Feb. 23, 1943. A. A. KUCHER 2,311,947

REFRIGERATING APPARATUS

Filed Oct. 30, 1941 2 Sheets-Sheet 1

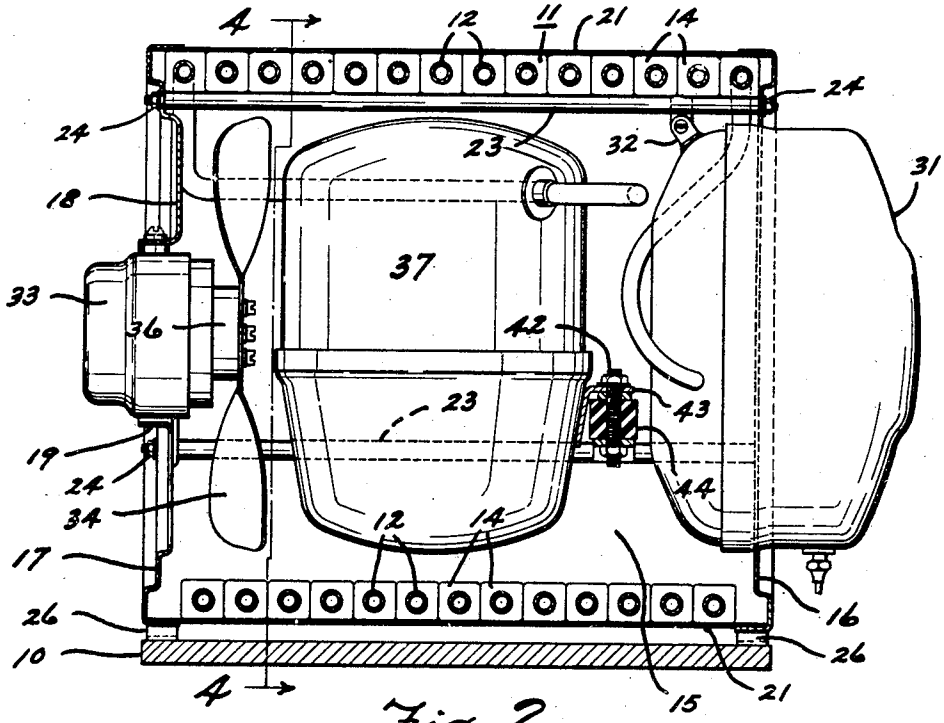


Fig. 2

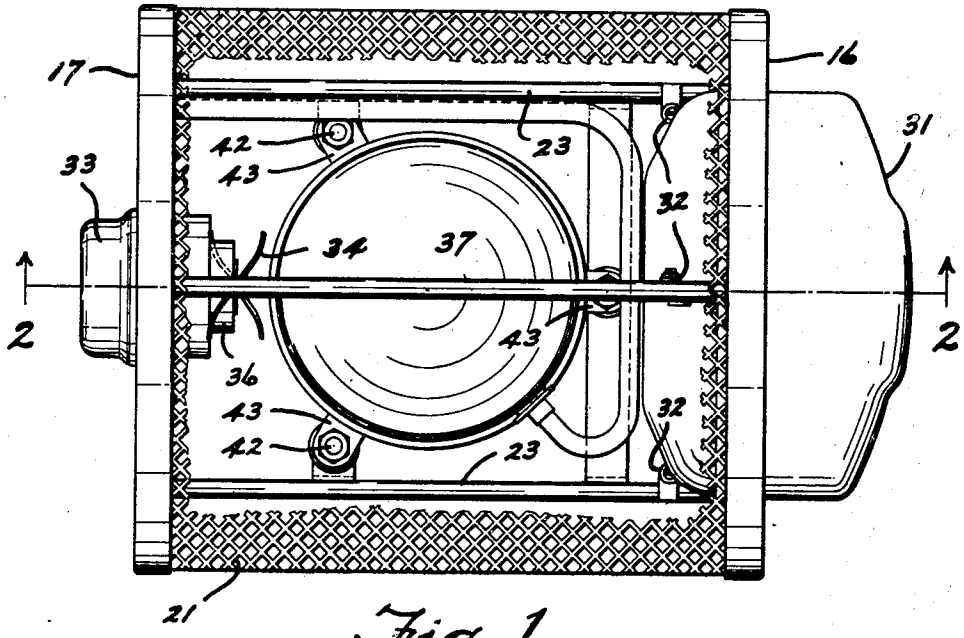


Fig. 1

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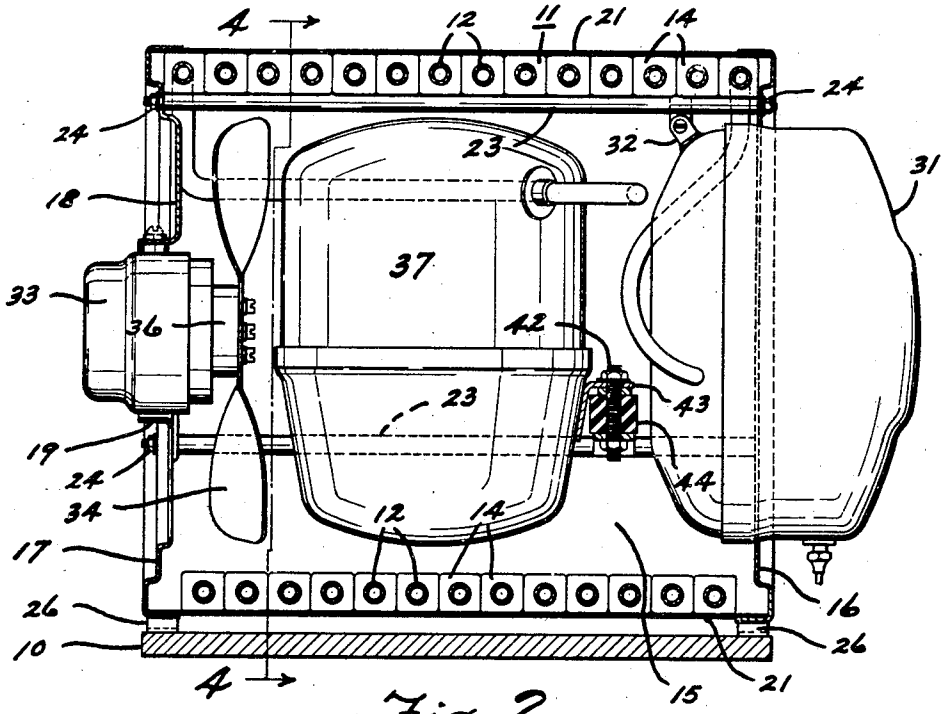


Fig. 2

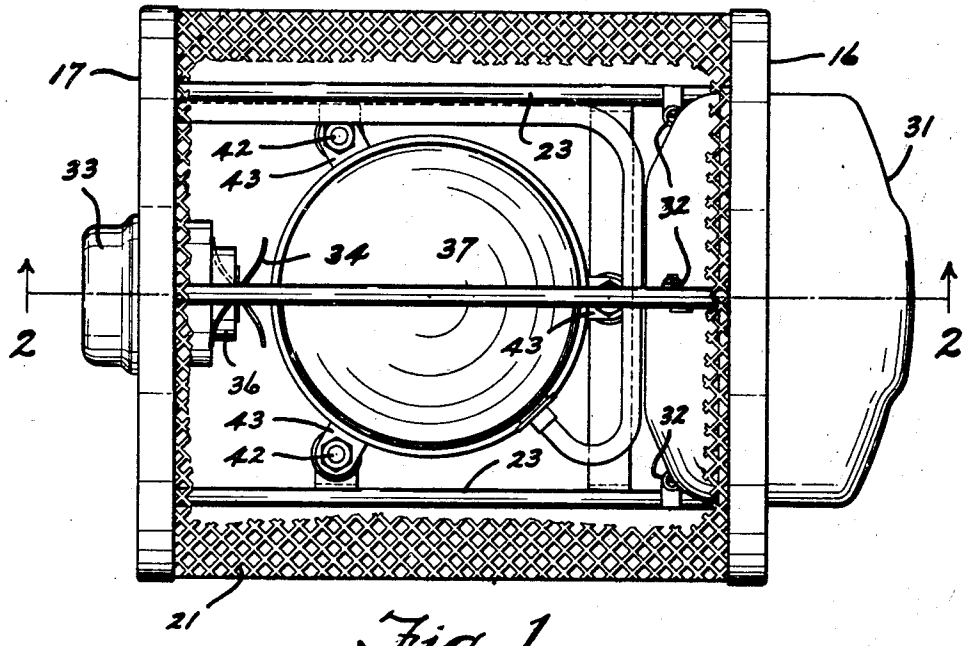


Fig. 1

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2,311,947

UNITED STATES PATENT OFFICE

2,311,947

REFRIGERATING APPARATUS

Andrew A. Kucher, Oakwood, Ohio, assignor to General Motors Corporation, Dayton, Ohio, a corporation of Delaware

Application October 30, 1941, Serial No. 417,173

8 Claims. (Cl. 62—115)

This invention relates to refrigerating apparatus and more particularly to the construction of a refrigerant liquefying and condensing unit of a refrigerating system.

An object of my invention is to provide a neat and compact refrigerant compressing and condensing unit.

Another object of my invention is to provide an improved arrangement of elements of a refrigerant compressing and condensing unit so as to obtain efficient air circulation thereover and whereby one of the elements of the unit forms a cover or shroud for the air circulating means.

A further object of my invention is to provide a condenser of a refrigerant liquefying unit which forms a compartment for housing the air circulating means, the receiver and a motor-compressor of the unit and wherein the receiver is of such form as to close one end of the compartment and serves to direct circulating air over the condenser.

In carrying out the foregoing objects it is a still further and more specific object of my invention to form or arrange convolutions of a condenser of a refrigerant liquefying unit so that they provide reticulated walls of an elongated horizontally disposed compartment having a refrigerant compressing means positioned therein and spaced from the compartment walls to permit a fan to circulate air into the compartment from one end thereof over the compressing means and outwardly of the reticulated walls along the length of the compartment.

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 top plan view of a refrigerant condensing and liquefying unit constructed in accordance with the present invention and showing a part thereof broken away;

Fig. 2 is a vertical sectional view taken along the line 2—2 of Fig. 1 and showing certain elements of the unit in elevation;

Fig. 3 is an end view of the unit; and

Fig. 4 is a transverse sectional view of the unit taken along the line 4—4 of Fig. 2.

Referring to the drawings I have shown a portable refrigerant liquefying unit mounted on a base 10. This unit includes a condenser generally represented by the reference character 11 and comprising tubing 12 having a plurality of individual spaced apart fins 14 thereon. The condenser tubing 12 is formed into a coil, the convolutions of which together with the fins 14 thereon, define or provide reticulated walls of an elongated horizontally disposed compartment 15. The horizontally elongated compartment 15 is preferably substantially cylindrical in cross-sectional contour. A plate 16, having an opening centrally thereof for a purpose to be hereinafter described, is secured to one end of the condenser 11. A spider-like plate 17 having webs 18 connected to a central portion 19 provided with an opening therein, for a purpose to be hereinafter described, is secured to the other end of the condenser 11. A reticulated cylindrical metal cover or sleeve 21 is disposed over the condenser 11 for maintaining the plurality of convolutions of the finned tubing 12 in horizontal alignment with one another. The ring-like plate 16 and the spider-like plate 17 each have a flange formed at their periphery and these flanges fit over the end of the sleeve 21 to hold the same on the condenser 11. In order to secure the plates 16 and 17 firmly to the condenser 11, for preventing spreading apart of the convolutions of tubing 12, I place rods 23 intermediate these end plates. Each rod 23 extends through the compartment 15 and has its ends projecting through suitable openings provided in the plates 16 and 17. A nut 24 is threaded upon threaded ends of the rods 23 and drawn tight against the plates 16 and 17 to maintain the fins 14 on the tubing 12 of condenser 11 in abutting relation with the convolutions of the condenser coil in spaced apart relation. The end plates 16 and 17 are each provided with legs 26 secured thereto and having bolts 27 passing therethrough and secured to the base 10 for firmly mounting the condenser upon the supporting base.

A receiver 31 having a conduit connection with the tubing 12 for receiving condensed liquefied refrigerant from condenser 11 cooperates with the opening in plate 16 to form a closure for the one end of the horizontally disposed elongated cylindrical compartment 15. Receiver 31 is provided with a nipple or the like at its lower portion adapted to be connected to a conduit for a purpose to be presently described. The receiver 31 is provided with outwardly extending brackets 32 that are secured by bolts to ears formed on the rods 23 and these bolts therefore rigidly mount the receiver upon the rods 23 within the central opening of plate 16. A motor 33 is mounted in the opening provided in the central portion 19 of spider-like plate 17 at the other end of the condenser and is thereby supported on the unit by plate 17. An air circulating means or fan

34 disposed within compartment 15 adjacent the open end thereof is mounted upon a shaft 36 of motor 33. It will be noted that the condenser 11 forms a cover or shroud for fan 34 and eliminates the necessity of providing other means for covering the fan. Refrigerant compressing means in the form of a combined motor-compressor mounted in the casing 37 is disposed within the horizontally elongated compartment 15 intermediate the receiver 31 and fan 34. The motor within casing 37 is preferably disposed above, in vertical alignment with and directly connected to a rotary compressor substantially of the type disclosed in my Patent No. 2,243,465 of May 27, 1941, and the casing has a conduit connection with the condenser 11 for forwarding refrigerant compressed by the compressor thereto. The nipple at the bottom of receiver 31 is adapted to be connected, by a conduit, with a cooling element or refrigerant evaporator of a refrigerating system for directing liquefied refrigerant thereto and refrigerant evaporated in the evaporator is adapted to be conveyed to the compressor by a gaseous refrigerant return conduit (not shown) as explained in the patent referred to. Casing 37 is spaced from the walls of compartment 15 so that air may flow around the casing toward the wall surface of receiver 31. In order to support the motor-compressor containing casing 37 within compartment 15 I provide legs 41 on the rods 23 and these legs have a bolt 42 passing therethrough for clamping outwardly directed fingers 43 provided on the casing 37 to the rods. A rubber or other suitable resilient bushing member 44 may be interposed between the fingers 43 and legs 41 for resiliently supporting the casing 37 upon the rods 23. Thus it will be seen that the rods 23 provide rigid mounting pieces within the compartment 15 for both the motor-compressor casing 37 and the receiver 31 as well as performing their primary purpose of clamping the condenser coil between the end plates 16 and 17.

The fan motor 33 may be connected in the electric circuit leading to the motor of the motor-compressor so as to be operated simultaneously with the operation of the motor-compressor. Operation of motor 33 rotates fan 34 and this fan draws air into the compartment 15 through its open end traversed by the webs 18 of plate 17. The air circulated into compartment 15 by fan 34 flows over the casing 37 to cool the motor-compressor housed therein and this casing deflects the air toward the walls of compartment 15. Some of the circulated air flows around the casing 37 and strikes the receiver 31 before it is deflected thereby toward the compartment walls. The compartment walls being reticulated by virtue of the fins 14 spacing the convolutions of the condenser tubing 12 apart, and by virtue of the reticulated outer condenser cover or sleeve 21 permits the air to flow over and in contact with the condenser tubing in its passage out of compartment 15 to thereby cool and condense compressed refrigerant forwarded to the condenser by the compressor. Since some of the air flows against or in contact with the receiver 31, this air tends to cool and condense any gaseous refrigerant contained in the receiver.

The reticulated or perforated sleeve or cover 21 in addition to providing structural rigidity to the unit as previously described, also performs an important function in the present device. By closing one end of compartment 15 with the plate 16 and/or the receiver 31 air is prevented from traveling horizontally entirely through the compartment and is directed laterally and outwardly of the reticulated compartment walls. The perforations in cover or sleeve 21 are uniform and are smaller than the space between the convolutions of the condenser tubing 12 and therefore air directed toward walls of compartment 15 is restricted from passing between the condenser convolutions at any one point along the condenser. The restriction imposed, by the perforated cover 21, to air directed against the compartment walls is utilized to break up the lateral flow of air through the compartment walls into a plurality of streams of air so that the circulated air passes through the compartment walls substantially uniformly along the length of compartment 15 for more effectively cooling the condenser. In other words the cover or sleeve 21 acts as a sieve to divide the air circulated by fan 34 and deflected laterally by the motor-compressor casing into other streams of air which flow past casing 37 toward receiver 31 and outwardly of compartment 15 along the entire length of the condenser. Therefore the perforated sleeve 21 prevents the exit from compartment 15 of a great amount of air immediately adjacent the casing 37 and insures a uniform flow of air over the condenser throughout the length thereof. This feature is particularly advantageous in a unit of the type disclosed wherein the casing 37, containing a motor and a compressor preferably disposed in the same vertical plane with one another, substantially as shown in my Patent No. 2,243,465 of May 27, 1941, is mounted in the path of air circulated by the fan.

The construction and arrangement of parts of the unit to provide structural strength also affords a rigid mounting means for the motor-compressor casing within the compartment formed by the condenser thus eliminating the necessity of providing additional mounting supports. The one end plate of the unit aids in supporting the liquid refrigerant receiver while the other end plate serves to provide the support for the fan motor to thus eliminate the provision of additional means for these purposes. By my novel form of condenser and by the improved arrangement of elements of the refrigerant liquefying unit I am enabled to increase the efficiency thereof while at the same time providing a compact unit which is of low manufacturing cost and neat in appearance.

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 refrigerant liquefying unit comprising, a condenser having its convolutions formed about a horizontally extending axis to enclose and provide walls of a compartment, the convolutions of said condenser being spaced apart to provide openings in said compartment walls along the length thereof, a casing within said compartment containing a motor and a compressor, said casing having its axis disposed in perpendicular relation to the axis of said compartment, means for closing one end of said compartment, means adjacent the other end of said compartment for circulating air horizontally thereinto, and the openings along the length of said compartment walls providing passages for the flow of air out of the compartment in a lateral direction relative to the axis thereof for cooling said condenser.

2. A refrigerant liquefying unit comprising, a condenser having its convolutions formed about a horizontally extending axis to enclose and provide walls of a compartment, the convolutions of said condenser being spaced apart to provide openings in said compartment walls along the length thereof, a casing within said compartment containing a motor and a compressor, a receiver closing one end of said compartment, air circulating means adjacent the other end of said compartment, said means being adapted to circulate air horizontally into said compartment, and the openings along the length of said compartment walls providing passages for the flow of air out of the compartment in a lateral direction relative to the axis thereof for cooling said condenser.

3. A refrigerant liquefying unit comprising, a condenser having its convolutions formed about a horizontally extending axis to enclose and provide walls of a compartment, the convolutions of said condenser being spaced apart to provide openings in said compartment walls along the length thereof, a casing within said compartment containing a motor and a compressor, a receiver closing one end of said compartment, air circulating means adjacent the other end of said compartment, said means being adapted to circulate air horizontally into said compartment, the openings in the compartment walls forming passages for the flow of air circulated by said means out of said compartment in a lateral direction relative to the axis thereof for cooling said condenser, and means adjacent said condenser and coextensive therewith for causing the air circulated through said compartment to be distributed along the length of said condenser.

4. A refrigerant liquefying unit comprising, a condenser having its convolutions formed about a horizontally extending axis to enclose and provide walls of a compartment, the convolutions of said condenser being spaced apart to provide openings in said compartment walls along the length thereof, a casing within said compartment containing a motor and a compressor, said casing having its axis disposed in perpendicular relation to the axis of said compartment, means for circulating air through the openings in said compartment walls in a lateral direction relative to the axis of said compartment for cooling said condenser, and means adjacent said condenser and coextensive therewith for causing the air circulated through the openings in said compartment walls to be distributed along the length of said condenser.

5. A refrigerant liquefying unit comprising, a condenser having its convolutions formed to enclose a compartment, a reticulated member coextensive with and surrounding said condenser, a first plate at one end of said compartment engaging said member, a second plate at the other end of said compartment engaging said member, a plurality of rods extending through said compartment closely adjacent the convolutions of said condenser and connected to said plates for securing same in engagement with said member, a casing within said compartment containing a motor and a compressor and having a connection with said condenser, and means for supporting said casing from said rods.

6. A refrigerant liquefying unit comprising, a condenser having its convolutions spaced apart and formed to enclose a compartment, a reticulated member coextensive with and surrounding said condenser, means for closing one end of said compartment, a plate having openings therein at the other end of said compartment, a plurality of rods extending through said compartment closely adjacent the convolutions of said condenser and connected to said means and to said plate for securing them in engagement with said member, a casing within said compartment containing a motor and a compressor and having a connection with said condenser, means for supporting said casing from said rods, and means carried by said plate for circulating air into said compartment at said other end thereof and out of the compartment through the reticulated member for cooling said condenser.

7. A refrigerant liquefying unit comprising, a condenser having its convolutions formed about a horizontally extending axis to enclose and provide walls of a compartment, the convolutions of said condenser being spaced apart to provide a plurality of horizontally spaced openings in said compartment walls along the length thereof, a casing within said compartment containing a motor and a compressor, means for circulating air into said compartment and against said casing, and the openings along the length of said compartment walls providing passages for the flow of air, circulated by said means, in a lateral direction relative to the horizontal axis of said compartment for cooling said condenser.

8. A refrigerant liquefying unit comprising, a condenser having its convolutions formed about a horizontally extending axis to enclose and provide walls of a compartment, the convolutions of said condenser being spaced apart to provide a plurality of horizontally spaced openings in said compartment walls along the length thereof, a casing within said compartment containing a motor and a compressor, means for circulating air into said compartment and against said casing, the openings along the length of said compartment walls providing passages for the flow of air, circulated by said means, in a lateral direction relative to the horizontal axis of said compartment, and means adjacent said condenser and substantially coextensive therewith for causing the air flowing through the openings in said compartment walls to be distributed along the length of the condenser for cooling same.

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