July 5, 1960 R. E. WOLFERMAN 2,943,462

ICE CHIPPING MACHINE

Filed June 24, 1958 2 Sheets-Sheet 1

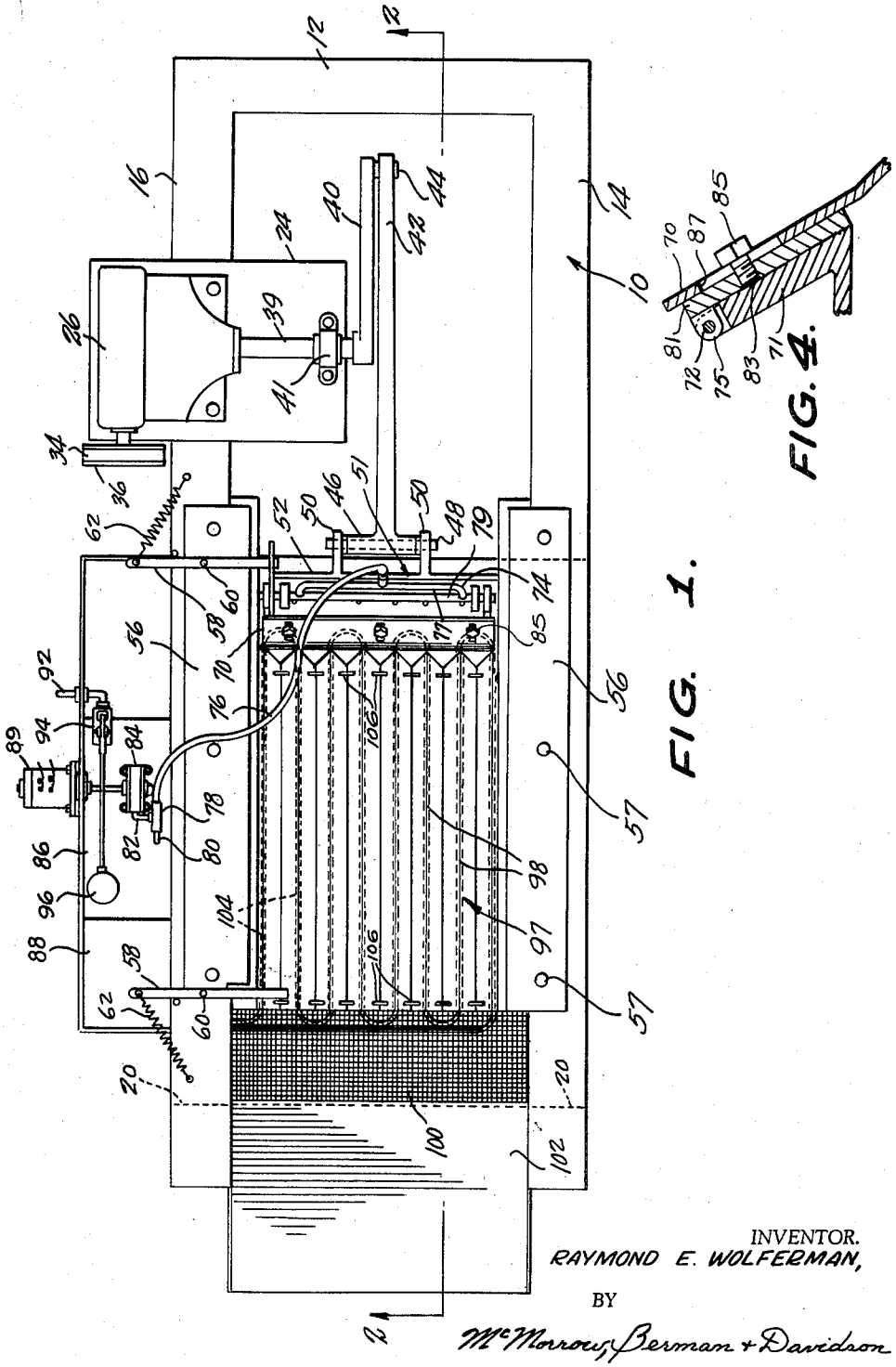


FIG. 1.

FIG. 4.

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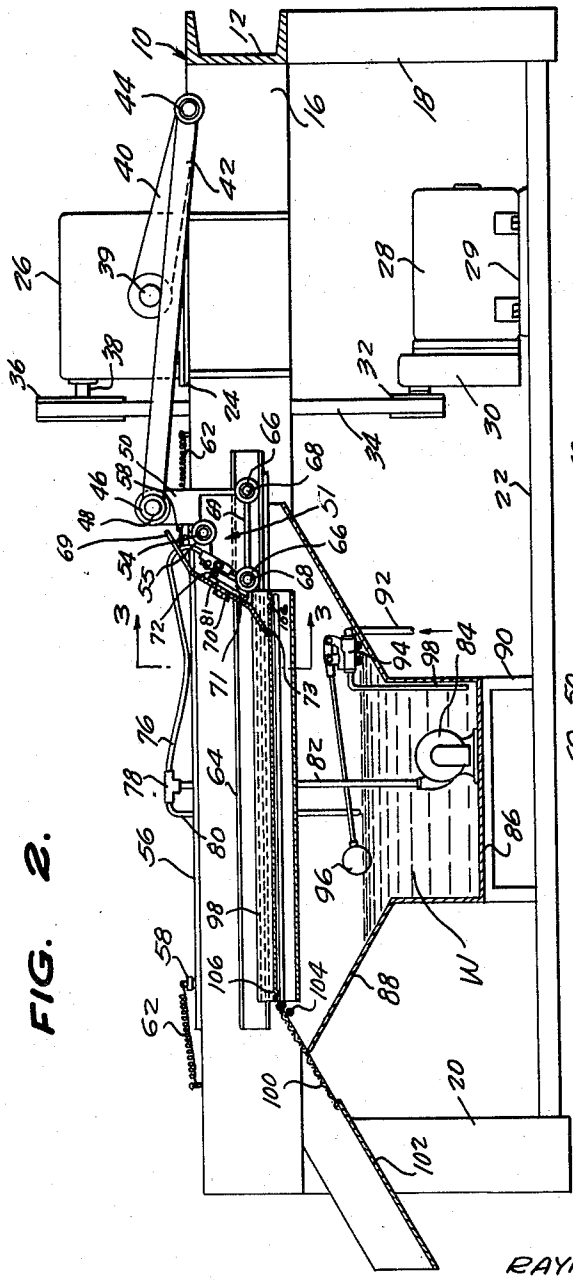


FIG. 2.

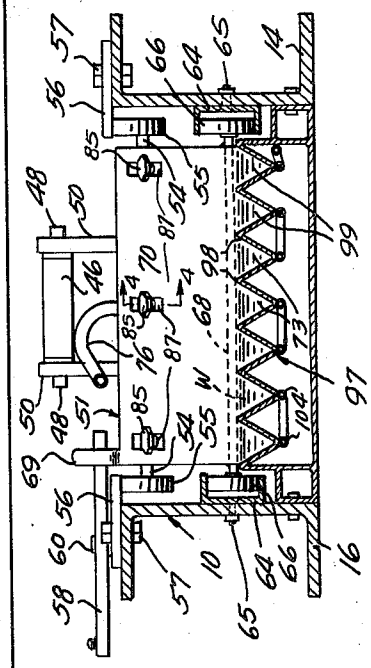


FIG. 3.

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ICE CHIPPING MACHINE

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7 Claims. (Cl. 62—354)

This invention relates to ice chipping machines, and more particularly has reference to a machine of this nature designed to be used whenever a medium crushed ice is needed, such as in the packing of foodstuffs, or as a chilling means for soft drinks, etc. In this connection, as regards the type of ice produced by operation of the machine, the machine is designed to produce hard-frozen ice chips, ranging in size from perhaps one-fourth to one-half inch in length and width, or perhaps slightly greater.

One object of importance is to provide a machine of the character stated which will be simple in construction, and yet highly efficient in action.

Another object is to form the machine in such manner that it will be rugged, and capable of operation for extended periods of time without requiring maintenance or repair.

Still another object is to provide a machine that will make use of conventional Freon-type refrigeration units.

A further object is to design the machine in such a manner that its capacity, in respect to ice produced in a given rate of time, will be substantially in excess of the capacity of other machines of the same general size and rating, the machine being so designed as to produce a loss well below that which is characteristic of other machines heretofore devised for the same purpose.

Still another object is to provide a machine which will be characterized by its ease of installation, its compact size, and its swift and substantial ice production.

Other objects will appear from the following description, the claims appended thereto, and from the annexed drawings, in which like reference characters designate like parts throughout the several views, and wherein:

Figure 1 is a top plan view of a machine formed according to the present invention;

Figure 2 is a longitudinal sectional view therethrough, substantially on line 2—2 of Figure 1;

Figure 3 is a transverse sectional view, substantially on line 3—3 of Figure 2; and

Figure 4 is a sectional view taken along the line 4—4 of Figure 3.

Referring to the drawings in detail, designated generally at **10** is a stationary support frame including, at one end of the frame, a transversely extending or end channel member **12**, disposed horizontally in and welded or otherwise fixedly secured at its opposite ends to the adjacent ends of parallel, outwardly facing, straight, elongated, longitudinal channel frame members **14**, **16**, respectively. The frame is formed open at its opposite ends to permit the discharge of the ice chips, in a manner to be described in greater detail hereinafter.

The frame includes corner supports or legs **18**, **20** extending vertically downwardly from opposite ends of the longitudinal members **14**, **16**, and fixedly secured to said longitudinal frame members. At their lower ends, the legs are connected by lower longitudinal members **22**. This provides a relatively low, elongated, open center support frame opening at one end.

A rectangular, horizontal, support plate **24** is fixedly

secured to the top surface of frame member **16**, and mounted thereon is a speed reducer **26** which is per se conventional, and in a preferred embodiment is a worm gear reducer having a 30-to-1 ratio between its input and output. A drive motor **28** is mounted upon a bracket **29** carried by the lower longitudinal frame members **22** of the frame. The motor is of the gear head type as shown at **30**, and to the output shaft of the gear head there is connected a pulley **32** about which is trained a belt **34** extending upwardly and trained about a driven pulley **36** connected to the input shaft **38** of reducer **26**. The output shaft **39** of said reducer extends laterally inwardly from frame member **60** above the same, and is journalled in bearing **41** carried by plate **24**.

Secured to shaft **39** for rotation therewith is a crank arm **40**, connected to a pitman or connecting rod **42** by means of a connecting pin **44**. Pitman **42**, at its other end, has a transversely extending sleeve **46** integral or otherwise made rigid with the pitman, and rotatably receiving a cross pin **48** that extends between upwardly projecting ears **50** of a knife assembly generally designated **51**. This includes a carriage, said carriage being elongated in a direction transversely of the frame and including a vertically disposed back plate **52**.

The carriage is provided with a transversely extending, upper roller shaft **54** the ends of which carry upper rollers **55** that are in contact with the undersides of hold-down plates **56** bolted at **57** to the top walls of the side frame members **14**, **16** in position projecting laterally inwardly, over the full length of the hold-down plate, from the side frame members.

The hold-down plates, in a commercial embodiment, might be adjusted upwardly or downwardly, to correspondingly adjust the distance between the cutter knife and the surface from which the ice is cut.

Trip means is provided, to adjust the cutting knife to and from opposite positions, at opposite ends of the stroke of the same, that is, at opposite ends of the travel of the carriage. To this end, there are provided elongated, horizontally swinging trip arms **58**, **58** fulcrumed intermediate their ends on vertical axes by means of pins **60**, on one of the plates **56**, adjacent opposite ends of said plate. Contractile springs **62** are connected between the outer ends of the arms and the frame member **16**, with one arm being normally biased clockwise in Figure 1, this being the arm at the right in this figure of the drawing, by its spring. The other arm is normally biased counterclockwise in the same figure of the drawing, about its pivot.

Elongated, confronting, channeled tracks or ways **64** are secured to the inner surfaces of the side frame members, below the hold-down plates, and in a commercial embodiment, are secured to the frame members by bolts **65** or their equivalents. If desired, the construction may be such that the members **14**, **16** have short vertical slots receiving the bolts, so that the tracks can be bodily adjusted in a vertical direction, again for the purpose of selectively locating the knife edge in respect to the surface over which the knife edge wipes.

In any event, lower rollers **66** are carried by the carriage, on a pair of transverse shafts **68** (see Figure 2). Shafts **68** are carried by a bottom plate **69** of the carriage, said bottom plate at the front of the carriage having an upwardly rearwardly inclined, transverse front flange **71** to which is secured a correspondingly inclined knife **70**. Knife **70** extends the full width of the carriage as shown in Figure 3, and has a lower edge formed with forwardly declining, triangularly pointed cutting teeth **73**.

The knife is pivoted to swing between its operative position shown in Figure 2, and an inoperative position in which the teeth **73** are spaced upwardly from their Figure 2 positions. The knife swings about a horizontal, trans-

verse axis defined by a pivot bar **72**, which extends between opposite sides of the carriage, being carried by the upper edge portion of the inclined front flange **71**, said bar **72** extending through keepers **75** projecting rearwardly from a knife carrier plate **81** having threaded openings **83** in which are engaged cap screws **85** extending through slots **87** formed in knife **70** so as to permit adjustment of the knife, in respect to an evaporator **97** to be described hereinafter.

Referring to Figure 3, integral with and extending upwardly from one side of the knife is a finger **69** which extends across the plane of swinging movement of the arms **58, 58**. When the carriage is in its return movement, that is, when the carriage travels from left to right in Figure 2, to its starting position shown in Figure 2, finger **69** engages the right hand arm **58**, viewing the same as in this figure of the drawing. Said arm **58** in actuality extends as a stop, and engaging the back of finger **69** will cause the knife **70** to be rocked counterclockwise in Figure 2 about its pivot axis, lowering teeth **73** to their operative, Figure 2 positions.

At the other end of the travel of the carriage, the front surface of finger **69** is cammingly engaged by the front stop **58**, so that the knife is now rocked clockwise in Figure 2, to elevate teeth **73**. There is sufficient frictional engagement between bar **72** and keepers **75** to maintain the knife in its upwardly swung position, until it engages the stop shown at the right in Figure 2 once again, which will of course now swing the knife in a return direction to once again lower the teeth.

A hose **76** is connected to a cross head **77** disposed in back of knife **70**. The cross head **77** has ends **74** (Figure 1) that are in communication with the end portions of a manifold **79** having a plurality of outlets adapted to discharge water in back of the knife, during the movement of the carriage forwardly and rearwardly in its tracks.

At its inlet end, hose **76** is connected to a **T 78**, to which are connected tubes **80, 82**.

Referring to Figure 2, tube **80** extends downwardly, and is continuously open at its lower end within a tank to be described in detail hereinafter. The tube **80** is provided to relieve back pressure developing within the **T**, thereby to reduce the amount of pressure with which water is forced through hose **76**, and in this way eliminate splashing on discharge of the water in spray jets from the small nozzles or jets of the manifold **79**.

Tube **82**, as shown in Figure 2, is also extended downwardly, and is connected to the output of the pump **84**, the input of which is in continuous communication with water W provided within a tank **86** having a flaring top portion **88**. The pump is driven by an electric motor **89** mounted on the wall of tank **86**. The tank is supported upon legs **90**, and water is supplied to the tank through a line **92** connected to a source of water under pressure, as for example the city water supply. A float-controlled valve **94** is opened responsive to dropping of a float **96** below a predetermined level, thus to maintain a constant level of water within the tank **86**.

An evaporator generally designated **97** is in the form of a thin, sheet metal tray having longitudinal ribs **98** of inverted V-shape in cross section, defining V-shaped recesses **99** within which the respective teeth **73** are disposed, the opposite side edges of each tooth being in wiping contact with the opposite side walls of each recess **99**. The evaporator tray or plate is fixedly mounted in horizontal positions, being extended across the open center of the support frame. The material used for the tray is preferably cast aluminum.

Extending longitudinally within each downwardly opening rib **98** is a length of copper tubing, through which a suitable refrigerant, such as Freon, is continuously circulated.

At the outlet or discharge end of the evaporator, shown as the left hand end in Figure 1, there is provided a screen **100** declining in a forward direction from the evaporator as shown in Figure 2, and preferably formed of stainless steel, said screen being adapted to prevent ice chips from falling into the water returns constituted by the inclined walls of the flared top portion of the tank. In other words, water deposited upon the evaporator may not be all frozen, and may be wiped off the discharge end of the evaporator by the knife during the forward movement of the carriage. Said water will flow off the evaporator through the screen, onto the inclined wall of the flared portion **88**, to be returned to the tank for reuse. Water wiped off the other end of the evaporator flows onto the other or rear wall of the flared portion **88**, as will be clearly apparent from Figure 2.

At its forward end, the screen **100** is connected to a discharge chute **102** extending transversely between the members **14, 16**, within the open end of the frame, and inclined correspondingly to the chute, so that ice chips will be discharged into a suitable receiver, not shown.

The evaporator coil is of serpentine or tortuous form, as clearly shown in Figure 1, and is a continuous length of copper tubing **104**, with each convolution extending immediately below adjacent ribs **98**, along the longitudinal median lines of the ribs.

Designated at **106** are small, transversely extending grooves **106** which are formed directly in the bases of the recesses, adjacent the opposite ends of each recess, said grooves extending partially up the walls of each recess. These grooves tend to bring the water that flows into the same closer to the copper coil, so that water within the grooves freezes almost instantly, causing expansion of ice and forming bumps at the opposite ends of the respective recesses, so that each recess is caused to hold more water to be sheared off in the form of ice with each cut of the knife.

In use, the carriage is of course continuously reciprocated responsive to operation of the motor and at the same time, water is continuously directed through the spray nozzles, onto the surface of the evaporator tray, in back of the carriage. The maximum water level is shown in Figure 3. Said water freezes almost instantly in the form of a thin sheet on the surface of the evaporator, so that each time the carriage moves forwardly, all the water, including that frozen in the form of bumps within the grooves **106**, that has previously been frozen, will be sheared off by the knife blades or teeth **73** to gravitate along screen **100** and sheet **102**. When the carriage reaches its forwardmost position, the left hand stop **58** swings the same as previously described to elevate the knife teeth, so that when the carriage moves to its starting position, it will not be in contact with the walls of the recesses. Therefore, water deposited within the recesses in back of the carriage during the forward movement thereof is given ample time to freeze. Then, when the carriage reaches its starting position the knife teeth are lowered and the carriage again moves forwardly, shearing off the ice formed during the last full forward and backward movement or cycle of the carriage.

As to this, it will be noted that during the forward movement of the carriage, the water is being discharged in a fine spray immediately in back of the carriage, over the full length of the evaporator tray, in a manner such that first there is a thin sheet of water laid down upon the tray during the forward movement of the carriage, which water freezes almost instantly, after which a second sheet is deposited during the backward movement of the carriage, directly upon the first sheet. This also freezes, awaiting the next or cutting stroke of the knife.

It is believed apparent that the invention is not necessarily confined to the specific use or uses thereof described above, since it may be utilized for any purpose to which it may be suited. Nor is the invention to be necessarily limited to the specific construction illustrated and described, since such construction is only intended to be illustrative of the principles of operation and the means presently devised to carry out said principles, it being

considered that the invention comprehends any minor change in construction that may be permitted within the scope of the appended claims.

What is claimed is:

1. An ice chip machine comprising: a frame; an evaporator thereon including a tray having longitudinally extending corrugations forming alternating ribs and recesses, and means for refrigerating the tray; a knife assembly reciprocating on said tray in a path parallel to the several corrugations, said assembly having a shearing stroke and a return stroke when reciprocated, and including a knife in the form of a blade the length of which extends transversely of the several corrugations, said blade being mounted in the assembly for retention at a predetermined angularity to the tray in juxtaposition thereto throughout the shearing stroke, and being formed with a longitudinal series of cutting teeth alternating with the ribs to extend into said recesses for shearing from the tray ice forming in the recesses; and means overlying the tray adapted for depositing water upon said tray.

2. An ice chip machine comprising: a frame; an evaporator thereon including a tray having longitudinally extending corrugations of inverted V-shape in cross section, whereby to define between adjacent corrugations longitudinal recesses of V-shaped cross section, said evaporator additionally including means for refrigerating the tray; a knife assembly reciprocation on said tray in a path parallel to the several corrugations, said assembly having a shearing stroke and a return stroke when reciprocated, and including a knife in the form of a blade the length of which extends transversely of the several corrugations, said blade being mounted in the assembly for retention at a predetermined angularity to the tray in juxtaposition thereto throughout the shearing stroke, and being formed with a longitudinal series of cutting teeth alternating with the corrugations to extend into said recesses, for shearing from the tray ice forming in the recesses; and means overlying the tray adapted for depositing water within the recesses, thus to provide, in the bottoms of the recesses, elongated, rod-like, thin lengths of ice to be broken into chip form by said teeth.

3. An ice chip machine comprising: a frame; an evaporator thereon including a tray having longitudinally extending corrugations of inverted V-shape in cross section, whereby to define between adjacent corrugations longitudinal recesses of V-shaped cross section, said evaporator additionally including means for refrigerating the tray; a knife assembly reciprocating on said tray in a path paralleling the corrugations through a shearing stroke and a return stroke, and including a knife having cutting teeth alternating with the corrugations to extend into said recesses, for shearing from the tray ice forming in the recesses, said assembly including a carriage carrying said knife and rollably mounted upon the frame in position extending transversely of said tray, the knife being in the form of a blade on which the cutting teeth are arranged in a series extending longitudinally of the blade, said blade being mounted in the assembly for retention at a predetermined angularity to the tray in juxtaposition thereto throughout the shearing stroke; and means carried by the carriage adapted for depositing water within the recesses, thus to provide, in the bottoms of the recesses, elongated, rod-like, thin lengths of ice to be broken into chip form by said teeth.

4. An ice chip machine comprising: a frame, an evaporator thereon including a tray having longitudinally extending corrugations of inverted V-shape in cross section, whereby to define between adjacent corrugations longitudinal recesses of V-shaped cross section, said evaporator additionally including means for refrigerating the tray; a knife assembly reciprocating on said tray in a path paralleling the corrugations through a shearing stroke and a return stroke, and including a knife having cutting teeth alternating with the corrugations to extend into said recesses, for shearing from the tray ice forming in the recesses, said assembly including a carriage carrying said knife and rollably mounted upon the frame in position extending transversely of said tray, the knife being in the form of a blade on which the cutting teeth are arranged in a series extending longitudinally of the blade, said blade being mounted in the assembly for retention at a predetermined angularity to the tray in juxtaposition thereto throughout the shearing stroke; and means carried by the carriage adapted for depositing water within the recesses, thus to provide, in the bottoms of the recesses, elongated, rod-like, thin lengths of ice to be broken into chip form by said teeth, comprising a spray head extending transversely of the carriage immediately in back of said knife.

5. An ice chip machine comprising: a frame, an evaporator thereon including a tray having longitudinally extending corrugations of inverted V-shape in cross section, whereby to define between adjacent corrugations longitudinal recesses of V-shaped cross section, said evaporator addtionally including means for refrigerating the tray; a knife assembly reciprocating on said tray and including a knife having cutting teeth alternating with the corrugations to extend into said recesses, for shearing from the tray ice forming in the recesses, said assembly including a carriage carrying said knife and rollably mounted upon the frame in position extending transversely of said tray; means carried by the carriage adapted for depositing water substantially continuously within the recesses, thus to provide, in the bottoms of the recesses, elongated, rod-like, thin lengths of ice to be broken into chip form by said teeth, comprising a spray head extending transversely of the carriage immediately in back of said knife, said knife being pivotally mounted upon the carriage for swinging movement about a horizontal axis extending transversely of the carriage, whereby to raise and lower said teeth; and means on the frame at opposite ends of the tray, engageable with said knife for rocking the same in one direction on movement of the carriage to one end of its path of reciprocation, and in the opposite direction on movement of the carriage to the opposite end of its path of reciprocation, said knife being swung in a direction to elevate the teeth out of contact with the tray when the carriage has moved through its ice-cutting stroke, and to lower the teeth into engagement with the tray following return of the carriage to its starting position.

6. An ice chip machine comprising: a frame, an evaporator thereon including a tray having longitudinally extending corrugations of inverted V-shape in cross section, whereby to define between adjacent corrugations longitudinal recesses of V-shaped cross section, said evaporator additionally including means for refrigerating the tray; a knife assembly reciprocating on said tray and including a knife having cutting teeth alternating with the corrugations to extend into said recesses, for shearing from the tray ice forming in the recesses, said assembly including a carriage carrying said knife and rollably mounted upon the frame in position extending transversely of said tray; means carried by the carriage adapted for depositing water substantially continuously within the recessses, thus to provide, in the bottoms of the recessses, elongated, rod-like, thin lengths of ice to be broken into chip form by said teeth, comprising a spray head extending transversely of the carriage immediately in back of said knife, said knife being pivotally mounted upon the carriage for swinging movement about a horizontal axis extending transversely of the carriage, whereby to raise and lower said teeth; means on the frame at opposite ends of the tray, engageable with said knife for rocking the same in one direction on movement of the carriage to one end of its path of reciprocation, and in the opposite direction on movement of the carriage to the opposite end of its path of reciprocation, said knife being swung in a direction to elevate the teeth out of contact with the tray when the carriage has moved through its ice-cutting stroke, and to lower the teeth into engagement with the tray following

return of the carriage to its starting position; and means for continuously pumping water through said spray head.

7. An ice chip machine comprising: a frame, an evaporator thereon including a tray having longitudinally extending corrugations of inverted V-shape in cross section, whereby to define between adjacent corrugations longitudinal recesses of V-shaped cross section, said evaporator additionally including means for refrigerating the tray; a knife assembly reciprocating on said tray and including a knife having cutting teeth alternating with the corrugations to extend into said recesses, for shearing from the tray ice forming in the recesses, said assembly including a carriage carrying said knife and rollably mounted upon the frame in position extending transversely of said tray; means carried by the carriage adapted for depositing water substantially continuously within the recesses, thus to provide, in the bottoms of the recesses, elongated, rod-like, thin lengths of ice to be broken into chip form by said teeth, comprising a spray head extending transversely of the carriage immediately in back of said knife, said knife being pivotally mounted

upon the carriage for swinging movement about a horizontal axis extending transversely of the carriage, whereby to raise and lower said teeth; means on the frame at opposite ends of the tray, engageable with said knife for rocking the same in one direction on movement of the carriage to one end of its path of reciprocation, and in the opposite direction on movement of the carriage to the opposite end of its path of reciprocation, said knife being swung in a direction to elevate the teeth out of contact with the tray when the carriage has moved through its ice-cutting stroke, and to lower the teeth into engagement with the tray following return of the carriage to its starting position; means for continuously pumping water through said spray head; and a discharge chute arranged to extend beyond one end of the tray for receiving ice sheared from the tray by the knife.

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