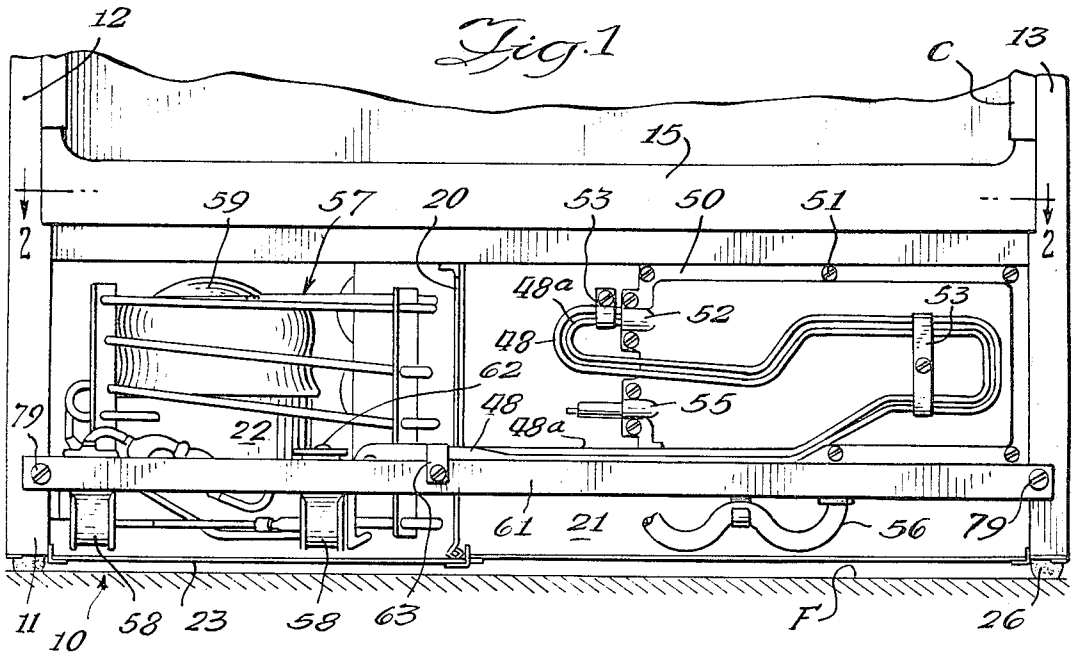
March 18, 1969 T. G. SCHEITLIN ETAL 3,433,031

REMOVABLE UNITARY REFRIGERATION SYSTEM

Filed Nov. 8, 1967 Sheet 1 of 3

Fig. 1



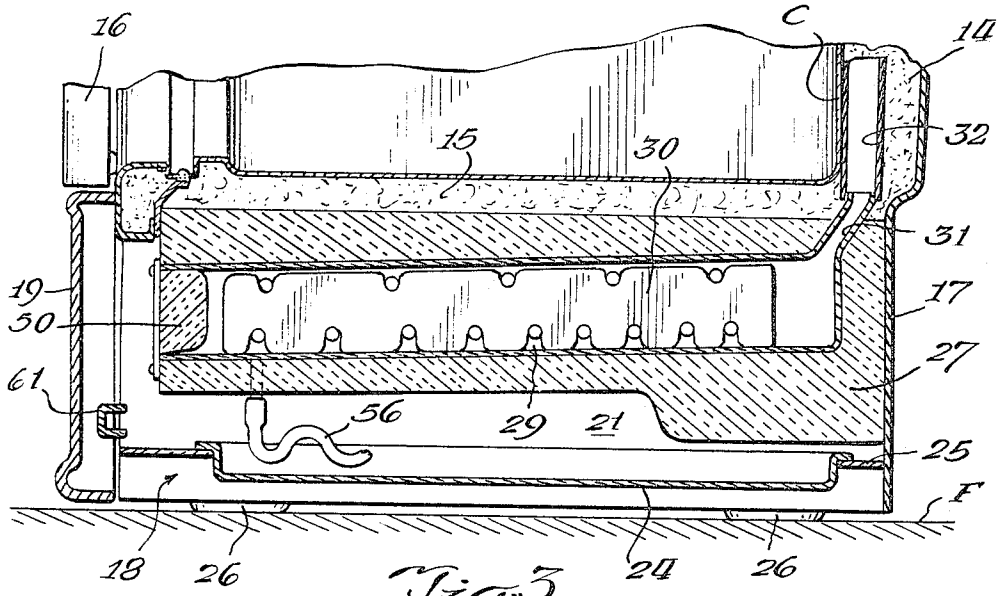


Fig. 3

INVENTORS
Thomas G. Scheitlin
William A. Hames
Alan J. Koch
BY Hofgren, Wegner, Allen, Stellman & McCord
ATTORNEYS

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Fig. 2

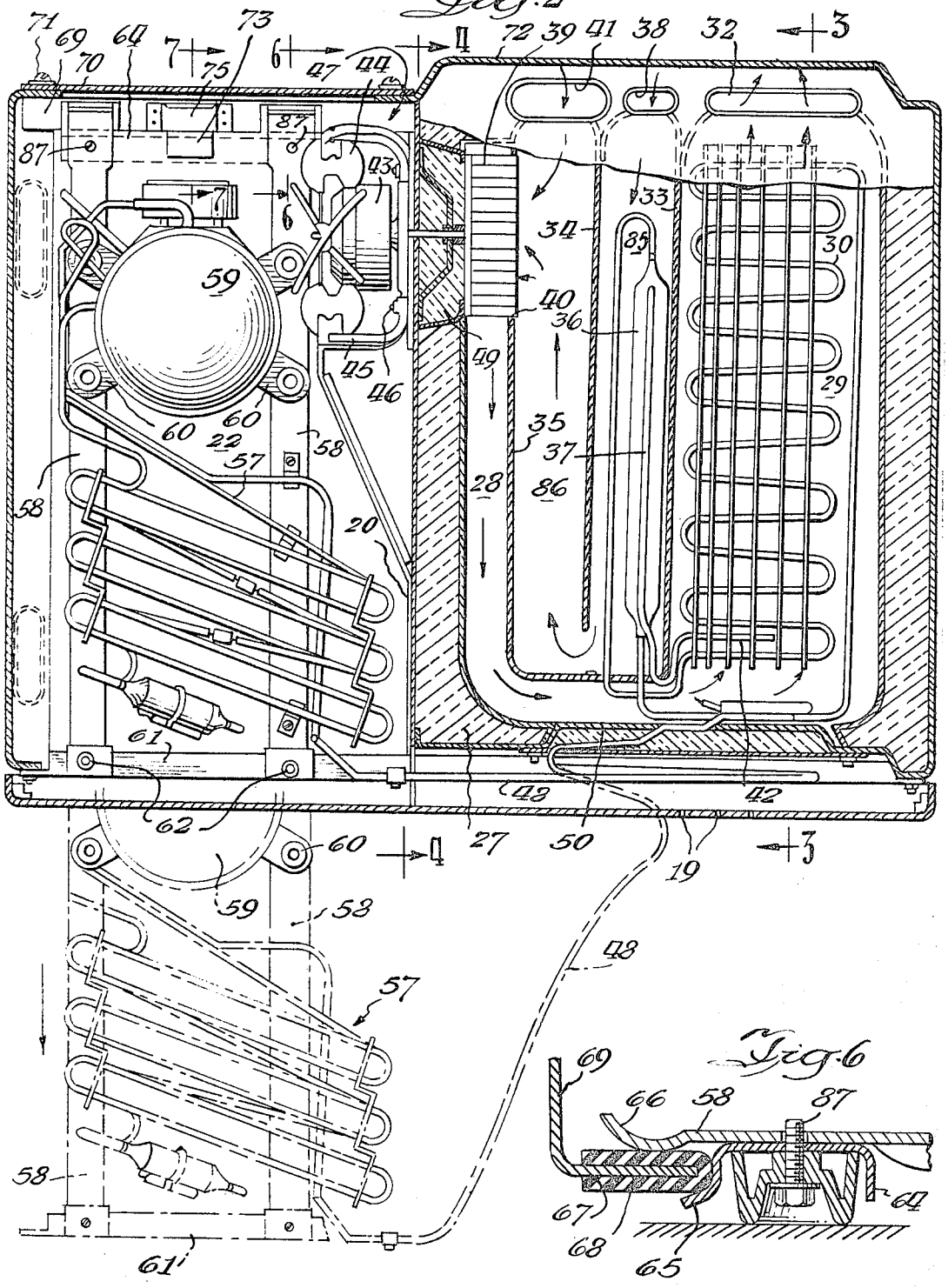

Fig. 6

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Fig. 4

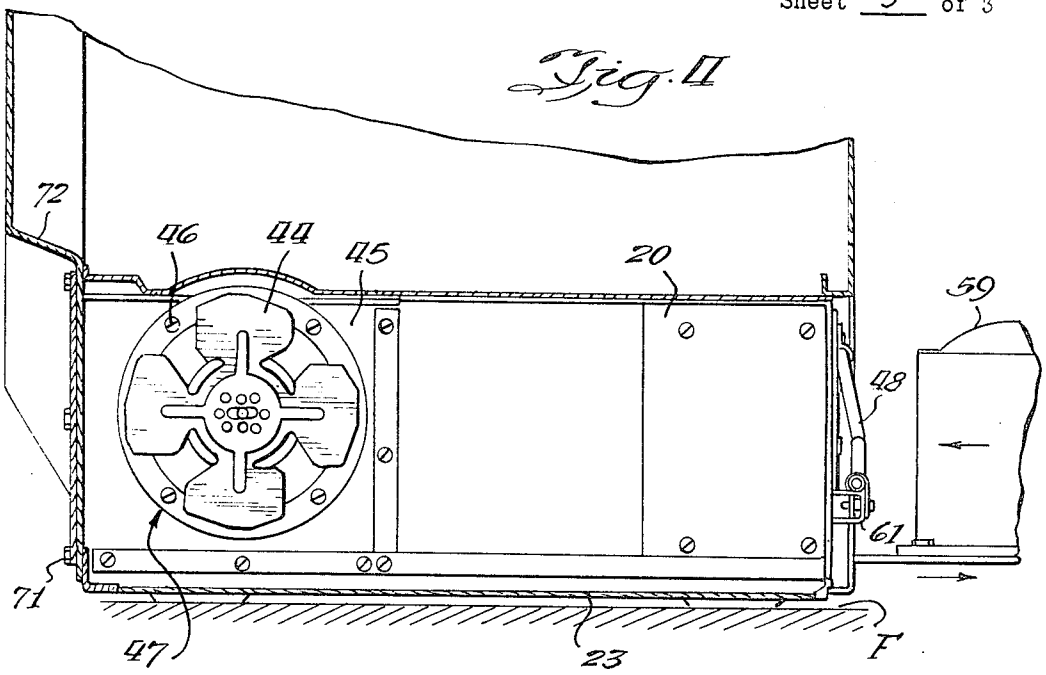


Fig. 5

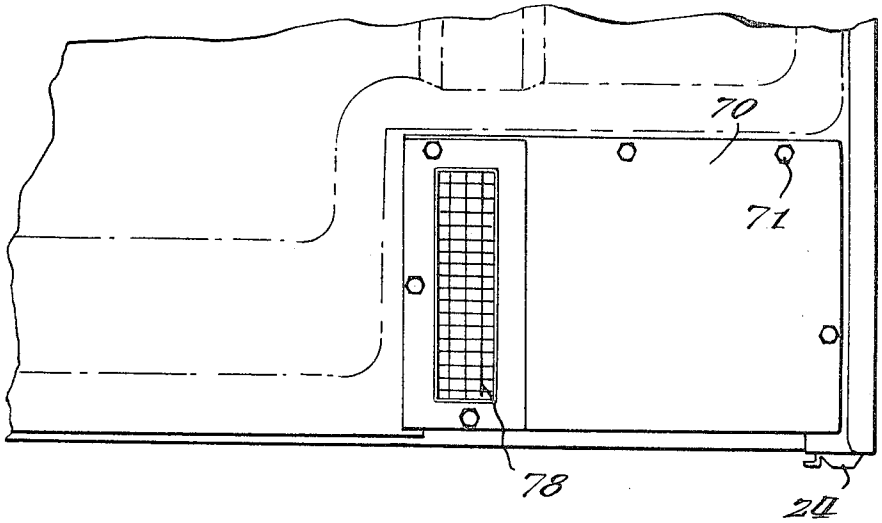
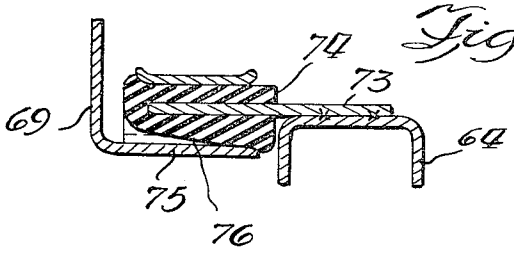


Fig. 7



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REMOVABLE UNITARY REFRIGERATION SYSTEM

Thomas G. Scheitlin, St. Paul, Minn., and William A. Hames and Alan J. Koch, Evansville, Ind., assignors to Whirlpool Corporation, a corporation of Delaware

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Int. Cl. F25d 19/02, 17/06

ABSTRACT OF THE DISCLOSURE

A removable unitary refrigeration system for a refrigerator comprising an evaporator connected by flexible conduits to a compressor and condenser mounted on a movable base, and means for moving air over the condenser and evaporator, with the evaporator, compressor and condenser accessible from the front and the air moving means accessible from the rear of the refrigerator.

This invention relates to refrigeration apparatus and in particular to a removable unitary refrigeration system.

One form of apparatus for refrigerating a cabinet such as a refrigerator cabinet including freezer and fresh food compartments includes a heat absorbing means, such as an evaporator for absorbing heat energy from the air provided for cooling the refrigerated compartments. The apparatus further conventionally includes a heat dispelling means, such as a condenser for dispelling heat energy to the ambient atmosphere. Certain of such refrigeration apparatuses include fluid moving means for effecting a circulation of fluid such as refrigerator compartment air in heat transfer association with the evaporator, and in certain of such apparatus, fluid moving means are provided for circulating a fluid such as the ambient atmosphere in heat transfer association with the condenser.

The present invention comprehends an improved refrigeration apparatus wherein the heat absorbing means, the heat dispelling means, and the air moving means are associated in a novel arrangement permitting facilitated servicing of the apparatus when desired.

Thus, a principal feature of the invention is the provision of such a refrigeration apparatus arranged in a new and improved manner for providing facilitated access to the air moving means as for servicing the same.

Another feature of the invention is the provision of such a refrigeration apparatus including means defining an equipment space, means in the space for absorbing heat, means in the space adjacent the heat absorbing means for dispelling heat, means in the space for moving a heat transfer fluid in heat transfer relationship with at least one of the heat absorbing and heat dispelling means, and means irremovably retaining the fluid moving means in the space when each of the heat absorbing and heat dispelling means are in a fully installed disposition in the space and permitting the fluid moving means to be removed from the space when one of the heat absorbing and heat dispelling means is displaced from the fully installed disposition.

A further feature of the invention is the provision of such a refrigeration apparatus arranged to provide such access to the air moving means without requiring removal of the heat absorbing means.

Other features and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawing wherein:

FIGURE 1 is a fragmentary front elevation of a refrigerator having a unitary refrigeration system embodying the invention;

FIGURE 2 is a horizontal section taken substantially along the line 2—2 of FIGURE 1 with the condenser portion of the apparatus shown in broken lines in a partially withdrawn position for providing access to the air moving means;

FIGURE 3 is a fragmentary vertical section taken substantially along the line 3—3 of FIGURE 2;

FIGURE 4 is a fragmentary vertical section taken substantially along the line 4—4 of FIGURE 2;

FIGURE 5 is a fragmentary rear elevation thereof;

FIGURE 6 is a fragmentary enlarged vertical section taken substantially along the line 6—6 of FIGURE 2; and

FIGURE 7 is a fragmentary enlarged vertical section taken substantially along the line 7—7 of FIGURE 2.

In the exemplary embodiment of the invention as disclosed in the drawing, a refrigerator generally designated 10 is shown to include a cabinet 11 defining a chamber C to be refrigerated. The cabinet 11 may include left side wall 12, right side wall 13, rear wall 14, and bottom wall 15. The chamber C may be selectively closed by a suitable conventional door 16. The side walls 12 and 13 may extend downwardly to below the level of the bottom wall 15, and the rear wall 14 may include an outer panel 17 which extends downwardly to below the level of bottom wall 15 to define an equipment space or compartment generally designated 18 below bottom 15. A suitable removable grille 19 may be provided for closing the front of space 18. Space 18 is divided by a vertical wall panel 20 into an evaporator compartment 21 and a condenser compartment 22. The bottom of the condenser compartment is closed by an acoustical baffle and air seal panel 23, and the bottom of the space beneath the evaporator compartment is closed by a pan 24 removably resting on a suitable flange 25 carried on the cabinet 11. Suitable depending legs 26 may be provided on the cabinet for supporting the cabinet slightly above the floor F.

Mounted in the evaporator compartment 21 is an evaporator housing 27 formed of a suitable insulating material, such as foamed plastic, and defining a blower outlet duct 28 (FIGURE 2) leading to an evaporator chamber 29 in which is mounted a conventional evaporator 30. Housing 27 further defines a rear air outlet duct 31 (FIGURE 3) leading to a delivery duct 32 within rear cabniet wall 14 arranged to deliver the refrigerated air to the refrigerated compartment, such as compartment C. As best seen in FIGURE 2, housing 27 includes spaced vertical walls 33, 34 and 35. Walls 33 and 34 define a space 85 in which is received an accumulator 36 and an accumulator heater 37. Air is delivered through space 85 from a first air inlet 38 which may comprise a refrigerator compartment inlet. Walls 34 and 35 define a passage 86 through which air is delivered from space 85 to a blower 39, the air being delivered to the blower 39 through an opening 40 in the wall 35. Air is additionally delivered to the passage 86 from a second air inlet 41 which may comprise an inlet from a freezer portion (not shown) of the refrigeration apparatus. As shown in FIGURE 2, the electric heater 37 would normally include a heater portion 42 in the evaporator chamber 29.

The blower 39 is driven by a motor 43 which also drives a fan 44 in a shroud 45 for conducting air from the condenser space 22 to the space 21 below the evaporator housing 27 and above pan 24. As shown in FIGURE 4, the fan assembly is secured to the wall 20 by means of suitable screws 46 removably securing the entire fan and blower assembly, generally designated 47, to the wall 20 with the blower 39 disposed within the evaporator housing 27 and the fan 44 disposed within the condenser space 22 to provide two separate air flows in the refrigeration apparatus. An insulated access plug 49 is part of fan and blower assembly 47 and seals the opening in

evaporator housing 27 through which blower 39 is inserted.

As discussed briefly above, at times it is desirable to remove the fan and blower assembly 47 as for servicing the same. In apparatus 10 this may be done without the need of removing the evaporator 30 and accumulator 36. As shown in FIGURE 1, refrigerant fluid conduits 48 and 48*a* leading to the evaporator 30 extend outwardly through an insulated front wall 50 secured to the front of the evaporator housing 27 by suitable means such as screws 51. The conduits extend through a suitable outlet 52 and are secured to the front of the wall 50 by suitable clamps 53. The electric heater wire 54 connects to the heaters 37 and 42 may similarly be brought out through the front wall 50 through an outlet 55. When secured in place, the front wall 50 seals evaporator housing 27. As shown in FIGURE 3, a drain conduit 56 may be provided extending downwardly from the housing 27 to deliver melt and the like into the pan 24.

As shown in FIGURE 2, conduit 48 is made to be sufficiently flexible to permit movement of the apparatus in condenser chamber 22 sufficiently forwardly therefrom to provide clearance within the chamber 22 in front of the fan and blower structure 47 thereby to permit removal of the fan and blower structure. More specifically, as shown in FIGURE 2, the conduit 48 is made to be sufficiently flexible so as to permit fixed retention of the evaporator structure in the space 21, thereby maintaining the sealed closure of evaporator housing 27 by front wall 50. As shown, the condenser 57 is carried on a pair of rails 58. A compressor 59 is mounted on the rails by suitable supports 60 adjacent the rear of the rails. The rails 58 are joined at their front ends by a cross, or front, rail 61 by suitable securing means such as screw means 62. As shown in FIGURE 1, the conduit 48 may be clamped to the front rail 61 by a suitable bracket 63. The rear ends of the rails 58 are joined by a cross rail 64 by means of suitable fastening means such as screws 87. As shown in FIGURE 6, the cross rail 64 is provided with a downturned rear flange 65 and the rear end of the rail 58 defines an upturned spring flange 66 cooperating with the flange 65 to define a spring clamp adapted to receive yieldingly a rubber isolator 67 carried on a forwardly turned flange 68 of a rear cabinet rail 69. As shown in FIGURE 7, the cross rail 64 further carries a rearwardly extending bracket 73 provided with a rubber isolator 74 adapted to be received in a socket portion 75 carried on the midportion of the cabinet back rail 69 (see FIGURE 2). As shown in FIGURE 7, the lower edge 76 of the isolator 74 is slanted rearwardly upwardly so as to cam the cross rail 64 upwardly and thereby assure that the assembly of the rails, condenser, and compressor is raised upwardly of the panel 23, thereby isolating the operating mechanism and effectively minimizing transmission of vibration therefrom to the floor during operation of the refrigeration apparatus.

As shown in FIGURE 5, a panel 70 covers a fan assembly access rear opening and is provided with a screen portion 78 through which some of the air delivered by the fan 44 is bled off to reduce static pressure within fan shroud 45.

The condenser 57 and evaporator 30 thusly may be preassembled by means of the front rail 61 which as shown in FIGURE 1 extends the width of the cabinet 11 and is secured to the cabinet by means of screws 79. Thus, the system may be precharged as a complete refrigeration system prior to the mounting thereof on the cabinet 11. To install this sub-assembly, the evaporator housing 27 is first disposed within the space 21, as shown in FIGURES 2 and 3. The evaporator 30 and accumulator 36 are then inserted into the housing while the condenser and compressor are inserted into the space 22 to the position shown in FIGURES 2 and 3. In the fully inserted position as discussed above, isolator 67 is received in the clamp defined by flanges 65 and 66, and isolator 74 is received in the socket 75. The fan and blower structure 47 is mounted in the cabinet prior to the installation of the condenser and compressor in the space 22. When the condenser and compressor structure are so installed, removal of the fan and blower structure 47 is prevented by the rearward portion thereof. The evaporator housing 27 is then sealingly closed by the front wall 50 and the conduit 48 is secured to the closure by clamps 53.

As discussed above, upon energization of the refrigeration apparatus, including the fan and blower assembly 47, ambient air is drawn by fan 44 inwardly through space 22, thereby to remove heat from the condenser 57 and compressor 59 and discharge the heated air forwardly through space 21 under the insulated evaporator housing 27. Concurrently, air is circulated from blower 39 through passage 28 over the evaporator coil 30 and delivered therefrom upwardly to the cabinet chamber C through delivery duct 32, as best seen in FIGURES 2 and 3.

It has been found from time to time that servicing of the fan and blower structure 47 may be required. Apparatus 10 is so constructed as discussed above to permit forward movement of the rails 58 carrying the condenser 57 and compressor 59 to a forward position, as shown in broken lines in FIGURE 2, providing clearance at the rear of the space 22 for facilitated removal of the fan, motor and blower structure 47 through the opening covered by panel 70. To permit this, the rail 61 is disconnected from the cabinet by removing the securing screw means 79. As shown in FIGURE 2, the conduit 48 is sufficiently flexible after removal of clamps 53 to permit such forward displacement of the condenser and compressor without the necessity of removing the closure 50 and thereby permitting the sealed closure of the housing 27 to be maintained.

When the fan, motor and blower structure 47 is suitably serviced and remounted within the cabinet, as shown in FIGURE 2, the compressor 59 and condenser 57 may be reinserted into the space 22 by the simple rearward movement of the compressor and condenser portion of the assembly. Upon completion of the reinstallation of the compressor 59 and condenser 57, the rail 61 may again be secured to the cabinet by the screws 79 and the clamps 53 replaced to complete the reassembly of the apparatus. As discussed above, the rails 58 are automatically guided and clamped in the reinserted position of FIGURE 2 by the cooperating isolator 67 and clamp structure 65, 66 and isolator 74 and structure 75.

Thus, apparatus 10 provides an improved preassembly relationship of the refrigeration apparatus including the compressor 59, evaporator 30, accumulator 36, and condenser 57, while yet permitting facilitated removal of the fan, motor and blower structure 47 when desired without the necessity of disturbing the sealed installation of the evaporator and accumulator within the housing 27. As shown, the refrigeration system may be disposed fully below the bottom wall 15 so that a standardized refrigeration system may be utilized with different cabinet chamber arrangements as desired. The forward displacement of the compressor 59 to permit removal of the fan, motor and blower structure 47 when desired is readily effected from the front of the cabinet as discussed above. Access to the fan, motor and blower structure 47 at the rear of the space 22 is readily effected by the removal of the panel 70.

While we have shown and described one embodiment of our invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as defined in the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a refrigeration apparatus having means forming

a compartment to be refrigerated and means forming an equipment compartment;

an insulated housing in said equipment compartment;

means forming air ducts connecting said compartment to be refrigerated to said insulated housing;

a condenser, compressor and evaporator assembled as a unit in said equipment compartment and having flexible conduit means for connecting said evaporator to said condenser and compressor, said evaporator being positioned in said insulated housing and said condenser and compressor being positioned adjacent said insulated housing;

air moving means in said equipment compartment for moving air relative to said condenser, compressor and evaporator, said air moving means including an evaporator blower in said insulated housing for moving air between said insulated housing and said compartment to be refrigerated;

means for sealing said insulated housing with a portion of said flexible conduit means positioned exteriorly of said insulated housing; and

means for mounting said condenser and compressor for movement relative to said evaporator and said insulated housing between a position preventing removal of said air moving means from said equipment compartment and a position permitting such removal, said movement being accomplished without disturbing the sealed condition of said insulated housing due to the flexibility of said flexible conduit means.

2. In a refrigeration apparatus as claimed in claim 1 wherein said means forming an equipment compartment includes a first and second access portion, one of said condenser and said evaporator being displaceable through said first access means and said air moving means being removable through said second access means.

3. In a refrigeration apparatus as claimed in claim 1 wherein said means forming an equipment compartment includes a front and rear access portion, one of said condenser and said evaporator being displaceable through said front access means and said air moving means being removable through said rear access means.

4. In a refrigeration apparatus as claimed in claim 1 wherein said means forming an equipment compartment includes a first portion and said air moving means includes means for flowing air seriatim inwardly through said first portion, in heat exchange relationship with said condenser, and outwardly through said first portion.

5. In a refrigeration apparatus as claimed in claim 1 wherein said air moving means includes unitary means for moving a first stream of air in heat exchange relationship with said condenser and a second stream of fluid in heat exchange relationship with said evaporator.

6. In a refrigeration apparatus as claimed in claim 1

wherein said one of said condenser and said evaporator and said means forming an equipment compartment are provided with cooperating gripping means for releasably holding said one of said condenser and said evaporator in fully installed disposition.

7. In a refrigeration apparatus as claimed in claim 6 wherein said means forming an equipment compartment includes a bottom wall, said one of said condenser and said evaporator includes means for movably engaging said bottom wall when moving toward and from fully installed disposition, and said means forming an equipment compartment includes means for spacing said one of said condenser and said evaporator upwardly of said bottom wall in said fully installed disposition.

8. A household refrigerator comprising a cabinet including freezer and fresh food compartments in the upper portion thereof separated by an insulated partition and a condensing unit compartment and an insulated evaporator compartment in side-by-side position in the lower portion of said cabinet and separated by an insulated wall, said condensing unit and evaporator compartments having access openings adjacent one another on a first side of said cabinet, a unitary removable refrigerating apparatus including a condensing unit in said condensing unit compartment and an evaporator unit in said evaporator compartment, an insulated over for closing the access opening to said evaporator compartment, refrigerant conduit means connecting said condensing unit and said evaporator, said conduit means being flexibly arranged outside of said insulated cover to permit movement of said condensing unit away from said first cabinet side independent of said evaporator, condenser and evaporator fan means mounted to said cabinet for flowing air over said condenser and said evaporator, and an access opening on a second side of said cabinet opposite said first side to permit removal of said condenser and evaporator fan means without having to remove said evaporator cover.

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LLOYD L. KING, *Primary Examiner.*

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