

Description

Continuous-Flow Drinking Fluid Dispenser

Technical Field

This invention relates to fluid storage and dispensing, and more particularly, to storing and dispensing of
5 drinking fluid in a water cooler.

Background Art

Bottled-water coolers have long been used by consumers as preferable sources of drinking water. In a typical bottled-water cooler, a refillable bottle filled with purified water is
10 placed atop a base. The base includes a tank reservoir having at least one spigot. The bottle and the tank reservoir are in fluid communication with each other. When an user turns on the spigot, water flows out of the tank reservoir which in turn withdraws water from the bottle. When all the water inside the
15 bottle is consumed, the bottle needs to be replaced.

There are various inconveniences associated with bottled-water coolers as mentioned above. First, replacing an empty bottle with a filled bottle is quite a strenuous task. Specifically, it requires a person with considerable physical
20 strength to carry and place a filled bottle atop the base. Mispositioning the bottle onto the base tank can cause water spillage. Normally, a water distributor is called via telephone in advance. Thereafter, a delivery person delivers a new water bottle and performs the replacement. Thus, replacing the empty
25 bottle is quite inconvenient and time-consuming, not to mention the cost associated with delivery. Alternatively, filled bottled water can be stored in advance. However, this option requires storage space. Still, there is a need for a person with physical strength to perform the bottle replacement.

30 There are continuous-flow water coolers available. A typical system is marketed by Topway Global, Inc., Brea, California under the model number POU-425H. Typically, in such a cooler, there is no water bottle visible. Instead, water comes directly from the water supply, such as the water line of

a building. That is, the supplied water goes directly to the water tank of the cooler base. Very often, the supplied water passes through a series of filters for purification before entering the tank. The water level inside the tank is sensed
5 electronically. When the water level is above a predetermined level, the sensor inside the tank signals an installed electro-mechanical valve to shut off the water supply into the tank. On the other hand, when the water level is below the predetermined level, the sensor directs the electro-mechanical valve to open
10 and allows water to flow into the tank.

In a continuous-flow water cooler, there is no need to constantly replace the depleted water bottles and thus eliminate all the associated inconveniences. However, a continuous-flow water cooler is more expensive. Furthermore, the electronic
15 sensors with the related circuits are more prone to failure. Since the water level is concealed, when the sensing mechanism fails, spillage can result in a hazardous flooding.

Despite the aforementioned drawbacks, bottled-water coolers have certain consumer appeals. Among other things, the
20 aesthetic display of the visibly clear water is a key attractive feature. More particularly, a large volume of clear water inside a transparent bottle conveys the perception of cleanliness and freshness, thereby favorably affecting the user psychologically even before any water is consumed.

25 To reap the advantages of both the bottled-water and continuous-flow water coolers, hybrid forms of water coolers have been devised. Such a cooler is typically disclosed in U.S. Patent No. 4,923,091, Sutera, entitled "Self-Filling Bottled-Water Cooler", issued May 8, 1990. In *Sutera*, a bottle is
30 attached to a water tank base. The bottle is hooked up to a constant water supply line. Water is admitted to the bottle through a water valve which is submerged under water level inside the bottle. The valve is linked and actuated by a float which wraps around an elongated tubular air vent. The air vent
35 in turn is centrally positioned inside the bottle in a direction along the height of the bottle. The outlet of the air vent is also below the water level. The float is capable of telescopically moving along the tubular air vent.

When the water level inside the bottle rises, the float moves upwardly until a certain level is reached and shuts off the water valve. On the other hand, when the water level falls, the float follows the receding water level and
5 consequently opens the water valve allowing water to flow into the bottle.

The water cooler of *Sutera* involves components of considerable large dimensions. The consequential disadvantages are increased costs of manufacturing and assembly. Furthermore,
10 the physically large components move relative to each other curtails the overall operational reliability.

There is a need to provide a water cooler having the aesthetic advantages of a conventional bottled-water cooler yet without its associated inconveniences.

15 Disclosure of the Invention

It is accordingly the object of the invention to provide a continuous-flow drinking fluid dispenser with the drinking fluid visible to the user.

It is yet another object of the invention to provide a
20 continuous-flow drinking fluid dispenser with less moving components and having smaller component sizes, thereby improving overall operational reliability and curtailing manufacturing costs.

The drinking fluid dispenser of the invention includes
25 a bottle having a closed end and an open end. In a first embodiment, the open end is attached with a gasket and is disposed into the opening of a dispenser base via the gasket sealingly. Mounted inside the bottle is a valve proximally connected to a float by an actuating arm. The valve is
30 positioned above the fluid inside the bottle and is connected to a continuous-flow fluid source. During normal operation, the float closes and opens the valve, respectively, via buoyantly floating on fluid which rises and falls inside the bottle. There is also a pressure vent with an orifice disposed through
35 the bottle and above the bottle fluid to maintain ambient atmospheric pressure inside the bottle.

In a second embodiment, an adapter is sandwiched between the gasket and the open end of the bottle. The adapter acts as a spacer which allows a regular water bottle to be converted for use as a continuous-flow fluid dispenser in accordance with the invention.

These and other features and advantages of the invention will be apparent to those skilled in the art from the following detailed description, taken together with the accompanying drawings, in which like reference numerals refer to like parts.

Brief Description of the Drawings

Fig. 1 is an exploded view, shown in perspective, of key components of the first embodiment of the invention;

Fig. 2 is a cross-sectional view, taken along the line 2-2 of Fig. 1, of the first embodiment of the invention;

Fig. 3 is a perspective view of the pressure vent used in the first embodiment;

Fig. 3A is a cross-sectional view of the pressure vent taken along the line 3A-3A of Fig. 3;

Fig. 4A is a fragmentary view, shown in cross-section, of the float actuating the valve when the fluid level recedes inside the bottle;

Fig. 4B is a fragmentary view, shown in cross-section, of the float actuating the valve when the fluid level rises inside the bottle;

Fig. 5A is an insert view taken within the circle 5A of Fig. 4A;

Fig. 5B is an insert view taken within the circle 5B of Fig. 4B;

Fig. 6 is an exploded view, shown in perspective, of the key components of the second embodiment of the invention; and

Fig. 7 is a cross-sectional view, taken along the line 7-7 of Fig. 6, of the second embodiment of the invention.

Modes of Carrying Out the Invention

Reference is now directed to Fig. 1 which shows an

exploded view of the key components of the first embodiment of the invention generally signified by the reference numeral 2.

The assembly 2 of this embodiment includes a water bottle 4 having an open end 8 and a closed end 6. The bottle 4 is

5 preferably made of transparent material such as clear plastic or glass. Disposed inside the bottle 4 is a fluid valve 10 which is actuated by a float 12 via an actuating arm 14. The fluid valve 10 may derive water from a continuous water supply source, such as the main water line (not shown) of a building.

10 Preferably, water from the water supply source passes through a series of filters (not shown) before entering the fluid valve 10. The purification process can be reverse osmosis, or carbon block filtration known in the art.

There is a gasket 16 disposed at the open end 8 of the
15 bottle 4. The gasket 16 is preferably made of resilient material, such as rubber or Teflon®. The gasket 16 can be press-fit or glued onto the open end 8 of the bottle 4. Disposed near the closed end 6 of the bottle 4 on the bottle sidewall is a pressure vent 18. In this embodiment, the pressure vent 18 is
20 designed to be insertable through the sidewall of the bottle 4. Fig. 3 is a perspective view of the pressure vent 18. Fig. 3A is a cross-sectional view taken along the line 3A-3A of Fig. 3. In the embodiment, the pressure vent 18 has a flange portion 17 integrally connected to a hollow shaft 19. An orifice 23 is
25 formed longitudinally through the hollow shaft 19. Inserted into the orifice 23 is a filter 21. Fig. 3A shows the filter 21 being partially inserted into the orifice 23 of the hollow shaft 19. The filter 21 is put in place for screening bacteria from entering into the water during use and is preferably made of a
30 porous material such as polypropylene, cotton or yarn.

Fig. 2 is a cross-sectional view taken along the line 2-2 of Fig. 1. Fig. 2 is shown somewhat schematically with the assembly 2 assembled onto a cooler base 20 which includes a housing 22. The overall dispenser is signified by the reference
35 numeral 24. Positioned inside the housing 22 is a tank reservoir 26 which is preferably made of corrosive-resistant material, such as stainless steel. Atop the tank reservoir 26 is an opening 28 formed in the base housing 22. The bottle 4 of

the first embodiment 2 is press-fit into the opening 24 sealingly secured by the gasket 16 as shown in Fig. 2.

The reservoir 26 is wrapped around by a cooling coil 30 which is in fluid communication with a compressor 32. In
5 operation, the compressor 32 compresses and pumps coolant through the hollow coil 30 via the coolant pipes 34. Passing through the bottom of the reservoir 26 is a cool water pipe 36 which is attached to a cool water spigot 38.

Centrally disposed through the bottom of the reservoir
10 26 is a heater pipe 40 which goes directly to a water heater 42. Exiting out of the water heater 42 is a hot water pipe 44 that is connected to a hot water spigot 46.

Surrounding the tank reservoir 26 is an insulating layer 48 made of thermal insulating material. In this
15 embodiment, the insulating layer 48 is made of styrofoam.

The operation of the water dispensing apparatus 24 is herein described.

During normal use, the bottle 4 maintains a predetermined water level 50, as shown in Fig. 2. Reference is
20 now directed to Figs. 4A and 4B, in conjunction with Fig. 2. Suppose one of the spigots 38 or 46 is turned on. Water 52 is withdrawn from the reservoir 26. Since the reservoir 26 is in fluid communication with the bottle 4, water flows from the bottle 4 to the reservoir 26. As a consequence, the water level
25 falls, as shown in Fig. 4A. Without the buoyancy support of the water 52, the float 12 drops due to its own weight. Consequently, the float 12 rotates the actuating arm 14 in the direction 51 about the arm pivot 55, thereby withdrawing the piston 54 away from the opening 56 of the valve passageway 58,
30 as shown in Fig. 5A. With no blockage of the piston 54, water 52 flows through the opening 56 from the valve passageway 58, and then into the bottle 4. The water 52 flowing into the passageway 58 is derived from a constant water supply source (not shown), such as the water line of a building.

35 While the water 52 is filling the bottle 4 as described above, the buoyancy force of the rising water 52 pushes the float 12 against its gravitational force and rotates the actuating arm 14 in the other direction 53 about the arm

pivot 55, as shown in Figs. 4B and 5B. As a result, the piston 54 pushes against the opening 56 of the valve passageway 58, thereby preventing any water 52 from escaping from the passageway 58.

5 It also should be noted that for water to freely flow in and out of the bottle 4, the air inside the bottle 4 beneath the closed end 6 but above the water level 50 must maintain the ambient atmospheric pressure. The pressure vent 18 disposed adjacent the closed end 6 of the bottle 4 performs this duty.
10 In particular, when the water level 50 recedes, air is sucked into the bottle 4 through the filter 21 disposed in the hollow shaft 19 of the air vent 18 (Figs. 3 and 3A). On the other hand, when the water level inside the bottle 4 rises, air is forced out of the bottle 4 through the filter 21 of the air vent
15 18.

 The air vent 18 is designed to be insertable and replaceable. After prolonged use, the air vent 18 may need to be unplugged and replaced with a different vent 18 having a new filter 21. Alternatively, only the filter 21 may be extracted
20 and replaced, without discarding the entire air vent 18.

 Albeit with relatively simple design and with not many components, there is an efficient regulatory mechanism built in the valve 10. The piston 54 is made of resilient material, such as rubber or Teflon®. The actuating arm 14 is designed to be
25 pivoted at a high leverage ratio. As such, the piston 54 can exert a strong force against the opening 56 of the valve passageway 58. For the sake of explanation, suppose there is water leakage from the opening 56. The leakage will accumulate water 52 inside the bottle 4, resulting in a higher water level
30 50 inside the bottle 4. Since the water 52 buoyantly pushes upwardly against the float 12 at the water level 50, the float 12 rotates the arm 14 further in the direction 53 (Fig. 4B). As a consequence, the arm 14 pushes the piston 54 tighter against the opening 56, thereby sealing the opening 56 from further
35 fluid leakage.

 In accordance with the invention, the valve 10 and the pressure vent 18 are positioned above the water level 50. Specifically, the key parts of the embodiment 2 occupy a

relatively small volume of space above the water level 50. As is known in the art, the more extensive the components in physical sizes, the less reliable is the final mechanical assembly. Likewise, the more moving parts are installed and
5 involved, the more likely is the final assembly prone to mechanical failure. In accordance with the invention, relatively few moving parts are used. Further, the moving parts are relatively small in geometry and are disposed above the fluid level, wherein the viscosity of the fluid impedes only
10 minimally to the moving parts. Consequently, the movement of the parts can be responded with reliability and agility.

Figs. 6 and 7 show the key components of a second embodiment of the invention generally signified by the reference numeral 64. Fig. 6 is an exploded view exposing the various
15 parts of this embodiment. Fig. 7 is a cross-sectional view taken along the line 7-7 of Fig. 6. Fig. 7 shows the assembly 64 assembled onto the base 20 of the dispenser generally denoted by the reference numeral 66.

As with the first embodiment, the assembly 64 of this
20 embodiment includes a water bottle 4 having an open end 68 and a closed end 6. The bottle 4 in this embodiment is made of transparent plastic. In a similar manner as the first embodiment, disposed inside the bottle 4 is a fluid valve 10 which is actuated by a float 12 via an actuating arm 14.
25 Inserted near the closed end 6 of the bottle 4 on the bottle sidewall is a pressure vent 18.

Disposed at the open end 68 of the bottle 4 is a plurality of parts assembled together and is generally referred to as an adapter signified by the reference numeral 70. The
30 adapter 70 includes a coupler 72 screwed onto one end 73A of a center tube 73 via a washer 74 and a nut 76. The other end 73B of the center tube 73 is attached to a bottle cap 78, which in turn is threadedly screwed onto the open end 68 of the bottle 4. The cap 78 is sandwiched between two pairs of washers 74 and
35 nuts 76, with one pair on each side of the cap 78, as shown in Fig. 7. The parts for the adapter 70 are preferably made of non-corrosive materials. For example, the coupler 72 can be made of plastic or glass. The nuts 76 and the washers 74 are

preferably made of PVC (polyvinyl chloride). There is also a gasket 80 either press-fit or glued onto the coupler 72. In use, the assembly 64 is press-fit into the opening 28 of the cooler base 20.

5 Again, during normal usage, the bottle 4 maintains a predetermined water level 50 inside. During operation, in this embodiment, the water 52 flows from the bottle 4 to the reservoir 26 via the center tube 73. It should be noted that the space between the bottle 4 and the coupler 72 is devoid of
10 water 52. The coupler 72 acts as a spacer accommodating the bottle 4 to the opening 28 of the cooler base 20. The rest of the operation of the cooler 66 is substantially similar to the previous embodiment. For the sake of clarity and conciseness, the operational details of the fluid dispenser 66 are not
15 further repeated.

 With the second embodiment, any refillable water bottle commonly used can be converted to a continuous-flow water bottle in accordance with the invention. The key parts of the assembly 64, such as the valve 10, the float 12, the adapter 70
20 can be made available as a kit allowing the consumers to perform their own conversion.

 Finally, other changes are possible within the scope of the invention. For all the embodiments as described, the apparatus is described as used for dispensing drinking water.
25 It is conceivable that the inventive apparatus can be used for dispensing other liquids, such as fruit juice, punches or soda. In addition, the bottle 4 is described as made of a transparent material. A wide variety of materials can be chosen. For instance, it is possible to have opaque or translucent bottles
30 installed. It certainly is also feasible to have bottles etched or printed with various design patterns. Furthermore, the bottle can be inserted with multiple air vents 18, or an air vent with multiple venting holes insertable with multiple filters. It will be understood by those skilled in the art that
35 these and other changes in form and detail may be made therein without departing from the scope and spirit of the invention.

CLAIMS

What is claimed is:

- 5 1. A drinking-fluid dispenser having a base with an opening, said dispenser comprising:

a bottle having a close end and an open end;

10 a gasket attached to said open end of said bottle, said bottle being disposed above said base via said gasket sealingly disposed in said opening of said base;

a valve disposed on said bottle;

a float member connected to said valve by an actuating arm;

15 a pressure-vent member disposed on said bottle, said pressure-vent member includes an orifice passing through said bottle; and

an adapter disposed between said open end of said bottle and said gasket, said adapter includes:

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(i) a bottle cap attached to said open end of said bottle, said bottle cap having a first aperture formed therethrough;

25 (ii) a coupler disposed adjacent said bottle cap, said coupler having a second aperture formed therethrough; and

30 (iii) a tubular member having first and second ends, said first end being attached to said bottle cap through said first aperture and said second end being attached to said coupler through said second aperture;

wherein during operation, said bottle maintains a predetermined fluid level therein, said valve and said float member being disposed above said fluid level, such that when fluid in said bottle reaches said fluid level, 5 said float member buoyantly rises with said fluid thereby moving said actuating arm in one direction allowing said actuating arm to shut off said valve, and such that when fluid in said bottle falls below said fluid level, said float member buoyantly falls with said fluid thereby moving 10 said actuating arm in another direction allowing said actuating arm to open said valve.

2. The fluid dispenser as set forth in claim 1 wherein said pressure-vent member comprises a shaft portion formed 15 with a flange portion, said shaft portion includes said orifice formed therethrough, said orifice being sized to receive a filter.