

Oct. 8, 1957

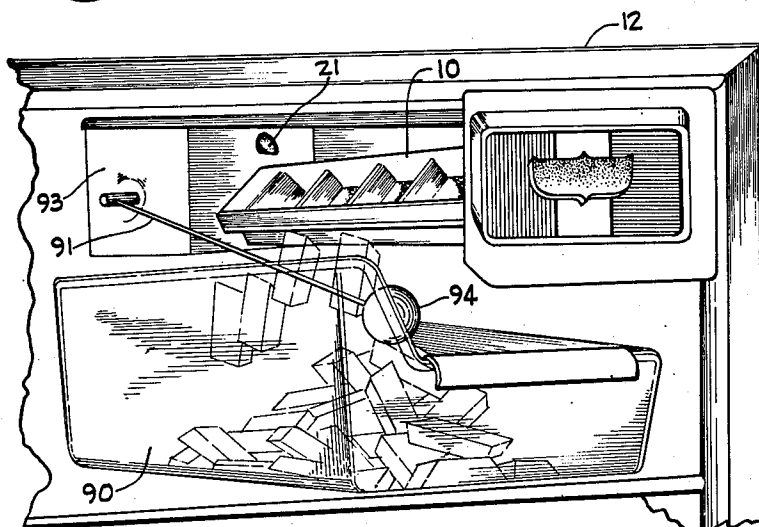
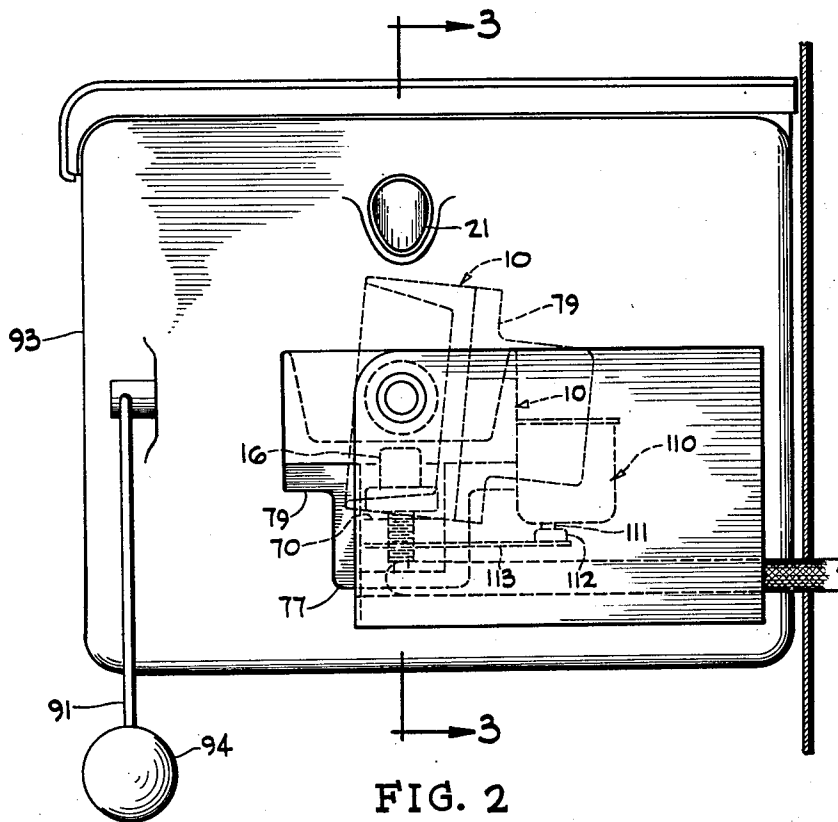
T. B. CHACE

2,808,707

ICE MAKING APPARATUS

Filed April 21, 1955

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

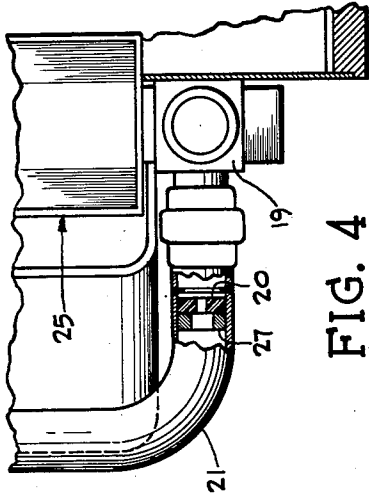
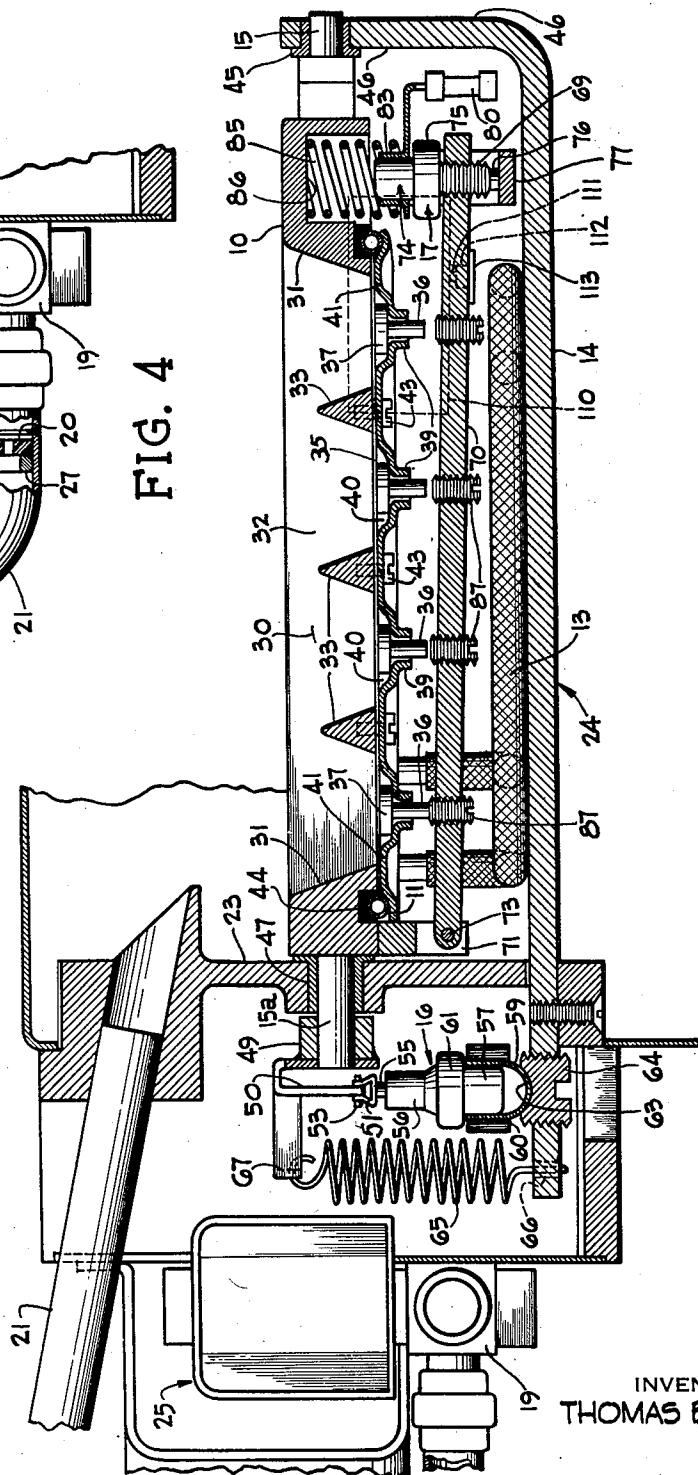


FIG. 4



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FIG.

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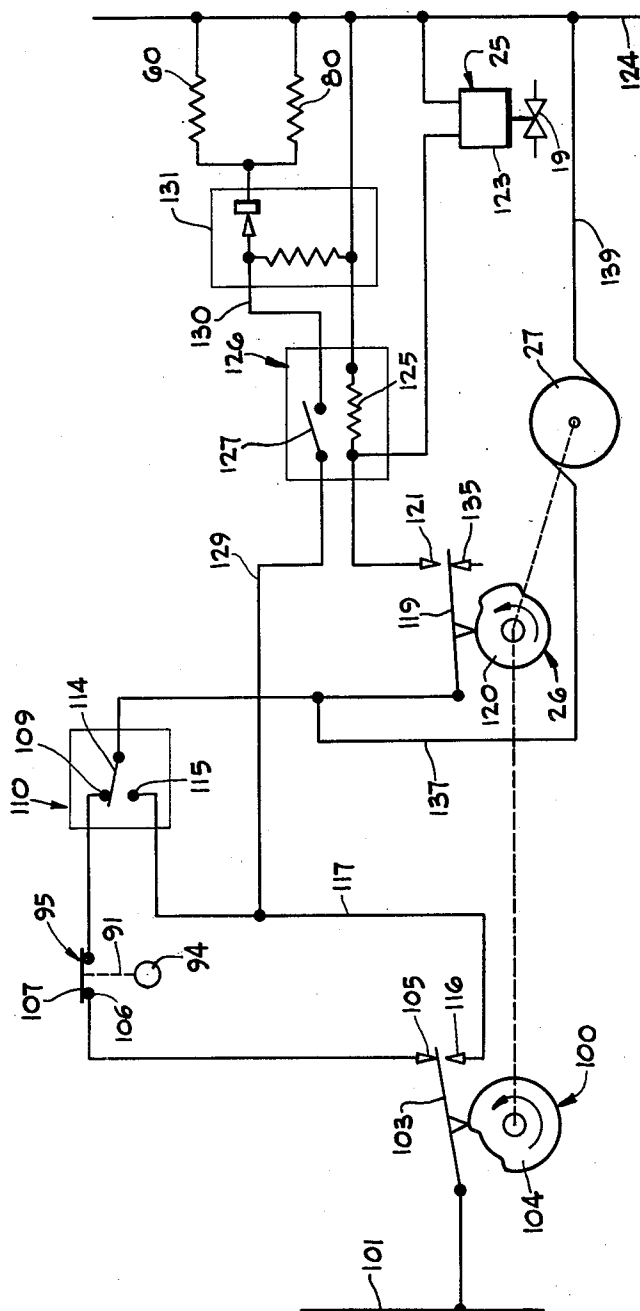
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ICE MAKING APPARATUS

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3 Sheets-Sheet 3



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2,808,707

ICE MAKING APPARATUS

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Application April 21, 1955, Serial No. 502,843

15 Claims. (Cl. 62—7)

This invention relates to improvements in ice making apparatus and more particularly relates to such apparatus which may be contained in a household refrigerator for automatically freezing water to form blocks of ice.

A principal object of my invention is to provide an improved apparatus for automatically making blocks of ice having a simplified means for ejecting the blocks of ice from the mold therefor.

A further object of my invention is to provide a novel and simplified form of apparatus for making blocks of ice in which the usual electric motor for tilting the ice mold for ejecting the blocks therefrom is eliminated.

Still another object of my invention is to provide an ice making apparatus which has obviated the necessity for heating the mold for removing the blocks of ice therefrom.

Another and important object of my invention is to provide a simple and improved form of ice making apparatus utilizing a thermal element for ejecting the blocks of ice from the mold therefor without first heating the mold to release the blocks of ice therefrom.

A still further object of my invention is to provide a simple and novel form of ice making apparatus in which individual blocks of ice are frozen in a mold having a refrigerant circulating therethrough and in which high motion solid or wax filled types of thermal elements both rotate the mold to an ejecting position and eject the blocks of ice therefrom.

A still further object of my invention is to provide an ice maker having a tiltable mold having a flexible bottom with a high motion solid or wax filled type of thermal element for tilting the mold to an ejecting position, a second high motion solid filled type of thermal element for flexing the bottom of the mold to eject the ice blocks or cubes therefrom together with heaters for the thermal elements operating in a predetermined timed sequence for heating the thermal elements to effect rotation of the mold and ejection of the ice blocks or cubes therefrom.

A still further object of my invention is to provide a novel and improved form of ice maker, particularly adapted for making ice in household types of refrigerators in which the mold is tilted and the ice cubes are ejected by high motion solid filled thermal elements and in which the thermal elements are heated and water is admitted to the mold for freezing purposes and freezing of the water is attained through a simplified and novel cyclic control circuit arranged to carry out the filling, freezing and ejecting operations in a predetermined cycle and to automatically repeat the operations to effect the supply of ice cubes or blocks in a continuous cycle as required.

These and other objects of my invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

Figure 1 is a fragmentary perspective view of a refrigerator having an ice making apparatus constructed in accordance with my invention contained therein;

Figure 2 is an enlarged fragmentary end view of the ice making apparatus shown in Figure 1;

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Figure 3 is a longitudinal fragmentary sectional view taken through the ice making apparatus shown in Figure 1 substantially along line III—III of Figure 2.

Figure 4 is a partial fragmentary sectional view taken through the rear end portion of the ice making apparatus and forming a rear continuation of Figure 3; and

Figure 5 is a wiring diagram illustrating the energizing circuit for operating the apparatus in a predetermined timed sequence.

In the embodiment of my invention illustrated in the drawings, the ice making apparatus includes generally a mold in the form of a cold plate 10 having a refrigerant tube 11 leading thereabout, connected with the cooling coils or evaporator of a refrigerator 12 through flexible refrigerant lines 13. The refrigerant lines 13 may rest on a bottom plate 14 of a support frame 24 for said mold or cold plate to accommodate free tilting of said cold plate about trunnion shafts 15 and 15a extending from opposite ends thereof.

A solid or wax filled type of thermal element 16 is provided to tilt the cold plate 10 from the horizontal position shown in Figure 3 to the generally upright position shown in dotted in Figure 2 to accommodate the ejection of the ice cubes or blocks from the mold or cold plate 10. A second thermal element 17, which may be of the solid or wax filled type is provided to flex the bottom of the mold or cold plate 10 and eject the frozen blocks of ice therefrom.

The apparatus also includes a solenoid controlled filling valve 19, shown as supplying water to a uniform volume flow control annulus 20 at the intake end of a filling tube 21, leading through a wall 23 of the frame 24 and terminating in cascade relation with respect to the mold or cold plate 10 for supplying water thereto for freezing.

The valve 19 may be a well known form of solenoid controlled valve having a solenoid 25 cyclically energized under the control of a filler switch 26 operated by an intermittently operating timer motor 27 (see Figure 5), as will hereinafter more clearly appear as this specification proceeds.

The flexible flow control annulus 20 may be of a type somewhat similar to that shown and described in Patent No. 2,389,134, which issued to Clyde A. Brown on November 20, 1945, so need not herein be described or shown in detail. The flow control annulus 20 rests against a flat seat or shoulder 27 in the tube or pipe 21, as in the aforementioned Brown patent, to provide a uniform volume of water in a predetermined time interval for filling the mold or cold plate 10 in a predetermined time, regardless of variations in pressure of the water at the source. While the flow control annulus 20 is herein shown as being at the outlet in the valve 19 it is readily apparent that it may be at the inlet to said valve or may be in various other locations desired.

The mold or cold plate 10 is shown as having a dished in or recessed portion 30 having opposite inclined end walls 31 and inclined side walls 32 connected together by spaced transverse dividers 33 to provide individual compartments in said cold plate for the freezing of water therein in the form of ice cubes or blocks. The dividers 33 are shown as being triangular in cross-section, the apices of which terminate a substantial distance beneath the top of the cold plate 10; to accommodate over-filling over the tops of said dividers without the overflow or spilling of water down onto the previously frozen ice blocks.

The dividers 33 substantially determine the thickness of the ice blocks, and water may first fill the space between the rear end wall 31 and first divider and flow over the tops of the successive dividers until the mold is full;

or else may flow along the bottom of the cold plate 10 through suitable passageways (not shown), which may be provided in the dividers 33 to accommodate the filling of the mold with water to the tops of the dividers 33.

The cold plate 10 is shown as having a flexible bottom 35 in the form of a diaphragm which may either be made from a thin metal sheet, or may be made from flexible material such as rubber, Neoprene, or any other like material, flexed to eject the ice blocks from the mold by the operation of plungers 36. The plungers 36 have disks 37 on the upper ends thereof, engaging the underside of the flexible bottom or diaphragm 35.

The plungers 36 are shown as being guided in spaced bosses 39 depending from recessed portions 40 of a plate 41 extending along the bottom of the cold plate 10 and secured thereto as by machine screws 43 extending through the plate 41 and shown as being threaded within the bottoms of the dividers 33. The recessed portions 40 of the plate 41 are shown as being of a depth sufficient to bring the tops of the disks 37 flush with the bottom of the flexible diaphragm 35 to provide a flat bottom for the mold when the plungers 36 are in their retracted positions and the mold is filled with water for freezing.

The marginal edge of the plate 41 is shown as being recessed to conform to the general form of the refrigerant tube 11 and to retain said refrigerant tube to a resilient packing 44 in a downwardly opening recess or groove extending about the bottom of the cold plate 10, as shown in Figure 3.

The cold plate 10 and the dividers therefor, dividing the recessed portion of said cold plate into a series of molds for ice blocks, may be made from any suitable material such as aluminum, copper clad with stainless steel, or copper having high heat transfer properties and a minimum surface sticking property to the ice. A copper clad with stainless steel has been found to be an exceedingly satisfactory material since the copper produces fast, efficient cold transfer for quick and uniform freezing and the stainless steel does not adhere or stick to the ice blocks. The surfaces of the dividers 33 and the walls 31 and 32 may also be coated with a silicone preparation to further facilitate the freeing of the ice blocks from the mold.

The trunnion shaft 15 extending from the front end of the cold plate 10 is shown as being shouldered and as journaled in a bearing 45 carried in an end wall 46 of the frame 24. The opposite trunnion shaft 15a extends through the wall 23 and is journaled thereon on a bearing 47. The rearwardly projecting end of the shaft 15a is shown as having a collar 49 thereon which may be pinned or otherwise secured thereto. A lever arm 50 abuts the outer face of the collar 49 and may be pivotally connected to a yoke 51, as by a pivot pin 53. The yoke 51 is mounted on the end of a piston or power member 55 extensible from a cylinder 56 of the thermal element 16.

The thermal element 16 is shown as being of the so-called power type or high motion solid fill type of thermal element such as is shown and described in the Vernet Patent No. 2,386,181, dated January 30, 1945, and has been selected for its compactness and simplicity, as well as its extreme power and relatively long range of travel of its power member or piston 55. In such types of thermal elements, a thermal medium (not shown) is contained within the casing 57 of the thermal element and acts against a membrane or deformable member (not shown), to extend the power member or piston 55 from the cylinder 56 as the thermal medium in the casing 57 reaches its fusion point. The thermal medium may be of a wax alone or a wax containing a powdered metal heat conductor and a binder, the material used being selected for its melting or fusion point and the fusion point thereof determining the temperature range of operation of the thermal element.

The casing 57 of the thermal element 16 is shown as being carried in a cup-like retainer 59 encircled by an electric heating element 60 which may be a resistance heater of a well known form, so need not herein be shown or described further. The outer margin of the retainer 59 is shown as being abutted by a heat conductor ring 61 encircling the casing 57 adjacent the inner end of the cylinder 56. The closed end of the retainer 59 is shown as being generally semi-spherical in form and as having pivotal bearing engagement with a socket 63 in the upper face of an adjustment screw 64. The adjustment screw 64 conforms to the form of the semi-spherical face of the retainer 59 and is herein shown as being threaded within the bottom plate 14. The socket 64 thus serves as a bearing support for the retainer 59 and thermal element 16, accommodating tilting movement thereof upon extension of the piston 55 from the cylinder 56 to tilt the cold plate 10. The thermal element 16 and retainer 59 are retained in position in the socket 63 as by a tension spring 65 forming a return spring for the thermal element 55 and also returning the cold plate 10 to the horizontal position shown in Figure 3, at the end of the operation of ejecting ice blocks therefrom. The spring 65 is shown as being hooked through an apertured portion 66 of the bottom plate 14 at one end and through an arm 67 extending outwardly from the lever 50 at its opposite end.

It may be seen from the foregoing that upon energization of the electric heater 60 and heating of the thermally expansible material within the casing 57 to its fusion point, that the piston 55 will be extended from the cylinder 56 and pivot the cold plate 10 from the horizontal position shown in Figure 3 to the generally vertical position shown in dotted line in Figure 2 into position to have the ice cubes ejected therefrom by operation of the plungers 36, as will hereinafter be more clearly described as this specification proceeds.

It should further be understood that the amount of pivotal movement of the cold plate 10 depends upon the length of the travel of the piston 55 of the thermal element 16, and that the travel of the piston may be increased or decreased by the use of larger or smaller thermal elements.

The thermal element 17 for ejecting the ice blocks from the cold plate 10 is shown as being of the same general form of thermal element as the thermal element 16 and as having a cylinder 69 threaded within the outer end of an ejector lever 70. The ejector lever 70 is pivoted at its end opposite the thermal element 17 between the furcations of a depending support bracket 71 on a transverse pivot pin 73.

The thermal element 17 also has a casing 74 containing a thermally expansible fusible material and a heat conductor ring 75 abutting the top surface of the ejector lever 70. A piston 76 extensible from the cylinder 69 is shown as abutting the end wall of a yoke 77 at its outer end for pivoting the ejector lever 70 in a direction which in Figure 3 is a counterclockwise direction when the thermally responsive material within the casing 74 is heated to its fusion point.

The yoke 77 is shown as extending upwardly along the opposite sides of the thermal element 16 and as having laterally extending feet 79 secured to the bottom of the cold plate 10.

A heater 80, which may be of a well known form of electrical resistance heater is shown as being carried on an arm 81 extending outwardly from the flange of a flanged sleeve 83 encircling the casing 74. The heater 80 supplies heat to heat the thermally expansible fusible material within the casing 74 to its fusion point to effect extension of the piston 76 from the cylinder 69, as has previously been described in connection with the thermal element 16. The flange of the flanged sleeve 83 is abutted by a spring 85 recessed within a downwardly opening recess 86 formed in the forward end of the cold

plate 10. The spring 86 serves to retractibly move the ejector lever 70 and to return the piston 76 within the cylinder 69 when the heater 80 is de-energized and the temperature of the thermally responsive material is reduced sufficiently to accommodate retractible movement of the piston 76 within the cylinder 69.

The ejector lever 70 is shown as having a plurality of adjustment screws 87 threaded therein. Each adjustment screw 87 is in registry with a plunger 36 to engage the same and effect operation of the disk 37 to flex the flexible diaphragm 35 upon pivotal movement of the lever 70 toward the cold plate 10. The screws 87 may be adjusted to adjust the period of ejection of the ice blocks from the cold plate 10 and effect the successive ejection of said ice blocks if desired, or to effect the simultaneous ejection of all of the ice blocks.

In Figure 1 of the drawings I have shown the ice making apparatus in the refrigerator 12 over a tray 90 spaced therebeneath and extending upwardly along the sides of the apparatus in spaced relation with respect thereto, to receive the cubes or blocks ejected from the cold plate 10 when frozen. An arm 91 is pivotally carried on a housing 93 in laterally spaced relation with respect to the cold plate 10 and adjacent the rear end thereof. The arm 91 is provided with a rider on its outer end, herein shown as being a hollow ball or sphere 94 which extends downwardly beneath the bottom of the housing 93 within the tray 90. A suitable stop (not shown) may be provided to limit downward movement of said arm and ball, and hold the arm 91 and sphere 94 in position to accommodate the ice cubes to pass thereunder. The sphere 94 is adapted to ride on the tops of the ice blocks deposited in the tray 90 and operate a switch 95 (Figure 5) to deenergize the energizing circuit for the apparatus when the tray 90 is over-filled.

When the over-fill switch 95 is open, the filling valve 19 will remain closed and the cold plate 10 cannot again be filled with water until sufficient ice blocks have been removed from the tray 90 to accommodate the arm 91 to drop into position to effect closing of the switch 95.

Referring now to the control circuit illustrated in Figure 5, the filling, ejecting and freezing operation is under the control of the filling switch 26 controlling energization of the solenoid 25 for effecting opening of the filling valve 19 and under the control of a main switch 100. The switches 26 and 100 are shown as being cam operated, operated by the intermittently operating timer motor 27.

A main line conductor 101 is shown as being connected with a switch arm 103 of the main switch 100. The switch arm 103 is shown as following a cam 104 and as being operated thereby at the initiation of the filling cycle, to engage a contact 105 having connection with a contact 106 of the over-fill switch 95. The contact 106 of the over-fill switch 95 is normally engaged by a switch arm 107 completing a circuit to a contact 109 of an ejector switch 110.

The ejector switch 110 is mounted on the cold plate 10 and extends to one side thereof and is herein shown as being a two-position switch operated by a switch button 111 engaged by a button 112 on the outer end of a resilient arm 113 mounted on the ejector lever 70 and extending outwardly therefrom. The contact 109 of the ejector switch 110 normally engages a switch arm 114 prior to and during the freezing operation. Upon the ejecting operation, however, movement of the ejector lever 70 toward the plunger 36 will engage the button 112 on the arm 113 with the button 111 of ejector switch 110 and depress the same and break the circuit from the contact 109 through the switch arm 114 and make a circuit from the switch arm 114 to a contact 115. The contact 115 has a connection with a contact 116 of the main switch 104 through a conductor 117.

When the over-fill switch 95 is closed and the con-

tact arm 103 is in engagement with the contact 105, the contact arm 114 is in engagement with the contact 109. A circuit is then completed to a contact arm 119 of the filling switch 26. The contact arm 119 follows a cam 120 driven by the motor 27 simultaneously with the cam 104. The cam 120 is so arranged as to produce a lag in the operation of the switch arm 119 from operation of the switch arm 103 and to engage the switch arm 119 with a contact 121 of the filling switch 26 a predetermined time interval after engagement of the switch arm 103 with the contact 105.

The switch arm 119 engaging the contact 121, will complete a circuit from the main line conductor 101 through a coil 123 of the solenoid 25 to a main line conductor 124, to energize the coil 123 and effect opening of the filling valve 19 and start the filling cycle under the control of the flow control valve or annulus 20.

The switch arm 119 engaging the contact 121 will also complete a circuit through a heater coil 125 of a temperature switch 126 to effect heating of the coil 125 to open a bi-metal switch 127 in a predetermined time interval. The bi-metal switch 127 completes a circuit from a conductor 129 connected with the conductor 117, to a conductor 130 connected with the heaters 60 and 80 through the contacts of an overheat safety switch 131.

The temperature switch 126 may be a well known form of bi-metal switch having a bi-metal switch arm 127, the contacts of which open by resistor heat and close at a low temperature and thus sense the temperature of the ice blocks, and do not close until the temperature to which the bi-metal arm 127 is subjected has dropped to a predetermined level below the freezing point, at which temperature level the ice blocks will be frozen.

At the end of the filling cycle, which may require an interval of 15 seconds, the switch arm 119 will ride off the raised surface of its cam and come into engagement with a contact 135, the circuit to which contact is open. This will deenergize the coil 123 of the solenoid 25 and effect closing of the filling valve 19. The heater coil 125 will also be deenergized. The switch arm 127, however, will be in its open position. The cam 104 will then have advanced a sufficient distance to effect disengagement of the switch arm 103 from the contact 105 and engagement of the switch arm 103 with a contact 116. The motor 27 will then be deenergized, and since the switch arm 127 is in its open position, the entire operating and heater circuits, will be deenergized.

As soon as the filling cycle is completed, the freezing cycle will commence and during the freezing cycle there is no current flow, as has previously been mentioned. As the ice blocks are frozen and the temperature thereof drops to a predetermined level below the freezing point, the bi-metal arm 127 will move to its closed position to complete a circuit through the heater coils 60 and 80.

The heater coil 60 will thus heat the casing of the thermal element 16 to effect extension of the piston 55 from the cylinder 56 and tilt the cold plate 10 from its horizontal position shown in Figures 2 and 3 to its dotted line position shown in Figure 2.

The heater coil 80 will likewise heat the casing 74 of the thermal element 17 to effect extension of the cylinder 76 from the piston 69 and pivotal movement of the ejector lever 70 toward the plungers 36, to flex the flexible diaphragm 35 by operation of the disk 37 on the ends of the plungers 36 and loosen the ice blocks so they will fall out of the cold plate 10.

As the ejector lever reaches the end of its ejecting operation, the arm 113 will engage the button 112 with the button 111 of the ejector switch 110. This will effect movement of the switch arm 111 of the ejector switch 110 to break the circuit to the contact 109 and make a circuit through the contact 115. At this point in the cycle of operation of the circuit, the switch arm 103 will be in engagement with the contact 116. The motor 27 will then be energized through the switch arm 103, contact 116,

conductor 117, contact 115, switch arm 114, and a conductor 137 connected with said motor and a second conductor 139 connected from said motor to the main line conductor 124.

The motor 27 will then operate the cam 104 to disengage the switch arm 103 from the contact 116 and engage said switch arm with the contact 105. The heater coils 60 and 80 will then be deenergized allowing the thermal elements 16 and 17 to cool. As these thermal elements cool, the spring 65 will return the cold plate 10 to the horizontal position shown in Figure 2. The spring 85 will also move the ejector lever 70 away from the plungers 36, accommodating the flexible diaphragm 35 to return to its unflexed position. The button 112 on the arm 113 will then disengage the button 111 of the ejector switch 110. The switch arm 114 will then engage the contact 109 to complete a circuit to the filling switch 26. Upon a delayed time interval, the cam 120 will move the switch arm 119 into engagement with the contact 121 to again energize the coil 123 of the solenoid 25 and open the valve 19 to effect a next succeeding filling operation. The heater coil 125 of the temperature switch 126 will likewise be energized, opening said switch at the start of a next succeeding filling and freezing operation, it being understood that during the filling operation, the circuit to the conductors 117 and 129 is open, regardless of whether the temperature switch is in its open or closed position.

It should here be understood that the over-heat safety switch is a well known form of switch operated by a series coil 140 and normally remaining closed and only opening upon excessive current conditions which may be effected by over-heating of the heater coils 60 and 80.

It should further be understood that the overflow switch 95 is normally closed and is only opened upon the discharge of an excessive amount of ice cubes in the tray 90 by operation of the arm 91 and sphere 94 riding on the ice cubes as they discharge into said tray.

It should also be understood that while I have shown a high motion type of solid fill thermal element, which serves as a heat motor to eject the ice blocks, when the mold is tilted, that it is within the scope of my invention to eject the ice blocks from the mold by the use of a heat motor, without tilting the mold and that various other ejecting means than the means shown and described herein may be used without departing from the spirit and scope of the novel concepts of the present invention.

I claim as my invention:

1. In an automatic ice block maker, an ice block mold, a thermal element for ejecting ice blocks from said mold, said thermal element comprising a casing containing a fusible material and a piston extensibly movable with respect to said casing upon fusion of the fusible material therein, an ejector arm on said mold operated adjacent one end by relative movement between said casing and piston, and means heating said thermal element to effect relative movement between said casing and piston and operate said ejector arm to eject ice blocks from said mold, the end of said ejector arm adjacent said thermal element having an arc of movement substantially equal to the stroke of said piston.

2. In an automatic ice making apparatus, a mold having a flexible bottom and mounted for positioning in a horizontal position for freezing water in the form of ice blocks and into a generally upright position for the ejection of ice blocks therefrom, a thermal element for moving said mold into an upright ejecting position, a second thermal element for deforming said bottom to eject ice blocks therefrom, individual heater means for each thermal element to effect operation thereof, valve means for introducing water into said mold when in a horizontal position, electrically energizable means for operating said valve means to introduce water into said mold, and means for energizing said heater means sequentially of

operation of said valve means, to effect operation of said thermal elements to pivot said mold into an ejecting position and to eject ice blocks therefrom.

3. In an automatic ice making apparatus, a cold plate forming an ice block mold having a flexible bottom, a refrigerant coil leading about said cold plate for cooling the same, said cold plate being pivotally movable about a horizontal axis and being in a horizontal position for freezing and in a generally vertical position for the ejection of ice cubes therefrom, a thermal element connected with said cold plate for tilting the same, a flexible refrigerant line connecting said refrigerant coil in said cold plate with a source of supply of refrigerant, a second thermal element for deforming said bottom to eject ice cubes therefrom, individual heater means for said thermal elements to effect operation thereof, a valve for introducing water into said cold plate, electrically energizable means for opening said valve, and an electrically energized circuit sequentially connected with said electrically energizable means for opening said valve and connected with said heater means for effecting opening of said valve and filling of said mold and upon freezing of the water in said mold effecting energization of said heater means to effect operation of said thermal elements in a predetermined sequence of operation.

4. An automatic ice making apparatus comprising a mold having a flexible bottom and a refrigerant coil recessed therein and extending thereabout, a support for said mold, supporting said mold for movement into a horizontal position for freezing ice cubes therein and into a generally upright position for the ejection of ice cubes therefrom, a valve for introducing water into said mold when in a horizontal position, a solenoid for operating said valve, a thermal element having a casing containing a fusible thermally expansible material, a piston extensible with respect to said casing upon predetermined increases in temperature and having pivotal connection with said mold for tilting the same upon predetermined temperature rises, an electrically energizable heater for said thermal element to heat the same and effect movement of said mold to an upright ejecting position, a second thermal element for deforming said bottom and including a casing containing a fusible thermally expansible material, a piston extensible with respect to said casing and an operative connection from said piston to said deformable bottom for deforming the same upon extension of said piston from said cylinder, an electrically energizable heating means for heating said thermal element to effect operation thereof and a cyclic control circuit for said solenoid and said heating means for opening said valve and filling said mold with water, and upon the freezing of the water in said mold heating said thermal elements in a predetermined sequence.

5. An automatic ice making apparatus comprising a mold for ice blocks having a flexible bottom, a support for said mold, supporting said mold for movement about a horizontal axis from a horizontal filling and freezing position into an upright ejecting position, a refrigerant tube extending about said mold, a flexible refrigerant line connecting said tube with a source of refrigerant in a vaporized state, a valve for introducing water into said mold when in a horizontal position, a solenoid energizable to open said valve, a thermal element having an extensible piston having pivotal connection with said mold and having a casing containing a fusible thermally expansible material, an electric heater for said thermal element to heat the same to effect extension of said piston with respect to said casing and tilting of said mold into an ejecting position, a second thermal element having an extensible piston, an operative connection from said piston to said deformable bottom for deforming the same upon extension of said piston, said second thermal element having a casing containing a fusible thermally expansible material and a heater for heating the thermally expansible material to effect extension of said piston and

deformation of said deformable bottom, and a cyclic control circuit for effecting the energization of said solenoid to effect opening of said valve for filling said mold and to effect the energization of said heaters at the termination of the freezing operation to effect tilting of said mold to an ejecting position and the ejection of ice cubes therefrom.

6. An automatic ice making apparatus comprising a mold for ice blocks, a support for said mold, supporting the same for movement about a horizontal axis from a horizontal freezing position into an upright ice block ejecting position, a thermal element for pivotally moving said mold into an upright ejecting position and having a casing containing a fusible thermally expansible material and a piston extensible with respect to said casing, a retainer for said thermal element encircling said casing and having pivotal bearing engagement with said support, a lever arm extending from said mold, a pivotal connection between said piston and said lever arm for tilting said mold, an electric heater encircling said retainer, means for energizing said heater to effect operation of said piston to tilt said mold into an ejecting position, and a spring for returning said mold into a horizontal position upon deenergization of said heater and also maintaining said retainer in bearing engagement with said support.

7. An automatic ice making apparatus comprising a mold for ice blocks, ejecting mechanism for ejecting ice blocks from said mold, and means for operating said ejecting mechanism from an adjacent end thereof comprising a solid fill thermal element having an extensible piston operatively connected with said ejecting mechanism, an electric heater energizable to heat said thermal element and effect operation thereof, and a return spring for returning said piston and ejecting mechanism upon deenergization of said heater, the end of said ejector arm adjacent said thermal element having an arc of movement substantially equal to the stroke of said piston.

8. An automatic ice making apparatus comprising a mold for ice blocks and the like having a flexible bottom, means for deforming said bottom to eject ice blocks from said mold comprising an ejector lever pivoted to said mold adjacent one end thereof in spaced relation with respect to the bottom thereof and extending along said mold and having operative connection with said bottom to deform the same upon movement of said lever toward said mold, a solid fill thermal element operatively connected with said lever adjacent the other end of said mold and having a casing containing a thermally expansible material, a cylinder extending from said casing, a piston extensible from said cylinder, a heater for heating said casing to effect the extension of said piston from said cylinder, electrically energizable means for energizing said heater, and a return spring for said ejector lever returning said lever and returning said piston within said cylinder, the end of said ejector lever adjacent said thermal element having an arc of movement substantially equal to the stroke of said piston.

9. An automatic ice maker comprising a tiltable mold having a flexible bottom, a thermal element having a piston and a fusible thermally expansible material for operating said piston, ejector means operated by said thermal element for deforming said bottom to eject ice blocks from said mold, a second thermal element having a piston and a fusible thermally expansible material for operating the same, means operated by said piston for tilting said mold into an ice block ejecting position, separate electric heaters for said thermal elements to effect operation thereof, a valve for filling said mold with water, a solenoid for operating said valve, an energizing circuit for said solenoid and heaters comprising a main switch having a switch arm and two contacts, a filling switch having a switch arm and one contact, an energizing circuit from said one contact of said filling switch to said solenoid, a motor for operating

said main and filling switches, an energizing circuit from one contact of said main switch to said motor, an energizing circuit from said one contact of said main switch to said filling switch arm, said motor operating to engage said switch arm of said filler switch with the contact thereof to effect the filling of said mold and to disengage said switch arm therefrom after a predetermined time interval and to sequentially engage said switch arm of said main switch with a second contact thereof and deenergize said motor, an energizing circuit from said second contact of said main switch to said electric heaters for energizing the same to effect operation of said thermal elements to tilt said mold and eject ice blocks therefrom, and spring means returning said mold to a filling position and returning said ejector means to an inoperative position at the end of an ice block ejecting cycle.

10. An automatic ice maker comprising a tiltable mold having a flexible bottom, a thermal element having a piston and a fusible thermally expansible material for operating the same, ejector means operated by said thermal element for deforming said bottom to eject ice blocks from said mold, a second thermal element having a piston and a fusible thermally expansible material for operating the same, means operated by said piston of said second thermal element for tilting said mold into an ice block ejecting position, separate electric heaters for said thermal elements to effect operation thereof, a valve for filling said mold with water, a solenoid for operating said valve, an energizing circuit for said solenoid and heaters comprising a main switch having two contacts and a filling switch energized through one contact of said main switch and having a contact connected with said solenoid for energizing the same, an energizing circuit from the other contact of said main switch to said heaters, and a temperature switch in said last mentioned energizing circuit and maintaining the energizing circuit to said heaters open during freezing of the ice blocks and sensing the temperature of the ice blocks and closing upon freezing thereof, to energize said heaters and effect the ejection of said ice blocks from said mold.

11. An automatic ice block maker comprising a tiltable mold having a flexible bottom, a thermal element having a piston and a fusible thermally expansible material for operating the same, ejector means operated by said thermal element for deforming said bottom to eject ice blocks from said mold, a second thermal element having a piston and a fusible thermally expansible material for operating the same, means operated by said last mentioned piston for tilting said mold into an ice block ejecting position, separate electric heaters for said thermal elements to effect operation thereof, a filling valve for said mold, a solenoid for operating said valve, an energizing circuit for said solenoid and heaters comprising a main switch having a switch arm and two contacts, a filling switch having a switch arm and one contact, an energizing circuit from said filling switch contact to said solenoid, a motor for operating said switches, an energizing circuit from one contact of said main switch to said motor to energize said motor, an energizing circuit from said one contact of said main switch to said filler switch arm, said motor being operable to engage said switch arm of said filler switch with the contact thereof when energized and to disengage said switch arm therefrom after a predetermined time interval and to sequentially engage said switch arm of said main switch with the second contact thereof and deenergize the energizing circuit for said motor, and an ejector switch operated by said ejector means and connecting said motor in said energizing circuit through said second contact of said main switch upon the ejection of the ice blocks from said mold and moving to complete a circuit from said second contact of said main switch to said switch arm of said filling switch when said mold is in a horizontal filling position, to initiate a next succeeding filling and ejecting operation.

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12. An automatic ice block maker comprising a tiltable mold having a flexible bottom, a thermal element having a piston and a fusible thermally expansible material for operating the same, ejector means operated by said thermal element for deforming said bottom to eject ice blocks from said mold, a second thermal element having a piston and a fusible thermally expansible material for operating the same, means operated by said last mentioned piston for tilting said mold into an ice block ejecting position, separate electric heaters for said thermal elements to effect operation thereof, a filling valve for said mold, a solenoid for operating said valve, an energizing circuit for said solenoid and heaters comprising a main switch having a switch arm and two contacts, a filling switch having a switch arm and one contact, an energizing circuit from said filling switch contact to said solenoid, a motor for operating said switches, an energizing circuit from one contact of said main switch to said motor to energize said motor, an energizing circuit from said one contact of said main switch to said filler switch arm, said motor being operable to engage said switch arm of said filler switch with the contact thereof when energized and to disengage said switch arm therefrom after a predetermined time interval and to sequentially engage said switch arm of said main switch with the second contact thereof and de-energize the energizing circuit for said motor, an ejector switch operated by said ejector means upon the ejection of ice blocks from said mold and connecting said motor in said energizing circuit through said second contact of said main switch at the end of an ice block ejecting operation and moving to complete a circuit from said one contact of said main switch to said switch arm of said filling switch when said mold is in a horizontal filling position, to effect the initiation of a next succeeding filling and freezing cycle, and an over-fill switch in series with said one contact of said main switch and said ejector switch and operable to prevent the initiation of a next succeeding filling and freezing cycle upon an over supply of ice blocks.

13. An automatic ice maker comprising a tiltable mold having a flexible bottom, a thermal element having a piston and a fusible thermally expansible material for operating the same, ejector means operated by said thermal element for deforming said bottom to eject ice blocks from said mold, a second thermal element having a piston and a fusible thermally expansible material for operating the same, means operated by said last mentioned piston for tilting said mold into an ice block ejecting position, separate electric heaters for said thermal elements to effect operation thereof, a filling valve for said mold, a solenoid for operating said valve, an energizing circuit for said solenoid comprising a main switch having a switch arm and two contacts, a filling switch having a switch arm and one contact, an energizing circuit from said filling switch contact to said solenoid, a motor for operating said switches, an energizing circuit from one contact of said main switch to said motor to energize said motor, an energizing circuit from said one contact of said main switch to said filler switch arm, said motor engaging said

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filler switch arm of said filler switch with the contact thereof to energize said solenoid and effect the filling of said mold and disengaging said filler switch arm therefrom after a predetermined time interval, a temperature switch having a bi-metal switch arm, an energizing circuit from the other contact of said main switch through said bi-metal switch arm to said heaters for energizing the same, a resistance heater for heating said bi-metal switch arm to effect the movement of said switch arm into an open position, an energizing circuit from said one contact of said filling switch to said resistance heater to energize the same and effect opening of said temperature switch during filling and the freezing operation, said motor moving said switch arm of said main switch into engagement with a second contact thereof and moving said filling switch arm out of engagement with a contact thereof to deenergize said solenoid, and said temperature switch maintaining the energizing circuit to said heaters open and sensing the temperature of the ice blocks and closing upon freezing thereof, to energize said heaters through the second contact of said main switch and effect the ejection of the ice blocks from said mold.

14. In an automatic ice block maker, a tiltable mold having a flexible bottom and side walls sloping outwardly with respect thereto, a solid fill thermal element for tilting said mold, means heating said thermal element to effect operation thereof to tilt said mold, a second thermal element for deforming said bottom to eject ice from said mold when tilted, and means heating said second thermal element to effect operation thereof to deform said bottom.

15. In an automatic ice making apparatus, a tiltable ice block mold having a flexible bottom and side walls sloping outwardly with respect thereto, fluid supply means for introducing water into said mold, a solid fill thermal element for tilting said mold, a second thermal element for deforming said bottom to eject ice blocks therefrom, individual heating means for said thermal elements to effect operation thereof, and electrically energizable means for effecting operation of said fluid supply means and energization of said heater means in predetermined sequences of operation.

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