

Oct. 17, 1950

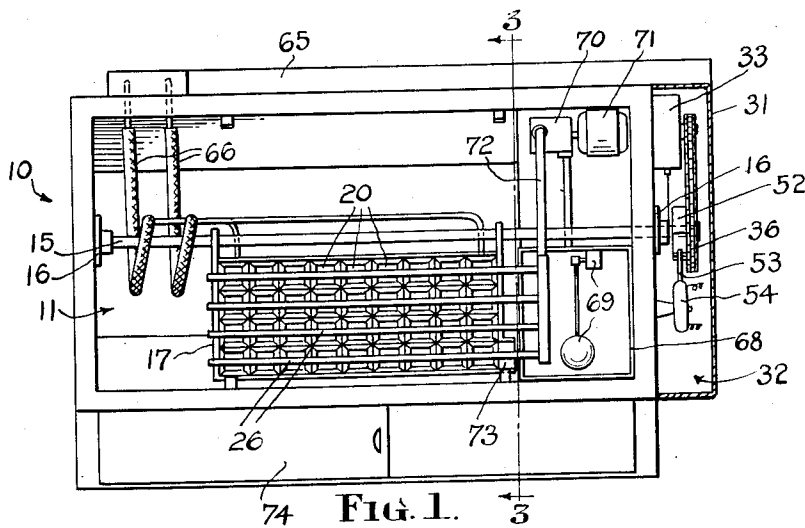
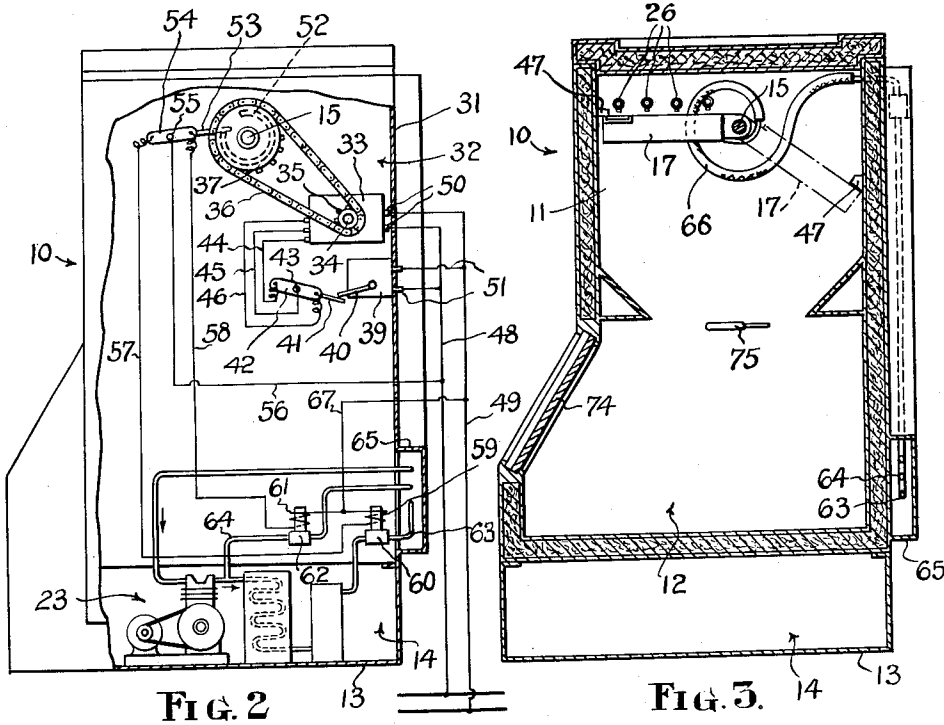
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2,526,262

AUTOMATIC ICE CUBE PRODUCING AND STORING APPARATUS

Filed Sept. 21, 1948

3 Sheets-Sheet 1



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AUTOMATIC ICE CUBE PRODUCING AND STORING APPARATUS

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3 Sheets-Sheet 2

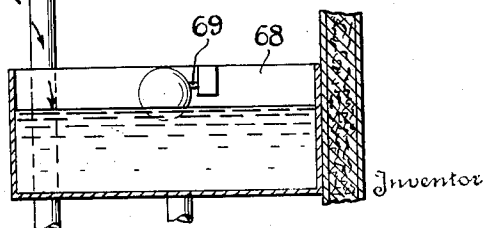
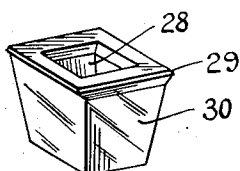
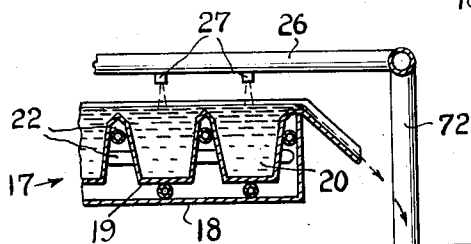
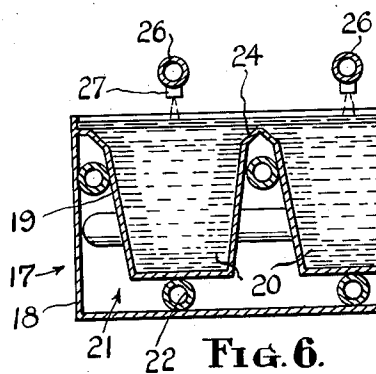
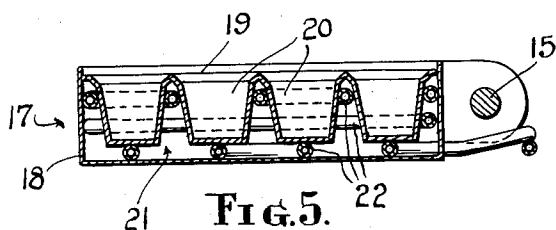
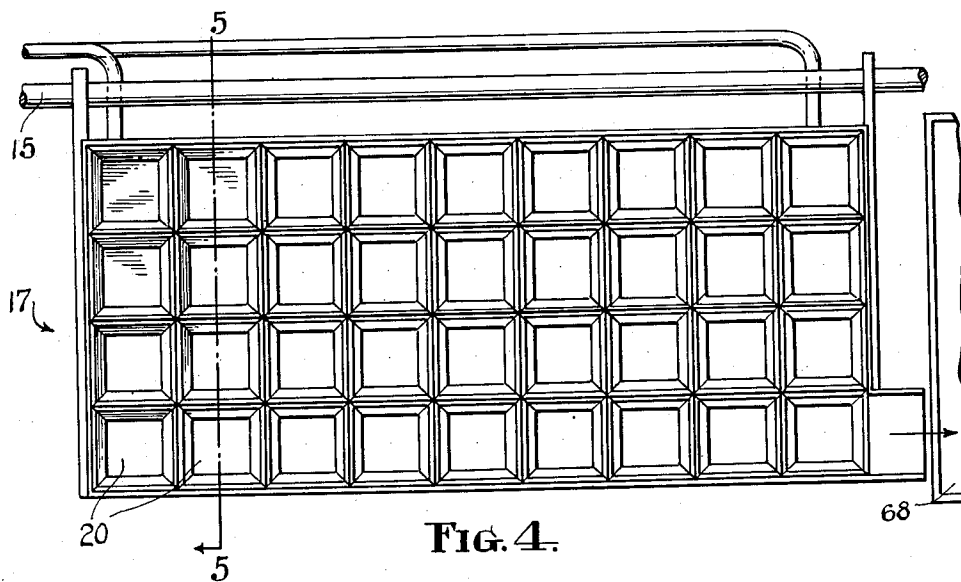


FIG. 8.

FIG. 7.

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AUTOMATIC ICE CUBE PRODUCING AND STORING APPARATUS

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3 Sheets-Sheet 3

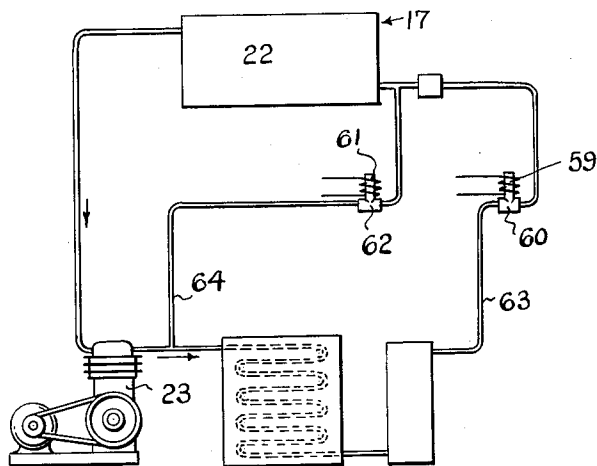


FIG. 9.

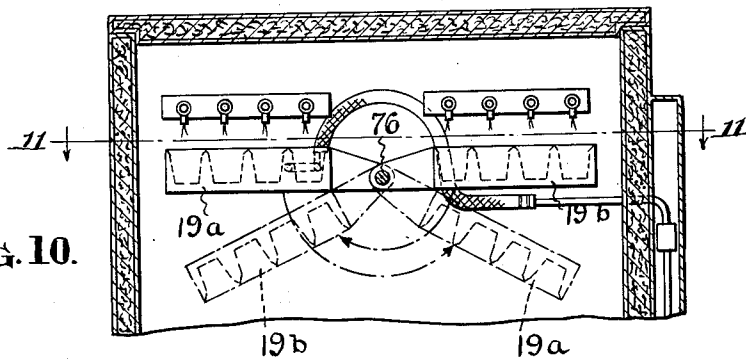


FIG. 10.

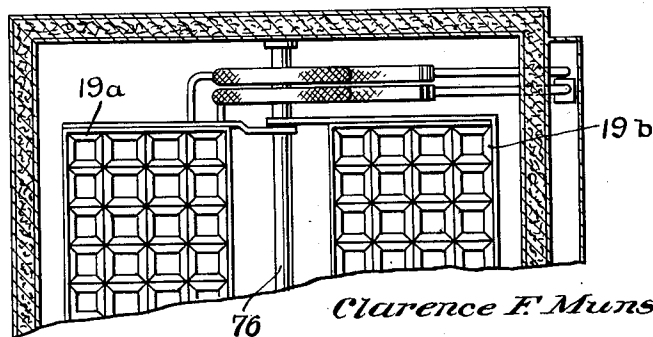


FIG. 11.

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AUTOMATIC ICE CUBE PRODUCING AND
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Application September 21, 1948, Serial No. 50,263

9 Claims. (Cl. 62-105)

1

This invention relates to ice-freezing apparatus and, with regard to its more specific aspects, is concerned with an ice-making machine adapted for the freezing of ice cubes of the type employed particularly in the cooling of beverages.

In hotels, restaurants, bars, hospitals and institutions, there is a very considerable demand for ice cubes for the cooling of various beverages. Where a large demand for such cubes or small ice blocks exists, it is a standard practice to purchase the same from commercial ice companies. While domestic refrigerators of the mechanically actuated type are customarily provided with ice cube-freezing means, their cube-forming capacity is so restricted that the same will not produce the volume of ice cubes needed for establishments of the kind indicated.

Accordingly, it is an object of the present invention to provide an ice cube-freezing machine adapted particularly for use in the operation of hotels, hospitals, institutions, restaurants and bars and wherein the machine possesses a cube-forming capacity adequate to meet the demands of such commercial establishments.

It is another object of the invention to provide an ice cube-forming machine which is substantially automatic in its operation and wherein the machine possesses cube-storage capacity so that the machine may be operated substantially continuously, whereby during periods of low or light demand for cubes, the machine will produce in storage an excess or reserve amount of finished cubes, so that during periods when the cubes are used in relatively large numbers, the same will be available in quantities meeting demands therefor.

For a further understanding of the invention, including additional objects, constructional details and operating advantages, reference is to be had to the following description and the accompanying drawings, wherein:

Fig. 1 is a top plan view of an ice cube-freezing machine formed in accordance with the present invention;

Fig. 2 is an end elevational view, with the cover plate removed, and disclosing the mold-actuating and timing mechanism utilized by the apparatus of the present invention;

Fig. 3 is a vertical transverse sectional view taken through the apparatus on the plane disclosed by the line 3-3 of Fig. 1;

Fig. 4 is a detail top plan view of the pivotally mounted cube-freezing mold or tray employed by the present invention;

Fig. 5 is a vertical transverse sectional view taken through the tray on the line 5-5 of Fig. 4;

2

Fig. 6 is a similar view on an enlarged scale, disclosing fragmentarily a portion of the tray and the means for supplying water to the cube-forming cavities or pockets of the tray;

Fig. 7 is a detail perspective view disclosing the shape of one of the so-called cubes or small blocks of ice produced by the apparatus comprising the present invention;

Fig. 8 is a detail transverse cross-sectional view disclosing the water overflow for the cube-freezing pans or trays;

Fig. 9 is a diagrammatic view of the refrigerating circuit, disclosing the valve-controlled shunt line for circulating warmed or heated gases through the cube-freezing trays for cube-releasing purposes;

Fig. 10 is a vertical sectional view taken through a modified form of the present invention, wherein dual cube-freezing trays or pans are utilized;

Fig. 11 is a horizontal sectional view on the plane indicated by the line 11-11 of Fig. 10.

Referring more particularly to the drawings, and to the form of my invention illustrated in Figs. 1 through 9 thereof, the numeral 10 designates a cabinet in which my improved ice-freezing mechanism is contained and supported. Advantageously, the cabinet is formed to embody outer walls of the type customarily found in refrigerator designs, the same being suitably insulated against heat-transmission losses. The walls of the cabinet are arranged to form internally and in the upper part of the cabinet a tray chamber 11 and in the bottom of the cabinet a cube-receiving compartment 12, which is of such volume as to possess storage capacity. The bottom of the cabinet is formed with a sub-base 13 which, in this instance, provides a space 14 in which may be positioned any suitable type of refrigerating or ice-producing mechanism by which a fluid refrigerant is reduced to sub-freezing temperatures when expanded.

Journalled in the upper portion of the tray chamber 11 is a rock shaft 15, the latter being suitably supported in bearings, indicated at 16, carried by the walls of the cabinet 10. In the particular embodiment of my invention now under consideration, the shaft 15 carries an ice-forming mold or tray 17, which is fixed to the shaft 15 to oscillate in unison therewith between a position of cube-freezing, as shown in full lines in Fig. 3, to a position of cube-discharge, as indicated by broken lines in Fig. 3. The tray or mold, in this instance, embodies an outer metallic shell 18 and an inner tray member 19. This member is formed to include a plurality of relatively

spaced pyramidal or cylindrical mold pockets or cavities 20, the walls of the latter being spaced from the adjacent walls of the shell 19, as disclosed at 21.

Occupying the space 21 and disposed immediately adjacent to and around the walls of the pockets or cavities 20 are pipes or tubes 22, constituting an expansion space for the fluid refrigerant released from the previously mentioned mechanically operated compressor and expansion unit 23 which is arranged in the space 14.

The pockets or cavities 20 are provided with open tops, see Figs. 5 and 6, and these tops are joined by webs 24, the latter being provided with oppositely inclined surfaces. Water is introduced into the pockets or cavities 20 by means of stationary cabinet-supported supply pipes 26, which are ported as at 27 in registration with the central portion of each of the pockets 20 when the tray occupies its horizontal or freezing position. During the freezing of the so-called cubes, water is constantly introduced into the center of each pocket so that the cube will freeze from its outer surfaces inwardly. The duration of the period of freezing is controlled so that at the end of said period, the water supplied to the pockets will be discontinued, leaving in each formed cube or block of ice an open-ended socket 28. The webs 24 enable each of the cubes or ice blocks to be united by relatively thin bodies of ice and these bodies are scored by means of the webs 24, so that when the tray is inverted to the dotted line position of Fig. 3, and the ice cubes fall out of the tray, the cubes readily separate as a result of the frangible nature of the connecting bodies.

While I refer to the formation of "ice cubes," it will be understood that by the use of this term I do not mean to exactly describe the exterior configuration of each of the small ice blocks produced by the mechanism. In the art, these small blocks are known as "ice cubes," regardless of their exterior form.

In the present mechanism, the cubes are, as shown in Fig. 7, smooth tapered cylindrical or pyramidal bodies 30 which at their tops are formed with the thin integral substantially square bodies 29. Other shapes may be imparted to the small ice blocks as may be desired.

It is preferable to provide the sockets or openings 28 axially in each cube, as such sockets or openings serve to increase the surface area of each cube or block so that the same has an accelerated action over solid cubes or blocks in the cooling of liquids in which the cubes are immersed.

To control automatically the operation of the tray or mold, I provide at one end of the cabinet a removable covering plate 31 which provides a timing-mechanism chamber 32. Mounted on the wall of the cabinet within this chamber is a reversible electric motor 33, whose armature shaft 34 is equipped with a sprocket 35. Around this sprocket passes an endless link chain 36, the latter being also trained over a larger sprocket 37, which is fixed to one end of the rock shaft 15.

Also mounted on the vertical end wall 38 of the cabinet below the motor 33, is a timer 39. This timer may be of the type including a synchronous alternating current motor, operated from a commercial house or building circuit, and serving at definite time intervals to rock a crank arm 40. Engageable with the arm 40 is a member 41 projecting from one end of a rockable

mercury tube switch 42, which is pivotally mounted on the wall 38 to turn about a pivot 43. The switch 42 is joined by means of three conductors 44, 45 and 46 with the motor 33. The conductors 44 and 46 extend to opposite ends of the switch 42, while the conductor 45 extends to the center of said switch or its pivot 43. With the tray 17 arranged as shown in Fig. 3, the switch 42 is positioned by the crank arm of the timer 39 so that the motor 33 is energized to maintain the tray in its horizontal position of cube-freezing, holding it firmly against an adjustable stop.

Through the automatic operation of the timer, when the period of freezing reaches a desired point of termination, the timer operates to move its crank arm 40 to a position causing the mercury tube switch to tilt and reverse the direction of rotation of the armature shaft of said motor, so that the tray swings from the full line position of Fig. 3 to the dotted line position. It will be understood that the motor 33 is of a type through which current may be passed when the motor is stalled without injury to the motor. Stop shoulders 47 may be provided within the cabinet to limit the swinging movement of the tray 17 in either its freezing or cube-discharging directions.

Current-supplying conductors 48 and 49 lead from a commercial source of current supply to the current input terminals 50 of the motor 33 and also to the corresponding terminals 51 of the timer 39. By this construction, it will be observed that the freezing tray is oscillated automatically at definite intervals between ice cube-freezing and discharging positions.

In order to control the flow of the refrigerant from the refrigerating unit 23 to the expansion pipes or tubes 22 of the tray structure when the latter occupies its horizontal freezing position, the sprocket 37, or the rock shaft 15, is provided with a cam 52. This cam coacts with a rigid operating extension 53 formed on a mercury tube switch 54 which is pivotally mounted as at 55 on the cabinet wall 38. A current-supplying conductor 56 leads from the conductor 48 to a central terminal 55 of the switch 54. Additional conductors 57 and 58 extend from terminals arranged at the ends of the tube of the switch 54, the conductor 57 leading to the windings 59 of a solenoid valve 60, while the conductor 58 extends to the windings 61 of a solenoid valve 62, the valves 60 and 62 being disposed on the end wall 38 in the chamber 32. Refrigerant-conducting pipes 63 and 64 are connected with the refrigerating unit 23 and extend to the inlet sides of the valves 60 and 62. The pipes also lead from the outlet side of said valves and pass through an L-shaped duct 65 mounted on the back wall of the cabinet 10. From the duct 65, the pipes 63 and 64 pass through the aforesaid back wall and enter the top of the tray chamber 11, where the pipes are joined with flexible helical loops or coils 66, which absorb thrusts or strains on the pipes due to the rocking motion of the tray structure 17 with which the refrigerant conducting pipes are connected. After forming the coil 66, the pipes 63 and 64 are passed through the walls defining the outer shell 18 of the tray structure and are joined with expansion pipes or tubes 22.

With the mercury switch 54 positioned as shown in Fig. 2, the windings 59 of the solenoid valve 60 are energized to open the latter against a spring-biasing force tending to normally main-

5

tain said valve in an open position. With the valve 60 open, the compressed refrigerant flows in a direction causing expansion thereof, producing sub-freezing temperatures in the tray structure. However, when the tray structure is rocked to its inverted cube-discharging position, the cam 52 operates the switch 54 to deenergize windings of the valve 60 and energize the field windings 61 of the valve 62, so that the direction of refrigerant flow through the pipes or tubes 22 of the tray structure is shunted.

With the valve 62 energized and open, heated refrigerant gases obtained from the unit 23 travel through the pipes or tubes 22 of the tray structure, thus providing a means for locally melting the ice cubes and breaking their adherence with the wall surfaces of the pockets or cavities 20, so that the formed ice cubes may gravitate from the tray structure and drop into the cube storage compartment 12 of the cabinet. Upon the completion of this discharge period, the timer 39 operates the motor 33 to return the tray structure to its freezing position. Return conductors 67 are joined with the windings 59 and 61 and lead to the return conductor 49.

Positioned in the cabinet 10 is an open-topped water reservoir or tank 68 in which a constant level of water is maintained by means of a float-valve mechanism 69. The water contained in the tank 68 is employed to fill the pockets or cavities 20 of the tray member or structure 19 for cube-producing purposes. Water is withdrawn from the tank 68 by means of a pump 70 which is driven by an electric motor 71, the latter being energized and deenergized simultaneously with the motor 33. Leading from the discharge side of the pump 70 is a pipe 72 which extends to the pipes 26 arranged over the tray member. With the motor 71 in operation, water is withdrawn from the tank 68 and delivered constantly to the pockets or cavities of the tray structure as long as the latter occupies its horizontal freezing position. The water is kept in a running or circulating state in that it serves to produce ice cubes characterized by their clarity and freedom from minute air voids or bubbles which produce opaqueness in ice cubes in which water is frozen while in a static condition. Cubes produced by the present invention are characterized by the crystal-like clarity.

It will be observed that the tray member at one end is formed with an overflow weir 73, the latter being disposed over the open top of the tank 68, so that the latter will receive the excess surplus and chilled water, permitting the chilled water to be recirculated until the cubes freeze sufficiently in the tray structure to produce the configuration illustrated in Fig. 7 in which the openings 28 are present. The cubes form by freezing inwardly and by regulating the duration of the freezing period and the diameter and size of the openings or sockets 28 in the cubes may be controlled.

In view of the foregoing, it will be seen that the present invention provides an automatically operating ice making machine which may be readily installed in restaurants, hotels, hospitals, institutions, bars or the like for producing small ice blocks in requisite quantities for beverage and other cooling purposes. The machine when properly adjusted will successively carry out its automatic working cycles without requiring manual attention. By forming the machine with the compartment 12, it possesses a sizeable storage capacity so that ice cubes may be frozen in quan-

6

tity during periods of low demand therefor and thus be available at periods when the demand for ice cubes exceeds the producing capacity of the machine.

The compartment 12 is made readily available and accessible by the provision of sliding doors 74 provided in an angularly sloping front portion of the cabinet. As a safety factor, the upper portion of the cube compartment 12 may be provided with a thermostatic switch 75. When the storage compartment 12 becomes filled with ice cubes to its intended capacity, the temperature of the cubes contacting the switch 75 will cause the latter to open so that electric current can not be supplied to the operating members of the machine. By this means, the machine is protected against overloading resulting from excess formation of ice cubes.

In the form of my invention illustrated in Fig. 10, use is made of a pair of cube-forming trays or pans shown at 19a and 19b. These trays are mounted for alternate swinging movement in a downward direction from the normal horizontal plane which they occupy and about a common axis indicated by the rod 76. When the contents of the tray 19a are frozen, said tray is rocked to a cube-discharging position shown in dotted lines and which is disposed beneath the tray 19b, the latter being maintained stationary during downward swinging movement of the tray 19a to and from its cube-discharging position. Upon release of the frozen cubes, which takes but a short time, the tray 19a is restored to its normal horizontal position, refilled with water and the freezing cycle resumed.

During the freezing of the water in the pan 19a, time is provided to complete the freezing of the cubes in the tray or pan 19b which, with the tray 19a maintained stationary in a horizontal position, is swung beneath the tray 19a to a cube-discharging position. By this arrangement, the machine possesses a much higher cube-producing capacity than the single tray machine disclosed in the previously described form of my invention and in addition, a substantially uniform load is maintained at all times on the refrigerating unit 23.

The trays 19a and 19b are oscillated through the use of the same type of motor-driven means employed in effecting the operation of the tray 17.

It will be understood that while I have described and illustrated what I consider to be certain preferred embodiments of my present invention, nevertheless various changes or modifications may be made in the construction from time to time as practice may dictate without departing necessarily from the spirit or scope of the following claims.

I claim:

1. In apparatus for producing small blocks of ice, a tray formed to provide inner and outer shells disposed in spaced relation and forming a chamber therebetween, the inner shell having a plurality of block-freezing cavities, a coil for the passage of a refrigerant positioned in said chamber in heat-exchanging relation with the walls of said cavities, means for introducing water into the tray cavities when the tray occupies a substantially horizontal position, means for circulating a heated fluid within said tray when the same assumes an inverted ice block-releasing position, and motor-driving means for rocking said tray between an active upwardly facing freezing position and an inactive downwardly facing block-releasing position.

2. Apparatus as defined in claim 1 for producing small blocks of ice, wherein the tray is mounted for swinging movement upon a longitudinal support arranged at one side of the tray.

3. In apparatus for producing small blocks of ice, a plurality of trays, each of said trays being constructed to provide inner and outer shells disposed in spaced relation to form a chamber therebetween, the inner shell having a plurality of block-freezing cavities, a coil for the passage of a refrigerant positioned in each of said chambers in heat-exchanging relation with the walls of said cavities, means for introducing water into the tray cavities when the trays occupy a substantially horizontal position, means for circulating a heated fluid within said trays when the same assume an inverted ice block-releasing position, and motor-driven means for rocking said trays between an active upwardly facing freezing position and an inactive downwardly facing block-releasing position.

4. In apparatus for producing small blocks of ice, a tray formed to provide inner and outer shells disposed in spaced relation forming a chamber therebetween, the inner shell having a plurality of block-freezing cavities, a coil for the passage of a refrigerant positioned in said chamber in heat-exchanging relation with the walls of said cavities, means for introducing water into the tray cavities when the tray occupies a substantially horizontal position, means for circulating a heated fluid within said tray when the same assumes an inverted ice block-releasing position, motor-driven means for rocking said tray between an active upwardly facing freezing position and an inactive downwardly facing block-releasing position, means for trapping water overflowing said tray, and means for returning the trapped overflowing water to the tray.

5. In apparatus for producing small blocks of ice, a tray formed to provide inner and outer shells disposed in spaced relation forming a chamber therebetween, the inner shell having a plurality of block-freezing cavities, a coil for the passage of a refrigerant positioned in said chamber in heat-exchanging relation with the walls of said cavities, means for continuously introducing water under circulating conditions into the tray cavities when the tray occupies a substantially horizontal position, said recirculating means including a pump driven by an electric motor, means for circulating a heated fluid within said tray when the same assumes an inverted ice block-releasing position, and motor-driven means for rocking said tray between an active upwardly facing freezing position and an inactive downwardly facing block-releasing position.

6. In apparatus for freezing small blocks of ice, a cabinet structure formed to provide an internal chamber, a tray disposed in said chamber formed with a multiplicity of cavities for the freezing of ice blocks, means arranged at one side of said tray supporting the latter for turning movement about a substantially horizontal axis, motor-driven means for imparting turning movement to said tray to move the same between a substantially upright block-freezing position and an inverted block-releasing position, mechanically operated means for circulating a cold refrigerant through said tray, a valve for governing the flow of said refrigerant from said mechanically operated means to said tray, and electrically actuated means operative automatically upon movement

of said tray from its upright position to actuate said valve to arrest flow of the refrigerant to said tray while the latter occupies its block-releasing position.

7. Automatic ice-cube-freezing and storing apparatus, comprising: a cabinet having thermally insulated walls defining a vertically disposed tray-receiving and cube-storing chamber, a tray supported in the upper part of said chamber for turning movement about a substantially horizontal axis, liquid supply means in the upper part of said chamber for introducing a liquid into said tray for cube-freezing purposes when said tray occupies a substantially horizontal position, motor-driven means for rocking said tray about said horizontal axis between cube-freezing and releasing positions, mechanically actuated means for circulating a fluid refrigerant through said tray, and flexible conduit means uniting a refrigerant outlet of said mechanically actuated means with said tray.

8. Automatic ice-cube-freezing and storing apparatus, comprising: a cabinet having thermally insulated walls defining a vertically disposed tray-receiving and cube-storing chamber, a tray provided with a multiplicity of cube-freezing cavities, means for supporting said tray for turning movement about a substantially horizontal axis between a horizontal position of cube-freezing and an inverted position of cube-discharge, motor-driven means for actuating said tray to turn the same between said positions at predetermined intervals of time, mechanically actuated means for producing a fluid refrigerant, conduit means uniting said refrigerant-producing means with said tray, a flow-controlling expansion valve positioned in said conduit means, and means actuated upon rocking movement of said tray to govern the operation of said valve to effect flow of the refrigerant in a vaporized state through said tray when the latter occupies its cube-freezing position and arrest flow of the refrigerant when said tray is moved to occupy its cube-discharging position.

9. Automatic ice cube freezing and storing apparatus, comprising a cabinet having thermally insulated walls defining a tray-receiving and cube-storing chamber, movable tray means in the upper part of said chamber, means cooperative with said tray means for freezing water therein to produce ice cubes when said tray means occupies a normal position of operation and releasing frozen cubes from said tray means when the latter occupies a second discharging position whereby to effect gravitational deposit of the frozen cubes in the bottom of said chamber, a mechanically actuated compressor-condenser unit, means for passing a fluid refrigerant developed by said unit through said tray means, an actuating circuit for said unit, and switch means responsive to an excessive accumulation of ice cubes in said chamber for opening said circuit to arrest automatically the operation of said unit.

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