Oct. 30, 1962 P. DE VINCENT 3,060,700

ICE BLOCK MAKER

Filed July 13, 1961 2 Sheets-Sheet 1

Fig. 2

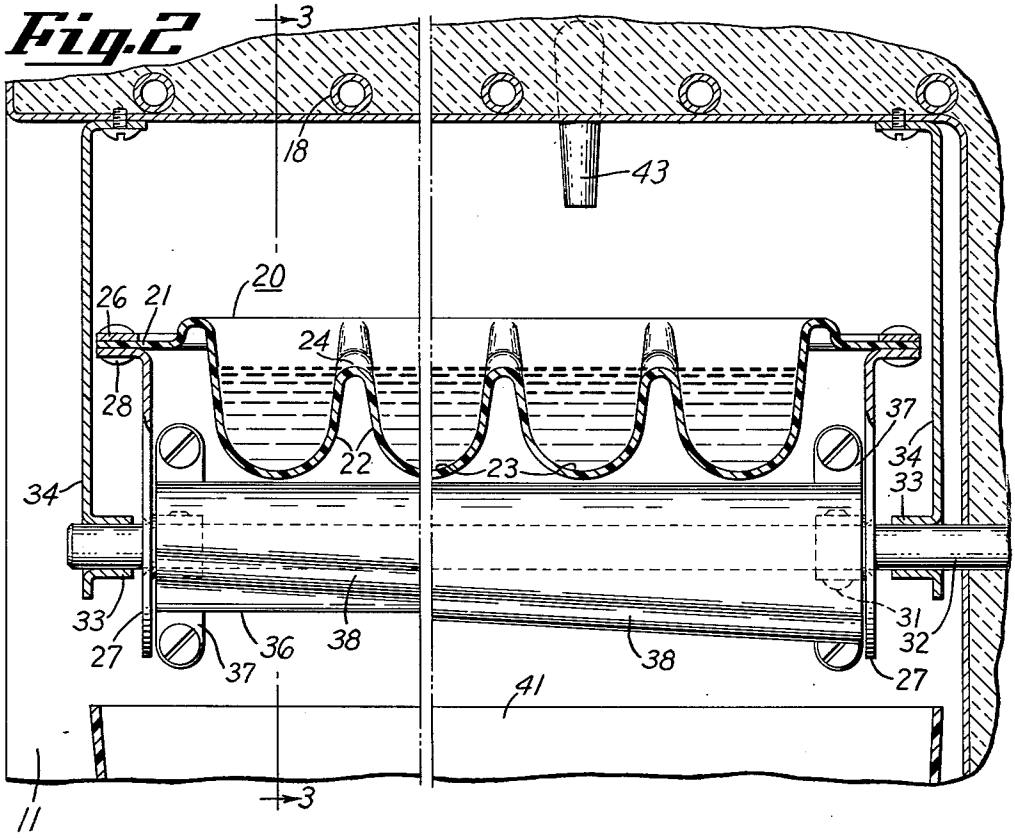


Fig. 1

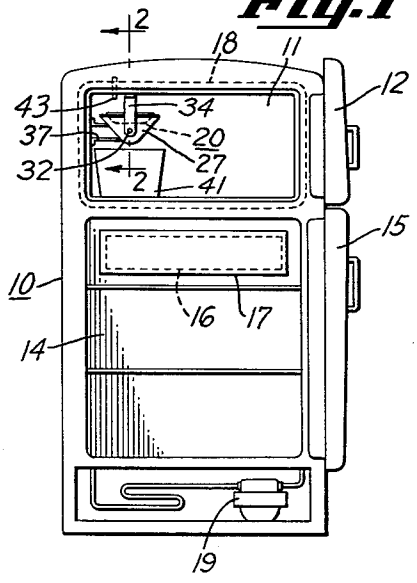
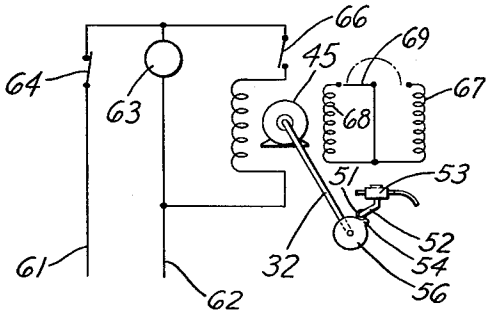


Fig. 5



INVENTOR.
PATSY DEVINCENT

BY

Lloyd M. Keighley.

HIS ATTORNEY

Oct. 30, 1962 P. DE VINCENT 3,060,700

ICE BLOCK MAKER

Filed July 13, 1961 2 Sheets-Sheet 2

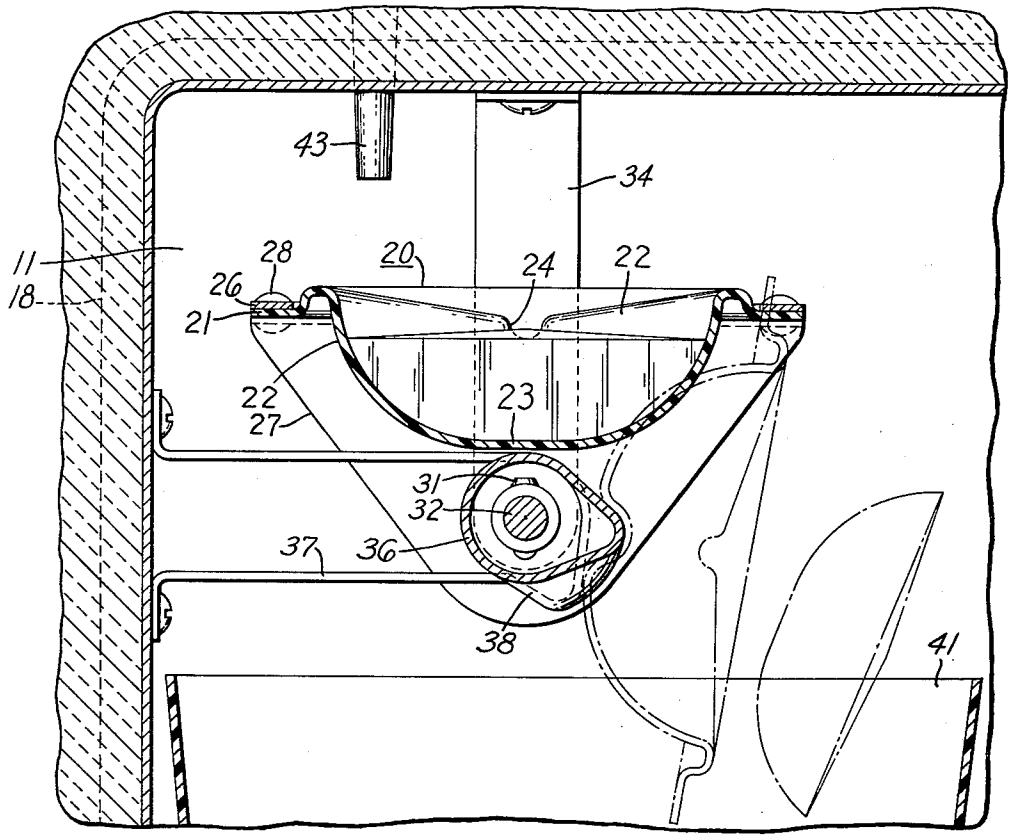


Fig. 3

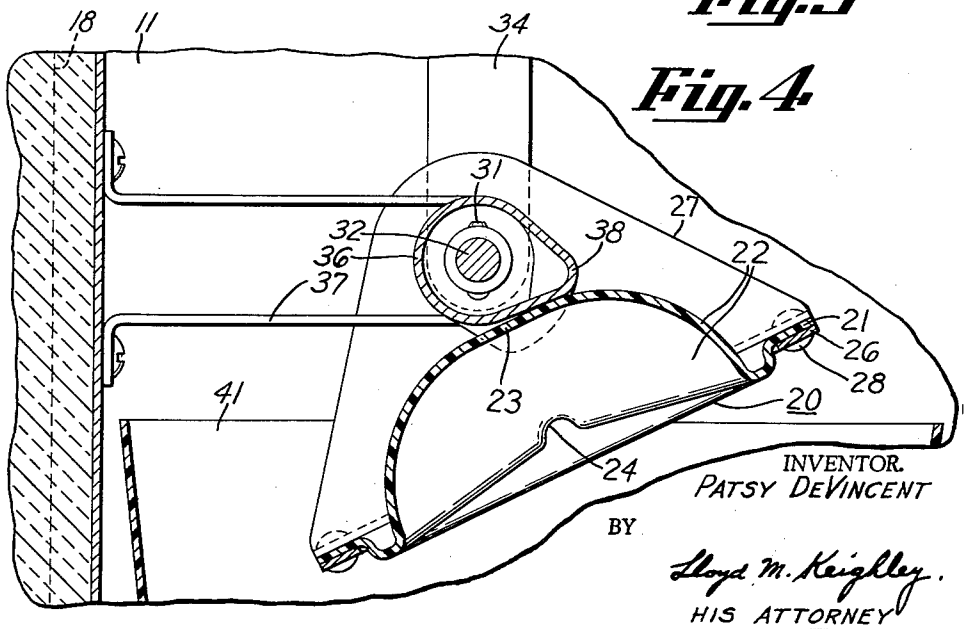


Fig. 4

INVENTOR.
PATSY DEVINCENT

BY

Lloyd M. Keighley.

HIS ATTORNEY

United States Patent Office

3,060,700

Patented Oct. 30, 1962

3,060,700
ICE BLOCK MAKER

Patsy De Vincent, Dayton, Ohio, assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Filed July 13, 1961, Ser. No. 123,792
2 Claims. (Cl. 62—353)

This invention relates to refrigeration and particularly to an ice block making apparatus for use in household refrigerators.

An object of my invention is to provide an improved and simplified ice making apparatus which is of low manufacturing cost due to a minimum number of parts required in its construction to adapt same for installation in a refrigerator.

Another object of my invention is to provide an ice block maker of the unitary rotatable tray type which occupies a minimum of valuable storage space in a freezing chamber of a refrigerator for rotating same therein to eject ice blocks from compartments in the tray.

A further object of my invention is to provide a mechanical means or method for ejecting ice blocks from compartments of a rotary type freezing tray or mold in an ice maker one after another in succession during rotation of the tray or mold so as to reduce the force required to rotate same.

In carrying out the foregoing objects it is a still further and more specific object of my invention to provide an ice making apparatus including an elongated freezing tray having a row of ice block compartments therein which tray is rotatable about a helical cam formed on a stationary member whereby the bottom of the compartments progressively engage different portions of the cam and are distorted or flexed for ejecting ice blocks one after another from the compartments as distinguished from flexing or twisting an entire tray or carrying out several operations of mechanisms in an ice maker to at one and substantially the same time obtain a batch of ice blocks.

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

In the drawings:

FIGURE 1 is a front view of a household refrigerator cabinet with its doors open and having an ice block making apparatus of the present invention incorporated in the freezing chamber thereof;

FIGURE 2 is an enlarged fragmentary broken sectional view through the refrigerator cabinet taken along the lines 2—2 of FIGURE 1 partly in elevation showing the mounting of parts of the ice making apparatus within the freezing chamber of the refrigerator cabinet;

FIGURE 3 is a fragmentary sectional view taken along the lines 3—3 of FIGURE 2 showing the relationship of a cam means with the tray of the ice maker in a water freezing position;

FIGURE 4 is a view siimlar to FIGURE 3 with the tray of the ice maker rotated relative to the cam means thereof and illustrating distortion of the bottom of an ice block compartment; and

FIGURE 5 is a schematic illustration of parts of the ice making apparatus in a wiring diagram and controls for the apparatus.

Referring to the drawings, wherein an embodiment of my invention is illustrated, I show in FIGURE 1 thereof a conventional household refrigerator cabinet generally represented by the numeral 10. Cabinet 10 is of the type including an insulated upper frozen food storage or freezing chamber 11, normally closed by a door 12, and a lower insulated unfrozen food storage chamber 14 separate

from chamber 11, and normally closed by a door 15. These chambers 11 and 14 are adapted to be cooled to a suitable temperature different from one another by a conventional refrigerating system. Such a refrigerating system includes, in addition to a metal plate-like evaporator 16 mounted within chamber 14 and located behind a protective baffle or cover 17, a refrigerant evaporator 18 in the form of a conduit coiled or wrapped around and secured in metal-to-metal contact with a metal liner forming walls of chamber 11. The refrigerating system also includes a refrigerant translating device which may be a motor-compressor-condenser unit 19 having suitable pipe or conduit connections with the evaporators for circulating refrigerant in succession, first through coiled evaporator 18 and thence through evaporator 16. Usual controls (not shown) as is well known in the art may be provided for controlling cyclical operations of the motor-compressor part of the refrigerator system. While I have disclosed one conventional manner of chilling the interior of chambers 11 and 14 it is to be understood that other arrangements may, if desired, be employed. For example, the food storage and freezing chambers 11 and 14 respectively may both be subjected to forced air circulation arrangements whereby to maintain the interior of chamber 11 at a temperature well below 32° F. and the interior of chamber 14 at a food preserving temperature above 32° F.

My improved ice block making apparatus associated with refrigerator cabinet 10 includes or comprises a nonmetallic elongated tray or mold 20 (see FIGURES 2 and 3) having a bounding rim 21 and integral walls dividing the interior of the tray or mold into a row of ice block compartments each provided with upstanding or upright sides 22 and a resilient or flexible bottom 23 adapted to receive water to be frozen into ice blocks in the compartments. Sides 22 of adjacent compartments of tray 20 are provided with a recess or weir 24 in webs therebetween which permit water to flow from one compartment to the other in establishing a common water level in the tray. Elongated tray 20 may be molded of any suitable or desirable plastic or rubber-like material which will render at least the lower portion or bottom 23 of the plurality of ice block compartments resilient or flexible so as to withstand repeated individual distortions and which compartment bottoms will snap or spring back into their normal position after being distorted or flexed. While I have disclosed a nonmetallic tray or mold it is to be understood that my invention is not so restricted to such a tray since it may be quite possible to make the tray of metal with thin resilient walls forming the flexible bottom of compartments therein. The bounding rim 21 of tray or mold 20 is clamped under a metal frame 26 and the opposite ends of the tray or mold are secured to simultaneously rotatable metal arms 27 by screws or rivets 28. Tray 20 is normally rotatably mounted within freezing chamber 11 of cabinet 10 in an upright position and the clamping of its peripheral bounding rim 21 to frame 26 prevents or holds the tray against being bowed or twisted.

In order to mount tray 20 within chamber 11 for rotation therein I lock or key arms 27, by a pin or the like 31, to a rotatable shaft 32 which is journaled in the bearings 33 provided on supports 34. The supports 34 are bolted or otherwise suitably secured to the top wall of chamber 11 for supporting the mold or tray 20 therein. Shaft 32 projects through a rigid hollow member (see FIGURES 2 and 3) which includes an elongated bar-like portion 36, substantially coextensive with the elongated tray 20, spaced-apart laterally extending mounting legs or bracket portions 37 and cam means 38 formed integral on portion 36. Shaft 32 is positioned at and is rotatable about the axis of cam means 38. Mounting bracket portions 37 of the rigid hollow member is bolted or otherwise

suitably fastened to a side wall of chamber 11 so as to stationarily secure this member within the freezing chamber in association with tray or mold 20. Cam means 38 is helically formed on the rigid stationary bar-like member and preferably extends continuously throughout the length of elongated tray or mold 20 from a predetermined fixed point at one end of the member to a locus point at the other end of the member. While I prefer cam means 38 to be continuous, it is to be understood that, insofar as my invention is concerned, this stationary cam means could be comprised of spaced-apart cam portions arranged in helix formation along the length of the stationary bar-like member from one given point thereon to a locus point of the formation. Tray 20 is normally out of engagement with cam means 38 in an upright position within chamber 11 but the cam means is located therebeneath in such a juxtaposition relative to the tray as to be in the path of rotation of at least the resilient bottom 23 of compartments thereof. An ice bucket or ice block storage receptacle 41 is removably located under the ice making apparatus and is supported on the bottom wall of chamber 11 in engagement with a spring biased electric switch (not shown) interposed in an electric wiring circuit for the apparatus to be hereinafter described. The electric switch just referred to is actuated in response to the weight of a predetermined quantity of ice blocks received in receptacle 41 for opening the electric circuit and discontinuing production of ice blocks by the apparatus. This is a common and well known expedient in the art and the electric switch actuated as stated needs no illustration or further description herein since it forms no part of the present invention. A water inlet pipe 43 (see FIGURE 1), connected to a suitable source of water supply, extends through a wall of refrigerator 10 and has its outlet end located within chamber 11 above the upright tray or mold 20 to discharge a measured amount of water thereinto as will also hereinafter be described. Shaft 32 projects through a wall of chamber 11 and this shaft is connected with a self-reversible electric driving motor 45 (see FIGURE 5) outside the chamber for rotating the tray or mold 20 throughout an arc, about the axis of cam means 38, of approximately 155° travel. The shaft 32 extends entirely through motor 45 and has an end projecting therefrom for carrying a cam thereon serving a purpose to be hereinafter described.

Assuming now that a proper or measured amount of water has been directed from pipe 43 into the plurality of compartments of the row thereof in tray or mold 20, while it is in its upright position in chamber 11, and the water has been hard-frozen into separated ice blocks therein. Motor 45 is energized in any suitable manner, as for example as will be hereinafter described, and rotates shaft 32 and the tray or mold 20 locked or keyed thereto in a clockwise direction, as viewed in FIGURE 3 of the drawings, throughout an arc of 155° about the axis of cam means 38 on the stationary bar-like member. The initial rotation of tray 20 causes bottom 23 of the compartment at one end of the tray to first engage a portion of helical cam means 38 and be slighly distorted or flexed whereby the block of ice in this compartment is forcefully ejected therefrom and directed into receptacle 41. Continued rotation of tray 20 thereafter causes bottom 23 of the remainder of the compartments of the row thereof in the tray to progressively engage portions of cam 38 and are also slightly distorted or flexed thereby one after another in succession from the one end of the tray to its other end (see FIGURE 4). Flexing or distorting the other compartment bottoms 23 releases all of the ice blocks from tray 20, during rotation of the compartments thereof into ice block ejecting positions, by virtue of the helical arrangement of cam means 38 on the stationary bar-like member and the progressive engagement of the compartments therewith. In this connection it is desired to here set forth that the substantial point contact of cam means 38 with the compartment bottoms 23, the slight distortion or flexing of these compartment bottoms thereby and the particular shape or contour of the ice block compartments all cooperate to play an important role in rendering the present disclosure feasible. First, the bottoms 23 of compartments of tray or mold 20 are never distorted or flexed beyond a distance where they will not spring, snap or flex back into their original or normal shape, when the tray or mold is uprighted, and consequently the compartment bottoms cannot be moved into a deformed permanently set position to render a subsequent ice block ejecting rotation of mold or tray 20 ineffective. Secondly, once compartment bottom 23 is only slightly flexed or distorted the ice block in the compartment is shifted relative to and loosened from all walls thereof and, due to the shape or contour of the compartment walls, the loosened ice blocks are not restrained thereby and they freely slide out of the compartments to gravitate or fall into receptacle 41 when the compartments are indexed or rotated far enough to create such gravitation.

Suitable timing mechanism, which will be described hereinafter, serves to reverse the direction of rotation of driving motor 45 and consequently shaft 32, after the tray or mold 20 has been rotated clockwise throughout its 155° travel for returning the tray to its upright normal water-fill position. The motor 45 may stall momentarily after rotating tray 20 into its ice block ejecting position before the timing mechanism reverses the direction of rotation thereof. This is typical of such motors and causes no damage thereto. As motor 45 nears the end of its reverse direction of rotation, a roller 51 (see FIGURE 5) on the end of a lever 52 of a water valve 53 of a water supply means rides over a lobe 54 provided on a cam 56, mounted on a projecting portion of shaft 32, and the movement of roller 51 is imparted to lever 52 to open valve 53 for discharging a measured amount of water through pipe 43 into the upturned tray or mold 20 to refill same after which the valve 53 closes. The water supply means is located exteriorly of chamber 11 of the refrigerator 10 and may be of any suitable character such as the water main leading into the residence or building in which the cabinet 10 is installed. Valve 53 is preferably a metering means or device and may be similar to the valve shown and described in the patent to F. W. Sampson No. 2,793,793 dated May 28, 1957, and assigned to the assignee of this application. The showing in FIGURE 5 of the drawings illustrates electric controls suitable for controlling the present ice making apparatus. Reference numerals 61 and 62 designate the power lines used for supplying electric current to the controls. Numeral 63 depicts a conventional timing motor, separate from the motor 45, which is connected across the power lines 61 and 62. Timer motor 63 is continuously operated, except when a switch 64 actuated by the ice block storage receptacle 41 is opened, and is adapted to operate a switch 66 at specified or predetermined intervals of time sufficient to insure hard-freezing of water in tray or mold 20 into ice blocks such, for example, as every hour or so. As hereinbefore stated, switch 64 is a weight actuated normally closed switch adapted to be opened by a predetermined ice accumulation in receptacle 41 and when same is opened switch 64 interrupts flow of electric current to timer motor 63 to render the ice maker inoperative until the supply of ice blocks stored in receptacle 41 has been substantially exhausted. Timer motor 63 operates switch 66 which is arranged in series with the reversible driving motor 45. For illustrative purposes this driving motor is shown as having a pair of direction reversed shading poles 67 and 68 controlled by a switch 69 also operated by timer motor 63 in such a manner that each time the timer motor 63 closes switch 66, switch 69 will close the circuit to a different one of the shading poles to reverse the direction of rotation of driving motor 45 and consequently rotation of tray 20. This control system is more

or less conventional and is therefore not pertinent to the invention herein disclosed.

It should, from the foregoing, be apparent that a novel, improved and simplified apparatus for freezing water into ice blocks, for releasing ice blocks therefrom in dry form and for storing the ice blocks in a household refrigerator cabinet has been provided. Such is accomplished by utilizing stationary cam means progressively engageable by the bottom of compartments of a tray or freezing device thus reducing to a minimum moving parts incorporated in the apparatus. My invention eliminates the necessity of employing artificial heat in an ice maker and therefore no extra refrigeration demand is placed on the refrigerating system associated with the refrigerator cabinet. By releasing or rejecting the ice blocks one after another in succession from the ice tray or mold during a single rotation thereof a lower capacity and consequently less expensive driving motor may be used to rotate the tray or mold. The minute amount of distortion or flexure required of the bottom of compartments of my tray or mold to eject ice blocks therefrom insures that the compartment bottoms will spring or flex back into their normal position when the tray or mold is uprighted thus eliminating mechanisms or camming devices for so returning same. Furthermore, the rather slight compartment bottom wall distortion or flexure cooperates with the progressive engagement of the compartment bottoms with portions of the stationary helical cam means to reduce to a minimum stresses or strains imparted to various parts of the apparatus whereby such parts can be made of thinner gauge material. These and other factors incorporated in the present ice making apparatus contribute to render the same practical and of low manufacturing cost.

While the embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. An ice making apparatus comprising in combination:

(*a*) a chamber cooled to a temperature below 32° F.,

(*b*) an elongated tray having opposed ends thereof supported within said chamber at an axis beneath and in a vertical plane intermediate long sides of the tray for rotation therein,

(*c*) said tray including spaced-apart double upright walls formed integral therewith dividing the interior thereof into a row of compartments adapted to receive water to be frozen into ice blocks.

(*d*) the compartments of said tray each having a resilient bottom separated from the bottom of other of said compartments by said double walls and rendering them distortable independently of one another,

(*e*) means stationarily mounted in said chamber provided with cam portions arranged in a helix-like formation throughout the length of said tray in the path of rotation thereof for progressive engagement by bottoms of said compartments of the tray,

(*f*) said tray being rotatable about said axis in an arc around said stationary means a sufficient distance to substantially invert the tray while same is supported within said chamber, and

(*g*) the rotation of said tray gliding bottoms of the compartments thereof sequentially into contact with the past cam portions on said stationary means for distorting said bottoms individually one after each other in succession to release ice blocks from said compartments whereby the blocks of ice fall downwardly therefrom out of said tray during its inversion.

2. An ice making apparatus comprising in combination:

(*a*) a chamber cooled to a temperature below 32° F.,

(*b*) an elongated tray having opposed ends thereof supported within said chamber at an axis beneath and in a vertical plane intermediate long sides of the tray for rotation therein,

(*c*) said tray including spaced-apart double upright walls formed integral therewith dividing the interior thereof into a row of compartments adapted to receive water to be frozen into ice blocks.

(*d*) the compartments of said tray each having a resilient bottom separated from the bottom of other of said compartments by said double walls and rendering them distortable independently of one another,

(*e*) the bottoms of said tray compartments being rounded in two opposite directions and said double upright walls spacing them apart to expose all walls thereof to chilled air in said chamber,

(*f*) cam means stationarily mounted in said chamber at the rotatable axis of said tray,

(*g*) said cam means extending helically around said axis throughout the length of said tray and disposed in its path of rotation for progressive engagement by bottoms of compartments thereof,

(*h*) said tray being rotatable about said axis in an arc around said cam means a sufficient distance to substantially invert the tray while same is supported within said chamber, and

(*i*) the rotation of said tray sequentially gliding bottoms of compartments thereof into contact with and past said helical cam means for individually distorting said bottoms one after each other to eject ice blocks downwardly out of said compartments in succession from end to end of the tray during its inversion.

References Cited in the file of this patent

UNITED STATES PATENTS

2,697,918	Comstock	Dec. 28, 1954
2,757,519	Sampson	Aug. 7, 1956
2,808,707	Chace	Oct. 8, 1957
2,957,604	Goldman	Oct. 25, 1960
2,981,079	Fink	Apr. 25, 1961
2,994,204	Archer	Aug. 1, 1961