US 20090249804A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2009/0249804 A1

(43) Pub. Date: Oct. 8, 2009

Davis et al.

(54) ICE HARVESTING MECHANISM

(75) Inventors: **Matthew William Davis**, Prospect, KY (US); **Russell J. Fallon**, Louisville, KY (US); **Stephen Bischoff**, Louisville, KY (US); **Bipin Shaha**, Mumbai (IN); **Anthony Brieschke**, Louisville, KY (US); **Aaron Williamson**, Cosby, TN (US)

Correspondence Address:
Fay Sharpe LLP
1228 Euclid Avenue, 5th Floor, The Halle Building
Cleveland, OH 44115 (US)

(73) Assignee: **General Electric Company**

(21) Appl. No.: **12/098,905**

(22) Filed: **Apr. 7, 2008**

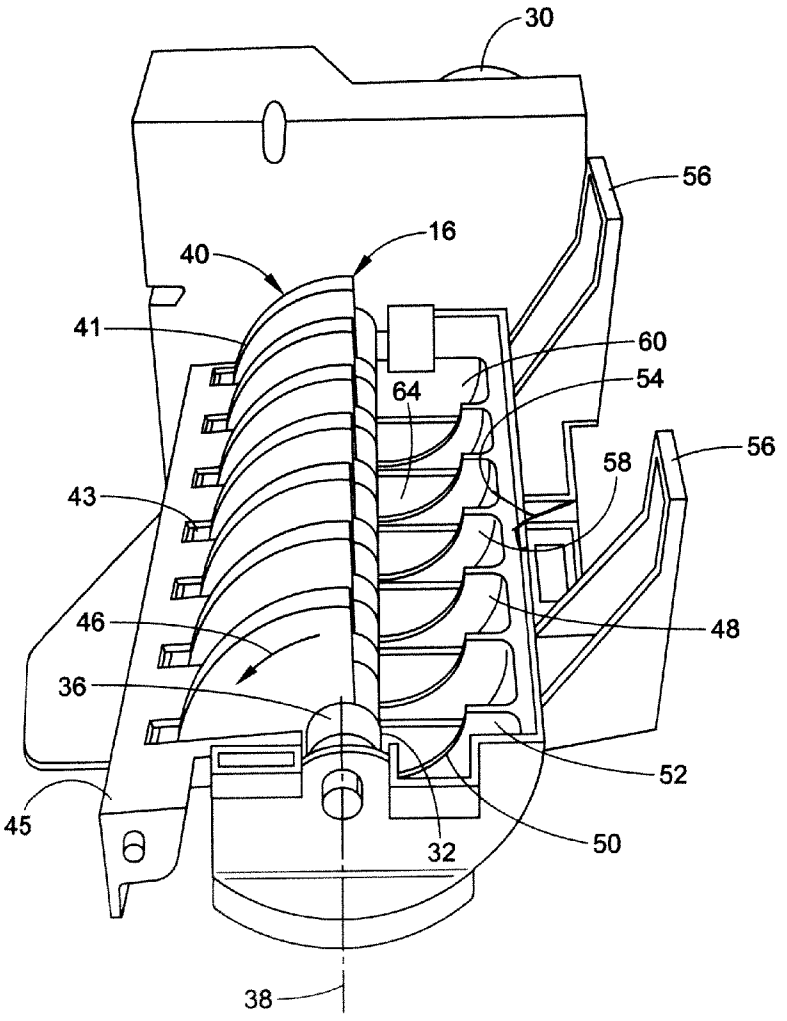
Publication Classification

(51) **Int. Cl.**
F25C 5/02 (2006.01)
F25C 1/00 (2006.01)

(52) **U.S. Cl.** **62/71**; 62/345

(57) **ABSTRACT**

An ice harvester has an ice cube tray having at least two compartments for holding ice cubes; a rotating member used to remove ice cubes from the ice cube tray; at least two arms extending from the rotary member for removing ice cubes from the ice cube tray; a motor coupled to the rotary member for powering rotation of the member; and a divider wall formed in the ice cube tray extending vertically between the arms having an edge, wherein the arms are rotated toward the edge to remove ice cubes from said tray, and wherein the edge breaks a web formed between adjacent ice cubes in the tray during rotation of the arms. The arms can be offset from each other along a circumference of the sweeping member. The edge of the divider wall can have ramped portions to facilitate the breaking apart of the cubes to reduce required motor torque.



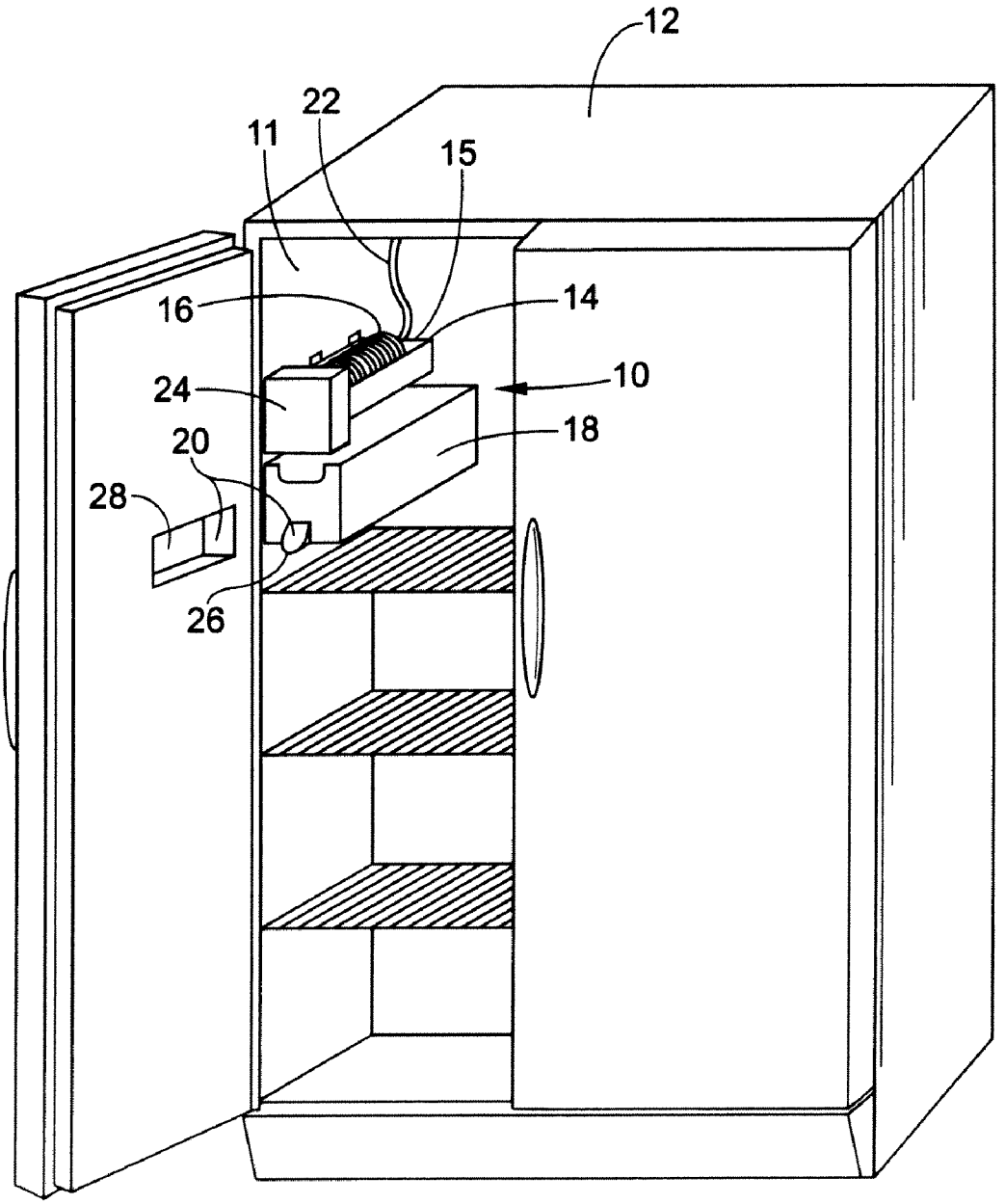


FIG. 1

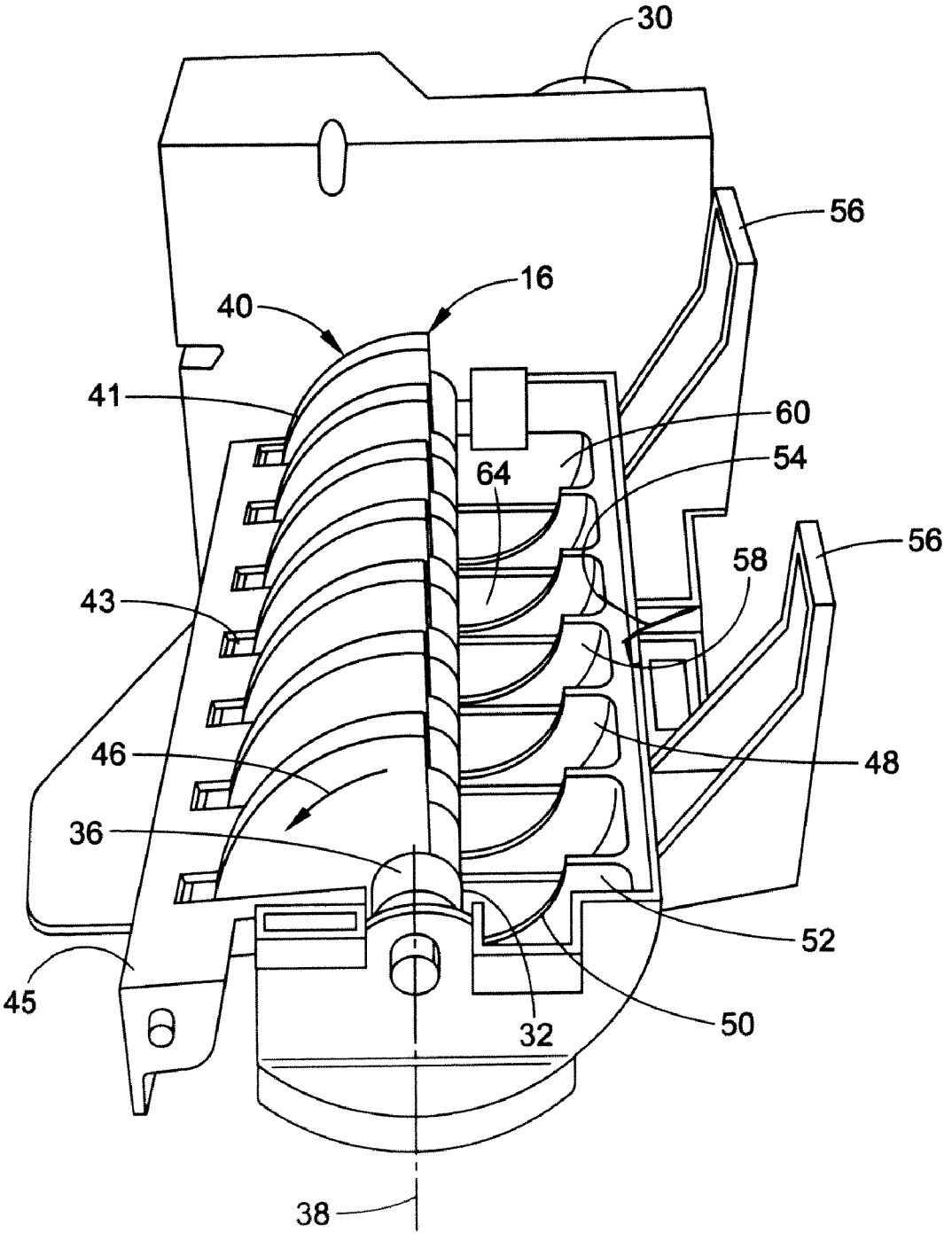


FIG. 2

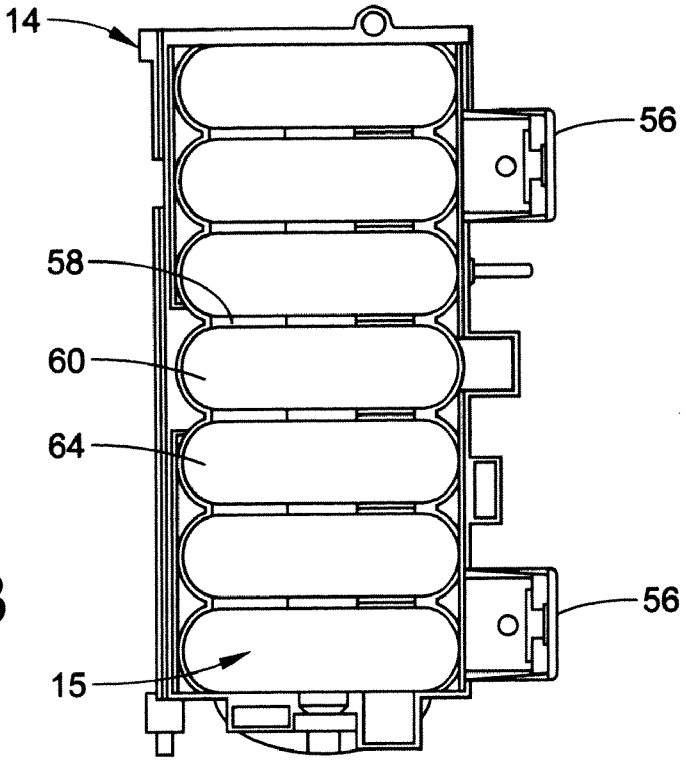


FIG. 3

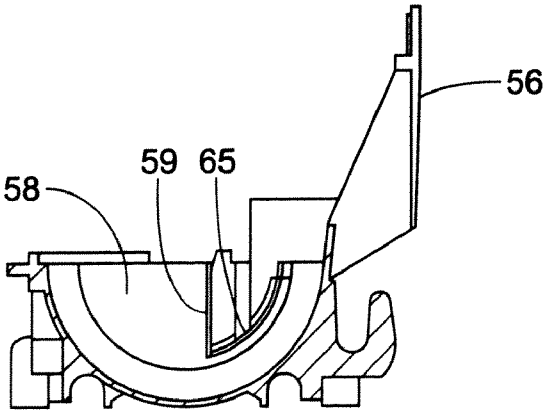


FIG. 4

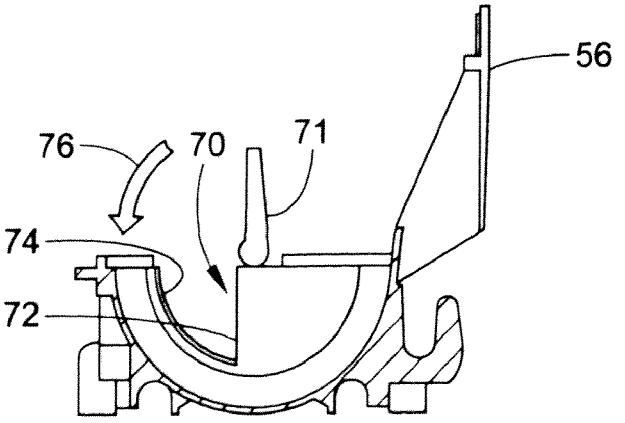


FIG. 5

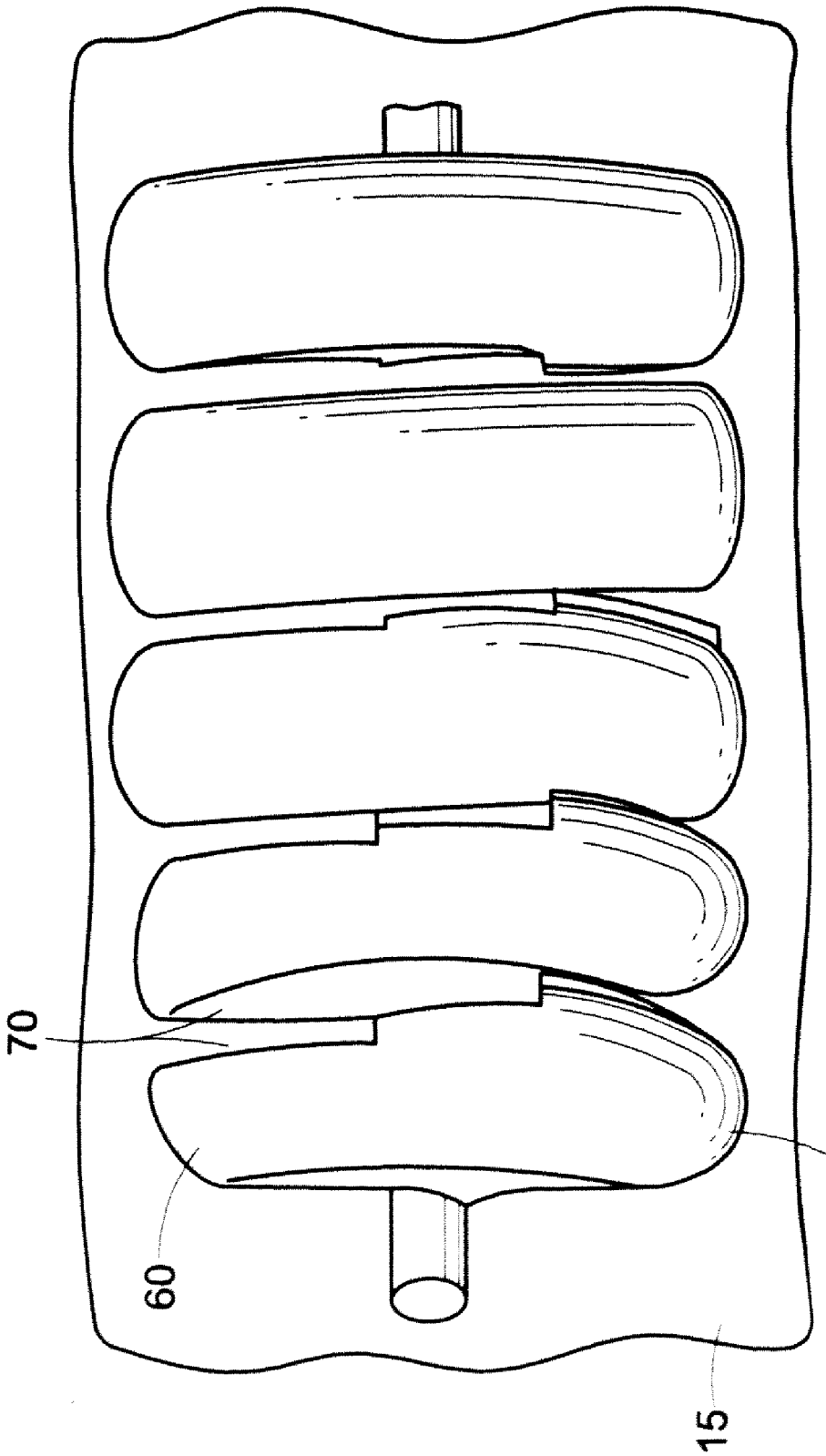


FIG. 6

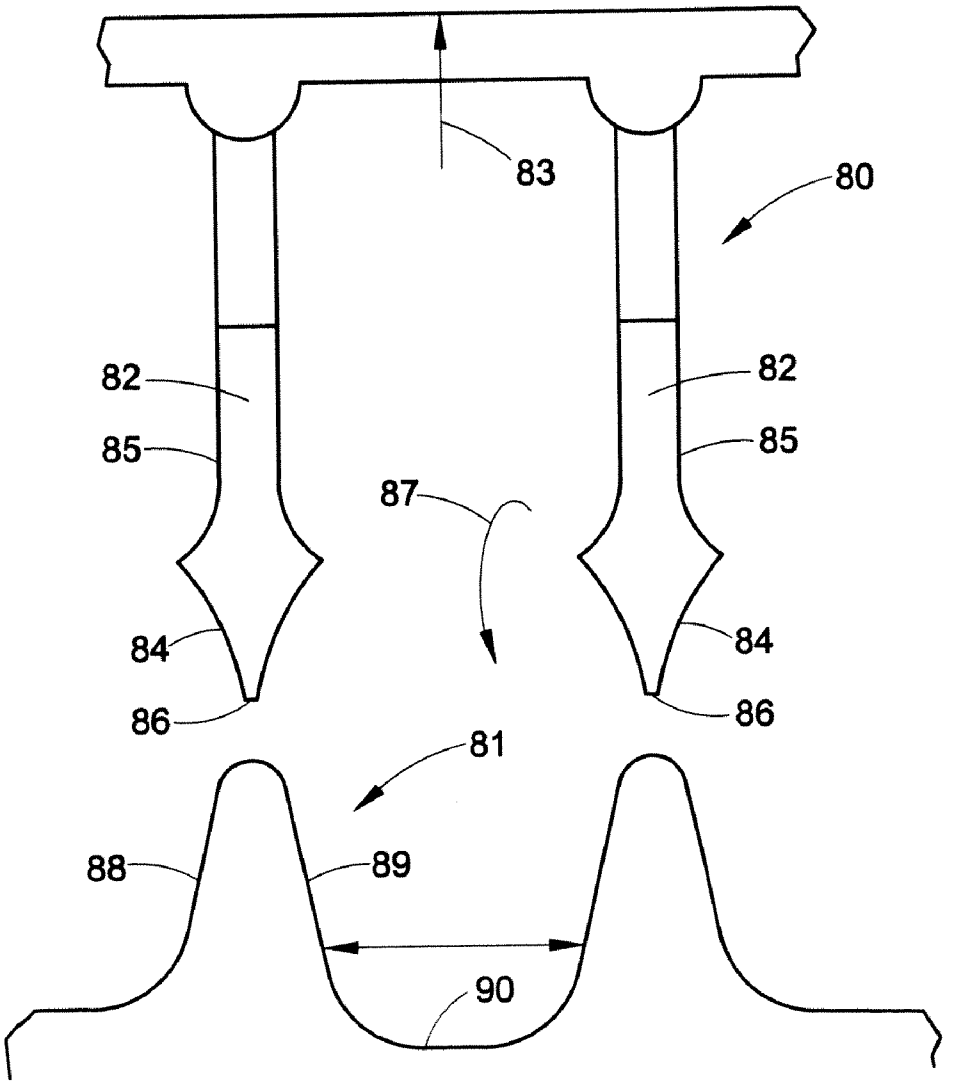


FIG. 7

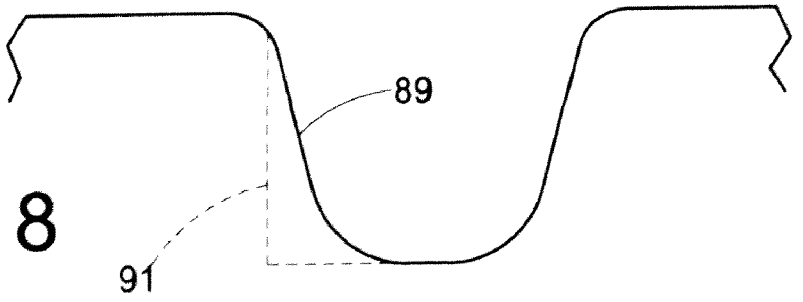


FIG. 8

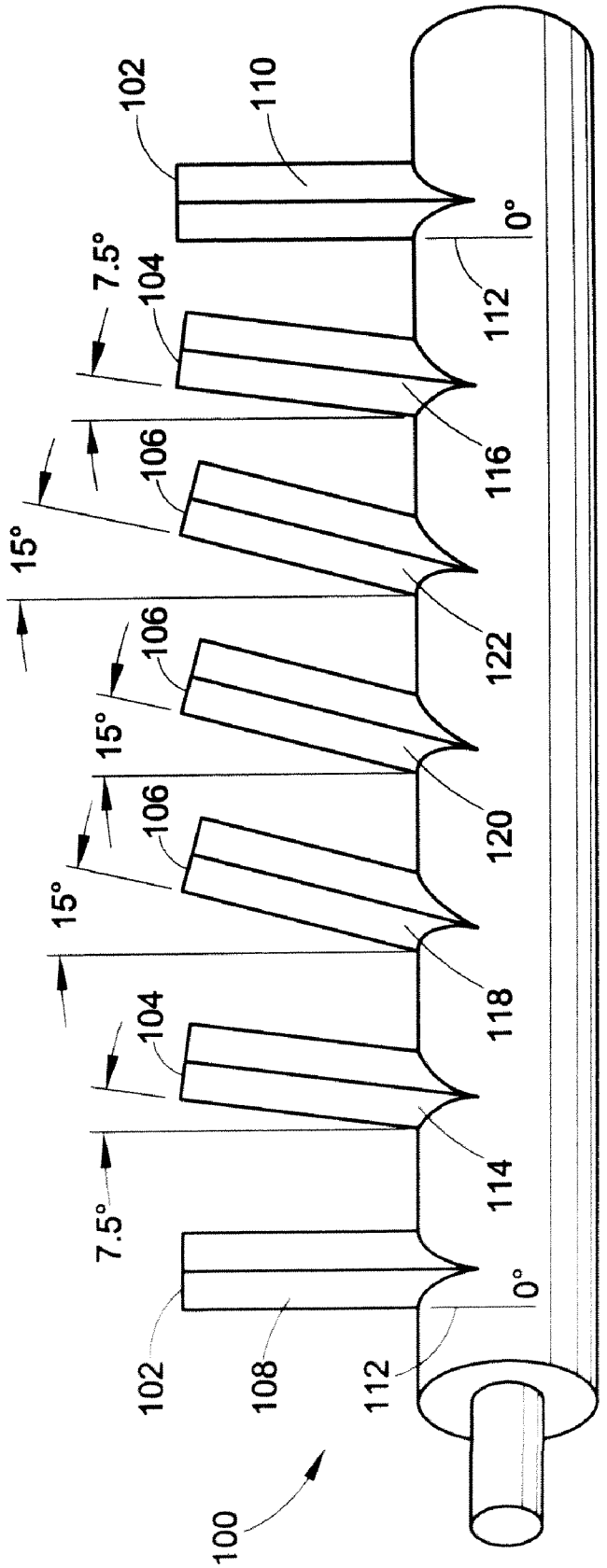

102
110
0°
7.5°
104
112
116
106
15°
122
106
15°
120
106
15°
118
104
114
7.5°
0°
102
108
112
100

FIG. 9

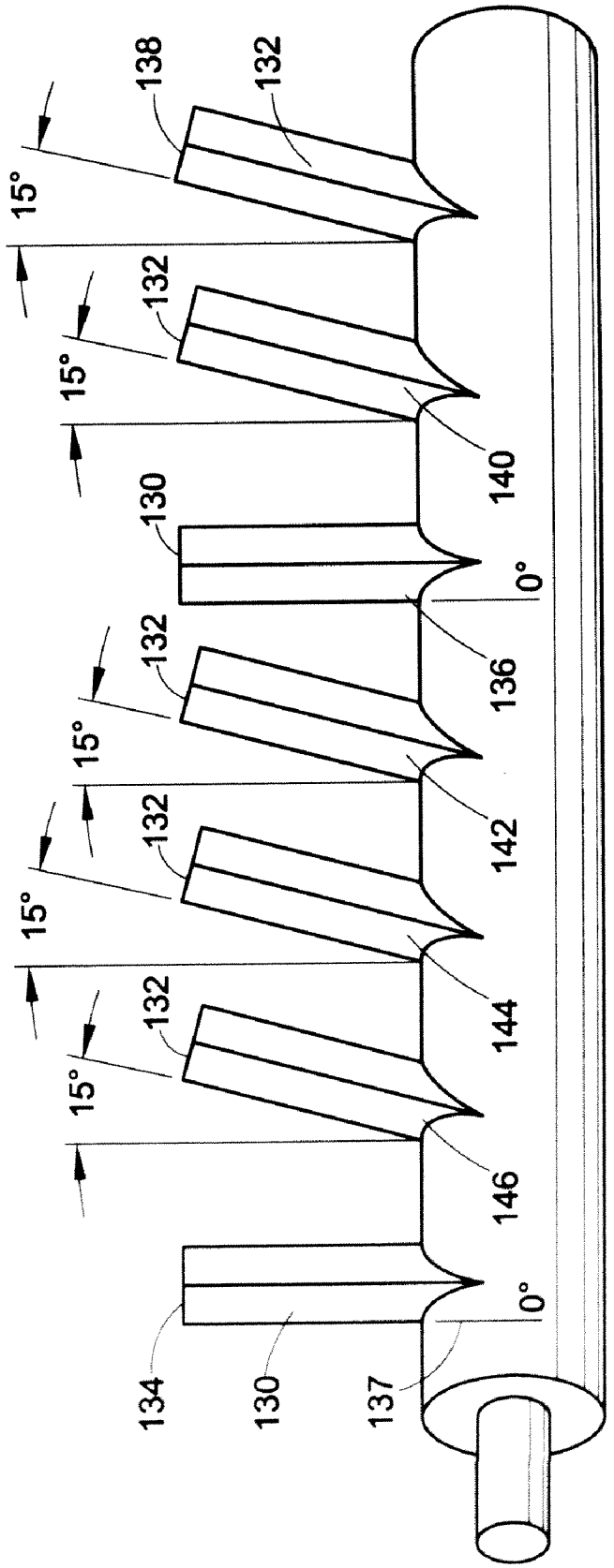

138
132
15°
132
15°
140
130
0°
132
15°
136
132
15°
142
132
15°
144
146
0°
134
130
137

FIG. 10

ICE HARVESTING MECHANISM

BACKGROUND OF THE INVENTION

[0001] This invention relates generally to refrigerators, and more particularly, to ice dispenser assemblies for a refrigerator and methods of assembling the same.

[0002] Typically, automatic icemakers for household refrigerators produce crescent-shaped ice cubes. An example of an existing ice maker is shown in published patent Application US 2006,0016209. dated Jul. 26, 2006. A tray including a plurality of crescent-shaped compartments separated by slotted weirs is provided. Near the top of each compartment, slots in the weirs that separate each compartment from its adjacent compartment(s) allow water to flow between compartments as they are filled with water. Often, a water inlet is in fluid flow communication with a single compartment so that water fills the compartment past the bottom of the slot(s) or weir and into the adjacent compartment. As each compartment is filled, water runs through the slot in the weir into adjacent compartments so that each compartment is filled. Once all of the compartments are filled, the water stands in the compartments until it freezes to form ice cubes.

[0003] Once frozen, the ice cubes are removed from each compartment, typically by turning an ejector rake or arm. The rake member is typically mounted above the tray to rotate about the longitudinal axis of the tray. Typically, a separate finger or tab for each compartment extends radially from the ejector rake. The tab has a length sufficient to permit the free end to extend into a compartment when the ejector rake is rotated to urge the ice cube therein out of the compartment. To facilitate removal of the ice cubes, a heater often runs for a period to cause the ice in the ice tray to slightly melt on surface of contact of the ice tray. This melted ice (water) film between the ice cubes and the ice tray permits the ice cubes to slide more freely from the tray under the inducement of the ejector rake. This water film can reduce the torque exerted on the ejector rake.

[0004] A problem with existing ice makers is they harvest a slab of several webbed or fused cubes into an ice bin from the ice mold body (tray). The rotating ejector rake of the ice maker sweeps the ice from mold body. However, ice cubes are not broken apart from each other; rather, the ice cubes are swept out in one webbed slab that results from the water that remains in the weir slots and freezes with the ice cubes. Thus, the ice cubes are harvested from the tray as one large group or webbed slab, and often rely on being separated by a combination of the impact of their fall into the ice bin (or storage compartment) and by the motion of the ice auger. Often, the ice cubes are not fully separated by their fall into the ice bin or by the motion of the ice auger. This results in occasional groups of two or three cubes being dispensed to the consumer through the ice dispenser of a refrigerator or ice making machine. This often makes it difficult for consumers to dispense ice from the ice dispenser of a refrigerator, and the fused cubes are undesirable to consumers. This also makes it difficult to retrieve a single ice cube from the ice bin. Thus, it is desirable to provide an ice harvester that harvests ice cubes individually to make it easier for consumers to dispense ice from the ice dispenser of a refrigerator.

[0005] The Underwriter Laboratory may be requiring a hand/forearm probe test, which may result in the refrigerator including requiring a narrower ice chute. Thus, it is desirable to provide an ice dispensing system that results in a narrower ice chute for a single ice cube instead of groups of webbed cubes.

BRIEF DESCRIPTION OF THE INVENTION

[0006] The present invention relates to an ice cube maker. More particularly, it relates to an ice cube harvesting mechanism that dispenses single ice cubes instead of a slab of fused or webbed cubes. The ice bridge that connects ice cubes into a slab, which results from the freezing of the water channel that allows for even water distribution to the ice cube mold body to create equal-sized cubes during mold filling, is forced into the cube divider walls (weirs) of the mold body while the ice is being harvested; thus breaking the ice cubes apart. Thus, the cube divider walls (weirs) are designed to assist the breaking of the ice bridge between each cube.

[0007] An icemaker assembly includes an ice tray, an ice ejector member and a motor having an output shaft coupled to the ice ejector. The ice tray has at least two ice forming compartments that define a space. Rotation of the output shaft of the motor causes the ejector member to advance into the space whereby ice located in the space is urged in an ejection path of movement out of the at least two ice forming compartments.

[0008] An appliance is provided including a freezer compartment, an ice bin positioned within the freezer compartment and configured to store ice cubes therein.

[0009] An ice harvester has an ice cube tray having at least two compartments for holding ice cubes; a rotating member used to remove ice cubes from the ice cube tray; at least two arms extending radially from the rotary member for removing ice cubes from the ice cube tray; a motor coupled to the rotary member for powering rotation of the member; and a divider wall (weir) formed in the ice cube tray extending vertically between said arms having an edge, wherein the arms are rotated toward the edge to remove ice cubes from the tray, and wherein the edge breaks a web formed between adjacent ice cubes in the tray during rotation of the arms.

[0010] An ice harvester has an ice cube tray for holding a plurality of ice trays, the tray has a plurality of compartments formed by divider walls (weirs) extending from a bottom wall; a sweeping member extending along a longitudinal axis of the ice cube tray, the member has a plurality of bars extending from the member which remove ice cubes from the tray when the sweeping member is rotated about the longitudinal axis; wherein the bars are offset from the other along a circumference of the sweeping member.

[0011] An ice harvester has a tray for holding a set of ice cubes, the tray has a plurality of compartments formed by divider walls; an arm which rotates to sweep ice cubes from the ice tray; a plurality of bars extending from the arm to sweep the ice cubes from the tray: wherein each of the bars comprises a first portion and a second portion, wherein the second portion has a ramped surface to break apart the ice cubes.

[0012] A method for harvesting ice, includes providing a tray for forming and holding ice cubes, wherein the tray has a plurality of divider walls, each having a vertical edge; providing motorized arm (ejector rake) having a plurality of bars (ejector rake fingers) extending therefrom, wherein rotating the arm so that the bars contact the ice cubes in the tray; and pushing the ice cubes with the bars against the edges of the divider walls to break apart a web formed between the ice cubes so that single ice cubes are disposed from the tray.

[0013] One aspect of the invention is to allow for single, non-bridged cubes to be dispensed instead of a slab of webbed cubes.

[0014] Another aspect is to reduce the required ice chute dimension since only single cubes will be dispensed at a time.

[0015] Another aspect of the invention is the benefit to the user of dispensing single ice cubes.

[0016] Another aspect of the invention is it reduces required rotating ejector rake arm motor torque to dispense cubes. A rotating ejector rake of the icemaker that sweeps the ice from the mold body is modified to a staggered design in which each individual rake finger (bar) is offset at a certain angle relative to other rake fingers. This enables each ice cube to be contacted by its corresponding rake finger at different times.

[0017] A rotary ejector rake of the ice maker sweeps the ice from the mold body and allows the cubes to be broken apart at different times, and the cube divider walls facilitate the breaking of the ice bridge between ice cubes, thereby reducing required motor torque.

[0018] Additional features and benefits of the present invention will become apparent to those skilled in the art upon consideration of the following detailed description of preferred embodiments exemplifying the best mode of carrying out the invention as presently perceived.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] FIG. **1** illustrates a side-by-side refrigerator;

[0020] FIG. **2** illustrates an existing ice dispensing mechanism;

[0021] FIG. **3** illustrates a top view of a mold body (ice tray) of an ice dispensing mechanism;

[0022] FIG. **4** illustrates a side view of the mold body (ice tray) of FIG. **3**;

[0023] FIG. **5** illustrates a side view of a modified mold body (ice tray) in accordance with an embodiment of the present invention;

[0024] FIG. **6** illustrates a bottom view of the mold body (ice tray) of FIG. **5**;

[0025] FIG. **7** illustrates an ice dispenser with an ejector rake having a ramped edge in accordance with another embodiment of the invention;

[0026] FIG. **8** illustrates a side view of the mold body (ice tray) of FIG. **7**; particularly the slot that allows for water to channel between compartments, and the weir around it;

[0027] FIG. **9** illustrates an ejector rake having three staggered sets of arms; each set being offset by a different angle (ranging from 0 to 180 degrees) relative to the other sets (one set of rake arms is at 0 degrees, a second set of rake arms offset from the first set by 7.5 degrees, and a third set of rake arms offset from the first set by 15 degrees) in accordance with another embodiment of the invention; and

[0028] FIG. **10** illustrates an ejector rake having arms staggered 15 degrees (angle can be anything between 0 and 180 degrees) apart in accordance with another aspect of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0029] Referring to FIG. **1**, an icemaker assembly **10** is incorporated in a freezer compartment **11** of a household side-by-side refrigerator/freezer **12**. However the invention applies to all types of refrigerators and freezer compartments. The illustrated refrigerator/freezer **12** includes a through-the-door ice and water dispenser. However, the invention can be used with ice cube trays in freezer compartments as well as other configurations. The icemaker assembly **10** includes an ice tray **14**, formed by a mold body **15**, an ice ejector rake **16**, an ice bin **18**, an ice dispenser **20**, a water inlet **22**, and a controller (not shown). The water inlet **22** is in fluid communication with ice tray **14** so that water is added to the ice tray. Water received in the ice tray freezes and is removed from the ice tray by the rake. Ice ejected from the ice tray is received in the ice bin **18** where it is stored. The ice bin includes a dispenser **20** from which ice is dispensed to the user. The dispenser is shown to be a through-the-door ice dispenser. The ice bin is configured to include a drive system of the dispenser for driving ice from the bottom of the ice bin to a dispenser opening **26** communicating with a chute **28** communicating with the ice outlet.

[0030] Referring now to FIGS. **2-4**, the ice dispenser includes a motor **30** having an output shaft, an ejector or rake arm **32** and a drive train coupling the output shaft of the motor to the ejector arm **32**. The rake arm includes a shaft **36** formed concentrically about a longitudinal axis **38** and a plurality of ejector or rake members **40** connected to and extending radially beyond the shaft **36**. The rake members can be rods, fingers, fins or tabs and are configured to extend from the shaft **36** into the ice tray when the shaft is rotated. The ejector members can be semi-circular in shape, rectangular, with ramped or sharp edges. Rotation of the output shaft of the motor is transferred through the drive train to induce rotation of the rake about its longitudinal axis **38**.

[0031] The motor **30** is controlled by the controller so that rotation of the ejector arm is stopped for a period of time to permit water to freeze in the ice tray. Once the water is frozen in the ice tray, the controller enables the motor to drive the ejector arm or rake in the direction of arrow **46** causing ice in the tray to be forced out of an ejection side **48** of the tray.

[0032] The ice tray is formed to include any number of semi-circular crescent or other shaped compartments **50**, an end inlet ramp **52**, a side inlet ramp **54** and ejector or rake arm mounting brackets **56**. The tray includes a plurality of divider walls (weirs) **58** to form the ice forming compartments **60**. The end inlet ramp is positioned below a water inlet to facilitate filling the compartments using a water channel through the slotted weirs method. The mounting brackets extend from the removal side of the ice tray to facilitate mounting the tray **20** to a mounting side or back wall of a freezer compartment.

[0033] Water from the water inlet flows down the inlet ramp (the rectangular portion above arm **32**) into the rear ice-forming compartment. The water enters and fills the rear ice-forming compartment until the level reaches the level of the slot, channel of the weir and flows into the adjacent compartment. After water fills each compartment, it flows through the channel into an adjacent compartment. When the water in all of the compartments has reached a desired level, water flow stops.

[0034] Freezing of water in the channel (or slots in the weirs) results in the ice cubes all being one group of fused webbed ice cubes. The presence of the webbed ice increases the torque that the rake must exert to remove the ice cubes from the tray.

[0035] The compartments in the ice tray are substantially identical and are configured to include a space **64** in which semi-circular (or other shaped) ice cubes are formed. Each

divider wall (weir) includes a top surface and two oppositely faced side surfaces. The compartments may be wide at the top and narrow near the bottom.

[0036] Water is released from the water inlet and flows down the end inlet ramp into the rear compartment. When sufficient water has entered the rear compartment to raise the level of the water in the compartment to the level of the slot in the weir/into the flow channel, water flows into an adjacent compartment until the adjacent compartment overflows into its corresponding adjacent compartment. This filling of the compartments through the channel continues until water has filled each compartment to a desired level.

[0037] Each cube is formed separately within its own compartment with an ice web extending between the cubes that results from water freezing in the channel/slot between weirs.

[0038] Once the ice cube has formed in each compartment, the controller can actuate a heater that heats the tray/mold body to slightly expand the tray and melt a small amount of ice cube adjacent the walls of each compartment.

[0039] Once the ice cubes are ready for removal, the controller actuates the motor to turn its output shaft that is coupled through the drive train to the ejector rake shaft **36**. The motor **30** drives the rake shaft to rotate about the rotation axis in the direction of the arrow **46** inducing a front portion **41** of each rake member to pass through a slot **43** in a cover **45** and into contact with the ice cube formed in its associated compartment. The front portion of each rake member contacts the top surface of its associated ice cube adjacent the narrow end of the cube downwardly along the arcuate bottom surface of the compartment.

[0040] The ejector rake arm proceeds along a path of movement a sufficient amount to completely remove the ice cubes from each compartment.

[0041] Referring to FIG. **3**, the mold body **15** is configured so that each cube in the mold body is filled by a water input, which eventually results in an ice bridge or web forming in the channel that allows for even water distribution to each cube. A heating mechanism, such as wires, in the mold body could be used to melt the ice bridge that forms between cubes.

[0042] Referring now to FIG. **4**, in the current ice harvesting mechanism, the mold body has water fill cutouts or slots **65** in the weirs between each compartment that allows water to enter and fill each of the compartments in the mold body/tray. The cutout/slot is shown in FIG. **4** to be on the right side of the mold body. The divider wall (weir) **58**, shown on the left side in FIG. **4** has a straight-edge **59** along the slot or cutout.

[0043] In the first embodiment of the present disclosure, a divider wall (weir) **70** is provided on an opposite or the right side of the mold body as seen in FIG. **5**. Wall **70** forms a straight or curved edge **72** that faces and forms part of the water fill cutout **74**. Essentially, the wall is the mirror image of the wall of FIG. **4**. As a series of rake arms **71** sweep the ice cubes from the mold body, the ice cubes contact the edge **72** of the vertical walls, which breaks the bridge or web or weir formed between the ice cubes as ice cubes are removed and harvested from the mold body/tray. The edge **72** faces the ejector rake arms as they rotate clockwise toward the removal direction, as shown as the arrow **76**. That is, the rake arms **71** rotate clockwise and contact and push the ice cubes toward the divider walls **70**. That is, the ice cube webs are broken apart by the sharp edge **72** of the divider wall (weir) **70**. The rake arm **71**, rotating toward the divider walls, brings the ice web into contact with wall **70**. FIG. **4** shows the opposite configuration where the divider walls do not break the web, since the rake arm rotates away from the divider wall (weir) **58**; thus the web is not broken by the edge of the weir. FIG. **6** shows the underside of the ice cube mold body/tray with a curved bottom wall **61** of each compartment **60** having a wall (weir) **70** formed on one side of each compartment within the mold body.

[0044] In a second embodiment, referring to FIG. **7**, the weir divider wall has an edge **84** that aids in splitting the ice web as the ejector rake sweeps out the ice. The wall thickness of longitudinal portion **85** of the rake is maintained, and the angled portion **84** is about 1.5 to 2 times wider than longitudinal straight portion **85**; as are the portions of the weirs (one such bottom portion of the weir is shown between **88** and **89**) on the bottom of FIG. **7**. A sharp-edged tip **86** is added to the ramped portion **84** of weir to break apart the cubes as the ejector rake sweeps into the ice in the mold body the direction of arrows **83** and **87**.

[0045] Referring now to a side view of the mold body to show the slot/channel in the weir that allows water to flow from each compartment to the next in FIG. **8**, changing the shape of the weir wall from a flat edge to add a slight ramp **89** will decrease slot/channel width and thus decrease the size and width of the webs, thus facilitating breaking of the web and splitting of the ice cubes. This results in a reduction in the force required to break apart the ice. At the bottom, the weir also has a slightly raised portion **90** that still permits water distribution to all of the ice cubes. Like the ramp, this decreases size and width of webs, reducing required motor torque to break the webbing and separate the ice cubes. Referring to FIG. **8**, the ramp portion **89** replaces an existing straight edged (i.e., 90 degree) wall **91** (shown in phantom). Thus, the wall's configuration is modified to facilitate ice breaking by reducing the webbed/fused area by raising a bottom rib area of the weir and minimizing the area for even water distribution to the entire tray; thereby reducing the required breaking force.

[0046] Referring now to FIG. **9**, the ice harvester mechanism has an ejector rake **100** that is modified to break apart the cubes in separate batches. This results in a reduction of motor torque, and prevents the motor from stalling or shutting off to allow the ice to melt. Referring to FIG. **9**, the rakes are split into three sets or groups **102**, **104**, **106**. A first set **102** of rake arms **108**, **110** are configured at about 0 degrees with respect to a reference axis **112**. The second set **104** of rake arms **114**, **116** are offset by about 7.5 degrees (or other such angle) with respect to the first set. The third set **106** of rake arms **118**, **120**, **122** are offset by about 7.5 degrees (or another such angle) with respect to the second set (and 15 degrees with respect to the first set). Any other variation of angles or offsets are contemplated by the invention. Thus, the rake arms are staggered to break apart the cubes in batches. The rake members/bars at staggered angles will contact the top of the ice cubes at different times as the rotating ejector rake arm sweeps around, thus forcing the web in between cubes into the edge **86** of the slot in the weirs and subsequently separating the ice cubes at different times. That is, the first set contacts the outer two cubes before the second set contacts the next inner two cubes, and then the third set contacts the next inner three cubes. Each set of rake arms makes two web breaks to separate the cubes. This configuration can also be used with the mold body designed to split apart the cubes as seen in FIGS. **5** and **6**.

[0047] In still another embodiment, referring to FIG. **10**, two sets **130**, **132** of rake arms are offset by about 15 degrees (or any such angle) with respect to each other. That is, first set

of rake arms **134**, **136** are positioned at about 0 degrees with respect to a reference axis **137**, and the second set of arms **138-146** are offset by about 15 degrees with respect to the reference axis. Any other variation of angles or offsets are contemplated by the invention. Thus, the rake arms are staggered to break apart the ice cubes in batches. That is, arms **134**, **136** break two cubes apart, then arms **138-146** break apart the remaining five cubes. The first set of two rake arms **134**, **136** makes three breaks in the cubes, and a second set of five rake arms **138**, **140**, **142**, **144**, **146** makes three breaks in the cubes as well. This configuration can also be used with the mold body of FIGS. **5** and **6**.

[0048] The invention has been described with reference to the preferred embodiments. Obviously, modifications and alterations will occur to others upon reading and understanding the preceding detailed description. It is intended that the invention be construed as including all such modifications and alterations.

What is claimed is:

1. An ice harvester comprising:
- an ice cube tray comprising at least two compartments for holding ice cubes;
- a rotating member used to remove ice cubes from said ice cube tray;
- at least two arms extending from said rotary member for removing ice cubes from said ice cube tray;
- a motor coupled to said rotary member for powering rotation of said member; and
- a divider wall formed in said ice cube tray extending vertically between said arms having an edge, wherein said arms are rotated toward said edge to remove ice cubes from said tray, and wherein said edge breaks a web formed between adjacent ice cubes in said tray during rotation of said arms.

2. The ice harvester of claim **1**, wherein said compartments of said ice tray are semi-circular or any shape that can be swept out by a rotating member.

3. The ice harvester of claim **1**, further comprising a mounting bracket for mounting said harvester in an associated refrigerator or ice-making machine.

4. The ice harvester of claim **2**, wherein each of said compartments is formed by divider walls or weirs extending vertically from a bottom wall of ice cube tray.

5. The ice harvester of claim **4**, wherein said rotary member comprises a shaft, and said arms extend from said shaft.

6. The ice harvester of claim **4**, wherein said bottom wall of said ice cube tray is arcuate in shape.

7. An ice harvester comprising:
- an ice cube tray for holding a pluralize of ice cubes, said tray comprising a plurality of compartments formed by weirs extending from a bottom wall;
- a sweeping member extending along a longitudinal axis of said ice cube tray, said member comprising a plurality of bars extending radially from said member which remove ice cubes from said tray when said sweeping member is rotated about said longitudinal axis; wherein said bars are offset from each other along a circumference of said sweeping member.

8. The ice harvester of claim **7**, wherein said bars comprise a first bar and a second bar offset by a first angle with respect to said first bar.

9. The ice harvester of claim **8**, comprising a third bar offset by a second angle with respect to said first bar.

10. The ice harvester of claim **9**, wherein said third bar is offset from said second bar by a third angle.

11. The ice harvester of claim **10**, further comprising a fourth bar offset from said first bar by a fourth angle.

12. The ice harvester of claim **11**, further comprising a fifth and sixth bar offset from said first bar by a fifth angle.

13. The ice harvester of claim **12**, further comprising a seventh bar which is in alignment with said first bar.

14. The ice harvester of claim **13**, wherein said sweeping member comprises a shaft from which each of said seven bars extend.

15. A method for harvesting ice, comprising:
- providing a tray for forming and holding ice cubes, wherein said tray comprises a plurality of divider walls, each having a vertical edge;
- providing a motorized arm having a plurality of bars extending therefrom;
- rotating said arm so that said bars contact and remove said ice cubes from said tray; and
- pushing said ice cubes with said bars against said edges of said divider walls to break apart a web formed between said ice cubes so that single ice cubes are dispensed from said tray.

16. The ice harvester of claim **15**, wherein said divider walls have a tip that facilitates breaking said webs and, correspondingly, the said ice cubes apart.

17. The ice harvester of claim **15**, wherein said divider walls have a slot with ramped/curved edges that facilitate the breaking apart of the web formed between ice cubes.

18. The ice harvester of claim **16**, wherein said tip comprises a sharp edge.

* * * * *