The present invention relates to ice making machines of the type having a chambered ice forming mold and more particularly to an arrangement to facilitate the cleaning of the mold.

Many cities have ordinances relating to the handling of edible products which require the equipment used to be cleaned at stated intervals. Such ordinances apply to ice making machines and the cleaning of a chambered mold having a large number of cubicle cells presents a problem of considerable magnitude.

One of the objects of the present invention is to provide a construction and arrangement of elements in an ice making machine for cleaning an ice forming mold by actively agitating a cleaning fluid therein to thoroughly clean all of its surfaces and draining the cleaning fluid from the mold after a cleaning operation.

Another object of the invention is to utilize certain of the ice forming elements of the machine for performing a cleaning operation.

Still another object is to provide a control for the machine which may be manually actuated to discontinue an ice freezing and releasing operation and initiate a mold cleaning operation.

Fig. 1 is a diagrammatic view of an ice making machine having a chambered mold adapted for cleaning by the construction and arrangement of elements constituting the present invention;

Fig. 2 is a side elevational view of the mold and showing the operating mechanism for raising and lowering the plate and actuating the agitator;

Fig. 3 is a transverse sectional view showing the motor and reduction gearing unit of the platens operating mechanism;

Fig. 4 is a bottom plan view of the agitator operating mechanism;

Fig. 5 is a transverse sectional view taken on line 5—5 of Fig. 2 and showing the perforated agitator plate in the platens and the connection to its operating mechanism;

Fig. 6 is a detail view showing the Scotch yoke arrangement for reciprocating the agitator plate;

Fig. 7 is a perspective view of the top of the platens showing the perforated agitator plate mounted therein; and

Fig. 8 is a diagrammatic view of an electric control circuit for the ice making machine and showing the manual control for discontinuing an ice making operation while continuing operation of the agitator plate.

The mold 9 is successively cooled and heated by a serpentine coil 19 mounted on its top wall. Coil 19 has straight sections overlying the partitions 10 and curved end portions connecting the straight sections. Preferably, the coil 19 is attached in good heat conducting relation to the top wall of the mold 9 as by brazing, soldering or welding it thereto. One end of the coil 19 is connected to the refrigerant receiver 30 of a compression type refrigeration system by a conduit 21 having an expansion valve 22 therein. The opposite end of the coil 19 is connected by a conduit 23 to the suction side of a compressor 24 driven by an electric motor 25. The high pressure side of the compressor 24 is connected to a condenser 26 by a conduit 27 and the outlet from the condenser is connected to the receiver 30. A by-pass conduit 28 also is connected between conduit 27 at the high pressure side of compressor 24 and the inlet end of coil 19 and a solenoid operated selector valve 29 is provided at the juncture of the coil and conduits 21 and 28. Selector valve 29 connects conduit 21 to coil 19 through expansion valve 22 when the solenoid is deenergized and connects by-pass conduit 28 directly to the coil 19 when the solenoid is ener-
Platen 12 is mounted adjacent one side of mold 9 for downward and rocking movement to an inclined position below the mold. Trunnion pins 30 project from the opposite sides of the platen 12 and into one end of links 31, see Figs. 1 and 3, and the opposite ends of the links are pivotally connected to adjustable supports 32. Adjustable stops 33 limit the pivotal movement of the links 31 on supports 32 to regulate the downward movement of the platen 12 relative to the mold 9.

The mechanism for operating the platen 12 comprises a lever 34 pivotally connected to a bracket 35 at one end, an adjustable push rod 36 connecting the opposite end of the lever to the bottom of the platen and a cam 37 for rocking the lever, see Fig. 2. Cam 37 is mounted fast on a cam shaft 38 rotatable in bearing blocks 39 on a channel frame member 40, see Fig. 3, the cam shaft 38 having a slot 41 therein between the bearing blocks to accommodate the cam. Cam shaft 38 is rotated by an electric motor and reduction gearing unit 42 mounted on the side of the channel frame member 40. The shaft 39 extends beyond the bearing block 39 at the side opposite the motor unit 42 and mounts three cams 43, 44 and 45 for operating control switches 46, 47 and 48. Lever 34 is provided with a cam follower 49 intermediate its ends which engages the periphery of the cam 37. When the cam is in the position illustrated in Fig. 2, the platen 12 is pressed against the bottom of the mold 9; and when the cam is rotated 180° from the position illustrated in Fig. 2 the platen will be moved to an inclined position below the mold to open the bottom thereof.

The arrangement of the platen support, serpentine coil 18 and thermal element of a thermostat, later to be described in detail, is the same as that described and claimed in an application for Letters Patent of Dudley R. Cook filed concurrently herewith and entitled Refrigeration, now Patent No. 2,613,506.

In accordance with the present invention a construction and arrangement of elements is provided for supplying a cleaning liquid to the interior of the mold; agitating the cleaning liquid in the mold to thoroughly clean all surfaces of the molds therein; draining the cleaning liquid from the mold; and controlling the machine to discontinue an ice freezing and releasing operation and initiate a mold cleaning operation.

The cleaning liquid, such as water containing soap or a detergent, may be introduced into the mold 9 through the funnel tube 13 or through a similar but separate connection. The mold 9 is usually located in a suitable cabinet and enclosed in insulating material with the funnel tube 13 extending upwardly from the top of the mold above the insulation. By removing a top cover from the cabinet the cleaning liquid may be poured into the funnel tube 13 or if a separate connection to the exterior of the cabinet is provided the liquid may be introduced into the mold without removing the top cover of the cabinet.

The agitator for agitating the liquid in the mold, 9, and also for agitating the liquid to be frozen during an ice making operation, comprises a plate 50, see Figs. 5 and 7, having perforations therein underlying the cells 41 of the mold 9. The plate 50 is located in a recess 52 in the top of the platen 12 and mounted on the ends of pins 53 extending downwardly through bearing bosses 54 depending from the bottom wall of the platen. The lower ends of pins 53 are connected to a reciprocating frame 55, see Figs. 4 and 5. Flexible cups 51 of a material such as rubber, or the like, surround the pins 53 and are clamped in recesses 56 in the bottom wall of the platen 12 by clamping rings 59. The flexible cups 51 are clamped between the top of the pins 53 and washers 60 by means of flat head machine screws 61 extending through countersunk holes in the perforated plate 55 and screwed into tapped holes at the upper ends of the pins. Thus the frame 55, pins 53 and agitator plate 50 are connected for reciprocation as a unit and the joints between the pins and bottom wall of platen 12 are sealed by the flexible cups 51.

Frame 55 is reciprocated by an electric motor 62 mounted on the bottom of the platen 12 and a shaft 63 connected to the motor 62 through a flexible coupling 64. Shaft 53 is journaled in a bearing 65 depending from the bottom wall of platen 12 and has a disk 66 at its outer end with an eccentric crank pin 67. Crank pin 67 projects into a longitudinal slot 68 in a depending flange 59 on the frame 55, see Fig. 6, and the pin and slot constitute a Scotch yoke connection for translating the rotary motion of the motor to reciprocation of the frame 55.

Cleaning liquid is drained from the platen 12 after a cleaning operation by means of a manually operable drain cock 70 in the bottom wall of platen 12. The drain cock 70 may take a variety of forms and, as illustrated, is of a well known type having a tubular body with threads at one end screwed into a tapped hole in the bottom wall of the platen 12 and a manually operable valve member 71. With the valve member 71 in the position illustrated in Fig. 5 the drain cock is closed to retain liquid in the mold 9 and by manually rotating the valve member a quarter turn of the drain cock is opened to drain cleaning liquid therefrom.

The operation of the ice making machine is controlled by a thermostat 72 having bulb 73 mounted on and responsive to the temperature of one side of the mold 9. Bulb 73 is connected to an expandable bellows 74 by a capillary tube 75 and the bellows is connected to operate a single-pole double-throw switch 76. The thermostatically operated switch 76 is connected in the electric control circuit, including the operating elements of the machine and control switches previously described to automatically control the operation of the machine. The electric circuit comprises line conductors 77 and 78, see Fig. 8, and the agitator motor 62 is connected across the line for continuous operation as controlled by a line switch 79. Line conductor 78, beyond its connection with the motor 62, is connected to a conductor 80 by a manually operable switch 81. Compressor motor 25 is connected across the line between conductor 80 and conductor 77 for continuous operation when manual switch 81 is closed. Conductor 80 also is connected to a pole of thermostatic switch 76. Low temperature contact 82 of switch 76 is connected to one side of the solenoid of selector valve 29 and the other side of the solenoid is connected to conductor 83. Low temperature contact 82 is also connected to the pole of switch 46 operated by cam 43 on cam shaft 38. Contact 83 of cam switch 46 is connected to one side of the platen-operating motor 42 by a jumper 84 so that when the cam switch is closed a circuit is completed to lower the platen 12. When cam shaft 38 has rotated 180° cam 43 will have opened switch 46 to hold the platen 12 in an open inclined position below the mold.
from low temperature contact 82 of the thermostatic switch 16 through cam switch 46 and jumper 84 to energize the platen motor 42. Platen motor 42 operating through reduction gearing rotates cam shaft 38 which permits the platen 12 to move downwardly to an inclined position below the mold 9. After 180° of movement of cam shaft 38, cam 43 opens switch 45 to stop the operation of platen motor 42 and hold the platen 12 in its lowered inclined position below the open bottom of the mold 9 and cam 44 closes switch 47. The heating of the mold 9 melts the ice at its contacting surfaces with the mold so that the ice may fall by gravity from the mold and onto the inclined platens 12.

When the ice is released and falls from the mold 9, the temperature of the latter rises rapidly, due to the heated gas in the coil 19, and operates the pole of thermostatic switch 76 from the low temperature contact 82 into engagement with the high temperature contact 85. A circuit is then completed through the then closed switch 47 to energize platen motor 42 which operating through the cam 37, lever 34 and push rod 36 moves the platen 12 into closed position against the bottom of the mold 9, as shown in Fig. 2. At the end of the closing movement of the platen 12, cam 45 closes switch 48 which completes a circuit from high temperature contact 85 through float operated switch 18 to energize the water valve 15 to again supply water to the mold 9. Thus, an ice freezing and releasing cycle is completed and a new cycle automatically initiated.

When it is desired to clean the mold 9, control switch 81 is manually opened with the platen 12 in the closed position illustrated in Fig. 2. Opening of switch 81 deenergizes the refrigerant motor 25, the selector switch 29, the platen motor 42 and the water valve 15 to discontinue an ice freezing and releasing operation. With neither refrigerant nor heating gas being supplied to coil 19, the mold 9 is subjected to the temperature of the ambient and holds switch 76 in the full line position illustrated in Fig. 8. A cleaning liquid such as soapy water or detergent is then poured through the funnel tube 13 into the interior of the mold 9. The motor 62 continues in operation and operating through the shaft 53 and Scotch yoke 87 and 68 reciprocates the frame 55 and agitator plate 50 connected thereto through the pins 53. Reciprocation of the agitator plate 50 splashes the cleaning liquid against all surfaces of the cells 11. After the agitator plate 50 has been operated for a sufficient period of time to thoroughly clean all surfaces of the mold 9, the valve 71 of the drain cock 70 is opened to drain the cleaning liquid from the mold. Preferably, fresh water is thereafter supplied through the funnel tube 13 which is also agitated by the plate 50 to rinse the cleaned mold. After a cleaning operation has been completed the drain cock 70 is closed by turning valve 74 and switch 81 is manually operated to closed position. Refrigerant motor 25, solenoid valve 29, platen motor 42 and water valve 15 are then energized as controlled by the various switches in the control circuit to initiate an ice freezing operation. Thus, the operation of the machine is controlled by the manual switch 81 to terminate ice freezing and releasing operations and initiate cleaning of the mold or vice versa.

It will now be observed that the present invention provides for cleaning the mold of an ice making machine by actively agitating a cleaning
fluid in the mold to thoroughly clean all surfaces thereof. It will also be observed that the present invention utilizes the ice freezing agitator of the machine to perform a mold cleaning operation. It will still further be observed that the present invention provides a control which may be manually actuated to control the machine for an ice making or mold cleaning operation.

While a single embodiment of the invention is herein illustrated and described, it will be understood that changes made be made in the construction and arrangement of elements without departing from the spirit or scope of the invention. Therefore, without limitation in this respect, the invention is defined by the following claims.

1. An ice making machine having surfaces on which liquid is frozen and ice released therefrom, means for cleaning said surfaces comprising a structure cooperating with the surfaces for retaining a cleaning liquid in contact with at least a portion of said surfaces, reciprocating mechanism for actively agitating the cleaning liquid to cause it to continuously contact and bathe the surfaces, and a connection for draining the cleaning liquid from the machine.

2. In an ice making machine, a mold in which liquid is frozen and ice released therefrom, means for cleaning the mold comprising mechanism for closing the mold, a connection for supplying a cleaning fluid to the interior of the closed mold, reciprocating mechanism in the mold for agitating the cleaning fluid to thoroughly clean all surfaces of the mold, and a connection for draining the cleaning fluid from the closed mold.

3. In an ice making machine, a mold, elements cooperating with said mold to close it and freeze liquid therein or open it and release ice therefrom, a connection for supplying cleaning fluid to the interior of the closed mold, reciprocating mechanism in the closed mold for agitating the cleaning fluid to thoroughly clean all surfaces of the mold, a connection for draining the cleaning fluid from the closed mold, and means for controlling the operation of the elements to discontinue an ice making operation and initiate a mold cleaning operation.

4. In an ice making machine, a mold, a connection for supplying liquid to the interior of the mold, means for agitating the liquid in the mold, means for successively cooling the mold to freeze liquid therein and heating the mold to release ice therefrom, control means for discontinuing cooling and heating of the mold while continuing the operation of the agitating means for cleaning the mold, and a connection for draining cleaning liquid from the mold.

5. In an ice making machine, a mold having cross partitions forming a plurality of cells and an open bottom, a movable platen for opening and closing the bottom of the mold, a connection for supplying liquid to the interior of the mold, a heat transfer system cooperating with the mold to successively cool the mold to freeze liquid therein and heat the mold to release ice therefrom, a perforated plate in the platen, driving means for reciprocating the perforated plate to agitate the liquid in the mold, control means for stopping operation of the heat transfer system and continuing the operation of the agitator driving means for cleaning the mold, and a drain cock at the bottom of the platen having a manually operable valve for draining cleaning fluid from the mold.

6. In an ice making machine, a mold having an open bottom, a movable platen for opening and closing the bottom of the mold, a connection for supplying liquid to the interior of the mold when closed by the platen, means for agitating liquid in the mold, and a manually controlled connection for draining liquid from the mold.

7. In an ice making machine, a mold having cross partitions forming a plurality of cells and an open bottom, a platen for closing the bottom of the mold, a perforated plate on the platen, driving means on the platen for reciprocating the perforated plate to agitate the liquid in the mold, and a drain cock on the platen for draining liquid from the mold.

8. In an ice making machine, a mold having cross partitions forming a plurality of cells and an open bottom, a movable platen for opening and closing the bottom of the mold, a perforated plate mounted for reciprocating on the platen, driving means on the platen for reciprocating the perforated plate, a heat transfer system cooperating with the mold to successively cool the mold to freeze liquid therein and heat the mold to release ice therefrom, control means for stopping operation of the heat transfer system and continuing the reciprocation of the perforated plate for agitating a cleaning fluid in the mold, and a connection for draining cleaning fluid from the mold.

9. In an ice making machine, a mold having an open side, a movable platen for opening and closing the open side of the mold, an agitator for agitating liquid in the mold, a heat transfer system cooperating with the mold to successively cool the mold to freeze liquid therein and heat the mold to release ice therefrom, automatic control means responsive to the temperature of the mold for regulating operation of the platen and heat transfer system to freeze liquid in the mold and release ice therefrom, and a manual control for modifying operation of the automatic control to discontinue operation of the heat transfer system while continuing operation of the agitator for cleaning the mold.

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