

Jan. 2, 1940.

E. F. SCHWELLER

2,185,228

REFRIGERATING APPARATUS

Filed Dec. 1, 1933

4 Sheets-Sheet 1

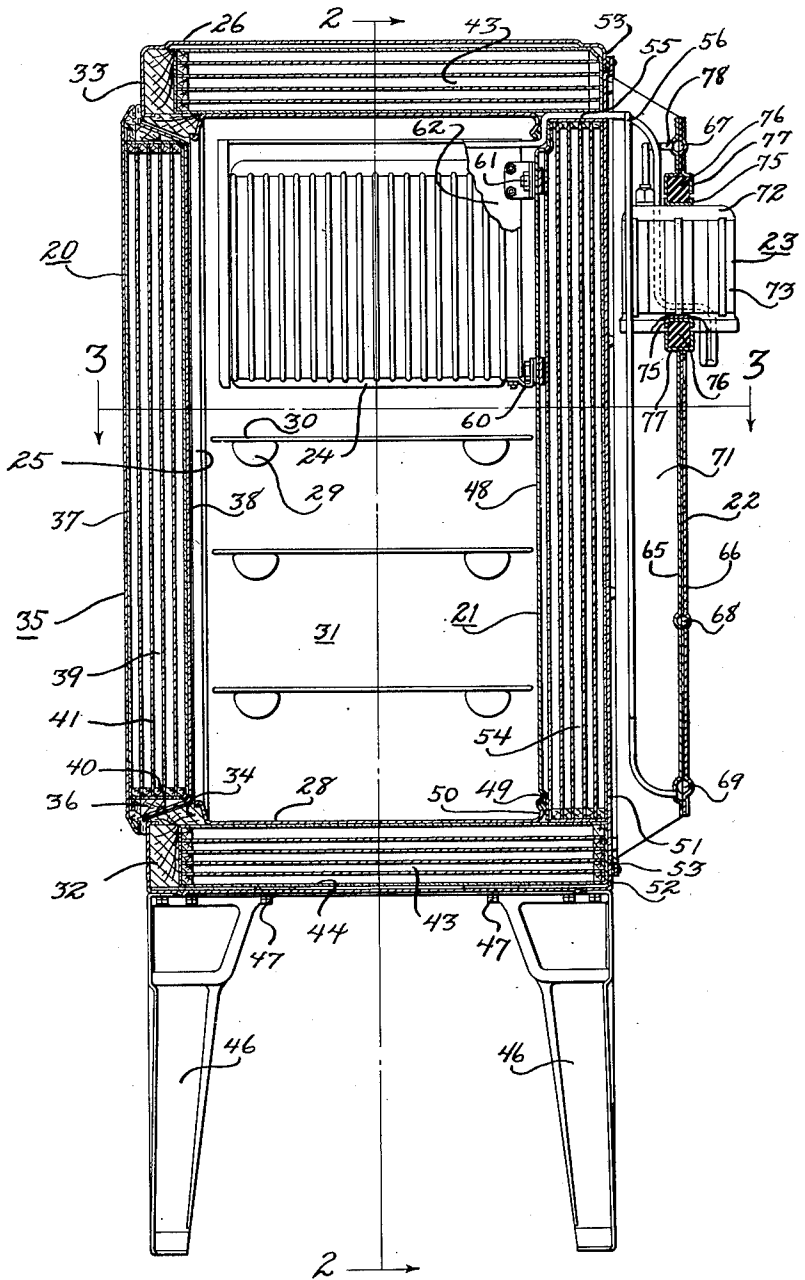


Fig. 1

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4 Sheets-Sheet 2

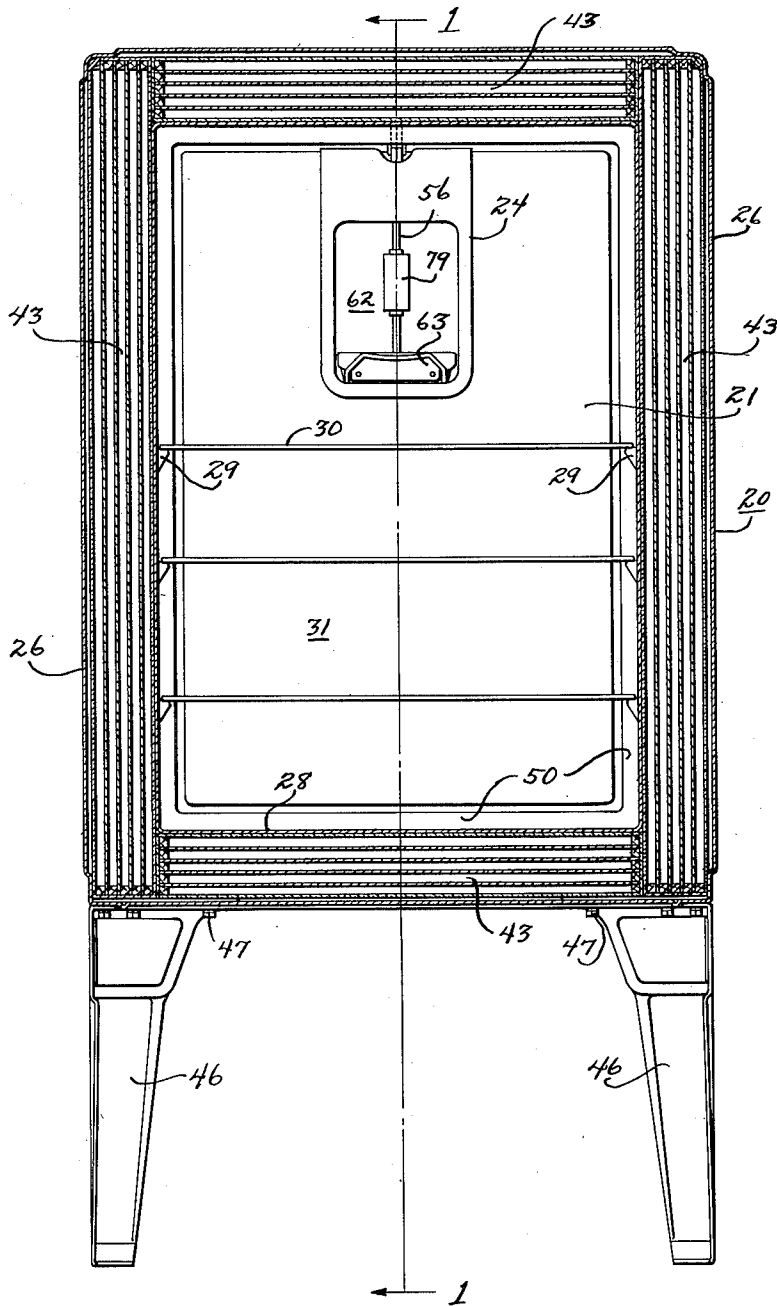


Fig. 2

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4 Sheets-Sheet 4

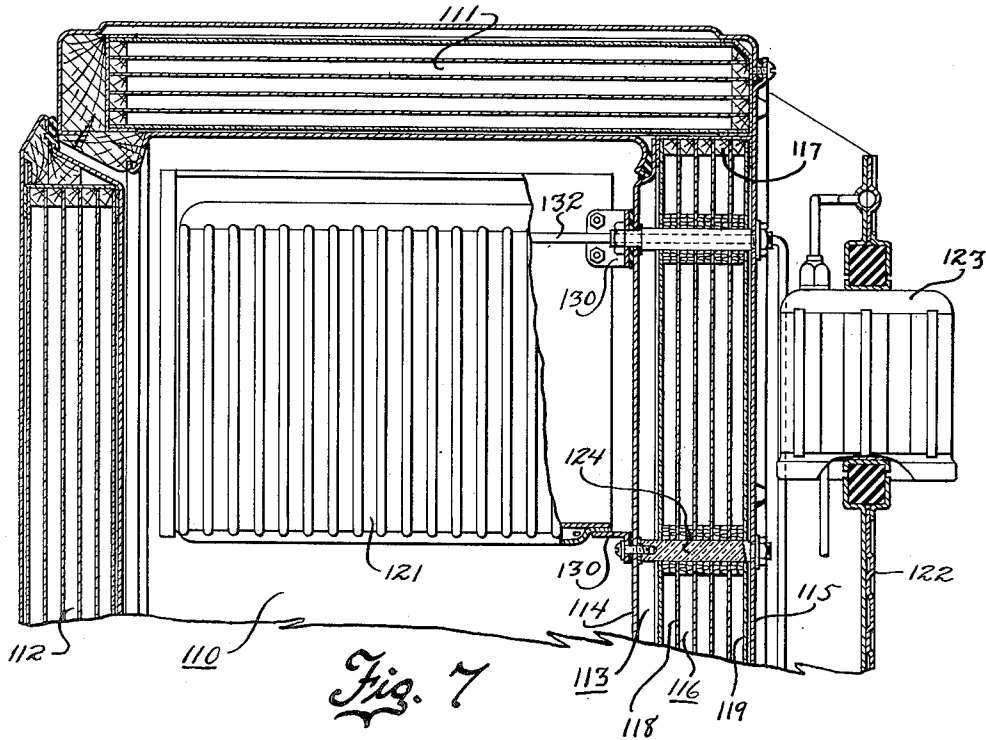


Fig. 7

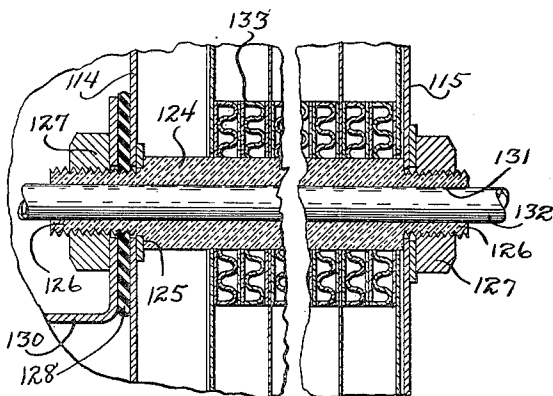


Fig. 9

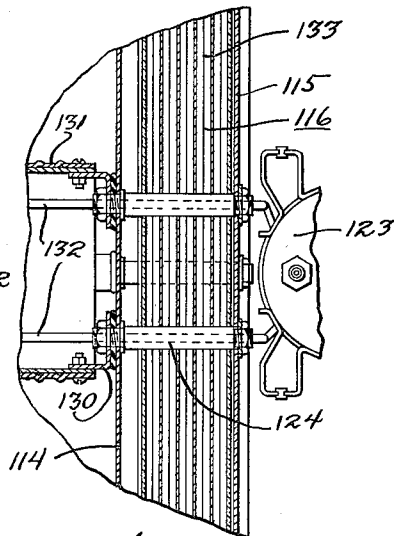


Fig. 8

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REFRIGERATING APPARATUS

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15 Claims. (Cl. 62—116)

This invention relates to refrigerating apparatus and more particularly to domestic electric refrigerators for household purposes.

Heretofore electric refrigerators have been designed with the greatest emphasis being placed upon appearance, durability in structure, economy in operation, and prior construction, with attention being given to manufacturing considerations only after the general design has been decided upon. This is not advantageous from a manufacturing standpoint and I propose to make manufacturing considerations of equal importance with appearance, durability in structure, and economy of operation in designing my improved electric refrigerator.

It is therefore an object of my invention to provide a domestic electric refrigerator extremely simple in construction in which the various parts of the refrigerating system are grouped together as closely as possible and removable as an entire unit from the cabinet.

It is another object of my invention to provide a domestic electric refrigerator having a simplified cabinet construction which lends itself to the economical use of materials, to large scale production, and to economical manufacturing methods and machinery.

It is a further object of my invention to provide an improved, simple, economical supporting means for the motor-compressor unit wherein any vibration or torsional reaction of the motor-compressor unit is prevented from being transmitted to the remainder of the apparatus and cabinet.

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 vertical sectional view along the line 1—1 of Fig. 2 of a domestic electric refrigerator embodying my invention;

Fig. 2 is a sectional view along the line 2—2 of Fig. 1;

Fig. 3 is a sectional view along the line 3—3 of Fig. 1;

Fig. 4 is an enlarged sectional view of a portion of Fig. 1 showing the connections between the compressor, condenser, and evaporator;

Fig. 5 is an enlarged sectional view of a portion of Fig. 1 showing a detail of a door and a door jamb construction;

Fig. 6 is a sectional view along the line 6—6 of Fig. 4;

Fig. 7 is a sectional view of the upper portion of a modified form of domestic electric refrigerator;

Fig. 8 is a sectional view looking downwardly upon the compressor in Fig. 7; and

Fig. 9 is an enlarged view of one of the bushings shown in Fig. 7 through which a refrigerant conduit extends.

Referring now to the drawings and more particularly to Figs. 1, 2, and 3, there is shown a domestic electric refrigerator having a refrigerator cabinet generally designated by the reference character 20 provided with a removable rear wall 21 upon which is mounted the entire refrigerating system which includes a vertical plate type condenser 22 having its edges folded and fastened to the edge portions of the removable rear wall, said condenser provided with an aperture in its upper portion carrying a sealed motor-compressor unit 23 which may have its internal construction of the type shown in the patent to A. A. McCormack No. 1,931,323, dated October 17, 1933, and entitled Refrigerating apparatus. Upon the opposite side of the rear wall 21 there is fastened a refrigerant evaporating means 24 which is operatively connected to the compressor 23 and the condenser 22.

Instead of constructing my cabinet in the usual way, I form the outer wall of this cabinet by taking a relatively long sheet of metal, serrating one of the edges thereof for making the corner portions of the cabinet, then folding this sheet into a hollow rectangle, welding the ends together, and folding the serrated edges inwardly to make the front face 33 of the cabinet around the door opening 25. This outer sheet so made and formed I designate by the reference character 26, and it forms the top, bottom, and side outer walls of my improved cabinet.

The inner walls or inner liner of this cabinet I form in a similar way by employing a single sheet designated by the reference character 28 and forming it into a hollow rectangle by folding the sheet and welding the ends together. I also form a flange extending around each edge of this hollow rectangle forming the inner liner 28. Within the sides of the inner liner I form projections 29 which extend into the interior of the food compartment for supporting the refrigerator shelves 30 within the food compartment 31. The inner wall or inner lining is placed inside of the outer wall 26. These two members are connected at the front portion of the cabinet by a door jamb frame 32, preferably of some insulating or low conducting material such as

wood, which is placed immediately behind the front face 33 of the cabinet. Fastened to this door jamb frame and the outer walls of the cabinet is a door molding 34 which at its rear edge is connected to the inner liner 28 in order to structurally connect the outer walls 26 with the inner liner 28. This door molding is of some suitable structural low conducting material, such as wood.

Within the door opening 25 there is provided a refrigerator door 35 having a rather light wooden framework 36 extending around the perimeter of the door to which is fastened the outer sheet metal cover 37 and the inner sheet metal cover or pan 38. Between this outer sheet metal cover and the inner sheet metal pan is provided an insulating panel 39 comprising a plurality of rectangular frames 40 between which are supported a plurality of spaced sheets 41 of some suitable material, such as paper, or metal foil, or both, which provide a plurality of substantially dead air spaces within the door. The top, bottom, and side walls of the cabinet are similarly insulated with the insulating panels 43 which are similar in construction and have the same materials as the panel 35, differing merely as to size. These insulation panels are each provided with an hermetically sealed outer covering 44 which prevents the access of external air and moisture to the interior of these insulating panels.

The cabinet is supported upon rather tall ornamental legs 46 which are fastened to the four corners of the bottom portion of the outer wall 26 by means of the cap screws 47.

As stated before, the rear wall 21 of the cabinet is removable and supports the entire refrigerating system. This rear wall has an inner wall portion or plate 48 which abuts the rear edge of the inner liner 28 and is provided with a rubber gasket 49 which extends around its edge of this inner rear wall portion and makes it a tight joint with a flange 50 which is provided around the rear edge of the inner liner 28. In order to complete the outer wall of the cabinet there is provided a removable rear outer wall portion 51 which covers the rear wall of the cabinet and which is fastened to the flange 52 which extends around the edge of the continuous outer wall 26. A suitable rubber gasket 53 seals the joint between the continuous member 26 and the plate 51. Between the inner plate 48 and the outer plate 51 is an insulating panel 54 which is somewhat similar to the insulating panel 35 in the front door but which is provided with grooved notch 55 better shown in Figs. 4 and 6 through which pass the refrigerant conduits 56 and 57 which connect the evaporating means 24 with the compressor 23 and the condenser 22.

The evaporating means 24 is provided with the brackets 60 at its rear end portion which are fastened by means of bolts 61 to the inner plate 48. This evaporating means is provided with a freezing chamber 62 containing one or more ice freezing trays 63 for freezing ice cubes within the evaporator. The evaporator is connected with the compressor and condenser by means of a pair of refrigerant conduits 56 and 57 which extend over the top of the removable rear wall 21 through the groove or notch 55 in the top edge of the insulating panel and through an aperture in the rear plate 51. The condenser 22 is of the plate type and is formed of two sheets of metal 65 and 66 which are first formed with grooves therein and then welded together to

form a sealed plate structure with refrigerant passages therein. This condenser 22 is provided with a receiving manifold 67 at its upper edge, distributing manifold 68 near its lower portion and a collecting manifold 69 at its lower edge. This condenser is also provided with flanges 70 and 71 which are welded to the side edge portions of the condenser 22 and which are fastened to the side edge portions of the rear plate 51.

In order to dispense with any additional or special mounting and mounting brackets for the motor-compressor unit, I merely provide an aperture in the upper portion of the plate type condenser 22 which is sufficient in size to receive the relatively small motor-compressor unit 23. This motor-compressor unit 23 is preferably of the hermetically sealed type provided with an outer casing 72 which encloses both the electric motor and the compressor and which is provided with fins 73 welded to its outer portion for carrying off the heat produced within the unit. The motor compressor unit preferably has a single vertical shaft in the center of the sealed enclosure 72 upon which is mounted both the electric motor and the compressor as is shown in the McCormack Patent No. 1,931,323 previously mentioned.

Although the compressor has very little vibration, I provide an improved rubber mounting for the compressor to prevent any vibration and any torsional reaction from being transmitted to the condenser and the cabinet. In order to do this, I provide a cup-shaped member 75 at either end of the motor-compressor unit directly in line with the vertical motor-compressor shaft so that these cup-shaped members are directly in line with the natural center of oscillation of the unit. These cup-shaped members each grip a small cylindrically shaped resilient rubber member 76 which are held within the cup-shaped recesses 77 formed in the bottom and top edge portion of the aperture directly above and below the motor-compressor unit so as to hold the motor-compressor unit with its shaft in a vertical direction. By providing this form of support for the motor-compressor unit, it is permitted to oscillate about its vertical axis a limited amount controlled by the rubber cylinders 76 in order that the vibrations be prevented from reaching the condenser and the cabinet. This form of support also permits a limited amount of vertical movement to absorb any vertical vibrations. By permitting this rather free movement of the motor-compressor unit about its vertical axis, the vibrations are absorbed and dissipated by the movement of the motor-compressor unit instead of being transmitted by restraining members to the condenser and the cabinet.

The motor-compressor unit compresses the refrigerant and forwards the compressed refrigerant through a flexible conduit means 78 to the receiving manifold from which the compressed refrigerant passes down through the passages in the plate condenser 22 and is collected in the collecting manifold 69 from which it is forwarded through the supply conduit 56 to a restrictor 79 which controls the flow of refrigerant to the evaporator 24. The liquid refrigerant vaporizes in the evaporator 24 and is returned to the compressor through the return conduit 57.

By placing the compressor in an aperture within the plate condenser directly back of the evaporator 24, the connecting conduits between the

evaporator and the compressor are made as short as possible and thus the cost of these conduits is reduced. This also provides the proper distribution and flow of cooling air since it is desired that the coolest air first contact with the refrigerant in the lower portion of the condenser and then rise and contact with the motor-compressor unit and the refrigerant in the upper portion of the condenser. In this way the very economical counterflow principle of cooling the compressing and condensing means is employed.

Referring now to the modifications shown in Figs. 7, 8, and 9, there is shown a refrigerator cabinet 110 which has a top, bottom, and side wall construction 111 similar to that shown in the first described modification and a door 112 also similar to that described for the first modification. The rear wall 115 is removable and is provided with an inner plate 114 and an outer plate 115. Between the inner and outer plate is provided an insulating pannel 116 comprising a plurality of rectangular frames 117, preferably of wood or some other low conducting material which holds a plurality of sheets 118 in spaced relation so as to provide air spaces therebetween. These sheets may be of aluminum foil, paper or both. The panel is provided with hermetic outer covering 119 to prevent the entrance of air and moisture.

In this modifications I extend the refrigerant conduit connecting the evaporator 121 with the condenser 122 and the compressor 123 directly through the removable rear wall 113. In order to do this I provide an insulating bushing 124 preferably of hard rubber or other suitable insulating material which is provided with a shoulder 125 at each end and a threaded end portion 126 which receives clamping nuts 127 which clamp the inner plate 114 and the outer plate 115 to the bushings. At the inner plate 114 there is provided a rubber gasket 128 for preventing air from leaking into the insulation space. These bushings 124 also support the brackets 130 which in turn support the evaporator 121. The upper bushings are provided with a passage 131 therethrough which receives the refrigerant supply conduit 132 and the refrigerant return conduit. In order to properly support the sheets of the insulation panel, there is provided frame members or strips extending from one side to the other of the panels through which the bushings pass. These strips 133 are formed of a plurality of thicknesses of corrugated paper and effectively support and prevent damage to the sheets within the panel and also prevent any entrance of air through the aperture provided by the bushings. While this form permits a more rigid rear wall construction, it does not permit the ready removal of the insulation panel as is permitted in the first described embodiment. In that embodiment, the insulation between may be removed whenever the rear wall is removed from the cabinet so that the system may be tested for leaks without damage to the insulation panels.

With this removable rear wall construction upon which I mount my entire refrigerating system, the compressor and condenser remain out of sight and do not take any room either at the top or at the bottom of the cabinet. The system is preferably one in which the system operates continuously and is controlled by the restrictor 79.

By employing the closed rectangle construction for my cabinet, the use of flash welding machines and methods is facilitated since the welding device can pass from one open side to the other

without being hindered and in particular without being bothered by any blind corners. In this way I have provided a domestic electric refrigerator which is easily manufactured and assembled, which is attractive in appearance and economical in operation.

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 refrigerator comprising an outer wall, an inner wall spaced from the outer wall, insulating means between the inner and outer walls, said refrigerator having a generally flat vertical removable rear wall, and an entire refrigerating system mounted thereon including an evaporating means on one side of the rear wall and a liquefying means on the opposite side and without the plane of the wall.

2. Refrigerating apparatus including a flat plate-like condenser having an aperture therein, a refrigerant compressor mounted within said aperture and operatively connected with the condenser, and a refrigerant evaporating means operatively connected with the compressor and condenser.

3. Refrigerating apparatus including a flat plate-like condenser having an aperture therein, a refrigerant compressor supported by the condenser within said aperture and operatively connected thereto, and a refrigerant evaporating means operatively connected with the compressor and condenser.

4. Refrigerating apparatus including a flat plate-like condenser having an aperture therein, a refrigerant compressor mounted within said aperture and operatively connected with the condenser, resilient mountings connecting the condenser and compressor for supporting the compressor by the condenser, and a refrigerant evaporating means operatively connected to the compressor and condenser.

5. Refrigerating apparatus including an insulated cabinet having a generally flat removable wall portion, a generally flat condensing means fastened to the removable wall portion, said condensing means having an aperture therein, a refrigerant compressor within the aperture and operatively connected to the condensing means, and a refrigerant evaporating means operatively connected to the compressor and condenser.

6. Refrigerating apparatus comprising an insulated cabinet having a generally flat vertical refrigerant condenser fastened to the rear wall of the cabinet, a refrigerant compressor supported by the condenser above the lower end thereof at the rear of the cabinet and operatively connected thereto, and a refrigerant evaporating means within the cabinet operatively connected to the compressor and condenser.

7. Refrigerating apparatus comprising an insulated cabinet having a generally flat vertical refrigerant condenser fastened to the rear wall of the cabinet, a refrigerant compressor, a rubber mounting connecting the compressor and condenser for supporting the compressor upon the condenser.

8. Refrigerating apparatus including an insulated cabinet having a removable rear wall portion, a refrigerant condensing means mounted on one side of the rear wall portion and a refrigerant evaporating means mounted within the

cabinet and fastened to the rear wall portion on the side opposite that of the condensing means and being operatively connected thereto, and a refrigerant compressing means supported by the condensing means and operatively connected to the condensing means and the evaporating means.

9. Refrigerating apparatus including an insulated cabinet having a removable wall portion with inner and outer walls, a bushing of an insulating material extending through the removable wall portion having fastening means for fastening the inner and outer walls thereto, a refrigerant liquefying means mounted upon one side of the removable wall, refrigerant evaporating means mounted on the other side of the removable wall, and refrigerant conduit means connecting the liquefying means and the evaporating means extending through the bushing.

10. Refrigerating apparatus including an insulated cabinet having a removable wall portion, a refrigerant evaporating means mounted on one side of the removable wall portion and a refrigerant liquefying means mounted on the opposite side of the removable wall portion, said removable wall portion fitting against the remaining portion of the cabinet, refrigerant conduit means extending between the removable wall portion and the remaining portion of the cabinet and connecting the liquefying means and the evaporating means.

11. Refrigerating apparatus including a generally flat condenser having a cut-out portion, a refrigerant compressor mounted within said cut-out portion and being operatively connected to the condenser, and a refrigerant evaporating means operatively connected with the compressor and condenser.

12. Refrigerating apparatus including a generally flat condenser having a cut-out portion, a refrigerant compressor mounted within said cut-

out portion and being provided with resilient mountings and operative connections connecting to the condenser, and a refrigerant evaporating means operatively connected with the compressor and condenser.

13. Refrigerating apparatus including a box-shaped insulated cabinet containing a compartment to be cooled, an evaporating means located in heat exchange relation with said compartment to be cooled, a condensing means including means forming a vertical flue extending upon one of the vertical walls of the cabinet, a compressor located adjacent the upper portion of the flue and supported by the flue forming means, and means for operatively connecting said compressor, condensing means and evaporating means.

14. Refrigerating apparatus including a box-shaped insulated cabinet containing a compartment to be cooled, an evaporating means located in heat exchange relation with said compartment to be cooled, a condensing means including means forming a vertical flue extending upon one of the vertical walls of the cabinet, a compressor located at the back of the cabinet outside the plane of the rear wall, said compressor having a portion located in alignment with said flue, and means for operatively connecting said compressor, condensing means and evaporating means.

15. Refrigerating apparatus including a box-shaped insulated cabinet containing a compartment to be cooled, said cabinet including a removable vertical wall portion, an evaporating means located within said compartment and supported by said removable wall portion, a condensing means including means forming a vertical flue supported by said removable wall portion, a compressor supported by said flue forming means, and means for operatively connecting said compressor, condensing means, and evaporating means.

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