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(54) BALL COCK CONSTRUCTION INCLUDING HORIZONTAL INLET MOUNTING AND ANTI-SYPHON DEVICE

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Anaheim, California, U.S.A., do hereby de-
clare the invention, for which we pray that
a patent may be granted to us, and the meth-
od by which it is to be performed, to be
particularly described in and by the follow-
ing statement:—

This invention relates to a ball cock
assembly.

The vast majority of the prior ball cocks
usable for controlling the water level of toilet
flush tanks heretofore provided have been
arranged requiring mounting thereof at the
bottom walls of such flush tanks, that is,
with the water inlet bodies thereof extend-
ing vertically upwardly within the flush tank
and being connected downwardly through
the flush tank bottom wall to a water supply
pipe. Obviously, with this ball cock posi-
tioning, the water inlet body exterior
through the flush tank bottom wall must
be properly sealed, and in many cases, not
only does the water inlet body project up-
wardly through the water of the flush tank
and is constantly exposed thereto, but there
are many cases where both the water flow
controlling valve and the water outlet body
are positioned spaced below the flush tank
upper water level so as to be constantly ex-
posed to the water within such tank. The
result has been the creation of two particular
problems, one being the difficulties of main-
taining water seals for such ball cocks and
proper continued functioning thereof due
to corrosion caused by the constant immer-
sion in the flush tank water and the col-
lection of sediment from such water, and the
other being the fact that in many installa-
tions of toilet flush tanks it is not conven-
ient and sometimes virtually impossible due
to the plumbing pipe locations to provide a
supply of water from beneath and upwardly
through the flush tank bottom wall, a flush

tank sidewall water supply being the only
water supply available and possible.

Additional problems have been encoun-
tered with certain of the prior ball cock as-
semblies as a result of noises created by the
water flow from such ball cocks into the
toilet flush tanks and these noises are par-
ticularly objectionable where the bathrooms
containing such installations are closely ad-
jacent bedrooms where the majority of such
installations must be. In an effort to over-
come these noise problems from inlet water
flow, many of the prior ball cock construc-
tions have included relatively complicated
and expensive configurations of water direct-
ing elements for carrying the water flow
through such ball cocks in a circuitous man-
ner and exciting such flow into the flush tank
below the flush tank lower water level. Even
with the additional complication and ex-
pense, such efforts have not always been
entirely successful.

A still further functioning problem en-
countered with many of the prior ball cock
assemblies has been one of proper float
movement in order to properly control the
opening and positive closing of the ball
cock valves during the automatic functioning
thereof in maintaining the proper flush tank
water levels. Although various forms of
floats and float connections have been
used, experience dictates that the most de-
pendable interaction between the float and
the actuating means of the ball cock valve is
produced by a guided float, that is, one
which is guided in its upward and down-
ward movement with the flush tank water
level by some form of stationary guide and
this has usually been accomplished by form-
ing the float telescoping rigid elements of
the ball cock such as water inlet and outlet
tubes thereof. In the case of flush tanks
bottom wall mounted ball cocks, a usual
form of ball cock construction is to pro-
vide long, telescoped, water inlet and outlet
tubes for the ball cock so as to position the
ball cock valve in the most desirable loca-

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tion above the flush tank upper water level and discharge water from the ball cock at an extreme lower level of the flush tank below the flush tank lower water level, and although this requires long water inlet and outlet tubes, it is relatively convenient to mount the float telescoped over the outer water outlet tube for proper guiding therealong in vertical movement of the float. Again, relatively expensive and complicated ball cock configurations are encountered.

Still a further important consideration in ball cock assemblies is the danger of contamination of an entire water system of a particular structure within which such ball cock may be installed by the syphoning of water from the toilet flush tank in the event of an extreme drop in water pressure within such structure water system. Such problem and danger are well-known to those skilled in the art and the prior anti-syphon devices of the prior ball cocks have usually been of relatively complicated nature and frequently not always of positive action. If the particular conditions under which such syphoning can take place are possible, unless the anti-syphon devices are of absolute positive action, the danger of contamination will always be present. Also, with the complicated nature of the prior anti-syphon devices, additional expenses are encountered which must be added to the overall cost of the ball cock assemblies.

An object of the present invention is to obviate or mitigate the disadvantages and problems set out above.

According to the present invention there is provided a ball cock assembly for a flush tank including a tubular water inlet body adapted for positioning within the flush tank and communicating with a supply of water, a tubular water outlet assembly having a part above the flush tank upper water level and being spaced outwardly of an inner cylindrical surface within the assembly to define therewith an annular water outlet passage, a valve communicating with said water inlet body and the annular water outlet passage, said valve being movable between a closed position sealing off and an open position permitting a flow of water there-through, float means operably connected to said valve for moving said valve between said open and closed positions upon changing water level in said flush tank, discharge opening means from said annular water outlet passage to below said flush tank upper water level, an anti-syphon means including a frusto-conical shaped member formed from a resilient material located in said annular water outlet passage, said member being adapted to make contact around said inner cylindrical surface of said water outlet passage and seal therewith and being outwardly peripherally seal-

ed with the water outlet assembly, air relief opening means formed through said water outlet assembly and communicating between said annular water outlet passage and air above said flush tank upper water level, said air relief opening means being positioned such that when water is flowing from the tubular inlet through the annular outlet passage the frusto-conical member seals the air relief opening means; and an air vent through said frusto-conical member positioned such that under syphoning conditions air passes from said air relief opening means through said air vent and into said water inlet body.

Further according to the present invention there is provided a ball cock assembly for a flush tank, including a water inlet body, a water outlet body, a valve means having an inlet communicating with the water inlet body and an outlet communicating with the water outlet body, a float operably connected to said valve means and an anti-syphon means including a resilient member located in the outlet body, an air relief means formed through the outlet body providing communication between the air above the flush tank upper water level and the outlet, said resilient member being adapted to seal the air relief means under water flow conditions from inlet to outlet to prevent water flowing through said air relief means, and under syphoning conditions to cover said water outlet and permit air to pass through said air relief means and into said water inlet body.

An embodiment of the present invention will now be described by way of example with reference to the accompanying drawings, in which:—

Figure 1 is a side-elevational view of a ball cock assembly installed in a typical toilet flush tank, said flush tank being shown in fragmentary vertical section;

Figure 2 is an enlarged, fragmentary, vertical sectional view of the ball cock assembly and toilet flush tank of Figure 1;

Figure 3 is a fragmentary, vertical sectional view looking in the direction of the arrow 3—3 in Figure 2;

Figure 4 is an enlarged, horizontal sectional view looking in the direction of the arrows 4—4 in Figure 1 and showing a top plan view of the float of the ball cock assembly of Figure 1;

Figure 5 is a fragmentary, vertical sectional view looking in the direction of the arrows 5—5 in Figure 4; and

Figure 6 is an enlarged, horizontal sectional view looking in the direction of the arrows 6—6 in Figure 1 and showing a bottom plan view of the float of the ball cock assembly of Figure 1.

Figure 1 shows a ball cock assembly including a water inlet body generally indi-

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 5 cated at 10, a water outlet body generally indicated at 12, a water valve generally indicated at 14 and a float generally indicated at 16, the ball cock assembly being installed within a typical toilet flush tank generally indicated at 18 for controlling the water level therein. All of the elements of the ball cock assembly are preferably formed of usual corrosion resisting materials and may be manufactured and assembled in somewhat usual manner. As an example, the water inlet body 10 may be formed of brass, the water outlet body 12 of plastic, the water valve 14 of a combination of stainless steel and various plastics, and the float 16 of plastic.

10 More particularly to the principles of the ball cock assembly, the water inlet body 10 is secured in usual manner through a sidewall 20, either an end wall or back wall, of the toilet flush tank 18 spaced above an upper water level generally indicated at 22 in Figure 1 of the flush tank. The axis of the water inlet body 10 is positioned generally horizontally so that the water inlet body projects generally horizontally into the interior of the flush tank 18. An outer end portion 24 of the water inlet body 10 is connected to a water supply pipe (not shown) of a structure water supply system normally supplying a flow of water under pressure to the water inlet body, an inner end portion 26 being formed of reduced diameter and terminating inwardly within the interior of the flush tank 18 space from the flush tank sidewall 20.

20 The water outlet body 12 is horizontally axially telescoped over the water inlet body 10 within the interior of the flush tank 18 and particularly telescopes the inner end portion 26 of the water inlet body. An inner end portion 28 of the water outlet body 12 over the reduced diameter portion of the inner end portion 26 of the water inlet body 10 is circumferentially enlarged forming an annular water outlet chamber generally indicated at 30 between these inner end portions of the water inlet and outlet bodies. As can be particularly seen in enlargement in Figure 2, this outward spacing of the inner end portion 28 of the water outlet body 12 around the inner end portion 26 of the water inlet body 10 provides the water outlet chamber 30 exposed horizontally inwardly toward the water valve 14.

25 The water valve 14 includes a, preferably stainless steel, outer valve casing 32 having a valve inlet 34 telescoped over and secured to an inner extremity of the water inlet body 10 or the inner end portion 26 thereof, said outer valve casing internally of the valve also forming an annular valve seat 36 circumferentially outwardly of the valve inlet and circumferentially inwardly of a

32 circumferentially outwardly of the valve outlet 38 projects outwardly along and abutting the inner extremity of the water outlet body 12 of the inner end portion 28 thereof and in the horizontal direction away from the water inlet and outlet bodies 10 and 12 telescopes a resilient material valve diaphragm 40 and a diaphragm overlying inner valve casing 42. This latter inner valve casing 42 is removably secured in the outer valve casing in usual manner and retains the valve diaphragm in proper operating position between the outer and inner valve casings. The water valve 14 is of a form well-known to those skilled in the art and for purposes of description of the present invention, it is sufficient to state that movement of a valve actuating pin 44 centrally telescoped by the valve diaphragm 40 horizontally inwardly toward the water inlet body 10 causes a small amount of admitted water to force the valve diaphragm against the valve seat 36 sealing off the flow of water from the water inlet body to the water outlet body 12, and movement of the valve actuating pin horizontally away from the water inlet body permits the flow of water to force the valve diaphragm horizontally away from the valve seat and permit a flow of water from the water inlet body, through the valve inlet 34, over the valve seat, reversely through the valve outlet 38 and downstream along the water outlet chamber 30 of the water outlet body.

Again more particularly to the principles of the present ball cock assembly at the downstream end of the water outlet chamber 30 or that end portion toward the left as shown in Figure 2, the water outlet body 12 is downwardly secured to a generally vertical water outlet tube generally indicated at 46, said tube being hollow cylindrical so as to have a circular cross-section and communicating upwardly into the water outlet body 12 and into the water outlet chamber 30. Anti-syphon means in the form of a resilient material, annular, generally frusto-conical member or part 48 is positioned within the water outlet chamber 30 of the water outlet body 12 surrounding the inner end portion 24 of the water inlet body 10, said anti-syphon frusto-conical part 48 being positioned generally upstream of the water outlet body connection to the water outlet tube 46 and generally downstream of the valve outlet 38 of the valve 14. Furthermore, the anti-syphon frusto-conical part 48 projects downstream inwardly normally resiliently abutting the outer surface of the valve inlet 34 so as to inwardly resiliently seal around the inner end portion 26 of the water inlet body 10 said anti-syphon frusto-conical part projecting angularly upstream and outwardly across the water outlet chamber 130

30 normally spaced from the water outlet body 12 and terminating outwardly in a reduced thickness portion 50 outwardly connected to an annular collar portion 52. The collar portion 52 of the anti-syphon frusto-conical part 48 seals outwardly with the water outlet body 12 by reception outwardly into an annular recess 54 of said water outlet body, the annular recess opening horizontally toward the outer valve casing 32 with the collar portion compressed horizontally thereagainst to also form a seal between the outer valve casing and the inner end portion 28 of the water outlet body.

As best seen in Figures 2 and 3, an annular, inwardly opening, air relief channel 56 is formed in the water outlet body 12 opening into the water outlet chamber 30 facing a portion of the anti-syphon frusto-conical part 48 downstream thereof, said air relief channel preferably being located outwardly of the major portion of the frusto-conical part and directly inwardly adjacent the collar portion 52 of said frusto-conical part. The air relief channel 56 furthermore terminates radially inwardly or inwardly forms an annular sealing shoulder 58 on the water outlet body 12 projecting into the water outlet chamber 30 upstream toward the anti-syphon frusto-conical part 48. This sealing shoulder 58 terminates inwardly of the water outlet chamber 30 upstream facing the anti-syphon frusto-conical part 48 in an inwardly angled sealing surface 60, that is, said surface angling inwardly downstream and outwardly upstream so as to be somewhat parallel to the extension of the anti-syphon frusto-conical part 48 but normally spaced downstream therefrom when the frusto-conical part is normally sealing around the inner end portion 26 of the water inlet body 10 as shown in full lines in Figure 2.

As best seen in Figure 3, the air relief channel 56 of the water outlet body 12 is downwardly connected to spaced downwardly opening air relief openings 62 which, as shown in Figure 1, communicate at all times with the air in the flush tank 18 above the flush tank upper water level 22. Completing the description of the anti-syphon frusto-conical part 48, an air vent opening 64 is formed through the anti-syphon frusto-conical part inwardly of the air relief channel 56 in the water outlet body 12 and outwardly of the frusto-conical part normal inward sealing around the inner end portion 26 of the water inlet body 10 and the valve inlet 34 so that this air vent opening will always be open through the frusto-conical part regardless of the frusto-conical part positioning during operation thereof as will be hereinafter described in detail. Furthermore, to ensure proper operation of the anti-syphon frusto-conical part 48, it is preferred to form the sum of the minimum cross-sectional dimensions of the air relief openings

62 through the water outlet body 12 at least as great as the maximum cross-sectional dimensions, or the sum of such maximum cross-sectional dimensions if two or more are provided, of the air vent opening 64 through the anti-syphon frusto-conical part 48, to thereby ensure a full supply of air through the air relief openings 62 of the water outlet body 12 as can be taken reversely upstream through the air vent opening 64 of the anti-syphon frusto-conical part 48.

As shown in Figure 1, the water outlet tube 46 terminates vertically downwardly opening into the interior of the flush tank 18 preferably below a lower water level generally indicated at 66 of said flush tank. Furthermore, as shown in Figures 1, 2 and 4 through 6, the water outlet tube 46 is telescoped by the float 16, the water outlet tube being received through a generally cylindrical vertical opening 68 of a guide portion 70 on said float. Inwardly projecting and circumferentially spaced guide ridges 72 are preferably formed projecting into the opening 68 of the float guide portion 70 inwardly slidably abutting the outer surface of the water outlet tube 46 so that water of the flush tank 18 may circulate upwardly between the water outlet tube and the float 16 during vertical movements of the float upwardly and downwardly along the water outlet tube preventing the collection of sediment and debris therebetween which could hinder such float movement.

An upwardly opening water chamber 74 is formed in the guide portion 70 of the float 16 horizontally surrounding a major portion of the horizontal cross section of the water outlet tube 46 so that said water chamber is concentrated around the float guiding vertically upwardly and downwardly along the water outlet tube. The water chamber 74, is, of course, downwardly closed and communicates with the water in the flush tank 18 through a vertical inlet opening 76 over an inner edge 78 of the float 16, the height of the inner edge 78 within the float determining the minimum water level in the water chamber 74 in the usual manner. The major portion of the float 16 extends horizontally outwardly from the water chamber 74 and the water outlet tube 46 being upwardly closed and downwardly open trapping air for the usual float effect well known to those skilled in the art.

A valve actuating boss 80 is formed on and projects horizontally from the outer extremities of the float 16 spaced a maximum distance from the float water chamber 74 and the float telescoping of the water outlet tube 46. The valve actuating boss 80 receives vertically therethrough a vertically extending valve connecting link 82 selectively adjustably secured through the valve ac-

uating boss by a spring clip 84 with both said connecting link and spring clip preferably being formed of stainless steel for corrosion resistance. An upper extremity of the connecting link 82 is pivotally connected to an outer extremity 86 of a generally horizontally extending, valve actuating arm 88, which arm is also preferably formed of stainless steel for the same purpose.

An inner extremity of the valve actuating arm 88 is pivotally connected to the valve 14 for upward and downward pivotal movement relative to the valve outer and inner casings 32 and 42. Spaced above its pivotal mounting on the valve 14, the valve actuating arm 88 is pivotally connected to the horizontally outwardly projecting extremity of the previously described valve actuating pin 44. Thus, downward movement of the float 16 will cause downward pivoting of the valve actuating arm 88 through the connecting link 82 moving the valve actuating pin 44 to the right as shown in Figure 2 and open the valve 14 admitting water therethrough as previously described, upward movement of the float through upward pivoting of the valve actuating arm moving the valve actuating pin to the left as shown in Figure 2 and closing the valve.

In operation of the ball cock assembly embodiment illustrated and described herein, when the water level within the flush tank 18 is at the upper water level 22, the float 16 is in its upper position as shown in Figures 1 and 2 retaining the valve actuating arm 88 in its upward pivoted position so that the valve 14 is closed. At this time, the supply of water under pressure within the valve inlet body 10 is sealed off and prevented from flowing at the valve seat 36 by the valve diaphragm 40. With no water flow through the water outlet body 12 and the water outlet chamber 30 thereof, the anti-syphon frusto-conical part 48 bears resiliently inwardly sealing around the valve outlet 38 and the water inlet body 10 as shown in Figure 2.

Upon the direction of water from the flush tank 18, the water level therein drops to the lower water level 66 which, in turn, permits the float 16 aided by its movement balancing water chamber 74 to drop downwardly along the water outlet tube 46 being guided thereby. This downward movement of the float 16 pivots the valve actuating arm 88 connected thereto by the connecting link 82 to the valve actuating arm downward pivoted position as shown in phantom lines in Figure 1, which, limits the downward movement of the float, also shown in phantom lines in Figure 1. More important, the downward pivoting of the valve actuating arm 88 withdraws the valve actuating pin 44 horizontally outwardly or to the left of the position shown in Figure 2 permitting

the water under pressure within the water inlet body 10 to force the valve diaphragm 40 away from the valve seat 36 and permit such water to flow reversely downstream through the valve outlet 38.

As the water under pressure flows from the valve outlet 38 into the water outlet chamber 30 of the water outlet body 12, such water flow forces the resilient anti-syphon frusto-conical part 48 outwardly away from sealing around the water inlet body 10 against the annular sealing surface 60 of the sealing shoulder 58 on the water outlet body 12, as shown in phantom lines in Figure 2. This expanded outward movement of the anti-syphon frusto-conical part 48 not only permits the downstream flow of water around the water inlet body 10 and downwardly through the water outlet tube 46 into the flush tank 18 below the lower water level 66 thereof, but also through the described abutment sealing over the sealing surface 60 of the sealing shoulder 58, seals off the air relief channel 56 and the air relief opening 62 of the water outlet body 12 preventing any possibility of water flow therethrough into the flush tank above the upper water level 22 thereof. Continued water flow from the water outlet tube 46 into the flush tank 18 below the lower water level 66 thereof ultimately refills the flush tank to the upper water level 22 causing the float 16 to move upwardly pivoting the valve actuating arm 88 upwardly and once again closing the valve 14 returning all elements to a non-water flow condition as shown in Figures 1 and 2 in full lines.

In the important operation of the anti-syphon means of the ball cock assembly as principally formed by the anti-syphon frusto-conical part 48, with possible syphoning conditions present as caused by an extreme drop in water pressure in the water supply system connected to the water inlet body 10, the ball cock construction would, of course, be under non-water flow conditions whether the valve 14 thereof was in open or closed condition. In other words, despite the position of the ball cock valve 14, there would be no water flowing therethrough and the anti-syphon frusto-conical part 48 would be in its normal, resiliently relaxed position bearing resiliently inwardly and sealing around the water inlet body 10 as shown in full lines in Figure 2, thereby exposing the air relief channel 56 and the air relief openings 62 of the water outlet body 12. Thus, any vacuum pressures upstream reversely through the valve 14 created by the attempted syphoning condition will cause a reverse or upstream flow of air from the valve outlet 38 and from within the water outlet chamber 30 which vacuum force will be relieved by air being drawn inwardly through the air relief openings 62

and air relief channel 56 of the water outlet body 12 from the air above the water level in the flush tank 18 and through the air vent opening 64 of the anti-syphon frusto-conical part 48 which will prevent any possibility of any of the water within the flush tank from being syphoned or drawn upwardly through the water outlet tube 46. As a result, the ball cock assembly as hereinbefore described, with the unique anti-syphon means therein gives complete syphoning protection.

According to the principles of the present ball cock assembly, therefore, a ball cock assembly is provided which is adapted for mounting horizontally through the sidewall 20 of the toilet flush tank 18 giving maximum convenience in plumbing and particularly with structure plumbing systems which do not permit connection of a ball cock assembly through lower portion of the toilet flush tank 18. In addition, the ball cock construction as hereinbefore described is of greatly simplified and compacted form advantageously positioned with the maximum part thereof, and particularly the important water flow and flow control elements, positioned at all times above the upper water level 22 of the flush tank 18 eliminating the major portion of the dangers from corrosion and other forms of contamination caused by the water stored in and flowing through the flush tank. Despite these advantages, however, the ball cock assembly still does not create excess noises from the direction of water under pressure into the flush tank 18, the water outlet tube 46, merely a simple single tube, projects downwardly below the flush tank lower water level 66 so that incoming water is always entering below a water surface muffling any flow sounds.

Still further, the water outlet tube 46 in its extremely simple form serves as a simplified and positive guide for the float 16 in the usual float movements upwardly and downwardly in controlling the ball cock valve 14 to control the water level within the flush tank 18. The perfect guiding of the float 16 by the water outlet tube 46 is also aided by the unique construction of the float which has the concentrated, weight adding water chamber 74 thereof concentrated around the water outlet tube despite the fact that the float otherwise projects horizontally a considerable distance from the water outlet tube and controls the movement of the valve actuating arm 88 at the float extremity of such projection. Also, with the unique construction of the float 16 and with it being perfectly capable of controlling the valve 14 from the projecting extremities thereof, the valve actuating arm 88 of the ball cock assembly is permitted to project horizontally directly from the location of the valve to

again add maximum compactness and simplicity to the overall ball cock assembly.

A still additional important feature of the ball cock assembly as hereinbefore described usable in the particular embodiment of ball cock shown or in many other forms of ball cocks, whether sidewall or bottom mounted with flush tanks such as the flush tank 18, is the unique anti-syphon means. As shown and described herein in the embodiment illustrated, the relatively simple, but specifically formed anti-syphon frusto-conical part 48 in combination with the air relief channel 56 and air relief openings 62 of the water outlet body 12, serves to positively protect the ball cock assembly of the present invention from any tendency to syphon water from the flush tank 18 even through the water pressure from the water inlet body 10 may drop to a point creating water syphoning conditions. Despite this complete syphoning protection, the anti-syphon frusto-conical part 48 has the still additional features of perfectly sealing off the air relief openings 62 through the water outlet body 12 absolutely required for the syphoning protection so as to prevent any of the normally flowing water through the ball cock assembly from passing outwardly through such air relief openings and creating water flow noises by dropping downwardly to the upper water level 22 in the flush tank 18, while still providing a unique form of compressive seal between the outer valve casing 32 and the water outlet body 12 as hereinbefore described.

An advantage of the ball cock assembly as hereinbefore described is that the water inlet is mounted in the flush tank wall above the upper water level of the tank and therefore the water tightness of the seal between the water inlet and the tank wall is not important.

A further advantage of the ball cock assembly as hereinbefore described is the novel anti-syphon device which positively protects the water supply from contamination due to syphoning of the water from the flush tank into the water supply.

WHAT WE CLAIM IS:—

1. A ball cock assembly for a flush tank, including a tubular water inlet body adapted for positioning within the flush tank and communicating with a supply of water, a tubular water outlet assembly having a part above the flush tank upper water level and being spaced outwardly of an inner cylindrical surface within the assembly to define therewith an annular water outlet passage, a valve communicating with said water inlet body and the annular water outlet passage, said valve being movable between a closed position sealing off and an open position permitting a flow of water there-through float means operably connected to said valve



and air relief channel 56 of the water outlet body 12 from the air above the water level in the flush tank 18 and through the air vent opening 64 of the anti-syphon frusto-conical part 48 which will prevent any possibility of any of the water within the flush tank from being syphoned or drawn upwardly through the water outlet tube 46. As a result, the ball cock assembly as hereinbefore described, with the unique anti-syphon means therein gives complete syphoning protection.

According to the principles of the present ball cock assembly, therefore, a ball cock assembly is provided which is adapted for mounting horizontally through the sidewall 20 of the toilet flush tank 18 giving maximum convenience in plumbing and particularly with structure plumbing systems which do not permit connection of a ball cock assembly through lower portion of the toilet flush tank 18. In addition, the ball cock construction as hereinbefore described is of greatly simplified and compacted form advantageously positioned with the maximum part thereof, and particularly the important water flow and flow control elements, positioned at all times above the upper water level 22 of the flush tank 18 eliminating the major portion of the dangers from corrosion and other forms of contamination caused by the water stored in and flowing through the flush tank. Despite these advantages, however, the ball cock assembly still does not create excess noises from the direction of water under pressure into the flush tank 18, the water outlet tube 46, merely a simple single tube, projects downwardly below the flush tank lower water level 66 so that incoming water is always entering below a water surface muffling any flow sounds.

Still further, the water outlet tube 46 in its extremely simple form serves as a simplified and positive guide for the float 16 in the usual float movements upwardly and downwardly in controlling the ball cock valve 14 to control the water level within the flush tank 18. The perfect guiding of the float 16 by the water outlet tube 46 is also aided by the unique construction of the float which has the concentrated, weight adding water chamber 74 thereof concentrated around the water outlet tube despite the fact that the float otherwise projects horizontally a considerable distance from the water outlet tube and controls the movement of the valve actuating arm 88 at the float extremity of such projection. Also, with the unique construction of the float 16 and with it being perfectly capable of controlling the valve 14 from the projecting extremities thereof, the valve actuating arm 88 of the ball cock assembly is permitted to project horizontally directly from the location of the valve to

again add maximum compactness and simplicity to the overall ball cock assembly.

A still additional important feature of the ball cock assembly as hereinbefore described usable in the particular embodiment of ball cock shown or in many other forms of ball cocks, whether sidewall or bottom mounted with flush tanks such as the flush tank 18, is the unique anti-syphon means. As shown and described herein in the embodiment illustrated, the relatively simple, but specifically formed anti-syphon frusto-conical part 48 in combination with the air relief channel 56 and air relief openings 62 of the water outlet body 12, serves to positively protect the ball cock assembly of the present invention from any tendency to syphon water from the flush tank 18 even through the water pressure from the water inlet body 10 may drop to a point creating water syphoning conditions. Despite this complete syphoning protection, the anti-syphon frusto-conical part 48 has the still additional features of perfectly sealing off the air relief openings 62 through the water outlet body 12 absolutely required for the syphoning protection so as to prevent any of the normally flowing water through the ball cock assembly from passing outwardly through such air relief openings and creating water flow noises by dropping downwardly to the upper water level 22 in the flush tank 18, while still providing a unique form of compressive seal between the outer valve casing 32 and the water outlet body 12 as hereinbefore described.

An advantage of the ball cock assembly as hereinbefore described is that the water inlet is mounted in the flush tank wall above the upper water level of the tank and therefore the water tightness of the seal between the water inlet and the tank wall is not important.

A further advantage of the ball cock assembly as hereinbefore described is the novel anti-syphon device which positively protects the water supply from contamination due to syphoning of the water from the flush tank into the water supply.

WHAT WE CLAIM IS:—

1. A ball cock assembly for a flush tank, including a tubular water inlet body adapted for positioning within the flush tank and communicating with a supply of water, a tubular water outlet assembly having a part above the flush tank upper water level and being spaced outwardly of an inner cylindrical surface within the assembly to define therewith an annular water outlet passage, a valve communicating with said water inlet body and the annular water outlet passage, said valve being movable between a closed position sealing off and an open position permitting a flow of water there-through float means operably connected to said valve



for moving said valve between said open and closed positions upon changing water level in said flush tank, discharge opening means from said annular water outlet passage to below said flush tank upper water level, an anti-syphon means including a frusto-conical shaped member formed from a resilient material located in said annular water outlet passage, said member being adapted to make contact around said inner cylindrical surface of said water outlet passage and seal therewith and being outwardly peripherally sealed with the water outlet assembly, air relief opening means formed through said water outlet assembly and communicating between said annular water outlet passage and air above said flush tank upper water level, said air relief opening means being positioned such that when water is flowing from the tubular inlet through the annular outlet passage the frusto-conical member seals the air relief opening means; and an air vent through said frusto-conical member positioned such that under syphoning conditions air passes from said air relief opening means through said air vent and into said water inlet body.

2. A ball cock assembly as claimed in Claim 1, wherein the minimum cross-sectional dimensions of said air relief opening means are at least as great as the maximum cross-sectional dimensions of said air vent.

3. A ball cock assembly as claimed in Claim 1 or Claim 2, in which said air relief opening means includes an annular air relief channel formed in said water outlet assembly opening into said annular water outlet passage, said air relief channel having at least one air relief opening therein opening through said water outlet assembly communicating between said air relief channel and said air above said flush tank upper water level.

4. A ball cock assembly as claimed in Claim 3, wherein the air relief channel opens inwardly into said annular water outlet passage.

5. A ball cock assembly as claimed in Claim 3 or Claim 4, wherein said air relief channel includes an annular shoulder projecting into said annular water outlet passage, said air relief channel being closed by said frusto-conical member being forced away from said inner cylindrical surface and against said annular shoulder in said annular water outlet passage by the flow of water from said inlet body to said annular water outlet passage.

6. A ball cock assembly as claimed in Claim 5, wherein the shoulder has an annular sealing surface projecting toward said frusto-conical member and angling downstream from said air relief channel, said air relief channel being closed by said frusto-

conical member upon said flow of water under pressure from said valve outlet into said annular water outlet passage downstream around said inner cylindrical surface and through said discharge opening means forcing said frusto-conical member away from said inner cylindrical surface against said annular sealing surface of said annular shoulder of said water outlet assembly.

7. A ball cock assembly as claimed in any one of Claims 3 to 6, wherein the sum of the minimum cross-sectional dimensions of all of said air relief channel is at least as great as a sum of the maximum cross-sectional dimensions of all air vents through said frusto-conical part.

8. A ball cock assembly as claimed in any one of the preceding claims, in which said frusto-conical member is a unitary part with a frusto-conical shape thereof terminating outwardly across said annular water outlet passage in an annular collar secured outwardly peripherally sealed with said water outlet assembly and sealing between said water outlet assembly and a casing of said valve.

9. A ball cock assembly as claimed in any one of the preceding claims, wherein said frusto-conical member includes an annular reduced thickness portion around said inner cylindrical surface spaced outwardly from said inner cylindrical surface and within said annular water outlet passage.

10. A ball cock assembly as claimed in any one of Claims 1 to 7, wherein said frusto-conical member is a unitary part having an annular reduced thickness section spaced outwardly of said inner cylindrical surface around said inner cylindrical surface within said annular water outlet passage, said frusto-conical member terminating outwardly of said reduced thickness section in an annular collar secured outwardly peripherally sealed with said water outlet assembly and sealing between said water outlet assembly and a casing of said valve.

11. A ball cock assembly for a flush tank, including a water inlet body, a water outlet body, a valve means having an inlet communicating with the water inlet body and an outlet communicating with the water outlet body, a float operably connected to said valve means and an anti-syphon means including a resilient member located in the outlet body, an air relief means formed through the outlet body providing communication between the air above the flush tank upper water level and the outlet, said resilient member being adapted to seal the air relief means under water flow conditions from inlet to outlet to prevent water flowing through said air relief means, and under syphoning conditions to cover said water outlet and permit air to pass through said



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air relief means and into said water inlet body.

12. A ball cock assembly as claimed in Claim 1 and substantially as hereinbefore described.

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