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(54) **ICE VENDING MACHINE**

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(57) **ABSTRACT**  
An ice vending machine automatically provides ice to a customer based upon a request from the consumer for the ice. In some embodiments, the ice vending machine includes an ice bagging system. In some embodiments, the bagging system operates without the use of a counterweight. In some embodiments, the ice vending machine includes a view window to view the ice being bagged. In some embodiments, the ice vending machine is an ice and liquid water vending machine that automatically provides ice or liquid water to a customer based on a request from the customer for the ice or liquid water. In some embodiments, the ice and liquid water vending machine includes an ultraviolet light flushing assembly. In some embodiments, the ice and liquid water vending machine includes a chill tank.

**Related U.S. Application Data**

- (60) Provisional application No. 61/714,412, filed on Oct. 16, 2012.

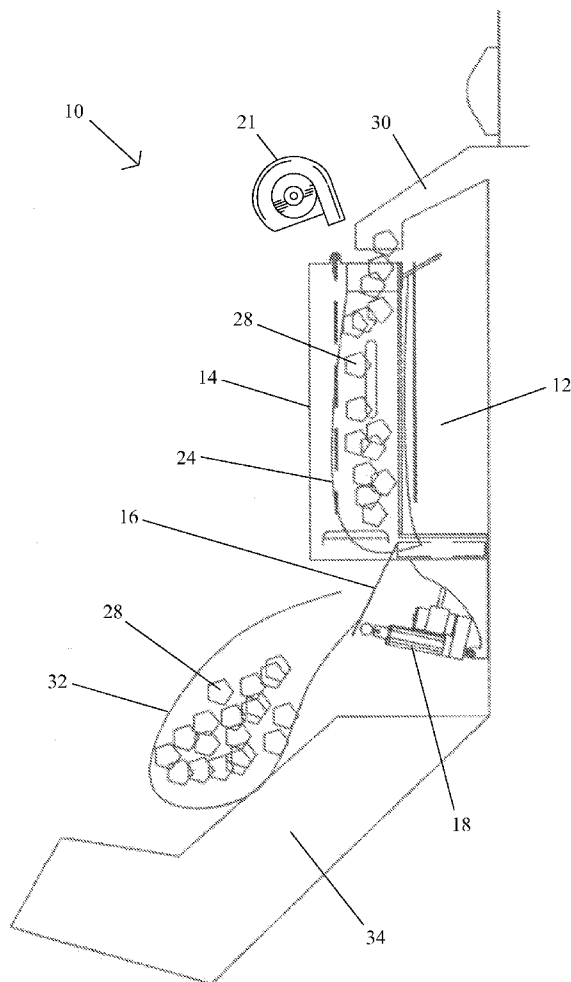


Fig. 1

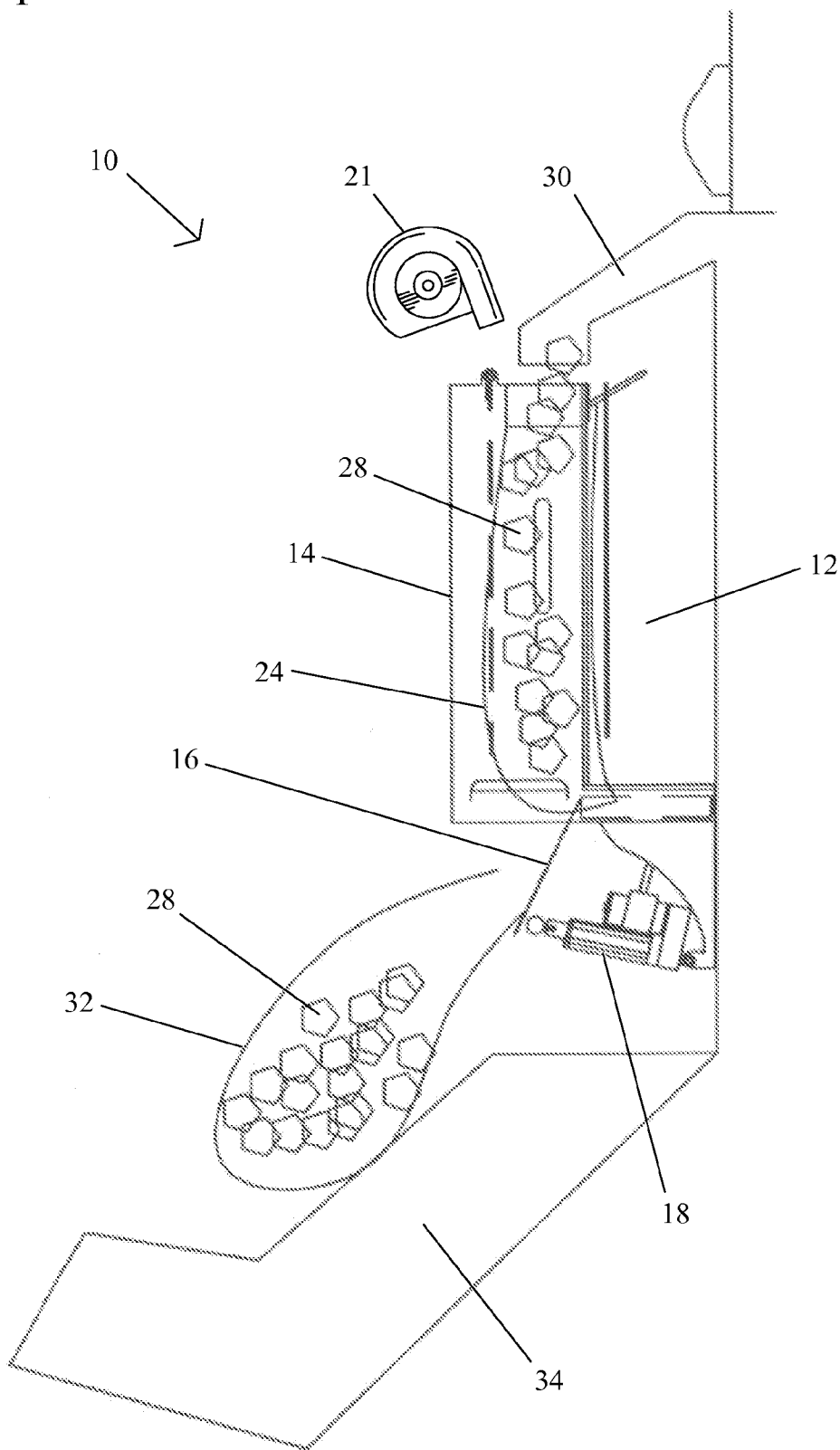


Fig. 2

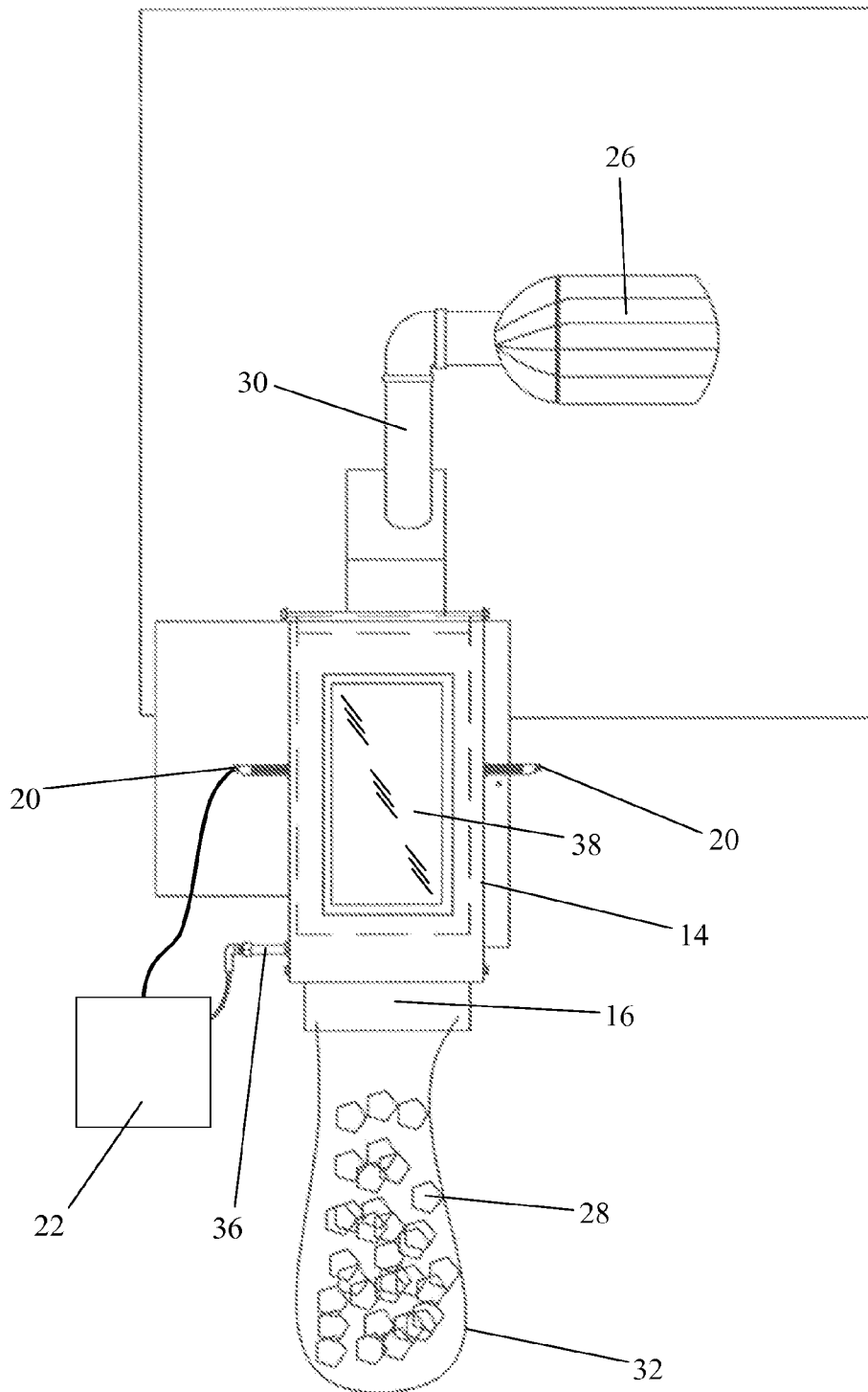


Fig. 3

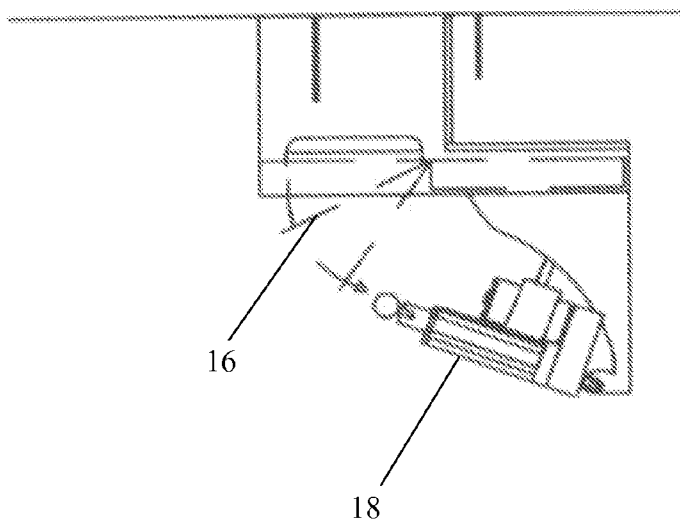


Fig. 4

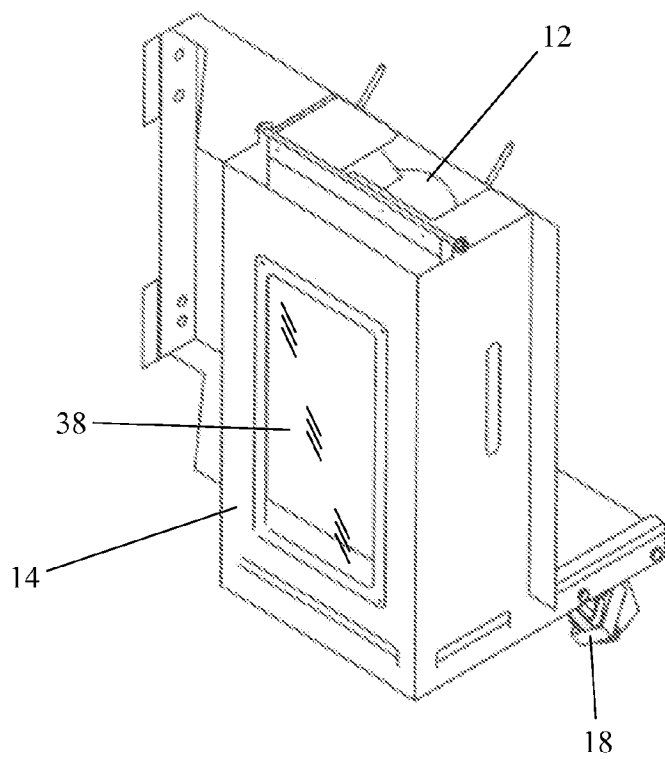


Fig. 5

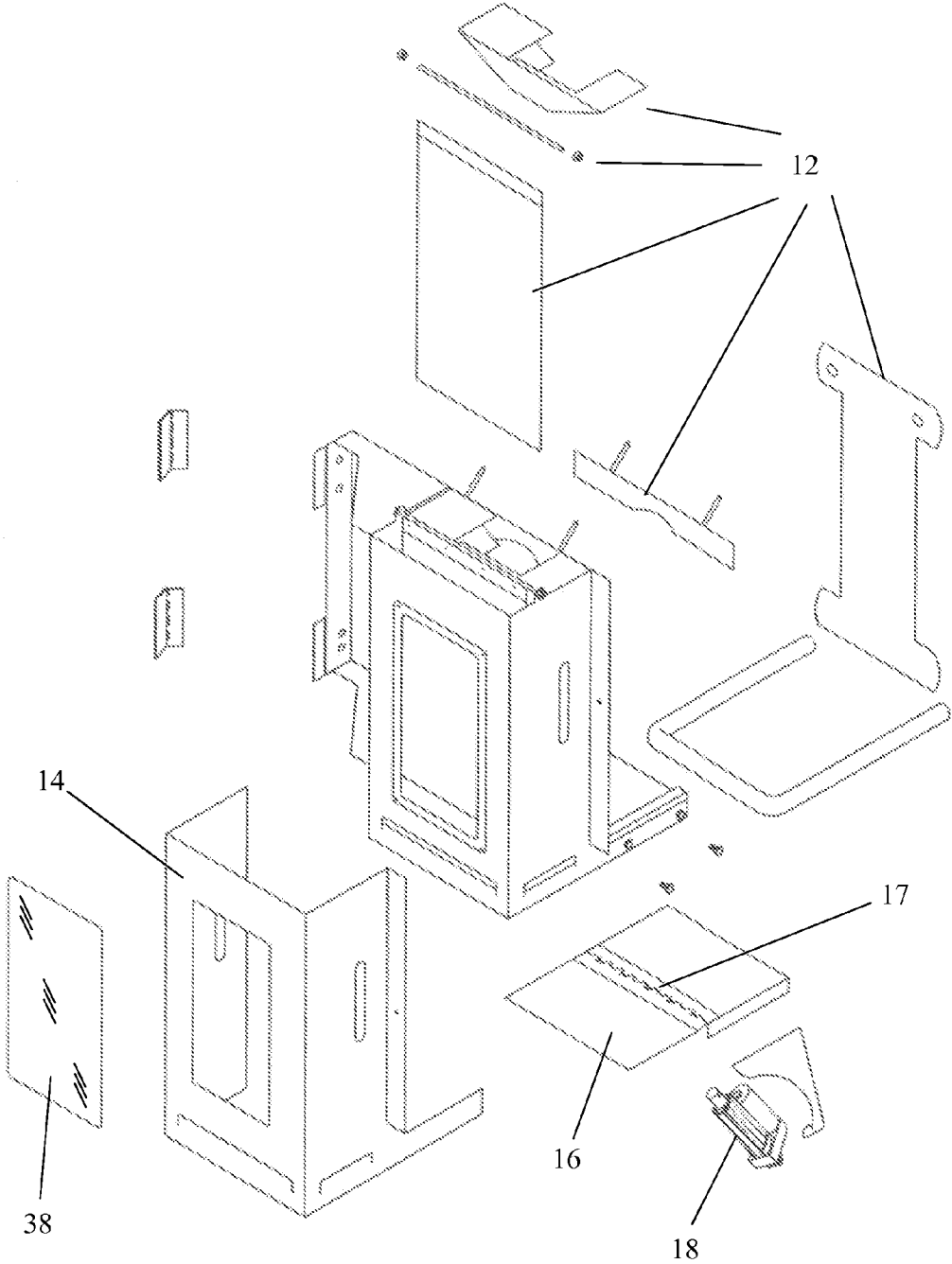


Fig. 6

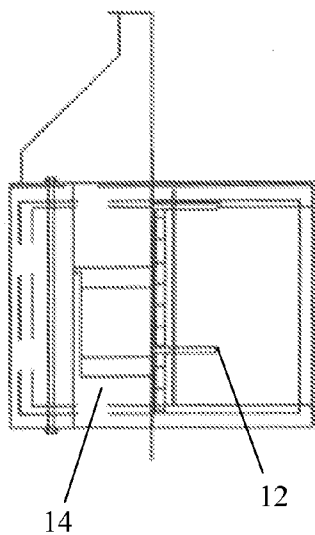


Fig. 7

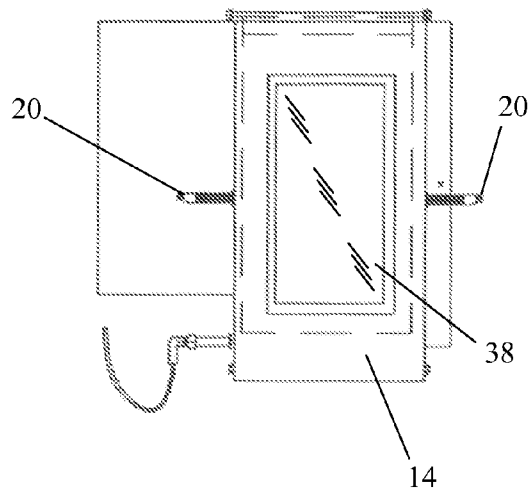


Fig. 8

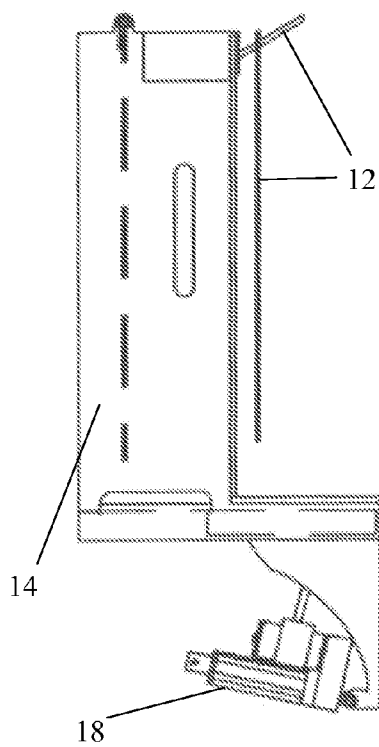


Fig. 9

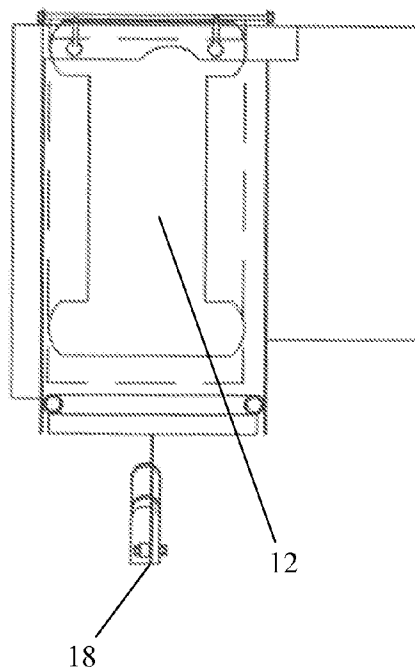
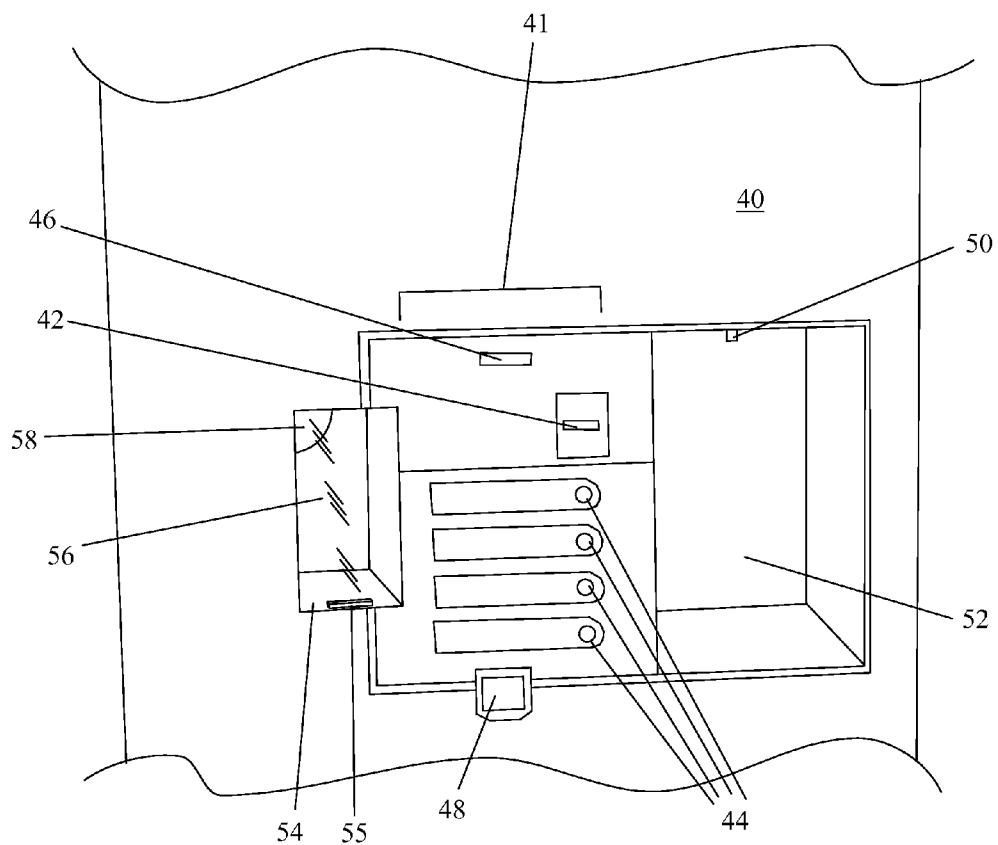


Fig. 10



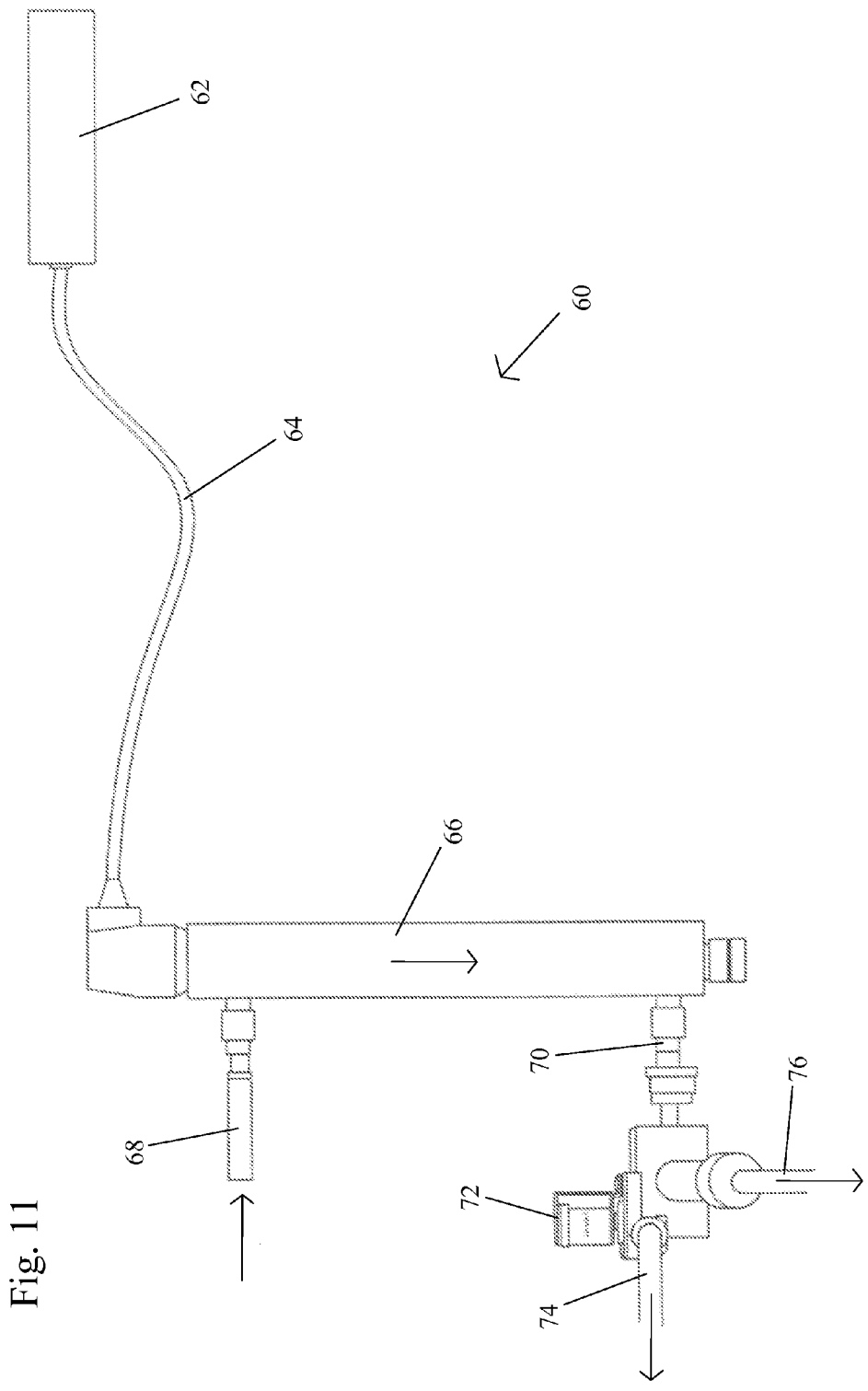


Fig. 11



Fig. 12

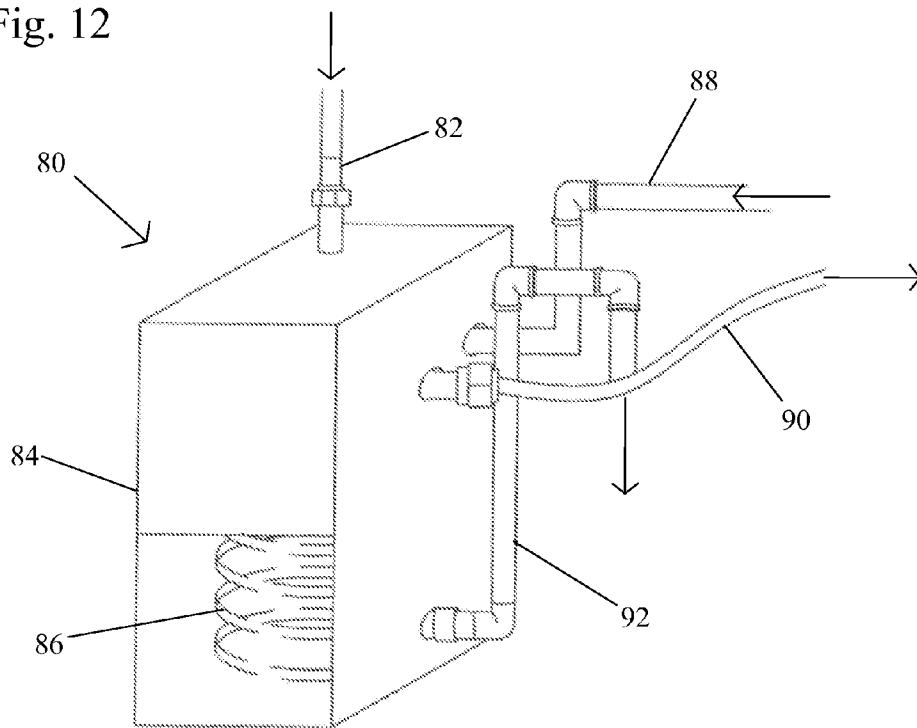


Fig. 13

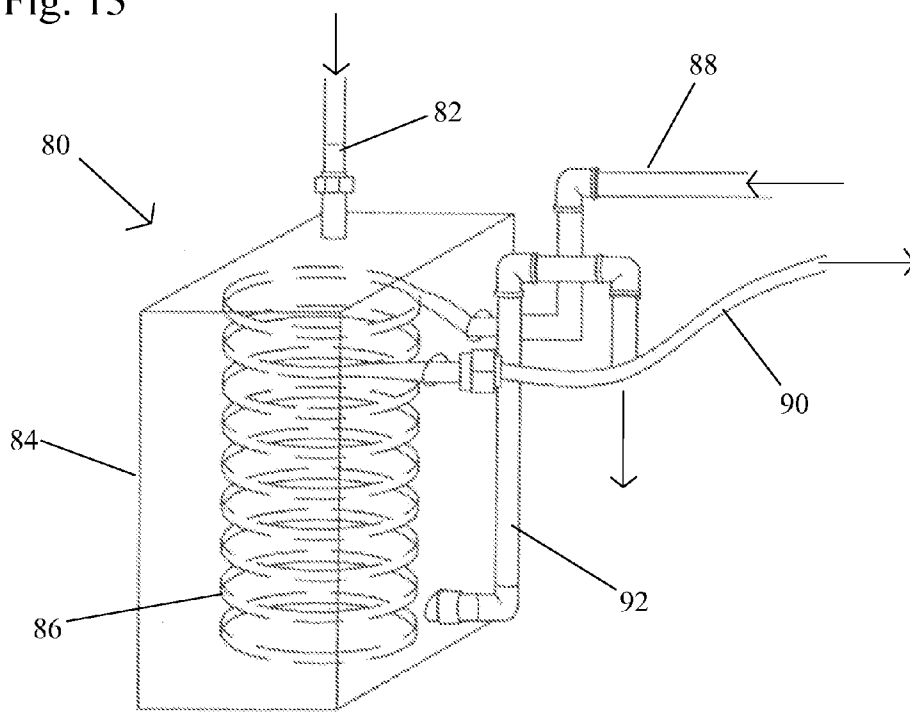
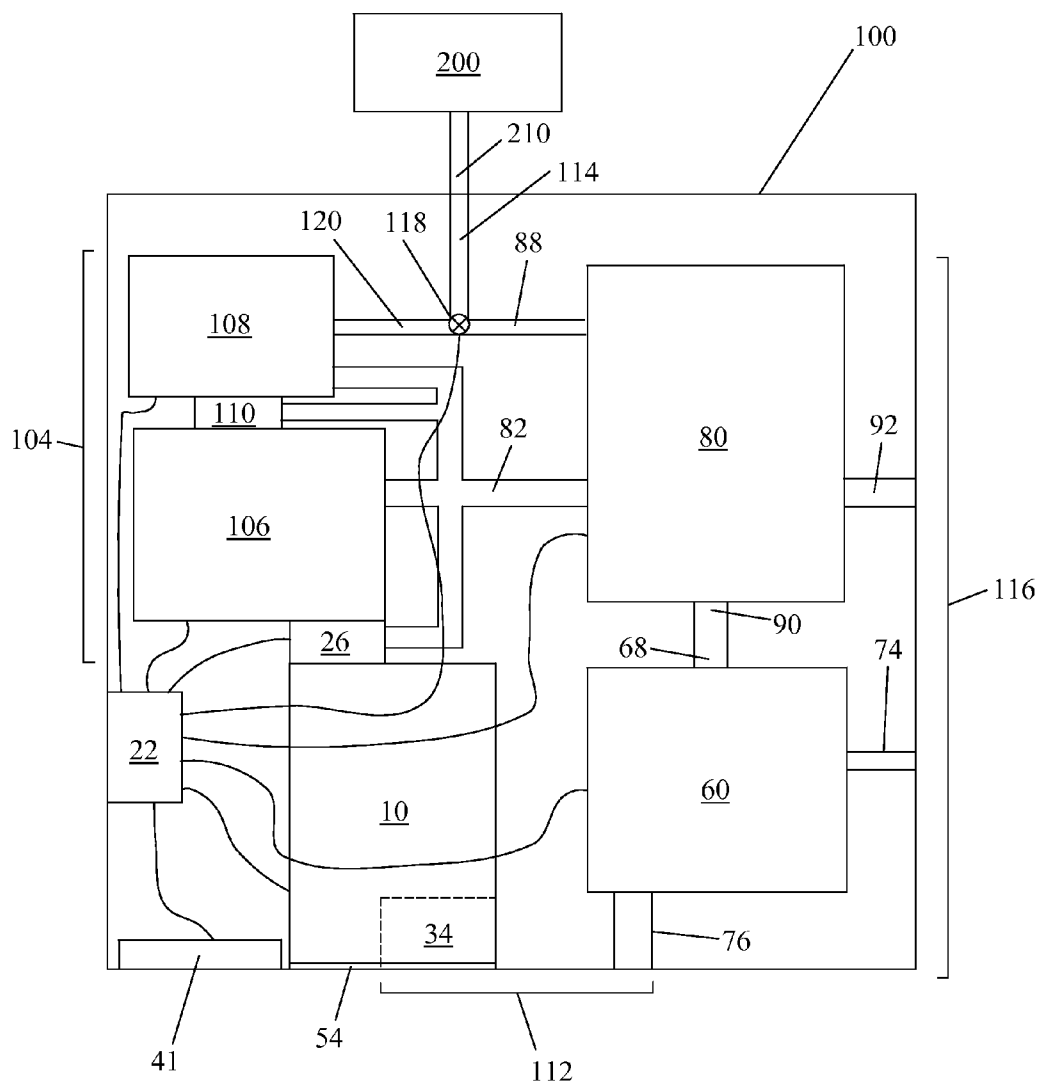


Fig. 14



## ICE VENDING MACHINE

### REFERENCE TO RELATED APPLICATIONS

**[0001]** This application claims one or more inventions which were disclosed in Provisional Application No. 61/714, 412, filed Oct. 16, 2012, entitled “ICE VENDING MACHINE”. The benefit under 35 USC §119(e) of the United States provisional application is hereby claimed, and the aforementioned application is hereby incorporated herein by reference.

### BACKGROUND OF THE INVENTION

**[0002]** 1. Field of the Invention

**[0003]** The invention pertains to the field of vending machines. More particularly, the invention pertains to ice vending machines.

**[0004]** 2. Description of Related Art

**[0005]** Ice vending machines that dispense ice automatically on demand to a customer are known in the art. U.S. Pat. No. 6,474,048, entitled “Automatic ice producing, bagging, and dispensing machine” and issued Nov. 5, 2002 to Metzger et al., U.S. Pat. No. 6,932,124, entitled “Automated Ice Bagging Apparatus and Methods” and issued Aug. 23, 2005 to Dalton et al., U.S. Pat. No. 7,104,291, entitled “Automated Ice Bagging Apparatus and Methods” and issued Sep. 12, 2006 to Dalton et al., U.S. Pat. No. 7,426,945, entitled “Automated Ice Bagging Apparatus and Methods” and issued Sep. 23, 2008 to Dalton et al., U.S. Pat. No. 7,735,527, entitled “Automated Ice Delivery Apparatus and Methods” and issued Jun. 15, 2010 to Dunn, U.S. Pat. No. 7,806,152, entitled “Automated Ice Bagging Apparatus and Methods” and issued Oct. 5, 2010 to Dalton et al., U.S. Pat. No. 8,122,689, entitled “Method and apparatus for producing, bagging and dispensing ice” and issued Feb. 28, 2012 to Pape, U.S. Pat. No. 8,245,488, entitled “Automated Ice Delivery Apparatus and Methods” and issued Aug. 21, 2012 to Dunn, U.S. Patent App. Pub. No. 2010/0319806, entitled “Automated Ice Bagging Apparatus and Methods” by Dalton et al. and published Dec. 23, 2010, and U.S. Patent App. Pub. No. 2012/0247066, entitled “Ice Bagging Apparatus and Methods” by Dunn et al. and published Oct. 4, 2012, each disclose a vending machine that dispenses ice on demand to a customer.

**[0006]** Ice vending machines that dispense both ice and liquid water automatically on demand to a customer are also known in the art. U.S. Pat. No. 5,112,477, entitled “Purified water and ice dispensing apparatus” and issued May 12, 1992 to Hamlin, U.S. Pat. No. 5,484,538, entitled “Multiple service water purifier and dispenser and process of purifying water” and issued Jan. 16, 1996 to Woodward, U.S. Pat. No. 6,093,312, entitled “Ice Dispenser with an Air-Cooled Bin” and issued Jul. 25, 2000, and U.S. Patent App. Pub. No. 2012/0186276, entitled “Ice and Chilled Water Producing and Dispensing Machine” by Seymour and published Jul. 26, 2012, each disclose a vending machine that dispenses both ice and liquid water.

**[0007]** The above-mentioned references are hereby incorporated by reference herein.

### SUMMARY OF THE INVENTION

**[0008]** An ice vending machine automatically provides ice to a customer based upon a request from the consumer for the ice. In some embodiments, the ice vending machine includes an ice bagging system. In some embodiments, the bagging

system operates without the use of a counterweight. In some embodiments, the ice vending machine includes a view window to view the ice being bagged. In some embodiments, the ice vending machine is an ice and liquid water vending machine that automatically provides ice or liquid water to a customer based on a request from the customer for the ice or liquid water. In some embodiments, the ice and liquid water vending machine includes an ultraviolet light flushing assembly. In some embodiments, the ice and liquid water vending machine includes a chill tank.

### BRIEF DESCRIPTION OF THE DRAWINGS

**[0009]** FIG. 1 shows a side view of a bagging system assembly for ice in operation in an embodiment of the present invention.

**[0010]** FIG. 2 shows a front view of the bagging system assembly of FIG. 1 in operation.

**[0011]** FIG. 3 shows a close-up side view of the drop floor assembly of the bagging system assembly of FIG. 1.

**[0012]** FIG. 4 shows an elevated perspective view of the bagging system assembly of FIG. 1 without the ice.

**[0013]** FIG. 5 shows an exploded view of the bagging system assembly of FIG. 4.

**[0014]** FIG. 6 shows a top view of the bagging system assembly of FIG. 4.

**[0015]** FIG. 7 shows a front view of the bagging system assembly of FIG. 4.

**[0016]** FIG. 8 shows a side view of the bagging system assembly of FIG. 4.

**[0017]** FIG. 9 shows a back view of the bagging system assembly of FIG. 4.

**[0018]** FIG. 10 shows a front view of a portion of an ice and water vending machine with a view window for viewing the process of bagging the ice in an embodiment of the present invention.

**[0019]** FIG. 11 shows a UV light flushing assembly in an embodiment of the present invention.

**[0020]** FIG. 12 shows a chill tank in an embodiment of the present invention.

**[0021]** FIG. 13 shows a cut-away view of the chill tank of FIG. 12.

**[0022]** FIG. 14 shows schematically an automated ice vending machine in an embodiment of the present invention.

### DETAILED DESCRIPTION OF THE INVENTION

**[0023]** An ice vending machine automatically provides ice to a customer based upon a request from the consumer for the ice. In some embodiments, the request includes a payment from the customer. In some embodiments, the ice is bagged by the ice vending machine after the request from the customer is made and prior to dispensing the ice to the customer. In some embodiments, the ice vending machine is an ice and liquid water vending machine that also automatically provides liquid water to a customer based on a request from the customer for the liquid water. In some embodiments, the liquid water is chilled to a temperature below room temperature. In some embodiments, the liquid water is put in a container supplied by the ice vending machine after the request from the customer is made and prior to dispensing the ice to the customer.

**[0024]** An automated ice vending machine preferably includes a customer request apparatus, an ice supplying apparatus, an ice bagging apparatus, and a bagged ice vending

apparatus. The customer request apparatus preferably receives a request from a customer for the ice in the form of a customer input, which may include, but is not limited to, a payment by the customer or a selection of a particular size of ice, a particular amount of ice, or a particular number of bags of ice. A programmable logic control or other computerized control system or logic preferably receives and validates the request and initiates the vending process by directing the ice supplying apparatus to begin supplying ice to the ice bagging apparatus upon receipt of a valid request from a customer. The computerized control system preferably also controls and directs the rest of the automated vending process.

**[0025]** The ice supplying apparatus preferably includes a holding vessel to hold the ice pieces to be vended. The holding vessel is sufficiently insulated to retain a majority of the ice pieces in solid form so as to minimize or avoid substantial melting of the ice. The holding vessel is preferably insulated from the environment by an insulation chamber.

**[0026]** In some embodiments, the ice supplying apparatus includes an ice making apparatus. In such embodiments, the ice making apparatus preferably forms ice pieces by freezing liquid water from a liquid water source and supplies the ice pieces to the holding vessel, as needed, such as when the amount of ice pieces in the holding vessel goes below a predetermined amount. In other embodiments, ice pieces are supplied to the holding vessel from an outside source rather than being made by the automated ice vending machine.

**[0027]** An ice transferring apparatus preferably includes a transport apparatus positioned in the holding vessel and configured and adapted to transport a portion of the ice pieces from the holding vessel to the ice bagging apparatus. The transport apparatus may include, but is not limited to, a conveyor belt, a chain, or a plurality of side-by-side rollers. The transport apparatus preferably operates in a continuous loop and is preferably motorized.

**[0028]** The ice bagging apparatus preferably includes a supply of bags in a bag supply zone, a bagging zone where one bag to be filled from the bag supply is opened and ice pieces from the ice supplying apparatus are received in the opened bag. In some embodiments, the bag supply zone includes a wicket on which the supply of bags is hung in a flattened stack. In some embodiments, a blower blows air to open the back at an open end of the bag. The ice bagging apparatus preferably includes a measuring apparatus to determine when the opened bag contains an appropriate predetermined amount of ice pieces. The measuring apparatus may include, but is not limited to, a scale, a counterbalance, or a beam sensor.

**[0029]** In some embodiments, the bagged ice is provided to the customer without closing the open end of the bag. In other embodiments, the ice bagging apparatus includes a bag closing apparatus. In some embodiments, the ice closing apparatus heat-seals the open end of the bag closed. In other embodiments, the ice closing apparatus applies a fastener to the open end of the bag. Fasteners may include, but are not limited to, staples, ties, or adhesives.

**[0030]** Once the ice bagging apparatus has determined that the opened bag contains the appropriate predetermined amount of ice pieces, the bagged ice vending apparatus delivers the bagged ice to the customer. In some embodiments, the bagged ice vending apparatus includes a vend door that the customer may open to remove the bagged ice from the bagging zone. In other embodiments, the bagged ice is released and travels down a vending chute to a vend window, from

which the customer takes the bagged ice. In other embodiments, the bagged ice is actively transported to a vend window.

**[0031]** In embodiments where the automated ice vending machine is an automated ice and liquid water vending machine, the automated ice vending machine preferably also includes a water supplying apparatus, a water vending apparatus, and at least one of a ultraviolet light irradiating assembly and a chill tank. The water supply apparatus is preferably a water inlet pipe that may be coupled to a municipal water line, a well water line, or any other source of potable water. The water supply apparatus may also supply the liquid water to be frozen by the ice forming apparatus.

**[0032]** The water vending apparatus supplies liquid water to the customer upon receipt of a valid request from the customer for liquid water through the customer request apparatus. In some embodiments, the liquid water is purified by an ultraviolet light irradiating assembly prior to being supplied to the water vending apparatus. In some embodiments, the computerized control system determines whether the control valve of the ultraviolet light irradiating assembly has been actuated within a predetermined period of time prior to receiving the vend request and actuates the control valve to supply a predetermined amount of the liquid water from the irradiation zone of the ultraviolet light irradiating assembly to the flush line, if the control valve has not been actuated within the predetermined period of time. The computerized control system then actuates the control valve to supply liquid water to the vending line to supply liquid water to the customer. In some embodiments, the liquid water is chilled by passage through the coils of a chill tank prior to being supplied to the water vending apparatus. In some embodiments, the liquid water is chilled by heat exchange in the chill tank with cold liquid water flushed from the ice forming apparatus of the automated ice and liquid water vending apparatus.

**[0033]** In some embodiments, the bags for bagging the ice rest in a stack on a wicket to be dispensed. In some embodiments, the ice bagging system includes the following method. Once a credit or a request in another form is received from a customer, the control board activates a blower that blows the front bag on the wicket open. Proximity sensors detect that the bag is open and send a signal to the control board, which activates the dispensing auger that augers ice from the storage bin into the blown-open bag. Through beam receivers, the control board receives a signal that the bag is filled with ice, once the beam has been broken. The control board activates a 2-inch actuator that supports a drop floor, on which the filled bag rests. The activated actuator drops, thereby allowing the drop floor to drop under the weight of the bagged ice. When the drop floor drops, the weight of the ice inside the bag rips the bag off the wicket and the bag of ice drops through the vending chute. The control board then activates the same actuator to open, which pushes the drop floor back up to await the next vend. The bagging system preferably works without the use of a counterweight or other weighing apparatus. Instead, the bagging system preferably relies on the beam receivers to determine whether a bag is full of ice.

**[0034]** FIG. 1 through FIG. 9 show a bagging system for an ice vending machine for automatically bagging ice upon a request input from a customer. In some embodiments, the ice vending machine vends ice but not liquid water. In other embodiments, the ice vending machine is an ice and liquid water vending machine. The bagging system 10 includes a wicket 12, a bagging enclosure 14, a drop floor 16, a drop

floor actuator **18**, at least one beam receiver **20**, and at least one proximity sensor **36**. The control board **22** of the vending machine, which is in electronic communication with the drop floor actuator **18** and the beam receiver **20**, activates a blower **21** that blows a vending bag **24** open inside the bagging enclosure **14** with the drop floor **16** in a closed or up position. Although the control board **22** is shown in a particular location in FIG. 2, the control board **22** may be located anywhere within or on the vending machine. At least one proximity sensor **36** detects the vending bag **24** and sends a signal to the control board **22**, which activates the dispensing auger **26** that augers ice **28** from the storage bin (not shown), down an ice chute **30**, and into the blown-open bag **24**. Through the beam receivers **20**, the control board **22** receives a signal that the vending bag **24** is filled with ice **28**, once the beam has been broken. The control board **22** then activates the drop floor actuator **18** that allows the drop floor **16**, on which the filled vending bag **24** rests, to open by hingedly pivoting at a pivot point **17** downward. The activated actuator **18** drops, thereby allowing the drop floor **16** to drop under the weight of the ice-filled bag **24**. When the drop floor **16** drops, the weight of the ice **28** inside the bag **24** rips the bag off the wicket **12** and the filled ice bag **32** drops through the vending chute **34** below the bagging enclosure **14** and to the customer. The control board **22** then activates the same actuator **18** to open, which pushes the drop floor **16** back up to await the next vend.

**[0035]** In some embodiments, the ice vending machine includes a view window to allow the customer to watch the ice vending process. This design element enhances the customer experience by allowing the customer to view the ice during the bagging process. The experience may be further enhanced by the use of accent lighting behind the view window. Conventional automated ice vending machines do not have any design attributes to allow the customer to view the ice during the bagging process. A viewing window, preferably with accent lighting, allows the consumer to see the ice during the bagging and delivery process. This design element conveys the concepts of freshness and the product not being touched by human hands during the ice making process. In a preferred embodiment, the bagging system **10** of FIG. 1 through FIG. 9 includes a viewing window **38**. The viewing window **38** is transparent and sits in the front wall of the bagging enclosure **14**. The viewing window **38** may be made of any solid transparent material, including, but not limited to, a transparent glass or a transparent plastic.

**[0036]** FIG. 10 shows a line drawing of the front **40** of an ice and liquid water vending machine. The front **40** of the vending machine includes a customer request area **41**, an ice vending area, and a liquid water vending area **52**. The customer request apparatus **41** includes a payment slot **42**, one or more vending buttons **44**, a digital screen **46**, and a change/receipt window **48**. The customer may insert payment into the payment slot **42** and then the customer may select one or more vending options by pushing one or more of the vending buttons **44**. The payment slot **42** may receive cash, in the form of bills or coins, or a credit, debit, membership, or other card associated with an account of the customer. The digital screen **46** provides messages to the customer, and the change/receipt window **48** provides change or a receipt to the customer. If the customer requests liquid water, liquid water is dispensed out a nozzle **50** into a liquid water vending area **52**. The liquid water is dispensed into a container placed in the liquid water vending area **52**. The container may be supplied by the vending machine or the customer. The container may be of any size

that fits in the liquid water vending area **52** and may hold any volume, although the volume preferably corresponds to the volume of liquid water requested by the customer.

**[0037]** A view window **54**, which may be made of any solid transparent material, including, but not limited to, glass or plastic, allows the customer to see the ice bagging area **56** behind the view window **54**. In some embodiments, an anti-fogging coating on one or both sides of the transparent material prevents condensation from forming on the surface of the transparent material that would prevent a customer from being able to see through the view window **54**. In a preferred embodiment, accent lighting **58** provides light to the ice bagging area **56** to provide the customer with a better view. In some embodiments, the view window **54** may be lifted by the customer using a handle **55** when the bag has been filled with the ice to allow the customer to remove the bag of ice from the vending machine. In some embodiments, the vending machine locks the view window **54** when the ice bagging area **56** is empty or when the bag is not yet ready to be removed by the customer. In other embodiments, the view window **54** is permanently in place and the filled bag of ice is transferred to a vending chute by the vending machine to supply the filled bag to the customer. In other embodiments, the view window allows the customer to see other stages of the ice making and ice bagging process. In some embodiments, the vending machine includes multiple view windows to see different stages of the ice making and ice bagging process. The view window or view windows may be of any size or shape to allow viewing of a portion or all of the ice formation and bagging process.

**[0038]** In embodiments where the ice vending machine also dispenses liquid water, the liquid water is preferably irradiated with ultraviolet (UV) light just prior to being dispensed. The UV light sterilizes the water passing through it, but if the water sits inside the UV compartment for a long period of time, the UV light may heat the water up to temperatures as high as 120° F. The customer, however, in most cases is expecting the dispensed water to be chilled. In some embodiments, to eliminate the heated water from being dispensed to the customer, when the controller determines that water has not been dispensed for a certain predetermined period of time, the controller causes a valve to be opened that allows water to be flushed out of the UV compartment. The valve is preferably a solenoid valve. In other embodiments, the controller waits until there is a customer request. At that time, the controller determines whether water has been dispensed within a certain predetermined period of time, and if the time since the last dispensing event has exceeded the predetermined period of time, the controller causes a solenoid valve to be opened that allows water to be flushed out the UV compartment prior to dispensing water to the customer.

**[0039]** FIG. 11 shows an ultraviolet light irradiating and warm water flushing assembly **60** for an ice and liquid water vending machine. An ultraviolet light source **62** generates ultraviolet light, which is transmitted along a conduit **64** to a liquid water irradiating zone **66**. The water to be irradiated enters the irradiating zone **66** by way of an inlet line **68** and exits the irradiating zone **66** by way of an outlet line **70**. A controller **72** directs a valve to control whether irradiated liquid water from the outlet line **70** is flushed through a flush line **74** or travels through a vending line **76** to the customer. The liquid water entering through the inlet line **68** is preferably chilled prior to entering the irradiating zone **66**.

[0040] In embodiments where the ice vending machine also dispenses liquid water, the liquid water is preferably chilled prior to being dispensed. In some embodiments, an insulated tank receives and holds the liquid water being flushed out by the ice maker after the ice maker harvests a batch of ice. This cold liquid water in the insulated tank is then used to chill the water to be dispensed before it is dispensed to the customer. Coiled tubing rests inside the insulated tank, and the incoming water line passes through the coiled tubing to remove heat from the water before it is dispensed to a customer.

[0041] FIG. 12 and FIG. 13 show a chill tank 80 for an ice and liquid water vending machine. The cold water being flushed out by the ice maker after the ice maker harvests a batch of ice travels down a tank inlet line 82 to an insulated tank 84 to serve as cooling water. Coiled tubing 86 runs inside the insulated tank 84. Incoming unchilled water flows into the coiled tubing 86 by way of a water inlet line 88 and is chilled in the coiled tubing 86 by heat transfer to the cooling water in the insulated tank 84. The chilled water then exits the coiled tubing 86 by way of a water outlet line 90 and is dispensed to the customer. A tank outlet line 92 drains excess cooling water from the insulated tank 84.

[0042] FIG. 14 schematically shows an automated ice vending machine. The automated ice vending machine 100 includes a customer request apparatus 41, an ice supplying apparatus 104, an ice bagging apparatus 10, and a bagged ice vending apparatus 34. The customer request apparatus 41 receives a request from a customer for the ice in the form of a customer input, which may include, but is not limited to, a payment by the customer or a selection of a particular size of ice, a particular amount of ice, or a particular number of bags of ice. A control board 22 including a programmable logic control or other computerized control system or logic receives and validates the request and initiates the vending process by directing the ice supplying apparatus 104 to begin supplying ice to the ice bagging apparatus 10 upon receipt of a valid request from a customer.

[0043] The ice supplying apparatus 104 includes a holding vessel 106 to hold the ice pieces to be vended. The holding vessel 106 is sufficiently insulated to retain a majority of the ice pieces in solid form so as to minimize or avoid substantial melting of the ice. The holding vessel 106 is preferably insulated from the environment by an insulation chamber. The ice supplying apparatus 104 also includes an ice making apparatus 108. The ice making apparatus 108 forms ice pieces by freezing liquid water from a liquid water source, preferably a municipal liquid water source 200, and supplies the ice pieces to the holding vessel 106, as needed, when the amount of ice pieces in the holding vessel goes below a predetermined amount. The ice is passively supplied from the ice making apparatus 108 to the holding vessel 106 by traveling down a chute 110 between the ice making apparatus 108 and the holding vessel 106. In other embodiments, the ice may be actively transported from the ice making apparatus 108 to the holding vessel 106. The ice supplying apparatus 104 also includes an ice transport apparatus 26 positioned in the holding vessel 106 and configured and adapted to transport a metered portion of the ice pieces from the holding vessel 106 to the ice bagging apparatus 10.

[0044] A view window 54 in front of the ice bagging apparatus 10 allows the customer to view at least a portion of the ice bagging apparatus 10 in order to view the bagging process. Once the ice bagging apparatus 10 has determined that the opened bag contains the appropriate predetermined amount

of ice pieces, the bagged ice vending apparatus 34 delivers the bagged ice to the customer. The bagged ice vending apparatus 34 is shown with dotted lines, as it lies below the ice bagging apparatus 10. The bagged ice is released from ice bagging apparatus 10 and travels down the vending chute 34 to the vend window 112, from which the customer takes the bagged ice.

[0045] The automated ice vending machine 100 of FIG. 14 is an automated ice and liquid water vending machine. The automated ice vending machine 100 also includes a water supplying apparatus 114 and a water vending apparatus 116, including an ultraviolet light irradiating assembly 60 and a chill tank apparatus 80. The water supply apparatus 114 is a water inlet pipe coupled to any drinkable water line, preferably a liquid water line 210 receiving liquid water from a municipal liquid water source 200. The water supply apparatus 114 also supplies the liquid water to be frozen by the ice forming apparatus 108. A water inlet valve 118 preferably controls whether liquid water is supplied to the liquid water inlet 88, the ice making apparatus inlet 120, neither inlet, or both inlets. In other embodiments, separate lines controlled by separate valves may supply liquid water to the ice making apparatus 104 and the liquid water vending apparatus 116.

[0046] The water vending apparatus 116 supplies liquid water to the customer upon receipt of a valid request from the customer for liquid water through the customer request apparatus 41. The liquid water is purified by the ultraviolet light irradiating assembly 60 prior to being supplied to the customer through the liquid water vending line 76. In some embodiments, the control board 22 determines whether the control valve of the ultraviolet light irradiating assembly 60 has been actuated within a predetermined period of time prior to receiving the vend request and actuates the control valve to supply a predetermined amount of the liquid water from the irradiation zone of the ultraviolet light irradiating assembly 60 to the flush line 74, if the control valve has not been actuated within the predetermined period of time. The control board 22 then actuates the control valve to supply liquid water to the liquid water vending line 76 to supply liquid water to the customer. The liquid water is chilled by passage through the coils of the chill tank apparatus 80 prior to being supplied to the ultraviolet light irradiating assembly 60 for irradiation. Although the tank inlet line 82 is shown in FIG. 14 as receiving cold water drained from the ice making apparatus 108, the chute 110, the holding vessel 106, and the ice transferring apparatus 26 of the ice supplying apparatus 104, the tank inlet line 82 may alternately receive cold water drained from one or any combination of these parts of the ice supplying apparatus 104. The liquid water is chilled by heat exchange in the chill tank apparatus 80 with cold liquid water flushed or drained from the ice supplying apparatus 104 of the automated ice and liquid water vending apparatus 100. A tank outlet line 92 drains excess cooling water from the chill tank 80. The chill tank outlet line 90 also serves as the ultraviolet light irradiating assembly inlet line 68.

[0047] The control board 22 preferably controls and directs the automated vending process by electronic communication with the customer request apparatus 41, the ice supplying apparatus 104, including the holding vessel 106, the ice making apparatus 108, and the ice transport apparatus 26, the ice bagging apparatus 10, the water inlet valve 118, and the water vending apparatus 116, including the ultraviolet light irradiating assembly 60 and the chill tank apparatus 80. As mentioned above, the control board 22 receives and validates a

customer request for ice through the customer request apparatus 41 and initiates the ice vending process by directing the ice supplying apparatus 104 to begin supplying ice to the ice bagging apparatus 10 upon receipt of a valid request for ice from a customer. More specifically, the control board 22 directs the ice transport apparatus 26 to begin transporting ice from the holding vessel 106 to the ice bagging apparatus 10. The control board 22 also communicates with the holding vessel 106 to monitor whether the amount of ice in the holding vessel 106 is within a predetermined range. When the amount of ice in the holding vessel 106 goes below the predetermined range, the control board 22 communicates with the ice making apparatus 108 to make more ice and communicates with the water inlet valve 118 to supply water to the ice making apparatus 108. The control board 22 also communicates with the ice bagging apparatus 10 to initiate the ice bagging process and to determine when to stop the ice bagging process.

[0048] The control board 22 also receives and validates a customer request for liquid water through the customer request apparatus 41 and initiates the water vending process by directing the water vending apparatus 116 to begin supplying liquid water upon receipt of a valid request for water from a customer. The water vending process includes the control board 22 communicating with the water inlet valve 118 to supply water to the chill tank 80. The control board 22 also preferably monitors the chill tank 80, including monitoring the temperature of the chilling water received from the ice supplying apparatus 104 and the temperature of the water to be vended passing through the chill tank 80. The control board also monitors the ultraviolet light irradiating assembly 60 in order to direct the ultraviolet light irradiating assembly 60 to vend chilled, irradiated water to the customer or to flush a predetermined amount of the irradiated water that is no longer sufficiently chilled.

[0049] Accordingly, it is to be understood that the embodiments of the invention herein described are merely illustrative of the application of the principles of the invention. Reference herein to details of the illustrated embodiments is not intended to limit the scope of the claims, which themselves recite those features regarded as essential to the invention.

What is claimed is:

1. An automated ice vending apparatus comprising:
  - an ice supplying apparatus;
  - an ice bagging apparatus comprising:
    - a bag supplying apparatus supplying at least one vending bag having an open end;
    - a bag opening apparatus receiving the vending bag from the bag supplying apparatus and preparing the vending bag to receive a plurality of ice pieces from the ice supplying apparatus into the open end of the vending bag; and
  - a bag weighing apparatus comprising:
    - at least one proximity sensor; and
    - at least one beam receiver;
 wherein the proximity sensor and the beam receiver are located such that, when the vending bag is filled with the ice pieces from the ice supplying apparatus to a level preventing the beam receiver from receiving a beam from the proximity sensor, the vending bag is considered a filled ice bag and the ice supplying apparatus stops supplying ice pieces to the bag weighing apparatus;

- a bagged ice vending apparatus supplying the filled ice bag to a customer; and
  - a control board communicating with the ice supplying apparatus, the ice bagging apparatus, and the bagged ice vending apparatus to automate vending of the ice from the automated ice vending apparatus;
- wherein the bag weighing apparatus operates without using a counterweight balance or a weighing scale.
2. The automated ice vending apparatus of claim 1, wherein the ice supplying apparatus comprises:
    - an ice making apparatus receiving liquid water from a liquid water source and forming the plurality of ice pieces from the liquid water;
    - a holding vessel receiving and storing the ice pieces from the ice making apparatus; and
    - an ice transferring apparatus transferring and metering the ice pieces from the holding vessel to the ice bagging apparatus.
  3. The automated ice vending apparatus of claim 2, wherein the ice transferring apparatus comprises an ice transport apparatus selected from the group consisting of a conveyor belt, a chain, and a plurality of side-by-side rollers.
  4. The automated ice vending apparatus of claim 1, wherein the bag supplying apparatus comprises a wicket.
  5. The automated ice vending apparatus of claim 4, wherein the bag supplying apparatus further comprises a plurality of the at least one vending bag hanging on the wicket.
  6. The automated ice vending apparatus of claim 1, wherein the bag opening apparatus comprises a blower supplying moving air to the open end of the vending bag to prepare the vending bag to receive the ice pieces from the ice supplying apparatus into the open end of the vending bag.
  7. The automated ice vending apparatus of claim 1, wherein the bagged ice vending apparatus comprises:
    - a drop floor supporting the vending bag receiving the ice pieces;
    - an actuator supporting the drop floor; and
    - a vending chute below the drop floor;
 wherein when the vending bag is considered the filled ice bag, the control board activates the actuator to drop, thereby allowing the drop floor to drop under the weight of the filled ice bag, the filled ice bag falling into the vending chute; and
    - wherein when the control board activates the actuator to rise, the actuator pushes the drop floor back up to await a next vend.
  8. The automated ice vending apparatus of claim 1 further comprising at least one view window comprising at least one transparent material in a location to permit the customer to view at least a portion of the ice supplying apparatus or the ice bagging apparatus.
  9. The automated ice vending apparatus of claim 1 further comprising:
    - a liquid water supplying apparatus; and
    - an ultraviolet light irradiating assembly comprising:
      - an inlet line receiving liquid water from the liquid water supplying apparatus;
      - an irradiation zone downstream from the inlet line;
      - an ultraviolet light source irradiating the liquid water passing through the irradiation zone with ultraviolet light;
      - a flush line;

- a vending line supplying liquid water to the customer; and
  - a control valve controlling whether liquid water from the irradiation zone is supplied to the flush line, supplied to the vending line, or retained in the irradiation zone; wherein when liquid water has been retained in the irradiation zone for at least a predetermined period of time, the control valve supplies a predetermined amount of the liquid water to the flush line before supplying liquid water to the vending line.
- 10.** The automated ice vending apparatus of claim **1** further comprising:
- a liquid water supplying apparatus supplying liquid source water;
  - a chill tank comprising:
    - an insulated tank receiving cold liquid water flushed from the ice supplying apparatus; and
    - coiled tubing in heat exchange contact with the insulated tank, the coiled tubing receiving the liquid source water from the liquid water supplying apparatus, the liquid source water being cooled by heat exchange with the cold liquid water in the insulated tank as the liquid source water flows through the coiled tubing; and
  - a cold water vending line receiving the liquid source water from the coiled tubing and supplying the liquid source water to the customer.
- 11.** An automated method of delivering a plurality of ice pieces to a customer comprising:
- a) an automated ice vending apparatus receiving a request from the customer for the ice pieces;
  - b) the automated ice vending apparatus supplying the ice pieces to a vending bag having an open end until the vending bag is filled with the ice pieces to a level preventing a beam receiver from receiving a beam from a proximity sensor to produce a filled ice bag comprising the ice pieces and the vending bag without using a counterweight balance or a weighing scale; and
  - c) the automated ice vending apparatus supplying the filled ice bag to the customer.
- 12.** The automated method of claim **11** further comprising the automated ice vending apparatus receiving liquid water from a liquid water source and forming the plurality of ice pieces from the liquid water.
- 13.** The automated method of claim **11** further comprising the automated ice vending apparatus supplying moving air to the open end of the vending bag to prepare the vending bag to receive the ice pieces from the ice supplying apparatus into the open end of the vending bag.
- 14.** The automated method of claim **11** further comprising the automated ice vending apparatus activating an actuator supporting a drop floor supporting the filled ice bag to drop, thereby allowing the drop floor to drop under the weight of the filled ice bag, the filled ice bag falling into a vending chute.
- 15.** The automated method of claim **14** further comprising the automated ice vending apparatus activating the actuator to rise, the actuator pushing the drop floor back up to await a next vend.

- 16.** An automated ice vending apparatus comprising:
- an ice supplying apparatus;
  - an ice bagging apparatus receiving a plurality of ice pieces from the ice supplying apparatus into an open end of a vending bag to form a filled ice bag comprising the vending bag and the ice pieces in the vending bag;
  - a bagged ice vending apparatus supplying the filled ice bag to a customer; and
  - at least one view window comprising at least one transparent material in a location to permit the customer to view at least a portion of the ice supplying apparatus or the ice bagging apparatus.
- 17.** The automated ice vending apparatus of claim **16**, wherein the ice bagging apparatus comprises:
- a bag supplying apparatus supplying at least one vending bag having an open end;
  - a bag opening apparatus receiving the vending bag from the bag supplying apparatus and preparing the vending bag to receive a plurality of ice pieces from the ice supplying apparatus into the open end of the vending bag; and
  - a bag weighing apparatus determining when the vending bag is considered a filled ice bag and causing the ice supplying apparatus to stop supplying ice pieces to the bag weighing apparatus.
- 18.** The automated ice vending apparatus of claim **17**, wherein the bag weighing apparatus comprises:
- at least one proximity sensor; and
  - at least one beam receiver;
- wherein the proximity sensor and the beam receiver are located such that, when the vending bag is filled with the ice pieces from the ice supplying apparatus to a level preventing the beam receiver from receiving a beam from the proximity sensor, the vending bag is considered the filled ice bag and the ice supplying apparatus stops supplying ice pieces to the bag weighing apparatus.
- 19.** The automated ice vending apparatus of claim **16** further comprising a control board communicating with the ice supplying apparatus, the ice bagging apparatus, and the bagged ice vending apparatus to automate vending of the ice from the automated ice vending apparatus.
- 20.** The automated ice vending apparatus of claim **16**, wherein the ice supplying apparatus comprises:
- an ice making apparatus receiving liquid water from a liquid water source and forming the plurality of ice pieces from the liquid water;
  - a holding vessel receiving and storing the ice pieces from the ice making apparatus; and
  - an ice transferring apparatus transferring and metering the ice pieces from the holding vessel to the ice bagging apparatus.
- 21.** The automated ice vending apparatus of claim **20**, wherein the ice transferring apparatus comprises an ice transport apparatus selected from the group consisting of a conveyor belt, a chain, and a plurality of side-by-side rollers.
- 22.** The automated ice vending apparatus of claim **16**, wherein the bag supplying apparatus comprises a wicket.
- 23.** The automated ice vending apparatus of claim **22**, wherein the bag supplying apparatus further comprises a plurality of the at least one vending bag hanging on the wicket.

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