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(12) **United States Patent**
Groesbeck

(10) **Patent No.: US 9,738,506 B2**
(45) **Date of Patent: Aug. 22, 2017**

(54) **BAG-IN-BOX ADAPTER FOR WATER DISPENSER**

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(72) Inventor: **Robert Clay Groesbeck**, Salt Lake City, UT (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/080,416**

(22) Filed: **Mar. 24, 2016**

(65) **Prior Publication Data**

US 2016/0207751 A1 Jul. 21, 2016

Related U.S. Application Data

(63) Continuation-in-part of application No. 14/490,670, filed on Sep. 19, 2014, which is a continuation-in-part of application No. 13/844,806, filed on Mar. 16, 2013, now Pat. No. 9,227,828.

(51) **Int. Cl.**
B67D 3/00 (2006.01)

(52) **U.S. Cl.**
CPC ***B67D 3/0032*** (2013.01); ***B67D 3/0009*** (2013.01); ***B67D 3/0067*** (2013.01); ***B67D 3/0083*** (2013.01); *B67D 2210/00062* (2013.01)

(58) **Field of Classification Search**
CPC B67D 3/008; B67D 3/0035; B67D 3/0038; B67D 3/0067; B67D 3/0093
USPC 141/351, 363–366; 222/146.6, 160, 222/185.1
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,060,703	A *	10/1962	Benua	F25D 31/002 222/105
3,688,950	A *	9/1972	Laurence	B67D 3/00 222/146.1
3,843,021	A *	10/1974	Schieser	B65D 77/06 222/105
6,098,844	A *	8/2000	Nicolle	B67B 7/28 222/105
6,398,073	B1 *	6/2002	Nicolle	B67B 7/28 222/105
6,442,960	B1 *	9/2002	Fournier	B67D 1/07 222/146.6
6,557,735	B1 *	5/2003	Stray	B67D 3/0029 222/185.1

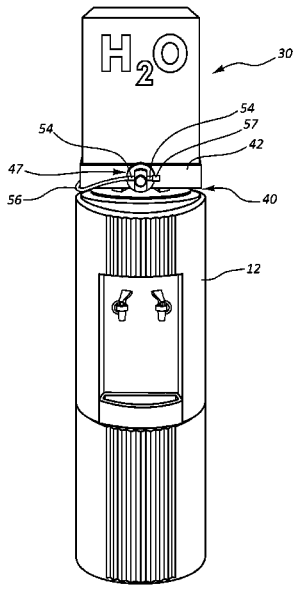
(Continued)

Primary Examiner — Timothy L Maust
(74) *Attorney, Agent, or Firm* — Thorpe North & Western LLP

(57) **ABSTRACT**

An adapter to convert a conventional water cooler designed for use with substantially rigid water bottles as the source of water to use of bag-in-box liquid containers as the source of water includes a holder for removably holding a bag-in-box liquid container in place of the water bottle at the top of the water cooler and a liquid supply line connectable to a bag dispensing fitting of a bag-in-box liquid container positioned in the holder and a water bottle opening cap engaging pin above a water reservoir in the water cooler. Water from the bag-in-box liquid container can flow by gravity from the bag-in-box liquid container through the liquid supply line and the water bottle opening cap engaging pin into the reservoir. A water level controller to control the flow of water from the bag-in-box container into the water reservoir to control the level of water in the reservoir can also be included.

16 Claims, 25 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

7,331,487	B2 *	2/2008	Macler, II	B67B 7/28 222/105
7,975,879	B2 *	7/2011	Groesbeck	B65D 5/4204 220/4.01
8,875,944	B2 *	11/2014	Shiotani	B67D 3/0009 141/352
9,227,828	B2 *	1/2016	Groesbeck	B67D 3/0067

* cited by examiner

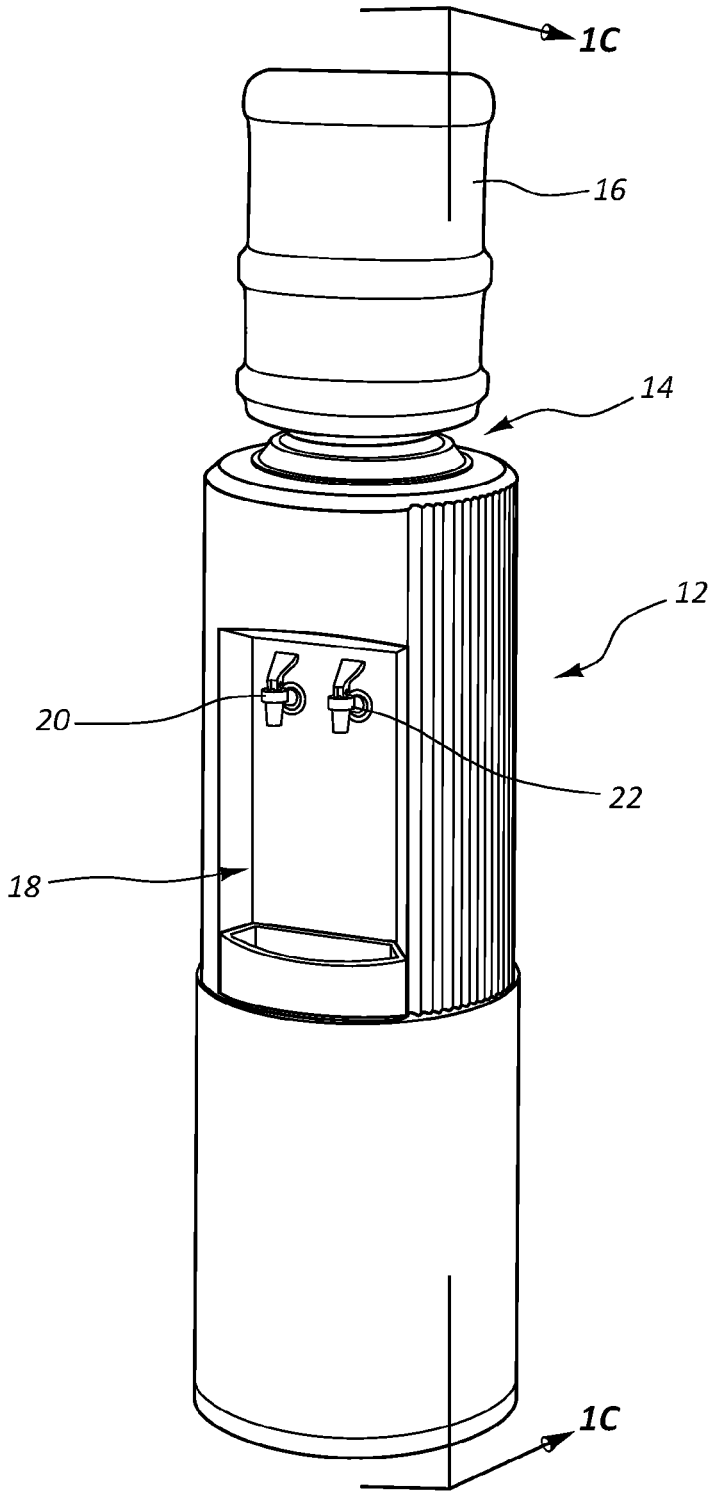


FIG. 1A
(Prior Art)

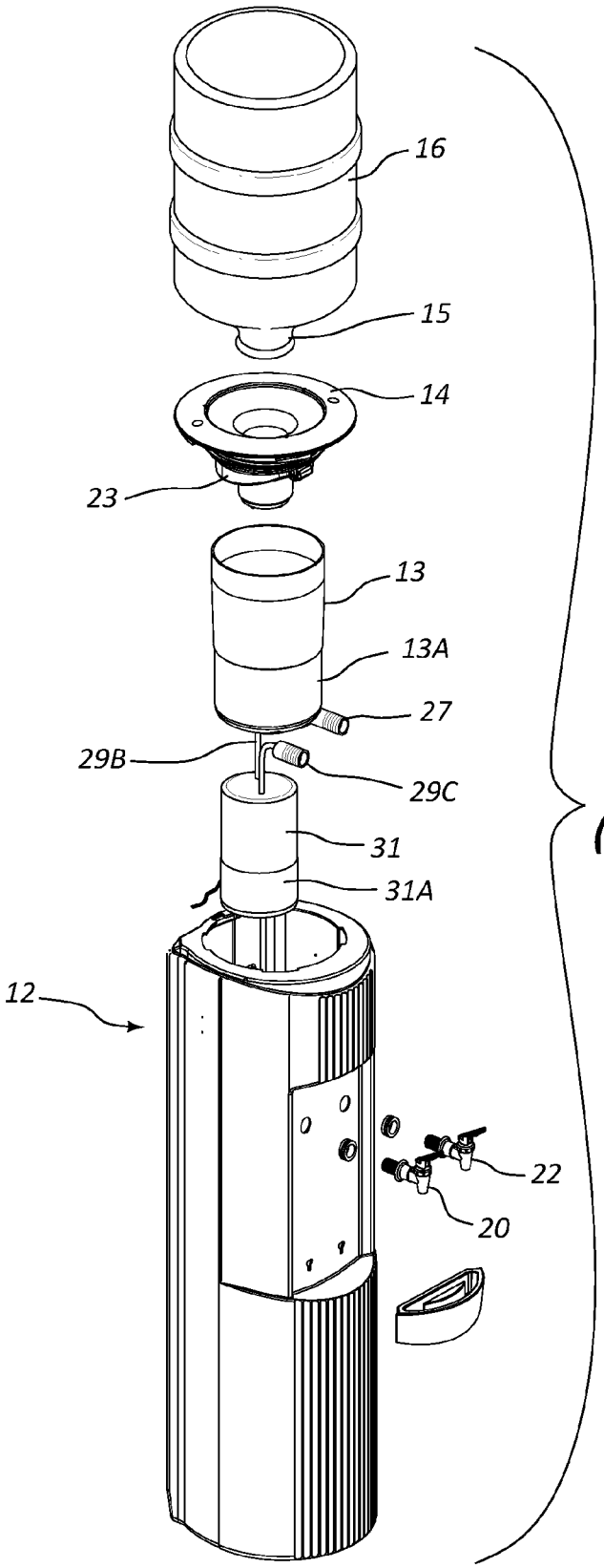


FIG. 1B
(Prior Art)

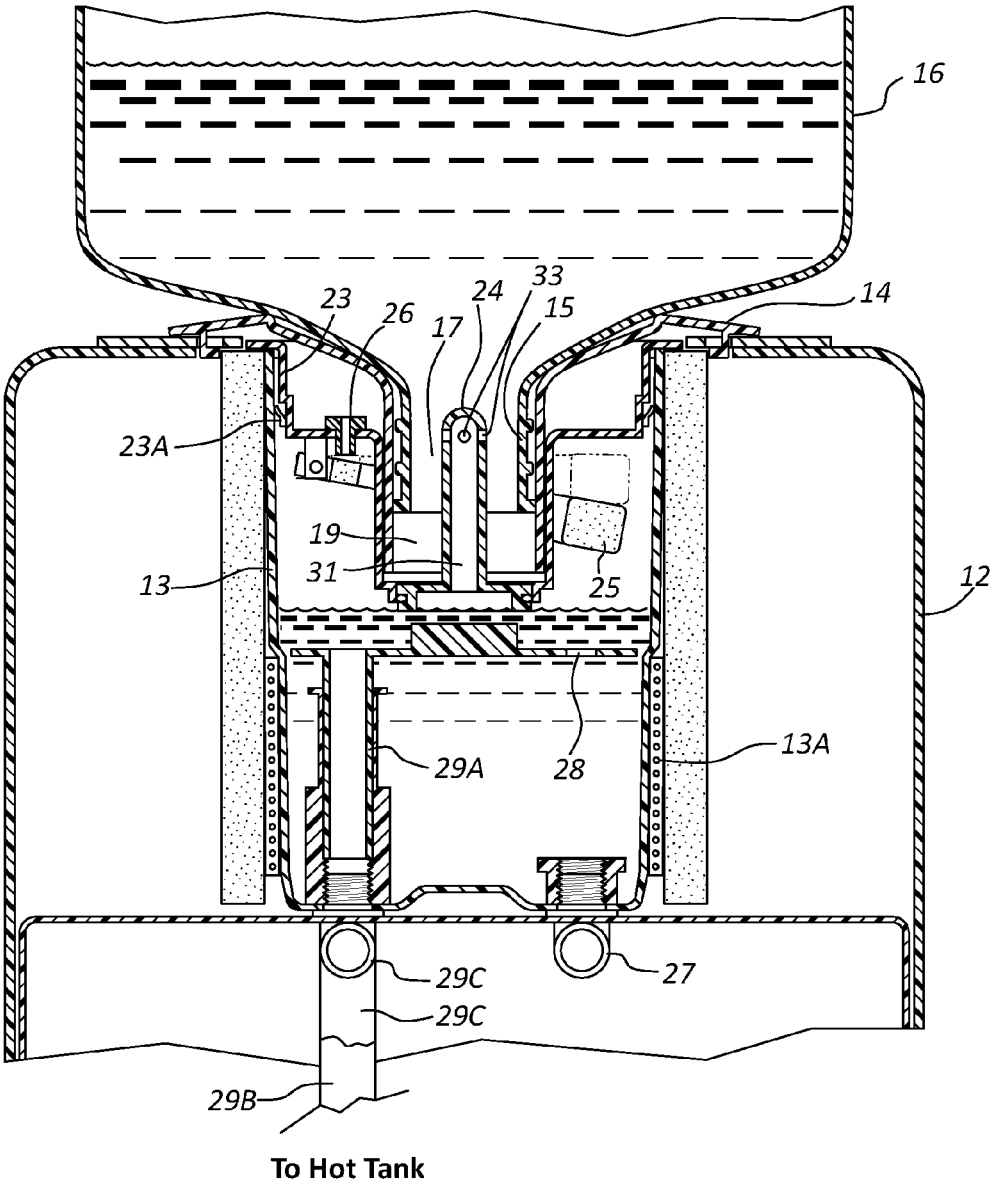


FIG. 1C
(Prior Art)

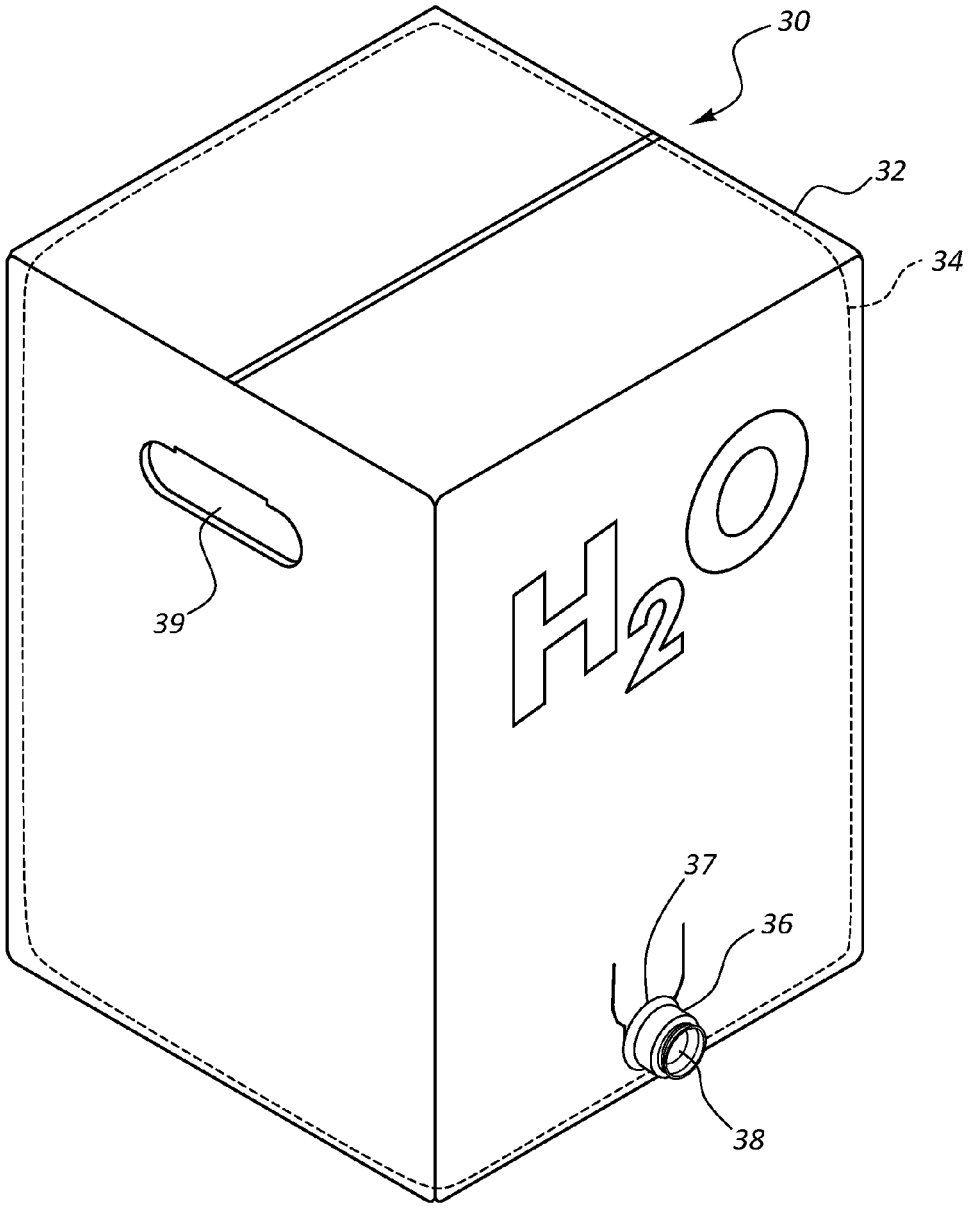


FIG. 2
(Prior Art)

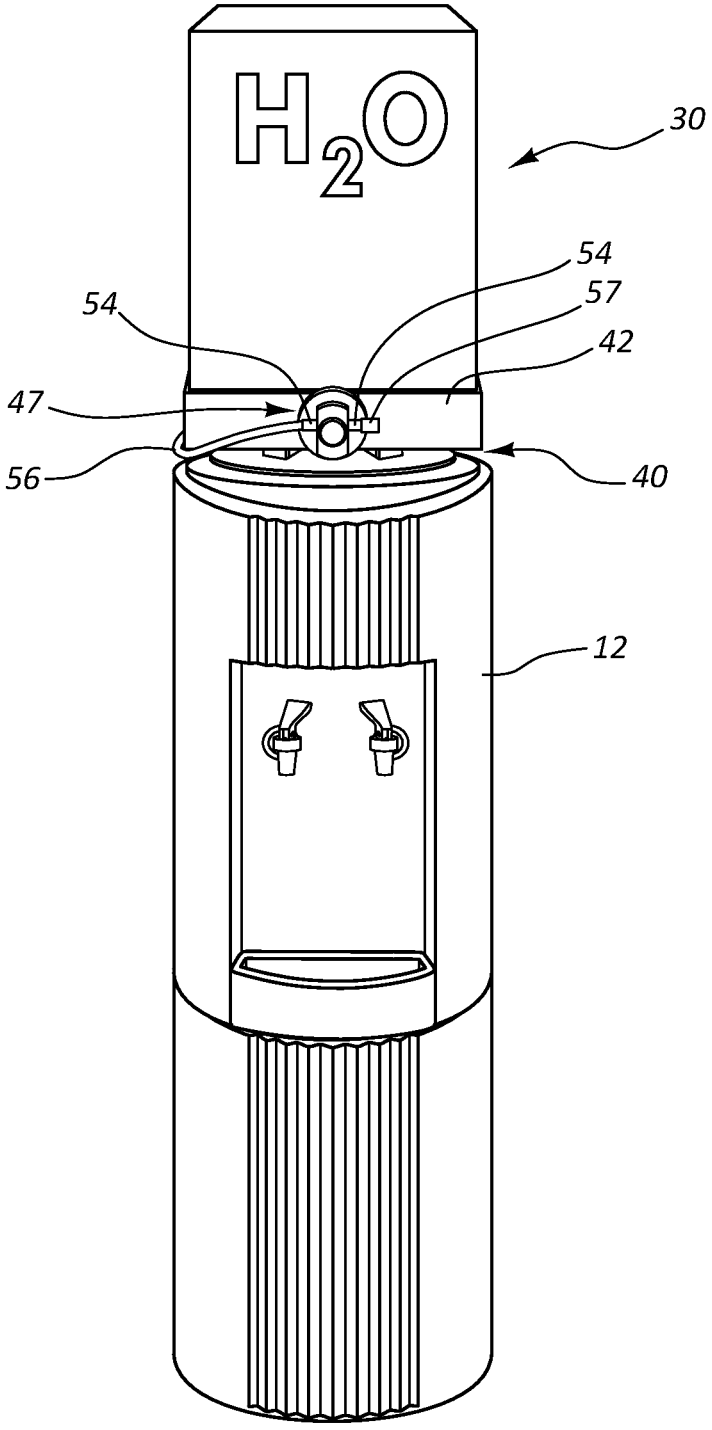


FIG. 3

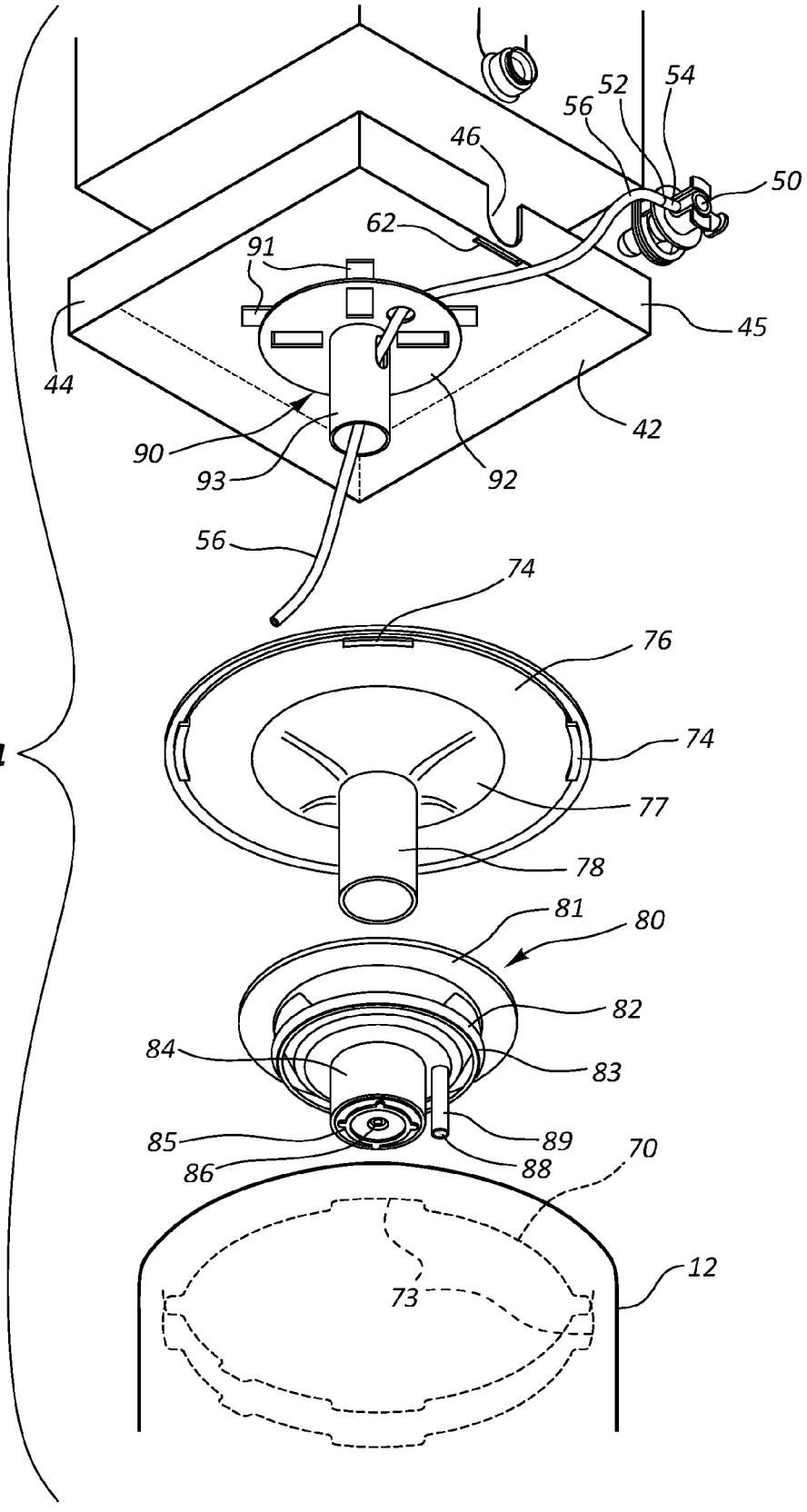

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FIG. 4

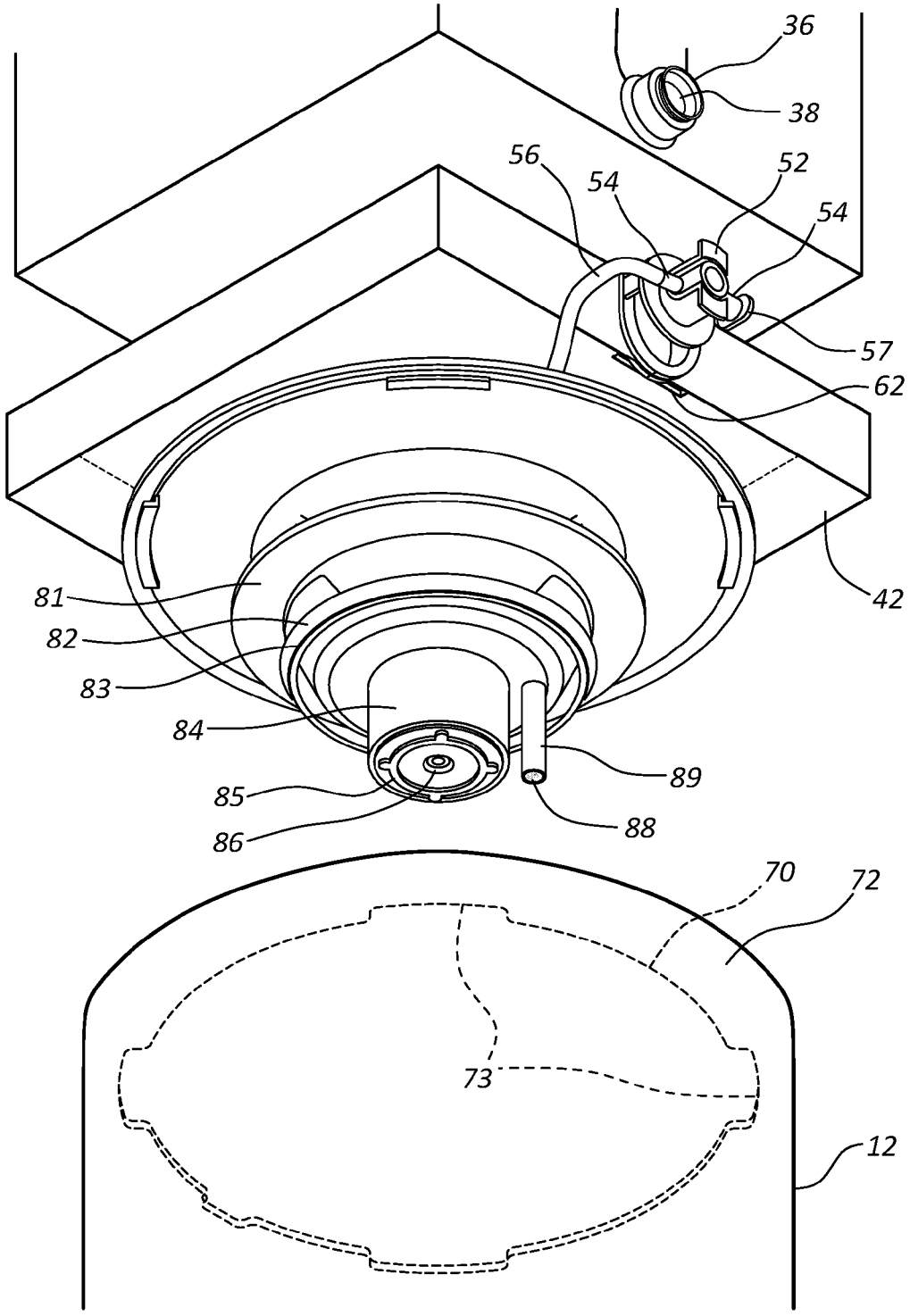

FIG. 5

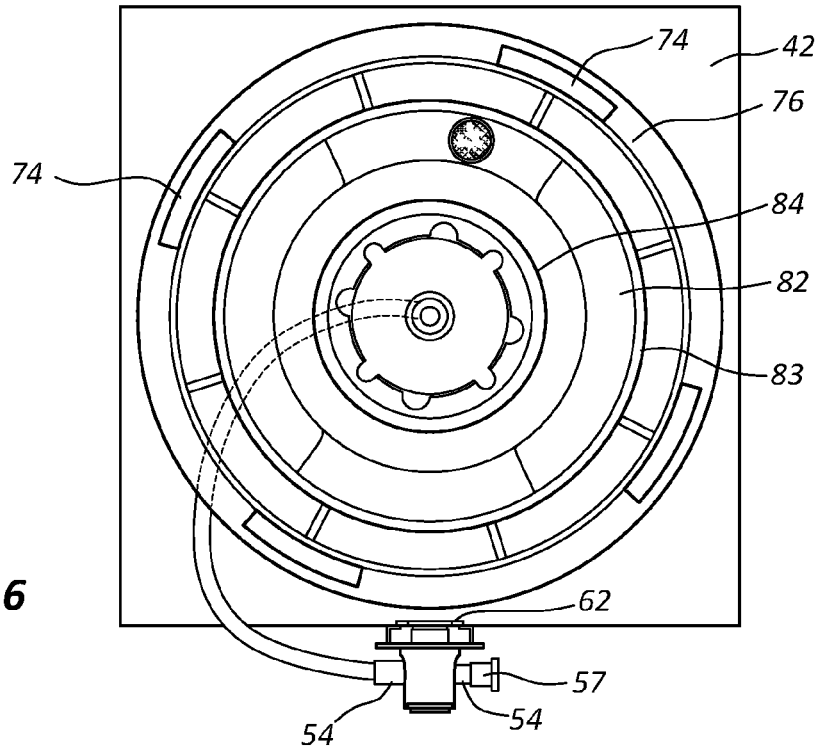

FIG. 6

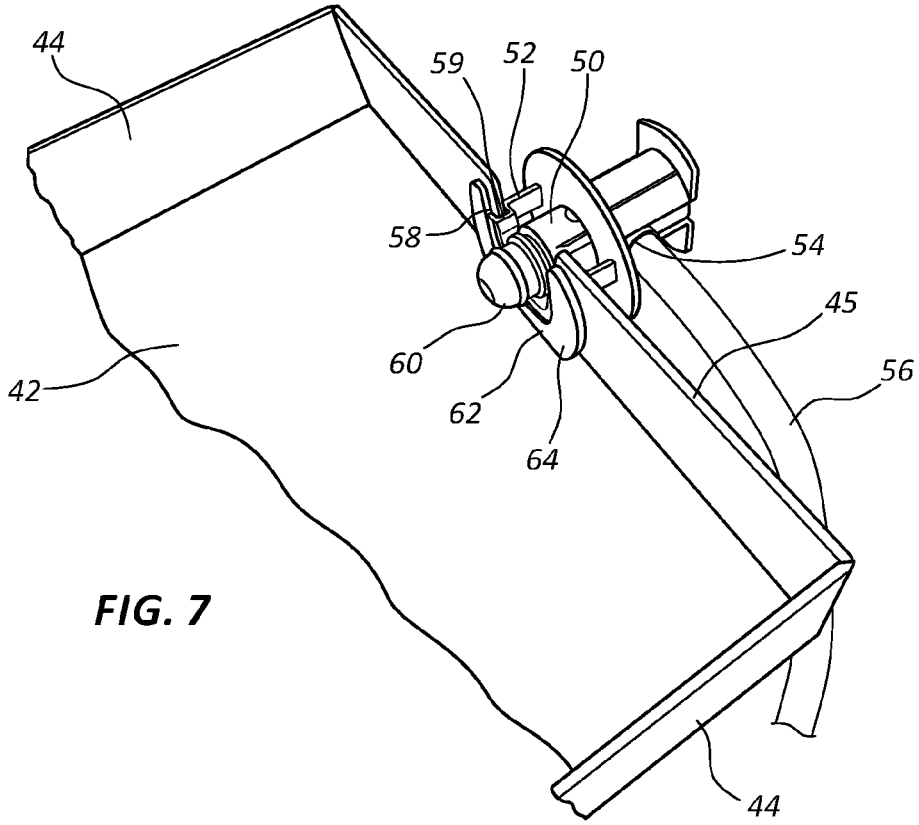

FIG. 7

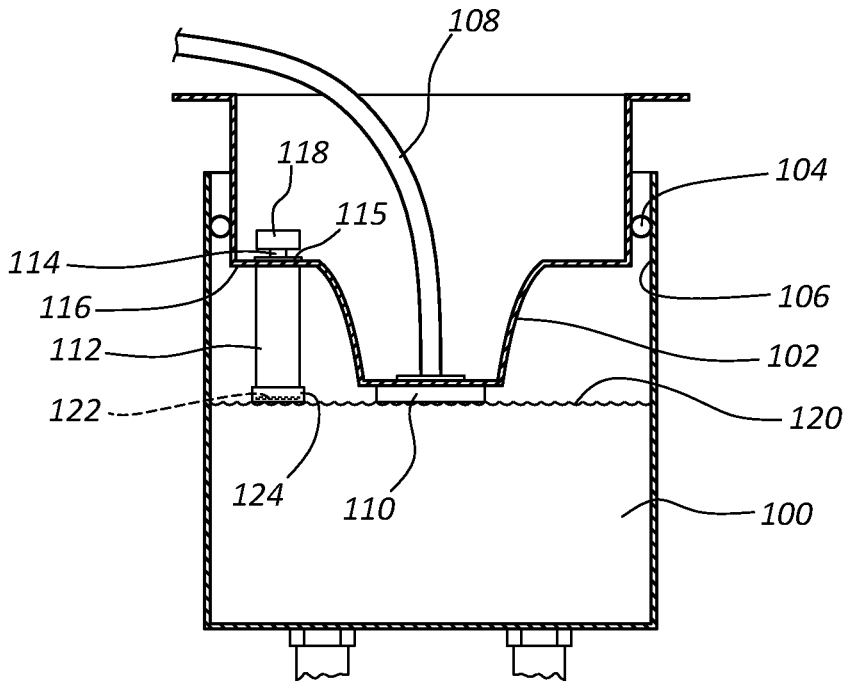
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FIG. 8A

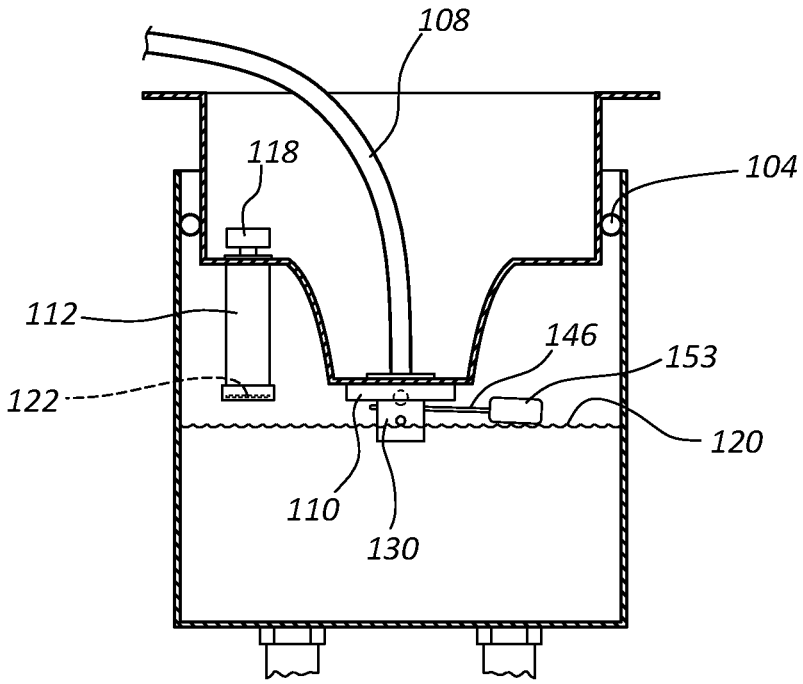
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FIG. 8B

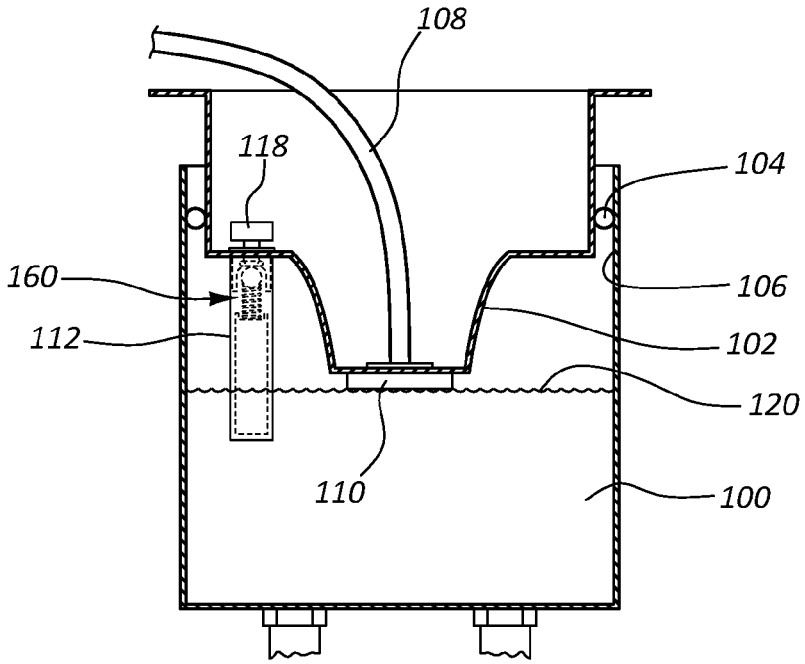
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FIG. 8C

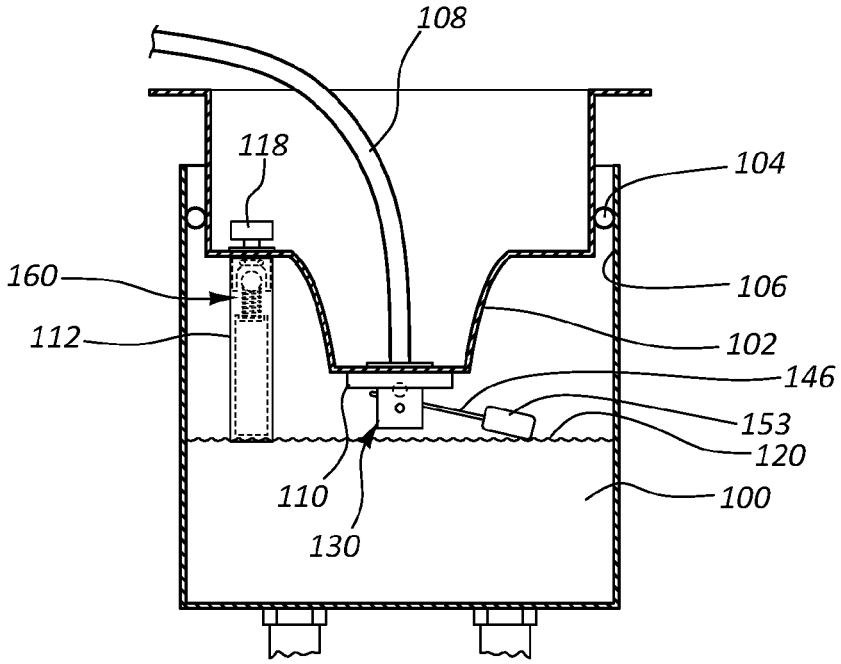
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FIG. 8D

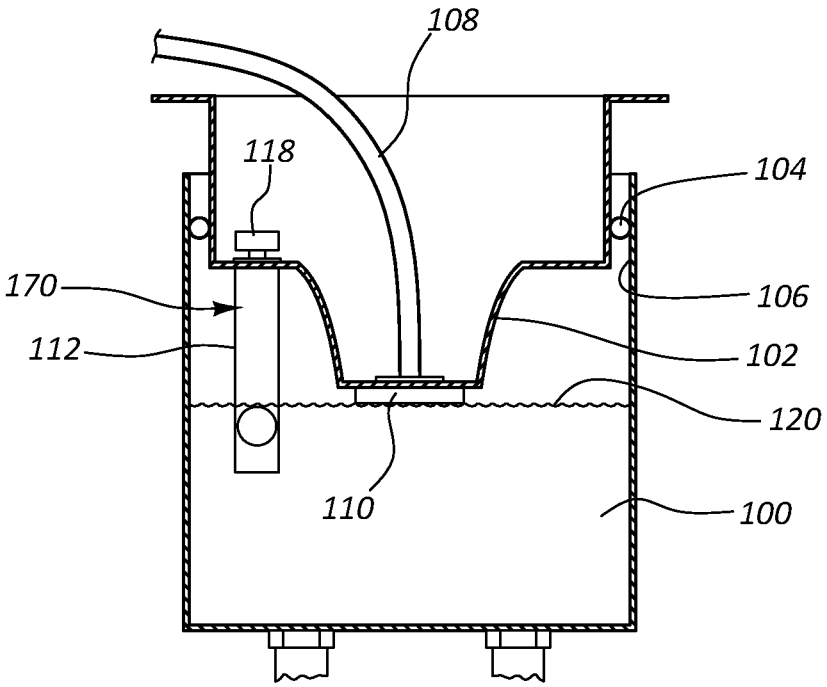
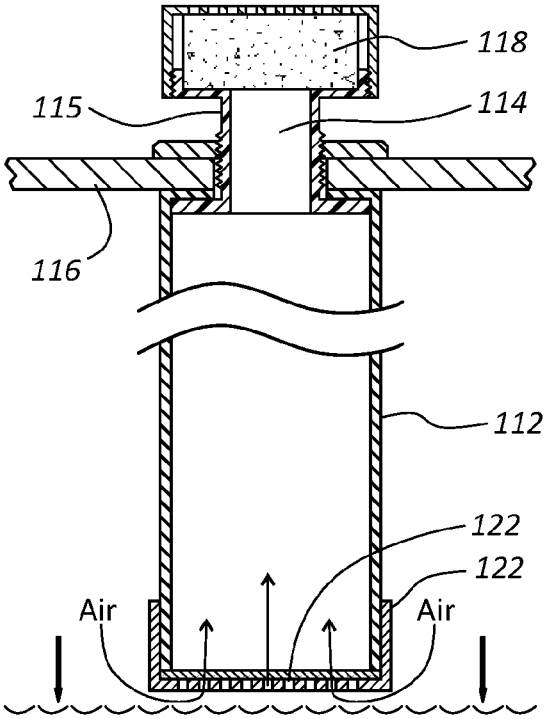


FIG. 8E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Air
Air

FIG. 9A

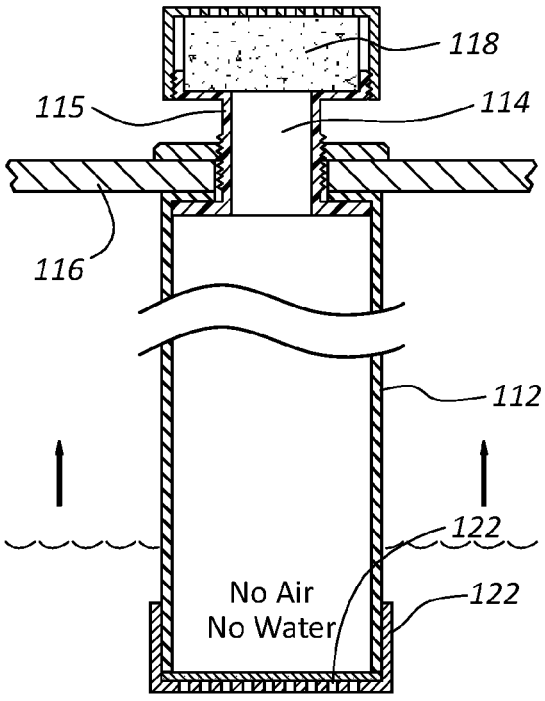
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FIG. 9B

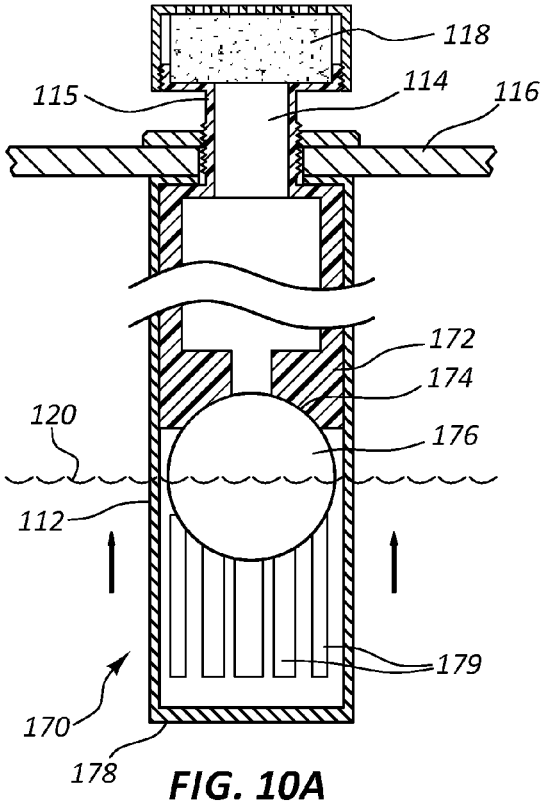
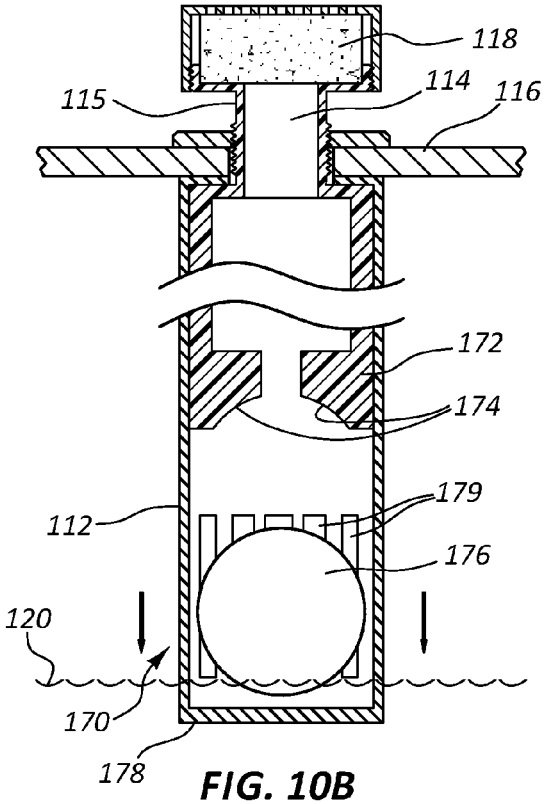


FIG. 10A



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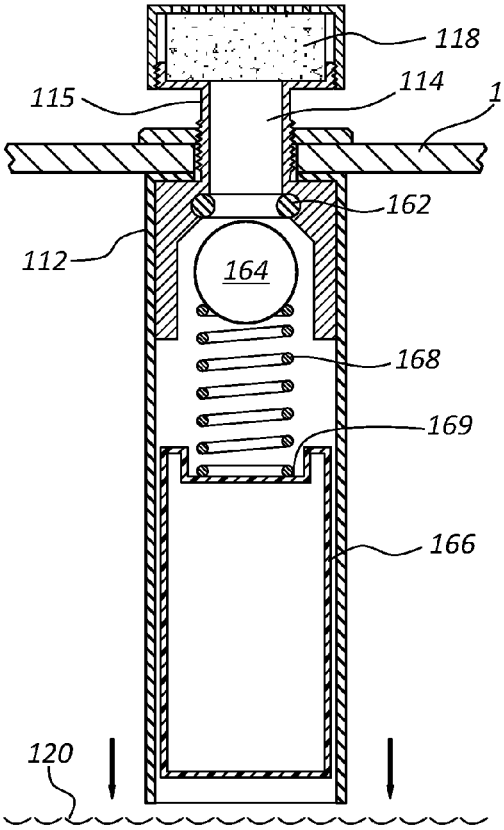

FIG. 11A

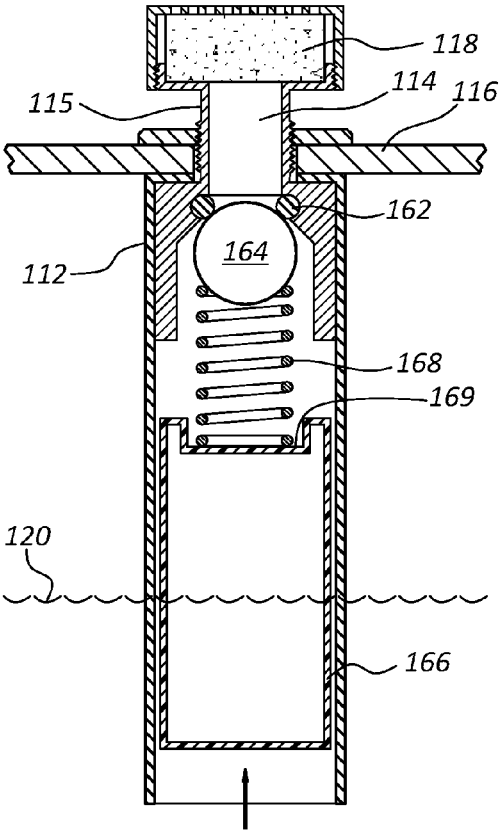

FIG. 11B

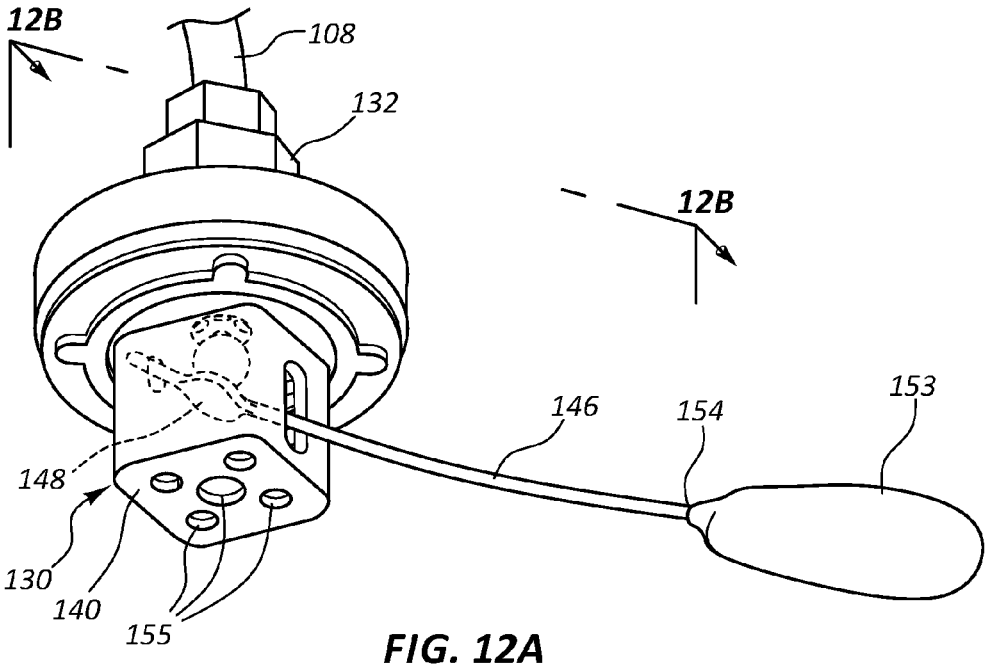

FIG. 12A

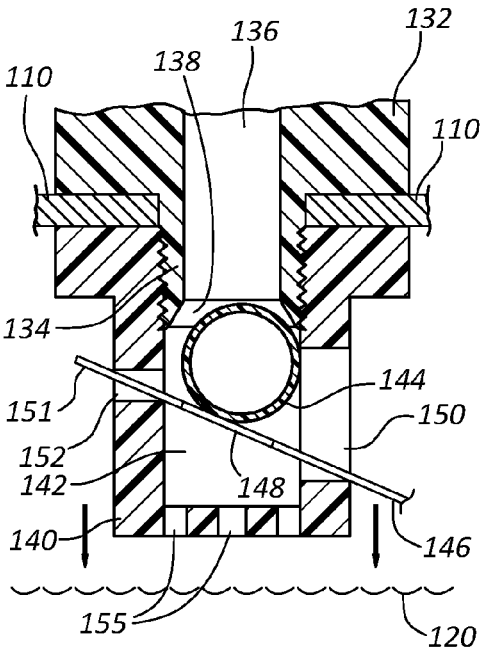

FIG. 12B

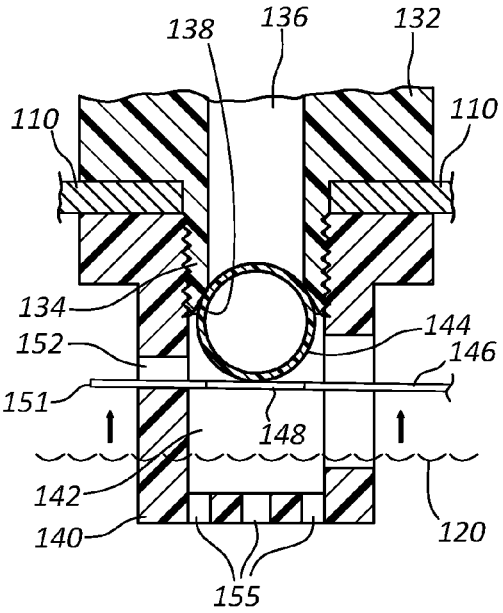

FIG. 12C

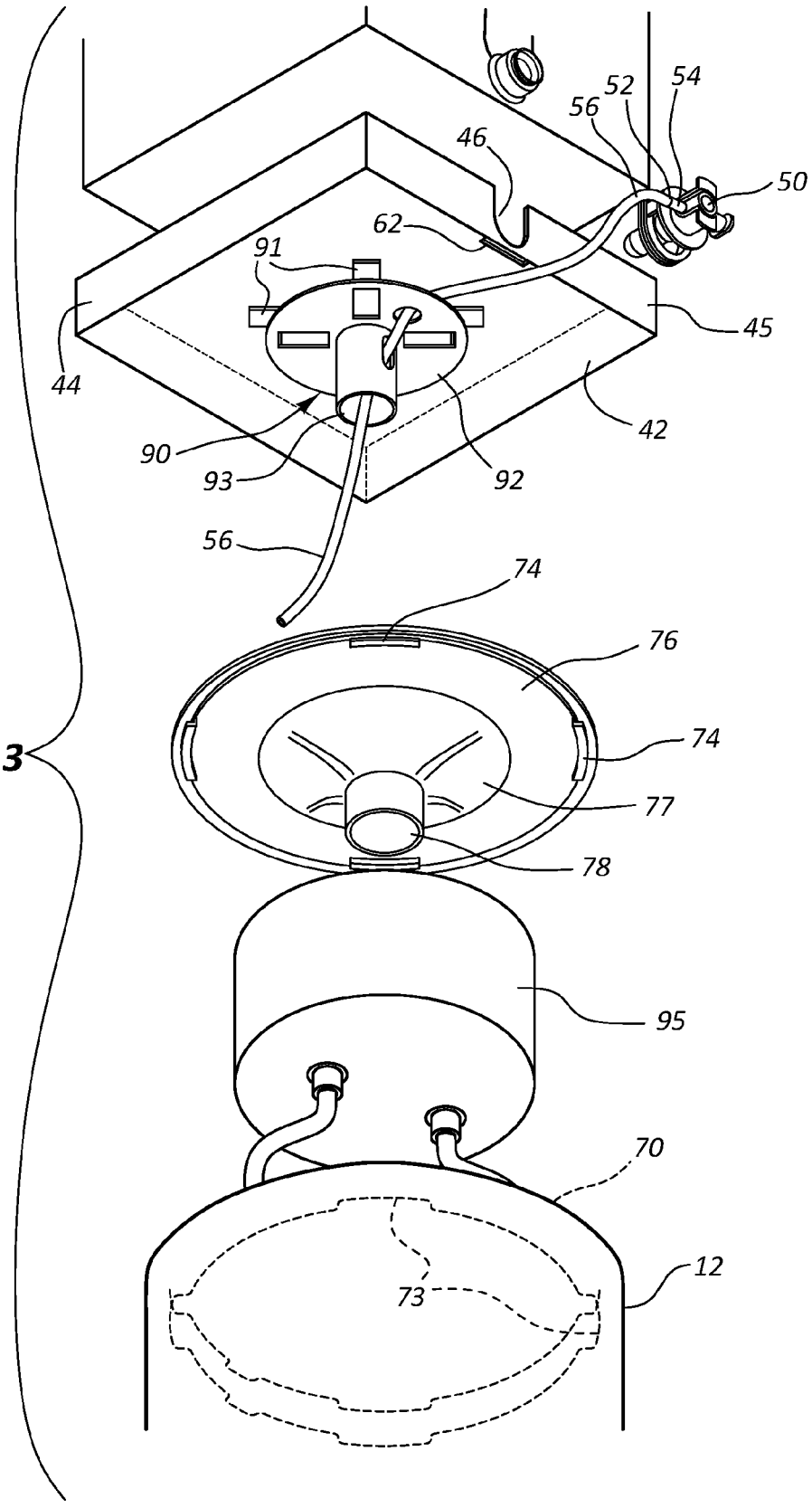

FIG. 13

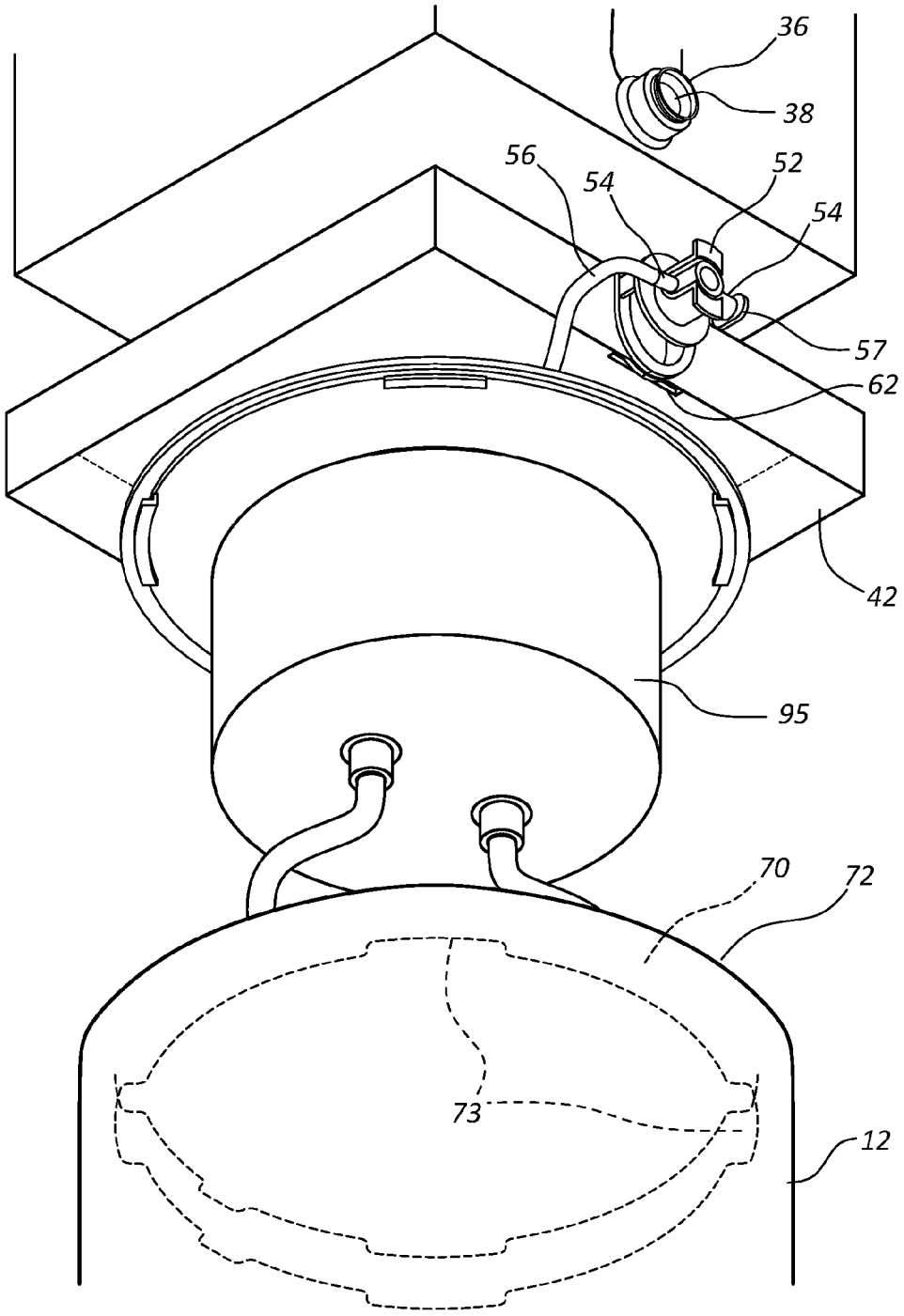

FIG. 14

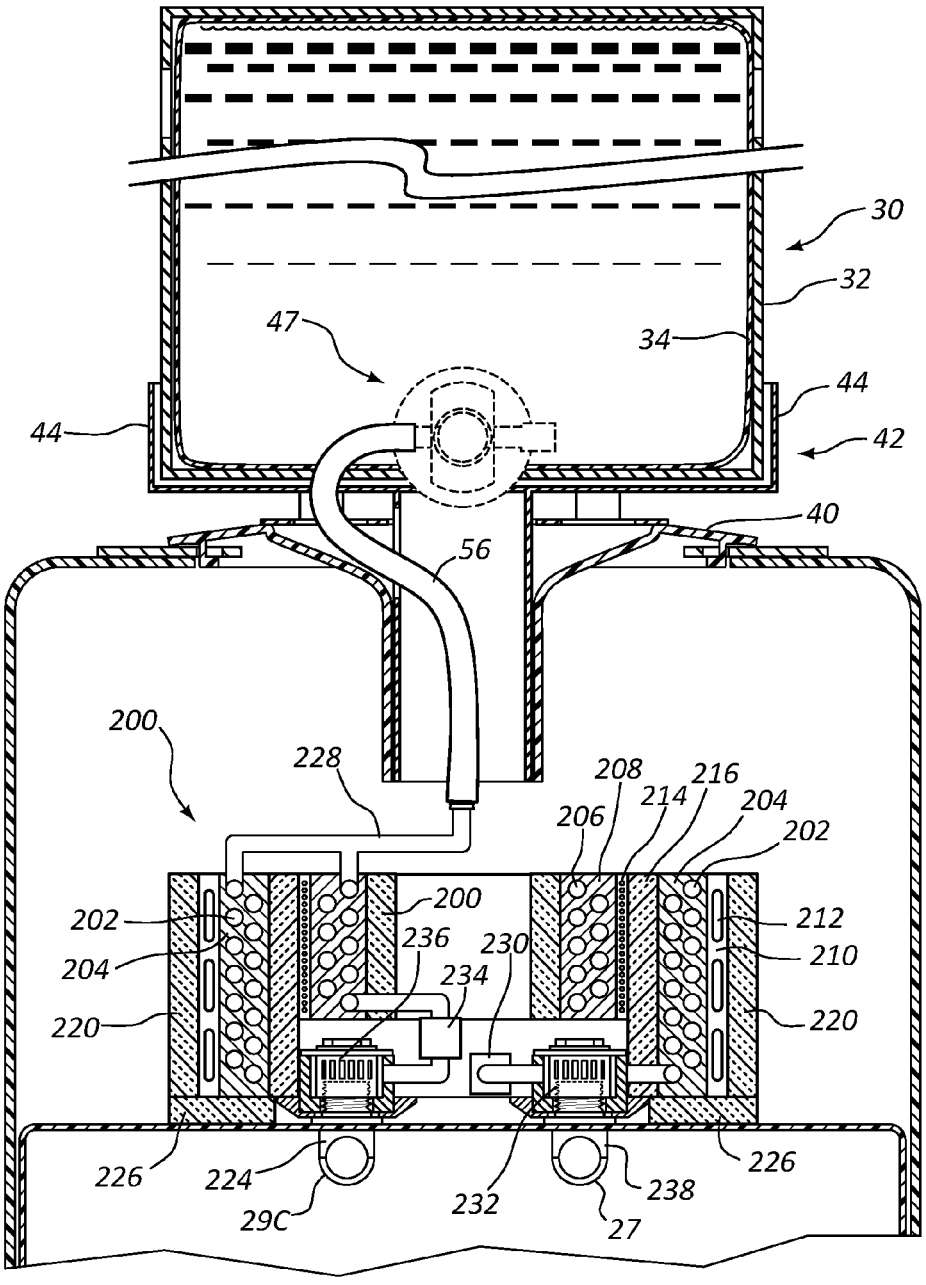
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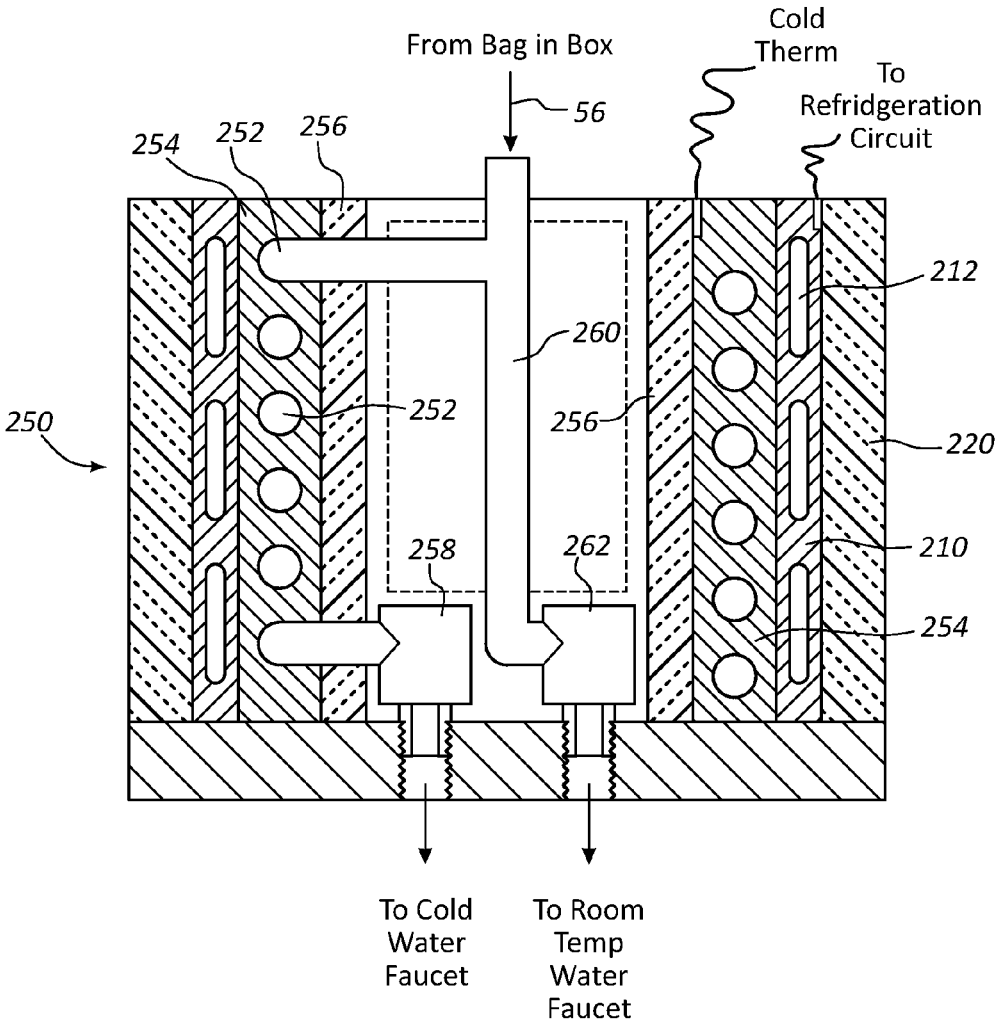
FIG. 15


From Bag in Box
56
Cold
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To Cold
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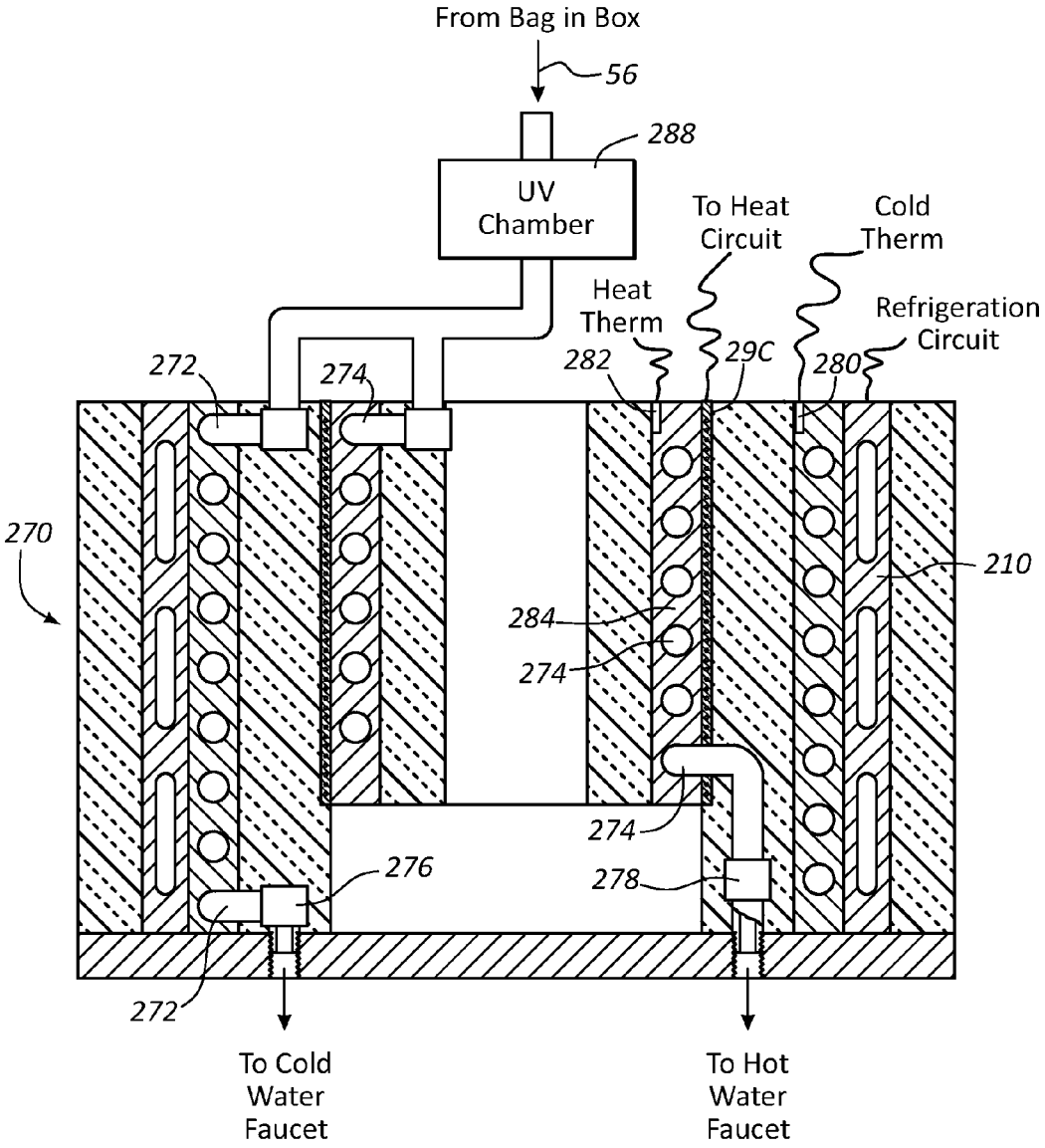
FIG. 16


From Bag in Box
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UV Chamber
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To Cold Water Faucet
To Hot Water Faucet

FIG. 17

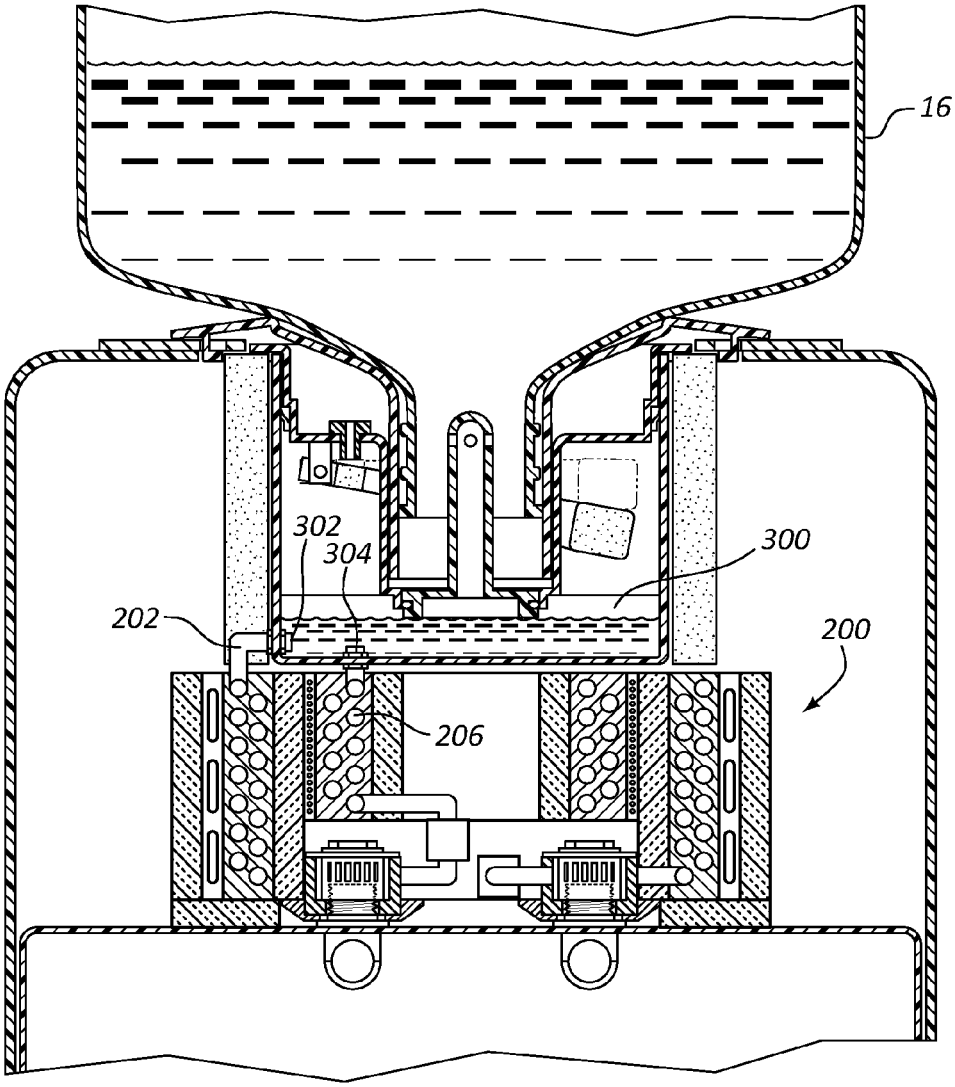
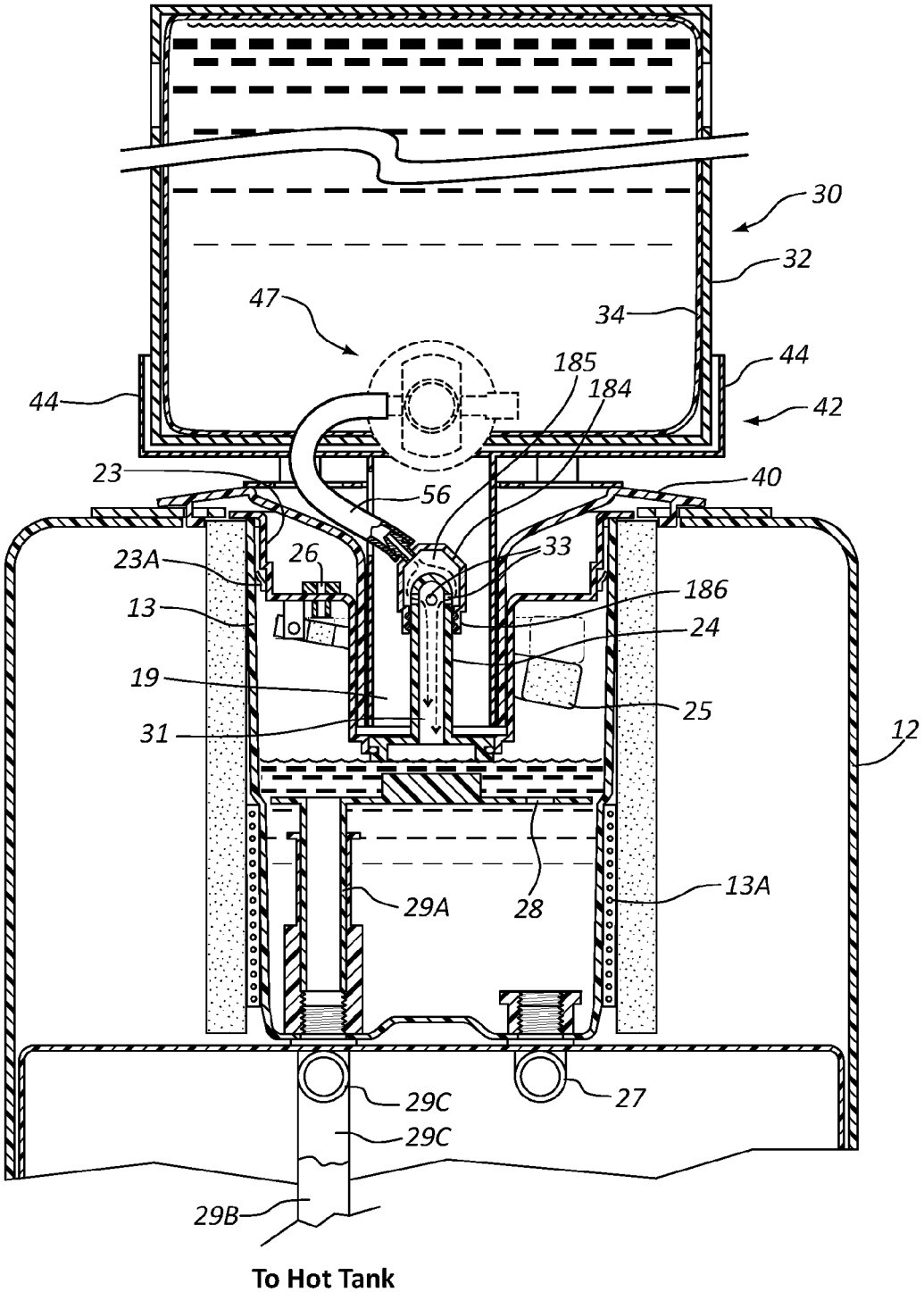


FIG. 18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To Hot Tank

FIG. 19

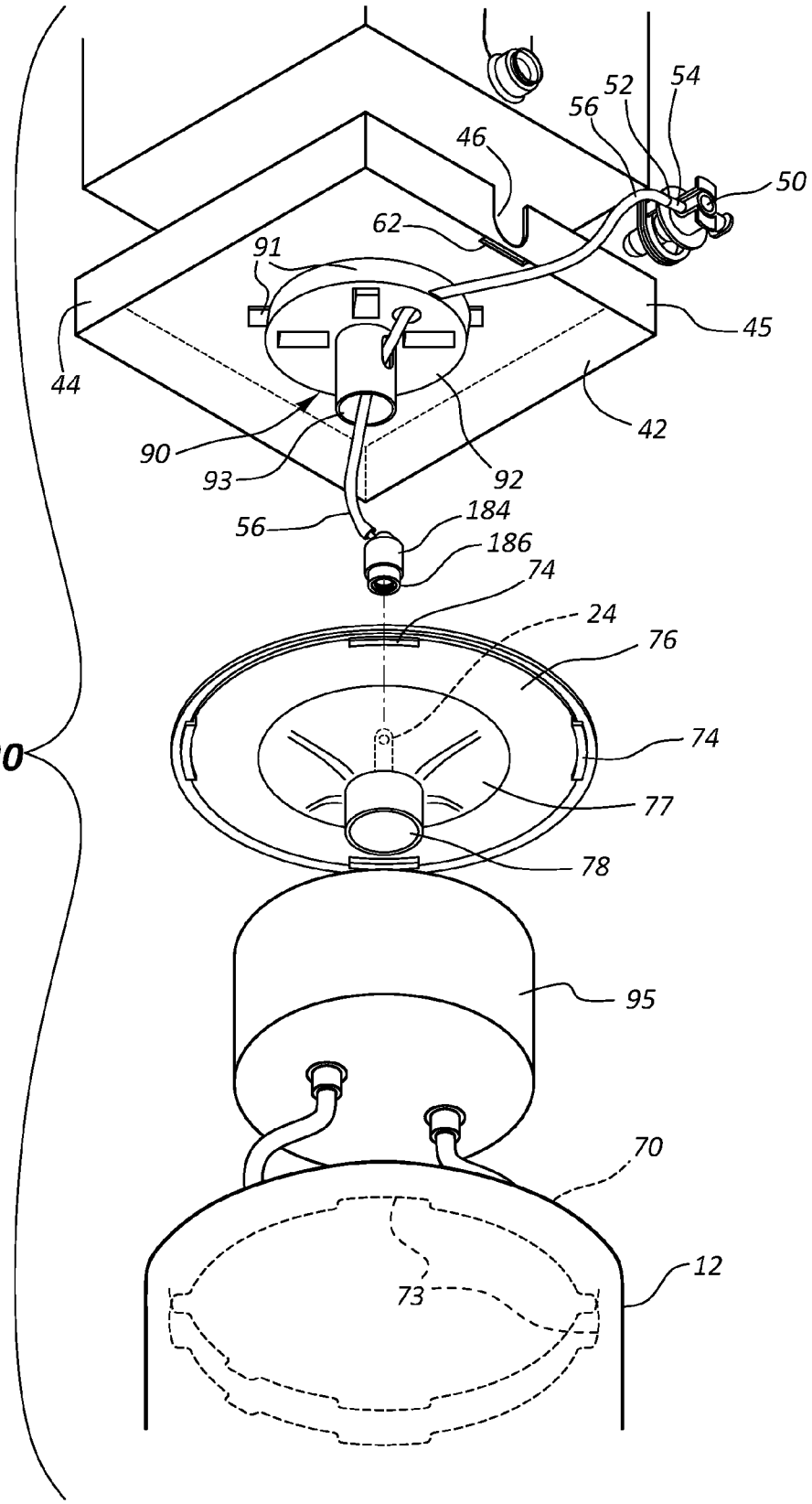
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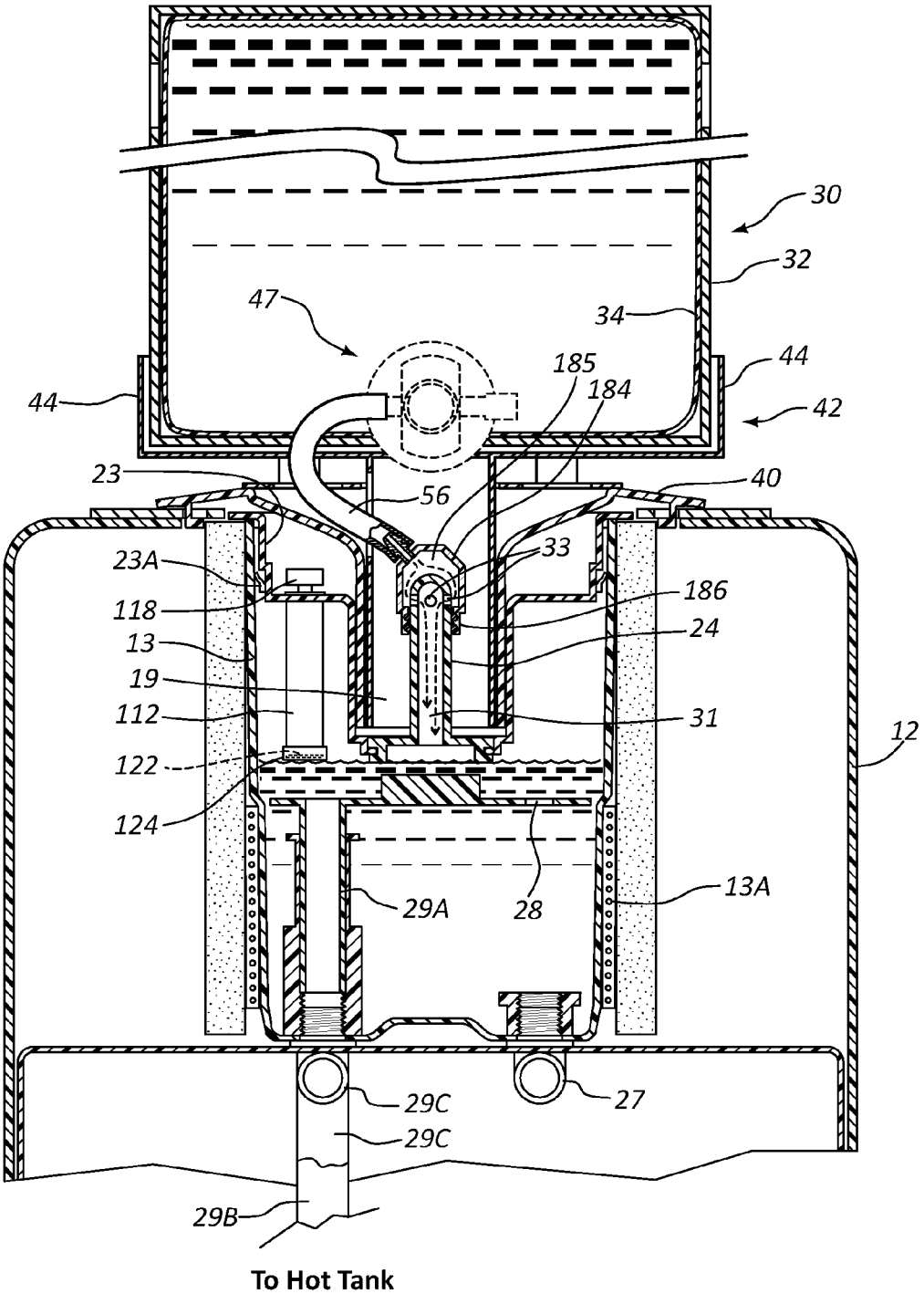
FIG. 20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29B
To Hot Tank

FIG. 21

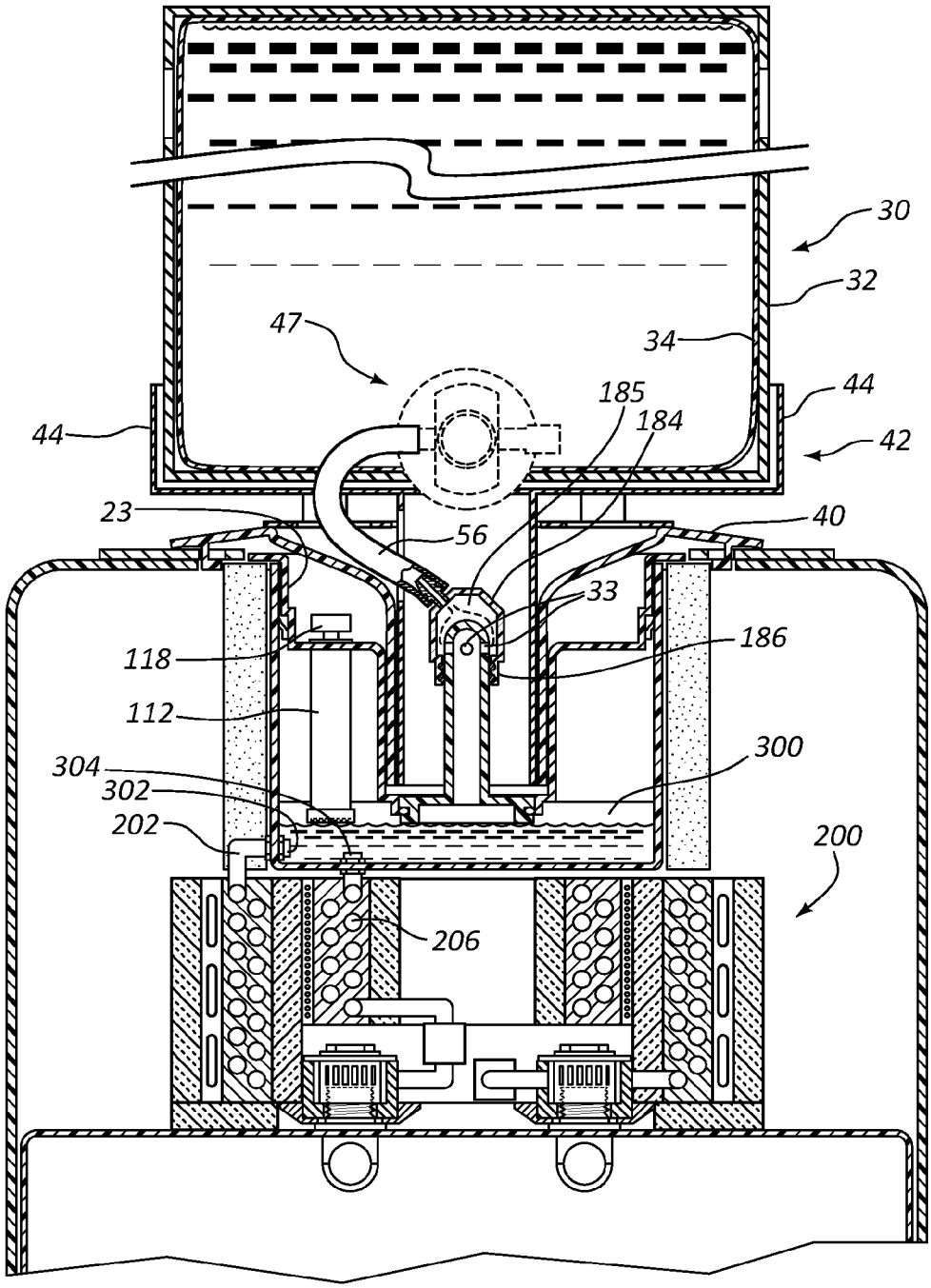
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FIG. 22

BAG-IN-BOX ADAPTER FOR WATER DISPENSER

RELATED APPLICATIONS

This is a continuation-in-part of application Ser. No. 14/490,670, filed Sep. 19, 2014, which was a continuation-in-part of application Ser. No. 13/844,806, filed Mar. 16, 2013, now U.S. Pat. No. 9,227,828, issued Jan. 5, 2016, both of which are incorporated herein in their entirety by reference.

BACKGROUND

Field of the Invention

The present invention relates generally to water dispensers commonly referred to as water coolers. More particularly, the present invention relates to water dispensers or water coolers wherein a container of water comprising a substantially rigid water bottle is placed on the top of the water dispenser and water is fed by gravity from the water container above the dispenser into a water reservoir in the dispenser wherein the water is cooled or heated by the dispenser and the cooled or heated water can then be dispensed by a user from the dispenser. The present invention also relates to bag-in-box liquid containers and dispensers for the liquid in such bag-in-box dispensers.

Related Art

Water dispensers, commonly also referred to as water coolers, are currently in common use throughout the world. With such water dispensers, water is supplied to the water dispenser from a substantially rigid, usually five gallon, water bottle made of glass or plastic and having a narrow neck forming the bottle opening. The bottle is inverted (neck and bottle opening facing downwardly) and placed on the top of the dispenser so that water flows by gravity from the bottle opening into a water reservoir in the dispenser where the water is cooled, and in newer water dispensers, a portion of the water is also heated. The cooled or heated water is then dispensed from the dispenser when desired by a user into a cup, glass, or other container for use by the user, usually for drinking. When the water bottle is inverted and placed on top of the water dispenser, the end of the water bottle neck with the bottle opening extends into the water reservoir. The flow of water from the water bottle is generally controlled by controlling flow of air into the bottle so that water flow is stopped by a vacuum created in the inside top of the water bottle as water flows from the bottle and air is prevented from entering the bottle. Air flow into the bottle is generally stopped by water in the reservoir reaching and closing the bottle opening in the reservoir when the reservoir is filled to the desired level set by the position of the opening into the bottle with respect to the reservoir. Cooled and/or heated water is dispensed from the water cooler by one or more user operated discharge valves which, when opened, allow water to flow from the cooled and/or heated water reservoir or reservoirs through the discharge valve or valves. As water is dispensed from the dispenser, the water level in the cooled and/or heated water reservoir goes down below the opening to the bottle and air can enter the bottle to allow additional water to flow from the bottle down into the reservoir until the water in the reservoir again covers the bottle opening to prevent further air flow into the bottle and further water flow from the bottle. This water flow control is based upon the substantial rigidity of the water bottle, i.e., the water bottle holds its shape and does not collapse so that unless air enters the bottle, a vacuum is maintained above the water in the bottle sufficient to prevent water from running out of the bottle. These substantially rigid water bottles are relatively expensive and are generally reusable. Full water bottles are delivered to the site of the water dispenser and empty water bottles are picked up, refilled, and reused.

Many of the currently used water bottles include a water bottle opening cap covering the water bottle opening which interacts with a water bottle opening cap engagement pin extending upwardly from the water cooler water reservoir so that when the water bottle is inverted and placed on the top of the water cooler, the water bottle opening cap engagement pin extends through the water bottle opening cap into the water bottle to provide a water flow path from the bottle into the reservoir. The water bottle opening cap engagement pin is secured in the water cooler reservoir and the opening of the water bottle opening cap engagement pin into the water reservoir serves as the opening of the bottle into the reservoir which the water in the reservoir closes to stop flow of water into the reservoir from the bottle to control the water level in the reservoir.

Bag-in-box container systems have become widely used as packing and shipping containers for a variety of liquid products such as soft drink syrup, milk, and wine. Such systems include a flexible bag or bladder disposed in a cardboard box such as a corrugated cardboard box. The flexible bag can conform to the shape of the inside of the box when filled with a liquid material. The box provides a fixed container shape for the bag and contents and protects the bag and contents during storage and shipping, and, in many instances, provides a holder for the bag during the dispensing of the contents of the bag. The bag will generally include a bag dispensing fitting secured thereto which is used to dispense the contents of the bag from the bag. The bag dispensing fitting can be located at various locations on the bag depending upon the application, such as at the bottom of the bag when positioned in the box when the contents of the bag is to be removed by gravity while the bag remains in the box. In such instance, the box will generally include an area adjacent the bag dispensing fitting which opens to expose the bag dispensing fitting and allow controlled gravity discharge of the contents of the bag. However, the bag does not provide a rigid container for the liquid and the bag collapses within the box when liquid is removed from the bag. Air does not flow into the bag. Such bag-in-box containers are usually relatively inexpensive to make and easy to produce and assemble. Therefore, the bag-in-box container is usually disposable and is disposed of after use rather than being saved and refilled. Bag-in-box containers come in various sizes, with many such containers having a five gallon capacity similar to the five gallon substantially rigid water cooler bottles.

Recently, water has become one of the liquids packaged in bag-in-box containers and water can be dispensed directly from the bottom portion of the bag-in-box container similarly to the way wine and milk is dispensed from such containers. Dispensers are being developed for cooling and heating water from bag-in-box containers of water and for dispensing such cooled and/or heated water, see, for example, U.S. Pat. No. 7,975,879. However, because the bags containing the water are not rigid and collapse as the water is dispensed from the bag, such bag-in-box containers with a flexible bag cannot be directly used with the various water dispensers designed for use with five gallon substantially rigid water bottles.

Adapters for adapting a conventional water cooler for use with a flexible bag full of water rather than a substantially

rigid water bottle are shown in U.S. Pat. Nos. 6,398,073, 7,331,487, and 8,117,096. These adapters show holders for receiving and holding a flexible bag of water above a water cooler and such holders include a piercing spike in the bottom thereof to pierce the bag as it is dropped into the holder to allow flow of water from the bag through the spike into the water reservoir of the cooler. Such flexible bags are not shown with bag dispensing fittings and no bag dispensing fitting is used in the adapters shown. U.S. Pat. No. 6,398,073 shows a ballcock float valve in the fluid passage from the spike to the reservoir to control the flow of water from the bag into the reservoir and to stop water flow when the level of water in the reservoir reaches a desired level as indicated by the float of the ballcock valve. U.S. Pat. No. 7,331,487 shows a sealed water reservoir with an open vent tube extending upwardly from the reservoir alongside the bag. The vent tube opens to the atmosphere above the top of the bag so that water fills the sealed reservoir and extends up into the vent tube. The water level in the vent tube is equalized with the water level in the bag. U.S. Pat. No. 8,117,096 shows a completely sealed water reservoir formed in the dispenser so that water flows from the bag into the reservoir and out through the dispenser valve. An air vent between the reservoir and the inside of the bag is provided so that air can flow between the sealed reservoir and the inside of the bag to allow water to flow into and substantially fill the sealed reservoir when the bag is initially connected to the reservoir. In this manner, the water cooler reservoir is substantially filled with water so that the water is cooled or heated in the reservoir prior to being dispensed from the dispenser.

The above described bag dispensers all provide bag receiving holders mounted on the top of the water cooler with spikes in the bottom thereof upon which the full water bags are dropped so that the spikes puncture the bottom of the water bag to extend into the water bag to provide fluid communication between the inside of the bag and the fluid reservoir thereby allowing fluid flow from the bag into the reservoir. The spikes are designed so that the bag being punctured seals around the spike to prevent leakage around the spike. While the water filled bags as used in the above described bag dispensers can be packaged and shipped in boxes, if packaged and shipped in boxes, the bags have to be removed from the boxes before used in the water coolers and the large, heavy, and bulky flexible bags full of water have to be removed from the box, lifted above the bag receiving holder mounted on top of the water cooler, and lowered or dropped into the bag receiving holder so that the spikes penetrate the bottom of the bag to allow water to flow into the water cooler reservoir. After use, the empty or almost empty bags have to be retrieved from the bag receiving holder, and if not completely empty, the remaining water from the bag will run into the bag receiving holder when the bag is removed from the spikes and may continuing running as the bag is moved from the holder to its disposal container. It should be noted that these spikes are not the same as or equivalent to the water bottle opening cap engagement pins which extends through a water bottle opening cap to provide a water flow path from a substantially rigid water bottle into the reservoir.

SUMMARY OF THE INVENTION

Applicant has recognized that it would be advantageous to be able to use bag-in-box water containers as replacements for the standard substantially rigid five gallon water bottles currently used in the common water coolers designed for use with such five gallon substantially rigid water bottles. Alternately, it would be advantageous to provide a water or other liquid dispenser similar to the common water coolers but which use bag-in-box liquid containers as the liquid source. The bag-in-box containers, being disposable, are more economical than the five gallon substantially rigid water bottles. The bag-in-box containers can be easily delivered to the site of such water coolers similarly to the delivery of the water bottles. However, since the bag-in-box containers are disposable, they do not need to be collected and returned for sterilization, refilling, and reuse. The boxes of the bag-in-box containers generally have openings in the sides thereof which serve as handles for picking up and lifting the bag-in-box containers which make it easier to lift the bag-in-box containers to place them on top of the standard water coolers. In addition, since the box of the bag-in-box container holds the flexible bag, a separate bag receiving holder is not required on the top of the water cooler so the bag-in-box container does not have to be lifted as high as the bag does to be placed in a bag receiving holder mounted on top of the water cooler. Further, a bag dispensing fitting secured to the bag in the bag-in-box container can include a valve so that the bag dispensing fitting can be attached to a hose leading into the water cooler reservoir and the valve can be opened after the attachment, and can be closed before disconnection of the fitting and removal of the bag-in-box container from the water cooler for disposal. This prevents leakage of water during removal of the bag. Therefore, the bag-in-box containers are easier to use than the five gallon water bottles which need to be lifted and inverted for insertion into the cooler and are easier to use than a flexible water bag that needs to be lifted above the bag holders and dropped into the holders and then removed from the holders without being closed. The bag-in-box containers are also more economical than the five gallon substantially rigid bottles.

According to the invention, an adapter is provided to receive and hold a bag-in-box container on top of the water cooler and to direct the flow of water or other liquid from the bag-in-box container into the water cooler. When water is referred to herein, it includes any liquid that may be supplied in a bag-in-box liquid container that needs to be dispensed from the container. The adapter includes a liquid supply line having a bag dispensing fitting connector adapted to be removably connected to the bag dispensing fitting of the bag in the bag-in-box container to allow liquid to flow from the bag through the liquid supply line and into the water cooler. A reservoir fitting may be provided to position an outlet end of the liquid supply line over the reservoir. The water is then cooled and/or heated in the water cooler by water temperature control mechanisms and the cooled and/or heated water can be dispensed from the water cooler by a user, when desired, through the appropriate cool water or hot water discharge valve.

In one embodiment of the adapter of the invention, the liquid supply line supplies liquid from the bag in the bag-in-box container to the water reservoir of the water cooler. The adapter also provides control for the flow of water from the bag into the reservoir and for maintaining a desired level of water in the reservoir. Water flow into and level control of water in the reservoir may be provided by controlling the flow of water into the reservoir from the water supply line, by sealing the reservoir from the atmosphere and controlling the venting of the sealed reservoir to the atmosphere, or by a combination of both. An example of control of the flow of water into the reservoir from the water supply line is a special float valve that allows high flow

capacity at low pressures, and examples of control of the venting of a sealed reservoir to the atmosphere can be through the use of hydrophobic membrane materials at the entrance to a reservoir vent positioned at the desired level of water in the reservoir which will allow air to flow through the membrane but not allow water to flow through the membrane, or through the use of float valves in the vent.

While the adapter of the invention may include a reservoir fitting to receive and position the outlet end of the liquid supply line over the reservoir wherein the reservoir fitting is an additional assembly inserted into the top of the water cooler reservoir of the existing water cooler, is a replacement assembly which replaces an assembly in the top of the reservoir or over the top of the reservoir of the existing water cooler, or is a modification of an existing assembly in the top of the water cooler reservoir wherein the outlet end of the liquid supply line is received in the assembly in place of the normal water bottle opening cap engaging pin, the reservoir fitting may be an existing assembly in the top of the water cooler reservoir which includes a water bottle opening cap engaging pin adapted to extend through the water bottle opening cap of a substantially rigid water bottle for which the water cooler was designed to be used with. In such instance, the outlet end of the liquid supply line is adapted to connect to the water bottle opening cap engaging pin so that water will flow from the liquid supply line into the water bottle opening cap engaging pin and through the water bottle opening cap engaging pin into the reservoir. Any of these alternatives provide a cover for the reservoir which receives the outlet or discharge end of the liquid supply line and directs the liquid from the liquid supply line into the reservoir.

In another embodiment of the adapter, the usual reservoir of the water cooler is replaced with a reservoir in the form of a heat exchanger having a liquid flow passage therethrough through which the liquid to be dispensed flows from the bag-in-box liquid container to the discharge valve or valves. The liquid supply line from the bag-in-box liquid container connects to an inlet of the heat exchanger to supply water from the bag in the bag-in-box liquid container to the inlet of the heat exchanger. The outlet of the heat exchanger is connected in flow communication with the appropriate discharge valve so that water flow from the bag and through the heat exchanger is controlled by the appropriate discharge valve. The heat exchanger cools and/or heats the water as the water flows through the liquid flow passage through the heat exchanger when the appropriate discharge valve is opened. The heat exchanger may include a spiral passage through a cooled or heated mass of material having high heat capacity and/or high heat transfer properties, such as a metal or gel block.

Rather than providing the invention as an adapter for an existing water cooler, the invention can be provided as a new liquid dispenser having the properties and construction as an adapted existing water dispenser would have.

BRIEF DESCRIPTION OF THE DRAWINGS

Additional features and advantages of the invention will be apparent from the detailed description which follows, taken in conjunction with the accompanying drawings, which together illustrate, by way of example, features of the invention; and, wherein:

FIG. **1**A is a pictorial view of a prior art water cooler with which the adapter of the invention can be used.

FIG. **1**B is an assembly view of the prior art water cooler of FIG. **1**A showing the parts thereof through which water from the rigid water bottle flow between the water bottle and the discharge valves of the water cooler of FIG. **1**A.

FIG. **1**C is a fragmentary vertical section through the upper portion of the prior art water cooler of FIG. **1**A showing the arrangement of the parts thereof shown in FIG. **1**B.

FIG. **2** is a pictorial view of a prior art bag-in-box water container which can be used with the adapter of the invention and showing a bag dispensing fitting extended through the box.

FIG. **3** is a pictorial view of the water cooler of FIG. **1** with the adapter of the invention installed thereon and showing a bag-in-box container as shown in FIG. **2** mounted on the adapter.

FIG. **4** is an assembly view showing the parts of the adapter of the invention as they fit into the top of the water cooler of FIG. **1**.

FIG. **5** is an assembly view similar to that of FIG. **4**, but showing several of the parts shown in FIG. **4** in assembled condition ready for insertion into the top of the water cooler of FIG. **1**.

FIG. **6** is a bottom plan view of the assembled parts shown in FIGS. **4** and **5**.

FIG. **7** is a fragmentary pictorial view of a portion of the bag-in-box receiving tray of the adapter of the invention and also showing a bag dispensing fitting connector adapted to mate with a bag dispensing fitting in the bag of the bag-in-box container to attach the bag of the bag-in-box container to the adapter supply hose.

FIG. **8**A is a simplified schematic vertical section representing the adapter of the invention installed in the top of the water cooler reservoir and showing a hydrophobic membrane embodiment for control of the venting of the reservoir.

FIG. **8**B is a simplified schematic vertical section similar to that of FIG. **8**A showing a special float valve that allows high flow capacity at low pressures from the water supply line into the reservoir when the water level in the reservoir is below the desired level in combination with the hydrophobic membrane embodiment for control of the venting of the reservoir.

FIG. **8**C is a simplified schematic vertical section similar to that of FIG. **8**A showing a float valve embodiment for control of the venting of the reservoir.

FIG. **8**D is a simplified schematic vertical section similar to that of FIG. **8**A showing a combination of the special float valve shown in FIG. **8**B for controlling water flow from the water supply line and the float valve of FIG. **8**C controlling the venting of the reservoir.

FIG. **8**E is a simplified schematic vertical section similar to that of FIG. **8**A showing a second embodiment of float valve for controlling the venting of the reservoir.

FIG. **9**A is a vertical section showing details of the hydrophobic membrane embodiment for control of the venting of the reservoir with the water level below the membrane.

FIG. **9**B is a vertical section showing details of the hydrophobic membrane embodiment for control of the venting of the reservoir similar to that of FIG. **9**A but with the water level above the membrane.

FIG. **10**A is a vertical section showing details of the second embodiment of float valve for controlling the venting of the reservoir as shown in FIG. **8**E with the water at a level in the reservoir to close the valve.

FIG. **10**B is a vertical section showing details of the second embodiment of float valve for controlling the venting of the reservoir as shown in FIG. **8**E with the water at a level in the reservoir to open the valve.

FIG. **11**A is a vertical section showing details of the float valve embodiment for controlling the venting of the reservoir as shown in FIG. **8**C with the water at a level in the reservoir to open the valve.

FIG. **11**B is a vertical section showing details of the float valve embodiment for controlling the venting of the reservoir as shown in FIG. **8**C with the water at a level in the reservoir to close the valve.

FIG. **12**A is a pictorial view of a float valve of the invention,

FIG. **12**B is a vertical section taken on the line **12**B-**12**B of FIG. **12**A showing the water level below the valve housing.

FIG. **12**C is a vertical section similar to that of FIG. **12**B showing the water level above the bottom of the valve housing.

FIG. **13** is an assembly view showing the parts of a further embodiment of the adapter of the invention as they fit into the top of the water cooler of FIG. **1**.

FIG. **14** is an assembly view similar to that of FIG. **13**, but showing several of the parts shown in FIG. **13** in assembled condition ready for insertion into the top of the water cooler of FIG. **1**.

FIG. **15** is a fragmentary vertical section through the upper portion of the prior art water cooler of FIG. **1**A with the adapter of FIGS. **13** and **14** installed showing the arrangement of the adapter of FIGS. **13** and **14**.

FIG. **16** is a vertical section through a heat exchanger of the invention providing cooled water and room temperature water.

FIG. **17** is a vertical section through a heat exchanger of the invention providing both cooled water and heated water.

FIG. **18** is a fragmentary vertical section through the upper portion of the prior art water cooler of FIG. **1**A, similar to FIG. **1**C, showing the prior art substantially rigid water bottle of FIG. **1**C with the reservoir of the invention as shown in FIGS. **13**, **14**, and **15**.

FIG. **19** is a fragmentary vertical section through the upper portion of the prior art water cooler shown in FIG. **1**A, similar to FIG. **1**C, but showing a bag-in-box liquid container in place of the substantially rigid water bottle with connection of a water supply line from the bag-in-box liquid container connecting to a water bottle opening cap engaging pin.

FIG. **20** is an assembly view showing the parts of a further embodiment of the adapter of the invention similar to FIG. **13**, and showing a fitting for attaching to a water bottle opening cap engaging pin.

FIG. **21** is a fragmentary vertical section through the upper portion of the prior art water cooler shown in FIG. **1**A, similar to FIG. **19**, and showing the level control of FIG. **8**A.

FIG. **22** is a fragmentary vertical section through the upper portion of the prior art water cooler of FIG. **1**A, similar to FIG. **18** but showing a bag-in-box liquid container in place of the substantially rigid water bottle with connection of a water supply line from the bag-in-box liquid container connecting to a water bottle opening cap engaging pin and showing the level control of FIG. **8**A.

Reference will now be made to the exemplary embodiments illustrated, and specific language will be used herein to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS

The invention is a liquid dispenser for dispensing liquid from a liquid containing bag in a bag-in-box liquid container, and is based on adapting standard prior art water coolers that use substantially rigid five gallon water bottles as the water supply to allow the water cooler to use a bag-in-box water container rather than the rigid five gallon water bottle. The adapters of the invention replace selected parts of the standard prior art water coolers to adapted the water coolers to use of the bag-in-box liquid containers. An adapter of the invention can be configured for use with various models and brands of prior art water coolers with minor modifications that will be obvious to those skilled in the art and without departing from the inventive aspects described herein. For purposes of this detailed description, an example of the invention will be illustrated and described for use with Glacier Series Bottled Water Coolers manufactured by Crystal Mountain Products Ltd. having an office in Edmonton, Alberta, Canada. Such bottled water coolers are readily available in the United States and are similar to most bottled water coolers commercially available in the United States and in most other parts of the world. FIGS. **1**A-**1**C show a Glacier Series Bottled Water Cooler as available from Crystal Mountain Products Ltd. As shown, the water cooler includes a water cooler body **12** which rests on a supporting surface, such as a floor, and includes cooled water reservoir **13** with a water bottle support assembly **14** forming the top of water cooler body **12** and which is positioned over and extends into the open top of cooled water reservoir **13**, FIGS. **1**B and **1**C, when assembled inside the top portion of the water cooler body **12**. Water bottle support assembly **14** receives and supports a five gallon substantially rigid water bottle **16** in inverted position (water bottle neck **15** and water bottle opening **17** facing downwardly) on the top of water cooler body **12**. Water bottle **16** will normally have a cap **19**, FIG. **1**C, over the opening **17**. FIG. **1**C shows the details of one embodiment of the water bottle support assembly of the prior art Galcier Series Water Cooler, referred to as the DryGuard™ Assembly, which are shown and described in more detail in prior art U.S. Pat. No. 7,051,902, incorporated herein in its entirety by reference. FIG. **1**B shows the water bottle **16** in inverted position above the water bottle support assembly **14** and cooled water reservoir **13** ready to be lowered into its supported position shown in FIGS. **1**A and **1**C hereof. Water cooler body **12** also includes a recessed portion **18** with heated water discharge valve **20** and cooled water discharge valve **22** accessible to a user to allow a user to fill a container, such as a cup, with either cooled water or heated water from the cooler.

In the prior art embodiment shown in FIGS. **1**B and **1**C and in prior art U.S. Pat. No. 7,051,902, a water bottle adapter **23** is provided below water bottle support assembly **14** with a circumferential lip seal **23**A that bears against the interior surface of the cooled water reservoir **13** to, with water bottle adapter **23** and water bottle support assembly **14**, seal the cooled water reservoir from the atmosphere to form a sealed cooled water reservoir. Water bottle adapter **23** includes a bottle cap engaging pin **24**, FIG. **1**C, extending upwardly from the bottom thereof to engage and extend through bottle cap **19**. Bottle cap engaging pin **24** has a passage **31** therethrough opening at is bottom end into reservoir **13** and communicating through openings **33** near the top end of bottle cap engaging pin **24** with the interior of bottle **16** to allow water to flow from bottle **16**, through openings **33** and passage **31** into reservoir **13** and allow air from reservoir **13** to flow in reverse direction into bottle **16**. Thus, when bottle **16** is positioned on top of water cooler body **12** as shown in FIGS. **1**A and **1**C, fluid communication is established through bottle cap engaging pin **24** between

the interior of bottle **16** and the interior of reservoir **13**. During normal operation of the illustrated prior art water cooler, reservoir **13** is open to the atmosphere through vent **26**. The water cooler operates in normal manner with water flowing from bottle **16** into reservoir **13** and air bubbling into bottle **16** from reservoir **13** until reservoir **13** is filled with water to a level to cover the entrance provided by bottle cap engaging pin **24** into bottle **16** (i.e., the open bottom end of passage **31**) to block further flow of air into bottle **16**. Flow of water then ceases from bottle **16** into reservoir **13** until the water level in reservoir **13** drops to uncover the entrance provided by bottle cap engaging pin **24** into bottle **16** to allow flow of air into bottle **16** and flow of water into reservoir **13**. The particular embodiment of prior art shown in FIG. **1**C provides a safety feature to prevent over flow of water from the cooler in the event of a hole in bottle **16** which allows air to flow into bottle **16** and water to flow from bottle **16** regardless of whether air can flow into bottle **16** from reservoir **13**. In such case, the water level in reservoir **13** will rise and cause float **25** to close vent **26** and stop further flow of water into the then sealed reservoir **13**. This closure is designed for and provided to operate only in emergency situations to prevent overflow of water if the substantially rigid water bottle **16** develops a hole therein. It is not used for normal control of water flow from the substantially rigid water bottle **16**. Normal control of water flow from the substantially rigid water bottle **16** into reservoir **13** is provided by the water level in reservoir **13** rising to the bottom opening of passage **31** through bottle cap engaging pin **24** to thereby block the flow of air from reservoir **13** into passage **31** and into substantially rigid water bottle **16**.

During normal operation of the water cooler shown in FIGS. **1**A-**1**C, water flows from bottle **16** into cooled water reservoir **13**. Cooled water reservoir **13** is provided with a cooling element **13**A surrounding the lower part of cooled water reservoir **13**. Cooled water outlet tube **27** extends from the bottom of cooled water reservoir **13** to cooled water discharge valve **22**. Water at the top of cooled water reservoir **13** is directed by baffle disc **28** into water discharge pipe **29**A and into water discharge tube **29**B extending from the bottom of cooled water reservoir **13**. Water discharge tube **29**B connects to a heated water reservoir **31** where water is heated and stored as heated water. A heating element **31**A is wrapped around the lower part of heated water reservoir **31** to heat the reservoir and water therein. A heated water tube **29**C connects the heated water reservoir to the heated water discharge valve **20**. A separate heating reservoir is provided in all prior art water dispensers that provide heated water. If room temperature water is provided rather than heated water, water discharge tube **29**B would be connected to a room temperature water discharge valve.

FIG. **2** shows a bag-in-box water container **30** which includes a box **32** having a flexible bag **34** therein, shown in broken lines, and a bag dispensing fitting in the form of a spout fitment **36**, located at the bottom of the bag **34** within the box **32** and extending out of an opening **37** in a side of the box adjacent its bottom. There are a number of different dispensing fittings currently in use with bag-in-box containers, the one being illustrated as an example in the illustrated embodiment is a multiple part dispensing fitting made by Liqui-Box Corporation of Worthington, Ohio, as shown in U.S. Pat. Nos. 4,421,146 and 4,445,551, both incorporated herein in their entirety by reference. With this Liqui-Box dispensing fitting, the bag **34** in the bag-in-box container **30** includes the spout fitment **36** sealingly secured to the bag **34**. The spout fitment **36** includes a normally closed spout valve member **38** therein which is normally closed to prevent flow of water out of the bag through the spout fitment **36**. The bag **34** contained in the box **32** includes this spout fitment **36** and the normally closed spout valve member **38**. The spout fitment **36** is positioned inside the box **32** until the bag-in-box container **30** is ready to be used. When ready to be used, the spout fitment **36** is pulled out of the box **32** through opening **37** so as to extend through opening **37** outwardly from the box **32**, as shown. Box **32** will usually include handle openings **39** in opposite sides which a user can use to lift and move the bag-in-box container.

FIG. **3** shows applicant's adapter, indicated generally as **40**, positioned on the top of the Glacier Water Cooler body **12**, in place of the prior art water bottle support assembly **14**, and mounting a five gallon bag-in-box water container **30** on top of the Glacier Water Cooler body **12** in place of the five gallon rigid water bottle **16** shown in FIGS. **1**A-**1**C. The bag-in-box water container **30** is mounted on and received by an adapter bag-in-box water container support tray **42** sized and configured to receive and support the bag-in-box container **30** thereon. The illustrated support tray **42** includes back and side tray flanges **44**, FIGS. **4**, **5**, and **7**, and front tray flange **45** to hold the bottom of the bag-in-box container **30** received on tray **42** from sliding off of tray **42**. The front tray flange **45** includes a slot **46**, FIG. **4**.

As indicated above in connection with the bag-in-box container **30** shown in FIG. **2**, bag **34** includes spout fitment **36** as part of a Liqui-Box multiple part bag dispensing fitting indicated generally in FIG. **3** as **47**. When bag-in-box container **30** is ready to be placed on bag-in-box container supporting tray **42**, spout fitment **36** is pulled out of the box **32** through opening **37** so as to extend from box **32** as shown in FIG. **2**. Rather than doing this before placing the bag-in-box container on the bag-in-box container supporting tray **42**, this could be done once the bag-in-box container **30** has been placed on the bag-in-box container supporting tray **42**. A separate service line connector **50**, FIG. **7**, is slidably mounted in a spout clamp **52** and includes two line connectors **54** to connect to service lines to be supplied with water flowing from the bag **34**. In the present application, only one of the two line connectors is connected to a supply line, here shown as supply line **56**, with the other line connector capped by cap **57**, FIGS. **3** and **6**. The end portion **58** of spout clamp **52** away from the line connectors is adapted to connect to the extended end of the spout fitment **36** and includes a groove **59** that can slide into slot **46** of front tray flange **45** to hold and stabilize spout clamp **52** and the attached spout fitment **36** extending from the bag-in-box container **30** with respect to adapter bag-in-box water container support tray **42**. When mounted in spout clamp **52**, service line connector **50** can slide with respect to spout clamp **52** between an extended position wherein the normally closed spout valve member **38** in the spout fitment **36** remains in normally closed condition to prevent flow of water out of the bag, and a retracted position wherein service line connector **50** is pushed along spout clamp **52** toward the bag-in-box container causing end **60**, FIG. **7**, of service line connector **50** to be pushed into spout fitment **36** to open the normally closed spout valve member **38** to allow the water to flow from bag **44**, through the spout fitment **36** into the service line connector **50** and through line connectors **54** into any service lines connected thereto, here single service line **56**. This operation is all as described in the cited prior art U.S. Pat. No. 4,421,146.

With this illustrated Liqui-Box dispensing fitting embodiment of the bag dispensing fitting **47**, FIG. **3**, the spout clamp **52** with service line connector **50**, as shown in FIGS.

4, 5, and 7, is reusable. Spout clamp 52 is disconnected from the spout fitment 36 extending from bag 34 when a bag 34 is empty and is connected to a new bag spout fitment 36 extending from a full bag 34 of a replacement bag-in-box container 30.

The adapter of the present invention includes the adapter supply line 56 adapted to connect to an outlet of dispensing fitting 47 to thereby connect the bag of the bag-in-box container with the adapter. With adapter supply line 56 connected to the outlet of the dispensing fitting 47, dispensing fitting 47 can be operated to allow water from the bag-in-box container to flow into adapter supply line 56 and to flow through adapter supply line 56 through the adapter and into the water cooler reservoir. For use with the described Liqui-Box dispensing fitting, the adapter supply line 56 is connected to one of the line connectors 54 of service line connector 50, as shown in, for example, FIGS. 4-7. With the adapter supply line 56 connected to one of a line connector 54, and with the spout clamp 52 connected to spout fitment 36 extending from the bag-in-box container, the service line connector 50 can be moved along spout clamp 52 toward the bag-in-box container in receiving tray 42 to move it to its retracted position to open the spout valve 38 in the spout fitment 36 to allow water from the bag 34 to flow through service line connector 50 and line connector 54 into adapter supply line 56 and through adapter supply line 56 into the water cooler. With this illustrated Liqui-Box dispensing fitting embodiment of the dispensing fitting 47, the bottom of support tray 34 includes a slot 62, FIGS. 4-7, immediately adjacent the front tray flange 45 at the bottom of front tray slot 46 to receive the lower portion of flange 64 of spout clamp 52 therein to allow spout clamp 52 to be properly positioned at the bottom of the bag in the bag-in-box container. This slot 62 may not be necessary, or may need to be modified, depending upon the bag dispensing fitting used with the bag-in-box container used.

The general construction of the top of the example Glacier Series water cooler shown in FIG. 1 is illustrated in FIGS. 2 and 3 of referenced U.S. Pat. No. 7,051,902 and shows a water reservoir positioned in the top of the water cooler body 12. FIGS. 4 and 5 herein show water cooler body 12 with top opening 70 above the open top water reservoir, not shown, and forming the open top of the water reservoir. Top opening 70 is encircled by top rim 72 of body 12. Top rim 72 includes receiving recesses 73 for receiving locking tabs 74 extending from top cover 76. Top cover 76 fits over top opening 70 and the edge of top rim 72 with locking tabs 74 initially fitting into receiving recesses 73, and top cover 76 is then rotated to move locking tabs 74 from receiving recesses 73 to a position under top rim 72 to lock top cover 76 in position in the top of body 12. Top cover 76 includes a downwardly extending substantially cone shaped center portion 77 with a lower central cylindrical portion 78 extending further downwardly as shown in FIG. 4. In the prior art embodiment of the water cooler as shown in FIG. 1, the substantially downwardly extending cone shaped center portion 77 receives and supports the top of the rigid water bottle 16 with the narrow neck of the rigid bottle extending into lower central cylindrical portion 78.

The downwardly extending cone shaped center portion 77 and lower central cylindrical portion 78 fit into a reservoir seal assembly 80, FIGS. 4 and 5. Reservoir seal assembly 80 includes a top ring portion 81 which abuts the bottom surface of top cover 76 when cone shaped center portion 77 and lower central cylindrical portion 78 of top cover 76 are received in reservoir seal assembly 80, and a sealing ring 82 with seal 83, FIGS. 4, 5, and 6, that bears against the interior surface of the reservoir when the reservoir seal assembly 80 is received into the open upper end of the reservoir. A central cylindrical extension 84 extends downwardly into the reservoir when the reservoir seal assembly 80 is positioned in the open top of the reservoir. The bottom of central cylindrical extension 84 is sealed by bottom fitting 85 which is sealingly secured in the bottom of central cylindrical extension 84, and includes a water inlet 86. In the prior art embodiment of the water cooler as shown in FIG. 1 (and as shown in detail in FIGS. 2 and 3 of referenced U.S. Pat. No. 7,051,902), bottom fitting 85 included a pin (water bottle opening cap engaging pin 24) for engaging the cap of the rigid water bottle which is received in central cylindrical extension 84 to connect water inlet 86 to the inside of water bottle 16 so that water from water bottle 16 can flow from water bottle 16 through water inlet 86 into the water reservoir. With the adapter of the present invention, water inlet 86 communicates with supply line 56 so that water from the bag-in-box container flows from the bag-in-box container through supply line 56 and through water inlet 86 into the water reservoir 13. A small air vent 88, corresponding to air vent 26 in the illustrated prior art embodiment of FIG. 1C, extends through sealing ring 82, which for the embodiment illustrated in FIGS. 4 and 5, is shown as extended from sealing ring 82 into the reservoir by means of air vent tube 89. It should be noted that, except for the air vent 88, the bottom of the reservoir seal assembly 80 is completely sealed from seal 83 in sealing ring 82 to water inlet 86. Therefore, with reservoir seal assembly 80 in place in the top of the water reservoir, the water reservoir is completely sealed except for the air vent 88 and the water inlet 86. Access to the reservoir is restricted to the flow of water into the reservoir through water inlet 86 and flow of air into and out of the reservoir through air vent 88.

Bag-in-box water container tray 42 is secured to and spaced above mounting fitting 90, FIG. 4, by legs 91 extending from mounting disc 92. Legs 91 may be welded to the bottom of tray 42 or otherwise attached in any suitable manner to the bottom of tray 42.

Mounting tube 93 extends downwardly from mounting disc 92. Mounting disc 92 is sized to fit into the top portion of downwardly extending cone shaped center portion 77 of top cover 76 with mounting tube 93 extending into lower central cylindrical portion 78. Supply line 56 extends from connection to a line connector 54 of dispensing fitting 47, between the bottom of tray 42 and the top of mounting disc 92, through an opening in mounting disc 92 and an opening in the side of mounting tube 93, through mounting tube 93 into and through lower central cylindrical portion 78 of top cover 76. Supply line 56 may extend through mounting tube 93 into and through lower central cylindrical portion 78 of top cover 76, into central cylindrical extension 84 of reservoir seal assembly 80 to where supply line 56 may attach to bottom fitting 85 and water inlet 86. Thus, when dispensing fitting 47 is attached to bag 34, water from bag 34 can flow from bag 34 to water inlet 86 and into the water cooler reservoir.

FIG. 13 is similar to FIG. 4, but rather than showing the reservoir seal assembly 80 and parts thereof separately, FIG. 13 shows schematically and generically a reservoir assembly 95, which for the embodiment of FIG. 4 would include the reservoir seal assembly 80 therein. FIG. 14 is similar to FIG. 5, but rather than showing the mounting disc 90 and related parts, FIGS. 4 and 13, the reservoir seal assembly 80 and parts thereof, FIGS. 4 and 5, separately, FIG. 14 shows schematically and generically the reservoir assembly 95 with the top cover 76, which for the embodiment of FIG. 5

would include the reservoir seal assembly **80** therein, and does not show the mounting disc **90** and related parts which are above and hidden by the top cover **76**. However, while the reservoir assembly **95** can include the reservoir seal assembly **80** and parts thereof as shown in FIGS. **4** and **5**, such reservoir seal assembly and parts may not be included for other embodiments of the invention, and such reservoir assembly **95** may include various other parts as will be described for additional embodiments of the invention. Similarly, the bag-in-box water container support tray **42** may be supported on top cover **76** in a different manner than as shown in FIGS. **4**, **5**, and **13**.

FIGS. **8**A-**8**E show a schematic cross section representative of a water cooler water reservoir **100** with a reservoir seal assembly **102** therein showing a seal **104** between the inner surface **106** of the water reservoir **100** and the reservoir seal assembly **102**, and with supply line **108** extending into reservoir seal assembly **102** and connecting to bottom fitting **110** so as to be connected to the water outlet through bottom fitting **110** into the water reservoir **100**. Air vent tube **112** extends from air vent passage **114**, FIG. **8**A, which vents through a vent fitting **115** extending through reservoir seal assembly sealing ring **116**, to communication with the atmosphere through air filter **118**. FIGS. **8**A-**8**E illustrate several embodiments of water flow and level control for reservoir **100**.

FIG. **8**A shows the water outlet through bottom fitting **110** discharging directly into water reservoir **100**. The flow of water into reservoir **100** and the level **120** of water in reservoir **100** is controlled by a hydrophobic membrane material **122** held at the entrance of vent tube **112** by ring **124**, see also FIGS. **9**A and **9**B. Hydrophobic membrane material **122** is a material through which gas, such as air, can flow, but through which a liquid, such as water, cannot flow. An example of such material is an Emflon II Membrane material available from Pall Corporation, Port Washington, N.Y. In this embodiment, when the water level is below the membrane material **122**, FIG. **9**A, air can escape from the reservoir through the membrane and air vent to allow water to flow into the reservoir. When water covers the membrane material, FIG. **9**B, air can no longer flow through the air vent because it is blocked by the water and water cannot flow through the membrane material so cannot flow out the vent. Depending upon the amount of water in the bag of the bag-in-box container, a small amount of water may continue to flow into the reservoir once the water level reaches the membrane and vent outlet as the air pressure builds up in the sealed area of the reservoir above the water to equalize with the atmospheric pressure acting on the bag and water in the bag. This will result in the water level in the reservoir rising slightly above the bottom of tube **112** as shown in FIG. **9**B. As water is dispensed from the reservoir and the water level drops below the membrane so that air can again pass through the membrane, water will again flow from the bag into the reservoir.

FIG. **8**B shows the flow of water into reservoir **100** and the level **120** of water in reservoir **100** controlled by controlling the flow of water from the water inlet into the reservoir. In the illustrated embodiment of this control, a float valve **130** is provided at the water inlet to the reservoir. Details of a satisfactory float valve **130** are shown in FIGS. **12**A, **12**B, and **12**C. Water outlet fitting **132** with threaded nipple **134** is secured to the end of supply line **108** by connector **135**. Threaded nipple **134** fits through an opening in bottom fitting **110**. Inlet passage **136** extends through water outlet fitting **132** and nipple **134** with a ball seat **138** at the end of nipple **134**. Ball housing **140** forming ball chamber **142** is screwed onto the end of nipple **134** after ball **144** has been placed in ball chamber **142**. This sandwiches bottom fitting **110** between water outlet fitting **132** and float housing **140**. Gaskets can be positioned between fittings **135** and/or **140** to ensure sealing with bottom fitting **110**. Float rod **146** with enlarged flattened portion **148** is inserted through slot **150** so that end **151** of float rod **146** extends through opening **152** of float housing **140** and enlarged flattened portion **148** is positioned under ball **144**. Float **153** is attached to end **154** of float rod **146**. Float **153** is of somewhat flattened configuration oriented similarly with float rod flattened portion **148** so that float **153** will tend to float in flattened orientation on top of the water in reservoir **100**. This will tend to keep float rod flattened portion **148** in flattened orientation under ball **144**. In this orientation, flattened portion **148** is transverse to, and will keep float rod flattened portion **148** and float rod **146** in position in float chamber **142** as flattened portion **148** will not pass through slot **150**. Float rod **146** can be rotated to align float rod flattened portion **148** with slot **150** to insert or remove the float rod from float chamber **142**. As can be seen from FIG. **12**B, when the water level **120** in water reservoir **100** is below the bottom of float housing **140**, float **153**, which floats substantially at water level, is below the bottom of float housing **140**, and float rod is in the position shown in FIG. **12**B with ball **144** below ball seat **138** so that the valve is open and water is free to flow through inlet passage **136**, float chamber **142**, and holes **155** in float chamber bottom into the reservoir **100**. As the water level rises in reservoir **100**, float **153** rises with it until it reaches the position shown in FIGS. **8**B and **12**C with float rod **146** in the position shown in FIG. **12**C. In this position, ball **144** has been raised by float rod flattened portion **148** against ball seat **138** to close inlet passage **136** and stop flow of water into reservoir **100**. Unlike a ballcock valve which has restricted slow flow through the valve, particularly at low pressure, this valve arrangement provides a large flow passage when open, FIG. **12**B, to allow large flow volume at low pressure. Further, because of this low pressure, the upward float pressure on float rod **146** and flattened portion **148** is sufficient to provide enough upward pressure on ball **144** against valve seat **138** to stop the flow of water into the reservoir. As shown in FIG. **8**B, in addition to float valve **130** which directly controls the water flowing into the reservoir and the level of the water in the reservoir, the vent tube **112** with hydrophobic membrane **122** as described for FIG. **8**A is still present. While a vent to allow air to flow into and out of the reservoir as the water level varies between the desire level and lower levels is necessary, the hydrophobic membrane is not necessary because the float valve controls the water flow and water level. However, the presence of the hydrophobic membrane provides a safety feature in that if float valve **130** fails to operate for any reason, the hydrophobic membrane over the air vent will stop filling of the reservoir at substantially the level of the membrane to prevent a water overflow from the reservoir through the air vent.

FIG. **8**C shows the water outlet through bottom fitting **110** discharging directly into water reservoir **100** as shown for FIG. **8**A. The flow of water into reservoir **100** and the level **120** of water in reservoir **100** is controlled by a float valve **160** in vent tube **112** which opens and closes the air vent into the reservoir. In the illustrated embodiment of this control, shown in more detail in FIGS. **11**A and **11**B, air vent passage **114**, which vents through vent fitting **115** extending through seal assembly sealing ring **116**, includes a seal, such as an O-ring **162**, at the lower end of air vent passage **114** to form a ball seat for ball **164**. A float **166** is slidably positioned in

vent tube **112**, with a spring **168** between a float upper end recess **169** and ball **164**. As shown in FIG. **11**A, when the water level **120** in reservoir **100** is below the bottom of vent tube **112**, float **166** is near the bottom of vent tube **112** allowing ball **164** at the upper end of spring **168** to drop below ball seat **162** thereby opening the air vent passage **114** to allow air flow into and out of reservoir **100**. When the water level **120** rises, float **166** rises in vent tube **112** to push ball **164** upwardly toward and then against valve seat **162** to close air vent passage **114** and prevent air flow out of reservoir **100**. This will cause the air pressure in the top of reservoir **100** to build up as water continues to flow into the reservoir and to stop flow of water into the reservoir as the air pressure in the reservoir equalizes with the atmospheric pressure acting on the bag and water in the bag.

FIG. **8**D shows the float valve **130** as previously described as the control for water flow into the reservoir and for the water level control, and shows the air vent float valve **160** as previously described as a backup safety feature if water control float valve **130** should malfunction.

FIG. **8**E shows the water outlet through bottom fitting **110** discharging directly into water reservoir **100** as shown for FIG. **8**A. The flow of water into reservoir **100** and the level **120** of water in reservoir **100** is controlled by a second embodiment of float valve **170** in vent tube **112** which opens and closes the air vent into the reservoir. In the illustrated embodiment of this control, shown in more detail in FIGS. **10**A and **10**B, air vent tube **112** includes an insert **172** in its upper end which forms a ball seat **174** for a float ball **176**. As shown in FIG. **10**B, when water level **120** is low, ball **176** falls below ball seat **174** to open air vent tube **112** and allow air to flow into and out of reservoir **100**. In this embodiment, air vent tube **112** includes a bottom **178** to prevent float ball **176** from falling out of the air vent tube **112** when the water level **120** in reservoir **100** drops well below the bottom of air vent tube **112** as can happen when all of the water in the bag-in-box container is used and the emptied bag-in-box container needs to be replaced with a new full bag-in-box container. Here openings **179** in the lower walls of air vent tube **112** allow air and water to flow into and out of the lower portion of air vent tube **112**. When the water level **120** rises in the reservoir, it pushes floating ball **176** upwardly toward and the against ball seat **174** to close air vent tube **112** and prevent air flow out of the reservoir **100**. FIG. **10**A show the water level **120** pressing float ball **176** against ball seat **174** to close to close air vent tube **112**.

While FIGS. **8**A-**8**E show schematically the outlet or discharge end of the supply line **108**, (supply line **56** of FIGS. **3**-**7**) connected to bottom fitting **110**, which represents bottom **85** with water inlet **86** in FIGS. **4** and **5**, various other connection arrangements can be used. For example, as indicated above, the reservoir fitting may be an existing assembly in the top of the water cooler reservoir which includes a water bottle opening cap engaging pin **24**, FIG. **1**C, adapted to extend through the water bottle opening cap of a substantially rigid water bottle for which the water cooler was designed to be used with. In some instances it may be desirable to leave the water bottle opening cap engaging pin **24** in place in the water bottle adapter **23**, FIG. **1**C, when adapting the water cooler to use a bag-in-box liquid container in place of the substantially rigid water bottle **16**. Leaving the water bottle opening cap engaging pin **24** in place can reduce the modifications that need to be made to the prior art water cooler, can provide easier cleaning of the water cooler, can provide easier assembly and disassembly of the water cooler, and/or provide other advantages depending upon the particular prior art cooler being adapted.

FIG. **19** shows the prior art water cooler of FIGS. **1**A, **1**B, and **1**C converted to hold a bag-in-box liquid container **30** on top of the cooler body **12**. FIG. **19** is similar to FIG. **1**C except for the change from the substantially rigid water bottle to the bag-in-box liquid container. The water bottle support assembly **14** and the water bottle adapter **23** are the same as when the substantially rigid water bottle was used and the water bottle opening cap engaging pin **24** remains. In the embodiment of the invention shown in FIG. **19**, the discharge end of the supply line **56** as described for previous embodiments is connected to an adapter fitting **184** that fits over the upper end of the water bottle opening cap engaging pin **24** to provide a liquid chamber **185** around the openings **33** connecting to the pin passage **31**. Seal **186** at the lower end of adapter fitting **184** seals liquid chamber **185** to prevent leakage down the outside of the water bottle opening cap engaging pin **24**. All liquid flowing through liquid supply line **56** is directed into liquid chamber **185** to flow through openings **33** into pin passage **31** and through pin passage **31** into water reservoir **13**. FIG. **20** is similar to FIG. **13**, but shows water bottle opening cap engaging pin **24** in assembly view as it would be in the lower cylindrical portion **78** when assembled into the reservoir assembly **95**. FIG. **20** shows adapter fitting **184** on the end of supply line **56** as the supply line **56** would be inserted into water reservoir **95** and attached over the upper end of adapter fitting **184**. With the adapter fitting as shown in FIG. **22** on the end of supply line **56**, the supply line **56** can be easily attached to or removed from the end of water bottle opening cap engaging pin **24**.

While this attachment to the water bottle opening cap engaging pin **24** provides water to water reservoir **13**, as previously explained, since bag **34** is flexible and collapses as the water drains from the bag, the invention requires a means for controlling the flow of liquid from the supply line **56** into the reservoir **13** to control the level of water in the reservoir **13**. While not provided for this purpose, as previously mentioned, this particular embodiment of prior art shown in FIG. **1**C provides a safety feature to prevent over flow of water from the cooler in the event of a hole in bottle **16** which allows air to flow into bottle **16** and water to flow from bottle **16** regardless of whether air can flow into bottle **16** from reservoir **13**. With this safety feature, if water in reservoir **13** rises to float **25**, it will cause float **25** to close vent **26** and stop further flow of water into the then sealed reservoir **13**. If this safety feature works properly, vent **26** is closed as the water level reaches vent **26** so water cannot flow through vent **26** and reservoir **13** is sealed. This will control the water level in reservoir **13** at the level of vent **26**. This should allow the prior art water cooler to operate in the manner of the invention. When water is withdrawn from the reservoir, the water level and float **25** will fall and vent **26** will be opened to allow water to flow from the bag-in-box liquid container to again fill the reservoir to full capacity. However, as indicated, this closure is designed for and provided to operate only in emergency situations to prevent overflow of water if the substantially rigid water bottle **16** develops a hole therein. It is not used for normal control of water flow from the substantially rigid water bottle **16** normally used with this water dispenser and normal water level as designed for this water cooler is much lower in the reservoir at the bottom outlet of the passage **31** through water bottle opening cap engaging pin **24**. The reservoir **13** would be constantly over filled, however, the water cooler would work with the bag-in-box water container.

FIG. **21** shows the prior art water cooler of FIG. **1**C modified as shown in FIG. **19** to mount a bag-in-box liquid container, and shows a further modification to provide a flow and level control of the invention as shown and described for FIGS. **8**A and **8**B which uses a hydrophobic membrane **122** in conjunction with a vent tube **112** to provide flow and level control. Rather than the hydrophobic control as described for FIGS. **8**A and **8**B, any of the flow and level controls as shown in FIGS. **8**A-**12**C and/or described in the application, or equivalents, can be used.

With the embodiments of the adapter described above, the water reservoir or reservoirs as provided in the prior art water cooler being adapted to use with a bag-in-box liquid container are used and, if the prior art water reservoirs are not already sealed or sealable, as is the case in many or most of the prior art water coolers, in most embodiments of the adaption, the existing water reservoirs will be sealed or made sealable as part of the adaptation. With such arrangements, it is necessary to provide for control of the flow of water from the bag of the bag-in-box container into the reservoir and generally to control the level of the water in the reservoir. In the embodiments shown, this control is provided by valves in the flow path from the bag-in-box container to the water reservoir or by confining the water to within the sealed reservoir. The cooling and/or heating of the water is provide in normal manner by the cooling reservoir and/or heating reservoir as provided in the prior art water cooler being converted.

In further alternate embodiments of the invention, a replacement reservoir in the form of a flow passage through a heat exchange block can be provided which can cool or heat water while in the passage or while flowing through the passage. FIG. **15** shows such an adaption wherein the cooled water reservoir and/or the heated water reservoir supplied with the original water cooler is replaced by a replacement reservoir in the form of a heat exchange block, indicated generally by reference number **200**, having a liquid cooling passage **202** in a spiral configuration through a ring of high heat capacity material **204** such as a metal or clay, and a liquid heating passage **206** in a spiral configuration through a similar ring of high heat capacity material **208**. Such passages along with the inlet and outlet can be formed of stainless steel tubing (acceptable for food applications) with the ring of high heat capacity material, such as aluminum, cast over the stainless steel tubing. A cooling element **210**, such as a high heat conductive material such as a metal, with passages **212** for cooled gas from a standard refrigeration unit used in water coolers, not shown, is wrapped around the outside of ring **204** in order to cool ring **204**. A temperature sensor, not shown in FIG. **15** but shown as **280** in FIG. **17**, in the material forming ring **204** provides feedback to a refrigeration unit control to control cooling of the cooling element in standard manner for a water cooler cooling reservoir. A heating element **214**, such as a silicone material with electrical resistance heating wires **216** therein, is wrapped around the outside of ring **208** in order to heat ring **208**. A temperature sensor, not shown in FIG. **15** but shown as **284** in FIG. **17**, in the ring **208** provides feedback to a heating circuit control to control heating of the heating element **214** in standard manner for a water cooler heating reservoir. Insulation rings **220**, **222**, **224**, and **226** are provided around the outside of cooling element **210**, between ring **204** and heating element **214**, around the inside of ring **208**, and under heat exchange block **200**, respectively. Liquid from the bag **34** of the bag-in-box liquid container **32** flows from the bag through supply line **56** and though manifold **228** to cooling passage **202** and heating passage **206**. Water from cooling passage **202** flows through connectors **230** and **232** into cold water outlet tube **27** to cooled water discharge valve **22** and water from heating passage **206** flows through connectors **234** and **236** into hot water outlet tube **29**C to hot water discharge valve **20**. While various connectors can be used, connectors **232** and **236** shown provide connection to the female ends of connectors **238** and **240** provided with the particular prior art Glacier Series water cooler embodiment shown for illustration purposes in FIG. **15**. The flow passages for the liquid from the bag in bag-in-box container **32** through the supply line **56**, the heat exchange block **200**, and out through tubes **27** and **29**C to water discharge valves **22** and **20** is completely closed so water will not flow from the bag **34** unless one of the water discharge valves **20** or **22** is opened. No other valves are needed to control flow. This simplifies the control of water flow in the water cooler. In addition, heat exchange block **200** replaces both the cooling reservoir and the separate heating reservoir provided in prior art water coolers which provide hot water as well as cold water.

FIG. **16** shows an embodiment of a heat exchange block **250** which provides water cooling and, rather than water heating, provides room temperature water through a room temperature discharge valve which replaces the hot water discharge valve. A number of prior art water coolers provide cooled water and room temperature water, rather than hot water. In the embodiment of FIG. **16**, a cooling passage **252** is provided in a ring of high heat capacity material **254** with cooling element **210** wrapped around the outside of ring **254**. Insulation ring **220** is provided around the outside of cooling element **210** and insulation ring **256** is provided around the inside of ring **254**. The outlet of cooling passage **252** is connected to a cooled water outlet tube, not shown, such as cooled water outlet tube **27** of FIG. **15**, through connector **258**. Stainless steel passage **260** extends without cooling or heating through the center of heat exchange block **250** to connection through connector **262** to a water outlet tube that connects to a room temperature discharge valve, which usually would correspond to the hot water discharge valve **20** since there is no hot water. Water from the bag of the bag-in-box liquid container enters the inlet of the passages **252** and **260** through supply line **56**, not shown.

FIG. **17** shows a heat exchange block **270** similar to heat exchange block **200** of FIG. **15** with both a liquid cooling passage **272** and liquid heating passage **274**, but showing liquid cooling passage **272** and liquid heating passage **274** each in the form of a single vertical spiral rather than having alternating wider and narrower width spiral coils as in FIG. **15**. Further, the connections to the respective water outlet tubes are shown more generically with connectors **276** and **278** without the special connectors to the particular example outlet tube connectors shown in FIG. **15**. In addition, temperature sensor **280** is shown in ring **282** to measure the temperature of the high heat capacity material surrounding the liquid cooling passage **272** and temperature sensor **282** is shown in ring **284** to measure the temperature of the high heat capacity material surrounding the liquid heating passage **274**. As indicated in connection with FIG. **15**, such temperature sensors provide feedback to a refrigeration unit control to control cooling of the cooling element **210** in standard manner for a water cooler cooling reservoir and provide feedback to a heating circuit control to control heating of the heating element **214** in standard manner for a water cooler heating reservoir. In addition, a UV Chamber **286** is provided in the water inlet passage to the heat exchange block to sterilize the water entering the heating and cooling passages of the heat exchange block.

The heat exchange block of the invention is not limited to use with the bag-in-box liquid supply of the invention, but can be used in a conventional prior art water cooler in place of the conventional water cooling reservoir and water heating reservoir. Thus, FIG. **18** shows the prior art rigid water bottle source of water as shown in FIG. **1**C, with the heat exchange block reservoir **200** of FIG. **15** used in place of the heating and cooling reservoirs of the prior art embodiment of FIG. **1**C. Since the water source of the embodiment of FIG. **18** is the rigid water bottle **16**, a water reservoir **300** is provided to provide the prior art water flow control from the rigid water bottle **16**. This water flow control is described in connection with FIGS. **1**A-**1**C and maintains water in water reservoir **300** as long as water remains in water bottle **16**. In the embodiment of FIG. **18**, an inlet **302** to the liquid cooling passage **202** of heat exchange block **200** opens into reservoir **300** so that the water in reservoir **300** flows by gravity into liquid cooling passage **202**. An inlet **304** to liquid heating passage **206** of heat exchange block **200** also opens into reservoir **300** so that the water in reservoir **300** flows by gravity into liquid heating passage **204**. As indicated for FIG. **15**, the outlet of liquid cooling passage **202** is connected to cooled water discharge valve **22** and the outlet of liquid heating passage **206** is connected to hot water discharge valve **20**. Therefore, upon opening of cooled water discharge valve **22** by a user, cooled water stored in liquid cooling passage **202** flows from cooled water discharge valve **22** and water form reservoir **300** which flows into and through liquid cooling passage **202** is cooled as it flows through the liquid cooling passage **202**. Upon opening of hot water discharge valve **20** by a user, heated water stored in liquid heating passage **206** flows from hot water discharge valve **20** and water form reservoir **300** which flows into and through liquid heating passage **206** is heated as it flows through the liquid heating passage **206**.

FIG. **22** is similar to FIG. **18** using the heat exchange block of the invention, but converted to hold a bag-in-box liquid container **30** on top of the cooler body **12**, and wherein the water bottle opening cap engaging pin **24** is used with the bag-in-box liquid container similarly to the showing in FIG. **19**. The supply of water to the reservoir is as described for FIGS. **19** and **22**, while operation of the heat exchange block is as described for FIGS. **15**-**18**.

While specific air vent controls and a specific water flow control have been shown and described, various other air vent controls and water flow controls can be used either alone or in combination to control the water flow into the reservoir and/or the air flow into and out of the reservoir.

While the description describes the bag-in-box container as containing water and is directed to the use of water and water dispensers, any liquid to be dispensed, where appropriate, can be used in place of water.

While the forgoing examples are illustrative of the principles of the present invention in one or more particular applications, it will be apparent to those of ordinary skill in the art that numerous modifications in form, usage and details of implementation can be made without the exercise of inventive faculty, and without departing from the principles and concepts of the invention. Accordingly, it is not intended that the invention be limited, except as by the claims set forth below.

The invention claimed is:

1. An adapter for allowing a bag-in-box liquid container having a collapsible bag containing the liquid within the box and a bag dispensing fitting extending from the bag for dispensing liquid from the bag, to be used with a conventional water cooler designed to use a substantially rigid water bottle having a water bottle opening with a water bottle opening cap as the source of water and having a water cooler body with a reservoir therein adapted to receive the substantially rigid water bottle positioned in inverted orientation at the top of the water cooler body with the water bottle opening extending into the water cooler body above the reservoir and having a water bottle opening cap engaging pin adapted to extend through the water bottle opening cap into the water bottle opening wherein water from the substantially rigid water bottle flows by gravity through the water bottle opening cap engaging pin through the water bottle opening from the substantially rigid water bottle into the reservoir and when water from the substantially rigid water bottle reaches a desired level in the reservoir, the water closes the bottle opening to the flow of air into the bottle thereby stopping flow of water from the substantially rigid water bottle into the reservoir, and including a user operated reservoir outlet to dispense water from the reservoir when desired by a user, comprising:

a holder for removably holding a bag-in-box liquid container in place of the water bottle at the top of the water cooler body; and

a liquid supply line having opposite ends, one end adapted for removable attachment to the bag dispensing fitting when a bag-in-box liquid container is positioned in the holder and the opposite end adapted to connect with the water bottle opening cap engaging pin whereby water from the bag-in-box liquid container can flow by gravity from the bag-in-box liquid container through the bag dispensing fitting, the liquid supply line, and the water bottle opening cap engaging pin into the reservoir.

2. An adapter for allowing a bag-in-box liquid container to be used with a conventional water cooler according to claim **1**, wherein the water bottle opening cap engaging pin includes openings therein positioned to receive liquid to flow through the water bottle opening cap engaging pin to the reservoir, and wherein the end of the liquid supply line adapted to connect with the water bottle opening cap engaging pin connects in liquid flow communication with the openings.

3. An adapter for allowing a bag-in-box liquid container to be used with a conventional water cooler according to claim **2**, wherein the end of the liquid supply line adapted to connect with the water bottle opening cap engaging pin includes an adapter fitting configured to fit over an end of the water bottle opening cap engaging pin and form a liquid chamber around the openings wherein water will flow from the liquid supply line into the liquid chamber and into the openings.

4. An adapter for allowing a bag-in-box liquid container to be used with a conventional water cooler according to claim **3**, wherein the liquid chamber is sealed around the water bottle opening cap engaging pin.

5. An adapter for allowing a bag-in-box liquid container to be used with a conventional water cooler according to claim **4**, wherein the adapter fitting removably fits over the end of the water bottle opening cap engaging pin.

6. An adapter for allowing a bag-in-box liquid container to be used with a conventional water cooler according to claim **2**, wherein the end of the liquid supply line adapted to connect with the water bottle opening cap engaging pin removably connects in liquid flow communication with the openings.

7. An adapter for allowing a bag-in-box liquid container to be used with a conventional water cooler according to claim **1**, wherein the end of the liquid supply line adapted to

connect with the water bottle opening cap engaging pin is adapted to removably connect with the water bottle opening cap engaging pin.

8. An adapter for allowing a bag-in-box liquid container to be used with a conventional water cooler according to claim **1**, additionally including means for controlling flow of liquid into the reservoir to control the level of liquid in the reservoir.

9. An adapter for allowing a bag-in-box water container to be used with a conventional water cooler according to claim **8**, wherein the reservoir is sealed and includes a vent from the reservoir to the atmosphere, wherein the means for controlling flow of liquid from the supply line into the reservoir to control the level of water in the reservoir includes a vent valve in the vent from the reservoir to the atmosphere responsive to the level of the liquid in the reservoir to allow flow of air through the vent into the reservoir when the level of the liquid in the reservoir is below a desired level and to stop flow of air from the reservoir when the level of liquid in the reservoir is at the desired level.

10. An adapter for allowing a bag-in-box water container to be used with a conventional water cooler according to claim **9**, wherein the vent has an entrance in the reservoir, wherein the entrance is positioned in the reservoir at the desired level of liquid in the reservoir, and wherein the vent valve is a hydrophobic membrane that allows air to pass therethrough and does not allow liquid to pass therethrough whereby when the liquid is below the entrance, air can flow through the membrane and vent and when the liquid is in contact with the membrane, air cannot flow through the membrane and vent.

11. An adapter for allowing a bag-in-box water container to be used with a conventional water cooler according to claim **9**, wherein the vent valve is a float valve in the vent responsive to the level of liquid in the reservoir whereby when the liquid in the reservoir is below the desired level, the float is below a float seat to allow flow of air through the vent and when the level of the liquid is at the desired level, the float is against the float seat to prevent flow of air through the vent.

12. An adapter for allowing a bag-in-box water container to be used with a conventional water cooler according to claim **8**, wherein the means for controlling flow of liquid from the supply line into the reservoir to control the level of water in the reservoir includes a flow valve responsive to the level of the liquid in the reservoir at a location where the water flows into the reservoir to allow flow of liquid from the supply line into the reservoir when the level of the liquid in the reservoir is below a desired level and to stop flow of liquid from the supply line into the reservoir when the level of liquid in the reservoir is at the desired level.

13. A method of converting a conventional water cooler designed to use as a source of water a substantially rigid water bottle having a water bottle opening with a water bottle opening cap as the source of water and having a water cooler body with a reservoir therein adapted to receive the substantially rigid water bottle positioned in inverted orientation at the top of the water cooler body with the water bottle opening extending into the water cooler body above the reservoir and having a water bottle opening cap engaging pin adapted to extend through the water bottle opening cap into the water bottle opening wherein water from the substantially rigid water bottle flows by gravity through the water bottle opening cap engaging pin through the water bottle opening from the substantially rigid water bottle into the reservoir and when water from the substantially rigid water bottle reaches a desired level in the reservoir, the water closes the bottle opening to the flow of air into the bottle thereby stopping flow of water from the substantially rigid water bottle into the reservoir, to a water cooler adapted to use as a source of water a bag-in-box liquid container having a collapsible bag containing the liquid within the box and a bag dispensing fitting extending from the bag for dispensing liquid from the bag, comprising:

adding a holder for removably holding a bag-in-box liquid container in place of the water bottle at the top of the water cooler body; and

connecting one end of a liquid supply line having opposite ends to the water bottle opening cap engaging pin, the opposite end adapted for removable attachment to the bag dispensing fitting when a bag-in-box liquid container is positioned in the holder whereby when the opposite end is attached to a bag dispensing fitting of a bag-in-box liquid container positioned in the holder, water from the bag-in-box liquid container can flow by gravity from the bag-in-box liquid container through the bag dispensing fitting, the liquid supply line, and the water bottle opening cap engaging pin into the reservoir.

14. A method of converting a conventional water cooler designed to use a substantially rigid water bottle as the source of water to a water cooler using a bag-in-box liquid container as the source of water according to claim **13**, additionally including positioning a bag-in-box liquid container having a liquid contained in the bag therein in the holder and attaching the end of the liquid supply line adapted for removable attachment to the bag dispensing fitting to the bag dispensing fitting of the bag-in-box liquid container positioned in the holder.

15. A method of converting a conventional water cooler designed to use a substantially rigid water bottle as the source of water to a water cooler using a bag-in-box liquid container as the source of water according to claim **14**, additionally including providing means for controlling flow of liquid from the bag-in-box liquid container into the reservoir to control the level of liquid in the reservoir.

16. A method of converting a conventional water cooler designed to use a substantially rigid water bottle as the source of water to a water cooler using a bag-in-box liquid container as the source of water according to claim **13**, additionally including providing means for controlling flow of liquid from the bag-in-box liquid container into the reservoir to control the level of liquid in the reservoir.

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