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H. B. HULL

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REFRIGERATING APPARATUS

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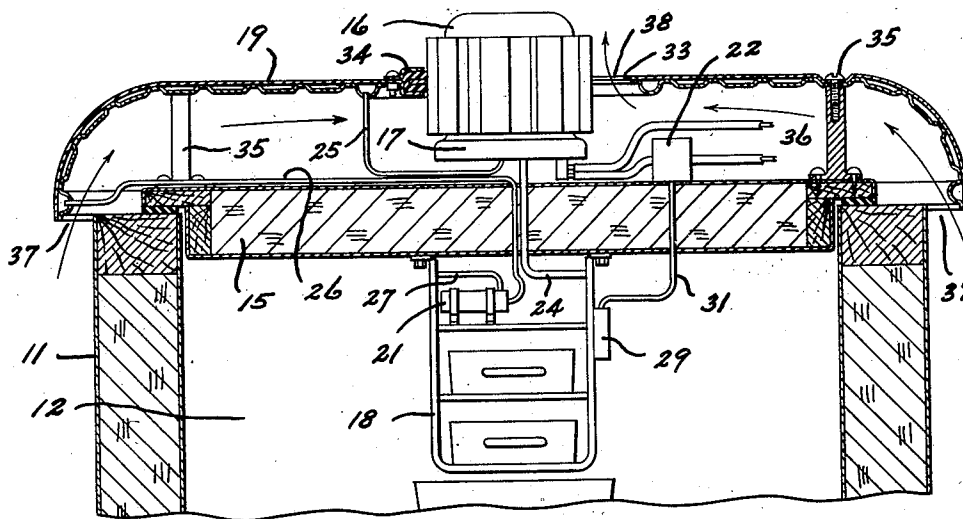


Fig. 3

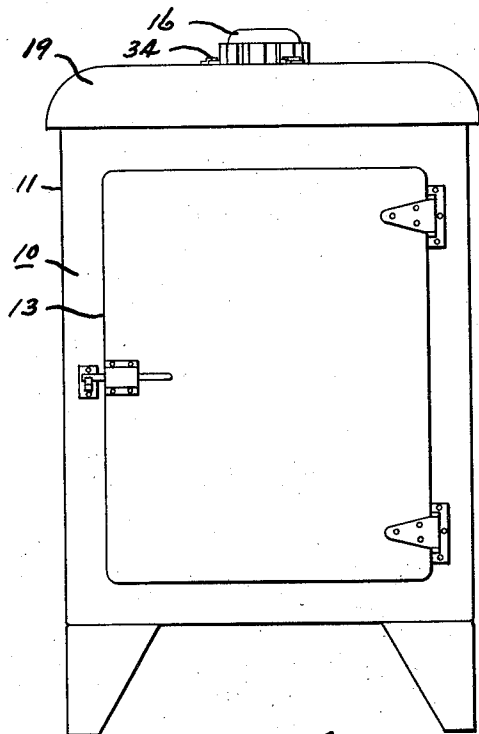


Fig. 1

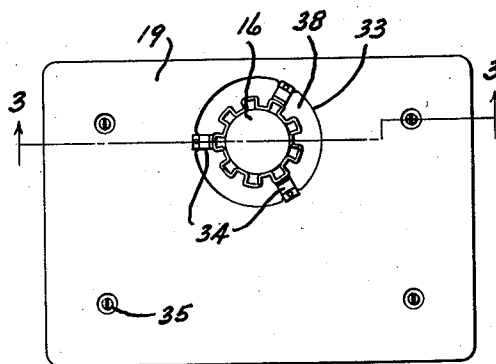


Fig. 2

Inventor
Harry B. Hull

By *Spencer, Hardman, and Lehr*
his Attorneys.

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REFRIGERATING APPARATUS

Harry B. Hull, Dayton, Ohio, assignor to General Motors Corporation, Dayton, Ohio, a corporation of Delaware

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18 Claims. (Cl. 62—116)

This invention relates to refrigerating apparatus and particularly to mechanical refrigerators and the arrangement of the refrigerating system therein.

An object of the present invention is to provide a small compact refrigerating apparatus and to facilitate removal thereof as a unitary structure from a cabinet with which the apparatus is associated.

Another object of the invention is to provide a refrigerating apparatus of the unitary removable type in which the condenser of the refrigerating system forms a cover or the top of the cabinet and also forms a flue at the top of the cabinet for causing thermosyphon circulation of air over the condenser and the motor and compressor of the apparatus.

In carrying out the foregoing objects, it is a still further object of the invention to provide a refrigerating apparatus of the unitary removable type which is efficient and quiet in operation while at the same time being capable of being manufactured at low costs due to improved arrangements of elements thereof.

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

In the drawing:

Fig. 1 is a front elevational view of a refrigerator cabinet of the household type having the refrigerating apparatus of the present invention installed therein;

Fig. 2 is a top plan view of the refrigerating apparatus shown in Fig. 1, and

Fig. 3 is an enlarged fragmentary vertical section of the refrigerating apparatus taken on the line 3—3 of Fig. 2 and showing the arrangement of elements of the refrigerating system.

Referring to the drawing, for the purpose of illustrating my invention, I have shown in Fig. 1 thereof a refrigerator cabinet 10. Cabinet 10 includes a finished metallic shell or a plurality of finished metallic exterior panel members 11 enclosing or disposed over any suitable insulating material and forming walls of a food storage compartment 12 having a door 13 closing an opening therein which provides access to the storage compartment. The top wall of the food storage compartment 12 of cabinet 10 is open and this open top is adapted to be closed by a removable insulated wall structure 15 which forms a base upon which elements of a closed refrigerating system are mounted.

The refrigerating system carried by the wall structure 15 includes a motor-compressor unit comprising a motor 16 and a compressor 17 directly connected to the motor, an evaporator or cooling element 18, a condenser 19, an expansion valve 21 and a switch 22. The evaporator 18 may be of any conventional or well known structure and may be suspended from the base or wall structure 15 so as to be positioned in the compartment 12 while other elements of the refrigerating system are mounted on the upper side of the structure 15. In the present disclosure the motor 16 is mounted above the compressor 17 and any suitable fin arrangement may be secured to the walls of the motor-compressor unit for dissipation of heat therefrom. The condenser 19 of the refrigerating system is constructed of sheet metal portions, secured together at certain points and spaced apart at certain other points and, cooperating with one another in a manner to provide a plurality of refrigerant passages therebetween. Refrigerant evaporated in the cooling element 18 is drawn to the compressor 17, by suction created thereby, through a pipe 24 where it is compressed and circulated through pipe 25 under pressure to the refrigerant passages in the condenser 19. The compressed refrigerant is cooled and liquefied in the combined condenser-receiver 19 and the liquid refrigerant flows to the bottom of the condenser-receiver. A pipe 26 connecting the passage in the lower portion of the condenser-receiver 19 conducts liquid refrigerant to the expansion valve 21 and a pipe 27 conducts refrigerant from the valve 21 to refrigerant expansion passages provided in walls of the evaporator 18. The expansion valve 21 may be of any of the conventional and well known types. The temperature of the evaporator or cooling element 18 is maintained between predetermined limits by a thermostat 29 having a pipe connection 31 with the electric switch 22. The thermostat 29 and connection 31 is charged with a volatile fluid which expands or contracts a bellows or diaphragm (not shown) contained in switch 22, in accordance with a rise or fall in the temperature of the evaporator, to actuate switch 22. The switch 22 is inserted in the power line leading to the motor 16 of the combined motor-compressor unit and is adapted to open or close the electric circuit to the motor for starting or stopping the motor and consequently the compressor.

It will be noted that the condenser-receiver 19 is constructed in the form of a shroud or

hood and has the portion adjacent its outer edges gradually curved downwardly. The outer edges of the condenser 19 are spaced laterally from the exterior metallic shell or panel members 11 of cabinet 10 and extend downwardly slightly below the top of the finished exterior panels 11 to conceal the upper extremity thereof. The condenser 19 is painted or porcelain enameled to match the coating or finish on the shells or panels 11 and forms a cover for the cabinet 10 or in other words forms an exterior finished metallic wall thereof and in the present disclosure the top of the cabinet thus eliminating the necessity of providing additional metallic panels or walls for enclosing the insulated walls of the cabinet or for concealing the elements of the refrigerating system. The motor-compressor unit is mounted in an opening 33 provided in the condenser 19 and is carried by or suspended from the condenser. A plurality of rubber mounting devices 34 are secured in any suitable manner to the condenser 19 at the edge of opening 33 therein and receive arms extending from the motor-compressor unit. The rubber mounting devices 34 space the motor-compressor unit from the edge of the opening 33 and floatingly carries the same on the condenser in order to reduce transmission of vibrations to cabinet 10 to a minimum. The condenser 19 is rigidly supported upon base 15 by a plurality of supporting members 35 which maintains the condenser in spaced relation to base 15. The condenser 19 and the portion of the motor-compressor unit extending above the condenser may be painted or porcelain enameled to correspond with the finish on the cabinet walls in order to render the apparatus uniform in appearance.

The umbrella formation of the condenser 19 forms a flue 36 for causing circulation of air over the condenser 19, motor 16 and compressor 17. The outer edges of the condenser 19 being spaced from the cabinet walls 11 provide an inlet 37 for flue 36 which inlet extends entirely around the cabinet 10. The space between the edge of opening 33 in condenser 19 and walls of the motor-compressor unit provides an outlet 38 for flue 36. Heat generated by the motor 16 and compressor 17, during operation thereof, and the heat of compression dissipated from refrigerant circulated to the condenser-receiver 19 causes a thermo-syphon circulation or flow of air through the flue 36. The inlet 37 of flue 36 picks up cool air and this relatively cool air upon entering the flue is warmed and flows upwardly along the under side of the condenser and thence outwardly of the flue at the outlet opening 38. In this manner I obtain efficient circulation of air for cooling and condensing refrigerant circulated to the condenser 19 and for cooling the motor 16 and compressor 17. The outer surface of condenser 19 being exposed at all times to room temperature augments dissipation of heat therefrom. The construction and arrangement of the elements of the refrigerating system as described eliminates the necessity of providing a fan for forcing air over the elements of the system and thus reduces the cost of manufacturing the refrigerating apparatus. It will be noted that the opening 33 provided in condenser 19, for receiving the motor compressor unit, is located near the rear portion of the condenser. This location of the opening 33 for the motor-compressor unit is preferable in order to permit the portion of the

condenser 19 near the front of the cabinet to be utilized as a shelf or ledge for temporarily placing articles during removal thereof from the cabinet or during re-arrangement of the articles in the cabinet.

From the foregoing it is apparent that I have provided an improved compact refrigerating system which can be installed in or removed from a refrigerator cabinet as a unitary structure. My improved construction and arrangement of elements of the refrigerating system eliminates the necessity of providing a box-like structure, walls or panels which are ordinarily employed either as a unit separate from the refrigerator cabinet or constructed as an integral part of the cabinet for enclosing the operating elements of a unitary removable refrigerating system. This improvement greatly facilitates removal of a unitary refrigerating system from a cabinet while at the same time provides an apparatus which is compact, neat in appearance, efficient in operation and of low manufacturing cost.

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. Refrigerating apparatus comprising in combination, a refrigerator cabinet including a plurality of stationary walls and a removable horizontal wall portion forming a food storage compartment, a closed refrigerating system associated with said removable wall portion of the cabinet and including a cooling element disposed within said food storage compartment and a refrigerant liquefying unit disposed exteriorly thereof, said refrigerant liquefying unit including a condenser carried by said removable wall portion and arranged to form a cover for said cabinet, and said condenser being spaced from the removable wall portion of said cabinet to provide a flue across at least a portion of the top of the cabinet.

2. Refrigerating apparatus comprising in combination, a refrigerator cabinet including a plurality of stationary walls and a removable horizontal wall portion forming a food storage compartment, a closed refrigerating system associated with said removable wall portion of the cabinet and including a cooling element disposed within said food storage compartment and a refrigerant liquefying unit disposed exteriorly thereof, said refrigerant liquefying unit including a condenser carried by said removable wall portion and arranged to form a cover for said cabinet, said condenser being spaced from the removable wall portion of said cabinet to provide a flue across at least a portion of the top of the cabinet, said condenser having an opening therein providing an outlet for said flue, and the edges of said condenser being bent downwardly below the plane of the top of said stationary cabinet walls and spaced therefrom to provide an inlet for said flue.

3. Refrigerating apparatus comprising in combination, a refrigerator cabinet including a plurality of stationary walls and a removable horizontal wall portion forming a food storage compartment, a closed refrigerating system associated with said removable wall portion of the cabinet and including a cooling element disposed within said food storage compartment and a refrigerant liquefying unit disposed ex-

teriorly thereof, said refrigerant liquefying unit including a condenser carried by said removable wall portion, said condenser being constructed of sheet metal portions and being arranged to form a cover for said cabinet, and means spacing said sheet metal condenser from the removable wall portion of said cabinet to form a flue across at least a portion of the top of the cabinet.

4. Refrigerating apparatus comprising in combination, a refrigerator cabinet including a plurality of stationary walls and a removable horizontal wall portion forming a food storage compartment, a closed refrigerating system associated with said removable wall portion of the cabinet and including a cooling element disposed within said food storage compartment and a refrigerant liquefying unit disposed exteriorly thereof, said refrigerant liquefying unit including a condenser carried by said removable wall portion, said condenser being constructed of sheet metal portions and being arranged to form a cover for said cabinet, means spacing said sheet metal condenser from the removable wall portion of said cabinet to form a flue across at least a portion of the top of the cabinet, said condenser having an opening provided intermediate the edges thereof forming an outlet for said flue, and the edges of said condenser being bent downwardly below the plane of the top of said stationary cabinet walls and spaced therefrom to provide an inlet for said flue.

5. Refrigerating apparatus comprising in combination, a refrigerator cabinet including a plurality of stationary walls and a removable horizontal wall portion forming a food storage compartment, a closed refrigerating system associated with said removable wall portion of the cabinet and including a cooling element disposed within said food storage compartment and a refrigerant liquefying unit disposed exteriorly thereof, said refrigerant liquefying unit including a condenser carried by said removable wall portion, said condenser being constructed of sheet metal portions and being arranged to form a cover for said cabinet, means spacing said sheet metal condenser from the removable wall portion of said cabinet to form a flue across at least a portion of the top of the cabinet, said condenser having an opening provided intermediate the edges thereof forming an outlet for said flue, the edges of said condenser being bent downwardly below the plane of the top of said stationary cabinet walls and spaced therefrom to provide an inlet for said flue, and said refrigerant liquefying unit also including a motor-compressor unit carried by said condenser and having a portion thereof disposed within the opening in said condenser.

6. Refrigerating apparatus comprising in combination, a refrigerator cabinet including a plurality of stationary walls and a removable top wall portion forming a food storage compartment, a closed refrigerating system associated with said removable top wall portion of the cabinet and including a cooling element disposed within said food storage compartment and a refrigerant liquefying unit disposed exteriorly thereof, said refrigerant liquefying unit including a sheet metal condenser carried by said removable wall portion, and said condenser being of substantially umbrella formation and forming the exterior top wall of said refrigerator cabinet.

7. A refrigerating apparatus comprising in

combination, a cabinet having a plurality of finished metallic exterior shells or panels disposed over insulated walls defining a compartment to be cooled, at least a part of a certain of said walls being formed by a removable wall portion, a closed refrigerating system associated with said cabinet and including a refrigerant liquefying unit, a cooling element and means forming a condenser for the refrigerating system, said cooling element and said condenser means being carried by said removable wall portion, said condenser means and said refrigerant liquefying unit being disposed exteriorly of said compartment and said cooling element being within said compartment, and said condenser means cooperating with said cabinet and being arranged to form at least a part of one of the exterior finished metallic shells or panels thereof.

8. A refrigerating apparatus comprising in combination, a cabinet having a plurality of finished metallic exterior shells or panels disposed over insulated walls defining a compartment to be cooled, at least a part of the top wall of said compartment being formed by a removable wall portion, a closed refrigerating system associated with said cabinet and including a refrigerant liquefying unit, a cooling element and means forming a condenser for said refrigerating system, said closed system being carried by said removable wall portion and having said condenser means and said unit disposed exteriorly of said compartment and said cooling element disposed within said compartment, and said condenser means cooperating with said cabinet and being arranged to form at least a part of the exterior finished top metallic shell or panel thereof.

9. Refrigerating apparatus comprising in combination, a refrigerator cabinet including a plurality of stationary walls and a removable top wall portion forming a food storage compartment, a closed refrigerating system associated with said removable top wall portion of the cabinet and including a cooling element disposed within said food storage compartment and a refrigerant liquefying unit disposed exteriorly thereof, said removable wall portion including an outer sheet metal structure forming a flat part and a downwardly extending part of the exterior top wall of said cabinet, and said sheet metal structure having refrigerant conveying passages formed in at least the downwardly extending portion thereof and providing a condenser for said refrigerant liquefying unit.

10. Refrigerating apparatus comprising in combination, a refrigerator cabinet including a plurality of stationary walls and a removable top wall portion forming a food storage compartment, a closed refrigerating system associated with said removable top wall portion of the cabinet and including a cooling element disposed within said food storage compartment and a refrigerant liquefying unit disposed exteriorly thereof, said removable wall portion including an outer sheet metal structure forming a flat part and a downwardly extending part of the exterior top wall of said cabinet, and said sheet metal structure having refrigerant conveying passages formed therein and providing a condenser for said refrigerant liquefying unit.

11. Refrigerating apparatus comprising in combination, a cabinet having a metallic exterior finish shell or panels disposed over insulated walls defining a compartment to be cooled, a

removable wall portion forming at least a part of the top wall of said compartment, a closed refrigerating system carried by said removable wall portion and removable from said cabinet therewith, said closed refrigerating system including a cooling element disposed within said compartment and a refrigerant liquefying unit disposed exteriorly thereof, said removable wall portion including an outer sheet metal structure forming a downwardly extending exterior finished top wall for said cabinet, and said sheet metal structure having refrigerant conveying passages formed in at least the downwardly extending portion thereof and providing a condenser for said refrigerant liquefying unit.

12. Refrigerating apparatus comprising in combination, a cabinet having a metallic exterior finish shell or panels disposed over insulated walls defining a compartment to be cooled, a removable wall portion forming at least a part of the top wall of said compartment, a closed refrigerating system carried by said removable wall portion and removable from said cabinet therewith, said closed refrigerating system including a cooling element disposed within said compartment and a refrigerant liquefying unit disposed exteriorly thereof, said removable wall portion including an outer sheet metal structure forming a downwardly extending exterior finished top wall for said cabinet, and said sheet metal structure having refrigerant conveying passages formed therein and providing a condenser for said refrigerant liquefying unit.

13. A refrigerating apparatus comprising in combination, a cabinet having a metallic exterior finish shell disposed over insulated walls defining a compartment to be cooled, at least a part of the top wall of said compartment being formed by a removable wall portion, a closed refrigerating system associated with said cabinet and including a refrigerant liquefying unit, a cooling element and means forming a condenser for the refrigerating system, said cooling element and said condenser means being carried by said removable wall portion, said condenser means and said refrigerant liquefying unit being disposed exteriorly of said compartment and said cooling element being within said compartment, and said condenser means cooperating with said cabinet and forming a downwardly curved exterior finished top wall thereof.

14. A refrigerating apparatus comprising in combination, a cabinet having a metallic exterior finish shell disposed over insulated walls defining a compartment to be cooled, at least a part of the top wall of said compartment being formed by a removable wall portion, a closed refrigerating system associated with said cabinet and including a refrigerant liquefying unit, a cooling element and means forming a condenser for the refrigerating system, said cooling element and said condenser means being carried by said removable wall portion, said condenser means and said refrigerant liquefying unit being disposed exteriorly of said compartment and said cooling element being within said compartment, and said condenser means being in the form of a sheet metal structure cooperating with said

cabinet to form the exterior finished top wall thereof.

15. Refrigerating apparatus comprising in combination, a cabinet having a plurality of finished metallic outer walls, a refrigerating system associated with said cabinet, said system including a refrigerant circulating unit, means providing a condenser for said refrigerating system and a cooling element all connected together to form a closed fluid circuit, said condenser means comprising a sheet metal structure forming the outer metallic top wall of said cabinet, and said sheet metal condenser structure including portions having certain parts thereof secured together and certain other parts thereof spaced apart to provide passages for the flow of refrigerant therethrough.

16. Refrigerating apparatus comprising in combination, a cabinet having a plurality of finished metallic outer walls, a refrigerating system associated with said cabinet, said system including a refrigerant circulating unit, means providing a condenser for said refrigerating system and a cooling element all connected together to form a closed fluid circuit, said condenser means comprising a sheet metal structure forming a flat part and a downwardly directed part of the outer metallic top wall of said cabinet, and said sheet metal condenser structure including portions having certain parts thereof secured together and certain other parts thereof spaced apart to provide passages for the flow of refrigerant therethrough in at least the downwardly directed part thereof.

17. Refrigerating apparatus comprising in combination, a cabinet having a plurality of finished metallic outer walls, a refrigerating system associated with said cabinet, said system including a refrigerant circulating unit, means providing a condenser for said refrigerating system and a cooling element all connected together to form a closed fluid circuit, said condenser means comprising a sheet metal structure forming a flat part and a downwardly directed part of the outer metallic top wall of said cabinet, and said sheet metal condenser structure including portions having certain parts thereof secured together and certain other parts thereof spaced apart to provide passages for the flow of refrigerant therethrough in both the flat and the downwardly directed part thereof.

18. Refrigerating apparatus comprising in combination, a cabinet including a plurality of stationary walls and a removable wall portion forming a food storage compartment, said stationary walls and said removable wall portion having finished metallic exterior surfaces, a closed refrigerating system associated with said removable wall portion of the cabinet and including a cooling element disposed within said food storage compartment and a refrigerant liquefying unit disposed exteriorly thereof, said removable wall portion including an outer sheet metal structure forming a part of the finished metallic exterior surface of said cabinet, and said sheet metal structure having refrigerant conveying passages formed therein and providing a condenser for said refrigerant liquefying unit.

HARRY B. HULL.