

[54] **WATER CONTROL FOR ICE MAKER**

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[58] Field of Search. **62/188, 354, 66**

[56] **References Cited**

UNITED STATES PATENTS

3,643,454 2/1972 Turner **62/354 X**

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Primary Examiner—William E. Wayner

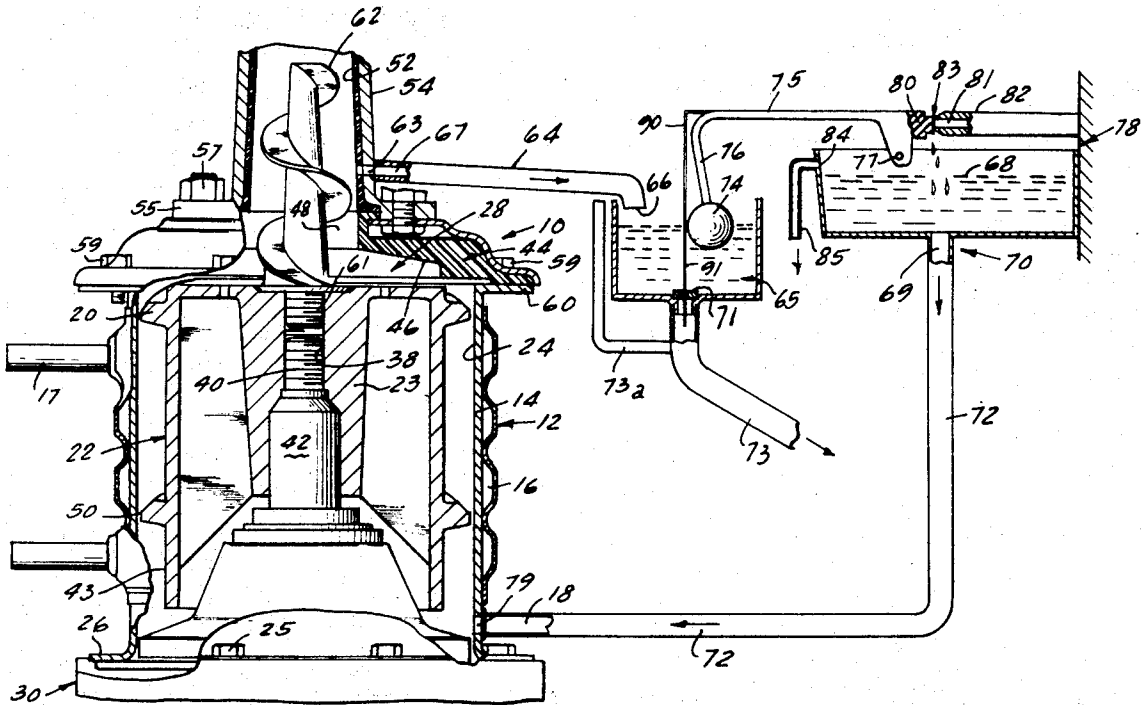
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[57]

ABSTRACT

A method and means for controlling the water flow of a water using device such as an ice making device in which water is fed in excess of the capacity of the ice making device. The excess water vented from the device is received in a drain reservoir having means for restricting the drainage of the excess water. The amount of water fed to the ice making device is proportional to the amount of excess water received in the reservoir, and thus varies directly with the amount of water used by the device.

9 Claims, 2 Drawing Figures



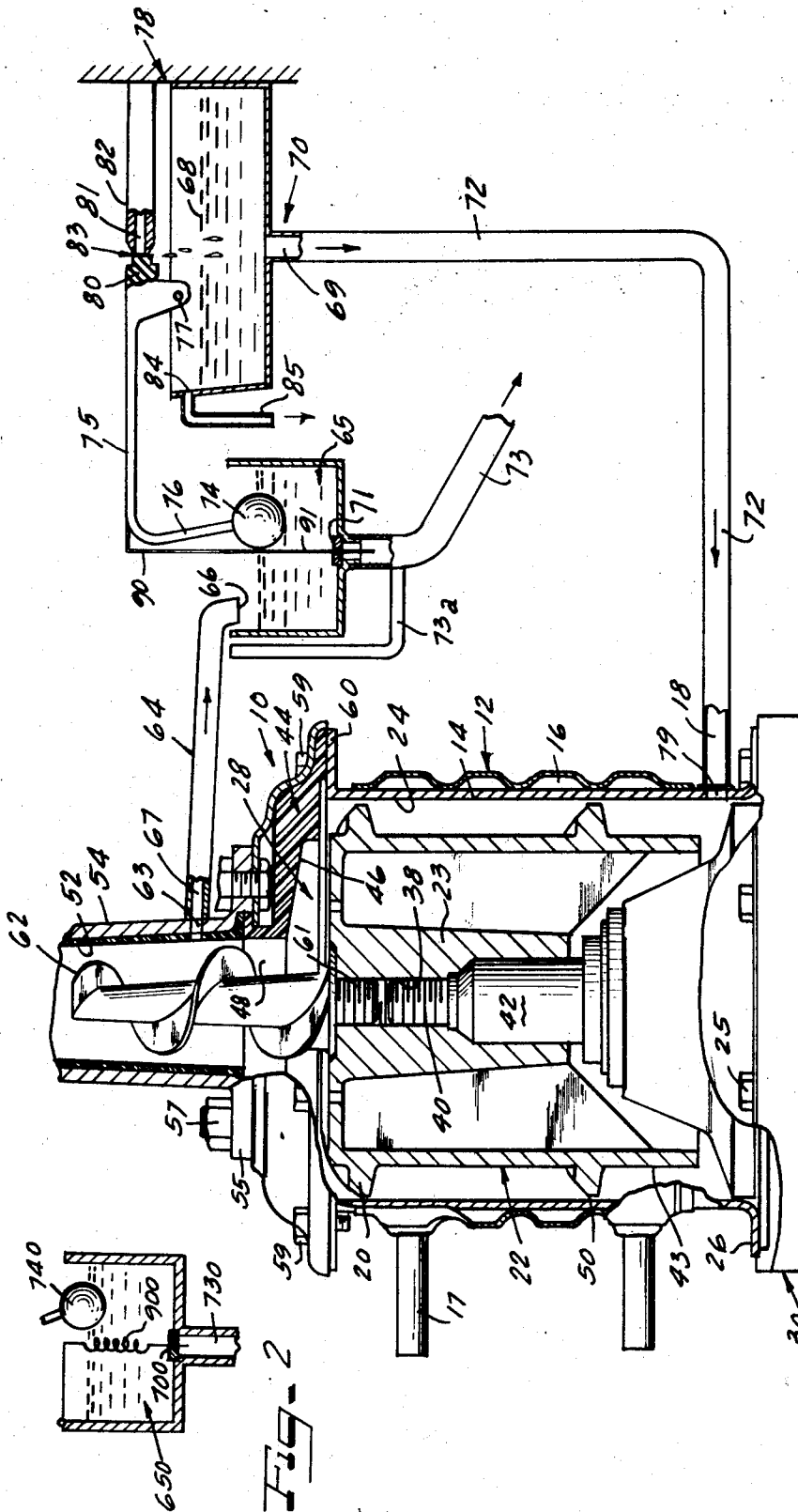


Fig. 1

Fig. 2

WATER CONTROL FOR ICE MAKER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to water supply systems for water using devices, and more particularly to a water flow control system for an ice making device.

2. Description of the Prior Art

The state of the Art is exemplified by copending patent applications Ser. No. 39,774, filed May 22, 1970, now U.S. Pat. No. 3,643,454, and Ser. No. 158,619 filed June 30, 1970, now U.S. Pat. No. 3,686,890, as a continuation of Ser. No. 867,248 filed Oct. 17, 1969, now abandoned and, both assigned to the same assignee as this application.

In ice making devices provided heretofore, finished ice products have been produced from ice flakes or slush harvested by an auger rotatable in a freezing chamber whereupon the ice product is compressed in a compression zone to form a column of hard ice. The water flow systems for such ice making devices includes means for gravitationally feeding or mechanically pumping water supplied from a source through the freezing chamber in an amount in excess of the freezing capacity of the freezing chamber. In such ice making devices, a portion of the feed water freezes into ice in the freezing chamber while another portion of the feed water remains in the liquid state for receiving minerals and other impurities migrating from the freezing water. All the liquid, the impurity-laden portion of the supply water and excess water, removed from the ice flakes or slush is drained from the ice making device.

SUMMARY OF THE INVENTION

In an ice making device having a water flow system which includes a water line supplying water from a source to a reservoir for feeding water to the freezing chamber and an outlet passage for venting the excess water from the ice extrusion passage of the ice making device, a water flow control system to provide water only in a slight excess of the capacity of the ice making device. A drain reservoir is provided for receiving the vented excess water and has a restrictive orifice in its bottom to control the drainage flow of the excess water. A pivotal arm is mounted on the water feed reservoir with one end arranged to form with the water line a control shut-off valve. A float is extended from the other end of the pivotal arm and is positioned in the water in the drain reservoir whereby when the water level is reduced to a predetermined level, the control shut-off valve is opened to supply water to the feed reservoir. Accordingly, when the water level is increased to a predetermined level the control shut-off valve is closed and thus, the water fed to the ice making device varies directly with the amount of water formed into ice.

The system may advantageously include means for preventing blockage of the restrictive orifice by impurities in the excess water drained from the system.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of the invention, its construction and operation, will best be understood from the following detailed description of an embodiment thereof taken in conjunction with the accompanying drawings in which:

FIG. 1 is a partial, sectional view of an ice making apparatus illustrated in combination with the water flow control system of the present invention diagrammatically illustrated; and

FIG. 2 is a fragmentary view of a portion of an ice making apparatus embodying an alternate means for preventing blockage of the restriction device of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, in FIG. 1 there is illustrated an ice making device together with a water flow control system embodying the present invention. As shown, the ice maker generally indicated at 10 includes a freezing chamber or evaporator unit 12 having an internal bore forming a cylindrical wall 14. An integrally formed evaporator passageway 16 has a refrigerant or coolant expanded therein by a refrigeration system through an expansion valve, and a compressor (not shown) is in communication with the passageway via a suction line 17. Water is introduced into the evaporator internally of the wall 14 through an inlet conduit 18 disposed near a base of the freezing chamber 12. The water tends to freeze on the wall 14 in the form of a thin film of ice. One or more helical flights 20 formed or carried on a rotating harvesting auger 22 cooperate with the wall 14 which in effect forms a freezing surface 24 whereby films of ice formed on the freezing surface 24 will continuously be harvested. The auger 22 progressively advances the harvested ice flakes or particles upwardly in the evaporator unit 12 toward a collection chamber 28 superjacent the evaporating unit 12.

Suitable fastening means, such as bolts 25, attach a radially outwardly extending support flange 26 formed on the evaporator unit 12 to a drive housing 30. A shaft 42 is disposed centrally of the evaporator unit 12 and has a lower end portion supported within axially spaced bearing means in the drive housing 30. Gear reduction means are driven by a prime mover such as an electric motor (not shown). The shaft 42 is disposed coaxially of the evaporator bore and has a driven connection with the gear reduction means. Water is prevented from entering the drive housing 30 by seal means including a shaft seal engaging the shaft 42.

The harvesting auger 22 includes a central hub portion 23 having a through bore. A threaded portion 38 of the bore receives an upward threaded end portion 40 of the shaft 42 to support the harvesting auger for rotation with the driven shaft 42. A somewhat cylindrical or slightly conical portion 43 formed on the harvesting auger 22 and spaced concentrically inward of the refrigerated freezing surface 24 has an outer diameter relatively larger than the diameter of the shaft 42 and carries the helically extending flights or blades 20 which have edges 50 closely spaced adjacent the surface 24 to harvest the thin film of ice as the harvesting auger 22 rotates relative to the surface 24.

The collection chamber 28 is formed by a generally circular or inverted cup-shaped cap means generally

indicated at 44 which is the cover of the evaporator unit 12. The cover 44 has one or more channels 46 receiving the flake ice products from the harvesting auger 22. Each of the channels 46 extends in a generally spiral path of increasing cross section for conducting the flake ice products discharged from the freezing chamber 12 upwardly into a central passageway 48 leading into an internal bore 52 of a compression and forming nozzle 54. The nozzle 54 has a generally outwardly extending flange 55 secured to cap means 44 by suitable fasteners, such as bolt and nut assemblies as at 57 and the cap means 44 is suitably secured by a plurality of circumferentially spaced bolts 59 to a radially outwardly extending flange 60 on the evaporator unit. Thus, the drive housing 30, the evaporator 12, the cap cover 44 and the compression nozzle 54 are detachably secured in a stacked relationship by the fastening means 25, 57 and 59.

In order to compress the flake ice products harvested from the refrigerating freezing surface 24 into a solid ice product a compression auger 62 mounted for rotation with the harvest auger 22 receives the flake ice product from the collection chamber 28 and squeezes the ice particles through the nozzle bore 54 to remove excess water and form an emergent solid column of ice at the upper end of the nozzle 54. The compression auger 62 has a depending, threaded stud 61 engaged into the threaded bore 38 of the harvesting auger.

In accordance with the principles of the present invention, a water flow control system is provided in conjunction with the water supply and ice making device as illustrated in the drawing. The water supply generally indicated at 70 gravitationally feeds water down through the conduit 72 and the evaporator inlet 18 and upwardly through the freezing chamber formed by the cylindrical refrigerated wall 14.

It is contemplated by the present invention to provide a flow control system for utilizing the quantum of discarded impurity-laden unfrozen or liquid portion of the inlet water as a controlling variable in controlling the flow of supply water to the evaporator and ice maker. Such control system provides a reservoir, a drain reservoir 65, for receiving any excess or impurity-laden unfrozen liquid through an outlet conduit 64 which has a discharge end 66 positioned over the drain reservoir 65. The outlet conduit 64 has a drain passageway 67 communicating with an outlet port 63 which intersects the nozzle bore 52. The excess water which is compressed from the ice flakes or slush forced through the tapered nozzle bore 52 by the compression auger 65 also drains from the nozzle 54 via the outlet port 63 and outlet conduit 64.

As illustrated in the drawing, the excess water vented from the compression zone via the opening 63 in the compression nozzle 54 and out through the outlet conduit 64 passes from the drain reservoir 65 through a water flow restrictor, a control orifice 71 positioned at the bottom of the reservoir and out a drain line 73. The line 73 may advantageously include a vent line 73a. The restrictive orifice 71 is arranged to control and meter the flow of the water from the drain reservoir and thus maintain a discernable level of water in the reservoir 65. As shown, a float 74 is positioned in the water in the drain reservoir 65. The float is mounted on the extended curved end 76 of a pivotal arm 75. The arm 75 is pivotally mounted by a pin 77 on an incoming or water supply reservoir 78. The free end 80 of the

pivotal arm 75 is arranged to be aligned with the open end 81 of a water line 82 through which water is supplied from any convenient source (not shown). The water supplied through line 82 is fed into the supply reservoir 78 and then down through the conduit 72 extending from the reservoir to the inlet 18 into the evaporator 12. As illustrated, the pivotal arm 75 with its free end 80 is arranged to form a control shut-off valve 83 with the open end 81 of the water line 82. The valve 83 controls the supply of water to the incoming reservoir 78.

In order to feed the inlet water to the inlet conduit 18 and upwardly through the evaporator unit 12, the collection chamber 28 and the nozzle bore 54, the water system 70 includes the tank or incoming reservoir 78 for holding water having a liquid level 68 maintained at a height above the outlet conduit 64 of the compression nozzle. Conduit means 72 form a passageway 69 communicating the reservoir 78 with an inlet port 79 formed in the evaporator wall 14 at a lower end portion thereof. The tank 78 outlet passageway 69 and the evaporator inlet port 63 are each sized relative to the height of the liquid level 68 maintained in the tank 78 to provide water flow through the evaporator freezing chamber in the desired quantity, which is in excess of the amount required for producing the finished ice product. It will be understood that a pump could be provided, if desired or if necessary.

An overflow outlet port 84 communicates with an overflow drain pipe 85 and is disposed slightly above the desired liquid level, thereby draining excess water from the reservoir 78 for preventing the liquid level 68 from exceeding the desired height.

As shown in the drawing, the water flow control restrictor 71 of the drain reservoir 65 is behind or downstream of the evaporator unit 12. With this arrangement, a selectively constant water flow through the ice making system is assured and the excess flow of water may be selectively regulated. Also, the inflow or feed of water varies directly with the amount of water used, i.e., made into ice.

In the operation of the water supply system and water control system, the water enters through the water supply line 82 and drops into the incoming or supply reservoir 78 and down through the conduit 72, the inlet conduit 18 and inlet port 79 into freezing chamber 12 of the ice making device. Then, after the ice flakes or slush are removed from the wall 14 of the chamber 12 by the harvest auger 22 and formed into solid ice by the compression auger 62, the excess water with the impurities and minerals therein flows out the outlet port 63 and conduit 64 into the drain reservoir 65 and thereby causes the float 74 to rise. The float 74 being on the end of the pivotal arm will pivot upward and thus the free end 80 of the arm is moved close to the open end 81 of the water supply line 82. The water supply line is not shut off entirely because of the small amount of water that flows out of the control restrictive orifice 71 at the bottom of the drain reservoir. Thus, with this arrangement, the water is allowed to flow continuously through the ice making system. However, the amount of excess water is limited and controlled to a minimal amount. When the ice maker makes ice, more water, accordingly, is supplied through the incoming water line 82 into the feed reservoir.

In accordance with the present invention, the water flow control system functions in combination with the

electrical control apparatus of the ice making device. The electrical control apparatus controls the drive motor for the harvest and compression augers, 22 and 62, and the compressor. A suitable electrical control apparatus such as described in the co-pending patent application Ser. No. 145,130, filed May 20, 1971, includes sensing and switch means to operate and stop the augers and other moving parts as needed in the operation of the ice maker. For example, if the drain line 73 clogs causing the drain reservoir 65 to fill, the float 74 rises, shutting off the incoming water through the line 82. The water in the evaporator unit 12 is used up and the unit shuts down because of the cold suction line sensor in the electrical control apparatus.

In order to decrease the time necessary to melt the accumulated ice in the evaporator, the water supply system 70 can include a selectively operable heating means (not shown) disposed in the incoming reservoir 78 for heating the inlet water. With this arrangement, the electrical control means would be interconnected to the heating means and include a safety thermostat or other appropriate means for sensing when the ice making apparatus becomes ice bound. During normal operation of the ice making apparatus the heating means would be inactive and when the control means senses that the ice making apparatus has become ice bound the heating means would operate to heat the water supplied to the inlet port 79 of the evaporator.

The system may advantageously include automatically functioning means for preventing clogging or blockage of the restrictive orifice 71 by impurities such as minerals in the excess water drained from the system. Such means may preferably be in the form of a bent wire 90 secured in any suitable manner to the pivotal arm 75 as shown in the drawing. The wire 90 has a depending portion 91 which extends downward for a short distance through control orifice 71. As pivotal arm 75 moves up and down under the influence of float 74, wire 90 moves also, thereby dislodging any impurities tending to form across orifice 71.

The means for preventing clogging or blockage of the restriction orifice may also take a form employing a spring which is moveable in accord with a natural frequency of vibration of the ice making device. Such an arrangement is disclosed in FIG. 2 wherein a spring 900 is rigidly attached by an arm to a wall of a drain reservoir 650 forming part of an ice making device or apparatus similar to the embodiment illustrated in FIG. 1. The reservoir 650 is provided with a float 740 and a drain line 730. A depending straight, vertical member extends downward from spring 900 through the orifice 710. As the ice making device (only pertinent details are shown) operates to make ice, vibrations in the ice making device will occur, and the spring 900 will pick up a sympathetic frequency of vibration from a natural frequency of the ice making device and oscillate the vertical member up and down, thereby dislodging any mineral or other impurities tending to form across orifice 710.

An important feature of the water flow control system as described above is to lessen the amount of excess water drained off from the ice making device. With this control system, when there is an overflow over a predetermined maximum amount of excess water, the control or restrictive orifice 71 causes the water in the drain reservoir 65 to back up and thereby raise the float to close the shut-off valve 83 and then discon-

tinue the feed of water to the incoming reservoir 78. Thus, the excess of the water supplied to the system or ice making device is limited and controlled.

Another important feature of the water flow control system is that it provides a constant water flow through the ice making device at the desired water flow rate under all ambient temperature conditions. Thus, there is provided the same flow of water during both high and low ambient temperature conditions.

Still another feature of the system is that it provides a fail safe condition in the event the drain line 73 becomes plugged for any reason. In such event, as indicated above, the drain reservoir 65 would fill to a level such that float 74 would pivot arm 75, causing shut-off valve 83 to close, stopping further water flow into the system, thereby preventing damage to the system due to water overflow.

Although those versed in the art may suggest various minor modifications, it should be understood that we wish to embody within the scope of the patent warranted hereon all such modifications as reasonably and properly come within the scope of our invention as defined in the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In an ice making device having a water flow system including a water line supplying a water feed reservoir for feeding water in excess of capacity of the freezing chamber and an outlet conduit for venting the impurity-laden and excess feed water from the extrusion passage of said ice making device, a water flow control system comprising:

a drain reservoir for receiving the water vented through said outlet conduit, said drain reservoir having a restrictive orifice positioned in its bottom to control the drainage flow therefrom of water; an arm pivotally mounted on said water feed reservoir, one end of said arm being arranged to form a control shut-off valve with the open end of said water line; and

a float extending downward from the other end of said pivoted arm and positioned in the water in said drain reservoir whereby when the water level in said drain reservoir is reduced to a predetermined level the float is lowered to open said control shut-off valve sufficiently to feed said water feed reservoir and, thus, the freezing chamber.

2. In an ice making device according to claim 1, wherein said restrictive orifice in said drain reservoir is arranged to meter out the excess water at a rate sufficient to provide a desired constant flow of water through said freezing chamber.

3. In an ice making device according to claim 1, wherein the water flow control system is arranged downstream from said freezing chamber.

4. In an ice making device according to claim 1, wherein the level of water in said water feed reservoir is at a height above the outlet conduit, thereby gravitationally feeding water into and through the freezing chamber.

5. In an ice making device according to claim 1, wherein there is provided means for preventing clogging of the restrictive orifice.

6. In an ice making device according to claim 5, wherein said means for preventing clogging comprises means moveable with said pivot arm.

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7. In an ice making device according to claim 5, wherein said means for preventing clogging comprises means moveable in accord with a natural frequency of vibration of said ice making device.

8. In a method of making pure ice which includes the steps of gravitationally feeding water through a freezing zone in an amount in excess of the freezing capacity of the zone and in excess of that required to produce the ice product and freezing a portion of the water fed through the zone while maintaining another portion in a liquid state, collecting the frozen and the liquid portions of the water fed through the freezing zones, compressing the collected frozen portions to remove liquid to form a compressed ice product, and discarding the excess water,

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a process of controlling the water flow in said ice making method comprising receiving the discarded excess water in a drainage zone, restricting the flow of water from the drainage zone, providing sensing downstream from said freezing zone in said drainage zone to sense the quantity of water in said drainage zone, and initiating the feeding of water through the freezing zone when a predetermined quantity of water is sensed in said drainage zone.

9. In a method according to claim 8, wherein the flow of water from said drainage zone is restricted at a rate sufficient to permit a constant flow of water to said freezing zone.

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