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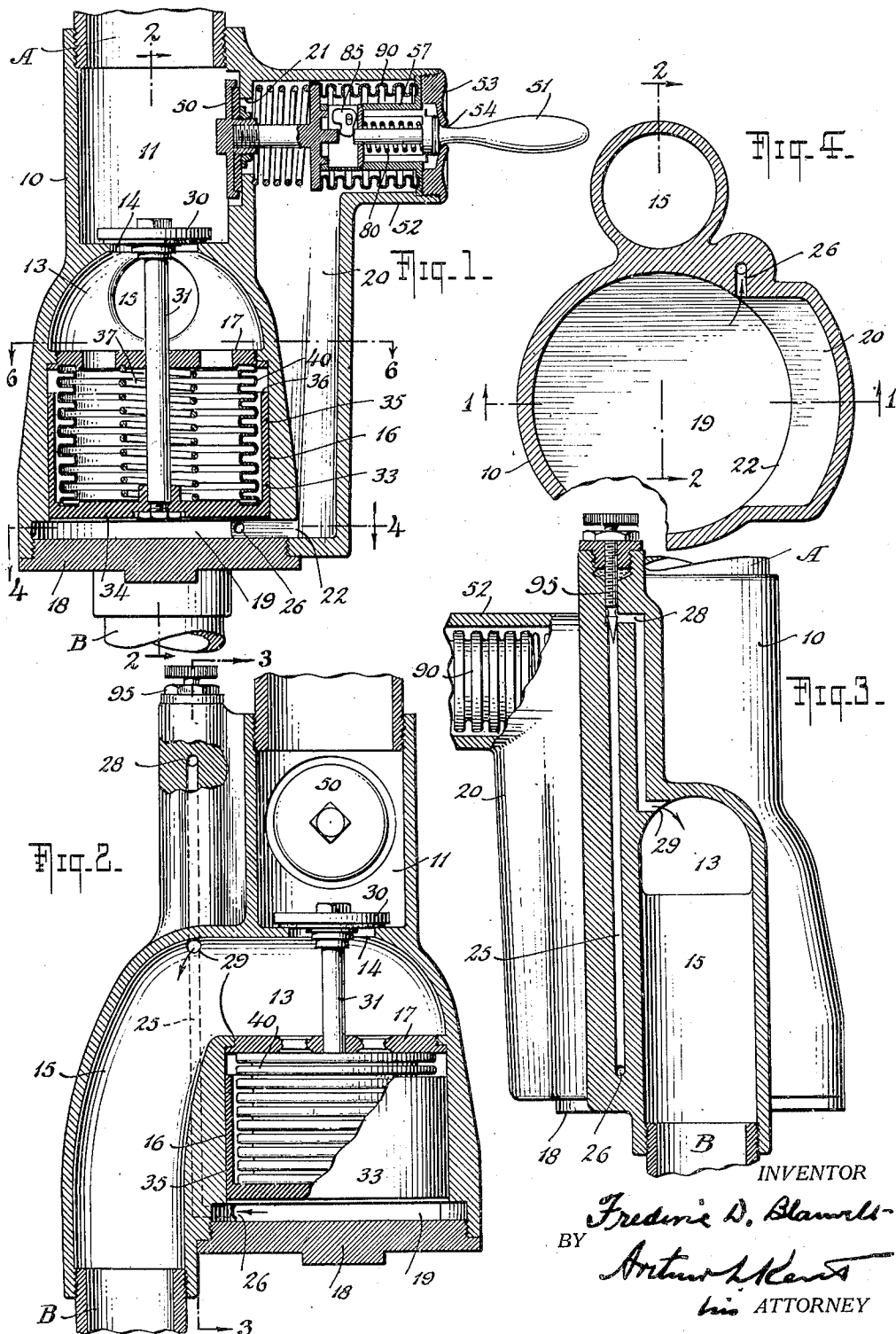
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F. D. BLAUVELT

FLUSHOMETER

Filed Nov. 23, 1922

2 Sheets-Sheet 1



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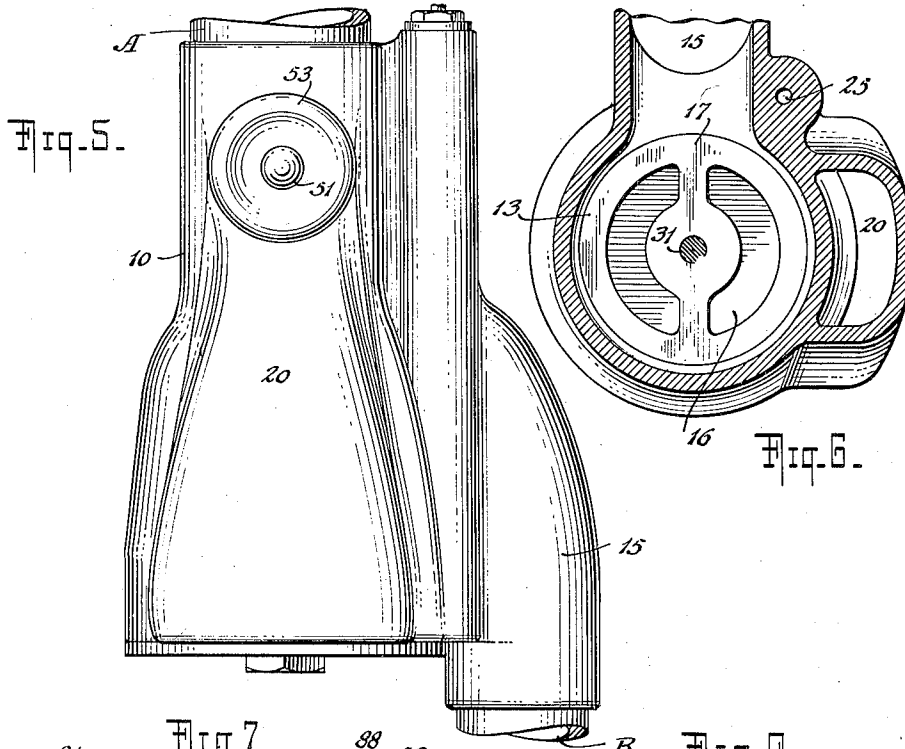
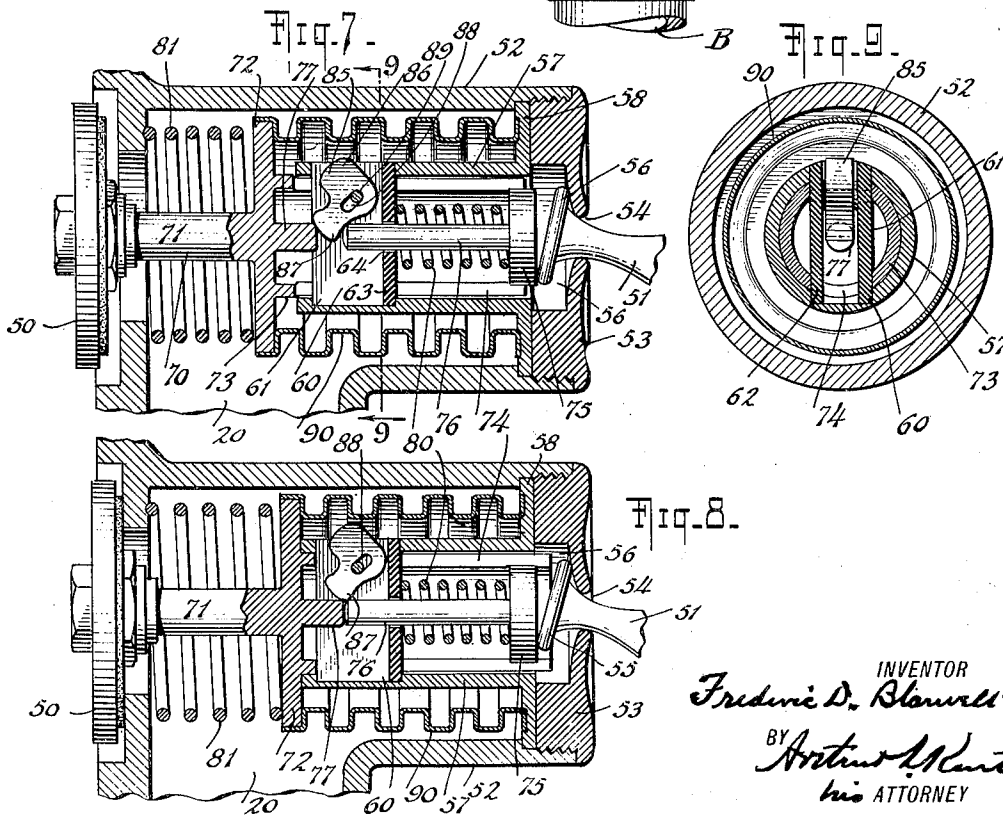
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Patented July 20, 1926.

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UNITED STATES PATENT OFFICE.

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FLUSHOMETER.

Application filed November 23, 1922. Serial No. 602,711.

This invention relates to flushometers or automatic flushing devices for sanitary and other purposes. A flushometer of the type to which the invention relates contains a main valve which is opened by liquid-actuated means. To open the valve, liquid is admitted to the opening means through a by-pass controlled by a manually operated valve. The liquid thus admitted is forced to find its way out through a constricted passage or opening, so that the closing of the main valve is delayed.

The present invention aims to provide an improved device of this character in which the main valve is opened very rapidly but without shock, and in which the amount of liquid which passes through the valve on each opening may be accurately predetermined and remains unchanged regardless of the manipulation of the handle operating the by-pass valve.

In an approved device embodying the invention, the by-pass by which the liquid is introduced into the opening means is of large cross-section and is maintained constantly full of water, so that the main valve is opened practically instantaneously upon the opening of a valve at the entrance to the by-pass. This by-pass valve is opened by a handle working through intermediate mechanism which insures the immediate closing of the by-pass valve regardless of the manner in which the handle is manipulated. The device contains no packings, but all leakage is positively prevented by flexible diaphragms of extruded metal.

Other objects and features of the invention are hereinafter described in connection with a detailed description of a flushometer embodying the invention, which is illustrated in the accompanying drawings, in which:

Fig. 1 is a central vertical section of the flushometer taken on the line 1—1 of Fig. 4;

Fig. 2 is a central vertical section of the flushometer taken on the lines 2—2 of Figs. 1 and 2;

Fig. 3 is a side elevation of the flushometer looking from the discharge side and sectioned on the line 3—3 of Fig. 2;

Fig. 4 is a horizontal section on the line 4—4 of Fig. 1;

Fig. 5 is a side elevation looking toward the entrance by-pass;

Fig. 6 is a horizontal section on the line 6—6 of Fig. 1;

Fig. 7 is an enlarged axial section of the mechanism for operating the by-pass entrance valve, showing this valve in open position;

Fig. 8 is a similar view showing the valve in closed position; and

Fig. 9 is a transverse section on the line 9—9 of Fig. 6.

The body 10 of the flushometer shown in the drawings may be made of a single casting. It provides an entrance chamber 11 to the upper end of which is connected the liquid supply conduit A; a center chamber 13 located below the entrance chamber 11 and connected with it by an opening 14, and communicating through a side opening with a passage 15, to the lower end of which the discharge conduit B is connected; and a cylindrical chamber 16 located below the center chamber 13 and separated from it by a bridged bushing 17 and having its bottom closed by a plug or cylinder head 18. As hereinafter explained, the main valve of the device controls the opening 14 so that the chamber 11 forms the entrance passage through which liquid is brought to the valve, while the central chamber 13 and the passage 15 together form the discharge passage by which liquid is conducted away from the valve. The cylinder 16 may have at its lower end a short portion 19 whose diameter is greater than that of the rest of the cylinder. This permits making the hole in which plug 18 is screwed large enough to facilitate the insertion of the bridged bushing 17 when the device is assembled. The body 10 also provides a by-pass passage 20 leading from an opening 21 at one side of the entrance chamber 11 to a side opening 22 in the lower portion 19 of the cylinder 16. The cross-section of the by-pass 20 is as large as that of the opening 14 and of the discharge conduit 15, and substantially uniform throughout its length. The opening 21 between the entrance chamber 11 and the by-pass passage 20 is less in area than the cross-section of the by-pass. The opening 22 which connects the lower end of the by-pass 20 with the cylinder extends around nearly one-third of the circumference of the cylinder, and has a cross-sectional area as large as that of the by-pass. The body 10 provides, also, an escapement passage 25 of small cross-section which leads from an opening 26 communicating with the lower portion 19 of the cylinder 16, upwardly to a point 28 on a level

with the upper end of the by-pass 20, and then downwardly to an opening 29 into the discharge passage 15.

The opening 14 between the entrance chamber 11 and the center chamber 13 is controlled by a main valve 30 mounted on a stem 31 which extends through the bridged bushing 17 into the cylinder 16 and is connected at its lower end to a piston or plunger 33 located in the cylinder 16. This piston 33 comprises a disc-shaped portion 34 and a cylindrical flange 35. The engagement of the upper end 36 of this flange with the bushing 17 limits the upward movement of the piston and valve. The piston is urged toward the position shown in Fig. 1, and the valve 30 is urged toward closed position, by a compression spring 37.

The flange 35 of the piston 33 fits loosely in the cylinder 16 so as to permit free movement of the piston without lubrication. The passage of water between the portion of the cylinder 16 below the piston and the portion of the cylinder 16 above the piston, which is in communication with the center chamber 13 through the openings of the bridged bushing 17 is prevented by a corrugated cylindrical diaphragm 40 of extruded metal. The upper end of this diaphragm is secured to the bushing 17 while its lower end is secured to the disc portion 34 of the piston near the periphery thereof. This diaphragm is so flexible that it does not materially retard longitudinal movements of the piston in the cylinder, although its resiliency tends to assist the spring 37 in urging the piston and the valve 30 downward.

The opening 21 at the entrance end of the by-pass 20 is controlled by a valve 50. This valve is manually actuated by means of a handle 51 and connecting mechanism between the handle and the valve which provides for an immediate closing of the valve after each opening, regardless of the manner in which the handle is manipulated. This connecting mechanism is located in a cylindrical extension 52 of the body 10, the outer end of which is closed by a plug 53 containing a central hole 54 through which the handle 51 projects. On the inner end of the handle 51 is a disc 55 which lies in the central recess 56 formed on the inner side of the plug 53. A fixed sleeve 57 projects inwardly from the plug 53. This sleeve is provided at its outer end with an external flange 58 which is retained in the outer end of the cylindrical extension 52 by the plug 53. A transverse member 60 is fixed in the sleeve 57 and extends diametrically across it near its outer end. This transverse member has two side walls 61, 62 and an end wall 63 containing a central hole 64.

The valve stem 70 on which the by-pass valve 50 is mounted is formed to provide

a rod 71, a disc 72, a sleeve 73, and a central stud 77 within the sleeve. The sleeve 73 fits within the fixed sleeve 57. The sleeve 73 is provided with opposite longitudinal slots 74 which fit around the transverse member 60. Fitting within the sleeve 73 is a disc shaped plunger 75 mounted on a pin 76 which extends through the hole 64 in the end wall 63 of the transverse member 60. A compression spring 80 reacts between the plunger 75 and the wall 64, and a compression spring 81 reacts between the disc 72 of the valve stem and the inner wall of the by-pass 20.

Movements of the pin 76 are transferred to the valve stem through a bell crank lever 85. The bell crank lever 85 is provided with a weight arm 86, an operating arm 87 and a slot 88 which extends in the direction of the operating arm. By means of this slot the lever is mounted within the transverse member 60 on a pin 89 which extends between the side walls 61, 62 of the transverse member.

In the normal position of this connecting mechanism, the valve 50 is closed and the various parts of the valve stem 70 occupy the positions illustrated in Fig. 1; while the plunger 75 is pressed against the disc 55 of the handle 51 and retains the handle in axial position as shown in Fig. 1. When the parts are in this normal position, there is sufficient space between the inner end of the pin 76 and the end of the central stud 77 to permit the operating arm 87 of the bell crank lever 85 to lie between them. The lever in consequence occupies the position shown in Fig. 1. To open the valve 50, it suffices to tip the handle 51 in any direction. This causes one edge of the disc 55 to press the plunger 75 inward against the force of the compression spring 80. The inward movement thus given to the pin 76 is transferred through the operating arm 87 of the bell crank lever 85 to the central stud 77 of the valve stem 70, so that the whole valve stem is moved inwardly against the force of the spring 81 and the valve 50 is unseated. During the inward movement of the pin 76 the bell crank lever 85 is swung about its pivot pin 89 until it reaches the position shown in Fig. 7. The operating arm 87 of the lever then slips out from between the pin 76 and the central stud 77, permitting the spring 81 to move the entire valve stem and valve to close the valve. The valve, therefore, is closed immediately even though the handle 51 is held at one side for some time. If the handle is thus held, the closing movement of the valve stem forces the lever 85 upwardly to the position shown in Fig. 8. The slot 88 in the lever provides for such upward movement. When the handle is then released, the spring 80 moves the plunger 75 and the pin 76 outwardly to their normal positions, allowing the lever 85

to drop back from its raised position shown in Fig. 8 to its normal position in which its operating arm 87 lies between the pin 76 and the central stud 77, as shown in Fig. 1.

To keep the operative parts of the connecting mechanism dry and to prevent any leakage of water through the central hole 54 of the plug 53, a corrugated cylindrical diaphragm 90 is provided. This diaphragm is made of extruded metal and is similar to the diaphragm 40 which has already been described. It is secured at its inner end to the disc 72 of the valve stem 70 and at its outer end to the flange 58 of the fixed sleeve 57.

A needle valve 95 of ordinary construction is provided to control the rate of flow of liquid in the escapement passage 25.

The operation of the flushometer which has been described is as follows: The liquid which is supplied through the entrance conduit A fills the entrance chamber 11, and, after the first opening of the by-pass valve 50, the by-pass 20 and the lower portion 19 of the cylinder 16 are maintained full of liquid. This is because the escapement passage 25 which is the only means of escape for liquid in the by-pass 20 and the cylinder 16 is at one point 28 at the level of the upper end of the by-pass 20.

To actuate the flushometer, the handle 51 is moved in any direction. This, as already explained, results in the opening and immediate closing of the by-pass valve 50. The instant that the by-pass valve 50 opens, the full pressure of the liquid in the entrance conduit A is applied to the lower surface of the piston 33. As this surface has a larger area than the valve 30 to which the pressure of the liquid is also applied, the piston is raised opening the valve 30. The initial upward movement of the piston is very rapid owing to the large cross-section of the by-pass 20. As, however, the space between the valve 50 and the periphery of the opening 21 is of much smaller cross-section than that of the by-pass, the final movement of the piston is less rapid than its initial movement, so that the flange 35 of the piston is not brought against the bushing 17 with sufficient force to jar the apparatus. The piston, however, completes its upward movement before the valve 50 closes. When the piston is thus raised and the valve 30 opened, the liquid from the entrance chamber rushes into the center chamber 13 and out through the discharge conduit 15 to the sanitary or other apparatus to be flushed.

As soon as the valve 50 closes, the piston 33 starts to descend under the force of the spring 37. In the downward movement of the piston the liquid in the cylinder 16 below the piston is forced out through the escapement passage 25 into the discharge conduit 15. By adjustment of the needle valve 95 in this passage the time required for the

descent of the piston and the closing of the valve 30 may be nicely adjusted.

The amount of liquid which passes through the main valve 30 each time that the flushometer is actuated depends upon the length of time that this valve remains open and the pressure of the liquid supplied through the entrance conduit A. By adjusting the needle valve 95 in accordance with the pressure at which the liquid is introduced into the flushometer, the amount of liquid which passes through the main valve each time the handle 51 is moved may be accurately predetermined.

It should be clearly understood that my invention is by no means limited to the particular embodiment of it which has been illustrated and described, and that while the various features of my flushometer may most advantageously be used in combination so as to form a unitary device such as that illustrated, it is nevertheless true that certain of these features may under some circumstances advantageously be used independently of the others and that such features in themselves constitute a part of my invention.

What is claimed is:

1. In a flushometer, a body providing a cylinder, an entrance passage at the upper end of the cylinder and coaxial therewith, a discharge passage, a by-pass having a cross-section substantially equal to that of the discharge passage and leading from the entrance passage to the lower end of the cylinder and lying against one side of the entrance passage and the cylinder so that its inner wall is formed by a part of the wall of the entrance passage and the cylinder, and an escapement passage leading upwardly from the lower end of the cylinder and communicating with the discharge passage.

2. In a flushometer, a body providing an entrance passage, a discharge passage, and an opening connecting said passages, a cylinder, a by-pass passage leading from said entrance passage to the lower end of said cylinder and having a cross-sectional area substantially equal to that of the discharge passage, an opening between the entrance passage and the by-pass passage having a cross-sectional area less than that of the by-pass passage, and an opening between the by-pass passage and the cylinder having a cross-sectional area substantially equal to that of the by-pass passage.

3. In a flushometer, the combination of a main valve and liquid actuated means for opening said valve comprising a cylinder, a piston having a cylindrical periphery fitting loosely against the inner wall of said cylinder, a connection between said piston and the main valve, means for admitting liquid to said cylinder at one side of said piston, means for permitting the escape of

liquid from said cylinder at said side of said piston, and a corrugated cylindrical diaphragm in said cylinder at the other side of the piston and secured at one end to said piston and at its other end to the wall of said cylinder beyond the travel of said piston.

4. In a flushometer, the combination of a main valve and liquid actuated means for opening said valve comprising a cylinder, a flange projecting inwardly from the wall of said cylinder, a piston in said cylinder connected to said valve and having a disc-shaped portion and a cylindrical flange extending toward the flange of the cylinder and fitting loosely against the inner wall of the cylinder, and a corrugated cylindrical diaphragm lying within said cylindrical flange having one of its ends secured to the disc shaped portion of the piston and its other end secured to said internal flange of the cylinder.

5. In a flushometer having a main valve, an entrance passage to conduct liquid to said valve, a discharge passage to conduct liquid away from said valve, a liquid-actuated means for opening said valve, and a by-pass passage leading from said entrance passage to said opening means, the combination of a valve controlling said by-pass, means for retaining said valve normally closed, manual means for opening said valve, and means directly actuated by said manual means immediately after the opening of said valve to disconnect said valve from said manual means to permit the immediate closing of the valve.

6. In a flushometer having a main valve, an entrance passage to conduct liquid to said valve, a discharge passage to conduct

liquid away from said valve, a liquid-actuated means for opening said valve, and a by-pass passage leading from said entrance passage to said opening means, the combination of a valve controlling said by-pass, means for retaining said valve normally closed, a manually moved actuating member having a limited reciprocatory movement, means actuated by movement of said handle in one direction to open said valve, and means actuated by a slight further movement of said member in the same direction to disconnect the valve from the handle so as to permit the valve to close without reversed movement of the handle.

7. In a flushometer having a main valve, an entrance passage to conduct liquid to said valve, a discharge passage to conduct liquid away from said valve, a liquid-actuated means for opening said valve, and a by-pass passage leading from said entrance passage to said opening means, the combination of a valve controlling said by-pass, and operating mechanism for said valve, comprising a stem on which the valve is mounted, a manually moved actuating member, a spring adapted to urge said valve stem toward said member, a spring adapted to urge said member away from said valve stem, and a pivoted lever having an arm normally extending between said member and said valve stem and adapted to remain between them during an initial movement of the member toward the valve stem and to swing out from between them during the final movement of the member in said direction.

In testimony whereof I have hereunto set my hand.

FREDERIC D. BLAUVELT.