

Sept. 25, 1962

W. C. LUNDSTROM
ICE CUBE MAKING MACHINE

3,055,185

Filed May 23, 1960

6 Sheets-Sheet 2

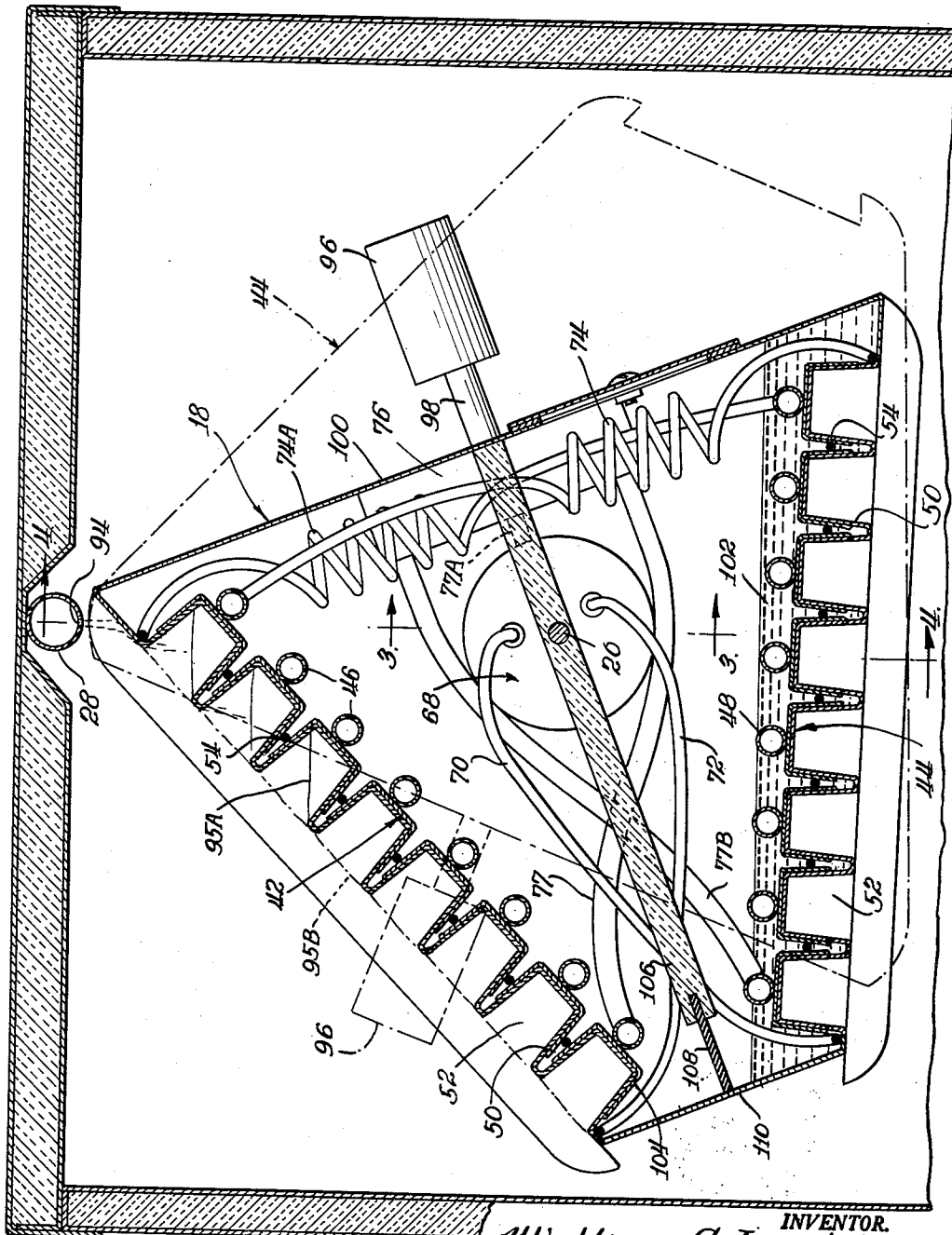


Fig. 2.

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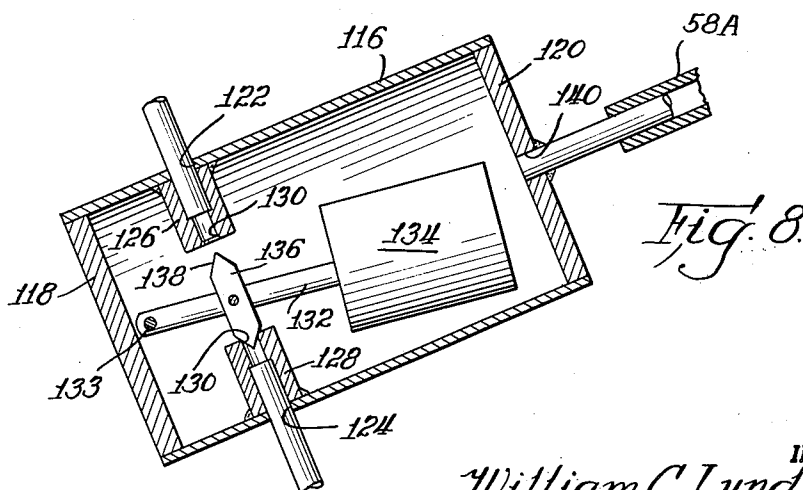
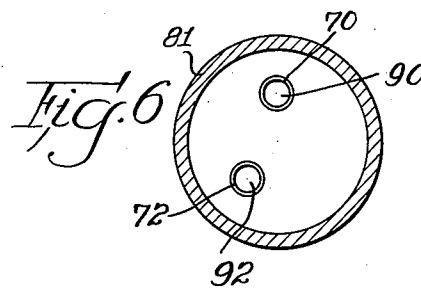
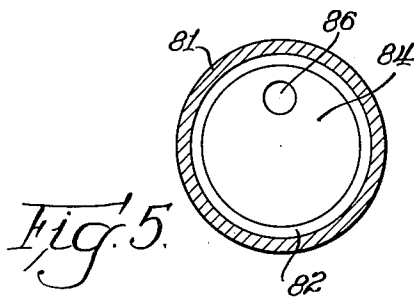
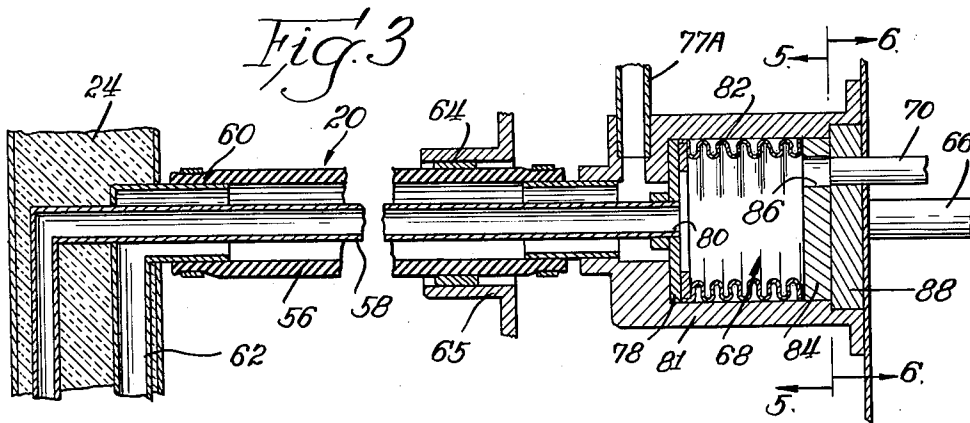
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6 Sheets-Sheet 3



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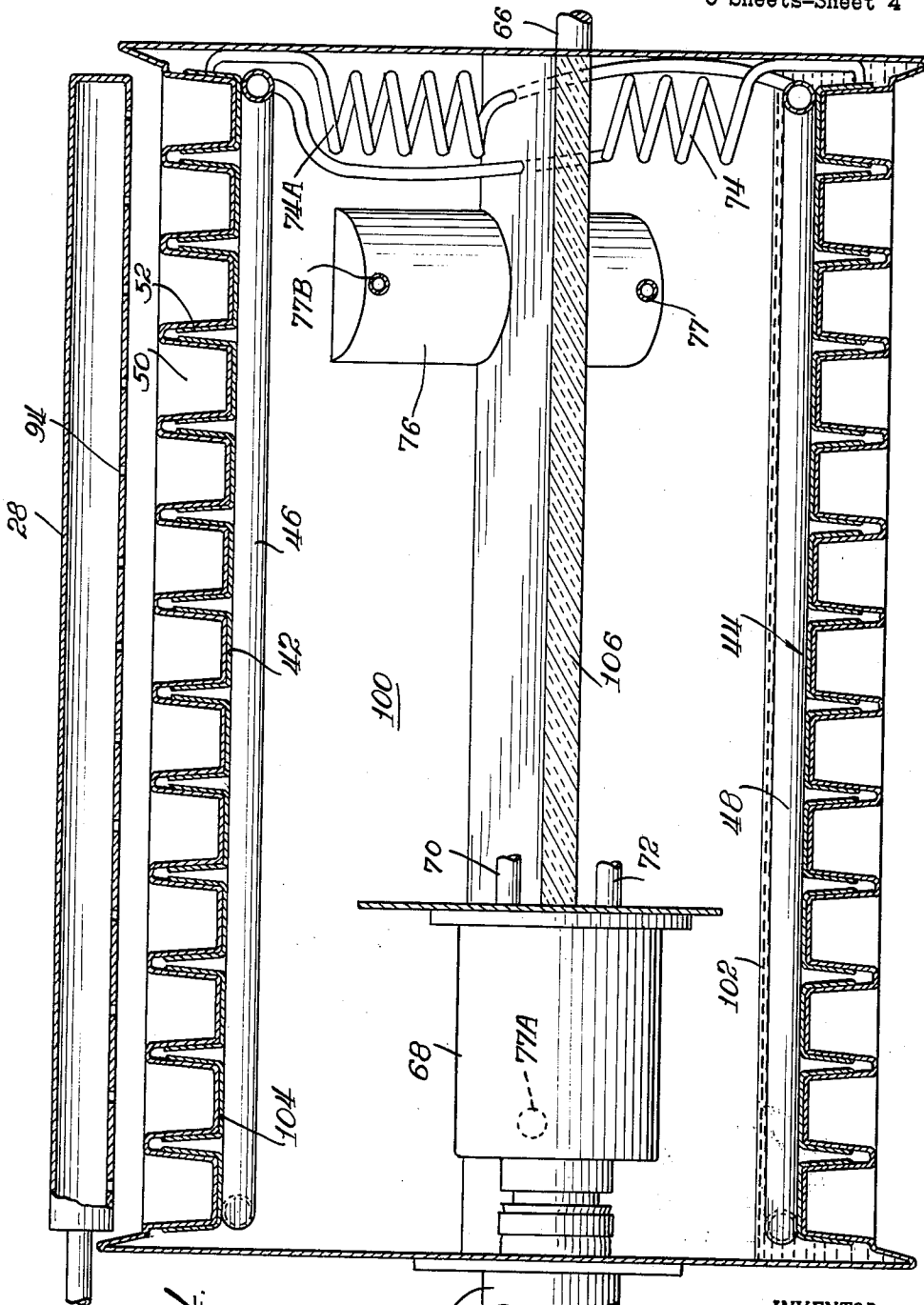


Fig. 11.

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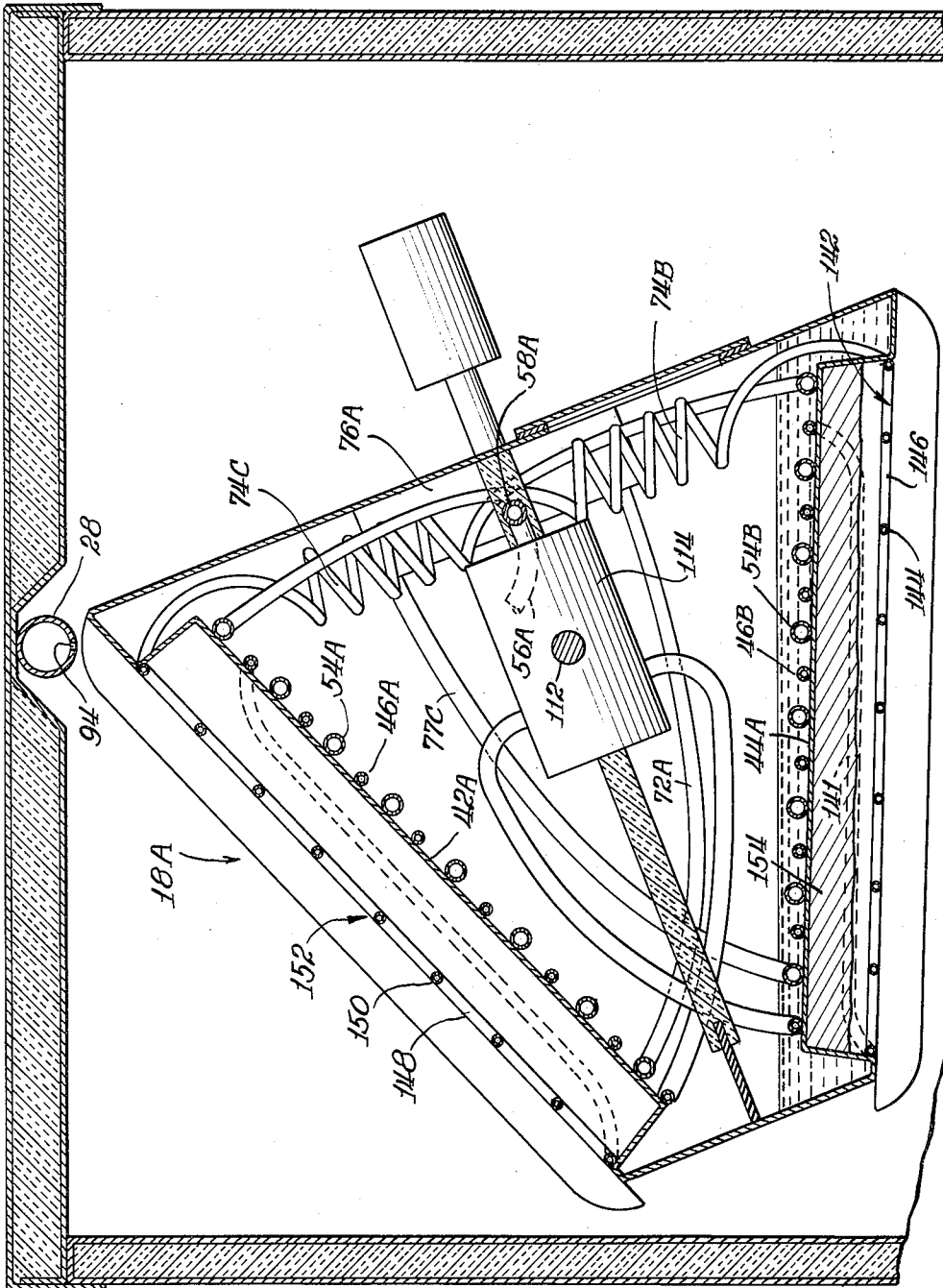


Fig. 7

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Fig. 9.

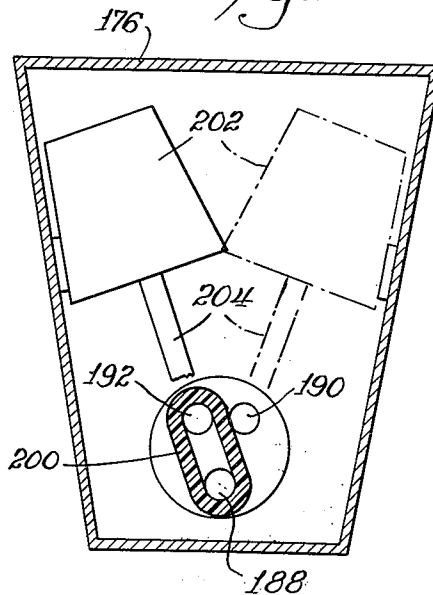


Fig. 10.

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3,055,185

ICE CUBE MAKING MACHINE

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Filed May 23, 1960, Ser. No. 30,810

18 Claims. (Cl. 62-138)

The present invention relates to ice making machines, and more particularly to ice cube making machines capable of unattended continuous production of ice.

One of the more satisfactory types of ice cube making machines presently employed freezes a slab of ice on an inclined freezing surface. By the application of heat, the slab is released and transferred from the freezing surface to an ice cutter which severs the slab into cubes. The cutters employed may be electrically heated wires forming a grid, such as disclosed in Patent No. 2,784,563 to Baker, or tubes containing hot refrigerant as disclosed in Patent No. 2,834,189 issued to Jaeger.

Ice cube making machines of this type require relatively complex controls in order to properly time the freezing of an ice slab, the application of heat to remove the slab, and the cutting of the slab. In addition, the time required for removal of the slab from the ice freezing surfaces is lost to the refrigeration cycle.

It is an object of the present invention to provide an improved machine for the automatic production of ice cubes, particularly clear ice cubes.

It is a further object of the present invention to provide a machine for the production of ice cubes which requires no separate cutter for severing an ice slab into cubes.

Also, it is an object of the present invention to provide an ice making machine which has an ice freezing surface and means for positioning the ice freezing surface upwardly for the freezing of ice and downwardly for the discharge of ice.

Further, it is an object of the present invention to provide an ice making machine with two freezing surfaces in which one surface is upwardly directed and the other surface is downwardly directed, said machine having a refrigeration system for cooling the upwardly directed surface and heating the downwardly directed surface, the positions of two surfaces being interchangeable.

Further, it is an object of this invention to provide an ice forming machine with an upwardly directed freezing surface and a downwardly directed freezing surface which utilizes the weight of ice forming on the upwardly directed surface to interchange the positions of the two surfaces.

It is a further object of the present invention to provide an ice cube making machine which has two surfaces in thermal contact with a refrigerant circuit for the freezing of ice and means for controlling the refrigerant circuit to heat one surface and cool the other.

These and further objects of the present invention will become readily apparent to those skilled in the art upon a further consideration of this disclosure, particularly when viewed in the light of the drawings, in which:

FIGURE 1 is a vertical sectional view of an ice cube making machine constructed according to the teachings of the present invention;

FIGURE 2 is a fragmentary sectional view taken along the line 2-2 of FIGURE 1;

FIGURE 3 is a sectional view taken along the line 3-3 of FIGURE 2;

FIGURE 4 is a sectional view taken along the line 4-4 of FIGURE 2;

FIGURE 5 is a fragmentary sectional view taken along the line 5-5 of FIGURE 3;

FIGURE 6 is a fragmentary sectional view taken along the line 6-6 of FIGURE 3;

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FIGURE 7 is a sectional view of another embodiment of the ice cube making machine taken along the line corresponding to that of FIGURE 2;

FIGURE 8 is a sectional view of the reversing valve structure employed in the ice cube making machine of FIGURE 7;

FIGURE 9 is a diagrammatic showing of another embodiment of the present invention; and

FIGURES 10 and 11 are sectional views of a valve suitable for use in the embodiment of FIGURE 9.

FIGURE 1 illustrates the ice cube making machine mounted within its cabinet 10. The cabinet has a cube bin 12 located near the bottom 14 of the cabinet 10 and an inclined surface 16 sloping into the bin 12. An ice cube forming unit 18 is mounted directly above the sloping surface 16 and is pivoted on a support rod 20 which extends between opposite walls 22 and 24 of the cabinet 10. A cover 26 encloses the upper side of the cabinet 10.

The ice cube forming unit 18 is positioned immediately beneath a water distributor 28 mounted on the cabinet 10, and the excess water passing over the ice cube forming unit 18 strikes the inclined surface 16 and is collected by a water trough 30. Water trough 30 communicates with a pump 32 and returns the excess water to the water distributor 28. A T-connection between the trough 30 and the pump and float assembly 32, designated 34, introduces additional water into the refrigerating cycle from a water main, not shown. A wall 36 of thermal insulating material extends vertically between the ice cube making unit 18 and the remainder of the cabinet 10 to improve the efficiency of the refrigeration cycle, and a flap gate 38 extends from the bottom end of the wall 36 to the inclined surface 16. The gate 38 permits water and cubes to pass from the inclined surface 16, and a screen 39 over the water trough 30 guides cubes over the trough and into the bin 12. A condensing unit 40 including a compressor and condenser is mounted on the cabinet 10 beneath the inclined surface 16.

FIGURES 2 through 6 illustrate the ice cube making unit 18 in detail. The ice cube making unit 18 is provided with two thermally conducting plates 42 and 44 which form surfaces for the production of ice, and the plates 42 and 44 are disposed at an angle relative to each other. Tubes 46 and 48 are mounted on the confronting surfaces of the plates 42 and 44, respectively, and are connected in a refrigerant circuit which will be described hereinafter. The plates 42 and 44 are also provided with a plurality of walls 50 which extend outwardly from their remote surfaces parallel to each other and spaced by a common distance. A second plurality of equally spaced walls 52 also extend outwardly from the remote surfaces of the plates 42 and 44 normal to the walls 50 to form rectangular pockets for the formation of cubes. Each of the walls 50 contains a channel 54 which is also connected in the refrigeration circuit. The plates 42 and 44 and the walls 50 and 52 are formed of thermally conducting material.

The unit 18 is pivotally mounted on the shaft 20, as indicated above. The shaft 20 contains an outer sleeve 56 and a spaced coaxial inner sleeve 58. The outer sleeve 56 is securely mounted at one end 60 to the wall 24 of the cabinet 10, and the inner sleeve 58 extends into the wall 24 of the cabinet and to the high pressure side of the compressor 40. The sleeve 56 is also connected to a tube 62 which extends through the wall 24 of the cabinet 10 to the low pressure side of the compressor.

A ring 64 is slidably disposed about the sleeve 20 and mounted within a hub 65 which extends from one end of the unit 18, and the cube forming unit 18 is mounted at one side thereto. A spindle 66 extends from the other side of the cube forming unit 18 on the same axis as the

ring 64, and is journaled within a bearing 67 in the wall 22 of the cabinet 10. In this manner, the cube forming unit 18 is free to rotate on the sleeve 20 and the spindle 66.

The unit 18 is limited in both its clockwise and counter-clockwise rotation so that the angle the upper plate 42 makes with the horizontal is approximately the supplement of the acute angle made by the plate 44 with the horizontal. These stops are formed by a pin 67A anchored in the spindle 66 abutting shoulders 67B formed in the hub 67.

The inner sleeve 58, which communicates with the high pressure side of the compressor 40, terminates at its end opposite the compressor in a valve 68 located within the cube forming unit 18. The valve 68 connects the high pressure side of the compressor 40 to one of two tubes 70 or 72. The tube 70 is connected to the end of the interconnected channels 54 which are disposed adjacent to the plate 44, and the tube 72 is connected to one end of the interconnected channels 54 adjacent to the plate 42. The channels 54 adjacent to the plate 42 are serially connected, as are the channels 54 adjacent to the plate 44. The end of the channels 54 of the plate 44 which are remote from the valve 68 are connected through a capillary tube 74 to one end of the tube 46 adjacent to the plate 42, the tube 46 forming a circuit extending adjacent to the entire plate 42. The opposite end of the tube 46 of the plate 42 is connected to a reservoir 76 by a tube 77. The reservoir 76 is illustrated in FIGURES 2 and 4, and communicates with the tube 56 and the return to the low pressure side of the compressor 40 through a tube 77A. The reservoir 76 is also connected to the end of the tube 48 adjacent to the plate 44 which is opposite the valve 68 by a tube 77B. A second capillary tube 74A is connected between the end of the channels 54 of the plate 42 remote from the valve 68 and the end of tubes 48 of the plate 44 opposite the reservoir 76 to complete the refrigeration circuit.

The inner sleeve 58 is rigid, and the outer sleeve 56 is flexible, that is, the sleeve 56 is constructed of a material capable of sustaining a substantial twist. The ice forming unit 18 is journaled about the sleeve 56 at one side by the ring 64, while the unit 18 is rigidly secured to the end of the sleeve 56 adjacent to its pivotal shaft 66. As a result, the unit 18 is adapted to rotate relative to the rigid sleeve 58, and this rotation twists the flexible sleeve 56.

The end of the fixed shaft 58 opposite the mounting means 60 terminates in the valve 68 which employs a first plate 78 having an orifice 80 communicating with the tube 58. A first plate 78 is at one end of a cavity in a housing 81, and a bellows 82 extends within the cavity from the plate 78 and terminates in a second plate 84 having a single aperture 86. The second plate 84 confronts and is adapted to abut a third plate 88 provided with two orifices 90 and 92. The second plate is illustrated in elevation in FIGURE 5, and the third plate is illustrated in elevation in FIGURE 6. One of the tubes 70 extends from the aperture 90, and the other tube 72 extends from the aperture 92 of the third plate 88. The third plate 88 is mounted rigidly on the ice forming unit 18 and rotates therewith, while the second plate 84 is mounted on the rigid tube 58 by the bellows 82 and therefore remains in the same rotational position at all times. Rotation of the ice forming unit 18 between its two operating positions is thus effective to align the aperture 86 with the orifice 90 of the plate 88 in one operating position and to align the aperture 86 with the orifice 92 in the other operating position.

When the ice cube is in operation, water enters the water distributor 28 and flows through a plurality of apertures 94 therein into the cups formed by the walls 50 and 52 of the plate 42 or 44 confronting the water distributor 28, the plate 42 being in this position in FIGURES 2 and 4. The water from the distributor 28 flows

into the first adjacent row of cups and fills the cups to the level permitted by the wall 50 thereof. Thereafter, the water flows down to the next row of cups and so forth until all of the cups are filled to the level permitted by the walls 50 thereof with the surface of the water horizontal. This condition of the water in the cups is shown by the solid lines 95A in FIGURE 2. Any excess flow of water flows over the end of the unit 18 adjacent the lowest of the cups, down the inclined surface 16 of the cabinet 10 into the trough 30, and thereafter repeats the cycle. The valve 68 is in the position aligning the aperture 86 with the orifice 90, thus connecting the high pressure side of the compressor to the channels 54 in the walls 50 of the plate 44, that is the plate which has assumed a nearly horizontal position. As a result, the capillary tube 74 provides the pressure drop required to supply refrigerant at a low temperature to the tubes 46 adjacent to the plate 42 which now is the freezing surface. This results in the water in the cups freezing, and as the water freezes, the additional water supplied to the cups fills in the remaining space in the cups to provide cups which are completely filled with ice, as indicated by the dashed line 95B in FIGURE 2.

It is to be noted that the pivotal axis for the ice forming unit 18 is formed by the shaft 20 and the shaft 66, and these shafts are disposed on a vertical plane located entirely on one side of the vertical surface traversing the water distributor 28. The ice forming unit 18 is counterbalanced by a weight 96 threadably adjustable on a shaft 98 which extends from a wall 100 of the unit 18 extending between the freezing plates 42 and 44 to prevent rotation of the unit 18 until the weight of the ice formed adjacent to the upwardly facing plates 42 or 44 is sufficient to overcome this counterbalance, and the counterbalance is selected to permit rotation of the ice forming unit 18 when the cups of the upper plate are completely filled.

Once the unit 18 begins to rotate, more positive rotation can be achieved by utilizing a liquid within the unit. For this reason, the walls 100 and 110 are sealed to opposite ends of the plates 42 and 44 to form a sealed housing, and a liquid 102, which may be an ethyl glycol refrigerant, is disposed within the volume confined by the housing of the unit 18. The liquid 102 is selected to have a level covering the tubes 48 adjacent to the lower plate, and as soon as the unit 18 begins to rotate, the liquid 102 flows to the region of intersection between the plates 42 and 44 and aids in achieving rotation. When rotation from the solid line position of FIGURE 2 is completed, the plate 42 has achieved the relatively horizontal position, and the plate 44 has rotated in a counterclockwise direction to assume an upwardly facing position on the opposite side of the vertical plane of the pivotal axis, as indicated by the dashed lines.

At the same time, the valve 68 has changed its position to align the aperture 86 with the orifice 92 and to connect the high pressure side of the compressor 40 to the tubes 54 of the plate 42. In this manner, heat is applied to the plate 42 for the purpose of unfreezing and releasing the ice cubes formed within the cups thereof and simultaneously applying refrigerant to the tubes 46 of the plate 44 which now is receiving water from the distributor 28. Any excess refrigerant remaining in the tubes 48 adjacent to the surface 42, which now is in the ice cube discharging position, is rapidly boiled from these tubes as a result of the liquid 102 as well as the application of heat in order to facilitate removal of the cubes. In practice, the cubes will be released from the lower surface in approximately one-half hour, while the cubes are frozen adjacent to the upper surface in a somewhat longer period of time. Release of the cubes has no effect upon the stability or the rotational position of the ice forming unit, largely because of the fact that the vertical plane of the pivotal axis approximately bisects the lower plate.

The inventor has found that the surfaces 42 and 44 and the walls 50 and 52 are preferably constructed of stainless steel. Stainless steel is a conductor of heat, but

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a relatively poor conductor of heat when compared with copper and the like. Because of the fact that stainless steel has a relatively poor thermal coefficient of conductivity, a coating 104 of material having a greater thermal coefficient of conductivity is disposed on the side of the plate 42 and the lower portions of the walls 50 and 52 confronting the tubes 46 and channels 54. As a result, the flow of heat to and from the ends of the walls 50 and 52 remote from the surface 42 is restricted, and freezing of water over these ends of the walls is thus largely avoided. Also, this construction facilitates removal of the cubes from the cups. It is also to be noted that the walls 50 and 52 are thicker adjacent to the plates 42 and 44 and taper to a thin thickness remote therefrom. This shape also facilitates removal of the cubes and the prevention of excessive icing at the remote ends of the walls 50 and 52.

Loss of thermal efficiency as a result of convection between the surfaces 40 and 42 is substantially reduced by a wall 106 extending centrally between the plates 42 and 44 from the wall 100. A flexible flapper 108 is disposed between the end of this insulating wall 106 remote from the wall 100 and the intersecting plate, designated 110, extending between the plates 42 and 44. The flexible flapper 108 permits the liquid 102 to transfer between the plates 42 and 44 in response to rotation of the ice forming unit 18 while substantially reducing heat losses between these plates by convection.

FIGURES 7 and 8 illustrate another embodiment of the present invention. In this embodiment of the invention, the ice forming unit 18A is journaled about a rigid shaft 112. The ice forming unit 18A differs from the ice forming unit 18 described in FIGURES 1 through 6 principally in that a separate ice cutting grid is employed and a different valve construction is employed, the valve 114 of the ice forming unit 18A being a gravity operated needle valve. It is to be understood that the valve 114 may be substituted for the valve 68 of the embodiment of FIGURES 1 through 6, and the separate ice cutting grid employed in this embodiment may be employed with the construction of FIGURES 1 through 6.

In this embodiment, the ice forming surfaces are formed by plates 42A and 44A which are positioned in the same manner as the plates 42 and 44 of the embodiment of FIGURES 1 through 6. A series of tubes 54A and 54B are disposed in contact with the confronting surfaces of plates 42A and 44A, respectively, and a second series of tubes 46A and 46B are also disposed in contact with the plates 42A and 42B, respectively, these tubes being disposed between the tubes 54A or 54B.

The valve 114 is connected to the high pressure side of the compressor 40 through a flexible hose 58A. The valve 114 is specifically illustrated in FIGURE 8, and is mounted on the ice forming unit between the plates 42A and 44A. The valve 114 employs a cylindrical housing 116 which is sealed at both ends 118 and 120. The housing 116 is provided with two orifices 122 and 124 which are aligned with the axis of the housing and on opposite sides thereof. A short sleeve 126 extends toward the axis of the housing 116 from the orifice 122, and a second short sleeve 128 extends from the orifice 124 toward the axis of the housing 116. Both of these sleeves 126 and 128 terminate at a distance from the axis of the housing in seats 130.

A rod 132 is pivotally mounted at the intersection of the axis of the housing 116 on the end 118 thereof by a pin 133, and the opposite end of the rod 132 carries a weight 134. A needle valve member 136 is pivotally mounted on the rod confronting the seats 130 of the sleeves 126 and 128, and the member 136 has conical ends 138 adapted to seat within each of the seats 130.

An opening 140 is disposed in the end 120 of the housing 116, and this opening is connected through the flexible coiled tube 58A to the high pressure side of the compressor 40. The low pressure side of the compressor 40

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is connected through a flexible tube to an accumulator 56A.

Gravity forces the weight 134 downwardly, thus closing the lower needle valve. As illustrated in FIGURE 7, the valve seat in the stem 128 is closed, and therefore the high pressure line from the compressor is connected through the sleeve 126. The sleeve 126 is connected to the channels 46B adjacent to the plate 44, which is located on the opposite side of the valve housing 116 from the sleeve 126. The tubes 46B are connected in series, and the end of this series of tubes is connected by a tube 141 to a cutting grid 142 which has two series of tubes 144 and 146 disposed normal to each other and serially connected. The cutting grid 146 is mounted on the housing of the unit 18A parallel to and spaced from the surface 44A. The end of the series of tubes of the cutting grid 142 is connected through a capillary tube 74B to the one end of the series of channels 54A adjacent to the plate 42A. The opposite end of the series of channels 54A is connected to the reservoir 76A through a tube 72A, and the reservoir 76A is connected to the low pressure side of the compressor through a flexible hose 56A.

In like manner, insert 128 of the valve 114 is connected to the series of channels 46A of the plate 42A, and in series with tubes 148 and 150 of a second cutting grid 152. The cutting grid 152 is identical to the cutting grid 142 and is mounted on the housing of the unit spaced from and parallel to the plate 42A. The end of the tubes of the cutting grid 152 is connected through a capillary tube 74C to one end of the channels 54B of the plate 44A. The other end of the channels 54B is connected to the reservoir 76A through a tube 77C.

As indicated in FIGURE 7, the valve 114 is directing the high pressure refrigerant to the channels 46B for purpose of melting a slab of ice from the surface 44A, the slab being designated 154. Also, the high pressure refrigerant is supplied in series with the cutting grid 142, so that the heat of this refrigerant will cut the slab 154 into cubes when it is released from the surface of the plate 44A.

The capillary tube 74B reduces the pressure of the cooled refrigerant which now is effective to freeze a slab of ice on the surface of the plate 42A in the manner described for the embodiment of FIGURES 1 through 6. The unit 18A rotates on the axis 112, in the manner of the previous embodiment, when the slab of ice on the upper plate 42A or 44A becomes of sufficient weight.

When the ice freezing unit 18A rotates on its shaft 112, the valve 114 thereby disconnects the high pressure side of the compressor 40 from the channels 46A or 46B adjacent to the lower surface 42A or 44A and connects the high pressure side of the pump to the channels of the new lower plate which is now ready to discharge the ice cubes. As the operation continues, the ice forming unit 18A automatically rotates about its axis to position the surface ready to discharge ice cubes in an essentially horizontal position and positioning the freezing surface in an inclined position. Each rotation of the ice forming unit 18A effects a transfer of the flow of high pressure refrigerant from one surface to the other.

From the foregoing disclosure, it will be apparent to those skilled in the art that the inventor has provided an ice cube forming machine which requires no electrical controls to govern its cycle and which automatically responds to the completion of the freezing portion of the cycle to initiate the discharge position of the cycle. Further, the ice cube forming machine of the inventor utilizes essentially the entire freezing capacity to achieve freezing of ice cubes, since it does not require any substantial period to transfer from the freezing to the discharge portions of the cycle. With the embodiment of FIGURES 1 through 6, the ice cube making machine here disclosed utilizes only a single application of heat in the discharge of the ice cubes. There is thus less heat added to the formed ice in this embodiment than that required by an

ice cube making machine which first removes a slab of ice by the application of heat and then cuts the slab into cubes by a second application of heat, as in the second embodiment.

It is to be noted that the ice cutting grids 142 and 152, which are heated in the construction set forth by hot refrigerant, may also be electrical resistance heating elements which utilize electrical power to generate heat. With such a construction, an electrical switching means responsive to the rotational position of the unit, such as a pair of mercury switches, is required to energize the lower grid and deenergize the upper grid.

FIGURE 9 diagrammatically illustrates another embodiment of the present invention. In this embodiment, two freezing surfaces or plates 42B and 44B disposed at an acute angle to each other are illustrated, and these plates may be identical to the plates 42A and 44A of FIGURE 7 or employ the construction of the plates 42 and 44 of the embodiment of FIGURES 1 through 6. These plates 42B and 44B are also mounted for limited rotation as in the manner of the earlier embodiments.

A series of tubes 160 is in thermal contact with the plate 42B, and a second series of tubes 162 is in thermal contact with the plate 44B. A capillary tube 164 interconnects one end of the series of tubes 160 with one end of the series of tubes 162, and a two-position valve 166 connects the other end of one series of tubes to the high pressure side of a compressor 40 through a flexible tube 168 and the other end of the other series of tubes to the low pressure side of the compressor 40 through a flexible tube 170. The valve 166 directs high pressure refrigerant to the lower or horizontal plate 42B or 44B to release ice thereon, and low pressure refrigerant is thus directed to the upper plate 42B or 44B to freeze ice thereon. It is thus clear that the operation of this embodiment of the invention is substantially the same as the operation of the two embodiments previously described. Constructionally, this embodiment differs in that it employs only one series of tubes in thermal contact with each freezing surface and reverses the flow of refrigerant through the circuit which comprises the two series of tubes 160 and 162 and capillary tube 164 or other restriction.

The details of a gravity actuated valve suitable for valve 166 are illustrated in FIGURES 10 and 11. The valve 166 has a casing 172 with a short end 174 and a long end 176 opposite thereto. An opening 178 in one wall 179 adjacent to the short end 174 is sealed to a pipe 180 which extends into the casing normal to the wall 179. The end of the pipe 180 exterior to the casing 172 is connected to the high pressure side of the compressor, and the portion of the pipe 180 disposed within the casing 172 is provided with perforations 182.

A plug 184 is disposed in the wall 186 confronting the wall 179, and the plug 184 has an aperture 188 aligned with the pipe 180 and connected to the low pressure side of the compressor by the flexible tube 170. The plug 184 also has two additional apertures 190 and 192 which are connected to the series of tubes 162 and 160, respectively. A cup 194 has an indentation 196 in a closed end 197 which is journaled about the end of the pipe 180 within the casing, and the side of the cup 194 opposite the closed end thereof slidably engages the plug 184. Since the cup must slidably engage the plug, Teflon has been found to be particularly suitable for the cup or plug. The cup 194 has a recess 198 formed by the closed end 197 and walls 200 normal thereto which is adapted to connect the aperture 188 with either aperture 190 or aperture 192, depending on which of the two positions of the valve is being utilized. The aperture 190 or 192 not covered by the cup is in communication with the casing 172, and hence the high pressure side of the compressor.

The position of the cup 194 is gravity controlled by a weight 202 connected to the cup by a shaft 204. As indicated in FIGURE 9, the angle formed by the two positions of the cup 194 is bisected by the bisector of the angle

between the two freezing plates 42B and 44B, or is parallel thereto. It is hence clear that the rotational position of the freezing unit controls the valve 166.

Those skilled in the art will readily foresee many additional advantages of the present invention. Further modifications of the ice cube making machine here disclosed will readily present themselves to those skilled in the art upon further consideration of this disclosure. It is therefore intended that the scope of the present invention be not limited by the foregoing disclosure, but rather only by the appended claims.

The invention claimed is:

1. An ice making machine comprising an ice making unit having a first thermally conducting surface and a second thermally conducting surface disposed at an acute angle to the first surface, means for pivotally mounting the ice making unit on an axis including rotational stop means for limiting the clockwise and counterclockwise rotation of the unit, clockwise rotation being limited to positioning the first surface at an acute angle to the horizontal and counterclockwise rotation being limited to positioning the second surface at approximately the same acute angle to the horizontal, the center of gravity of the unit being between the first and second surfaces on the side of the pivotal axis remote from the intersection of the extensions of the first and second surfaces, and a refrigeration system having a refrigerant circulating circuit with a high pressure portion adjacent to the second surface and a low pressure portion adjacent to the first surface in the clockwise position, said refrigeration system having control means responsive to the rotational position of the unit for transferring the high pressure portion of the system to adjacent to the first surface and for transferring the low pressure portion to adjacent to the second surface of the system when the unit is rotated fully counterclockwise.

2. An ice making machine comprising an ice making unit having a first thermally conducting surface and a second thermally conducting surface disposed at an acute angle to the first surface, means for pivotally mounting the ice making unit on an axis including rotational stop means for limiting the clockwise and counterclockwise rotation of the unit, clockwise rotation being limited to positioning the first surface at an acute angle to the horizontal and the second surface approximately horizontal, and counterclockwise rotation being limited to positioning the second surface at an acute angle to the horizontal and the first surface approximately horizontal, the center of gravity of said unit being between the two surfaces on the side of the rotational axis remote from the axis of intersection of the extensions of said surfaces, and a refrigeration system having a refrigerant circulating circuit with a high pressure portion and a low pressure portion, said refrigeration system including valve means responsive to the rotational position of said unit for connecting ducts adjacent to the horizontal surface into the high pressure portion and for connecting ducts adjacent to the surface at an acute angle to the horizontal into the low pressure portion of the system.

3. An ice making machine comprising the elements of claim 2 in combination with a water distributor mounted above the unit and directed to flow water onto the surface at an acute angle to the horizontal.

4. An ice cube making machine comprising the elements of claim 3 wherein each of the surfaces is provided with outwardly extending walls forming a plurality of cups for the formation of a plurality of ice cubes.

5. An ice cube making machine comprising the elements of claim 3 in combination with a grid mounted parallel to each surface, and means to heat the grid adjacent to the horizontal surface for cutting a slab of ice into cubes.

6. An ice cube making machine comprising the elements of claim 5 wherein the grids comprise hollow tubes connected in series and the means for heating the

grid adjacent to the horizontal surface includes the high pressure portion of the refrigeration circuit.

7. An ice cube making machine comprising the elements of claim 4 in combination with a layer of material having greater thermal conductivity than the walls of the cups disposed on the surface of the cups, said layer terminating at a distance from the edges of the walls remote from the surfaces.

8. An ice making machine comprising the elements of claim 2 wherein the refrigerating system includes a compressor, a valve having a sealed housing having an opening connected to the high pressure side of a compressor and two ports disposed in a vertical plane on opposite sides of the housing, a shaft pivotally mounted at one end and disposed in said vertical plane, said shaft having a weight at the other end and carrying a needle valve member confronting each of the ports, whereby the lower port is closed by the needle valve member and the upper port is connected to the compressor.

9. An ice making machine comprising an ice making unit having a first thermally conducting surface and a second thermally conducting surface disposed at an acute angle to the first surface, means for pivotally mounting the ice making unit on an axis parallel to the surfaces including rotational stop means for limiting the clockwise and counter clockwise rotation of the unit, clockwise rotation being limited to positioning the first surface at an acute angle to the horizontal and the second surface approximately horizontal, and counter clockwise rotation being limited to positioning the second surface at an acute angle to the horizontal and the first surface approximately horizontal, the center of gravity of said unit being between the two surfaces on the side of the rotational axis remote from the axis of intersection of the extensions of said surfaces, and a refrigeration system including first and second refrigerant passages in thermal relationship with the first and second surfaces, respectively, first and second ducts in thermal relationship with the first and second surfaces, respectively, a first flow restricting means connecting one end of the first passage to one end of the second duct, a second flow restricting means connecting one end of the second passage to one end of the first duct, an expansion tank mounted on the thermally conducting surfaces having a first port adjacent to the first surface connected to the other end of the second passage and a second port adjacent to the second surface connected to the other end of the first passage, said expansion tank having a third port located between the first and second ports connected to the low pressure side of the compressor, and valve means connected to the high pressure side of the compressor and to the other end of the first and second ducts responsive to the rotational position of the unit for connecting the high pressure side of the compressor to the duct in thermal relation with the horizontal surface.

10. An ice making machine comprising the elements of claim 9 wherein the valve means comprises a sealed housing mounted on the first and second surfaces having an opening connected to the high pressure side of the compressor and two ports disposed in a vertical plane normal to the first and second surfaces on opposite sides of the housing, a shaft disposed within the housing and mounted at one end to pivot in said vertical plane, said shaft having a weight at the other end and carrying a needle valve member confronting each of the ports, whereby the lower port is closed and the upper port is open.

11. An ice making machine comprising the elements of claim 2 wherein the means for pivotally mounting the ice making unit comprises a support structure, a pair of coaxial tubes extending from the unit and anchored to the support structure, the inner tube being rigid and the

outer tube being flexible, said unit being mounted on the outer tube, a casing disposed within the unit mounted on the end of the outer tube, said housing having a cavity traversed by the inner tube and communicating with the outer tube, the outer tube being in one portion of the refrigeration circuit and the inner tube and cavity being in the other portion of the refrigeration circuit.

12. An ice making machine comprising the elements of claim 9 wherein the means for pivotally mounting the ice making unit on an axis parallel to the ice freezing surfaces comprise a support structure, a pair of coaxial tubes extending from one side of the unit parallel to the ice freezing surfaces thereof and mounted at their ends opposite the unit on the support structure, the outer tube being twistable and the inner tube being rigid, said ice forming unit being secured to the end of the outer tube opposite the support structure.

13. An ice making machine comprising the elements of claim 12 wherein the valve means connected to the high pressure side of the compressor includes a casing mounted on the ice forming unit having a cavity therein with an opening at one end through which the inner tube of the pivotal mounting means enters the cavity, a disc having a single aperture therein mounted on the end of the inner tube and disposed within the cavity, a plate slidably abutting the disc having two openings therein, each opening being connected to the other end of one of the two ducts and one of the openings being aligned with the aperture of the disc in each stopped rotational position of the unit.

14. An ice making machine comprising the elements of claim 13 wherein a flexible bellows is mounted between the disc and the end of the inner tube.

15. An ice making machine comprising the elements of claim 13 wherein the casing mounted on the inner tube is sealed within a housing mounted within the ice forming unit on the end of the outer tube, the housing being provided with a cavity communicating with the outer tube and an opening into the cavity connected to the third port of the expansion tank.

16. An ice making machine comprising the elements of claim 1 wherein the control means comprises a reversing valve.

17. An ice making machine comprising the elements of claim 2 wherein the control means comprises a gravity actuated flow reversing valve.

18. An ice making machine comprising the elements of claim 17 wherein the valve comprises a casing defining a sealed cavity having a first aperture in one wall and second and third apertures in said wall, a cup having a recess mounted in slidable engagement with the wall to pivot about the axis of the first aperture, the recess of said cup extending at least the distance to the second and third apertures, means to connect the casing to the high pressure side of the compressor, and means to orient the cup to connect the first aperture with the second aperture in one stopped rotational position and with the third aperture in the other stopped rotational position.

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