

Aug. 16, 1960

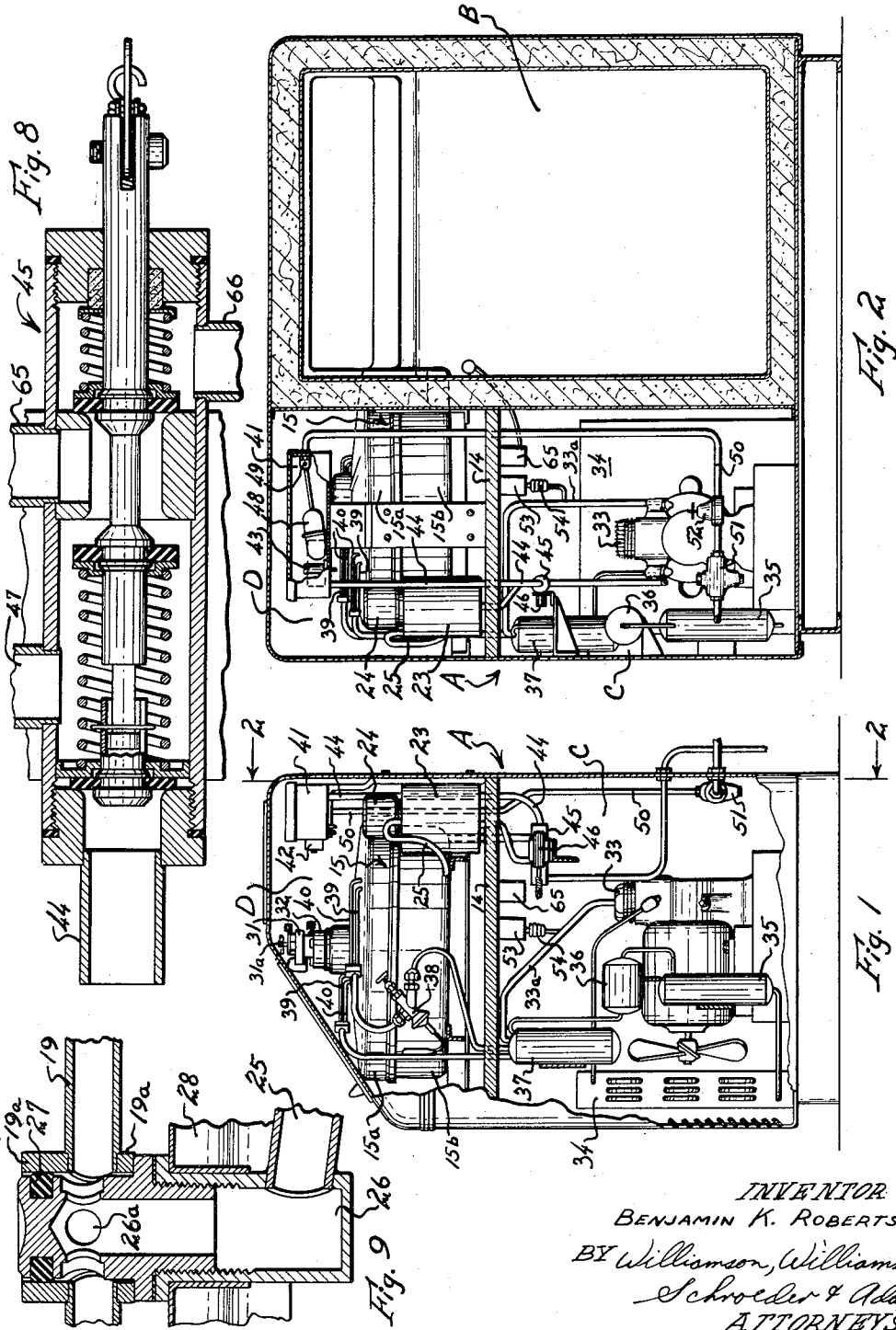
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2,949,019

INVERTED MOLD APPARATUS FOR PRODUCING ICE CUBES

Filed March 31, 1954

3 Sheets-Sheet 1



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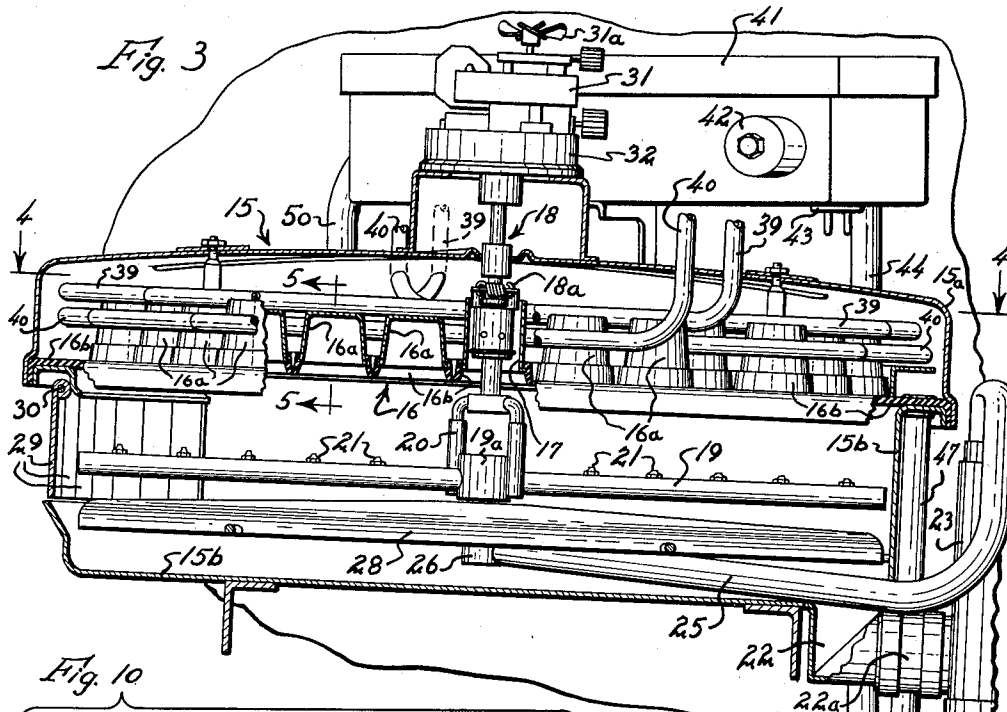
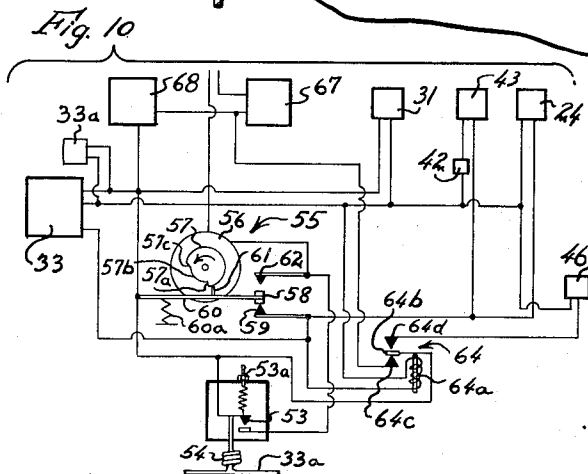
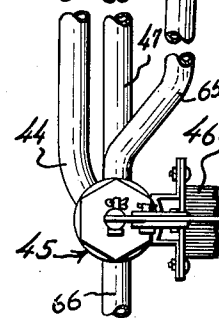
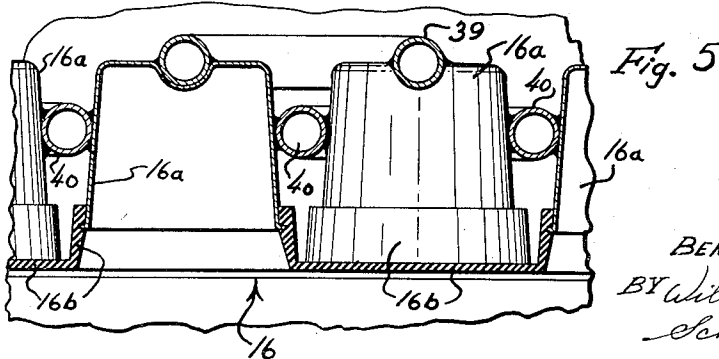
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3 Sheets-Sheet 2



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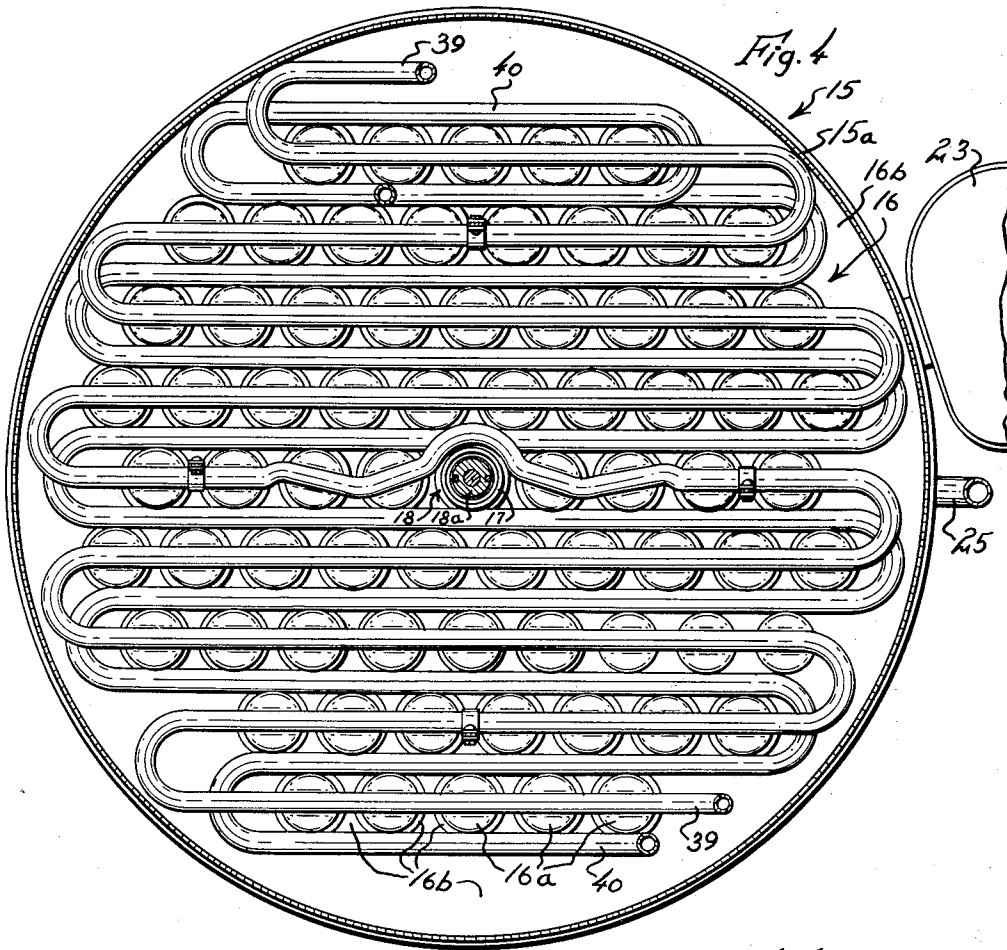
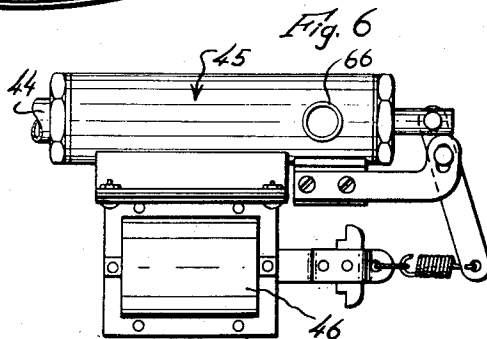
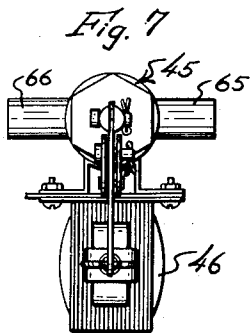
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INVERTED MOLD APPARATUS FOR PRODUCING ICE CUBES

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3 Sheets-Sheet 3



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1

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INVERTED MOLD APPARATUS FOR PRODUCING ICE CUBES

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6 Claims. (Cl. 62—347)

This invention relates generally to inverted mold ice machines and, more particularly, to such an ice making machine provided with a number of moving spray nozzles.

In the producing of clear, substantially pure, ice, it is obvious that the impurities contained in the water before the same is frozen, are removed from the portions of the water which are frozen, thereby leaving an undue concentration of such impurities in the remaining water which will ultimately produce clogging of the apparatus and render the same inefficient or even inoperative. Also, it is obvious that the water being frozen must, of necessity, be maintained at a relatively cold, near freezing temperature in order to obtain the desired quick freezing thereof and efficient operation of the machine, thus prohibiting the use of continuous flowing water supplies and requiring a recirculation system to be used to produce the desired efficiency of operation.

It is an object of my present invention to provide a fully automatic, clear ice cube producing machine provided with a recirculation system for efficient operation, but also constructed to prevent the concentrated impurities collected at the end of each freezing cycle from being recirculated during subsequent freezing cycles.

It is another object to provide a fully automatic, clear ice producing machine provided with inverted overhead molds having a number of moving spray nozzles mounted thereunder to be progressively upwardly directed into said molds to permit clear ice cubes to be produced therein, and having means for quickly removing said cubes from said molds after formation of said cubes, and constructed to discharge the remaining impurities left in the water after the freezing of said cubes before introducing a new batch of liquid to be pumped through said nozzles and recirculated during the subsequent freezing cycle.

It is another object to provide a clear ice producing machine wherein the inverted molds are provided with a defrosting chamber thereabove into which a predetermined volume of heated water is introduced to release the cubes therefrom, and having means for delivering said water after the same has been cooled by said mold structure to a recirculation sump from which said water is pumped under pressure to said spray nozzles.

It is still another object to provide a combination refrigerant fluid pressure responsive and time system for controlling the various elements of the machine to automatically carry said machine through successive freezing and defrosting and cleaning cycles.

More specifically, it is an object to provide an inverted mold, clear ice cube producing machine having a swingably mounted spray bar disposed therebelow with a plurality of generally upwardly directed nozzles formed therein and having refrigeration means for freezing the water as it is sprayed into said molds and including means for defrosting said molds to release the cubes therefrom with all of said mechanism being automatically controlled

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in accordance with the back pressure of the refrigeration fluid in combination with a timer mechanism.

It is another specific object to provide a machine of the class described wherein the spray bar, during its shifting movement, also forms a cube-engaging and ejecting member for discharging the released cubes from the freezing chamber.

These and other objects and advantages of this invention will more fully appear from the following description made in connection with the accompanying drawings wherein like reference characters refer to the same or similar parts therein, and in which:

Fig. 1 is an end elevational view of my assembled machine with a portion of the outer casing broken away;

Fig. 2 is a longitudinal vertical sectional view taken substantially along the line 2—2 of Fig. 1;

Fig. 3 is a central vertical sectional view of the ice producing and harvesting unit with portions thereof being shown in side elevation;

Fig. 4 is a horizontal sectional view of the ice producing and harvesting unit taken substantially along the line 4—4 of Fig. 3;

Fig. 5 is a fragmentary vertical sectional view taken substantially along the line 5—5 of Fig. 3;

Fig. 6 is a side elevational view of the solenoid valve for controlling the water flow;

Fig. 7 is an end elevational view of the solenoid valve shown in Fig. 6;

Fig. 8 is a longitudinal vertical sectional view of the ported valve structure per se;

Fig. 9 is a central vertical sectional view of the spray bar hub; and

Fig. 10 is a diagrammatic view showing the electrical control system for the machine.

As illustrated in the accompanying drawings, I provide an automatic ice cube producing and storing machine provided with an outer cabinet, designated as an entirety by the numeral A, and divided into an insulated ice storage chamber B, and a pair of compartments C and D respectively housing the refrigeration equipment and the ice producing and harvesting equipment. A divider platform 14 separates the two compartments C and D. A casing 15 is mounted in the upper compartment D and has a top section 15a sealingly connected with a lower section 15b, which is supported by suitable support members on said partition 14, as best shown in Figs. 1 and 2. An inverted mold assembly, designated as an entirety by the numeral 16, and having a plurality of inverted freezing cups 16a sealingly interconnected by a foraminous mounting member 16b made as from rubber to form a separation or breaker element between adjacent cups, receives said cups in the respective openings thereof to sealingly interconnect the same. As best shown in Fig. 3, the rubber mounting member 16b has a plurality of downwardly enlarged tapered annular elements surrounding each cup 16b and extending a slight distance downwardly below the lower peripheral edge of said cup, and the outer periphery of said mounting member 16b is flanged and forms a sealing gasket between the upper casing section 15a and the lower casing section 15b. An overflow drainage sleeve or stand pipe 17 is sealingly connected around the central annular opening of the mounting member 16b to receive the drive shaft assembly 18 which includes a spring-tensioned cam clutch 18a through which the spray bar 19 is driven, as by the drive arm connecting assembly 20. The spray bar 19 has a plurality of upwardly directed jet nozzles 21 through which the water to be frozen is discharged under pressure. The jet nozzles 21, on one arm of the spray bar, are, in the form shown spaced radially outwardly from the spray bar hub a distance intermediate the spacing of the jet nozzles 21 on the other

arm of said spray bar, and the positioning of these nozzles is such that opposite side portions of the molds 16a alternately receive a jet discharge of water from the respective nozzles mounted on said two spray bar arms.

The bottom of the lower casing section 15b is, of course, imperforate and is inclined slightly toward a water collecting sump 22 into which the water which does not freeze in the respective cups flows for subsequent recirculation as will hereinafter be described. The collection sump 22 communicates through a conduit 22a with a sump tank 23, best shown in Figs. 1 and 2, and a sump pump of any conventional design driven by an electric motor 24 delivers the collected water back to the spray bar 19 through a delivery conduit 25, and the central manifold hub 26, best shown in Fig. 9, which has an upstanding hollow manifold passage extending upwardly therein with a plurality of radially disposed apertures 26a formed in peripherally spaced relation around the upper portion thereof at the same elevation as the spray bar 19 which is journaled on said upper portion of said hub 26 with suitable sealing means such as O-ring 27 for preventing the flow of water upwardly between the hub 26 and the cap or mounting sleeve 19a. The lower end of said sleeve 19a is supported on an annular shoulder formed on said hub 26 and the weight of the spray bar assembly substantially prevents leakage between the two elements and permits the water pressure to be maintained for upwardly directed discharge through the nozzles 21. The water, of course, forms a lubricant to permit easy, substantially frictionless rotation of the sleeve 19a on the hub 26. A slightly conical cube receiving and delivering platform 28 is mounted in fixed relation around said hub and extends outwardly therefrom with its top surface sloping downwardly toward the outer periphery thereof, as best shown in Fig. 3, with said outer periphery terminating in slightly spaced relation to the inside upstanding wall of the lower casing section 15b, an annular drainage passage surrounding said conical platform 28 to permit the liquid to flow therethrough, but of sufficiently small size to prevent the cubes from passing therethrough.

The side portion of the casing section 15b adjacent the storage chamber B has a delivery opening through which the harvested cubes are delivered and this opening is normally closed by a curtain structure which, in the form shown, is made from a plurality of swingably mounted, depending small plastic sheets 29 which are freely pivoted on a mounting rod 30 disposed at the upper end thereof whereby gravity will normally maintain said plastic elements 29 in upright position, but said elements being of sufficiently light weight to permit unrestricted passage of the cubes therethrough. As best shown in Fig. 2, the delivery portion of the casing 15 extends into the storage chamber B to deliver said cubes directly into said chamber.

As will hereinafter be described, a predetermined volume of water is initially delivered to the sump tank 23 from which the sump pump driven by motor 24 delivers said water through conduit 25 and manifold hub 26 into the two arms of spray bar 19 and upwardly through nozzles 21 into the inverted molds 16a. Suitable means for driving the spray bar driving shaft assembly 18 is provided such as the electric motor 31 which drives said shaft assembly 18 through a gear box 32. A small motor cooling fan 31a is provided to prevent overheating of said motor 31. A refrigeration system is provided with a motor driven compressor 33 which delivers refrigeration gas under pressure to a condenser 34 and thence to a receiver 35 through a dehydrator 36 and a heat exchanger coil in an accumulator 37 and thereafter to an expansion valve 38 and ultimately to the evaporator coils 39 and 40 which are respectively connected with the closed tops of the freezing cups and to the side walls thereof, as best shown in Figs. 3 and 4. The gas is then, of course, delivered back to the accumulator 37 and

to the low side of the compressor 33 in the usual manner through return line 33a.

A control system, which will be subsequently described, is provided for shutting off the motor of compressor 33 and for defrosting the mold cups 16a to harvest the cubes which are formed therein. In my present invention this harvesting is accomplished by providing hot water supplied from a water heater tank 41 which constantly maintains a predetermined volume of water at a predetermined temperature controlled by a thermostat 42, the heat being supplied by a heating element 43, best shown in Fig. 2. The heated water passes from the heater tank 41 through a conduit 44 to a solenoid operated control valve 45 actuated by a solenoid 46. When the control valve 45 is shifted into defrost position by the control system, this hot water flows through the valve 45 and up through conduit 47 to the flood chamber formed within the upper casing section 15a which houses the low side of the refrigeration system including the evaporator coils 39 and 40 and the upwardly extending outside closed portions of the mold cups 16a. The rubber foraminous cup mounting member 16b sealingly surrounds each cup and the central stand pipe sleeve 17 as well as forming a peripheral seal with the lower outer periphery of the upper casing section 15a to provide a closed bottom for the chamber disposed within said casing section. As best shown in Fig. 2, a float 48 is provided within water heater tank 41 to actuate a valve 49 which controls the flow of supply water through supply conduit 50. Said supply conduit 50 is connected with any suitable source of water supply, and a water filter 51 is provided to remove any solid particles which may be present in said supply water. A pressure regulating valve 52 is also provided in said water supply conduit to reduce the water supply pressure and maintain the same substantially constant so that the volume of water flowing through float controlled valve 49 is always substantially uniform during each defrost cycle. The heater tank is, of course disposed above the level of the compartment within upper casing section 15a to permit the water from the tank to flow by gravity into said compartment or chamber to harvest the cubes previously formed therein. Obviously, the warm water initially supplied to said compartment within section 15a is cooled by the exterior of the cups 16a and the evaporator tubing of coils 39 and 40 while accomplishing its cube harvesting function during the defrost cycle. As the cubes are released from the cups 16a by the warm water surrounding the same, said cubes drop down onto the conical platform 28 and the continuously rotating spray bar 19 combines with the conically inclined upper surface of said platform to carry said cubes to the outer side wall of the lower casing section 15b and ultimately discharge the same through the pivotally mounted curtain elements 29 to deliver the same into the storage compartment B. The rate of rotation of the spray bar 19 is in the neighborhood of 20 r.p.m. which is, of course, sufficient to produce a centrifugal action on the slippery cubes to materially assist in delivering the same to the outer wall of the lower section 15b.

Obviously, the control system is an extremely important part of the automatic operation of my ice machine. This control system includes the combination of a back pressure switch responsive for closing a circuit to a drop in the pressure in the refrigeration return or suction side of the refrigeration system and a time controlled mechanism responsive for starting to the closing of the circuit by the back pressure switch. Such a back pressure switch is designated by the numeral 53 and has a pressure-sensing element connected to the return line 33a of the compressor 33, such as the bellows element 54 which closes said switch in response to a drop in the fluid pressure in said line 33a below a predetermined limit. Thus, it will be seen that, when a predetermined amount of work has been done by the refrigeration system to pro-

duce a predetermined amount of ice in each of the mold cups, said back pressure switch 53 will be closed. This back pressure switch 53 is connected in series with a circuit to a timer mechanism 55 which, as has been previously stated, is started as soon as said switch 53 is closed. It is, of course, well known that, as the accumulation of ice in the respective mold cups reaches the desired volume, the differential in the back pressure on the suction side of the refrigeration system varies only slightly with increased work. Therefore, to produce a highly accurate control mechanism for all ambient temperatures, I have set the back pressure switch 53 to close during a time in the work or freezing cycle when slight changes in the cube size will produce relatively large variations in the reflected back pressure to permit a precisely controlled starting point for the timing mechanism to be easily obtained. As best shown in the wiring diagram (Fig. 10), the timer mechanism 55 contains a timing motor 56 which, as has been previously stated, is energized by back pressure switch 53. This timing motor drives a cam 57 which normally holds shiftable contact 58 in engagement with stationary contact 59 to close the circuit through the compressor 33 and pump motor 24. The shiftable contact 58 is mounted on a cam operated spring loaded lever arm 60 to which an elongated cam follower pin 61 is fixed and said pin engages the peripheral surface of timer operated cam 57. Said cam 57 has a sharply inclined depressed surface 57a formed therein and, when the follower 61 reaches said inclined surface 57a, the compression spring 60a which maintains contact between the follower and the cam surface snaps arm 60 upwardly to immediately break the circuit between contacts 58 and 59 to open the circuit to the compressor 33 and sump pump motor 24 and also, in the form shown, to the water heating element 43. As is best shown in Fig. 10, a relay, designated as an entirety by the numeral 64, has its control winding 64a connected in series with the switch contacts 58 and 59 and is in parallel with the motor of compressor 33. Said control winding 64a, when energized, holds the armature of relay 64 in downward position, as shown in Fig. 10, to normally maintain contact between the moving armature carried contact 64b and the stationary contact 64c.

While the back pressure switch 53 is connected in a manner to start the timer mechanism 55, it is obvious that as soon as the defrost cycle begins the back pressure in suction line 33a will rise rapidly to expand bellows 54 and open switch 53. Therefore, the defrost cycle must be controlled solely by the timer mechanism. To accomplish this, the circuit through the timer motor 56 is closed whenever the movable contact 58 is shifted into engagement with fixed contact 62. The timer control cam 57 has a depressed peripheral segment 57b extending around a portion of the periphery thereof from the sharply inclined surface 57a to permit the spring 60a to hold shiftable contact 58 into engagement with fixed contact 62 for a predetermined time interval while at the same time holding the circuit open through the motor of compressor 33 and sump pump 24 as well as water heating element 43 during the entire defrost cycle. Obviously, it is optional whether or not the heating element 43 of the hot water supply tank 41 is shut off during the defrost cycle. After a predetermined time has elapsed as controlled by the timer cam 57, the cam follower pin 61 will be engaged by a sharply inclined rise 57c formed in the cam surface to disengage contact 58 from contact 62 and re-engage said contact 58 with contact 59 to close the circuit through the motor of compressor 33, sump pump motor 24 and heating element 43. The compressor 33 has a condenser fan 33b which is constantly driven during the defrost cycle as well as the freezing cycle. The motor 31 which drives the radially disposed spray bar 19 is, of course, constantly driven during both the freezing and defrost cycles.

The solenoid 46 is spring-loaded to normally hold the

valve 45 in its freezing cycle position and, when said solenoid 46 is energized, said valve will be shifted into its defrost cycle position. The relay 64 closes the circuit to the winding of solenoid 46 whenever the control winding 64a of said relay is de-energized by the breaking of the circuit through contacts 58 and 59 when the timer 56 initiates the defrost cycle, as has been previously described. When the valve 45 is in freezing cycle position, as shown in Fig. 8, the drain conduit 65 from sump tank 23 will be closed and communication will be shut off between the hot water supply conduit 44 and the conduit 47 leading to the flood chamber which is defined by upper casing section 15a and the cup mounting and sealing member 16b, and, when the valve 45 is shifted into defrost position by energization of the solenoid 46, communication between the hot water supply conduit 44 and flood chamber supply conduit 47 will be permitted to supply a predetermined quantity of hot water to the flood chamber surrounding the evaporator coils 39 and 40 and the freezing cups 16a and the quantity of hot water supplied thereto is sufficient to melt the outer surface of the cubes formed within said cups and release said cubes therefrom. The cubes will drop onto the slightly conical delivery platform 28, and rotation of the spray bar 19 will deliver said cubes through the discharge opening normally closed by the plastic closures 29. As soon as the valve is shifted into defrost position, the unfrozen residual water remaining in the sump tank 23 will flow therefrom through drain conduit 65 and waste drain conduit 66 and, of course, this sump drain will remain open until after the valve has been shifted back into freezing cycle position. The valve, of course, prevents communication from the conduits 44 and 47 into the waste drain conduit 66 when in defrost position while of course permitting intercommunication between said conduits 44 and 47 as has been previously stated. After completion of the defrost cycle, the timer cam 57 closes contacts 58 and 59 and again energizes relay winding 64a to open the circuit to the winding of solenoid 46 and permit said valve 45 to shift back into freezing cycle position to thus open the valve port between conduit 47 and sump conduit 65 whereby said defrost water from the flood chamber will flow by gravity into sump tank 23 through conduit 65 after being cooled by the defrost cycle. I have found that it is desirable to set the timer 55 so that a sufficient volume of pressure regulated water is supplied through supply conduit 50 to overflow the flood chamber a sufficient amount to thoroughly flush the sump tank 23. This overflow water, of course, passes over stand pipe sleeve 17 and down through sump 22 from the peripheral portion of platform 28 and the imperforate bottom panel of lower casing section 15b. This, of course, removes any accumulation of solids from the sump tank 23 which are left after the unfrozen water is discharged therefrom through drain conduits 65 and 66 at the beginning of each defrost cycle. The pressure reducing valve 52 is set at approximately 6 lbs. per square inch so that any water supply pressure in excess thereof will always produce satisfactory and efficient operation of my new ice cube machine.

A manual control switch 67 is connected in series with the main line to shut off the entire mechanism and, when relay 64 is de-energized, a bin control switch 68 is connected in series with the winding of solenoid 46 through shiftable contact arm 64b of relay 64. As best shown in Fig. 2, the bin control switch 68 has a sensing bulb 68a mounted in the ice storage compartment B and serves as a master switch to automatically shut off the cube supply when the level of the cubes reaches the height of the sensing element 68a within the storage bin. In the form of my invention illustrated, the relay 64, as best shown in Fig. 10, is connected in parallel with the compressor motor circuit and is connected in a manner to shunt out the bin control 68 whenever the machine is operating in the freezing cycle, to stop the machine only

at the beginning of the defrost cycle. Obviously, this prevents the machine from being shut off by the bin control 68 during the freezing cycle and permits completion of said freezing cycle before the bin control can shut off the compressor. This, of course, prevents the formation of partially formed cubes and pre-sets the machine to resume operation when new supplies are called for by running through a complete defrost cycle. In other words, the timing mechanism 55 is stopped by the bin control switch 68 at the beginning of the defrost cycle and, when the machine is again started, the timing mechanism will resume operation at this point.

In addition to the apparatus herein described, I have also provided a new method for automatically producing and harvesting ice which consists in initially freezing ice bodies of a predetermined size in ice-forming molds, defrosting the molds to remove the bodies formed therein, and timing the defrosting operation to form the sole means for controlling the same, said timing mechanism being responsive for starting solely to the accumulation of a predetermined volume of ice in said molds. More specifically, this method consists in freezing a plurality of cubes in inverted molds, heating a predetermined volume of water to a predetermined temperature, defrosting said molds by surrounding the upper imperforate portions thereof with said warm water, timing said defrost operation and again initiating the freezing operation solely in response to the completion of said timed defrost cycle and freezing the cooled defrost liquid during the next freezing operation. The additional step of discharging the residual unfrozen liquid during the defrosting operation is also important to remove the impurities collected therein from each batch of freezing liquid.

It will be seen that my new method and apparatus will produce in a highly efficient manner clear ice cubes regardless of the ambient air temperatures, temperature of the water supply, pressure of water supply, as well as the mineral impurities carried in the supply water. In other words, the efficiency of my system as disclosed herein is not reduced by variations in any of said factors and none of said factors is in any way critical to the successful production of clear ice cubes.

It should be noted that, by maintaining a predetermined volume of defrost supply water at a predetermined temperature within heater tank 41, a precisely predetermined quantity of defrost heat is provided for defrosting a precisely predetermined volume of frozen ice. During the defrost cycle, the defrosting water is, of course, cooled and is, thereafter, used for the supply of liquid to be frozen during the next freezing cycle. The rubber mounting member 16b not only combines with the cups to form a sealed bottom for the flood chamber, but also is designed to provide a peripheral breaker around the open base of each cup, as best shown in Fig. 5, to prevent the lower portions of the cubes from freezing from the outside in, and thus permitting a solid flat-bottomed cube to be formed which is substantially clear throughout its entire depth and has little, if any, depression formed in the central bottom surface thereof since the inner portion of the cube is formed from cold supplied through the body of ice previously frozen within the mold. It is obvious that the ambient air temperatures do not affect the size of the cubes produced since the duration of the freezing cycle depends upon the back pressure on the low pressure side of the refrigeration system.

It is also important to note that the combination of the back pressure switch 53 and timer 55 provides a control mechanism which will enable ice cubes of substantially the same size to be produced regardless of the ambient temperatures and water supply temperatures. The temperature and volume of the water supplied to the sump tank is always substantially uniform at the beginning of each freezing cycle since a predetermined volume of water at a predetermined heated temperature is always supplied to the flood chamber for defrosting the molds and

removing the cubes therefrom. This water is, of course, cooled to substantially the same degree by each defrost cycle and therefore the temperature of the water delivered to the sump tank at the beginning of each freezing cycle will always be substantially constant regardless of the temperature of the supply water delivered to the heating tank. During operation in high ambient temperatures, it is obvious that a longer freezing cycle will be called for by the pressure regulating switch in order to produce a substantially predetermined quantity of ice before closing the circuit to the timer 55. It is inherent in refrigeration systems controlled solely by the pressure of the refrigerant gas that larger sized ice bodies will be produced in warmer ambient temperatures than in cooler temperatures. It is obvious that cubes produced in high ambient temperatures by a time controlled system will be smaller than cubes produced in low ambient temperatures during the same freezing period. Therefore, I combine a back pressure switch to control the first portion of my freezing cycle and a time controlled mechanism for controlling the final stages of said freezing cycle so that the effect of ambient temperatures on the one portion of the cycle will be offset by the opposite effect of said ambients on the other portion of the cycle and thus cubes of substantially uniform size will always be produced regardless of the surrounding air temperatures. In order to permit the size of the cubes to be controllably varied by the operator, I provide a control spring adjustably tensioned by a screw 53a, as best shown in Fig. 10.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the parts without departing from the scope of this invention which, generally stated, consists in the matter shown and described herein and set forth in the appended claims.

What I claim is:

1. An ice cube producing machine comprising a sump tank, means defining a freezing compartment having a drain conduit communicating with said sump tank, a mold structure sealingly dividing said compartment into an upper and a lower chamber, a single conduit connected with the upper chamber and forming both a drain and an inlet conduit therefor, a water heater tank, conduit means delivering therefrom, a single multiple ported valve interconnecting said conduits to control the flow relationship therebetween and having a sump tank drain conduit connected therewith with an outlet drain conduit, said valve controlling communication between said drain conduits.

2. A clear ice cube producing machine, comprising means defining an enclosed compartment, an inverted mold structure dividing said compartment into an upper and a lower chamber, said upper chamber being arranged to retain a predetermined volume of water therein, means defining a fluid passage interconnecting said chambers, refrigerating means provided in said upper chamber in association with said mold structure for freezing water within said mold structure, a collection tank communicating with the lower chamber and having a portion disposed below said lower chamber, said tank being arranged to hold a volume of water therein substantially equal to said predetermined volume, upwardly directed spraying means mounted in the lower chamber, a pump having its intake communicating with said collection tank to draw water therefrom for delivery to said spraying means under pressure to direct a spray upwardly into said inverted mold structure whereby a portion of said water is frozen therein, the unfrozen portion of the sprayed water constantly draining back through said lower chamber and into the collection tank, a drain connected to the bottom of said collection tank, means for opening the drain to drain the collection tank, means for supplying a predetermined quantity of water to the upper chamber to warm the mold structure and release ice therefrom, said predetermined quantity being in excess of said predetermined volume with the excess of water supplied to said

upper chamber passing through said fluid passage and into the lower chamber, whereby said lower chamber and collection tank are flushed of impurities, means for closing said drain after said excess water has drained and means for delivering the water retained in the upper chamber into said collection tank for use in the next cycle of operation.

3. The machine of claim 2 including means for heating water supplied to the upper chamber.

4. The machine of claim 2 in which said lower chamber is generally circular in horizontal cross-section and is provided with a discharge opening therethrough and in which said spraying means is mounted for rotation about a substantially vertical axis at the center of curvature of said wall, said spraying means being provided with a radial arm extending substantially to said wall, there being means providing a floor immediately below the path of movement of said arm whereby rotation of said spraying means causes the spraying arm to sweep ice cubes falling from said mold structure to the floor into said discharge opening.

5. An ice cube producing machine comprising a casing having a compartment therein, an inverted mold structure in said compartment, a movably mounted spray bar below said mold structure for spraying liquid upwardly thereinto, refrigerating means operatively associated with said mold structure to freeze portions of the liquid supplied thereto, means for releasing the ice frozen in said mold structure, a floor disposed in closely spaced relation below said spray bar to receive the ice released from said mold structure, said compartment having an opening therein adjacent an edge of said floor, and means for moving said spray bar to cause the same to engage ice on the floor and sweep the same toward and into said opening.

6. The ice cube producing machine of claim 5, wherein the spraybar is rotatably mounted and including a slip clutch mechanism interconnecting the spray bar and said

moving means, said clutch being arranged to slip when a predetermined resistance to rotation is encountered by said spray bar.

References Cited in the file of this patent

UNITED STATES PATENTS

2,407,058	Clum	Sept. 3, 1946
2,524,815	Leeson	Oct. 10, 1950
2,542,892	Bayston	Feb. 20, 1951
2,545,558	Russell	Mar. 20, 1951
2,551,163	Rickert	May 1, 1951
2,569,113	Munshower	Sept. 25, 1951
2,575,509	Bayston	Nov. 20, 1951
2,586,588	Weseman	Feb. 19, 1952
2,595,588	Lee	May 6, 1952
2,597,008	Lee	May 20, 1952
2,628,479	Powers	Feb. 17, 1953
2,656,686	Bayston	Oct. 27, 1953
2,656,689	Muffly	Oct. 27, 1953
2,657,547	Heuser	Nov. 3, 1953
2,674,858	Magnuson	Apr. 13, 1954
2,677,249	Mason	May 4, 1954
2,682,155	Ayres	June 29, 1954
2,691,275	Andrews	Oct. 12, 1954
2,717,498	Shagaloff	Sept. 13, 1955
2,721,452	Brandin	Oct. 25, 1955
2,722,110	Denzer	Nov. 1, 1955
2,729,070	Ames	Jan. 3, 1956
2,747,375	Pichler	May 29, 1956

FOREIGN PATENTS

28,194	Great Britain	1906
--------	---------------	------

OTHER REFERENCES

Air Conditioning and Refrigeration News, February 25, 1952, page 11.