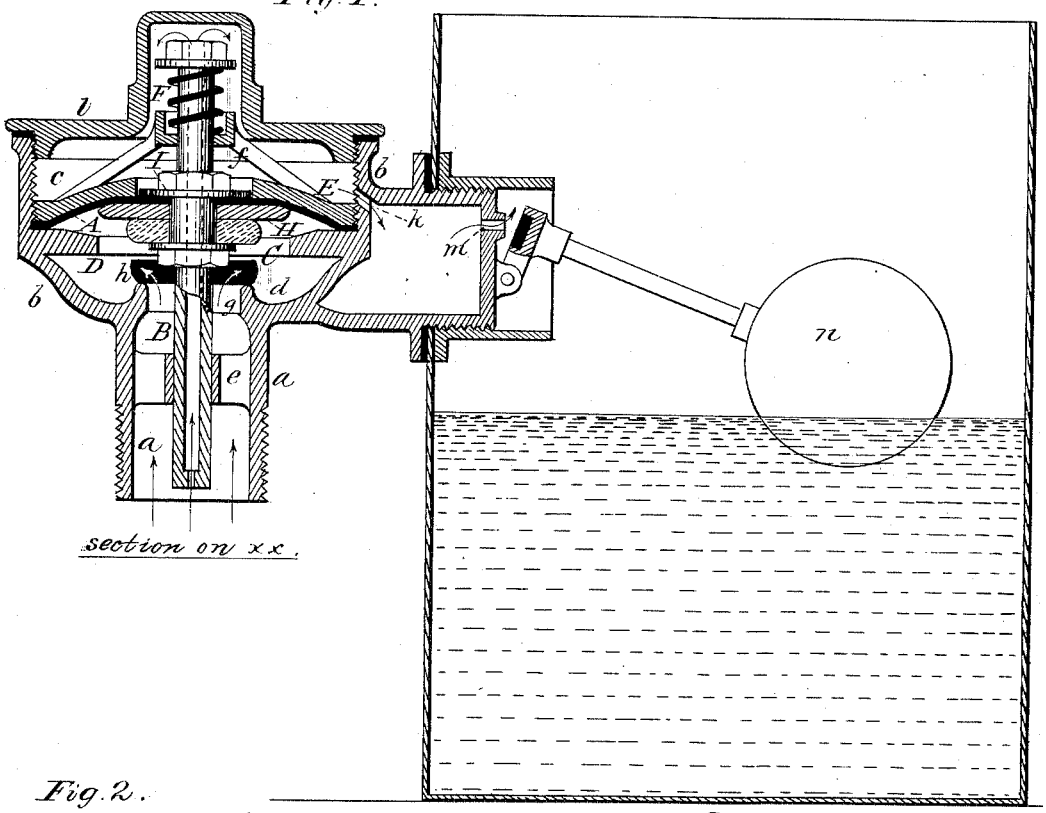
H. H. CRAIGIE.

Diaphragm-Valve for Water-Tanks, &c.

No. 209,867. Patented Nov. 12, 1878.

Fig. 1.



section on x x.

Fig. 2.

section on o o.

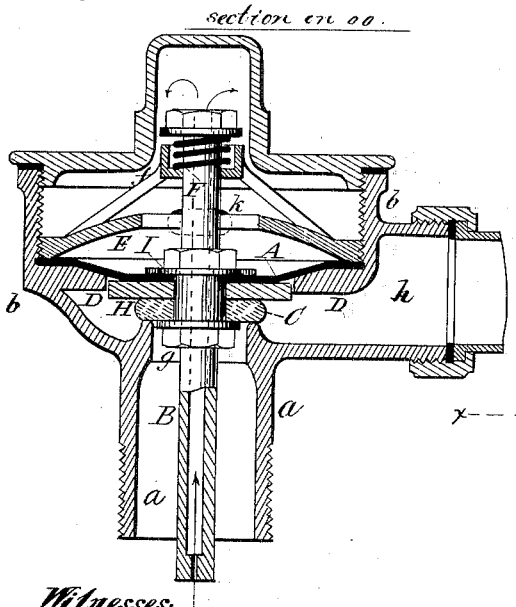
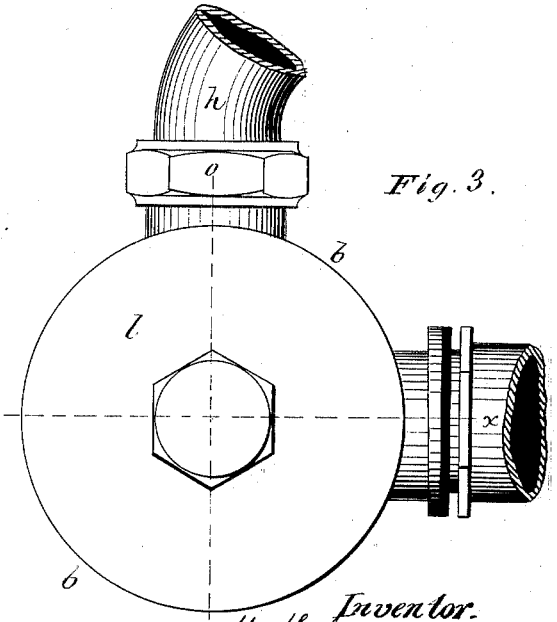


Fig. 3.



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UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN DIAPHRAGM-VALVES FOR WATER-TANKS, &c.

Specification forming part of Letters Patent No. **209,867**, dated November 12, 1878; application filed August 5, 1878.

To all whom it may concern:

Be it known that I, HUGH H. CRAIGIE, of Stamford, Fairfield county, Connecticut, have invented a certain new and useful Improvement in Diaphragm-Valves for Water-Tanks, &c., of which the following is a specification:

My invention relates to that class of float-valves designed to regulate the supply of water to water-closets or tanks in which the float, instead of acting directly in the discharge-orifice of the valve, acts to open or close a small water-vent, which confines or releases the water-pressure above a flexible diaphragm, the consequent movement of which seats or unseats an independent valve which controls the discharge-orifice, and thus delivers a more rapid supply; and the object of my invention is to produce a valve of this class which, while being simple, shall possess greater efficiency, durability, and sensitiveness.

To this end my invention may be stated to consist in the arrangement of the diaphragm between two annular supporting plates or ledges having a central aperture, which permits the movement of the valve-stem, in connection with disks upon the valve-stem, between which the center of the diaphragm is clamped, which disks enter and exactly coincide with the apertures of the supporting-ledges when the diaphragm is at either end of its stroke, so as to present a solid support to the entire surface of the diaphragm when at rest at each end of its stroke, and thus prevent its rupture or penetration by the pressure of the water.

The invention also consists in a tubular valve-stem connecting the diaphragm and disk-valve, and in a counterbalancing upwardly-acting spring actuating the valve-stem to neutralize the weight thereof and assist the rise of the diaphragm and the unseating of the discharge-valve; and in constructing the diaphragm of flexible leather, as hereinafter fully set forth.

In the annexed drawings, Figure 1 gives a sectional view of my improved valve shown connected with a water-tank. Fig. 2 is a section at right angles to plane of section of Fig. 1, or through the main discharge-branch of the valve, while Fig. 3 represents a plan view of the valve, and indicates the planes on which the sectional views are taken.

As shown in the drawings, *a* represents the shank or neck of the valve, which forms the water-inlet, and which is connected with the water-supply pipe in the usual manner of making such connections. From the top of the neck the body expands into a bulb, *b*, in which the main operative parts are inclosed, and which is covered by a screw-cap, *l*. A is a flexible diaphragm, which extends across the cavity of the bulb about centrally thereof, dividing the cavity into an upper and lower chamber, *c d*. This diaphragm is held at its circumference between an annular ledge, D, which projects circumferentially into the interior of the bulb, and a concave annular plate, E, which is screwed down upon the diaphragm to clamp it against the ledge, the inner side of the bulb being screw-threaded to receive the said annular plate, and also the screw-cap *l*, as shown.

The center of the diaphragm is secured to a tubular valve-stem, B, which is arranged centrally in the cavity of the valve, and is guided at the bottom by a cross-bar, *e*, in the neck *a*, and at the top by arms *f* on the annular plate E. The aperture *g* of the neck *a*, where it enters the base of the bulb *b*, is ground to form a valve-seat, on which the disk C, which forms the discharge-valve, is adapted to tightly seat itself. This disk is preferably formed of strong sole-leather, and is fixed centrally on the tubular stem B below the diaphragm A, as shown. The water thus finds access through the apertures *g* under the valve-disk C to the lower chamber, *d*, of the bulb below the diaphragm A, and it escapes therefrom into the tank in a large volume by a lateral branch, *h*, which forms the discharge of the valve. A smaller stream of water, however, rises from beneath the valve-disk C through the bore of the tubular stem B to the upper chamber of the bulb above the diaphragm A, from which it finds lateral escape through the small vents *k m*, the latter of which is controlled by the usual float *n*.

Now, supposing, as indicated in Fig. 1, that

the water-level of the tank has fallen, the vent *m* has become opened, the diaphragm has risen to the top of its stroke, and the discharge-valve C consequently raised from its seat, the water will accordingly rise through the aperture *g*, pass through the chamber *c*, and rush in a large volume from the main discharge *h*, while, at the same time, a smaller stream will find its way into the upper chamber *c* through the bore of the tubular valve-stem B, and escape therefrom by the vents *k m*. This double flow will thus continue till the float has risen sufficiently to check the flow from the vent *m*, when the water-pressure, becoming thereby confined above the diaphragm, while the main discharge yet finds free escape below it without exerting any upward pressure thereon, the water will therefore accumulate in the upper chamber, and, acting upon the comparatively large surface of the diaphragm, will depress the same with hydraulic positiveness, and thus force the discharge-valve C tight upon its seat *g*, and thus completely shut off the flow to the tank, as indicated in Fig. 2. The flow will thus remain checked till the water-level of the tank again falls, when, the pressure above the diaphragm being thus relieved by finding free escape through the opened vent *m*, the upward pressure on the valve-disk C will then preponderate, unseat the valve, and raise the diaphragm, and thus permit the discharge to again take place, which will be again checked in the same manner, when the float again rises.

The valve-stem B is fitted with a light spring, E, which has a gentle upward action, which acts auxiliary to the upward water-pressure to raise the diaphragm A and open the valve C, and it serves to counterbalance or neutralize the weight of the valve-stem and its attachments, thus rendering the diaphragm very sensitive to the water-pressure, this feature being more particularly desirable where the supply of water is under but slight head or pressure, as it makes the action of the valve more certain.

The diaphragm A is preferably constructed of flexible leather—that is, thin oak sole or belt leather or strong upper-leather—as this material is admirably adapted for the purpose of a diaphragm-valve, not only being cheap, but possessing the most perfect flexibility, as when the leather becomes wet its movements occur without any resistance, and this imparts great ease and sensitiveness to the motion of the valve. Moreover, the leather has no tendency to stick to the metallic surfaces of the valve, and has no corrosive affinity therefor, as is the case with rubber, which, while being more expensive, is less flexible, has a strong tendency to stick to the metal surfaces, and has such a corrosive affinity for the brass of the valve as to become quickly destroyed thereby.

The diaphragm, at either end of its stroke, is supported, as already described, at its circumference by the annular ledge D and annular plate E, which are stationary, while the center of the diaphragm is supported by central disks I H on the valve-stem B, between which it is clamped. These disks correspond to and exactly fit the central aperture of the annular supports D E, through which the valve-stem moves, so that when the diaphragm arrives at either end of its stroke the disks enter and exactly fill the central aperture, as shown in Figs. 1 and 2, and this coincidence of the annular and central support thus presents a continuous surface, upon which the diaphragm cushions itself, and receives the solid support which effectually prevents the pressure of the water rupturing or penetrating the same. Hence a very flexible, light, and easily-movable material may be used to form the diaphragm without any danger of injury thereto, and by this means the advantages of greater sensitiveness, ease of motion, efficiency, and durability which are claimed for the improved valve are obtained.

Where strong rubber diaphragms have been employed heretofore they have been liable, from the defective support furnished thereto, to rupture by the pressure of the water, which has constituted a serious objection to this class of valves; but by means of my construction comparatively weak and delicate materials may be used without damage, and hence this construction and arrangement of the diaphragm is considered an important improvement in this class of valves.

My improved valve may be used for water-closet tanks or for water-tanks generally, or may be attached directly to the water-closets in that class known as "plug-closets," which contain a reservoir of water attached to the bowl, or may be used for any other similar purpose for which it is adapted.

What I claim as my invention is—

1. In a diaphragm-valve, the combination of a float or valve, *n*, governing a discharge-orifice above the diaphragm, and a valve-disk, C, governing a discharge-orifice below the diaphragm, with the movable actuating-diaphragm A, constructed of flexible leather, substantially as and for the purpose set forth.

2. In a diaphragm-valve, a movable diaphragm, A, supported at its circumference by a fixed annular plate or plates, D E, and at its center by a movable central disk or disks, I H, which, at the end of the diaphragm's stroke, coincide and present a continuous surface and solid support, on which the diaphragm becomes cushioned and protected from the pressure of the water, substantially as herein shown and described.

3. The combination, in a diaphragm-valve, of the actuating-diaphragm A, dividing the valve-cavity into upper and lower pressure-chambers, a valve-disk, C, controlling the admission of the pressure below the diaphragm, with a tubular valve-stem, B, on which the said diaphragm and disk are sustained, and which conveys the water-pressure from beneath

the said disk to the chamber above the diaphragm, substantially as and for the purpose set forth.

4. In a diaphragm-valve, the combination of the actuating-diaphragm A and the disk C, which controls the admission of water below the diaphragm, with the auxiliary spring F, acting upwardly on the diaphragm and valve to counterbalance the weight thereof, and thus assist the unseating of the valve and render the diaphragm more sensitive to the water-pressure, substantially as set forth.

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Witnesses:

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