June 19, 1928. 1,673,860

F. S. WOOD ET AL

ELECTRIC REFRIGERATOR

Filed May 22, 1926

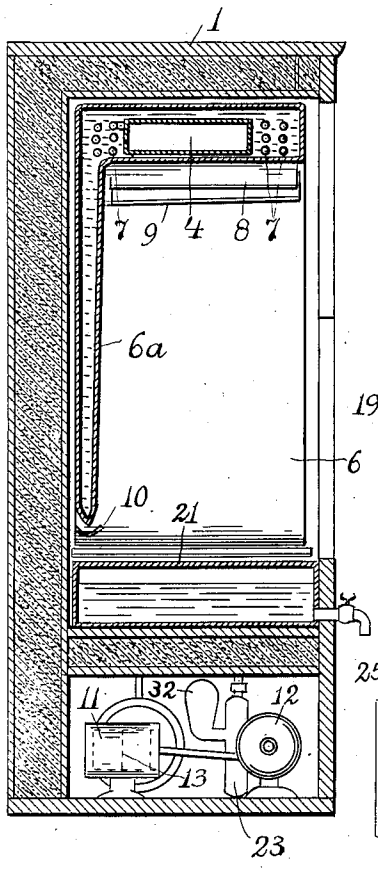


Fig. 2

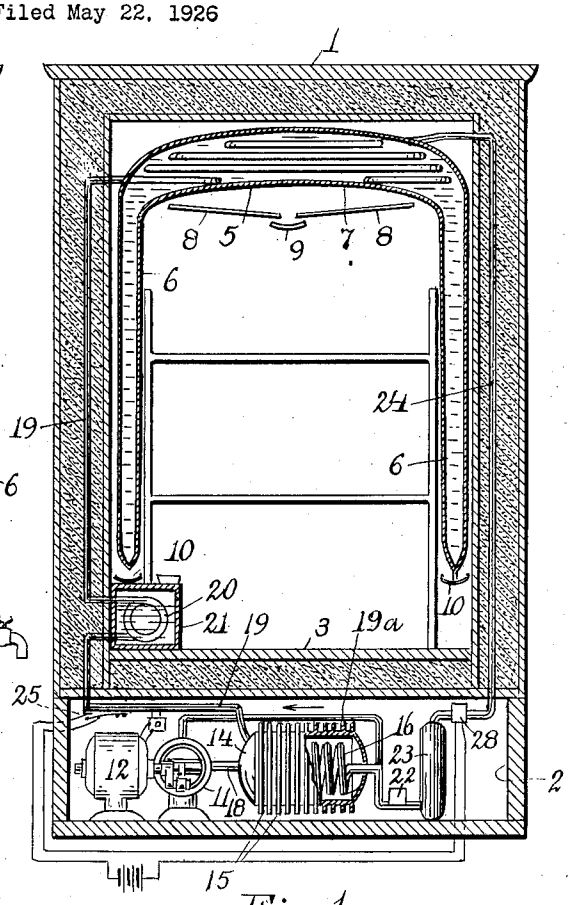


Fig. 1

Fig. 3

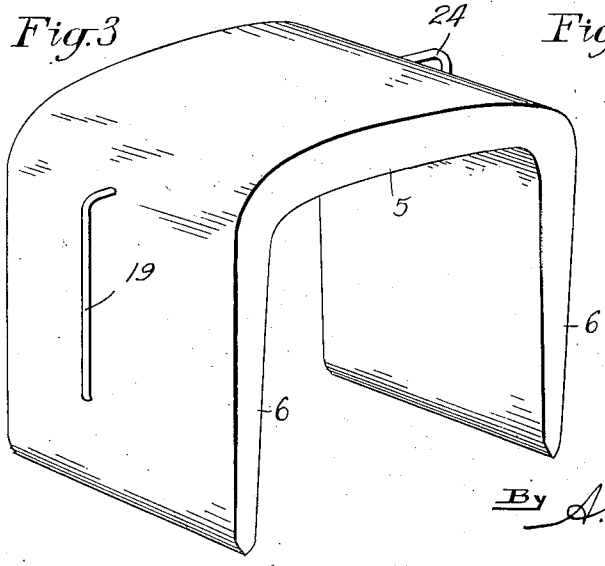
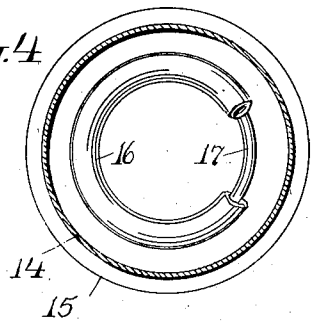


Fig. 4



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UNITED STATES PATENT OFFICE.

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ELECTRIC REFRIGERATOR.

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Our invention relates to refrigerating devices wherein the heat-extraction is performed by means of the vaporization of liquids and their return to their normal liquid condition by means of suitable mechanical instrumentalities.

The object of our invention is to provide a refrigerator complete in itself, capable of giving the maximum storage space for a minimum exterior, to obtain the highest efficiency and economy in operation, and, in general, to improve the refrigerator in important details of construction and arrangement.

To provide the largest possible storage capacity, the refrigerant container is made in the form of an arch or hood, whose top and side branches are close to the ceiling and sides of the refrigerator chest, leaving an ample space for the butter, milk and other articles to be cooled between the side branches. Further, instead of adapting the device for freezing slabs of ice to be put into drinking water, I have the refrigerant, after having parted with much of its heat absorbing property, operate to cool a small reservoir of water to a palatable degree, which can be drawn off as desired.

The other features of our invention will be set forth in the course of the general description of the refrigerator.

In the drawings forming a part of this specification, Fig. 1 is a front sectional elevation of a refrigerator embodying our improvements. Fig. 2 is a sectional side elevation. Fig. 3 is a perspective view of the fluid tank. Fig. 4 is a cross section on a larger scale of the refrigerant condenser.

The refrigerator chest 1 is of well known construction, but is provided with an apartment 2 below its floor 3 for the reception of the electric operating mechanism and apparatus. Within the chest proper is located a fluid tank comprising a body 5 close beneath the ceiling of the chest, having depending hollow arms 6 near the sides of the chest; the arms and body being composed of metal and made liquid-tight. The fluid tank is in approximately the shape of an inverted U, as viewed from the front, and is designed to be filled with brine, or water carrying a proper amount of alcohol. In the body portion 5 is an expansion chamber 4 and a coil of pipe 7 designed to receive the refrigerant, which is preferably methyl chloride.

To prevent the dripping upon food below of the moisture condensing upon the body portion 5, shields 8 are supported close beneath the same, suitably inclined to deliver any condensate into a drip-trough 9. A similar drip-trough 10 is provided for each of the branches 6.

The means for delivering the refrigerant to the expansion chamber 4 and coil 7 consists of a compresser 11 actuated by an electric motor 12 designed for low speed in order to be directly connected to the plunger 13 thereof; a condenser comprising a thin walled cylinder 14 having radiating ribs 15; a coil of large tubing 16 within this cylinder and having a coil 17 of smaller tubing within it. The compresser 11 is connected by a pipe 18 with the cylinder 14 to force the refrigerant into the latter. The inner end of the coil 16 is open to permit the contents of the cylinder to be driven through it past a check valve 22 into the receiver 23, and thence up through a pipe 24 into the expansion chamber 4 and coil 7.

The vapor from the coil 7 descends through a tube 19 to a coil 20 within a water tank 21, and thence on down to pass through an end of the condenser and to connect with the small coil 17, the other end of which emerges from the tubing 16 and passes through a pipe 19ª to the compressor 11 by which its contents are compressed and forced into the cylinder 14 through the pipe 18; thus completing the cycle.

The cylinder 14 being filled with the refrigerant which is partially cooled by its radiating ribs 15, and the coil 17 containing comparatively cold refrigerant, that within the cylinder as it escapes through the large coil 16 becomes very much colder, and passes on to perform its refrigerating function in a suitably condensed and cold condition.

At any desired point of the tube 24, preferably within the sub-apartment 2, is an electrically controlled needle valve 28 of well known construction, which is controlled through the agency of a thermostat 25 located in contact with the pipe 19; whereby the temperature of the refrigerant at the completion of its work is caused to switch current to the needle valve, so that if the temperature is too high, the vapor is permitted to pass on up the tube 24; and if too low, the valve closes.

By thus intermittently operating the valve to control the temperature of the refrigerant

in accordance with the requirements of the contents of the chest 1, we are able to secure a far more equal temperature within the chest than is possible with the pressure-controlled devices now in use.

Through the great increase in refrigerating surface made possible by the arch-shaped fluid-tank, its cooling function is correspondingly rendered of maximum efficiency; the same shape providing maximum space for the reception of food and other perishables, while permitting a comparatively small size of chest.

For the larger sizes of refrigerators, we prefer to connect with the body 5, additional to the branches 6, another branch 6^a at the back of the same, as shown in Fig. 2, in order to give increased refrigerating effect; but for the medium sized chests we use the two branches 6 only; while for the small sizes, we may use the rear branch 6^a alone.

As illustrated in Fig. 2, the receiver 23 is connected with an air-cushion chamber 32, whereby, upon the opening of the needle valve 28 by the action of the thermostat 25, the liquid held back by the valve will instantly be thrown on up into the tube 24, instead of stopping at the valve. The air chamber is, therefore, a very important adjunct to the needle valve and its controlling thermostat.

We have discovered that a flatly extended vertical brine chamber having the refrigerating means in its upper portion, is much more efficient than a compact brine chamber of equal capacity. While this is, of course, partly due to the increased surface exposed to the refrigerating space by its exterior, we find that it is largely owing to the increased quickness of circulation given to the brine within. This more rapid circulation is caused by the quicker warming of the liquid in the lower section of the vertical chamber and its consequent more urgent rise, and the more rapid circulation. It is apparently similar to the fact that the higher the chimney, the greater the draft. The result of the rapid circulation is a more efficient refrigeration of the food adjacent thereto. We also find that by having the vertical chambers 6 approximately wedge-shape, with their thinner portions below, this quickness of circulation is still further increased.

The reason why the circulation of the brine within the wedge-shaped sections of the tank is increased by the thinner lower portions thereof is due to the fact that the body of liquid therein being much less than above, absorbs heat from the interior of the chest much quicker and rises therefrom more speedily. This overcomes the sluggishness of action of the liquid due to its heavy nature, especially when it is a true brine and contains a large proportion of salt; and by thus increasing the circulation, heat is absorbed from the contents of the chest more rapidly, and the required low temperature obtained more efficiently and with a lessened consumption of electric power.

Another advantage secured by the wedge-shape of the sections or arms 6 is this: The outer surfaces being entirely vertical where they are adjacent the walls of the chest, the surfaces of the parts 6, next to the contents of the chest, overhang the points thereof below, whereby as the air within is chilled by its contact with the inclined surfaces, it can descend without frictional interference with surfaces below. At the same time, the ascending currents of warmer air can reach the inclined surfaces at the upper sections thereof with lessened interference with the descending chilled air. Consequently, not only is there more perfect circulation of the brine within the tank, but a better circulation of air in the chest, and hence a more efficient refrigerating action.

What we claim as our invention is:

In a domestic refrigerator, the combination of a chest, and a tank comprising a horizontally extended portion close beneath the top of the chest, and thin flatly extended portions descending from the lateral edges of the first-named portion close to the sides of the chest, all said portions being in communication with each other and adapted to be filled with a refrigerating liquid and the upper portion having cooling means within it, said descending portions being each thinner at its lower sections than at its juncture with the first-named portion, whereby the liquid in said lower sections absorbs heat more rapidly than in the upper sections.

In testimony that we claim the foregoing invention we have hereunto set our hands this 20th day of May, 1926.

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