May 6, 1958 G. P. KENNEDY ET AL 2,833,123

AUTOMATIC ICE CUBE MACHINE

Filed Aug. 15, 1955

5 Sheets-Sheet 1

Fig. 10

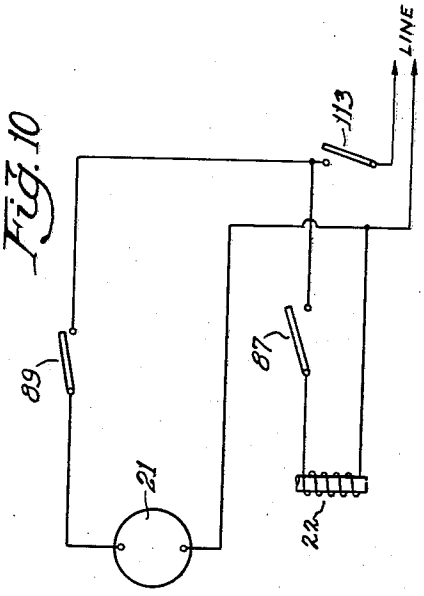


Fig. 3

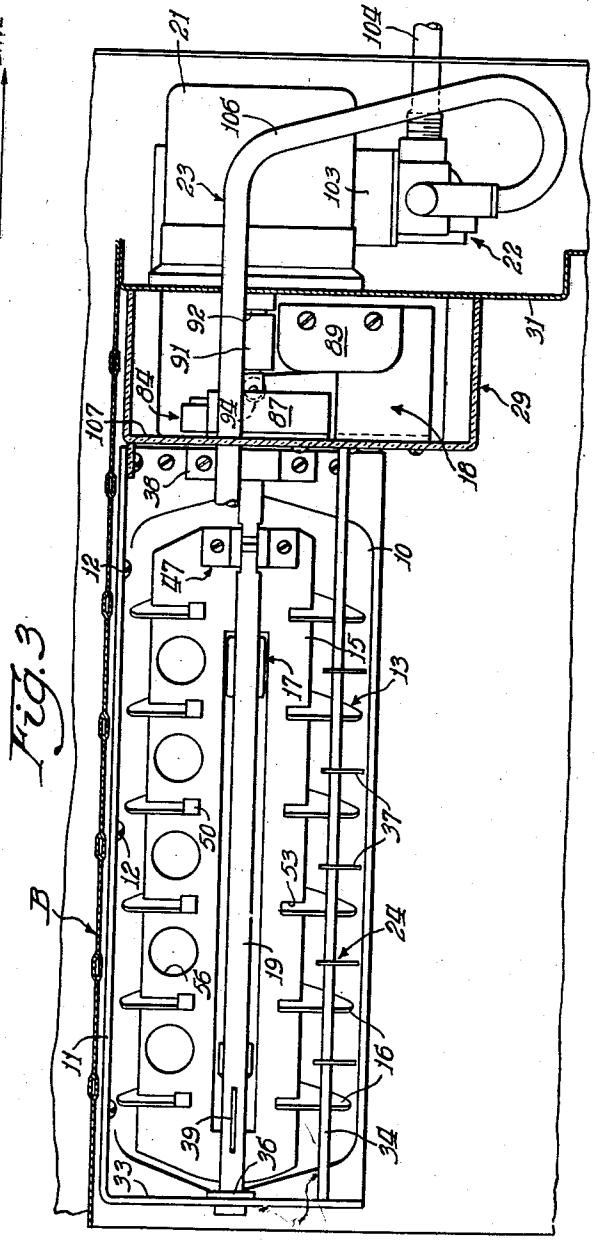
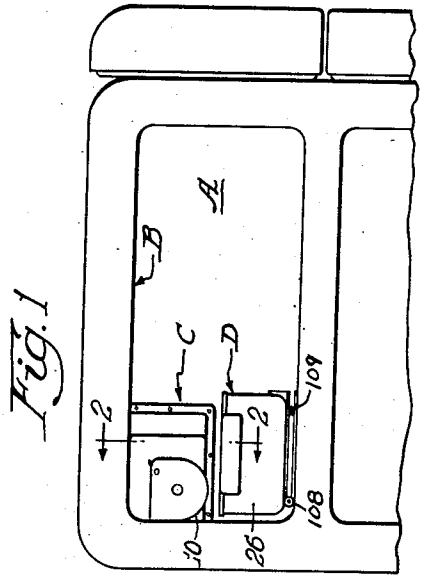


Fig. 1



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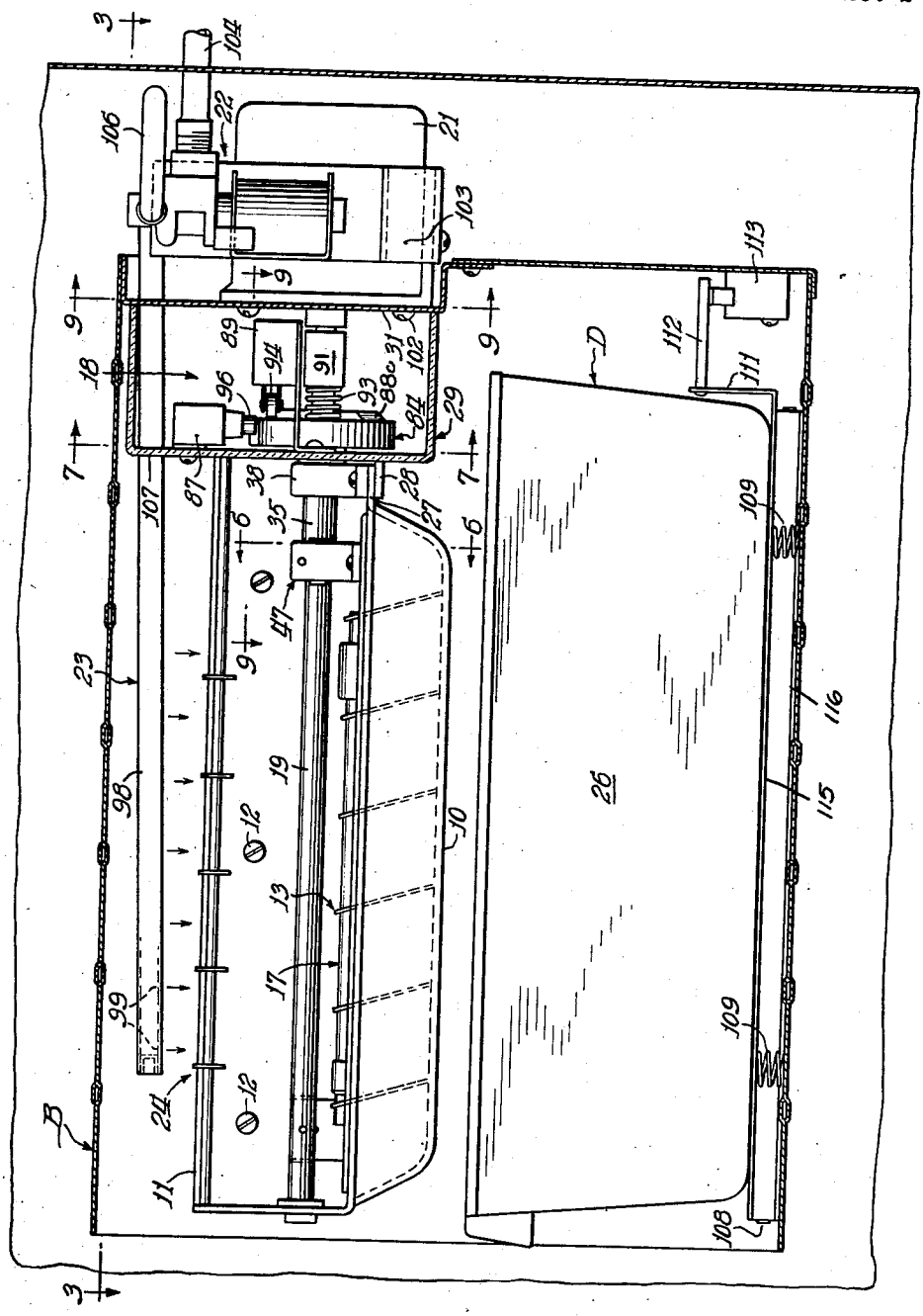

Fig. 2

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Fig. 8

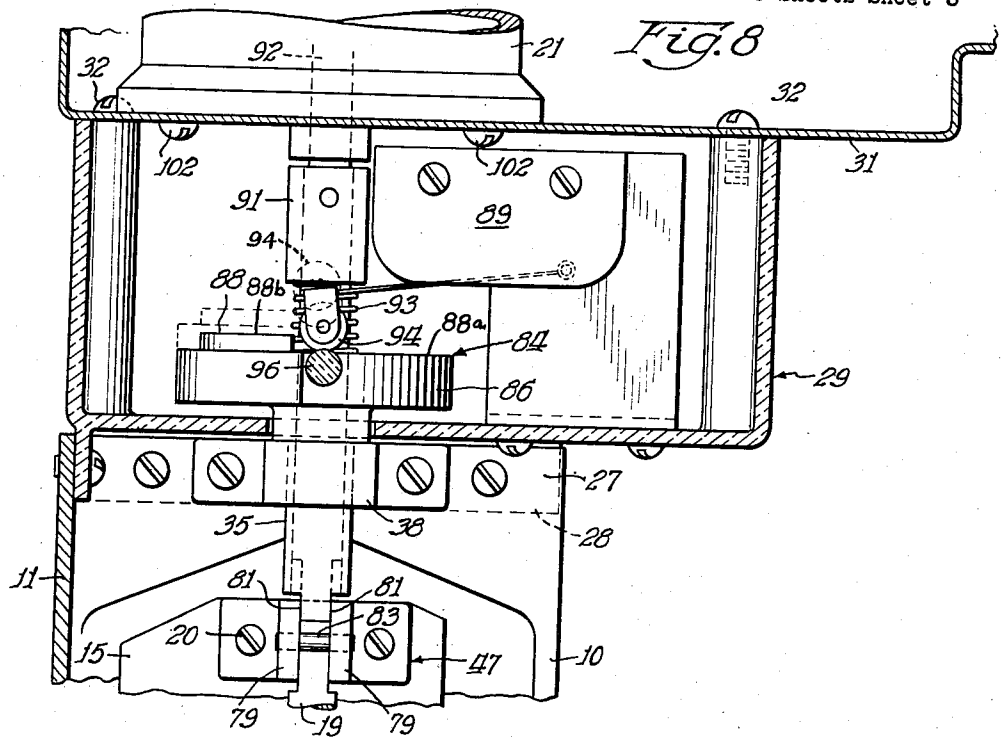

Fig. 7

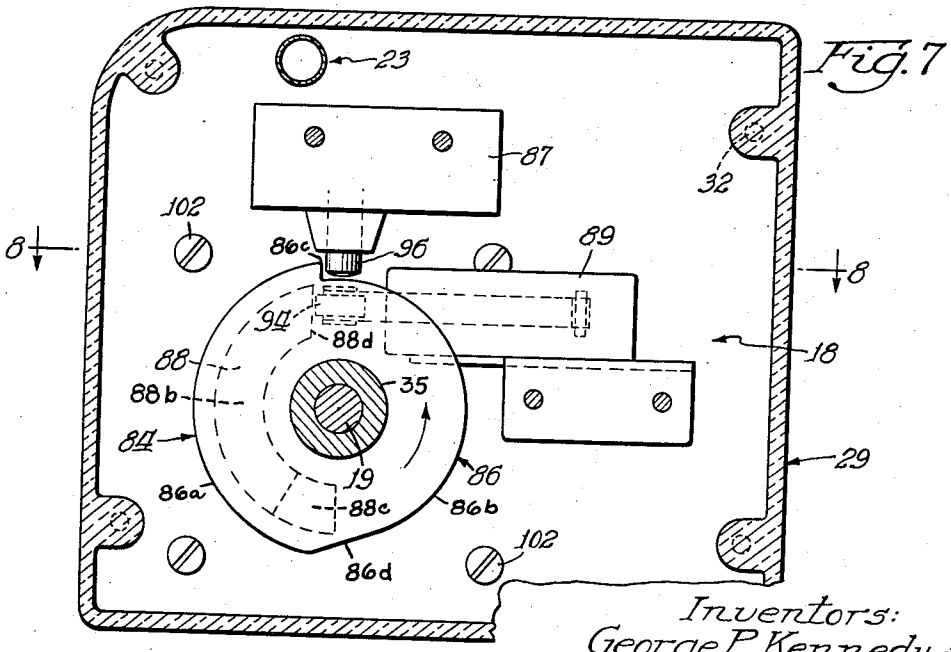

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Fig. 9

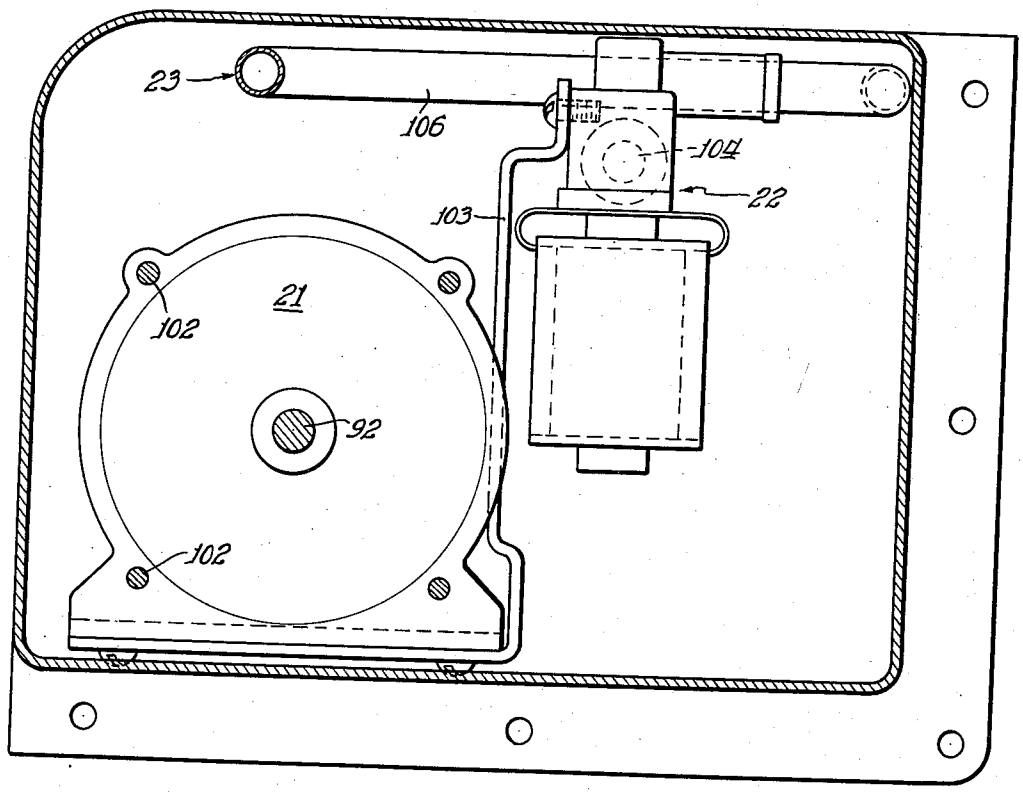
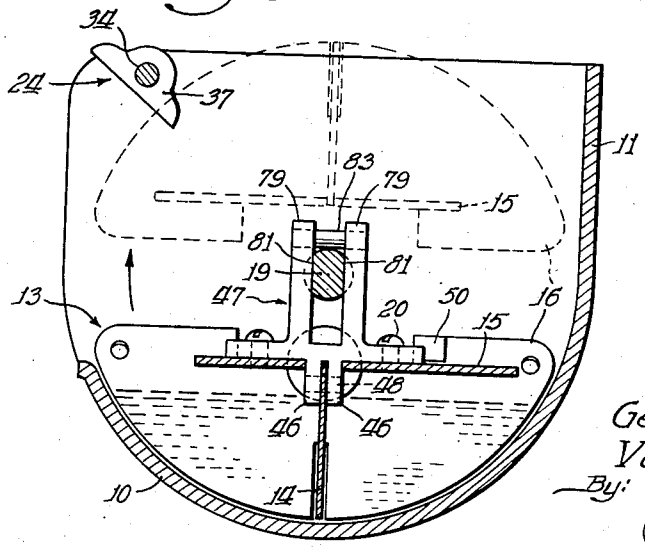


Fig. 6



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AUTOMATIC ICE CUBE MACHINE

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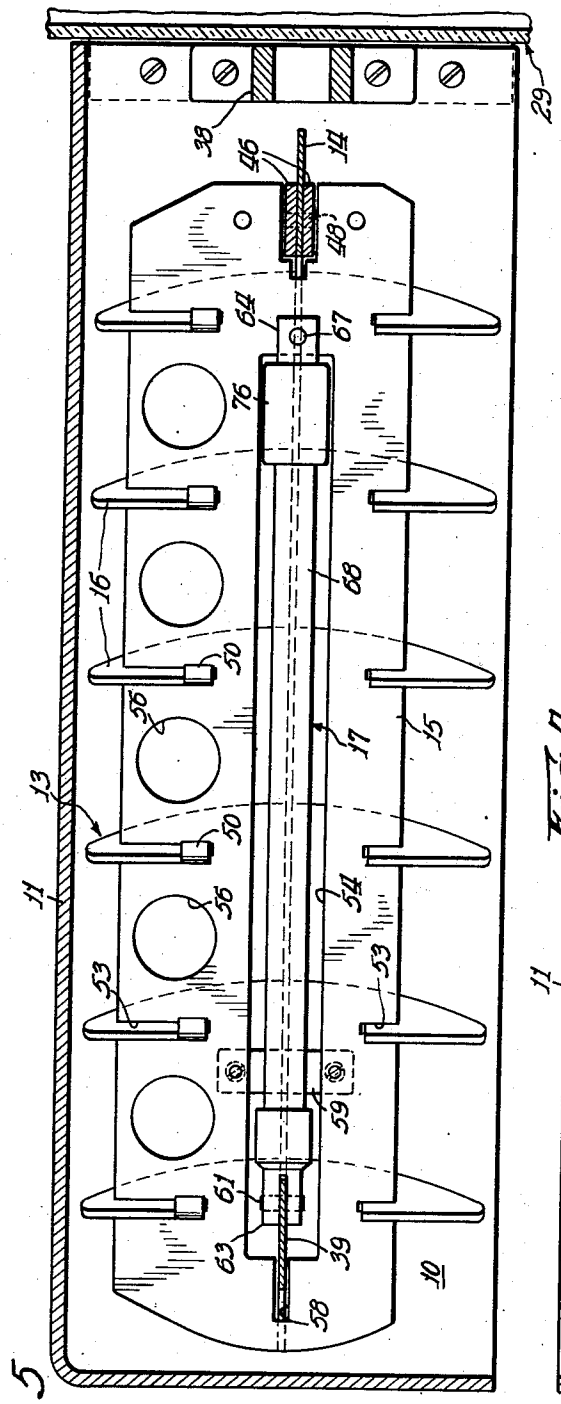

Fig. 5

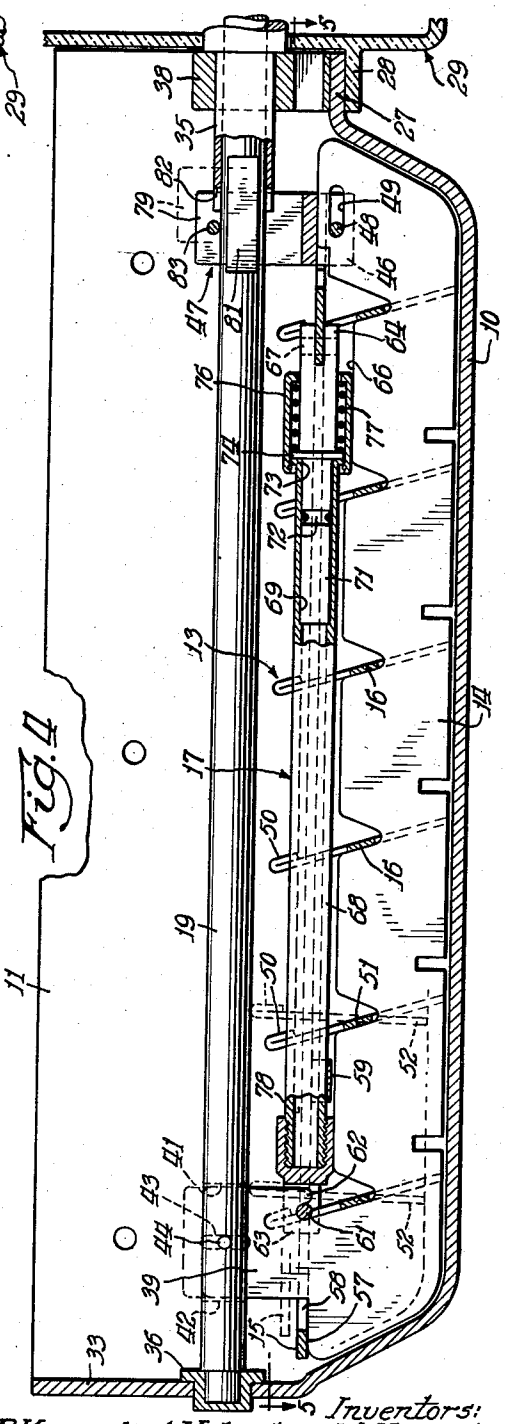

Fig. 4

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United States Patent Office

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AUTOMATIC ICE CUBE MACHINE

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Application August 15, 1955, Serial No. 528,475

19 Claims. (Cl. 62—7)

This invention relates to ice machines and more particularly to an automatic machine for continuously producing blocks or cubes of ice within the freezing compartment of a domestic refrigerator.

An object of the invention is to provide an automatic machine for producing a supply of ice cubes readily available and individually removable from a bulk storage bin located within the freezing compartment of a domestic refrigerator.

Another object of the invention is to provide an ice cube machine of the above general class having relatively simple structure, and compact design.

A further object of the invention is to provide an ice cube machine capable of producing batches of cubes continuously and automatically.

Another object of the invention is to provide an ice cube machine which automatically frees and dumps each batch of cubes.

Another object of the present invention is to provide an ice cube machine which is filled automatically with drinking water or other palatable fluid such as fruit juices, where the fluid is supplied through a connection to the domestic water system or from a container associated with the refrigerator.

A still further object of the invention is to provide an ice machine operable to maintain a predetermined quantity of ice cubes available in bulk from within the freezing compartment of a domestic refrigerator.

Other objects and features of the invention will become more apparent from a study of the appended specification and drawings wherein:

Fig. 1 is an elevational view of a portion of a conventional domestic refrigerator showing the disposition of the ice cube machine, and the ice cube basket within the freezing compartment of the refrigerator;

Fig. 2 is a vertical section through the ice cube machine of Fig. 1 as viewed in the plane of line 2—2;

Fig. 3 is a plan view of Fig. 1 as viewed in the plane of line 3—3;

Fig. 4 is an elevational view of a portion of Fig. 2 with certain parts thereof broken away to show the construction of the mechanism for freeing ice cubes from the grid structure;

Fig. 5 is a plan view of Fig. 4 as viewed in the plane of line 5—5;

Fig. 6 is a sectional view of the right end of Fig. 2 as viewed in the plane of line 6—6 and in the direction indicated by the arrows;

Fig. 7 is an elevational view of Fig. 2 as viewed in the plane of line 7—7 and showing to advantage the disposition of two (2) micro-switches with respect to an actuating cam;

Fig. 8 is a plan view of Fig. 7 as viewed in the plane of line 8—8;

Fig. 9 is a sectional view of a portion of Fig. 2 taken along the line 9—9 showing the means for mounting the power mechanism and the solenoid valve;

Fig. 10 is a wiring diagram showing the electrical circuitry of the ice cube machine;

An ice cube machine embodying certain features of the present invention may comprise a refrigerator having a freezing compartment, a fluid tight pan, a grid having a plurality of relatively movable, loosely interlocking grid elements disposed within the pan, said grid structure serving to define a plurality of regions wherein ice cubes may be frozen, hydraulic means for moving said grid elements relative to one another to free ice cubes frozen there-between, automatic means responsive to the hydraulic means for removing the grid structure from the pan whereby the ice cubes are swept out of the pan, said automatic means being effective to replace the grid structure within the pan.

Referring now to Fig. 1, there is shown a portion of a conventional domestic refrigerator having a freezing compartment A, and continuous evaporator B, forming the top, bottom and side walls of the freezing compartment. Located in the upper left hand corner of the freezing compartment is an ice machine C embodying the principles of the present invention. An ice cube storage basket D, having a hinged support is disposed below the ice machine and operates to accept and retain in bulk form ice cubes which are continuously produced by the machine C. The hinged basket D is provided with a limit switch operative after a predetermined number of ice cubes have been accumulated to shut down the ice cube machine until the supply thereof has fallen below a predetermined quantity.

Referring now to Fig. 2, there is shown an ice cube tray or pan **10** formed of aluminum or other suitable metallic material and having an upwardly extending bracket portion **11**, by which the pan is secured to the side wall of the refrigerator by the screws **12**. Removably disposed in the ice cube tray **10**, is a grid structure indicated generally by the reference numeral **13**. The grid structure is primarily for the purpose of subdividing the tray **10** into a plurality of small divisions wherein fluid such as drinking water, may be converted into a solid block or cube by freezing. Generally, the grid structure **13**, is composed of a vertical plate **14**, extending along the full length of the tray **10**, and being disposed substantially equi-distance from the side walls thereof. A plurality of divider plates **16** disposed generally normal to the vertical plate **14** loosely interlock and are relatively movable with respect to the vertical plate. The disposition of the divider plates **16**, and the vertical plate **14**, and the freedom for relative movement therebetween is more apparent from the showing of Figs. 4 and 5. The divider plates **16** (Fig. 4), are movable from a slanted position representing the position which they assume prior to operation of the hydraulic means to a substantially vertical position substantially normal to the bottom of the tray after operation of the hydraulic means. Each divider plate **16** is loosely interlocked with a horizontal plate **15**.

Thus, in an exemplary embodiment of the present invention, shown in Fig. 2 there is illustrated a portion of the evaporator B which encircles the freezing compartment, the ice cube tray **10**, grid structure **13**, a hydraulic power means **17** (sometimes referred to as an ice motor), switch mechanism **18**, a drive shaft **19**, an electric motor **21**, a solenoid operated water valve **22**, a water distributor tube **23**, an ice cube shedder **24**, and an ice cube storage basket **26**.

It is to be understood that the ice cube machine of the present invention may be disposed in any convenient location within the freezing compartment of a refrigerator as considerations of design, appearance and economy of manufacture may dictate.

It is to be further understood that the automatic supply of feed water for refilling the ice tray subsequent to the production of a batch of cubes, may originate through a permanent connection to the domestic water system or from a reservoir associated with the refrigerator and having no connection with the household water system.

For purposes of saving space and avoiding unnecessary protuberances upon the outer rear wall of the refrigerator, the electric motor **21** is nested between the inner and outer rear walls of the refrigerator, wherein the motor is surrounded by conventional insulating material, such as fiber glass or the like.

Having established an environment for the present invention, and having described one possible arrangement of the principal components thereof a detailed description of the ice cube machine will now be undertaken:

As indicated previously, the tray **10**, having an upstanding bracket portion **11** and having a semicircular configuration in cross-section (Fig. 6), is secured to the evaporator B by means of the screws **12**. A laterally projecting margin **27** of the tray (Fig. 2), overlays a similar projection **28**, extending from a plastic switch housing **29**, secured to the rear wall **31** of the freezing compartment by means of the screws **32** (Fig. 8). The left end of the tray **10**, formed with an upstanding ear **33** supports the left end of a shedder rod **34**, and the left end of the drive shaft **19** through a thrust bearing **36**. The shedder rod **34** carries a plurality of cam fingers **37**, spaced intermediate divider plates **16**, for a reason that will become more apparent as the description proceeds. The right end of the shedder rod **34** is suitably supported in the plastic housing **29**, while the right end of the drive shaft **19** is splined to a hollow shaft **35** in turn supported by the bearing **38** secured to the lapping projections **27** and **28**.

The grid structure **13** (Figs. 4 and 5) is composed of a centrally disposed vertical plate **14**, having an upstanding lug **39**, received into a slot **41**, formed in the drive shaft **19**. The lug **39**, adapted to bear upon the rear of the slot as at **42**, is formed with an elongated aperture **43** and is free to ride upwardly and downwardly upon a pin **44** rigidly fixed to the driving shaft.

As is more apparent in Fig. 4, the right end of the vertical plate **14** is supported and straddled by two depending arms **46** (only one shown), of a yoke element **47** rigidly mounted to the plate **15** by the screws **20** (Figs. 2 and 6). The arms **46** carry a pin **48** received into a horizontal slot **49** formed in the plate. The yoke **47** is thus free to move along the plate **14** and within the limits set by the slot **49** and the pin **48** when driven by the horizontal plate **15** as will be more apparent hereinafter.

Loosely interlocking the vertical and horizontal plates **14** and **15** respectively, and disposed transversely of the longitudinal axis of the tray are a plurality of divider plates **16**. As stated previously the vertical plate **14** and the divider plates **16** cooperate to divide the ice cube tray into a plurality of compartments for molding ice cubes by freezing drinking water or other platable fluid contained within the tray. It is to be noted that the divider plates **16** may be provided with a return bend portion **50** conjugable with the top surface of the horizontal plate **15**. As illustrated in Fig. 4, the divider plates **16** are normally inclined to the vertical and bear loosely upon the vertical plate **14** as at **51**. After ice cubes are molded and subsequent to the operation of the hydraulic power means **17** to free the cubes from the grid structure and the pan, the dividers assume a position generally normal to the bottom of the tray **10**, as indicated by the position of the several dividers referenced **52**.

The horizontal plate **15** overlays the grid structure **13**, and loosely interlocks the divider plates **16** by the engagement of the slots **53** therewith. The horizontal plate **15** acts to transmit power from the ice motor to the divider plates (in a manner that will be more apparent presently); consequently the horizontal plate may also be referred to as the driving plate. The plate **15** is formed with an elongated opening **54**, providing clearance for the ice motor **17** (Fig. 5). For considerations of rigidity and strength consistent with adequate access for fluid into the tray **10**, through apertures **56**, the driving plate **15** may be displaced towards the upstanding bracket portion **11** (Fig. 3).

As is apparent in Figs. 4 and 5, the rear end of the driving plate **15** is supported upon the vertical plate **14** as at **57**, and is formed with a slot **58**, which together with the elongated central opening **54** provides clearance for the upstanding lug **39** and permits the plate **16** to move to the right and upwardly relative to the vertical plate (Fig. 4). Note the dotted line position of plate **15**.

The rear end of the ice motor **17** is supported in a saddle **59**, secured to the under side of the driving plate **16** and is anchored to the upstanding lug **39** by the engagement therewith of a pin **61**. The pin **61**, of course, passes through a bifurcation **63**, which threadedly engages the ice motor with a hook **62** formed upon the ear. Since the lug **39** bears against the left side of the slot **41** formed in the drive shaft **19**, and the drive shaft in turn bears upon thrust bearing **36**, it is apparent that the rear end of the ice motor cannot move to the left with respect to the tray **10** (Fig. 4).

The forward end of the ice motor is formed with a bifurcation **64**, and is supported by the vertical plate **14** as at **66**. The bifurcation **64** makes a driving connection with the plate **16** by means of the pin **67**. The ice motor consists of a hollow tube **68** threadedly engaging the bifurcation **63** so as to make a liquid tight seal at the rear end thereof. The forward end of the tube is formed with a bore **69** for receiving a piston **71**. The piston **71** is integral with the bifurcation **64** and is formed with an under cut portion **72** for receiving a gasket or O-ring so as to provide a running fit between the piston and the tube and also a liquid tight seal. The forward end of the tube **68** is formed with a circular flange **73**, which acts as a stop for a flange **74** formed upon the piston. Surrounding both flanges and held fixed against axial movement to the right by a snap ring, is a housing **76**. The housing is formed with a bore to provide clearance for the piston and encloses a coil spring **77**, which bears upon the housing and the flange **74** for constantly urging the piston to the left (Fig. 4), to maintain the flanges **73** and **74** in abutting engagement. The cylindrical void **78** within the tube **68** is filled with a suitable fluid such as water or a mixture of water and sodium nitrite or water and sodium-metasilicate which have a freezing point below the freezing point of water. Upon freezing the fluid contained within the void sufficient expansion will occur to drive the piston to the right against the spring **77**, thus driving the plate **15** to the right. Since the plate **15** is in interlocking engagement with the divider plates **16**, the divider plates will be rotated to the dotted line position shown in Fig. 4. It will be recalled that the yoke **47** is rigidly mounted to the plate **15**, thus it will also move to the right. It is to be further recalled that the yoke and the plate will move relative to the vertical plate **14** by virtue of the clearance provided by the slot **49**.

Referring now to Figs. 4 and 6, it is apparent that the yoke **47** is formed with two upstanding arms **79**, which straddle the drive shaft **19** in the region of the flats **81** formed on the drive shaft. The forward end of the drive shaft is disposed in telescoping but splined engagement with respect to the hollow shaft **35**, in turn slidably and rotatably supported upon the bearing **38**. In other words, the hollow shaft **35** is free to move axially with respect to the drive shaft, but is also capable of rotating with the shaft **19**. The forward ends of the upstanding arms **79** may engage the hollow shaft **35** as at **82**, so that upon operation of the ice motor

piston 71 to the right, the yoke 47 is correspondingly driven to the right and the yoke in turn drives the hollow shaft to the right.

As stated earlier and for a reason which will become more apparent hereinafter, the driving plate 15 tends to move upwardly to a plane represented by the dotted line position thereof shown in Fig. 4, when the piston drives the plate to the right. Since the yoke is secured to the driving plate, it will necessarily move upwardly and to the right to the dotted line position shown in the right hand side of Fig. 4. The yoke is free to move in such fashion by virtue of the fact that the arms 79 slide along the flats 81. A pin 83 is provided solely for the purpose of preventing the yoke from moving downwardly with respect to the drive shaft 19.

Referring now to Figs. 2, 7, and 8, it is apparent that the hollow shaft 35 extends through the housing 29 and carries the actuating cam 84. The cam 84, integral with and formed as a continuation of the hollow shaft 35, has a peripheral face 86 provided with radially and circumferentially spaced, substantially concentric, arcuate surfaces 86*a* and 86*b*, terminating at adjacent ends thereof by an abrupt shoulder 86*c* and having a flat cam surface 86*d* between and connecting the other ends of the surfaces 86*a* and 86*b*. The cam 84 also has a lateral face 88 defined by a flat surface 88*a* and a raised cam surface 88*b*, said surfaces lying in parallel planes, opposite ends of the cam surface 88*b* at the juncture of said flat surface 88*a*, being defined by a sloping, leading shoulder 88*c* and a trailing shoulder 88*d*. The cam member 84 is rotatable in a counterclockwise direction as shown by the arrow in Fig. 7, the abrupt shoulder 86*c* on the peripheral face 86 lying behind of and adjacent to the leading shoulder 88*d* of the lateral face 88, in the direction of rotation of the cam member 84, and the flat cam surface 86*d* on the peripheral face 86 lying ahead of and adjacent to the raised flat surface 88*b* on the lateral face 88. The flat cam surface 86*d* is provided for energizing a micro-switch 87 and the abrupt shoulder 86*c* is provided for deenergizing the micro-switch 87. The drive shaft 19 makes a splined connection with a coupling 91, rigidly fastened to a shaft 92 driven by the electric motor 21. A spring 93 is disposed between the splined coupling 91, and the cam 84, and acts to urge the cam, as well as the hollow shaft 35, to the left as viewed in Fig. 2. The flat surface 88*a* is effective upon movement of the hollow shaft to the right in response to the operation of the ice motor as hereinbefore described, to cause a follower 94, integral with the microswitch 89, to be depressed to close the switch whereby the electric motor 21 is energized to rotate the shaft 19 in a counterclockwise direction (as viewed in Fig. 7), rotating the coupling 91 and the hollow shaft 35. The grid structure is thereby rotated, preferably at a speed of about 1 R. P. M. through 360°. The grid structure is rotated with and about the shaft 19, of course, by virtue of the connection between the shaft and the lug 39 and by virtue of the connection between the shaft, the yoke 47 and the vertical plate 14 (Fig. 4).

During the course of the rotation of the grid structure, a follower 96 follows the arcuate surface 86*b*, gradually depressing the follower until the follower is sufficiently depressed and rides upon the arcuate surface 86*a* to operate the micro-switch 87, which in turn energizes the solenoid operated valve 22 to admit domestic water to a distributor tube 98. It is clearly apparent that this operation is effected by the follower 96 engaging the flat surface 86*d* of the cam member 84 and remaining depressed while the follower 96 remains in engagement with the surface 86*a*. Upon the follower 96 riding over the abrupt shoulder 86*c*, the follower 96 will move outwardly of the switch 87 to break the contact to the solenoid-operated valve 22.

The distributor tube 98 is formed with a plurality of apertures 99, so disposed with respect to the ice motor 17, that domestic water passing through the tube is showered upon the ice motor before entering the apertures 56 to refill the ice cube tray 10. (The tube 98 may have a small heater clipped thereto operative to keep the apertures 99 free of ice.) This flow path has been selected so that upon discharge of molded ice cubes from the tray in a manner which will become apparent hereinafter, the frozen fluid in the ice motor will be melted by the showering water, thus permitting the spring 77 to return the piston 71 to its original position, namely, to that position wherein the flanges 73 and 74 abut.

It is obvious, of course, that as soon as the fluid within the ice motor is melted, the piston 71 necessarily moves to the left as viewed in Fig. 4 by virtue of the action of the coil spring 77 previously described. Correspondingly, the plate 15, the upstanding arms 79 and the hollow shaft 35, will necessarily carry the actuating cam 84 to the left in response to the coil spring 93. In order to compensate for this motion of the hollow shaft to the left, which incidentally occurs gradually, and after the solenoid operated valve 22 has been opened to admit fluid to the distributor tube, the raised cam surface 88*b* of the cam member 84 is effective to maintain the follower 94 depressed and the micro-switch 89 closed until a full 360° rotation of the shaft has completed to return the grid structure 13 to its original position. As stated previously, upon completion of a full rotation of the shaft 19, and upon returning the grid structure to the ice cube tray 10, the follower 94 will drop off of the surface 88*b* upon encountering the shoulder 88*d* to move the follower 94 away from the micro-switch 89 to open the micro-switch and to de-energize the motor 21.

As is apparent in Figs. 2, 7, 8 and 9, the switching mechanism including the two micro-switches and the actuating cam are housed within the plastic housing 29 mounted upon the back wall 31 of the freezing compartment. The electric motor 21 is suitably fastened as by the screws 102 to the opposite side of the back wall and carries a bracket member 103 for supporting the valve 22. An examination of Fig. 3 reveals that the valve is fitted with an inlet tube 104 in the form of suitable copper tubing or plastic tubing. The inlet may be connected to the domestic water system of the household or may communicate with a reservoir of domestic water suitably located upon or around the refrigerator. Domestic water then may flow through the valve and immerge therefrom through a conduit 106, which passes through and is supported by the rear wall 31 of the freezing compartment and the wall 107 of a plastic housing.

It is noteworthy that the electric motor, as well as the solenoid operated valve, are disposed within the inner and outer shells of the refrigerator in an area which, except for the disposition of these elements therein, is occupied by conventional insulating material.

It is further noteworthy that the ice cube tray has a semi-circular configuration in cross section, and that the dividers 16 are also formed in the lower edges thereof in semi-circle fashion so as to complement the configuration of the ice cube tray and to lend themselves to convenient rotation therefrom.

Referring now to Figs. 1 and 2, it is apparent that the basket 26, which acts as a receptacle for molded ice cubes, is disposed below the tray 10. The basket may be formed of plastic or other suitable material such as aluminum, and is supported on a platform 115 which is hinged as at 108 at one end thereof to a plate 116 which rests on the bottom wall of the freezing compartment. Between the plates 115 and 116 at the ends thereof remote from the hinge 108 are disposed a pair of springs 109, having sufficient compressive strength to maintain the basket

normally at a height sufficient to permit an arm **111**, intergral with and extending upwardly from the plate **115**, to clear an actuator **112** of a micro-switch **113**. The springs **109** have been so selected to permit the basket, after it has been filled with a predetermined quantity of cubes, to pivot about the hinges **108** to allow the arm **111** to move the actuator **112** to open the switch **113**.

As will be apparent from Fig. 10, wherein there is disclosed the electric circuitry of the present invention, opening the switch **113** to cut off all power to the ice cube machine precludes operation of the machine until a sufficient quantity of cubes have been removed from the basket whereupon the switch will be closed and cyclic operation of the machine will resume. It is further apparent in Fig. 10 that the micro-switch **89** is in series with the electric motor **21**, while the micro-switch **87** is in series with the winding of the solenoid operated valve **22** connected across the line.

Operation

In describing the operation of the disclosed ice cube machine embodying the principles of the present invention, assume that the operation of the valve **22** has admitted a metered quantity of water to the tray and the tray is filled to the level shown in Fig. 6 with domestic water and that the fluid within the ice motor is melted. In this condition the piston **71** will be in the position shown in Fig. 4 and the divider plates **16** will be inclined to the vertical as shown in solid lines. The hollow shaft **35** supporting the actuating cam **84**, will be at its extreme left as shown in Fig. 2 or solid line position as viewed in Fig. 8 with the micro-switch **89** open. The angular position of the cam will be as shown in Fig. 7, and the micro-switch **87** will also be in the opened condition. Assumed further that the basket **26** is void of cubes; correspondingly the micro-switch **113** will be closed, thereby admitting power to the switches **87** and **89**. Since the ice cube machine is disposed within the freezing compartment of a refrigerator, the temperature of the air therein will necessarily be substantially below 32° F. and the water within the ice cube tray will begin to freeze. During the course of freezing cubes, the heat that necessarily must be removed from the water, as well as from the metal of the tray itself will flow upwardly and toward the ice motor. This action develops sufficient warmth and coupled with the slower freezing of the liquid in the ice-motor is effective to preclude freezing the fluid within the ice motor until an appreciable interval subsequent to freezing the cubes. Ultimately, and after the water in the tray **10** is frozen into ice cubes, the fluid within the ice motor **17** is frozen with sufficient expansive force that the piston **71** is moved to the right against the spring **77**. Since the piston is connected to the driving plate **15**, which in turn engages the divider plates **16**, the ice motor acts to rotate the dividers to a substantially vertical position as shown in dotted lines in Fig. 4. The yoke mechanism **47** mounted upon the driving plate is in turn driven to the right as viewed in Fig. 2 and to the dotted line position shown in Fig. 8 with the result that the hollow shaft **35**, and the actuating cam **84**, are driven to the right to actuate the follower **94** to close the micro-switch **89**.

During the course of the operation of the ice motor or the hydraulic power means **17**, and the resultant rotation of the divider plates **16**, the ice cubes are forced to the left and upwardly as will be apparent from Fig. 4. Since the driving plate **15** overlies the ice cube grid structure, the loosened cubes will act to raise the plate to the dotted line position shown in Fig. 4. Since the yoke is mounted to the plate, it too will be raised to the dotted line position shown in Fig. 4.

The action just described, that is the rotation of the divider plates, operates to free the cubes from the tray, as well as from the grid structure. Since micro-switch **89** has been closed the electric motor **21** is energized and operates to rotate shaft **19**. It will be recalled that shaft **19** engages the ear **39**, formed on the vertical plate **14** and also engages the upstanding arms **79** of the yoke **47**, which in turn engages the vertical plate. Rotation of the shaft **19** in a clockwise direction (Fig. 6), will rotate the grid structure out of the ice cube tray. The grid structure will carry with it the loosened cubes, which if sufficiently freed, will drop by gravity into the basket below as soon as they clear the lip of the tray. To insure the removal of all cubes from the grid structure the shedder **24** is provided with a plurality of fingers **37**, which act to cam the cubes from between the dividers as the grid structure rotates. The shedder fingers first encounter those cubes molded on the left side of the tray as viewed in Fig. 6 and subsequently encounter those cubes on the right side in the course of the rotation of the grid structure.

After all cubes have been removed from the grid and with continued rotation thereof the follower **96** encounters the flat cam surface **86*d*** and thereafter the arcuate cam surface **86*a***. The cam thus acts to close the switch **87**, thus energizing the winding of the solenoid of the valve **22**. Water is admitted to the distributor tube and permitted to shower downwardly over the ice motor and ultimately into the tray **10** to fill the tray. As stated previously, the water which is relatively warm, melts the fluid in the ice motor and permits the ice motor to assume its original or contracted position. Obviously, the dividers are returned to their inclined position and although the hollow shaft **35** and the actuating cam are returned to the left in response to the spring **93**, the configuration of the rear face of the cam and more particularly the cam surface **88*b*** is so designed to maintain the micro-switch **89** closed until a full 360° revolution of the shaft **19** is completed. Upon completion of one full revolution, the two followers **94** and **96**, encounter abrupt "drop-offs" namely, the shoulders **86*c*** and **86*d*** respectively as is apparent in Figs. 7 and 8, and both switches **87** and **89** are permitted to open. The effect of this cam action is to close the solenoid valve **22**, and to shut down the electric motor **21**.

The ice cube machine is thus in condition to freeze a new batch of cubes and will continue cycling to freeze batches of cubes until the basket **26** is filled. Filling the basket will provide sufficient weight for the opening of the switch **113**, thus cutting off power to the machine until the accumulation of cubes therein has been reduced by the housewife.

It is anticipated that various arrangements and representations of the present invention may be undertaken without departing from the spirit and scope of the appended claims.

We claim:

1. In an ice making machine, a tray, a grid structure disposed within said tray and composed of relatively movable plates for dividing frozen material contained within the tray into blocks, said grid structure being rotatable relative to the tray, a first power means associated with the grid structure for moving the plates relative to one another and effective to loosen the blocks while said grid structure is disposed within said tray, a second power means connected to the grid structure and means operative in response to the operation of the first power means to actuate said second power means to rotate the grid structure with respect to the tray to remove the blocks from the tray.

2. In a machine for continuously making blocks of ice, a tray, a grid structure composed of relatively movable plates for dividing frozen material contained within the tray into blocks, said grid structure being rotatable relative to the tray, a first power means associated with the grid structure for moving the plates relative to one another and effective to loosen the blocks while said grid structure is disposed within said tray, a second power means connected to the grid structure and means opera-

tive in response to the operation of the first power means to actuate said second power means to rotate the grid with respect to the tray whereby the grid structure and the blocks are removed from the tray, and means disposed in the path of rotation of said grid structure for dislodging the blocks from the grid structure.

3. An ice making machine comprising a tray, a grid structure disposed in the tray and comprising a driving plate loosely interlocking a plurality of divider plates for dividing frozen material contained within said tray into blocks, said divider plates being movable from a first position to a second position, said grid structure being rotatable relative to the tray, an ice motor carried by and connected to the grid structure and having relatively movable members in contact with a freezing liquid and actuatable thereby and operable through the driving plate to move the divider plates from the first position to the second position to loosen the blocks from the tray while said grid structure is disposed within said tray, means responsive to the operation of the ice motor for rotating said grid structure relative to the tray to remove the blocks from the tray and means effective upon rotation of said grid structure through a predetermined angle to return the dividers to the first position.

4. In an ice making machine, a tray for containing a fluid adapted to be frozen, means for freezing the fluid, a removable grid structure composed of relatively movable plates for dividing the frozen fluid contained within the tray into blocks, said grid structure being rotatable relative to the tray, an ice motor carried by and connected to the grid structure and having relatively movable members in contact with a freezing liquid and actuatable thereby for moving the plates relative to one another and effective to loosen the blocks from the plates and from the tray while said grid structure is disposed within said tray, power means including a drive shaft connected to the grid structure and means operative in response to operation of the ice motor to actuate said power means to rotate the grid and the blocks with respect to the tray to remove the blocks from the tray, means including an actuating cam associated with the drive shaft and operable upon rotation of the shaft thru a predetermined arc to admit fluid to the tray.

5. An ice making machine comprising a tray, a grid structure disposed in the tray and comprising a driving plate loosely interlocking a plurality of divider plates, said divider plates being movable from a first position to a second position, said grid structure being rotatable as a unit about a horizontal axis relative to the tray, an ice motor carried by and rotatable with the grid structure and operable through the driving plate to move the divider plates from the first position to the second position to loosen the blocks while said grid structure is disposed within said tray, and means responsive to the operation of the ice motor for rotating said grid structure through a predetermined angle to return the dividers to the first position.

6. An ice making machine comprising a tray, a grid structure disposed in the tray and comprising a driving plate loosely interlocking a plurality of divider plates for dividing frozen material contained within the tray into blocks, said divider plates being movable from a first position to a second position, said grid structure being rotatable relative to the tray, an ice motor carried by and connected to said grid structure and having relatively movable members in contact with the freezing liquid and actuatable thereby and operable through the driving plate to move the divider plates from the first position to the second position, to loosen the blocks while said grid structure is disposed within said tray, power means tending to oppose movement of said movable members as the liquid freezes, mean responsive to the operation of the ice motor for rotating the grid structure relative to the tray to remove the blocks from the tray, and means effective upon rotation of the grid structure through a predetermined angle for melting the frozen liquid whereby said power means is effective to return the dividers to the first position.

7. In a machine for continuously making blocks of ice, a tray, said tray having a semi-circular configuration in cross section, a grid structure disposed in said tray and having a configuration in cross section complementary to that of said tray, means mounting said grid structure on a member whose axis corresponds substantially to the center of curvature of said tray, said grid being rotatable as a unit relative to the tray and means for rotating the grid structure relative to the tray whereby the grid is fully removed from the tray.

8. In an automatic machine for continuously making blocks of ice the combination of a tray, a grid structure disposed within the tray for dividing frozen material contained therein into blocks, said grid structure including a plurality of divider plates loosely interlocked by a driving plate, hydraulic power means supported by the grid structure and operatively connected to said driving plate, said hydraulic power means being operable to move the divider plates by operation of the driving plate and effective to free the blocks from the grid and from the tray while said grid structure is disposed within said tray, electrical power means including an electric motor and a drive shaft connected to said grid structure and rotatable in response to the operation of the hydraulic power means to remove the grid structure and the frozen blocks from the tray, and means including a cam and a switch responsive to rotation of the drive shaft thru a predetermined arc effective to admit fluid to the tray after the blocks have been removed.

9. In a machine for continuously making blocks of ice, the combination of a tray, a grid structure within the tray for dividing frozen material contained therein into blocks, said grid structure being composed of a plurality of relatively movable interlocking plates, a rotatable member mounting said grid structure for rotation with respect to said tray, an ice motor supported by the grid structure and operable to move the plates thereof relative to one another effective to loosen the blocks from the plates and from the tray while said grid structure is disposed within said tray, power means operatively connected to the rotatable member grid structure and effective to rotate the member and thereby the grid structure and the ice motor with respect to the tray whereby the grid and the loosened blocks are removed from the tray, said power means being operative in response to the operation of the ice motor.

10. In a machine for continuously making blocks of ice, the combination of a tray, a loosely assembled removable grid structure disposed within the tray for dividing frozen material contained within the tray into blocks, said grid structure being interlocked by a driving plate, hydraulic means supported by the grid structure and operable through the driving plate to free the frozen blocks from the grid structure and from the tray while said grid structure is disposed within said tray, and power means connected to the grid structure and means operable in response to operation of the hydraulic means for actuating said power means for removing the grid structure as well as the frozen blocks from the tray, said power means being further effective to return the grid structure to the tray automatically.

11. In a machine for continuously making blocks of ice, the combination of a tray, a grid structure disposed within the tray for dividing frozen material within the tray into blocks, hydraulic means supported by said grid structure and operable to free said blocks from the grid and from the tray while said grid structure is disposed within said tray, and power means connected to said grid structure and including an electric motor and a drive shaft operable in response to said hydraulic means for remov-

ing the grid structure and the frozen blocks from the tray, said power means being further effective to return said grid to the tray automatically.

12. In a machine for continuously making blocks of ice, the combination of a tray, a grid structure disposed within the tray for dividing frozen material within the tray into blocks, hydraulic means supported by said grid structure and operable to free said blocks from the grid and from the tray while said grid structure is disposed within said tray, power means connected to said grid structure and including an electric motor and a drive shaft operable in response to said hydraulic means for removing the grid structure and the frozen blocks from the tray, said power means being further effective to return said grid to the tray automatically, and means including a valve responsive to the operation of said drive shaft for admitting fluid to the tray after said blocks have been removed.

13. In a machine for continuously making blocks of ice, the combination of a tray, a grid structure disposed within the tray for dividing frozen material within the tray into blocks, hydraulic means supported by said grid structure and operable to free said blocks from the grid and from the tray while said grid structure is disposed within said tray, and power means connected to said grid structure and operable in response to said hydraulic means for removing the grid structure and the frozen blocks from the tray, said power means being further effective to return said grid to the tray automatically.

14. In an ice making machine, a tray for receiving a liquid to be frozen, means for freezing said liquid, a grid structure in the tray and composed of relatively movable plates for dividing the frozen liquid into blocks, power means associated with the grid structure for moving the plates relative to one another and effective to loosen the blocks from the grid structure and tray while said grid structure is disposed within said tray, a rotatable shaft, means connecting said grid structure to said shaft, motor means for rotating said shaft, and means on said shaft responsive to said power means to actuate said motor means to rotate said shaft and grid structure to remove said blocks from said tray.

15. In an ice making machine, a tray for receiving a liquid to be frozen, means for freezing said liquid, a grid structure in the tray and composed of relatively movable plates for dividing the frozen liquid into blocks, power means associated with the grid structure for moving the plates relative to one another and effective to loosen the blocks from the grid structure and tray while said grid structure is disposed within said tray, a rotatable shaft, means connecting said grid structure to said shaft, a cam member rotatable with and movable axially on said shaft, means operatively connecting said grid structure to said cam member, an electrical circuit, an electric motor in said circuit and adapted to drive said shaft, a switch in said circuit for controlling operation of said motor, said cam member being moved axially by the operation of said power means to actuate said switch to start operation of the electric motor to rotate the shaft and grid structure to remove the loosened blocks from the tray, and means associated with said cam member for inactivating said switch to stop the operation of the motor.

16. In an ice making machine, a tray for receiving a liquid to be frozen, means for freezing said liquid, a grid structure in the tray and composed of relatively movable plates for dividing the frozen liquid into blocks, power means associated with the grid structure for moving the plates relative to one another and effective to loosen the blocks from the grid structure and tray while said grid structure is disposed within said tray, a rotatable shaft, means connecting said grid structure to said shaft, a cam member rotatable with and movable axially on said shaft, means operatively connecting said grid structure to said cam member, an electrical circuit, an electric motor in said circuit and adapted to drive said shaft, a first switch in said circuit for controlling said motor, means for admitting liquid to said tray including an inlet valve, a second switch in said circuit for controlling said inlet valve, said cam member being moved axially by the operation of said power means to actuate said first switch to start operation of the electric motor to rotate the grid structure and thereby remove the loosened blocks from the tray, said motor also rotating said cam member through a predetermined angle to actuate said second switch to open said inlet valve to permit liquid to enter said tray, and means associated with said cam member for inactivating both said switches to close the liquid inlet valve and stop the operation of said motor.

17. In an ice making machine, a tray for receiving a liquid to be frozen, means for freezing said liquid, a grid structure in the tray and composed of relatively movable plates for dividing the frozen liquid into blocks, power means associated with the grid structure for moving the plates relative to one another and effective to loosen the blocks from the grid structure and tray while said grid structure is disposed within said tray, a rotatable shaft, means connecting said grid structure to said shaft, a cam member rotatable with and movable axially on said shaft, said cam member having a peripheral face provided with circumferentially spaced and also radially spaced outer and inner substantially concentric arcuate surfaces terminating at adjacent ends thereof by an abrupt shoulder and having a flat inclined surface between and connecting the other ends of said surfaces, means operatively connecting said grid structure to said cam member, an electrical circuit, an electric motor in said circuit and adapted to drive said shaft, a first switch in said circuit for controlling the operation of said motor, means for admitting liquid to said tray including an inlet valve, a second switch in said circuit for controlling said inlet valve and having normally open contacts positioned adjacent the inner radially spaced surface of the peripheral face of said cam, said cam member being moved axially by the operation of said power means to energize said first switch to start operation of the electric motor to rotate the grid structure and thereby remove the loosened blocks from the tray, said motor also rotating said cam member to close the contacts by engagement thereof with said flat surface and said outer surface to actuate said second switch to open said inlet valve to permit liquid to enter said tray, the contacts of said switch remaining closed until rotation of said cam causes said switch to pass beyond said abrupt shoulder of said cam member whereupon the contacts of said second switch open to close the liquid inlet valve, and means associated with said first switch to stop the motor.

18. In an ice making machine, a tray for receiving a liquid to be frozen, means for freezing said liquid, a grid structure in the tray and composed of relatively movable plates for dividing the frozen liquid into blocks, power means associated with the grid structure for moving the plates relative to one another from a first position to a second position and effective to loosen the blocks from the grid structure and tray while said grid structure is disposed within said tray, a rotatable shaft, means connecting said grid structure to said shaft, a cam member rotatable with and movable axially on said shaft, said cam member having a lateral face defined by a flat surface and an axially spaced cam surface, the juncture of said surfaces being defined by first and second shoulders disposed in spaced relation to the direction of rotation of said cam, means operatively connecting said grid structure to said cam member, and electrical circuit, an electric motor in said circuit and adapted to drive said shaft, a switch for controlling said motor, said cam member being moved axially by the operation of said power means to move said plates to a second position whereby said flat surface actuates said switch to start the electric motor to rotate the grid structure and thereby remove the loosened blocks from the tray, means for returning said plates to said first position, rotation of said cam causing

said first shoulder and said raised cam surface to maintain said first switch actuated after the plates have been returned to their first position and before the grid structure has been returned to the tray, further rotation of said cam member effecting movement of said second shoulder beyond said switch inactivating said switch when said grid has been returned to the tray.

19. In an ice making machine, a tray for receiving a liquid to be frozen, means for freezing said liquid, a grid structure in the tray and composed of relatively movable plates for dividing the frozen liquid into blocks, power means associated with the grid structure for moving the plates relative to one another from a first position to a second position and effective to loosen the blocks from the grid structure and tray while said grid structure is disposed within said tray, a rotatable shaft, means connecting said grid structure to said shaft, a cam member rotatable with and movable axially on said shaft, said cam member having a lateral face defined by a flat surface and an axially spaced cam surface, the juncture of said surfaces being defined by first and second shoulders disposed in spaced relation to the direction of rotation of said cam, means operatively connecting said grid structure to said cam member, an electrical circuit, an electric motor in said circuit and adapted to drive said shaft, a first switch in said circuit for controlling the operation of said motor, means for admitting liquid to said tray including an inlet valve, a second switch in said circuit for controlling said inlet valve, said cam member being moved axially by the operation of said power means to move said plates to a second position whereby said flat surface actuates said first switch to start the electric motor to rotate the grid structure and thereby remove the loosened blocks from the tray, said motor also rotating said cam member through a predetermined angle to actuate said second switch to open said inlet valve to permit liquid to enter said tray, means associated with said cam member for inactivating said second switch to close the liquid inlet valve, means for returning said plates to said first position, the rotation of said cam causing said first shoulder and said axially spaced cam surface to maintain said first switch actuated after the plates have been returned to their first position and before the grid structure has been returned to the tray, and further rotation of said cam member effecting movement of said second shoulder beyond said switch inactivating said first switch when said grid has been returned to the tray.

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