Dec. 9, 1952 S. O. JOHNS 2,620,826

FLUSHING VALVE

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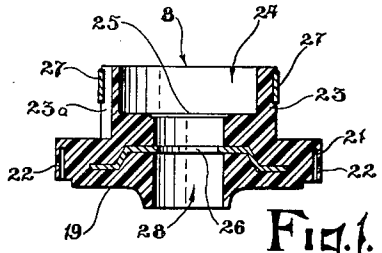


Fig. 1.

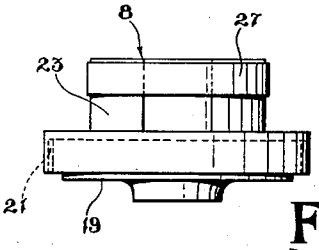


Fig. 2.

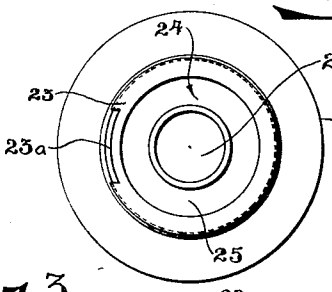


Fig. 3.

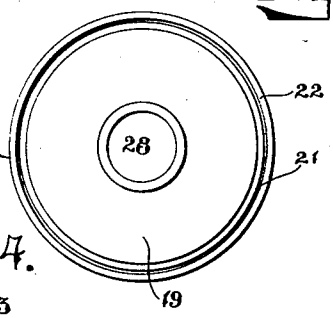


Fig. 4.

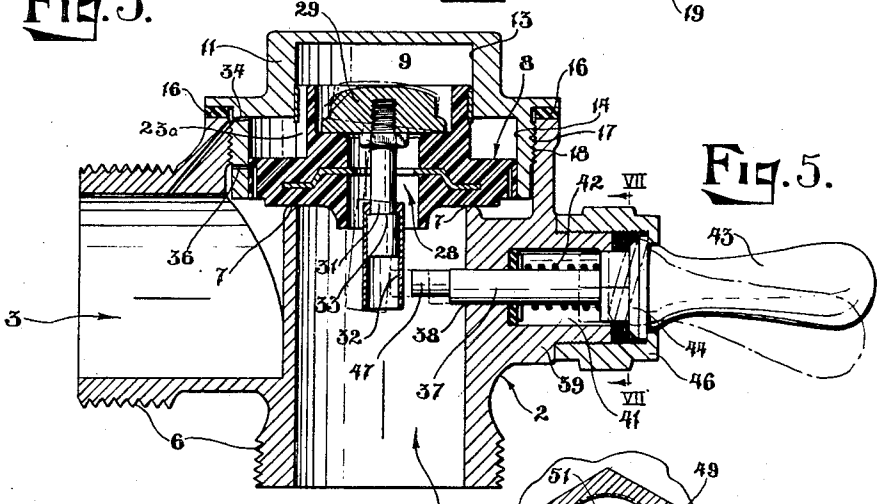


Fig. 5.

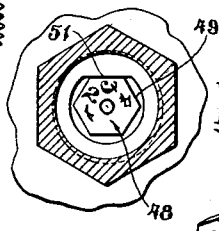


Fig. 7.

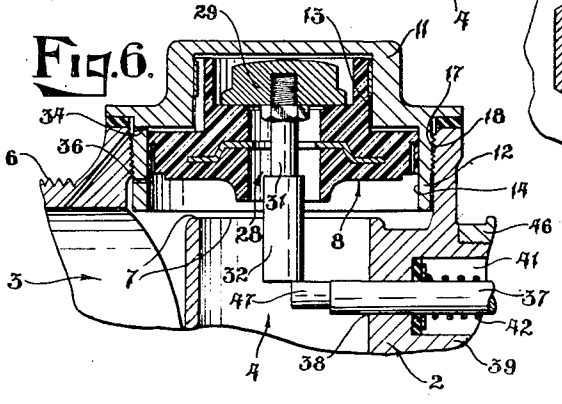


Fig. 6.

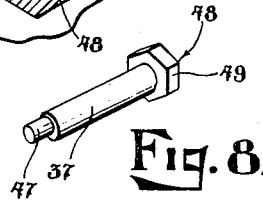


Fig. 8.

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FLUSHING VALVE

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This invention relates to flushing valves for lavatories and like purposes and more particularly concerns that type of valve which includes a main control valve carrying a tiltable pilot valve and which is slidable within a valve chamber under the influence of the water pressure in such a manner as to permit a predetermined quantity of water to be discharged whilst the valve is moving from its open to its closed positions.

Hitherto such types of valves have not proved to be entirely satisfactory due mainly to difficulty in ensuring the delivery of the required quantity of water after the adjustable by-pass and other valve parts have been disassembled for repair or cleaning purposes and subsequently replaced usually by an unskilled person.

Another disadvantage is that in such known constructions the main control valve usually consists of a plurality of metal parts, fitted with several independent sealing washers which require periodical renewal. The cost of this known type if valve is relatively high whilst the metal parts are frequently damaged when the washers are being replaced.

The primary object of the present invention is to provide an improved flushing valve of the kind indicated whereby the various parts thereof may be disassembled when required and easily reassembled if necessary, by relatively unskilled persons, without altering the volume of water delivered during each flush.

Another object is to provide an improved flushing valve of the kind indicated which is capable of being adjusted in a most simple and effective manner so as to ensure the discharge of the desired volume of water during each flush irrespective of the water pressure obtaining in any particular locality.

A further object is to provide an improved main control valve of unitary construction for use in flushing valves of the kind indicated which avoids the use of the usual plurality of separate sealing washers and is of such simple and inexpensive construction that it may be economically replaced when found necessary.

Other objects and various novel constructional features of the invention will be more readily apparent from the following description.

Referring to the drawings which form part of this specification:

Figure 1 is a sectional elevation of a unitary main control valve in accordance with the present invention.

Figure 2 is a side elevation looking at the left hand side of Figure 1.

Figure 3 is a plan view of Figure 1.

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Figure 4 is an inverted plan view of Figure 2.

Figure 5 is a sectional elevation of a flushing valve in accordance with the present invention, the main control valve being shown in its closed position.

Figure 6 is a fragmentary detail of some of the parts seen in Figure 5 showing the main control valve in its open position for flushing purposes.

Figure 7 is a cross section taken on the line VII—VII of Figure 5.

Figure 8 is a perspective view of the adjustable push rod seen in Figures 5 to 7.

As seen more clearly in Figure 5 of the drawings, the improved flushing valve includes a valve body 2 provided with inlet and outlet passages 3 and 4 respectively which may be arranged in substantially L-shaped formation as shown or they may be co-aligned as desired. The walls of both the inlet and outlet passages are preferably externally screw threaded as at 6 for detachable connection to piping.

Located between the inlet and outlet passages is an annular seating 7 for a main control valve 8 which is preferably arranged with its axis substantially upright so that the valve may slide up and down within a valve chamber 9 as hereinafter described.

So that the main control valve may be readily accessible the valve chamber is preferably formed within a removable closure cap 11 which is provided with a depending flange 12 and an internal stepped shoulder forming two concentric valve guideways 13 and 14 of different diameters adapted to prevent tilting of the valve during its sliding movements. The depending flange is fitted with a sealing washer 16 and is preferably screw threaded as at 17 to engage an upstanding screwed socket 18 on the valve body.

As seen in Figures 1 to 4 of the drawings, the main control valve 8, is of circular shape in plan and composed of synthetic polyvinyl-chloride or any other resilient material suitable for providing three sealing faces. One of these faces 19 is located on the bottom of the valve so as to engage the valve seating 7 while the second is located on the periphery of the valve body. In order that the latter sealing face may function in a manner similar to the well-known type of bucket or U-shaped seal, an open mouthed continuous channel 21 is formed in the peripheral edge portion of the valve body so as to extend upwardly from the bottom face thereof. An annular sealing skirt 22 is thus formed around the valve body which skirt is free at its lower end and connected at its upper end to the body portion of the valve.

The valve body is also provided with a stepped

shoulder forming an upstanding neck portion **23** provided with an open topped recess **24** therein. The latter is provided with a substantially flat bottom forming the third sealing face or seating **25**. The neck portion is adapted to be slidably accommodated within the upper guideway **13** in the valve chamber whilst the sealing skirt **22** is adapted to be slidably accommodated within the lower guideway **14**.

In view of the resilient nature of the main control valve, suitable reinforcement thereof is desirable. As seen more clearly in Figure 1, an annular reinforcing member **26** which may be of angular cross section and composed of metal or any other suitable rigid material is preferably embedded in the body portion of the valve, during its formation. In addition a reinforcing band **27** preferably encircles the neck portion of the valve. This reinforcing band may be composed of brass or any other suitable non-corrodable material and be adapted to form a sliding fit within the guideway **13** in the valve chamber.

A passage is provided in the neck portion **23** of the main control valve to establish communication between the two sections of the valve chamber. This passage may consist of an open topped recess **23***a* formed in the exterior of the neck portion so as to extend behind the reinforcing band **27** as seen in Figures 5 and 6.

The main control valve is provided with an open ended pressure release passage **28** extending axially therethrough and this passage has a tiltable pilot valve **29** associated therewith. The latter is accommodated within the aforesaid recess **24** so as to engage the seating **25** therein. The pilot valve is provided with a depending stem **31** which may either be of a fixed length or of telescopic formation. For example, the stem may be fitted with a sleeve **32** which is freely slidable lengthwise thereof, suitable stops or shoulders **33** being provided on both the stem and the sleeve so as to limit the downward movement of the latter.

The length of the fixed stem **31** or the sleeve **32** is predetermined in order to limit the lift of the main control valve and the resultant quantity of water to be discharged during each flush as hereinafter described.

As is well known, the main control valve **8** is normally held on its seating by the pressure in the inlet passage of the valve body and which is communicated to the valve chamber **9** by a by-pass passage. Hitherto, this by-pass passage has been formed through the main control valve or valve body and has been fitted with an adjustable valve to take care of variations in the pressure and ensure the discharge of a substantially constant volume of water at each flush.

According to another feature of the present invention, non-adjustable means are provided for regulating the closing movement of the main control valve in such a manner that the initial part of such movement is effected more slowly than the concluding part whereby most of the predetermined volume of flushing water is discharged at substantially full bore rate of flow whilst the remainder is discharged at a more rapidly diminishing rate. Such valve control means consists of primary and secondary by-pass passages **34** and **36** respectively which extend through the wall of the valve chamber whilst the primary by-pass passage may also require to extend through the adjacent wall of the valve body as shown.

Both of these primary and secondary by-pass passages are open ended and devoid of adjustable valves. In addition they are spaced lengthwise of the valve chamber in such a manner that the primary by-pass passage **34** is constantly open but the secondary by-pass passage **36** is inoperative for the greater part of the closing movement of the main control valve and is not opened to the valve chamber until the lower part of the seating skirt **22** has passed downwardly beyond the secondary by-pass passage. As seen in Figure 5, even when the main valve is closed the secondary by-pass passage need not necessarily be entirely clear of the upper part of the sealing skirt for the reason that there is sufficient clearance between the upper edge portion of the skirt and the wall of the valve chamber to permit the passage of liquid under pressure through the secondary by-pass passage into the valve chamber.

Associated with the foregoing is manually operable means for tilting the pilot valve **29** when it is desired to release the main control valve from its seating. For this purpose a longitudinally slidable push rod or the like **37** is employed. This may pass through an open ended hole **38** formed in a lateral extension **39** of the valve body. This extension may be hollow to form a pocket **41** adapted to accommodate a seal around the push rod and a coil spring **42** which functions to hold the push rod in a retracted, inoperative position and may also serve to retain the seal in engagement with the rod. The latter may be operable by a universally movable handle **43** having a cam like inner end **44** engaging the adjacent end of the push rod. The handle may be retained in position by a screwed cap **46** removably connected to the lateral extension.

The inner end of the push rod **37** is adapted to strike the depending valve stem **31** or the sleeve **32** carried thereby, thus tilting the pilot valve and holding it open until the main control valve rises sufficiently to enable the lower end of the stem or its sleeve to clear the push rod and permit the pilot valve to return to its seating. It will be appreciated that the extent of such upward movement of the main control valve determines the volume of water which is discharged prior to the control valve returning to its seating.

In those localities where the water pressure is greater than usual, the main control valve is forced down further onto its seating and consequently has to lift a correspondingly greater distance before the first pilot valve stem or its sleeve is freed from the push rod. The volume of water discharged during each flush, may for example, be upwards of one-half gallon greater than the predetermined amount fixed by the Water Board or other Authorities. Naturally the use of such excess water is wasteful. In order to avoid this objection, manually adjustable means are provided for varying the uplift of the main control valve that is necessary to free the lower end of the valve stem or the sleeve carried thereby from the push rod. The provision of such means enables a substantially constant volume of water to be discharged at each flush irrespective of the pressure in various localities.

For this purpose, the inner end portion **47** of the push rod is of variable radial thickness relative to the axis of the push rod. For example, such inner end portions may be of substantially cylindrical form of less diameter than that of the push rod and located eccentrically in relation to the axis thereof. The latter formation is seen more clearly in Figure 8 of the drawings from which it will be noted that appropriate turning and setting of the push rod will vary the degree

to which the main control valve must rise before the lower end of the valve stem or the sleeve carried thereby is freed from the eccentric end portion of the push rod.

Means are provided for slidably retaining the push rod in the desired operative position after it has been turned to the required setting. Such retaining means may consist of inter-engaging stop members on the valve body and the push rod. As seen in Figures 7 and 8 of the drawings, such stop members may consist of an enlarged head 48 on the outer end portion of the push rod and provided with a series of circumferentially arranged flat faces 49 any one of which is adapted to slidably engage a complementary flat face 51 on the valve body. The respective flat faces on the enlarged head may be identified by symbols located for example, on the outer end of the head. As indicated in Figure 7, the appropriate faces on the push rod may be marked (1) (2) (3) (4) indicating a pressure range of from 10 to 40 lbs. per square inch which should cover the normal mains pressure.

Hitherto similar types of main control valves have been formed with flat bottom surfaces with the result that when the valve is open, the water being discharged has a tendency to rise in the central passage 28 and temporarily unseat the pilot valve 29. This of course delays the closing of main valve and causes wastage of water.

Such a disadvantage is avoided by providing the main control valve 8 on the bottom with a depending annular lip 53 surrounding the passage 28 and provided with a concave outer face 54 which merges with the valve bottom. A depending lip of substantially the cross sectional form illustrated in the drawings, functions to deflect the water being discharged downwardly and thus prevents or at least minimizes the possibility of the pilot valve being unseated by the undesirable entry of water into the central passage 28.

In use, assuming that the main control valve 8 occupies its closed position on its seating 7 as in Figure 5, operation of the handle 43, moves the push rod 37 lengthwise against the influence of its spring 42 and tilts the pilot valve 29 off its seating. Water under pressure in the valve chamber 9 is thus permitted to escape through the pressure release passage 28 with the result that the water pressure beneath the valve lifts it upwardly until the lower end of the valve stem 31 or the sleeve 32 carried thereby clears the eccentric end portion 47 of the push rod and permits the pilot valve to return to its seating. It will be apparent that if the handle is held so as to retain the push rod in its operative or forward position, the sleeve will telescope on the valve stem without interfering with the closing movement of the main control valve.

Immediately the pilot valve returns to its seating 25 the water entering the valve chamber through the primary by-pass passage 34 commences to restore the pressure in the valve chamber and cause the main control valve to return towards its seating. The initial return movement is however relatively slow and thus permits most of the predetermined volume of water for the flush to be discharged at substantially full bore rate of flow. However when the sealing skirt 22 of the main control valve passes the secondary by-pass passage 36 sufficiently to permit it to supply additional water under pressure to the valve chamber, the continued downward movement of the main control valve is accelerated which provides a rapidly diminishing flow of water suitable for forming the necessary water seal for example, within a lavatory bowl. Undesirable friction and tilting of the main control valve is avoided in that the main volume of water being discharged is free to flow beneath the raised valve without at any time impinging against its side. In addition cushioning of the main control valve is also provided when the latter is closing so as to avoid undesirable water hammer.

It will be appreciated from the foregoing that the improved flushing valve enables the push rod to be initially adjusted to discharge the desired predetermined volume of water at each flush irrespective of the pressure obtaining in any particular locality. In addition the main control valve and pilot valve may be removed for maintenance purposes and subsequently replaced by relatively unskilled persons without necessitating adjustment of any parts which might vary the volume of water being discharged at each flush.

Furthermore the aforesaid unitary construction of the main control valve enables it to be readily and economically replaced when any of the sealing faces thereon become defective.

Instead of being of substantially cylindrical formation as aforesaid, the inner end portion 47 of the push rod may be provided with a plurality of angularly disposed flat faces located at varying distances radially from the axis of the push rod.

Various other alterations, modifications and/or additions may be introduced into the foregoing construction and arrangement of parts without departing from the ambit of the invention as defined by the appended claims.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. For use in a flushing valve of the kind indicated a unitary main control valve which is composed of synthetic resinous or other resilient material of sufficient elasticity to form a sealing face on the bottom of the valve to engage its seating, a continuous sealing face around the periphery of the valve so as to engage the wall of an associated valve chamber and a third sealing face in the form of a pilot valve seating located within an upstanding hollow neck on the top of the main control valve which is provided with an internal metal reinforcement, said upstanding hollow neck being fitted with a surrounding metal band which stiffens the neck portion and also provides a bearing surface for slidably engaging the adjacent side wall of said valve chamber.

2. An improved flushing valve comprising a valve body having inlet and discharge passages and a valve chamber and seating located therebetween, a unitary main control valve having a pressure release passage therethrough and a tiltable pilot valve associated therewith, said main control valve being composed of synthetic resin or other resilient material so as to form a sealing face for its seating, a continuous sealing face around the periphery of the valve for slidably engaging the wall of said valve chamber and a third sealing face at/or adjacent to the top of the valve for said pilot valve, said main control valve comprising a continuous open mouthed channel extending upwardly from the bottom face thereof adjacent the peripheral edge portion of said valve, primary and secondary by-pass passages extending through the wall of said valve chamber between the latter and said inlet passage, both of said by-pass passages being open ended, devoid of adjustable valves and spaced lengthwise of said

valve chamber so that the primary by-pass passage is constantly open but the secondary by-pass passage is closed to the valve chamber for the greater part of the closing movement of said main control valve which functions to open the secondary by-pass passage as it nears its seating, said pilot valve having a depending valve stem adapted to be engaged and tilted by a longitudinally slidable push rod which is spring influenced and provided with an inner end portion of substantially cylindrical formation of less diameter than the push rod and located eccentrically in relation to the axis thereof and means for manually adjusting said push rod by partially turning and retaining it in any one of several operative positions without interfering with the longitudinal sliding movements thereof.

3. A flushing valve comprising, in combination, a valve body provided with inlet and discharge passages and a valve chamber connecting said inlet and discharge passages, said valve chamber having two portions one of which is of smaller cross sectional area than the other; a main control valve made of a resilient material and mounted in said valve chamber, said main control valve having a first portion located in said other portion of said valve chamber and having a second portion of reduced cross-section with respect to said first portion, said second portion of said main control valve being mounted in said small portion of said valve chamber and having a reinforcing ring mounted thereon, said ring being of such a size that it slidingly engages the wall of said small portion of said valve chamber, said second portion of said main control valve being formed with a recess located on the outer surface thereof and extending beneath and beyond said ring so as to provide a passage between said portions of said valve chamber; and means for actuating said main control valve so as to control the flow of water through said valve body by movement of said main control valve in said valve chamber, said movement of said main control valve being guided by cooperation of said second portion of said main control valve with said small portion of said valve chamber.

4. A flushing valve comprising, in combination, a valve body provided with inlet and discharge passages and a valve chamber connecting said inlet and discharge passages, said valve chamber having two portions one of which is of smaller cross sectional area than the other; a main control valve made of a resilient synthetic resin material and mounted in said valve chamber, said main control valve having a first portion located in said other portion of said valve chamber and having a second portion of reduced cross-section with respect to said first portion, said second portion of said main control valve being mounted in said small portion of said valve chamber and having a reinforcing ring mounted thereon said ring being of such a size that it slidingly engages the wall of said small portion of said valve chamber, said second portion of said main control valve being formed with a recess located on the outer surface thereof and extending beneath and beyond said ring so as to provide a passage between said portions of said valve chamber; and means for actuating said main control valve so as to control the flow of water through said valve body by movement of said main control valve in said valve chamber, said movement of said main control valve being guided by cooperation of said second portion of said main control valve with said small portion of said valve chamber.

5. A flushing valve comprising, in combination, a valve body provided with inlet and discharge passages and a valve chamber connecting said inlet and discharge passages, said valve chamber having two portions one of which is of smaller cross sectional area than the other; a main control valve made of a polyvinyl-chloride and mounted in said valve chamber, said main control valve having a first portion located in said other portion of said valve chamber and having a second portion of reduced cross-section with respect to said first portion, said second portion of said main control valve being mounted in said small portion of said valve chamber and having a reinforcing ring mounted thereon, said ring being of such a size that it slidingly engages the wall of said small portion of said valve chamber, said second portion of said main control valve being formed with a recess located on the outer surface thereof and extending beneath and beyond said ring so as to provide a passage between said portions of said valve chamber; and means for actuating said main control valve so as to control the flow of water through said valve body by movement of said main control valve in said valve chamber, said movement of said main control valve being guided by cooperation of said second portion of said main control valve with said small portion of said valve chamber.

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