Oct. 6, 1959 A. J. FREI 2,907,179

ICE MAKING APPARATUS

Filed May 23, 1958 4 Sheets-Sheet 1

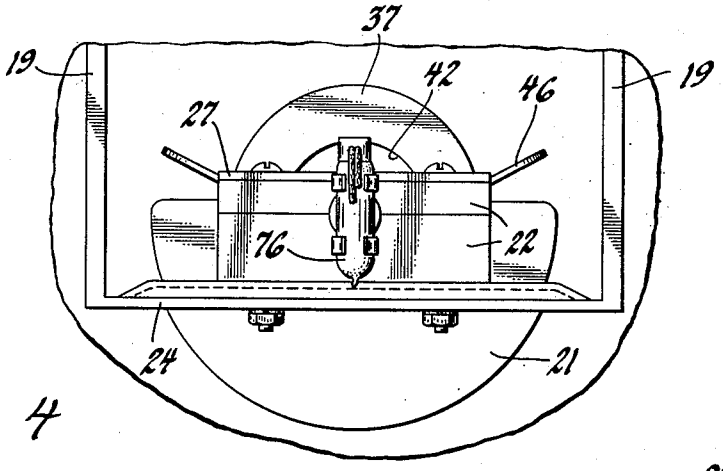


Fig. 4

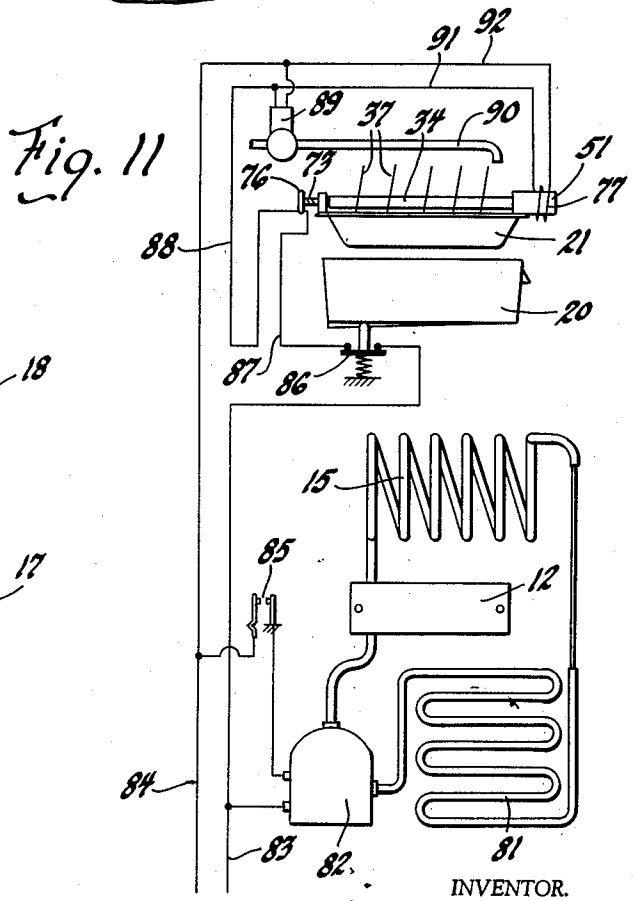


Fig. 11

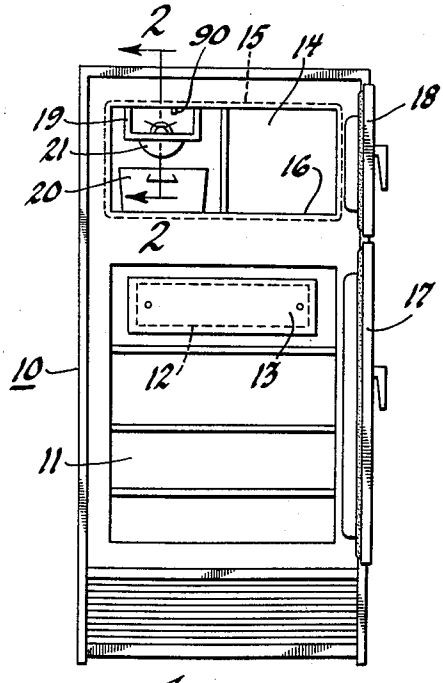


Fig. 1

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ICE MAKING APPARATUS

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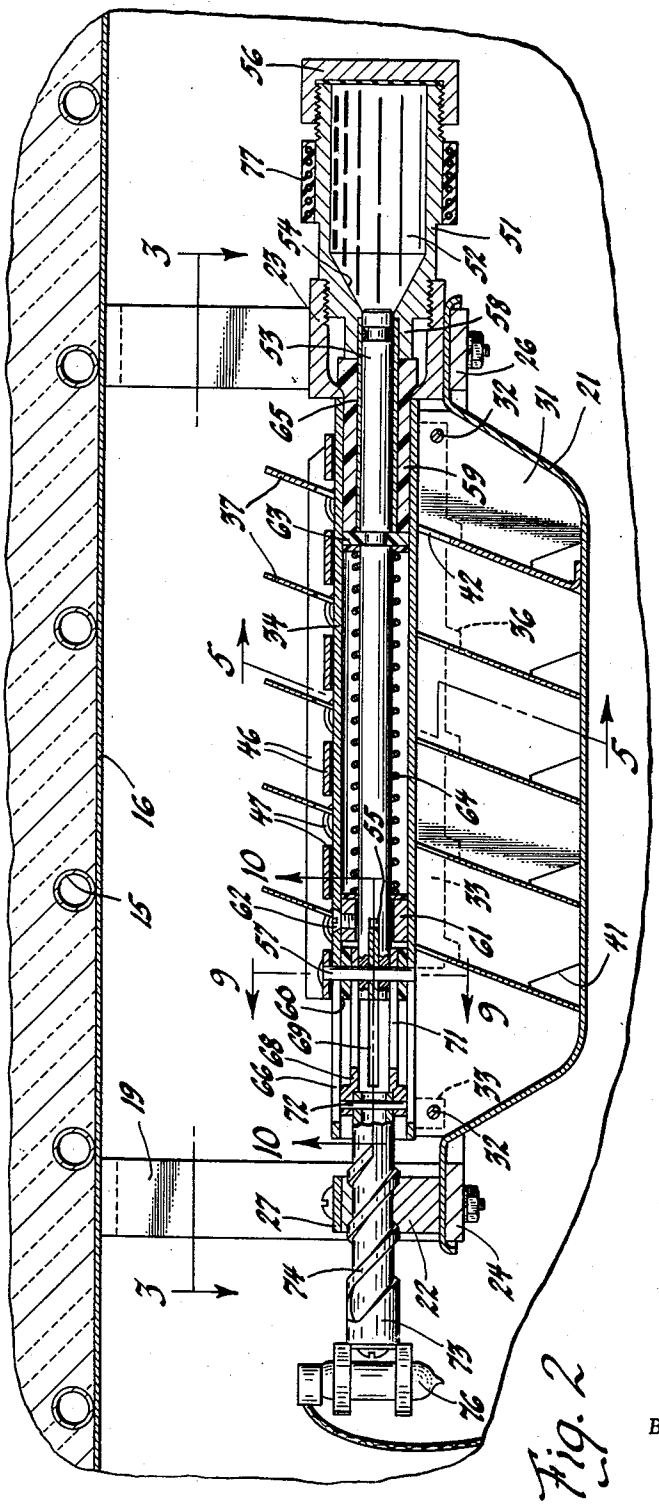


Fig. 2

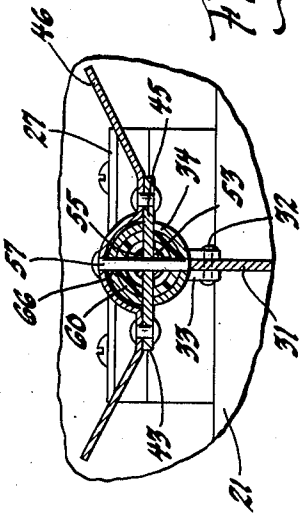


Fig. 9

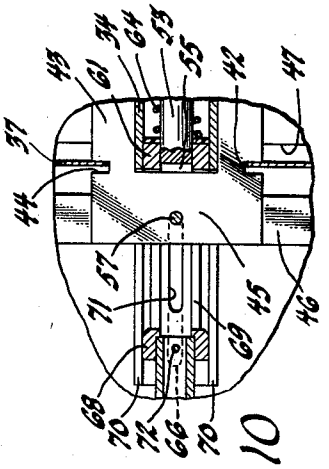


Fig. 10

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ICE MAKING APPARATUS

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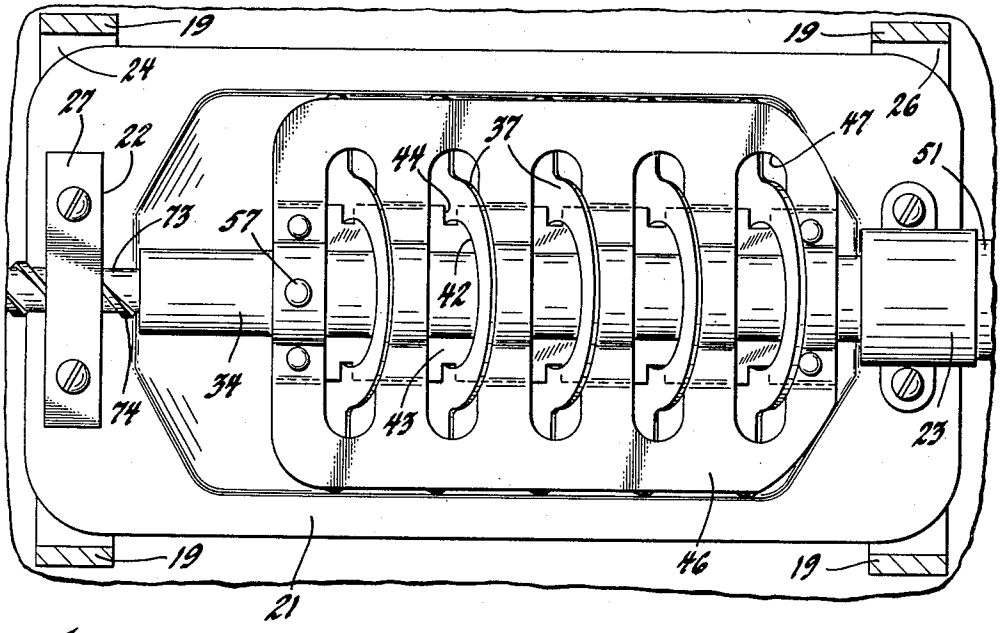


Fig. 3

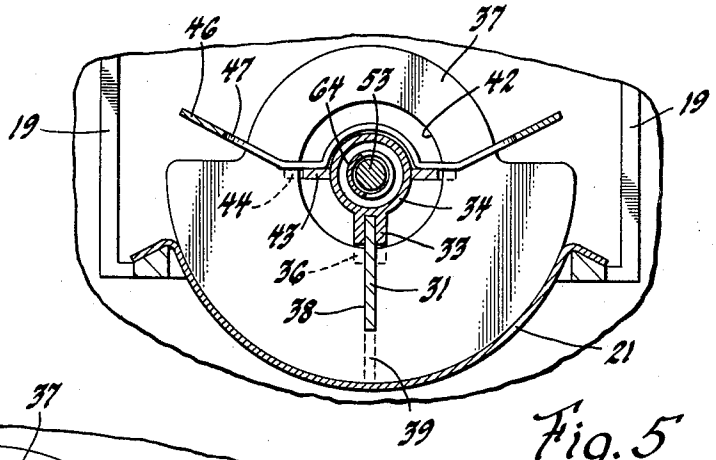


Fig. 5

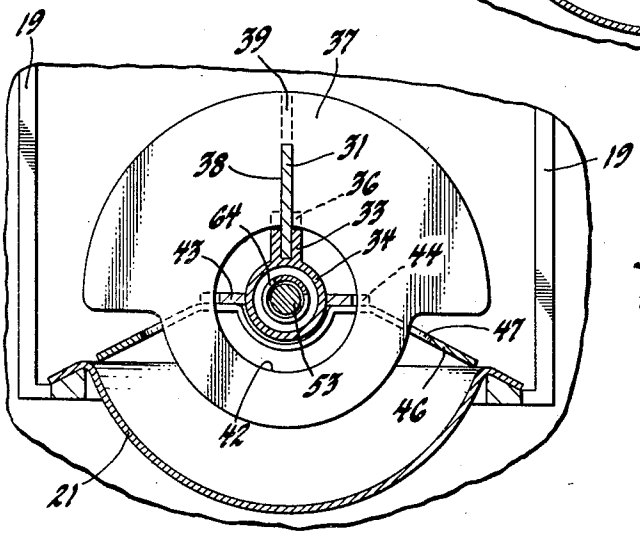


Fig. 8

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ICE MAKING APPARATUS

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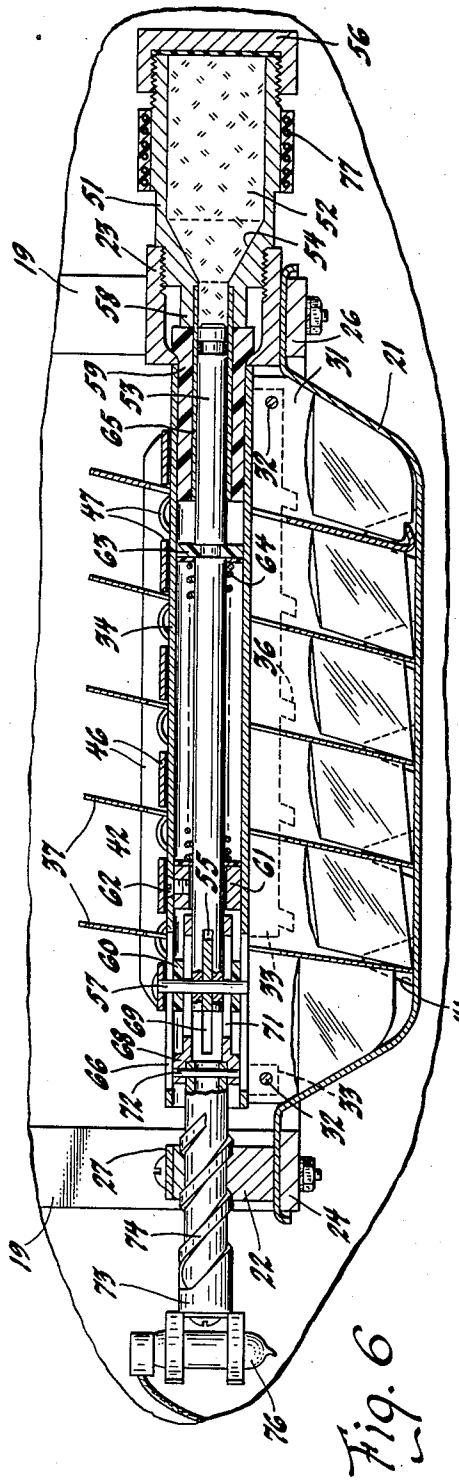


Fig. 6

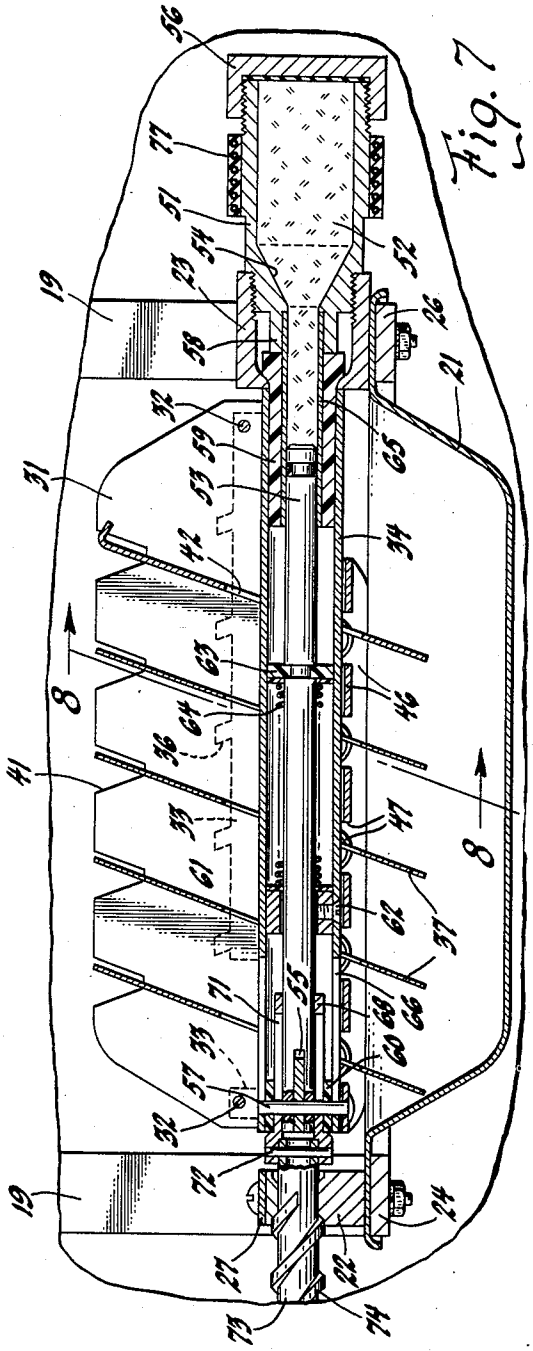


Fig. 7

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ICE MAKING APPARATUS

Arthur J. Frei, Dayton, Ohio, assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application May 23, 1958, Serial No. 737,249

21 Claims. (Cl. 62—135)

This invention relates to refrigeration and particularly to an apparatus for making and harvesting ice blocks.

Apparatuses for making and automatically harvesting ice blocks therefrom of the type specifically applicable to household refrigerator cabinets have not as yet become popular because such prior apparatuses are extremely complicated, are expensive to manufacture and render a refrigerating system associated with a refrigerator cabinet less efficient. Their initial retail cost together with the high cost of operating a household refrigerator equipped with such an apparatus has retarded if not excluded sales and use thereof by the general public. I therefore contemplate the provision of an ice making apparatus which employs an ice-operated motor utilizing the principle of choking or constricting the expansion of a confined body of freezable liquid therein to obtain an increased movement of a reaction element of the motor as shown and fully described in my copending application Serial No. 737,250 entitled "Freezing Device Power Unit" and filed on even date herewith as one factor in reducing the cost of the apparatus.

A general object of the present invention is to provide a simplified fully automatic ice block making and releasing apparatus at a cost which is commensurate with what the public would be willing to pay for this feature in a household refrigerator cabinet equipped with such apparatus.

Another object of the invention is to provide an ice block making apparatus for a household refrigerator cabinet which will release separated ice blocks in dry condition and store the same in the refrigerator for future use so as to at all times afford an ample supply of the ice blocks for harvesting from the refrigerator.

A further object of the invention is to provide an ice block making apparatus of the tray and grid type wherein an ice-operated motor or unit is employed which is capable of sufficient movement to tilt walls of the grid for mechanically loosening separated ice blocks from the grid walls and from the tray and to thereafter rotate the grid with respect to the tray while continuing to tilt the walls for enlarging ice block compartments and discharging ice blocks from the apparatus.

A still further object of the invention is to provide an ice block making apparatus in an insulated freezing chamber of a household refrigerator cabinet maintained below 32° F. having a freezing device comprising a stationary non-distortable metal tray member of arcuate shape in cross section adapted to contain water to be frozen, by an evaporator means of a refrigerating system associated with the cabinet, and a rigid movable metal walled grid structure or member disposed in the tray with a motor which is directly and solely responsive to the evaporator means for operating same to move walls of the grid member and rotate the grid member about the axis of the tray member for ejecting ice blocks from the freezing device and discharging them from the apparatus without thawing the ice blocks.

In carrying out the foregoing object it is a more specific object of the invention to provide an improved ice block making and releasing apparatus wherein an ice-operated motor unit functions to release separated ice blocks from the apparatus and wherein movement of portions of the freezing device part of the apparatus is utilized to automatically refill the tray of the device and to cause the motor unit to return a grid together with walls thereof to their normal ice freezing position or association with the tray.

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 multiple chambered household refrigerator cabinet with its doors open and showing an ice making apparatus of the present invention located in the freezing chamber thereof.

Figure 2 is an enlarged vertical longitudinal sectional view of the freezing device portion of the ice making apparatus in normal freezing position taken on line 2—2 of Figure 1 and shows an ice-operated motor associated therewith;

Figure 3 is a top view of the freezing device portion of the ice making and releasing apparatus taken on the line 3—3 of Figure 2 showing a deflector above the tray of the freezing device portion thereof;

Figure 4 is an end view of the freezing device portion of the apparatus;

Figure 5 is a vertical sectional view taken on the line 5—5 of Figure 2 through the tray and grid of the freezing device portion of the apparatus;

Figure 6 is a sectional view similar to Figure 2 showing elements of the ice motor extended with walls of the grid initially tilted and ice blocks loosened from the grid walls and from the tray;

Figure 7 is a sectional view similar to Figure 2 showing further extension of elements of the ice motor with the grid rotated with respect to the tray and ice blocks released from the freezing device portion of the apparatus;

Figure 8 is a vertical sectional view taken on the line 8—8 of Figure 7 through the freezing device portion of the apparatus with the deflector over the top of the tray thereof;

Figure 9 is a fragmentary vertical sectional view taken on the line 9—9 of Figure 2 showing a connection between a movable element of the ice motor and the grid wall actuating member;

Figure 10 is a horizontal fragmentary sectional view taken on the line 10—10 of Figure 2 showing elongated openings and slots in parts of the connection disclosed in Figure 9; and

Figure 11 is a diagrammatic illustration of the refrigerating system and the ice making apparatus of the refrigerator showing controls rendering the apparatus automatic in operation.

Referring to the drawings, for illustration, I show in Figure 1 thereof an insulated household refrigerator cabinet 10 of the multiple compartment or chamber type in which an ice making apparatus of the present invention is installed. Cabinet 10 is provided with a lower unfrozen food storage chamber 11 cooled to a temperature of from 37° to 43° F. by a plate-like sheet metal evaporator 12 of a refrigerating system associated with the refrigerator and which evaporator is located behind a protecting baffle 13 mounted on the back wall of chamber 11. Cabinet 10 is also provided with an upper or frozen food storage chamber 14 the interior of which is cooled to a temperature well below 32° F., say, for example, between 5°

and 10° F., for the storage of frozen foods, for freezing foods and/or for freezing water into ice blocks for table use in chilling salads or the like and drinks in glasses. Chamber 14 is refrigerated 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 to a metal can-like member 16 forming the liner of chamber 14 as is usual in refrigerator cabinet structures of the type illustrated. Doors 17 and 18, shown in open position, are hingedly mounted on cabinet 10 and provide individual closures for the chambers 11 and 14 respectively. An open metal horizontally disposed frame or support has upright standards 19 integrally formed thereon or welded thereto which are secured, in any suitable or conventional manner, to the top wall of liner 16 of chamber 14 so as to be in metal-to-metal contact therewith and consequently with evaporator 15. The horizontal suspension frame is utilized to support a freezing device portion of an ice making and releasing apparatus to be hereinafter described and a removable ice bucket or receptacle 20, resting on the bottom wall of chamber 14, is adapted to receive and store ice blocks released from the apparatus. A perforated partition may be vertically secured in chamber 14 to confine ice blocks released from the freezing device portion of the ice making apparatus to the one side of this chamber.

The freezing device portion of the present ice maker comprises a stamped metal elongated non-distortable pan or tray member 21 stationarily mounted on the suspension support by opposed end pieces 22 and 23 (see Figure 2) bolted to cross parts 24 and 26 respectively of the frame. End piece 22 is in the form of a split helically splined bearing provided with a clamping plate 27 to facilitate assembly thereof and hold the bearing in place on support part 24 and end piece 23 is a stationary reaction element of an ice motor to be hereinafter described. A grid member or grid structure is disposed in tray member 21 of the freezing device portion of the ice making apparatus and includes a longitudinal metal wall or partition 31 rigidly secured at its ends, by pins 32, to a grooved out lip portion 33 depending from a metal sleeve 34 which is provided with lugs 36 for positioning movable or tiltable substantially inflexible metal cross or transverse walls or partitions 37 in tray 21. Sleeve 34 forms a rotatable part of a reaction means or element for the ice-operated motor in the present disclosure. The plurality of spaced apart walls 37 are normally inclined with respect to the vertical and divide the interior of tray member 21 into ice block forming compartments. It is to be noted (see Figure 4) that tray 21 is of an arcuate or substantially half moon shape in cross section and that the grid transverse walls 37 are substantially circular in shape to conform to the contour of the tray member so as to permit rotation of the grid member with respect thereto as will be described hereinafter. Circular walls 37 are provided with a central hole 42 which surrounds sleeve 34 and locates the walls 37 on the same axis therewith. The wall of central hole 42 in each partition 37 is preferably cut out at two opposed points therearound (not shown) to permit these partitions to be slipped over a grid wall actuating bar and rotated relative thereto for interlockingly assembling the partitions to the grid. Grid walls 37 are also slotted as at 38 (see Figure 5) for the reception of longitudinal partition 31 and have an integral web portion 39 fitting in notches 41 provided in the longitudinal wall or partition (see Figures 2 and 4). The grid structure further includes a flat elongated U-shaped actuating bar 43 for the walls 37 which bar is provided on opposite outer long sides thereof with notches 44, of different widths relative to one another, receiving the wall of the central hole 42 in the circular cross partitions. The bight portion 45 of U-shaped bar 43 and a hole provided therein is utilized for a purpose to be hereinafter described. To and above this bar 43, which forms a part of the shiftable element of the ice motor, is secured, by rivets or the like (see Figures 3 and 9), baffle or deflector 46 straddling sleeve 34 and having spaced apart cut out clearance openings 47 for receiving the upper part of walls 37 and permitting tilting thereof (see Figure 3). Sleeve 34 is rotatable with respect to stationary element 23 and the bar 43 and consequently deflector 46 secured to this bar are slidable lengthwise relative to element 23 as and for a purpose to be hereinafter described.

An ice-operated motor is associated with and forms a part of the freezing device portion of the ice making apparatus. The ice motor is of elongated construction and is mounted on or at the axis of the arcuate shaped tray member 21. In order to obtain sufficient movement of one of the reaction elements of the ice motor to both tilt walls 37 and rotate the grid structure or member with respect to stationary tray member 21 I employ a motor having the principle of choking and constricting a freezable liquid confined therein as fully described in my copending application hereinabove referred to. This motor in the present disclosure is however somewhat structurally modified over that shown in said copending application and employs a spring, instead of a flexible resilient sleeve, to rotate and return the grid and its walls to a normal ice block forming position in the tray 21. The ice motor therefore includes, in addition to the stationary reaction element 23 and rotatable reaction sleeve 34, a housing 51 threaded into element 23 and provided with a chamber 52 adapted to contain and confine therein a freezable liquid. Chamber 52 is divided into an enlarged cylindrical part and a choke part gradually tapered or beveled toward an elongated smaller diametered plunger or piston 53 by the inclined wall 54 thereof. The freezable liquid is confined in chamber 52 by the plunger 53 and by an end cap 56 threaded upon housing 51. A sleeve-like element 65 forming a stationary cylinder for plunger 53 is welded or brazed in a bore provided in an inner end part 58 of housing 51. A non-metallic shouldered tubular member 59 is locked between cylinder 65 and element 23 to provide a bearing for the rotatable sleeve 34. The one end of plunger 53 is disposed adjacent the choke portion, wall 54, of chamber 52 and the other end of this plunger is slotted, as at 55, and provided with a hole in its slotted end which receives a pin 57. This pin locks a non-metallic split bearing 60 within sleeve 34 for the slotted end of plunger 53. The plunger or piston 53 is held centrally within sleeve 34 by a collar 61, secured to the sleeve by a screw 62, and by a non-metallic bearing washer 63 located intermediate ends of the plunger. In the ice-operated motor herein disclosed it is desirable to employ means for applying force to plunger 53 so as to yieldably bias same toward chamber 52 and the body of freezable liquid therein for returning elements of the motor to normal position after such reaction element has been shifted by expansion of the freezable liquid. Thus a coil spring 64 is located in sleeve 34 intermediate collar 61 and bearing washer 63. Pin 57 is adapted to slide in elongated closed ended openings 66 provided in sleeve 34 when shiftable parts of the one reaction element of the ice motor is shifted. Another short shouldered sleeve 68 has its enlarged shouldered part slip fitted into the end of sleeve 34 with its reduced diameter slip fitted into bearing 60. Sleeve 68 is slotted as at 69, to register with the slots 55 in plunger 53, and is provided with elongated closed ended openings 71 which receive the pin 57 and permits sliding of sleeve 68 relative to plunger 53 and to the long rotatable sleeve 34. The slot 55 in plunger 53 and the slots 69 in short sleeve 68 receive the bight portion 45 of actuating bar 43 and pin 57 also extends through a hole provided in this bight portion of bar 43 to simultaneously slide this bar and deflector 46 lengthwise along sleeve 68 relative to tray 21 (see Figures 9 and 10). Slots 70 extending inwardly of the end of long sleeve 34 (see Figure 10) permit the bight por-

tion 45 of bar 43 to be assembled to plunger 53 and pin 57 and also permits shifting movement of the grid wall actuating bar 43 lengthwise relative to the long sleeve. It is to be noted that the openings 66 in sleeve 34 are longer than the openings 71 in short sleeve 68 and this is important in the present invention in that it provides for a multiplied or prescribed shifting distance of the shiftable element of the ice motor. The enlarged shouldered end of sleeve 68 is provided with a pair of opposed holes receiving a pin 72 which extends through a pair of similar holes provided in a shaft 73 helically splined as at 74 to match the helix spline in the split end bearing 22. Pin 72 is tightly or press fitted into the holes of sleeve 68 to rigidly secure same thereto. Plunger 53 and short sleeve 68 form parts of one reaction element of the ice motor which are shiftable away from the stationary reaction element 23 and housing 51 and sleeve 34 forms a part of this one reaction element to be rotated relative to stationary reaction element 23. The outer end of splined shaft 73 has a sealed glass tube mercury switch 76 of a conventional type rigidly mounted thereon in any suitable or desirable manner for rotation with the shaft. An electric resistance heating unit 77 is wrapped around and secured to housing 51 for applying artificial heat to the freezing liquid confined in chamber 52. The purpose of switch 76 and heater 77 will be described hereinafter in connection with the electric circuit and controls therein for rendering the ice making apparatus fully automatic in operation.

Assume now that various parts of the freezing portion and ice motor of the ice block maker are in their normal position as shown in Figure 2 of the drawings and water flown into tray 21 has been hard-frozen into separated ice blocks in compartments of the device by the below freezing temperature created by evaporator 15 within chamber 14 of the refrigerator 10. This low temperature within chamber 14 then chills the freezable liquid, which may be a suitable mixture of alcohol and water, contained in chamber 52 of the ice-operated motor portion of the freezing device to a predetermined or below water freezing temperature for causing expansion of the body of freezable liquid. The choke portion, wall 54, of chamber 52 of the ice motor constricts expansion of the freezable liquid and confines expanding thereof to a point or small area exposed to the end of plunger 53 to multiply linear shifting movement of this plunger as is more fully explained in my copending application hereinbefore referred to. The freezable substance in the ice motor expands against plunger 53 to shift same longitudinally or to the left as viewed in Figure 2 of the drawings. This shifting of plunger 53 also shifts pin 57 in elongated opening 66 of sleeve 34 and openings 71 in short sleeve 68 to slide bar 43 and consequently deflector 46 secured thereto lengthwise of sleeve 34 while sleeve 34 is prevented from so sliding by the longitudinal partition 31 being secured thereto and located or fitting in tray member 21. The notches 44 in actuating bar 43 engage the cross grid walls 37 one after another from end to end of the freezing device to progressively tilt these walls, in a direction toward the vertical, while the grid is positioned in tray 21 (see Figure 6). Ice blocks in the compartments of the freezing device portion of the ice maker are broken loose from grid walls 31 and 37 and from walls of tray member 21 (see Figure 6). The freezable substance in chamber 52 upon being further chilled with its expansion constricted expands into the part of cylinder 65 opened or uncovered, by shifting of plunger 53 therein, to chamber 52 and the expanding substance then expands into this cylinder to multiply and continue the shifting movement of the plunger. By virtue of this multiplied movement of plunger 53 it further shifts pin 57 in the longated openings 66 and 71 and consequently moves the bight portion 45 of bar 43 along the slots 70 in long sleeve 34. This movement causes pin 57 to engage the end of elongated openings 71 in sleeve 68 whereupon it imparts force to shaft 73 to thread the helical spline 74 thereon into the splined threads within nut or end piece 22. This, while continuing to tilt grid walls 37 toward the vertical, rotates shaft 73, short sleeve 68 and main sleeve 34 through pin 57, about the bearing 59 and relative to the stationary reaction element 23 of the ice motor. The design and arrangement of the spline shaft 73 and its nut 22 is such that parts of the movable and shiftable reaction element of the ice-operated motor will rotate walls 31 and 37 of the grid member, actuating bar 43 and consequently deflector 46 throughout an arc of 180° about the axis of tray member 21 (see Figure 7) while the plunger 53 is shifted along its prescribed distance in accordance with the continued full or complete expansion of the freezable liquid in the ice motor. As the grid structure or member begins to rotate its walls 37 are not as yet tilted entirely to the vertical and the loosened ice blocks remain in the grid due to the angular shape of their compartments or to the still inclined position of the walls 37. Continued rotation of the grid member and continued tilting of walls 37 toward the vertical enlarges the ice block compartments intermediate these walls and the ice blocks may be released therefrom since they no longer tend to cling to an inclined wall. Longitudinal grid wall 31 and deflector 46 cooperate to provide a guard over tray member 21 to prevent released ice blocks from remaining in the tray and their rotary movement about the axis thereof transversely through same sweeps the loose ice blocks therefrom over its side whereupon the ice blocks gravitationally fall into the removable storage and harvesting bucket or receptacle 20.

Reference is now directed to Figure 11 of the drawings wherein I show a diagrammatic illustration of the refrigerating system associated with refrigerator 10, a wiring diagram therefor and controls for rendering the ice making apparatus fully automatic in operation. In this showing the closed refrigerating system includes, in addition to the evaporators 12 and 15 previously mentioned, a condenser 81 and a sealed motor-compressor unit 82 all connected in series fluid flow relationship by suitable refrigerant conveying conduits. An electric circuit includes a wire 83 having a branch wire leading to the motor of unit 82 and a wire 84 having a branch wire leading to a thermally operated switch 85 for controlling starting and stopping of the electric motor of unit 82 as is conventional in the art. Wire 83 leads to a normally closed switch 86 associated with receptacle 20 and which is operated or opened only in response to the weight of a sufficient supply of ice blocks stored in the receptacle. A wire 87 leads from switch 86 to the mercury switch 76 and a wire 88 leads from switch 76 to a solenoid operated water valve 89 interposed in a water pipe 90. The wire 84 also leads to valve 89 and branch wires 91 and 92 lead from wires 88 and 84 respectively to the electric heater 77 on housing 51 of the fluid expansion chamber 52 of the ice motor associated with the freezing device portion of the ice making apparatus. Thus when the grid structure is rotated 180° with respect to tray 21 of the freezing device portion of the ice maker, by the ice-operated motor as previously described, contacts in switch 76 on shaft 73 of the motor are closed by mercury in the glass tube of this switch to energize solenoid valve 89 and heater 77. This opens valve 89 and permits a measured or metered amount of water from a metering device of any suitable or conventional construction (not shown) to flow, by way of valve 89 and pipe 90, into tray 21 through the space between the back end thereof and the shifted bar 43 and deflector 46. Heater 77 being simultaneously energized by switch 76 applies heat to housing 51 of the ice motor to warm the expanded freezable liquid in chamber 52 thereof. The freezable liquid thereupon contracts and spring 64 in the ice motor then returns piston or plunger 53 to its normal position adjacent the choke portion, wall 54, of the expansion chamber 52. Plunger 53 upon return-

ing to its normal position slides pin 57 within openings 66 and 71 to withdraw short sleeve 68 into sleeve 34 and consequently shaft 73 relative to bearing or nut 22. The actuating bar 43 and deflector 46 are also returned by the sliding of pin 57. Withdrawal of shaft 73 in this manner again rotates same in an opposite or counterclockwise direction to also rotate the grid structure and actuating bar 43 together with deflector 46 to their normal position as shown in Figure 2 of the drawings. The cross grid walls 37 are tilted backward by bar 43 and released therefrom whereupon they then move into their normal inclined position against the depending lugs 36 on sleeve 34 to ready the freezing device portion of the ice making apparatus for another ice block freezing and releasing cycle. The apparatus continues to function or cycle automatically to produce ice blocks and store them in receptacle 20. However when receptacle 20 becomes substantially filled with ice blocks the weight of the filled receptacle will actuate or open switch 86 to render the ice making apparatus inoperative.

It should, from the foregoing, be apparent that I have provided an improved ice block making apparatus of a simplified low cost construction wherein an ice motor associated with the freezing device portion thereof is directly and solely responsive for operation to temperatures produced by the freezing evaporator of a refrigerating system to thus distinguish from and eliminate the use of an electric motor, a thermostatically controlled switch therefor and means for reversing rotation of the motor. The ice blocks are mechanically broken loose from the grid walls and from the tray of the freezing device portion of the apparatus without twisting the tray and thus the ice molds need not be artificially heated. Ice blocks are released in dry form and are stored in this form in a receptacle in the household refrigerator cabinet for harvesting therefrom. By virtue of utilizing an ice-operated motor in the freezing device portion of the apparatus the reaction elements of which have in addition to sufficient linear or longitudinal shifting movement away from one another, to tilt walls of the grid, also have a multiplied or prescribed further movement to cause rotation of one of the motor elements for imparting a relative rotary movement to one of the tray or grid members with respect to the other. My improved and simplified ice making apparatus is of such character that it can be readily installed in the freezing or frozen food chamber of existing household refrigerator cabinets now in use as well as being incorporated in those to be manufactured in the future at a cost commensurate with what the public is willing to pay for this convenience or feature.

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, a freezing device including a tray member adapted to contain water and a grid member in said tray having spaced apart walls dividing the interior thereof into a plurality of compartments, means for cooling said freezing device to freeze water in said compartments into separated ice blocks, an operable ice motor associated with said device having a freezable liquid confined therein and solely responsive to said means, said motor comprising reaction elements one of which is forced to be shifted a prescribed distance away from another of said reaction elements by said freezable liquid at a predetermined temperature after ice blocks are frozen in said compartments, said one reaction element having parts thereof adapted to engage said grid walls, the initial shifting movement of said one element causing it to engage walls of said grid member and move them while positioned in said tray to mechanically break ice blocks loose from said walls and from the tray member, and said one element reacting between portions of said freezing device upon further shifting same along said prescribed distance to impart a relative rotary movement of one of said members with respect to the other of said members while continuing to move said walls for discharging ice blocks from said freezing device.

2. An ice block making apparatus as defined by claim 1 wherein a means is rendered effective automatically in response to the relative rotary movement of the one member for causing return thereof to a normal ice block freezing position with the other member after ice blocks have been discharged from the freezing device.

3. In an ice block making apparatus, a freezing device including a tray member adapted to contain water and a grid member in said tray having spaced apart walls dividing the interior thereof into a plurality of compartments, means for cooling said freezing device to freeze water in said compartments into separated ice blocks, an operable ice motor associated with said device having a freezable liquid confined therein and solely responsive to said means, said motor comprising reaction elements one of which is forced to be shifted a prescribed distance away from another of said reaction elements by said freezable liquid at a predetermined temperature after ice blocks are frozen in said compartments, said one reaction element having parts thereof adapted to engage said grid walls, the initial shifting movement of said one element causing it to engage walls of said grid member and move them while positioned in said tray to mechanically break ice blocks loose from said walls and from the tray member, said one element reacting between portions of said freezing device upon further shifting same along said prescribed distance to impart a relative rotary movement of one of said members with respect to the other of said members while continuing to move said walls for discharging ice blocks from said freezing device, means rendered effective automatically in response to the relative rotary movement of said members for warming the liquid in said motor, and means in said motor for thereafter rerotating said one member back into a normal ice block freezing position with said other member.

4. In an ice block making apparatus, a freezing device including a tray adapted to contain water and a grid in said tray having spaced apart walls dividing the interior thereof into a plurality of compartments, means for cooling said freezing device to freeze water in said compartments into separated ice blocks, an operable ice motor associated with said device having a freezable liquid confined therein and solely responsive to said means, said motor comprising reaction elements one of which is forced to be shifted a prescribed distance away from another of said reaction elements by said freezable liquid at a predetermined temperature after ice blocks are frozen in said compartments, said one reaction element having parts thereof adapted to engage said grid walls, the initial shifting movement of said one element causing it to engage the grid walls and move them while positioned in said tray to mechanically break ice blocks loose from said walls and from the tray, and said one element reacting between relatively movable portions of said freezing device upon further shifting same along said prescribed distance to rotate the grid together with the loosened ice blocks therein with respect to said tray while continuing to move said walls for discharging ice blocks from said freezing device.

5. In an ice block making apparatus as defined by claim 4 wherein a means is rendered effective automatically in response to the rotation of the grid for causing return thereof to its normal freezing position in the tray after ice blocks have been discharged from the freezing device.

6. In an ice block making apparatus as defined by claim

4 wherein a means is rendered effective automatically in response to the rotation of the grid for heating the ice motor and causing same to return the grid and its walls to their normal ice block freezing position in the tray after ice blocks have been discharged from the freezing device.

7. In an ice block making apparatus as defined by claim 4 wherein a switch is closed automatically in response to the rotation of the grid for energizing an electric heater and applying heat to the ice motor to cause it to return the grid and walls thereof to their normal ice block freezing position in the tray after ice blocks have been discharged from the freezing device.

8. In an ice block making apparatus, a freezing device including a tray adapted to contain water and a grid in said tray having spaced apart tiltable walls dividing the interior thereof into a plurality of compartments, means for cooling said freezing device to freeze water in said compartments into separated ice blocks, an operable ice motor associated with said device having a freezable liquid confined therein and solely responsive to said means, said motor comprising reaction elements one of which is forced to be shifted a prescribed distance away from another of said reaction elements by said freezable liquid at a predetermined temperature after ice blocks are frozen in said compartments, said one reaction element having parts thereof adapted to engage said grid walls, the initial shifting movement of said one element causing it to engage the grid walls and tilt them while positioned in said tray to mechanically break ice blocks loose from said walls and from the tray, and said one element reacting between relatively movable portions of said freezing device upon further shifting same along said prescribed distance to rotate the grid together with the loosened ice blocks therein with respect to said tray while continuing to tilt said walls for discharging ice blocks from said freezing device.

9. In an ice block making apparatus, a freezing device including a tray member adapted to contain water and a grid member in said tray having spaced apart tiltable walls inclined with respect to the vertical dividing the interior thereof into a plurality of compartments, means for cooling said freezing device to freeze water in said compartments into separated ice blocks, an operable ice motor associated with said device having a freezable liquid confined therein and solely responsive to said means, said motor comprising reaction elements one of which is forced to be shifted a prescribed distance away from another of said reaction elements by said freezable liquid at a predetermined temperature after ice blocks are frozen in said compartments, said one reaction element having parts thereof adapted to progressively engage said grid walls, the initial shifting movement of said one element causing it to engage and tilt walls of said grid member one after the other in succession while they are positioned in said tray member to mechanically break ice blocks loose from said walls and from the tray member, and said one element reacting between portions of said freezing device upon further shifting same along said prescribed distance to cause a relative rotary movement of one of said members while continuing to tilt said walls toward the vertical for enlarging said compartments and discharging the ice blocks from said freezing device.

10. In an ice block making apparatus, a freezing device including a stationary tray adapted to contain water and a grid in said tray having spaced apart tiltable walls inclined with respect to the vertical dividing the interior thereof into a plurality of compartments, means for cooling said freezing device to freeze water in said compartments into separated ice bolcks, an operable ice motor associated with said device having a freezable liquid confined therein and solely responsive to said means, said motor comprising reaction elements one of which is forced to be shifted a prescribed distance away from another of said reaction elements by said freezable liquid at a predetermined temperature after ice blocks are frozen in said compartments, said one reaction element having parts thereof adapted to progressively engage said grid walls, the initial shifting movement of said one element causing it to engage and tilt the grid walls one after another in succession while they are positioned in said tray to mechanically break ice blocks loose from said walls and from the stationary tray, and said one element reacting between relatively movable portions of said freezing device upon further shifting same along said predetermined distance to rotate the grid together with the loosened ice blocks therein with respect to said stationary tray while continuing to tilt said walls toward the vertical for enlarging said compartments and discharging the ice blocks from said freezing device.

11. In an ice block making apparatus, a freezing device including a stationary tray adapted to contain water and a grid in said tray having spaced apart tiltable walls inclined with respect to the vertical dividing the interior thereof into a plurality of compartments, means for cooling said freezing device to freeze water in said compartments into separated ice blocks, an operable ice motor associated with said device having a freezable liquid confined therein and solely responsive to said means, said motor comprising reaction elements one of which is forced to be shifted a prescribed distance away from another of said reaction elements by said freezable liquid at a predetermined temperature after ice blocks are frozen in said compartments, said one reaction element having parts thereof adapted to progressively engage said grid walls, the initial shifting movement of said one element causing it to engage and tilt the grid walls one after another in succession while they are positioned in said tray to mechanically break ice blocks loose from said walls and from the stationary tray, said one element reacting between relatively movable portions of said freezing device upon further shifting same along said predetermined distance to rotate the grid together with the loosened ice blocks therein with respect to said stationary tray while continuing to tilt said walls toward the vertical for enlarging said compartments and discharging the ice blocks from said freezing device, and means rendered effective automatically in response to the rotation of said grid relative to said tray for causing return of the grid and its walls to their normal freezing position in said tray after discharging ice blocks from the freezing device.

12. In an ice block making apparatus, a freezing device including a stationary tray adapted to contain water and a grid in said tray having spaced apart tiltable walls inclined with respect to the vertical dividing the interior thereof into a plurality of compartments, means for cooling said freezing device to freeze water in said compartments into separated ice blocks, an operable ice motor associated with said device having a freezable liquid confined therein and solely responsive to said means, said motor comprising reaction elements one of which is forced to be shifted a prescribed distance away from another of said reaction elements by said freezable liquid at a predetermined temperature after ice blocks are frozen in said compartments, said one reaction element having parts thereof adapted to progressively engage said grid walls, the initial shifting movement of said one element causing it to engage and tilt the grid walls one after another in succession while they are positioned in said tray to mechanically break ice blocks loose from said walls and from the stationary tray, said one element reacting between relatively movable portions of said freezing device upon further shifting same along said predetermined distance to rotate the grid together with the loosened ice blocks therein with respect to said stationary tray while continuing to tilt said walls toward the vertical for enlarging said compartments and discharging the ice blocks from said freezing device, and means rendered effective in response to the rotation of said grid relative to said tray for automatically refilling the tray with water

after ice blocks have been discharged from the freezing device.

13. In an ice block making apparatus, a freezing device including a stationary tray adapted to contain water and a grid in said tray having spaced apart tiltable walls inclined with respect to the vertical dividing the interior thereof into a plurality of compartments, means for cooling said freezing device to freeze water in said compartments into separated ice blocks, an operable ice motor associated with said device having a freezable liquid confined therein and solely responsive to said means, said motor comprising reaction elements one of which is forced to be shifted a prescribed distance away from another of said reaction elements by said freezable liquid at a predetermined temperature after ice blocks are frozen in said compartments, said one reaction element having parts thereof adapted to progressively engage said grid walls, the initial shifting movement of said one element causing it to engage and tilt the grid walls one after another in succession while they are positioned in said tray to mechanically break ice blocks loose from said walls and from the stationary tray, said one element reacting between relatively movable portions of said freezing device upon further shifting same along said predetermined distance to rotate the grid together with the loosened ice blocks therein with respect to said stationary tray while continuing to tilt said walls toward the vertical for enlarging said compartments and discharging the ice blocks from said freezing device, and means rendered effective automatically in response to the rotation of said grid relative to said tray for heating said motor and causing same to return the grid and its walls to their normal ice block freezing position in the tray after ice blocks have been discharged from the freezing device.

14. In an ice block making apparatus, a freezing device including a stationary tray adapted to contain water and a grid in said tray having spaced apart tiltable walls inclined with respect to the vertical dividing the interior thereof into a plurality of compartments, means for cooling said freezing device to freeze water in said compartments into separated ice blocks, an operable ice motor associated with said device having a freezable liquid confined therein and solely responsive to said means, said motor comprising reaction elements one of which is forced to be shifted a prescribed distance away from another of said reaction elements by said freezable liquid at a predetermined temperature after ice blocks are frozen in said compartments, said one reaction element having parts thereof adapted to progressively engage said grid walls, the initial shifting movement of said one element causing it to engage and tilt the grid walls one after another in succession while they are positioned in said tray to mechanically break ice blocks loose from said walls and from the stationary tray, said one element reacting between relatively movable portions of said freezing device upon further shifting same along said predetermined distance to rotate the grid together with the loosened ice blocks therein with respect to said stationary tray while continuing to tilt said walls toward the vertical for enlarging said compartments and discharging the ice blocks from said freezing device, and means rendered effective in response to the rotation of said grid relative to said tray for automatically refilling the tray with water and for causing return of the grid and its walls to their normal freezing position in said tray after ice blocks have been discharged from the freezing device.

15. In an ice block making apparatus, a freezing device including a tray adapted to contain water and a grid in said tray having spaced apart walls dividing the interior thereof into a plurality of compartments, means for cooling said freezing device to freeze water in said compartments into separated ice blocks, an operable ice motor associated with said device having a freezable liquid confined therein and solely responsive to said means, said motor comprising reaction elements one of which is forced to be shifted a prescribed distance away from another of said reaction elements by said freezable liquid at a predetermined temperature after ice blocks are frozen in said compartments, said one reaction element having parts thereof adapted to engage said grid walls and carrying a deflector thereon, the initial shifting move- of said one element causing it to engage the grid walls and move them while they are positioned in said tray to mechanically break ice blocks loose from said walls and from the tray, said one member reacting between relatively movable portions of said device upon further shifting same along said prescribed distance to rotate the grid together with the loosened ice blocks therein with respect to said tray while continuing to move said walls for discharging ice blocks from said freezing device, and said deflector being rotatable with said grid to provide a guard over the top of said tray for directing the discharged ice blocks therearound.

16. An ice block maker comprising, a freezing device including an elongated arcuate shaped in cross section tray member adapted to contain water and a grid member in said tray having spaced apart substantially circular movable walls dividing the interior thereof into a plurality of compartments, means for cooling said freezing device to freeze water in said compartments into separated ice blocks, an ice motor on said device mounted at the axis of said arcuate shaped tray thereof and operable by a freezable liquid confined therein, said motor including reaction elements one of which is forced to be shifted lengthwise a prescribed distance away from another of said reaction elements and rotatable relative thereto by said freezable liquid at a predetermined temperature after ice blocks have been frozen in said compartments, said one reaction element having parts thereof adapted to engage said grid walls, the initial shifting movement of said one element moving walls of said grid member while they are positioned in said tray member to mechanically break ice blocks loose from said walls and from the tray, and said one element reacting, during further lengthwise shifting movement thereof along said prescribed distance, between portions of said freezing device to rotate one of the members about said axis with respect to the other member while continuing to move walls of said grid member for discharging ice blocks from said freezing device.

17. An ice block maker comprising, a freezing device including an elongated arcuate shaped in cross section tray member adapted to contain water and a grid member in said tray having spaced apart substantially circular movable walls dividing the interior thereof into a plurality of compartments, means for cooling said freezing device to freeze water in said compartments into separated ice blocks, an ice motor on said device mounted at the axis of said arcuate shaped tray thereof and operable by a freezable liquid confined therein, said motor including reaction elements one of which is forced to be shifted lengthwise a prescribed distance away from another of said reaction elements and rotatable relative thereto by said freezable liquid at a predetermined temperature after ice blocks have been frozen in said compartments, said one reaction element having parts thereof adapted to engage said grid walls, the initial shifting movement of said one element moving walls of said grid member while they are positioned in said tray member to mechanically break ice blocks loose from said walls and from the tray, said one element reacting between portions of said freezing device during further lengthwise shifting thereof along said prescribed distance to impart a relative rotary movement of one of said members about said axis with respect to the other of said members while continuing to move said walls for discharging ice blocks from said freezing device, and means rendered effective in response to said relative rotary movement of the one element for returning said members to normal ice block freezing association with one another.

18. An ice block maker comprising, a freezing device including an elongated arcuate shaped in cross section tray member adapted to contain water and a grid member in said tray having spaced apart substntially circular movable walls dividing the interior thereof into a plurality of compartments, means for cooling said freezing device to freeze water in said compartments into separated ice blocks, an ice motor on said device mounted at the axis of said arcuate shaped tray thereof and operable by a freezable liquid confined therein, said motor including reaction elements one of which is forced to be shifted lengthwise a prescribed distance away from another of said reaction elements and rotatable relative thereto by said freezable liquid at a predetermined temperature after ice blocks have been frozen in said compartments, said one reaction element having parts thereof adapted to engage said grid walls, the initial shifting movement of said one element moving walls of said grid member while they are positioned in said tray member to mechanically break ice blocks loose from said walls and from the tray, said one element reacting between portions of said freezing device during further lengthwise shifting thereof along said prescribed distance to impart a relative rotary movement of one of said members about said axis with respect to the other of said members while continuing to move said walls for discharging ice blocks from said freezing device, and means rendered effective in response to said relative rotary movement of the one element for returning said members to normal ice block freezing association with one another, said last named means also causing refilling of said tray member with water to be frozen in said freezing device.

19. In an ice making apparatus, a tray member adapted to contain water, a grid member within said tray member and including a plurality of spaced apart walls dividing the interior thereof into compartments in which water contained therein is to be frozen into separated ice blocks, means for freezing water in said tray member, said members being mounted for movement relative to one another, a single ice motor associated with said grid member having a freezable liquid confined therein and operated solely in response to said means, said motor comprising reaction elements one of which is forced to be shifted away from another of said reaction elements by said freezable liquid at a predetermined temperature after ice blocks are frozen in said tray member, said one element also being rotatable relative to the other element while being shifted, said one reaction element having parts thereof engaging and moving walls of the grid member in said tray member during initial shifting thereof to loosen ice blocks

from said walls and from the tray, and continued shifting of said one reaction element causing a relative rotary movement of one of said members with respect to the other of said members for removing the loosened ice blocks from said apparatus.

20. An apparatus for continuously making ice comprising, a freezing device including a tray member, a grid member disposed in said tray member having walls dividing ice frozen therein into separated ice blocks and a single motor associated with the device provided with a freezable liquid confined therein for operating same, one of said members being mounted for rotation with respect to the other of said members, said freezable liquid expanding subsequent to freezing of ice into solid ice blocks in said device for actuating said motor and initially moving said grid walls, while said grid member is disposed within said tray member, to loosen the ice blocks from said walls and from the tray member, and continued expansion of said freezable liquid further actuating said motor to forcibly rotate said one member relative to said other member for removing the loosened ice blocks from said freezing device.

21. An automatic ice maker in which water is frozen in repeated cycles as governed by a single ice operated motor responsive to a freezable and expansible liquid confined therein comprising, a cooling element, an ice mold in heat exchange relation with said cooling element, a series of walls extending across said mold and anchored therein for tilting movement relative thereto, said walls dividing the interior of said mold into a plurality of compartments to form separated ice blocks therein, means connected to and actuated by operation of said ice motor in response to an initial freezing and expanding of the freezable liquid therein subsequent to freezing water into solid ice blocks in said compartments for engaging and tilting said walls to loosen the ice blocks therefrom and from said mold while the walls are positioned in the mold, said motor being further operated in response to a continued freezing and expanding of the freezable liquid therein, and said further operation of said single ice motor serving as the sole means for thereafter forcefully rotating said walls and sweeping the loosened ice blocks out of said mold.

References Cited in the file of this patent

UNITED STATES PATENTS

Re. 24,628	Heath	Apr. 7, 1959
2,776,545	Miller et al.	Jan. 8, 1957
2,833,123	Kennedy	May 6, 1958