F. H. MASON, DEC'D.

M. H. MASON, C. A. BARTLESON & R. R. GILL, EXECUTORS.

VALVE.

APPLICATION FILED APR. 28, 1913.

1,146,012.

Patented July 13, 1915.

4 SHEETS—SHEET 1.

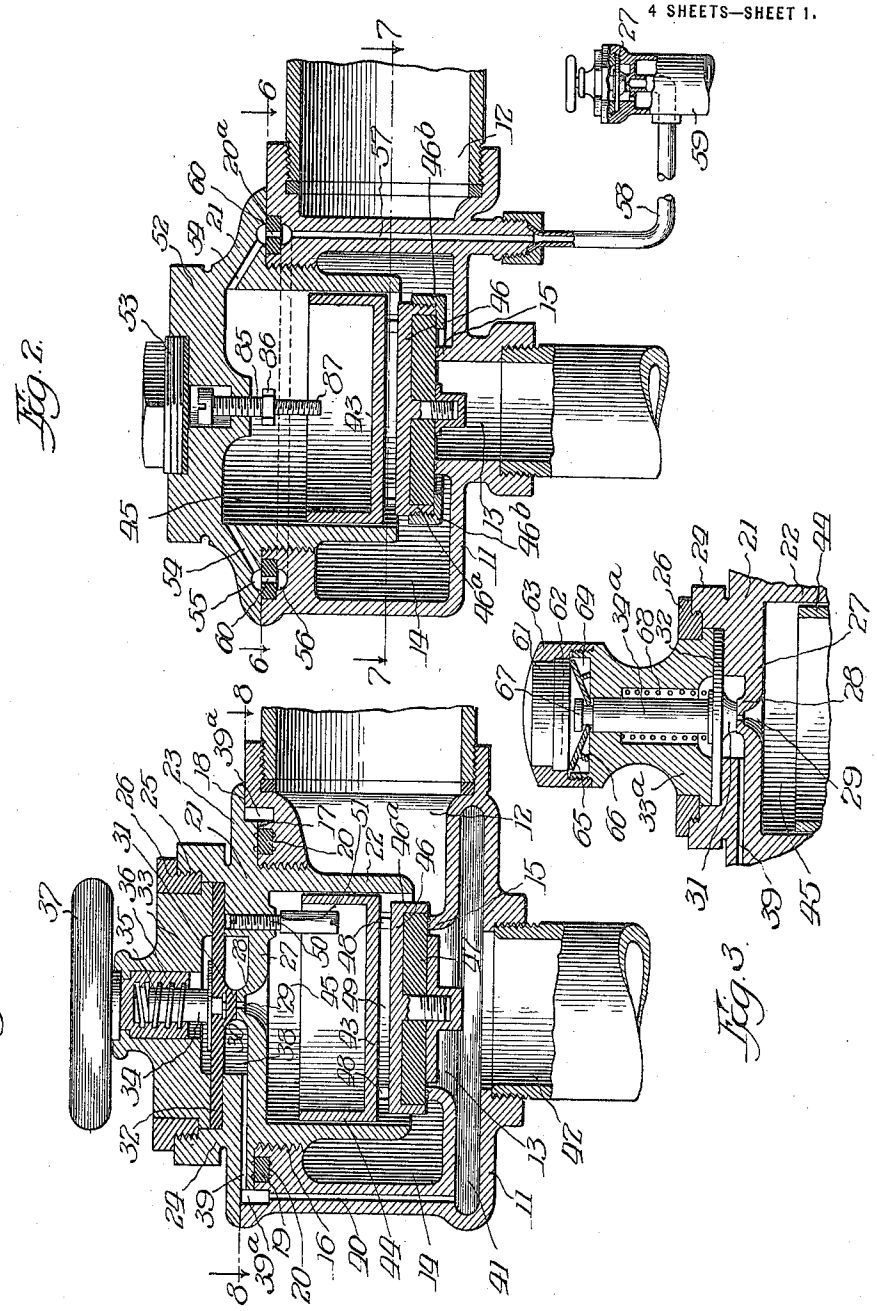


Fig. 1

Fig. 2

Fig. 3

Witnesses:

Geo. C. Purion

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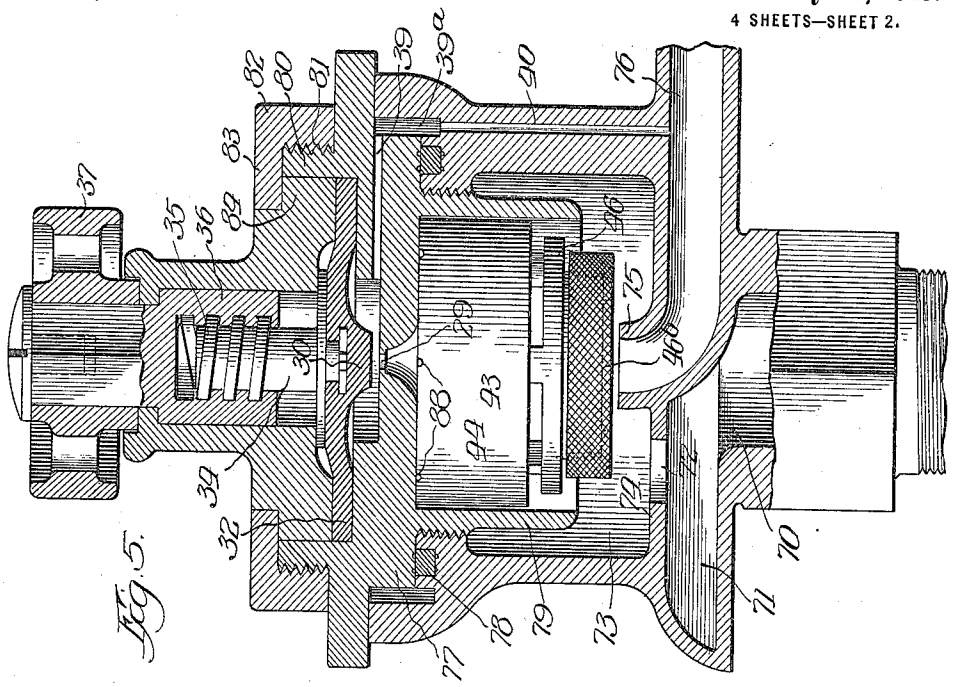


Fig. 5.

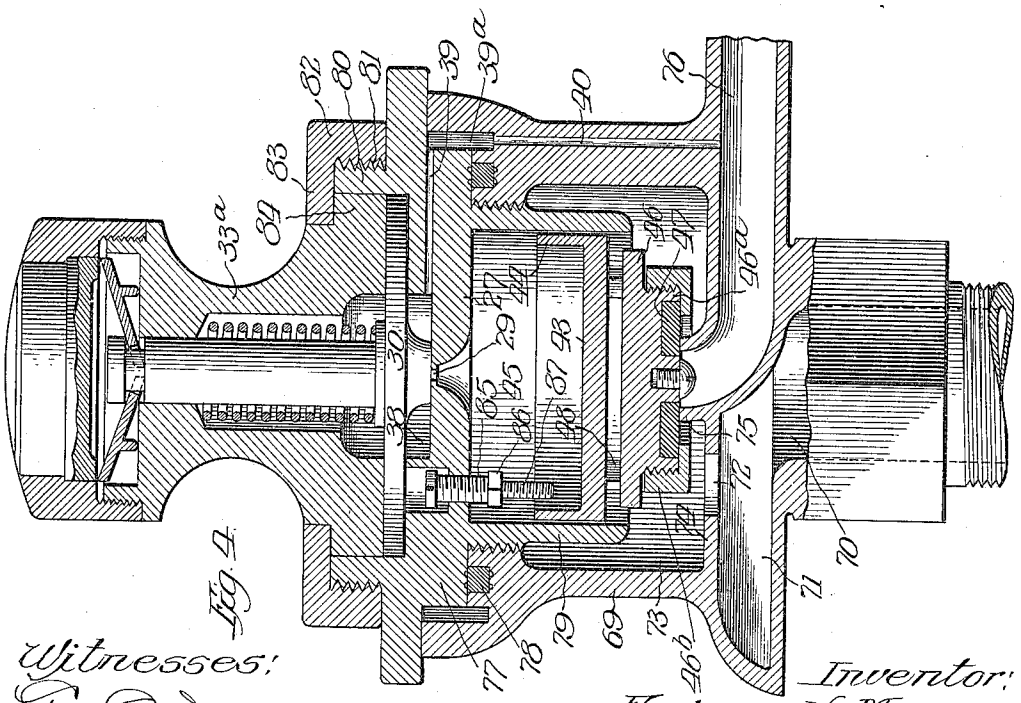


Fig. 4.

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Fig. 9.

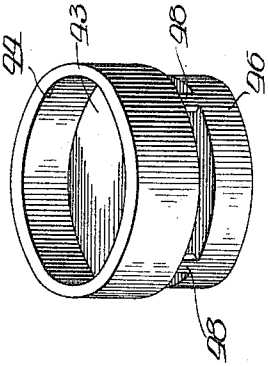


Fig. 8.

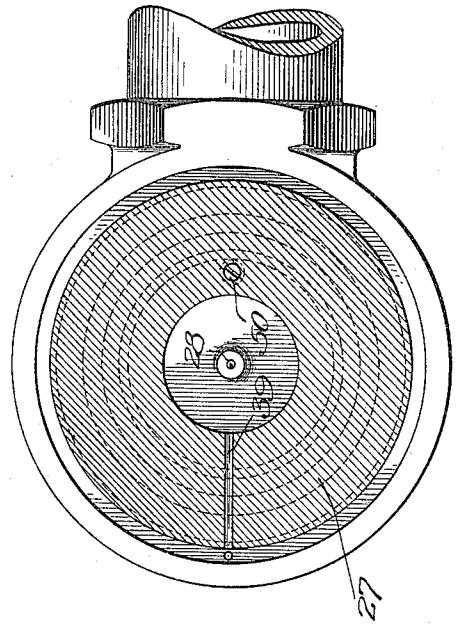


Fig. 6.

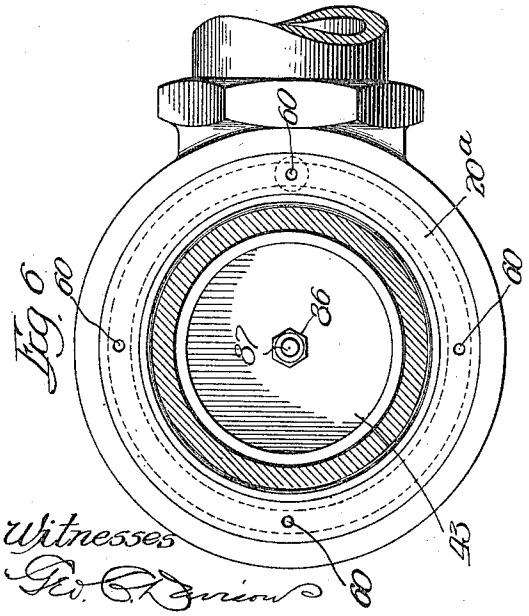
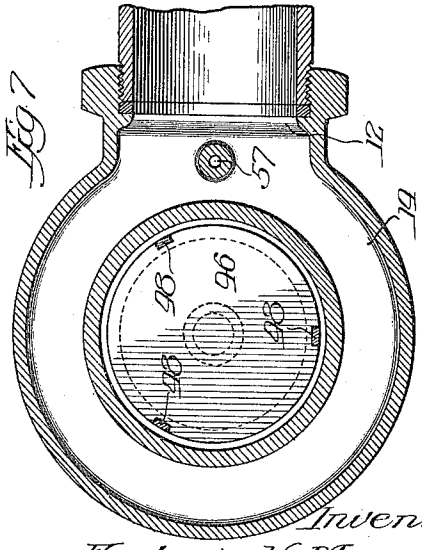


Fig. 7.



Witnesses

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VALVE.

APPLICATION FILED APR. 28, 1913.

1,146,012.

Patented July 13, 1915.

4 SHEETS—SHEET 4.

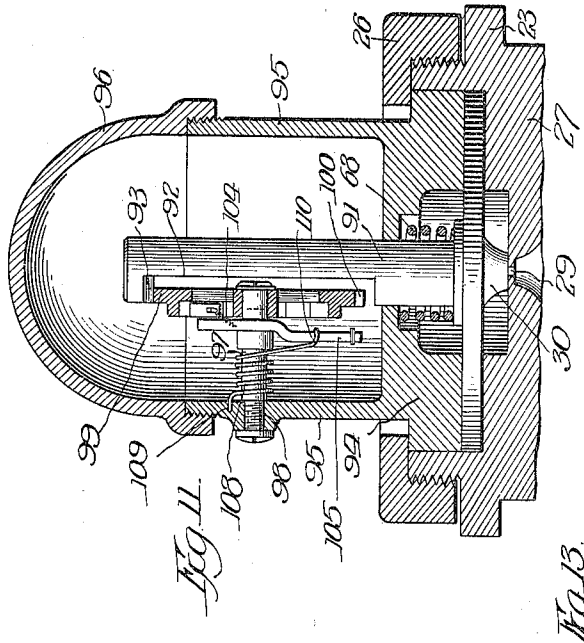


Fig. 11.

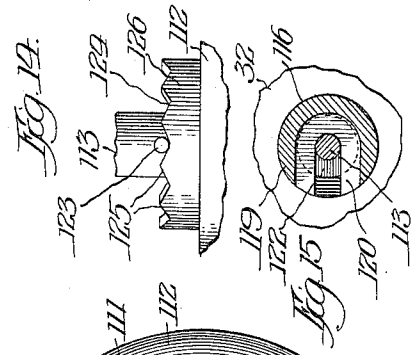


Fig. 14.

Fig. 15.

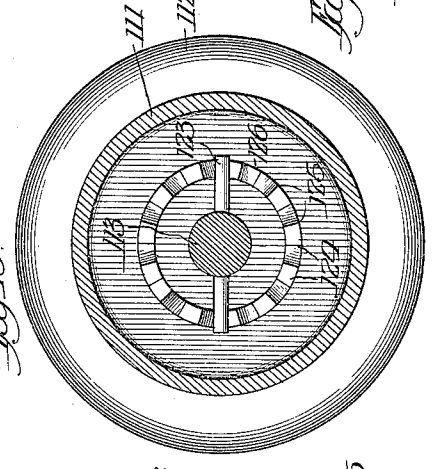


Fig. 13.

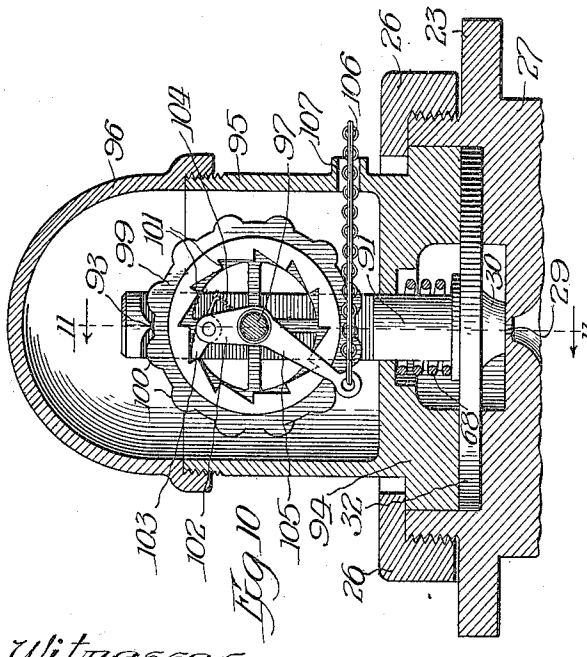


Fig. 10.

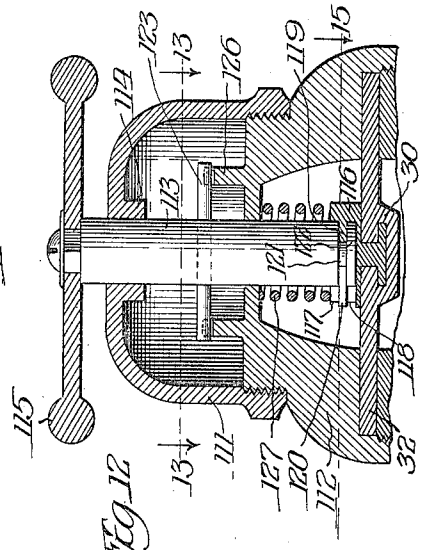


Fig. 12.

Witnesses

Geo. C. Dawson

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UNITED STATES PATENT OFFICE.

FREDERIC H. MASON, OF SPOKANE, WASHINGTON; MOLLIE H. MASON, C. A. BARTLESON, AND ROY R. GILL EXECUTORS OF SAID FREDERIC H. MASON, DECEASED.

VALVE.

1,146,012. Specification of Letters Patent. Patented July 13, 1915.

Application filed April 28, 1913. Serial No. 763,959.

To all whom it may concern:

Be it known that I, FREDERIC H. MASON, a citizen of the United States, residing at Spokane, in the county of Spokane and State of Washington, have invented certain new and useful Improvements in Valves, of which the following is a specification.

My invention pertains to improvements and features of novelty in valves but relates more particularly to valves of the balanced fluid pressure actuated type, operated by means of a relief or operating valve whereby the fluid pressures are balanced and unbalanced upon opposite sides of a piston or diaphragm connected to a main valve of smaller cross sectional area than said piston or diaphragm.

The principal and most important object of the invention is to devise a valve of this character whereby when the secondary or operating valve is entirely opened the main valve will quickly leave its seat and move to the limit of travel allowed it, and when the operating valve is entirely closed the main valve will be so nicely and accurately balanced that it will move back toward its seat gradually, and at same ratio of speed during its entire return movement until finally reseated, the ratio of speed depending upon the service pressure to which the valve is subjected.

A further object is the provision of means whereby the fluid which the valve controls is prevented from reaching the mechanism of the secondary or operating valve; and, the further provision of a device in which the valve may be operated from a point at any required or convenient distance from the main valve.

These important objects are accomplished by devising a main valve, one portion of which is freely movable within a ported cylinder provided for it in the valve casing, said valve having another portion of less diameter adapted to seat upon and close the opening which the valve is to control, this reduced portion being slightly spaced away from the enlarged portion and preferably marginally connected therewith by three equidistant connecting studs, thereby providing in the valve itself a space extending between the reduced portion and the enlarged portion, said space being open on all sides to the entrance of the fluid and unobstructed throughout its central area whereby the opposed faces of the two valve portions are at all times exposed to fluid pressure.

The characteristic features of a valve constructed according to my invention are that a very slight movement of the operating valve in one direction will cause the main valve to open and a like movement of the operating valve in the opposite direction will close the main valve; the valve operating mechanism is protected from any injury which might result from contact with the fluids which the valve controls, as for instance, corrosive gas, acids and the like; the valve will adjust itself to operating pressures and will work equally well under high direct pressure or low gravity pressure, without the necessity of manual readjustment of the working parts; the valve may be operated from any desired distance, this being of great importance in steam, compressed air and water emergency valves and the like; predetermined amounts of fluid may be discharged through the valve by an adjustment of the same without shutting off the service pressure, whereby the amount of flow can be increased or decreased at will, thus adapting the same preëminently for use as a measuring valve and for the convenience of the traveling public on a lavatory bib or on drinking fountains, the valve cannot be readily clogged by sediment in fluids passing therethrough, and can be made very compact of few working parts, and will be economical to manufacture and not likely to get out of order in constant use.

In order that the invention will be readily understood by those skilled in the art, a preferred and modified embodiments of the same are set forth in the accompanying drawings and in the description predicated thereon. As, however, the invention is capable of embodiment in other and varied structural forms, the drawing and description are to be construed in an illustrative and not in an unnecessarily limiting sense.

In the drawings Figure 1 is a central vertical section through an angle valve embodying the invention and equipped with a wheel actuated operating valve directly associated therewith; Fig. 2 is a similar section through a valve equipped with a wheel actuated operating valve operable from a distance; Fig. 3 is a fragmentary detail showing in vertical section a self closing spring actuated op

erating valve which can be substituted for the type of operating valve shown in Figs. 1 and 2; Fig. 4 is an enlarged central vertical section through a self closing basin cock embodying the invention and comprising means by which the same may be made self closing or caused to deliver a predetermined amount before closing; Fig. 5 is a similar section showing valve in open position and equipped with a wheel actuated operating valve; Fig. 6 is a horizontal section taken on the line 6—6 of Fig. 2; Fig. 7 is a similar section taken on the line 7—7 of Fig. 2; Fig. 8 is a similar section taken on the line 8—8 of Fig. 1; Fig. 9 is a perspective view of the main valve; Fig. 10 is a vertical section through another form of operating valve mechanism; Fig. 11 is a section taken on the line 11—11 of Fig. 10; Fig. 12 is a vertical section through yet another form of operating mechanism; Fig. 13 is a horizontal section on the line 13—13 of Fig. 12; Fig. 14 is a fragmentary detail; and Fig. 15 is a section on the line 15—15 of Fig. 12.

Referring to the drawings in detail, and having especial reference to Fig. 1, the valve comprises a casing indicated generally at 11, the said casing being provided with an inlet at 12 and an outlet at 13. The valve casing is hollow, having an interior chamber 14 of substantial capacity. Projecting upwardly into this chamber is an annular flange 15 surrounding the entrance to the outlet 13, the upper edge of the flange forming a seat for the main valve which will be hereafter described.

The top portion of the casing has a central opening threaded at 16 and marginally of said opening the upper face of the casing is stepped to provide a recess having its bottom in the plane indicated at 17 and an upper plane surface indicated at 18. A packing ring 19 is advantageously seated within a groove 20 formed in the bottom 17 of the recess. Within the opening and in engagement with the thread 16 is screwed a fitting 21 having a depending cylindrical portion 22 which projects into the casing in substantial alinement with the outlet 13 and terminates near the valve seat formed by the flange 15. The fitting 21 has a lateral flange 23 which is adapted to overlie the stepped upper surface of the casing and which has a lower face which is substantially complementary to the upper face of said casing. The fitting shown in Fig. 1 is also provided with an upstanding annular flange 24 which is interiorly threaded at 25 for the reception of the retaining collar 26.

Substantially in horizontal alinement with the lateral flange 23 the upper wall of the fitting is formed as a comparatively thin web 27 closing off the cylindrical depending portion 22, the central portion of the web being offset upwardly at 28 and provided with a relief port 29. The port 29 is controlled by a diaphragm valve 30 the effective portion 31 of which seats upon the upper face of the offset 28 while the marginal portion 32 of the diaphragm is clamped within the flange 24 between the upper face of the fitting and lower face of a supporting member 33, which member is pressed downwardly and securely held upon the diaphragm by means of the collar 26. A stem 34 is secured to the central portion of the diaphragm, which stem is threaded as indicated at 35 and is in threaded engagement with the interiorly threaded sleeve 36 which is rotatably mounted within the supporting member 33 in such manner as to prevent longitudinal movement. The sleeve 36 is carried by the hand wheel 37 and may be formed integral therewith or removably mounted thereon. Between the lower face of the diaphragm 30 and the upper face of the web 27 is formed a chamber 38 which communicates through a passage having a horizontal portion 39, an annular portion 39^a and a vertical portion 40 leading by way of the space 41 to the discharge pipe 42. It is noted that the outlet 13 from the valve is in line with the cylinder 22 and is of less diameter, the cylinder serving for the guiding and actuation of the valve which controls the outlet opening from the casing.

The main valve comprises an upwardly cupped guiding member 43 the upstanding cylindrical walls 44 of which are proportioned to slide freely within the cylinder 22 so as to form therebetween an annular passage for the flow of fluid between the upper and lower sides of the valve, the member 43 serving after the manner of a piston to separate the space within the cylinder into two compartments, a counterpoise compartment 45 between the said member and the web 27 and the downwardly open space within said cylinder and below the member 43. In addition to the guiding member 43 the valve comprises a control member 46 which may be advantageously equipped with a packing 47 in its lower face and adapted to seat upon the upper edge of the flange 15 to control the outlet 13. The guiding member 43 is preferably of somewhat larger diameter than the control member 46 and has consequently a larger cross sectional area exposed to the pressure of the fluid within the chamber 45. The control member 46 is carried by the guiding member 43 and is spaced therefrom by means of connecting studs 48 arranged at equal distance about the margin of the control member. The studs 48 are of reduced size having as small cross sectional area as is consistent with the necessary strength and rigidity and preferably not to exceed 2% that of the guiding member. The disposition of the connecting studs 48 is such as to permit the fluid to enter freely from all

sides into the space 49 between the members 43 and 46, which space is entirely unobstructed in its central area.

In the fitting 21 is arranged an adjusting screw 50 which is preferably inserted from below and is provided with a shoulder 51 whereby its upward adjustment is limited, the screw being provided in its upper end with a notch for the reception of a screw driver. By adjusting the screw 50 the upward travel of the main valve is limited to a predetermined extent whereby to govern the duration of time that the valve shall remain open. The mounting of the screw in this way and the provisions of the shoulder 51 insures against the head of the screw being left sufficiently high to interfere with or injure the marginal portion of the overlying diaphragm.

In Fig. 2 I have shown a valve construction which differs in certain details from that just described and possesses certain advantages in construction and operation, as for instance the capacity for operation from a distance. In this form of device the fitting 21 instead of being provided with a ported web 27 controlled by a secondary valve is provided with a web or crown portion 52 within which is arranged the adjusting screw in a manner similar to that described in reference to Fig. 1. The adjusting screw is protected from unwarranted interference and accidental disarrangement by means of a screw cap 53 threaded into the crown 52 in such manner as to give ready access for the purpose of adjustment. In this case the counterpoise compartment 45 is connected directly by means of the radial passages 54, the annular grooves 55 and 56, the vertical passage 57 and the tube 58 with an outlet 59 which is controlled by the diaphragm valve 27 operated by means indentical with those shown in Fig. 1. The packing ring 20[a] which separates the annular grooves 55 and 56 is provided at intervals with transverse openings 60 affording communication between the two grooves. Herein, it will be observed, the outlet 13 and the valve seat formed by the upper edge of the flange 15 are considerable smaller than the control member 46 of the valve and as a result the control member 46 overhangs the valve seat and has a considerable area upon its lower face exposed to fluid pressure.

In Fig. 3 I have shown a form of operating mechanism for the secondary valve which can be substituted for the operating mechanism shown in Figs. 1 and 2. This secondary valve mechanism comprises a push button 61 having its lower terminal portion enlarged at 62, the button being guided for vertical reciprocation within a cap 63 removably secured upon the upper end of the support 33[a] which has in its upper face a recess 64. Within this recess is mounted a pair of segmental wings 65 each having upon its lower face a rib 66 which rests upon the bottom of the recess and serves as a fulcrum upon which the wings may be rocked. The enlarged portion 62 of the button bears upon the outer edge of each fulcrumed wing while the inner edge of the same engages beneath an undercut head 67 formed on the upper end of the valve stem 34[a]. It will be readily understood that as the button 61 is depressed, the flange portion 62 presses downwardly upon the outer edge of the segments, causing each of said segments to rock upon its fulcrum and thereby to elevate its inner edge, lifting therewith the valve stem 34[a] against the tension of the spring 68, and opening the port 29; and upon the release of the button 61, the tension of the spring 68 will depress the valve stem and valve closing the port 29 and restoring the button and the segments to the normal position shown in Fig. 3.

In Fig. 4 is shown a basin cock embodying this invention. In this form of construction the valve casing 69 is provided with an inlet 70 to an interior chamber 71 whence the fluid passes through the arcuate opening 72 to the interior pressure chamber 73. Upstanding from the partition 74 which separates the chamber 71 from the chamber 73 and projecting into the chamber 73 centrally thereof is the flange 75 defining the entrance to the outlet 76 and serving as a seat for the control member 46 of the main valve. In this form of construction the fitting 77 is screw threaded into the casing 69 as in the former construction, a packing ring 78 being compressed between the lower face of the fitting and the upper face of the casing. The cylinder 79 corresponds to that previously described and receives loosely the upstanding walls 44 of the cap-shaped guiding member 43 of the main valve. As previously described the guiding member 43 and the control member 46 of the main valve are connected marginally by studs 48 of small cross section. The upstanding flange 80 of the fitting is exteriorly threaded at 81 for engagement with an interiorly threaded collar 82 having an inwardly extending portion 83 adapted to overlie the shouldered portion 84 of the secondary valve support 33[a], whereby the parts are securely assembled in such manner as to effectively guard against leakage. The port 29 controlled by the valve 30 establishes a connection between the counterpoise chamber 45 and the relief chamber 38 whence the fluid finds escape through the horizontal passage 39, the annular passage 39[a] and the vertical passage 40 to the outlet 76. While I have illustrated the secondary valve, in this case, as controlled by operating mechanism of the push button type, obviously the wheel type may

be used instead and, if desired, the operating mechanism of either type may be arranged at a distance by adopting certain modifications of structure heretofore described and illustrated. In this form of construction as also in that shown in Fig. 2, I illustrate the employment of an adjusting screw 85 which is insertible from above, but the range of upward adjustment of which is limited by a nut 86 threaded from below upon the lower end of the screw, this portion of the screw being of smaller diameter and provided with a left hand thread at 87 for engagement with the nut whereby to prevent accidental displacement of the nut when it is brought into frictional contact with the lower face of the web or crown in adjusting the screw upwardly.

In Fig. 5 is shown a basin cock having a wheel operated secondary valve and in which the parts are substantially identical with those illustrated in connection with Fig. 4 except that the adjusting screw 85 is omitted and the upper edge of the walls 44 of the cup shaped guiding member of the main valve are provided with transverse grooves or notches 88 by which the fluid passing around the member 43 and between the walls 44 and the cylinder 79 is afforded access to the interior of said member. In this form of construction the valve opens to a uniform extent at each actuation of the operating valve. The lift of the main valve is but slight and the parts are so proportioned that immediately upon the closing of the port 29 the fluid will pass from the chamber 73 around the walls 44 to the upper side of the member 43 and thereby return the main valve to its seat at once. By reason of the fact that the pressure fluid has free access to the spaces between the guiding member and control member of the valve and also to a large proportion of the lower face of the control member at all times, even after the seating of the valve, vibration or hammering of the valve is prevented. A quarter revolution is sufficient to entirely open the port 29 and permit the lifting of the valve to full extent from the seat 75. So long as the hand wheel is left in the open position the flow of fluid through the valve will be continuous and immediately upon the closing movement of the hand wheel, the main valve will seat and the flow will be interrupted. By marginally gaging the extent to which the hand wheel is opened and the valve 30 is lifted from the port 29, the relative flow through said port can be so proportioned to the inflow of pressure fluid to the upper side of the member 43 as to maintain an equilibrium and cause the main valve to float with its control member 46 at a greater or less distance above the valve seat 75 whereby the volume of flow through the valve may be controlled.

It is of particular advantage in valves designed for use in connection with flushometers that provision be made whereby the valve will be actuated by a slight movement of the operating mechanism and also that whether the valve operating means be immediately released or not the valve itself will close after the proper interval, and that any attempt through ignorance or design to hold the valve open will be ineffective and will not interfere with the normal operation of the valve in performing its flushing function. As but a momentary lifting of the secondary valve from its seat is necessary in order to cause the main valve to unseat and travel upward to the limit of its path and then return slowly to its seat, during which time and after the closing of the secondary valve the fluid flows through the main valve in an unobstructed stream, I have in Figs. 10 to 15 inclusive illustrated forms of operating mechanism whereby the secondary valve may be lifted from its seat and may return immediately even though the means for actuating the secondary valve be held under tension in the effort to hold the valve open.

Referring to Figs. 10 and 11 the stem 91 of the diaphragm 30 is cut away to provide in one face a recess 92 and the upper portion of the stem overhanging said recess is provided with a downwardly projecting tooth 93. The support 94 carries a housing 95 extending upwardly around the stem 91 and having a cover 96 threaded upon its upper edge. An arbor 97 is journaled at 98 in one wall of the housing and carries upon its inner end a wheel 99 having exterior spaced projections 100 about its periphery and interiorly arranged ratchet teeth 101. Also mounted upon the arbor 97 is a lever, one arm 102 of which carries a pawl 103 which is held by the spring 104 in engagement with the ratchet teeth 101 while the other arm 105 of the lever has attached thereto an operating cord or chain 106 which extends outward from the housing through an opening 107 to any suitable point and may terminate in a pendent pull, operating lever or the like. A spring 108 coiled about the arbor 97 has one end anchored in the housing at 109 while the other end is bent at 110 around the arm 105 of the lever, the spring 108 serving to restore the lever to the position shown in Fig. 10 after having been displaced therefrom by a pull upon the chain 106. It will be readily understood that when the cord or chain 106 is pulled the arm 105 of the lever moves to the right and the rocking of the lever upon the arbor causes the pawl 103 to rotate the wheel 99 to the left a distance corresponding to that separating the ratchet teeth. This movement of the wheel causes the next adjacent projection 100 to engage the sloping side

of the tooth 93 and elevate the same thus lifting the valve stem 91 and with it the valve 30 from over the port 29. The throw of the lever is sufficient to carry the projection 100 beyond the tooth 93, thus permitting the tooth to drop into the space between the two projections and close the port 29 under the influence of the spring 68. If the pull upon the chain 106 be continued it will be ineffective to hold the secondary valve open and in order to again open the valve it will be necessary to release the chain and again pull the same.

In Figs. 12, 13 and 14 I have illustrated another form of construction whereby the operating valve is insured against being held open. Herein a housing 111 is threaded upon the support 112 and the valve stem 113 extends axially through a boss 114 in the top wall thereof, and has mounted upon its upper end a hand wheel 115. The diaphragm valve 30 has formed upon its central portion a metal shell 116 having its interior divided into two compartments 117 and 118 by a web 119 having a lateral slot 120. The lower end of the valve stem 113 is provided with an annular groove 121 which separates the main body of the stem from a head 122 which is inserted within the chamber 118 laterally through the slot 120. A pin 123 transfixes the stem 113 in its medial portion and rests normally within diametrical depressions 124 formed between adjacent projections 125 on the edge of an upstanding flange 126 carried by the support 112. A slight turn of the hand wheel 113 in either direction will cause the pin 123 to ride upwardly upon the inclined faces and over the apices of the two opposite projections 125 thus immediately lifting the secondary valve from its seat and then permitting the same to again seat as the pin drops into the succeeding depressions 124. The spring 127 which tends to seat the valve 30 serves also to draw the pin 123 downward off the apices of the projections into the depressions alongside, and it will be apparent that it will be difficult if not practically impossible to hold the hand wheel 115 in such manner as to maintain the pin 123 upon the points of the projections 125 and thus to hold the secondary valve open. The mounting of the valve-operating mechanism of this general character within the housing of the valve itself is made possible by constructing the secondary valve as a diaphragm, the marginal portions of which are clamped between the opposing faces of the secondary valve and the main valve fittings and clamping the same securely into position as shown, whereby the secondary valve-operating mechanism is entirely isolated from the fluid chambers of the valve proper and the fluid passing through the valve, whether liquid or gaseous, is effectually excluded from contact with the operating mechanism.

The operation of the several forms of construction illustrated may be described in general terms as follows: The pressure fluid within the valve casing finds its way from the main pressure chamber around the guiding member of the main valve to the space within the cylinder and above the guiding member, upon which latter it exerts a closing pressure to hold the control member upon its seat to maintain the outlet closed. The pressure fluid also exerts force in the opposite direction upon the opposed faces of the guiding and control members, having free access to both by reason of the substantially unobstructed inter-space between said members. As the connecting studs which join the guiding and control members are of a small cross section in the aggregate, the pressure upon the upper and lower faces of the guiding member is very nearly balanced there being a slight preponderance on the upper side while the pressure upon the upper face of the control member exceeds that upon its lower face, in the closed position of the valve, by the excess area of such upper face over the marginal area of the lower face exposed to the fluid pressure about the valve seat. It will thus be seen that immediatetly upon the opening of the relief port from the cylinder the preponderance of pressure above the guiding member will be reduced below the point of equilibrium, and the main valve will quickly leave its seat and move to the upper limit of its travel as fixed by the upper wall of the cylinder or the adjusting screw provided for that purpose, the travel of the valve being accelerated as soon as it leaves its seat by the exposure of the entire under face of the control member to the fluid pressure. Immediately thereafter, the secondary valve being closed, the accumulation of pressure fluid within the counterpoise chamber will cause the main valve to gradually, and at a uniform rate of speed settle upon its seat. As the pressure fluid has at all times access to the interspace between the guiding and control members of the main valve, by reason of said space being entirely unobstructed in its central portion, the pressure is so nicely gaged and maintained in uniform relation to a state of equilibrium that the travel of the valve will be absolutely uniform until it has actually seated upon the outlet, at which instant, the pressure upon the central portion of the under face of the control member having ceased, the preponderance of pressure in the closing direction holds the valve firmly seated.

By providing the lower face of the control member with a portion, such as the gasket-retaining cap, which enters the outlet opening and thus reduces the volume of discharge

from the valve during the final closing movement, in that form of construction intended for use primarily as a flushing valve (Fig. 1), the final flow is in volume insufficient to supply the demand of the siphon and the seal in the bowl will be broken and the water in the ascending leg of the siphon will drop back into the bowl; the movement of the valve is, however, during the time of this reduced flow, sufficiently slow to allow enough water to pass through the valve to provide the desired refill before the valve finally closes.

By providing the valve having the general characteristics stated in reference to Fig. 4 wherein, as a special feature, the control member of the main valve has a diameter greatly in excess of that of the seat with which it coöperates, a very sensitive and accurate measuring valve is obtained. By suitable adjustment of the screw provided for that purpose, the travel of the main valve and consequently the time during which the flow through the valve shall continue, may be regulated with such nicety that the valve may be caused to discharge with unfailing regularity a predetermined amount of fluid upon a single actuation of the secondary valve, the cut-off being clean and without vibration or hammering.

As shown, the packing 47 is mounted within a recess formed in the lower face of the control member, its periphery being guarded by the flange 46^a against the fluid flowing in from the side toward the outlet, whereby to prevent the cupping of the packing and the entrance of the fluid behind the same and consequent malformation of the packing disk and any tendency to flutter. In Figs. 2, 4 and 5, the packing disk is shown as further protected by housing the same within an annular cap 46^b which is threaded on to the exterior of the flange 46^a. By mounting the diaphragm of the secondary valve within the recess of the fitting and beneath the edge of the secondary valve housing, the latter being clamped on the margin of the diaphragm with direct pressure in a right line under the influence of the threaded collar, any twisting or distorting of the diaphragm is prevented, however tightly the housing may be forced downward.

An advantage of my valve construction is that the same applied to flushing purposes will, as demonstrated by test, operate perfectly with a supply pipe of $\frac{3}{4}$ inch diameter with a direct pressure as low as ten pounds and will work without adjustment at any higher pressure whereas other flushometer valves now on the market require a special supply pipe of larger diameter and a higher pressure. This enables my device to be installed in a house without expensive special plumbing as the three-quarter inch pipe is standard and the low pressure at which the valve will operate is to be found under all ordinary conditions. Moreover, by reason of the fact that the operating valve port is so easily controlled, the valve is peculiarly adapted for operation by a ball or float mechanism. The function of the float being confined to opening and closing the small port, but a minimum of energy is required and the usual copper ball may be made quite small or even replaced by a float of cork, wood or the like at a great reduction in expense.

I claim:

1. In a valve, the combination of a casing having inlet and outlet passages and a ported member, a main valve comprising a guiding member freely slidable in said chamber and dividing the same into a main compartment and a ported counterpoise compartment and a control member spaced away from and connected marginally only to said guiding member and adapted to control the connection between said inlet and outlet passages, said casing having a relief discharge passage connecting with the port of the counterpoise compartment, and a secondary valve coöperating with said port whereby to govern the actuation of the main valve, substantially as described.

2. In a valve, the combination of a casing having inlet and outlet passages and a ported chamber, a main valve comprising a guiding member freely slidable in said chamber and dividing the same into a main compartment and a ported counterpoise compartment and a control member spaced away from and carried by the guiding member and adapted to control the connection between inlet and outlet passages, the central portions of said members being free from connections, the casing having a relief discharge passage connecting with the port of the counterpoise compartment, and a secondary valve coöperating with said port to govern the actuation of the main valve, substantially as described.

3. In a valve, the combination of a casing having inlet and outlet passages, a fitting having a fluid tight connection with said casing and including a hollow ported downwardly opening cylindrical portion, a main valve comprising a guiding member freely slidable in said cylinder and dividing the same into an open main compartment and a ported counterpoise compartment and a control member carried by the guiding member by marginal connection only and in spaced relation thereto and adapted to coöperate with a seat to control the connection between the inlet and outlet passages, the fitting having a relief discharge passage connecting with the port of the cylinder, and a secondary valve coöperating with said port to govern the actuation of the main valve, substantially as described.

4. In a valve, the combination of a casing

having inlet and outlet passages, a hollow ported cylinder fitted in said casing and including means adapted to form a fluid tight connection with said casing, a main valve comprising a guiding member freely slidable in the cylinder and a control member carried by, spaced away from, and connected marginally only to said guide member and adapted to establish and break connection between inlet and outlet passages, and means to control the cylinder port whereby to govern the actuation of the main valve, the wall of said cylinder in the closed position of the valve projecting beyond the guiding member in the direction of the control member, substantially as described.

5. In a valve, the combination of a casing having a valve seat between inlet and outlet passages, a hollow ported cylinder within said casing, a main valve comprising a guiding member freely movable in said casing and dividing the latter into an open main compartment and a ported counterpoise compartment and a control member of less cross-section than the guide member, and spaced away from, and connected marginally only to said guiding member, the control member adapted to coöperate with the valve seat to establish and break connection between the inlet and outlet passages, the casing having a relief discharge passage connecting with a cylinder port, means to operate the secondary valve and including a support, an internally threaded sleeve rotatably mounted in said support, and a screw connected with the secondary valve and co-acting with the threaded sleeve, whereby when the sleeve is turned the secondary valve will be actuated, substantially as described.

6. In a valve, the combination of a casing having a valve seat between inlet and outlet passages, a hollow ported cylinder within said casing, a main valve comprising a guiding member freely movable in said cylinder and dividing the latter into an open main compartment and a ported counterpoise compartment and a control member of less cross-section than the guide member and connected marginally only to and spaced away from said guiding member, the control member adapted to coöperate with the valve seat to establish and break connection between the inlet and outlet passages, the casing having a relief discharge passage connecting with the cylinder port, and a secondary valve coöperating with said port to govern the actuation of the main valve, and means to operate the secondary valve including a diaphragm carrying said valve, a support engaging the periphery of the diaphragm, an internally threaded sleeve rotatably mounted in the support and held against longitudinal movement, and a screw threaded stem connected to said diaphragm, the threads of the stem co-acting with those of the sleeve, whereby the stem of the diaphragm and valve are actuated by the turning of the sleeve, substantially as described.

7. In a valve, the combination of a casing having a valve seat between inlet and outlet passages, a ported cylinder within said casing, a main valve comprising a guiding member freely slidable in the cylinder and dividing the latter into an open main compartment and a ported counterpoise compartment and a control member spaced away from and carried by said guiding member by marginal connections only and adapted to coöperate with the valve seat, a diaphragm, a secondary valve carried by said diaphragm and controlling the cylinder port, a support, a collar having a threaded connection with said casing and overlying the support to form a fluid tight connection therebetween, a threaded sleeve rotatably mounted in the support and held against longitudinal movement, means to operate said sleeve, and a screw threaded stem connected to said diaphragm and secondary valve, the threads of the stem coöperating with those of the sleeve, whereby the turning of the sleeve opens and closes the port by said secondary valve and governs the actuation of the main valve, substantially as described.

8. In a valve, the combination with a casing provided with a ported cylinder, of a valve adapted to freely move in said cylinder, means to open and close the port from said cylinder whereby to actuate said valve and thereby establish and break communication between an inlet to and an outlet from said casing, said valve comprising one member adapted to freely move in said ported cylinder and another member of reduced diameter spaced away therefrom and connected marginally only thereto, said interspace being unobstructed centrally and open at all sides and in all positions of the valve to freely admit the fluid service pressure to which the valve is subjected, substantially as described.

9. In combination, a casing provided with a ported cylinder, a valve comprising a cup-shaped member adapted to freely move in said cylinder and a member of smaller diameter spaced away therefrom and connected thereto marginally only, said valve being adapted by movement to control an outlet provided in said casing and to establish and break communication between said outlet and an inlet provided in said casing, means to open and close the port from said cylinder to balance and unbalance the fluid pressures bearing against opposite faces of said valve whereby to actuate said valve, all of the larger member of said valve and that side of the smaller member adjacent to and spaced away from said larger member being at all times exposed to fluid pressure, the

fluid pressure bearing against said larger member in the cylinder only exceeding the fluid pressure bearing directly against the opposite side of said member by the cross sectional area of the connections between the enlarged member and the depending spaced away member, substantially as described.

10. In combination, a casing having an inlet port and an outlet port and provided interiorly with a cylinder having a lower open end in alinement with one of the ports and a closed upper end provided with a relief port, a main valve comprising a guiding member slidable loosely within the cylinder and a control member carried by the guiding member in spaced relation thereto and adapted in one extreme position of the valve to seat upon the valve port and in another position to open said port, the control member having a cross sectional area slightly less than that of the guiding member and connected with the latter by marginal studs only having a cross sectional area not exceeding 2% that of the latter, and operating means to control the relief port of the cylinder whereby to actuate the valve, substantially as described.

11. In combination, a casing having an inlet port and an outlet port and provided interiorly with a cylinder having a lower open end in alinement with one of the ports and a closed upper end provided with a relief port, a main valve comprising a guiding member slidable loosely within the cylinder and a control member carried by the guiding member in spaced relation thereto and adapted in one extreme position of the valve to seat upon the valve port and in another position to open said port, the control member having a cross sectional area slightly less than that of the guiding member and connected with the latter by marginal studs only having a cross sectional area not exceeding 2% that of the latter, operating means to control the relief port of the cylinder whereby to actuate the valve, and adjustable means to limit the maximum lift of the valve, substantially as described

12. In a valve, the combination of a casing having an inlet and an outlet and open on one side, a fitting having a fluid-tight connection with the casing and including an open end cylindrical portion projecting through the opening into the casing, the casing provided in its outer face about said opening with an annular groove, and a fitting having a shoulder adapted to overlie said groove and provided in its lower face with a registering groove, a gasket mounted between the opposed faces of the casing and fitting and separating the registering grooves, said gasket provided at intervals with transverse openings to establish communication between the two grooves, a passage connecting the groove of the fitting with the interior of the cylindrical portion at a point remote from its open end, a second passage leading from the groove in the casing to a point of discharge, a secondary valve adapted to control the last named passage, and a main valve comprising a guiding member freely slidable in the cylinder, and a control member adapted to establish and break communication between the inlet and outlet, substantially as described.

In witness whereof I have signed my name in the presence of two witnesses.

FREDERIC H. MASON.

Witnesses:
LEWIS T. GREIST,
MARION G. ELWELL.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."