

July 16, 1957

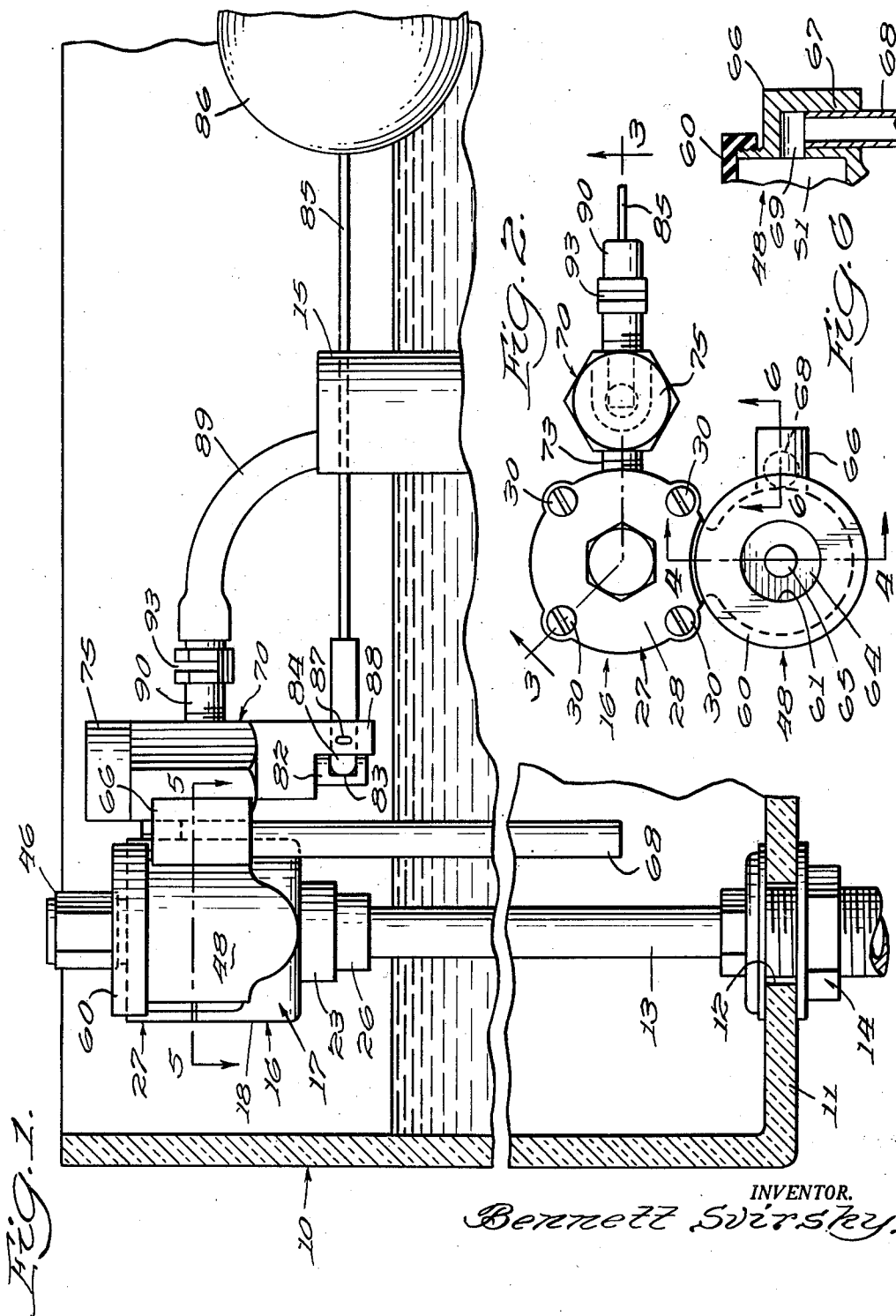
B. SVIRSKY

2,799,290

FLUSH TANK VALVE

Filed Sept. 14, 1955

2 Sheets-Sheet 1



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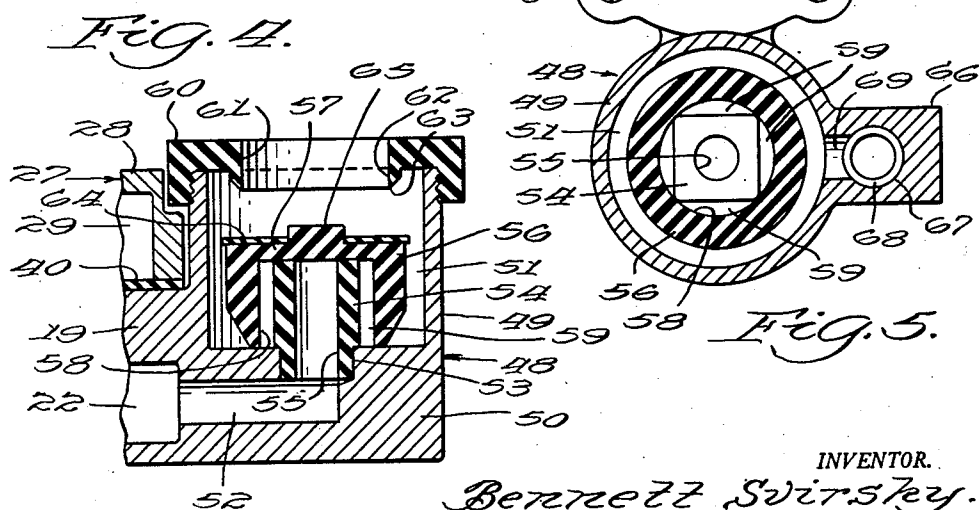
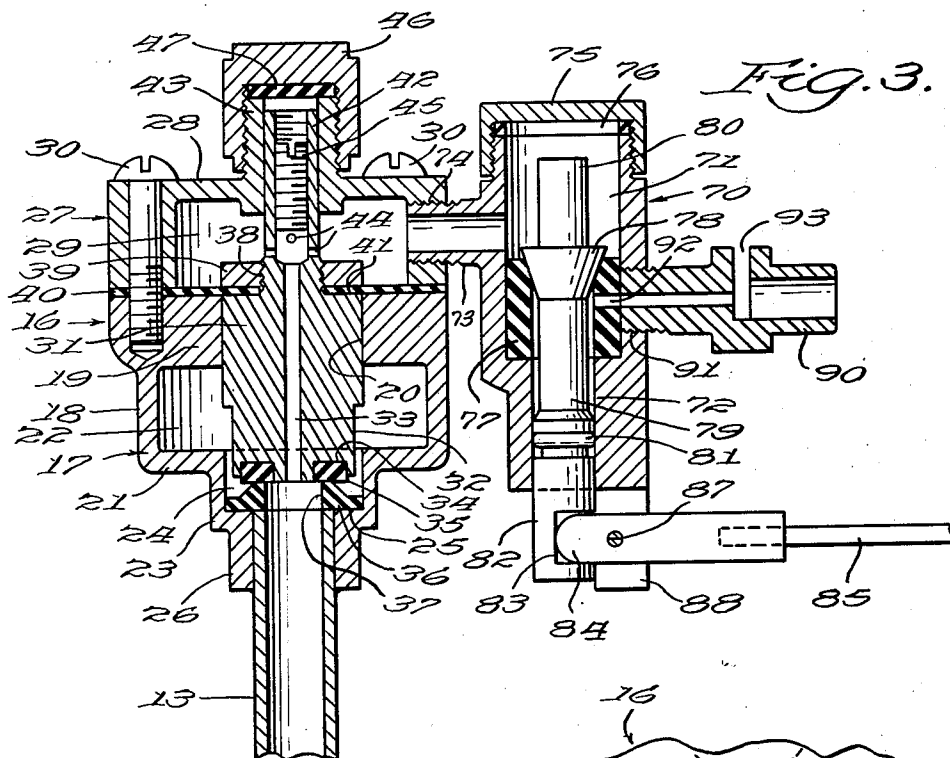
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FLUSH TANK VALVE

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6 Claims. (Cl. 137-414)

This invention relates to valve mechanism for toilet flush tanks and the like.

A primary object of the invention is to provide an improved water inlet valve for toilet flush tanks and the like, including as part of a unitary assembly novel and simplified water outlet and anti-siphoning means, and also simplified float operated pilot valve and water closet trap filling means.

A further object of the invention is to provide valve mechanism of the above-mentioned type which is silent and positive in operation, leak-proof and quick acting to admit water into the flush tank for refilling same, in response to opening or unseating of the float operated pilot valve.

Another object of the invention is to provide valve mechanism of the above-mentioned character forming a unitary assembly, bodily mounted upon the upright water inlet pipe of the flush tank, and so constructed that access may be readily had to the interior of the three major components of the device for servicing or maintaining the same.

A still further object is to provide valve mechanism of the above-mentioned character which is sturdy and durable in construction, compact, and relatively inexpensive to manufacture.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings, forming a part of this application, and in which like numerals are employed to designate like parts throughout the same.

Figure 1 is a side elevation of flush tank valve mechanism in accordance with the present invention, parts broken away and parts in section,

Figure 2 is a plan view of the valve mechanism alone,

Figure 3 is an enlarged vertical section taken on line 3-3 of Figure 2,

Figure 4 is a similar section taken on line 4-4 of Figure 2,

Figure 5 is an enlarged fragmentary horizontal section taken on line 5-5 of Figure 1, and

Figure 6 is a fragmentary vertical section taken on line 6-6 of Figure 2.

In the drawings, where for the purpose of illustration is shown a preferred embodiment of the invention, the numeral 10 designates a toilet flush tank, or the like, including a bottom wall 11 having an opening 12 through which an upstanding water inlet pipe 13 extends in the usual manner. The pipe 13 is rigidly secured to the bottom wall 11 of the tank by conventional screw threaded clamping means 14, as shown in Figure 1. The pipe 13 extends above the bottom wall 11 for a substantial distance, and terminates somewhat below the top of the tank and preferably slightly above the normal filled water level of the tank. The tank 10 is also equipped with the usual upstanding overflow pipe 15, and with conventional water discharge or flushing valve

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mechanism, not shown, and forming no part of the present invention.

The valve mechanism of the present invention is designated generally by the numeral 16, and includes an inlet valve casing 17 which may be generally cylindrical and upright, as shown. The valve casing 17 embodies a lower section having a side wall 18 and a relatively thick top wall 19 provided with a central vertical cylindrical bore 20. The lower section of the valve casing 17 also has a bottom wall 21 defining with the top wall 19 and side wall 18, a lower chamber 22. A depending sleeve extension 23 is integrally secured to the bottom wall 21 and has formed therein an upwardly opening cylindrical recess 24, having a bottom annular ledge or shoulder 25. A somewhat reduced depending tubular extension 26 is formed integral with the sleeve extension 23 and engages over the top end of the water inlet pipe 13 and is rigidly secured thereto by any suitable means, such as by welding, soldering or the like. The arrangement is such that the top end of the pipe 13 is preferably flush with the shoulder 25, Figure 3. It is thus seen that the entire valve mechanism 16 is bodily supported by the inlet pipe 13 within the tank 10.

The valve casing 17 further comprises an upper section or cap 27 having a side wall and a top wall 28. An upper chamber 29 is formed within the cap 27 and opens through the bottom of the cap opposite the wall 19 of the lower casing section. The cap 27 is detachably rigidly secured to the lower casing section by screws 30, or the like. The diameter of the upper chamber 29 is substantially larger than that of the bore 20 and recess 24, as shown.

A plunger or piston 31 extends slidably through the bore 20 and through the lower chamber 22, Figure 3. A lower reduced portion 32 of the plunger 31 is adapted to enter the recess 24, as shown, and the plunger 31 has a small central axial bore or passage 33 extending there-through from end to end, with its lower end adapted to communicate directly with the top of the inlet pipe 13. The lower end of the plunger 31 has an annular recess 34 formed therein for receiving an annular washer 35 of rubber, or the like. A valve seat 36 of rubber or the like is mounted within the recess 24 and rests upon the shoulder 25 and the top of the pipe 13, and is preferably securely held by friction within the recess 24. The valve seat 25 is annular, and has a bore 37 which registers with the bore of the pipe 13. The valve seat 36 is preferably frusto-conical in shape, with its tapering end directed upwardly for sealing engagement with the bottom of the washer 35, within the recess 24.

Adjacent the upper face of the wall 19, the piston or plunger 31 has a reduced upstanding screw threaded extension 38, integral therewith for receiving a nut 39. A flexible diaphragm 40 of rubber or the like surrounds the extension 38 and is clamped against a top shoulder 41 of the plunger 31 by the nut 39. The diaphragm 40 entirely covers the bottom of the upper chamber 29 and effects the sealing or separation of the chambers 22 and 29. The marginal portion of the diaphragm 40 is tightly clamped by the screws 30 between the bottom of the cap 27 and the wall 19.

Above the screw-threaded extension 38, the plunger 31 carries a reduced tubular extension or guide 42, integral therewith slidably received within an upstanding tubular extension or nipple 43, formed integral with the top wall 28, Figure 3. The tubular extension 42 is provided near its lower end and within the chamber 29 with a pair of transversely arranged small ports or weep openings 44 extending therethrough at different elevations. The tubular extension 42 is internally screw-threaded for the reception of an adjusting screw 45 which may be

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utilized to close off the upper port 44, when desired, where the incoming water pressure is excessively high. The tubular extension 43 is externally screw-threaded for the reception of a top closure cap 46, having screw-threaded engagement therewith and a compressible gasket or washer 47 is interposed between the top of the extension 43 and the cap 46 for effecting a fluid-tight seal therebetween, and also for limiting resiliently the upward travel of the guide extension 42.

Integrally formed upon the inlet valve casing 17 at one side of the same is an outlet and anti-siphoning casing 48 having an upstanding cylindrical side wall 49 and a thick bottom wall 50. The casing 48 defines a water chamber 51, open at its top as shown in Figure 4. The lower chamber 22 of the inlet valve casing communicates with the chamber 51 by means of a horizontal branch passage 52 and a recess 53 formed in the top face of the bottom walls 50. An upstanding sleeve or tube 54 of hard rubber or the like has its lower reduced end firmly anchored within the recess 53 and has its bore 55 directly communicating with the passage 52 and with the interior of the chamber 51, centrally thereof. A water pressure actuated cap member 56 which is cylindrical surrounds the sleeve 54 and has a top wall 57 adapted to rest upon the top end of the sleeve 54, Figure 4. The sleeve 54 is preferably square in cross section, Figure 5, and the cylindrical bore or recess 58 which opens through the bottom of the cap member 56 slidably receives the four corners of the sleeve 54 as shown in Figure 5. The lower end of the cap member 56 is adapted to substantially contact the bottom wall 50 when the cap member is resting upon the top of the sleeve 54. As best shown in Figure 5, a plurality of vertical passages 59 are formed between the flat sides of the square sleeve 54 and the bore 58 of the cap member 56 so that water passing from the bore 55 may enter the chamber 51 when the cap member is elevated by water pressure, or the like. The cap member 56 may be formed of hard rubber, light weight plastics material, or the like.

The upper end of the casing 48 is screw-threaded for the reception of the cap 60 formed of hard rubber, plastics material, or the like and having screw-threaded engagement therewith. This cap 60 partially covers the top of the chamber 51, but has a large opening 61 formed there-through leading into the chamber 51. A short depending sleeve extension 62 on the cap 60 has a tapered or knife-like edge 63 at its lower end to form a seat for a flat compressible washer 64 carried by the top wall of the cap member 56, and preferably formed of rubber or the like. The washer 64 surrounds an upstanding lug 65 of the cap member 56, and is maintained centered thereby for proper engagement with the depending seat 63. A boss or projection 66 is formed integral with one side of the casing 48, as shown, and this boss has a vertical bore 67 opening through its bottom end, and receiving the upper end portion of a depending vertical water outlet tube 68, having its lower end terminating near and above the bottom wall 11 of the tank 10. The outlet tube 68 is rigidly secured within the bore 67 by any suitable means. A passage 69 leads from the bore 67 of boss 66 into the water chamber 51 of the casing 48, near the top of the latter. This passage 69 also leads into the opened top end of the tube 68, within the boss 66. When the cap member 56 is elevated by water pressure, the water may flow from the sleeve 54 through the passages 59, to the chamber 51, and from this chamber through the passage 69 to the outlet tube 68.

A pilot valve casing 70 is arranged adjacent one side of the casing 17 in an upright position, and this pilot valve casing has a cylindrical vertical chamber 71, as shown and a reduced vertical bore 72 leading from the bottom of the chamber 71 through the lower end of the casing 70. A tubular extension or nipple 73 extends transversely of the casing 70 and is preferably integral therewith. The nipple 73 is screw-threaded for engagement within a screw-threaded opening 74 in the side wall of the cap 27. The

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chambers 29 and 71 are thus in communication through the nipple 73 and the nipple serves to rigidly mount the pilot valve casing 70 upon the inlet valve casing 17. The top end of the casing 70 carries a screw-threaded cap 75 having a compressible gasket 76 contained therein for sealing engagement with the top of the casing 70.

A tubular valve seat or sleeve 77 of rubber or the like is mounted within the bottom of the chamber 71 and has its bore registering with the bore 72, Figure 3. A conically tapered pilot valve element 78 is adapted to engage the upper end of the compressible seat 77 for sealing the same, and this valve element 78 is carried by a vertically reciprocatory stem 79 having a top extension 80 which projects above the valve element 78 for contact with the cap 75 to limit the upward travel of the valve element 78. The valve stem 79 carries an O-ring seal 81, below the seat 77, which seals the bore 72. The valve stem 79 includes a bottom extension 82 projecting below the casing 70 and recessed in one side at 83 to receive a cam extension 84 of a generally horizontal vertically swingable float arm or lever 85, carrying the usual float ball 86. The cam extension 84 is pivoted at 87 between a pair of depending lugs 88 formed integral with the lower end of the casing 70 on opposite sides of the recess 83. It may thus be seen that when the cam extension 84 of the float lever turns upon its pivot 87, the pilot valve element 78 is raised and lowered.

A water closet trap refill tube 89 is provided, and extends into the top of the overflow pipe 15, in the usual manner. One end of the refill tube 89 engages over and is secured to a nipple 90 having its screw-threaded end 91 secured within a screw-threaded opening in the side wall of the casing 70, adjacent the tubular seat 77. A side opening 92 of the tubular seat 77 registers with the bore of the nipple 90 and places this nipple in communication with the bore of the seat 77 and the bore 72. The nipple 90 has an air vent or notch 93 cut in one side thereof to prevent siphoning of water from the overflow pipe 15 back into the casing 70 which is a part of the fresh water system.

The operation of the valve mechanism is as follows:

When the tank 10 is filled with water to the usual level and the float ball 86 is elevated to the position shown in the drawings, the pilot valve 78 is closed and water cannot escape from the upper chamber 29. Incoming water under pressure, from the pipe 13 passes through the small passage 33 and port or ports 44 to the upper chamber 29, filling the same. Since the diameter of the chamber 29 and diaphragm 40 is much greater than the diameter or area of the washer 35 subjected to the pressure of the water in the pipe 13, the water pressure in the chamber 29 will readily maintain the plunger 31 closed or seated upon the rubber seat 37. Incoming water will therefore be unable to enter the lower chamber 22 when the tank 10 is full.

When the tank is emptied for flushing the water closet by means not shown, the float ball 86 will descend, and the cam extension 84 will be elevated for raising the pilot valve 78 from its seat 77. This will instantly allow water to pass from the chamber 29 through the nipple 73 to the chamber 71, and through the bore of the seat 77 to the opening 92, and through the nipple 90 to the trap filler tube 89. The trap in the water closet will by this means be maintained filled or sealed, and no contaminated water may be siphoned through the tube 89 to the chamber 71, because of the vent 93.

Simultaneously with the opening of the pilot valve 78, and the relief of water pressure in the chamber 29, the diaphragm 40 will flex, and the plunger 31 will be elevated by water pressure so that water from the pipes 13 may enter the chamber 22 and then flow through the passage 52 and sleeve bore 55 to elevate the cap member 56. When this occurs, the washer 64 of the cap member 56 will instantly seal against the seat 63, and the chamber 51 will be filled, and the water under pressure will flow from the tube or sleeve 54 through the passages 59 to

the chamber 51, and from this chamber through the passage 69 to the outlet tube 68, and through this tube into the tank 10 to refill the same.

As the tank 10 is refilled, the float ball 86 is again elevated for closing the pilot valve 78, and creating water pressure within the chamber 29, which acts upon the diaphragm 40 to lower or close the plunger 31, thus completing the cycle of operation.

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred example of the same and that various changes in the shape, size and arrangement of parts may be resorted to, without departing from the spirit of the invention or scope of the subjoined claims.

Having thus described my invention, I claim:

1. Valve mechanism for a toilet flush tank comprising a casing to be mounted upon the inlet pipe of the flush tank and having first and second chambers and a passage connecting said chambers, a plunger slidable within said passage and having a port extending there- 20 through with one end of the port communicating with said inlet pipe, a tubular guide extension carried by the end of the plunger remote from the inlet pipe and having port means communicating with the first-named port of the plunger, adjustable means carried by the guide extension to regulate the opening of said port means, said guide extension slidably engaging said casing, said port means communicating with said second chamber, a flexible diaphragm connected with the plunger and covering the second chamber and being of substantial diameter, a 30 valve seat arranged within said casing adjacent the inlet pipe, a valve element secured to the plunger and engageable with the valve seat to prevent the passage of water from the inlet pipe to the first chamber when the plunger and flexible diaphragm are acted upon by water pressure in the second chamber, float operated relief valve means connected with said casing and communicating with the second chamber, and fluid pressure operated water outlet means connected with said casing and operable to permit the passage of water from the first chamber into the tank when said relief valve means is opened.

2. A water inlet valve for toilet flush tanks and the like comprising a casing to be mounted upon the water inlet pipe of the tank and having first and second chambers and a passage connecting said chambers, there being outlet opening means leading from said first chamber of the casing, a reciprocatory plunger mounted within said passage connecting the first and second chambers, valve element and seat means for the plunger adapted to control the passage of water from the inlet pipe to said first chamber, a tubular extension secured to the end of the plunger remote from the inlet pipe and extending through the second chamber and slidably en- 50

gaging a part of said casing, said plunger having a reduced port extending axially therethrough from the inlet pipe to said tubular extension, said tubular extension having transverse port means communicating with the second chamber, an adjustable element contained within the tubular extension for regulating the opening of the transverse port means, an element carried by said casing and engaging the end of the tubular extension for limiting the movement of the plunger in one direction, a flexible diaphragm connected with the plunger within the second chamber and acted upon by water pressure in the second chamber to maintain said valve element and seat means in sealed engagement, the valve element and seat means having an area exposed to water pressure substantially smaller than the exposed area of said diaphragm, and float operated relief valve means connected with said casing and communicating with said second chamber.

3. In valve mechanism for toilet flush tanks, having an inlet pipe, an inlet casing divided to provide upper and lower chambers, a plunger vertically slidable in an opening in the casing, the bottom chamber communicating with the inlet pipe of said tank, the plunger having a passage providing communicating connection between the inlet and the upper chamber, a flexible diaphragm connected with said plunger and a fixed part of said chamber, an extension rising from said plunger, said casing top being provided with a recess in which said plunger extension reciprocates, and means adjustably mounted on said casing for limiting the reciprocating movement of said extension and plunger.

4. In valve mechanism according to claim 3 wherein said plunger is provided with a plurality of vertically spaced ports affording communication between the passage in the plunger and the upper chamber, and means 35 on the extension for selectively closing said ports.

5. In a valve mechanism according to claim 3 wherein a float operated valve is disposed to communicate with said upper chamber of the casing, said float operated valve having an outlet tube provided with an air vent to prevent siphoning of water back into the inlet casing.

6. In valve mechanism according to claim 5, an anti-siphon casing mounted at one side of and having communication through a lateral passage with the lower chamber of said inlet casing, said anti-siphon casing having an opening in the top and an outlet at the side, a vertical outlet tube in said anti-siphon casing and a fluid pressure actuated cap slidable on said outlet tube.

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