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FLUSH VALVE.

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This invention relates to flush valves for water closets and the like and relates more particularly to such valves of the self-closing type.

5 An object of the invention is to provide a flush valve capable of convenient and noiseless operation.

Another object of the invention is to provide a flush valve having a multiple diaphragm member cooperating with other movable elements of the valve to eliminate chattering noises during operation.

Another object of the invention is to provide a flush valve having a multiple diaphragm having associated therewith a relief valve, air snifter, and self-cleansing equalizing port, so arranged as to operate without chattering.

Another object of the invention is to provide a flush valve having a novel form of operating mechanism for the relief valve.

A further object of the invention is to provide an effective and simple arrangement of operating parts for translating motion from a handle to the valve and to construct such parts with a view to economy of space and material to give a more compact valve mechanism.

30 A further object of the invention is to provide a flush valve of simplified construction and one which may easily be actuated to discharge a predetermined amount of water.

A further object of the invention is to provide a flush valve in which the amount of water discharged from the compression chamber at each flushing operation is reduced to a minimum.

40 A still further object of the invention is to provide a flush valve having improvements in the construction and arrangement of the equalizing port, air-snifter, relief valve and diaphragm whereby the water entering and leaving the compression chamber effects a cleansing of the passages of the equalizing port.

45 Other objects of the invention will be apparent from a reading of the following description.

50 Valves of the present character are generally manually operated, that is, the action of the elements is put into operation by a comparatively slight manually applied force

which produces a positive mechanical movement of the valve from its seat to effect the flushing operation, the valve being returned 55 to its seat by the pressure of the water in the system to which the flush valve is connected.

The present type of flush valve may have a main and a supplemental or compression chamber, the main chamber being in constant communication with the source of supply of water and, obviously, at equal pressure therewith, the supplemental or compression chamber being separated from the main chamber, in the present invention by 65 a separating or operating diaphragm which carries a valve head. The valve head has associated therewith a flexible member, preferably of disk-shape and disposed in spaced relation to the operating diaphragm as an 70 aid in carrying the valve head and also serving as a valve face to engage with a seat to close the main chamber from an outlet or discharge passage. For the purpose of maintaining the valve head seated, a bleed- 75 ing hole or equalizing conduit is provided so that the two chambers are normally maintained at substantially equal pressures.

Ordinarily where a bleeding hole is employed, the valve or control element therein 80 is of a fixed character, such as a needle valve, thus the effective area of the hole is constant and additional means are necessary to provide for a rapid flow of water during the actuation of the valve to allow of the re- 85 quired quick opening of the valve to discharge a predetermined amount of water from the compression chamber. Moreover, needle valves as heretofore used often become clogged by the accumulation of particles of solid matter such as sediment or grit which interfered with the proper functioning of the valve.

Many types of valves as heretofore constructed have employed valve heads of the 95 plunger type which, although desirable under certain conditions, lack the ease of operation and have frequently been found to be comparatively noisy and even in valves using a diaphragm objectionable chattering 100 noises could not be avoided.

The elimination of noise in valves is important since the desideratum of valve construction is to provide a valve in which no

chattering noises occur, particularly in closet valves of the flush type.

The present invention, therefore, includes a double diaphragm arrangement to carry a valve head, and it has been found that by utilizing one diaphragm as an operating diaphragm or control element and the other as a valve diaphragm, a quick and effective as well as a noiseless operation of the valve results.

No positive reasons are advanced as to just why the additional diaphragm or flexible member causes the elimination of the chattering noises which accompany the operation of valves of this general type. The theory is, however, that the diaphragm or second disk-shaped member serves as a muffler or shock absorber having an opposing action to movement which would result in undesirable sound waves, or else that the mass of water interposed between the diaphragms absorbs such vibrations.

On the other hand, the noiseless operation may be attributed to the opposing action of the valve diaphragm which although spaced from the operating diaphragm actuates as a part of the same, the motion being carried over thus bringing the diaphragm proper close to the seat and avoiding the fluttering action which ordinarily may accompany the otherwise relatively highly flexible diaphragm in closing. By disposing the operating diaphragm and the valve diaphragm face to face and spaced a uniform distance apart both diaphragms have the same amount of movement during an operation of the valve and act as a single member.

The present construction also comprises a valve having a bleeder passage controlled by a valve operable to permit a constricted flow of water in one direction and also to give an ample flow in an opposite direction. A valve of this general type is shown in my Patent No. 1,176,754, issued March 28, 1916.

In addition, my valve provides an improved arrangement of the diaphragm, bleeder, air-snifter and relief valve whereby a substantially minimum amount of water is removed from the compression chamber, the air being effectively removed and the bleeder conduits being kept free of dirt and the like. Such construction also contributing to the elimination of the chattering noises. In addition, the valve provides a novel form of operating mechanism for moving the relief valve from its seat, whereby a neater structure is had together with an economy in materials.

The invention will be more fully understood by reference to the accompanying drawings, in which

Fig. 1 is a longitudinal sectional view of a valve embodying my invention.

Fig. 2 is a view taken on line II—II in Fig. 1.

Fig. 3 is a side view of the valvehead, partly broken away to show an auxiliary valve in its closed position.

Fig. 4 is an end view of a rocker-cam member for lifting the valve head, and

Fig. 5 is a side view of the cam-member shown in Fig. 4.

A practical embodiment of the invention may comprise a casing 10 threadedly connected to a cup or bonnet 11, which together constitute a valve body 12 having an inlet aperture 13 and an outlet aperture 14. The valve body is provided with an inwardly extending flange 15 threaded to receive a threaded end 16 of a tubular member 17 having its free end so constructed as to provide a valve seat 18 to receive a valve head 19 in a manner to be presently described.

The valve head may comprise a primary or operating diaphragm 21 and an auxiliary or valve diaphragm 22 held at their peripheries between an edge of the bonnet 11 and a shoulder of the casing 10. A spacer ring 23 is provided to separate the diaphragms to permit their required independent functions. The diaphragms 21 and 22 are provided with centrally disposed openings in which is positioned the valve head 19. The valve head in conjunction with the diaphragms 21 and 22 divide the valve body into two chambers 28 and 29 and the tubular member 17 in conjunction with the diaphragm 22 separates the chamber 29 from an outlet compartment 31 which is provided with the outlet aperture 14. The inlet aperture 13 communicates with the chamber 29 and is normally cut off from the outlet compartment by the tubular member 17 which is closed by a contact face or valve portion 32 of the diaphragm 22.

The valve head 19 is reciprocable as a whole to afford communication between the chamber 29 and the outlet 14 and is provided with a relief valve 35 having a suitable packing 36 to make contact with a seat 37 integral with a cylindrical part 38 having a flange 39. A threaded collar 41 secures the diaphragm 22 to the part 38 and a recessed member or valve box 42 threadedly connected to the said part secures the diaphragm 21 thereto. The diaphragm 21 being secured between the lower end of the relief box and flange 39 of the part 38 which is suitably secured to the box 42. The flange is preferably made the same thickness as the ring 23 so that the diaphragms are spaced equally apart and have equal movement during the operation thereof.

The relief valve 35 is normally held closed by means of a helical spring 43 disposed between the valve and a shoulder within the recessed member 42, although I have found that the valve 35 will return to normal position without the use of a spring.

A stem or plunger 44 is attached to the

relief valve 35 and extends through a central bore in the part 38, a portion of the stem being of a reduced diameter to provide a passage 46 communicating with the outlet chamber 31 by reason of one or more apertures 47 in the lower end of the part 38. The valve 35, however, by reason of the spring 43, closes the opposite end of the passage-way 46.

For the purpose of equalizing the pressure in the chambers 28 and 29, apertures 48 are provided in the flange 39 which in turn connect with space 49 around the relief valve 35, which space is in communication with the interior of the recessed member 42, an outlet orifice 51 being provided at the upper portion thereof. The diaphragm 22 is provided with apertures 52 and a restricted conduit or bleeder passage results in permitting water to pass from the compartment 29 to the compartment 28 to equalize the pressures therein.

The orifice 51 is disposed at the smaller end of a tapered passage 53 in which is disposed an auxiliary or release valve 54 which may be of conical formation to enter the conical passage and reduce the flow of water therethrough, a shallow groove 55 being provided extending along the tapered portion of the valve so that when the same is seated only a relatively fine stream of water is permitted to enter the passage 53. The upper end of the valve box 42 in which the passage 53 is disposed, extends into the upper end of the chamber 28 and serves as a stand-pipe for an outlet for air which may accumulate at the top of the chamber. Normally the valve 54 remains open and is supported on an extension 57 of the stem 44.

The opposite end of the stem 44 is disposed in position for engagement with a rocker cam 58 operable through the actuation of a handle 59, a guide 61 being provided for the stem 44 during the reciprocation thereof when the cam 58 is moved.

The cam 58 may be pivoted at 62 to the body of the valve within the outlet chamber 31, a contact surface 63 of the cam being positioned beneath the lower end of the stem. Upon the cam and offset with respect to the stem is a contact cam or extension 64 disposed in the path of a plunger or push-rod 65 which may be thrust inwardly to move the contact cam and thus operate the cam 58 to lift the stem.

The present construction comprising the rocker arm provides for the novel disposition of the hinge at the front of the valve. The push rod 65 is off-center with respect to the valve body, thus making it possible to bring the handle bonnet closer to the body of the valve, which is an advantage in that it reduces the amount of material in making the valve and enhances the appearance of the device.

The plunger 65 may be moved by any suitable mechanism, that shown being of a well known type having contacting disks 66 and 67 integral with the plunger and handle, respectively, a spring 68 holding them normally in contact. The plunger may extend into the chamber 31, the usual form of stuffing-box 68 comprising a packing 69 and gland 70 being provided. A handle bonnet comprising a flanged collar 71 threadedly connected to a housing 72 holds the handle in place. The housing which may be integral with the stuffing box is threadedly connected to the casing 10.

An upward movement of the valve head under the action of the cam 58 may be limited by an adjustable stop comprising a screw 74 having one end extending into the compartment 28 and engageable with the upper end of the valve head 19. The opposite end of the screw may extend through a composite packing 75, preferably of a ring of fibre and a ring of lead. The outward end of the screw may be slotted to facilitate adjustment, and a cap 76 may be provided to encase the end of the screw and to compress the packing therearound to prevent leakage.

The valve may be operated as follows: When the handle 59 is actuated to move the plunger, the cam 58 is moved and the stem 44 raised. The initial movement of the stem opens the relief valve 35, such movement bringing the relief valve into contact with the upper wall of the part 42. When the valve is in its upper position, communication is maintained by reason of aperture 35' in a wall of the relief valve 35. A continued movement of the stem operates to lift the valve head from the tubular member 17 or valve seat, thus opening communication between the chamber 29 and the outlet 14, at the same time the valve head displaces the water in the chamber 28 only to a minimum extent, the water being permitted egress from the compression chamber by means of the orifice 51, passage 53, and the passage 46. Inasmuch as the auxiliary valve 55 is in its lower position, an ample flow of water is attainable and any air that may have become pocketed at the upper end of the bonnet is released and silently dissipated. Owing to the construction of the handle and by reason of the adjustable stop screw 75, the valve head can only be moved a predetermined distance to permit a flow of water from the inlet 13 to the outlet 14. When the handle is released the relief valve 35 within the valve head closes at once under the action of the spring 43 and the valve head begins to drop by reason of the difference in pressures between the chambers, and water passes through the bleeder conduits 52. The flow of water through the bleeder conduits is, however, retarded since

such flow carries the valve 54 upwardly and the tapered end thereof enters the conical constriction of the orifice 51, leaving a passage equal in area to the area of the groove 55. It will thus be evident that the compartment 28 will have a lag in reaching the pressure of the compartment 29, thereby giving a time interval in which the flowing water may oppose the downward movement of the valve head. As the water enters the compartment 28 through the bleeder conduit, the valve head gradually moves to engage the diaphragm 22 with the seat of the tubular member 17.

It will be understood that a valve of the present type may be used with different pressures of water and for the purpose of permitting a uniform quantity of water to pass through with each operation. It may be necessary to vary the distance the valve head travels, which is readily accomplished by manipulation of the screw 75.

Although a preferred embodiment of my invention is illustrated and described, it is obvious to those skilled in the art that modifications may be made therein which may fall within the spirit and scope of the appended claims.

What I claim is:

1. A flush valve comprising a hollow body having inlet and outlet openings, an annular valve seat centrally disposed within said body, a valve head having a pair of diaphragms secured thereto and spaced apart, the outer edges of said diaphragms being secured in spaced relation to the body, said valve head having a hollow extension extending into the upper portion of the valve body to such an extent as to effect the removal of air therefrom prior to a flushing operation, a relief valve carried by said valve head, and a bleeding conduit extending through said hollow extension and communicating with the space between said diaphragms and through one of said diaphragms with said inlet.

2. A flush valve comprising a hollow body having inlet and outlet openings, a supply chamber, a compression chamber, and an outlet chamber, a valve head carrying a plurality of diaphragms separating said chambers from one another, said valve head having a hollow extension extending into the

upper portion of the compression chamber to such an extent as to effect the removal of air therefrom upon operation of said valve, said hollow extension communicating with the space between said diaphragms and with said supply chamber through one of said diaphragms, and a relief valve and an auxiliary valve carried by said valve head.

3. A flush valve comprising a hollow body having inlet and outlet openings, a supply chamber, a compression chamber, an outlet chamber, a valve head having means for permitting the removal of water and air from said compression chamber during a flushing operation and the admission of water from the supply chamber to said compression chamber to equalize the pressure therein with respect to said supply chamber, and a plurality of diaphragms secured to said valve head and separating said chambers one from another.

4. A flush valve comprising a hollow body, a diaphragm for separating said hollow body into a supply chamber, a compression chamber and a discharge chamber, a seat for said valve, a relief valve box secured to said diaphragm, said box being so designed to serve as an air snifter, bleeder conduit and to remove a limited quantity of water from said compression chamber, a relief valve within said relief valve box, and means for operating said valve and for lifting said diaphragm from said seat.

5. A flush valve comprising a hollow body, a diaphragm for separating said hollow body into a supply chamber, a compression chamber and a discharge chamber, an annular seat for said valve, a relief valve box secured to said diaphragm, said box having means for effecting the removal of air from within said compression chamber and a limited quantity of water with each flushing operation, said box additionally serving to effect the equalization of pressures within said supply and compression chambers, and means for operating said diaphragm positively and to permit said diaphragm to be closed by the fluid pressure.

In testimony whereof, I have hereunto subscribed my name this 4th day of December, 1924.

EDWARD G. HEDGES.