July 4, 1961 E. J. BUZICKY 2,990,697

CONTINUOUS BELT TYPE ICE CUBE MAKER

Filed Feb. 18, 1957 4 Sheets-Sheet 1

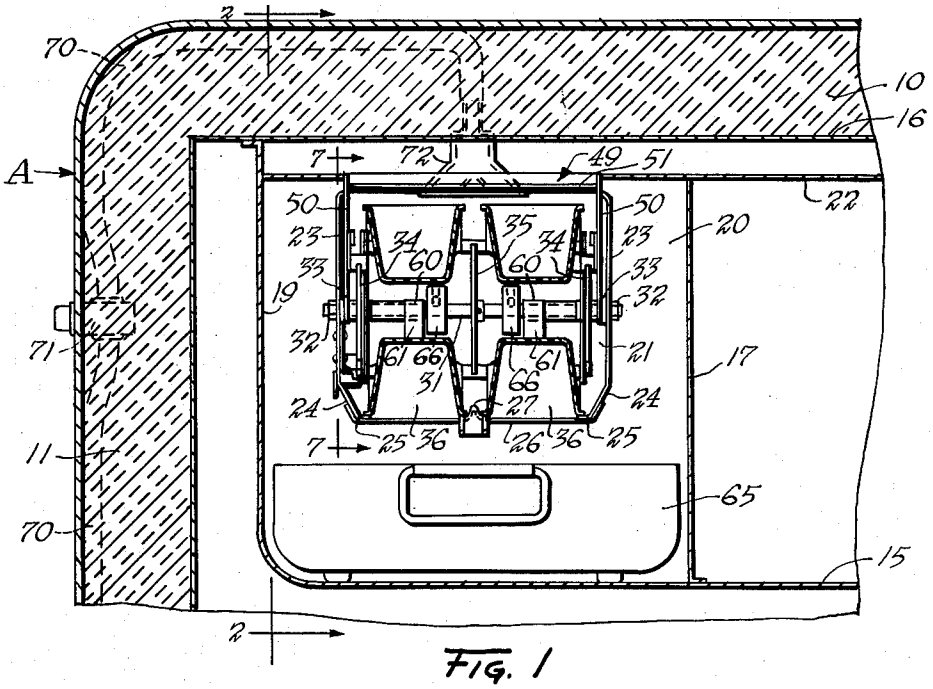


FIG. 1

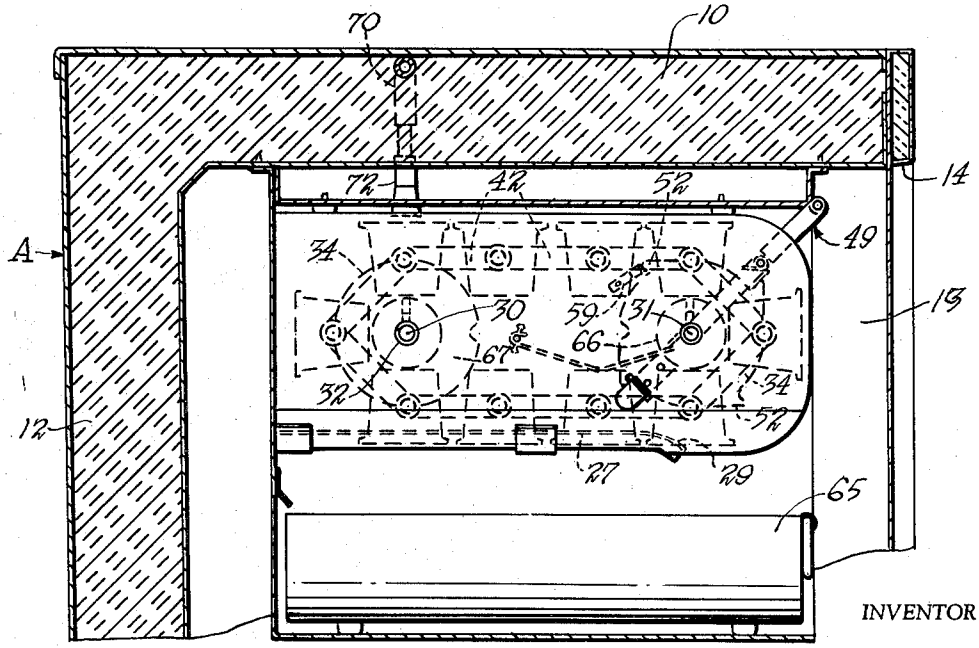


FIG. 2

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CONTINUOUS BELT TYPE ICE CUBE MAKER

Filed Feb. 18, 1957 4 Sheets-Sheet 2

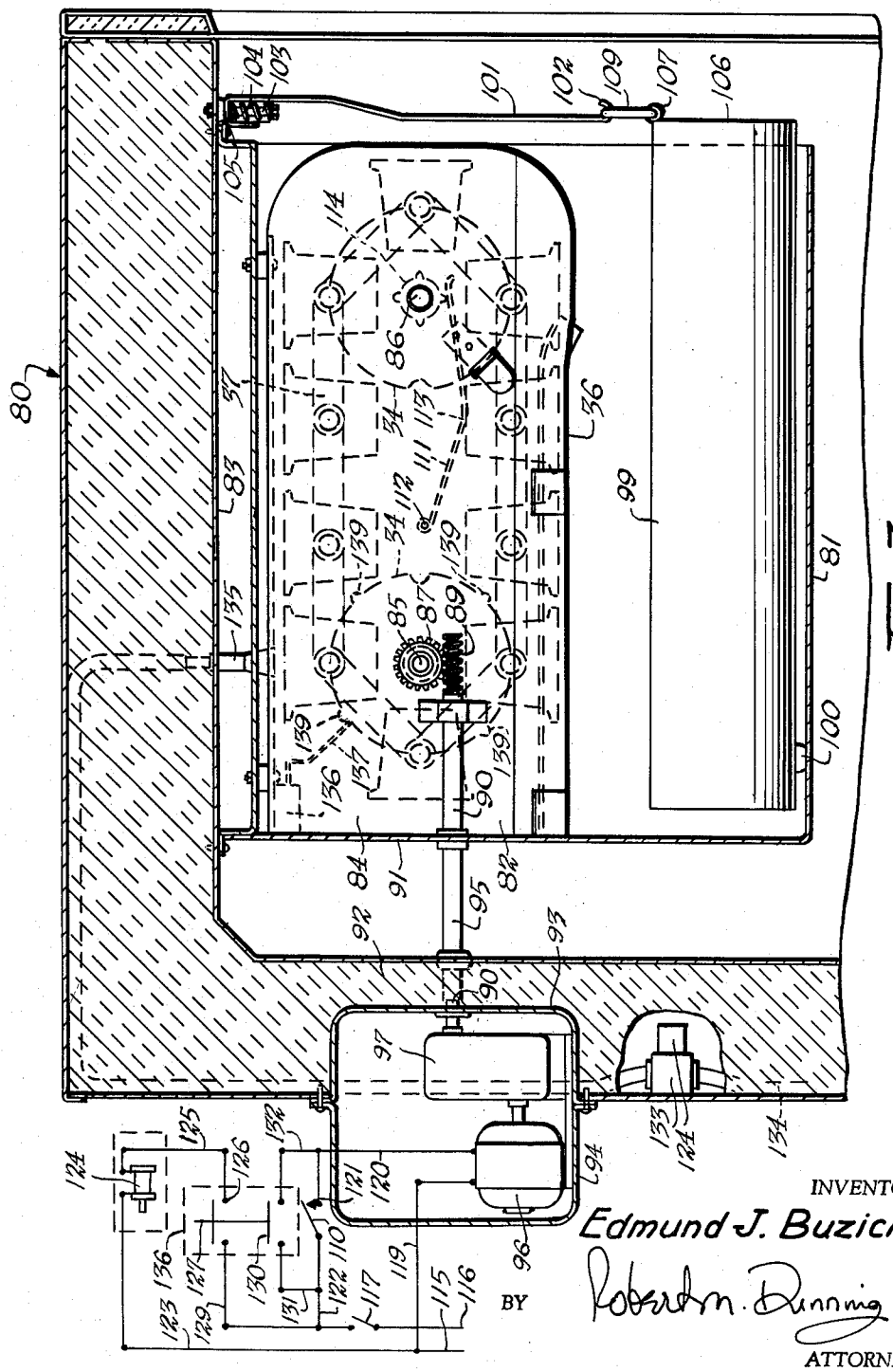


FIG. 3

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July 4, 1961 E. J. BUZICKY 2,990,697

CONTINUOUS BELT TYPE ICE CUBE MAKER

Filed Feb. 18, 1957 4 Sheets-Sheet 3

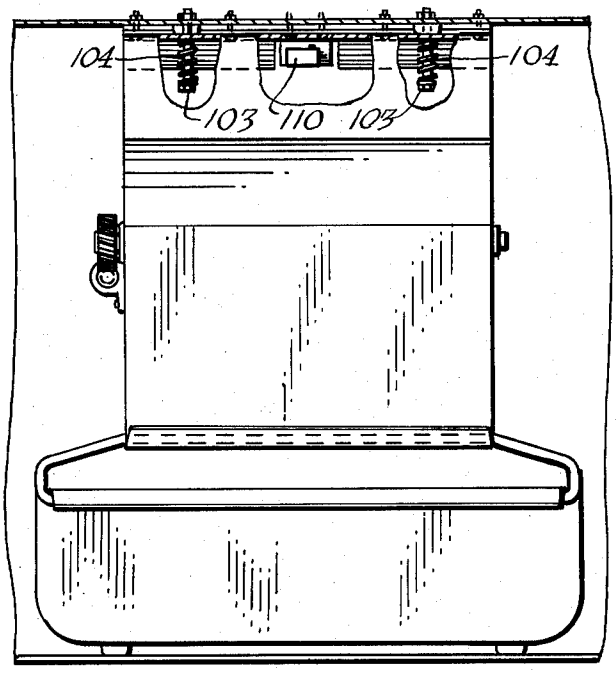


FIG. 4

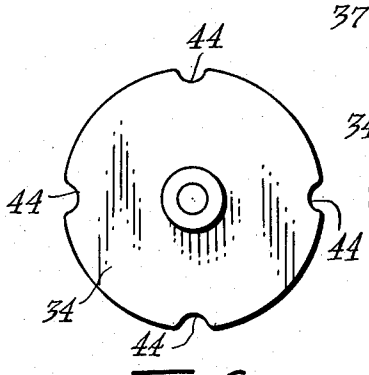


FIG. 6

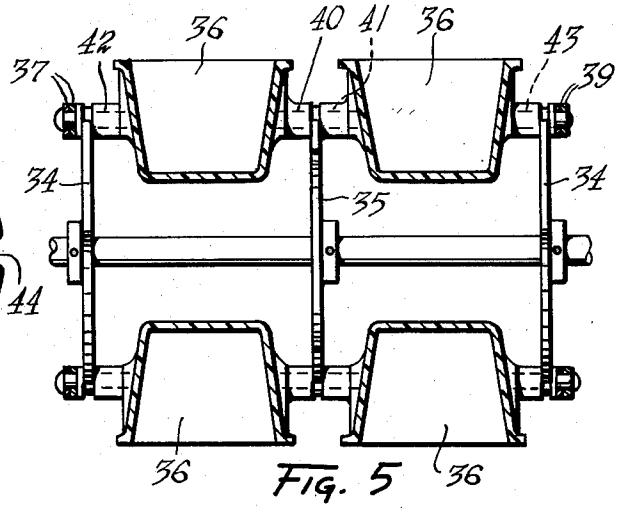


FIG. 5

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July 4, 1961 E. J. BUZICKY 2,990,697

CONTINUOUS BELT TYPE ICE CUBE MAKER

Filed Feb. 18, 1957 4 Sheets-Sheet 4

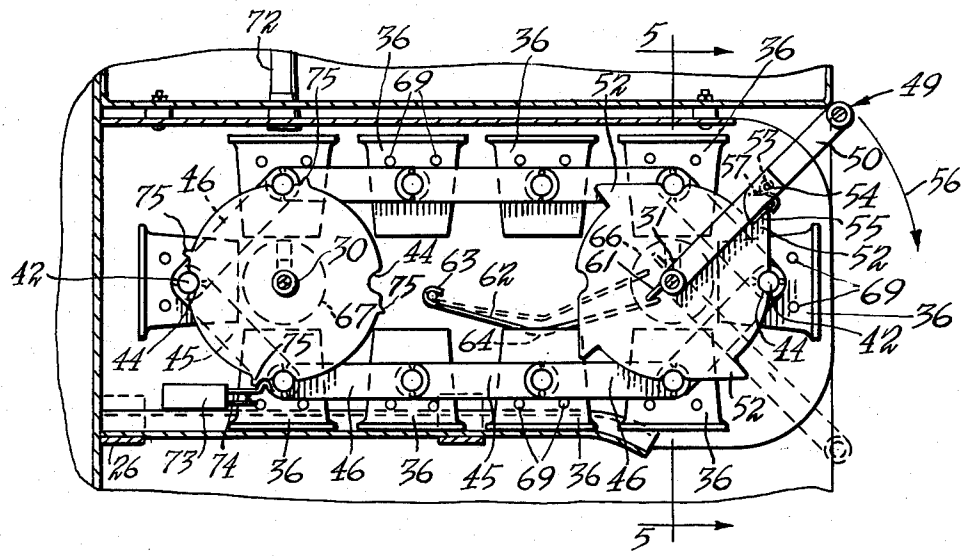


FIG. 7

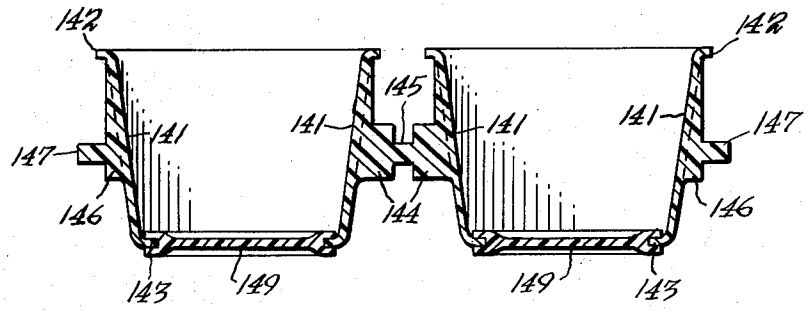


FIG. 8

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CONTINUOUS BELT TYPE ICE CUBE MAKER

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Filed Feb. 18, 1957, Ser. No. 640,666
7 Claims. (Cl. 62—345)

This invention relates to an improvement in continuous belt type ice cube makers and deals particularly with an apparatus for making ice cubes and which may be operated either manually or automatically.

An object of the present invention resides in the provision of an ice cube maker which includes a series of flexible cups which are mounted in a continuous belt arrangement and which are designed to receive water to be frozen. During passage of these cups over the upper flight of the endless belt, the water is frozen into ice. As the cups reach the end of the endless conveyor, they turn into inverted position. While in inverted position, means is provided for applying pressure against the cups to remove the ice therefrom. The ice is then free to drop into a suitable storage bin.

A feature of the present invention resides in the fact that the apparatus may be readily constructed to operate either by manual power or by an automatic continuous drive. When worked manually, means are provided for moving the belt a distance preferably equal to the distance between the water receiving cups. Thus, as ice cubes are removed from the storage bin, additional cubes may be deposited in the bin, it only being necessary that the ice trays or cups in the upper flight remain upright for a time sufficient to cause the ice in these cups to freeze.

A feature of the present invention resides in the provision of an apparatus for automatically filling the cups, this means being operated by operation of the belt. As the cups reach the upper flight of the conveyor, means is operated to automatically fill the cups to the desired level.

A further feature of the present invention resides in the provision of spring means for automatically flexing the cups to remove the frozen cubes therefrom. As the cups reach a certain predetermined position in the lower flight, means is provided for applying pressure to the bottoms of the cups so as to force the cubes out of place.

In the automatically operable form of construction, a feature of the invention resides in the provision of a means for automatically filling the cups when they reach the upper flight of the conveyor and of a means of stopping the operation of the conveyor when the storage bin contains a predetermined quantity of ice. A means is also provided for maintaining the operating motor in operation even though the storage bin contains the necessary quantity of ice in the event the motor controlling switch is open while the cups are in filling position. As a result, the cups will not be overfilled due to the operation of the filling mechanism but will move past this filling position in the event the mechanism operating the cup filling valve is not a time delay mechanism.

These and other objects and novel features of the present invention will be more clearly and fully set forth in the following specification and claims.

In the drawings forming a part of the specification:

FIGURE 1 is a sectional view through a portion of a refrigerator showing the ice cube forming mechanism in position therein.

FIGURE 2 is a sectional view through the refrigerator, the position of the section being indicated by the line 2—2 of FIGURE 1.

FIGURE 3 is a view similar to FIGURE 2 showing a modified form of construction.

FIGURE 4 is a front elevational view of the structure illustrated in FIGURE 3.

FIGURE 5 is a sectional view through the freezer cup supports.

FIGURE 6 is a side elevational view of one of the freezer cup supports illustrated in FIGURE 5 removed from the remainder of the apparatus.

FIGURE 7 is a sectional view on the line 7—7 of FIGURE 1.

FIGURE 8 is a sectional view through a modified form of ice cube forming cups.

None of the figures of the drawings show a complete refrigerator as such refrigerators are generally conventional with the exception of the ice cube maker itself. FIGURE 1 of the drawings shows a portion of the insulated top wall **10** of the refrigerator A and a portion of the side wall **11** on one side thereof. FIGURE 2 also illustrates a portion of the top wall **10** as well as the rear wall **12** and this view also illustrates a portion of the side wall **13** opposite the side wall **11**. The front of the cabinet is provided with an opening illustrated at **14** which is normally closed by the refrigerator door, not illustrated in the drawings.

An evaporator unit **15** is suspended from the cabinet lining **16** forming a part of the top wall **10** thereof and a portion of the evaporator unit is separated from the remainder by a partition wall **17**. The portion of the evaporator unit between the partition wall **17** and the side wall **19** thereof forms an ice cube freezing compartment **20** within which the ice cubes are frozen. Obviously some or all of the walls of the evaporator unit contain refrigerant passages or are in heat transfer relation with evaporator coils so as to produce a low temperature within the evaporator body. The entire structure which has been described is merely an indication of how the units may be formed and the particular construction described is merely for the purpose of illustration.

A generally rectangular freezing chamber **21** is suspended from the top **22** of the evaporator chamber. The chamber **21** is defined by a pair of substantially parallel sides **23** which incline downwardly and inwardly as indicated at **24** and which terminate in inturned flanges **25**. Bottom strips **26** are attached to the flanges **25** and the inclined portions **24** to form a bottom support for the compartment **21**. A central track **27** is mounted upon the bottom strips **26** intermediate the sides thereof. The forward end of the track **27** is inclined downwardly as indicated in FIGURE 2 of the drawings for a purpose which will be later described in detail.

A pair of spaced pivot shafts **30** and **31** extend between the sides **23** and the compartment **21** and are supported thereby. Some means is provided near the ends of these shafts to hold the same from axial movement, as for example nuts **32**. Bearings **33** are provided extending inwardly of the walls **23** within which the shafts **30** and **31** may rotate. Three axially spaced notched discs or sprockets are rotatably supported upon each of the shafts **30** and **31**, there being a pair of side sprockets **34** on each shaft and an intermediate or central sprocket **35**. The sprockets are rotated in a manner which will be described.

An endless conveyor is supported by the sprockets on the shafts **30** and **31**. The endless conveyor includes a series of cup elements formed of flexible resilient material capable of retaining its resiliency even at low temperatures. FIGURE 5 discloses a pair of cup shaped receptacles **36** which are connected in side by side relation between endless chain members **37** and **39**. In the particular arrangement illustrated, the cups **36** are connected by an integral cylindrical connecting member **40**

which may if desired be reinforced by an internal reinforcement 41. Cylindrical bosses 42 and 43 extend outwardly from the outer surfaces of the side by side cups and these bosses may also be reinforced by internal reinforcements such as 41. The cylindrical connection 40 and the bosses 42 are engageable in peripheral angularly spaced notches 44 in the outer sprockets 34 and in the center sprocket 35.

As may be seen, each conveyor is formed of a series of links connecting the bosses of adjoining pairs of cups. Alternate of the links 45 are supported on the bosses 42 inwardly of the remaining links 46 and the links are held assembled on the bosses 42 by any suitable means such as by cotter pins. The sprockets 34 and 35 may be secured to their shafts 30 and 31 so that all of the sprockets rotate in unison and the sprockets on the shaft 30 are rotated by engagement with the conveyor chains 37 and 39.

In order to actuate the conveyors so as to invert the pockets or cup elements in which ice has been frozen, a manually operable handle element indicated in general by the numeral 49 is provided. The handle element 49 includes a pair of arms 50 which are rotatably supported upon the shaft 31 and which are connected by a transverse connecting handle 51. As is indicated in FIGURE 7 of the drawings, the outer sprockets 34 which are mounted upon the shaft 31 are provided with ratchet teeth 52 which are preferably provided intermediate the sprocket notches 44. A ratchet dog or pawl 53 is pivotally mounted at 54 to each handle arm 50. The handle arms 50 are mounted outwardly of the sprockets 34 and each pawl is provided with a laterally extending projection 55 which is engageable with the ratchet teeth 52. Thus, upon movement of the handle arms 50 in a clockwise direction as indicated by the arrow 56 in FIGURE 7, the pawl 53 acts to engage a corresponding ratchet tooth 52 on a corresponding sprocket 34 to rotate the sprockets in a clockwise direction. The handle arms 50 are movable through an angle of slightly greater than 90° as is indicated by the position of the handle arms 50 shown in dotted outline. This action moves the endless conveyors a distance equal to the spacing of adjoining pairs of cups 36.

A spring 57 urges the pawl 53 in a clockwise direction as viewed in FIGURE 7. However, upon reversed rotation of the handle arms 50, the transversely projecting portion 55 of each pawl 53 may swing in a counter-clockwise direction as viewed in FIGURE 7 to slide over the various bosses 42 and over the next ratchet tooth 52 of each sprocket. Thus, upon return rotation of the handle arms, the conveyors remain stationary. If desired, a spring such as 59 (FIGURE 2) may be mounted upon the side wall 23 of the freezing compartment, this spring being engageable with the sprocket teeth 52 to prevent a reverse rotation of the sprockets 34. As ratchet engaging springs of this general type are well known in the art, this structure has not been illustrated in detail.

A pair of hubs 60 are mounted upon the shaft 31 for rotation in unison therewith. Each hub 60 is provided with a projecting arm 61, one such arm being indicated at 61 in FIGURE 7 of the drawings. A pair of elongated spring arms 62 are pivotally supported upon a transverse shaft 63 extending between, and supported by, the side walls 23 of the freezing compartment. The arms 62 are bent intermediate their ends as indicated at 64, the point of bend being directly above one of the cups or receptacles 36. The arms 62 are properly spaced so that one arm is engageable with one cup of each pair while the other arm is engageable with the companion cup of this pair. As the handle arms 50 are moved into their normal elevated position, as shown in full lines in FIGURE 7, the arms 61 on the shaft 31 are pivoted into engagement with the ends of the resilient arms 62, forcing the portions of these arms adjoining the bends 64 against the bottom wall of an inverted cup 36. This operation tends to flex the cup sufficiently to disengage the ice cubes therefrom. The disengaged ice cubes drop downwardly into a pan or receptacle 65 mounted upon the bottom wall of the evaporator unit 15 directly beneath the ice cube making apparatus.

A pair of rollers 66 are mounted upon the forward shaft 31 inwardly of the bottoms of the cup shaped receptacles to assist in guiding these various cups from upright to inverted position as the conveyors carry them around the forward end of the conveyor. A similar pair of rollers 67 are provided on the rear shaft 30 inwardly of the bottoms of the cup shaped receptacles for guiding the cups from an inverted position to an upright position. As is indicated in FIGURE 7 of the drawings, the outer surfaces of the pairs of cups 36 are provided with spaced laterally projecting pins 69 which extend over the links 45 and 46 of the conveyors 37 and 39 and hold the various receptacles from tilting when in upright position. These pins 69 also limit the rotation of the cups about their supporting bosses while the cups are traveling about the ends of the conveyors. A means is provided for automatically filling the various cups as they assume upright position. Any suitable means, which is either mechanically or electrically actuated, may be employed. In the present construction a water supply pipe 70 is provided with a control valve 71 which operates, when actuated, to open for a predetermined period of time and thus to admit a measured quantity of water. The pipe 70 is connected to a double ended spray nozzle 72 which is directed toward the side by side cups 36 as the cups reach the top of the rear sprockets or reach the upper flight of the endless conveyors. The valve 71 is operated in any suitable way such as by a control circuit including a normally open switch 73 including a switch blade 74 successively engageable with protuberances 75 on the center cam 35 at the rear end of the conveyor or on the shaft 30. As each of the protuberances 75 engage the switch blade 74, they momentarily close the circuit to the valve 71 which admits a measured amount of water to the cups 36 at the top of the rear sprockets or at the beginning of the upper flight of the conveyors.

The operation of this form of my ice cube maker is believed quite clear from the foregoing description. Water is injected into the cups attached to the upper flight of the conveyors until these cups are properly filled with water. This is accomplished by rotating the operating handle in a clockwise direction through approximately 90° to move two cups into position in the upper flight of the conveyor and automatically filling them with water when they reach this position. When these cups are filled, the handle lever may again be oscillated downwardly, moving the first filled cups forwardly and automatically filling a second pair of cups. This operation is continued until all of the cups of the upper conveyor flight are filled. The cups then remain in this position until the water has frozen.

When the ice cubes have frozen, further operation of the handle arm moves these cups step by step into inverted position and disengages the cubes from the cups to drop into the receptacle 65. A new set of cubes may then be frozen and deposited into the receptacle. When a supply of ice cubes has been collected in the receptacle 65, the freezer is merely used to replenish the supply of cubes as they are used. The supply of cubes may be easily maintained and if the ice cubes are used from the receptacle at a rate faster than they can be produced, the supply of cubes in the receptacle may be used and the supply replenished when convenient.

In FIGURES 3 and 4 of the drawings, I have disclosed a construction which is quite similar to that previously described but which is automatically, rather than manually, operated. In this form of construction, the refrigerator 80 includes an evaporator in the form of an enclosure as indicated at 81 and a freezing chamber 82 is suspended from the top 83 of the refrigerator liner as in

the previously described construction. The sides 84 of the freezing chamber 82 supports a pair of parallel shafts 85 and 86, which correspond to the shafts 30 and 31 of the previous construction. These shafts support the sprockets 34 and 35 as in the previous construction, the sprockets in turn supporting the endless conveyors 37 and 39 which support pairs of cup shaped receptacles 36. This inner construction is virtually identical with that previously described and therefore is not again described in detail.

The shaft 85 supports a worm wheel 87 which engages the worm 89 on a shaft 90 projecting rearwardly through the rear evaporator wall 91 and through a portion of the rear wall 92 of the refrigerator cabinet 80.

A motor chamber 93 having a removable cover panel 94 extends partially into the rear wall 92 of the refrigerator. The shaft 90 extends through a tubular support 95 and into the housing or enclosure 93. The enclosure 93 supports a motor 96 and a gear reduction device 97. The motor 96 is connected through the gear reduction device to the shaft 90 to rotate the shaft 90 at an extremely low rate of speed. Rotation of the shaft 90 causes a corresponding rotation of the shaft 85 so as to drive the endless conveyors 37 and 39 continuously. The speed of rotation is such that the receptacles 36 traveling along the upper flight of the conveyor may be filled with water at one end of this flight and the water will be frozen into ice at the end of the flight.

A pan or receptacle 99 is positioned beneath the freezing compartment 82 to receive the ice cubes which drop from the lower flight of the conveyor. The receptacle 99 is provided with legs 100 near the rear end thereof which rest upon the bottom of the evaporator chamber 81. A panel 101 having a hook shaped lower edge 102 is slidably supported by vertically extending bolts 103. Springs 104 encircle the bolts 103 and normally hold the panel 101 in its uppermost position. The panel 101 is provided with an inturned flange 105 against which the springs 104 may engage.

The forward end 106 of the receptacle 99 is provided with a rolled edge 107 which forms a bearing for a handle loop 109. This handle loop 109 is engageable in the hook shaped lower extremity 102 of the panel 101. When there are a predetermined number of ice cubes or a predetermined weight of ice in the receptacle 99, this weight is sufficient to overcome the tension of the springs 104 and to permit the panel 101 to slide downwardly a short distance. Downward movement of the panel 101 actuates a normally closed switch 110 to open the circuit to the conveyor motor 96 as will be later described. A pair of spring strips 111 are pivotally supported upon a transverse rod 112 extending between the opposite sides 84 of the freezing chamber 82. These spring strips 112 are bent intermediate their ends as indicated at 113 and the free end of each spring is engageable with a cam 114 mounted on the shaft 86. As a result, each time one of the cup shaped receptacles 36 moves between the bent portion 113 of the spring strips 111, the cam 114 serves to swing the strips 111 downwardly against the inverted bottom portion of the cups 36. Thus, the spring may flex these cups sufficiently to disengage the ice therefrom.

The circuit which controls the apparatus includes a pair of line wires 115 and 116, at least one of which includes a manually operable control switch 117. The line wire 115 is connected by a conductor 119 to one terminal of the motor 96. The other motor terminal is connected by a conductor 120 to the terminal 121 of the normally closed switch 110 which was previously described. The other terminal of the switch arm 110 is connected by a conductor 122 through the switch 117 to the line wire 116 thus completing the circuit.

The line wire 115 is also connected by a conductor 123 to one terminal of a solenoid 124, the other terminal of which is connected by a conductor 125 to one terminal 126 of a switch blade 127. The other terminal of the switch blade 127 is connected by a conductor 129 through the switch 117 to the line wire 116 thus completing the circuit.

The switch 127 is of the two pole type and includes a second switch blade 130. The terminals of the switch blade 130 are connected by the conductor 131 to the line wire 116 and by the conductor 132 to the conductor 120 leading to the motor 96. Thus, when the switch blades 127 and 130 are simultaneously closed, the solenoid 124 is energized, and the circuit to the motor 96 is maintained.

The solenoid 124 controls a solenoid valve 133 in a water line 134 leading to the double water nozzle 135 positioned above the cups 36 at the start of the upper flight of these cups. The switches 127, 130 are incorporated in a single switch structure 136, the operation of which is controlled by an operating arm 137. This arm 137 is momentarily engaged with any of a series of angularly spaced projections 139 on the intermediate sprocket 35 and which are similar to the projections 75 previously described.

The operation of the apparatus is simple to understand. When the manually operable switch 117 is closed, the endless conveyors are actuated at a very low rate of speed, the cups remaining in the upper flight of these conveyors a length of time necessary to freeze water in the cups. At the forward end of the conveyors, the cups are carried around the forward sprockets 34 and 35 and are carried into inverted position. As each pair of cups 36 move into position beneath the bent portions 113 of the springs 111, these springs are urged downwardly by the cam 114 and the cubes are released from the cups to drop into the receptacle 99. This operation continues a length of time necessary to build up a predetermined weight of ice cubes in the receptacle 99. When sufficient ice accumulates in the receptacle 99, the weight of these cubes actuates the switch 110 to open the circuit to the motor 96.

As the conveyor moves each successive pair of cups beneath the filling nozzle 135, the switch arm 137 is engaged by one of the projections 139 and the switch blades 127 and 130 forming a part of the switch are closed. This operation closes a circuit to the solenoid 124 which opens the valve 133 for a predetermined length of time thereby providing a measured quantity of water delivered to the cups. The circuit may be such that the solenoid 124 remains in operation for a predetermined period regardless of how long the switch blade 127 is in closed position. However, if the circuit is such that the solenoid 124 may be reactivated in the event the motor 96 should be stopped in operation while the projection 139 was in engagement with the arm 137 of the switch 136, the second switch blade 130 would prevent this difficulty by maintaining the circuit to the motor 96 as long as the switch 136 was closed.

The detail construction of the operation of the device may be widely varied, the drive and control illustrated in FIGURES 3 and 4 of the drawings being merely a suggested form of construction. For example, the water supply system could be provided with a metering tank, the contents of which would be delivered to the cups 36 each time a different pair of cups moved into position beneath the nozzles.

In FIGURE 8 of the drawings a modified form of ice freezing receptacles or cups are disclosed. In this arrangement, each side by side pair or series of cups include rectangularly arranged tapered side walls 141, shown as having a top outwardly directed wall encircling flange 142 and a bottom inwardly directed flange 143. Integral bosses 144 project from the inner opposed wall surfaces and are connected by a reduced diameter shank 145. Outwardly directed bosses 146 terminating in reduced diameter portions 147 are provided in axial alignment with the shank 145. The shank 145 and shaft por-

tions 147 form connections with the conveyor links and ride in the sprockets supporting the conveyors, as has been stated.

The bottom of each cup or receptacle comprises a flexible diaphragm 149 of resilient rubber plastic or other suitable material which closes the cups at the lower end thereof. These diaphragms or closures may be vulcanized or molded in place to form a water tight closure. The resilient cup bottoms may flex when pressure is applied thereto to simplify the removal of ice cubes. This structure has the advantage of reducing the freezing cycle by increasing the rate of heat transfer to the water in the cups.

In accordance with the patent statutes, I have described the principles of construction and operation of my belt type ice cube maker, and while I have endeavored to set forth the best embodiments thereof, I desire to have it understood that obvious changes may be made within the scope of the following claims without departing from the spirit of my invention.

I claim:

1. An ice cube maker including a plurality of rows of cups, the cups of each row being connected for movement in unison, pivots connected to the cups of each row to project outwardly therefrom, links connecting said pivots of one row to the pivots of the next adjacent rows to provide an endless conveyor, parallel shafts supported in a common substantially horizontal plane, sprockets on said shafts engageable with said pivots to support said conveyor, and means on said cups engageable with said links to hold the cups from pivoting relative to said links.

2. The structure of claim 1 and in which said last named means includes projection means on said cup engageable with said links.

3. The structure of claim 2 and in which said projection means includes spaced projections on opposite sides of said pivots.

4. An ice cube making device including a freezing chamber, a pair of shafts supported in parallel relation in said freezing chamber, said shafts being in a substantially common horizontal plane, rotatable conveyor supports mounted upon said shafts, a conveyor supported between said rotatable supports and including a pair of endless conveyor members and cups supported between said conveyors, water supply means for supplying water to said cups as said cups enter the upper flight of said conveyor, means holding said cups upright as they move along the upper flight of said conveyor and holding said cups inverted as they travel along the lower flight of said conveyor, a motor, and means connecting said motor to one of said shafts to move said conveyors, a tray positioned beneath said conveyor to receive the cubes, means at the rear end of said chamber supporting one end of said tray, a baffle closing the upper part of the front of said freezing chamber above said tray, means on the lower end of said baffle engaging the forward end of said tray to support the same with the forward portion of the tray forming, in effect, a continuation of said baffle, said baffle being vertically slidable, resilient means urging said baffle means, and a motor control switch in the path of downward movement of said baffle.

5. An ice cube freezing apparatus including an endless conveyor including a plurality of rows of cups arranged in side by side relation, means connecting the cups of each row in fixed relation, generally cylindrical bosses projecting outwardly on opposite sides of the cups of each row, links pivotally connecting the bosses of one row to the bosses of the next row, spaced parallel supporting shafts, and sprockets on said shafts engageable with said bosses to support said rows of cups, said cups having means thereupon engageable with said links to hold the cups from tilting relative to said links.

6. An ice cube maker including a pair of parallel pivotal conveyor supports arranged on a substantially horizontal common plane, an endless conveyor, said conveyor being mounted upon said conveyor support, a series of spaced water receiving receptacles carried by said conveyor, said receptacles being upright as they traverse the upper flight of the conveyor and inverted as they pass along the lower flight of the conveyor, water supply means for supplying water into said cups as they successively enter the upper flight of the conveyor, and a receptacle supported beneath said conveyor and extending throughout the length thereof for receiving ice cubes which drop from the cups as they move along the lower flight of the conveyor, said conveyor support including a pair of spaced shafts, sprockets on said shafts engageable with said conveyor to support the same, an arm supported on one of said shafts for oscillation about the shaft, and ratchet dog means on said arm engageable with one of said sprockets upon oscillation of said arm in one direction to rotate the same, and including means actuated by said arm for engaging said pockets to flex the same.

7. An ice cube maker including a pair of parallel pivotal conveyor supports arranged on a substantially horizontal common plane, an endless conveyor, said conveyor being mounted upon said conveyor supports, a series of spaced water receiving receptacles carried by said conveyor, said receptacles being upright as they traverse the upper flight of the conveyor and inverted as they pass along the lower flight of the conveyor, water supply means for supplying water into said cups as they successively enter the upper flight of the conveyor, and a receptacle supported beneath said conveyor and extending throughout the length thereof for receiving ice cubes which drop from the cups as they move along the lower flight of the conveyor, said conveyor supports including a pair of spaced shafts, sprockets on said shafts engageable with said conveyor to support the same, means pivotally supported between said conveyor flights and engageable with the bottoms of said cups in said lower flight, and means on one of said shafts engageable with said last named means at intervals during rotation of said one shaft to pivot said last named means against said cup bottoms.

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