April 21, 1953 J. C. OWENS 2,635,622

ANTISIPHONIC BALL COCK

Filed Aug. 11, 1947

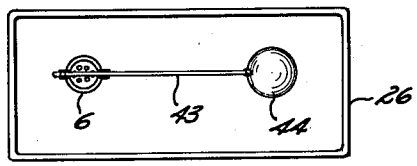



Fig. 1

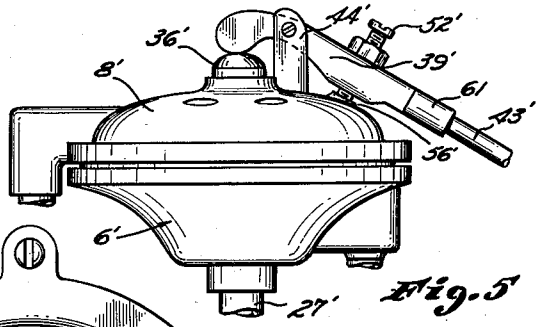



Fig. 5

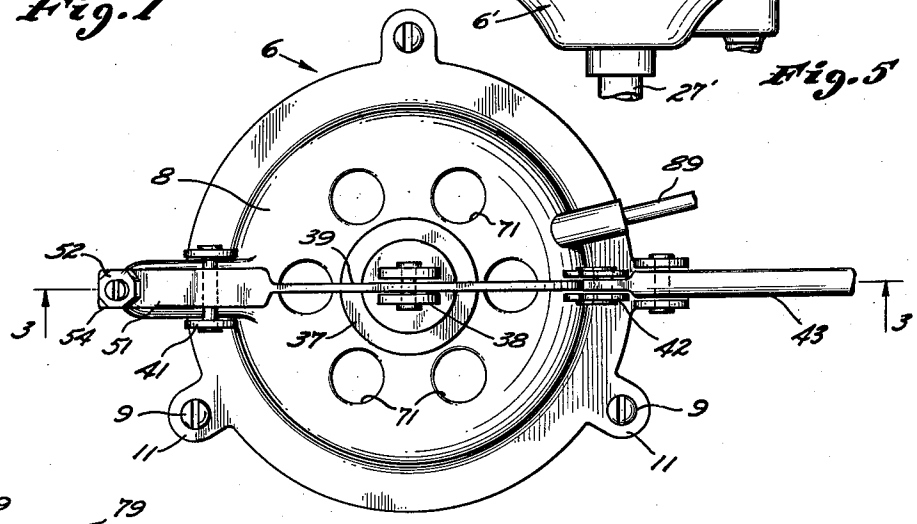



Fig. 2

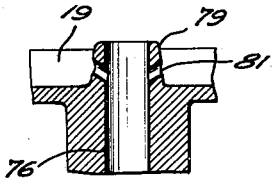



Fig. 4

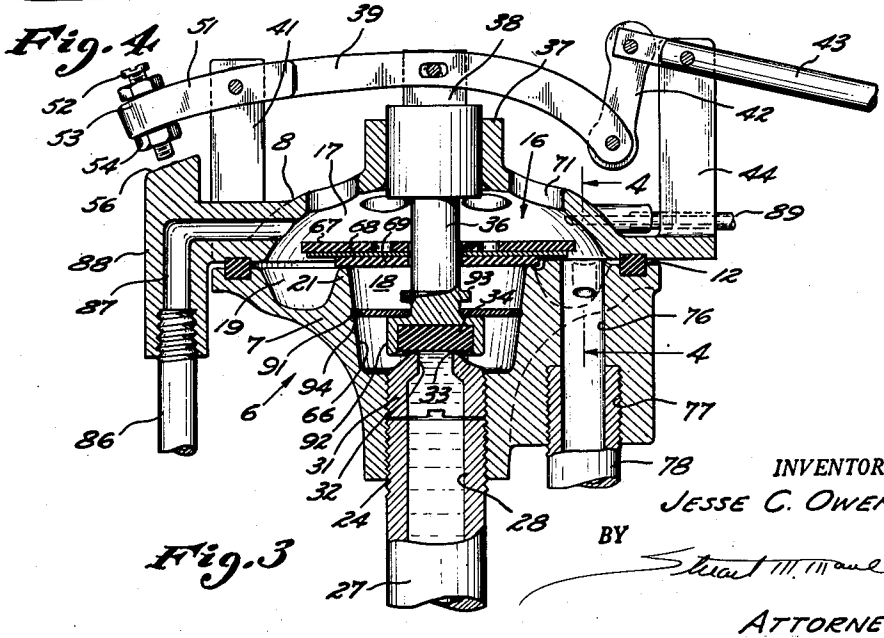



Fig. 3

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## ANTISIPHONIC BALL COCK

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4 Claims. (Cl. 137—218)

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This invention relates to valves of the type employed for controlling supply of water to a reservoir, and more particularly to a float-actuated valve, or "ball cock valve" as it is known in the trade, for maintaining a supply of water in a reservoir such as the flushing tank commonly employed in connection with toilet fixtures.

An object of this invention is to provide an improvement in anti-siphonic ball cocks, i. e., an improved design for float-actuated valves capable of avoiding the danger of contaminating the fresh water supply by drawing water back into the supply pipe from the storage tank or from the toilet fixture associated therewith if and when the pressure within the supply system fails to the extent that a partial vacuum develops therein.

The present application constitutes a continuation-in-part of my copending application, Serial No. 737,667, filed March 27, 1947, and now Patent No. 2,491,131, granted December 13, 1949.

A more detailed object of the present invention in this connection is to provide an anti-siphonic ball cock having means for introducing air from the ambient atmosphere to the interior of the valve when the hydrostatic pressure therein is reduced to less than atmospheric pressure, and thereby positively preventing the development of siphonic conditions therein, which air-introducing means has additional means associated therewith for preventing escape of water from the valve through the air-introducing means, even in the event that hydrostatic pressure within the valve increases to any value greater than atmospheric pressure, thus making possible the discharge of water from the valve and into the storage tank at pressure substantially equal to that prevailing within the supply system and consequently at a much higher rate than is possible with anti-siphonic valves from which water can be permitted to discharge by gravity flow only.

Another object of my present invention is to provide an anti-siphonic valve of the character described which is characterized by more nearly noiseless operation than those of more conventional design by virtue of its being capable of positively closing off all communication between the interior of the valve and the atmosphere whenever water is flowing through the valve from the supply line to the valve's discharge outlet, thereby not only positively preventing air from being drawn into the valve to mingle with the water flowing therethrough as the operation of refilling the storage tank is being carried out, and thus avoiding the bubbling and gurgling sounds developed by other anti-siphonic valves

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when a mixture of water and air bubbles flows through them, but also serving effectively to muffle any hissing sounds which might accompany the flow of water under pressure through the restricted space between the valve seat and its valve when in nearly closed relation thereto.

A further object of the present invention is to provide an improved anti-siphonic ball cock of the character described, the design of which, though highly efficient, dependable, and durable, is unusually compact and correspondingly economical in production due to the fact that the means for closing off the air inlet openings are operated by the water in flowing through the valve housing, thus avoiding the necessity of providing mechanical operating means therefor, and also due to the fact that both the air-inlet closing means and the water flow control valve are both mounted within a common chamber with the former guided upon the stem of the latter.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of the preferred form of my invention which is illustrated in the drawings accompanying and forming part of the specification. It is to be understood that I do not limit myself to the showing made by the said drawings and description, as I may adopt variations of the preferred forms within the scope of my invention as set forth in the claims.

Certain details of the ball cock of the present invention are disclosed in my co-pending application, Serial No. 737,667, filed March 27, 1947, now Patent No. 2,491,131, granted December 13, 1949, of which the subject matter of the present application constitutes a continuation-in-part.

Referring to the drawings:

Figure 1 is a top plan view of a conventional toilet flush tank showing an anti-siphonic ball cock valve incorporating the principles of the present invention operatively installed therein.

Figure 2 is an enlarged view in top plan of the anti-siphonic ball cock of Figure 1.

Figure 3 is a transverse, medial, vertical sectional view taken upon the line 3—3 of Figure 2, with the direction of view as indicated.

Figure 4 is a detail view drawn to more highly enlarged scale in vertical section, the plane of which is indicated by the line 4—4 of Figure 3, and the direction of view by ths arrows.

Figure 5 is a view in side elevation of a slightly modified form of ball cock incorporating the principles of the present invention.

Referring first to that modification of the pres-

ent invention which is illustrated in Figures 1 to 4, inclusive, the housing 6 of my improved anti-siphonic ball cock comprises a body portion 7 and a cap portion 8 which preferably is removable from the body portion 7 and is adapted to be detachably secured thereto as by a plurality of screws 9 extending through clearance holes in lugs 11 extending radially outwards from the peripheral edge of the cap 8 to be received within tapped holes in properly aligned lugs (not shown) on the body portion 7. A gasket 12 of suitable resilient material is interposed between the cap 8 and the body portion 7 to define a fluid-tight seal therebetween.

A chamber 16 is defined within the housing 6. This chamber is of a compound nature, being defined by the hollow interior 17 of the dome-shaped cap 8 and a recess 18, the upper end of which is in communication with the cap's hollow interior 17 and which extends downwards therefrom within the body portion 7. The chamber 16 also includes a substantially annular channel 19 formed in the upper surface of the body portion 7 so that it communicates with the cap's hollow interior 17. The channel 19 is disposed in co-axial relationship with the recess 18, the upper end of which it surrounds and from which it is separated by an upwardly extending annular shoulder or ridge 21, the upper edge of which is preferably substantially in planar alignment with the remainder of the top surface of the body portion 7 of the housing 6.

The ball cock is intended to be mounted within a reservoir so as to control the supply of water thereto. Figure 1 illustrates such an installation more or less diagrammatically, the reservoir being in the form of a conventional toilet fixture flushing tank 26. The ball cock housing 6 is mounted within the tank 26, being supported upon the upper end of the water supply pipe 27 which extends upwardly through the bottom of the tank 26 to receive the housing 6 upon its threaded upper end 28. The opening 29 in the bottom of the housing's body portion 7 into which the end 28 of the water supply line 27 is threaded opens into the bottom of the recess 18, with the result that water under pressure is supplied to the chamber 16, preferably through a ferrule 31 also threaded into the opening 29 above the end 28 of the supply pipe 27. This ferrule 31 is provided with a relatively restricted orifice 32 surrounded by an annular valve seat 33 which is preferably elevated above the bottom of the recess 18 through which the ferrule 31 extends so as to make it possible for a resilient valve insert 34 carried by a valve stem 36 thereabove to engage the seat 33 without interference.

The valve stem 36 is disposed in co-axial alignment with the valve seat 33 and is reciprocably mounted within a centrally located boss 37 provided at the top of the housing's cap 8. Moreover, the stem 36 extends through the boss 37 so as to enable an extension 38 on the upper end of the stem 36 to engage a substantially horizontal lever 39 disposed above the housing 6.

In the modification of my invention presently being discussed, the lever 39 is pivoted at a point spaced at one side of the stem 36 upon a supporting bracket 41 rigid with the cap 8 of the housing 6, whereas the opposite end of the lever 39 is pivoted to the lower end of a link 42, the upper end of which is pivoted to one end of a rod 43 which, in turn, is pivoted to another bracket 44 at the minimum practical distance from the link 42. The other end of the rod 43 is much longer than that to which the link 42



is connected, and carries a float 44 which operates in the well-known manner to raise and lower the outer end of the rod 43 in response to corresponding variations in the level of the water stored within the tank 26. It is apparent, therefore, that when the float 44 assumes a lower position in response to lowering of the water level within the tank 26, the lever 39 will swing upwardly, resulting in raising the valve stem 36 and its valve insert 34 and thus permitting water to flow into the chamber 16 from the supply line 27. Inasmuch as it is desirable at times to limit the rate at which water is permitted to flow from the supply line 27, I have provided an extension 51 of the lever 39 beyond the bracket 41 upon which it is pivotally mounted. The extension 51 carries an adjusting screw 52 extending preferably through a boss 53 on the end of the lever's extension 51 and, also preferably, provided with a lock nut 54. The lower end of the screw 52 is adapted to engage a suitable abutment 56 provided on the upper surface of the housing's cap 8 and thereby limit the distance that the lever 39 can swing upwardly about the axis of its pivotal connection to the bracket 41, and correspondingly limit the distance that the valve insert 34 can rise off its valve seat 33.

Figure 5 illustrates a slightly modified form of ball cock incorporating the principles of the present invention which is the same as that of Figures 1 to 4, inclusive, except that it includes a different type of valve opening means. The housing's cap 8' carries a single upwardly extending bracket 44' and the lever 39' which actuates the valve stem 36' is pivoted to this bracket 44'. The outer end of the lever 39' is provided with a socket 61 into which the rod 43' of the float (not shown) is threaded. Inasmuch as the bracket 44' is closely adjacent the valve stem 36', that end of the lever 39' which engages the valve stem 36' is of minimum length, thus developing ample mechanical advantage to enable the float to rotate the lever 39' about the axis of its pivotal support and forces the valve stem 36' downwardly against its valve seat (not shown) with ample force to insure against leakage of water from the supply pipe 27' into the housing 6'. In this instance, also, the valve-actuating lever 39' is provided with an adjusting screw 52' threaded through the lever 39' and adapted to engage a suitable abutment 56' on the housing's cap 8' when the valve stem 36' has risen to its maximum desirable height.

Referring again to Figure 3, which shows the interior construction of both illustrated modifications, it will be observed that the recess 18 which constitutes a portion of the ball cock's interior chamber 16 is defined by an upwardly flaring wall 66 terminating at its upper edge in the shoulder or ridge 21 which, as mentioned hereinabove, separates the annular channel 19 from the recess 18. Preferably a plurality of valve disks 67, 68, 69 are slidably mounted upon the valve stem 36 within the upper portion 17 of the chamber 16. The uppermost of these disks, i. e., the disk 67, is composed of suitable flexible material, preferably resilient, such as sheet rubber, as is also the lowermost, i. e., the disk 69, whereas the intermediate disk 68 is preferably of suitable non-corrosive, relatively rigid material, such as sheet brass. These three disks 67, 68, and 69 are of gradually lesser diameter in the order named, i. e., the smallest disk 69 is located at the bottom. Its diameter, however, is sufficiently greater than that of the ridge 21 to enable the ridge 21 to support all three disks 67, 68, and 69

when they are at their lowest extreme of movement, as illustrated in Figure 3. The function of the disks 67, 68 and 69 is to close air inlet openings 71, a plurality of which are provided in the cap 8 leading from the ambient atmosphere to the interior of the chamber 16. The disks so function, however, only when they are raised from that position in which they are illustrated in Figure 3. Such raising of the disks is effected by water flowing upwardly from the recess 18 and over the upper edge of the ridge 21 as is necessary for the water to escape from the recess 18 into the other portions of the chamber 16.

Preferably the inlet openings are disposed in a circle concentric with the opening in the cap 8 through which the valve stem 36 extends. The openings 71 are spaced radially outwards from the valve stem 36 a distance greater than the radius of the openings in the discs 67, 68, and 69, through which the valve stem 36 extends, so that when the upper disc 67 is pressed against the under surface of the cap 8, it engages that surface in an area of contact completely encircling each of the openings 71, thus not only making for efficiency of the seal established by such contact, but also minimizing any tendency toward trusion of an edge of the disc into and through any one or more of the openings 71. Another detail of importance arises out of the resiliently flexible characteristic of the upper valve disc 67, inasmuch as this flexibility permits the disc to conform itself to the substantially dome-shaped under surface of the cap 8 when pressed upwardly thereagainst by internal water pressure. Being possessed of an inherent degree of resiliency, when the water pressure is relieved, the disc 67 will tend to resume its flat configuration, thereby assuring its moving back away from the under surface of the cap 8 and positively uncovering the openings 71 to assure freedom of entrance of air to relieve any siphonic conditions which might subsequently develop.

After water has thus passed from the recess 18, it escapes from the housing to the interior of the tank through an outlet opening 76 leading downwardly from the channel 19 to the bottom of the housing 6 where a tapped hole 77 permits a delivery tube 78 to be secured in communication with the outlet opening 76. Preferably the upper end of the outlet opening 76 is encircled by a boss 79 upstanding from the bottom of the channel 19 and having a plurality of downwardly inclined openings 81 establishing communication between the channel 19 and the outlet opening 76. This arrangement has been found to enhance the ability of the ball cock to deliver water to the storage tank 26 with a minimum of noise.

If desired, an auxiliary delivery tube 86 communicates by a passage 87 with the side of the chamber 16 but at an elevation above that at which the opening 76 enters. For this purpose, the passage 87 is formed in a lateral extension 88 of the cap 8.

Still another delivery tube 89 communicates with the chamber 16, preferably also the upper portion thereof, this tube 89 being smaller than the other two and serving as a refill tube to supply water directly to the toilet fixture after the flushing operation has been completed and while the storage tank 26 is being refilled, thus assuring that the fixture's trap will be properly filled.

When the valve stem 36 is raised as the result of lowering the float 44, the valve insert 34 will be lifted from its seat 33, thus permitting water under pressure to be ejected from the supply line 27 into the recess 18. In order to escape from the recess 18, the water must rise therein and flow over the ridge 21, and in doing so it raises the disks 67, 68, and 69. In normal operation the water flows at such velocity that the disks are raised to the limit of their upward movement, with the result that they effectually close the air openings 71 and thus prevent the escape of water from the housing 6 by any means other than the outlet tubes 78, 86, and 89, even though the water within the housing is at sufficient hydrostatic pressure to cause the water to flow through these tubes at considerable velocity.

However, when the valve insert 34 is pressed onto its seat 33, water will cease to flow from the inlet tube 27, with the result that the disks will fall by gravity back to those positions thereof illustrated in Figure 3, thereby effectually re-establishing communication between the ambient atmosphere and the interior of the housing 6. This assures the maintenance of atmospheric pressure within the chamber 16 and positively prevents the development of the partial vacuum which would be required were any siphonic conditions to develop.

An auxiliary disk 91, slightly smaller in diameter than the upper portion of the recess 18, is slidably mounted upon the stem 36 above the head 92 at the stem's lower end within which the valve insert 34 is mounted. Upward movement of the disk 91, which preferably is composed of suitable resiliently flexible material such as rubber, is limited by a shoulder or outwardly projecting flange 93, whereas downward motion of the outer peripheral edge of the disk 91 is limited by an annular flange or shoulder 94 projecting inwardly from the interior surface of the housing 6 defining the recess 18. Being limited in its upward movement by the flange 93, the disk 91 operates, when the valve insert 34 is raised off its valve seat and water is flowing upwardly through the recess, to confine the water to an annular upwardly diverging cone adjacent to the walls of the recess so that as it enters the upper portion of the chamber it impinges against and raises the upper disks 67, 68, 69 into that position in which they close the air inlet openings 71. The valve disk 91 may, however, be omitted as the configuration at the bottom of the recess tends to divert the water into a cone which normally follows the walls of the recess. It is believed that in some conditions of pressure at the inlet port, the valve disk tends to quiet the sound of the valve. This is not always true, however, as in many cases, the difference in sound with use of the disk and without use of the disk, cannot readily be detected. It has been found that the metal disk 68 may be omitted and the upper disk 67 may be imperforate, that is, the holes in the disk 67 may be eliminated without appreciably affecting the operation of the valve.

I claim:

1. A ball cock for controlling supply of water to a toilet flushing tank, comprising a housing having a chamber therein and a recess in the bottom of said housing defining a downward extension of said chamber, a valve seat adjacent the bottom of said recess and encircling an inlet port opening into said recess, a valve stem extending slidably through the top of said housing above said opening, a valve head mounted on the lower end of said stem, means for lowering said stem and thereby pressing said valve head onto said seat, the top of said housing having an air inlet opening therein, a valve disk slidably

mounted on said stem in position to be engaged by water flowing upwards within said chamber and to be carried thereby into closing relation with said air inlet opening, a smaller valve disk slidably mounted on said stem below said first-mentioned valve disk and within said recess, and means limiting upward movement of said smaller valve disk and thereby retaining said smaller disk within said recess, said smaller disk being adapted to confine the water to an annular upward flow adjacent to the walls of said recess.

2. An anti-siphonic ball cock, involving: a housing structure defining a shallow silencing chamber of relatively large diameter, a central axially extending downwardly converging recess substantially smaller in diameter than said chamber in the bottom wall thereof, an annular water channel in said chamber and around said recess, and a ring of axially directed anti-siphon ports in the opposite wall of said chamber; an inlet port within said recess, an outlet port in said annular water channel at one side of said recess and directed downwardly parallel to said inlet port; a valve stem extending from said housing structure, within said ring of anti-siphon ports; a valve head at the inner end of said stem engageable with said inlet port and in its open position spaced from the inner walls of said recess to form an annular space therebetween; a disk means slidably mounted on said valve stem within said chamber to cover said anti-siphon ports in one position and said recess in another position, said valve head and recess tending to deflect liquid from said inlet port into an upwardly diverging stream against said disk means and said disk means tending to re-deflect said stream downwardly in a further diverging annular stream, impinging in said annular water channel surrounding said recess, the reaction of said stream tending to seal said disk means over said anti-siphon ports.

3. An anti-siphonic ball cock involving: a housing structure including an upper and a lower portion having confronting shallow cavities forming a silencing chamber; the lower portion having a central recess, an axially directed inlet port in said recess, said recess being imperforate except for said inlet port, an annular water channel in said chamber and surrounding said recess, and a downwardly directed outlet port in said annular water channel at one side of said recess; the upper portion of said housing



structure having a central axially directed guide bore in alignment with said inlet port and a ring of anti-siphon ports around said guide bore; a valve stem slidable in said guide bore and equipped with a valve head engageable with said inlet port; a seal disk means loosely slidable on said valve stem between a position sealing said anti-siphon ports and a position sealing said recess; said valve head and recess tending to deflect incoming water into a diverging conical upward stream impinging on said portions of said housing structure, said portions redirecting the water in a continuingly diverging downward stream.

4. An anti-siphonic ball cock, involving: a housing structure defining a shallow chamber of relatively large diameter having upper and lower walls, a central recess in the lower wall of said chamber, a primary valve seat at the bottom of said recess, a secondary valve seat at the rim of said recess, an annular water channel in said chamber and surrounding said rim, a downwardly directed outlet port in said annular water channel, and a ring of axially directed anti-siphon ports piercing the upper wall of said chamber; a valve stem slidably mounted in said housing structure and protruding therefrom within said ring of anti-siphon ports; a valve head at the inner end of said valve stem engageable with said primary valve seat; a floating seal means slidably mounted on said stem movable between said anti-siphon ports and said secondary valve seat independently of movement of said valve stem; and float operated means for forcing said valve head to close said primary valve seat port.

JESSE C. OWENS.

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