

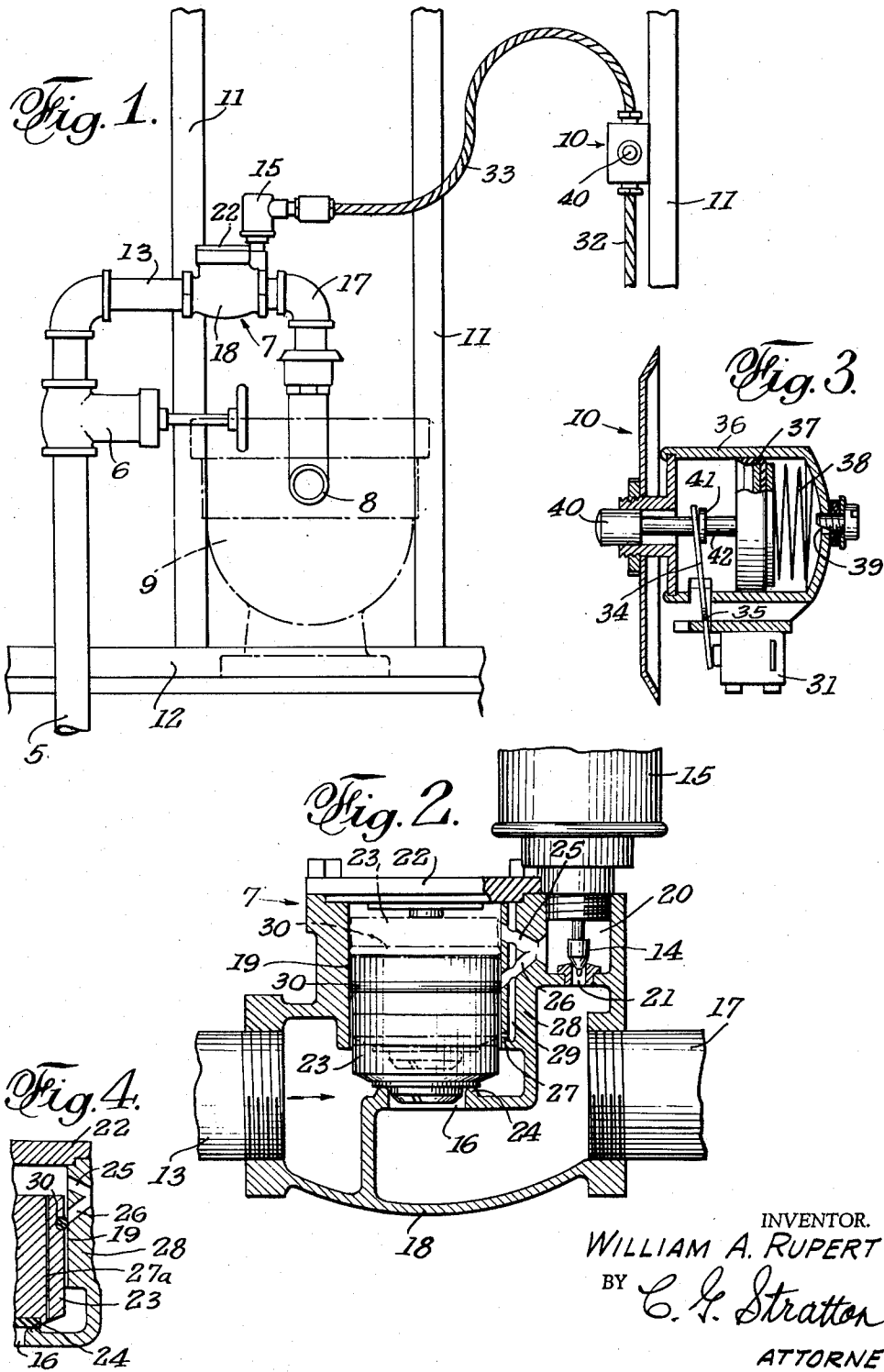
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PRESSURE WATER FLUSHING SYSTEM

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1

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PRESSURE WATER FLUSHING SYSTEM

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This invention relates to a flushing system for toilets and the like that flushes directly from the water supply line under the pressure of said line regardless whether said pressure is high, normal or low.

An object of the present invention is to provide a flushing system that, after institution of water flow, closes slowly to such flow to obviate water hammer in the system and also allow for filling of the toilet bowl (if such is served by the system) after flushing has been completed.

Another object of the invention is to provide a pressure flushing system that is quiet in operation, both when opened to flushing flow and when closing to said flow.

A further object of the invention is to provide a system of the character referred to in which a flow-controlling valve automatically changes from an initial fast-closing speed to a subsequent slow-closing speed so that the operation is rendered quiet, as above contemplated.

A still further object of the invention is to provide a flushing system of the character indicated that provides a time delay before the flow-controlling valve begins to close to, thereby, allow for a copious flushing flow in the system.

A yet further object of the invention is to provide a novel pilot-operated flow-controlling valve in a system of the type referred to.

The invention also has for its objects to provide such means that are positive in operation, convenient in use, easily installed in a working position and easily disconnected therefrom, economical of manufacture, relatively simple, and of general superiority and serviceability.

The invention also comprises novel details of construction and novel combinations and arrangements of parts, which will more fully appear in the course of the following description. However, the drawing merely shows and the following description merely describes, preferred embodiments of the present invention, which are given by way of illustration or example only.

In the drawing, like reference characters designate similar parts in the several views.

FIG. 1 is an elevational view of a water flushing system according to the present invention.

FIG. 2 is an enlarged and partly broken longitudinal sectional view of a flow-controlling valve used in the present system.

FIG. 3 is a similarly enlarged sectional view of a time-delay switch used in the invention.

FIG. 4 is a fragmentary sectional view of a modification.

The present water flushing system comprises, generally, a water supply source 5 provided with a conventional shut-off valve 6 that, however, is normally open at all times, a valve 7 controlling flow from the supply line 5 to an outlet 8, the same supplying flushing water to any suitable device or installation, such as a toilet bowl 9, and time-delay means 10 for opening the valve 7 and to control the quantity of flow through said valve. The components of the present system are shown in their approximate operative positions with respect to wall or partition framing 11 and a support sill 12 for said framing.

2

The supply source 5 is shown as an inlet pipe from a conventional water main or from any other supply that conducts water through said pipe under pressure. Such pressures vary considerably in different areas and may be as low as 20 p.s.i. and as high as 80. The shut-off valve 6, globe or gate, is quite usually provided and may be used to regulate flow if too high for the use intended. In any case, said valve 6 is ordinarily open and conducts water to the valve 7 by way of a piping connection 13.

The valve 7 is a pilot-operated valve in which the pilot 14 is shown as controlled by a solenoid 15 to control flow from the connection 13, through the valve opening or port 16 and outwardly through the piping connection 17. Said valve 7 has a body 18 through which said flow takes place, the same being provided with a cylinder 19 that is aligned with the valve port 16 and with a chamber 20 in which the pilot 14 operates. Said chamber 14 is provided with an orifice 21 that, when open, communicates said chamber 20 with the discharge or outlet side of the valve body 18. A cap plate 22 covers the top of cylinder 19 in which is fitted a free piston that, in its low position, closes the port 16 by sealing against a valve seat 24 around said port. Said piston is preferably loosely fitted in the cylinder 19. A port 25 communicates the upper portion of the cylinder with the chamber 20.

According to the present invention, a second port 26 extends between said chamber 20 and a lower point of the cylinder, a bleed orifice 27 is formed in the wall 28 that surrounds the cylinder 19 and a passage 29 connects said orifice and the ports 25 and 26, thereby having communication with the cylinder above the piston 23. A sealing ring 30 around the pistons seals with the cylinder and is located so as to close the port 26 against upward flow between the piston and cylinder when the former is seated on the seat 24.

FIG. 2 shows the closed position of the valve 7 wherein the pressure on the top of the piston 23 is greater than the pressure of the inlet flow on the bottom of the piston around the seat 24, because the orifice 27 conducts the pressure of said flow through passage 29 to the upper portion of the cylinder. The unit pressure on the piston at both ends is the same, the seated position of the piston being maintained because of the larger effective area of the piston top as compared to the bottom of the piston around the seat 24.

To open valve 7, the solenoid 15 is energized to retract the pilot 14. Such retraction may be mechanically effected by means of a handle provided for the purpose. Opening of orifice 21 releases water from above piston 23, such water draining through port 25 into chamber 20 and then into the outlet side of the valve body 18. The instant that this drainage reduces the pressure on top of the piston to a point lower than the pressure on the bottom, the piston 23 moves up opening the port 16 to flow from the source 5. The upward movement is buffered by the slow loss of pressure above due to the restriction to draining flow through orifice 21. In any case, the piston 23 rises to the dot-dash line position with the O-ring seal 30 between the ports 25 and 26. The flow through the valve 7 will continue at the pressure of the inlet 5 by retaining energization of the solenoid 15 and, therefore, retraction of the pilot 14.

Upon de-energization of said solenoid, the pilot will drop gravitationally to close orifice 21. As a consequence, water pressure will begin to build up on the top of the raised piston because of pressure flow between the piston and its cylinder and through the connected ports 26 and 25 into the cylinder 19 above the piston. The piston 23 will start down, at one speed, as the pressure above the piston approaches equality with the pressure

3

against the bottom and the weight of the piston becomes the primary piston-dropping factor. As this downward movement brings the sealing ring 30 across the port 26, gradually closing the same, only the orifice 27 remains open to flow that by-passes the sealing ring. Since this orifice is of a small metering size, the speed of descent of the piston is reduced to a slower speed and causes the piston to gently seat as the pressure above the piston equalizes with that on the piston bottom.

It will be clear that the valve 7 has a noiseless operation both when opening and closing and that when the same is closing slowly, a restricted flow past port 16 is had. Thus, the bowl 9 may be thoroughly flushed during the full open position of valve 7 and provide a residual bowl-filling restricted flow during the slow speed closure of the valve, as above described.

The time-delay means 10 for opening the valve 7 and holding the same open for a desired flushing period is shown as electrical means for energizing the solenoid 15. Said means 10 comprises a self-closing micro-switch 31 that receives electric current from a line 32 and, when closed, conducts current to the solenoid 15 by means of a line 33. Said micro-switch is shown as controlled by an operating lever 34 that is fulcrumed at 35 to a cylinder housing 36 in which is disposed a piston 37 that is biased in one direction by a spring 38. An adjustable air bleed means 39 controls recovery movement of the piston 37 after the same is pushed, through the medium of a button 40, against the bias of spring 38. A collar 41, on a stem 42 that connects said button and the piston 37, controls the lever 34 to hold switch 31 open until the button 26 is pressed, at which time the lever is moved to allow said switch to close. The same remains closed until the piston is re-projected by the spring 38 as permitted by the air bleed means 39.

The means 10 allows for a desired flushing flow simply by a touch of the button 40. It will be evident that any switch that may be manually held closed will operate the present system but will require that the switch be held closed for a predetermined period, manually. The same is true of manual means for controlling the pilot 14.

Since the metering orifice bypasses the sealing ring 30 to equalize the pressure in the upper part of the cylinder with the pressure below the piston, the same result may be obtained by a bleed orifice 27a in the piston 23, as shown in FIG. 4. In such case, the passage 29 may be omitted.

While the foregoing specification illustrates and describes what I now contemplate to be the best modes of carrying out my invention, the constructions are, of course, subject to modification without departing from the spirit and scope of my invention. Therefore, I do not desire to restrict the invention to the particular form of construction illustrated and described, but desire to cover all modifications that may fall within the scope of the appended claims.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. A flow-controlling valve for flushing systems comprising a body having a flow inlet and a flow outlet with a flow-passing port within the body between the inlet and outlet, a cylinder in the body above and aligned with the port, a piston loosely fitted in said cylinder and having an end adapted to close said port to close flow through the valve, said piston being provided with a passage-sealing ring, said body having a chamber disposed on the outlet side of the valve, an orifice in the body communicating said chamber and said outlet, a pilot normally closing said orifice, and a set of flow-metering and by-passing passages in the valve body comprising, in part, connected flow ports having upper and lower openings into the cylinder and communicating the mentioned chamber with the cylinder above the piston therein, during all positions of the piston, and communicating said cylinder above the piston with the inlet only when the piston is in valve-open position, said set of passages further including a bleed

4

orifice and a passage connecting said bleed orifice and the connected flow ports, said bleed orifice being open to the inlet during all positions of the piston, the passage-sealing ring on the piston, when the piston is in raised position, being above the lower opening in the connected flow ports, thereby providing a flow between the cylinder above the piston and the inlet through the upper opening in the connected flow ports through said flow ports, the mentioned connecting passage, and the bleed orifice, and said lower opening in the flow ports being sealed off from flow directly from the inlet by said sealing ring when the piston is in lowered closed position, said piston having uniform and rapid movement toward valve-closing position when both the connected flow ports and the bleed orifice are open to flow from the inlet, and a substantially slower valve-closing speed after said lower port opening is sealed off from direct flow from the inlet.

2. In a water flushing system, a flow line, a flow-controlling valve in said line, said valve including a free piston movable in a cylinder by pressure on opposite ends thereof between a flow-stopping and an open position, an outlet for said valve, a pilot controlling said outlet to retain closing pressure on the piston, when closed, and releasing said pressure, when open, a sealing ring around said piston to seal the pressure in the cylinder above the piston from the pressure on the opposite end open to the inlet, and passages in the valve to vary the by-passing flow around said sealing ring when the pilot is closed to impart a two-speed closing movement to the piston that is initially faster than at the end of the closing movement, said passages comprising a set of flow-metering and by-passing passages in the valve body comprising, in part, connected flow ports having upper and lower openings into the cylinder and communicating the mentioned pilot-controlled outlet with the cylinder above the piston therein, during all positions of the piston, and communicating said cylinder above the piston with the inlet only when the piston is in valve-open position, said set of passages further including a bleed orifice and a passage connecting said bleed orifice and the connected flow ports, said bleed orifice being open to the inlet during all positions of the piston, the passage-sealing ring on the piston, when the piston is in raised position, being above the lower opening in the connected flow ports, thereby providing a flow between the cylinder above the piston and the inlet through the upper opening in the connected flow ports through said flow ports, the mentioned connecting passage, and the bleed orifice, and said lower opening in the flow ports being sealed off from flow directly from the inlet by said sealing ring when the piston is in lowered closed position, said piston having uniform and rapid movement toward valve-closing position when both the connected flow ports and the bleed orifice are open to flow from the inlet, and a substantially slower valve-closing speed after said lower port opening is sealed off from direct flow from the inlet.

3. In a flushing valve having an inlet and an outlet and provided with a free piston movable between positions opening and closing flow between said inlet and outlet, said piston being guided in a cylinder that is open at the bottom thereof to the inlet and having a closed top, said valve further including a pilot valve having an inlet chamber to control flow between the cylinder above the piston and the outlet, the improvement that comprises a sealing ring around the piston in sealing engagement with the cylinder, a first port in the wall of the cylinder directly communicating the cylinder with said inlet chamber of the pilot valve, a second port in said wall extending between the cylinder, at a point below where the first port enters said cylinder, to said inlet chamber of the pilot valve, said sealing ring, when the piston is raised, sealing between the ports, and, when the piston is lowered, sealing the second port against direct flow from the valve inlet, and a smaller metering port communicating the valve inlet and the cylinder above the piston, to provide a slow by-pass from the inlet around the piston-sealing ring into

5

the cylinder above the piston to provide piston-closing pressure thereon.

4. In a flushing valve according to claim 3, the metering port being provided in the cylinder wall and extending into communication with the first and second ports.

5. In a flushing valve according to claim 3, the metering port extending through the piston.

6. A flushing valve according to claim 3 in which a passage connecting the mentioned three ports is provided in the cylinder wall, thereby providing a by-pass flow around the sealing ring of the piston during all positions of the latter.

5

10

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