

June 5, 1945.

L. L. MALLARD

2,377,436

ICE MOLD WITH SPRING TENSIONED DIAPHRAGM

Filed Dec. 4, 1941

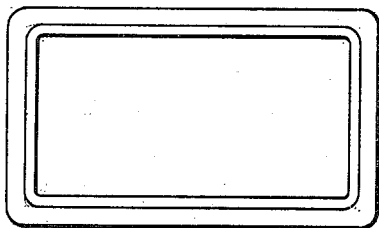


Fig. 2.

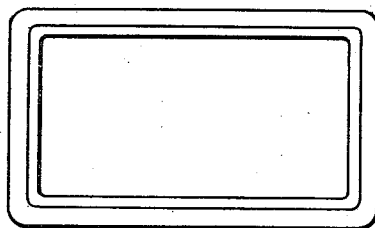


Fig. 4.

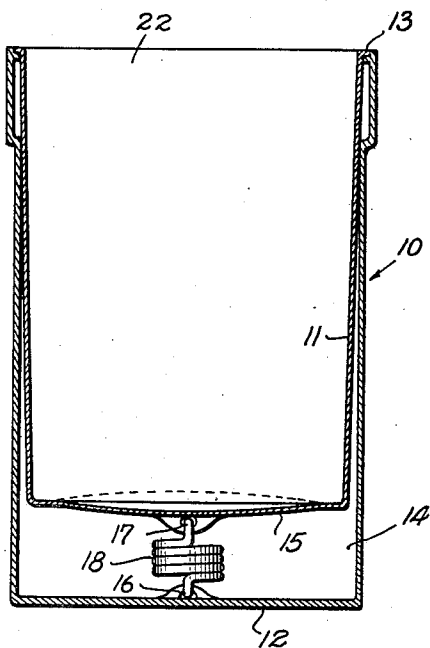


Fig. 1.

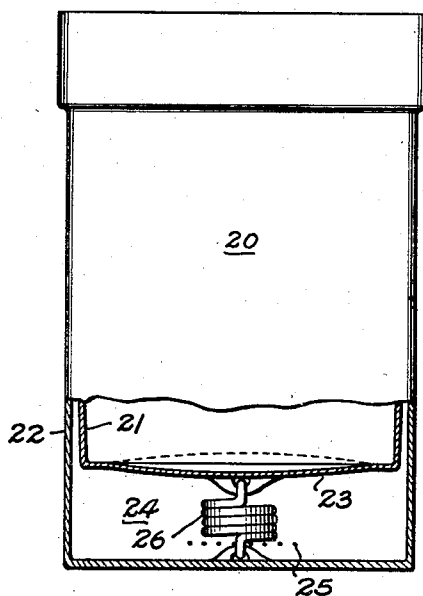


Fig. 3.

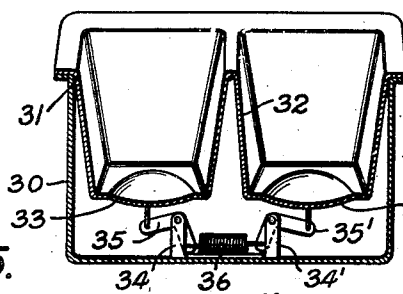


Fig. 5.

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2,377,436

ICE MOLD WITH SPRING TENSIONED
DIAPHRAGM

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Application December 4, 1941, Serial No. 421,641

6 Claims. (Cl. 62—108.5)

This invention relates to refrigeration, and particularly to ice forming apparatus and means for releasing ice from the mold or other device in which it is frozen.

The apparatus herein disclosed is primarily adapted for use with ice molds of the type disclosed in my copending applications, Ser. Nos. 290,479 and 421,648, filed August 16, 1939 and December 4, 1941, respectively, and wherein the ice mass is dislodged or ejected from its mold by means of expansible gases entrapped in an expansion chamber preferably located in the base of the mold, the gases contracting or becoming more dense upon a drop in temperature and expanding and acting on a flexible or movable diaphragm beneath the ice mass when subjected to a rise in temperature, for example, when the mold is removed from its freezing chamber and subjected to room or atmospheric temperature.

Gases having varying characteristics with respect to boiling point, coefficient of expansion and other factors may be used in molds of the type disclosed in my above noted applications. Thus in certain instances the gas used may expand sufficiently when subjected to room temperature to move the flexible base or diaphragm upwardly but may not condense sufficiently during the freezing process to permit the diaphragm to flex downwardly. In other instances, pressure tolerance or range between the point at which the diaphragm will flex upwardly and the point which will release the diaphragm for downward movement may be relatively narrow so that consistent operation of the diaphragm becomes doubtful. Also in large molds such as those used in ice manufacturing plants, the base of the mold which may constitute the ejecting or dislodging diaphragm must be of relatively great strength and therefore necessitates relatively heavy gauge metal, and this coupled with the fact that a certain amount of residual pressure may remain in the pressure chamber of the mold, sometimes results in the diaphragm remaining in its "up" position.

An object of the present invention, therefore, is to provide means which will insure consistent operation of molds of the gas pressure ice-ejecting type. More specifically, the invention provides means which will act to return the diaphragm or other movable ice-ejecting member at the base of the mold to its "down" position after being acted upon by the expanded gases, and which means may be selected or adjusted in accordance with the particular characteristics of the gas used in the expansion chamber.

The foregoing and other objects and advan-

tages will become apparent in view of the following description taken in conjunction with the drawing, wherein:

Figure 1 is a transverse vertical section of a mold constructed in accordance with the invention;

Figure 2 is a top plan view of Fig. 1;

Fig. 3 is a view in section and elevation of a mold of the type utilizing air in the expansion chamber having the present invention embodied therein;

Fig. 4 is a top plan view of Fig. 3;

Fig. 5 is a transverse vertical section of a multiple compartment or grid section mold embodying the invention.

Referring to the drawing in detail and first to Figs. 1 and 2, a mold is generally indicated at 10 and comprising an inner container or mold proper 11 and an outer receptacle or shell 12, said inner and outer containers being united at their top margins by an interlocking joint 13, which may be sealed by beading, soldering, welding or the like. The relative dimensions of the inner and outer containers are such as to provide an expansion chamber 14 in the bottom of the mold adapted to be filled or loaded with a suitable gaseous medium, such as a refrigerant gas having characteristics which will adapt it for the intended purpose. The bottom wall of the mold proper 11 is preferably constructed as a flexible diaphragm 15 which is acted upon by the gas when the latter expands and is caused to flex upwardly and eject the ice mass from the mold.

The bottom of the outer container 12 and the inner container 11 are provided with lugs 16 and 17 to which are connected the opposite ends of a spring 18. This spring should be of sufficient strength to pull the diaphragm 15 from its upper or dotted line position to the full line position indicated in Fig. 1, and at the same time it should permit upward movement of the diaphragm when the latter is subjected to pressure of the expanding gas within the chamber 14. Certain types of gases may require heavier springs than others. Also, a gas may be selected having a coefficient of expansion such that even when the mold is in its freezing chamber, the pressure would be sufficient to prevent downward movement of the diaphragm unless the latter were aided by the spring. The strength of the spring 18 may be such as to insure downward movement of the diaphragm 15 over a relatively wide range of pressures.

In Figs 3 and 4 a mold is shown wherein the ice-ejecting diaphragm may be operated by air.

In this instance the mold is generally indicated at 20 and comprises an inner container 21 and an outer container 22 provided with a flexible bottom or diaphragm 23. The containers are of such relative dimensions as to provide an expansion chamber 24 in the base of the mold, the wall of which is formed with a series of vents or "breather openings" 25, as disclosed in my co-pending application, Serial No. 421,648, above noted. A spring 26 is connected at one end to the bottom wall or diaphragm 23 and its opposite end is anchored to the bottom of the outer container 22.

The mold shown in Figs. 3 and 4 operates substantially as follows:

The vents or openings 25 are of such size as to permit air to "leak" or "breathe" into the pressure chamber 24. This intake of air may be gradual and take place during the initial freezing operation. Sometimes the breather vents 25 may become clogged or occluded by frozen moisture after a certain period of time, but in such instances occlusion does not take place until after the pressure chamber 24 has taken in the required quantity of air. When the mold is taken from its freezing chamber and subjected to a rise in temperature, the air in the chamber 24 is caused to expand and exert pressure on the diaphragm 23 and thereby eject the ice mass or block from the mold proper 21. The spring 26 insures downward movement of the diaphragm 23 when a predetermined pressure is reached in chamber 24.

Fig. 5 shows a mold of the multiple cell or grid type comprising an outer casing 30 and inner casing or mold proper 31, the outer and inner containers being joined and sealed at their upper marginal edges and which edges are preferably formed with coating interlocking flanges. The inner container 31 is formed with a series of freezing compartments 32, each having a flexible bottom or diaphragm 33, 33'. Upstanding brackets 34 and 34' are anchored to the floor of the outer container 30 and have pivoted thereto bell-crank levers 35 and 35' which at their inner or lower ends are connected by a spring 36, the opposite ends of the levers being pivotally connected to the diaphragms 33 and 33'.

The operation of this form of mold is essentially the same as that of the molds 10 and 20, the difference being that in this instance one spring may serve any number of ice molds or freezing compartments.

The springs 18, 26 or 36 have functions other than simply to retract the ice-ejecting diaphragm or movable bottom of the mold cavity. For example, they enable the satisfactory use of gases which might not wholly liquefy within a certain temperature range, such as sulphur dioxide which at 22° F. has a remaining or residual pressure of approximately 3½ pounds per square inch. By the use of a spring of a certain predetermined strength or tension, the downward pull of the diaphragm will become effective although only a partial change in the state of the gas has occurred; and upon removal of the mold from its freezing chamber, the spring will still permit the diaphragm to eject the ice by the kinetic action of the gas. Thus, the gas expansion chamber may be loaded at substantial saturation of the gas and a spring used which will hold the diaphragm downwardly with a pull just sufficient to carry it beyond the center of its normal plane in a downward direction.

If desirable or found necessary, the springs 18, 26 or 36 may be provided with a corrosion-resistant coating to insure long life and constant tension.

It will be understood that certain limited changes in construction and design of the improved mold may be made without departing from the spirit or scope of the invention as defined in the copending claims.

What is claimed is:

1. In an ice mold, a mold proper having a mold cavity and a flexible diaphragm at the base thereof, an outer container or receptacle for said mold proper spaced from the latter and defining in conjunction therewith an expansion chamber adapted to contain an expansible gas or fluid medium which when subjected to a temperature rise expands and exerts pressure on said diaphragm and flexes it upwardly to eject an ice block or mass from the mold cavity, and resilient means connecting said diaphragm to the outer container and normally urging the diaphragm to its "down" position.

2. An ice mold comprising an inner container having a mold cavity and outer container spaced from the inner container and providing an expansion chamber therebetween, said expansion chamber containing a gaseous or fluid medium expansible and contractible in volume when subjected to varying degrees of temperatures, the bottom of the mold cavity being flexible to provide an ice ejecting diaphragm, and a spring connecting the bottom of the inner container with the bottom of the outer container and normally urging the said diaphragm to its "down" position.

3. In combination with a freezing chamber, an ice mold comprising a mold proper having a mold cavity with a flexible bottom wall providing an ice-ejecting diaphragm and an outer wall or shell surrounding the base of the said mold and providing an expansion chamber beneath said diaphragm, said shell being formed with one or more vents functioning as "breathing openings" to admit air into the said chamber as the volume of the air is reduced during the ice freezing period while said mold is in its freezing chamber, removal of the mold from its freezing chamber subjecting the air to a rise in temperature and causing the air to expand and actuate said diaphragm, and resilient means interconnecting said diaphragm with said shell and normally urging the diaphragm to its "down" position.

4. An ice mold comprising an inner container having downwardly sloping walls and an outer container joined thereto adjacent its top margin to provide a sealed chamber therebetween, a flexible diaphragm in the bottom of said inner container, and resilient retarding means connecting the bottom of said outer container with the under surface of said diaphragm.

5. A device of the character described comprising a wall having a pocket formed therein for receiving water to be frozen into a unit of ice, the bottom wall of said pocket being deformable; means cooperating with said bottom to form a chamber; and a body of fluid confined in said chamber in position to react against said deformable bottom wall; said means being constructed and arranged to transfer heat from an external source to said fluid and said fluid being of such character and being present in such amount as to exert, upon a rise in temperature thereof, a force upon said bottom sufficient to move the

same toward the center of said pocket, break the bond between the walls of said pocket and ice frozen therein, and means normally urging said deformable bottom wall downwardly.

6. An ice mold comprising a body having a wall structure providing a mold cavity, and a movable bottom therefor operable to release ice

from said cavity, the structure providing an expansion chamber for an expansible fluid capable of moving said bottom to release ice upon the expansion of said fluid due to rise in temperature, and resilient means normally urging said bottom toward non-ice-releasing position.

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