

Oct. 8, 1946.

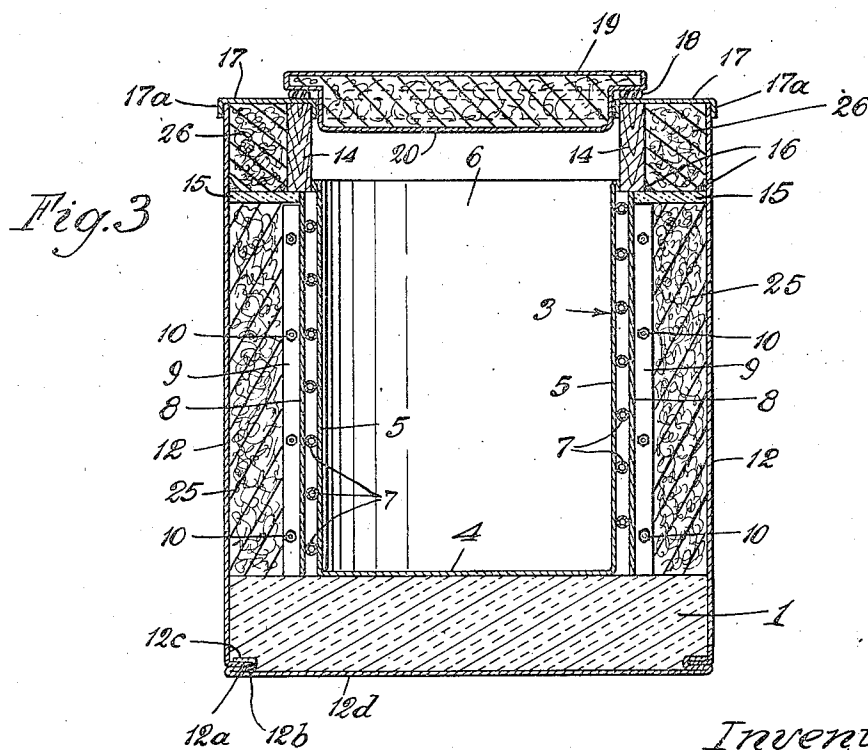
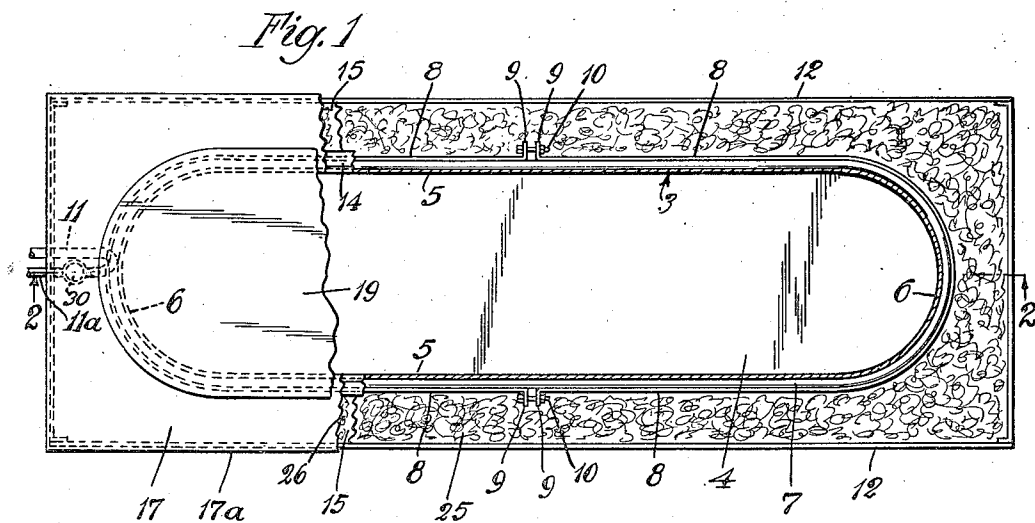
A. T. MILLOTT ET AL

2,408,805

REFRIGERATOR

Filed Aug. 11, 1944

2 Sheets-Sheet 1



Inventor
 Arthur T. Millott
 Edmund C. Graham
 by Parker & Slater
 Attorneys.

Oct. 8, 1946.

A. T. MILLOTT ET AL

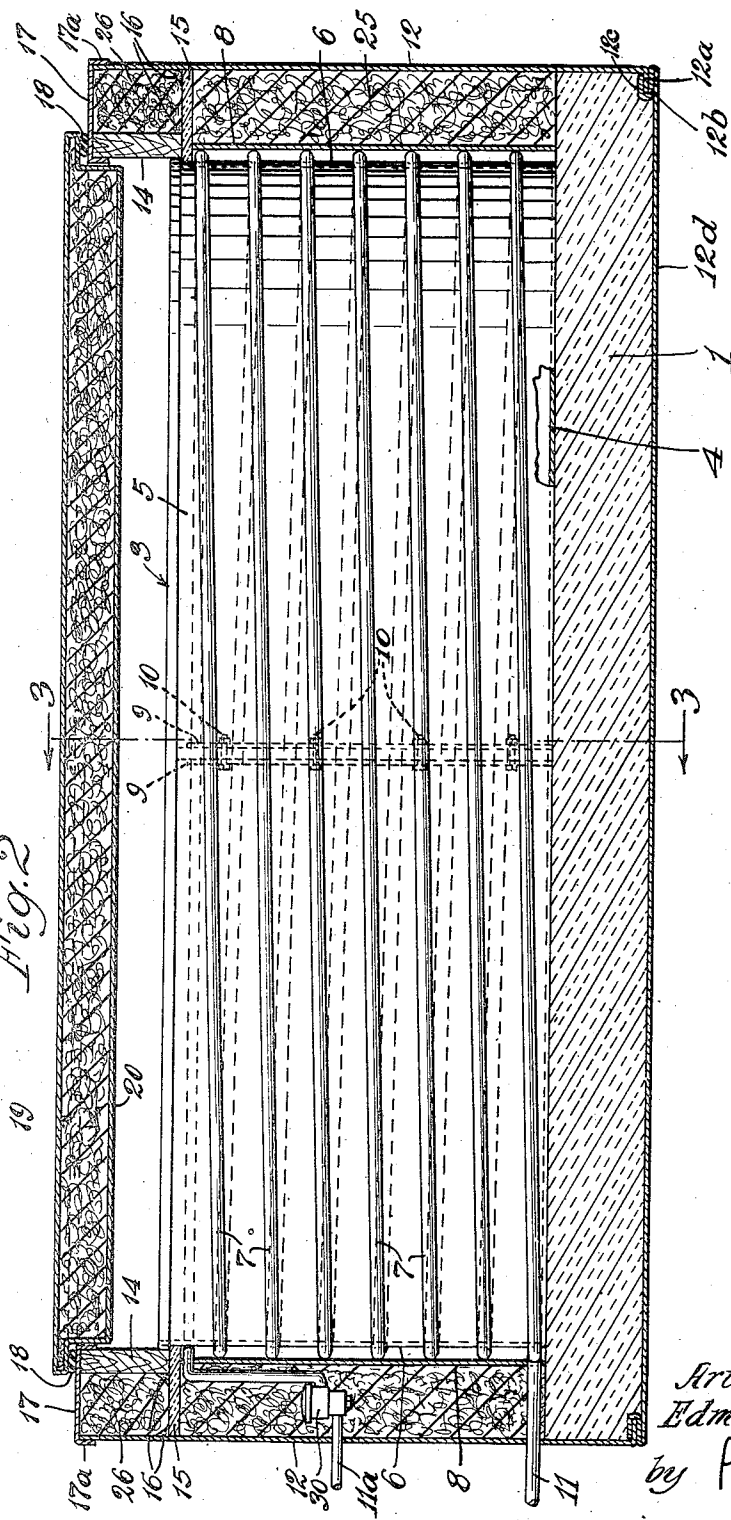
2,408,805

REFRIGERATOR

Filed Aug. 11, 1944

2 Sheets-Sheet 2

Fig. 2



Inventor
Arthur T. Millott
Edmund C. Graham
by Parker Slater
Attorneys

UNITED STATES PATENT OFFICE

2,408,805

REFRIGERATOR

Arthur T. Millott and Edmund C. Graham,
Minneapolis, Minn., assignors to Conditioned
Air Equipment Co., Minneapolis, Minn.

Application August 11, 1944, Serial No. 548,948

5 Claims. (Cl. 62—126)

1

This invention relates to an improvement in cooling devices and relates particularly to an improved evaporator and storage structure for home or store refrigerators.

One purpose is to provide an improved refrigerating device and the evaporator-storage element therefor.

Another purpose is to provide an improved evaporator and storage structure adaptable for use with home or store refrigerators.

Another purpose is to provide an improved construction in which evaporators of any desired size may be readily and quickly assembled to suit the particular requirements of a particular installation.

Other purposes will appear from time to time in the course of the specification and claims.

The invention is illustrated more or less diagrammatically in the accompanying drawings wherein:

Figure 1 is a plan view, with parts broken away and parts in section.

Figure 2 is a section on the line 2—2 of Figure 1; and

Figure 3 is a section on the line 3—3 of Figure 2.

Like parts are indicated by like symbols throughout the drawings.

Referring to the drawings 1 generally indicates any suitable bottom plate or board which may be positioned in the bottom of any suitable housing. One such housing is below described. The board 1 is preferably a high density insulating board or member which may be of substantial thickness. Positioned upon it, in the completed structure, is an inner container generally indicated as 3 and shown as including an integral bottom portion 4, and as having rectilinear horizontal parallel side wall members 5 and arcuate connecting end wall members 6. The bottom portion 4 and the side wall portions 5 and 6 define an open topped container area into which material to be cooled may be inserted from above for freezing and storage.

The space within the container is cooled by an evaporator which includes the coil or tubing 7. The tubing 7 is wound about the side walls 5 and 6 of the inner container 3 in such fashion as to be in intimate contact therewith. In assembling the evaporator, the tubing 7, of copper or the like, may be wound directly about the exterior of the container 3 in a series of loops or sections which pass continuously about the exterior of the container and may be generally uniformly spaced 55

2

from top to bottom thereof as shown for example in Figures 2 and 3.

In order to initially position the tubing 7 it may be welded or soldered or temporarily secured to the container 3 at widely separated points, preferably at the opposite ends of the container. Any substantial amount of soldering or welding is undesirable. After the container 3 has received the tubing 7, and it has been wound and temporarily secured in position, the tubing may be permanently secured in intimate relationship with the opposed outer face of the inner container 3 by the use of one or more compression members 8 which are locked in tension about the tubing. For example, as shown in Figure 1 two members 8 are employed, their opposed edges having ears 9 outwardly extending therefrom to receive any suitable locking member or bolts 10. Thus the two members 8 may be drawn together, and will firmly lock the tubing 7 against the outer face of the inner container 3, in intimate and continuous contact. It will be understood that whereas we show two members 8, a single member may be employed or a member composed of more than two sections. What is essential is that the outer member 8 shall be tensioned about the tubing, thus compressing the tubing 7 inwardly against the inner container 3, and maintaining the tubing in such intimate contact with the heat conductive wall of the inner container 3 that the passage of a refrigerant through the tubing results in a substantially uniform cooling effect throughout side wall 5, 6 of the member 3.

We do not illustrate any specific structure for maintaining the flow of a refrigerant through the tubing 7. However, a practical arrangement is to employ a compressor, a condenser, and a receiver in circuit with the tubing 7, together with any suitable expansion valve, 30. These features do not of themselves form part of the present invention and are not herein indicated in detail. I illustrate however, an inlet tube 11a and an outlet tube 11 which put the evaporator tubing 7 in circuit with any suitable compressor-condenser unit which may be arranged exteriorly of the refrigerator housing.

After the evaporator structure is completed, as above described, it may be positioned in an outer housing. As is shown in Figures 1 to 3 the high density bottom board 1 extends outwardly beyond the periphery of the inner container 3 in all directions.

We may form a vapor-proof outside cabinet by assembling sheets 12 of any suitable material, such as metal, in vapor tight relationship. The

3

sheets 12 may be secured together at their edges by soldering. The member 1, cut to size, is positioned in the bottom of the cabinet, and the evaporator is put in place. We may employ breaker strips 14 of wood or the like which rest on the upper edge of the evaporator structure which includes the inner container 3, the tube 7 and the compression member or band 8. We may pack any suitable insulating material 25 into the space between the outside cabinet or housing formed by the side and end panels 12, and the member 8. The space thus filled with insulating material 25 is closed at the bottom by the outwardly extending portion of the board 1. It is desirable that the outside panels 12 be of vapor-proof material and be vapor-proof at their joints or connecting edges.

15 indicates a vapor-proof high density board which closes the top of the space thus described and rests on the insulating material 25 packed between the panels 12 and the evaporator. The breaker strips 14 may rest on said vapor-proof high density board 15, in such fashion as to frame an access opening to the interior of the storage member 3. Any suitable plastic vapor tight seal may be positioned along the joints as indicated at 16. The space above the board 15 and outside of the breaker strips 14 may be filled with any suitable insulating material 26, and a top plate 17 may be employed to confine the material. The plate 17 may be of metal or of any other suitable material. It is shown as flanged at its edges as at 17a. 18 is any suitable rubber insulating strip adapted to support a removable cover 19 with its downwardly extending centering portion 20.

It will be understood that whereas we have shown a practical and operative device, nevertheless many changes may be made in size, shape, number and disposition of parts without departing from the spirit of the invention. We therefore wish our description and drawings to be taken as in a broad sense illustrative and diagrammatic, rather than as limiting us precisely to the structure and method of manufacture herein described and shown. It will be understood for example that the shape of the evaporator-storage unit may be widely varied. However, we find it desirable to employ a container about which the tubing may be wrapped without any special forming of the tubing, and without the production of areas in which the tubing is outwardly spaced from the wall of the container. This involves forming the container with rounded ends or corners, and insuring that the minimum radius of any rounded part is sufficiently great to render it easy to bend the tubing 7 thereabout.

In rendering the outer housing substantially gas-tight, we find it advantageous to form it with sheets having overlapping, interpenetrating edges. Thus the lower edge of the side sheet 12 may be inwardly turned as at 12a, and may be received between the lapped edges 12b and 12c of the bottom sheet 12d. Then the overlapping edges may be soldered or seam welded or otherwise tightly secured, the single edge of one plate penetrating the double edge of the other.

In the form of the device herein shown, the space between the outer sheets 12 and the outer surface of the evaporator, which is filled with the insulating material 25, constitutes a proper receiving and supporting medium for any suitable ducts, control devices etc. We illustrate for example any suitable expansion valve 30.

4

The employment of the tension wall or secondary outer wall 8 is advantageous for various reasons. The insulation is held away from the tubing 7 and this provides a more efficient use of the primary tube surface. The same tensioning of the member or members 8 which holds the tubing firmly against the inside liner or container 5, bonds the opposite side of the tubing to the secondary wall portion 8, which acts as an effective refrigeration surface to take care of heat lost through the insulation.

In practice it is important that the end 6 of the container 5 be formed with a true radius, from the center line of the container. The employment of a true radius is important in connection with our method of coiling the tubing and of installing the tensioning sheet or sheets or secondary wall 8.

The use and operation of the invention are as follows:

Our refrigerating element includes, as its storage unit, an inner liner 3 constructed with a sheet metal bottom 4 which is either unitary with the side wall 5, 6, or is in vapor sealed relation therewith. This bottom 4 gives rigidity to the wall structure of the inner container 3. It is important that the container be water and vapor tight, to protect the insulation in case the unit is defrosted.

In fabricating the refrigerator, the rigid board insulation 1 is cut to size and may be laid in the bottom of the outer container or cabinet formed by the panels or sheets 12. The tubing 7 is wound about the inner container 3 before the evaporator unit is positioned on the board 1. The inner container 3 may be held rigid at its top by the surrounding breaker strips 14. If desired, the breaker strips 14 may be secured to the inner container 3 before the tubing 7 is wound about the container 3; thus it forms a fairly rigid liner which acts as a mandrel about which the tubing 7 is wound. The coils or tubing 7 may be wound by hand and tacked by solder at each end, merely to hold and properly space the tubing for fabrication. It is not necessary to place tension on the coils while winding them, although it is desirable to wind them into reasonably close contact with the outer face of the inner container 3. Thereafter the tension member or draw band 8 is employed to force the coil or tubing into contact with the outer face of the inner container 3. It eliminates the necessity of tension and soldering, and at the same time renders it practically impossible for the tubing 7 to be out of contact with the opposed outer face of the inner container 3. This construction also eliminates the necessity of employing pressure from the outside insulation in order to maintain the tubing 7 locked against the container 3. We find it desirable to employ a draw band or tension member 8 with two tension or draw points located on the opposite flat sides of the container. The employment of draw points with ears 9 and drawings bolts 10 extending substantially outwardly from the tubing 7 is advantageous. Thus, when pressure is exerted longitudinally it is also exerted inwardly toward the coil. This forces the coil to follow any rises or drops in contour of the side wall of the inner container 3. The draw points, being placed intermediate the ends of the opposite parallel and generally rectilinear side walls, thus force the tubing 7 inwardly against the container 3 along its flat sided walls. If the draw points were placed at the rounded ends of the container 3, then any inward bowing of the rectilinear side walls would tend to withdraw the straight wall portions of

5

the container 3 inwardly away from the tubing 7. The result of the draw band constructions also forces any longitudinal excess of the coil itself to be taken up in rises and drops, and forces the coil to lie tight along the inner container. In practice, after the cabinet is constructed and refrigeration has started, the frost line which first appears, disappears completely when the liner is completely cooled. Note that no solder is used except at the end points, and there only to space the coils before the surrounding draw band or tension member 8 is applied.

It is possible, although not in general desirable, sometimes to pack the insulation 25 in so tightly between the outer housing 12 and the inner container that the packed insulation tends to assist in holding the tubing 7 against the inner container 3. However, the draw band structure above described is preferable.

The outer housing may be made of 16 or 18 gauge sheet metal, vapor sealed by soldering the joints which are made with a single edge into a double edge, the double edge being on the insulation side of the sheet. This construction gives a rigid corner and bottom seam and eliminates the necessity of riveting. No separate framework need be employed. The rigid insulation board 1 is laid on the bottom and the inner liner assembly 3, 7, 8, rests on the board 1. Any suitable insulation may be employed.

We claim:

1. In a refrigerating structure, an evaporator and storage unit including an inner member having a circumferential generally upright side wall, and a bottom wall, of heat conducting material, said upright side wall having arcuate portions connected by generally rectilinear portions, a tube coiled around the exterior of said inner member in a plurality of vertically spaced loops, and an outer flexible draw band structure and means for drawing it tightly about said tube and for thereby holding said tube in close contact with the opposed outer surface of said side wall, said draw band structure including means for forcing inwardly against the tube those parts of the draw band which are opposed to the generally rectilinear portions of the side wall.

6

2. The structure of claim 1 characterized by the fact that said draw band, of heat conductive material, extends continuously from top to bottom of said inner member.

3. The structure of claim 1 characterized by the fact that said draw band structure is a multi-piece device having opposed edge portions and adjustable means for securing them together in tension creating relationship, said edge portions and securing means being located opposite rectilinear portions of said upright wall.

4. The structure of claim 1 characterized by and including an outer housing having a bottom portion of heat insulating material, on which said evaporator and storage unit rests, side walls defining a space surrounding said storage unit and a body of insulating material filling the space between said side walls and the draw band structure of said storage unit.

5. In a refrigerating and storage structure, an open-topped evaporator and storage unit including an inner member having a circumferential, generally upright side wall, and a bottom wall, of heat conducting material, said upright side wall being at least in part arcuate, a tube coiled around the exterior of said side wall in a plurality of vertically spaced loops, and an outer flexible drawband structure for drawing said tube tightly about said side wall and for thereby holding said tube in close contact with the opposed outer surface of said side wall, said drawband having opposed edges, means for positively drawing said edges towards each other, and for thereby maintaining said drawband under substantial tension, and said tube under substantial compression, and means for supporting and insulating said evaporator and storage unit, including a body of heat insulating material upon which said bottom wall is positioned, and a body of heat insulating material surrounding the exterior of said side wall and drawband, said tube having a refrigerant inlet duct and a refrigerant outlet duct, adapted for the passage of a volatile refrigerant.

ARTHUR T. MILLOTT.
EDMUND C. GRAHAM.