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J. M. TEAHEN

2,213,753

VALVE

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FIG. 1.

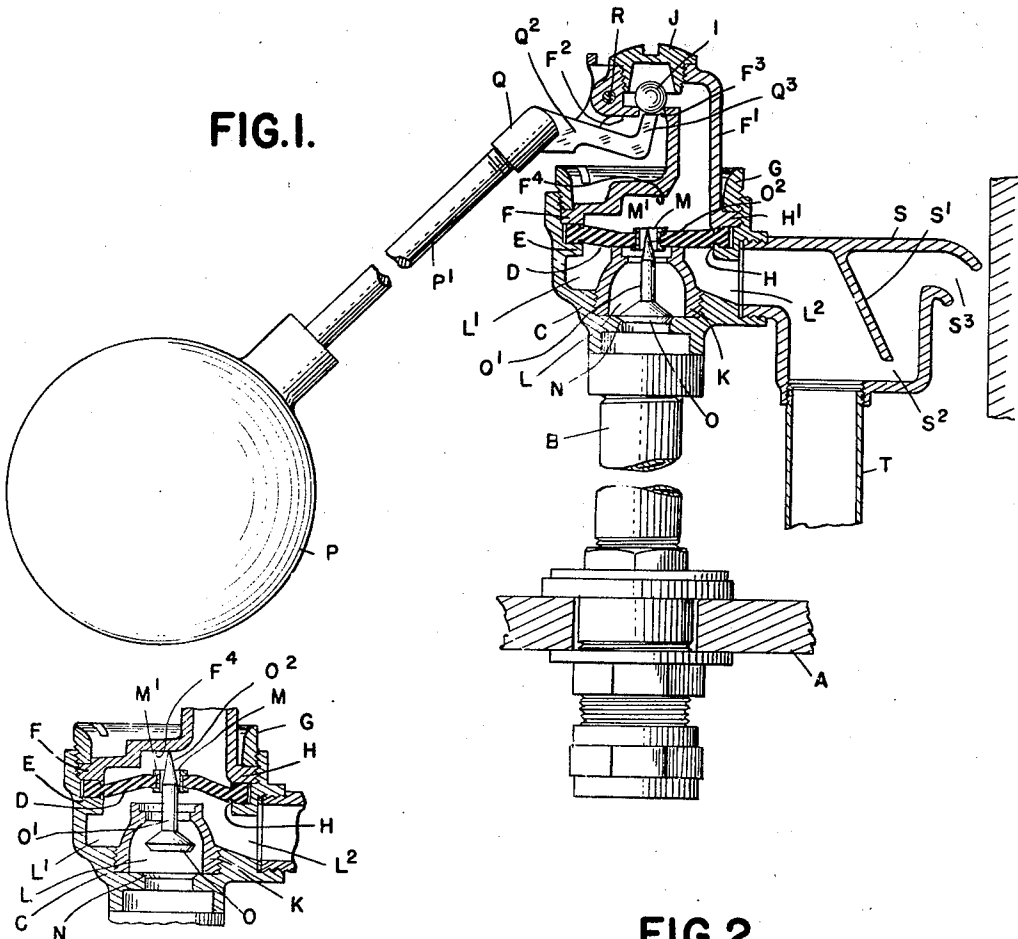


FIG. 3.

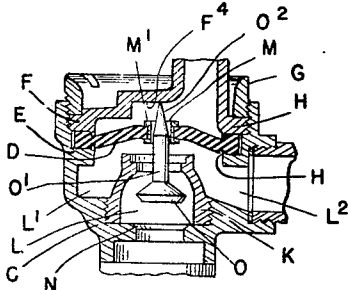
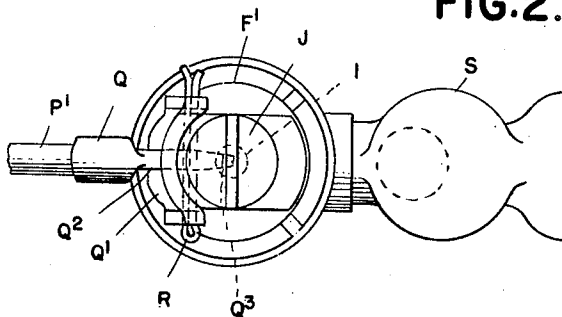


FIG. 2.



INVENTOR

JAMES M. TEAHEN

BY
Whittemore, Hulbert & Belknap
ATTORNEYS

UNITED STATES PATENT OFFICE

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VALVE

James M. Teahen, Detroit, Mich.

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7 Claims. (Cl. 137—139)

The invention relates to valves and has more particular reference to a construction designed for controlling the water inlet to flushing apparatus. My improved valve is of the type in which a flexible diaphragm engageable with a valve seat surrounding the fluid inlet is normally held to said seat by fluid pressure in a chamber on the opposite side of the disk operating on a larger area thereof. This pressure is normally maintained the same as that within the seat by a restricted passage therebetween. However, upon the venting of the chamber for the opposed fluid pressure the diaphragm will be flexed away from its seat permitting flow of liquid thereover. One serious defect of most constructions of valves of this type is in the means for forming the restricted passage between the chambers having the opposed pressures. If this passage is too large then it is difficult to secure the proper differential pressure permitting the opening of the valve. Also, in closing it is likely to produce a water hammer, which is highly objectionable. On the other hand, if the passage is too restricted, it is difficult to maintain it in operative condition, particularly after the valve has remained closed for a considerable period of time. Thus, a slight deposit of sediment or corrosion of some part might easily completely close the passage and render the device inoperative.

It is the object of the present invention to obtain a construction of valve of the above mentioned type which avoids the defects of constructions heretofore made. It is a further object to obtain a construction which has various additional advantages. With these objects in view, the invention consists in the construction as hereinafter set forth.

In the drawing:

Figure 1 is a vertical section partly in elevation, through my improved valve as applied to the water inlet of a flushing tank;

Figure 2 is a plan view thereof;

Figure 3 is a view similar to Figure 1 showing the valve in open position.

With flushing tanks used in connection with water closets, it is usual to provide the water inlet connection with what is commonly termed a "ball cock." This consists of a float-operated valve which is closed by the rise of water in the tank to a predetermined level and is opened by the falling of this level. To obtain the necessary force to completely close the valve a fairly large float is required and with a comparatively long operating arm or lever. This makes the closing of the valve very gradual, so that for a consider-

able portion of the closing operation the flow of water into the tank is greatly restricted. This increases the length of time required to completely fill the tank and also has the objection that it frequently produces a hissing noise. With my improved construction the valve will remain fully open during practically the entire tank filling operation, and will quickly close but without the production of any water hammer.

My improved valve is applicable to different types of flushing apparatus and may be operated by different means. However, as specifically illustrated, it is applied to an apparatus including a flushing tank A and a water inlet conduit B passing through the bottom of said tank and rising therein to substantially the level at which the water is to stand. C is a fitting mounted on the upper end of the conduit B and enlarged in diameter to receive a flexible diaphragm D. The marginal portion of this diaphragm engages an annular ledge E within the fitting C and is secured thereto by a superposed member F. This member is clamped against the diaphragm by a threaded collar G engaging a correspondingly threaded portion at the upper end of the fitting C. The ledge E and member F are also preferably formed with annular ridges H and H' which are pressed into the diaphragm to insure firm attachment thereof and an effective water seal.

The member F is hollow to form above the diaphragm a water chamber to which is exposed the full area of the upper side of the diaphragm within the clamped margin thereof. At one side of the center the chamber is extended upward in the portion F' and then laterally to form an overhanging portion F². The latter is provided on its underside with a port F³ which is normally closed by a ball valve I seated by gravity. The upper wall of this overhanging portion is also apertured for the entrance of the ball I there-through and is then closed by a threaded cap J. Beneath the diaphragm D there is arranged within the fitting C a member K threaded at its lower end for engagement with the member C and at its upper end forming an annular seat for contact with the lower face of the diaphragm. This member K thus divides the space within the enlarged portion of the fitting C into a central chamber L which communicates with the conduit B and a surrounding annular chamber L' having a discharge opening L² at one side thereof. Thus, when the diaphragm D is held against the seat the chambers L and L' will be out of communication, but upon the upward flexing of the diaphragm the liquid from the inner chamber L will be per-

mitted to flow over the member K into the chamber L' and then out from the discharge port L².

To hold the diaphragm D to its seat on the member K the pressure on the upper face of the diaphragm must exceed that on its lower face within the chamber L. Inasmuch as the area of the upper face of the diaphragm exposed to the liquid in the hollow member F is considerably greater than the area on the lower side of the diaphragm within the chamber L, it is evident that if the liquid pressure in both chambers is equal, the diaphragm will be firmly held to its seat. Such equalization of pressures is effected through a port M, preferably in the center of the diaphragm D and preferably formed by a bushing M' of hard rubber or other suitable comparatively rigid non-corrodible material. This bushing is externally grooved to receive the flexible diaphragm which may be sprung into engagement therewith. The port M is sufficiently large in cross section to avoid any danger of clogging by sediment or from any other cause. However, this would permit such free flow of liquid therethrough as to render it difficult to unbalance the pressures, even where the ball valve I is removed from its seat to open the port F³. I have, therefore, provided means for restricting the port M whenever the port F³ is opened, this being preferably of the following construction.

N is an annular ledge within the fitting C below the member K which on its upper face is provided with a conical seat for a valve O. This valve has an upwardly extending stem O' terminating in a tapering portion O² which latter is within the port M when the valve O is seated. As the lower face of this valve is exposed to the water pressure within the conduit B, it is evident that whenever the pressure above said valve is lowered, by reason of the opening of the port F³, the valve will be lifted from its seat, which will move the larger portion of the stem O' into the port M. This stem is only slightly less in diameter than the diameter of the port so that the passage will be very greatly restricted. Complete closure of the passage is prevented by the contact of the upper end of the stem O' with a shoulder F⁴ on the member F.

With the construction as thus far described, it will be understood that the pressure of the water within the conduit B will be communicated through the chamber L and port M to the chamber within the member F so that when the valve I is seated, the pressure per unit area will be the same above as below the diaphragm D. However, as the area on the upper side of this diaphragm exposed to such pressure, is considerably greater than that on the underface, the diaphragm will be pressed firmly to its seat on the member K which will cut off communication between the chambers L and L'. If, however, the valve I is by any means unseated, this will have the effect, first of lowering the fluid pressure in the chamber within the member F and also that within the chamber L through the communicating port M. Second, the excess pressure within the conduit B will lift the valve O from its seat and raise the stem O' to the point where it restricts the area of the port M. Third, the pressure within the chamber L raised to substantially that within the conduit B will flex the diaphragm D, removing it a sufficient distance from the member K to provide for free flow of liquid therebetween. Thus, the liquid will pass from the chamber L to the chamber L' and then out through the discharge port L².

The unseating of the valve I may be accomplished by various means. In a co-pending application for patent I have described one means which consists in the unseating of the valve by the upward movement of the flush valve controlling the discharge of water from the tank. In the present application another specific means is shown, viz: a float-actuated member which when the tank is full, will be in a position permitting the seating of the valve I, but when the level of the tank is lowered, will be shifted to a position which will unseat said valve. The specific construction is as follows:

P is a float member preferably formed of hard rubber or equivalent material which is not subject to corrosion and which will retain its form for a long period of time. P' is a stem or lever arm connected to the float P and engaging at its upper end a member Q which is pivotally mounted upon the member F. As shown, this member Q has a bifurcated portion Q' which embraces the overhanging portion of the member F and is secured thereto by a pivot pin R passing through said portion. The member Q is further provided with a portion Q² which passes beneath the overhanging portion F² and has an upwardly extending finger Q³ for entering the port F³. When the water level in the tank is at normal height the float P will be sufficiently lifted to separate the finger Q³ from the ball I, but as soon as the water level drops the downward movement of the float P and arm P' will raise the finger Q³ to a point where it will unseat the valve I. Further downward movement is prevented by engagement of the member Q² with the collar G. It will be noted that the unseating of the ball valve I is accomplished by the weight of the float P which is constant and sufficient for the purpose, when acting through the lever arm P'. The buoyancy of the float is only utilized to hold it normally in a position where the ball valve is permitted to seat. This is the reverse of the usual operation of a ball cock, where the work of seating the valve against water pressure is performed by the rising of the float.

It is usual to provide ball cocks with hush tubes which direct the water downward to the bottom of the tank and prevent noise in refilling. Such condition, however, will form a syphon which under certain conditions where there is a vacuum formed in the supply line, might draw water back from the tank and into the line. To prevent such possibility, it is required that the discharge from ball cocks should be normally open to atmospheric pressure, thereby breaking any syphon. With my improved construction a further safeguard is provided, viz: the valve O which operates as a check valve to prevent any back flow of water into the conduit B. Should suction occur within the conduit B, this will only draw the valve O more firmly to its seat, so that under no condition can water pass backward from the tank into the supply line. In addition to this, my improved construction complies with the requirement for opening the discharge to atmospheric pressure. This is accomplished by a fitting S which has a threaded engagement with the fitting C surrounding the discharge port L². T is a hush tube connected to the fitting S and extending downward in the tank. S' is an inclined deflector wall within the fitting S which is opposed to the discharge from the port L² so as to direct the water downward toward the hush tube T. This deflector wall does not, however, extend

completely to the bottom of the fitting S, but leaves a passage S² thereunder, communicating with the chamber on the opposite side of the deflector S' and connected with an open discharge port S³. The arrangement of the parts within the tank is preferably such that the discharge from the port S³ is adjacent to the wall of the tank A, so that any portion of the water which does not descend through the hush tube T, but passes under the deflector S' and out through the port S³, will be directed against the wall of the tank to avoid noise.

What I claim as my invention is:

1. A valve comprising a casing having a fluid inlet passage and a surrounding fluid outlet passage, a valve seat between said passages, a flexible diaphragm extending across said casing adjacent to said valve seat, a chamber within said casing on the opposite side of said diaphragm, a port of substantial area through said diaphragm connecting said inlet passage with said chamber, means for venting said chamber to exhaust the pressure therein, a check valve in said inlet passage for preventing reverse flow of fluid there-through, and means actuated by said check valve when lifted from its seat by fluid flow for greatly restricting said port without completely closing the same.
2. A valve comprising a casing having a fluid inlet passage and a surrounding outlet passage, a valve seat between said passages, a flexible diaphragm extending across said casing adjacent to said seat, a hollow member above said diaphragm for marginally clamping the same to said casing and forming a fluid containing chamber, said chamber having a laterally extending portion with a port through the bottom thereof, a valve for normally closing said port, a port of substantial area extending through said diaphragm and connecting said inlet passage with said chamber, means for unseating said valve to exhaust fluid pressure in said chamber, a check valve in said inlet passage for preventing reverse flow of fluid therein, and a tapering stem on said check valve extending into the port in said diaphragm adapted on the lifting of said check valve by fluid flow to greatly restrict said port without completely closing the same.
3. A ball cock comprising a casing having therein a fluid inlet passage and a surrounding outlet passage, a valve seat between said passages, a flexible diaphragm extending across said casing adjacent to said seat and provided with a port therethrough connecting said fluid inlet passage, a hollow member above said diaphragm for marginally clamping the same to said casing forming a fluid containing chamber and provided with an inwardly laterally extending overhanging portion with a port through the bottom thereof, a gravity seated valve within said lateral extension for normally closing said port, a lever arm pivotally attached to said casing and having a finger registering with said port and valve, and means for actuating said lever arm whereby in one position thereof said finger will unseat said valve.
4. A ball cock comprising a casing having therein a fluid inlet passage and a surrounding outlet passage, a valve seat between said passages, a flexible diaphragm extending across said casing adjacent to said seat and provided with a port therethrough connecting said fluid inlet passage, a hollow member above said diaphragm for marginally clamping the same to said casing forming a fluid containing chamber and pro-

vided with an inwardly laterally extending overhanging portion with a port through the bottom thereof, a gravity seated valve within said lateral extension for normally closing said port, a lever arm pivotally attached to said casing and having a finger registering with said port and valve, means for actuating said lever arm whereby in one position thereof said finger will unseat said valve, and means for normally holding said lever in a position to withdraw said finger and permit said valve to seat.

5. A valve comprising a casing having a fluid inlet passage, a surrounding fluid outlet passage, and a valve seat between said passages, an apertured flexible diaphragm extending across said casing adjacent to said seat, a fluid pressure chamber within said casing on the opposite side of said diaphragm for normally holding the latter to said seat, means for venting said chamber to exhaust the fluid pressure therein and to permit the separation of said diaphragm from said seat, and means controlling the flow of fluid through said aperture comprising two relatively movable members, one constituting a bushing for said aperture providing a port of substantial area therethrough, the other member having a stem extending into said port with a portion but slightly less in diameter to form a predetermined restriction thereof when engaged therewith but normally out of engagement and another portion of smaller diameter normally in engagement with said port, one of said members being in the path of fluid flowing from said inlet past said seat to be actuated thereby into the port restricting position.

6. A valve comprising a casing having a fluid inlet passage, a surrounding fluid outlet passage, and a valve seat between said passages, a flexible diaphragm extending across said casing adjacent to said seat provided with a port of substantial area therethrough, a fluid pressure chamber within said casing on the opposite side of said diaphragm for normally holding the latter to said seat, means for venting said chamber to exhaust the fluid pressure therein and to permit the separation of said diaphragm from said seat, and means controlling the flow of fluid through said port comprising a freely movable member located in said inlet passage having a tapering portion normally engaging said port and also a portion normally out of engagement with said port and but slightly less in diameter to form a predetermined restriction when engaged with the port, said freely movable member being in the path of fluid flowing from said inlet past said seat to be actuated thereby into the port restricting position.

7. A valve comprising a casing having a fluid inlet passage, a surrounding fluid outlet passage and a valve seat between said passages, an apertured flexible diaphragm extending across said casing adjacent to said seat, a fluid pressure chamber within said casing on the opposite side of said diaphragm for normally holding the latter to said seat, means for venting the chamber to exhaust the fluid pressure therein and to permit the separation of said diaphragm from said seat, and means controlling the flow of fluid through said aperture comprising a bushing therefor providing a port of substantial area therethrough, a freely movable member beneath said diaphragm having a stem with a portion but slightly less in diameter than said port to form a predetermined restriction thereof when en-

gaged therewith, a tapering portion at the upper end of said stem and a head at the lower end thereof located in the path of fluid flowing from said inlet past said seat, means for supporting
5 said freely movable member when said diaphragm is engaged with said seat so that the tapering

portion only of said stem engages said port, and a stop for limiting further upward movement of said stem when in port restricting position to prevent complete closure of said port.

JAMES M. TEAHEN.