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(54) **ICE MAKER COOLER**

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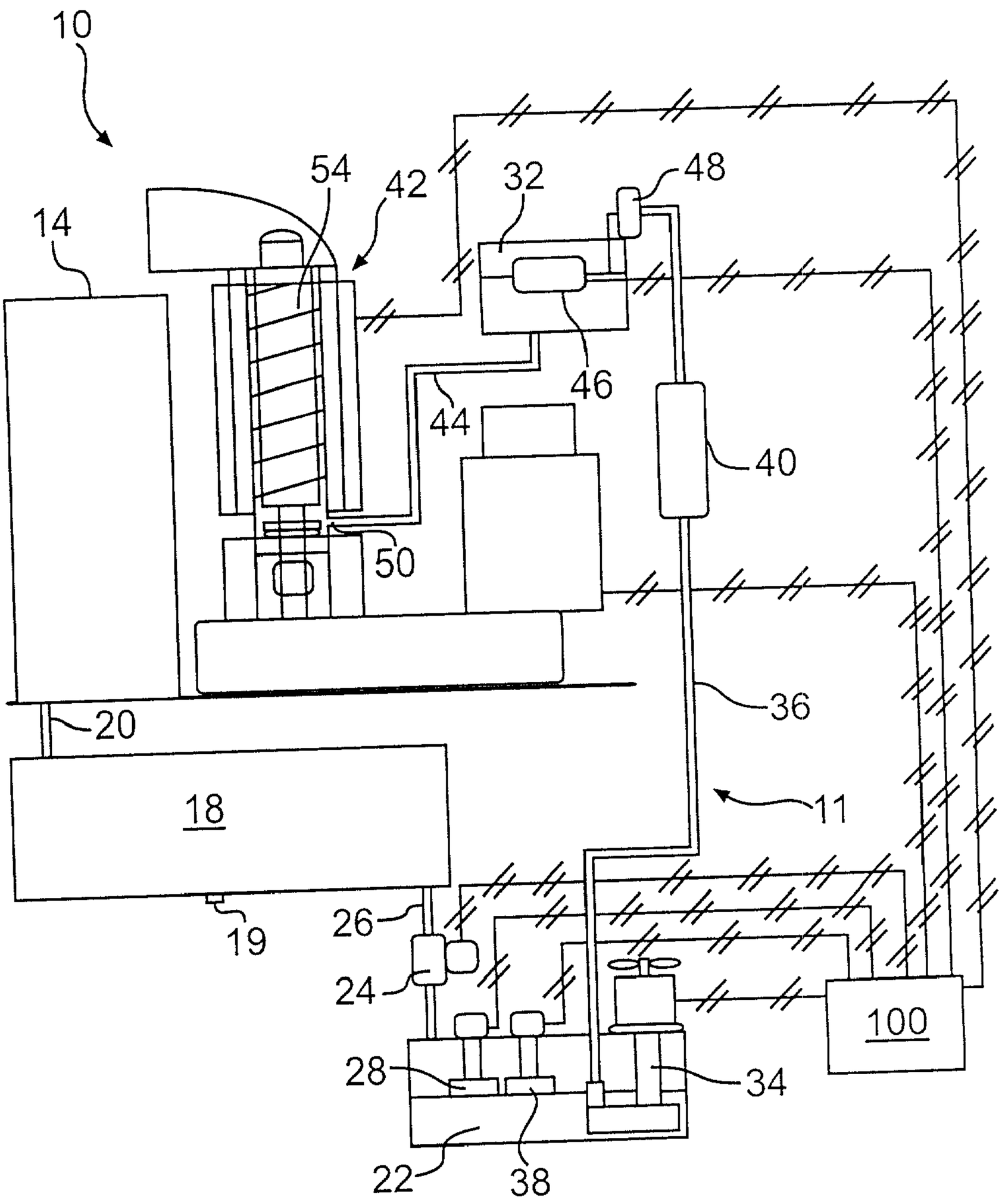
(57) **ABSTRACT**

An ice-making system may include a bin configured to contain an initial quantity of water and an ice making assembly configured to make ice solely from the initial quantity of water. A conveyor may be configured to transport the ice from the ice making assembly to the bin, and a water circuit may be configured to re-circulate the initial quantity of water through the ice making assembly.



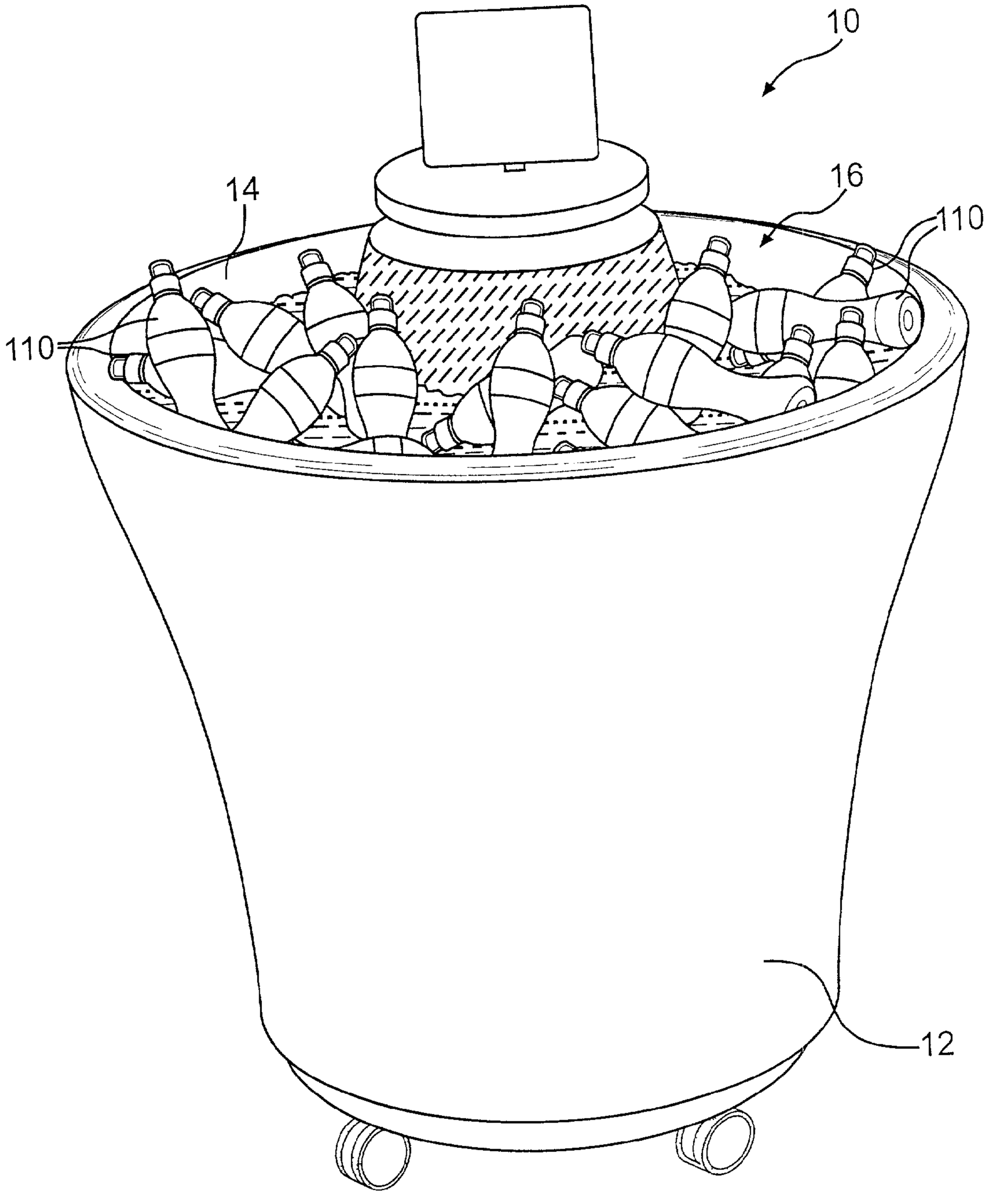



FIG. 1

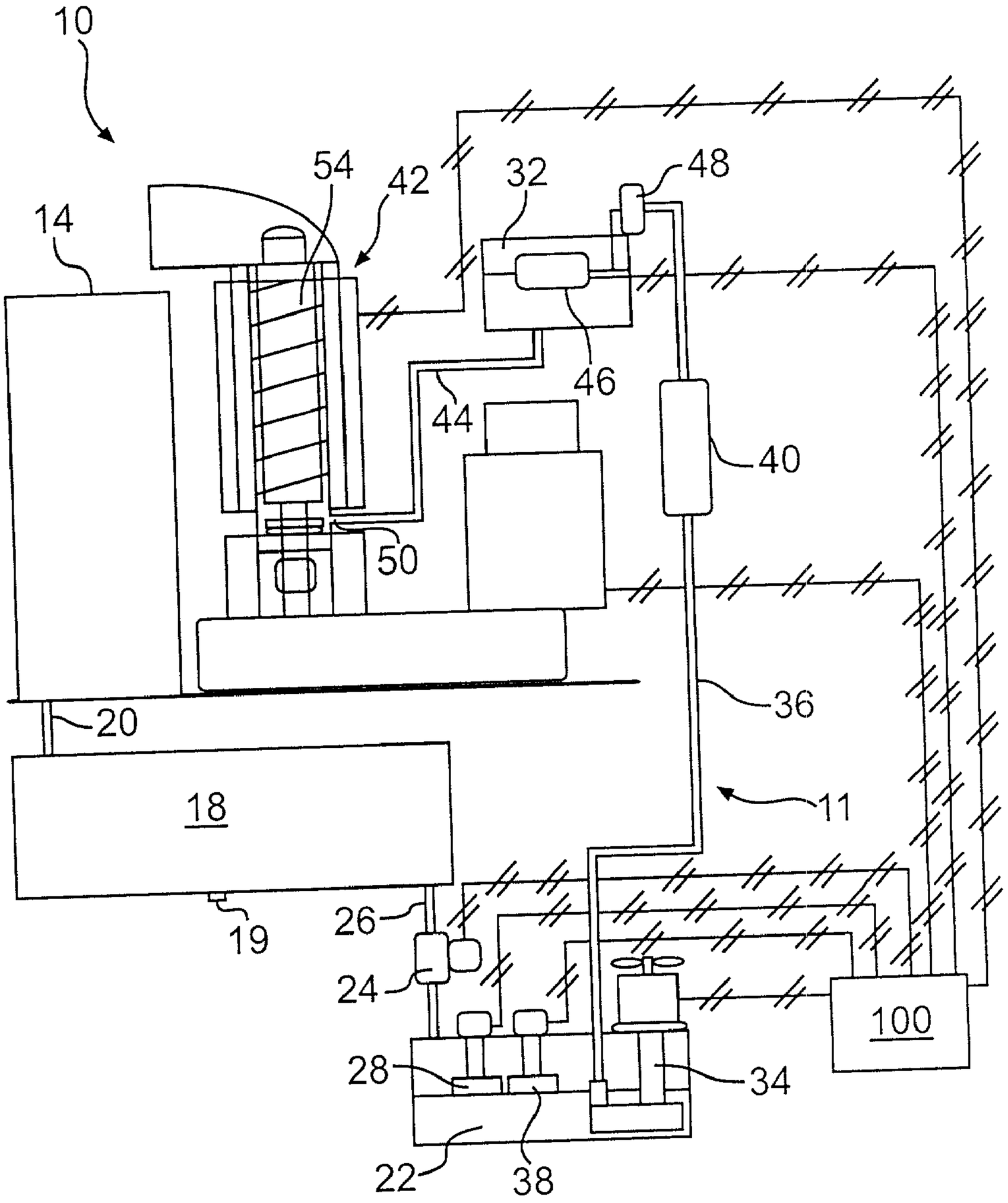



FIG. 2

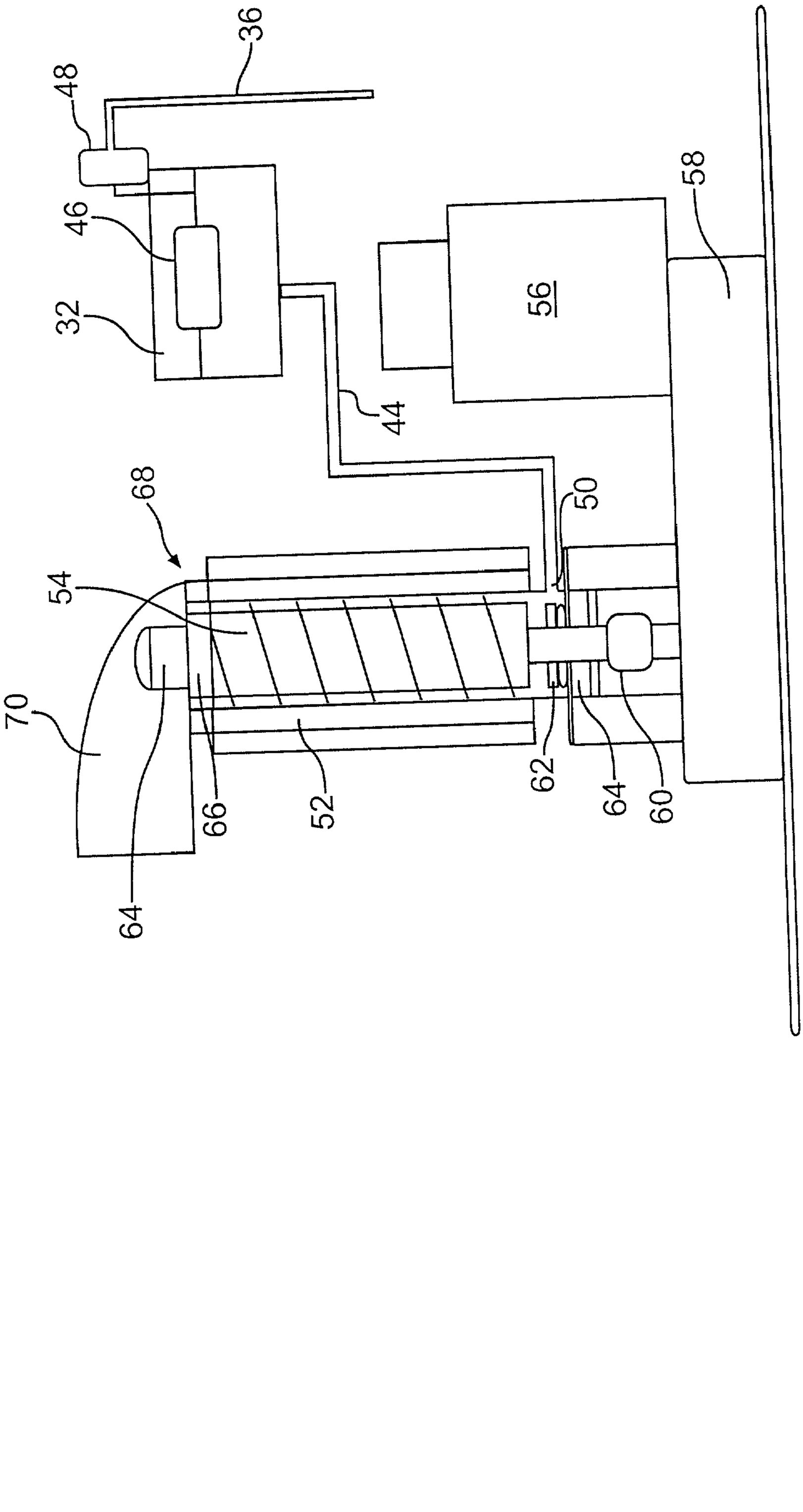



FIG. 3

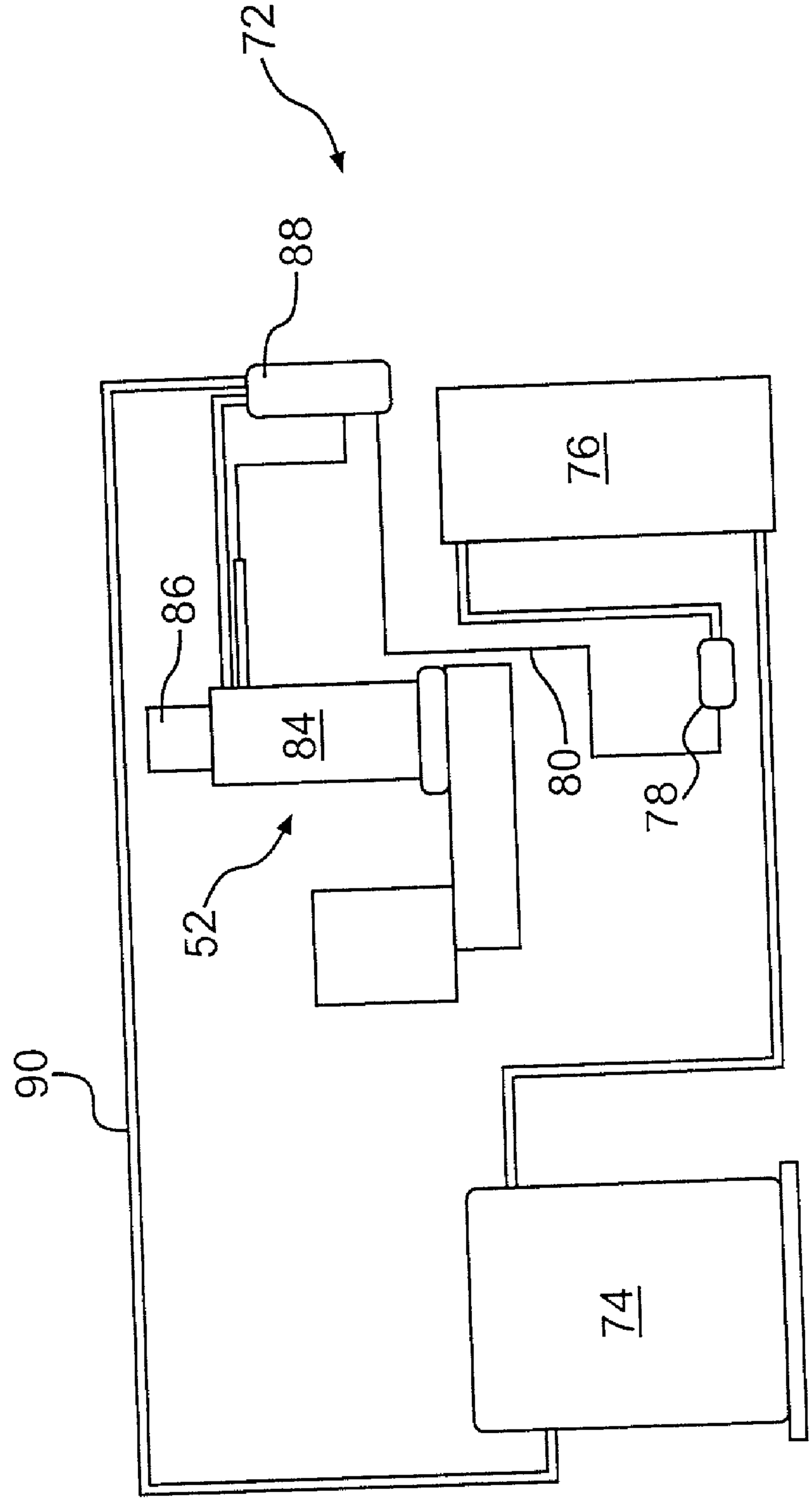



FIG. 4

# ICE MAKER COOLER

## TECHNICAL FIELD

[0001] The invention relates generally to a cooler and, more particularly, to an ice maker cooler configured to contain, display, and/or cool products, for example, beverage containers, produce, and the like.

## BACKGROUND

[0002] Conventional coolers include a compartment for containing one or more products. Often times, the compartment completely encloses the products such that ice or mechanical cooling mechanisms can maintain the products at a desired temperature below ambient temperature. Other times, the compartment may be open such that the products are prominently displayed. These open compartments typically contain ice to maintain the products at a desired temperature.

[0003] In conventional coolers that use ice to maintain products at a desired temperature, the ice is typically loaded manually into a storage compartment together with the products. When ambient air temperature is above freezing, the ice eventually melts and the quantity of ice becomes depleted. If someone monitors the cooler, additional ice may be manually loaded into the storage compartment at an appropriate time. The compartment may include a drain to allow the meltdown water from the ice to exit the compartment. The drain may communicate with a waste water outlet or a waste bucket.

[0004] Conventional ice dispensers and cold drink vendors with ice dispensers re-circulate meltdown water by continuously pumping the meltdown water back to an ice maker reservoir. In these systems, the ice produced by the ice maker and the recirculated meltdown water are intended for human consumption in either solid or liquid form. Thus, these systems require a constant water source to continuously generate additional ice and cold drinks.

## SUMMARY OF THE INVENTION

[0005] According to one optional aspect of the invention, an ice maker and cooler apparatus for displaying products may comprise a bin configured to contain ice and the products. The bin may include an access opening configured to receive and display the products. The apparatus may also comprise an ice making assembly configured to make the ice, a conveyor configured to transport ice from the ice making assembly to the bin, and a recirculation system configured to recirculate meltdown water from the ice contained in the bin.

[0006] According to another optional aspect of the invention, a system for displaying chilled products may comprise a chamber configured to hold and display the chilled products, an ice making assembly configured to periodically feed a stream of ice particles to the chamber, and a control system configured to sense an amount of water in a region of the ice making assembly and to enable the ice making assembly when the sensed amount of water reaches a predetermined, or threshold, level.

[0007] According to yet another optional aspect of the invention, an ice maker and cooler apparatus for displaying products may comprise a housing configured to contain at least one component of the apparatus. The apparatus may also comprise a refrigeration system including a compressor and an evaporator, a bin configured to contain ice and the products, and an ice making chamber having the refrigeration system evaporator therein for making ice. The apparatus may further comprise a first reservoir configured to receive a supply of water from the bin and a second reservoir in fluid communication with the ice making chamber. The apparatus may also comprise a conveyor configured to transport ice from the ice making chamber to the bin and a sensor in the first reservoir for determining when the water level therein is above or below a threshold level; and. A pump may be provided in fluid communication with the first and second reservoirs for pumping water from the first reservoir to the second reservoir when the water level sensed is above said threshold level.

[0008] According to another optional aspect of the invention, a method for making ice may comprise loading an ice making system with an initial quantity of water as a sole source of water and making ice from the initial quantity of water. The method may also comprise conveying the ice made from the initial quantity of water to a bin and recirculating meltdown water from the bin. The meltdown water may solely comprise meltdown water from the ice made from the initial quantity of water.

[0009] According to still another optional aspect of the invention, an ice-making system may comprise a bin configured to contain an initial quantity of water, an ice making assembly configured to make ice solely from the initial quantity of water, a conveyor configured to transport the ice from the ice making assembly to the bin, and a water circuit configured to re-circulate the initial quantity of water through the ice making assembly.

[0010] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate exemplary embodiments of the invention and, together with the description, serve to explain the principles of the invention. In the drawings,

[0012] **FIG. 1** is a perspective view of an ice maker cooler in accordance with an embodiment of the present invention;

[0013] **FIG. 2** is a schematic view of an ice maker cooler in accordance with an embodiment of the present invention;

[0014] **FIG. 3** is a schematic view of a exemplary freezer assembly of the ice maker cooler of **FIG. 2**; and

[0015] **FIG. 4** is a schematic view of an exemplary refrigerant circuit associated with a freezer assembly of the ice maker cooler of **FIG. 2**.

## DETAILED DESCRIPTION

[0016] Reference will now be made in detail to embodiments of the invention, examples of which are illustrated in the accompanying drawings.

[0017] In accordance with the present invention, an ice maker cooler is provided. Referring to **FIGS. 1 and 2**, an ice

maker cooler **10** may include a housing **12** and a bin **14**. The housing **12** may contain mechanical and/or electrical components of the cooler **10**. The bin **14** may contain ice and/or products, for example, containers such as beverage containers, produce, and the like. The bin **14** may have an access opening **16**, for example, and open top, a side opening, or the like, that facilitates loading of the bin **14** and viewing of the products and/or ice contained in the bin **14**.

[**0018**] Referring to **FIG. 2**, the cooler **10** may include a fluid circuit **11**, for example, a water circuit. The circuit **11** may comprise the bin **14** and a tank **18**, for example, a water tank, in fluid communication with the bin **14** via drain line **20**. The drain line **20** may comprise a flexible hose, a rigid tube, or the like. It should be appreciated that more than one drain line may provide fluid communication between the bin **14** and the tank **18**. The capacity of the tank **18** may be varied according to design criteria, for example, capacity of the circuit **11**, the bin **14**, etc. The tank **18** may include a filter (not shown), for example, a metal strainer. The filter may be configured to remove relatively large particles from the water before the water exits the tank **18**. The tank **18** may also include a drain port **19** for facilitating periodic draining of the water from the cooler.

[**0019**] The water circuit **11** may also include a first reservoir **22** in fluid communication with the tank **18**. A solenoid valve **24** may be associated with a flow line **26** between the tank **18** and the first reservoir **22**. A first sensor **28** may be disposed in the first reservoir **22**. The first sensor **28** may comprise, for example, a float switch configured to energize and de-energize the solenoid valve **24** when the water level in the first reservoir **22** is above or below a threshold level. As a result, the flow of water into the first reservoir **22** and the water level in the first reservoir **22** may be controlled. The first reservoir **22** may be associated with a pump **34**.

[**0020**] The water circuit **11** may further include a second reservoir **32** in fluid communication with the first reservoir **22**. The pump **34** may be associated with a flow line **36** providing the fluid communication between the first and second reservoirs **22**, **32**. The pump **34** may be configured to pump water from the first reservoir **22** to the second reservoir **32**.

[**0021**] A second sensor **38** may be disposed in the first reservoir **22**. The second sensor **38** may comprise, for example, a float switch configured to energize and de-energize the pump **34** when the water level in the first reservoir **22** is above or below a threshold level. As a result, the flow of water from the first reservoir **22** to the second reservoir **32** may be controlled.

[**0022**] A filter **40** may be associated with the flow line **36** between the first and second reservoirs **22**, **32**. The filter **40** may reduce the impurities in the water being pumped to the second reservoir **32** and subsequent components of the cooler **10** including the water circuit **11**. The filter **40** may eliminate, for example, small particles and color from the water. The filter **40** may comprise, for example, a twenty micron filter.

[**0023**] The cooler **10** may comprise a freezer assembly, for example, an ice maker assembly **42**. The water circuit **11** may comprise portions of the ice maker assembly **42**. A flow line **44** may provide fluid communication between the second reservoir **32** and the ice maker assembly **42**. A sensor assembly **46** may be disposed in the second reservoir **32**. The sensor assembly **46** may comprise, for example, a float valve and/or a float switch. The sensor assembly **46** may be configured to control the level of water in the second reservoir **32**. For example, a mechanical float valve may shut off the inlet **48** to the second reservoir **32** when the water level in the second reservoir reaches a predetermined maximum level. Additionally or alternatively, a float may be configured to disable operation of the cooler **10** when the water level in the second reservoir **32** is below a threshold level.

[**0024**] Referring to **FIG. 3**, the ice maker assembly **42** may comprise an inlet **50** configured to receive water from the second reservoir **32** via flow line **44**. The ice maker assembly **42** may also include a freezing cylinder **52** and a conveyor, for example, an auger **54**. The freezing cylinder **52** may be concentric with and/or surround the auger **54**. The auger **54** may comprise, for example, stainless steel.

[**0025**] The auger **54** may be rotatably held by bearings **64** and may be configured to rotate counter-clockwise relative to the freezing cylinder **52**. The auger **54** may be driven by a motor **56**, for example, a direct drive gear motor optionally including a gear reducer **58**. The motor **56** may be connected to the auger **54** by any well-known coupling **60**. A water seal **62** may be provided to prevent water from entering the motor **56**.

[**0026**] The freezer assembly **42** may also comprise an ice breaker **66** disposed at an output end **68** of the auger **54** and freezing cylinder **52**. The ice breaker **66** may include teeth (not shown) configured to crack ice as the ice is forced to the outlet end **68** by rotation of the auger **54**. The freezer assembly **42** may further include a chute **70**, for example, an inverted funnel spout, disposed adjacent to the ice breaker **66** at the output end **68** of the auger **54**. The chute **70** may be spaced vertically above the bin **14** and configured to distribute ice to the bin **14**. The shape and size of the chute **70** and the bin **14**, as well as the spacing between them, may be varied as desired.

[**0027**] Referring to **FIG. 4**, the freezing cylinder **52** may be associated with an optional refrigerant circuit, for example, exemplary refrigerant circuit **72**. The exemplary circuit **72** may include a compressor **74**, a condenser **76**, a drier filter **78**, and a capillary tube **80**. In operation, a refrigerant, for example, a hot gas refrigerant, may be discharged from the compressor **74** toward the condenser **76**. After being cooled down at the condenser **76**, the gas condenses into liquid. The liquid may pass through the drier filter **78** and continue through the capillary tube **80**, where the liquid loses some of its pressure such that its pressure and temperature are lowered. The refrigerant may eventually enter an evaporator coil **84** wrapped around an inner tube **86** of the freezing cylinder **52**. As water is fed to an interior of inner tube **86**, heat exchange may take place between the water and the refrigerant in the evaporator coil **84**, causing the refrigerant to boil off and evaporate, i.e., changing from liquid to vapor. The vapor refrigerant may pass through a suction accumulator **88** and through a suction line **90** before being sucked into the compressor **74** to be re-circulated.

[**0028**] The cooler **10** may also comprise a controller **100** in electrical communication with one or more components of the cooler **10**, for example, the sensors **28**, **38**, the sensor

assembly **46**, the pump **34**, the solenoid valve **24**, the freezer assembly **42**, and/or the motor **56**. The controller **100** may be configured to control operation of one or more of these and other components. The controller **100** may also be configured to receive operator inputs so as accommodate user-defined changes in sensor sensitivity, pump speed, freezer temperature, and the like.

[**0029**] Referring again to **FIG. 2**, the ice maker cooler **10** may operate in a self-contained manner. That is, the cooler **10** and the water circuit **11** do not need to be connected to a water supply line. An initial quantity of water may be supplied to the cooler and that quantity may be re-circulated through a closed-loop water circuit. The initial quantity of water may be removed and replaced periodically.

[**0030**] An initial quantity of water in a liquid and/or frozen state may be manually loaded into the bin **14** of the cooler **10**. In either case, the water or meltdown water from the ice will eventually flow from the bin **14** to the water tank **18**. The initial quantity of water may be measured prior to loading so as not to exceed the capacity of the cooler **10**. Alternatively the tank **18** may be sized in accordance with a capacity of the cooler **10**. Thus, an unmeasured quantity of water may be poured into the bin **14**. The water will drain into the tank **18** until the tank is filled, at which time water will back up into the bin **14**. Pouring of water may cease and excess water in the bin **14** may be drained, for example, by opening the tank drain port **19** until the bin is empty.

[**0031**] If the first sensor **28** senses a water level in the first reservoir **22** less than a threshold level, the controller **100** may control operation of the solenoid valve **24** to allow water to flow from the tank **18** to the first reservoir **22**. If the first sensor **28** senses a water level in the first reservoir **22** greater than a threshold level, the controller **100** may control operation of the solenoid valve **24** to prevent water from flowing from the tank **18** to the first reservoir.

[**0032**] If the second sensor **38** senses a water level in the first reservoir **22** greater than a threshold level, the controller **100** may control operation of the pump **34** to pump water from the first reservoir **22** to the second reservoir **32**. The water may pass through a filter **40** while traveling to the second reservoir **32**. If the second sensor **38** senses a water level in the first reservoir less than a threshold level, the controller **100** may prevent water from being be pumped from the first reservoir **22** to the second reservoir **32**.

[**0033**] Optionally, the pump **34** may operate as long as the first reservoir **22** contains some amount of water. The sensor assembly **46** may open the inlet **48** as long as the assembly **46** senses a water level in the second reservoir **32** below a threshold level, thereby allowing water pumped from the first reservoir **22** to enter the second reservoir **32**. If the sensor assembly **46** senses a water level above a threshold level, the assembly **46** may close the inlet **48**. For example, the assembly may comprise a mechanical valve. Although the pump **34** may continue to operate, the pressure supplied by the pump may not be great enough to open the inlet **48**.

[**0034**] If the sensor assembly **46** senses a water level in the second reservoir **32** less than a threshold level, the controller **100** may stop operation of the cooler. Additionally or alternatively, the sensor assembly **46** may sense an inadequate water quality, for example, excessively soft water, and the controller **100** may consequently stop operation of the cooler.

[**0035**] As shown in **FIG. 2**, the water may enter the freezer assembly **42** by way of an inlet **50** disposes at a bottom end of a vertically-arranged freezing cylinder **52**. Refrigerant in the evaporator coil **84** causes water near the inner tube **86** of the freezing cylinder **52** to freeze into ice, for example, flakes of ice. The conveyor or auger **54** carriers the ice upward along the refrigerated inner wall of the inner tube **86**. As a result, the ice gets progressively thicker and harder as it travels vertically through the freezer assembly **42**.

[**0036**] As the auger **54** forces the ice toward the outlet end **68**, the ice may engage the ice breaker **66**. The auger **54** and the ice breaker **66** may cooperate to compact and crack the ice. The ice breaker **66** may cause the ice to lose any excess water content such that very hard, dry bits of ice may result.

[**0037**] The ice may eventually be forced from the auger **54** and into the distributor spout **70**. The spout **70** may be configured to receive the ice forced through the outlet end **68** by the auger **54** and to direct the ice into the bin **14**. As the spout **70** may be positioned vertically above the bin **14**, consumers may see the falling ice being directed from the spout **70** to the bin **14**. The audible and visual effects of the falling ice may attract the attention of consumers.

[**0038**] Products **110** may be loaded into the bin **14** at any time. As the ice is directed into the bin **14** from the spout **70**, the ice may contact and/or at least partially cover the products **110**. The visual effect of the products **110** mixed among the ice in the bin **14** may enhance the perception of an ice-cold refreshment.

[**0039**] After being in contact with ambient air, the ice may eventually melt. The meltdown water from the ice may be collected back into the tank **18** and re-circulated through the water circuit as just described.

[**0040**] It should be appreciated that any one or more of the tank **18**, the first reservoir **22**, and the second reservoir **32** may be referred to as a reservoir assembly.

[**0041**] It should also be appreciated that the cooler **10** may be equipped with a drain in communication with a waste-water line or a waste bucket. Such a drain may facilitate emptying of the water at desired intervals. At such time, fresh water and/or fresh ice may be loaded into the cooler **10** by way of, for example, the bin **14**.

[**0042**] It should further be appreciated that the cooler **10** may equipped with other devices to attract the attention of consumers. For example, lights and/or movable devices may be associated with the cooler **10**. Optionally, a rotating device with internal illumination may be mounted on the top of the spout **70**.

[**0043**] While the exemplary embodiment is described with respect to water, it should be appreciated that other liquids may be employed in the cooler **10**. For example, a liquid combination of water and an icing agent may be employed to raise the freezing temperature of the liquid above that of water.

[**0044**] It should be appreciated that the controller **100** may comprise a general purpose or special purpose computer, a programmed microprocessor or microcontroller and peripheral integrated circuit elements, an ASIC or other integrated circuit, a hardware electronic or logic circuit such as a discrete element circuit, a programmable logic device such

as a PLD, PLA, FPGA or PAL, or the like. In general, any device on which a finite state machine capable of implementing the operation of the cooler **10** can be used to implement the controller functions of this invention.

[**0045**] It will be apparent to those skilled in the art that various modifications and variations can be made to the ice maker cooler without departing from the scope or spirit of the invention. Other embodiments of the invention will be apparent to those skilled in the art from consideration of the specification and practice of the invention disclosed herein. It is intended that the specification and examples be considered as exemplary only, with a true scope and spirit of the invention being indicated by the following claims and their equivalents.

What is claimed is:

**1**. An ice maker and cooler apparatus for displaying products, comprising:

a bin configured to contain ice and the products, the bin comprising an access opening configured to receive and display the products;

an ice making assembly configured to make the ice;

a conveyor configured to transport ice from the ice making assembly to the bin; and

a recirculation system configured to recirculate meltdown water from the ice contained in the bin.

**2**. The apparatus of claim 1, further comprising a chute having an input end in communication with the conveyor and an output end configured to deliver the ice into the bin.

**3**. The apparatus of claim 2, wherein the chute is configured to deliver ice through the access opening and onto at least one of said products.

**4**. The apparatus of claim 3, wherein the access opening comprises an opening in a top wall of the bin.

**5**. The apparatus of claim 1 further comprising:

a reservoir assembly configured to receive meltdown fluid from the bin; and

a controller, the controller configured to operate the ice making assembly when a level of fluid in the reservoir assembly exceeds a threshold level.

**6**. The apparatus of claim 5 further comprising a sensor associated with the reservoir assembly, the sensor being configured to sense the level of fluid in the reservoir and to communicate with the controller.

**7**. The apparatus of claim 6, wherein the fluid comprises water.

**8**. The apparatus of claim 1, wherein the conveyor comprises a rotary auger.

**9**. The apparatus of claim 8, wherein the ice making assembly comprises an ice making chamber, and wherein at least a portion of the rotary auger is in the ice making chamber.

**10**. The apparatus of claim 8, further comprising an ice breaking device at an output end of the rotary auger adjacent to an output end of the ice making chamber.

**11**. The apparatus of claim 1, further comprising a housing configured to contain at least one component of the ice making assembly.

**12**. A system for displaying chilled products, comprising:

a chamber configured to hold and display the chilled products;

an ice making assembly configured to periodically feed a stream of ice particles to the chamber; and

a control system configured to sense an amount of water in a region of the ice making assembly and to enable the ice making assembly when the sensed amount of water reaches a threshold level.

**13**. The system of claim 12, wherein the chamber comprises an opening configured to receive the stream of ice particles, and wherein the stream of ice particles is visible to a consumer through the opening of the chamber.

**14**. The system of claim 13, wherein the opening comprises an open top in the chamber, the open top being configured to accommodate loading the bin with chilled products and viewing at least one of the chilled products and ice in the bin.

**15**. The system of claim 12, wherein the ice making assembly comprises:

a conveyor configured to transport ice particles to the chamber; and

a chute having an input end in communication with the conveyor and an output end configured to deliver the stream of ice particles onto at least one of the chilled products.

**16**. The system of claim 15, wherein the conveyor comprises a rotary auger, and wherein the ice making assembly comprises an ice making chamber, at least a portion of the rotary auger being in the ice making chamber.

**17**. The system of claim 16, further comprising an ice breaking device at an output end of the rotary auger adjacent to an output end of the ice making chamber.

**18**. The system of claim 12, said region of the ice making assembly comprises a reservoir assembly configured to receive meltdown fluid from the chamber.

**19**. The system of claim 18, wherein the control system comprises:

a controller; and

a sensor associated with the reservoir assembly, the sensor being configured to sense the level of fluid in the reservoir assembly and to communicate with the controller.

**20**. The system of claim 19, wherein the fluid comprises water.

**21**. An ice maker and cooler apparatus for displaying products, comprising

a housing configured to contain at least one component of the apparatus;

a refrigeration system including a compressor and an evaporator;

a bin configured to contain ice and the products;

an ice making chamber having the refrigeration system evaporator therein for making ice;

a first reservoir configured to receive a supply of water from the bin;

a second reservoir in fluid communication with the ice making chamber, the second reservoir being configured to supply water to the evaporator for making the ice;

a conveyor configured to transport ice from the ice making chamber to the bin;

a sensor in the first reservoir for determining when the water level therein is above or below a threshold level; and

a pump in fluid communication with the first and second reservoirs for pumping water from the first reservoir to the second reservoir when the water level sensed is above said threshold level.

**22**. The apparatus of claim 21, further comprising:

a sensor in the second reservoir for determining when water therein is above or below a threshold quantity; and

a controller associated with the sensor in the second reservoir, the controller being configured to disable the apparatus when the water quantity sensed is below the threshold quantity.

**23**. The apparatus of claim 21, wherein the supply of water comprises an initial quantity of water manually introduced into the bin.

**24**. The apparatus of claim 22, wherein the initial quantity of water comprises at least one of ice and liquid.

**25**. The apparatus of claim 22, wherein the initial quantity of water comprises a sole water supply of the apparatus, and wherein the initial quantity of water is re-circulated by the apparatus.

**26**. The apparatus of claim 21, wherein the bin comprises a top opening for loading the bin with products and viewing the products and ice therein.

**27**. The apparatus of claim 26, further comprising a chute having an input end in communication with the conveyor and an output end for delivering ice through the top opening of the bin onto at least one of the products.

**28**. The apparatus for claim 21, wherein the conveyor comprises a rotary auger in the ice making chamber.

**29**. The apparatus of claim 28, further comprising an ice breaking device at an output end of the auger adjacent to an output end of the ice making chamber.

**30**. The apparatus of claim 21 further comprising an electric power supply for energizing the conveyor and ice making system, and wherein the refrigeration system comprises an electrically-powered mechanical refrigeration system.

**31**. A method for making ice, comprising:

loading an ice making system with an initial quantity of water as a sole source of water;

making ice from the initial quantity of water;

conveying the ice made from the initial quantity of water to a bin; and

recirculating meltdown water from the bin, the meltdown water solely comprising meltdown water from the ice made from the initial quantity of water.

**32**. The method of claim 31, further comprising:

sensing a level of water in a reservoir associated with the ice making system; and

controller operation of the ice making system in response to the sensed level of water in the reservoir.

**33**. The method of claim 32, wherein said controlling operation comprises disabling the ice making system when the sensed level of water is below a threshold level.

**34**. The method of claim 31, wherein said conveying comprises transporting ice from an ice making assembly to the bin.

**35**. The method of claim 34, wherein said transporting comprises distributing ice onto at least one product contained in the bin.

**36**. An ice-making system, comprising:

a bin configured to contain an initial quantity of water;

an ice making assembly configured to make ice solely from the initial quantity of water;

a conveyor configured to transport the ice from the ice making assembly to the bin; and

a water circuit configured to re-circulate the initial quantity of water through the ice making assembly.

**37**. The system of claim 36, further comprising:

a sensor configured to sense a level of water in a reservoir associated with the ice making system; and

a controller configured to control operation of the ice making system in response to the sensed level of water in the reservoir.

**38**. The system of claim 37, wherein said controller is configured to disable the ice making system when the sensed level of water is below a threshold level.

**39**. The system of claim 36, wherein said conveyor comprises an auger configured to transport ice from an ice making assembly to the bin.

**40**. The system of claim 36, further comprising a chute, the chute being configured to receive ice from the conveyor and distribute the ice onto at least one product contained in the bin.

* * * * *