Feb. 9, 1971 B. T. JOHNSON 3,561,014

FLUSH VALVE CONTROL ASSEMBLY

Filed Oct. 1, 1968 2 Sheets-Sheet 1

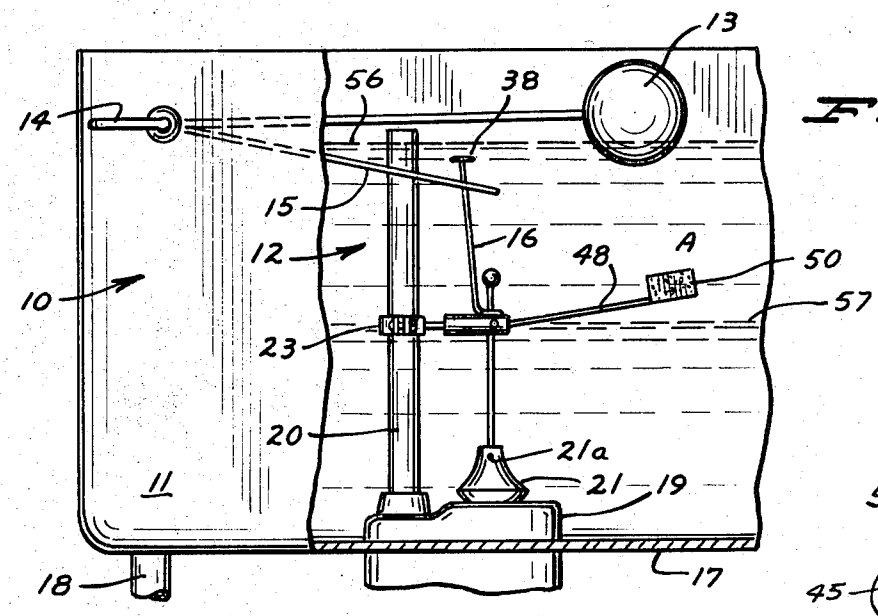

FIG. 1

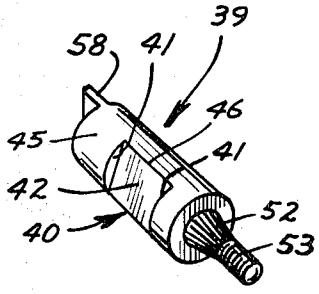

FIG. 3

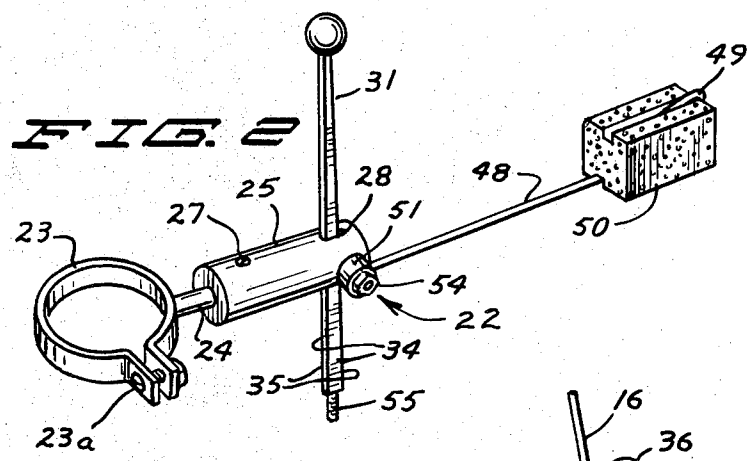

FIG. 2

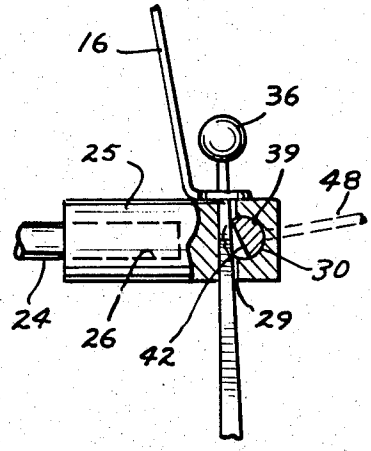

FIG. 4

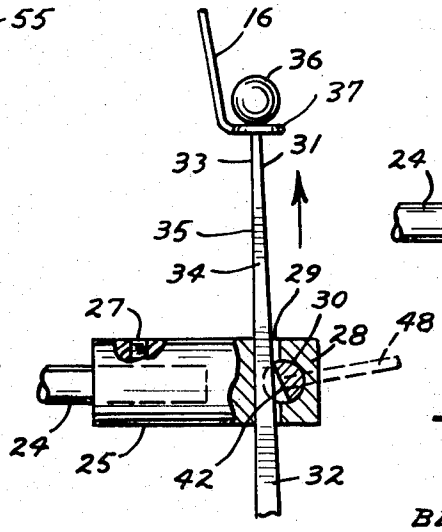

FIG. 5

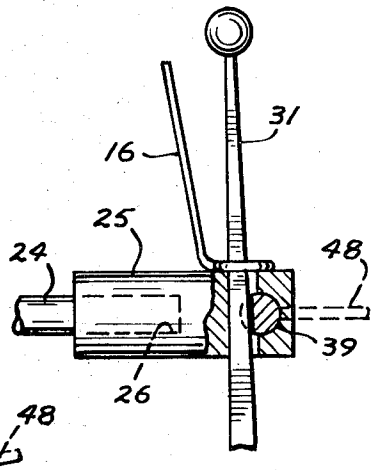

FIG. 6

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Feb. 9, 1971 B. T. JOHNSON 3,561,014

FLUSH VALVE CONTROL ASSEMBLY

Filed Oct. 1, 1968 2 Sheets-Sheet 2

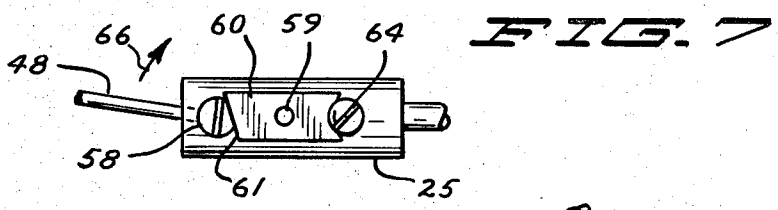

FIG. 7

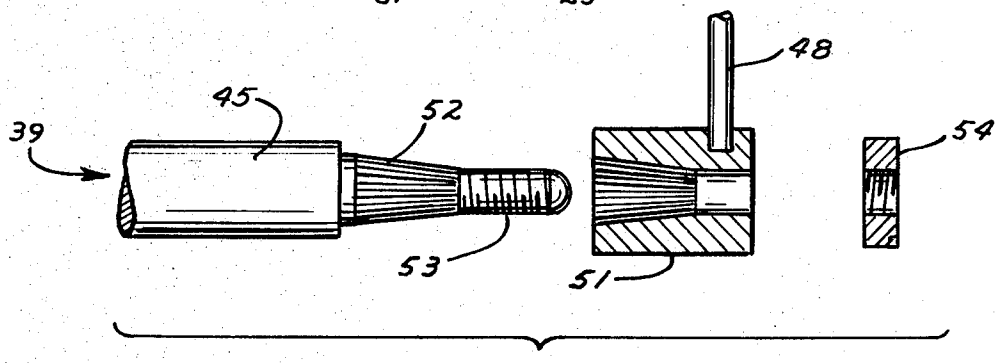

FIG. 8

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FLUSH VALVE CONTROL ASSEMBLY

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Int. Cl. E03d 1/34
U.S. Cl. 4—53 10 Claims

ABSTRACT OF THE DISCLOSURE

A flush valve control assembly for regulating the flushing operation by limiting the quantity of water flow out of a water closet that includes a float operated cam for retaining the valve stem of a ball valve in a flush position until the float lowers to a preselected level and then releases the ball valve stem. Adjustment mechanism is provided to retain the cam in a valve stem release position when the valve stem is in a non-flushing position and to limit the movement of the cam and thereby the maximum lowering of the float.

BACKGROUND OF THE INVENTION

This invention relates to float operated mechanism to limit the quantity of water flow out from a water closet that operates independently of other water closet elements once the flushing operation commences.

U.S. Pat. No. 2,817,849 to Hewitt discloses flush tank control mechanism that includes a float operated foot for holding a valve stem that has been moved to a flush position in a flush position until either the tank has been completely flushed and then partially refilled or until the lever arm is manually rotated in a direction opposite that for commencing a flushing operation. With this structure, one may manually control the operation thereof to use less than the total tank capacity of water. However, to do so, requires observing the decrease of water level in the tank and a manual operation to discontinue the flushing.

In order to cause the flushing operation to automatically cease prior to the water closet or flush tank becoming completely empty, this invention has been made.

SUMMARY OF THE INVENTION

For controlling the degree of emptying of a water closet, a flush valve control assembly having a float operated cam to bind against a valve stem when the valve stem has been raised to a flushing position and to release the valve stem when the water level has lowered a preselected amount. Advantageously adjustment mechanism is provided to limit the lowering movement of the float.

One of the objects of this invention is to provide new and novel mechanism for flushing a water closet that cause the flushing operation to cease before the water tank empties to the level of inlet of the flush water outlet. A further object is to provide an improved and simplified flush valve control assembly which operates independently of other water closet elements once the flushing operation commences and the assembly is activated.

Another object is to provide a flush valve control assembly which requires a minimal modification of the elements already existing in the conventional water closet. A further object is to provide a flush valve control assembly which is inexpensive to manufacture and is free of parts which may be subject to rapid wear.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial side view of a water closet, right hand portions being removed beyond the broken line and a portion of the front wall also being removed to expose the interior elements of the water flushing mechanism;

FIG. 2 is an enlarged perspective view of the flush valve control assembly;

FIG. 3 is an enlarged perspective view of the wedging cylinder alone, as well as portions of the float rod;

FIG. 4 is an enlarged side view of the wedging block and its associated elements. Portions of the block are broken away to show the internal relation of the parts;

FIG. 5 is a view similar to FIG. 4 but with the valve stem being moved vertically along its axis by the lift wire;

FIG. 6 is a view similar to FIG. 4 but with the valve stem being released vertically whereby to close the flush water outlet;

FIG. 7 is a fragmentary side view of the wedging block and associated elements as viewed from the opposite side as that shown in FIG. 3 for illustrating the structure to limit the downward movement of the float block; and

FIG. 8 is a fragmentary exploded view to illustrate the structure for adjusting the level to which the water will fall in the water closet when flushed.

In more detail, and referring generally to FIG. 1, a water closet **10**, typical of that used in flushing type toilet stools, is shown with a portion of the front wall **11** broken away to expose the interior of the closet and the water flushing mechanism referred to generally as **12**. Included in the flushing mechanism **12** are the conventional elements such as the float **13**, the trip lever and trip arm **14** and **15**, respectively, and a lift wire **16**. Fitted through the bottom wall **17** are a water inlet pipe **18** and a flush water outlet **19**. Mounted in communication with the flush water outlet **19** is an overflow stand pipe **20** and also resting upon part of the flush water outlet **19** is a hollow valve ball **21** having a hole **21***a* adjacent the upper end thereof. The valve ball is imperforated beneath hole **21***a*, or if it had any opening below hole **21***a*, such an opening is sealed.

The remaining elements of the flushing mechanism **12** constitute a flush valve control assembly referred to generally as **22** which is clearly shown in more detail in FIG. 2.

The assembly **22** has a clamping ring **23** which is adapted to be slipped over the top of the stand pipe **20** and then vertically adjusted to approximately the final desired height. The ring is provided with a bolt **23***a* for tightly securing the ring to the pipe.

Fixedly secured to the outer periphery of the ring **23** and projecting at right angles thereto is a mounting shaft **24**. A wedging block **25**, having an axial bore **26** (see FIG. 4) is slidably journaled upon the shaft **24**. The set screw **27** provides positive securement of the block **25** upon the mounting shaft **24** at any one of the many possible axial positions. The outer end **28** of the wedging block is provided with a vertically disposed transverse passageway **29** (see FIG. 5) of a square cross sectional area. Positioned at right angles to the passageway **29** is a second transverse opening or bore **30** of a circular cross section. Bore **30** is in partial communication with opening **29** as may readily be seen in FIGS. 4–6.

Positioned within the passageway **29** is an elongated guide pin or valve stem **31** that has its lower end **55** threadedly attached to the upper end of the ball valve **21** (see FIGS. 1 and 2). The stem **31** shown is of a rectangular cross section so as to mate with the cross section of the passageway **29**. The lower portion **32** of the valve stem is substantially square and small enough so that it will be freely movable within passageway **29** thereby preventing any binding of the stem with the passageway walls. The upper end **33** of the stem is of a rectangular cross

section such that stem sides **34** are parallel and stem sides **35** converge as they approach the upper end. Although the valve stem preferably is of the shape described above, it could be a rounded tapered rod (elongated frusto conical shape), or could be of a stepped construction having an upper end portion that throughout its length was of a rectangular cross section that had a smaller horizontal dimension in one direction than the corresponding dimension of the lower end portion which also is of rectangular cross section.

The upper end **33** of the stem **31** also has secured thereto a ball **36** or some such similar element for the hook **37**, of lift wire **16**, to force upon thereby imparting a lifting force to the valve stem to vertically and axially move it upwardly upon depression downwardly of the trip lever **14**. The trip arm **15** acts upon the lift wire **16** by engaging the crown **38** located on the upper end of the lift wire (see FIG. 1).

Journaled horizontally through the bore **30** is a wedging cylinder or cam **39** which is more clearly shown in FIG. 3. The cylinder **39** is provided with an angulated cutout side portion **40** which is defined by a pair of parallel confronting side walls **41** and face surface **42** (see also FIG. 4) which is recessed relative to circumferential surface **45** of the cylinder. Face surface **42** joins the outer cylindrical surface **45** in a gripping edge **46**, the function of which will be described in detail subsequently. Side walls **41** are so positioned as to slidably mate with the parallel sides **34** of the valve stem **31** thereby providing an additional guide means for the valve stem during raising and lowering thereof in addition to the guiding provided by the passageway **29**.

One end portion **52**, **53** of the wedging cylinder **39** extends outwardly of the wedging block. To one end portion of the cylinder is secured a control float rod **48**, the outer end of which is bent into a C-shaped hook **49** that is in turn secured to a control float **50**. The other or inner annular end **51** of the rod **48** has an inner surface to form a matching fit with the splined portion **52** of the wedging cylinder. A nut **54** is threaded on the thread portion **53** of the wedging cylinder to retain rod end **51** in a selected adjusted position on splined portion **52**. The relative angular positions of portions **51**, **52** determines the height of upward movement of the float **50**. The control float is preferably comprised of an expanded cellular polystyrene which has a high buoyancy characteristic. Any similar element having like buoyancy characteristics may also be used, however.

The end portion of the wedging cylinder opposite the splined portion **52** has a tongue **58** that extends axially. A pivot member **59** mounts an elongated adjusting plate **60** on the wedge block **25** for pivotal movement about an axis parallel to the axis of angular movement of the wedging cylinder relative to the block, the pivot member being secured to the mid-portion of plate **60**. Plate **60** has a tapered edge **61** that is abutable against tongue **58** to limit the pivotal movement of wedging cylinder as will be subsequently described. The opposite edge **62** is curved to permit adjusting the angular position of plate **60** and at the same time retaining the plate in the adjusted angular position by threading in the screw **64** to clamp the plate against the wedging block, screw **64** being threaded into the wedging block.

In the installation of the flush valve control assembly, the clamping ring is vertically positioned upon the stand pipe to the desired height as mentioned previously. This height may vary according to different water flushing mechanisms. The tapered valve stem **31** is then slipped through the lift wire hook **37** and passageway **29** of wedging block **25** and then the threaded portion **55** of trip rod **31** is secured to the valve ball **21**. The valve ball **21** is squeezed to force the air out through hole **21***a*. As the ball resumes its shape through natural resiliency, it fills with water. Prior to the insertion of the valve stem through the passageway it is necessary that the wedging

cylinder be inserted in bore **30** and then rotated so that the face surface **42** is positioned as shown in FIG. 6 whereby to prevent blocking the passageway and insertion of the trip rod therethrough.

With the parts thus assembled, the wedging block **25** may be horizontally adjusted upon mounting shaft **24** until the valve ball **21** is precisely centered over the flush water outlet. Then, set screw **27** is tightened.

Float arm **48** is rotated relative the wedging cylinder portion **52** so that the float will be at position A of FIG. 1 (together with any necessary angular adjustment of plate **60** that may be necessary) when the tongue abuts against edge **61** and the end portion **51** is moved angularly to abut against splined portion **52** and nut **54** threaded to permit portion **51** moving angularly relative portion **52**. Thus the tongue and plate **60** limit the upward movement of float **50** (rotation of float **50** in the direction of arrow **66**). At this time surface **42** slopes upwardly toward the valve stem but edge **46** is spaced from the valve stem. Edge **61** is tapered to permit the wedging cylinder rotating in the direction opposite arrow **66**.

In the use and operation of the flush valve control assembly, water is allowed to fill the water closet to the height shown at **56** (see FIG. 1). In this condition, the control float **50** tends to float upwardly to the water level at **56** but is instead restricted to the position A because of tongue **58** bearing against plate **60** and preventing further movement. In this position, edge **46** is rotated to a maximum counterclockwise position (see FIG. 4). When a flushing operation is desired, the trip lever is manually pushed downwardly whereby to raise trip arm **15** and lift wire **16**. As this operation takes place, the valve stem is likewise raised vertically (as shown in FIG. 5) until the width of the tapered valve stem between sides **35** is sufficient that a wedging or binding relation exists between the valve stem, passageway **29** and edge **46**. When sufficiently wedged, the trip lever may be released and the edge **46** will maintain the valve stem secure and thus, the valve ball **21** above the flush water outlet **19**. Water within the water closet **10** is then permitted to escape.

When the water level reaches the lower level of **57**, the float will slightly rotate clockwise (opposite arrow **66**). This slight amount of rotation will release edge **46** from its wedging relation with the tapered valve stem **31** as shown in FIG. 6, and thus permit the water filled valve ball **21**, to descend downwardly whereby the valve ball will again seat upon the flush water outlet. Consequently, the minimum amount of water remaining in the water closet after a flushing operation will be that depicted by level **57**. Thus, it is readily recognized that the maximum head of water has been utilized (which in and of itself provides adequate flushing) and the remainder of the water saved. As the water begins to replenish in the water closet, float **50** will again float to position A, being restricted again by tongue **58** and stop **60**, and edge **46** will also be repositioned for wedging the tapered trip rod when a flushing operation is begun.

To be mentioned is that in the event one holds the trip lever **14** too long, i.e. until no water was left in the tank, without the tongue and plate limiting the movement in the direction opposite arrow **66**, the float **50** would drop to a level that the edge of surface **42** opposite edge **46** would come up against stem **31** and hold it up and thus allow water to escape. This plate prevents this as well as adjusts the cam to have surface **42** adjacent but not binding against stem **31** when the tank is full, and still allow the cam to lock the valve stem up for flushing action.

If it is desirous to use a greater or lesser amount of water for the flushing operation, the control float rod **48** may be bent, or the nut **54** loosened and portion **51** rotated relative portion **52** and the angular position of plate **59** adjusted so that the position A of float **50** is either lower or higher. The operation of the assembly will still remain the same.

It is pointed out at this time that by providing the tapered trip rod with a very gradual taper, a considerable

degree of wedging may be realized during the tripping action. Thus, the valve ball will be held up in spite of the weight of the nonbuoyant valve ball **21**.

Through the above-detailed description of the invention, it will be readily recognized that the flush valve control assembly is very simple in operation, is easy to install upon existing water flushing mechanisms, and is of considerable value when considering the water savings occasioned through its use over a period of time.

It will, of course, be understood that various changes may be made in the form, details, arrangements and proportions of the parts without departing from the scope of my invention as set forth in the appended claims.

What is claimed is:

1. A flush valve control assembly for a flushing mechanism utilized in water closets and the like, said flushing mechanism having a stand pipe and a lift wire, said flush valve control assembly comprising a non-buoyant valve ball, an elongated valve stem having an upper end adapted to be engaged by said lift wire and a lower end secure to said valve ball to move with said valve ball, first means secured to said stand pipe for guiding the valve stem as it moves between a flushing position and a non-flushing position, said first means including a mounting member secured to said stand pipe and having a surface abuttable against said valve stem, and second means adapted to engage said valve stem upon initial tripping of said flush mechanism and subsequently respond to the water level in said water closet to release said valve stem from engagement, said valve stem having an upper intermediate portion and a lower intermediate portion that in transverse cross section is of a larger area than the upper intermediate portion, said upper intermediate portion being closely adjacent said mounting member surface in the valve stem non-flushing position, said lower intermediate section being closely adjacent said mounting member surface in the valve stem flushing position, said upper intermediate portion having a first generally vertically extending surface and a second generally vertically extending tapered surface that is progressively further transversely spaced from the first surface in a direction toward the lower intermediate portion, the second means including a float and third means attached to the float and mounted by said mounting member for limiting the upward movement of the valve float while permitting the valve stem to be moved from the non-flushing position to the flushing position and thereafter retain the valve stem in a flushing position with the tapered surface transversely adjacent the first means surface until the float has moved to a preselected lower elevation due to the water flowing from the closet.

2. The apparatus of claim **1** further characterized in that the third means includes a cam rotatably mounted by the mounting member between a first position for binding against the valve stem laterally opposite said first means surface when the valve stem is in a flushing position and a second position out of binding engagement with the valve stem in a flushing position, and fourth elongated means for attaching the float to the cam to rotate the cam between said cam positions when the elevation of the float varies.

3. The apparatus of claim **2** further characterized in that the third means includes stop means on the mounting member for limiting the angular movement of the cam and thereby through the fourth means limit the maximum and minimum elevations of the float relative the stand pipe regardless of the level of the water in the tank, the stop means and cam having cooperating means to limit the angular movement of the cam to positions where the cam is spaced from the valve stem when the float is at its maximum elevation and the valve stem is in its non-flushing position, to bindingly engage the valve stem when the valve stem is in its flushing position and the float is at its maximum elevation and to release the binding engagement with the valve stem when the valve stem is in its flushing position and the float is in its minimum elevation and block binding engagement with the valve stem when the float is at its minimum elevation.

4. The apparatus of claim **2** further characterized in that the third means includes stop means on the mounting member for limiting the angular movement of the cam and thereby through the fourth means limit the maximum and minimum elevations of the float relative the stand pipe regardless of the level of the water in the tank, said cam being mounted by the mounting member to be spaced from said valve stem surfaces and on the opposite side of said valve stem from said mounting member surface when the valve stem is in the non-flushing position and the float is at said maximum elevation.

5. The apparatus of claim **4** further characterized in that the stop means is mounted on the mounting member to limit the angular movement of the cam in its direction to a float minimum elevation condition so that the cam is transversely spaced from the valve stem when the valve stem is in the flushing position.

6. A flush valve control assembly for a flushing mechanism utilized in water closets and the like, said flushing mechanism having a stand pipe and a lift wire, said flush valve control assembly comprising a non-buoyant valve ball, an elongated valve stem having an upper end adapted to be engaged by said lift wire and a lower end secured to said valve ball to move with said valve ball, first means secured to said stand pipe for guiding the valve stem as it moves between a flushing position and a non-flushing position, said first means including a mounting member secured to said stand pipe and having a generally apertured surface portion abutable against one side of the valve stem as the valve stem moves between its positions, and second means adapted to engage said valve stem upon tripping of said flush mechanism and subsequently respond to the water level in said water closet to release said valve stem from engagement, said mounting member having a horizontal wedging cylinder opening, opening to said apertured surfaced portion, a wedging cylinder rotatably mounted in said cylinder opening, a float, third means for connecting the float to the cylinder for rotatably urging the cylinder to rotate in one direction as the level of water in the closet raises and mounts the float for movement between a lower elevation and an upper elevation, said cylinder having a portion abutable against the valve stem for bindingly engaging the valve stem when the valve stem is in its flushing position and the water level is sufficiently high that the float is intermediate said upper and lower elevations and closely adjacent said upper elevation and a second position releasing the binding engagement with the valve stem when the water level has decreased to a preselected level, and a stop member mounted on the mounting member adjacent the cylinder for cooperating with the cylinder to limit rotation of the cylinder in said one direction and a direction opposite said one direction to angular positions that the movement of the float is limited to elevations intermediate said upper and lower elevations.

7. The apparatus of claim **6** further characterized in that the wedging cylinder and stop member have cooperating means for limiting rotation of the wedging cylinder in said one direction to a position that said cylinder portion is out of binding engagement with the valve stem when the valve stem is in its non-flushing position.

8. The apparatus of claim **7** further characterized in that the mounting member surface portion and the cylinder portion are located to transversely abut against opposite sides of the valve stem and that the valve stem has an elongated upper tapered surface of a taper that in the transverse dimensions between the valve stem opposite sides increases in a direction toward the valve ball.

9. The apparatus of claim **8** further characterized in that the taper surface is of a length to be transversely adjacent said cylinder portion and the mounting member surface portion both in the valve stem flushing position and non-flushing position.

10. The apparatus of claim 6 further characterized in that said mounting member includes a vertical passageway having said apertured surface portion, that said cylinder portion is located to have the passageway open thereto, and that said valve stem has an upper portion and a lower portion that are movable adjacent said cylinder portion, said upper portion in horizontal cross section having a horizontal dimension in a horizontal direction that said bore opens to said passageway that is less than the corresponding horizontal dimension of the lower portion.

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U.S. Cl. X.R.

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