

Oct. 23, 1945.

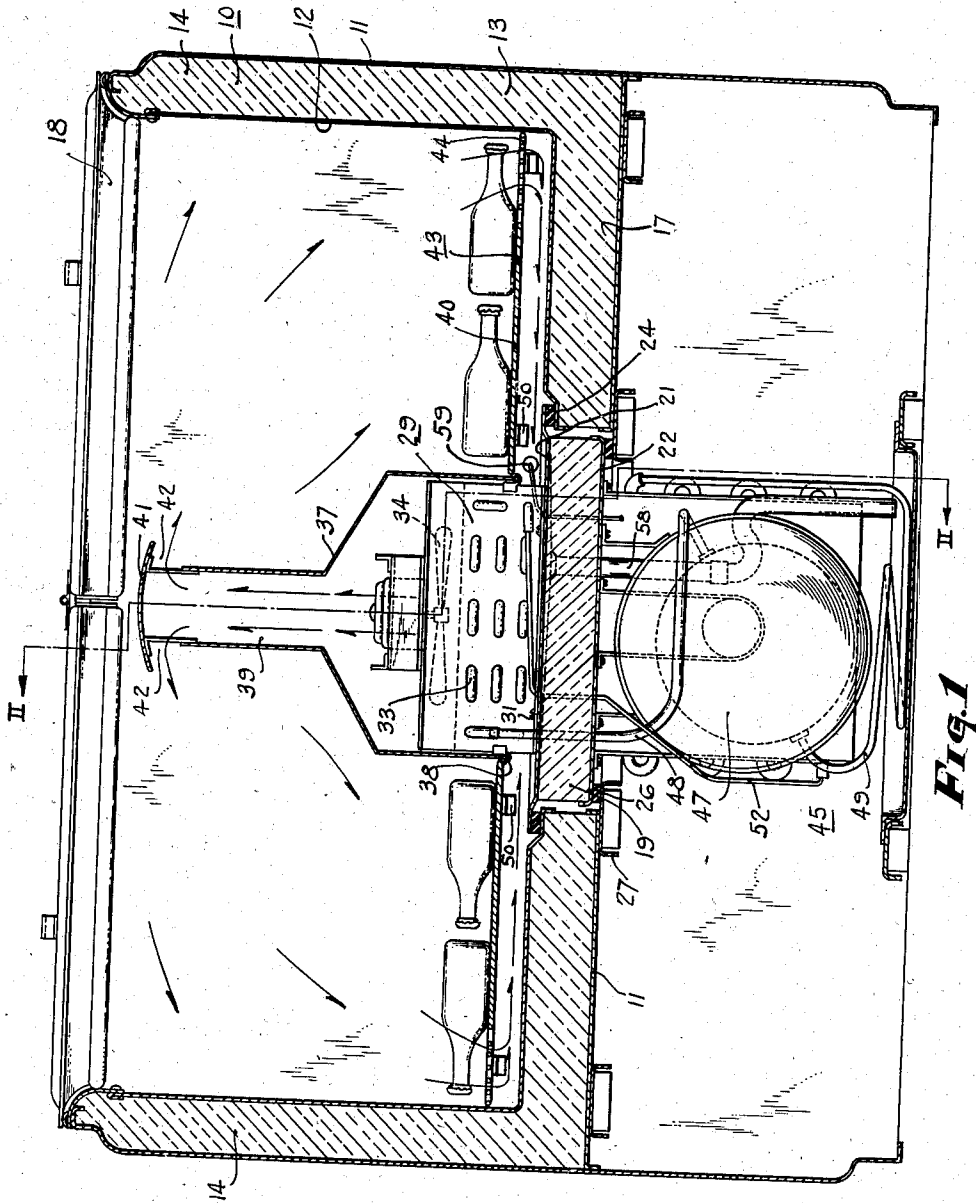
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2,387,622

REFRIGERATION APPARATUS

Filed March 8, 1943

4 Sheets-Sheet 1



WITNESSES:

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4 Sheets-Sheet 2

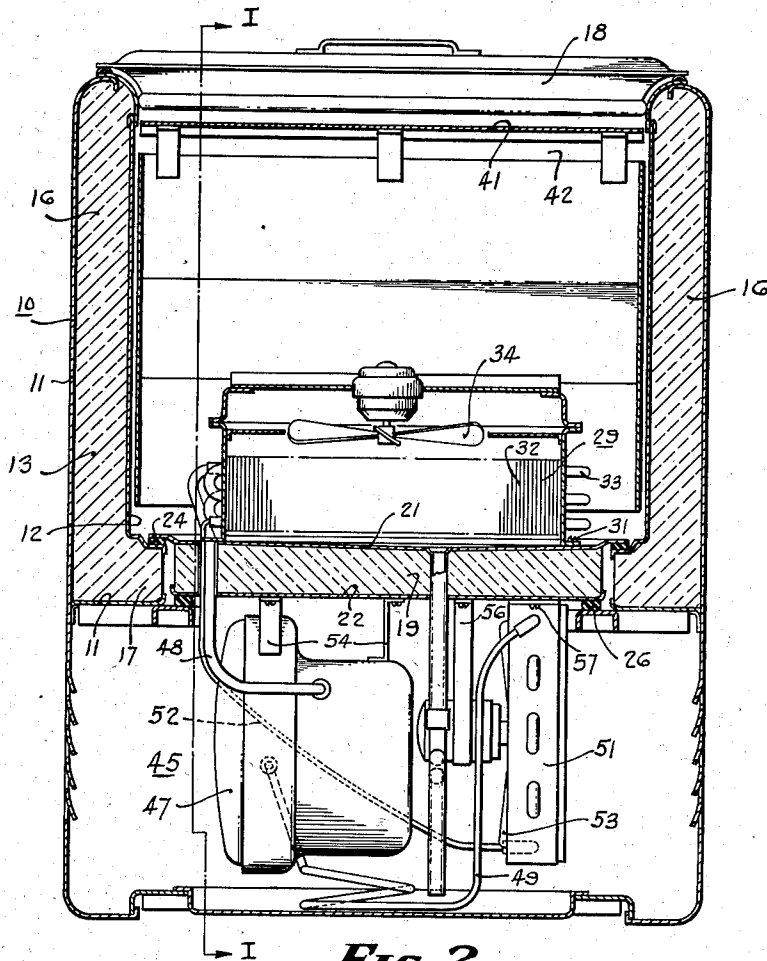


Fig. 2

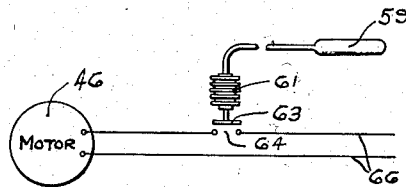


Fig. 3

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4 Sheets-Sheet 3

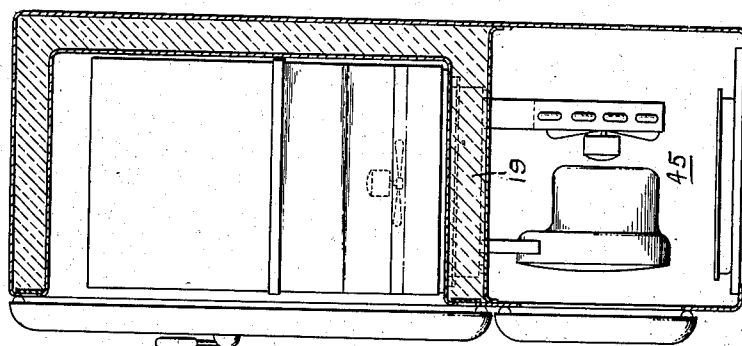


Fig. 5

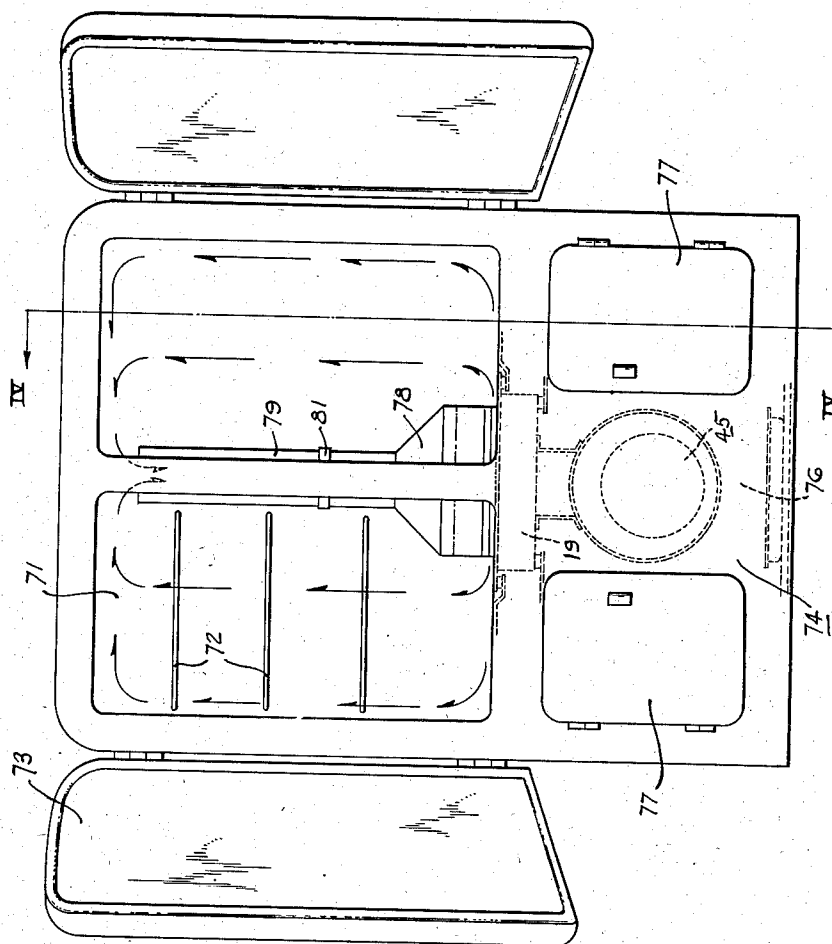


Fig. 4

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4 Sheets-Sheet 4

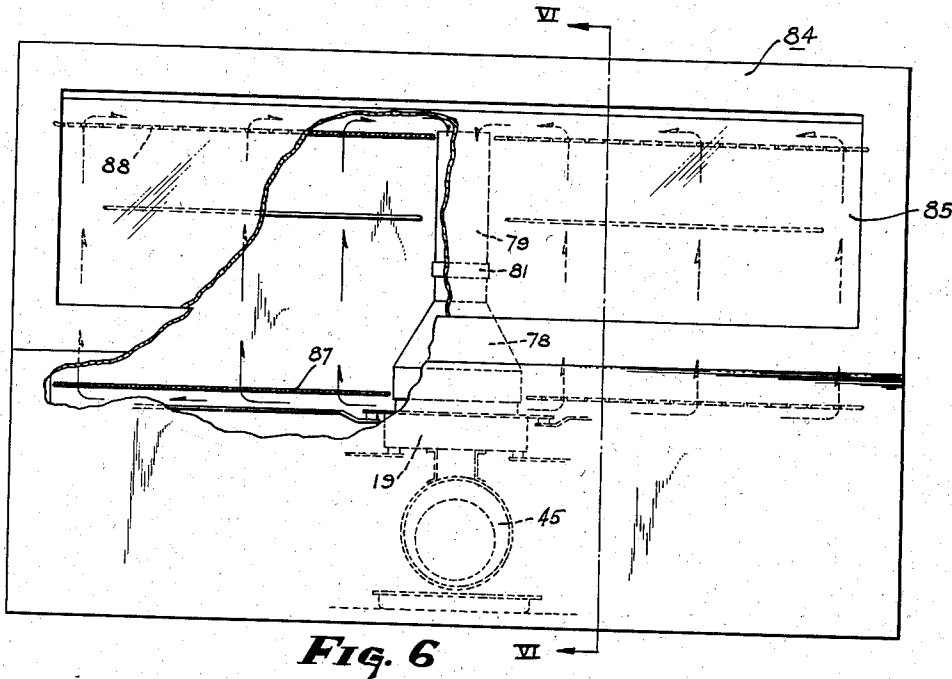


Fig. 6

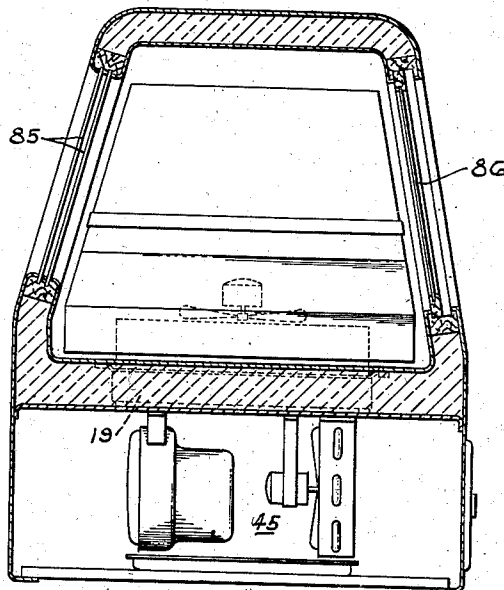


Fig. 7

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UNITED STATES PATENT OFFICE

2,387,622

REFRIGERATION APPARATUS

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Application March 8, 1943, Serial No. 478,341

3 Claims. (Cl. 62—102)

This invention relates to refrigeration apparatus, and more particularly to a refrigerator employing forced air circulation.

One object of the invention is to provide a refrigerator employing novel air circulating and refrigerating apparatus incorporated in a removable unit.

Another object of the invention is to provide a centrally located cooling and air circulating apparatus which is removable from the cabinet as a unit.

A further object of the invention is to provide refrigerating and air circulating apparatus for a refrigerator and an enclosing duct therefor which is detachable therefrom to facilitate the removal of the apparatus from the cabinet as a unit.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a longitudinal vertical section of the apparatus of this invention applied to a bottle cooler. The section is taken on the line I—I of Fig. 2;

Fig. 2 is a vertical section on the line II—II of Fig. 1;

Fig. 3 is a schematic drawing of the thermostat of the apparatus of this invention;

Fig. 4 is an elevation showing the adaptation of the apparatus of this invention to a reach-in cooler;

Fig. 5 is a vertical section on the line IV—IV of Fig. 4;

Fig. 6 is an elevation showing the adaptation of the apparatus of this invention to a display case; and,

Fig. 7 is a sectional view on the line VI—VI of Fig. 6.

Referring now to Figs. 1, 2, and 3 for a detailed description of the invention, the reference numeral 10 represents an insulated cabinet comprising an outer shell 11, an inner liner 12, and heat-insulating material 13 packed therebetween. The cabinet 10 comprises two end walls 14, two side walls 16, a bottom wall 17, and a top wall 18. The top wall 18 comprises a removable cover composed of two sections hinged together. The bottom wall 17 includes a removable portion 19 which extends substantially to the two side walls 16 but is spaced from the two end walls 14.

The removable bottom portion 19 comprises an upper plate 21, a lower plate 22, and heat-insulating material between the plates 21 and 22. The upper plate 21 rests on a gasket 24 sup-

ported on the inner liner 12 of the bottom wall. The lower plate 22 rests on a gasket 26 secured to a support 27 which also supports the outer shell 11 of the bottom wall 17.

A cooling unit 29 rests on and is secured by screws 31 to the removable portion 19 of the bottom wall 17. The cooling unit 29 comprises a plurality of parallel and spaced-apart metal plates 32 through which a refrigerant-carrying tube 33 passes back and forth at right angles to the plates 32. A motor driven fan 34 is supported above the cooling unit 29 and is adapted to draw air upwardly through the spaces between the plates 32 of the cooling unit 29.

A removable shroud structure 37 is supported on the cooling unit 29 by means of hook elements 38 which engage the lower edges of the shroud structure 37. The shroud structure 37 extends sidewardly substantially to each of the two side walls 16 of the cabinet 10 and extends vertically from near the bottom wall 17 of the cooler to near the top wall 18 thereof. The shroud structure 37 thus forms a partition in the center of the cabinet 10 which divides the same into two storage chambers. The portion of the shroud structure 37 above the fan 34 is reduced in area to provide a duct 39. A curved plate 41 extends over the opening of the duct 39 and is spaced therefrom to provide two sidewardly facing air outlets 42.

A removable shelf 43 is supported in each of the storage chambers on brackets 50 secured to the side walls 16 of the cabinet 10. Each of the shelves 43 comprises an imperforate portion 40 located adjacent the shroud 37 and a short grille portion 44 located adjacent an end wall 14. The shelves 43 are spaced above the bottom wall 17 of the cabinet 10 to provide air ducts therewith and extend sidewardly to the side walls 16 of the cabinet 10.

When the motor driven fan 34 is in operation, air from adjacent the bottom of the cooling unit 29 is drawn upwardly therethrough, passes through the duct 39, and issues from each of the air outlets 42. The air thereupon circulates across the top of the storage chambers and diagonally downwardly therethrough to the grilles 44 and thereafter returns to the lower portion of the cooling unit through the space below each of the shelves 43.

Since the cooling unit 29 is located substantially centrally in the cabinet 10, each of the air-circulating paths through the storage chamber and the cooling unit is relatively short. The central location of the cooling unit 29 and of the

duct structure 37, furthermore, exposes them on two sides to the heat radiated from the articles stored in the food-storage chamber so that these articles are cooled rapidly.

The two storage chambers of the cabinet 10 may be used alternately so that when one chamber is empty, it is refilled with bottles and while these bottles are being cooled, the cold bottles of the other chamber are dispensed. The cold air from the cooling unit, furthermore, first passes over the upper bottles in the chambers so that these bottles are cooled first. The upper bottles are also the ones which will be dispensed first from each chamber so that dispensation of the coldest bottles in each chamber results.

The cooling unit 29 is of the evaporative type and is supplied with refrigerant by a refrigerant-condensing unit 45 suspended from the removable wall portion 19. This unit 45 comprises a sealed casing 47 which encloses a compressor and a motor 46 (shown only in Fig. 3) for driving the same. The compressor withdraws vaporized refrigerant from the cooling unit 29 through a suction tube 48, compresses it and passes the compressed vapor through a tube 49 to a condenser 51 wherein the refrigerant and vapor is condensed. The condensed refrigerant is then returned through a capillary impedance tube 52 to the evaporator 29. The condenser 51 is cooled by air circulated therethrough by means of a motor driven fan 53. The sealed casing 47 is secured to the lower wall of the removable wall portion 19 by means of brackets 54. The motor driven fan 53 is secured to the removable portion 19 by means of brackets 55 and the condenser 51 is directly secured to the removable wall portion 19 by screws 57.

The refrigerating condensing unit 45 is controlled by a thermostat, the temperature-sensitive bulb 59 of which is located in the return air stream below one of the shelves 43. The thermostat is shown diagrammatically in Fig. 3 and comprises a bulb 59 which connects with a bellows 61. The bulb 59 contains a volatile fluid which vaporizes when the temperature of the return air rises above a predetermined degree. The increased pressure of the vapor expands the bellows 61 so that a contact arm 63, attached to the bellows 61, bridges a gap 64 in the electrical supply lines 66 to the motor 46 in the sealed casing 47. This energizes the motor 46 to actuate the refrigerant condensing apparatus. The motor driven fan 34 preferably runs continuously when the cooler is in use.

With this arrangement, the bulb 59 is responsive to the temperature of the air after it has passed over the bottles to be cooled. If a large number of warm bottles are placed in the chamber in which the bulb 59 is located, the air passing over the bulb 59 will be relatively warm and will cause increased activity of the refrigerant-supplying apparatus 45. Under these conditions, the cooling unit 29 will be operated at a lower temperature until the bottles in the chamber containing the bulb 59 are cooled, thus cooling the bottles rapidly.

The upper plate 21 of the removable wall portion 19 is dished and provided with a trapped drain which conducts the condensate from the cooling unit 29 to a pan located below the refrigerant condensing unit. A portion of the tube 49 passes through the interior of the pan to heat the condensate therein to facilitate its evapora-

tion. The condensate vapor is carried off by the air stream from the motor driven fan 53.

The removable wall portion 19, together with the cooling unit 29 and the refrigerant condensing unit 45, forms an integral structure which may be lifted from the cabinet 10 when the shelves 43 and the hinged cover 18 are removed. When removing the integral structure 62, the duct structure 37 is preferably taken off to reduce the bulkiness of the structure to be removed.

The modifications shown in Figs. 4 and 5 represent a reach-in cooler in which the refrigerating unit of this invention is installed. The upper portion 71 of the reach-in cooler comprises an insulated chamber provided with shelves 72 and doors 73. The lower portion 74 of the cabinet comprises a machine compartment 76 and two dry storage chambers 77. The cooling unit is similar as in the first described modification and like parts are provided with the same reference numerals. The shroud structure comprises two sections 78 and 79 removably secured together through a bell joint 81.

When the refrigerating unit is to be removed, the upper section 79 is first removed. Thereupon the lower portion 78 can be lifted from the cooling unit so that the removable wall portion 19 together with the refrigerant condensing unit 45 and the cooling unit can be removed from the cabinet in substantially the same manner as in the previously described modification.

The circulation of air in this modification is preferably reversed from that shown previously so that the air flows upwardly through the insulated chamber 71. This direction of circulation causes less dehydration of foods when stored in open dishes because the air strikes the bottom of the dish.

A further modification of the invention is shown in Figs. 6 and 7, which show the cooling unit of this invention applied to a display case. The display case comprises a long, horizontally extending cabinet 84 having a multiple glazed window 85 in the front wall thereof and sliding doors 86 in the rear wall. The cooling unit is generally similar to the last described modification of the invention and like parts are provided with the same reference numerals. In this modification, a perforate elevated platform 87 provides a duct similar to the one shown in the first described modification. A perforate wall 88, spaced slightly below the upper wall of the display case, provides a similar air duct which communicates with the upper end of upper portion 79 of the shroud structure. The air passes substantially uniformly through the display case in an upward direction and passes from the perforations in the platform 87 to the perforations in the partition 88.

The upper portion 79 of the shroud structure is in sliding engagement with the edges of the partition 88 so that it can be moved upwardly to disengage its lower edge from the bell joint 81. The upper portion 79 of the shroud structure can then be removed from the cabinet by tilting and the lower portion of the shroud structure 78 and the cooling apparatus is removed in the same manner as in the last described modification.

It will be apparent from the above that this invention provides a unitary refrigerating and air circulating apparatus which is removable as a unit from the refrigerator cabinet with which it is associated. It will be further apparent that

the apparatus of this invention is adapted for use in many types of cabinet.

While I have shown my invention in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. In a refrigerator, the combination of an insulated cabinet having two side walls, two end walls, a top wall, and a bottom wall, said bottom wall including a removable portion spaced from both of said end walls, a cooling unit on said removable portion, said cooling unit having vertical air passages therein communicating at their lower ends with the air in the cabinet adjacent said bottom wall, a vertical duct structure enclosing said cooling unit and extending from near the bottom wall to near the top wall of the cabinet, said duct structure and cooling unit being spaced from each of said end walls and extending to substantially each of said side walls to form a partition dividing said cabinet into two storage chambers, an imperforate platform in each of said storage chambers, each of said platforms being near but spaced from the bottom wall of said chamber and extending from adjacent the duct structure to within a short distance of the nearest end wall of the cabinet, each of said platforms also extending substantially from one side wall to the other side wall of said cabinet, said platforms forming air passages with the bottom of said cabinet, a fan in said duct structure and above said cooling unit for forcibly moving air through the duct structure, whereby said air is circulated through the storage chamber and through said air passages, refrigerant-supplying apparatus below said removable wall portion and connected in operative relationship with said

cooling unit, and means uniting said removable wall portion, cooling unit, and refrigerant-supplying apparatus into a unitary structure, said structure being removable as a unit from the cabinet.

2. In a refrigerator, the combination of a cabinet having an insulated top, bottom, and side walls, a portion of said bottom wall being removable, a condensing unit suspended beneath and supported from said removable wall portion, an evaporator and a fan located one above the other, both said evaporator and fan being located in the bottom portion of the cabinet immediately adjacent to the removable wall portion and supported thereon, said evaporator, fan, condensing unit, and removable wall portion being removable from the cabinet as a single structure entity, and a vertical air duct encompassing the evaporator and fan and extending upwardly to adjacent the top wall of the cabinet, one end of said duct constituting an air inlet and the other end constituting an air outlet, said duct being separately removable from the cabinet.

3. In a refrigerator, the combination of a cabinet having an insulated top, bottom, side and end walls, a portion of said bottom wall spaced from one of said side walls being removable, a condensing unit suspended beneath and supported from said removable wall portion, an evaporator and a fan located one above the other, both said evaporator and fan being located in the bottom portion of the cabinet immediately adjacent to the removable wall portion and supported thereon, said evaporator, fan, condensing unit, and removable wall portion being removable from the cabinet as a single structure entity, and a vertical air duct encompassing the evaporator and fan and extending upwardly to adjacent the top wall of the cabinet, one end of said duct constituting an air inlet and the other end constituting an air outlet.

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