

[54] **WATER DISTRIBUTION CONTROL
FOR AUTOMATIC ICE CUBE MAKER**

[75] Inventors: **Harold Herman Esser**, Chicago;
Ralph Brent Olson, Lombard, both
of Ill.

[73] Assignee: **Schneider Metal Manufacturing Co.**,
Chicago, Ill.

[22] Filed: **Sept. 14, 1970**

[21] Appl. No.: **71,869**

[52] U.S. Cl.**62/347, 239/519, 261/112**

[51] Int. Cl.**F25c 1/12**

[58] Field of Search**62/347, 348; 165/115, 118;**
239/519, 521; 261/112; 159/43, 7

2,288,003 6/1942 Kleucker 165/115 X
1,543,009 6/1925 Hedges 239/519 X
3,546,896 12/1970 Hagen et al. 62/347

Primary Examiner—William E. Wayner
Attorney—Kegan, Kegan and Berkman

[57] **ABSTRACT**

In an automatic ice cube maker of the type in which water flows on the underside of a refrigerated plate to form ice thereon, interceptor means or baffle means interposed between the water supply means and a spatial zone below the refrigerated plate to prevent water loss from the water circulation system and to prevent water contamination of ice through discharge of water from the water supply means to the spatial zone below the refrigerated plate.

[56] **References Cited**

UNITED STATES PATENTS

3,608,822 9/1971 Berthoud 261/112
3,171,266 3/1965 Weiss 62/347

7 Claims, 5 Drawing Figures

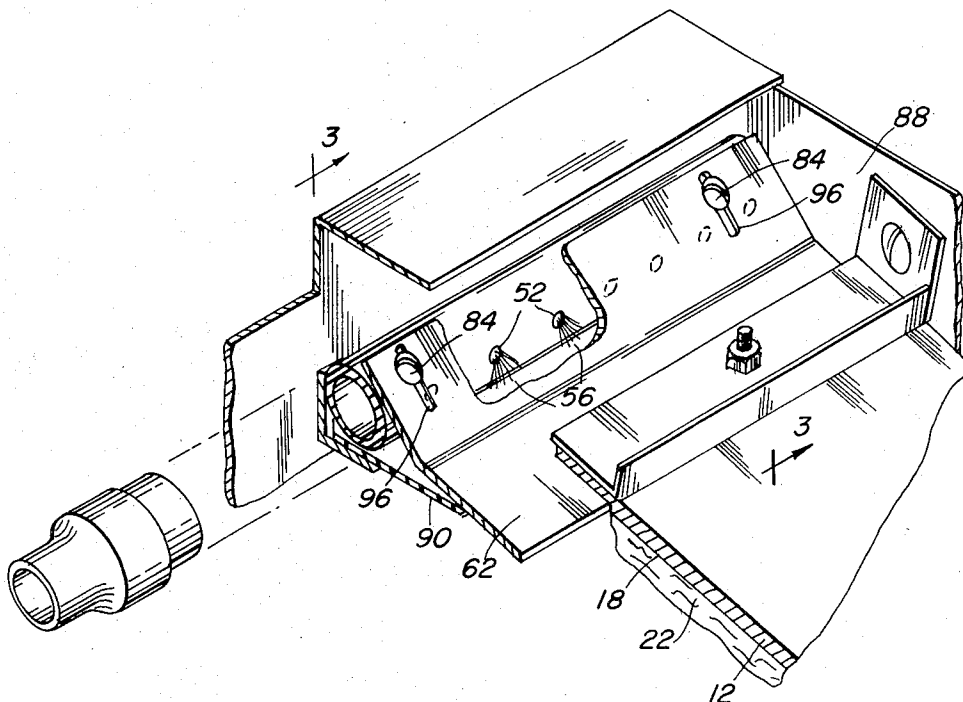


FIG. 1

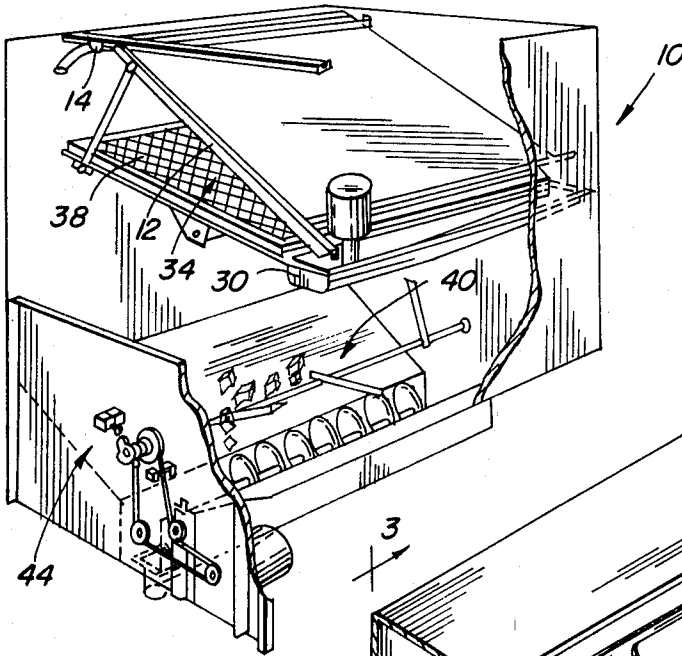


FIG. 2

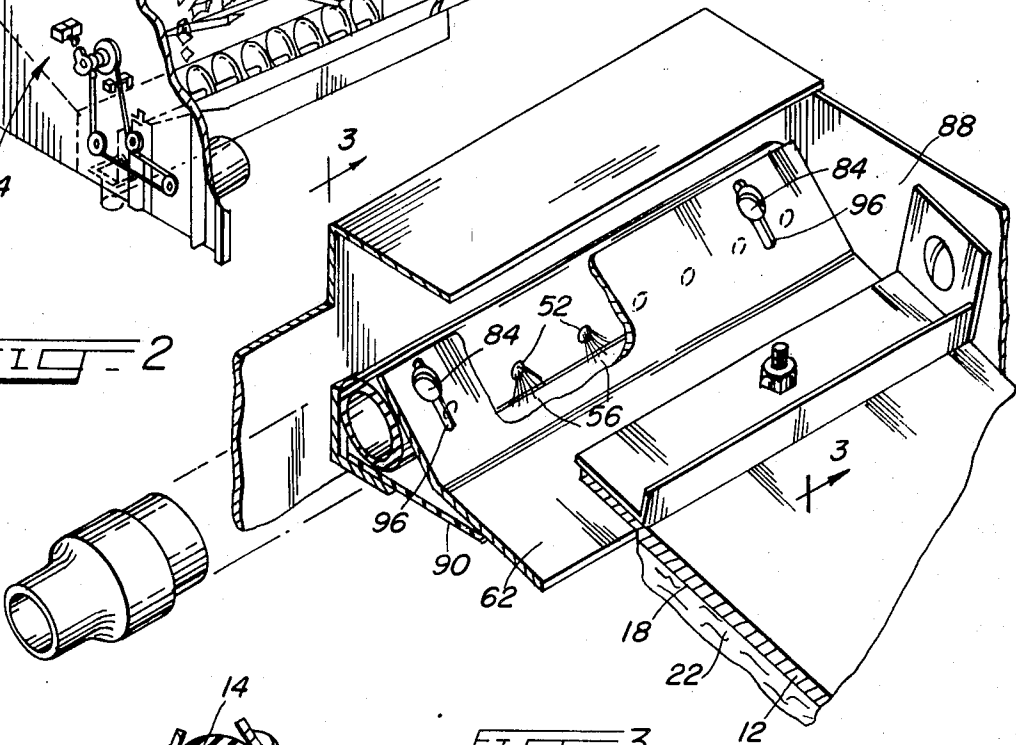
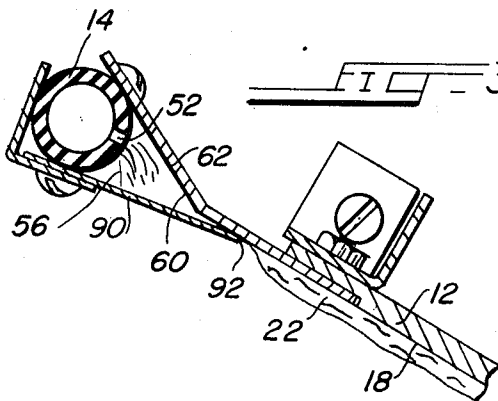


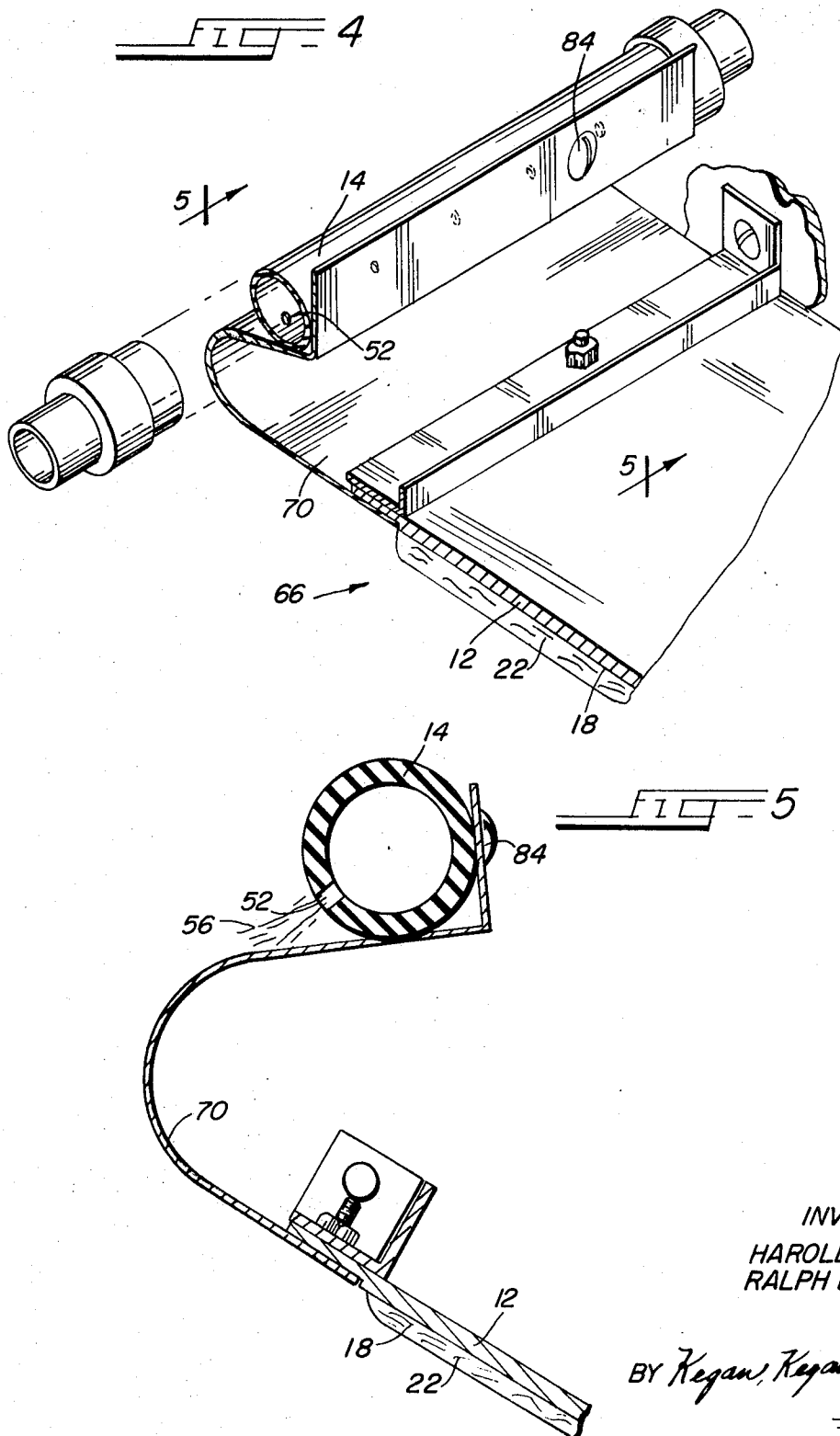
FIG. 3



INVENTORS.

HAROLD H. ESSER
RALPH B. OLSON

By Kegan, Kegan & Berkman
ATTY'S



INVENTORS
HAROLD H. ESSER
RALPH B. OLSON

BY *Kegan, Kegan & Berkman*

ATTY

WATER DISTRIBUTION CONTROL FOR AUTOMATIC ICE CUBE MAKER

This invention relates to ice cube maker apparatus which automatically produces ice-cubes or cubelets. More particularly, the invention is directed to an improvement in the water distribution and circulation system in an automatic ice cube maker of the type in which water is caused to flow on the underside of a refrigerated plate or evaporator plate to form ice thereon, the ice thereafter being dissected into cubes or cubelets. An automatic ice cube maker generally of the type in which the present invention finds utility is described in Leeson and Esser U. S. Pat. No. 3,423,949. That patent illustrates and described in detail the overall construction and operation of such an automatic ice cube maker, and the entire disclosure of that patent, to the extent that it is not inconsistent herewith, is hereby incorporated by reference.

Many machines for producing ice cubes automatically are known in the prior art, and these machines have taken various physical forms and have utilized various engineering mechanisms and techniques. The Leeson and Esser automatic ice cube maker referred to above includes a water supply system which delivers water to a cooled plate or evaporator plate on the underside of which an ice slab is formed, refrigeration means for cooling the plate on which the slab forms, a sump and pump system through which the excess, unfrozen water is recirculated during the ice making process, and evaporator recycling means by which the plate is "warmed" and the ice slab is freed from the plate. Means are also provided for dissecting the ice slab to provide a particulate product such as ice cubes or cubelets. Optional additional equipment includes an ice cube storage bin to which the cubed ice product is discharged. It is to an improved mechanism for ensuring the controlled delivery of water to the underside of the refrigerated plate that the present invention is directed.

In ice maker apparatus of the type in which a slab of ice is formed on the underside of a refrigerated or evaporator plate as a result of flowing water on the undersurface of the plate while the plate is suitably refrigerated, the plate itself is conventionally slightly inclined to facilitate the desired water flow and to permit the finished ice slab to slide downwardly, along the plate, when ultimately freed. During the slab forming cycle, water is sprayed on or otherwise caused to flow onto the refrigerated plate from a water header or manifold. Surface tension, capillary attraction, and velocity factors contribute to causing the water to flow along the underside of the plate, a portion of the water being transformed into ice and the remainder being delivered into a trough and directed to a sump from which it is recirculated through the water distribution system. In a preferred embodiment of the invention, the water recirculated is ultimately discarded as waste so that build-up of objectionable solids is obviated.

Refrigerant is supplied to the evaporator through a suitable pipe from a conventional refrigeration assembly and a slab of ice is built up upon the underside surface of the evaporator plate. When the ice slab has reached the desired thickness, the flow of water onto the plate is terminated and the slab is freed from the plate and delivered to an ice-cutting grid assembly or other suitable means for transforming the slab into a

particulate form such as cubes or cubelets. The water pump or other water circulation means delivering water to the underside of the freezer plate turns off at the initiation of the ice harvesting cycle.

It will be appreciated that the transition from a flowing system to a "stand-by" water supply system inherently introduces a finite period during which the water flow rate is slowed from normal operating velocity to zero velocity. During this period some of the water released from the header or water supply manifold fails to jump the gap between the header and the freezing plate and fails to reach the underside of the plate. This water drips down from the header into a spatial zone located below the plate on which the ice slab is formed. The drippage is objectionable for several reasons. In those embodiments of the ice cube maker in which a cube storage bin is utilized, the bin is ordinarily located beneath the freezer plate (and beneath the water supply manifold). Under these conditions, water discharged from the manifold but not reaching the evaporator plate drips into the ice cube storage bin, such dripping occurring both at the shut-off of the water supply and at the start-up or initiation of a new freezing cycle. The dripping water causes fusion and agglomeration of the particulate ice particles stored in the bin. In addition, water leaving the water supply manifold and failing to reach and flow downwardly on the freezer plate is lost from the circulatory water supply system. At reduced water pressure or reduced water flow rates the water fails completely to reach the freezing plate and an ice slab cannot form. It is to a unique, simple, and exceedingly effective mechanical system for alleviating the problems outlined above that the present invention is directed.

It is a principal object of the invention to provide mechanical guide means to direct water flow from a water supply means onto the underside of a refrigerated plate and to prevent drippage of water into a spatial zone below that plate.

It is a related object of the invention to provide water interceptor means or baffle means interposed between a water supply means and a spatial zone below a refrigerated plate to prevent water drippage from the supply means into the spatial zone.

Yet another object of the invention is to provide water interceptor means for directing water onto the underside of a freezing plate and to ensure retention and prevent loss of flowing water in a circulatory water supply system.

Still another object of the invention is to provide improved water flow distribution means for regulating the volume rate of flow of circulating water along the surface of a freezing plate.

It is another important object of the invention to provide automatic means for controlling the cross-sectional area of a slit through which circulatory water is supplied to impinge upon the surface of a freezing plate.

A related object of the invention is to provide automatic water distribution control means responsive to water pressure to regulate the extent of opening of a laterally extending slit through which water is supplied to the underside of a freezing plate.

Yet another object of the invention is to obviate dripping of water from a water supply manifold into an ice storage bin therebelow.

Still another object of the invention is to ensure, in a water supply system for delivering water to the underside of a freezing plate, that the circulating water either flows over the plate or returns to the reservoir of the circulatory system, without loss of water from the system.

Another object of the invention is to prevent the drippage of water from a water supply manifold during cut-off of flow, during start-up, and during periods of reduced water pressure.

A related object of the invention is to prevent loss of water from the circulatory system supplying water to a freezing plate in the event of reduced water pressure or water flow velocity under which conditions water fails to bridge the gap between a freezing plate and a water feeding manifold.

An important feature of the invention is that it provides spacer means to ensure that there is even distribution of water across the lateral expanse of a freezing plate on which a slab of ice is to be frozen.

Other objects, features and advantages of the invention will become apparent from a reading of the following specification taken in conjunction with the drawing in which:

FIG. 1 is a perspective view showing generally, one type of automatic ice cube maker in which the present invention finds utility;

FIG. 2 is a perspective view of one preferred embodiment of the invention, illustrating the cooperating elements thereof;

FIG. 3 is a cross-sectional view taken substantially on the line 3—3 of FIG. 2;

FIG. 4 is a perspective view showing a second preferred embodiment of the invention; and

FIG. 5 is cross-sectional view taken substantially on the line 5—5 of FIG. 4.

The aims and objects of the invention are achieved by providing, in conjunction with a water circulation system including conducting means or a manifold for the delivery of water to the underside of a freezing plate, a baffle, guide, interceptor, or deflector which is interposed between the manifold and a spatial zone therebelow to prevent the dripping of water into that spatial zone. The deflector or guide means ensures that, irrespective of water pressure drop or reduced flow rate, all of the water discharged from the manifold will reach the undersurface of the freezer plate. Two preferred forms of the invention, provided only for the purpose of illustrative disclosure and not by way of limitation, are depicted in FIGS. 2 and 3 and FIGS. 4 and 5.

In the drawing, the perspective view, FIG. 1 shows an ice maker incorporating the features of the invention and including the novel water interceptor or guide means. As shown, the ice cube maker 10 includes a refrigerated plate or evaporator plate 12, and a water jet tube or water manifold 14 for delivering a supply of water to the underside 18 of the evaporator plate 12 to build an ice slab 22 thereon. The freezing plate 12 is inclined downwardly from the front toward the rear, and the flowing water in excess of that transformed into ice on the evaporator plate 12 is received in a collecting trough 30 positioned below the evaporator plate at its lower end. The water collected in the trough is subsequently and continuously recirculated to the plate 12 by means of a suitable pump 32 and associated piping,

and ultimately discharged as the concentration of objectionable solids builds up.

Refrigerant is supplied to the evaporator 12 from a conventional refrigeration assembly (not shown). Neither the refrigeration assembly nor the apparatus for dissecting the final ice slab into discrete particles constitutes a part of the instant invention. Accordingly, no detailed description of these structural components is provided herein. A slab of ice 22 is produced on the underside surface of the evaporator plate 12 and, when the ice slab has reached the desired thickness, the plate 12 is heated so that the slab is freed and drops upon a frame-supported ice-cutting grid assembly 34 disposed below the evaporator plate 12 in substantially vertical correspondence therewith. In the exemplary form of the apparatus illustrated, the ice-slab is supported by and bears upon a lattice of electrically heated ice-cutting wires 38 which melt their way through the slab whereby the slab is dissected into discrete units such as prisms, cubes, or the like 40 and the formed cubes fall into a storage receptacle or bin 44 below the ice cutting grid 34, all in accordance with a procedure more fully described in the above referred to U. S. Pat. No. 3,423,949.

In the usual and intended operation of the ice-cube maker, when the ice slab 22 has been freed from the evaporator plate 12, and while the grid wires 38 are dissecting the ice slab into discrete portions, water continues to flow downwardly over the surface of the underside of the evaporator plate 12 and a new ice slab is formed. As indicated schematically in FIG. 3, the water supply is delivered to the underside of the plate from a water header or manifold 14, the water exiting from a plurality of orifices or ports 52 disposed as an array along the laterally extending expanse of the pipe-like manifold 14. As illustrated schematically in FIG. 3, the water streams 56 emanating from the ports 52 impinge upon the undersurface 60 of a web or panel 62 which lies against or is otherwise in effective contact with the evaporator plate 12. If preferred, the water streams may be applied directly to the undersurface of the evaporator plate 12 itself. Referring further to FIG. 3, it is clear that since the water receiving portion of the panel 62 is not below the water port 52 and since the panel occupies a position physically spaced from the ports 52 of the water header 14, the water streams or jets 56 must ultimately "bridge" the span to effectuate a flow path along the surface of the evaporator 12. In normal pumping and spraying operation, the force under which the water streams 56 exit from the ports 52 is ordinarily sufficient to overcome gravity and to carry the stream onto the panel or feed plate 62. However, at the end of a freezing cycle, when the water supply is shut off, the velocity and kinetic energy of water exiting from the ports 52 drop off sharply and at least some exiting water, (in prior art apparatus) fails to reach the plate. This water then drips downwardly into the spatial zone 66 below the water header 14. Prior to the instant invention the same objectionable occurrence took place at each start-up of the pumping cycle. Moreover, under any conditions causing a general drop in water pressure, it will be appreciated that even during the pumping cycle the water streams 56 could fail to reach the panel 62, or the evaporator plate 12. Under such conditions, ice cubes 40 stored in a storage

bin 44 below the water header 14 become inundated with water from the header, causing fusion and agglomeration as well as melting of the stored cubes. At the same time, since no water reaches the freezer plate 12, no ice will form on the plate. The instant invention cures these difficulties and obviates shortcomings inherent in prior art structural arrangements. Two preferred embodiments of the present invention are described below.

Referring now to FIGS. 4 and 5, which illustrate one preferred form of the invention, there is provided a water interceptor or baffle 70 which comprises a sheet extending rearwardly from and being reversely looped to overlie the evaporator plate 12. Water delivered from the water supply manifold 14 falls upon the "top side" of the sheet 70, flows along and around the bend of the sheet onto the "underside" thereof, and then onto the underside of the evaporator plate 12. Thus, at all, including extremely low flow rates, the water will be delivered to the underside of the evaporator plate, and no water will be discharged into the spatial zone 66 below the water supply manifold 14. Any water not freezing on the plate will remain in the circulation system. None will be lost, and none will contaminate cubes contained in the storage bin.

A second embodiment of the water interceptor or baffle means of the invention is shown in FIGS. 2 and 3. As depicted, the water supply tube or manifold 14 is supported to direct the water streams 56 onto the underside 60 of the feed plate 62, the latter being fastened, bolted to or otherwise secured to the evaporator plate 12, so that water flowing downwardly along the feed plate 62 continues on to the underside of the evaporator plate 12. In the particular form of the invention illustrated, the manifold 14 is supported by the feed plate, suitable nut and bolt assemblies 84 being utilized. If desired, the water manifold 14 may be independently mounted on the frame 88 to which the evaporator plate is secured. Fastened to and carried by the water supply manifold 14 and disposed therebeneath is a water interceptor, web, or baffle 90 which projects toward and abuts the underside of the feed plate 62 along the lateral expanse thereof. In the particular example of the invention illustrated, web 90 consists of a flexible and resilient panel which is conveniently fabricated of plastic sheet material such as polycarbonate (Lexan) polyethylene, polypropylene, a polyester such as Mylar or any other equivalent material. Thin sheet material of metal such as stainless steel or copper or bronze alloys may also be used. The spacing between the free edge of the web 90 extending along the feed plate 62 is such as to prevent uncontrolled passage of water along the plate 62. The spacing between the edge 92 of the web 90 and the feed plate 62 is such that water flowing on the plate 62 contacts the web 90 as well. It has been found advantageous to provide adjustment means to regulate the spacing and to provide stressing abutment of the web edge 92 against the feed plate 80. In the physical form of the structure illustrated, the adjustment is achieved by means of shifting the nut and bolt assemblies 84 in slots 96 formed in the feedplate 62 to which the manifold 14 and its associated baffle or web 90 are secured. It is recognized that any other mechanical expedient may be utilized in order to accomplish the same purpose.

The web or baffle 90 may be independently mounted rather than secured to the water jet tube or manifold 14.

It will be recognized upon consideration of the structure illustrated in the cross-sectional view of FIG. 3 that, with adequate water pressure, the water streams or jets 56 emanating from the orifices 52 of the manifold 14 will impinge upon the feedplate 62 and water will flow past the edge 92 of the baffle 90 and onto the undersurface 18 of the refrigerated plate 12. During cut-off or start-up or in the event or reduced water pressure, water not reaching the feedplate 62 will fall onto the baffle 90 and will then be directed onto the underside of the evaporator plate 14. No water will be dissipated into the spatial zone 66 beneath the water supply manifold and the evaporator plate.

In addition to serving as a water baffle means, the web functions also as a mechanical means for evenly distributing the water along the lateral expanse of the underside of the refrigerated plate 12. With increased water flow, the edge 92 of the baffle 80 will be forcibly urged away from the feedplate 12 to accommodate the impressed water supply. With decreasing water supply and decreasing associated pressure, the web 90 will relax resiliently to approach the feed plate 62. If desired, the baffle may be so positioned as to abut the refrigerated plate 12 directly. It is also contemplated that the water supply manifold 14 may deliver water directly to the underside of the evaporator plate 12, under which condition the auxiliary feedplate 62 may be dispensed with.

It is to be understood that the specific preferred embodiments of the invention shown in the drawings and described above are merely illustrative of the many forms which the invention may take in practice without departing from the spirit of the invention or from the scope of the invention as defined in the appended claims.

What is claimed is:

1. In an ice maker apparatus including a refrigerated plate and water supply means for delivering water to an underside of said plate to form ice thereon,
 - guide means to direct the flow of water and to transfer the water from said water supply means onto said plate and to obviate objectionable loss of water into an ice cube storage zone below said plate during start-up and cut-off of water supplied to said plate,
 - said guide means comprising water interceptor and transfer means interposed between said water supply means and said zone below said plate and consisting of a baffle physically distinct from said refrigerated plate and having an edge proximate to and extending laterally across said plate,
 - said baffle constituting resilient means physically interposed to define a water-impervious physical barrier between said water supply means and said ice cube storage zone therebelow and overlying said storage zone to divert therefrom water discharged from said water supply means for delivery to said refrigerated plate,
 - said edge of said baffle being disposed for effective cooperation with said plate to define therewith during flow of water onto said baffle a slit operable to control and to distribute water flowing from said baffle onto said plate,

slit spacing between said plate and the edge of said baffle being so limited as to ensure water flow control at all flow rates, including very low flow rates, thereby to ensure full transfer of water from said baffle to said plate and to preclude free gravitational fall of water from said edge of said baffle downwardly during start-up and during cut-off of water supplied to said plate,

whereby the water flowing onto said baffle is effectively transferred to said plate and objectionable dripping of water into the ice cube storage zone below said plate is prevented.

2. The structure as set forth in claim 1 wherein said edge of said baffle is substantially in contact with said plate to which water is delivered along a lateral expanse thereof, and

wherein said baffle is biased for stressed contact against said plate and is resiliently responsive to pressure of water flowing along said baffle to bend downwardly, thereby to space said edge of said baffle from said plate and to establish a water-flow-rate-responsive laterally extending open slit between said baffle and said plate for passage of water therethrough for delivery to an undersurface of said refrigerated plate.

3. The structure as set forth in claim 1 and further comprising means for adjusting said slit to control spacing between said refrigerated plate and said edge of said baffle.

4. The structure as set forth in claim 1 and further comprising means for establishing tensioned contact between said refrigerated plate and said baffle and means for adjusting tensioned contact between said refrigerated plate and said baffle.

5. In an ice maker apparatus including a refrigerated plate and water supply means for delivering water to an underside of said plate to form ice thereon,

guide means to direct flow of water from said water supply means onto said plate and to obviate loss of water into an ice cube storage zone below said plate,

said guide means comprising water pressure responsive interceptor and transfer means interposed between said water supply means and said zone below said plate and consisting of a web extending laterally along said plate, and

means supporting said web to present a laterally extending edge substantially in contact with said plate,

spacing between said plate and the laterally extending edge of said web presented to said plate being sufficiently close to ensure transfer to said plate of water flowing on said web and to preclude free gravitational fall of water from the edge of the web downwardly during start-up and during cut-off of water supplied to said plate.

6. The structure as set forth in claim 5 and further comprising means for establishing tensioned contact between said web and said plate, and wherein pressure of water flowing on said web is effective to displace said web from physical abutment against said plate to provide a water flow passage between said web and said plate and permit transfer of water flow from said web to said plate.

7. The structure as set forth in claim 6 and further comprising means for adjustment of said tensioned contact between said web and said plate.

* * * * *

35

40

45

50

55

60

65