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FLUSH CONTROL VALVE

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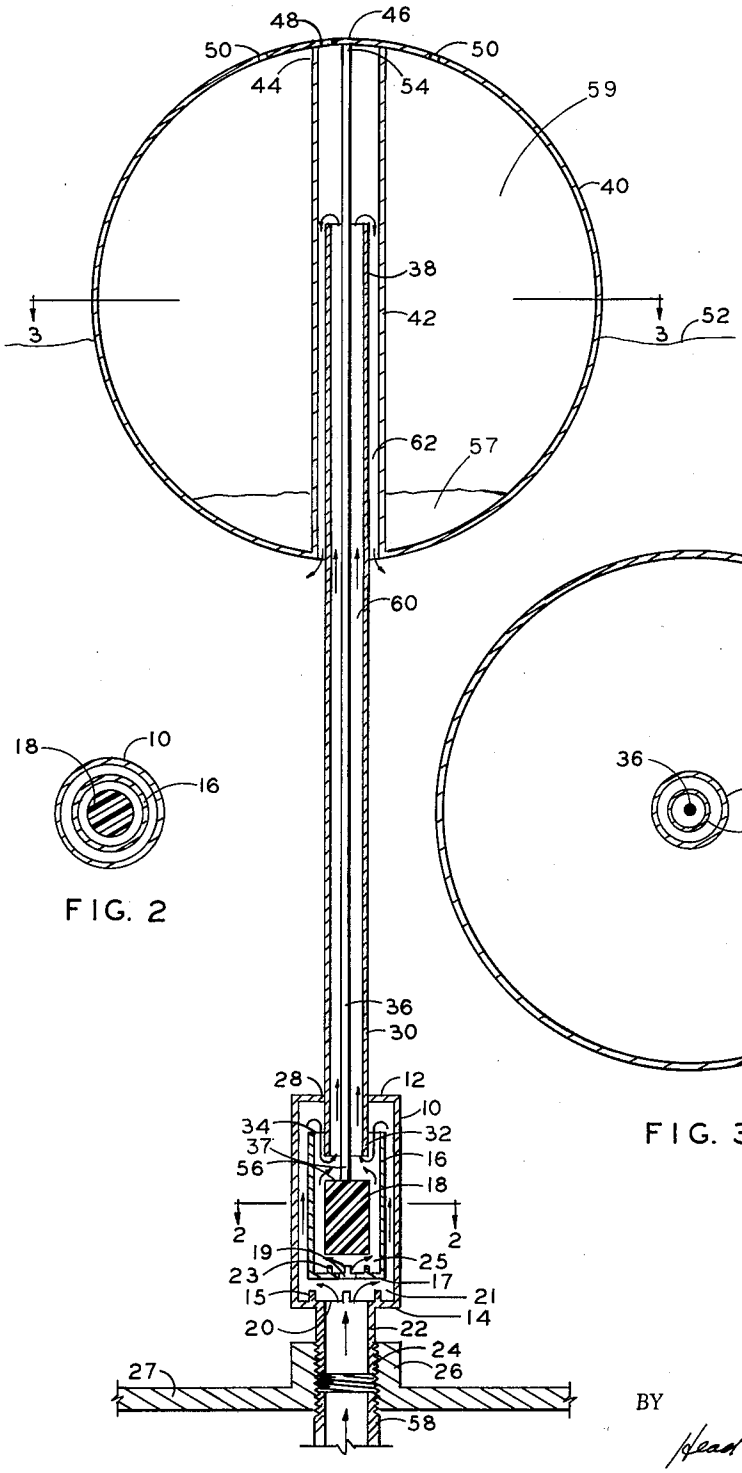

FIG. 1

FIG. 2

FIG. 3

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FLUSH CONTROL VALVE

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This invention relates to an improved flush control valve. More particularly, this invention relates to an improved flush control valve for controlling the supply of water to a toilet water cabinet.

Flush control valves for toilet water cabinets have long been in use, however, these prior art flush control valves have been characterized by a number of undesirable disadvantages. Not least among these disadvantages is the highly annoying noise resulting from flutter vibration of the valve during fill-up of the water cabinet. Also prominent among these disadvantages is the slowness of the water cabinet fill-up.

Therefore, it is an object of this invention to provide an improved flush control valve that is free from all the disadvantages of prior known flush control valves.

Another object of this invention is to provide a flush control valve for toilet water cabinets that is relatively silent in operation.

Yet another object of this invention is to provide an improved flush control valve that allows rapid fill-up of the toilet water cabinet.

A further object of this invention is to provide an improved flush control valve through which water flows at full unobstructed speed until the approximate moment at which the valve closes thereby allowing for rapid fill-up of the toilet water cabinet.

Still another object of this invention is to provide an improved flush control valve for toilet water cabinets in which the shut off of the valve is immediate and complete. Therefore, there is no flutter or vibration of the valve element which is the primary source of noise in the operation of previously known flush control valves.

A further object of this invention is to provide an improved flush control valve for toilet water cabinets in which the valve element moves in the direction of flow of the water to its shut off position.

A still further object of this invention is to provide an improved flush control valve for water cabinets in which the valve is controlled by a float element and in which the float element is located immediately above the valve such that there is no necessity for providing the conventional arrangement of levers and a fulcrumed float arm.

Yet a further object of this invention is to provide an improved flush control valve for a toilet water cabinet which prevents siphoning of the water from the water cabinet without the necessity of including an anti-siphoning tube or similar previously known anti-siphoning mechanisms.

Another object of this invention is to provide an improved flush control valve for toilet water cabinets in which the flush control valve is of relatively simple construction and is easily adaptable for use in a conventional toilet water cabinet.

Further objects and advantages of this invention will be apparent from the following description and appended claims, reference being had to the accompanying drawings forming a part of the specification wherein like reference characters designate corresponding parts in the several views.

FIGURE 1 is an elevational cross-sectional view of the flush control valve of this invention.

FIGURE 2 is a sectional view taken along line 2—2 of FIGURE 1.

FIGURE 3 is a sectional view taken along line 3—3 of FIGURE 1.

Referring now to the drawings and particularly to FIGURE 1, wherein is shown in cross-section the float operated flush control valve of this invention operably mounted in a water closet. The flush control valve of this invention consists of a substantially cylindrical shaped valve housing 10 closed at its upper end by a top plate 12 and closed at its bottom end by a bottom plate 14. Housing 10 may preferably be made up of two or more tubular pipe sections joined together by threaded pipe connections, instead of being a single cylindrical section as shown in FIGURE 1, thereby to facilitate disassembling the valve for inspection and repair.

Freely movably located within housing 10 is a substantially cup shaped member 16, the bottom 17 of which is provided with a central orifice 19. Located within member 16 and freely movable therein is a vertical substantially solid cylindrical shaped valve element 18.

Extending upwardly from bottom plate 14 is an annular row of lugs 15 for receiving and supporting thereupon member 16 to insure at all times a space 21 between the bottom 17 of member 16 and the bottom plate 14 of housing 10. Likewise, an annular row of lugs 23 extend upwardly from bottom 17 for receiving and supporting thereupon the valve element 18, thereby insuring at all times a space 25 between valve element 18 and bottom 17.

Valve element 18 may be made from any material suitable for forming a seal against the opened end of a metallic pipe with a hard rubber material being preferred.

The bottom closure plate 14 of housing 10 is provided with a centrally located opening 20 and has a tubular extension 22 depending coaxially downwardly therefrom with the lower end 24 of extension 22 being provided with external threads for threaded attachment into a raised portion 26 in the bottom 27 of the water cabinet.

The upper closure plate 12 is provided with a central opening 28 through which extends a vertical small diameter open ended tubular member 30. The lower end 32 of tubular member 30 extends coaxially into housing 10 to a point slightly above the upper edge 34 of cup shaped member 16 when member 16 is in its lowermost position. Tubular member 30 is attached to top plate 12 as by welding or similar attaching means, not shown.

Reciprocally located within tubular member 30 is an elongated small diameter rod 36, the purpose of which will be described more fully hereinafter. The bottom end 37 of rod 36 contacts and is at all times supported upon the upper surface 56 of valve element 18. Rod 36 is sufficiently longer than tubular member 30 that its upper end 54 extends a substantial distance above the upper end 38 of member 30.

Slidably located about the upper ends 38 and 54 of tubular member 30 and rod 36, respectively, is a float member 40 of any conventional design, shown here to be a hollow sphere. Extending diametrically through the center of float 40 is a sealed passage 42 for receiving tubular member 30 and rod 36 therein. The upper end 44 of passage 42 is closed by a closure plate 46. Plate 46 is provided with an orifice 48 for communicating the inside of passage 42 with the atmosphere to prevent siphoning of the water in the water cabinet back through the valve.

Float 40 normally floats upon the surface of the water when the water cabinet is filled to its predetermined level and when in this position no part of the weight of float 40 is supported by rod 36. However, the weight of float 40 will shift to rod 36 when the water level drops after flushing the toilet bowl.

It should be noted also that additional orifices 50 are provided in the upper portion of float 40 in order that water 57 or other weighting material may be added to or taken from chamber 59 within float member 40. The functioning of this weighting material will be described within the operation section of this application.

Operation

In the operation of this invention when the toilet bowl is flushed the water level 52 within the water cabinet will be lowered, thereby lowering the float 40 onto the upper end 54 of rod 36. The combined weight of the rod 36 and the float 40 applied to the upper surface 56 of valve 18 will force valve element 18 downwardly within cup shaped member 16 and out of sealing engagement with the bottom open end 32 of tubular member 30. When the seal between valve element 18 and the bottom end 32 of tubular member 30 is broken, water is allowed to flow from a source, indicated simply as a threaded pipe 58 connected to the bottom of water cabinet 26, through the flush control valve of this invention along the flow path indicated in FIGURE 1 by the black arrows.

As is indicated by the black arrows in FIGURE 1, water flows upwardly from pipe 58 through tubular extension 22, into the bottom space 21 of the valve housing 10. The water then divides, a first portion of it flowing upwardly in the annular space between cup shaped member 16 and valve housing 10 and a second portion flowing upwardly through orifice 19 in the bottom of member 16, against the bottom of valve element 18. The first portion of water flows over the upper edge of cup shaped member 16, downwardly into the upper interior of member 16, thence upwardly into tubular member 30, around its bottom end 32. At the same time, the second portion of flowing water flows upwardly around the valve element 18 and into the open bottom end 32 of tubular member 30.

It should be noted that cup shaped member 16 serves as a buffer device; that is, it reverses a portion (the first portion described above) of the flowing water downwardly against the upper surface of the valve element 18. Therefore, the forces of the flowing water are applied to the top surface of the valve element 18 as well as the bottom and side surfaces of that element. Although these forces are not exactly balanced the resultant upwardly directed force is stabilized and reduced sufficiently that there is no tendency of the valve element 18 to move upwardly into closed contact with tubular member 30 until the weight of float 40 is removed from the rod 36 and element 18. Therefore, the valve is not subjected to rapid opening and closing due to unbalanced forces acting on element 18 with associated undesired vibration chatter.

When the water level 52 reaches the predetermined desired high water level within the water cabinet, float member 40 will lift off the upper end 54 of rod 36. As the weight of float member 40 is taken from rod 36 and from valve element 18 the water pressure differential acting upwardly across valve element 18 will be sufficient to overcome the combined weight of the rod 36 and the water in the annular space 60, thereby the element 18 is caused to move upwardly into sealing contact with the bottom end 32 of tubular member 30.

Therefore it should be obvious that when the desired water level is reached within the water cabinet, immediate shut off of the valve is obtained with no fluttering or vibration of the valve element 18. The height of the high water level within the water cabinet is determined by the length of rod 36 and the distance above the surface 52 of the water at which the float 40 rides. The high water level can be varied by varying the length of rod 36, which is most easily done by simply replacing rod 36 with a similar rod of different length. Obviously, the rod length must remain sufficiently short that the combined weight of the rod and the water in annular space 60 does not exceed the water pressure differential existing across valve element 18 when the valve is closed.

Likewise, this high water level can be varied by changing the distance above surface 52 of the water at which the float 40 rides (i.e. by changing the buoyancy of the float), thereby changing the elevational point at which the float lifts off the upper end 54 of rod 36. This is done simply by adding to or taking from float 40 a predetermined amount of weight. In the embodiment of FIGURE 1, the buoyancy of float 40 can be varied by passing water or other weighting material through orifices 50, into or out of float chamber 59.

The anti-siphoning property of this flush control mechanism is found in the provision of the orifice 48 in the closure plate 46 of tubular passage 42 in float 40. In the event that the water pressure from water source 58 acting upwardly against the bottom surface of valve element 18 should drop to a pressure less than the pressure from the combined weight of rod 36 and the water in annular space 60, which would result in a depression of valve element 18, water would tend to back flow through the flush control valve from the water stored in the water cabinet. However, the interior of passage 42 is at atmospheric pressure because of orifice 48 in plate 46 therefore the necessary vacuum in the water flow passage from water storage cabinet through the flush control valve would be broken at this point, thereby preventing a siphoning from the water cabinet to the water source.

It must be understood that although valve element 18 has been described as a solid cylindrically shaped element, any convenient shape may be used provided it is suitable to form a seal against the bottom open end 32 of tubular member 30 and also is adapted to support the bottom end of rod 36. Such other shapes would include a substantially square shaped element, a disc shaped element, or a spherical shaped element having a detent in one portion thereof for receiving therein the bottom end of rod 36.

Furthermore, it should be evident to one skilled in the art that the shut off of this improved flush control valve will be immediate upon the lifting of the float 40 from the upper end 54 of the rod 36. This immediate shut off is further facilitated by the fact that the valve element 18 moves in the direction of water flow when it moves to its shut off position. It is this immediate shut off characteristic of the valve element that at least in part prevents valve flutter or vibration thereby preventing the undesired chattering noise common to most previously known flush control valves.

It should also be clear that water flow through this flush control valve is relatively rapid during the entire water cabinet fill-up operation until the water level reaches the predetermined desired water level in the water cabinet. Also the improved flush control valve of this invention is easily adapted for use in a conventional water cabinet by simply screwing the tubular extension 22 of the valve 10 into the threaded opening conventionally provided in the bottom portion of the water cabinet 26.

The invention has been described by reference to specific and preferred embodiments. It will be apparent, however, that many modifications can be made without departing from the spirit and scope of the invention. Accordingly, this invention should be construed not to be limited to the embodiment herein described, but should be limited only by the scope of the appended claims.

What is claimed:

1. A float operated flush control valve for controlling the flow of water into a water cabinet to raise the water level within said cabinet to a predetermined high water level including;

a substantially cylindrical shaped outer housing closed at its upper end by an orificed upper closure plate and closed at its bottom end by an orificed bottom closure plate;

a tubular extension depending from said bottom plate, coaxial with said orifice in said bottom plate, for connection into the bottom of said water cabinet, in flow communication with a source of water under pressure;

an upwardly opening substantially cup shaped member closed at its bottom end by an orificed plate positioned within said housing, said cup shaped member freely longitudinally movable by water flow through said housing;

a valve element movably located within said cup shaped member and freely longitudinally movable relative thereto;

an open ended tubular member extending vertically from within the upper portion of said cup shaped member, coaxial with said housing;

an elongated small diameter vertical rod, longer than said tubular member and reciprocally located inside said tubular member, said rod being supported at its bottom end by said valve element;

a variable weight float member having a central diametric passage therethrough, closed at its upper end by an orificed closure plate and receiving therein the upper end portion of said tubular member and said rod;

means for supporting said valve element out of contact with said orificed plate bottom of said cup shaped member; and

means for supporting said cup shaped member out of contact with said orificed bottom closure plate of said housing.

2. A float operated flush control valve according to claim 1, wherein said means for supporting said valve element out of contact with said orificed plate bottom of said cup shaped member consists of at least one lug member extending upwardly from said orificed plate bottom, and wherein said means for supporting said cup shaped member out of contact with said orificed bottom closure plate of said housing consists of at least one lug member extending upwardly from said orificed bottom closure plate.

3. An improved float operated flush control valve for controlling the flow of water into a water cabinet to raise the water level within said cabinet to a predetermined high water level including;

a vertical substantially cylindrical shaped outer housing closed at its upper end by a top closure plate and closed at its lower end by a bottom closure plate;

an upwardly opening cup shaped member having circular sides and an orificed bottom, movably located within said outer housing, the outside diameter of said member being substantially less than the inside diameter of said outer housing thereby to form an annular water flow passage between said respective outer housing and cup shaped member;

at least one lug member extending upwardly from said bottom closure plate of said outer housing for supporting thereon, out of contact with said bottom closure plate, said cup shaped member;

a tubular extension depending from said bottom of said housing, coaxially therewith, for connection to the water cabinet and for conducting water from a water source into the bottom of said housing;

an open ended tubular member extending vertically from within the upper portion of said housing to a point above said high water level for conducting water from within said housing into said cabinet;

a variable weight float member having a tubular diametric passage therethrough, closed at one end by an orificed plate, for slidably receiving therein the upper portion of said tubular member;

a vertical, substantially solid cylindrical shaped valve element movably located within said cup shaped member, the outside diameter of said valve element being substantially less than the inside diameter of said cup shaped member thereby to form an annular water flow passage between said respective valve element and cup shaped member, said element being normally displaced upwardly into sealing contact with the bottom open end of said tubular means by action of the water pressure differential existing across said element;

at least one lug member extending vertically from said orificed bottom of said cup shaped member for supporting thereon, out of contact with said orificed bottom, said valve element;

an elongated rod member, longer than said tubular member and reciprocally located within said tubular member for receiving on its upper end the weight of said float member when the water level within said cabinet drops below the predetermined high water level thereby being actuated downwardly to unseat said valve element from sealing engagement with the bottom end of said tubular member to thereby open said flush control valve.

4. An improved float operated flush control valve for controlling the flow of water into a water cabinet to raise the water level within said cabinet to a predetermined high water level comprising

a vertical substantially cylindrical shaped outer housing closed at its upper end by a top closure plate and closed at its lower end by a bottom closure plate;

an upwardly opening cup shaped member having circular sides and an orificed bottom, movably located within said outer housing, the outside diameter of said cup shaped member being substantially less than the inside diameter of said outer housing thereby to form an annular first water flow passage between said outer housing and said cup shaped member;

a tubular extension depending from and through said bottom closure plate of said housing, coaxially therewith, for connection to the water cabinet and in communication with a source of water for conducting water from said source into the bottom of said housing;

an open ended tubular member extending vertically from within the upper portion of said housing, through said top closure plate, to a point above said high water level for conducting water from within said housing into said cabinet, the external diameter of the lower end portion of said tubular member being smaller than the internal diameter of said cup shaped member with the lower end portion of said tubular member extending slightly into the upper end portion of said cup shaped member when said cup shaped member is resting upon said bottom closure plate of said housing;

a variable weight float member having a diametric passage therethrough, closed at its upper end by an orificed plate, for slideably receiving therein the upper end portion of said tubular member, the external diameter of the upper end portion of said tubular member being smaller than the internal diameter of said passage through said float member;

a vertical, substantially solid cylindrical shaped valve element moveably located within said cup shaped member, the outside diameter of said valve element being substantially less than the inside diameter of said cup shaped member thereby to form an annular second water flow passage between said valve element and said cup shaped member, said element being normally displaced upwardly into seating contact with the bottom end of said tubular member by action of the water pressure differential existing across said element;

an elongated rod member longer than said tubular member and smaller in external diameter than the interior diameter of said tubular member, said rod member reciprocally located within said tubular member for receiving on its upper end the weight of said float member when the water level within said cabinet drops below the predetermined high water level thereby being actuated downwardly to unseat said valve element from sealing engagement with the bottom end of said tubular member to thereby open said flush control valve.

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