Oct. 10, 1961 A. J. FREI ET AL 3,003,329

REFRIGERATION

Filed Dec. 21, 1959 2 Sheets-Sheet 1

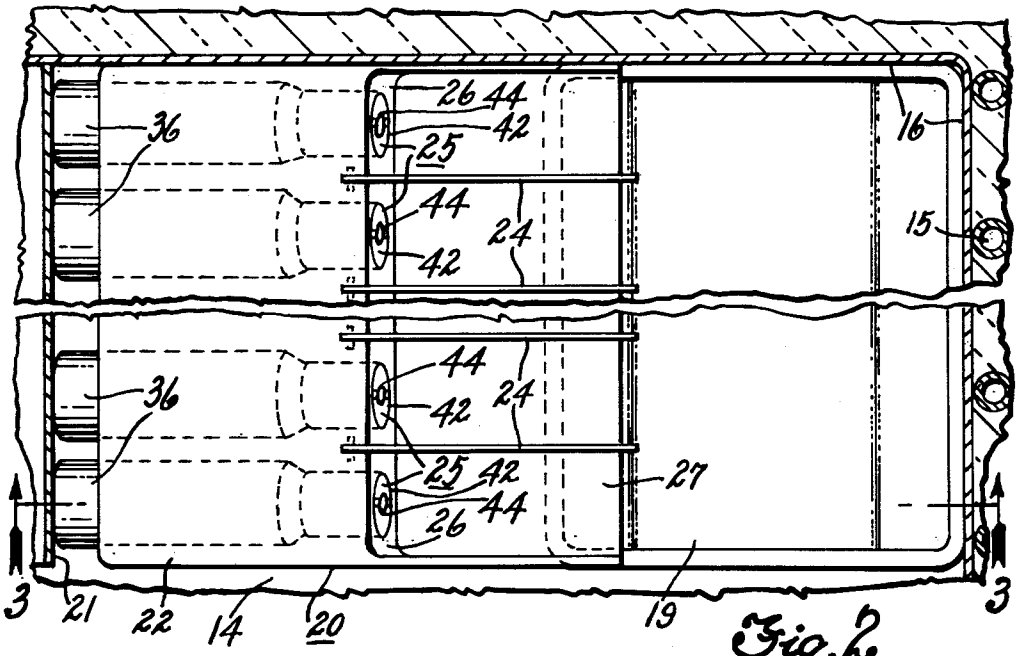


Fig. 2

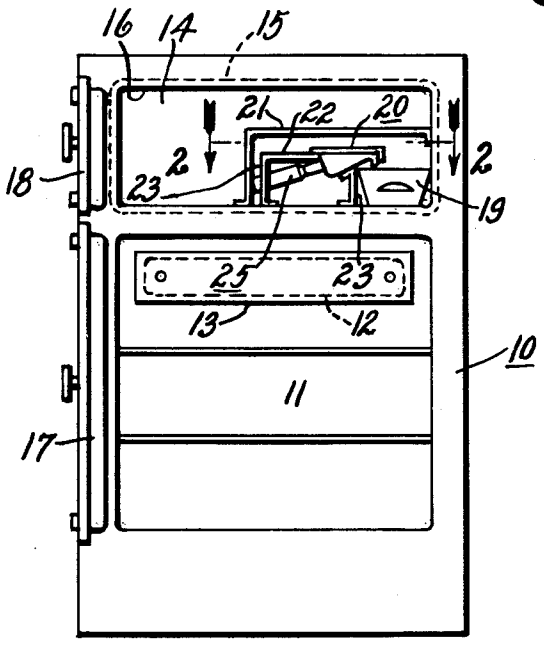


Fig. 1

INVENTORS
ARTHUR J. FREI
WALTER G. KNIFFIN

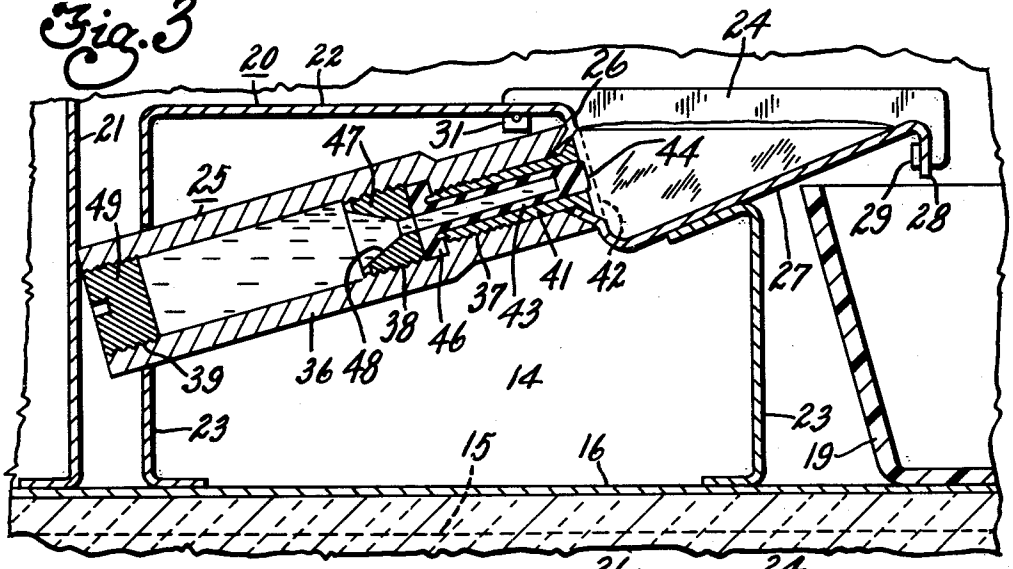
BY Lloyd M. Keighley.
THEIR ATTORNEY

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Fig. 3



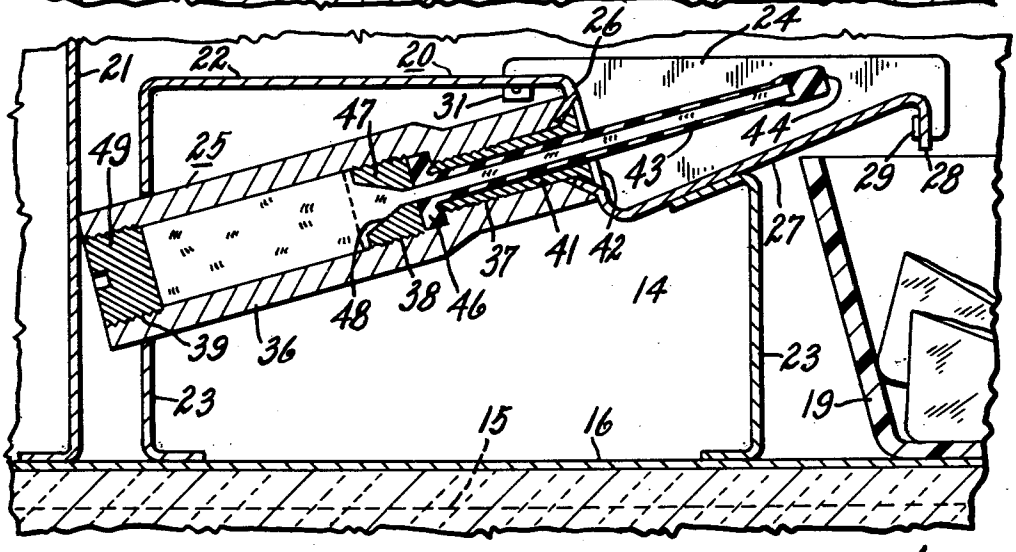


Fig. 4

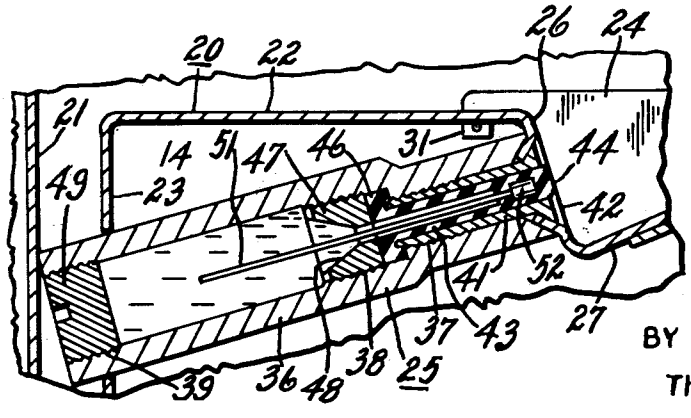


Fig. 5

INVENTORS
ARTHUR J. FREI
WALTER G. KNIFFIN
BY Lloyd M. Keighley.
THEIR ATTORNEY

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REFRIGERATION

Arthur J. Frei and Walter G. Kniffin, Dayton, Ohio, assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware

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2 Claims. (Cl. 62—135)

This invention relates to refrigeration and particularly to the production of ice blocks in a freezing compartment.

An object of our invention is to provide an improved method of and device for freezing water into ice blocks or pieces and automatically ejecting the ice blocks from the device into an ice block storage receptacle as distinguished from merely loosening ice blocks from compartment walls of a tray and grid type freezing device.

Another object of our invention is to utilize a thermal responsive operable unit or ice-operated motor in combination wth a freezing device or mold provided with an ice block forming compartment of a predetermined character wherein shifting of a movable part of the unit or motor, subsequent to freezing water in the compartment, into the confine of the compartment loosens an ice block frozen therein and also removes the loosened ice block from the compartment into an ice block storage receptacle removably associated with the freezing device.

A further object of our invention is to provide a thermal responsive operable unit or ice-operated motor with a resilient stretchable moving element normally closing an aperture in and forming a part of an upright rigid wall of an ice block forming compartment in a freezing device which element is motivated into the compartment after an ice block has been frozen therein in a direction laterally or substantially perpendicular to the upright wall thereof to shift the ice block out of the compartment.

A still further and more specific object of our invention is to associate a motor having a freezable liquid sealed therein by a movable part thereof with an ice block forming compartment of a predetermined vertical cross sectional contour in such fashion that the movable motor part is extended into the compartment a sufficient distance in response to hte freezing and expanding fluid in the motor after an ice block has been frozen in the compartment for, in addition to loosening the ice block therefrom, shifting it along one wall of the compartment, over the top thereof and out of the compartment into an ice storage receptacle adjacent thereto.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein preferred embodiments of the present invention are clearly shown.

In the drawings:

FIGURE 1 is a front view of a multiple compartmented refrigerator cabinet with the doors of the compartments or chambers therein open and showing an ice block making and harvesting arrangement of the present invention located in the freezing chamber of the cabinet;

FIGURE 2 is an enlarged fragmentary broken sectional view taken on the line 2—2 of FIGURE 1 showing ice block compartments in a freezing device mold and an ice-operated motor associated with each compartment;

FIGURE 3 is an enlarged vertical sectional view taken on the line 3—3 of FIGURE 2 showing one of the ice-operated motors in section;

FIGURE 4 is a sectional view similar to FIGURE 3 showing a motor operated and an ice block ejected from the freezing device into a storage receptacle associated therewith; and

FIGURE 5 is a sectional view similar to FIGURE 3 and shows a modified form of ice-operated motor.

Referring to the drawings, for illustrating our invention, we show in FIGURE 1 thereof a refrigerating apparatus including an insulated refrigerator cabinet 10 of the multiple chamber type in which our ice block making and harvesting arrangement is incorporated. Cabinet 10 is provided with a lower unfrozen food storage chamber 11 which is cooled to a temperature of from, for example, 37° to 45° F. by a plate-like sheet metal evaporator 12 of a refrigerating system associated with the cabinet which evaporator is located within the chamber and secured to the back wall thereof behind a protecting cover or air baffle 13. The refrigerator and the refrigerating system form the refrigerating apparatus with which our invention may be employed. Cabinet 10 is also provided with an upper or frozen food storage chamber 14 which is cooled to a temperature well below 32° F. for the storage of frozen foods, for freezing foods and/or for freezing water in freezing devices or molds into ice blocks or ice pieces for table use in chilling salads or the like and drinks in glasses. Chamber 14 is refrigerated to a below water freezing temperature by an evaporator 15, of the refrigerating system associated with cabinet 10, which evaporator is in the form of a conduit coiled or wrapped around the outside of and secured in metal to metal contact to a can-like member 16 forming the inner liner of chamber 14 (see FIGURE 2). Doors 17 and 18 are hingedly mounted on cabinet 10 to provide closures for individual access openings to chambers 11 and 14 respectively. The evaporators 12 and 15 may be connected by pipes or conduits to one another and to a refrigerant translating or motor-compressor condenser unit of the refrigerating system (not shown) associated with and usually located in the bottom portion of cabinet 10. While we show a more or less conventional arrangement for refrigerating the chambers 11 and 14, it is to be understood that other arrangements now known to those skilled in the art may, if desired, be used for this purpose.

For the sake of simplicity in illustrating the essence of our invention we removably support an ice block storage receptacle 19 and a freezing device, generally represented by the reference numeral 20, adjacent thereto on the bottom wall of liner 16 within chamber 14 and these elements constitute the ice block making and harvesting arrangement of our conception. A partition 21 (see FIGURE 1) in chamber 14 divides same into a frozen food section and an ice making and harvesting section. The freezing device 20 removably disposed and supported within chamber 14 includes a mold in the form of a metal plate 22 having supporting legs 23 depending therefrom and resting on liner 16. One side of plate 22 is depressed or so shaped as to provide an elongated pocket therein and a plurality of spaced apart parallel partitions 24 (see FIGURE 2) divide this pocket into open top ice block compartments adapted to contain water to be frozen. The ice block compartments are substantially triangular in vertical cross sectional contour and a clearance is provided between partitions 24 and walls of the compartments to permit water, during filling of the mold or device 20, to flow from one to another of the ice block compartments. Freezing device 20 also includes a pluraliy of thermal responsive operable units or ice-operated motors 25, one of which is associated with each of the ice block compartments and constructed and arranged as will be presently described. Each of the ice block compartments comprises, in addition to its side walls formed by the partitions 24, a generally upright wall 26 and another wall 27 extending laterally from wall 26 and inclined upwardly with respect thereto. Wall 27 of the water pocket or of the ice block compartments has a down-turned lip or flange 28 formed thereon (see FIGURE 3) provided with horizontally

spaced apart vertically elongated openings adapted to receive a hook portion 29 formed on the partitions 24. The other end of each partition 24 is provided with a leg 31 which is adapted to be projected into one of a plurality of spaced apart horizontally elongated openings cut or stamped in plate 22. Each partition 24 is assembled onto the mold portion of freezing device 20 by inserting hook portion 29 thereof into an opening in the lip 28 and by extending the leg 31 through an opening of plate 22. A stud or cotter pin is pressed through a hole provided in the end portion of leg 31 of partitions 24 beneath plate 22 to lock the partitions to freezing device 20 so that they form side walls of the molds or ice block compartments. The elongation of the openings in plate 22 and in lip 28 serve to hold or maintain the partitions 24 in a vertically disposed position paralleling one another. Each thermal responsive operable unit 25 associated with an ice block compartment of freezing device 20 is in the present invention in the form or a choked or restrictor type ice-operated motor having a freezable and expansible fluid, such as a brine solution or a mixture of water and alcohol, sealed therein for operating same. A choked ice-operated motor is disclosed in the A. J. Frei Patent 2,908,146 dated October 13, 1959, and reference to this patent is made for a clearer understanding of how the distance of movement of one movable part of such a motor is greatly multiplied or increased over prior conventional ice-operated motors. The liquid sealed in ice-operated motors 25 preferably has a lower freezing point than the water to be frozen in the ice block compartments.

Each motor 25 comprises an elongated metallic tube or cylinder 36. The bore of tube or cylinder 36 is threaded at three spaced apart points therealong as at 37, 38 and 39 (see FIGURE 3) for purposes to be presently described. A metal sleeve 41 provided with a threaded end and having an outwardly flared head 42 thereon, provided with a screw driver or the like slot therein, is projected through a flared wall aperture cut or stamped in the upright wall 26 of an ice block compartment of the freezing device and is inserted into the bore of tube or cylinder 36 with its threaded end screwed upon the threads 37 for clamping cylinder or housing 36 of the motor to plate 22. A hollow resilient rubber-like plunger 43 forms a movable part of the ice-operated motor and has a closed end 44 and another end flanged outwardly as at 46. The plunger 43 is inserted into the bore of cylinder 36 and its closed end 44 is passed through sleeve 41 until the flange 46 engages the inner end of this sleeve. A threaded metal collar or choke member 47 provided with a cone-shaped or tapered surface opening therein, as at 48, and a screw driver or the like slot is inserted into the bore of cylinder 36 and threaded upon the threads 38 thereof. Tightening of collar 47 towards sleeve 41 clamps the flanged end 46 of resilient plunger 43 therebetween and also locks a motor 25 to plate 22. The cavity or chamber in the ice-operated motor formed by the cylinder bore, the hollow portion of resilient plunger 43 and the opening in collar 47 is then filled with a brine solution or a water and alcohol mixture. Thereafter, a closure cap or screw plug 49 is threaded into the threads 39 to seal the fluid within the ice-operated motor 25. It is to be noted that sleeve 41 and the end 44 of plunger 43 closes the aperture in the ice block compartment upright wall 26 and the snug fit of plunger 43 within sleeve 41 prevents water placed in the compartment from entering the ice-operated motor. Plunger or movable part 43 of motor 25 is exposed to the freezable fluid sealed therein and this plunger isolates the freezable mixture in the motor from water placed in an ice block forming compartment to be frozen therein. It is to be understood that the freezing device may include any desired number of ice block compartments and associated ice-operated motors 25 depending upon the size of the freezing device and the desired quantity of ice blocks to be made at one time. It is also to be understood that the substantially triangular shaped ice block compartments need not be restricted to the length herein shown as they can be longer and additional or multiplied shifting of the movable part or stretchable plunger 43 of the ice-operated motor provided. For example, by reference to FIGURE 5 of the drawings, we show a means for increasing the stretchability or extension of movable part or plunger 43 of a motor 25. In this showing a wire or small diametered metal rod 51 provided with a head 52 which is molded as an insert in the closed end portion of rubber-like plunger 43. The wire or rod 51 extends inwardly from its head 52 along and spaced from the hollow inner walls of plunger 43. This rod or wire forms, in addition to choke collar 47, a further constriction within the movable part or hollow plunger 43 of the ice-operated motor. As liquid in the modified motor congeals or freezes and expands, the expansion of the freezing mass in a straight line direction against the closed end 44 of plunger 43 is caused, by wire or rod 51, to be multiplied or increased to thereby cause greater stretching and travel of the plunger into the confine of an ice block compartment.

Assume now that a housewife or user of a refrigerator cabinet, having an ice maker or freezing device of the present disclosure removably associated or used in conjunction therewith, desires a ready supply of ice blocks in the storage receptacle 19 within chamber 14. The molds or compartments of the freezing device 20 are filled either by partially withdrawing the device from chamber 14, with drinking water by a pitcher at the refrigerator, or the device may be bodily removed from the refrigerator cabinet and held under a supply of tap water. After substantially filling the molds or compartments with water, the device is then repositioned into the freezing chamber 14. As before stated, the edges of partitions 24 are, preferably and partly due to manufacturing tolerances, slightly spaced from the rigid ice block compartment walls 26 and 27 and the level of water placed in the freezing device is thereby equalized throughout the various compartments. When water filled device 20 is slid back into or repositioned in chamber 14 and door 18 closed, this water as well as the fluid sealed in motors 25 begins to be chilled by the refrigerating effect produced by evaporator 15 and by cold air in the freezing chamber. This chilling continues and ice blocks become hard-frozen in the compartments or molds of the freezing device 20 prior to freezing and congealing liquid sealed in the motors 25. In other words, water contained in the open top substantially triangular shaped in vertical cross section compartments of device 20 is frozen into solid ice blocks or pieces preceding congealation or solidification of the liquid in ice-operated motors 25 (see FIGURE 3). Further chilling of device 20 within chamber 14 below water freezing temperature then causes the water and alcohol mixture in units or motors 25 to freeze and expand in the bore of cylinders 36 thereof. The cone shaped or tapered wall surface 48 of choke collar or member 47 constricts the freezing and expanding mass in cylinders 36 and restricts expansion thereof into the hollow movable part or extensible plunger 43. Force of the freezing and expanding mass within motors 25 stretches walls of part or plunger 43 and shifts its closed end 44 relative to cylinder 36 in a direction laterally or substantially perpendicular to a compartment upright wall 26 longitudinally along its inclined wall 27 into the confine of the compartment. This stretching or shifting of plunger 43 loosens ice blocks from their compartments and moves the loosened ice blocks upwardly relative to the compartment wall 27 where they become overbalanced on the top of down-turned lip or flange 28 whereupon they fall by gravity into the storage receptacle 19 (see FIGURE 4). As before stated, if increased shifting movement of part or plunger 43 of thermal units or ice-operated motors 25 relative to the ice block compartments or into the confine thereof is desired, this multi-

plied or increased movement can be had by employing the additional constrictor or wire-like rod **51** of the modified type of thermal responsive unit or ice-operated motor disclosed in FIGURE 5 of the drawings. Thus, the plurality of separate individual ice blocks are, in addition to being freed from walls of their compartments, ejected out of the top thereof into the storage receptacle **19** under influence of or in response to the power or force developed or generated by the expanding mass within units or motors **25**. The receptacle **19** is separate and detachable from freezing device **20** so as to permit its removal from chamber **14** of refrigerator **10**. Therefore, ice blocks received in receptacle **19** can be harvested therefrom while the receptacle remains in chamber **14** or the receptacle may be removed from this chamber so that the ice blocks can be served from receptacale **19** at a point remote from the refrigerator **10**, such, for example, as at a dinner or cocktail mixing table. In order to thaw the frozen or partially frozen content of ice-operated motors **25**, so as to again ready or condition them for operation, the freezing device **20** is removed from chamber **14** and exposed to room temperature and the resiliency of walls of movable part or plunger **43** will then cause its closed end **44** to be withdrawn back into the motor or to be shifted from the position thereof shown in FIGURE 4 of the drawings into its position shown in FIGURE 3. A removed device **20** may be held under a faucet and warm tap water flown thereover to speed the thawing of its frozen content. If the presently disclosed arrangement is employed in an automatic ice block maker or machine, it is to be understood that the cylinders **36** or motors **25** could be surrounded by electrically energized wire resistor heating elements to thaw the mass in the motor and to cause the return of the movable part or plunger **43** for rendering the motors operable when a subsequent freezing cycle is initiated. The compartments of freezing device **20** removed from chamber **14** may be refilled with water and reinserted into the chamber for freezing the water into additional ice blocks and for ejecting the additional ice blocks from their compartments into receptacle **19** as desired.

Ice blocks may have been previously loosened from walls of compartments in a tray of a freezing device and remained loosely positioned therein with the use of so-called ice-operated motors, but these motors have not heretofore been constricted to provide sufficient movement of elements thereof relative to one another to shift a loosened ice block entirely out of its compartment and therefore the prior motors have not been practical to serve as automatic ice block ejectors. In view of this, it should be apparent from our disclosure that we have provided a new and novel method of and arrangement for automatically ejecting ice blocks entirely out of a device or mold in which they have been frozen for harvest from a refrigerator. Our improvement obsoletes the use of conventional ice tray and grid structures in a refrigerator cabinet and eliminates the necessity of a housewife to exert considerable force thereto during the act of harvesting ice blocks therefrom. The shape of the ice block compartments and the particular direction of shifting a movable part of an ice-operated motor relative thereto as herein disclosed is novel and of importance to the automatic ejection of ice blocks entirely out of their compartments into an ice block storage receptacle from which they can be readily harvested without first removing a mold or freezing device in which the ice blocks are frozen from a refrigerator cabinet.

While the embodiments of the present invention as herein disclosed, constitute preferred forms, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. In combination, a chamber having a freezing device and a storage receptacle therein, said freezing device comprising a mold and a thermal responsive unit secured together against movement with respect to one another, said mold being composed of a plurality of inflexible walls forming a compartment adapted to contain water to be frozen, one of said walls being directed upwardly of the bottom of said compartment and provided with an aperture therein intermediate the top thereof and said compartment bottom, said thermal unit including a shiftable part separate from and independent of said compartment walls, said shiftable part of said unit communicating with the interior thereof and having a permanently closed end disposed in said aperture preventing passage of water therethrough and defining a continuing inner surface of said one compartment wall thereat, a refrigerating system including a refrigerant evaporator for chilling said mold within said chamber to freeze water in said compartment into a solid block of ice therein, said evaporator also cooling said thermal unit to a temperature below that at which the ice block freezes solid for activating the unit, and activation of said thermal unit shifting said shiftable part thereof relative to said inflexible mold walls through the aperture in said one wall a sufficient distance into the confine of said compartment whereby the unit serves as the sole means to eject the whole solid ice block out of the mold into said storage receptacle.

2. In combination, a chamber having a freezing device and a storage receptacle therein, said freezing device comprising a mold and a thermal responsive unit secured together against movement with respect to one another, said mold being composed of a plurality of inflexible walls forming a compartment adapted to contain water to be frozen, one of said walls being directed upwardly of the bottom of said compartment and provided with an aperture therein intermediate the top thereof and said compartment bottom, said thermal unit including an elongated resilient rubber-like plunger separate from and independent of said compartment walls, said plunger of said unit having a hollow part communicating with the interior thereof and having a permanently closed end disposed in said aperture preventing passage of water therethrough and defining a continuing inner surface of said one compartment wall thereat, a refrigerating system including a refrigerant evaporator for chilling said mold within said chamber to freeze water in said compartment into a solid block of ice therein, said evaporator also cooling said thermal unit to a temperature below that at which the ice block freezes solid for activating the unit, and activation of said thermal unit stretching said plunger and shifting same relative to said inflexible mold walls through the aperture in said one wall a sufficient distance into the confine of said compartment whereby the unit serves as the sole means to eject the whole solid ice block out of the mold into said storage receptacle.

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