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Pozzi

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[54] **FLUSHING SYSTEM**

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[52] **U.S. Cl.** ..... **4/26,** 4/31, 4/41, 4/52, 4/63, 4/67 R

[51] **Int. Cl.** **E03d 3/00**

[58] **Field of Search** .. 4/67 R, 67 A, 57 R, 57 P, 26, 4/27, 28, 29, 31, 33, 34, 37, 38, 41, 52, 55, 63

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[57] **ABSTRACT**

Flushing apparatus is provided comprising a cistern mounted between the feed-pipe and the flush-pipe and containing a device with an entry and air escape valve as well as a valve connected with a seating formed at the entry to the flush-pipe and subject to the hydrostatic pressure of the water contained in a chamber communicating with the said pipe through a valve governed by the handle operating the flush, wherein the valve (connected with the seating formed at the entry to the flush-pipe) is suspended from a flexible diaphragm forming one of the walls of said chamber communicating with the cistern through a small aperture provided in another section of the wall.

12 Claims, 3 Drawing Figures

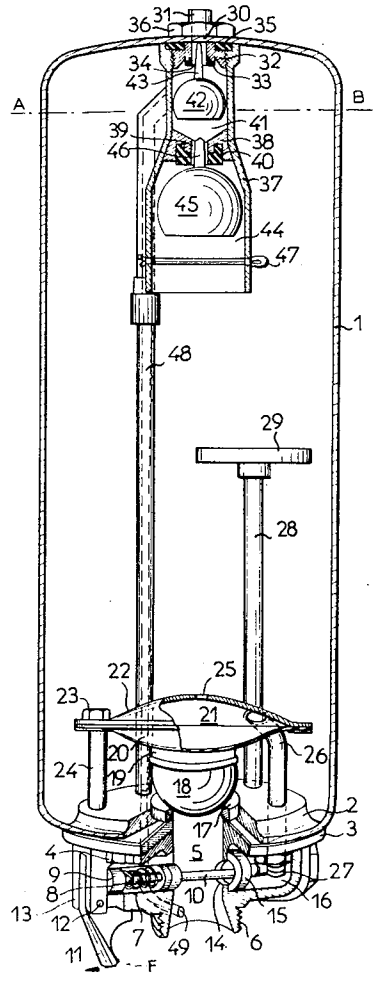

FIG.1

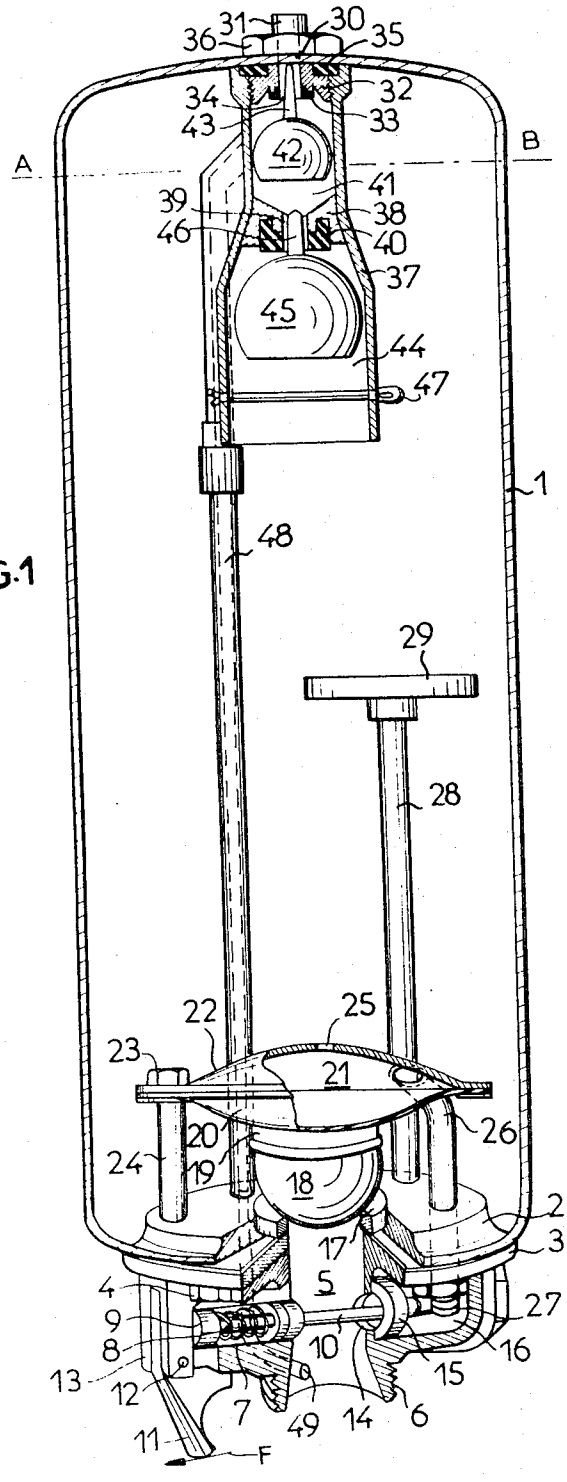
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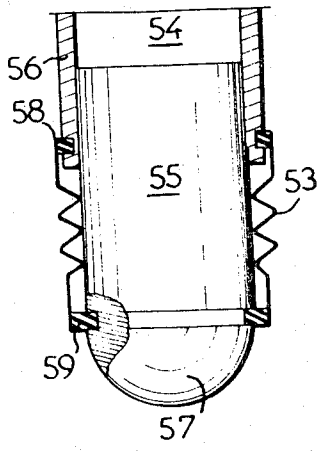
FIG.3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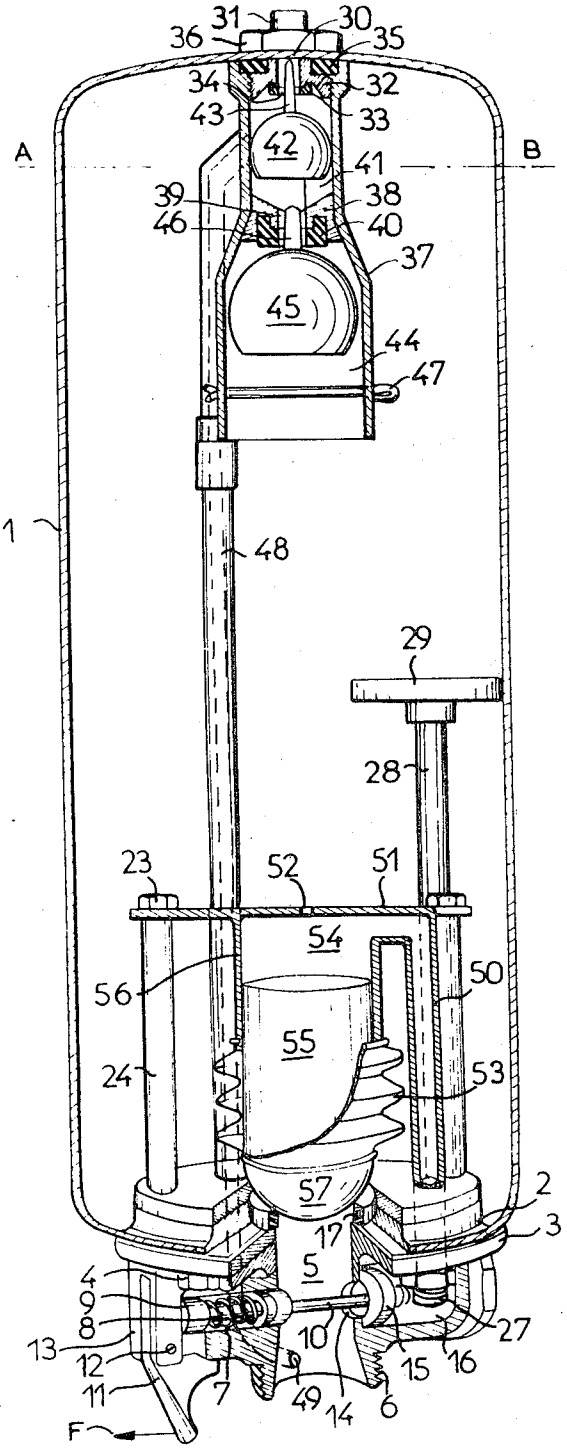
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FIG.2

FLUSHING SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates to a flushing system of the type comprised of a cistern set between the feed-pipe for water under pressure and the flush-pipe and containing in its upper part an entry and air escape valve, governed by the level of refill in the cistern, and, in its lower part, a valve acting in conjunction with a seating formed at the entry to the flush-pipe and subject to the effect of the hydrostatic pressure of the water contained in a chamber, the upper part of which communicates with the flush-pipe through a valve governed by the handle operating the flush.

In a flushing system of this kind, the said valve is formed by a piston of plastic material for example, sliding in the said chamber executed in the form of a cylinder communicating through a side-opening with the cistern so that the water may circulate round the latter and fill the whole of the said chamber situated above the piston, in order to keep the semi-spherical lower part forming the valve in contact with the seating affixed at the entry to the flush-pipe.

Although flushing systems made in this way have proved themselves to the point where they have become commercially mandatory, it has appeared that the axial movements of the piston forming the valve tended in the long run to cause wear in the lower wall of the cylinder, finally causing it to wear out of round and this was detrimental to the good running of the piston valve, the water-tightness of which is affected when it bears with its semi-spherical part on the seating affixed at the entry to the flush pipe.

In addition, piston and cylinder have to be made with great precision, since free play is essential to the smooth functioning of the apparatus.

SUMMARY OF THE INVENTION

In order to remedy these disadvantages, the invention proposes, in a flushing system of the above-mentioned type, to suspend the valve from a flexible diaphragm, elastic for preference, forming one of the walls of the lower chamber which communicates with the cistern through a small aperture arranged in another part of the wall of the said chamber or of the outlet pipe.

According to a first embodiment, the elastic diaphragm forms the lower part of the said lower chamber, the upper part of which is formed by a cupel bolted to the diaphragm, the outer face of the diaphragm bearing a spherical element constituting the said valve.

According to another embodiment, the lower part at least of the said chamber is formed by an elastic bellows, one end of which is fixed to the side wall of the chamber and the other to the semi-spherical end of a cylindrical body introduced into the said chamber.

The valve may, with advantage, be mounted on the flexible diaphragm or on the bellows by means of a groove in the diaphragm or bellows which fits over a peripheral flange on the body of the valve, the bellows being affixed to the said chamber by the same type of join.

By way of example, two embodiments of a flushing system according to the invention are described below and illustrated in the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view in section with partial cut-away of a first embodiment of a flushing system according to the invention.

FIG. 2 is a similar view of a second embodiment.

FIG. 3 is a view in section of the lower part of the said chamber, showing the method by which the valve is attached to the elastic bellows.

DESCRIPTION OF PREFERRED EMBODIMENTS

In FIG. 1, reference No. 1 indicates the cistern made of an outer casing of enamelled plating and having a possible inner casing of anti-corrosive material, preferably polyethylene, not shown.

The lower part of the cistern is enclosed between two base-plates 2, 3, water-tight and held by nuts. The base-plates 2, 3 and the bottom of the cistern have a hole in their centre providing an outlet indicated by the general reference 5, the base-plate 3 being furnished with a threaded section 6 to connect with the flush-pipe, not shown, which extends below the outlet 5. For the sake of convenience, the outlet 5 will be referred to as the flush-pipe.

In a horizontal boring 7 in the base-plate 3, the head 9 of a rod 10 moves against the action of a compression spring 8; the head of the rod bears on the handle operating the flush 11 jointed at 12 to a yoke 13 carried by the base-plate 3. The rod 10 passes through an aperture 14 in the wall of the flush-pipe 5 and carries a rubber joint 15 which forms a valve and is situated in a cavity 16 in the base-plate 3.

The upper opening of the flush-pipe 5 carries a seating 17 for a spherical valve 18 attached, by means not shown, to the base 19 provided on the outer face of an elastic diaphragm 20 forming a lower chamber 21 with a rigid cupel 22 to which it is fixed so as to be water-tight by means of bolts 23 passing through cross-braces 24 and screwing into the base-plate 2. The rigid cupel 22 is provided with a small opening 25 through which the lower chamber 21 communicates with the cistern 1 and an outlet pipe 26 from its periphery opens freely at 27 into the cavity 16, communication between the cavity 16 and the flush-pipe 5 being controlled by the valve 15.

The water feed pipe 28 is attached by means not shown to the source of water under pressure and surmounted by an anti-return valve 29.

In the upper part of the cistern 1 there is a hole 30 through which passes the hollow rod 31 bearing a threaded flange 32; the bottom of the rod 33 has an aperture 34 in it and the said hollow rod is held in place by means of an interposed joint 35 and a nut 36 screwed to the part of the hollow rod coming out of the cistern 1. To the flange 32 is screwed a bell 37 provided with a horizontal dividing wall 38 with a hole 39 in it and having on its lower face a joint 40. The bell is thus divided into a first chamber 41 in which is a free-moving first spherical ball 42 with a needle 43, and a second chamber 44 in which is a free-moving second spherical ball 45 surmounted by a needle 46, the said second ball being prevented from moving out of the second chamber 44 by an under-pin 47. A pipe 48 leads from the first chamber 41 to the flush-pipe 5 at 49.

The flushing system just described functions as follows.

Suppose that the feed-pipe **28** is connected to the source of water under pressure; the water enters the cistern **1** passing through the anti-return valve **29** and begins to fill the cistern **1**, the water at the same time filling the chamber **21**, passing through the hole **25** in the upper part of the rigid wall **22** of the said chamber.

When the level of the water reaches the level of the ball **45**, the ball is carried upwards and its needle **46** enters the aperture **39** and the ball **45** comes to rest against its seating **40**, thus preventing any water from passing from chamber **44** to chamber **41**.

If by chance the needle **46** should stick in the aperture **39** or fail to enter it, then the water from the cistern will fill the upper chamber **41**, raising the ball **42** so that the needle **43** of ball **42** enters the aperture **34** and the outlet **31** is blocked by the said ball **42** coming to rest against its seating **33**. The water which continues to pass through the upper chamber **41** then flows away through the deviation **48** and into the flush-pipe **5** through the opening **49**.

In normal conditions, in which the ball **45** comes to rest correctly against its seating **40**, the level of water continues to rise in the cistern **1**, up to the level AB for instance, above which an air cushion forms which is compressed by the column of water. When the pressure of this air cushion is equal to the pressure of the water fed through the feed-pipe **28**, the flow of water into the cistern automatically stops.

To work the flush, the lever **11** is pulled in the direction of the arrow F. The rod **10** is driven back to the right in the drawing, against the action of the spring **8** and the valve **15** is detached from its seating.

As a result, the water contained in the lower chamber **21** is able to flow away through the pipe **26**, the cavity or intermediate chamber **16**, and the aperture **14**, into the flush-pipe **5**. The pressure exerted through the flexible diaphragm **20** on the spherical valve **18** diminishes; the said valve **18** is raised from its seating **17** and the water contained in the cistern **1** is able to pass directly into the flush-pipe **5** until the cistern **1** is completely emptied.

It is of course understood that it is not necessary for this operation to keep the lever **11** pressed to the left in the drawing, in the direction of the arrow F; a gentle movement of the lever in the direction of the arrow F is sufficient to start the operation of emptying the cistern **1**, as just defined.

When the cistern **1** has been emptied in this way, it is immediately refilled from the feed-pipe **28**, the water passing through the retention valve **29** to fill the cistern up to the level AB, as previously described, and the flush is then ready to be operated again.

The embodiment of the flushing system according to FIG. **2** is essentially identical to that of FIG. **1**, except for the formation of the lower chamber.

In the embodiment according to FIG. **2**, two or more cross-brace bolts **23–24**, screwed into the upper part of the base-plate **2**, serve to hold in place a plate **51** with a central aperture **52**.

The chamber underlying it, formed by a cylindrical wall **56**, communicates freely with a pipe **50** which is the equivalent of the pipe **26** in the embodiment according to FIG. **1**, the said pipe or conduit **50** communicating freely with the intermediate chamber **16**.

To the lower part of the cylindrical wall **56** is attached, as can be seen for example in FIG. **3**, a bellows **53** of elastic material such as rubber or plastic, the bellows in question ending in a semi-spherical head **57**.

A piston **55** with a semi-spherical head is engaged in the bellows, its upper part sliding in the spherical wall **56**.

The semi-spherical part **57** acts in conjunction with the valve seating **17** at the upper end of the flush-pipe **5**.

The method of functioning of the flushing system shown in FIG. **2** is exactly the same as that of the flush in FIG. **1**, the difference between the two embodiments relating only to the practical execution of the means of closing the lower chambers **21** or **54**.

The suspension of the bellows **53** of the embodiment shown in FIG. **2** is shown on a large scale in FIG. **3**.

The cylindrical wall **56** is provided with a peripheral groove into which fits a ring-flange **58** carried by the upper part of the bellows **53**, while the lower part of the bellows carries a circular flange **59** which fits into a corresponding groove in the lower part of the piston **55**, the semi-spherical part of which is indicated by the reference No. **57**.

It is of course possible to eliminate the means of attachment **59** and to give the lower end of the bellows **53** a semi-spherical form, as already described, into which the semi-spherical head **57** of the piston **55** fits.

The embodiments of the flushing systems described above have been given by way of example only and it is of course understood that different variations may be conceived without departing from the spirit of the invention.

I claim:-

1. Flushing apparatus comprising:

a cistern;

a feed-pipe for feeding water under pressure into said cistern;

a flush-pipe coupled to said cistern for flushing water out of said cistern;

means initiating operation of the flushing apparatus;

a device with at least one air entry and air escape valve governed by the level of refill water in said cistern and situated in the upper part of said cistern for allowing air entry and air escape from said cistern;

a chamber selectively containing water and located inside said cistern and being formed with a wall having at least a deformable flexible part;

a first valve element situated at the lower part of the cistern, said valve element being suspended from said flexible part and coacting with the entry to said flush-pipe which is in the form of a seat receiving said first valve element, said first valve element being subject to the effect of the hydrostatic pressure of the water contained in said chamber; and

a second valve element through which said chamber communicates with the flush-pipe and which is operatively coupled to said iniating means;

the wall of said chamber having a small aperture therein which communicates said chamber with said cistern, said small aperture arranged in another part of the wall of said chamber.

2. Flushing apparatus as claimed in claim **1**, wherein said flexible part comprises elastic diaphragm means forming the lower part of the said chamber, the upper part of said chamber being formed by a cupel attached to said elastic diaphragm, and wherein said first valve

element is a spherical element carried on the outer face of said elastic diaphragm.

3. Flushing apparatus as claimed in claim 2, including a plurality of cross-braced bolts coupling said cupel to said elastic diaphragm.

4. Flushing apparatus as claimed in claim 1, wherein said chamber includes a cylindrical body located therein and having a semi-spherical end, and the lower part of said chamber is formed by an elastic bellows which comprises said flexible part, one end of said bellows being fixed to a side wall of said chamber and the other end of said bellows being fixed to said semi-spherical end of said cylindrical body.

5. Flushing apparatus as claimed in claim 4, wherein the flexible bellows has a flange thereon and said side wall of said chamber has a groove therein for engagement with said wall flange, thereby attaching said bellows to said wall of said chamber.

6. Flushing apparatus as claimed in claim 1, wherein said flexible part comprises a flange thereon, and said first valve element has a corresponding groove therein for engagement with said flange, to thereby attach said first valve element to said flexible part.

7. Flushing apparatus as claimed in claim 1, including a fluid passage means coupling said chamber to said flush-pipe, said second valve element selec-tively opening and closing said fluid passage means.

8. Flushing apparatus as claimed in claim 7, comprising a biased rod element coupling said handle with said second valve element.

9. Flushing apparatus as claimed in claim 1, wherein said first valve element is at least partially spherical and selectively seats on said seat at the entry to said flush-pipe.

10. Flushing apparatus as claimed in claim 1, wherein said second valve element includes at least one float valve mounted at the upper portion of said cistern.

11. Flushing apparatus as claimed in claim 1, wherein said flexible part comprises an elastic bellows forming the lower part of said chamber.

12. Flushing apparatus as claimed in claim 1, comprising two air entry and air escape valves connected in series and situated in the upper part of said cistern.

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