A drawing of an ice cube system is shown, indicating a grid with open outer ends, the outer portions of the grid being inclined inwardly at its lower end. The grid has compartments that incline downwardly towards open outer ends.

**ABSTRACT**

An ice making machine having an ice cube molding grid having a back wall adjacent an evaporator, the lower walls of compartments of the grid being inclined downwardly toward open outer ends, the outer portions of the grid being inclined inwardly at its lower end.

10 Claims, 3 Drawing Figures
ICE MAKER WITH SWING-OUT ICE CUBE SYSTEM

FIELD OF THE INVENTION

This invention is in the field of ice cube making machines of the kind which have a grid mounted on an evaporator and in which, during harvest, an ice cube assembly formed of ice cubes in each of the compartments of the grid, falls from the grid to break up into ice cubes by impact.

DESCRIPTION OF THE PRIOR ART

Ice making machines in the field described have had their grids disposed so that the rearward walls and also the outermost edges of the grid are disposed in vertical planes. This has the disadvantage that, during harvest cycle, the earlier melting of the lower part of the ice assembly has little effect on how soon the ice assembly can fall out of the grid because the entire ice assembly or cake must come out at once. In other words, it comes out whenever the uppermost portions have melted away from the grid and are loose.

In such prior art machines, the entire ice assembly or cake cannot become loosened until a much longer time period has passed for defrosting than is necessary with the ice machine of my concept.

It is an objective of this invention to provide a grid, the outer surfaces of which are included approximately 15° with respect to the vertical so that as the lower portions of the ice cube melt free of the grid, then the weight of the lower portions, being pulled by gravity, will have the effect of prying the upper portions loose faster. Speed of harvest is important in ice machines.

In prior art ice machines, the water flowing down across the outsides of a grid flows down across the upper wall of a compartment in a vertical direction and must make a turn of approximately 105° in order to cling to the underside of the upper wall of a compartment as the water moves on its way to the back end wall of a compartment. Because the water must turn at such a sharp angle as a 105°, the ice cubes made by such a machine of the prior art are not as uniform as is desired.

However, by using my concept of having the water flow downwardly across the outer surface of the upper wall of a compartment at an inclination of 15° with respect to the vertical, therefore, the amount of turn that the water must make in order to flow back across the upper surface of a compartment on its way to the rearward end wall of the compartment is only a 90° turn. Since water can make this 90° turn much more easily, the net result is a desirable uniform ice cube.

It is not possible with prior art concepts to simply reduce the amount of the angle of inclination of the upper wall of the compartment with respect to the horizontal in order to cause water not to need to flow around such a sharp angle because a substantial inclination is already needed for the purpose of desirable harvest and so that a ice cake is not held unduly long by its grid.

And so, with this invention, even though the upper wall of an ice compartment is slanted the same as in the prior art, yet the amount of turning that the water must make in order to follow the upper wall is a much less sharp turn by the amount of 15°.

A particular disadvantage of the prior art machines of the kind described has been that ice tends to build up below the outer tip edges of the upper wall of each compartment. This build-up of ice curtails the flow of water in the desired fashion back up along the underside of the upper wall because the amount of turn of the water must make is even greater because of the ice build-up. This ice build-up places make drip points which encourage further ice build-up in these undesirable locations. This ice build-up is particularly a problem because this problem of ice build-up at the outer edge is particularly great in the prior art because the outer edges of each compartment are directly below and in the drip-path of the outer edges of upper compartments.

It is an object of this invention to prevent this problem by so inclining the grid that the outer edges of the compartment walls of lower compartments are not directly beneath, but are instead, staggered to one side of the outer edges of the respective upper compartments.

SUMMARY OF THE INVENTION

An ice making machine comprising an ice-molding grid having a plurality of compartments disposed one above another and one alongside another in which the upper wall of each of the compartments is inclined with respect to the horizontal downwardly toward its outer end for ease of harvest of an ice cake, and further in which the inclination of a plane in which the outermost surfaces of a grid is inclined with respect to the vertical by an amount of preferably 15° so that water flowing across the outer edge of an upper wall of a compartment will not need to make a turn on its way along the upper wall to the rearward wall of a compartment, which turn is as sharp as would be the case if the outermost surfaces of the side walls of compartments of the grid were disposed in a vertical plane, whereby the ice chunks formed by the grid are more uniform.

The ice making machine described in which the evaporator behind the grid heats up first in its lower portions and then progressively toward its upper portions during the harvest cycle, whereby loosening of the ice cake on the grid begins at the lower end so that its lower end tends to swing outwardly under the influence of gravity and this tendency exerts a force of the ice in the upper portions of the ice cake against the respective compartment walls tending to bring about an earlier loosening of the upper portions of the ice cake.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a diagrammatic view showing in perspective a portion of an ice making machine of this invention in which there are two evaporator sections and two grids, and for purposes of illustration, the left-hand grid is shown with an ice cake thereon in a position it would assume toward the end of a harvest cycle just before the ice cake becomes completely loose and falls downward. On the right side of the view in FIG. 1, the closest side wall portion of the grid is broken away in its upper side to show there beneath the arrangement of the walls of the grid, a dotted line indicating the flow-path of water during the freezing cycle, end portions of upper sections of the evaporator which is on the right side of the view of FIG. 1 are broken away for purposes of illustration.

FIG. 2 is a diagram showing the evaporator sections and piping leading thereto, the remainder of the operating parts of the refrigerator being diagrammatically shown in a rectangle for convenience of illustration,
since such parts are common to ice making machines. FIG. 3 is a diagram showing how water is recycled and how fresh water can enter this system, the grids and evaporator sections not being shown in FIG. 3 for convenience of illustration.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The ice-making machine of this invention is generally indicated at 10 and comprises and evaporator chamber 12 in a frame 14, the chamber 12 receiving a first and a second evaporator, each of which is generally indicated by the numeral 20. Each evaporator 20 comprises a plurality of coils or loops 32 which are disposed one above another.

The coils of each evaporator lie in a plane that is inclined with respect to the vertical by 15°, such plane being parallel to the back wall 39 of an ice-chunk molding grid generally indicated at 40.

First and second grids 40 are provided and are disposed spaced apart with respect to each other a greater distance at their upper ends than at their lower ends and the inner walls or back walls 39 of each grid 40 are each disposed in planes inclined with respect to the horizontal and vertical and disposed specifically at an inclination of approximately 15° with respect to the vertical with the upper end of the back wall 39 of one grid 40 disposed a substantially greater distance from the upper end of the other grid 40 than the lower ends of the back walls 39 are spaced.

The grid 40 can be called an ice-chunk molding grid and has a plurality of compartments 46, each of which has an open outer end 48 and each of which has an inner end wall 52 and has a plurality of other side walls, which latter form a side wall configuration generally indicated at 54 composed of an upper wall 62, a lower wall 64, and two side walls 66.

Each of the side walls 66 is disposed transversely to and preferably at a right angle to the respective inner end wall 52 and extends outwardly to the respective open end 48 of the respective compartment 46.

The compartment open ends 48 face generally in the same direction as shown.

The lower side wall 64 of each compartment is inclined with respect to the vertical and, more particularly, inclined with respect to the horizontal, which latter is indicated by a line 80 in FIG. 1, inclining downwardly toward the open end 48 of the respective compartment so that a piece of ice in a respective compartment which has been melted loose from its compartment wall can slide out of the respective compartment because of the inclination with respect to the horizontal indicated by line 80. The specific inclination preferred is approximately 15° as indicated by the angle A in FIG. 1, the angle A being taken between the horizontal line 80 and a line 90 which is parallel to a lower wall 64.

Preferably, all walls of the compartments 46 form a configuration which is rectangular on all of its sides. Such configurations are commonly called “ice cubes” in the terminology of the trade, even though they are often not exactly cubic. The term used in this application for the piece of ice made by the interior of one of the compartments 46 is simply ice chunk 100, may of which can be seen in FIG. 1 on the left-hand side.

Each of the compartments 46 has its upper and lower side walls and its inner end wall 52 each disposed at an angle with respect to the horizontal such that substantial amounts of water from those parts of each upper side wall which latter parts are nearest the respective open end 48, will flow across the respective upper side wall over to the respective inner end wall 52 and then will flow down the respective inner end wall 52 to the respective lower side wall 64 and then will flow across the lower side wall to the respective open end 48 and down across the outermost edge 94 of the respective lower wall 64 down into the next lower compartment. The direction of flow indicated by the last sentence herein is shown in a dotted diagrammatic line seen at 110 in FIG. 1.

At the upper end of the frame 14 a header 120 is mounted and water is contained within it which flows out through openings 122 in each of two sides thereof downwardly across a downwardly extending deflector panel as diagrammatically indicated by the line 110, across the outer edge 126 of the panel 124 and then down under the upper wall 62 of an uppermost compartment, which latter has its upper wall 62 spaced from the deflector panel 124 by a strip of insulation 128.

The grid 40 on the opposite side of the grid assembly 150 from the right-hand grid shown is a left-hand grid 40 of identical construction to the right-hand grid 40, but it faces in an opposite direction. Its respective grid wall surfaces all have inclinations with respect to the vertical that have been described for the right-hand grip shown.

The inner walls 52 of the grid compartments 46 are disposed at an angle of 15° with respect to the vertical, preferably.

The inner wall 52 of each of the compartments is disposed close enough to the evaporator section which it is nearest so as to be cooled and heated thereby by means later described.

The compartments 46 are disposed one above another in rows and each row is disposed alongside another row so that there are as many rows as desired, both vertically and horizontally.

The header 120 and the openings 122 and the deflector 124, all form parts of a water delivery assembly generally indicated at 150 in FIG. 1, other parts of which can be seen in FIG. 3 and which comprise a water-carrying pan 160 having on its upper side suitable ice-breaking means 170, which latter can be criss-crossing wires or bars firmly fastened to the upper side of the water pan 160 and having spaced water passages 172 therebetween for allowing water dripping down from the grids 40 to fall into the pan 160 from where it can be pumped out continuously through pipe 164 to a pump 170 which delivers the water to the header 120 through a pipe 172.

Since the pump 170 operates continuously, there is a continuous recycling of already cooled water upwardly again for distribution once more down across the grids 40.

Fresh water enters the pan 160 through a suitable pipe 180 from a city water supply and at a rate suitable for operation.

As best seen in FIGS. 1 and 2, the evaporator has lower and upper portions generally indicated at L and U.

Referring to FIG. 2, a cooling medium and heating medium delivery means is generally indicated at 200 and can be of a form commonly found in refrigeration systems and, in its broad sense, delivering heating,
moving medium, such as Freon F-12 through a pipe 220 in the direction of an arrow 222 down to the lower portion of the evaporator first so that during the harvest cycle, the heating medium flowing to the bottom or lower portion of each evaporator section 40 during the harvest cycle so that chunks 100 of ice in the lower compartments opposite the lower portions of each evaporator 40 are melted free of their compartment walls sooner than upper chunks 100 in upper compartments so that an ice chunk assembly, such as generally indicated at 300 in FIG. 1 and disposed on a grid 40 will swing towards vertical at its lower end in the direction of an arrow 310 in FIG. 1. As soon as it is free and thereafter will continue to melt loose from the upper compartment walls at the top of a grid until it is completely free, and thereafter, the ice chunk assembly 300 will drop vertically downward, or substantially vertically downward, directly onto the ice-breaking bars or wires 170.

This has great advantage because if a ice chunk assembly 300 to become free from its grid on all parts of the grid at once, or even on the upper part of the grid first and before becoming free from the lower part of a grid, then the chunk assembly would tend to pivot outward at its upward end and would not fall directly down from a vertically hanging position, but would, instead, swing out at its upper end, whereby the ice-breaking bar or wire assembly 170 would need to be of a much larger area in order to be in a position to receive the impact of the ice chunk, and such a large area would mean a larger housing for the entire machine and much greater manufacturing cost. In addition, it would mean a larger floor area for the machine, as is much less desirable in such a product.

During a freezing cycle, the moving refrigerant medium, which is also preferably Freon F-12, follows the same path in the direction of the arrow 222 in FIG. 2, and therefore, enters the evaporator section at the bottom first. The only difference between the refrigerant medium and the heating medium is the difference in pressure and temperature causing them to have the cooling and heating effects that are common to evaporators in ice machines.

Dependability is assured because the weight of the ice in an ice chunk 300 that has become loose helps to pull the rest of the ice chunk off of a grid until the entire ice chunk has slid out into the substantially vertical position, whereupon it is ready to fall straight downward while remaining vertical until it crashes against the ice-breaking bars or wires 170 and thereby breaks up into separate chunks 100 because the ice webs 350 and a chunk 300 tend to break upon impact with the ice-breaking assembly 170. The webs 350 exist in the first place because of water that freezes while passing over the outermost edge of the lower wall of each compartment.

1. An ice making machine comprising: a frame, an evaporator mounted on said frame and having an inlet and an outlet, delivery means mounted on said frame, said delivery means being operably connected to said evaporator and delivering a moving cooling medium to said evaporator during a freezing cycle and for delivering moving heating medium to said evaporator during an ice harvest cycle, an ice chunk molding grid adjacent said evaporator and having a plurality of compartments disposed one above another and one along side another and each having an open outer end and an inner end wall and a plurality of other side walls which latter form a substantially closed side wall configuration, each of said side walls being disposed transverse to and connecting the respective inner end wall and open end, said compartment open ends facing generally in the same direction, two of said side walls of each of said compartments being upper and lower side walls, each of said lower side walls being inclined with respect to the horizontal downwardly toward the open end of the respective compartment so that a piece of ice in the respective compartment which is melted loose from its compartment walls will slide by gravity out of the open end of the respective compartment, each of said upper walls being disposed at an angle with respect to the respective lower wall of the same compartment so as to permit a piece of ice in the respective compartment which is melted loose from its compartment walls to slide by gravity out of the open end of the respective compartment, each of said compartments having its upper and lower side walls and its inner end wall disposed at angles with respect to the horizontal such that substantial amounts of water from those parts of each upper side wall which latter parts are nearest the respective open end will flow across the respective upper side wall to the respective inner end wall and down said respective inner end wall to the respective lower side wall and across said lower side wall to the respective open end, means mounting said grid on the remainder of said machine in a position such that the inner end wall of each of said compartments is disposed close enough to said evaporator to be cooled and heated thereby, and means on said frame for delivering a flow of water to the open end edges of the upper side walls of upper ones of said compartments, said evaporator having lower and upper portions, and said delivery means delivering said heating medium to said evaporator during said harvest cycle specifically to the lower portion of said evaporator first so that the chunks of ice in lower compartments are first melted free of their compartment walls so that an ice chunk assembly of connected ice chunks on said grid will first swing outwardly of said grid towards vertical at its lower end and so that after said ice chunk assembly is free from said grid said ice chunk assembly will slide outwardly of said grid and then will drop downwardly while remaining in substantially upright position.

2. The ice making machine of claim 1 in which outermost edges of said upper and lower side walls are disposed substantially in a plane disposed at an acute angle with respect to the vertical, which angle is less than 30°, said upper and lower side walls being disposed in parallelism.

3. The ice making machine of claim 2 in which said angle is approximately 15°.

4. The ice making machine of claim 2 in which said side walls and said end wall of each compartment define the five equally sized walls of a cube.

5. The ice making machine of claim 3 in which said side walls and said end wall of each compartment define the five equally sized walls of a cube.

6. The ice making machine of claim 2 having a second like ice chunk molding grid disposed at an acute angle of less than 30° with respect to the vertical but having its said outermost edges disposed in a plane diverging toward its upper end with respect to the said
plane of the outermost edges of said first mentioned grid.

7. The ice making machine of claim 6 in which said angle is approximately 15°.

8. The ice making machine of claim 1 in which said side walls and said end wall of each compartment define the five equally sized walls of a cube.

9. The ice making machine of claim 8 in which the lower side walls incline downwardly at an angle of approximately 15° with respect to the horizontal.

10. The ice making machine of claim 1 in which said lower side walls of said compartments are in planes at right angles to the respective end walls thereof.

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