

Feb. 26, 1957

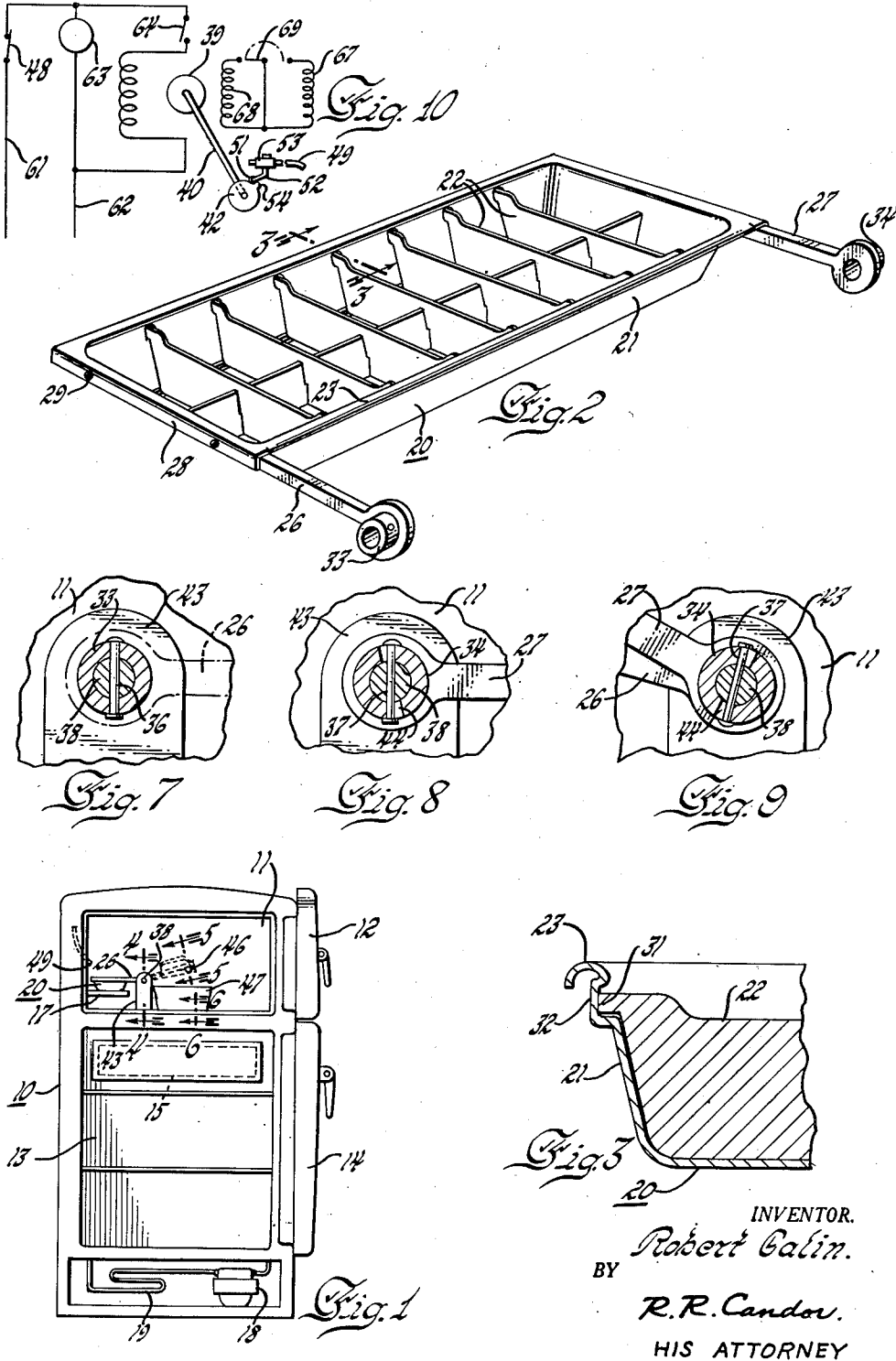
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2,782,609

ICE BLOCK MAKING APPARATUS

Filed April 11, 1955

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## ICE BLOCK MAKING APPARATUS

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Application April 11, 1955, Serial No. 500,457

10 Claims. (Cl. 62—106)

This invention relates to refrigeration and particularly to ice block making apparatuses.

An object of this invention is to provide an automatic ice block making apparatus, which may, if desired, be incorporated in a household refrigerator, and a novel method of releasing separated ice blocks therefrom.

Another object of this invention is to provide an automatic ice block maker with a freezing device portion which retains the feature of rapidly freezing water into ice blocks while at the same time insuring mechanical release of ice blocks therefrom as distinguished from applying artificial heat to a portion of the freezing device.

A further object of this invention is to rotate a unitary tray and grid type freezing device portion of an automatic ice block making apparatus relative to a stationary refrigerated freezing support therefor into an inverted position and to thereafter release separated ice blocks from the inverted unitary device in dry form into a storage receptacle from which they may be harvested at will.

In carrying out the foregoing objects it is a still further and more specific object of this invention to rotate a unitary distortable freezing device portion of an ice block maker, relative to a stationary refrigerated member upon which it is supported while freezing water therein, into a substantially inverted position and to flex and twist a metal tray of the device to cause rigid walls loosely anchored therein to shift in respect to one another and relative to the tray for releasing ice blocks from the device.

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 form of the present invention is clearly shown.

In the drawings:

Figure 1 is a front view of a household refrigerator having the ice block making apparatus of the present invention incorporated in a freezing or frozen food storage compartment thereof;

Figure 2 is a perspective view of the unitary tray and grid freezing device portion of the ice maker;

Figure 3 is a fragmentary enlarged sectional view taken on the line 3—3 of Figure 2 showing a rigid wall loosely anchored in the tray of the freezing device;

Figure 4 is an enlarged fragmentary sectional view taken on the line 4—4 of Figure 1 showing arms on the freezing device mounted upon a rotatable shaft;

Figure 5 is an enlarged fragmentary sectional view taken on the line 5—5 of Figure 1 showing the tray of the freezing device twisted and rigid walls therein shifted relative thereto;

Figure 6 is an enlarged fragmentary sectional view taken on the line 6—6 of Figure 1 showing an ice block storage receptacle and a weight actuated switch associated therewith;

Figure 7 is a fragmentary sectional view taken on the line 7—7 of Figure 4 showing the mounting of the front

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arm of the freezing device on a motor driven rotatable shaft;

Figure 8 is a fragmentary sectional view taken on the line 8—8 of Figure 4 showing the mounting of the rear arm of the freezing device on the rotatable shaft;

Figure 9 is a view similar to Figure 8 showing the rear arm of the freezing device after it has engaged a stop and showing a means for permitting the front arm of the freezing device to be rotated throughout a greater arc than the rear arm thereof; and

Figure 10 is a schematic electric wiring diagram and controls for the ice maker.

Before proceeding with the description of the present apparatus it is desired to point out that this invention constitutes an improvement over the ice cube maker disclosed in my co-pending application S. N. 411,160, filed February 18, 1954, and that the present apparatus has incorporated therein a unitary freezing device of the character shown and described in the co-pending application of Richard S. Gaugler, S. N. 438,897, filed June 24, 1954, now Pat. No. 2,752,762, granted July 3, 1956, entitled "Freezing Device." Both of these co-pending applications are assigned to the assignee of this application.

Referring now to Figure 1 of the drawings wherein an embodiment of the invention is shown, 10 generally represents a conventional household refrigerator cabinet of the type including an insulated freezing or frozen food storage compartment 11, normally closed by a door 12, and an insulated unfrozen food storage compartment 13 separate from compartment 11, normally closed by a door 14, which are adapted to be cooled by means of a conventional closed refrigerating system. The refrigerating system includes in addition to a plate-like evaporator 15 within compartment 13 and a refrigerant evaporating conduit 16 (see Figure 6), which may be wrapped around the liner of compartment 11, another refrigerant evaporating conduit in the form of a coil or a passageway provided in a plate 17 which forms a stationary refrigerated shelf member or support within the frozen food compartment 11 for the freezing device portion of the present ice block maker. The refrigerating system also includes a motor-compressor unit 18, a condenser 19, and suitable pipe or conduit connections with the evaporators for circulating the refrigerant in succession first through plate 17, thence through the evaporator conduit 16 and thereafter through the plate-like evaporator 15. Usual or conventional controls would be provided for controlling the operation of the motor-compressor unit 18 as is well known to those skilled in the art.

The ice block making apparatus associated with refrigerator cabinet 10 includes a unitary freezing device generally represented by the reference numeral 20 and comprising a stamped sheet metal distortable tray 21 having a plurality of rigid metal or molded plastic walls 22 (see Figures 2 and 3) loosely locked therein against removal therefrom to provide a grid therefor. It will be noted that the plurality of walls 22 within tray 21 include a longitudinal wall locked in the tray by the transverse walls straddling same. The general construction of the unitary freezing device 20 is of the character of the device shown and more fully described in the co-pending application of Richard S. Gaugler above referred to. Tray 21 of device 20 may be formed of aluminum or any other suitable metal capable of being flexed or twisted from end to end thereof and of such resiliency as to spring back into its normal state of configuration after having been flexed or twisted. The tray 21 of freezing device 20 has a depending top rim 23 therearound and this rim while increasing the structural strength of the tray provides the same with a certain amount of resiliency rendering it suitable for use in the present application. Front and rear arms 26 and 27 respectively are secured to down-

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turned lips 28 on the rim 23 of elongated tray 21 at the ends thereof as by screws or bolts 29. Each of the tapered cross walls 22 of the grid within device 20 are provided at the ends thereof with a small ear-like projection 31 (see Figure 3) loosely fitted in vertically elongated depressions or dimples 32 formed in the inclined sides of tray 21. Projections 31 fitting in the inwardly facing recesses 32 lock walls 22 within tray 21 of the unitary freezing device 20 against removal therefrom. These loose anchoring or attaching points of walls 22 to tray 21 permit the walls 22 to move a short distance angularly relative to the tray in a direction along the length thereof and to also rock or swing about their anchor points with respect to one another and to walls of tray 21, as is more fully shown and described in the co-pending Gaugler application hereinbefore referred to, when the tray of the unitary freezing device 20 is flexed and/or twisted by an ice block releasing means to be presently described.

According to this invention the unitary freezing device 20 is normally received and supported on the refrigerated member or plate 17 and is pivotally mounted within the compartment 11 of cabinet 10 for rotary or swinging movement relative to the stationary plate 17 into a substantially inverted position in a manner and for a purpose to be hereinafter explained. The apertured bushing-like outer ends 33 and 34 of arms 26 and 27 respectively of device 20 are keyed as by locking pins 36 and 37 (see Figures 4, 7, 8, and 9) to a shaft 38 adapted to be rotated by an electric driving motor 39 (see Figure 10) preferably located outside compartment 11. Shaft 38 is rotatably mounted in a bearing 41 secured to the back wall of the liner of compartment 11 (see Figure 4) and has its rear end 40 extending beyond the cabinet back wall through motor 39 for receiving and rotating a cam 42 mounted thereon (see Figure 10). The forward end of shaft 38 is rotatably supported in an upright support bracket 43 which may be secured to the floor of compartment 11. Arm 26 of device 20 is rigidly locked by pin 36 to shaft 38 against movement relative thereto (see Figure 7) and for rotary movement therewith. Arm 27 is locked by an elongated pin slot 44 provided in the bushing-like end 34 thereof and pin 37 (see Figures 8 and 9) to permit rotary movement of the shaft 38 throughout a predetermined arc relative to arm 27 in a manner and for a purpose to be hereinafter described.

A stop stud 46 (see Figures 1 and 5) is welded or otherwise stationarily secured to the back wall of the liner of compartment 11 at a predetermined location in the path of swinging movement of rear arm 27 of device 20 and is adapted to be engaged by this arm. An ice block receiving and storage receptacle 47 is supported on the floor of compartment 11 at one side of the pivotal mounting of device 20 so as to be positioned beneath this device when it is rotated or swung into an inverted position. Receptacle 47 rests on a button of an electric switch 48 (see Figures 6 and 10) utilized for a purpose to be presently described. A water inlet pipe 49 (see Figure 1) extends in an inclined manner through a wall of cabinet 10 and has its outlet end so located as to discharge water, from any suitable source of supply into the tray 21 of the freezing device portion of the ice making apparatus.

Assuming now that a proper amount of water has been directed from pipe 49 into the unitary freezing device 20, while it is supported on the refrigerated member or plate 17, and the water has been hard-frozen into separated ice blocks by virtue the grid walls 22 therein. Motor 39 may be energized in any suitable manner, as for example as will be hereinafter described, and rotates the shaft 38 and the device 20 keyed thereto in a clockwise direction as viewed in Figure 1. This initial rotation of shaft 38 swings the rigid arms 26 and 27 of device 20 upwardly about the pivotal mounting there-

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of and elevates the unitary freezing device 20 from the refrigerated plate member 17. Continued rotation of the unitary freezing device 20, together with separated ice blocks frozen therein, about its pivotal support or mounting on shaft 38 relative to the stationary plate 17 swings the freezing device into a substantially inverted position within compartment 11. At this inverted position of device 20, as shown in dot-dash lines in Figure 1 of the drawings, arm 27 thereon will strike or engage the stop stud 46 and halt the swinging movement of the rear end of the freezing device. By virtue of the elongated pin slot 44 in the bushing-like end 34 of arm 27 the shaft 38 may continue to be rotated through a small predetermined arc by motor 39. Continued rotation of shaft 38 throughout this small predetermined arc, while the rear end of device 20 is stopped or held stationarily by stud 46, causes the inverted metal tray 21 to be flexed and/or twisted from end to end thereof (see Figure 5). It is to be understood that while a stop stud engageable by a portion of the unitary freezing device is herein illustrated any other suitable means or arrangement for effecting twisting of the device, after it has been rotated may be employed. For example, means may be included in the apparatus for simultaneously twisting both ends of the freezing device relative to one another. Twisting of tray 21 of the unitary freezing device 20 shifts the rigid grid walls 22 therein about their loose anchoring or attaching points therewith so that these rigid walls bodily move angularly in a direction along the length of the device and also rise and rock relative to the bottom of tray 21. Both the twisting of tray 21 and shifting of walls 22 relative to one another and to the tray effectively breaks an ice bond between the unitary freezing device and ice blocks in compartments thereof whereby the ice blocks are released therefrom and freely fall into the storage receptacle 47 in dry form. Suitable timing mechanism, which will be more fully described hereinafter, serves to reverse the direction of rotation of driving motor 39 and consequently shaft 38, after the tray of the freezing device has been twisted and ice blocks released therefrom, so as to return the unitary device 20 to the position thereof shown by full lines in Figure 1 on the refrigerated plate 17. The drive motor 39 may stall momentarily after twisting the tray of the freezing device and before the timing mechanism reverses its direction of rotation without causing any damage thereto. As motor 39 nears the end of its reverse direction of rotation a roller 51 on the end of a lever 52 of a water valve 53 of a water supply means (see Figure 10) rides over a lobe 54 provided on cam 42, mounted upon the rear end 40 of shaft 38, and this movement imparted to lever 52 opens the valve and permits a measured amount of water to flow through pipe 39 into device 20 to refill the metal tray 21 thereof after which the valve 53 closes. The water supply means is, of course, located exteriorly of compartment 11 of the refrigerator cabinet 10 and may be of any suitable or conventional type. The valve 53 is preferably a metering means and may be similar to the valve shown in the co-pending application of Frederick W. Sampson, S. N. 407,202, filed February 1, 1954, entitled "Metering Device" and assigned to the assignee of this application.

Referring now to Figure 10 of the drawings wherein electrical controls are shown reference numerals 61 and 62 designate the power lines used for supplying electric current to the controls. Numeral 63 designates a conventional timer motor which is connected across the power lines 61 and 62. Timer motor 63 is continuously operated, except when switch 48 is opened, and is adapted to operate a switch 64 at specified or predetermined intervals of time sufficient to insure hard-freezing of water in the unitary device 20 into ice blocks such, say for example, as every forty-five minutes. The switch 48 is a weight operated normally closed switch adapted to be actuated into open position by a predetermined number

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of ice blocks received in receptacle 47. Switch 48 is opened in response to a predetermined accumulation of ice blocks in receptacle 47 indicating that the receptacle is full of ice blocks and that no more ice blocks should be frozen. This switch is interposed in the power line 61 and when opened it interrupts the flow of current to timer motor 63 to render the ice making apparatus inoperative until the supply of ice blocks in receptacle 47 has been substantially exhausted. Timer motor 63 operates switch 64 which is arranged in series with the reversible driving motor 39. Driving motor 39 is of the well-known type which is adapted to have its direction of rotation reversed each time it is energized by the timer 63. For illustrative purposes, the driving motor 39 has been shown as having a pair of direction reversed shading poles 67 and 68 controlled by a switch 69 also operated by the timer motor in such a manner that each time the timer motor 63 closes switch 64, switch 69 will close the circuit to a different one of the shading poles.

It should be apparent from the foregoing that a novel apparatus for freezing water into separated ice blocks, for releasing ice blocks from the freezing device portion of the apparatus and for storing the ice blocks in dry form in a refrigerator cabinet has been provided. Such is accomplished by using a unitary freezing device of the inseparable tray and grid type, by rotating or swinging the device together with ice blocks therein as a unit away from a refrigerated support into a substantially inverted position and by flexing or twisting the tray of the device to release ice blocks therefrom. In doing this in one continuous operation the invention eliminates the necessity of breaking ice blocks adhering to a grid loose from a tray and thereafter releasing in some fashion or other ice blocks from walls of the grid in separate operations.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. In an ice block making apparatus, the combination of a unitary freezing device for containing water to be frozen comprising a flexible metal tray having a plurality of rigid walls loosely anchored therein for movement therewith and relative thereto, said walls dividing the interior of said tray into compartments in which water is frozen into separated ice blocks, a refrigerated stationary means for supporting said device while freezing water therein, means pivotally mounting said unitary freezing device for rotary movement with respect to said stationary supporting means, means for rotating said unitary device together with ice blocks frozen therein about its pivotal mounting away from said stationary supporting means into a substantially inverted position relative thereto, and means for stopping the rotary movement of one end of said unitary freezing device while continuing to rotate its other end to twist said tray and shift the rigid walls therein relative thereto for breaking a bond between said unitary device and ice blocks in said compartments thereof whereby to release the separated ice blocks therefrom.

2. An apparatus as defined in claim 1 wherein the rigid walls in the unitary freezing device thereof are bodily shifted in a plurality of directions relative to the tray when the same is twisted.

3. In an ice block making apparatus, the combination of a freezing device for containing water to be frozen comprising a distortable tray and a plurality of rigid walls therein, said rigid walls having points of loose attachment to said distortable tray and adapted to be moved with respect thereto, said loose attachment points of said walls to said tray forming the sole means of locking said walls against removal from the tray to provide a unitary freezing device, said walls dividing the interior of said tray into compartments in which water is

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frozen into separated ice blocks, a stationary refrigerated member receiving and supporting said unitary freezing device thereon, means pivotally mounting said unitary freezing device for rotary movement with respect to said refrigerated member, means for rotating said unitary device together with ice blocks frozen therein about its pivotal mounting away from said stationary refrigerated member into a substantially inverted position relative thereto, and means for thereafter twisting said tray and shifting said rigid walls therein relative thereto for breaking a bond between said unitary device and ice blocks in said compartments thereof whereby to release the separated ice blocks therefrom.

4. An apparatus as defined in claim 3 wherein at least the tray of the unitary freezing device thereof is formed of metal.

5. In an ice block making apparatus, the combination of an insulated chamber, a unitary freezing device within said chamber for containing water to be frozen comprising a distortable tray and a plurality of rigid walls therein, said rigid walls having points of loose attachment to said distortable tray and adapted to be moved with respect thereto, said loose attachment points of said walls to said tray forming the sole means of locking said walls against removal from the tray, said walls dividing the interior of said tray into compartments in which water is frozen into separated ice blocks, a stationary refrigerated member receiving and supporting said unitary freezing device thereon within said chamber, means pivotally mounting said unitary freezing device within said chamber for rotary movement with respect to said stationary refrigerated member, means for rotating said unitary device together with ice blocks frozen therein about its pivotal mounting away from said stationary refrigerated member into a substantially inverted position relative thereto, a storage receptacle removably disposed in said chamber below the inverted position of said unitary freezing device, and means for twisting said tray and shifting said rigid walls therein relative thereto for breaking a bond between said unitary device and ice blocks in said compartments thereof whereby the ice blocks fall into said storage receptacle.

6. An apparatus as defined in claim 5 wherein at least the tray of the unitary freezing device thereof is formed of metal.

7. In an ice block making apparatus, the combination of a unitary freezing device for containing water to be frozen comprising a flexible metal tray having a plurality of rigid walls loosely anchored therein for movement therewith and relative thereto, said walls dividing the interior of said tray into compartments in which water is frozen into separated ice blocks, a refrigerated stationary means for supporting said device while freezing water therein, means pivotally mounting said unitary freezing device for rotary movement with respect to said stationary supporting means, means for rotating said unitary device together with ice blocks frozen therein about its pivotal mounting away from said stationary supporting means into a substantially inverted position relative thereto, a storage receptacle located beneath said inverted freezing device, and means for stopping the rotary movement of one end of said unitary freezing device while continuing to rotate its other end to twist said tray and shift the rigid walls therein relative thereto for breaking a bond between said unitary device and ice blocks in said compartments thereof whereby the ice blocks fall into said storage receptacle.

8. An apparatus as defined in claim 7 wherein the rigid walls in the unitary freezing device thereof are bodily shifted in a plurality of directions relative to the tray when the same is twisted.

9. In an ice block making apparatus, the combination of a unitary freezing device for containing water to be frozen comprising a flexible metal tray having a plurality of rigid walls loosely anchored therein for movement therewith and relative thereto, said walls dividing the in-

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terior of said tray into compartments in which water is frozen into separated ice blocks, a refrigerated stationary means for supporting said device while freezing water therein, means pivotally mounting said unitary freezing device for rotary movement with respect to said stationary supporting means, means for rotating said unitary device together with ice blocks frozen therein about its pivotal mounting away from said stationary supporting means into a substantially inverted position relative thereto, and means for thereafter twisting said flexible metal tray longitudinally from end to end of said device to shift said rigid walls in the tray relative thereto for breaking a bond between said unitary device and ice blocks in said compartments thereof whereby to release the separated ice blocks therefrom.

10. In an ice block making apparatus, the combination of a frozen food storage chamber and means for maintaining same at a temperature below 32° F., a unitary freezing device within said chamber comprising a resilient metal tray having a plurality of rigid walls loosely anchored therein for movement therewith and relative thereto, said walls dividing the interior of said tray into compartments in which water is to be frozen into separated ice blocks, a refrigerated stationary support in said chamber upon which said freezing device is supported in an upright substantially horizontal position while freezing water therein, means pivotally mounting said freezing device within said chamber for rotary movement with respect to said stationary support, motor driven means for rotating said unitary freezing device together with ice

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blocks therein upwardly relative to and over a side of said support into a substantially inverted position within said frozen food chamber and for thereafter automatically returning said device to its upright water freezing position on said support, an ice block storage receptacle removably supported in said chamber and located beneath said freezing device when in its said inverted position, and means for distorting said tray prior to returning said device to its upright water freezing position for shifting said rigid walls in said tray relative thereto and breaking bonds between said device and ice blocks in said compartments thereof whereby to discharge the freed separated ice blocks into said removable receptacle within said chamber.

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