developed in the vicinity of said cap and the flange-like wall of said drain opening.

6. In a refrigerated cabinet the combination, comprising: spaced apart inner and outer shells arranged to define a space divided by a wall-like partition member into a food storage compartment and an air-cooling compartment; refrigeration apparatus operative to cool said compartments including, a refrigerant evaporator cooling element, air circulating means, and refrigerant-carrying conduits; said evaporator cooling element and said air circulating means being disposed in said air-cooling compartment; a plurality of food receptacles providing air baffle means, and having said air baffle means cooperative with said inner shell to provide an air duct within said food storage compartment; a defrost heater element disposed in intimate thermal contact with said evaporator cooling element and operative for the defrosting thereof; moisture evaporating means including a liquid container disposed in intimate thermal contact with a portion of one of said refrigerant-carrying conduits; the floor of said air-cooling compartment being formed to provide a moisture collecting well having an opening therein; a drain pipe extending through said opening and into said well to provide an upstanding wall adjoining said opening and additionally extending through a bottom wall of the cabinet and terminating proximate said liquid container; and a highly heat-conductive cap positioned over the end of said drain pipe extending into said well, and having a portion of said cap disposed so as to extend into good thermal and physical contact with the defrost heater element of said evaporator cooling element whereby heat from the evaporator during defrosting thereof is effective for melting ice formed in said moisture collecting well in the vicinity of said cap.

7. A refrigerated cabinet, comprising: spaced apart inner and outer shells fashioned to define a food storage compartment and an air-cooling compartment with an access opening for each compartment; a closure member

hingedly mounted on the cabinet and arranged to cover the access opening of each of said compartments; refrigeration apparatus operative to cool said compartments including, a refrigerant evaporator cooling element, air circulating means, and refrigerant-carrying conduits; said evaporator cooling element and said air circulating means being disposed in said air-cooling compartment; a plurality of air passageways communicating with each of said compartments; a plurality of food receptacles in said food storage compartment providing air baffle means that are cooperative with said inner shell to provide air duct means adjacent a wall of said inner shell and extending through said food storage compartment; a defrost heater element disposed so as to be in intimate thermal contact with said evaporator cooling element and with a bottom wall of said cooling compartment and operative to effect the defrosting of said evaporator cooling element and to melt formations of ice on the bottom wall of said cooling compartment; moisture evaporating means including a liquid container disposed in intimate thermal contact with a portion of one of said refrigerant-carrying conduits; means for conveying moisture from said evaporator cooling element to said liquid container including, a moisture collecting well disposed beneath said evaporator cooling element, and a drain pipe one end of which extends into said well and the other end of which discharges into said liquid container; and a cover member of highly heat conductive material positioned over the end of said drain pipe extending into said well, and having a portion of said cover member extending into intimate thermal contact with said defrost heater element whereby heat from said defrost heater during defrosting of said evaporator is effective for melting ice formations adjoining the said well and said cover member.

8. In a refrigerated cabinet having a pair of vertically aligned compartments with a front access opening in each, and a closure member hingedly mounted to cover the access openings, the combination, comprising: refrigeration apparatus operative to cool the compartments and including, a refrigerant evaporator, air moving means, and refrigerant-carrying conduits; said refrigerant evaporator and said air moving means being disposed in the one of the compartments; a pair of air passageways, one in the front and the other in the rear communicating with each of the compartments; a plurality of food receptacles slidably positioned in the other of the two compartments; said food receptacles being arranged so that one wall of each provides baffle means which cooperate with the walls of the other of the two compartments to provide air duct means extending vertically through said other compartment; a defrost heater element buried in said refrigerant evaporator and operative to effect the defrosting thereof; moisture evaporating means including a liquid container located remote from both of the compartments and disposed in intimate thermal contact with a portion of said refrigerant-carrying conduits; means for draining moisture removed from said refrigerant evaporator, during the defrosting thereof, to said liquid container including, a sump formed in a bottom wall of the one compartment, and pipe means for conveying moisture from said sump to said liquid container; said pipe having one end thereof extending inwardly into said sump and providing a trap to contain a small quantity of moisture in said sump; and a cover member of highly heat conductive material positioned over the inwardly extending end of said pipe and having a portion of said cover member extending into intimate thermal contact with said defrost heater element whereby heat from said defrost heater during defrosting of said refrigerant evaporator is operative for melting ice formations in said sump.

9. A refrigerated cabinet, comprising: spaced apart inner and outer shells fashioned to define a food storage compartment and an air-cooling compartment with an access opening for each compartment; a closure member hingedly mounted on the cabinet and arranged to cover the access opening of each of said compartments; refrigeration apparatus operative to cool said compartments and including, a refrigerant evaporator cooling element, air circulating means, and refrigerant-carrying conduits; said evaporator cooling element and said air circulating means being disposed in said air-cooling compartment; a plurality of air passageways communicating with each of said compartments; a plurality of food receptacles in said food storage compartment providing air baffle means that are cooperative with said inner shell to provide air duct means adjacent a wall of said inner shell and extending through said food storage compartment; a defrost heater element disposed so as to be in intimate thermal contact with said evaporator cooling element and with a bottom wall of said air cooling compartment and operative to effect the defrosting of said evaporator cooling element and to melt formations of ice on the bottom wall of said cooling compartment; moisture evaporating means including a liquid container disposed in intimate thermal contact with a portion of one of said refrigerant-carrying conduits; a moisture collecting well disposed beneath said refrigerant evaporator cooling element; said well having an opening therein and an upstanding rim around said opening; conduit means for draining moisture from said well to said liquid container; and a cover member positioned over said upstanding rim, and having a portion thereof extending into intimate thermal contact with said defrost heater element whereby heat from said defrost heater during defrosting of said evaporator is effective for melting ice formations in the immediate vicinity of said upstanding rim and said cover.

10. A refrigerated cabinet, comprising: spaced apart inner and outer shells fashioned to define a food storage compartment and an air-cooling compartment with an access opening for each compartment; a closure member hingedly mounted on the cabinet and arranged to cover the access opening of each of said compartments; refrigeration apparatus operative to cool said compartments and including, a refrigerant evaporator cooling element, air circulating means, and refrigerant-carrying conduits; said evaporator cooling element and said air circulating means being disposed in said air-cooling compartment; a plurality of air passageways communicating with each of said compartments; a plurality of food receptacles in said food storage compartment providing air baffle means that are cooperative with said inner shell to provide air duct means adjacent a wall of said inner shell and extending through said food storage compartment; a defrost heater element disposed so as to be in intimate thermal contact with said evaporator cooling element and with a bottom wall of said air cooling compartment and operative to effect the defrosting of said evaporator cooling element and to melt formations of ice on the bottom wall of said cooling compartment; moisture evaporating means including a liquid container disposed in intimate thermal contact with a portion of one of said refrigerant-carrying conduits; a moisture collecting well disposed beneath said refrigerant evaporator cooling element; said well having an opening therein and an upstanding rim around said opening; conduit means for draining moisture from said well to said liquid container; and a cover member positioned over said upstanding rim, and having a portion thereof extending into intimate thermal contact with said defrost heater element whereby heat from said defrost heater during defrosting of said evaporator is effective for melting ice formations in the immediate vicinity of said upstanding rim and said cover.

11. A refrigerated cabinet, comprising: spaced apart inner and outer shells fashioned to define a food storage compartment and an air-cooling compartment with an access opening for each compartment; a closure member hingedly mounted on the cabinet and arranged to cover the access opening of each of said compartments; refrig-

eration apparatus operative to cool said compartments and including, a refrigerant evaporator cooling element, air circulating means, and refrigerant-carrying conduits; said evaporator cooling element and said air circulating means being disposed in said air-cooling compartment; a plurality of air passageways communicating with each of said compartments; a plurality of food receptacles in said food storage compartment providing air baffle means that are cooperative with said inner shell to provide air duct means adjacent a wall of said inner shell and extending through said food storage compartment; a defrost heater element disposed so as to be in intimate thermal contact with said evaporator cooling element and with a bottom wall of said air cooling compartment and operative to effect the defrosting of said evaporator cooling element and to heat the bottom wall of said air cooling compartment; moisture evaporating means including a liquid container disposed in intimate thermal contact with a portion of one of said refrigerant-carrying conduits; a moisture collecting well disposed beneath said refrigerant evaporator cooling element; said well having an opening therein and an upstanding rim around said opening; conduit means for draining moisture from said well to said liquid container; a cap member surmounting said upstanding rim; said cap being fashioned with a top wall from which depends an annularly extending wall having openings therein in which latter wall extends into said well; said cap additionally being provided with an arm of high-heat-conducting material which, when said cap is in position surmounting said upstanding rim, extends into intimate thermal contact with said defrost heater element whereby heat therefrom during defrosting of said evaporator is effective for melting ice formations in the immediate vicinity of said upstanding rim and said cap.

12. A condensate disposal system for a refrigerator including a cabinet, air circulating means, and a refrigerant compressor, a condenser and an evaporator with refrigerant-carrying conduits connected therebetween, heating means for defrosting said evaporator, a portion of said conduit connecting said compressor with said condenser being disposed in intimate heat exchange relation with a supporting plate member and disposed beneath the bottom wall of the cabinet, a liquid receptacle positioned in a heat exchange relation on said supporting plate, a drain extending through the bottom wall of the cabinet opposite said liquid receptacle, a drain cap covering one end of said drain, said drain cap having a highly heat conductive portion thereon that extends into intimate heat exchange relation with said evaporator whereby heat from the evaporator upon defrosting thereof becomes operative to melt ice formed in the drain in the vicinity of said drain cap.

13. In a refrigerated cabinet having a defrost heater element in intimate heat exchange relation with the evaporator cooling element of the refrigeration apparatus thereof, a condensate disposal system, comprising: a liquid receptacle disposed in intimate heat exchange relation with a portion of the refrigeration apparatus of the cabinet; a drain for collecting condensate from beneath the evaporator and discharging it into said liquid container; a cap covering one end of said drain; said cap having a highly heat conductive portion thereon disposed in good thermal and physical contact with the defrost heater element whereby heat therefrom upon defrosting of the evaporator is operative to melt ice formed in the drain in the vicinity of said drain cap.

14. In a refrigerated cabinet the combination, comprising: spaced apart inner and outer shells arranged to define a space divided by a wall-like partition member into a food storage compartment and an air cooling compartment; air-communication means between said compartments; refrigeration apparatus operative to cool said compartments including, a refrigerant evaporator cooling element, air circulating means, and refrigerant-carrying conduits; said evaporator cooling element and said air circulating means being disposed remote from said food storage compartment; a plurality of food receptacles providing air baffle means in a wall of each thereof, and having said air baffle means cooperative with said inner shell to provide an air duct within said food storage compartment; heating means for defrosting said evaporator; moisture evaporating means including a liquid container disposed in intimate thermal contact with a portion of one of said refrigerant-carrying conduits; means for draining moisture from said evaporator cooling element to said liquid container including, a moisture collecting well disposed beneath said evaporator cooling element, and a drain pipe extending into said well and discharging into said liquid container; and a cover member fashioned of good thermally conductive material overlying one end of said drain pipe, and having a portion thereof extending into physical contact with said evaporator cooling element whereby heat from said evaporator during defrosting thereof is effective for melting ice formations developed in the moisture collecting well in the vicinity of said covering member.

15. A refrigerated cabinet, comprising: spaced apart inner and outer shells fashioned to define an upper and a lower compartment adjacent thereto with access openings in each compartment; a closure member hingedly mounted on the cabinet and arranged to cover said access openings; refrigeration apparatus operative for cooling the interior of the cabinet; said apparatus including an evaporator cooling element and air circulating means disposed in said lower compartment; a first air passageway between said compartments; a plurality of individual food storage containers fashioned with at least one wall of each container imperforate and being disposed in vertically spaced relation in said upper compartment; said containers being further disposed so that at least one imperforate wall of each is vertically positioned and disposed in substantially the same plane so as to provide a baffle-like wall having an opening therein between each such container; said baffle-like wall being spaced from a proximate wall of said inner shell and cooperating therewith to form air duct means extending from said first air passageway upwardly into the upper compartment and having said closure member spaced from the access opening of said lower compartment to provide a second air passageway between said compartments which cooperates with said first air passageway to effect the flow of air, forced by said air circulating means into intimate heat exchange relation with said evaporator cooling element, successively in a continuous circuit between and through each of said compartments.

References Cited in the file of this patent

UNITED STATES PATENTS

2,511,126	Philipp	June 13, 1950
2,532,816	Kurtz	Dec. 5, 1950
2,562,057	Norberg et al.	July 24, 1951