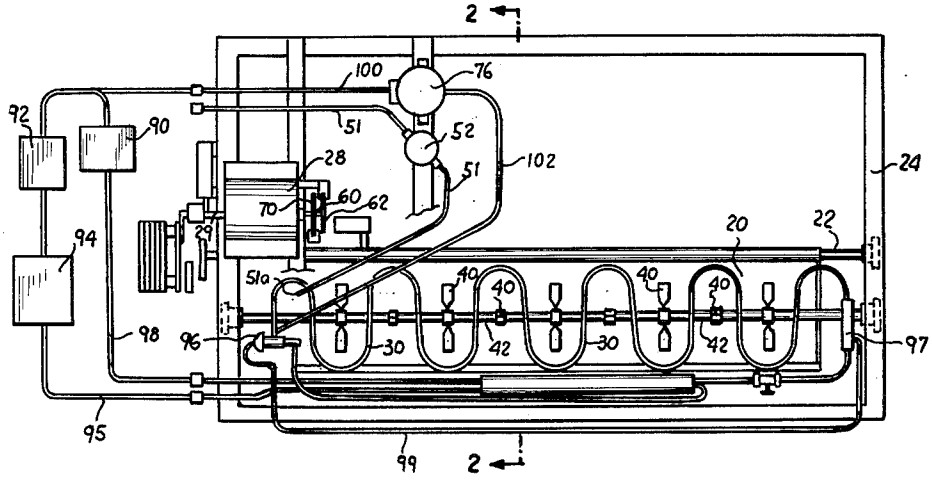
April 3, 1962 M. L. LINDENBERG ET AL 3,027,731

ICE CUBE MAKING MACHINE

Filed Aug. 6, 1959 2 Sheets-Sheet 1

FIG. 1



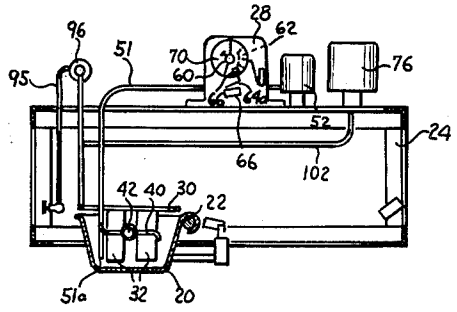


FIG. 2

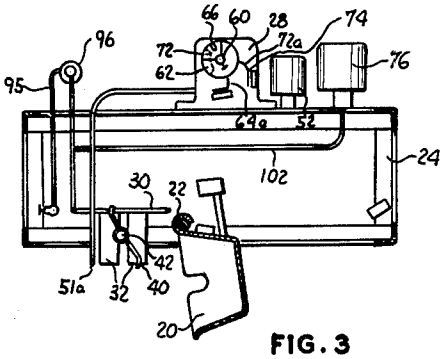


FIG. 3

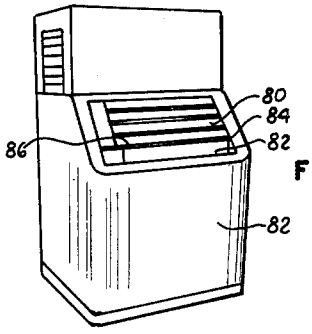


FIG. 4

INVENTOR.

MILTON L. LINDENBERG

GLEN W. LINDENBERG

John W. Adams

ATTORNEY

April 3, 1962 M. L. LINDENBERG ET AL 3,027,731

ICE CUBE MAKING MACHINE

Filed Aug. 6, 1959 2 Sheets-Sheet 2

FIG. 5

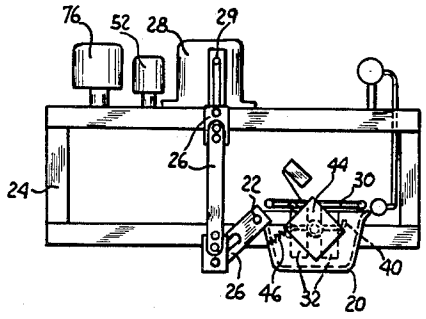


FIG. 6

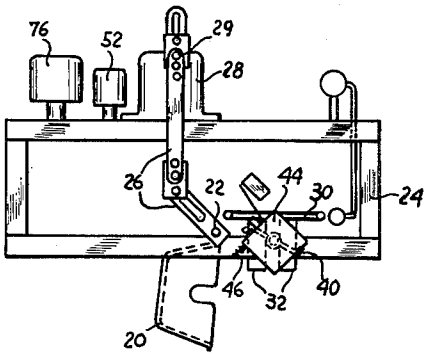


FIG. 7

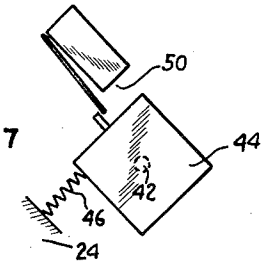
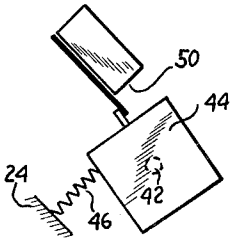


FIG. 8



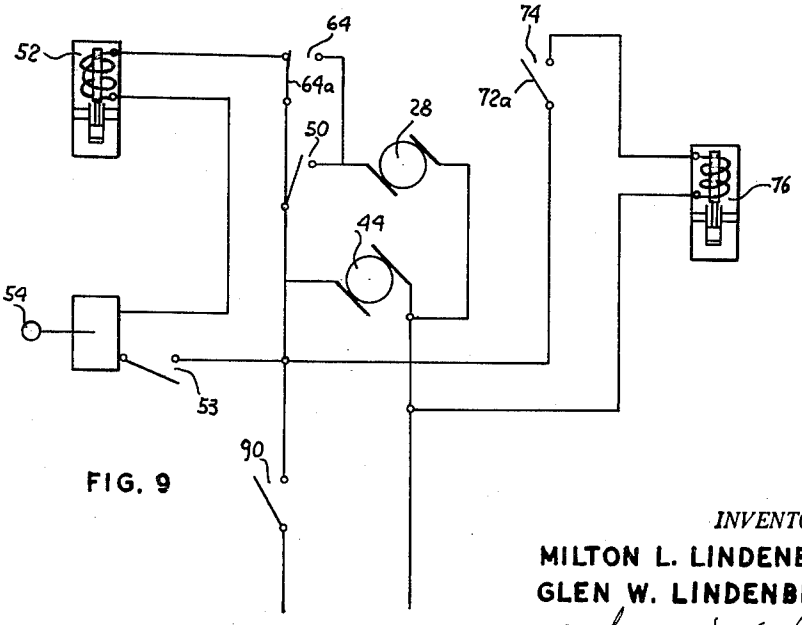


FIG. 9

INVENTOR.

MILTON L. LINDENBERG

GLEN W. LINDENBERG

John W. Adams

ATTORNEY

United States Patent Office 3,027,731 Patented Apr. 3, 1962

3,027,731

ICE CUBE MAKING MACHINE

Milton L. Lindenberg, 1129 Moore, Beloit, Wis., and Glen W. Lindenberg, Beloit, Wis.; said Glen W. Lindenberg assignor to said Milton L. Lindenberg

Filed Aug. 6, 1959, Ser. No. 831,988
9 Claims. (Cl. 62—138)

This invention relates to clear ice cube making apparatus, in which ice cubes are formed upon freezing elements extending downwardly into an open top liquid holding tray which is periodically emptied in response to ice cubes of a predetermined size being formed on said elements.

It is an object of this invention to provide ice cube making apparatus which produces ice cubes of uniform predetermined size under all ambient air temperature conditions.

It is another object to provide such a device which will manufacture and maintain in storage a predetermined quantity of such ice cubes.

It is another object to provide such a device in which ice cubes are formed in an open top liquid holding tray which is completely emptied of residue and impurities after the formation of each batch of ice cubes.

It is another object to provide such a device in which the ice cubes are formed upon depending freezing elements which extend downwardly into the liquid in the tray and having a plurality of agitating paddles for producing clear ice cubes and moving in paths at predetermined distances from said freezing elements to agitate the freezing liquid and produce clear ice cubes and also forming detecting elements to sense the size of the formed ice cubes.

It is a further object to provide such a device having a tray dumping mechanism actuated in response to the formation of ice upon the freezing elements of sufficient size to impede the movement of agitating paddles through the freezing liquid to dump the contents of the tray and replace the tray for formation of a new batch of ice cubes.

It is a further object to provide such a device in which the freezing elements upon which the ice is formed are heated in response to actuation of the tray dumping mechanism to release the ice cubes from the freezing elements.

It is also an object to provide such a device in which liquid to be frozen into solid bodies is introduced into the liquid holding tray after the same is returned to freezing position following dumping of the residue of the prior freezing cycle.

These and other objects and advantages of our 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 throughout the several views, and in which:

FIG. 1 is the top plan view of a device embodying the present invention having portions thereof broken away to permit observance of the parts below;

FIG. 2 is a side sectional view of the device shown in FIG. 1 taken along the line 2—2 showing the liquid holding tray positioned for the freezing of ice cubes;

FIG. 3 is a side sectional view taken along the line 2—2 in FIG. 1 showing the liquid holding tray positioned at the end of the tray dumping cycle;

FIG. 4 is a perspective view of the apparatus shown in FIG. 1 housed in a protective outside housing having an ice cube storage bin therebeneath and means for access thereto;

FIG. 5 is a side view of the device shown in FIG. 1 with the tray positioned in ice cube freezing position and showing the ice cube dumping mechanism;

FIG. 6 is the same view as FIG. 5 showing the tray and the dumping mechanism in tray dumping position;

FIG. 7 is a side view of the paddle rotating motor showing the spring connection thereof to the supporting structure and the switch by which the tray dumping mechanism is actuated;

FIG. 8 is a side view of the device shown in FIG. 7 showing the paddle turning motor in position closing the switch energizing the tray dumping mechanism; and,

FIG. 9 is a schematic wiring diagram of the ice cube making machine shown in FIG. 1.

There are numerous ice cube making devices available at the present time but none of these provide the simple and highly desirable features of the present invention of producing and maintaining a predetermined quantity of clear ice cubes of predetermined size and purity regardless of the ambient air temperature, by the use of a plurality of rotating paddles which both agitate the liquid being frozen to produce clear ice cubes and also actuate the dumping of the ice cube tray and collection of the cubes when the cubs have attained a predetermined size.

In the form of the invention shown in the accompanying drawing, liquid to be frozen into ice is contained in an open top tray designated by the numeral **20** which is supported in generally horizontal position during the freezing operation by a rotatable shaft **22** journaled upon a supporting housing **24** and which is rotated to dump the tray **20** at the end of the ice forming cycle by a tray dumping actuating arm assembly **26** which is driven by the motor **28** mounted upon the supporting housing **24** as best shown in FIGS. 5 and 6. A freezing coil **30** positioned above the tray **20** when the same is in freezing position, as best shown in FIGS. 2 and 5, is provided with a plurality of spaced apart depending freezing elements **32** which extend downwardly into the liquid confined within the tray **20**. A cooling mechanism such as a conventional refrigeration compressing unit shown in FIG. 1 is connected to the freezing coil **30**. A plurality of rotating paddles **40** are connected to a paddle rotating shaft **42** disposed above the tray **20**, in spaced apart relation to the freezing tips **32** as best shown in FIG. 1. The shaft **42** is adjustable to predetermine the distance between the freezing elements **32** and the paddles. During the freezing operation these paddles **40** are rotated by the shaft **42** to agitate the liquid within the tray **20** and clarify the ice formed upon the freezing elements **32**. The shaft **42** is driven by a motor **44** which is also mounted upon the shaft **42**. The motor **44** driving the shaft **42** is connected to the supporting housing **24** by a coil spring **46** as best shown in FIGS. 7 and 8, which maintains the motor **44** in spaced relation to the housing **24** while the ice cubes are being formed.

When ice is formed upon the freezing elements **32** of sufficient size to impede the movement of the rotating paddles **40** the resulting torque exerted upon motor **44** by the shaft **42** is sufficient to overcome the tension exerted by the spring **46**, and the motor **44** is rotated upon the axis of the shaft **42** thereby extending the spring **46** as best shown in FIG. 8.

This rotation of the motor **44** in response to formation of ice cubes of desired size, as predetermined by the space between the freezing elements **32** and the paddles **40** initiates the tray dumping cycle which is described as follows:

When ice cubes are formed upon the freezing elements **32** as described earlier, a tray dumping cycle is initiated in which the tray **20** is tilted upon the shaft **22** to empty the contents thereof, the freezing elements **32** are heated to release the ice cubes formed thereon, the freezing elements are again cooled for freezing ice cubes, the tray is then returned into the freezing position, and water is then introduced into the tray to be frozen into cubes

during the subsequent cube freezing cycle. When ice cubes of the sufficient size to engage one of the paddles 40, have been formed on the freezing elements 32, the resulting torque produced on the paddle turning motor 44 closes the switch 50 which completes an electric circuit to energize the tray dumping motor 28. The tray dumping motor 28 being engerized drives a shaft 29 which is connected to the tray dumping actuating arm assembly 26 to rotate the shaft 22 and tilt the tray 20 through a predetermined arc and return the empty tray into cube freezing position upon one complete revolution of the shaft 29.

The motor 28 also drives a cam rotating shaft 60 which controls the circuits to the defrost assembly and to the water supply assembly, and which also controls the duration of the tray dumping cycle. A cam 62 is rotated by the cam shaft 60. Very slight rotation of the cam 62 closes a normally open dumping motor circuit through the single-pole, double-throw switch 64 by driving the switch contact 64*a* out of a narrow slot 66 at the periphery of the cam 62 as best shown in FIG. 2. Closing of the switch 64 completes a circuit energizing the motor 28, in parallel with the circuit switch 50. The switch 64 being closed by the cam 62 remains closed until the cam 62 has completed one complete revolution to permit the switch contact 64*a* to slide back into the slot 66 in the cam 62.

A defrost cam 70 is also rotated by the cam shaft 60. The defrost cam 70 has a slot 72 of adjustable width which receives a cam riding switch contact 72*a* which rides within the slot 72 and closes the switch 74 completing a circuit to energize the defrost solenoid valve 76 when the contact 72*a* is driven out of the slot 72 by rotation of the cam 70, as best shown in FIG. 2. The cam 70 may be adjusted to time the closing of the defrost switch during the defrosting cycle independently of the actual movement of the tray dumping mechanism. The defrost solenoid valve 76 being energized by the closing of the switch 74 opens the valve permitting hot gas from the freezer system to enter the freezing coil 30 and the freezing elements 32 to melt the ice in immediate contact with the freezing elements 32 and permit the cubes to drop therefrom to be collected and stored as hereinafter described.

As shown in FIG. 1, a compressor 90 compresses and pumps the freezing liquid under high pressure and corresponding high temperature through a condenser 92 into a receiving tank 94. From the receiving tank 94 the liquid passes under high pressure through a refrigeration liquid conduit 95 to an expansion valve 96 where the pressure is drastically reduced to cause expansion and cooling of the liquid. The rarified cold gas and liquid then passes through the freezer coil 30. From the freezer coil 30 the freezing liquid is drawn back to the compressor through the suction line 98. A defrost or hot gas line 100 communicates between the hot, highly compressed gas conduit leading from the compressor 90 to the condenser 92 and the defrost solenoid 76. When the hot gas solenoid valve is opened as described earlier, hot gas from the compressor is directed through the solenoid valve 76 through a conduit 102 directly into the freezer coil 30, below the expansion valve 96. The high pressure thus produced in the freezer coil prevents cooling liquid from passing through the expansion valve 96 into the freezer coil 30.

In the form of the invention shown, a conventional thermostatic control 97 is positioned at the discharge end of the freezer coil 30 and is co-operatively associated with the expansion valve 96 through a tube 99 to regulate the amount of freezing liquid passing through the valve 96.

The duration of the freezer coil heating process, which may be predetermined by adjustment of the size of the slot 72 in the cam 70 is interrupted by the riding of the switch contact 72*a* into a slot 72 in the hot gas cam 70 after a predetermined time interval independently of the operation of the tray dumping mechanism but within the temporal limits thereof. In the form of the invention illustrated, the opening in the hot gas cam 70 is adjustable to close the defrost solenoid valve 76 as soon as the ice has been released from the freezing elements 32, which normally occurs while the tray is in inverted position. The defrost solenoid valve 76 being de-energized permits the freezer coils to again assume their normally cold freezing temperature before the tray has been returned to horizontal freezing position.

The cam shaft 60 and the tray dumping shaft 29 are driven by the motor 28 to complete one revolution in the same time interval so that the switch contact 64*a* returns into the slot 66 in the cam 60 to open the switch 64 and de-energize the motor 28 at the instant at which the shaft 29 has completed one revolution to rotate the tray dumping shaft 22 through the predetermined dumping arc and has returned the tray 20 to ice freezing operative position.

The paddle turning motor 44, after being pivoted by the torque exerted upon the shaft 42 by the formation of ice impeding the turning of the paddles 40, is urged back into its normal ice forming position by the spring 46 when the ice has been released from the freezing elements 32 during the defrost cycle. The motor 44 is constantly energized to rotate the shaft 42 and the paddles 40 throughout the ice forming and the tray dumping and defrosting cycles, so that the rotating paddles 44 are in rotating ice forming position when the tray 20 is returned into ice forming position by the shaft 22.

A water supply line 51 connected to any convenient water supply source is provided having a discharge opening 51*a* positioned to deliver water to be frozen into the tray 20 when the tray is in operative ice freezing horizontal position as best shown in FIGS. 2 and 3. The flow of water into the tray 20 is controlled by operation of a water solenoid valve 52 which is energized to open and deliver water into the tray 20 through a normally open electric circuit which is closed by cam actuation of the single-pole double-throw switch 64 to open the dumping motor circuit and closing of a float actuated switch 53. The switch 53 is closed when liquid in the tray reaches a predetermined level as determined by adjustment of the float 54. The solenoid 52 is therefore actuated to deliver water into the tray only when the tray has been returned into horizontal ice freezing position at the end of the defrost cycle.

Collection of Ice

Beneath the freezing elements 32 and the pan 20, a slanted strainer 80 is provided. Ice cubes dropped from the freezing elements 32 land upon the slanted surface and slide into an insulated storage bin 82 at the lower end thereof. Liquid residue and impurities left in the tray 20 at the end of a freezing cycle are dumped onto the strainer 80 and fall through the openings 84 therein to a waste drain 86.

A weight responsive adjustable switch 90 disposed at the storage bin 82 is normally closed during operation of the ice cube maker and is opened in response to the collection therein of a predetermined quantity of ice to open all circuits to the ice making apparatus.

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 is claimed is:

1. An ice making machine comprising a supporting structure, a tray member for holding the liquid to be frozen, a horizontal rotary shaft disposed above said tray, a source of rotary power connected to said rotary shaft for imparting rotary motion thereto, a plurality of spaced apart elongated paddle elements attached to said shaft for ro-

tation therewith, said paddle elements being positioned to move through the liquid within the tray, freezing means for freezing portions of the liquid within the tray, a tray tilting rotatable shaft connected to said tray, means co-operatively associated with said paddle elements to rotate said tray tilting shaft in response to formation of sufficient ice within said tray to impede the rotation of said paddle elements thereby tilting the tray to empty the contents thereof and return the empty tray to ice freezing operative position.

2. The structure set forth in claim 1, and conduit means carrying a freezing substance overlying said tray, a plurality of hollow freezing tips communicating with said conduit means and depending therefrom into the liquid within said tray in spaced apart relation to said rotating paddles whereby ice forms upon said tips in the shape of cubes separated by interspersed rotating paddles.

3. The structure set forth in claim 2, and warming means co-operatively associated with said conduit means and said tray tilting shaft to warm said conduit means and said freezing tips to release the ice cubes therefrom in response to tilting of said tray to empty the contents thereof.

4. The structure set forth in claim 3, and a timed delay means co-operatively associated with said tray tilting shaft to return said shaft and said tray to ice making operative position after a predetermined time interval following emptying of said tray, said time delay means being adjustable to insure that all of the ice cubes have dropped from the freezing tips before the tray is returned to freezing position.

5. The structure set forth in claim 4 and means co-operatively associated with said tray tilting shaft to introduce a predetermined amount of ice forming liquid into said tray when the tray has been returned to ice making position following emptying of the tray.

6. The structure set forth in claim 5 and said paddle driving rotary shaft being journaled upon said supporting structure, the source of rotary power rotating said shaft being supported upon said shaft and the torque generated by said rotary source being normally absorbed by spring tension means attached respectively to said rotary source and said supporting structure, additional torque exerted upon said rotary source by ice formation impeding rotation of said paddles being sufficient to pivot said rotary source upon the axis of said rotary shaft, a second source of rotary power connected to said tray tilting shaft and switch means actuated by pivoting of said first rotary source to energize said second source of rotary power to rotate said tray tilting shaft and commence a tray emptying cycle.

7. An ice making machine comprising a supporting structure, an open-top, liquid confining tray, means for maintaining a predetermined liquid level within the tray, a plurality of depending freezing elements with portions thereof disposed below said liquid level in said tray, means for refrigerating said elements, a plurality of

paddles moving through a path disposed in predetermined spaced relation to said depending elements to agitate the liquid within said tray, a tray dumping mechanism connected to said tray, means driving said paddles, means responsive to obstruction to the movement of any of the paddles by the ice built up on said freezing elements to actuate said tray dumping mechanism to dump the contents of said tray and return the tray to ice making position, heating means connected to said freezing elements and responsive to said obstruction of any of said paddles to heat said freezing elements to release the ice formed thereon when said tray is in dumping position.

8. An ice making machine comprising a supporting structure, an open-top liquid confining tray, means for maintaining liquid in said tray at a predetermined level, a plurality of depending freezing elements with portions thereof disposed below said predetermined liquid level in said tray, refrigeration means for cooling said freezing elements during a freezing cycle, a plurality of liquid agitating members moving through a path disposed in predetermined spaced relation to said freezing elements to agitate the liquid adjacent said elements and produce clear ice thereon, a rotary driving mechanism connected with said agitating members for driving the same, a yieldable torque balancing means connected with said rotary driving mechanism to balance the same in stationary position during ice freezing operational movement of said agitating members, said balancing means being constructed and arranged to permit rotation of said driving mechanism when sufficient ice has accumulated on said freezing elements to obstruct the movement of said agitating members, a tray dumping mechanism connected to said tray and responsive to rotation of said agitating member driving mechanism to dump said tray when said agitating members are obstructed and return the empty tray to operative freezing position, and heating means connected to said freezing elements and responsive to obstruction of said agitating members to heat said elements and release the ice therefrom when said tray is dumped.

9. The structure set forth in claim 8 and an ice storage compartment positioned below said freezing elements and receiving the ice dropped from the freezing elements, switch means responsive to quantity of ice in said storage compartment to de-energize said ice making apparatus when said ice reaches a predetermined quantity and energizing said apparatus when said quantity falls below a predetermined amount.

References Cited in the file of this patent

UNITED STATES PATENTS

1,979,546	Heintz	Nov. 6, 1934
2,114,642	West	Apr. 19, 1938
2,585,240	Grow	Feb. 12, 1952
2,613,506	Cook	Oct. 14, 1952
2,836,038	Morgan	May 27, 1958
2,907,183	Roberts	Oct. 6, 1959