

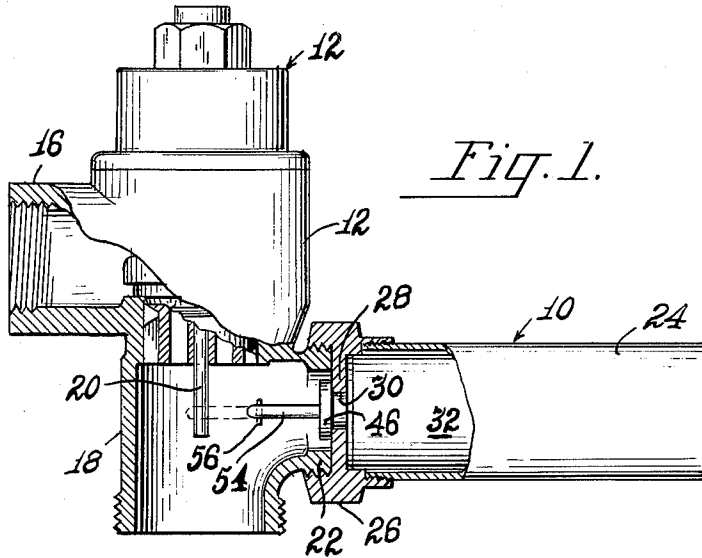
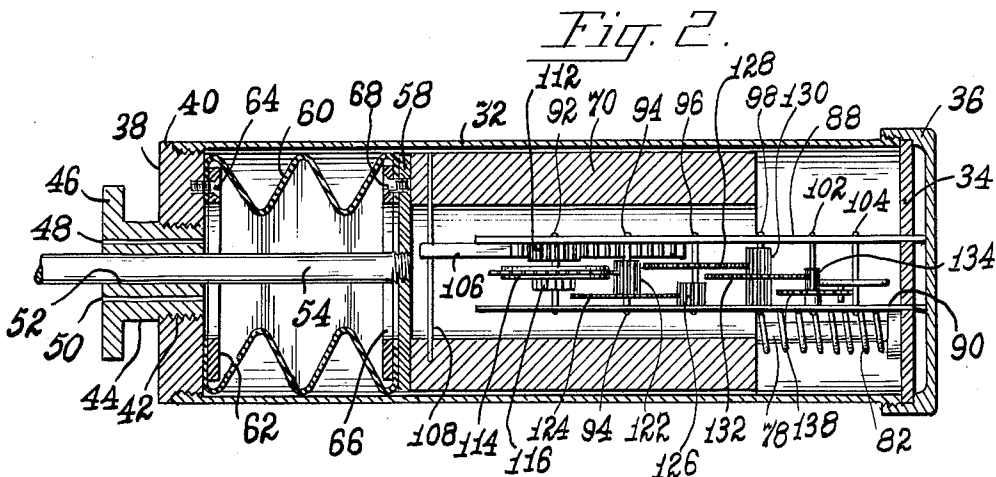
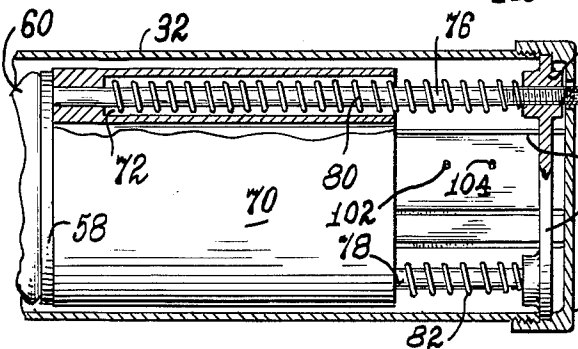
July 24, 1962

G. R. WHITNEY
ACTUATING DEVICE

3,045,698

Filed Dec. 8, 1958

2 Sheets-Sheet 1



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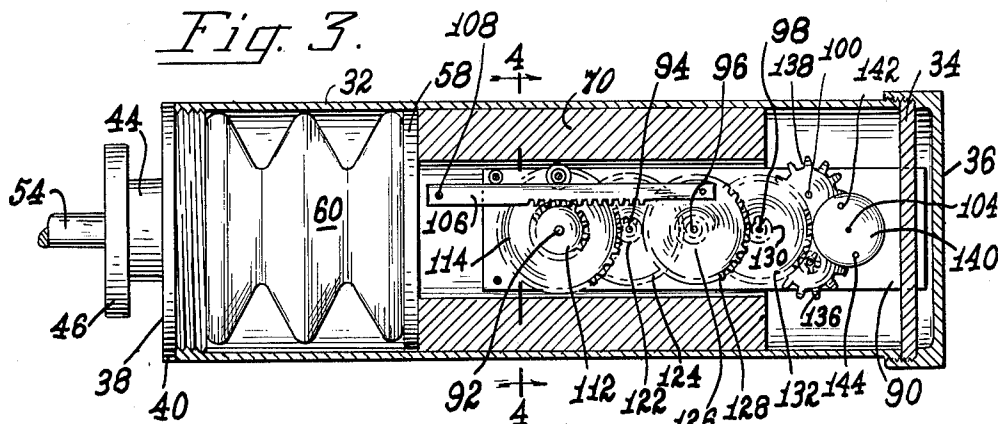
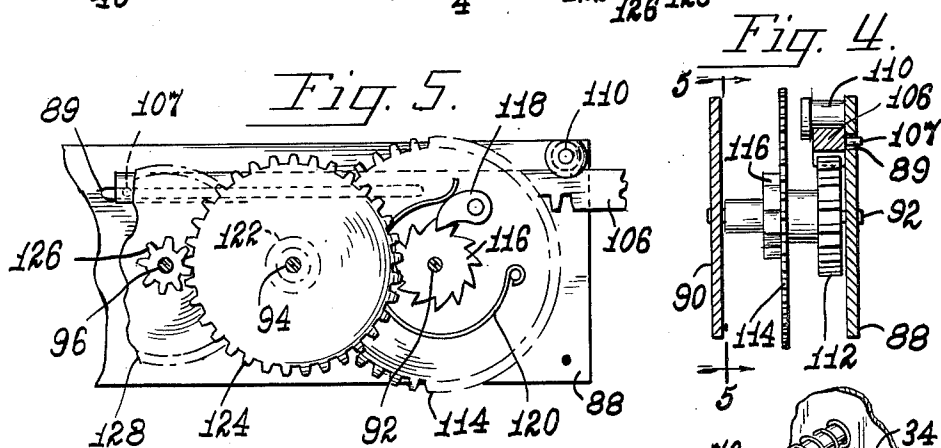
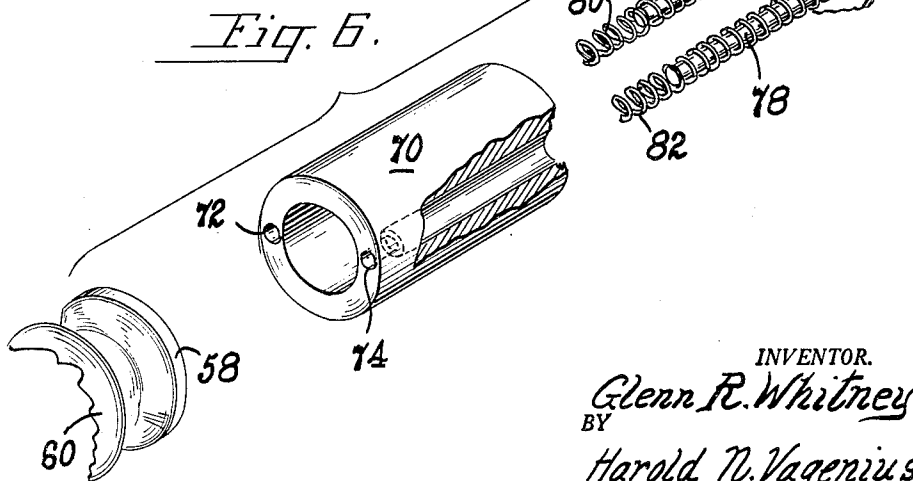
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ACTUATING DEVICE

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7 Claims. (Cl. 137-624.14)

This invention relates to means for automatically actuating or operating a valve or other device at predetermined time intervals. The means of the present invention are particularly well adapted for operating flush valves of the type commonly used in urinals.

The means of the present invention include a spring hammer which, when released, by its impact opens a valve or otherwise actuates a device to be operated; bellows or other means whereby the spring pressing against the hammer is compressed through the action of water pressure; and timing means, such as an escapement, for at predetermined time intervals triggering the release of said spring pressed hammer.

Other and further features of the present invention will become apparent from the following description and appended claims as illustrated by the accompanying drawings which show, by way of an example, a device according to the present invention, and in which drawings:

FIGURE 1 is a side elevation, with parts broken away to show other parts in side elevation or in central longitudinal section, of a device according to the present invention as mounted on a conventional flush valve of the type used in urinals for operating said flush valve;

FIGURE 2 is an enlarged fragmentary horizontal longitudinal cross sectional view, with parts shown in plan view, and illustrates the device of FIGURE 1 as reset for operating the flush valve;

FIGURE 3 is a fragmentary vertical longitudinal cross sectional view, with parts shown in elevation;

FIGURE 4 is a fragmentary cross sectional view taken along the line 4-4 of FIGURE 3, with parts shown in end elevation;

FIGURE 5 is a fragmentary cross sectional view taken along the line 5-5 of FIGURE 4;

FIGURE 6 is a fragmentary exploded perspective view of parts also illustrated in FIGURE 2; and

FIGURE 7 is a fragmentary longitudinal cross sectional view showing means for adjusting the stroke of the above noted hammer.

Referring now to FIGURE 1, there is shown a device according to the present invention indicated generally at 10 and mounted on a flush valve indicated generally at 12. This flush valve includes a vertically extending housing 14, a transverse inlet conduit 16, and a depending vertical outlet conduit 18. The valve 12 is of conventional construction and is operated by swinging displacement of a rod 20 depending into the outlet conduit 18. The valve mechanism operated by the rod 20 is disposed in the housing 14 above the outlet conduit 18 and to the right of the inlet conduit 16. For providing access to the rod 20, the wall of the outlet conduit 18 is formed with a circular opening surrounded by an externally threaded flange 22. Since the construction of such a flush valve is well known, there is no need to describe the valve in detail.

The actuating device 10 further includes a tubular inner casing 32 open at both ends and threaded internally at its left end, externally at its right end, as viewed in FIGURE 2. The right end is closed by a circular disk 34 resting on the end of the casing 32 and held in place of an internally threaded cap 36 screwed onto this end of the casing 32. The left end of the casing 32 is closed by a plug 38 externally threaded to be screwed into the left casing end and formed with an end flange 40 overlying the left end of the casing 32 and flush with the surface of the latter, as shown in FIGURE 2. The plug 38 is

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pierced by a central threaded aperture 42 which holds one end of an externally threaded cylinder 44 the other end of which projects through the aperture 30 defined by the flange 28 of the coupling nut 26 and is formed with a peripheral terminal flange 46 overlying the flange 28. Thus, as the cylinder 44 is screwed into the aperture 42, the flange 28 is clamped between the plug 38 and the flange 46, to hold the casing 32 (which is threaded onto the plug 38) rigidly in the position shown in FIGURE 1.

The cylinder 44 is pierced by two narrow channels 48 and 50 which permit flow of water between the inlet conduit 18 of the valve and the interior of the casing 32. The cylinder 44 is further formed with a central aperture 52 which slidably receives a rod 54 adapted to engage the valve rod 20 to operate the valve 12. The free end of the rod 54 (the left end, as viewed in FIGURES 1 and 2) may be pierced by a transverse pin 56 serving to prevent retraction of the rod 54 too far into the casing 32. The other end of the rod 54 is screwed into a plate 58 slidably and transversely disposed within the casing 32. A bellows 60 extends between the plug 38 and the plate 58, being fixed at the left end to the plug 38 by means of a ring 62 and screws 64 and at the right end to the plate 58 by means of a ring 66 and screws 68.

Water admitted through the passages 48 and 50 enters the bellows 60. However, the rings 62 and 66 compress the ends of the bellows, respectively, against the plug 38 and the plate 58, to form tight seals, so that the water pressure expands the bellows whereby the plate is pushed further into the casing 32 and the rod 54 is retracted from the valve operating rod 20.

To the right of the plate 58, as illustrated in FIGURES 2 and 3, a tubular hammer 70 having heavy walls is slidably disposed within the casing 32. Two longitudinal channels 72 and 74 are formed within the hammer 70 and have respectively, rods 76 and 78 disposed therein. These rods are thinner than the width of the channels 72 and 74 to accommodate helical springs 80 and 82 disposed around the rods 76 and 78. The channels 72 and 74 have their left ends constricted (as shown in FIGURE 6) to provide shoulders against which the left ends of the springs 80 and 82 may bear, while still permitting sliding movement with respect to the rods 76 and 78. These left ends of the rods thus may contact the plate 58 and serve to limit the movement (to the right, as viewed in FIGURES 2 and 3) under the influence of the expanded bellows 60. Both rods 76 and 78 have their right ends fixed to the closure plate 34 of the casing 32 against which the right ends of the springs 80 and 82 bear. Thus, as the plate 58 is moved to the right by the expanding bellows 60, the hammer 70 is likewise moved to the right, thereby compressing or loading the springs 80 and 82. For adjusting the extent of such movement of the plate 58, the rod 76 may have its right end attached to the plate 34 by being screwed thereinto, and a knob 84 may on the right face of the plate 34 may be provided in alignment with this rod, so that an internally threaded aperture for receiving the threaded end of the rod 76 whereby the position of the latter may be varied within fairly broad limits. For rotating the rod 76 to adjust its position, the end of the rod 76 may be formed with spaced holes 86 for receiving the spanner tool.

Within the central space of the hammer 70 two parallel rails or plates 88 and 90 extend short of the left ends of the rods 76 and 78, and with their right ends rigidly attached to the plate 34. Seven shafts 92, 94, 96, 98, 100, 102 and 104 extend between the rails 88 and 90, with their ends journaled therein. Together with gear wheels and other parts described hereinbelow, these shafts form an escapement cooperating with a rack bar 106 having one end fixed to a pin 108 extending across the interior of the hammer 70 adjacently the plate 58.

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The rack bar 106 is guided by a flanged roller 110 rotatably supported from the rail 88 above the bar 106 to engage the flat upper side of the latter and by a pin 107 extending from the rack bar and slidable in a slot 89 in the rail 88. The lower side of the bar 88 having the gear teeth engages a pinion 112 fixedly mounted on the shaft 92. The latter also carries thereon gear wheels 114 and 116 which are respectively, rotatably and fixedly mounted thereon. A pawl 118 mounted on the wheel 114 is pressed by a spring 120 also mounted on the wheel 114 into engagement with the teeth of the wheel 116. As shown in FIGURE 5, the pawl 118 will ride over the teeth of the wheel 116 when the hammer 70 is moved to the left under the influence of the expanding bellows 60, without rotating the wheel 116. However, movement of the bar 106 in the opposite direction will cause the pawl 118 to engage the teeth of the wheel 116 so that any movement to the right (as shown in FIGURE 5) will lock the wheels 114 and 116 together whereby these wheels and also the pinion 112 will rotate as a unit.

The shafts 94, 96 and 98 have fixedly mounted thereon, respectively, a pinion 122 engaging the wheel 114 and a gear wheel 124 (shaft 94), a pinion 126 engaging the wheel 124 and a gear wheel 128 (shaft 96) and a pinion 130 engaging the gear wheel 128 and a pinion 132. The shaft 102 carries fixedly thereon a pinion 134 engaging the gear wheel 132 and also a gear wheel 136. The shaft 100 carries fixedly a gear wheel 138 of the same size as the gear wheel 136. The shaft 104 has a round disk 140 affixed thereto carrying thereon at diametrically opposite points transversely projecting pins 142 and 144. These pins are adapted to engage, respectively, the gear wheels 136 and 138.

It will be understood that when the expanding bellows 60 has pushed the hammer 70 and thereby also the bar 106 to the right (as shown in FIGURE 3), the springs 76 and 78 will then urge the hammer 70 to the left. However, leftward movement of the hammer 70 is permitted to take place only slowly, since the rack bar 106 engages the pinion 112 which then moves as a unit with the gear wheels 114 and 116. Further, the gear ratios of the gear train 112, 114, 122, 124, 126, 128, 130, 132, 134 and 136 are such that the rate of rotation of the pinion 112 is much less than that of the gear 136. As the hammer 70 is urged to the left (as shown in FIGURE 3), the shaft 104 is caused to rock, and the pins 142 and 144 alternately engage, respectively, the gear wheels 136 and 138, to permit slow intermittent rotation of the gear 136. As such intermittent rotation of the gear 136 is transmitted through the above noted gear train to the pinion 112, to cause still slower rotation of the gear 112, the rack bar 106 is gradually permitted to move to the left (as shown in FIGURE 3), under the influence of the springs 76 and 78. The rack bar 106 is suddenly released for rapid movement to the left (as shown in FIGURE 3), when the last gear tooth to the right has moved out of engagement with the pinion 112. The hammer 70 then moves rapidly to the left. The rod 54 strikes against the operating rod 20 of the valve 12 to open the latter whereby water is caused to flow through the outlet conduit 18. Some of this water is admitted through the passages 48 and 50 into the bellows 60, to expand the latter, whereby the hammer 70 is caused to be retracted to the position shown in FIGURES 3 and 5, as explained hereinabove.

Thus, as explained hereinabove, the present valve actuating device includes a casing opening into a valve outlet conduit into which a valve operating rod projects. A bellows within this casing has one closed end and another open end sealed to the casing opening so that water entering the casing from the valve outlet will be confined to the bellows interior. A hammer is associated with the closed end of said bellows within the casing. When water is admitted from the valve outlet conduit into the

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bellows, as when an impact of the hammer has opened the valve, the bellows is expanded and the hammer is pushed away from the valve to be operated. A spring is compressed by this movement of the hammer and thereafter urges the hammer toward its original position. Further, the same movement of the hammer away from the valve places the latter in a closed position, so that water no longer flows through the outlet conduit. However, returning movement of the hammer is permitted, over a first portion of the return path, only at a slow rate, by provision of an escapement which nevertheless releases the hammer for rapid movement over the last portion of the return path so that the hammer, when released by the escapement, will jump across the last portion of the return path to strike a blow or impact against the valve operating rod to actuate the valve. Then, as mentioned hereinabove, water entering the bellows (which have been collapsed and emptied of water on return movement of the hammer) will expand the bellows and cause the hammer to be retracted or reset, the spring again being compressed.

The time lapse between resetting of the hammer and the next subsequent valve operating hammer impact is determined by the gear ratios of the escapement. These gear ratios may be set as desired, for instance, for a 20 minute interval. Further adjustment may be effected by restricting retraction of the hammer, thus shortening the return stroke of the hammer.

The device of the present invention is suitable for use wherever a valve or the like is to be operated intermittently at predetermined intervals, for instance, urinal flush valves. The device of the present invention is characterized by one specific advantage highly desirable for this purpose, namely, ability to open a valve against water pressures ranging all the way from 15 to 150 or more pounds per square inch.

Many details of construction may be varied without departing from the principles of this invention. It is therefore not my intention to limit the patent granted on this invention otherwise than necessitated by the scope of the appended claims.

I claim:

1. A valve assembly having an inlet, an outlet and a valve closure element actuator projecting into said outlet and serving to open said valve closure element when displaced from a predetermined position, said assembly comprising a collapsible bellows arranged to communicate with said outlet, means projecting into said outlet for displacing said actuator, a spring compressible by the opening of said bellows from collapsed condition, means actuated by said spring when compressed to collapse said bellows and to operate said actuator displacing means, and an escapement for regulating the rate of action of said spring.

2. A valve assembly having an inlet, an outlet and a valve closure element actuator projecting into said outlet and serving to open said valve closure element when displaced from a predetermined position, said assembly comprising an elongated casing having one end attached to said valve outlet, said casing end being apertured to provide communication with said outlet, a bellows in said casing having one end closed and the other end encompassing the said casing aperture, a member movable within said bellows and projecting into said outlet when said bellows is collapsed for displacing said valve closure element actuator to open said valve, a spring compressible by the opening of said bellows from collapsed condition, means actuated by said spring when compressed to collapse said bellows and to move said member for displacing said valve actuator, and an escapement for regulating the rate of action of said spring.

3. A valve assembly having an inlet, an outlet and a valve closure element actuator projecting into said outlet and serving to open said valve closure element when

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displaced from a predetermined position, said assembly comprising an elongated casing having one end attached to said valve outlet, a web closing said one casing end except for an aperture through said web, a collapsible bellows in said casing having one closed end and another end encompassing said web aperture, a rod extending axially within said bellows and adapted to project into said outlet for displacing said valve actuator, a tubular guide for said rod extending through said web, a spring compressible by the opening of said bellows from collapsed condition, means actuated by said spring when compressed to collapse said bellows and to move said rod for displacing said valve actuator, and an escapement for regulating the rate of action of said spring.

4. A device for operating a valve or the like comprising an elongated casing apertured at one end, a bellows within said casing encompassing said casing aperture, a hammer within said casing displaceable by the expansion of said bellows, a spring within said casing operative to displace said hammer and compressible by expansion of said bellows, and means for regulating the expansion of said spring after compression thereof.

5. A device according to claim 4 in which said regulating means releases said spring before the expansion of said spring has been completed.

6. A device according to claim 4 further comprising means for adjusting the length of the displacement stroke of said hammer.

7. A device for operating a valve or the like comprising an elongated casing apertured at one end, a bellows within said casing encompassing said casing aperture, a tubular hammer within and guided by said casing for axial movement therein, said bellows having a closed

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end adjacent said hammer for displacement thereof on expansion of said bellows, a rod extending within said bellows with one end attached to the closed bellows end and the other end extending through said casing aperture, spring means within said casing urging said hammer toward said casing aperture, and an escapement supported within said casing in fixed position and projecting within said hammer, said escapement including a train of gears and a rack bar extending within said hammer and having one end affixed thereto, the gearing on said rack bar being of such length as to be released from engagement with said gear train before expansion of said spring has been completed, said hammer then being free to move toward said casing aperture over a substantial distance to impact forcibly against said closed bellows end whereby said rod is suddenly and forcibly displaced outwardly through said casing aperture for valve operating purposes, said device being capable of being reset for repeated valve operation by admission of fluid under pressure through said apertured casing end into said bellows to expand said bellows.

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