

July 17, 1951

W. P. HILL

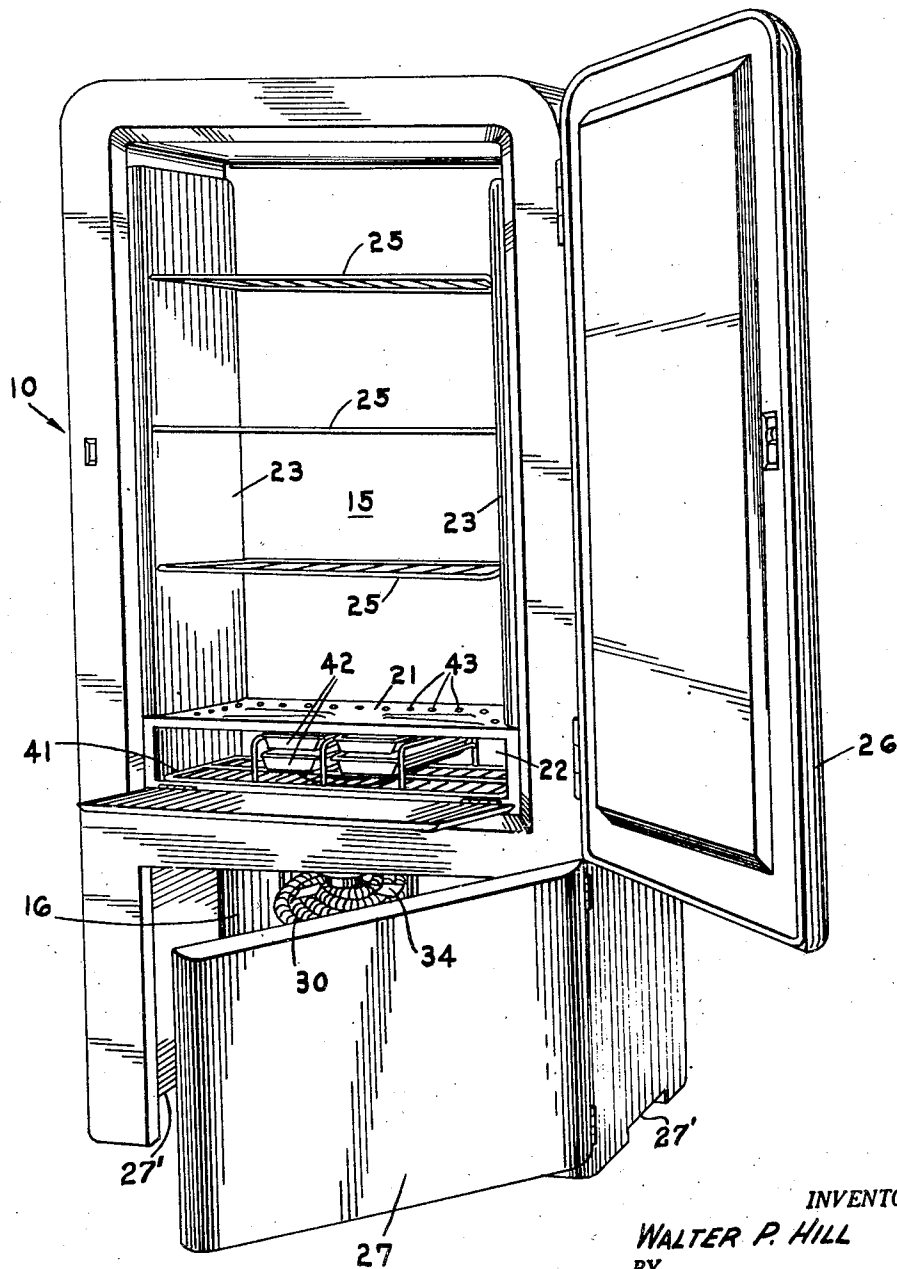
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REFRIGERATOR CABINET CONSTRUCTION

Filed Aug. 2, 1948

3 Sheets-Sheet 1

FIG. 1



INVENTOR.

WALTER P. HILL

BY

Whittemore, Hulbert & Bulkley
ATTORNEYS

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W. P. HILL

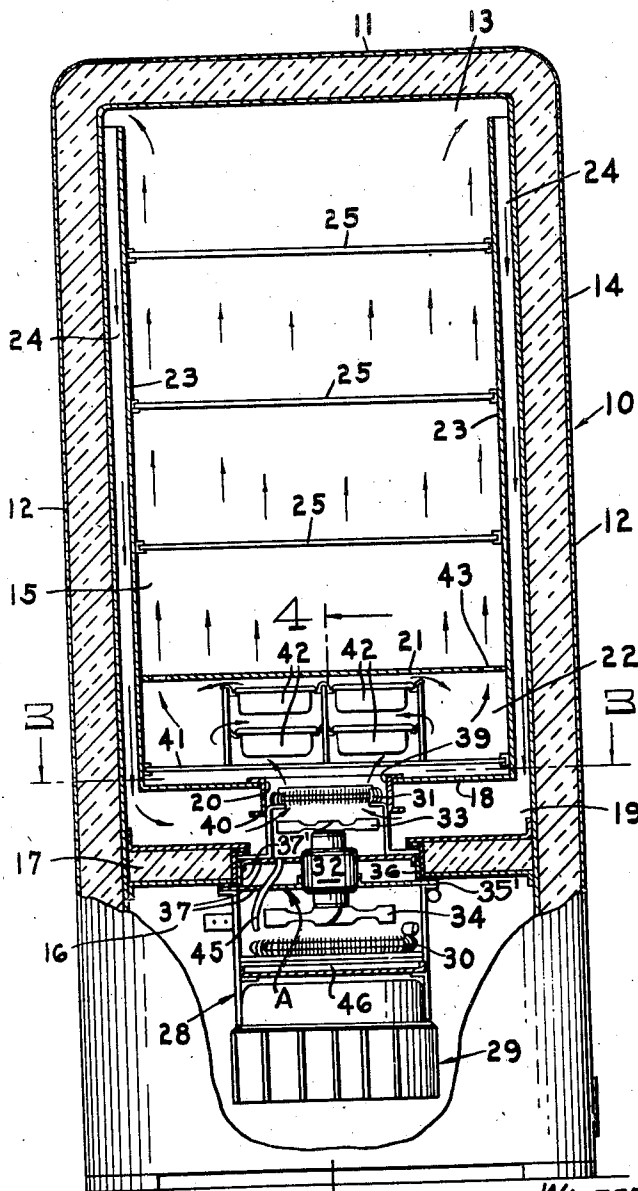
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FIG. 2



INVENTOR.

WALTER P. HILL

BY

Waltham & Belknap
ATTORNEYS

July 17, 1951

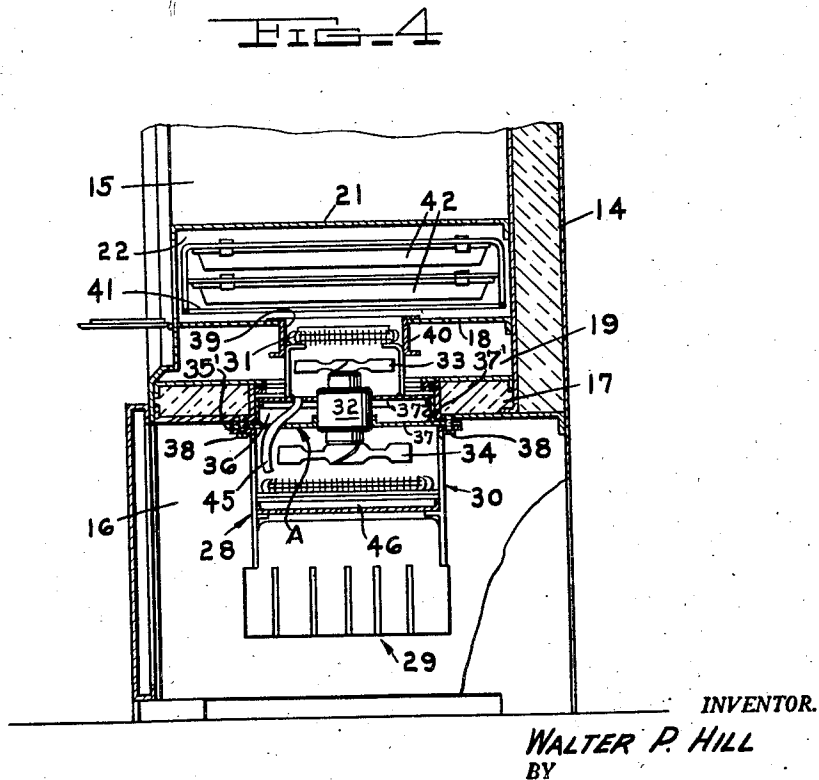
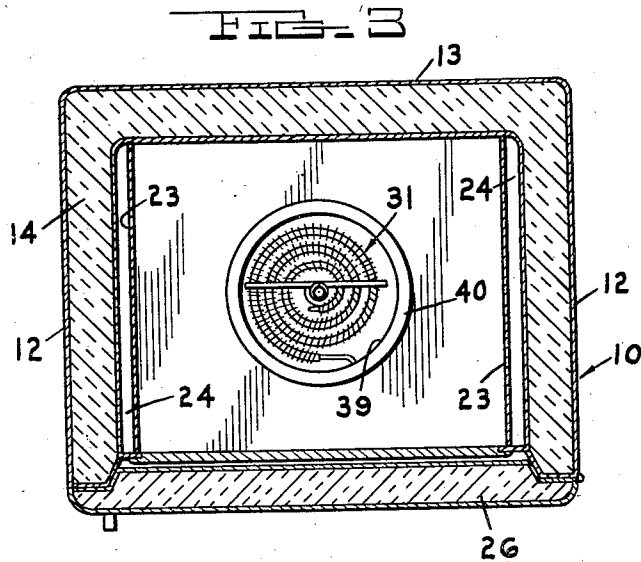
W. P. HILL

2,561,276

REFRIGERATOR CABINET CONSTRUCTION

Filed Aug. 2, 1948

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Waltham & Hulbert & Belknap
ATTORNEYS

UNITED STATES PATENT OFFICE

2,561,276

REFRIGERATOR CABINET CONSTRUCTION

Walter P. Hill, Detroit, Mich., assignor to Calumet and Hecla Consolidated Copper Company, Calumet, Mich., a corporation of Michigan

Application August 2, 1948, Serial No. 42,045

7 Claims. (Cl. 62-117.3)

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This invention relates to refrigerators and refers more particularly to refrigerator cabinets having provision for accommodating a refrigerating system.

One of the objects of this invention is to provide a refrigerator cabinet having a food storage compartment and having a refrigerating system for lowering the temperature within the food storage compartment by circulating refrigerated air upwardly through the food storage compartment. The use of this particular technique for cooling the compartment has many advantages, among which are: (1) the construction of the cabinet is simplified, and the interior of the compartment is more effectively insulated, because it is not necessary to interrupt the insulation by incorporating conduits or coils within the side walls of the cabinet as is ordinarily the procedure in fabricating conventional refrigerator cabinets; and (2) the refrigerated air carries a certain amount of moisture which assists materially in maintaining a higher humidity within all portions of the food compartment without the necessity of providing special equipment.

Another object of this invention is to support an evaporator within a space beneath the bottom wall of the compartment in a position where it registers with an opening formed in the bottom wall and to force air upwardly through the space over the evaporator into the lower end of the compartment.

Still another object of this invention is to provide vertical passages at opposite sides of the compartment for returning the air from the top of the compartment to the space beneath the bottom wall of the compartment. Thus the air is recirculated by the fan and is refrigerated by the evaporator prior to being introduced into the compartment. Also the blast of air passing over the evaporator by the action of the fan tends to evaporate any ice that accumulates on the evaporator and not only increases the humidity within the compartment, but in addition, eliminates or at least reduces the defrosting time.

A further feature of this invention is to provide an ice forming area or chamber within the compartment directly above the bottom wall where it receives the air immediately after it is refrigerated by the evaporator. Provision is made for suspending ice trays within this chamber in a manner to enable circulation of the refrigerated air in heat absorbing relationship to the side and bottom walls of the trays.

A still further object of this invention is to provide the refrigerator cabinet with a compartment below the food storage compartment within which the several parts of the refrigerating system are housed. This lower compartment has an access opening at the front side of the cabinet through which the various parts of the refrigerat-

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ing system may be installed and removed as an assembly.

The refrigerating assembly per se forms the subject matter of another application to be later identified, and is exceptionally compact so that the compartment at the bottom of the cabinet need not be abnormally large. This assembly includes all of the various instrumentalities of the refrigerating system including the evaporator, motor-compressor unit, condenser and motor for operating both the evaporator and condenser fans. Thus all of the fluid connections are short and need not be extended through the cabinet walls.

In addition to the above the present invention contemplates an arrangement where moisture resulting from defrosting the evaporator, if required, is collected in a pan supported beneath the condenser where it not only assists in cooling the condenser, but is eventually discharged or evaporated into the room. Thus no provision need be made for draining this moisture from the cabinet.

The foregoing as well as other objects will be made more apparent as this description proceeds, especially when considered in connection with the accompanying drawings, wherein:

Figure 1 is a perspective view of a refrigerator constructed in accordance with the present invention;

Figure 2 is a front elevational view partly in section of the refrigerator shown in Figure 1;

Figures 3 and 4 are respectively sectional views taken on the lines 3-3 and 4-4 of Figure 2.

The refrigerator forming the subject matter of the present invention comprises a cabinet having top side and rear walls 11, 12 and 13, respectively. It will be noted that each of the above walls are formed of inner and outer panels spaced laterally from one another to accommodate heat insulation 14 of substantial thickness. For reasons to be more fully hereinafter described, the rear or back wall 13 of the cabinet is imperforate, and the insulation 14 extends continuously from one panel to the other. In other words, the present construction is such that the rear or back wall 13 need not be formed with openings of any description for receiving any part of the refrigerating system, and as a consequence, this back wall is not only capable of being completely insulated, but in addition, presents a pleasing finished appearance. Also by virtue of the refrigerating technique employed, it is not necessary to disturb the mass of insulation between the panels by extending conduits or cooling coils into the space provided between the panels. Thus the entire available space between the panels may be used for accommodating insulation, and as a result, the interior of the cabinet, is more effectively insulated.

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Located within the cabinet 10 is a pair of compartments 15 and 16. The compartment 15 is positioned above the compartment 16 and forms a storage space for food. The compartment 16 is separated from the compartment 15 by a partition 17 which comprises vertically spaced plates having a mass of insulating material therebetween.

The compartment 15 has a bottom wall 18 spaced vertically above the partition 17 to form a space 19 and is formed with an opening 20 through the central portion thereof. A second wall 21 is secured within the compartment 15 in vertical spaced relation to the bottom wall 18 and cooperates with the latter to form an ice forming area 22. As shown particularly in Figure 2 of the drawings, the compartment 15 is provided with opposite side walls 23 which are spaced laterally inwardly from adjacent side walls 12 of the cabinet 10 to form vertical passages 24. The upper ends of the passages 24 communicate with the interior of the compartment 15 at the top of the latter, and the lower ends of the passages 24 communicate with the space 19 below the bottom wall 18 of the compartment. It will further be noted from Figure 2 of the drawings that food supporting shelves 25 are respectively slidably supported on the opposite side walls 23 of the compartment in a manner to enable the shelves to be readily removed, if desired. These shelves are preferably formed of wire and have openings of considerable area therethrough in order to permit free passage of air.

The front side of the cabinet opposite the compartment 15 is formed with an access opening which extends for substantially the full length and width of the compartment 15 in order to expose both the food storage area and the ice forming area. This access opening is adapted to be closed by a door 26 of conventional construction. The front wall of the cabinet opposite the compartment 16 is also provided with an access opening, and this opening is adapted to be closed by a door 27. The bottom of the compartment 16 is open and suitable openings 27' are provided at opposite sides of the compartment to vent the interior of the latter to the atmosphere.

The refrigerating system is designated generally by the reference numeral 28, and is supported within the compartment 16. The refrigerating system per se forms no part of the present invention, and is described in detail in my copending application Serial No. 42,047, filed August 2, 1948. Briefly the refrigerating system 28 comprises a motor-compressor unit 29, a condenser 30 and an evaporator 31. Supported between the condenser 30 and evaporator 31 is an electric motor 32. The shaft of the motor extends vertically, and a fan 33 is secured to the upper end of the shaft immediately below the evaporator 31. A second fan 34 is secured to the lower end of the shaft in a position directly above the condenser 30. All of the above parts of the refrigerating system are secured together to form a unitary assembly, which is of such a compact nature to enable the same to be inserted into and removed from the compartment 16 as an assembly.

One of the outstanding features of the refrigerating system which renders it possible to greatly reduce the overall dimension thereof without sacrificing capacity is attributed to the construction of the evaporator and condenser. Both the evaporator and the condenser are formed of substantially flat coils of tubing having an integral

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helical fin of substantial height thereon. Thus the heat transfer areas of both the evaporator and condenser are considerable, and the overall dimension of these parts may be substantially reduced in size without appreciably reducing the heat transfer capacity. Moreover, by employing the fan 34 for forcibly directing air in heat absorbing relation to the condenser, the latter is cooled more readily. Also by employing the fan 33 for forcibly discharging air over the relatively large heat absorbing area of the evaporator, a larger volume of air is cooled in a shorter length of time.

Although as state above the refrigerating assembly 28 is inserted as a unit into the compartment 16 through the access opening in the front wall of this compartment, nevertheless, the evaporator 31 and fan 33 are actually positioned within the space 19 above the partition 17. In this connection it will be noted that the partition 17 is formed with a central opening 36 of sufficient dimension to enable freely extending the evaporator and fan 33 through the partition 17 to the position aforesaid. The opening 36 is closed by a removable section in the form of a housing A having vertically spaced plates 37 and having side walls 37' connecting the plates 37. As shown in Figure 4 of the drawings the housing has an attaching flange 35' at the bottom, and fastener elements 38 are provided for securing the flange to the partition 17. The arrangement is such that the partition 17 and housing A cooperate to provide a common dividing wall between the space 19 and compartment 16. Also it will be noted that the motor 32 is secured to the housing A, and that opposite ends of the motor project through aligned openings in the plates 37 to enable respectively connecting opposite ends of the motor drive shaft 18 to the fans 19 and 20.

The evaporator 31 is actually positioned within a passage 39 formed by a vertical tubular member 40 having the upper end communicating with the interior of the ice forming area through the opening 20 in the bottom wall 18 of the compartment 15 and having the lower end communicating with the space 19. The fan 33 is positioned directly below the lower end of the tubular member 40 and serves to discharge a blast of air upwardly through the passage 39 into the ice forming area 22. This air, of course, passes over the relatively large radiating surfaces of the evaporator 31, and is refrigerated prior to being introduced into the ice forming area 22. The air is cooled to a temperature below the freezing point of water, say for example, 10° to 15° F.

Removably supported within the chamber or area 22 is a grille 41 having openings of substantial area therethrough enabling the free passage of refrigerated air and having means for supporting a plurality of ice trays 42. The ice trays are independently removably supported on the grille 41 in spaced relation to each other and to the grille, so that refrigerated air may circulate around the individual trays in heat absorbing relationship to the side and bottom walls of the trays. Thus the temperature of the water within the trays is rapidly lowered and the water is converted to ice in a very short time. The air is discharged from the ice forming area 22 into the food storage area through openings 43 in the wall 21 and passes upwardly through the food supporting shelves 25 to the upper ends of the passages 24. The air flows downwardly through the vertical passages 24 back to the space

19 where it is recirculated by the fan 33 through the passage 39 into the compartment 15.

The blast of air passing over the evaporator 31 has an evaporating effect on the ice which may accumulate on the evaporator and increases the humidity of the air passing upwardly through the food storage area. This not only results in preventing dehydration of the food, but in addition, greatly reduces the time required for defrosting the evaporator. In fact in some cases it may eliminate entirely the necessity of defrosting the evaporator.

However, provision is made for defrosting the evaporator 31. In this connection it will be noted from Figures 2 and 4 of the drawings that during the defrosting phase, moisture dropping from the evaporator collects on the top plate 37 and is conducted through a tube 45 to a pan 46 suitably supported immediately below the condenser 30. This moisture assists in cooling the condenser and is eventually dissipated by evaporation into the room. Thus no provision need be made for draining the moisture from the cabinet.

What I claim as my invention is:

1. In a refrigerator, a cabinet having a dividing wall adjacent the bottom, a refrigerated storage compartment in the cabinet having a bottom wall spaced above the dividing wall to provide a space between said walls and having an opening through said bottom wall communicating with said space, a partition extending across the storage compartment in vertical spaced relation to said bottom wall and cooperating with the latter to provide a freezing chest, means forming a passage having the lower end connected to said space and having the upper end communicating with the interior of the refrigerated compartment adjacent the top of the latter, means for refrigerating the storage compartment including a cooling element positioned within the space below the bottom wall of the storage compartment and in registration with the opening through said bottom wall, means also located within said space below the bottom wall of the storage compartment for drawing air from the top of the storage compartment and directing the air over the cooling element and into the freezing chest through the opening in the bottom wall of the storage compartment, and means establishing communication between the freezing chest and storage compartment permitting refrigerated air from the freezing chest to pass into the storage chamber.

2. The refrigerator defined in claim 1 wherein the cooling element comprises a coil of finned tubing supported directly below the opening in the bottom wall of the storage compartment with its axis extending vertically to occupy a minimum space vertically between said bottom wall and the cabinet dividing wall.

3. In a refrigerator, a cabinet having first and second compartments positioned one above the other, means separating the compartments and thermally insulating one compartment from the other, said means including a division wall of heat insulating material in the cabinet having a central section removable to provide an opening through said wall, means for circulating refrigerated air in the first compartment including a cooling element positioned in the first compartment adjacent the bottom of the latter and a fan also positioned in the first compartment for flowing air over the cooling element, a motor for driving the fan substantially enclosed by the removable central section of the division

wall and secured to the latter, and refrigerant supplying apparatus located within the second compartment and connected to the cooling element.

4. In a refrigerator, a cabinet having first and second compartments positioned one above the other, means separating the compartments and thermally insulating one compartment from the other, said means including a division wall of heat insulating material within the cabinet and having a removable central section closing an opening through the wall, means in the first compartment for circulating refrigerated air within the first compartment including a cooling element and fan both secured to the removable section and being of a size to pass freely through the opening in the division wall, a motor substantially enclosed within the removable section and having a drive shaft connected to said fan, means in the second compartment for supplying refrigerant to the cooling element including a condenser and a compressor unit, and means for securing the condenser and compressor unit to the removable section of said division wall.

5. The refrigerator defined in claim 4 wherein the condenser is positioned directly below the removable section of the division wall and wherein air is directed over the condenser by a second fan positioned between the removable section and condenser and driven by said motor.

6. In a refrigerator, a cabinet having first and second compartments positioned one above the other, a heat insulating wall separating the compartments and having a removable central section, a storage area within the first compartment and having a bottom wall positioned above the division wall to provide a space between said walls, means defining a passage communicating at the lower end with said space and at the upper end with the interior of the storage area adjacent the top of the cabinet, a cooling element positioned within said space in registration with an opening in the bottom wall of the storage space, a fan located in the space below the cooling element for flowing air from the top of the storage area through the passage and over the cooling element into the storage area through the opening in the bottom wall of said area, means for supporting the cooling element and fan on the removable central section of the division wall, and refrigerant supplying apparatus located in the second compartment and connected to the cooling element.

7. The refrigerator defined in claim 6 having a motor substantially enclosed by the removable section of the division wall and having a drive shaft projecting into said space and connected to the fan.

WALTER P. HILL.

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