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METHOD OF CHARGING GAS-EXPANSION CHAMBERS OF ICE MOLDS

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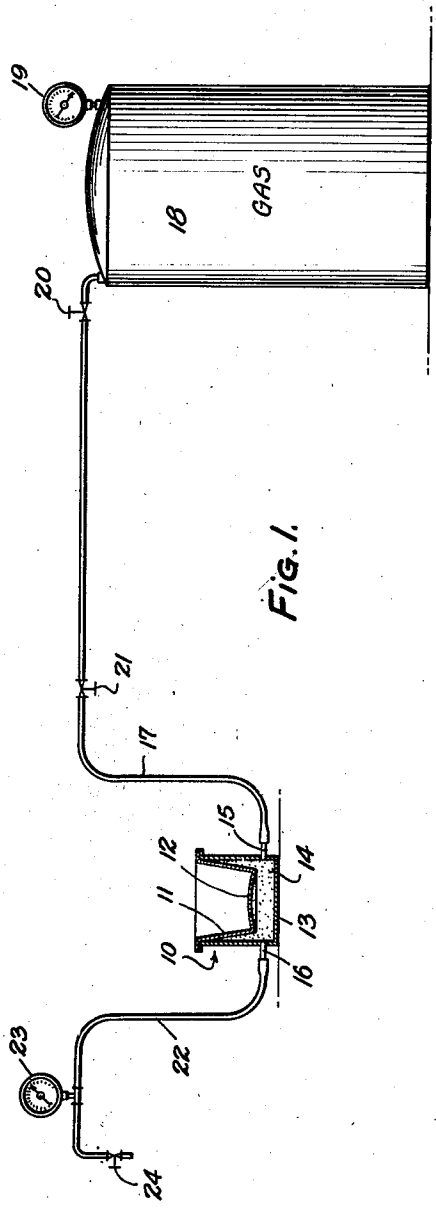

FIG. 1.

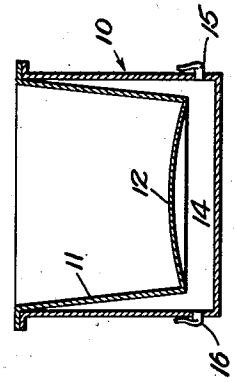

FIG. 3.

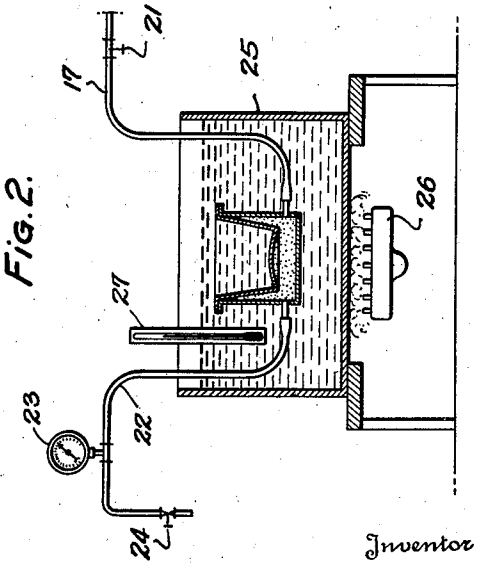

FIG. 2.

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METHOD OF CHARGING GAS-EXPANSION CHAMBERS OF ICE MOLDS

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6 Claims. (Cl. 226—20)

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This invention relates to refrigeration, and particularly to the production of frozen or congealed substances in the freezing compartment of a refrigerator, either domestic or commercial.

Specifically, the present invention is concerned with the charging of the gas expansion chambers of ice molds or trays such as disclosed in my copending applications Ser. No. 290,479, filed August 16, 1939, and Ser. No. 421,641, filed December 4, 1941, now Patent Number 2,377,436, dated June 5, 1945. In these molds or trays, the ice cell or mold proper is provided with a flexible or movable bottom or diaphragm which is subjected to the expansion pressure of a gaseous medium when the tray is removed from its freezing chamber and exposed to room or atmospheric temperature; and when the tray is returned to its freezing chamber or compartment the gas contracts or becomes denser, permitting the flexible bottom or diaphragm to move downwardly ready to eject or dislodge the ice cube or block when the tray is again removed from its freezing chamber.

In charging the gas expansion chambers of these molds, it is desirable that the range or coefficient of expansion of the charge be such as to provide the necessary pressure while at the same time rendering the tray "fool proof" against rupture or explosion, irrespective of the temperatures to which the tray may be subjected while in use. Thus, for example, a housewife may place the tray in boiling water to sterilize the same, or in a commercial ice plant the molds may be exposed to extremely high temperatures during warm weather.

An object of the present invention therefore is to provide a method of charging the gas expansion chamber of an ice mold whereby the charge will have a predetermined range of expansion irrespective of the temperatures encountered by the mold in service, thus rendering the mold proof against rupture due to excessive gas pressures and safe in handling.

Generally stated, the method consists in charging the expansion chamber of a mold with a gas or a mixture of gases having a known boiling point, subjecting the mold so charged to a temperature within the region of the highest temperatures encountered by a mold of this type during service, adjusting the gas pressure as by bleeding the gas from the chamber until a safe operating pressure is obtained having a constant expansion value, and then sealing the chamber.

A type of apparatus suitable for carrying out the method is illustrated in the accompanying drawings, in which:

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Figure 1 is a view in section and elevation of an expansion chamber type ice mold and apparatus for charging said chamber;

Fig. 2 is a transverse vertical section through the mold of Fig. 1 and a heating tank for heating and expanding the gas to a predetermined charging pressure; and

Fig. 3 illustrates the mold in section after it has been fully charged and sealed.

Referring to the drawings in detail, a single cell ice mold is generally indicated at 10 and comprising a mold proper or cell 11 having a flexible bottom or ejecting diaphragm 12 and an outer shell 13 in which the cell 11 is seated and sealed around the upper marginal edges thereof, the said outer shell being spaced from the mold proper to provide an expansion chamber 14.

It will be noted that the flexible bottom or diaphragm 12 is in its "up" position. This results from expansion pressure of the gases or gaseous medium in the chamber 14 and the force of this pressure should be sufficient to eject or dislodge an ice mass or block to be frozen in the cell 11. The range of operating temperatures of certain gases suitable for charging the chamber need not necessarily be very great, since the ice in the tray tends to maintain the temperature while the tray is in the freezing chamber in the neighborhood of 32 degrees, and only a slight warming or rise in temperature may be necessary to cause the gases to expand sufficiently to move the diaphragm upwardly and dislodge or eject the ice block. The present method of charging places a definite limit to the expansion range, and this limit is never exceeded irrespective of the temperatures to which the mold may be subjected while in service.

The shell 13 is bored or punctured to receive the one end of a charging nipple or tube 15 and a charge-adjusting or bleeding tube 16. To the charging nipple is connected the one end of a conduit 17, said conduit being connected to a gas tank 18 provided with a pressure gauge 19. The conduit 17 is provided with a shut off valve 20 and an adjusting valve 21.

The tube 16 has connected thereto a bleeding conduit 22 provided with a gauge 23 and bleeding valve 24.

The tubes 15 and 16 are preferably made of flexible material, such as lead, zinc or other bendable metals capable of retaining a set shape after being bent or deformed, and the bore of the tube need only be very small, so that when the tube is bent or distorted as shown in Fig. 3, it immediately closes the bore therein and seals the chamber.

These tubes may be so constructed and arranged as to be scarcely noticeable and to impose little or no obstruction to the normal use of the tray.

The position in Fig. 1 illustrates the first step of the method, viz: the charging of the mold with a gas or blend of gases having a boiling point suitable for the type of mold to be charged. Any of the highly expansible gases may be used in charging the molds, assuming the boiling point of the gas is within the range of the freezing unit. A type of gas which has been used successfully for trays of domestic refrigerators is normal butane pure. An example of a blend of gases is commercial butane or propane, or a mixture of the two, assuming the composition is such as to retain a boiling point sufficiently high to come within the range of the average domestic freezing unit. Irrespective of what type of gas is used, the boiling point should be calculated in accordance with the freezing temperatures to which the tray is subjected. If the freezing temperature is quite low, such as in a commercial ice plant, then a relatively large selection of gases are available. Also, it may be desired in certain instances to have an extremely forceful or violent ejecting action on the ice block when the mold is removed from its freezing chamber. Thus in certain instances, the operating pressure need be only relatively slight or just sufficient to dislodge the ice block, or it may be increased to forcefully eject the block. All of these factors should be taken into consideration in selecting the gas for charging the expansion chamber.

The pressure or density of the tank gas may be normal at room or atmospheric temperatures. This tank or initial charging gas may be purchased already bottled or sealed in tanks, or it may be manufactured on location.

The mold is then heated as by placing it in a tank 25 having therein water brought to a boiling temperature by heater 26, the temperature of the bath being gauged by a thermometer 27. As the temperature of the gas charge rises and the gas expands, the valve 24 is used to bleed the excess gas from the chamber 14 until the gage 23 shows that the predetermined operating pressure has been reached. The applied heat drives out condensed moisture or "dew" from the gas and places a definite limit on the range of expansion of the charge in the chamber 14. Thus let it be assumed that the gases are bled from the chamber 14 until the gage 23 shows a pressure of approximately 20 pounds per square inch at a temperature of 212° F. Let it further be assumed that when this charge of "dry" gas is subjected to a temperature of 20° F., for example, it will contract to a point where the diaphragm 12 will move to its "down" position, and when subjected to a temperature of 33° F., for example, it will expand sufficiently to force the diaphragm to its "up" position and dislodge an ice block or mass from the cell 11. Both the upper and lower limits of the range of expansion are definitely fixed by the removal of volatile matter or moisture from the charge in attaining this range.

When the charge has been adjusted to the desired point, the tubes or nipples 15 and 16 are bent or deformed as indicated in Fig. 3, sealing the chamber 14.

The mold is now ready for use bearing a charge having a safe pressure range.

It will be understood that the steps of the method may be varied to attain the desired objects and also that the apparatus shown in the drawings is for illustrative purposes only and may be varied or selected to meet conditions, without departing from the spirit or scope of the invention as defined by the appended claims.

What is claimed is:

1. In the art of refrigeration, the method of charging the expansion chamber of an ice mold having a movable ice dislodging member or diaphragm subject to the pressure of said chamber, which consists in first charging the chamber with a gas at normal pressure and density, heating the charge in said chamber, bleeding the gas from said chamber to adjust the upper pressure limit of its range of expansion, and sealing said chamber.

2. In the art of refrigeration, the method of charging the expansion chamber of an ice mold having a movable ice dislodging member or diaphragm subject to the pressure in said chamber, which consists in conducting a gas of normal density and pressure to said chamber, closing off the chamber from the source of supply, heating the charge, bleeding the gas from said chamber to obtain the upper pressure limit of its range of expansion, and sealing the charge in said chamber.

3. In the art of refrigeration, the method of charging the gas expansion chamber of an ice mold having a movable ice-dislodging member or diaphragm subject to the pressure of the gas in said chamber, which consists in first charging said chamber with a gas having a predetermined boiling point at normal temperatures, heating the charge by subjecting the latter to a bath of fluid such as water brought to a predetermined temperature, and while the charge is being heated, bleeding gas from said chamber until the pressure in the chamber attains a predetermined point consistent with the operation of said ice-dislodging member, and then sealing the said chamber.

4. In the art of refrigeration, the method of charging the gas expansion chamber of an ice mold having a movable ice-dislodging member or diaphragm subject to the pressure in said chamber which consists in conducting to said chamber a charge of expansible gas at normal pressure and density and having a known boiling point, closing off the chamber from its source of supply and immersing the mold in a vat or tank of water, heating the water to a boiling temperature to heat the charge, bleeding the gas from said charge while the latter is being heated until the charge attains a predetermined pressure, and then sealing the chamber.

5. The method of charging the gas expansion chamber of an ice mold having a movable ice-dislodging wall portion, comprising providing a supply of gas for charging, providing a line from said supply to the chamber to be charged, providing a separate discharge from said chamber, conducting gas from the source of supply to pass through said line and chamber to thereby clear the line and chamber, shutting off discharge through said separate discharge from said mold but retaining the line from the mold to the source of supply open, subjecting the mold to the desired temperature and pressure to provide gas of a desired density for operation of the mold under the desired conditions, and shutting off the supply and discharge lines from the mold to obtain a predetermined charge of expansible gas in the chamber and of a character to expand under certain conditions for removing ice from the mold.

6. The method of charging the expansion

chamber of an ice mold having a movable ice-dislodging member or diaphragm movable by pressure in said chamber, said method comprising blowing gas from a supply tank through said chamber to discharge air therefrom, shutting off the discharge from said chamber while the chamber is in communication with the gas in the tank, subjecting said chamber to the desired temperature and pressure to determine the operation of the ice-dislodging portion of the mold, and sealing the mold to contain the gas therein by sealing the connection between the mold and the gas tank and between the mold and the atmosphere.

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