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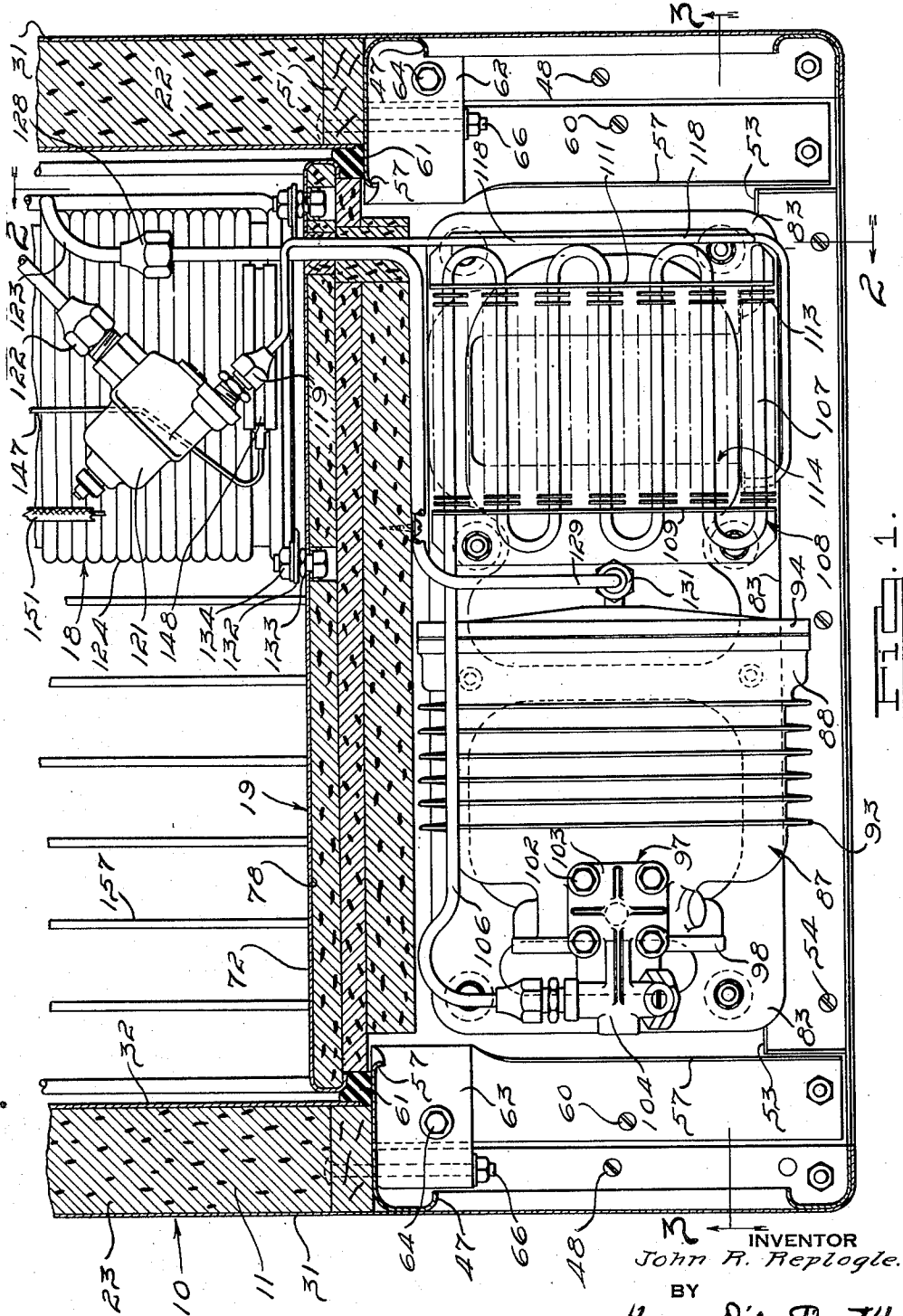
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INWARDLY REMOVABLE REFRIGERATION UNIT

Filed Feb. 20, 1932

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

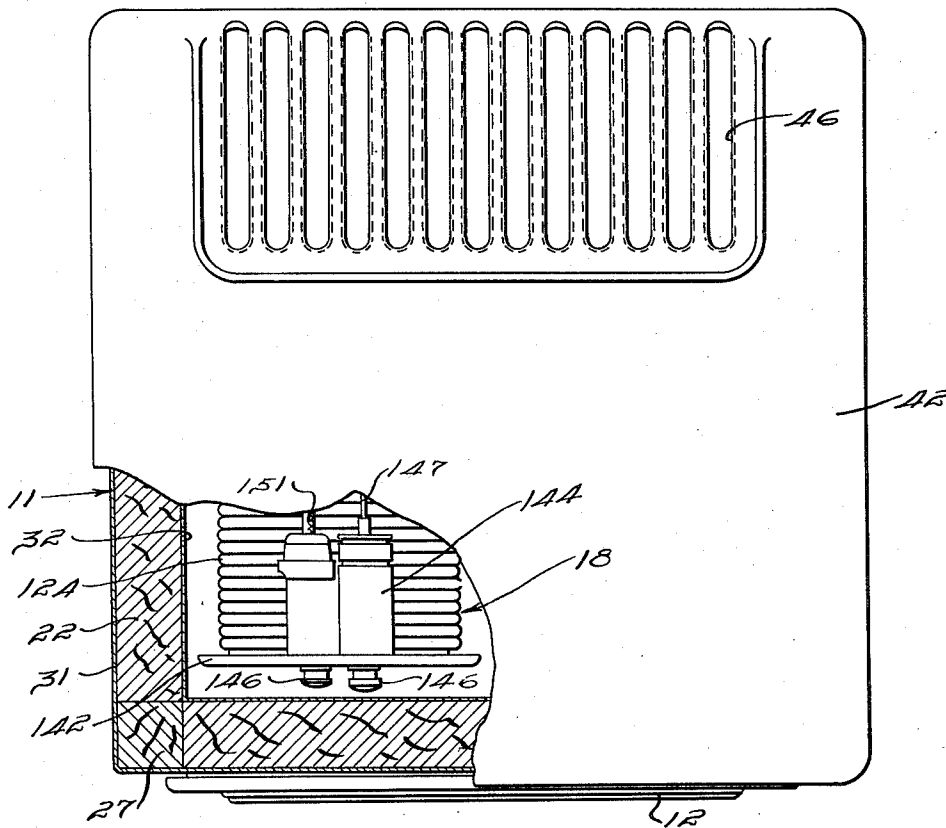
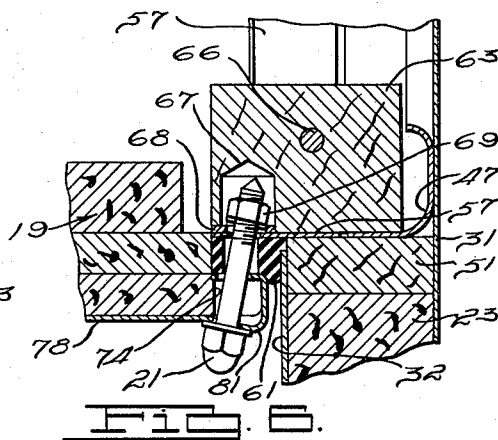
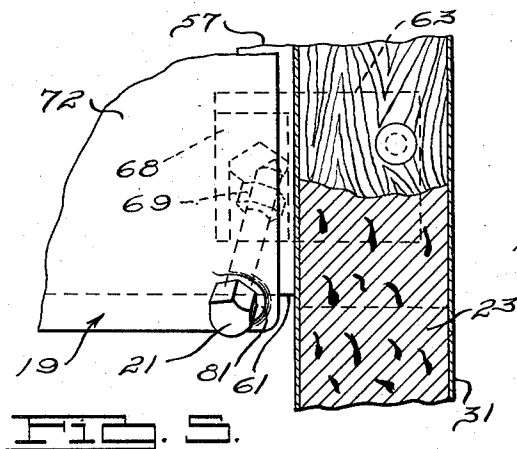


FIG. 4.

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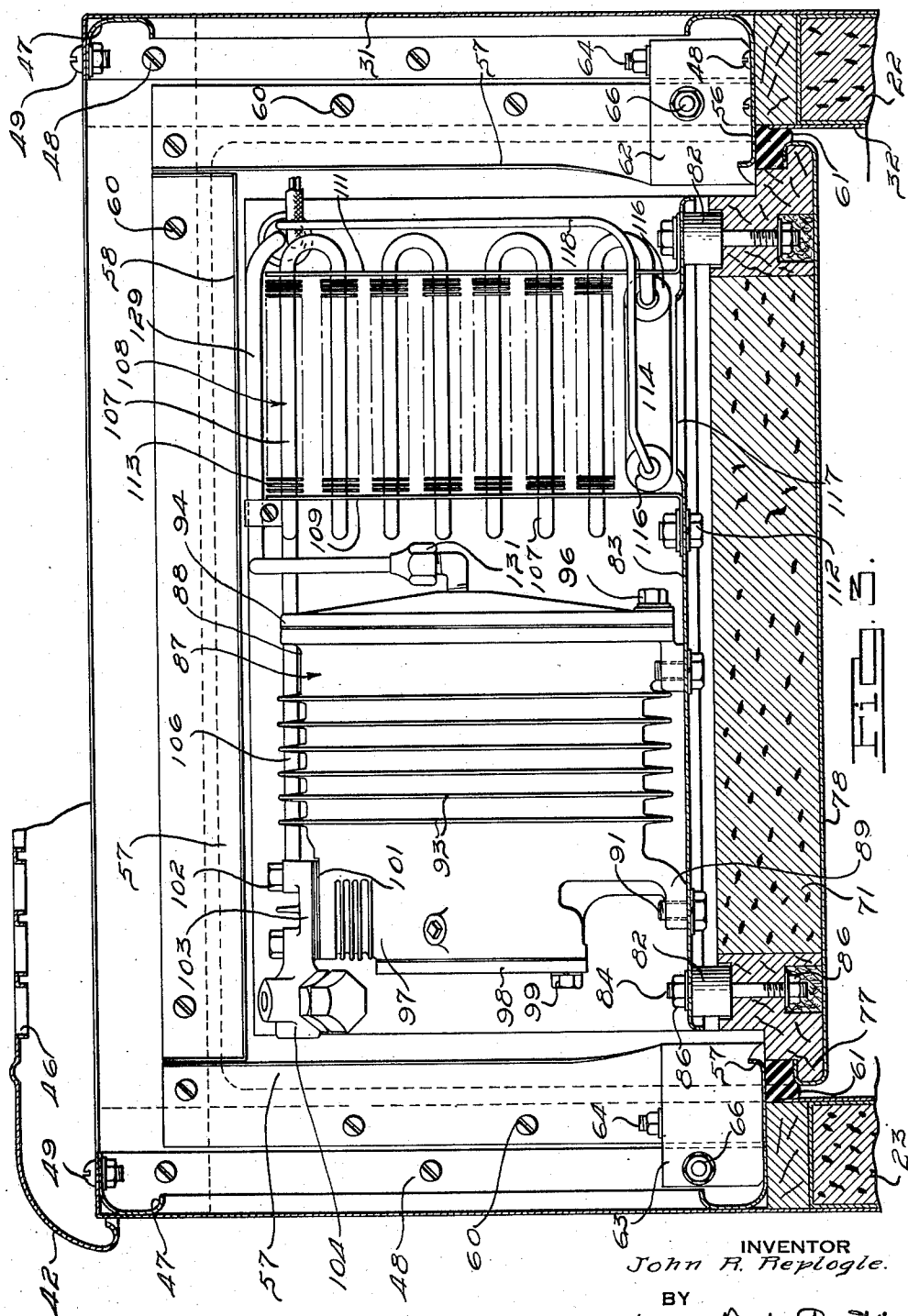
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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

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INWARDLY REMOVABLE REFRIGERATION UNIT

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Application February 20, 1932, Serial No. 594,161

1 Claim. (Cl. 62—116)

This invention relates to refrigeration apparatus and has particular relation to the coordination of cabinet and refrigerating mechanism designs in order to simplify the construction and to widen the range of application of the apparatus.

An object of the invention is to provide a refrigerator which can be located in any desired position in a building, even permanently built into a wall thereof if such is desired, and from which the refrigerating mechanism can be removed without the necessity for moving the cabinet or for disarranging any other household equipment or furnishings which may be positioned adjacent thereto.

Another object of the invention is to provide a refrigerating mechanism constructed as an integral operating unit which can be installed and removed through the door through which the refrigerator content is accessible.

Another object of the invention is to construct a refrigerator having an uninsulated machine compartment located in an upper rearwardly disposed region therein and an insulated refrigerating compartment disposed in front of and beneath said machine compartment with the dividing heat insulating wall between said compartments secured to and supported by the refrigerating mechanism employed therein.

Another object of the invention is to provide a refrigerating mechanism which can be removed from a refrigerator with which it is employed either downwardly or laterally, or by a resultant of such two movements, and then outwardly through a door through which the interior of the refrigerator is accessible.

Another object of the invention is to provide a relatively inexpensive refrigerator construction with which a unitary and removable refrigerating mechanism, operable for efficiently cooling the interior of the refrigerator, can be employed.

The illustrated embodiment of the invention comprises generally a heat insulated refrigerating compartment and an uninsulated machine compartment located within the exterior limits of the refrigerator in a recess formed behind an upper portion of said insulated compartment and above a lower portion thereof. The machine and the refrigerating compartments are in open communication with each other along the front and lower limits of the machine compartment except when the refrigerating mechanism is operatively installed and then the two compartments are separated by a vertically disposed wall separating the evaporating and condensing units of the re-

frigerating mechanism and a horizontally disposed wall on which the condensing unit is mounted. These two walls comprise a partition which is secured within the refrigerator by bolts or other securing means and is removable with the refrigerating mechanism through the refrigerator compartment and the door opening by which said compartment is accessible. When the bolts supporting these walls are removed the refrigerating mechanism unit is released except along the rear edge of the horizontal partition, which is supported by the rear wall of the cabinet, and this part of the unit can be released simply by pulling the unit forwardly toward the refrigerator door.

In the drawings:

Figure 1 is a horizontal sectional view through a refrigerator embracing the principles of this invention and taken on a plane just above the refrigerating mechanism employed therein;

Fig. 2 is a fragmentary vertical sectional view taken through the refrigerator illustrated by Fig. 1, substantially on line 2—2 thereof;

Fig. 3 is another vertical sectional view of an upper portion of the refrigerator illustrated by Fig. 1 taken in a plane substantially normal to the plane of Fig. 2 and on line 3—3 of Fig. 1;

Fig. 4 is a plan view on a smaller scale of a refrigerator illustrated by Figs. 1, 2 and 3 with a portion of the structure broken away so as to expose the view, a part of the refrigerating mechanism disposed therein;

Fig. 5 is a fragmentary cross-sectional view taken directly in front of and at one side of the removable refrigerating mechanism unit for illustrating the manner in which such unit is held in position;

Fig. 6 is a cross-sectional view of the structure illustrated by Fig. 5 as it might appear in the plane of one of the refrigerating unit supporting bolts.

Referring more particularly to the drawings, a refrigerator 10, employed in practicing the invention, comprises a heat insulated cabinet 11 having a front door 12 through which a refrigerating compartment 13 formed inside the cabinet 11 is accessible. Also embraced within the refrigerator 10 is a removable refrigerating mechanism unit 14 comprising a condensing unit 16 located in a machine compartment 17 and an evaporating unit 18 located in the refrigerating compartment 13. Supporting such refrigerating mechanism and providing a heat insulated partition between the machine compartment 17 and the refrigerating compartment 13 is an insulated

wall or partition 19 which is secured rigidly to the cabinet 11 by bolts 21.

The cabinet 11 essentially comprises a pair of insulated side walls 22 and 23 connected at their lower edges by a bottom wall (not shown) and at the rear edges thereof by a rear wall 24. The rear wall terminates at the machine compartment 17 and the side walls are cut out forwardly therefrom to the front of the machine compartment. The upper extremities of the side walls 22 and 23 in front of the machine compartment are closed by an upper wall 26 and these walls, together with the partition 19 and the front door 12, complete the refrigerating compartment 15 formed by the cabinet 11.

Embraced in the front edges of the side, top and bottom walls of the cabinet 11, is a wooden or other suitable door frame 27 around the inner edge of which is secured in spaced relation the inwardly and outwardly flanged edges 28 and 29 respectively of outer and inner refrigerator linings 31 and 32 respectively. The edges of these linings are secured to the frame 27 by rows of screws 33 and 34 which also extend through openings formed in the opposite edges of door moldings or trim strips 36 formed of any suitable heat insulating material.

The door 12 comprises a frame 37, by which the door is secured to the cabinet by hinges and a latch not shown, and to the edges of which, in a region directly opposite the front surface of the cabinet, is secured the inwardly and outwardly flanged edges of outer and inner door linings 38 and 39 respectively. Secured to the door 12 directly over such outer and inner lining edges is a compressible door gasket 41 which abuts the front surface of the cabinet for restricting the circulation of air to or from the interior of the cabinet.

The outer refrigerator lining 31 continues rearwardly beyond the upper portions of the side walls 22 and 23 and upwardly beyond the rear wall 24 and thus defines the two sides and back of the machine compartment 17. The top of the machine compartment 17 is covered by a continuation of the outer lining 31 which extends rearwardly from the upper surface of the upper cabinet wall 26. Both the upper and rear walls of the machine compartment 17 thus formed have large openings formed therein to permit the upwardly directed circulation of air over the condensing unit 16 from the rear of the refrigerator.

The cabinet also is provided with a removable cover 42 which is supported on the upper part of the refrigerator outer lining 31 by transversely extending supporting brackets 43 secured to the lining by small bolts 44. Above the machine compartment 17, the cover is provided with a plurality of louvers 46 to permit the circulation of air upwardly from the condensing unit 16. The refrigerator outer lining 31 at the sides of the machine compartment 17 is reinforced by rectangularly shaped and flanged inserts 47 which are secured to the edges of the side walls 22 and 23 by screws 48 and to the upper and rear parts of the refrigerator lining 31 by bolts 49.

In the opening in the cabinet 11, between the refrigerating and the machine compartments 13 and 17 respectively, is a cabinet reinforcing frame 51 which provides the cabinet with sufficient interior strength to support the refrigerating mechanism unit 14. The portion of this frame above the rear wall 24 is provided with a longitudinal notch 52, along the upper inner edge thereof,

which is partly closed by an overhanging strip 53 secured to the upper surface of the wall by screws 54. Similar strips 56, 57 and 58 secured to the sides and top respectively of the frame 51 project inwardly of the opening between the machine compartment 17 and a refrigerating compartment 13 to provide, together with the strip 53, abutments for supporting resilient gaskets 61 disposed on the strips on the refrigerating compartment side thereof. The gaskets are secured to the strips in any suitable manner as, for example, by the employment of cement or other adhesive capable of uniting the materials selected for the construction of these parts.

Rigidly secured in the corners of the frame 51, remote from the rear and upper walls 24 and 26, and projecting inwardly of the cabinet along the surface of the strips 56 and 57 are a pair of unit supporting blocks 62 and 63 secured to the frame 51 by bolts 64 and 66 extending at right angles to each other through the frame and blocks. The inwardly projecting ends of these blocks (see Fig. 6) are provided with diagonally disposed openings 67 extending inwardly of the blocks from the refrigerating compartment sides thereof and over which are secured, by screws or other suitable means (not shown), the flattened corners of angle brackets 68. Inside these openings and secured rigidly in any suitable manner to the angle brackets 68 are nuts 69 in which are received the threaded ends of studs 21 employed in supporting the refrigeration unit 14. Suitable openings are provided in the brackets and the gasket 61 for receiving the studs.

The removable unit supporting partition 19 comprises a horizontally disposed section 71 having formed integrally with the front edge thereof a vertically disposed section 72 projecting upwardly therefrom. Disposed diagonally with respect to these sections and extending along the adjacent edges thereof is an interiorly disposed supporting bar 73, the opposite edges of which are slotted, as indicated at 74, for receiving the studs 21. Frame members 76, disposed within the partition 19 around the outer extremity thereof and elsewhere where reinforcement is required are provided with laterally extending edge portions 77 normally abutting the refrigerating compartment surfaces of the compressible gasket 61. Around these edges and along the rearmost edge of the partition 19 are disposed the inwardly flanged edges of an inner partition lining 78, with which the partition 19 is covered. The lining 78 is provided with abutments 81 formed in the regions where the bolts 21 extend through openings formed in the lining, for supporting the heads of the bolts 21 in the proper position to direct the bolts at an angle toward the nuts 69.

Secured above the horizontal wall 71 of the partition 19 and on rubber blocks or other suitable resilient supporting members 82, is a horizontally disposed condensing unit base 83 which is secured against displacement by bolts 84 projecting through the blocks 82 and part way through members of the frame 76 disposed within opposite sides of the horizontal partition. Nuts 86 disposed on opposite ends of the studs 82 are employed for securing the bolts to the frame and for retaining the base 83 on the blocks 82.

Disposed at one end of the base 83 is a motor-compressor unit 87, of the refrigerant condensing unit 16 and which embraces a casing 88 having a plurality of supporting legs 89 projecting downwardly therefrom which are secured rigidly to the upper surface of the base 83 by studs 91. The

casing 88, which is approximately of cylindrical formation, has extending around a middle portion thereof a plurality of outwardly projecting circular fins 93 by which a considerable portion of the heat generated by the operation of the motor-compressor unit is dissipated to the atmosphere. Within the casing 88 is disposed the rotor and stator of any suitable motor (not shown) which is mounted for operation within the casing on suitable bearings formed internally thereof. The end of the casing adjacent the motor is closed by a relatively large cover 94 which is secured to a flanged open end of the casing by a plurality of bolts such as indicated at 96.

15 An opposite end of the casing has formed integrally therewith a refrigerant compressor 97, the operating mechanism of which is connected directly to the motor within the casing 88. The end of the casing adjacent the compressor 97 is likewise closed by a head 98 which is secured to the casing by studs such as that indicated at 99. The compressor 97 is provided with a valve plate 101 on which is secured, by studs 102, a compressor head 103 in which gas discharged by the compressor, through the valve plate 101, is collected and discharged through a fitting 104 extending therefrom and a conduit 106 communicating at its opposite end with the upper one of a plurality of sections 107 of a refrigerant condenser 108.

30 This condenser may be cooled either by an air circulating fan, by a fluid other than air circulating in any suitable manner thereover or, as illustrated, by the natural draft circulation of air resulting from the construction and arrangement of the parts thereof. For accomplishing such circulation of air each of the sections 107 comprises a continuously wound conduit and all of the sections are connected together at corresponding ends and arranged one above another between a spaced pair of supporting plates 109 and 111, the outwardly flanged lower edges of which are secured to the base 83 by bolts 112. The sections of conduit between the aforesaid plates are provided with fins 113 of any suitable character for increasing the heat exchanging surface of the condenser.

The lower section of the condenser is connected at one end to one end of a curved refrigerant receiver 114 having a pair of parallel legs 116 disposed immediately adjacent the lower extremities of the supporting plates 109. Below the receiver the base 83 is provided with one or more openings 117 to permit the circulation of air upwardly, through the receiver and the sections of the condenser, from beneath the base 83. The opposite leg of the receiver 114, from that to which the lower condenser section is connected, communicates with a refrigerant liquid line 118 which extends upwardly along one side of the condenser and to an opening in the vertical section 72 of the partition 19, and thence into the refrigerating compartment 13. The liquid line is there connected by a fitting 119 to a refrigerant expansion valve 121 in turn connected by a coupling 122 to the inlet end 123 of an elongated expansion conduit 124 which is wound in convolutions around the exterior surface of an elongated sleeve 126 which forms the freezing compartment of the evaporator 18.

70 The opposite end of the conduit 124 is connected by a coupling 128 to one end of a suction line 129 which extends out of the refrigerating compartment 13, along with the liquid line 118, through the opening in the partition 19 and into the machine compartment 17. There the suction

line 129 is connected by a coupling 131 to the interior of the casing 88 through the head 94. During the operation of the apparatus, evaporated refrigerant is withdrawn from the evaporator 18, through the suction line 129 and the interior of the casing 18, into the suction side of the compressor 97.

For supporting the evaporating unit 18 the rear end of the sleeve 126 is provided with a plurality of brackets 132 secured rigidly in spaced relation to the partition 14 between nuts 133 and 134 engaging bolts 136, the heads of which are secured inside the lining 78 in reinforcing channel bars 137. The bars are secured by screws or other suitable means (not shown) to the internal frame of the partition 19 to prevent the load of supporting the evaporator 18 from being carried by the lining 78.

Secured in a horizontal position on the side walls of the sleeve 126 is a shelf 138 on which is supported a freezing tray 139, while beneath the shelf a similar tray 141 is supported on the lower wall of the sleeve 126. Secured on the front of the sleeve is a baffle 142, having an opening formed therein through which the trays 139 and 140 can be inserted and removed, and having an upwardly projecting portion 143 on the rear surface of which is supported a refrigerator thermostat or other suitable controlling device 144. The upper portion 143 of the baffle is provided with an opening through which adjusting elements 146 or the thermostat or controller project. Extending from the rear of the controller 144 is a small conduit 147 the other end of which terminates in a bulb 148 which is secured by a bracket 149 between a pair of convolutions of the conduit 124 adjacent the suction line thereof. This bulb contains a suitable fluid the pressure of which responds to the variation in temperature of the evaporator 18 and causes the operation of a switch embraced within the controller 144 which controls the cycling operation of the refrigerating mechanism.

The switch and the motor located in the casing 88 are connected in series by conductors embraced in a power line 151 which supplies electrical energy to the mechanism. The opening in the wall or partition 19, which also receives the power line 151, is closed around the various connecting elements of the mechanism projecting therethrough by the insertion therein of any suitable plastic insulating material indicated at 153, which prevents circulation of air between the refrigerating compartment 13 and the machine compartment 17.

In order to provide means for supporting food and other products in the interior of the refrigerator, the lining 32 is provided with a plurality of inwardly extending supports 156 upon which a plurality of shelves 157 are disposed in suitably spaced relation.

In order to remove the refrigerating unit 14 from the cabinet 11, the evaporator end thereof is held upwardly in its normal position in any suitable manner while the studs 21 are removed. Thereafter the mechanism unit is withdrawn from the cabinet simply by pulling the unit forwardly to release its support, along the rear edge of the partition section 71, upon the upper end of the rear refrigerator wall 24. Thereafter the unit is removed from the cabinet through the door opening in the front thereof, all without moving the cabinet 11 and without having approached the cabinet from a direction other than the front door opening. To reinstall the same or

another unit, the unit is placed in the cabinet through the front door opening with the rear edge of the partition section 71 sliding across the upper extremity of the rear wall 24 and beneath the gasket 61. Thereafter the front end of the unit is elevated until the unit is disposed in its normal position and then the studs 21 are inserted in the partition and tightened within the nuts 69 until the gasket 61 is sufficiently compressed throughout. Under such circumstances the unit is securely held in operative position within the cabinet and can be employed for refrigerating the interior thereof merely by connecting the terminals of the power line 151 to a source of electrical energy.

While the structure as herein disclosed constitutes a preferred form and application of the invention, it is to be understood that other structures differing widely from that herein disclosed are within the scope and spirit of the invention as defined by the appended claim.

I claim:—

A refrigerator comprising a heat insulating cabinet having a rear wall terminating at its upper edge below the upper edges of the side walls thereof and a top wall terminating at its rear edge in front of said rear wall, a removable L-shaped heat insulating partition extending across the space between the upper extremity of said rear wall and the rear extremity of said upper wall comprising a vertically extending section and a horizontally extending section permanently secured together, a refrigerant evaporator mounted on the forward face of said vertically extending section, a refrigerant condensing unit supported by said partition rearwardly of said vertically extending section, means connecting said evaporator and unit, and threaded means located adjacent the line of junction of said sections and acting in an upward and rearward direction to secure said partition in place in said cabinet and transmit the weight of said partition and parts mounted thereon to the body of said cabinet.

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