Feb. 25, 1969 A. SCHOEPE ET AL 3,428,966

BALL COCK FLOAT

Filed June 23, 1966

FIG. 1.

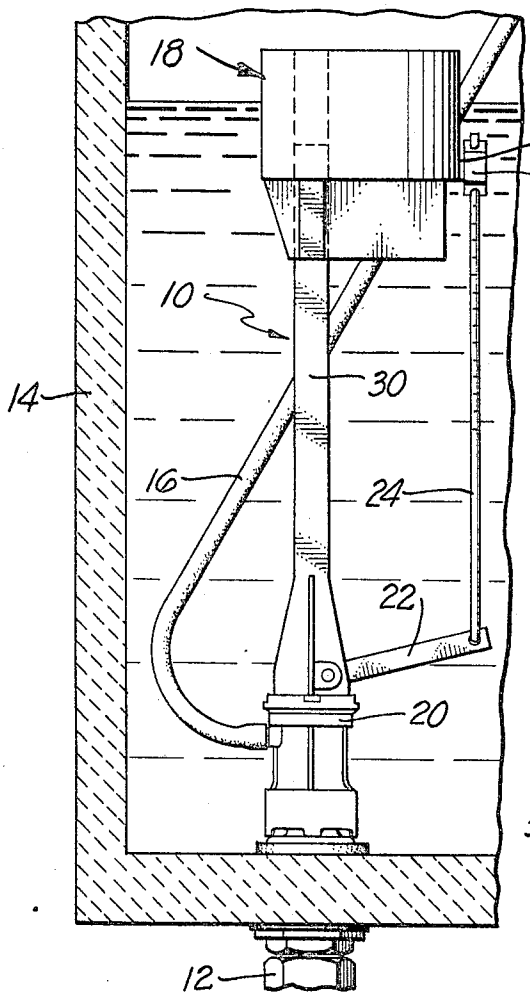


FIG. 2.

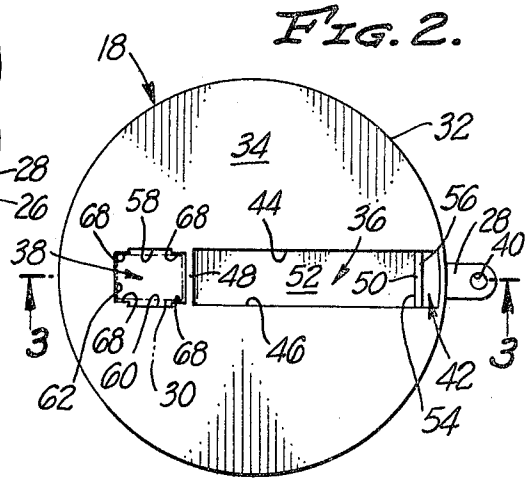


FIG. 3.

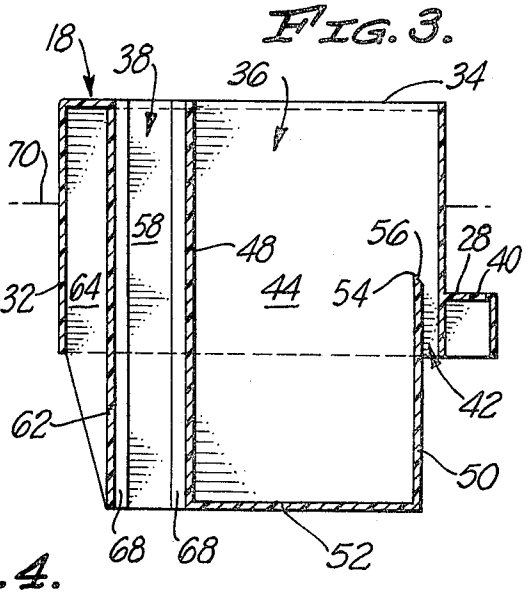
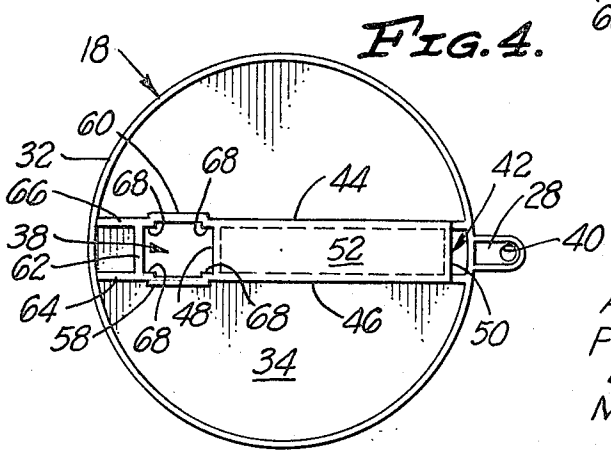


FIG. 4.



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BALL COCK FLOAT

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ABSTRACT OF THE DISCLOSURE

A unitary float body of a ball cock float determining the water level in a toilet flush tank has rectangular cross-section, vertically elongated guide passage receiving a similar cross-section vertical ball cock guide. A water chamber in the float determines the buoyancy thereof and a vertically elongated water passage determines the minimum amount of water in said chamber. Said water passage opens downwardly into the flush tank and upwardly intermediate the water chamber in a dam formed by a sharpened body edge preventing the formation of a meniscus thereupon during the flow of water through said water passage.

This invention relates to a float for controlling the operation of a ball cock disposed in a toilet flush tank and, more particularly, to a float which is adapted to be mounted for vertical movement on a vertically oriented guide operatively associated with a flush tank ball cock.

The float disclosed herein, in addition to performing the ball cock control function alluded to hereinabove, also is designed, in a manner to be described in greater detail below, to facilitate the assembly or disassembly of associated components of the ball cock whose operation it controls. Hence, the float may be grasped, and utilized, in essence, as a lever to permit relative rotation between the associated components of the ball cock with which it is operatively connected to release said components from co-operative relationship with one another.

It is, therefore, an object of our invention to provide a ball cock float which is vertically movable along a vertical axis on a vertically oriented guide, said guide being associated with said ball cock and said float being operatively connected to said ball cock to control the actuation thereof.

Another object of our invention is the provision of a float of the aforementioned character which includes an elongated guide passage adapted to receive a correspondingly elongated guide and wherein said guide passage incorporates guide engaging portions along its length which reduce the area of contact between the guide passage and the guide to reduce the friction between said float and said guide and to provide intervening spaces between said areas to limit the collection of detritus and other material in said passage.

Another object of our invention is the provision of a float of the aformentioned character which includes a body having a buoyancy control chamber incorporated therein, said buoyancy control chamber depending below the main portion of said body and being disposed in communication with the water in an associated flush tank to maintain the water level in said buoyancy control chamber at a predetermined height to accurately control the float level in the water in said flush tank.

A further object of our invention is the provision of a float of the aforementioned character which incorporates the aforesaid buoyancy control chamber, said buoyancy control chamber having water height determining means therein to determine the minimum volume of water held in said chamber, said water height determining

means being located adjacent a water inlet opening communicating with said chamber and permitting the influx of water into said chamber from the associated flush tank.

One of the problems encountered in the flow of water past a restricted opening or over an adjacent edge is the formation of a meniscus which causes the surface tension of the water to resist free flow thereof through said opening or over said edge.

An additional object of our invention is the provision of a meniscus-eliminating means on the height determining means incorporated in said buoyancy control chamber to prevent the formation of a meniscus thereupon which would inhibit the free flow of water into said chamber.

An additional object of the invention is the provision of a float of the aforementioned character which can be manufactured as a single and integral unit from suitable plastic material, such as linear polyethylene, and which will last as long as the associated ball cock thus eliminating the necessity for replacement characteristic of conventional ball type floats.

Other objects and advantages of the invention will be apparent from the following specification and the accompanying drawing, which is for the purpose of illustration only, and in which:

FIG. 1 is a fragmentary, vertical, sectional view of a toilet flush tank having a ball cock assembly and refill hose, shown in side elevation, operatively mounted therein, said ball cock assembly incorporating an embodiment of the ball cock float of the present invention:

FIG. 2 is an enlarged, top plan view of the float removed from the ball cock assembly of FIG. 1 with the exception that the ball cock mast is shown in broken lines positioned therein;

FIG. 3 is a vertical, sectional view taken along the broken line 3—3 in FIG. 2; and

FIG. 4 is an enlarged, bottom plan view of the float removed from the ball cock assembly of FIG. 1

Referring to the drawing, an embodiment of the ball cock float incorporating the principles of the present invention is shown associated with a unique form of ball cock **10**, which ball cock is operably connected in communication with the water inlet pipe **12** of a conventional toilet flush tank **14** for controlling the flow of water into the flush tank and through the refill hose **16** into a usual refill tube, not shown. As stated, the ball cock **10** is of a unique form and includes the ball cock float **18** of the present invention in the assembly thereof, but this ball cock does not form a part of the invention of the present application other than the float portion thereof, the overall combinations and other portions thereof being separately described and claimed in our copending applications, Ser. No. 559,779 entitled "Ball Cock" and Ser. No. D. 2796 entitled "Design For Ball Cock," now Patent No. D. 206,850, both filed on an even date herewith.

For purposes of the present description, it is sufficient to state that the ball cock **10** includes the valve **20** operable through the valve operating lever **22** which is connected to the float connection lever **24** adjustably secured by the spring clip **26** through the boss **28** formed integrally on the float **18**. Downward movement of the valve operating lever **22** causes the valve **20** to open and direct the flow of water into the flush tank **14** and simultaneously through the refill hose **16**, with upward movement of this valve operating lever to the position shown in FIG. 1 causing the valve to close and cut off the flow of water. Furthermore, the mast or pylon **30** of the ball cock **10** is upright or vertical and is of polygonal cross section, preferably rectangular.

Referring more particularly to FIGS. 2, 3 and 4, the ball cock float **18** is preferably formed as a unitary body moulded from a suitable plastic material, such as linear

polyethylene, and being generally cylindrical in configuration having the outer, downwardly depending, cylindrical skirt 32 connected at the upper extremities thereof to the top wall 34. The top wall 34 upwardly closes the skirt 32 with the exception of the water chamber 36 and guide-receiving passage 38 formed diametrically of and radially within the skirt, both of which water chamber and guide-receiving passage form an important part of the present invention. Furthermore, the float connection lever boss 28 projects radially, outwardly from the skirt 32 for receiving the float connection lever 24 through the opening 40 thereof, as previously described.

The water chamber 36 is a downwardly closed chamber, with the exception of the important measured fluid inlet opening 42 and opens upwardly through the top wall 34, being vertically elongated and generally rectangular in cross section. This water chamber 36 is formed at three sides by the spaced side walls 44 and 46 and the inner end wall 48, and at the forward side partially by the shortened outer end wall 50 and partially by a portion of the skirt 32, with the side walls 44 and 46 and the end walls 48 and 50 being downwardly closed by the bottom wall 52. Aligned with the skirt 32, the side walls 44 and 46 extend outwardly and are connected to the skirt, and the shortened outer end wall 50 is spaced inwardly from the skirt with this outer end wall and skirt vertically overlapping, so as to form the vertically extending, rectangular cross section fluid inlet opening 42 forming a measured communication through the float 18 into the water chamber 36.

The upper extremity of the shortened outer end wall 50 forms a dam 54 which constitutes fluid level determining means for the water chamber 36, and this end wall upper extremity is beveled at the outer side thereof so as to provide the upwardly and inwardly angled surface 56 forming the dam 54 as an upwardly extending, relatively sharp edge and this constitutes meniscus preventing means. As was hereinbefore briefly discussed, one of the problems encountered in the flow of water past a restricted opening and over an adjacent edge or dam is the formation of a meniscus which causes the surface tension of the water to resist free flow thereof through this opening and over the edge or dam. The provision of the angled surface 56 so as to provide the beveled dam 54 serves as meniscus preventing means for this dam and ensures the free flow of water through the fluid inlet opening 42 into the water chamber 36, important for optimum results according to the principles of the present invention and as will be hereinafter more fully discussed.

The side and end walls 44, 46, 48 and 50 of the water chamber 36 extend downwardly spaced below the lower extremity of the skirt 32 with the bottom wall 52 connecting the lower extremities of these walls and providing the water chamber 36 projecting below the skirt. Furthermore, the water chamber end wall 48 also forms an end wall of the guide-receiving passage 38, which is diametrically aligned with the water chamber. The other three sides of the vertically elongated, rectangular cross section guide-receiving passage 38 are formed by the spaced side walls 58 and 60 and the end wall 62, with the partially upward angled, reinforcing webs 64 and 66 being generally outwardly aligned with the side walls 58 and 60 and connecting to the skirt 32.

As shown, the side walls 58 and 60 of the guide-receiving passage 38 are formed outwardly reinforced and are centrally grooved at the inner surfaces thereof so as to form the inwardly facing, vertically extending, spaced guide surfaces 68 on each of these side walls adjacent the end walls 48 and 62. Thus, the spaced guide surfaces 68 on the side wall 58 are laterally spaced from and oppose the spaced guide surfaces 68 on the side wall 60 so as to provide four point guide engaging means for slidably engaging and guiding vertical movement of the float 18 on the mast 30 of the ball cock 10. Furthermore, the fact that these guide surfaces 68 are relatively narrow so as to provide four point sliding contact with the mast 30 will greatly reduce the frictional resistance for this sliding movement and at the same time provide spacing throughout a large portion of the surfaces to limit the collection of detritus and other material in the guide receiving passage 38.

In the assembly of the ball cock 10, as shown in FIG. 1, the float 18 formed according to the principles of the present invention and as described, is positioned over the mast 30, with this mast being received in the guide receiving passage 38 and with the float connected to the float connection lever 24 through the boss 28, as previously described. With no water in the toilet flush tank 14, the float 18 will be in a position slid downwardly along the mast 30 from that shown in FIG. 1 so as to position the valve operating lever 22 in a down position and open the valve 20 admitting water into the tank through the water inlet pipe 12. As the water level rises in the tank 14 and encompasses the lower part of the float 18, the water will flow through the fluid inlet opening 42, over the dam 54 and into the water chamber 36, eventually reaching a level in the water chamber above the dam, as shown in FIG. 1 and as indicated by the broken line 70 in FIG. 3.

Upon original installation of the float 18 in the tank 14, it is necessary to force the float downwardly in the water so as to insure a positive flow of water over the dam 54 and into the water chamber 36, and the ultimate water level in the tank will be determined by the combination of the buoyancy of the float as opposed to the weight of the float, the weight of the connected parts, the frictional resistance to movement of the various parts and the force required to move the valve 20 to closed position, as shown in FIG. 1. The minimum amount of water which will remain in the water chamber 36 will be determined by the level of the dam 54, and this dam is positioned such that the water chamber will be filled to a level sufficient that the combined weight of this water and the float 18, along with the weights of the other involved components, will be sufficient to overcome the various frictional forces, including the frictional forces between the float and the mast 30, so that the float will move down the mast and provide sufficient force for opening the valve 20. Thus, when the flush valve (not shown) is opened for draining the water from the tank 14 into the associated toilet (not shown), as the water level in the tank moves downwardly, the float will move downwardly, with the water in the water chamber 36 eventually draining down to the level of the dam 54 and the valve 20 eventually moving to open position.

By providing the float 18 with the dam 54 in the fluid inlet opening 42, and by providing this water chamber extending below the float skirt 32, there is always insured a minimal amount of water in the float before this float will begin to rise with the water level, thereby insuring that the float will always have sufficient weight to perform the function described. Furthermore, by the provision of the dam 54 with the angled surface 56 so as to be beveled, a meniscus preventing means is formed preventing the formation of a meniscus at the top edge of the dam, which could inhibit the smooth flow of water through the fluid inlet opening 42 and over this dam. Also, by providing the guide receiving passage 38 with the spaced guide surfaces 64 providing the vertical, sliding movement between the float 18 and the mast 30 with a minimum of friction, proper and positive action of the float is assured.

Still further, it is preferred to form the ball cock 10 with certain parts of the valve 20 selectively disengageable by rotating the mast 30 a few degrees about the vertical axis thereof, as is fully shown and described in our before-mentioned copending application, Ser. No. 559,779, and this rotation of the mast is accomplished conveniently by using the float 18 as a lever. In view of the polygonal cross section of the guide receiving passage 38 in the float 18 vertically, slidably receiving the polygonal cross section of the mast 30, in this case both rectangular cross

section, the float **18** is made nonrotative on the mast so that rotation of the float will directly cause rotation of the mast. Thus, the parts of valve **20** may be conveniently disengaged merely by grasping the float **18**, rather than having to work in the area of the valve **20** near the bottom of the tank **14**.

Finally, it is apparent from the foregoing descriptions and discussions that the float **18**, according to the principles of the present invention, may be provided with all of the above discussed features insuring positive action of the valve **20** in the ball cock **10**, yet this float may be manufactured as a single and integral unit from suitable plastic material, such as linear polyethylene. By forming this float **18** of plastic, the float will be corrosion resistant and will last as long as the associated ball cock **10**. This, therefore, will eliminate the necessity for replacement of this float **18**, which has been otherwise characteristic of conventional ball type floats.

We claim:

1. A vertically movable float for controlling the actuation of a ball cock regulating the water in a toilet flush tank including a float body, said body having an elongated guide-receiving passage therein and a water chamber for determining the buoyancy of said float, said body incorporating fluid inlet means connecting said water chamber with said water in said tank, and said chamber incorporating fluid level determining means to maintain a minimum amount of water in said chamber, said fluid level determining means being constituted by a dam in said chamber.

2. A vertically movable float as defined in claim **1** in which said dam of said fluid level determining means is juxtaposed to said fluid inlet means.

3. A float adapted to be mounted for vertical movement on a vertically oriented guide which is secured in operative relationship with a ball cock regulating the water in a toilet flush tank including, a unitary body having a guide-receiving passage therein, said passage having spaced guide-engaging means along the length thereof, a water chamber in said body for determining the buoyancy of said body, and said body having a fluid inlet opening therein connecting said water chamber with the water in said flush tank to permit the ingress of water from said tank through said fluid inlet opening into said water chamber, said fluid inlet opening being vertically elongated opening downwardly into said flush tank and opening upwardly over a generally horizontal body edge into a vertically intermediate part of said chamber.

4. A float for actuating a flush tank ball cock including a body incorporating a water chamber for receiving a predetermined amount of water to determine the buoyancy of said float, said body incorporating a water inlet opening for permitting the ingress of water from a flush tank in which said float is located into said water chamber, said water chamber incorporating fluid level determining means for determining the minimum amount of water in said chamber, said fluid level determining means being constituted by a dam, and said dam having meniscus preventing means thereupon to prevent the formation of a meniscus thereupon.

5. A float as defined in claim **4** in which said meniscus preventing means is constituted by a bevel on the upper extremity of said dam.

6. A float for actuating a flush tank ball cock where said ball cock has vertically oriented guide means associated therewith including a body having elongated guide passage means receiving said ball cock guide means therein for nonrotation therebetween, said guide passage means being of polygonal cross-sectional configuration for receiving a ball cock guide means of polygonal cross-sectional configuration, said body having a buoyancy chamber therein for the reception of a predetermined volume of water, said chamber incorporating fluid level determining means therein, and said body having a water inlet opening therein for permitting the ingress of water from said tank into said chamber.

7. A float as defined in claim **6** in which said guide passage means includes an elongated, rectangular guide passage incorporating spaced guide-engaging surfaces along the length thereof.

8. A vertically movable float for controlling the actuation of a ball cock regulating the water in a toilet flush tank including a float body, said body having an elongated guide-receiving passage therein and a water chamber for determining the buoyancy of said float, said body incorporating fluid inlet means connecting said water chamber with said water in said tank, said fluid inlet means comprising a vertically elongated fluid inlet opening having a lower end opening downwardly into said flush tank and an upper end opening into said chamber vertically intermediate said chamber, and said chamber incorporating fluid level determining means to maintain a minimum amount of water in said chamber, said fluid level determining means comprising a generally horizontal edge on said body.

9. A float for actuating a flush tank ball cock where said ball cock has vertically oriented guide means associated therewith including, a body having elongated guide passage means receiving said ball cock guide means therein for nonrotation therebetween, said guide passage means comprising an elongated and rectangular cross-sectional configured guide passage receiving said ball cock guide means of a similar cross-sectional configuration, said body having a buoyancy chamber therein for the reception of a predetermined volume of water, said chamber incorporating fluid level determining means therein comprised of a dam located in said chamber, and said body having a water inlet opening therein for permitting the ingress of water from said tank into said chamber.

10. A float as defined in claim **9** in which said fluid level determining means is constituted by a dam located in said chamber, said dam having meniscus preventing means thereupon, said meniscus preventing means being comprised of an angular surface on the upper extremity of said dam.

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U.S. Cl. X.R.

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