

[54] **BALL COCK CONSTRUCTION INCLUDING HORIZONTAL INLET MOUNTING AND ANTI-SYPHON DEVICE**

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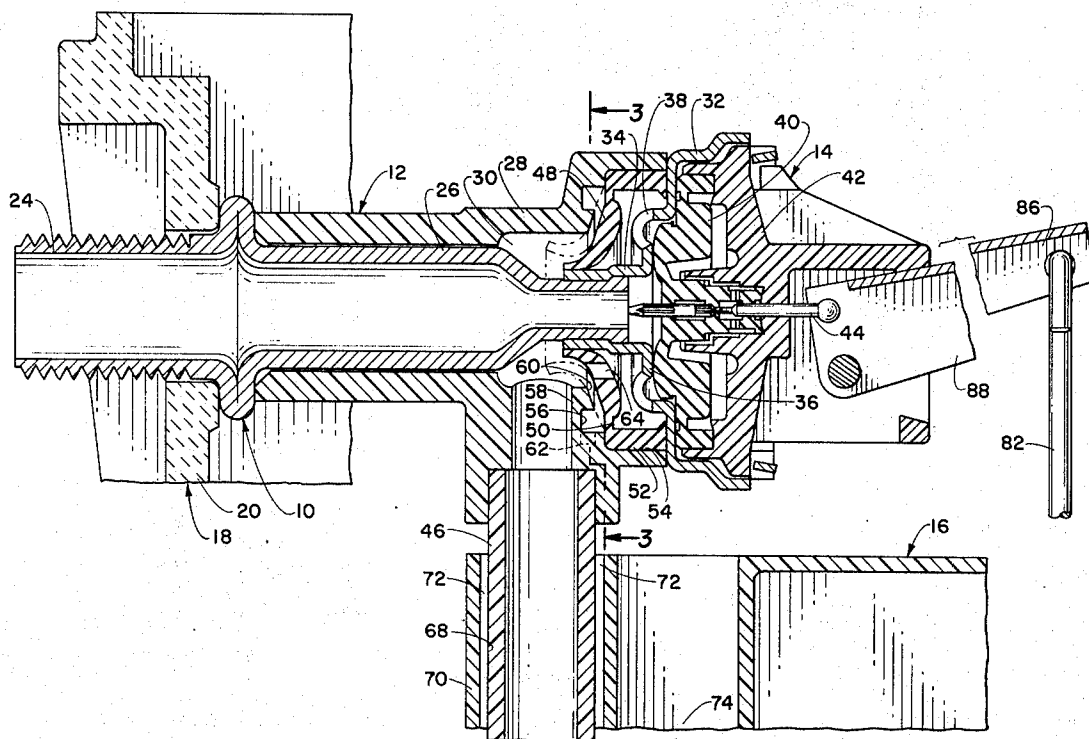
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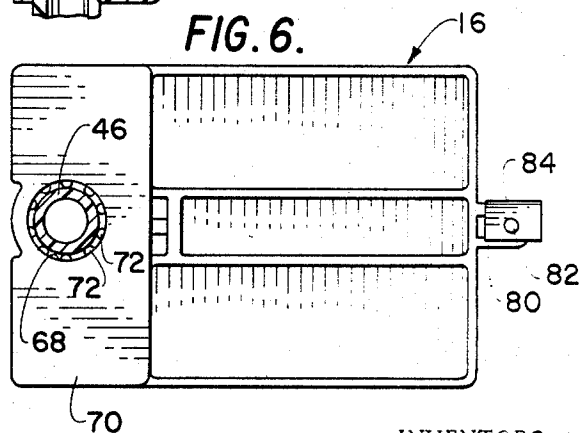
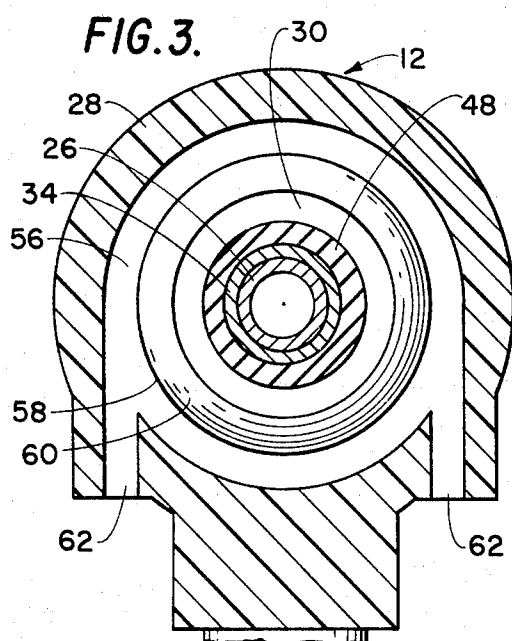
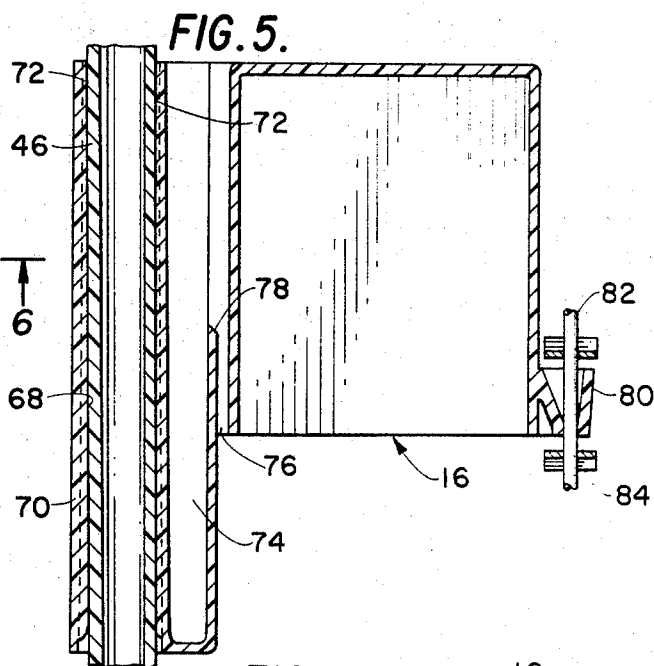
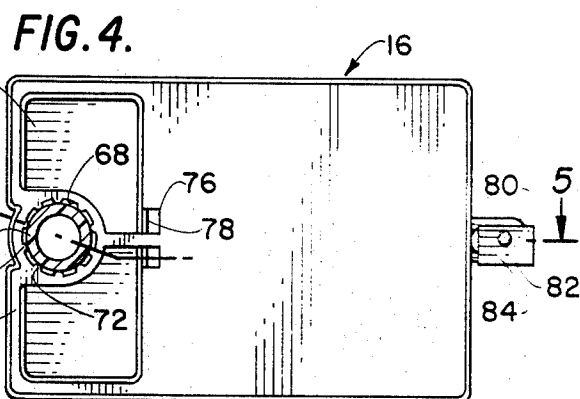
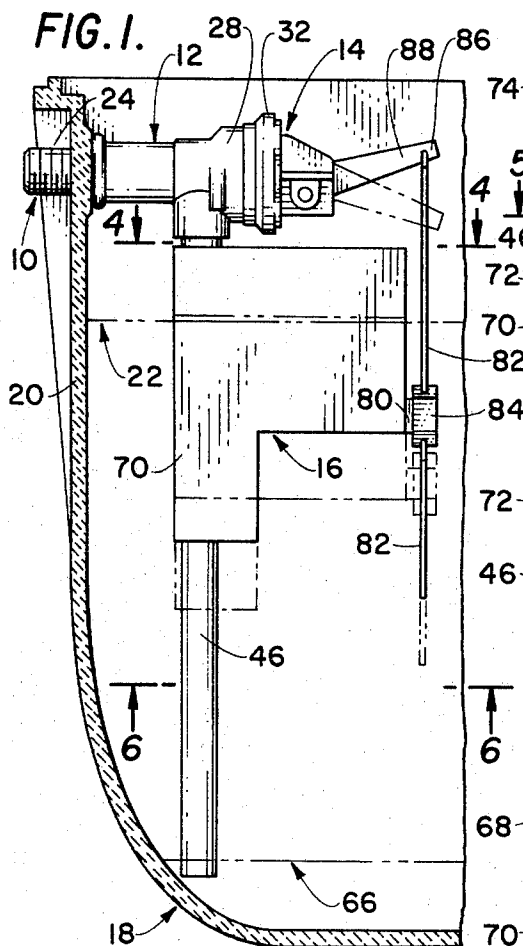
[57] **ABSTRACT**

A horizontally extending water inlet body is mounted through

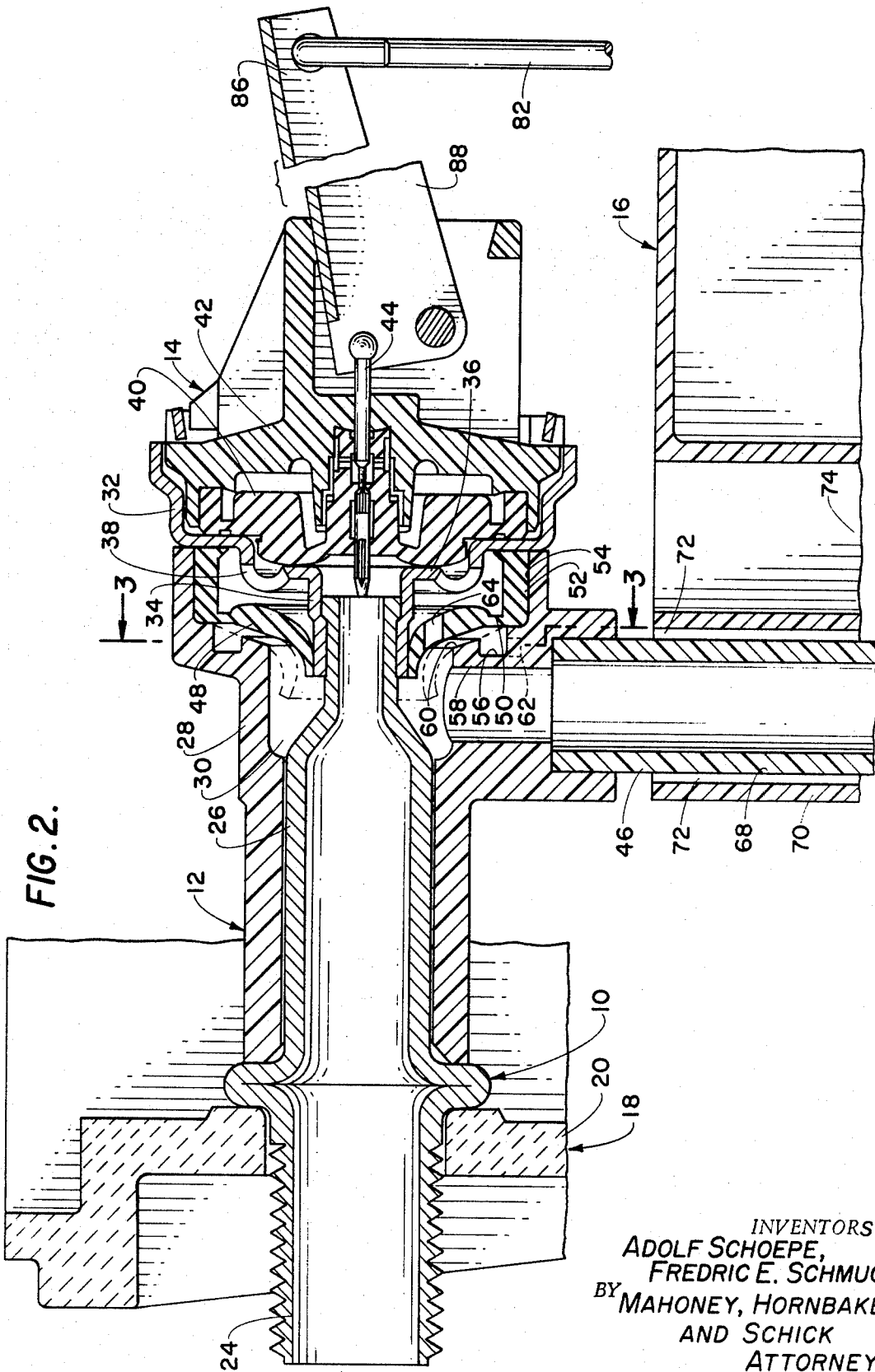
a sidewall of a toilet flush tank above the tank upper water level and an inner end portion thereof is telescoped by a water outlet body with a water valve positioned between inner ends of said bodies. An annular water outlet chamber formed between inner end portions of the inlet and outlet bodies is downwardly connected communicating with a generally vertical water outlet tube projecting downwardly, preferably to below a flush tank lower water level. A float telescopes the water outlet tube guided thereby in upward and downward movement with the flush tank water level, the float controlling the valve through a generally horizontally extending pivotal actuating arm on the valve connected to the float through a vertical connecting link. A water chamber of the float is compacted in the float portion telescoping the water outlet tube to give float balanced movement despite float horizontal projection therefrom and connection to the valve actuating arm horizontally spaced from the water outlet tube guiding. A frusto-conical, resilient material, anti-syphon member is positioned within the annular water outlet chamber of the water outlet body normally sealing inwardly against the water inlet body, but annularly expanding away from the water inlet body upon water under pressure being admitted through the valve into the water outlet chamber and downwardly through the water outlet tube. During such annular expansion of the frusto-conical member, the walls thereof seal air relief openings through the water outlet body communicating with the air in the flush tank above the upper water level thereof, but in non-expanded condition of the frusto-conical member, attempted syphoning air forces against the upstream side of the frusto-conical member may draw air through an air vent opening of said frusto-conical member and from the tank air through the outlet body air relief openings to relieve any syphoning forces upwardly through the water outlet tube.

5 Claims, 6 Drawing Figures





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

BACKGROUND OF THE INVENTION

This invention relates to a ball cock construction including horizontal inlet mounting and an anti-syphon device, and more particularly to a ball cock adapted for sidewall mounting within a toilet flush tank and having the major portion of said ball cock including the major portion of the important water flow controlling elements positioned at all times above an upper water level of the flush tank. Even more particularly, with a preferred embodiment of the ball cock of the present invention, all of a water inlet body, a water outlet body and a water controlling valve thereof are positioned at all times above the tank upper water level with the only projections therefrom extending below said tank upper water level being a water outlet tube for directing water flow finally into the tank, a portion of a valve controlling float and the connection of said float to the water valve, thereby eliminating any exposure of these vital water flow directing and controlling elements to water corrosion and water sediment collection normally encountered when such elements are below the tank water surface. Still further according to certain of the principles of the present invention, and regardless of the particular form of ball cock involved and regardless of the mounting thereof relative to the toilet flush tank, an improved simplified and positively acting anti-syphon protecting device is provided positioned directly within the water outlet chamber of the ball cock and positively serving to prevent reverse flow syphoning of water from the toilet flush tank despite syphoning forces being created by an extreme drop in water pressure within the plumbing system serving the water supply for such toilet flush tank.

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 extending 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 positioning, the water inlet body extension through the flush tank bottom wall must be properly sealed, and in many cases, not only does the water inlet body project upwardly 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 exposed to the water within such tank. The result has been the creation of two particular problems, one being the difficulties of maintaining water seals for such ball cocks and proper continued functioning thereof due to corrosion caused by the constant immersion in the flush tank water and the collection of sediment from such water, and the other being the fact that in many installations of toilet flush tanks it is not convenient 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.

Still a further important consideration in ball cock constructions 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 the prior anti-syphon devices, additional expenses are encountered which must be added to the overall cost of the ball cock construction.

OBJECTS AND SUMMARY OF THE INVENTION

It is, therefore, an object of this invention to provide a ball cock construction including horizontal inlet mounting wherein all of the elements of said ball cock with the exception of the water outlet tube, the float and the valve actuating connection between the float and the valve are positioned totally above the upper water level of the toilet flush tank within which the ball cock is installed, thereby eliminating the major portion of the water corrosion and sediment problems with the important water flow and directing elements thereof. According to a preferred embodiment of the ball cock of the present invention, a tubular water inlet body is connected through the flush tank sidewall spaced above the flush tank upper water level and a tubular outlet water body is telescoped over said water inlet body with a valve being connected to horizontally inward ends of said telescoped inlet and outlet bodies. A water outlet tube is upwardly connected to the water outlet body and projects downwardly beneath the flush tank upper water level discharging the incoming water flow downwardly into said flush tank below the upper water level thereof and also serving as a vertical guide for guiding a valve controlling float telescoped therewith and upwardly connected to the water valve.

It is still an additional object of this invention to provide a ball cock construction including an anti-syphon device which is extremely simple in construction, may be provided at a minimum of additional cost, yet is of positive action virtually eliminating the dangers of causing contamination in a structure water system by eliminating possibility of syphoning water of the toilet flush tank reversely through the ball cock and back into such water system. According to an embodiment of the present invention, the anti-syphon device includes an annular, frusto-conical part formed of resilient material positioned in the annular water outlet chamber of the ball cock water outlet body and normally resiliently inwardly telescoping and abutting the water inlet body within said water outlet body so as to normally constitute a resilient barrier across the water flow channel of the ball cock spaced above the flush tank upper water level. In normal operation of water flow through the ball cock, the flow of water under pressure exiting the valve passes downstream along the water inlet body within the annular water outlet chamber forcing the frusto-conical part to expand outwardly away from the water inlet body and against a portion of the water outlet body closing air relief holes through the water outlet body communicating with the air in the flush tank above the flush tank upper water level, thereby permitting normal downstream water flow through the ball cock into the flush tank. If, however, the water pressure in the structure water supply line drops sufficiently that a reverse vacuum or syphoning force is created through the water inlet body into the ball cock construction, there then, of course, being no downstream water flow, such reverse syphoning force will draw air through an air vent opening of the frusto-conical member and from the air above the flush tank upper water level through the air relief openings of the water outlet body so as to prevent such reverse syphoning forces from acting downwardly through the water outlet tube which could otherwise cause a syphoning force on the water within the flush tank.

Other objects and advantages of the invention will be apparent from the following specification and the accompanying drawing which are for the purpose of illustration only.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side-elevational view of an embodiment of the ball cock construction of the present invention installed in a typical toilet flush tank, said flush tank being shown in fragmentary vertical section;

FIG. 2 is an enlarged, fragmentary, vertical sectional view of the ball cock construction and toilet flush tank of FIG. 1;

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

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

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

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

DESCRIPTION OF THE BEST EMBODIMENT CONTEMPLATED

Referring to the drawings, an embodiment of the ball cock construction of the present invention is shown including a water inlet body generally indicated 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 construction 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 construction 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.

More particularly to the principles of the present invention, 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 FIG. 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 spaced from the flush tank sidewall 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 portion of the water inlet and outlet bodies. As can be particularly seen in enlargement in FIG. 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.

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 valve outlet 38. The outer valve casing 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 invention, at the downstream end of the water outlet chamber 30 or that end portion toward the left as shown in FIG. 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 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 FIGS. 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 FIG. 2.

As best seen in FIG. 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 FIG. 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 FIG. 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 FIGS. 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 actuating boss by a spring clip 84 and 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 FIG. 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 FIG. 2 and closing the valve.

In operation of the ball cock construction 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 FIGS. 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 FIG. 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 FIG. 1, which, limits the downward movement of the float, also shown in phantom lines in FIG. 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 FIG. 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 FIG. 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 FIGS. 1 and 2 in full lines.

In the important operation of the anti-syphon means of the ball cock construction of the present invention 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 FIG. 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 up-

stream 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 construction of the present invention with the unique anti-syphon means therein gives complete syphoning protection.

According to the principles of the present invention, therefore, a ball cock construction 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 construction through lower portions of the toilet flush tank 18. In addition, the ball cock construction of the present invention 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 construction 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 construction is permitted to project horizontally directly from the location of the valve to again add maximum compactness and simplicity to the over-all ball cock construction.

A still additional important feature of the ball cock construction of the present invention 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 of the present invention. 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 construction 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 construction 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.

We claim:

1. In a ball cock usable for controlling the flow of water into and the water level within a toilet flush tank; said ball cock being of the type having a tubular water inlet body adapted for positioning within a flush tank interior communicating with a supply of water from exteriorly of said flush tank interior, a tubular water outlet assembly having a part above a flush tank upper water level spaced outwardly of an inner cylindrical surface forming an annular water outlet passage above said flush tank upper water level about said inner cylindrical surface, valve means having a valve inlet communicating upstream with said water inlet body and a valve outlet communicating downstream with said water outlet assembly and through said annular water outlet passage, said valve being movable between a closed position sealing off and an open position permitting a flow of water therethrough between said valve inlet and valve outlet, float means operably connected to said valve means for moving said valve means between said open and closed positions upon changing water level in said flush tank from and to said flush tank upper water level, and discharge opening means of said water outlet assembly located for discharging water downstream below said flush tank upper water level; the improvements comprising: anti-syphon means formed in said water outlet assembly at said annular water outlet passage including a resilient material, annular, generally frusto-conical part projecting generally downstream around said inner cylindrical surface and normally bearing resiliently inwardly sealing around said inner cylindrical surface, said frusto-conical part upstream of said normal sealing around said inner cylindrical surface extending outwardly across said annular water outlet passage and being secured outwardly peripherally sealed with said water outlet assembly, air relief opening means formed through said water outlet assembly normally communicating between said annular water outlet passage and air above said flush tank upper water level, said air relief opening means being positioned intermediate said frusto-conical part downstream projection downstream of said frusto-conical part peripheral sealing with said water outlet assembly and being closed by said frusto-conical part upon a 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 part away from said inner cylindrical surface against said water outlet assembly over said air relief opening means, air vent opening means through said frusto-conical part spaced away from said inner cylindrical surface in all positions of said frusto-conical part, minimum cross-sectional dimensions of said air relief opening means through said water outlet assembly being at least as great as maximum cross-sectional dimensions of said air vent opening means through said frusto-conical part.
2. A ball cock as defined in claim 1 in which said air relief opening means includes an annular air relief channel formed in said water outlet assembly generally U-shaped in cross section and opening into said annular water outlet passage adjacent and downstream of said frusto-conical part outward peripheral sealing with said water outlet assembly, at least one air relief opening formed through said water outlet assembly from within said air relief channel communicating between said air relief channel and said air above said flush tank upper water level, said air relief channel terminating spaced from said frusto-conical part outward sealing with said water outlet assembly in an annular shoulder around said frusto-conical part having an annular sealing surface projecting toward said frusto-conical part and angling downstream from said air relief channel approximately parallel to facing surfaces of said frusto-conical part, said air relief channel being closed by said frusto-conical part 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 part

away from said inner cylindrical surface against said annular sealing surface of said annular shoulder of said water outlet assembly.

3. A ball cock as defined in claim 1 in which said air relief opening means includes an annular air relief channel formed in said water outlet assembly generally U-shaped in cross section and opening into said annular water outlet passage downstream and adjacent to said frusto-conical part outward sealing with said water outlet assembly, spaced air relief openings formed through said water outlet assembly from within said air relief channel communicating between said air relief channel and said air above said flush tank upper water level, said air relief channel terminating spaced downstream from said frusto-conical part outward sealing with said water outlet assembly in an annular shoulder around said frusto-conical part having an annular sealing surface angled downstream from said air relief channel approximately parallel to facing surfaces of said frusto-conical part, said air relief channel being closed by said frusto-conical part upon a 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 part away from said inner cylindrical surface against said sealing surface of said annular shoulder; and in

which said frusto-conical part includes an annular reduced thickness portion around said inner cylindrical surface spaced outwardly from said inner cylindrical surface and extending within said annular water outlet passage free of said frusto-conical part outward peripheral sealing with said water outlet assembly.

4. A ball cock as defined in claim 1 in which said frusto-conical part includes an annular reduced thickness portion around said inner cylindrical surface spaced outwardly from said inner cylindrical surface and extending within said annular water outlet passage free of said frusto-conical part outward peripheral sealing with said water outlet assembly.

5. A ball cock as defined in claim 1 in which said frusto-conical part is a unitary part having an annular reduced thickness section spaced outwardly of said inner cylindrical surface around said inner cylindrical surface and extending within said annular water outlet passage free of said frusto-conical part outward peripheral sealing with said water outlet assembly, said frusto-conical part 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 separate casing of said valve means.

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