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(54) **ICE BAGGING APPARATUS AND METHODS**

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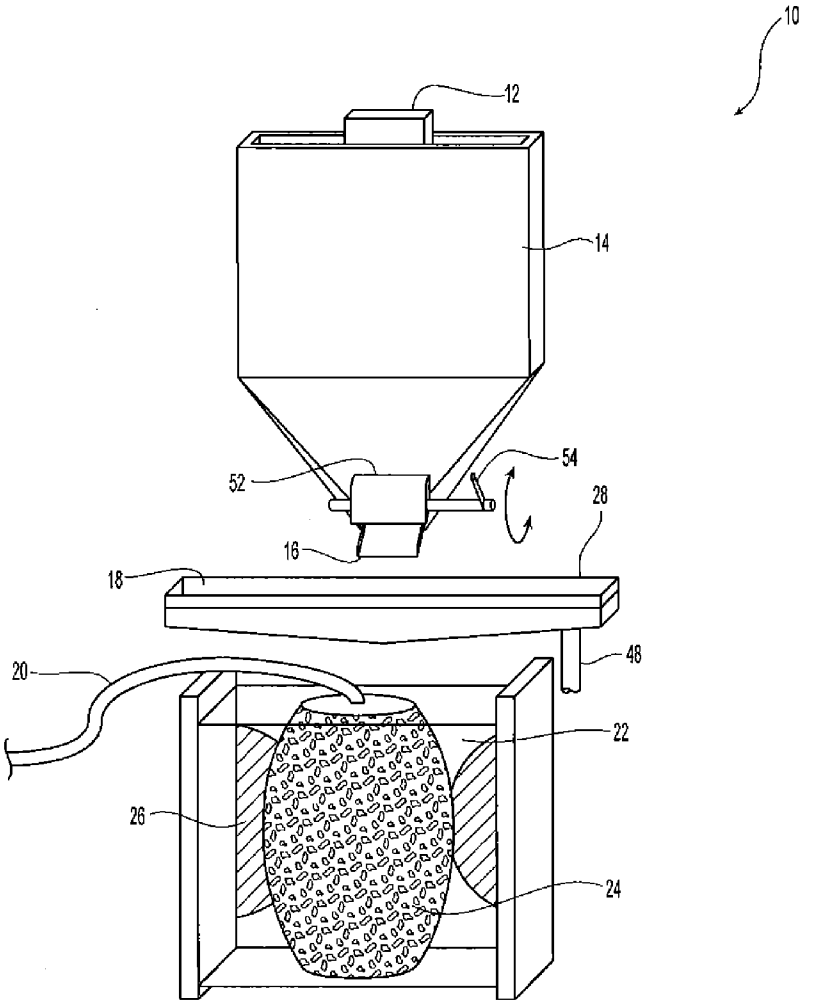
(57) **ABSTRACT**

An ice vending apparatus adapted to remove moisture from ice pieces during dispensing, which apparatus includes a ramp having a lower lip and being adapted to transfer a quantity of ice pieces from a holding vessel to a container; and a channel having an upwardly facing opening that is in operative association with the ramp and arranged so that moisture is adapted to flow around the lower lip of the ramp into the channel while excluding the ice pieces so as to separate at least a portion of the moisture from the ice pieces as the ice pieces are transferred to the container. Methods of providing ice pieces, particularly with reduction of associated moisture to a consumer, are also described.



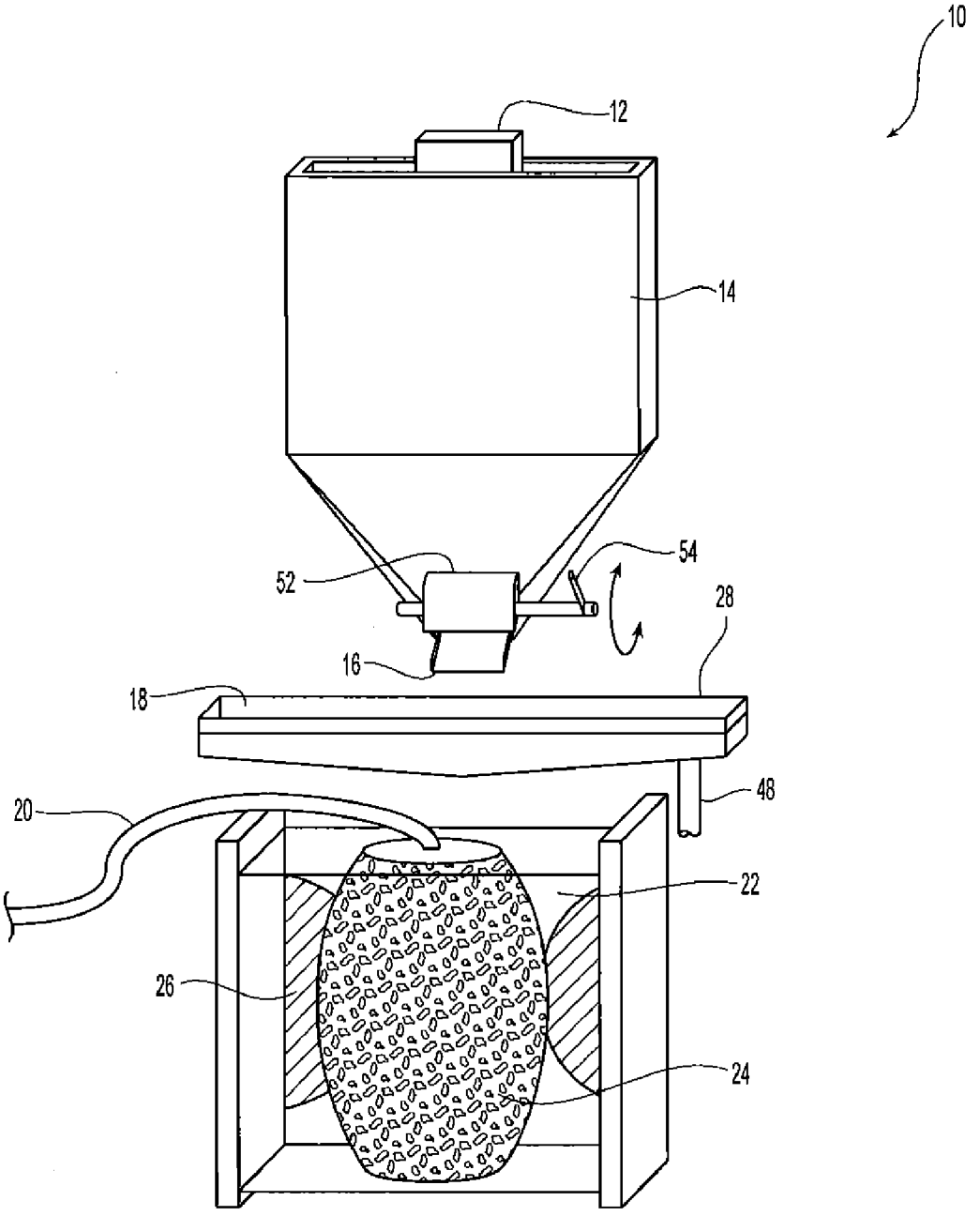


Fig. 1

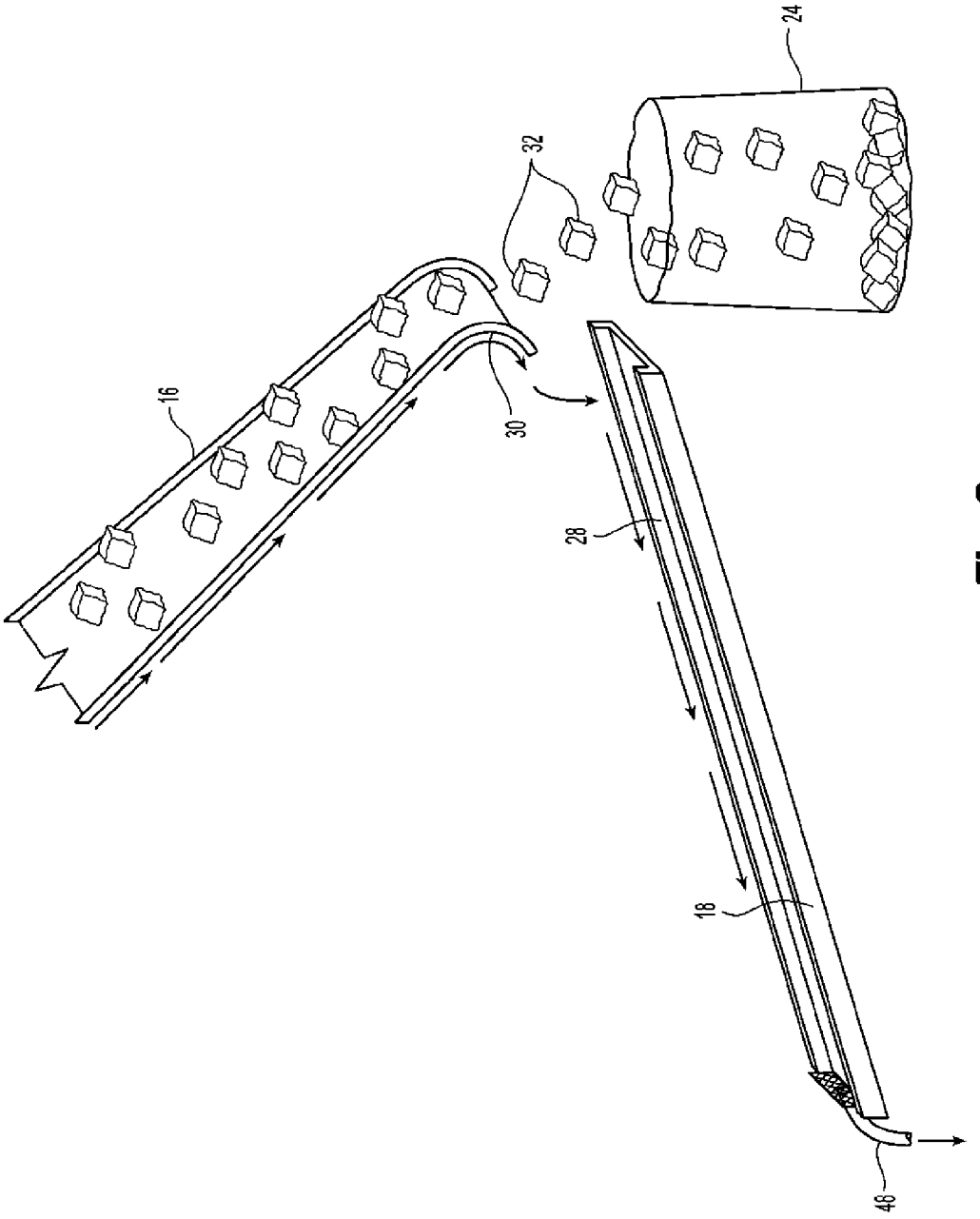


Fig. 2

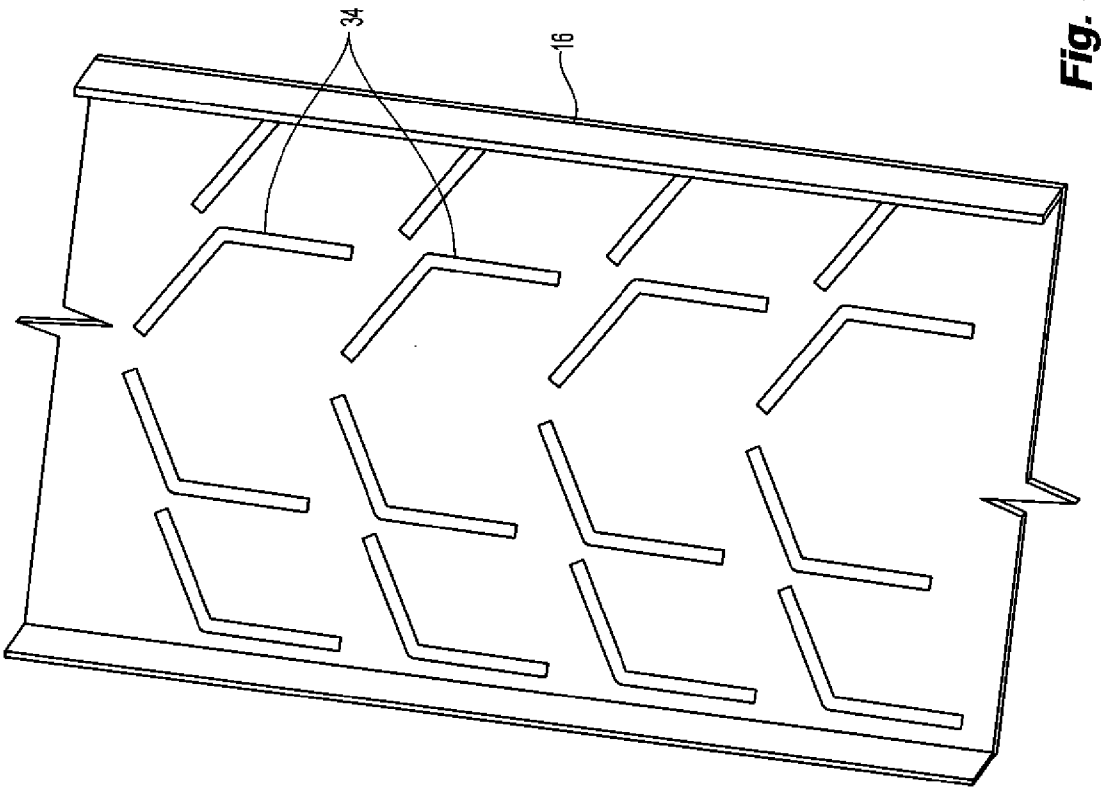


Fig. 3

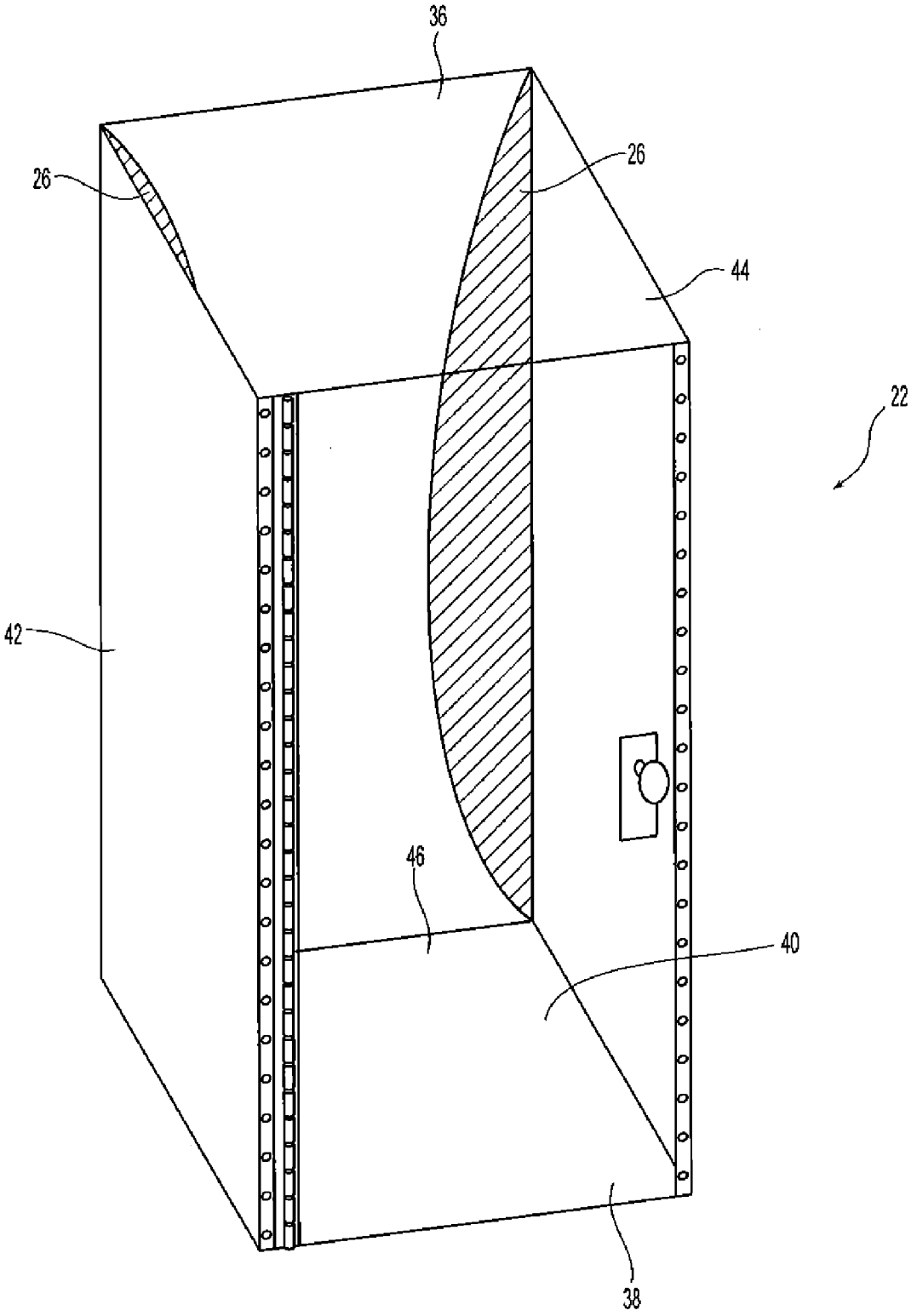


Fig. 4

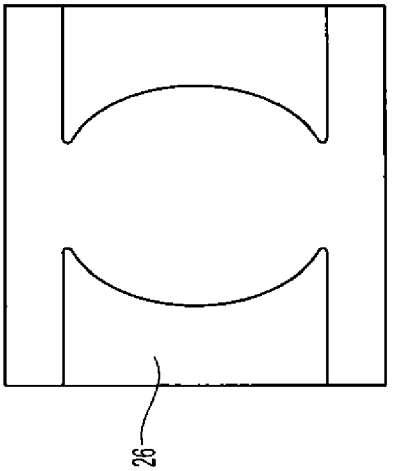


Fig. 5B

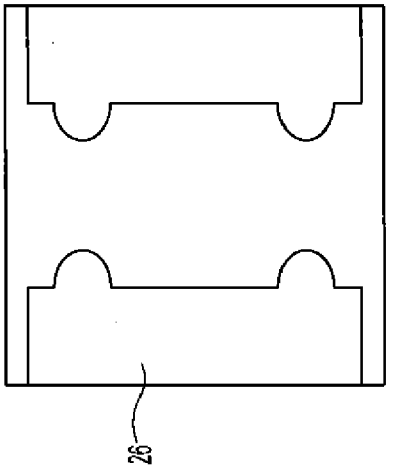


Fig. 5D

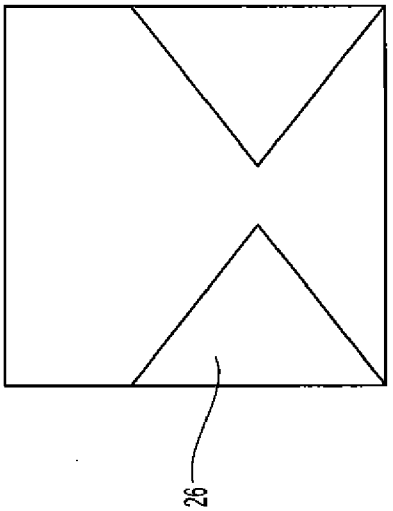


Fig. 5A

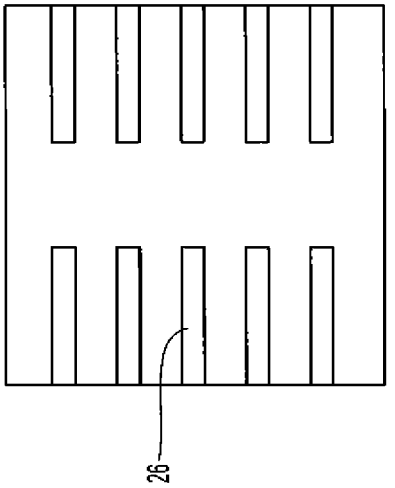


Fig. 5C

ICE BAGGING APPARATUS AND METHODS

TECHNICAL FIELD

[0001] The invention disclosed herein encompasses ice vending apparatuses adapted to remove moisture from ice pieces during dispensing. Also encompassed are ice vending apparatus that fill a portion of a container with ice pieces upon demand by a consumer including a plurality of containers stored inside a housing to containerize ice pieces in successive containers upon demand and an interlock system constructed and arranged to receive each container one at a time. Methods of providing ice pieces to a consumer by rotating a ramp zone between a storage position and a transferring position and removing a portion of moisture from the dispensed ice pieces as they move through and past the ramp zone to the container are also included.

BACKGROUND

[0002] Ice is used in many situations in everyday life, from cooling beverages and preserving food to treating injuries. Ice that is accessible, fresh, and easily transported has thus become a commodity and may become more of one due to global warming.

[0003] Basic ice bagging machines and ice vending machines of various kinds have been commercialized. These machines, however, typically fail to keep ice sufficiently dry as it is delivered to consumers, such as before it is bagged, to inhibit ice from clumping together. Often, an individual purchasing a bag of ice cubes finds that the ice cubes from such ice vending machines have undesirably frozen together, so that instead of finding individual ice cubes within the bag the individual finds one or more large masses or chunks of ice that prevent pouring the cubes or even prevent ready use of the cubes because the ice chunks are too large to fit in a drinking container. This is a major shortcoming of bagging ice cubes and then storing the bagged ice cubes.

[0004] Various attempts have been made in the past to provide ice cube bagging and vending machines that bag ice cubes on demand rather than in advance. In this way, ice cubes are promptly bagged and/or delivered rather than being stored in a bag long enough to cause the formation of masses of ice in the bag or other container. On the other hand, many ice cube bagging and vending machines are not sanitary, dispense inaccurately metered amounts of ice cubes, and/or do not provide efficient and fault-free operation. Moreover, many machines fail to incorporate drainage mechanisms to assist in the channeling away of melting ice, which results in unwanted bridging/fusing of ice pieces. Furthermore, because such machinery may bag ice based on weight of the collected ice, fused clumps of ice are often deposited into the bags that cause excess ice delivery after when the required weight of ice, clumped or not, has been met. As a result, bags of ice from these machines generally contain fused clumps of ice particles/cubes/pieces, which inconvenience the purchaser/customer by requiring him/her to break apart the chunks of ice into smaller useable pieces if possible, and which may result in delivery of more ice than ordered because smaller discrete amounts cannot be delivered due to such bridging/fusing.

[0005] Although some establishments may be equipped with ice-making machinery, most are typically not equipped with efficient and automated ice-bagging machinery. Notably, the devices typically cannot operate autonomously for long periods of time without human intervention. Additionally, these devices are typically unreliable in their attempts to automate the ice bagging process due to the numerous cooperating components. Such a method is often awkward, as bags and other soft containers can easily collapses before a sufficient amount of ice can be put therein, or successive bags are stuck together. The top of the bag must therefore be opened reliably with a device during every filling stroke, or a second operator may be required to hold the bag open.

[0006] Therefore, it is readily apparent that there is a need for an ice-bagging apparatus that provides an establishment with the ability to automatically and continuously produce and bag discrete ice pieces without the need of manual labor and/or continuous human monitoring or checking of the ice vending machinery.

SUMMARY OF INVENTION

[0007] The present invention encompasses an ice vending apparatus adapted to remove moisture from ice pieces during dispensing. The apparatus includes a ramp having a lower lip that is adapted to transfer a quantity of ice pieces from a holding vessel to a container and a channel having an upwardly facing opening that is in operative association with the ramp and arranged so that moisture is adapted to flow around the lower lip of the ramp into the channel while excluding the ice pieces so as to separate at least a portion of the moisture from the ice pieces as the ice pieces are transferred to the container. In one embodiment, the channel is at least partially covered. In another embodiment, the ramp is rotatable between a storage position and a dispensing position to transfer the ice pieces to the container.

[0008] Preferably, the apparatus further includes a rotatable door in operative association with the ramp. The door is adapted to rotate between a closed position where the ice pieces are restricted from being transferred to the container and an open position that allows the transfer of the ice pieces to the container.

[0009] In one embodiment, the ramp is inclined at about 60 degrees to 85 degrees with respect to the horizontal. In another embodiment, the container comprises a flexible plastic material. Typically, the ramp further includes one or more chevron-shaped grooves adapted to further separate moisture from the ice pieces when the ice pieces are dispensed over the ramp.

[0010] In an exemplary embodiment, the ice vending apparatus further includes a bagging apparatus to collect a preselected quantity of ice pieces in a container to deliver to a consumer. The bagging apparatus preferably includes an interlock system constructed and arranged to receive the container. The interlock system generally includes a pair of vertically-oriented inner and outer doors arranged in association with a pair of side walls to define a chamber therebetween, wherein the interlock system is adapted to close the inner door to inhibit or prevent access to additional containers while the outer door is adapted to be opened by a consumer. The doors are preferably spaced from about 10 inches to about 24 inches apart and arranged to support opposing portions of the container that has been prepared to receive the ice pieces. In one embodiment, the interlock system further includes at least one container-holding extension located adjacent to one of the doors and adapted to support a portion of the container during filling.

[0011] In another embodiment, the bagging apparatus includes a bag detection sensor to detect the presence or

absence of a container, which is preferably sufficiently opened. In yet another embodiment, the bagging apparatus includes an ice detection sensor to detect and signal when sufficient ice is present, e.g., when ice pieces reach a predetermined height in a container.

[0012] The present invention also encompasses an ice vending apparatus adapted to fill a portion of a container with ice pieces upon demand by a consumer. The apparatus includes a plurality of containers stored inside a housing for dispensing containerized ice pieces in succession upon demand by one or more consumers and an interlock system. The interlock system is constructed and arranged to receive one of the containers, and includes a pair of vertically-oriented inner and outer doors arranged in association with a pair of side walls to define a chamber therebetween. The interlock system is adapted to close the inner door to inhibit or prevent access to additional containers while the outer door is adapted to be opened by a consumer to retrieve a filled container.

[0013] In one embodiment, the interlock system further comprises at least one container-holding extension located adjacent to one of the doors and adapted to support a portion of the container during filling. In another embodiment, the doors are spaced from about 6 inches to about 24 inches apart and arranged to support opposing portions of the container that has been prepared to receive the ice pieces.

[0014] Preferably, the ice vending apparatus further includes a container-opening device adapted to open an end of a container disposed in the chamber so as to receive ice pieces. In an exemplary embodiment, the container-opening device comprises a blower to blow gas into the end at the top of the container so as to separate the tops of opposing portions of the container and thereby partially open the container so it is adapted to be filled with ice pieces. The apparatus can also include a plurality of fasteners disposed inside the chamber so that a consumer can close a filled container.

[0015] The present invention further relates to a method for providing ice pieces to a consumer. The method includes rotating a ramp zone from a storage position to a transferring position so as to direct a plurality of ice pieces from a holding zone over the ramp zone to a container and removing moisture from the dispensed ice pieces as they move through the ramp zone to the container. The removed moisture is directed away from the container.

[0016] Preferably, the method further includes detecting the presence of a container before rotation of the ramp zone from the storage position to the transferring position. In one embodiment, the ramp zone is arranged to direct the flow of moisture exiting the ramp zone away from the ice pieces and the container. In another embodiment, the container comprises a flexible plastic material.

[0017] In a preferred embodiment, the method further includes partially opening the container at a top end before ice pieces are disposed through the ramp zone into the container. The partial opening preferably includes blowing a gas in a pre-determined direction at the top end of the container.

[0018] The method typically further includes supporting the container on at least one front, back, or side surface. Generally, the method further includes providing an interlock system that inhibits or prevents a consumer from taking more than one bag at a time. In an exemplary embodiment, the method further includes filling the container in a filling zone and operating the interlock system to close at least one barrier between the filled container and additional containers to be filled.

BRIEF DESCRIPTION OF FIGURES

[0019] The present disclosure is best understood from the following detailed description when read with the accompanying figures. It is emphasized that various features are not drawn to scale. In fact, the dimensions of the various features may be arbitrarily increased or reduced for clarity of discussion. It is to be expressly understood that each of the figures is provided for the purpose of illustration and description only and is not intended as a definition of the limits of the present invention.

[0020] FIG. **1** is a partial cutaway view of a preferred embodiment of an ice vending apparatus according to the present invention;

[0021] FIG. **2** is a perspective view of a preferred embodiment of a ramp apparatus according to the present invention;

[0022] FIG. **3** is a preferred embodiment of a ramp design with chevron grooves according to the present invention;

[0023] FIG. **4** is a top view of a preferred embodiment of an interlock system according to the present invention; and

[0024] FIGS. **5**A-**5**D illustrate different embodiments of the container-holding extension according to the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0025] The present invention relates to ice vending machines that inhibit or prevent bridging and sticking together of the ice pieces by removing a portion of the moisture in the form of water or melting ice from ice pieces before or as they are directed to a container associated therewith. The ice vending machines of the present invention advantageously operate autonomously to provide bagged ice to consumers while minimizing or avoiding containers sticking together, ice pieces sticking together, and preferably both.

[0026] Referring to FIG. **1**, an exemplary ice vending machine **10** is illustrated. An ice making machine **12** makes ice that is dropped into a holding vessel **14** of desired size. In one embodiment, the holding vessel is such that the entire apparatus fits into the size of a standard vending machine, e.g., 50"W×41"D×8'1H. In another embodiment, the holding vessel is sized to fit in a smaller space for use in environments such as a floor of a hotel. From the holding vessel **14**, the ice is transported to a ramp **16**, and the rotatable door **52** reversibly rotates from a closed storage position to an open dispensing position to transfer the ice to a container **24**. In the illustrated embodiment, an attachment **54** is moved by an actuator (not shown) to rotate the door from the closed to the open position. In another embodiment, the ramp **16** itself is rotatable between a storage position and dispensing position. In this embodiment, the ramp **16** can act as a door to the holding vessel to inhibit or prevent ice pieces from passing through the aperture, or a separate door **52** and ramp **16** may be used. When separate door **52** and ramp are used, these may be operatively associated so that both rotate into position concurrently or simultaneously, or the ramp **16** may be fixed and the door **52** may rotate as needed. The door **52** is preferably configured and positioned to inhibit or prevent ice pieces from passing through an aperture in the holding vessel so as to retain the ice pieces until they are dispensed. As used herein,

"ramp zone" refers to the ramp **16** in combination with the door **52** or alternatively, the rotatable ramp on its own.

[0027] The ramp apparatus also includes a channel **18** that has an upwardly facing opening **28** that is in operative association with the ramp **16**. The channel **18** includes a trough or bottom that is preferably inclined to facilitate water drainage through drain **48**. FIG. **2** illustrates an exemplary embodiment of the ramp apparatus in connection with the channel. In this embodiment, the ramp **16** includes raised edges, but the ramp **16** may be U-shaped or concave to minimize the need for such raised edges. The ramp **16** advantageously has a lower lip **30** sized and shaped so that moisture is directed to flow around a portion of the lower lip **30** and into the channel **18** when ice pieces **32** are transferred to the container **24**. The arrows in FIG. **2** show the flow of moisture, while the path of the ice is shown by the ice pieces **32**. The lower lip **30** is preferably curved or otherwise shaped in such a way that the moisture curves around the lower lip and away from the path of the ice pieces **32** moving towards the container **24**. The lower lip **30** facilitates the removal of water from the path of the ice pieces **32**, and redirects the flow of moisture away from the path of the ice pieces **32** and preferably into the channel **18** so as to separate the moisture from the ice pieces **32** and into the drain **48**. This separation typically occurs as the ice pieces are falling from the ramp preferably into the container below. The lower lip **30** and channel **18** are arranged so that at least a portion of the moisture from the ice flows into the channel **18**, but the ice pieces **32** are excluded or at least substantially excluded. In one embodiment, the channel **18** is at least partially covered, and the covered part may be as small an area as that which passes underneath the lower lip **30** of the ramp **16**. The lower lip **30** may be a straight run of the ramp at a selected angle to help divert a portion of the moisture passing thereover, but in a preferred embodiment the lower lip **30** can be curved or otherwise formed of a variety of angled flat portions to cause an overall curved effect, or a combination thereof.

[0028] The channel **18** includes an opening **28** that is sized and positioned to allow moisture to enter, but substantially or entirely excludes the ice pieces **32**. The opening **28** may be about 1 inch to 0.1 inches, preferably 0.5 inches to 0.2 inches, and more preferably, 0.3 inches to 0.25 inches at its widest point. The opening **28** is preferably connected via the channel **18** to a drain **48** for eliminating excess moisture collected therein. In one embodiment, the melt water is recycled to form a portion of the feed water to the ice making machine **12** (not shown).

[0029] Another mechanism to minimize entry of the ice pieces into the opening and channel **18** is to cover a portion of the channel **18** below the lower lip **30**. The partial cover is intended to serve as a deflector of ice pieces **32** so that they fall or are otherwise directed into an associated container **24** while allowing the excess moisture to be directed over the outer edge of the cover and into the opening **28** for collection and disposal. The channel **18**,ramp **16**, and door **52** can be formed from one or more of the various well-known food-safe materials, including but not limited to metals such as copper, aluminum alloy, stainless steel, or the like, as well as from a plastic, or any combination of the foregoing.

[0030] The ramp **16** may in an optional but preferred embodiment include a plurality of shapes or grooves, or both, in any pattern, that facilitates removal of moisture or separation of moisture from ice pieces as the ice pieces traverse the ramp **16**. The shapes may shake loose the moisture to flow down the ramp and be directed by the lower lip away from the containers, while any grooves may include one or more apertures through which such moisture can be diverted downwards to the channel or a secondary channel without flowing down the remainder of the ramp **16**. In one such preferred embodiment, the ramp **16** includes one or more chevron-shaped grooves **34** adapted to further separate moisture from the ice pieces when the ramp is in the dispensing position by agitating or vibrating the ice pieces as they pass thereover so as to help shake excess moisture off the ice piece(s). FIG. **3** shows a preferred embodiment of the ramp design that includes a plurality of such chevron grooves and raised edges or lips to prevent keep the ice on the ramp. By "chevron" is meant having generally an angled shape such as the shape of an L, V, or U or an inverted L, V, or U or any triangular shape directed upward or downward. For example, chevron patterns include any pattern with a closed L, open L, closed V, open V, C shaped, or Y type profiles. In the embodiment in FIG. **3**, the grooves are shown pointing in one direction, but it should be understood that the grooves may point in the other direction, i.e., the grooves are U or V shaped instead of inverted U or V shaped as shown.

[0031] The ramp **16** is preferably inclined at an angle that allows the moisture to flow into the channel **18** and allows ice pieces **32** to fall down the ramp and into the container **24** with the help of gravity, although the ramp **16** may be mechanically agitated through an operatively associated shaking or vibrating device and the ice pieces may be forcibly directed down the ramp to provide assistance to the gravity if either or both are desired. The channel **18**, on the other hand, may be at any angle with respect to the horizontal, as long as it is positioned to catch moisture that flows down the ramp **16** and either through grooves **34** or over the lower lip **30**. Thus, the ramp **16** may preferably be inclined at about 35 to 89 degrees with respect to the horizontal, preferably about 50 degrees to 87 degrees, and more preferably about 60 degrees to 85 degrees with respect to the horizontal.

[0032] The ice pieces are dispensed into containers **24** that are transportable by the consumer. Suitable containers include bags, coolers, boxes, drums, trash cans, kegs, or the like, any of which can be stored within the apparatus of the invention, filled with the desired amount of ice pieces, sufficiently sealed to inhibit escape of ice pieces until the container is desired to be opened (if desired), and delivered to the consumer. In a preferred embodiment, the delivery occurs first and the consumer may if desired seal the container by closing a lid, knotting the top of a bag, or applying a twist tie or other closure device to the container. Preferably, the container **24** includes a flexible plastic material such as a plastic bag. Plastic bags can be any shape or size, and can include logos or other writing thereon.

[0033] The ice vending apparatus **10** preferably further includes a bagging apparatus **22** to collect a pre-selected quantity of ice pieces in a container to deliver to a consumer. In an exemplary embodiment, a plurality of bags are supported by a pair of parallel rods or prongs and stored in a housing associated with a filling zone. The rods preferably extend through holes in one side of the bag that is taller than the other side of the bag. Thus, the prongs pass over the top of the other side of the container and only the one side contains a pair of holes for the rods or prongs to hold the container before it is further opened to receive ice pieces. In this embodiment, the plastic bag is made up of two plastic sheets affixed together, thereby forming a bag sufficient to hold about 1 to about 60 lbs. of ice. Each sheet is of approximately

the same width. One sheet is preferably a larger height than the other sheet. The larger sheet, i.e., the taller sheet when the bag is upright, includes two or more holes through which corresponding rods or prongs may hold the bag while flat and optionally as the filling process begins. The prongs may be angled in a downward direction to facilitate the delivery of a bag to an area underneath the rotatable ramp, and in a preferred embodiment may have an upward slant at the tip to inhibit or prevent the container from falling off the prongs until the consumer removes the container after receipt of the desired ice pieces.

[0034] The bagging apparatus **10** in one optional but preferably embodiment typically includes an interlock system **22** constructed and arranged to receive the container **24**. FIG. **4** provides a top and side view of a preferred interlock system in more detail. The interlock system **22** includes a pair of vertically-oriented inner **36** and outer **38** doors arranged in association with a pair of side walls **42**, **44** to define a chamber **40** therebetween. By "inner" is meant the door adjacent to the container supply, and by "outer" is meant the door more adjacent to the consumer. The interlock system **22** is adapted to close the inner door **36** to inhibit or prevent access to additional containers while the outer door **38** is adapted to be opened by a consumer. The outer door may be vertical or inclined for ease of access and lifting of the heavy ice-laden container from the filling zone. The interlock system **22** restricts the opening of the inner door **36** when the outer door **38** is open, and vice versa. This inhibits or prevents the consumer from reaching in to grab extra containers, or otherwise undesirably modifying the flow of the containers, and helps ensure that only one bag receives ice at a time.

[0035] The doors **36**, **38** can be opened in any suitable manner, including by sliding horizontally or vertically or by the use of hinges. The doors **36**, **38** can be two doors that split in the middle like an elevator. The doors **36**, **38** are preferably made of glass or clear plastic so that a consumer can see the container as it is being filled and so it is clear when the container is ready to be removed. In a preferred embodiment, the inner door **36** is slidable, and the outer door **38** opens on hinges or otherwise pivots open. More preferably, the interlock **22** system also locks the inner door **36** during filling of a container so that both doors can act as supports for a flexible container as it is partly filled. It should be understood that completely filling a container is often not desirable, as it would then be impossible to close and ice pieces at the top would be likely to spill out either into the floor of the filling zone or the floor near the outer door, thereby causing a safety hazard.

[0036] The doors **36**, **38** may be spaced from about 3 inches to 36 inches apart, preferably about 6 inches to about 30 inches apart, more preferably about 10 inches to about 24 inches apart, to fit the corresponding containers. Of course, if a larger ice vending apparatus is desired, larger containers and a larger distance between doors in the filling zone would be used. The doors **36**, **38** are preferably arranged to support opposing portions of the container, particularly after it has been prepared to receive the ice pieces, so that the container remains upright with the open end directed upwards to receive ice pieces while being at least partially filled.

[0037] The filling zone **46** preferably further includes at least one container-holding extension **26** located adjacent to at least one of the doors **36**, **38**. The extension **26** is adapted to support a portion of the container **24** during filling. The container **24** is generally supported on at least one front, back, or side surface, and preferably on multiple sides. The container-holding extension **26** may take any form that can be used to support a portion of the container **24**. For example, as shown in FIGS. **5**A-**5**D, the container-holding extensions **26** can be triangular-shaped (FIG. **5**A), curved concavely with rounded points (FIG. **5**B), made up of a plurality of smaller extensions (FIG. **5**C), or include an extension or plurality of extensions associated with an extension of any suitable shape (FIG. **5**D). In the preferred embodiment in FIGS. **1** and **4**, there are two extensions **26** convexly bowed outwards in the middle towards the opposing side wall. There may, however, be only one, or three or even four extensions **26** to help support the container **24**. It is possible for one or more of these extensions to be disposed on the floor directed upwards like a stalagtite, as well. These extensions **26** are preferably fixed, but can also be retractable or extendable, and can be curved pieces like a camera lens. The extensions **26** can be made of any suitable food-grade material or combination of materials, but they are preferably sufficiently rigid to support the container, even when 95% filled with ice pieces. In one embodiment, the extensions **26** can form a lensed aperture that can be adjusted. The extensions **26** leave a sufficient gap for an unopened container to be passed therebetween from the container storage zone to the filling zone, at which point they can be opened. Alternatively, the containers can be partially opened before being disposed in the container-filling zone **46** or partially opened so as to cause the container to bulge open past or through the extension(s) **26** and so as to extend into the filling zone **46**.

[0038] The ice vending apparatus **10** preferably includes a container-opening device **20** adapted to open an end of a container **24** disposed in the chamber, or filling zone, so as to receive preferably moisture-depleted ice pieces from the associated dispensing ramp. The container-opening device **20** may be in the form of one or more robotic fingers, or a curved piece of metal, rubber, or other rigid material to grip a top part of the container **24** to open it, but preferably it is a blower **20** to blow gas, e.g., air or nitrogen, into the container **24** to at least partially open the upward facing end of the container **24** by separating the tops of the container **24** so as to prepare the container **24** for receipt of ice pieces.

[0039] Preferably, in one embodiment, a blower **20** is used to open a top end of a bag **24** prior to ice being deposited in the bag **24**. The blower **20** may be approximately U-shaped to channel a stream of air from the device to the inside surface of the bag **24** adjacent the top of the high side of the bag **24** held by the prongs or rods. Programmable logic control or other actuation may be used in this preferred embodiment to energize the blower **20** to direct an air stream into a bag **24** to at least partially fill the bag **24** with air sufficiently quickly to thereby cause the bag **24** to open at the top.

[0040] In a preferred embodiment, when a bag **24** is sufficiently opened and in place beneath the rotatable ramp **16**, the bag **24** or other container is detected by a bag detection sensor (not shown). One of ordinary skill in the art will understand that the bag detection sensor may be any poly-detector, such as a Cutler Hammer clear object detector or an equivalent thereof. When the bag **24** is open, the shorter side of the bag **24** is preferably moved away from the longer side by the gas blast from the blower **20**. Ice pieces are then delivered into the sufficiently or preferably fully open bag **24**, and the blower **20** is de-energized typically promptly after sufficient ice pieces have been received to ensure the bag remains open on its own. In any event, the bag detection sensor preferably detects the

presence or absence of a bag **24**, preferably that is sufficiently opened, so as to control when the rotatable ramp is then positioned in the dispensing position to dispense ice pieces towards the bag filling area and the preferably open container. The bag detection sensor may be a capacitance or reflective sensor, or any other suitable mechanism or sensor and associated control logic or software. When the bag detection sensor does not detect a bag **24**, the inner door may be reopened and the blower **20** may be automatically or manually activated again, or remain activated, to attempt to open a bag **24** and hold the bag **24** open beneath rotatable ramp **16**.

[0041] During filling, ice pieces are disposed into the bag **24**. Preferably, an ice detection sensor (not shown) detects when ice pieces reach a predetermined height in the bag **24**, or alternatively, that a sufficient weight or volume of ice pieces are present in the bag. The sensor then signals that the delivery of ice pieces should stop, such as by signaling a motor to cease delivery of ice pieces to a bag **24**, preferably by at least rotating the ramp into a storage position whereby ice pieces are no longer delivered to a bag **24**. The ice vending apparatus **10** is preferably filled based on calculated volume of ice in the bag **24**, rather than a measured weight. This can be achieved based on a known or calculated volume or cross-sectional area of each container **24** being used, coupled with the height of the ice detection sensor. Alternatively, weight measurement could be used by installing a measuring device or any other convention weighing device available in the art, e.g., in the floor of the filling zone such as a pressure plate, or multiple forms of measurement could be used as a check-and-balance to ensure a fair transaction where the customer receives sufficient ice for the payment made yet not so much ice that it becomes unfair to the ice vending apparatus owner. The containers are preferably sufficiently light that their weight need not be accounted for, although it can be subtracted or the ice detection sensor calibrated to account for the standard containers being used

[0042] Both the bag **24** and ice detection sensor may be electro-optically sensor based. These operate by automatically detecting fill height by both transmitted and reflected light means. In a preferred embodiment, each bag **24** may have a special marking, such as dot or bar code, or a line, which is positioned on the bag **24** in a location to signal that the desired height of ice has been reached to the ice detection sensor. When this desired height, and therefore calculated amount, of ice has been reached, the ice vending device can be shut off by rotating the ramp back into the storage position to cease the depositing of ice in the container. At that point, the interlock system **22** can lock the inner door if it has not already done so to support the container being filled, and can unlock the outer door for consumer pickup of the container.

[0043] To assist a consumer in closing a filled container, the apparatus **10** typically further includes a plurality of fasteners disposed inside the chamber **40**. After the bag **24** is filled, the outer door **38** automatically opens or is opened by the consumer, the consumer reaches inside, retrieves a fastener if desired, and closes the sufficiently filled bag **24**. Suitable fasteners include, for example, rubber band, twist ties, staples, making a knot in the top end of the flexible bag container, etc.

[0044] A preferred method of providing ice pieces to a consumer will now be described with respect to FIG. **1**. A consumer inserts the required amount of money in the ice vending apparatus **10** and, optionally, selects an appropriate sized bag **24** if multiple sizes are provided. Typically, only a single sized bag will be provided in the ice vending apparatus of the invention, but multiple sizes could be used and a carousel or other mechanism to insert the proper size container into the filling zone could be used if desired. The outer door adjacent the customer is preferably locked in a closed position before the vending apparatus will properly operate, and the inner door is unlocked and may be opened. Ice is transferred from the holding vessel **14** to the ramp **16**. The inner door opens, and a bag **24** is deposited in the chamber defined by the interlock system **22**. The bag detection sensor detects the presence of the bag **24**, and the blower **20** blows the bag open. The inner door closes to cut off the extra bags and to support a portion of the bag and optionally but preferably locks the inner door. The door **52** rotates from the closed position to the open position. Ice is transferred across the ramp **16** to the container **24**, while a portion of the moisture is removed by the lower lip of the ramp **16**, by shapes and or grooves, or both, and by the operatively associated channel **18**, until the ice detection sensor detects the appropriate height of ice in the bag **24**. Once the bag **24** is filled with sufficient ice pieces to comply with the ordered ice, the outer door may be unlocked and opened, but the inner door remains shut and locked. The consumer may then close the bag **24** with a fastener. Once the consumer closes the outer door again, the inner door may be unlocked and opened to prepare the apparatus for the next order.

[0045] The term "about," as used herein, should generally be understood to refer to both numbers in a range of numerals. Moreover, all numerical ranges herein should be understood to include each whole integer and each tenth of a number within the range.

[0046] Although preferred embodiments of the invention have been described in the foregoing description, it will be understood that the invention is not limited to the specific embodiments disclosed herein but is capable of numerous modifications by one of ordinary skill in the art. It will be understood that the materials used and the mechanical details may be slightly different or modified from the descriptions herein without departing from the methods and devices disclosed and taught by the present invention.

What is claimed is:

1. An ice vending apparatus adapted to remove moisture from ice pieces during dispensing, which comprises:

a ramp having a lower lip and being adapted to transfer a quantity of ice pieces from a holding vessel to a container; and

a channel having an upwardly facing opening that is in operative association with the ramp and is arranged so that moisture is adapted to flow around the lower lip of the ramp into the channel while excluding the ice pieces so as to separate at least a portion of the moisture from the ice pieces as the ice pieces are transferred to the container.

2. The ice vending apparatus of claim **1**, which further comprises a rotatable door in operative association with the ramp, the door being adapted to rotate between a closed position where the ice pieces are restricted from transfer to the container and an open position that allows the transfer of the ice pieces to the container.

3. The ice vending apparatus of claim **1**, wherein the ramp is rotatable between a storage position and a dispensing position to transfer the ice pieces to the container.

4. The ice vending apparatus of claim **1**, wherein the channel is at least partially covered.

5. The ice vending apparatus of claim **1**, wherein the ramp is inclined at about 60 degrees to 85 degrees with respect to the horizontal.

6. The ice vending apparatus of claim **1**, wherein the container comprises a flexible plastic material.

7. The ice vending apparatus of claim **1**, wherein the ramp further comprises one or more chevron-shaped grooves adapted to further separate moisture from the ice pieces when the ice pieces are dispensed over the ramp.

8. The ice vending apparatus of claim **1**, which further comprises a bagging apparatus to collect a pre-selected quantity of ice pieces in a container to deliver to a consumer.

9. The ice vending apparatus of claim **8**, wherein the bagging apparatus comprises an interlock system constructed and arranged to receive the container, the interlock system comprising a pair of vertically-oriented inner and outer doors arranged in association with a pair of side walls to define a chamber therebetween, wherein the interlock system is adapted to close the inner door to inhibit or prevent access to additional containers while the outer door is adapted to be opened by a consumer.

10. The ice vending apparatus of claim **9**, wherein the doors are spaced from about 6 inches to about 24 inches apart and arranged to support opposing portions of the container adapted to receive the ice pieces.

11. The ice vending apparatus of claim **9**, wherein the interlock system further comprises at least one container-holding extension located adjacent to one of the doors and adapted to support a portion of the container during filling.

12. The ice vending apparatus of claim **8**, wherein the bagging apparatus comprises a bag detection sensor to detect the presence or absence of a container positioned to catch the ice pieces therein.

13. The ice vending apparatus of claim **8**, wherein the bagging apparatus comprises an ice detection sensor to signal when ice pieces reach a predetermined height in a container.

14. An ice vending apparatus adapted to fill a portion of a container with ice pieces upon demand by a consumer, which comprises:

a plurality of containers stored inside a housing associated with an ice dispensing portion adapted to containerize ice pieces in successive containers upon demand by one or more consumers; and

an interlock system constructed and arranged to receive each container one at a time, the interlock system comprising a pair of inner and outer doors arranged in association with a pair of side walls to define a chamber therebetween, wherein the interlock system is adapted to close the inner door to inhibit or prevent access to additional containers while the outer door is adapted to be opened by a consumer to retrieve a container that has received ice pieces.

15. The ice vending apparatus of claim **14**, wherein the interlock system further comprises at least one container-holding extension located adjacent to one of the doors and adapted to support a portion of the container during filling thereof with the ice pieces.

16. The ice vending apparatus of claim **14**, wherein the doors are spaced from about 6 inches to about 24 inches apart and arranged to support opposing portions of the container that has been prepared to receive the ice pieces.

17. The ice vending apparatus of claim **14**, which further comprises a container-opening device adapted to open an end of a container disposed in the chamber so as to facilitate receipt of the ice pieces.

18. The ice vending apparatus of claim **17**, wherein the container-opening device comprises a blower to blow a gas into the end at the top of the container so as to separate a top of each opposing portions of the container and thereby partially open the container so it is adapted to be at least partially filled with ice pieces.

19. The ice vending apparatus of claim **18**, which further comprises one or more fasteners disposed inside the chamber so that a consumer can close a partly filled container therewith.

20. A method for providing ice pieces to a consumer, which comprises:

rotating a ramp zone between a storage position and a transferring position so as to direct a plurality of ice pieces from a holding zone over the ramp zone to a container in the transferring position; and

removing a portion of moisture from the dispensed ice pieces as they move through and past the ramp zone to the container, wherein the removed moisture is directed away from the container.

21. The method of claim **20**, further comprising detecting the presence of a container in position to receive the plurality of ice pieces before the rotating of the ramp zone from the storage position to the transferring position.

22. The method of claim **20**, wherein the ramp zone is arranged to direct the flow of moisture exiting the ramp zone away from the ice pieces and the container.

23. The method of claim **20**, wherein the container comprises a flexible plastic material.

24. The method of claim **23**, which further comprises partially opening the container at a top end before ice pieces are disposed through the ramp zone into the container.

25. The method of claim **24**, wherein the partial opening comprises blowing a gas in a pre-determined direction at the top end of the container to facilitate partially opening the container.

26. The method of claim **23**, which further comprises supporting the container on at least one front, back, or side surface.

27. The method of claim **20**, which further comprises providing an interlock system that inhibits or prevents a consumer from tampering with a supply of the containers.

28. The method of claim **27**, which further comprises directing ice pieces into the container in a filling zone and operating the interlock system to close at least one barrier between the filled container and additional containers to be filled.

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