April 4, 1950 W. L. MORRISON 2,502,581

DEMOUNTABLE REFRIGERATOR

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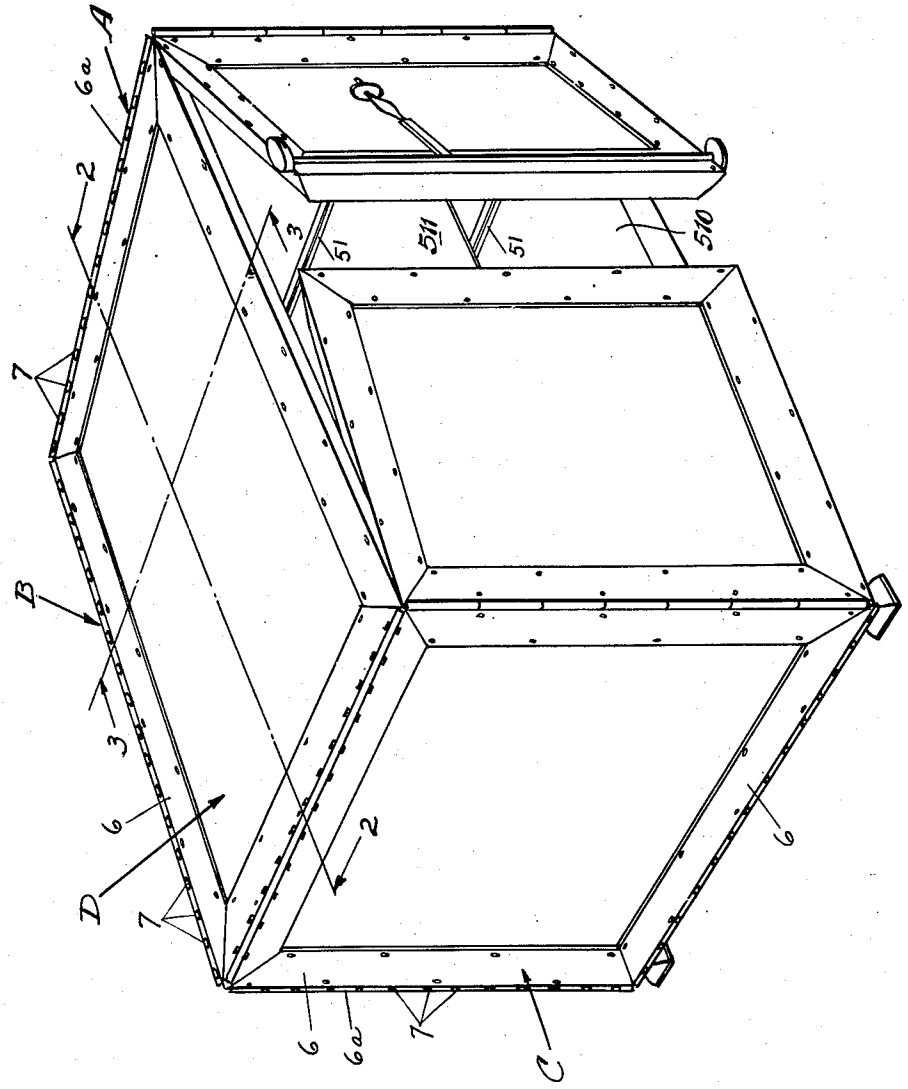


Fig. 1

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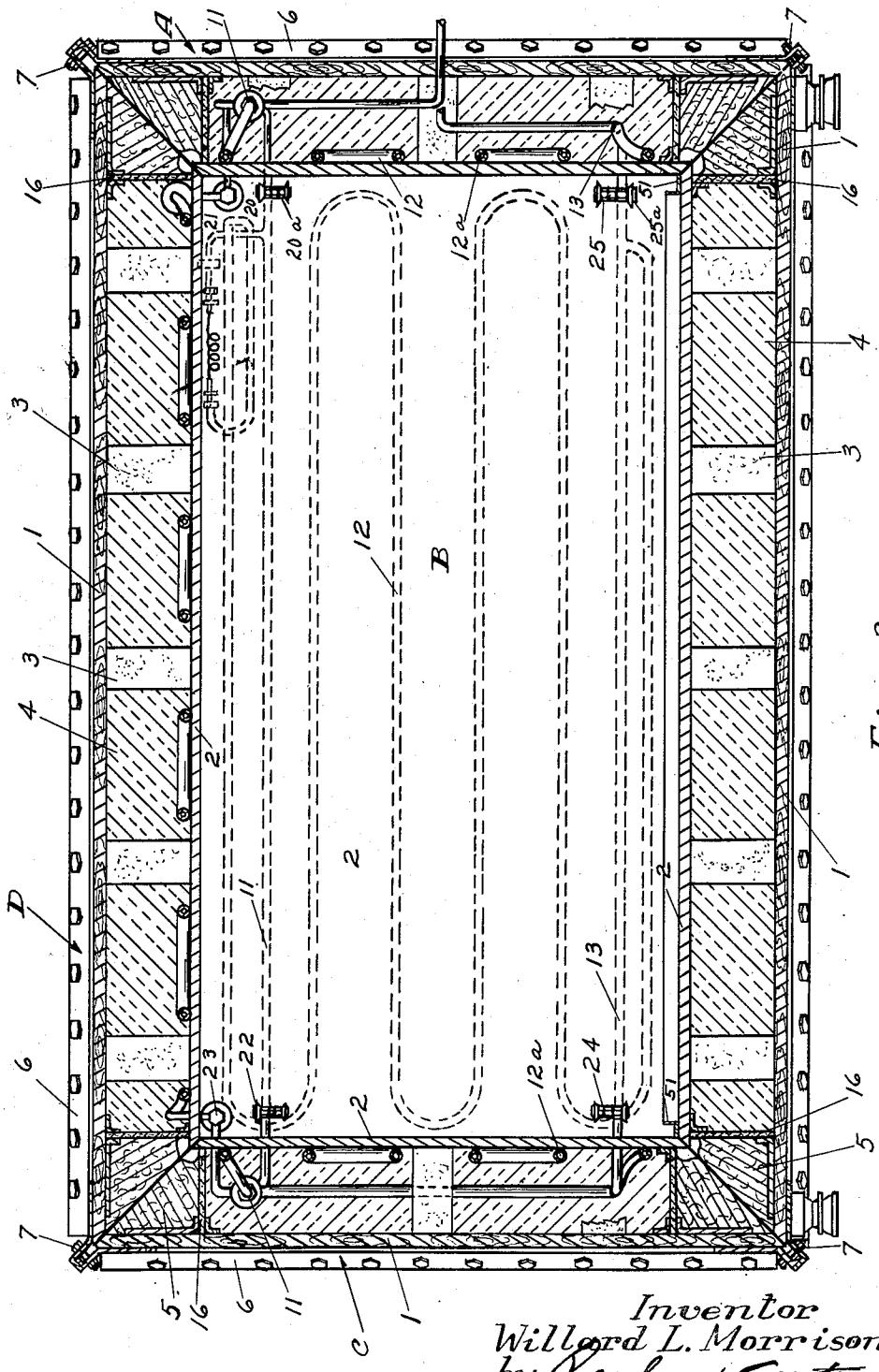


Fig. 2

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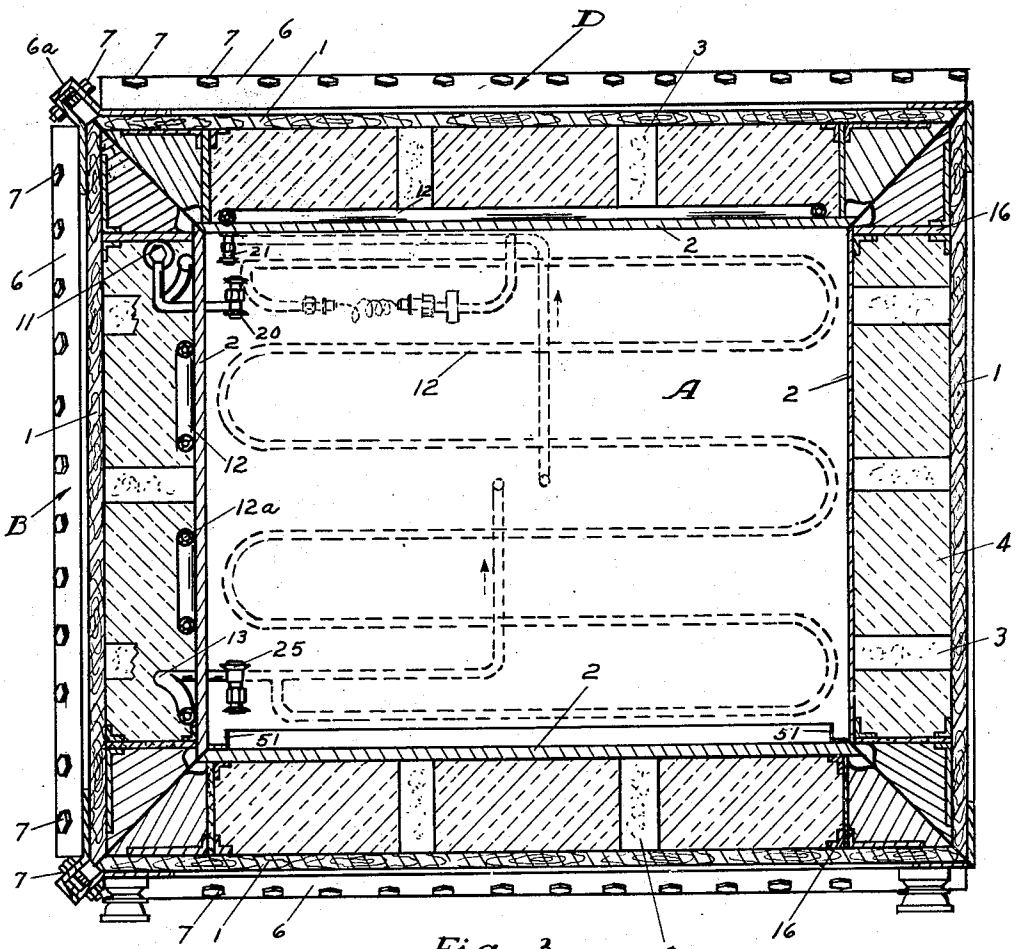


Fig. 3

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DEMOUNTABLE REFRIGERATOR

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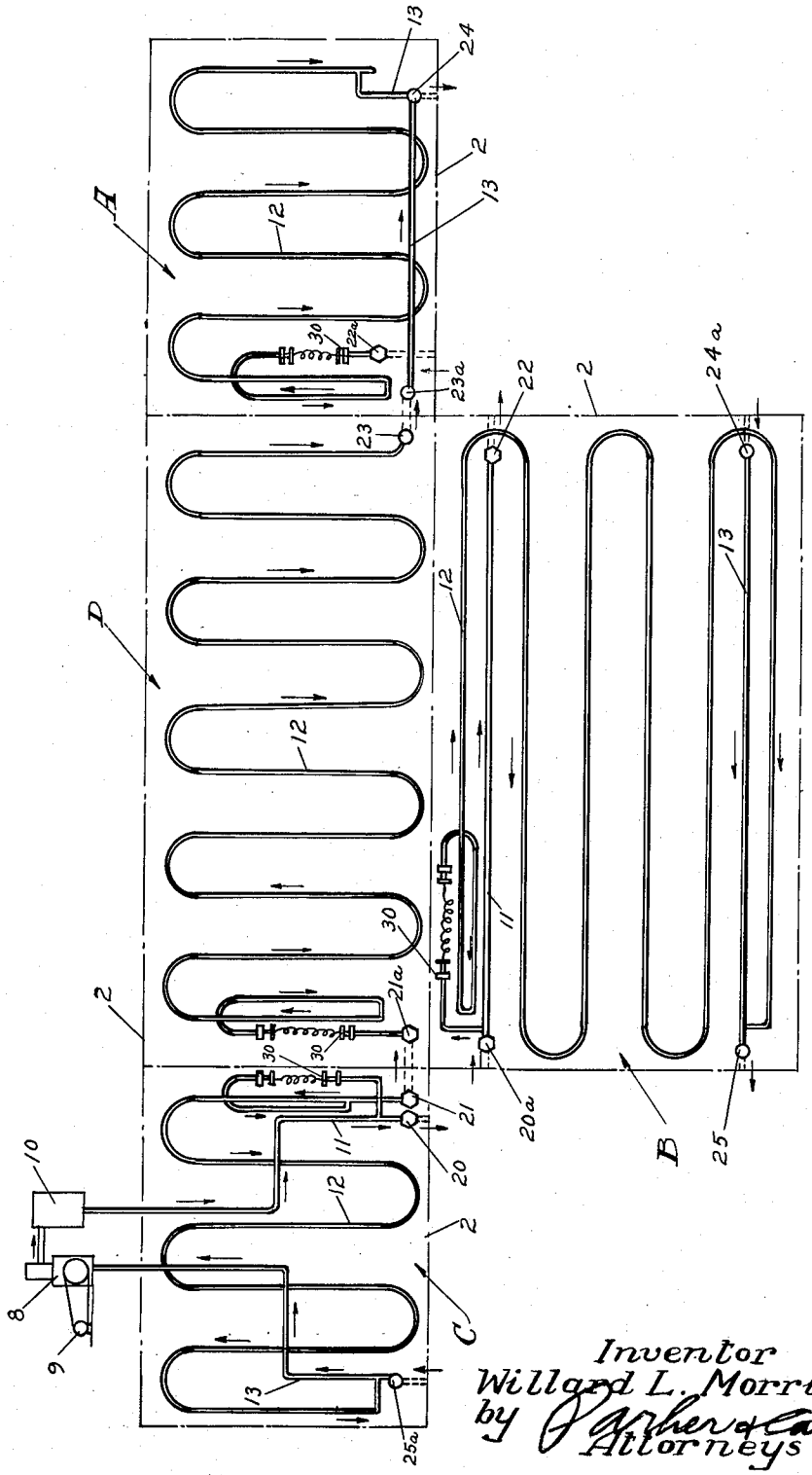


Fig. 4

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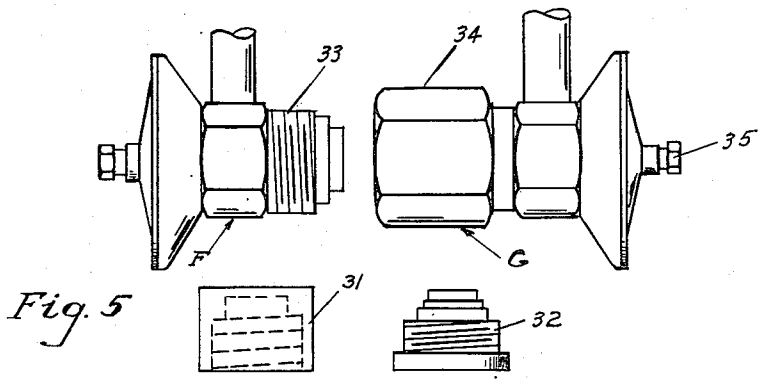


Fig. 5

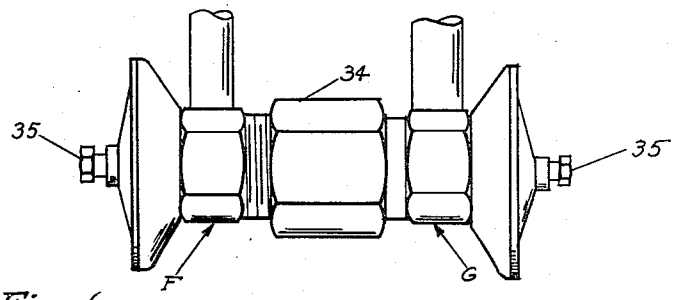


Fig. 6

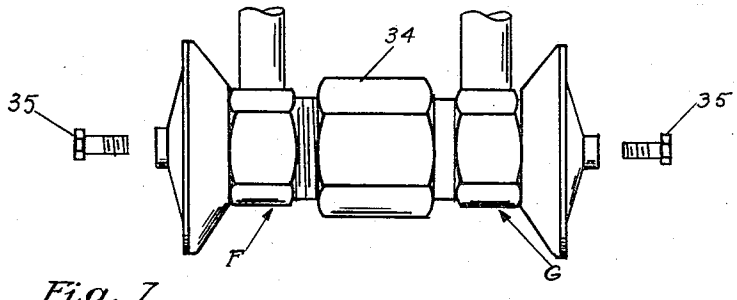


Fig. 7

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DEMOUNTABLE REFRIGERATOR

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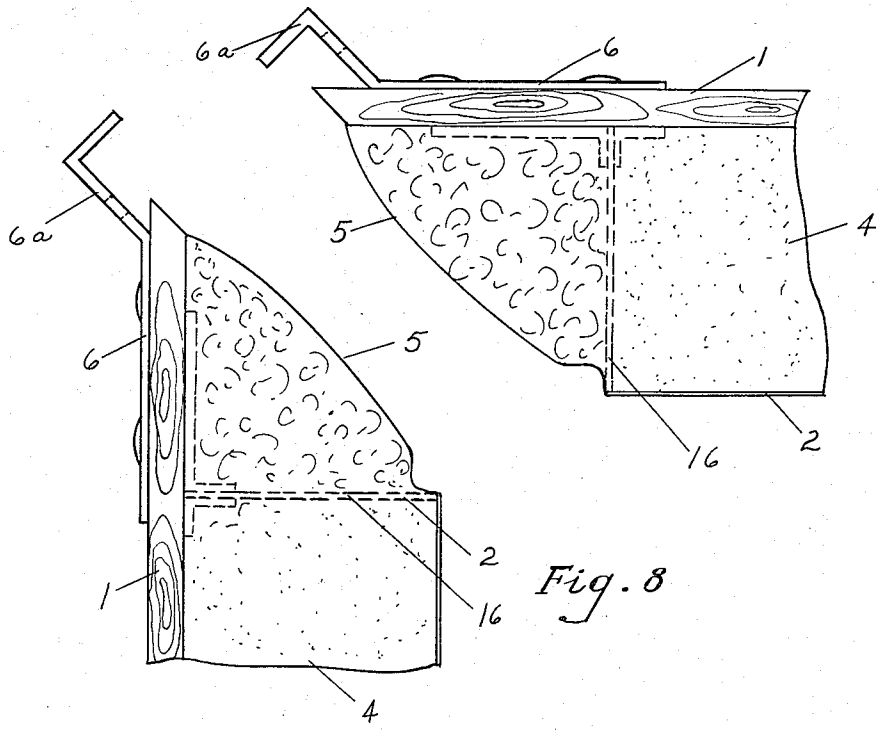


Fig. 8

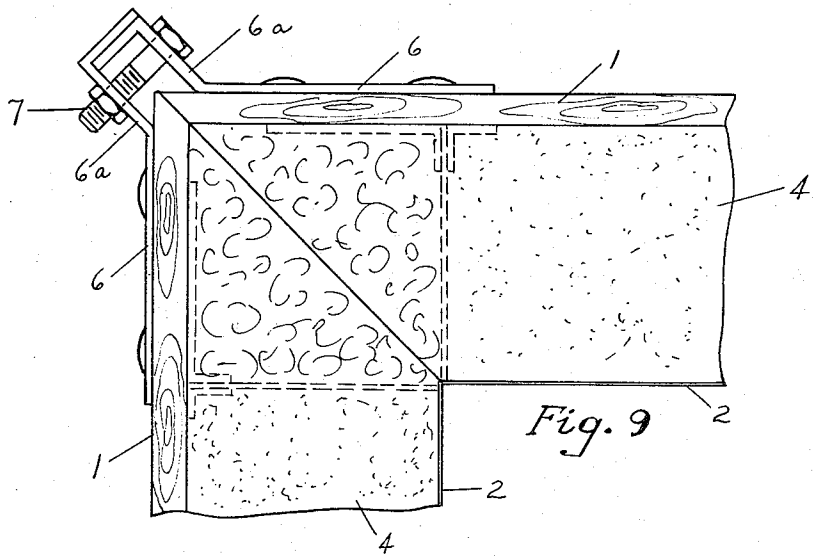


Fig. 9

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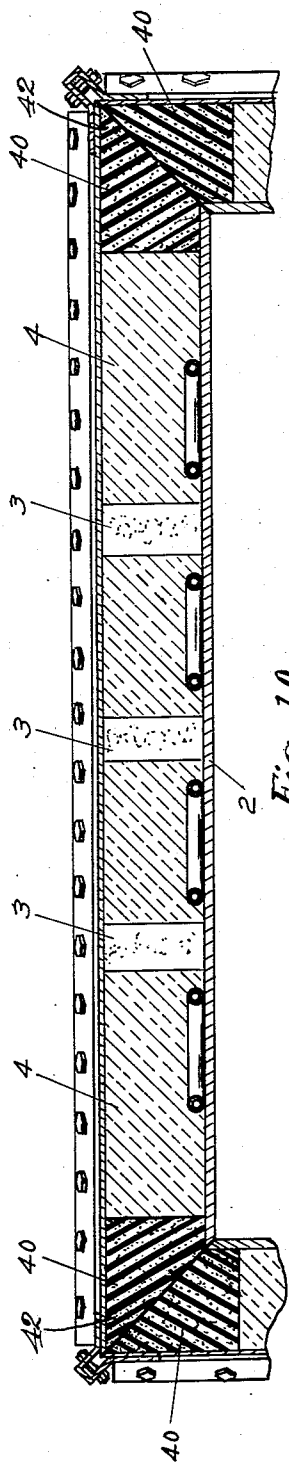


Fig. 10

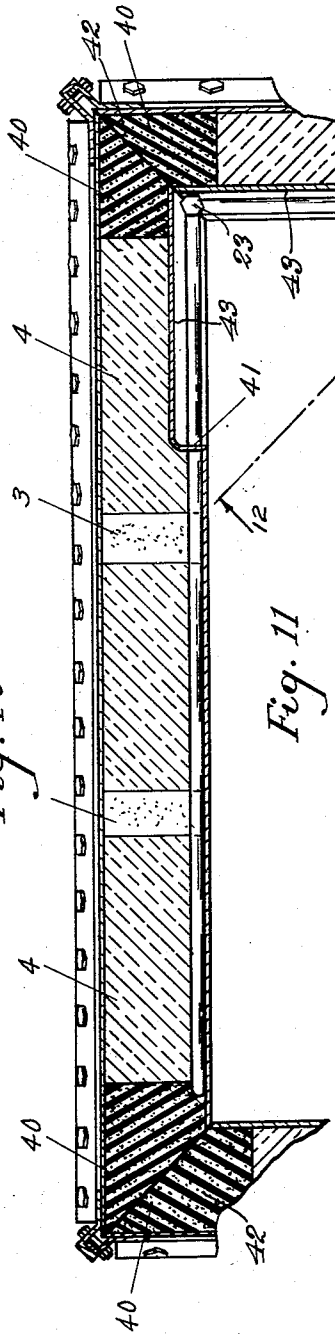


Fig. 11

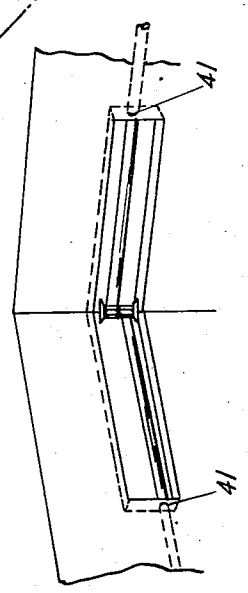


Fig. 12

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UNITED STATES PATENT OFFICE

2,502,581

DEMOUNTABLE REFRIGERATOR

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Application April 28, 1947, Serial No. 744,484

9 Claims. (Cl. 62—116)

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My invention relates to improvements in refrigerating means and has for one object to provide a new and improved form of cold box which may be easily and conveniently shipped in knocked down condition, and which may readily be assembled by unskilled operators with a minimum of tools and instruction.

Another object is to provide a cold box which includes a plurality of wall elements including cold plates, each one containing, when shipped, its share of coolant so that no filling or adjusting or clearing of the system is necessary. All that the assembler does is to put it together, connect up the pipe connections, start the motor and operate the box.

Other objects will appear from time to time throughout the specification and claims.

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

Figure 1 is a perspective view of my box in the assembled condition with doors ajar;

Figure 2 is a vertical section taken along the line 2—2 of Figure 1;

Figure 3 is a vertical section of the assembled box taken along the line 3—3 of Figure 1 with the door closed;

Figure 4 is a diagrammatic view of back, top and two ends of the box in planar projection to illustrate diagrammatically the refrigerant flow paths;

Figure 5 shows the two parts of the packless valve, used to connect the piping in the various plates upon assembly, with protective plugs removed;

Figure 6 shows the initial assembly position of the packless valve;

Figure 7 shows the special packless valve after it has been opened, assembled and with the end screws removed;

Figure 8 illustrates the adjacent ends of two wall plates before they are fastened together;

Figure 9 illustrates a corner of the box with the ends of two plates assembled together;

Figure 10 is a section similar to the left hand side of Figure 2 showing a modified form;

Figure 11 is a section similar to Figure 10 showing a modified form wherein the valve connection between the separate panels are countersunk;

Figure 12 is a perspective generally along the line 12—12 of Figure 11.

Like parts are indicated by like characters throughout the specification and drawings.

I illustrate in the drawings a demountable refrigerator which is shown as including four individually demountable side elements, a bottom element and a top element. As will appear from Figure 1, a double door constitutes one of the side elements, but if desired a door could be employed as part of the top element.

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Each wall member consists of an outer wall element 1 which may, for example, be of plywood or thin sheet metal or any other finish or material suitable to form the outside of the completed refrigerator. The inner walls of the doors and the bottom members are made of a thin metal. The inner walls 2 of the two ends, back and top members, A, B, C, D, the cold plates, are made of a thin metal with a suitable number of ducts, tubes or runs 12 engaging the outer sides of the walls to convey the refrigerant. The runs 12 may be of tubular metal suitably formed to define and surround open spaces 12a in which the refrigerant is evaporated, but other types of cold plate may be used. The inner and outer walls are spaced apart by heat-insulating spacing blocks 3, and the space surrounding the blocks between the inner and outer walls is filled with a mass of insulation 4, of balsam wool or any other suitable material.

At the corners of the box where the wall units abut, the inner walls, or the cold plates, terminate at their edges at a proper distance within the edges of the outer walls, to provide a corner with a meeting surface at an angle of generally 45 degrees to the outer faces of the abutting wall units. At the abutting corners a hair stuffing is used to furnish a resilient effect, the corners being overstuffed as shown in Figure 8 at 5. This overstuffing is held in place by an insulating material 16 such as Celotex.

The abutting walls are fastened together by angle plates 6 on their outer surfaces. Figure 8 illustrates the angle plates separated, and Figure 9 illustrates them fastened together and secured by means of a row of bolts 7 extending through the spaced parallel extensions 6a. When the sides of the box are bolted together the valve connections which seal the refrigerant in each wall are connected as shown in Figures 5, 6 and 7. In Figure 5 I show the two parts of the valve with protective cap and plug 31 and 32 removed. Temporary cap 31 fits over end section 33 of the left half of the valve, and temporary plug 32 fits into coupling 34 of the right half of the valve. In Figure 6 the two parts of the valve are fitted together, coupling 34 being screwed on part 33. When the valve parts are securely fastened together and ready for the refrigerant to be re-

leased, the screws **35** are removed permitting a spring mechanism, not shown as it forms no part of the present invention, to open the passage between F and G. After the passage is open, the screws **35** can be removed, as shown in Figure 7, and will be of further use only if the box is to be demounted and the valves closed.

When the valves are connected the refrigerant is able to flow through its cycle as illustrated in Figure 4 from a compressor **8**, driven by a motor **9** to a condenser **10**. From the condenser **10** the refrigerant flows through the liquid fluid line **11** which feeds the evaporator tubes **12** of the cold plates **2**. After completing its run through the tubes of the cold plates the refrigerant empties into the return ducts **13** which return it to the compressor **8** to complete the cycle.

The refrigerant flows from one cold plate to another through the valve connections illustrated in Figures 5, 6 and 7. When the two parts of the valve are fastened and the releasing screws **35** are removed, the refrigerant will flow from wall or cold plate C to wall B at valve **20** and **20***a*; from wall C to wall D at valve **21** and **21***a*; and from liquid line **11** of wall B to wall A at valve **22** and **22***a*. It should be understood that each wall is fed separately from liquid side manifold common to all and drained from suction manifold also common to all.

From the liquid lines **11** the refrigerant passes through a thermostatic check valve **30** which reduces the pressure in a manifold common to the inlet of the series of capillaries or tubes individual to each plate. These capillaries are individually calibrated to feed the proper amount to each plate and take into consideration their various locations both horizontal and vertical and provide an even cooling effect throughout the united surfaces. The result is that each plate is tuned to do an even share of the heat pick-up. The refrigerant feeds into the tubes **12** attached to the outer side of the cold plates **2**. After completing a circuitous trip on the cold plate the refrigerant flows into return ducts **13**. The return ducts connect between wall D and A at connecting valves **23** and **23***a*; the refrigerant from plate D flows through the return duct **13** of plate A to join the return flow from plate A. The refrigerant from both plates flows from plate A to plate B at connecting valves **24** and **24***a*. The refrigerant that has flowed through plate B also flows into return duct **13** of plate B and the return flow passes from plate B to plate C at connecting valves **25** and **25***a*.

On wall C the returning refrigerant travels through return duct **13** where it is joined by the refrigerant that has cooled plate A. Thus the returning refrigerant travels to compressor **8** where it is recompressed before repeating its cycle.

I have provided outwardly extending members **6***a* at all edges, thus providing means whereby the layman in putting the side wall members together has a visible and accessible series of bolts to install as shown in Figures 8 and 9. When put in place this results in a rigid rectangular frame work which supports the inner cold plates and insulation.

Referring now to Figure 10, **40** is a mass of laminated hard and sponge rubber having structural strength but serving as a vapor sealing member. **42** indicates the soft sponge rubber which cooperates with the hard rubber, the frame in each panel mating to form the air-tight fit between the panels. **43** is a channel or recess in

the wall **2** which permits the refrigerant tubes to pass from the insulation or outer side of the cold plate to the inside of the panel for connection between adjacent panels. Thus the valve member **23** while accessible from the inside for connecting does not infringe on the volumetric area of the cold box.

The members **40** and **42** serve as a substitute for the rigid vapor seal **16** and the pad **5** as indicated in Figures 8 and 9.

Referring again to Figure 1, the floor **510**, and the horizontal partition **511** both carry the rail **51** around their outer peripheries spaced inwardly from the wall of the box so as to prevent actual contact between the cold plate or box wall and the material, crate or hamper contained within the box.

The use and operation of my invention are as follows:

It is frequently desirable to provide a strong and practical refrigerator of substantial size, which, if shipped whole, would be too large to be placed in the desired area of use. The demountable feature of my refrigerator makes it possible to ship it disassembled, and to assemble it at the point of use. The assembling structure is sufficiently simple, so that the device may be assembled, in many instances, by the ultimate user. For example, a farmer or suburban householder of ordinary intelligence, and with ordinary equipment, can himself assemble a refrigerator made in accordance with my invention without the need of difficult or complicated equipment, and without expert assistance.

My invention is particularly well adapted to refrigeration where a relatively high temperature is satisfactory. For example, it may be used as storage means for vegetables or for articles which will advantageously keep at a little below freezing, or at slightly above freezing.

Cold plates comprise more than half of the interior walls of the refrigerator. This large area of cold element is the factor which prevents temperature differential within the box. Food placed in the box is quickly reduced to the same temperature as the cold plates. Warm, moist air entering the box when the doors are opened is cooled quickly which causes condensation of the moisture suspended in the warm air. This moisture falls on the food in the box. The combination of these factors prevents dehydration of the food. Maintaining a temperature of around 32° F. retards ripening of fruits and vegetables so that food placed in my refrigerator can be kept for considerable time without becoming overripe or dehydrating.

Each plate or wall unit is self-contained to the extent that it includes a cold plate **2**, an outer wall **1**, an enclosed body of insulating material **4**, and the ducts necessary to supply refrigerant to the tubes **12** of the cold plate and to remove it from the plate. The non-conductive Celotex blocks **3** form a powerful stabilizing means for the whole structure, and a robust and sturdy individual wall element is provided.

When the wall elements are secured together, they are adequately sealed by the opposed flexible overstuffed walls **5** as shown, for example, in Figures 8 and 9. The valves that connect the ducts for the incoming refrigerant and the return refrigerant are then connected as shown in Figures 5, 6 and 7. When these connections are made the refrigerant can cycle from compressor to condenser, then by means of the feed ducts **11** and check valve **30** travel through the tubes **12**

of the cold plate and empty into the return ducts 13 which returns the refrigerant to the compressor.

I claim:

1. In a cold box, demountable side wall members having soft flexible overstuffed edges and outwardly extending opposed flange members, means for attaching the members together to form a rigid rectangular outer framework and hold the soft edge elements together to seal the box, separate elements of a refrigeration circuit mounted on some of the wall members, and means for joining such elements to close the circuit when the wall members are joined.

2. A cold box including a plurality of demountable wall sections, a plurality of said walls including cold plates, a refrigerant circuit a portion of which is included in each cold plate, means for removably attaching the walls together to form the box, and means for removably connecting the refrigerant circuits in the cold plates to close a refrigerant circuit.

3. A cold box including a plurality of demountable wall sections, a plurality of said walls including cold plates, a refrigerant circuit a portion of which is included in each cold plate, means for removably attaching the walls together to form the box, and means for removably connecting the refrigerant circuits in the cold plates to close a refrigerant circuit, means associated with the circuit connecting means to close the exposed ends of the portion of the circuit in each wall whereby the refrigerant is maintained in each wall section during the time that the sections are disconnected.

4. A cold box including a plurality of demountable wall sections, a plurality of said walls including cold plates, a refrigerant circuit a portion of which is included in each cold plate, means for removably attaching the walls together to form the box, and means for removably connecting the refrigerant circuits in the cold plates to close a refrigerant circuit, means associated with the circuit connecting means to close the exposed ends of the portion of the circuit in each wall whereby the refrigerant is maintained in each wall section during the time that the sections are disconnected, manually actuated means for opening the system to permit free circulation of refrigerant after the connections have been made.

5. In a cold box, a plurality of cold plates forming some of the sides of the box, each cold plate including a portion of a refrigerant circuit, means for connecting the refrigerant circuit portions together to complete a closed refrigerant circuit, and separate means for removably holding the cold plates together to form a demountable box.

6. In a cold box, a plurality of cold plates forming some of the sides of the box, each cold plate including a portion of a refrigerant circuit, means for connecting the refrigerant circuit portions together to complete a closed refrigerant circuit, and separate means for removably holding the cold plates together to form a demountable box, that portion of the refrigerant circuit in each cold plate being adjusted to separately control the cooling effect of such plate with respect to the other plates.

7. A plurality of separate wall sections, means for detachably fastening them together to form a cold box, cold plates forming the inner surfaces of some of the wall sections, a refrigerating compressor associated with one of the wall sections, means for connecting the plates together to form a refrigerating circuit including the plates and the compressor.

8. A plurality of separate wall sections, means for detachably fastening them together to form a cold box, cold plates forming the inner surfaces of some of the wall sections, a refrigerating compressor associated with one of the wall sections, means for connecting the plates together to form a refrigerating circuit including the plates and the compressor, and separate means for closing the ends of that part of the refrigeration circuit associated with each plate to hold the refrigerant therein when the plates are disconnected.

9. A plurality of separate wall sections, means for detachably fastening them together to form a cold box, cold plates forming the inner surfaces of some of the wall sections, a refrigerating compressor associated with one of the wall sections, means for connecting the plates together to form a refrigerating circuit including the plates and the compressor, and separate means for closing the ends of that part of the refrigeration circuit associated with each plate to hold the refrigerant therein when the plates are disconnected, and manually controlled means for opening said closures, when the refrigerating circuit sections are connected, to permit circulation of a refrigerant through the system to cool the box.

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