Feb. 23, 1937. J. N. LEWIS 2,071,798

REFRIGERATION

Filed March 8, 1934

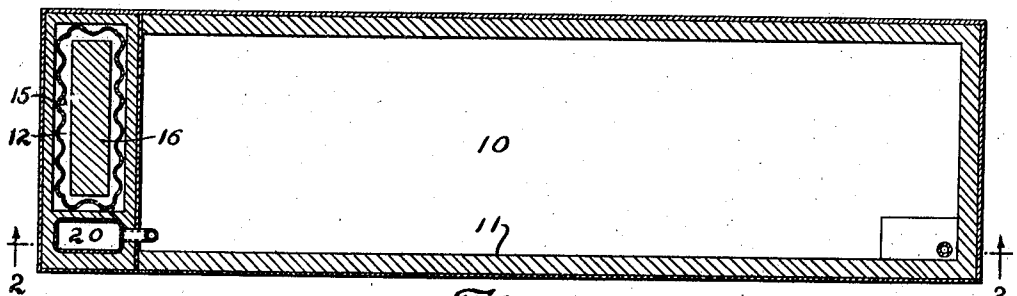


Fig. 1

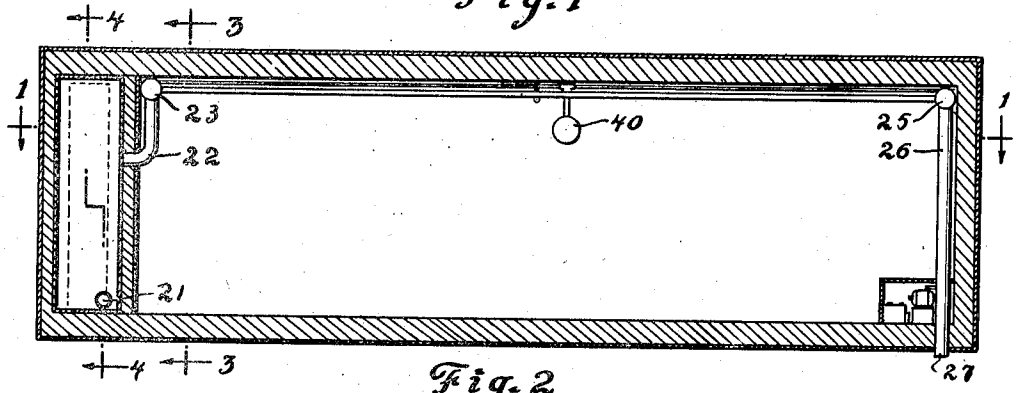


Fig. 2

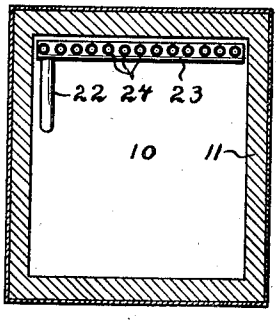


Fig. 3

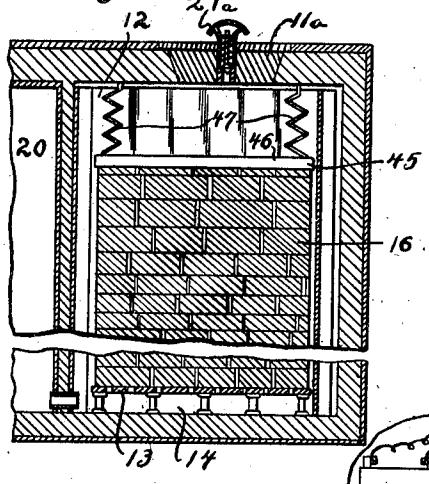


Fig. 4

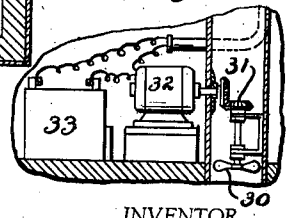


Fig. 5

INVENTOR.

James N. Lewis

BY Dean, Frye & Hardesty.

ATTORNEYS.

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REFRIGERATION

James N. Lewis, Columbus, Ohio, assignor to Lewis Refrigeration, Inc., Columbus, Ohio, a corporation of Ohio

Application March 8, 1934, Serial No. 714,577

5 Claims. (Cl. 62—91.5)

The present invention relates to refrigeration processes and means and particularly to the maintenance of refrigeration temperatures in enclosures of room size though with suitable modification the processes and means may be adapted to larger or smaller units.

Among the objects of the invention is a process and means utilizing the potential refrigeration of solid carbon dioxide, known as "dry-ice" and so referred to hereinafter.

Another object is a process and means for exercising control over the sublimation of this material and the distribution of its influence in the desired manner.

Heretofore dry ice has been used for the purpose of refrigeration but no simple means for controlling its action has been devised. The results have been unsatisfactory in uneven cooling or waste.

Still another object of the invention therefore is to eliminate these objections and provide a method of and means for obtaining uniform controlled temperatures in the refrigerated space with a minimum of loss in refrigerant.

Other objects and advantages will readily occur to those skilled in the art upon reference to the following description and the accompanying drawing in which

Figure 1 is a horizontal section through an enclosure to be refrigerated, taken on line 1—1 of Figure 2 and indicating the use of the invention.

Figure 2 is a vertical longitudinal section on line 2—2 of Figure 1.

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

Figure 4 is a section on line 4—4 of Figure 2, but somewhat enlarged, and

Figure 5 is an enlarged detail showing the pump unit.

An enclosure to be refrigerated is indicated at 10 being provided with a layer of insulating material 11 which will extend entirely around the enclosure at the top, bottom and sides so as to provide against undue inflow of heat to the contents thereof. At one end of the enclosure or at any other suitable location or locations will be provided a smaller chamber 12 also well insulated, both from the exterior and from the main portion of enclosure 10. The main part of chamber 12 will be provided with a grating 13 spaced somewhat from the bottom to provide a small passage 14 and will have its side walls corrugated or fluted as indicated at 15. This chamber is intended to contain the supply of dry-ice, indicated at 16, as consisting of suitable blocks of the material placed within the chamber upon the grating.

In one end of chamber 12 is a third and smaller chamber 20 extending vertically alongside of chamber 12 and communicating with the space below the grating through a suitable conduit 21. This chamber 20 will be closed at the top but will have an outlet conduit 22 leading therefrom at a point somewhat below its top, and extending to a header 23 located near the ceiling of enclosure 10 and preferably extending across the latter. This header has connected to it a plurality of conduits 24 extending the length of the enclosure near the ceiling and leading into a second header 25 at the other end.

From the second header 25 an outlet pipe 26 extends vertically to the bottom of the chamber and out through the bottom or side wall thereof to the exterior. Near the outlet end 27 of conduit 26 will be located a pumping device shown best in Figure 5 which device may consist of a fan 30 operable through suitable gearing 31 by a motor 32 receiving its current from a suitable source of supply indicated at 33 by the conventional representation of a storage battery. This motor 32 will be controlled by means of a suitable thermostat 40 located within the enclosure 10 and preferably near the center of the space to be refrigerated.

When a supply of dry ice is in chamber 12, which is well insulated, this material will only slowly sublime and the gas so produced will flow in a leisurely manner out through the conduits 22 to 26 and discharge to the atmosphere, but flow at such slow rate that very little refrigeration is produced. When the temperature in the enclosure 10 reaches a predetermined upper limit the thermostat 40 will operate to start the motor 32 and pump 30 to reduce the pressure within the conduits and chamber 12, so that sublimation of the dry ice is increased and there will be a more copious flow of the cold gas through the conduits. Being located near the upper ceiling of the enclosure the cold gas flowing through the conduits will of course cool the warmer upper air in the enclosure and cause air circulation to be established, so that, in a short space of time the entire body of air will be reduced in temperature. When the temperature has reached a predetermined lower limit, the thermostat will operate to stop the motor and pump and sublimation of the dry ice will be retarded.

In order to increase the sublimation, there may be provided a small heating element 45 in chamber 12 so arranged that it is always in contact with or closely adjacent the upper surface of the dry-

ice supply. Element 45 may take the form of a flat plate or box containing a resistance heated coil 46 to which current will be supplied through the flexible extensible leads 47 so that, as the supply of dry-ice diminishes and the upper surface lowers, the plate 45 can follow down. When such a heater is used for adding stimulus to the sublimation, it may be supplied with current during the operation of the motor or it may be operated only temporarily so as to initiate sublimation rather than to continue to heat. In either case the thermostatic control 40 may be arranged to provide for closing the circuit through the heater 15 temporarily or continuously during pump operation as determined to be best under the conditions of operation.

During the sublimation of the dry-ice the gas formed will fall to the bottom of chamber 12 into the space 14 and flow into the chamber 20 from which it is drawn by the pump. In order to provide for free movement of the gas in chamber 12 the walls 15 are corrugated to provide vertical channels.

While the plate 45 is described as providing a stimulus for the sublimation, it is of course to be understood that decreasing the pressure in chamber 12 also stimulates the sublimation.

The present invention is particularly suitable for the refrigeration of railroad cars and for large enclosures such as the refrigerators used by meat markets and the like, but it is of course to be understood that suitable modification will render it useful for smaller or larger units such as household refrigerators or household air conditioning.

Now having described the invention and the preferred embodiment thereof, it is to be understood that said invention is to be limited, not to the specific details herein set forth, but only by the scope of the claims which follow.

What I claim is:—

1. A refrigerator comprising a heat insulated storage compartment, a second heat insulated compartment adjacent to but heat insulated from the storage compartment, an uninsulated conduit opening to said second compartment and extending through the first compartment to the exterior thereof, and means in said conduit for drawing off gases from the second compartment and discharging them to the outside atmosphere.

2. A refrigerator comprising a heat insulated storage compartment, a second heat insulated compartment adjacent to but heat insulated from the storage compartment, an uninsulated conduit connected to the bottom portion of said second compartment and extending through the first compartment to the exterior thereof, and means in said conduit for drawing off gases from the second compartment and discharging them to the outside atmosphere.

3. A refrigerator comprising a heat insulated storage compartment, a second heat insulated compartment adjacent to but heat insulated from the storage compartment and provided with a supporting grating or the like spaced from the bottom thereof, an uninsulated conduit connected to the bottom portion of said second compartment and extending through the first compartment to the exterior thereof, and means in said conduit for drawing off gases from the second compartment and discharging them to the outside atmosphere.

4. A refrigerator comprising a heat insulated storage compartment, a second heat insulated compartment adjacent to but heat insulated from the storage compartment and provided with a supporting grating or the like spaced from the bottom thereof, an uninsulated conduit connected to the bottom portion of said second compartment and extending through the first compartment to the exterior thereof and with vertically fluted side walls, and means in said conduit for drawing off gases from the second compartment and discharging them to the outside atmosphere.

5. A refrigerator comprising a heat insulated storage compartment, a second heat insulated compartment adjacent to but heat insulated from the storage compartment, an uninsulated conduit opening to said second compartment and extending through the first compartment to the exterior thereof, means in said conduit for drawing off gases from the second compartment and discharging them to the outside atmosphere, and thermostatic means for intermittently causing operation of said drawing off means.

JAMES N. LEWIS.