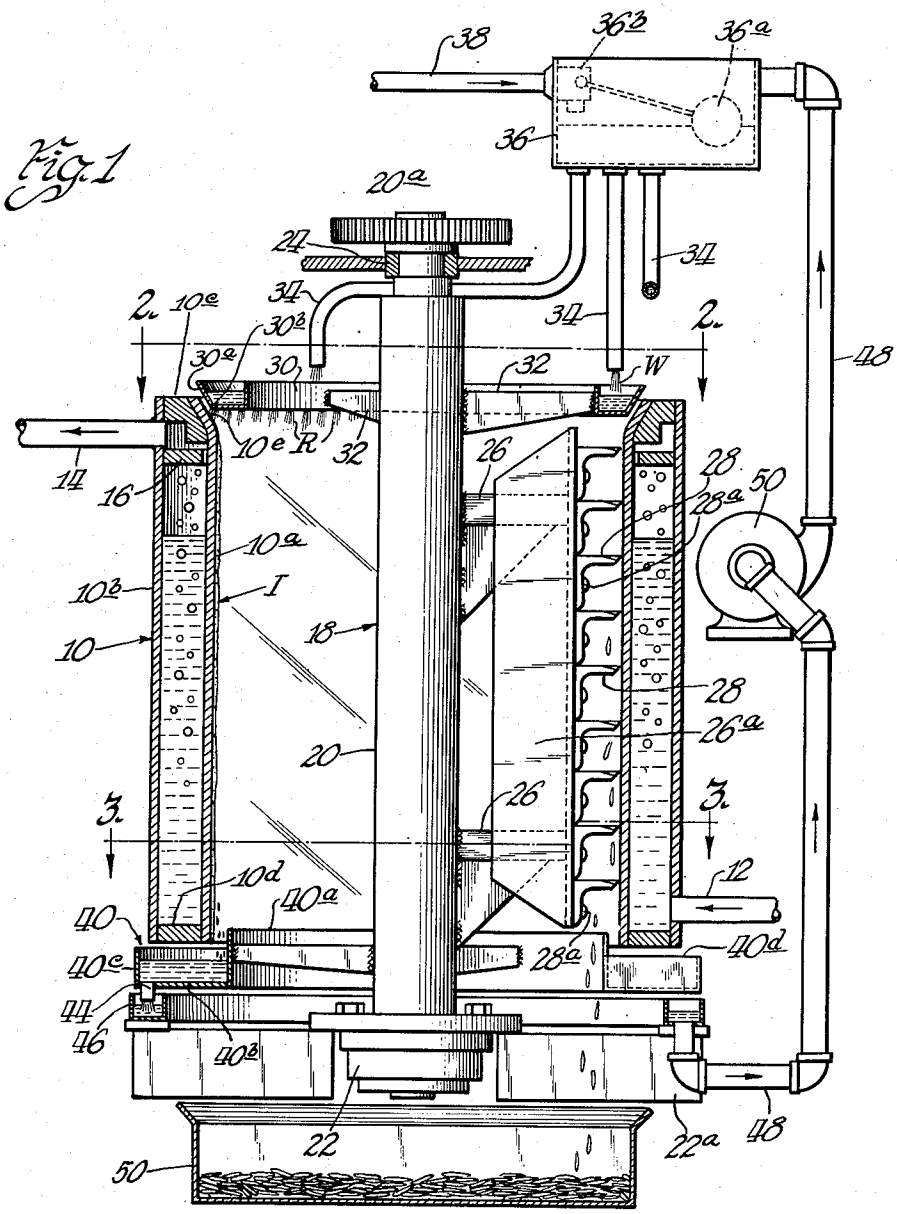
July 13, 1954 E. J. ALBRIGHT 2,683,357

FLAKE ICE MAKING MACHINE

Filed Oct. 26, 1951 2 Sheets-Sheet 1

Fig. 1



Inventor
Edward J. Albright
By Bair, Freeman & Molinare
Attys.

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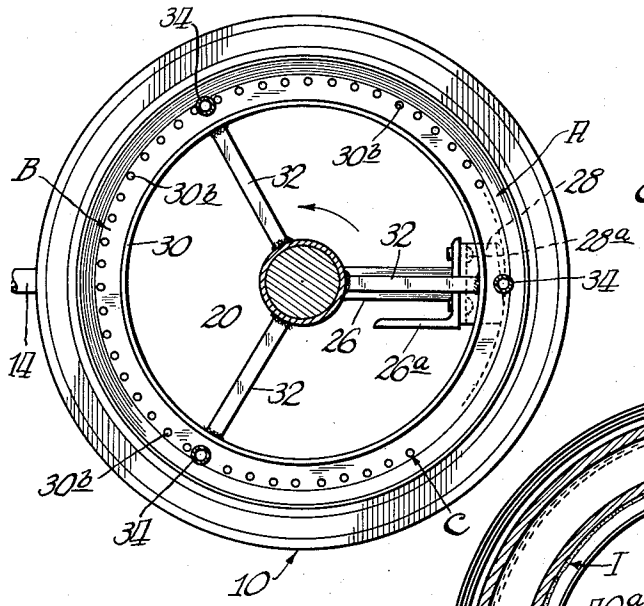

Fig. 2

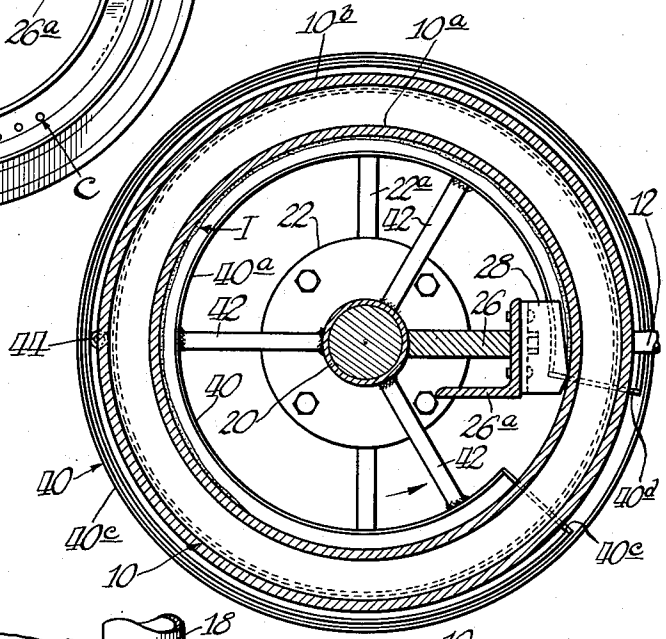

Fig. 3

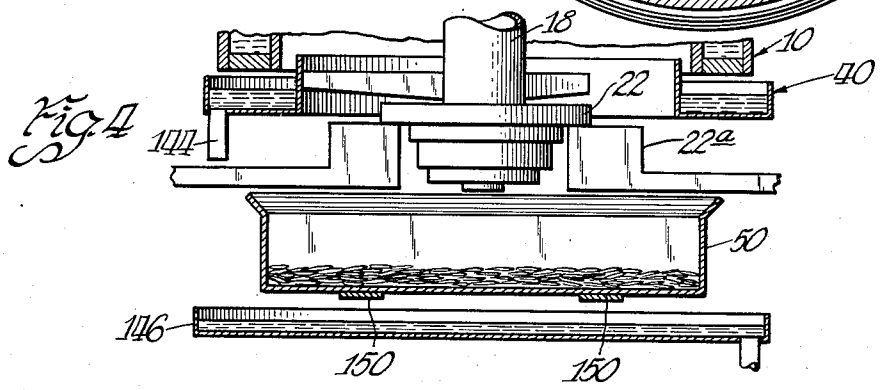

Fig. 4

Inventor
Edward J. Albright
By Bair, Freeman & Molinare
Attys.

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FLAKE ICE MAKING MACHINE

Edward J. Albright, Chicago, Ill., assignor to Akshun Manufacturing Company, Chicago, Ill., a corporation of Illinois

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5 Claims. (Cl. 62—107)

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My invention relates to an improved flake ice making machine characterized by a simple construction and the ability to effectively form dry crisp flake ice.

In one type of flake ice making machine, water is flowed upon one surface, usually the interior, of a vertical cylindrical evaporator. The water thus flowed freezes on the cylinder and is subsequently dislodged in the form of flakes by suitable means, such as knives. The dropping ice flakes form the product of the machine.

In machines of the above type, it is of crucial importance to allow the ice to freeze dry and to dislodge it in the form of flakes without water contamination. This demands that the water supply to the cylinder be interrupted in advance of the moving blades and; moreover, that the water or "rain" which falls from the machine be caught and separated from the falling ice. In addition, it is necessary to accomplish this with smiple and inexpensive mechanism which is reliable in operation and can be easily cleaned to assure the production of sanitary ice suitable for food preservation.

In accordance with the present invention the water is flowed over the ice forming cylinder from an annular rotating trough which moves in unison with the ice dislodging knives. Fixed water supply pipes empty into the trough to keep the same at a fixed water level. The trough empties onto the freezing cylinder through a series of discharge holes oriented to direct the water onto the top surface of the cylinder. The trough is imperforate in the circumferential region immediately leading and immediately trailing the knives so that water freezes to dry, sub-cooled, ice before the blades reach it. The rain dripping from the cylinder is caught by an annular gutter which likewise moves with the rotor. This gutter has a discharge outlet spaced radially of the cylinder. It has a window in the region immediately trailing the knives so that the falling ice drops into a suitable container provided for the purpose.

It is, therefore, a general object of the present invention to provide an improved flake ice making machine.

A further object of the present invention is to provide an improved water distributing mechanism for a flake ice making machine.

Another object of the present invention is to provide an improved rain collecting mechanism for a flake ice making machine.

Additionally, it is an object of this invention to achieve the above objects with a machine that

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is inherently simple and inexpensive in construction, highly reliable in operation, and easily cleaned.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following description taken in conjunction with the accompanying drawings in which:

Figure 1 is a view in axial cross-section, with parts in elevation, of a flake ice making machine constructed in accordance with the present invention;

Figure 2 is a cross-sectional view through axis 2—2, Figure 1;

Figure 3 is a cross-sectional view through axis 3—3, Figure 3; and

Figure 4 is a fragmentary view in axial cross-section of an alternative embodiment of the present invention.

Referring now to Figure 1 there is shown generally at 10 an evaporator drum having inner shell 10*a*, outer shell 10*b* and top and bottom caps 10*c* and 10*d*, respectively, forming a closed annular space. Liquid refrigerant is supplied to evaporator 10 through the pipe 12 and escapes as a vapor through the pipe 14. An annular baffle 16 is affixed to the outer shell 10*b* and defines a constructed annular passage 16*a* through which the vaporous refrigerant escapes at a velocity sufficient to prevent deposit of oil in the evaporator. The refrigerant is at such pressures as to maintain the surface of shell 10*a* well below the freezing point of water.

A rotor, indicated generally at 18, is mounted within the evaporator 10 and is coaxial therewith. This rotor includes a shaft 20, supported at its bottom by the thrust bearing 22 and at its top is held concentric with the evaporator by the sleeve bearing 24. This bearing 24 is supported by suitable support brackets (not shown) and bearing 22 is supported by arms 22*a*.

The shaft 20 carries a pair of aligned upper and lower radial arms 26 which at their outer ends receive the vertical angle bar 26*a*. This bar in turn supports an array of ice removing knives 28.

Each knife is of angle bar construction with one side attached by bolts 28*a* to the bar 26*a*. The other side of each knife extends radially outward in a horizontal plane and is sharpened to engage and remove ice on the interior face of the

shell 10a. In the form shown in Figures 2 and 3 these blades engage the ice at their trailing edges.

The knives 28 are aligned vertically so as to define an element of the cylinder formed by the shall 10a. Consequently, as the rotor is turned the element travels in relation to the shell and thus traverses the entire surface thereof.

The rotor 18 is turned by the gear 20a which is driven by suitable means (not shown).

As shown in Figure 1 the top surface of the shell 10a is bevelled at 10e. Water is flowed on this bevelled portion by the trough 30. This trough, as shown, is of annular conformation with an outer sloping side 30a forming to and overlying the beveled portion 10e of the shell 10a. This trough is mounted on and carried by the shaft 20 by reason of the three spider arms 32, Figures 1 and 2, so that it is in fixed relation to the shaft and knives at all times.

The trough 30 has a series of openings 30b, Figures 1 and 2, through which water flows onto the beveled edge 10e of the shell 10a. This water, which is fed to the trough by means described hereafter, fills the same to a predetermined level as shown at W, Figure 1. Upon passing through the openings or parts 30b, it strikes the upper beveled edge 10e of the shell 10a and spreads as shown by the rivulets R, Figure 1, so as to cover uniformly the surface of the shell 10a.

The trough 30 is perforated by the holes 30b only in the C-shaped region extending from point A, Figure 2, through point B, to point C. The imperforate region of the trough 30 extends from point A, Figure 2, to point C, through the region of the knives. This region is the region in advance of the knives where the ice freezes dry and the region trailing the knives where the ice is falling from the machine.

Water is supplied to the trough 30 by the three discharge pipes 34 which are positioned at their outlet ends above the trough. At their inlet ends these pipes receive water from the tank 36. Consequently, as the trough 30 rotates in unison with the knives 28 as the rotor 18 turns, the trough is fed with a continuous supply of water at all positions of rotation. A sufficient number of pipes 34 is used to provide essentially uniform flow from all the openings 30b.

The tank 36 is maintained at a predetermined level by the float 36a which actuates valve 36b to admit water from pipe 38 as required to maintain the desired water level in tank 36. This water level determines the pressure head acting on pipes 34, the flow through these pipes, and hence the water level in trough 30 and the rate of water flow through the openings 30b of the trough.

Water dripping from the machine, or "rain," is collected by the gutter shown at 40, Figures 1 and 3. As shown, this gutter underlies the inner shell 10a and extends radially outwardly therefrom. It consists of an inner cylindrical wall 40a, a nearly annular bottom 40b, and an outer cylindrical wall 40c. It is carried by the shaft 20 from the three spider arms 42 which are welded or otherwise attached at their ends to the shaft and to the gutter.

As shown in Figure 3, the gutter 40 is mutilated in the region below and trailing the knives 28. Imperforate end plates 40d are provided to form a water-holding unit. The gutter 40 has an outlet or discharge pipe 44 which is positioned to discharge into the fixed annular gutter 46 which is concentric with the rotor.

Water from gutter 46 is pumped through the pipes 48 by the pump 50 to the tank 36 where it is recirculated to form ice. This avoids the loss of efficiency otherwise attendant upon loss of the cooled water dripping from the machine. It also avoids loss of efficiency by reason of ice flakes that happen to fall into the gutter 30.

The mutilated or window portion of gutter 30 is below and immediately trailing the knives 28 as shown in Figure 3. In this region the ice flakes fall from the machine. They pass through this mutilated portion or window portion of the gutter to fall into the ice container 50, Figure 1. Since the gutter 40 extends under all the regions of the shell 10a other than the region of ice fall, all the water dripping from the machine falls into the gutter and the ice in container 50 remains dry and uncontaminated.

Thus in the operation of the machine, the water is flowed on the shell 10a only in the regions in advance of the knives 28 by an amount sufficient to form Dry Ice and the water dropping from the machine is intercepted to prevent fall into the ice container, while the ice flakes are permitted to dry freely.

The ice on the interior surface of the shell 10a is indicated generally at I. At any rotor position, the thickness of ice increases gradually from practically zero at region C where the first holes in the trough are effective to maximum thickness immediately in advance of the knives.

In the alternative embodiment of the present invention shown in Figure 4, the fixed annular gutter 46 is replaced by a full cylindrical gutter 14b located below the ice container 50. The ice container 50 is supported by suitable rails 150 extending across gutter at 46. The discharge pipe 144 is made of sufficient length to avoid splashing and yet to clear the supports 22a.

While I have shown and described a specified flake ice making machine it will be understood that many modifications and alternative constructions may be made without departing from the true spirit and scope of my invention. I, therefore, intend by the the appended claims to cover all structures coming within their true spirit and scope.

What I claim as new and desire to secure by letters patent of the United States is:

1. A rain collecting mechanism for a flake ice making machine of the type having a vertical freezing cylinder over which water is discharged and in which ice removing means dislodges ice along a moving element, the mechanism comprising: a gutter underlying the lower edge of the cylinder and mounted to move in unison with the ice removing means; the gutter extending about the greater portion of the periphery of the drum and defining a window extending circumferentially in the regions adjacent the ice removing means to avoid catching falling ice flakes; the gutter further having an outlet located in radially spaced relation to the region of ice fall; and a fixed water collecting gutter underlying the outlet at all positions of travel.

2. A rain collecting mechanism for a flake ice making machine of the type having a vertical freezing cylinder over which water is discharged and ice dislodging means which traverses a moving element of the cylinder to dislodge ice therefrom; the mechanism comprising: a gutter underlying substantially the entire lower edge of the cylinder to catch rain dripping therefrom and mounted to move in unison with the ice dislodging means, the gutter defining a circumferentially extending window in the regions of ice fall; the

gutter further having a discharge outlet radially spaced from the freezing cylinder.

3. A rain collecting mechanism for a flake ice making machine of the type having a vertical freezing cylinder over which water is discharged and ice dislodging means which traverses a moving element of the cylinder to dislodge ice therefrom; the mechanism comprising: a gutter underlying substantially the entire lower edge of the cylinder to catch rain dropping therefrom and mounted to move in unison with the ice dislodging means, the gutter defining a circumferentially extending window in the regions of ice fall; the gutter further having a discharge outlet radially spaced from the freezing cylinder; and, an ice collecting container located below the lower edge of the cylinder and radially spaced from said discharge outlet.

4. A flake ice making machine comprising in combination: a vertical freezing cylinder; a rotor; means on the rotor to dislodge ice from the surface of the cylinder along a travelling element as the rotor is turned; a trough mounted on the rotor and forming a complete annulus overlying the top edge of the freezing cylinder, the trough having a series of openings peripherally spaced from the region immediately leading the ice removing means and oriented to direct water onto the upper edge of the cylinder; and a gutter mounted on the rotor and underlying substantially the entire lower edge of the cylinder to catch rain dripping therefrom, the gutter defining a circumferentially extending window in the

regions of ice fall and having a discharge outlet radially spaced from the freezing cylinder.

5. A flake ice making machine comprising in combination: a vertical freezing cylinder; a rotor; means on the rotor to dislodge ice from the surface of the cylinder along a travelling element as the rotor is turned; a trough mounted on the rotor and forming a complete annulus overlying the top edge of the freezing cylinder, the trough having a series of openings peripherally spaced from the region immediately leading the ice removing means and oriented to direct water onto the upper edge of the cylinder; and a gutter mounted on the rotor and underlying substantially the entire lower edge of the cylinder to catch rain dripping therefrom, the gutter defining a circumferentially extending window in the regions of ice fall and having a discharge outlet radially spaced from the freezing cylinder; and a fixed water supply pipe adapted to discharge into the trough, and a fixed water collecting gutter in registry with said discharge outlet.

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