Jan. 14, 1936. C. I. JUSTHEIM 2,027,382

PORTABLE DRY ICE REFRIGERATION

Filed Sept. 25, 1933 2 Sheets-Sheet 1

Fig. 1.

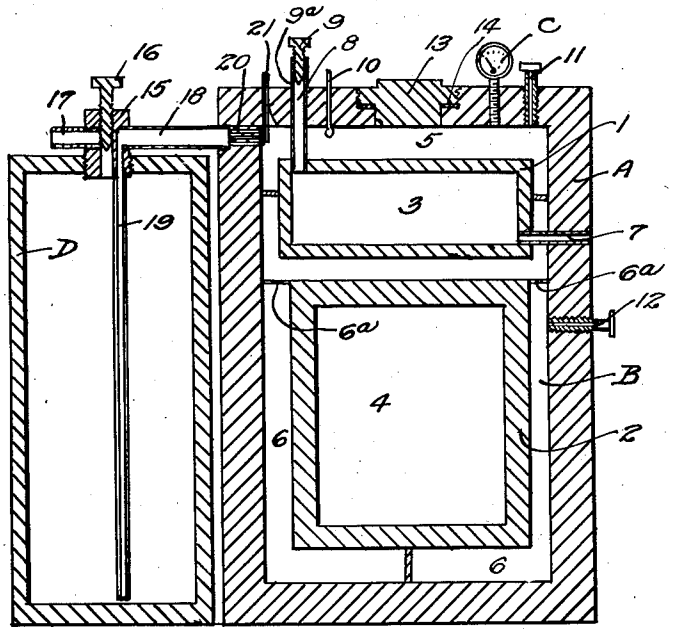
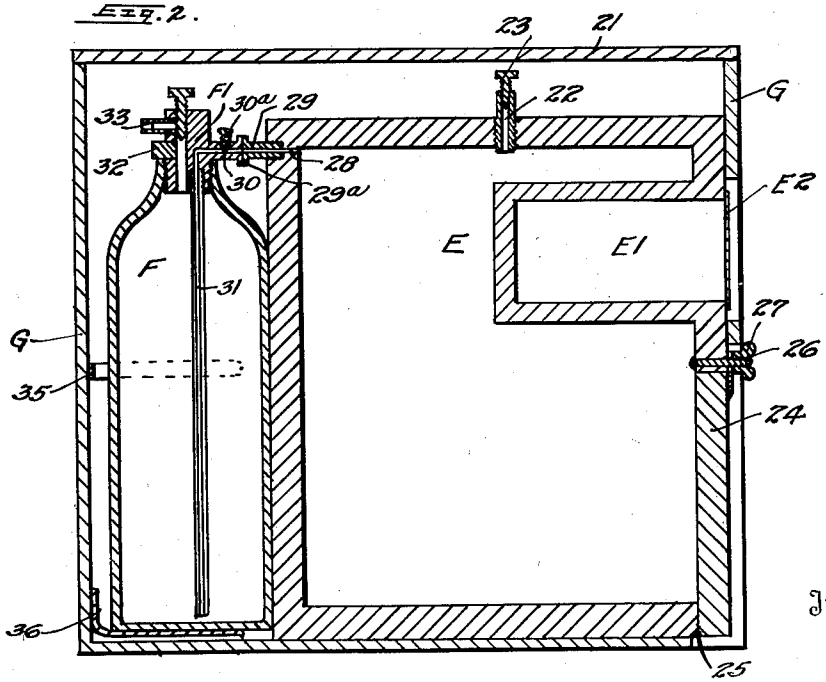


Fig. 2.



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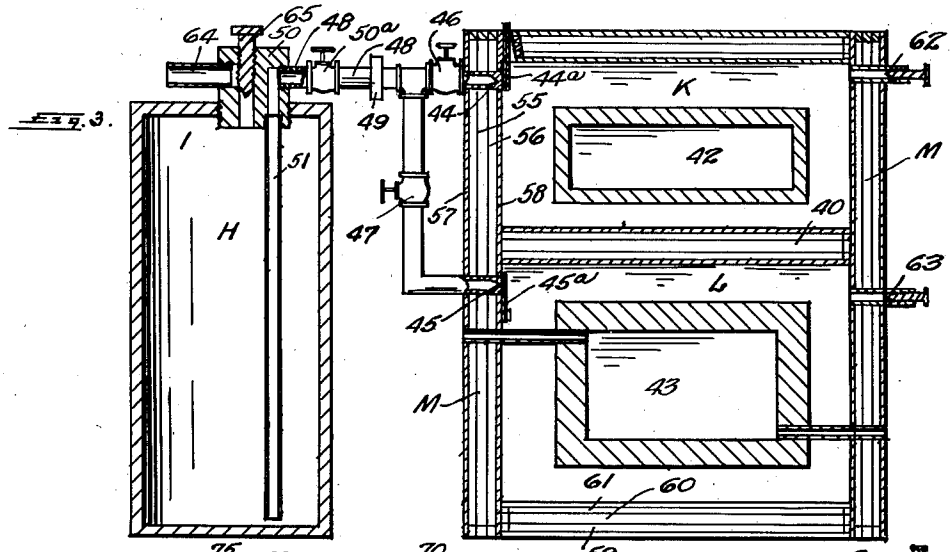
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PORTABLE DRY ICE REFRIGERATION

Filed Sept. 25, 1933 2 Sheets-Sheet 2



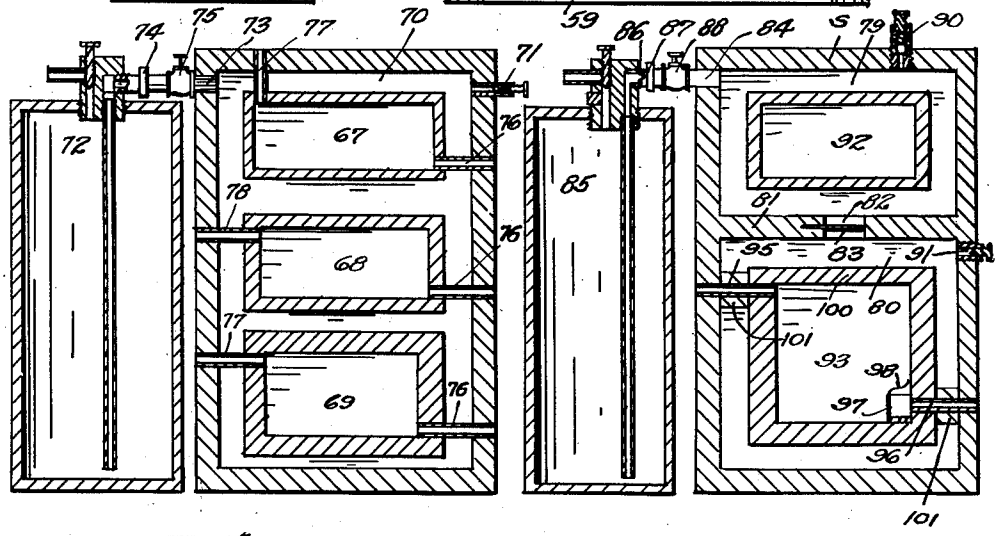


Fig. 4.

Fig. 5.

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PORTABLE DRY ICE REFRIGERATION

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Application September 25, 1933, Serial No. 690,873

10 Claims. (Cl. 62—91.5)

My invention relates to portable dry ice refrigerators and portable dry ice making devices and has for its object to provide a new and efficient dry ice device, so constructed, that the dry ice snow may be made as desired or necessary.

A further object is to provide a portable dry ice device which may be taken to canyons on picnics or other places and which may be used to make any amount of dry ice snow for freezing ice cream or keeping foodstuffs cold.

A still further object is to provide a controlled dry ice device for use in either the home or on trips and which may be used to make any desired amount of dry ice snow or CO_2 in a semi-solid form by allowing the liquid CO_2 to escape from a closed container where it is held under pressure into a closed container having only atmospheric pressure, with means in the last container to allow excess gas to escape and to allow the person using the device to control the flow of fluid and the amount of escape of the gas and to also allow the user to insert any article into the snow thus formed or remove the snow thus formed for any desired purpose.

A still further object is to provide a refrigerator which will be built to use the principle of escaping carbon dioxide liquid into a closed container to form the dry ice snow the snow to be formed on a refrigeration chamber having thin insulation therearound to hold the temperature therein to a certain predetermined freezing temperature, but not as low as that of the snow and then the escaping and evaporating gases from the snow may be moved down over another insulated chamber with the insulation therearound thickened to the degree to hold the last mentioned chamber to the desired degree for keeping foods at the best refrigeration temperature.

A still further object is to provide a dry ice refrigerator for home use which will be automatically controlled by thermostatic valves, the valves to control the flow of fluid to form the dry ice snow and to control the evaporating gases from the snow into a separate chamber where the temperatures will be higher.

These objects I accomplish with the device illustrated in the accompanying drawings in which similar numerals and letters of reference indicate like parts throughout the several views and as described in the specification forming a part of this application and pointed out in the appended claims.

In the drawings in which I have shown my device,

Figure 1 is a sectional view of a refrigerator device.

Figure 2 is a sectional view of a dry ice snow making device.

Figure 3 is a vertical section of a refrigerator having two separate compartments for forming the carbon dioxide snow, each controlled by manual valves and also by thermostatic valves.

Figure 4 is a form of refrigerator having only one large snow compartment with separate food chambers therein, each to be a different temperature.

Figure 5 is a modified form showing two compartments in the refrigerator with a partition therebetween and a thermostatic control valve in a port in the partition to make the upper compartment the colder and the lower compartment the higher temperature.

In the drawings I have shown the insulated refrigeration body as A, having a compartment B therein, divided into two compartments 5 and 6, with an insulated chamber 3 in the top portion of compartment 5 and a thicker insulated chamber 4 in the lower compartment 6 with the chamber 3 in the compartment 5 having thin walls 1 and the chamber 4 having thicker walls 2.

A system of circulation may be provided for the refrigeration chambers, one being shown in the chamber 3 with an inlet pipe 7 and an outlet pipe 8 with a valve 9 to control a port 9a in the pipe 9, to control the circulation through the chamber 3. A like device may be used in the chamber 4 if desired. A thermometer 10 may be provided to tell the temperature in the compartment 5, and a pressure gauge C tells the pressure within this compartment. A valve 11 allows for escapement of excess carbon dioxide gases. A valve 12 is provided in the compartment 6 to allow for escapement of gases therefrom. A plug 13 may be provided through the top of the casing or body A to allow for entrance thereinto and to allow for removal of the dry ice or carbon dioxide snow therefrom, if so desired.

The gas tank D is made with a plug 15 in the open end thereof and with a valve 16 to control the filling tube 17. A pipe 18 leads into the series of ports 20 through the wall of the body A into the compartment 5 and a thermostat valve 21 controls the flow of fluid through the said valves 20. A siphon tube 19 through which the liquid CO_2 is forced by its own pressure, connects the pipe 18 with the liquid carbon dioxide in the tank D so that the liquid will be insured of passing through the ports 20 into the compartment 5. It is absolutely necessary to fill tank D with CO_2 under sufficient pressure to form the liquid CO_2 so that the liquid when passing through the ports 20 will expand suddenly when thermostat 21 operates and form the carbon dioxide snow in chamber 5. The pipe 18 may be provided with a manual control valve if desired. Thermostats 6a on each side of the chamber 4 are used to control the temperatures of the compartment 6.

In Figure 2 I have shown the device as carried in a portable carrying case G with the tank F

supported therein by springs 35 and 36 and adjacent the carbon dioxide snow chamber E. The top of the case G is removable to replace the gas tanks F. A valve 23 controls the escaping of gas from the chamber E through the port 22. A side opening or door 24 is provided on one side near the bottom thereof which is hingedly connected to the chamber E by the hinge 25. A screw 26 is provided with a thumb nut 27 thereon to lock the door 24 closed when desired. The tank F is provided with a closure plug F1 and a pipe 30 is connected with a pipe 29 by a union 29a to provide detachable means for the tank and chamber E so that the tanks may be removed and refilled with carbon dioxide gas. A port 28 connects the pipe 29 with the interior of the chamber E and is the port through which the liquid carbon dioxide escapes into the chamber E for the expansion therein and forming of the carbon dioxide snow therefrom. A pipe 31 connects the pipe 30 with the liquid carbon dioxide in the tank F to insure liquid through the port 28 at all times when there is sufficient pressure in the tank F to force the liquid therefrom and make the snow desired. A blow out plug 32 is provided for safety to insure that the tank F will not explode from too great pressure and a filling pipe 33 is provided by which the tank may be refilled. This tube may not be necessary as it will be possible to connect the coupling 29a with any carbon dioxide gas compressor to fill the tank if desired. A valve 30a will be provided in the pipe 30 to control the flow of gas from the tank F into the chamber E as desired.

In Figure 3 I have shown a refrigerator having two compartments K and L with one directly above the other and insulated from each other by the wall 40. Within the top compartment K there is a chamber 42 for freezing at extreme low temperatures and in the compartment L there is a chamber 43 for holding the temperature around 40 degrees Fahrenheit. Each compartment is provided with means to make dry ice snow therein as shown by the two jets 44 and 45 with the jet 44 in the compartment K controlled by a hand valve 46 and thermostatic valve 44a and with the jet 45 into the compartment L controlled by the hand valve 47 and thermostatic valve 45a. Thus the two compartments may be controlled and operated independently. A pipe 48 leads from the fluid tank H to a coupling 49 which coupling is then connected with the two control valves 46 and 47 by suitable pipe connections. The pipe 48 leads into a tank plug 50 through a control valve 50a. The plug 50 has a pipe 51 leading from the pipe 48 into communication with the liquid carbon dioxide in the tank H; thus one pipe 48 feeds the two compartments with dry ice snow and each compartment is then independent of the other. The chambers 42 and 43 are made of different thicknesses and different amounts of insulation are used in their walls to provide the desired temperature therein. For instance, in the chamber 42 the walls are thinner than in the chamber 43, thus the same amount of dry ice snow allowed to enter the compartments there surrounding, will create different temperatures in the two chambers. The walls M of the refrigerator shown in Figure 3 may be made of the insulation shown which consists of very thin sheets of aluminum or of other material covered with aluminum paint with the surfaces then highly polished to deflect the heat and retain the cold waves. The sheets of aluminum 55 and 56 are held in place by suitable spacer strips and the outer surface 57 may be of porcelain, steel, or other material as likewise may the inner surface 58. This construction provides dead air spaces 59 and 60 and 61 within the walls of the refrigerator to insure that there will be very little heat transmitted into the refrigerator and that there will be little cold allowed to leave.

The wall 40 is also made of like construction.

Valves 62 and 63 provide for escapement of gas from each compartment and the valves may be set to allow for escape of gas when excessive pressures have developed therein.

A pipe 64 and valve 65 control the filling of the tank H when empty.

In the type of refrigerator shown in Figure 4, there are separate food chambers 67, 68 and 69 with the walls of each chamber of different thickness so that each will maintain a separate degree of cold. These chambers are all mounted in a single compartment casing 70 with a control valve 71 to control the pressure therein and a filling or snow making tank 72 connected with the jet 73 by the coupling 74 and control valve 75. Each of the compartments are shown with inlet and outlet pipes 76 and 77 respectively therein to provide for air circulation therein, but these pipes may be dispensed with in any chamber desired.

In the refrigerator S shown in Figure 5, there are two compartments 79 and 80 therein, with said compartments separated by a partition 81. The partition 81 is provided with a port 82 therethrough, in which a thermostatic valve 83 is mounted, the valve 83 to open or close the port depending upon the temperatures in the compartment 80. The liquid from which the snow is made is introduced through the jet 84 connected with the tank 85 by a pipe 86 and coupling 87. A valve 88 controls the flow of liquid gas into the jet and compartment 79.

Each compartment is provided with a pressure and release valve shown as 90 and 91. Within the compartments are storage chambers 92 and 93 with the chamber 92 having thin walls to allow the snow to instantly freeze anything placed therein and the chamber 93 is made with thicker walls than the chamber 92 so that there will be higher temperatures within this chamber for keeping food, but not freezing it or subjecting it to too cold temperatures for good food conditioning. Also this chamber is provided with a ventilation device and humidifying method which consists of an outlet pipe 95 and an inlet pipe 96, each open to the atmosphere and the inlet pipe introduces the air into the chamber 93 over a water cup 97 and then passing through a saturated fabric 98. This provides sufficient moisture for the foods contained in this chamber. If necessary some force method may be applied to the natural draft conditions to thoroughly saturate the air passing into this compartment. As shown in this type of device, the top 100 of the chamber 93 may be made of thinner wall than the sides and bottom of the chamber to make the top of the chamber colder than the bottom or if desired the bottom may be made thinner than the top to reverse the condition and make the bottom of the chamber colder. Insulation 101 may be used on the pipes 95 and 96 to prevent frosting of the interior of the pipe and provide proper air passage therethrough.

In the device shown in Figure 2, if ice cubes are desired, there may be a separate chamber E1 formed within the chamber E, having a separate closure E2 therefor which may be used to slip

ice trays therein without opening the door to the compartment E.

It will be possible to use the chamber E in Figure 2 as a cooler or ice substitute in common refrigerators and such substitution may be made by using the entire device and placing it in the ice compartment of an ice refrigerator. Also chamber E may be removed from the tank and a piece of solid carbon dioxide placed in the chamber through the opening 24 and the chamber E used alone within a refrigerator or as a portable device. This would eliminate the use of the tank either temporarily or permanently as desired by the user.

The operation of the device is as follows:

In the device which I have shown in the several views, the tanks are filled with carbon dioxide gas under sufficient pressure to form liquid carbon dioxide so that when it is released into the refrigerator it will form a semi-solid carbon dioxide which has been termed snow in several instances in the above description. The pressure in the tanks will force the liquid out through the pipes which are shown led down thereinto so that when the control valves are open, liquid will be forced from the tanks into the refrigerator compartments where the release into atmospheric pressure or lesser pressure will form the snow.

The control valve may be manually turned to release the liquid into the compartments and when the liquid is released and the snow formed in the compartments, then the temperature drop in these compartments will close the thermostatic valves, shutting off the flow of liquid into the compartment until the temperature has risen again sufficiently to open the thermostatic valve. When the snow is being formed in the compartments there is also carbon dioxide gas liberated which is taken care of by the safety valves in the compartments. As shown in Figure 3, the two compartments K and L are controlled, each by a manual valve and also by a thermostatic valve, so that the two compartments are entirely separate in their operations. One may be used without the other. As shown in Figures 1 and 4, there are thermostats for controlling the temperature in the lower chamber, separate from the upper chamber and when the lower compartment temperature rises then the thermostatic valves open and allow the colder gas in the upper compartment to descend through the openings and enter the lower compartments until the lower compartments have reached a predetermined degree.

Having thus described my invention I desire to secure by Letters Patent and claim:

1. In a refrigerator of the class described, the combination of a large compartment having separate food chambers therein, means to introduce carbon dioxide liquid into said compartment to form semi-solid carbon dioxide; means to control the flow of liquid therein; and means to provide separate degrees of temperature in each of the food chambers by making the insulation of the walls of different cold resisting insulation.

2. In a refrigerator, the combination of a large compartment having a partition therein; a port through said partition; a thermostatic control valve in said port; food chambers disposed in the compartment; means to insert semi-solid carbon dioxide in the upper compartment and means to circulate moist air in one food chamber.

3. In a refrigerator, the combination of a casing having two compartments therein; food chambers in each compartment, one having thicker insulated walls than the other; means to allow excess pressure to escape from each compartment; and means to form carbon dioxide snow in either compartment independently of the temperature in the other compartment.

4. In a refrigerator, the combination of a casing having two compartments therein insulated from each other; means to form solid carbon dioxide in each compartment; means to automatically control the temperatures in each compartment independently; and food chambers in each compartment in which food may be placed, one chamber being to freeze food quickly and the other to hold a non-freezing temperature around the food at all times and different degrees of insulation for said chamber, to hold the temperature of each compartment to the temperature desired.

5. In a refrigerator, the combination of a compartment having two food chambers therein; means to form solid carbon dioxide in the compartment; means to control the vapors from the carbon dioxide surrounding one chamber into the space surrounding the other chamber, depending upon the temperature within the compartment; and a thermostatic control valve to control the making of the solid carbon dioxide in said compartment.

6. In a refrigerator, the combination of a casing; compartments in said casing; valves to control the temperature in the compartments; food chambers in the compartments; means to insulate each food chamber to varying degrees to provide different temperatures therein; means to allow excess gas to escape from each compartment; and means to introduce liquid carbon dioxide into said casing wherever desired to expand and form semi-solid carbon dioxide to cool the compartments as desired.

7. In a refrigerator, the combination of a casing divided into compartments; means to insulate said compartments; food chambers in said compartments insulated to varying degrees; and means to introduce liquid carbon dioxide into said compartments as desired, comprising a liquid holding tank and a tube leading from the liquid into a controlled jet leading into the refrigerator casing to liberate the liquid carbon dioxide into the casing to form semi-solid carbon dioxide.

8. In a refrigerator, the combination of a compartment having two food chambers therein; means to form solid carbon dioxide in the compartment; means to control the vapors from the carbon dioxide surrounding one chamber into the space surrounding the other chamber; and a thermostatic valve to control the forming of the carbon dioxide in said compartment.

9. In a refrigerator, the combination of a casing, means to insert solid carbon dioxide into said casing; food chambers in said casing and different amounts of insulation used around the separate food chambers to hold the contained foods at different temperatures.

10. In a refrigerator, the combination of a casing; food chambers formed therein with each chamber provided with a separate opening thereinto so that one may be opened without the other; insulation for said food chambers of different thickness to keep the temperatures of each chamber at a definite predetermined degree of temperature; and means to provide a constant degree of cold within the casing.

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