June 30, 1942. A. A. KUCHER 2,288,166

REFRIGERATING APPARATUS

Filed Dec. 23, 1940 3 Sheets-Sheet 1

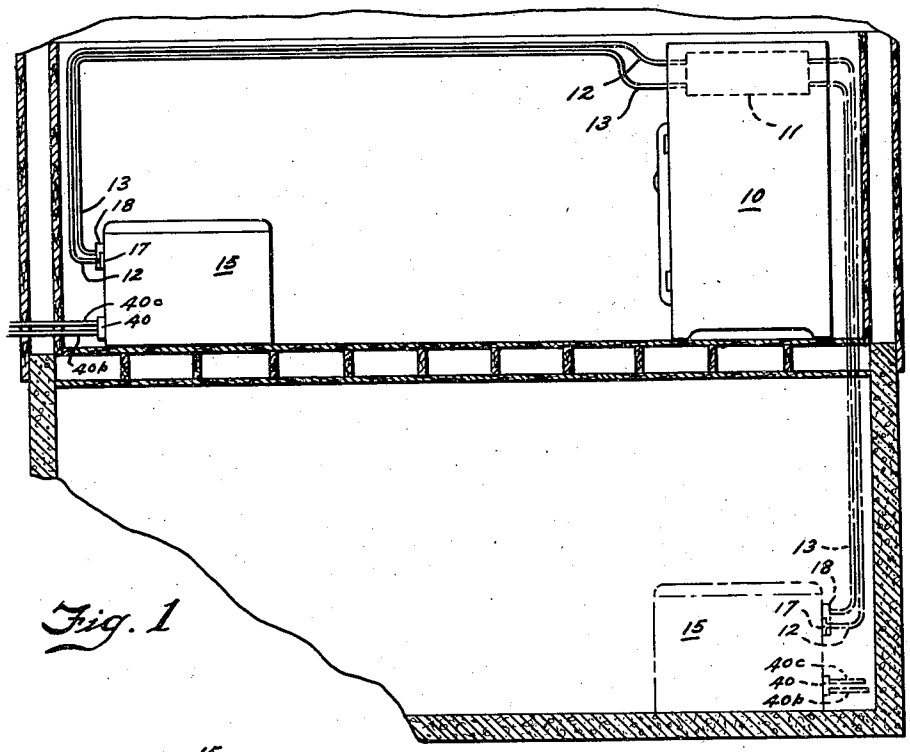


Fig. 1

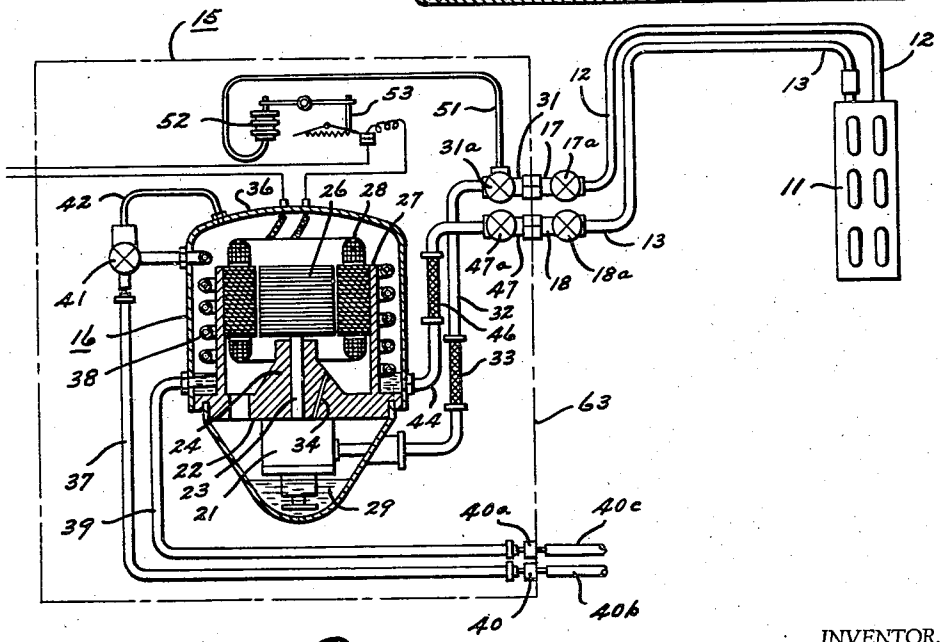


Fig. 2

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REFRIGERATING APPARATUS

Filed Dec. 23, 1940 3 Sheets-Sheet 2

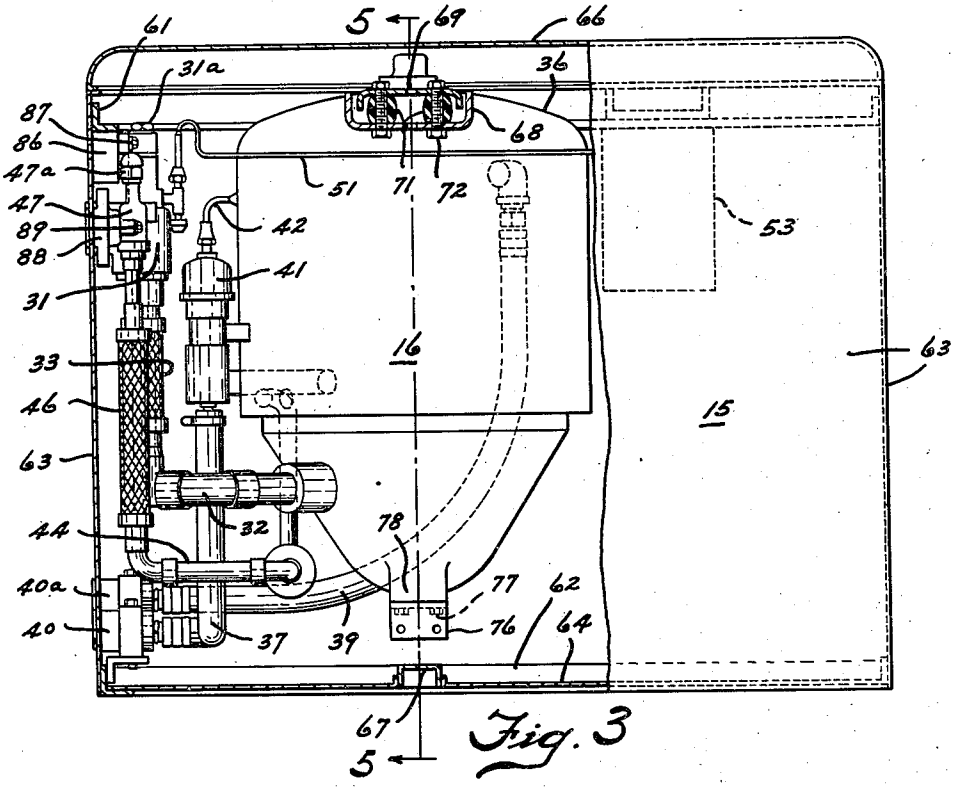


Fig. 3

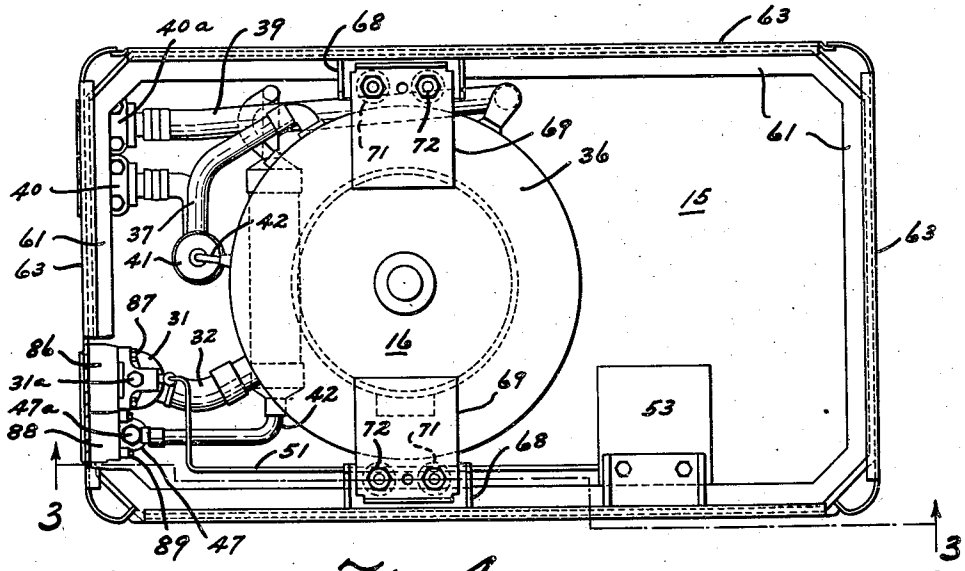


Fig. 4

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Filed Dec. 23, 1940 3 Sheets-Sheet 3

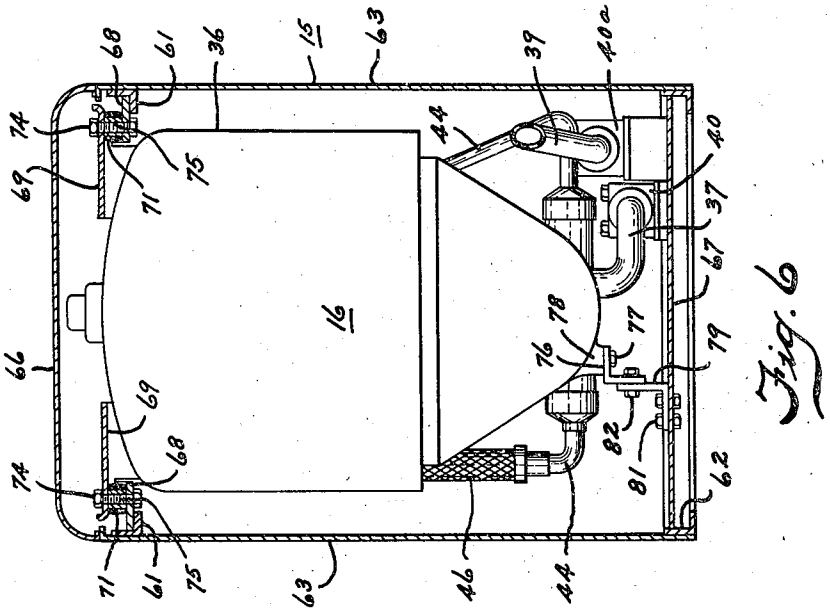


Fig. 6

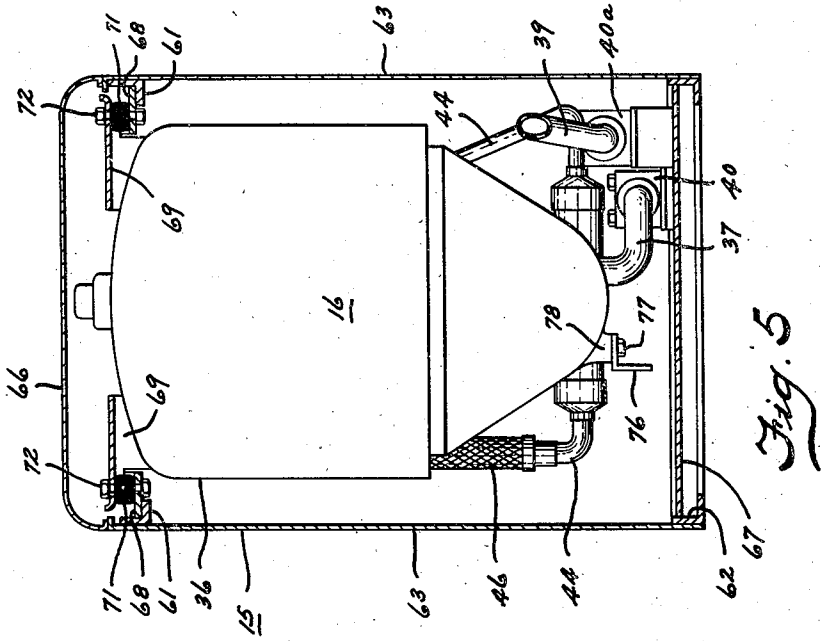


Fig. 5

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Patented June 30, 1942 2,288,166

UNITED STATES PATENT OFFICE

2,288,166

REFRIGERATING APPARATUS

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Application December 23, 1940, Serial No. 371,241

9 Claims. (Cl. 62—116)

This invention relates to refrigerating apparatus and particularly to portable commercial refrigerating units.

An object of my invention is to provide an improved refrigerant compressing and liquefying unit that can be readily connected with an evaporator or evaporators of a refrigerating system and quickly disconnected therefrom to permit replacement of the unit.

Another object of my invention is to provide an improved refrigerating apparatus in the form of a unitary portable cabinet containing a sealed motor-compressor-condenser-receiver unit and the desired controls therefor, wherein the unit is suspendingly supported within the cabinet solely through sheet metal side walls thereof.

Another object of my invention is to rigidly mount a casing, having a rotary compressor, a motor and a condenser-receiver unit sealed therein, within a cabinet for shipping purposes which mounting includes flexible members for resiliently suspending the casing within the cabinet and which flexible members are rendered effective by rendering the rigid mountings ineffective after the cabinet is installed in its desired location.

A further object of my invention is to provide a unitary packaged structure comprising a cabinet having a rotary compressor, a motor and a condenser-receiver unit disposed therein and provided with refrigerant conduits extending to a wall of the cabinet for connection from exteriorly of the cabinet to refrigerant pipes leading to an evaporator or evaporators to form a closed refrigerating system.

In carrying out the foregoing objects, it is a still further and more specific object of my invention to provide the refrigerant conduits located at the wall of the packaged unit with couplings, each containing a valve and adapted to be connected to similar couplings provided on the ends of refrigerant pipes leading to an evaporator whereby the valves may be closed and the couplings disconnected to permit replacement of the unit by another unit without pumping refrigerant from one portion of the refrigerating system to another portion thereof and without losing any appreciable amount of refrigerant from the system.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a view illustrating the refrigerant compressing and liquefying unit of the present invention disposed at optional locations with respect to a refrigerator to be cooled;

Fig. 2 is a diagrammatic view of a closed refrigerating system having the refrigerant compressing and liquefying unit of the present invention interposed therein;

Fig. 3 is a vertical sectional view of the unitary portable cabinet structure containing the refrigerant compressing and liquefying unit and is taken on the line 3—3 of Fig. 4;

Fig. 4 is a top view of the structure shown in Fig. 3 with the top wall of the cabinet removed;

Fig. 5 is a vertical sectional view taken on the line 5—5 of Fig. 3; and

Fig. 6 is a view similar to Fig. 5 showing shipping bolts in place to rigidly clamp the refrigerant compressing and liquefying unit to the frames of the cabinet.

Referring to the drawings, for illustrating my invention, I have shown in Fig. 1 thereof, a refrigerating apparatus of the commercial type including a large meat storage box or the like to be refrigerated by an evaporator connected with a refrigerant compressing and liquefying unit constructed in accordance with the present invention. The refrigerated box 10 may be of conventional construction and may include a storage compartment and a compartment disposed thereabove and containing an evaporator 11 of any suitable or conventional design. Evaporator 11 has refrigerant conveying pipes 12 and 13 connected thereto and extending outwardly of box 10 and leading to a portable structure, generally represented by the reference character 15, and which comprises a cabinet housing refrigerant compressing and liquefying unit with which the pipes 12 and 13 communicate. The portable cabinet structure 15 is disposed remote from the refrigerator 10 and may be located on the same floor therewith or in a basement below the floor of the building in which the box 10 is located. This latter or alternate location of the portable cabinet structure 15 is illustrated in Fig. 1 by the dot-dash lines. The self-contained portable cabinet structure 15 encloses a hermetically sealed motor-compressor-condenser-receiver unit, generally represented by the reference character 16 and the pipes 12 and 13 leading from the evaporator 11 are connected by valved couplings 17 and 18, disposed on the outside of a wall of cabinet 15, to the unit 16.

As diagrammatically shown in Fig. 2, the unit 16 comprises a conventional rotary compressor

21, supported from a main frame 22, forming a part of the sealed casing of the unit. The drive shaft 23, of compressor 21, is journalled in the main bearing 24 formed integral with the main frame 22. Secured to the upper end of the drive shaft 23 is a conventional motor rotor 26. A cylindrical motor stator support 27, which supports a conventional motor stator 28, is also formed integral with the frame 22. In the lowermost portion of the hermetically sealed casing of unit 16 there is provided a supply of lubricant 29 which may be used for lubricating the bearing surfaces and other operating parts of the motor-compressor in any well known manner. Refrigerant vapor returning from the evaporator 11 through pipe 12 and coupling 17 enters a valved coupling 31 disposed adjacent the inner face of a side wall of cabinet 15. The refrigerant vapor is conducted from coupling 31 by a conduit 32, having a flexible conduit portion 33, into the compressor 21. This vaporous refrigerant is compressed by the compressor 21 and discharged through the discharge passage 34, provided in the main frame 22. The compressed refrigerant vapor passes upwardly between the motor rotor and the motor stator into the upper portion of a dome 36 of the casing of unit 16, which dome cooperates with the frame element 22 to form a condensing cavity. In order to remove the heat of compression and to cause condensation of the compressed refrigerant, a cooling fluid, such as water, is supplied through conduit 37 and flows through coil 38 disposed in the space between the motor stator support 27 and the outer dome 36. The cooling fluid leaves the unit through the conduit 39. The water conduits 37 and 39 include a rubber hose or flexible portion and the ends thereof are attached to fittings 40 and 40*a* respectively mounted upon a bracket secured to a lower frame of cabinet 15. These fittings are disposed adjacent a side wall of cabinet 15 and project through this wall for connection with a water supply pipe 40*b* and a drain pipe 40*c*. The amount of cooling water flowing through coil 38 is controlled by a conventional pressure responsive valve 41 which responds to the high side pressure within the condensing chamber. In order that valve 41 may respond to condensing pressure, a pipe line 42 is provided between the pressure chamber of valve 41 and the interior of the main condensing chamber. The condensed refrigerant collects in the lower portion of the space between the wall 27 and the outer dome 36 and flows toward the evaporator 11 through a conduit 44, having a flexible conduit portion 46, to the valved coupling 47, disposed adjacent the inner surface of the wall of cabinet 15. From the fitting 47, liquid refrigerant flows through the valved coupling 18 and by way of pipe 13 into the evaporator 11 under the control of a suitable restrictor or the like device. The compressor motor may be started and stopped in response to the pressure in the low pressure side of the refrigerating system. Thus a pipe line 51 communicating with the interior of valved coupling 31, disposed in the low or suction pressure conduit line of the refrigerating system, extends to an expansible and contractible bellows 52 of a snap acting switch 53 which controls the electric circuit to the motor and consequently controls operation of the rotary compressor directly connected to the motor.

Having diagrammatically illustrated the refrigerating system, the structure of the portable construction or cabinet 15, will now be described with reference to Figs. 3, 4, 5 and 6. Structurally, the cabinet 15 comprises an upper horizontally disposed angle iron frame 61 and a lower horizontally disposed angle iron frame 62, having a plurality of sheet metal side walls 63 welded or otherwise permanently secured to one another and to the frame. A sheet metal bottom wall 64 (see Fig. 3) is secured to the bottom frame 62 and a sheet metal top wall 66 is removably placed upon the side walls 63 to provide an enclosure or compartment within the cabinet 15 for housing the refrigerant compressing and liquefying unit 16. One of the long side walls of cabinet 15 is removable from the cabinet frames 61 and 62, and this side wall together with the removable top provides access to the unit compartment should adjustment of various elements be necessary. The vertical edges of the short side or end walls 63 of cabinet 15 are preferably bent around a corner of the cabinet (see Fig. 4) to increase the rigidity or structural strength of these side walls. A brace 67 extends between opposite sides of the lower frame 62 and is welded thereto for a purpose to be presently described. Each side of the upper frame 61 has a heavy metal piece 68 welded thereto and extending inwardly therefrom. The dome 36, of sealed casing or unit 16, has arms 69 welded thereto and projecting outwardly therefrom. The outer ends of the arms 69 are located above the metal pieces 68, secured to frame 61, to suspend or support unit 16 from the frame. A pair of rubber cushions or blocks 71 are disposed between each arm 69 and its respective metal piece 68, to resiliently suspend the unit 16 and to prevent sounds generated thereby from being transmitted to the cabinet. Small bolts 72 pass through the metal pieces 68, cushions 71 and the ends of arms 69 to retain the cushions in proper place. After installation of cabinet 15, at a desired location, unit 16 therein is connected to the cabinet only in the manner heretofore described and the unit 16 is resiliently suspended from the upper frame and supported within the cabinet compartment solely by the sheet metal side walls of the cabinet. However, during shipment or transportation of cabinet 15, unit 16 is preferably rigidly clamped or secured thereto at several places in order to prevent twisting of the cabinet by the weight of the unit. Therefore, I provide rather heavy bolts 74 (see Fig. 6) and extend these bolts through the arms 69, pieces 68 and a bushing 75, placed between the arms 69 and pieces 68, to rigidly clamp the uppermost portion of unit 16 to the frame 61. These shipping bolts 74 and clamping bushings 75 are disposed intermediate each pair of rubber cushions 71. I also rigidly clamp the lower portion of unit 16 to the bottom frame 62 of cabinet 15 to prevent the unit from swinging and twisting about its upper connection with the top frame. Metal piece 76 has one leg thereof secured by bolts 77 to a lug 78 formed on the casing at the bottom of unit 16. Another metal piece 79 has a leg secured by bolts 81 to the horizontal brace 67, extending between the sides of the lower frame 62. The upwardly directed leg of piece 79 and the depending leg of piece 76 abut one another and have bolts 82 extending therethrough. Metal pieces 76 and 79 being tied together and secured to the brace 67, thus rigidly clamp the unit 16 to the lower cabinet frame 62 through the horizontal brace 67. The clamping of the upper

portion of unit 16 at the two spaced apart points with the upper frame 61 and the clamping thereof at the one point with the lower frame 62 thereby rigidly secures the unit to the cabinet during shipment and prevents the cabinet from being damaged by the weight of the sealed unit mounted therein. The clamping devices or bolts are readily removed after installation of the cabinet to permit the resilient suspension of the unit within the cabinet as previously described and shown in Figs. 3 and 5 of the drawings. For example, after the cabinet has been installed at a predetermined location, the bolts 81 and 82, and the metal piece 79 are removed. Thereafter the bolts 74 and bushings 75 are removed from the upper unit supports to render the cushions 71 effective for resiliently suspending unit 16 within cabinet 15. The cushions 71 and the flexible portions 33 and 46 of conduits 32 and 44 permit slight vibrating movement of unit 16 relative to cabinet 15 upon the cushions 71.

The valved housings or couplings 17, 18, 31 and 47 each include a body having a passage therethrough and a valve for controlling the passage. The valves 17*a*, 18*a*, 31*a* and 47*a*, as illustrated in Fig. 2, of each coupling, are preferably disposed in and enclosed by the body portion of the couplings. As before stated the valved couplings 31 and 37 connected with the conduits 32 and 44, respectively, are disposed adjacent one another within the cabinet 15 and preferably project through a suitable opening provided in one side wall thereof to permit the other valved couplings 17 and 18 to be detachably connected therewith from exteriorly of the cabinet. Coupling 31 is mounted by bolts 87, upon a block 86 (see Fig. 3) which is welded or otherwise secured to the cabinet frame 61 so as to retain the coupling 31 in its proper location adjacent the opening in the side wall of cabinet 15. Coupling 31 has an offset portion 88 formed integral therewith to receive bolts 89 which clamp the coupling 47 thereto. In this manner both couplings or valve housings 31 and 47 are attached to the block or plate 86 secured to the upper frame 61. The detachably connected together couplings 17—18 and 31—47 each of which have a valve therein, are provided for the purpose of facilitating connecting the unit 16, within cabinet 15, into the closed refrigerant circulating system and to permit replacement of the refrigerant compressing and liquefying unit. The refrigerant pipe lines 12 and 13, connected to the evaporator 11, are extended to a point where the cabinet 15 is to be located and the ends of these pipe lines are normally sealed by valves 17*a* and 18*a* of the valved couplings 17 and 18. The valved couplings 17 and 18 may be secured to the pipes 12 and 13 or they may be shipped as a part of the cabinet structure 15 and secured to the pipes 12 and 13 after location of cabinet 15 in the desired position of installation. The valves 31*a* and 47*a* of couplings 31 and 47 respectively, projecting through a side wall 63 of cabinet 15, are also closed to seal the ends of conduits 32 and 44 of unit 16. Therefore, when cabinet 15 is placed in its predetermined position of installation, coupling 17 is detachably connected with coupling 31 and coupling 18 is detachably connected with coupling 47 to thereby form the closed refrigerant circulating system between the evaporator 11 and unit 16. Should the unit 16 become inoperative, due to damage thereto, beyond repair, while the same is connected in the closed refrigerating system, this unit can be readily removed from the refrigerating system, without pumping refrigerant from one portion of the system to another portion thereof and without losing any appreciable amount of refrigerant from the system. For example, should it be necessary to replace unit 15, the valves 17*a*, 18*a*, 31*a* and 47*a* are all closed. Thereafter coupling 17 is detached from coupling 31 and coupling 18 is detached from coupling 47. Then after closing off the water supply and disconnecting water pipes 40*b* and 40*c* attached to the fittings 40 and 40*a* at the ends of the water conduits 37 and 39, the cabinet 15 and consequently unit 16 may be removed. Upon reversing these operations, a replacement unit may be readily interposed in the refrigerating system in order that the evaporator can quickly resume the function of producing a refrigerating effect within the food storage box 10. It is to be understood that the water supply and drain pipes leading to the conduits 37 and 39 connected to the unit must also be reconnected when replacing the cabinet 15.

From the foregoing, it will be seen that I have provided an improved refrigerant compressing and liquefying unit which is neat in appearance and can be located at any desired or convenient locality remote from the refrigerator box. The cabinet containing the refrigerant compressing and liquefying unit is in itself a complete construction to form one portion of a refrigerating system and the necessary valves, controls and switches are disposed therein to thus avoid mounting these elements on walls or partitions of the building in which the refrigerating apparatus is located. By rigidly securing some of the sheet metal side walls to the horizontal frames of the cabinet, these side walls form the sole support for suspendingly mounting the casing of the refrigerant compressing and liquefying unit within the cabinet. I have provided means for rigidly clamping the refrigerant compressing and liquefying unit to the cabinet for shipping the portable structure which rigid clamping means when removed, after installation of the cabinet, renders resilient suspending means for the unit effective. The valved couplings in the refrigerant pipes, in addition to facilitating the installation and connection of a refrigerant compressing and liquefying unit into a closed refrigerant circuit or system, are detachable from one another, after the valves therein are closed to permit replacement of the unit without losing any material amount of refrigerant from the refrigerating system. By providing means whereby the refrigerant compressing and liquefying unit of a refrigerating system can be readily and quickly removed and replaced, I have improved commercial refrigerating systems in that the refrigerator box is not deprived of refrigeration for a long period of time. The change over from one unit to another requires but a few minutes and therefore food stored within the refrigerator cabinet is not permitted to deteriorate or spoil.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A refrigerating apparatus comprising in combination, a portable cabinet having upright and other walls forming a compartment therein, a refrigerant compressing and liquefying unit resiliently mounted within said compartment,

refrigerant conduits connected to said unit and to couplings disposed adjacent the inner face of an upright wall of said compartment, couplings disposed adjacent the outer face of said upright compartment wall and adapted to be connected to refrigerant conveying pipes communicating with an evaporator, said second named couplings communicating with said first named couplings and adapted to form a closed refrigerant circuit between the evaporator and said unit, a valve in each of said couplings, said valves being operable to close off communication between said couplings, said second named couplings being detachable from said first named couplings to permit movement of said cabinet relative to said refrigerant conveying pipes, and said refrigerant conduits including a flexible conduit portion for permitting movement of said unit relative to said compartment walls.

2. A refrigerating apparatus comprising in combination, a cabinet having a lower horizontally disposed frame, an upper horizontally disposed frame and side walls secured to said frames to form a compartment, a refrigerant compressing and liquefying unit enclosed by said side walls within said compartment, means for suspending said unit from said upper frame and supporting same within said compartment above said lower frame solely by said side walls, said suspending means including detachable means for rigidly clamping said unit to said upper frame during transportation of said cabinet, and said suspending means also including resilient means rendered effective upon detachment of said detachable means for preventing transmission of sound from said unit to said cabinet.

3. A refrigerating apparatus comprising in combination, a cabinet having a lower horizontally disposed frame, an upper horizontally disposed frame and side walls secured to said frames to form a compartment, a refrigerant compressing and liquefying unit enclosed by said side walls within said compartment, means for suspending said unit from said upper frame and supporting same within said compartment above said lower frame solely by said side walls, said suspending means including detachable means for rigidly clamping said unit to said upper frame during transportation of said cabinet, and said suspending means also including a rubber cushion disposed between said unit and said upper frame and rendered effective upon detachment of said detachable means for preventing transmission of sound from said unit to said cabinet.

4. A refrigerating apparatus comprising in combination, a cabinet having walls forming the top and four sides of a compartment therein, an upper horizontally disposed frame and a lower horizontally disposed frame, at least three of said side walls of said compartment being secured to said frames, a refrigerant compressing and liquefying unit within said compartment, means for suspending said unit from said upper frame and supporting same within said compartment above said lower frame solely by the side walls secured to said frames, and the top and at least one side wall of said compartment being removable from said frames to provide access to said unit.

5. A refrigerating apparatus comprising in combination, a cabinet having walls forming the top and four sides of a compartment therein, an upper horizontally disposed frame and a lower horizontally disposed frame, at least three of said side walls of said compartment being secured to said frames, a refrigerant compressing and liquefying unit within said compartment, means for suspending said unit from said upper frame and supporting same within said compartment above said lower frame solely by the side walls secured to said frames, the top and at least one side wall of said compartment being removable from said frames to provide access to said unit, said suspending means including detachable means for rigidly clamping said unit to said upper frame during transportation of said cabinet, and said suspending means also including resilient means rendered effective upon detachment of said detachable means for preventing transmission of sound from said unit to said cabinet.

6. A refrigerating apparatus comprising in combination, a portable cabinet having walls forming a compartment therein, a refrigerant compressing and liquefying unit within said compartment, said unit including a motor, a rotary compressor and a condenser enclosed in a sealed casing, refrigerant conduits connected to the compressor part of said casing and having couplings therein disposed adjacent the inner face of a wall of said compartment, couplings disposed adjacent the outer face of said compartment wall and adapted to be connected to refrigerant conveying pipes communicating with an evaporator, said second named couplings communicating with said first named couplings and adapted to form a closed refrigerant circuit between the evaporator and said rotary compressor, a valve in each of said couplings, said valves being operable to close off communication between said couplings, and said second named couplings being detachable from said first named couplings to permit movement of said cabinet relative to said refrigerant conveying pipes.

7. A refrigerating apparatus comprising in combination, a portable cabinet having a horizontally disposed frame at the top thereof and a horizontally disposed frame at the bottom thereof, side walls secured to said frames to form a compartment, a refrigerant compressing and liquefying unit enclosed by said side walls and having provisions for connecting same with refrigerant conduits adapted to communicate with an evaporator located exteriorly of said cabinet, said unit including a motor, a compressor and a condenser enclosed in a sealed casing, and said casing being suspended from said frame at the top of said cabinet and supported within said compartment above the frame at the bottom of said cabinet solely by said side walls.

8. A refrigerating apparatus comprising in combination, a portable cabinet having walls forming the top and four sides of a compartment therein, an upper horizontally disposed frame and a lower horizontally disposed frame, certain of said side walls of said compartment being secured to said frames, a refrigerant compressing and liquefying unit within said compartment and having provisions for connecting same with refrigerant conduits adapted to communicate with an evaporator located exteriorly of said cabinet, means for suspending said unit from said upper frame and supporting same within said compartment above said lower frame solely by the side walls secured to said frames, and the top and at least one side wall of said compartment being removable from said frames to provide access to said unit.

9. A refrigerating apparatus comprising in combination, a portable cabinet having walls

forming the top and four sides of a compartment therein, an upper horizontally disposed frame and a lower horizontally disposed frame, certain of said side walls of said compartment being secured to said frames, a refrigerant compressing and liquefying unit within said compartment, means for suspending said unit from said upper frame and supporting same within said compartment above said lower frame solely by the side walls secured to said frames, said suspending means including detachable means for rigidly clamping the upper portion of said unit to said upper frame during transportation of said cabinet, detachable means for rigidly clamping the lower portion of said unit to said lower frame during transportation of said cabinet, the top wall of said compartment being removable from said cabinet to provide access to said detachable means for the upper portion of said unit, at least one side wall of said compartment being removable from said frames to provide access to said detachable means for the lower portion of said unit, and said suspending means also including resilient means rendered effective upon detachment of the two detachable means for resiliently supporting said unit in said compartment.

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