(No Model.) 2 Sheets—Sheet 1.

H. H. CRAIGIE.

SIPHON FLUSH TANK.

No. 433,447. Patented Aug. 5, 1890.

Fig. 1.

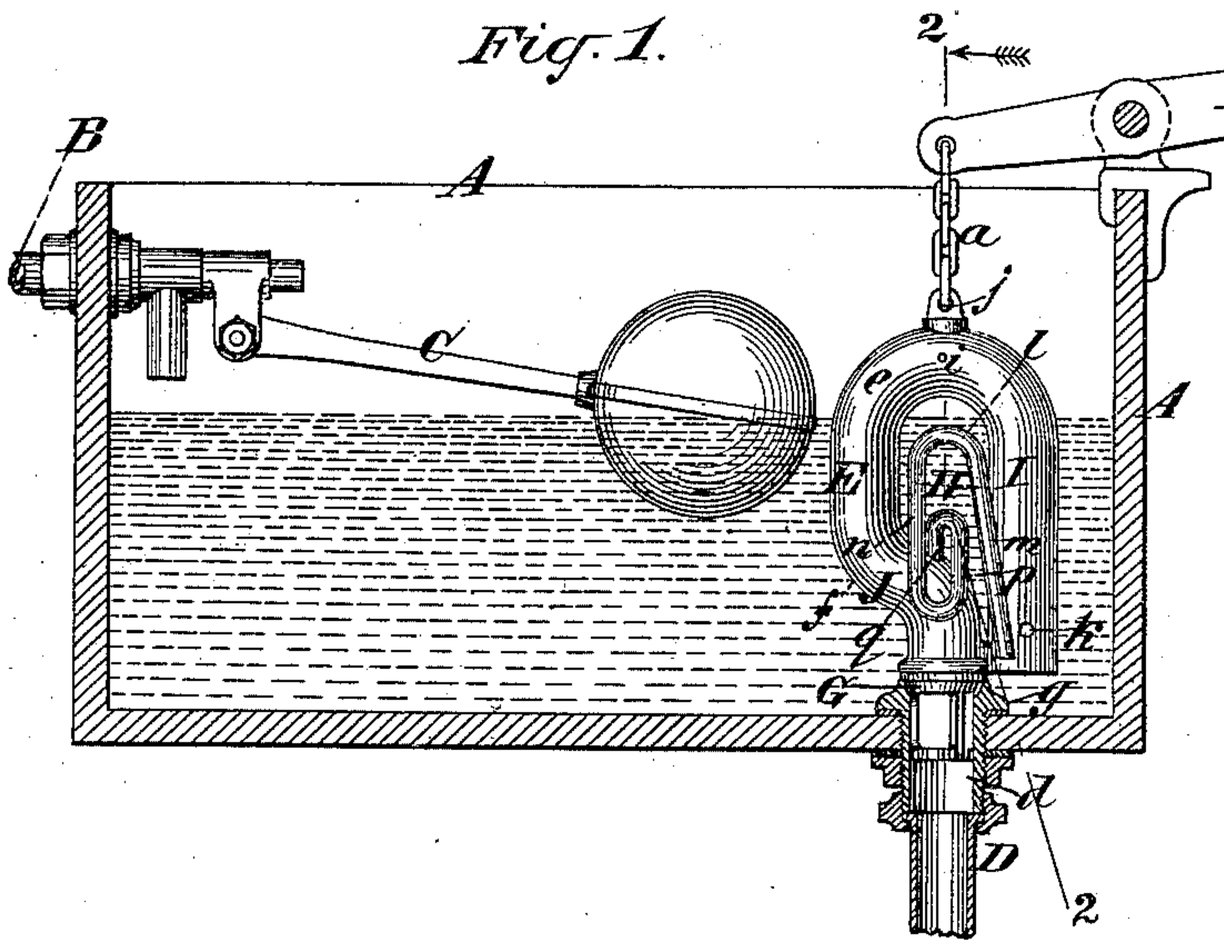


Fig. 2.

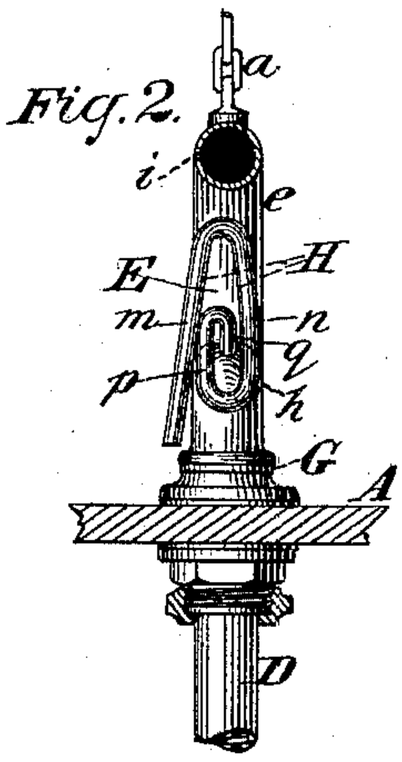


Fig. 3.

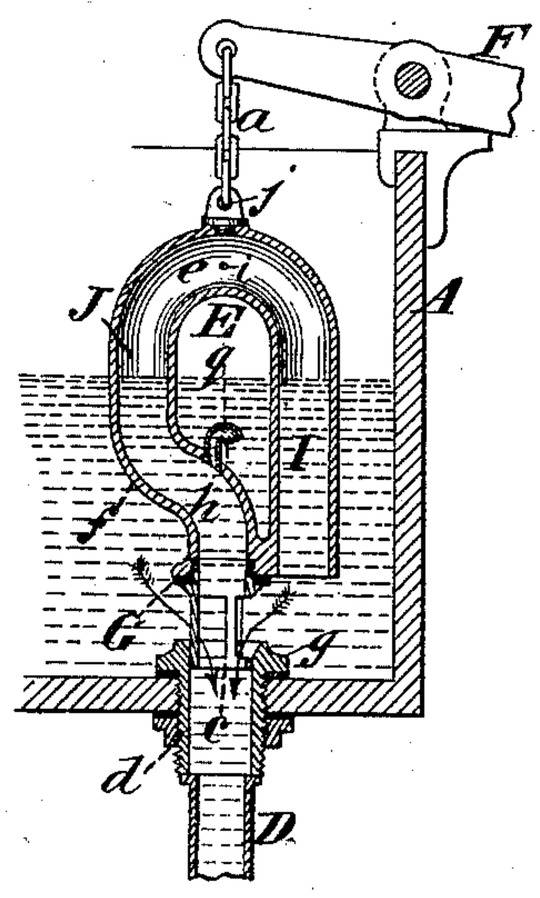


Fig. 4.

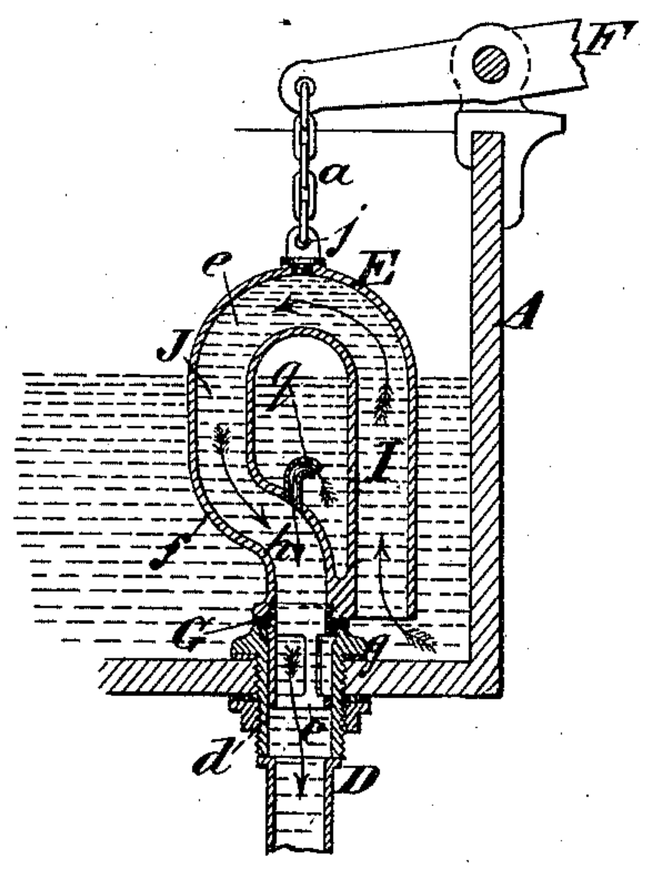
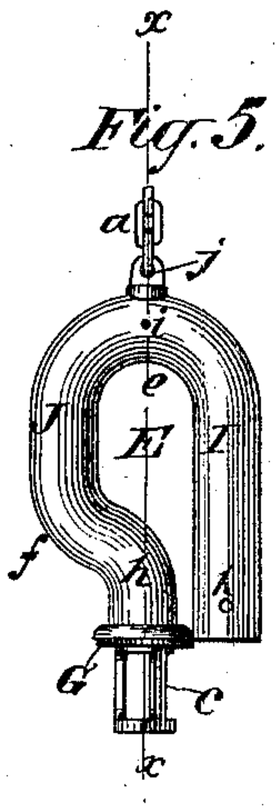


Fig. 5.



WITNESSES

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(No Model.) 2 Sheets—Sheet 2.

H. H. CRAIGIE.

SIPHON FLUSH TANK.

No. 433,447. Patented Aug. 5, 1890.

Fig. 7.

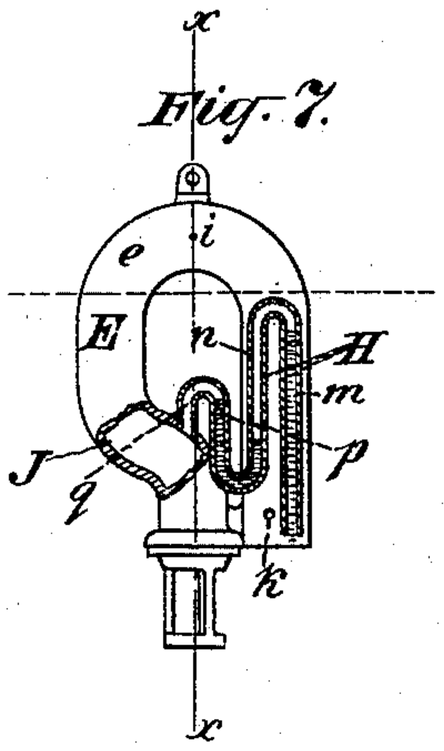


Fig. 6.

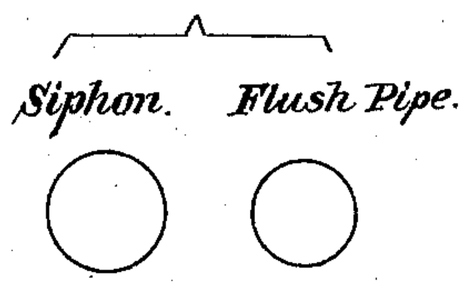
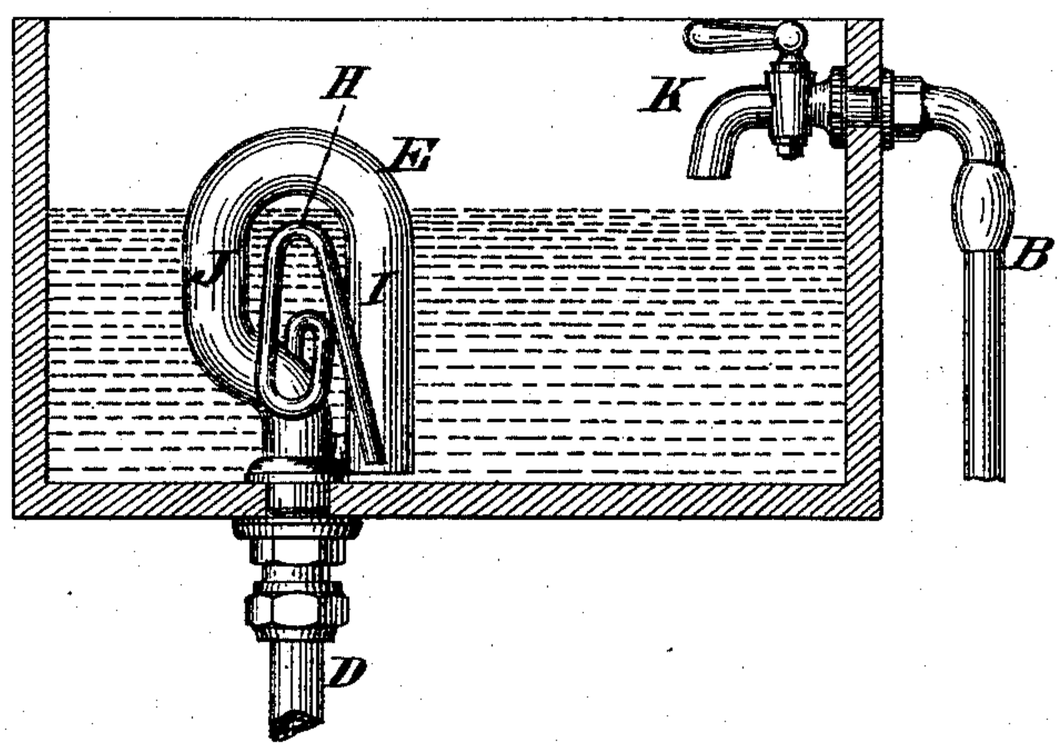


Fig. 8.



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UNITED STATES PATENT OFFICE.

HUGH H. CRAIGIE, OF STAMFORD, CONNECTICUT.

SIPHON FLUSH-TANK.

SPECIFICATION forming part of Letters Patent No. 433,447, dated August 5, 1890.

Application filed March 6, 1888. Serial No. 266,319. (No model.)

To all whom it may concern:

Be it known that I, HUGH H. CRAIGIE, of Stamford, Fairfield county, Connecticut, have invented certain new and useful Improvements in Siphon Flush-Tanks, of which the following is a specification.

This invention relates to flushing-tanks for flushing water-closets, urinals, and other devices either upon the manual or automatic operation of a pull or periodically at predetermined intervals.

My improved tank is of that class which is provided with a siphon for the purpose of discharging the contents of the tank at each flushing operation. For a water-closet tank, or one to be discharged upon the manipulation of a pull, the siphon terminates in a valve which closes the outlet to the flushing-pipe and which when lifted to admit the outflow of water from the tank directly to the flushing-pipe serves to start the siphon, so that after the seating of the valve the outflow of water will be continued through the siphon until the water-level descends below the inlet into the short leg of the siphon. For periodical flush-tanks—such as are commonly used for urinals—the siphon is started by the rise in the water-level, causing the water to overflow from the short into the long leg of the siphon and thereby create a vacuum sufficient to start the outflow.

Siphon-valves as most commonly heretofore constructed have consisted of a stand-pipe passing through the valve and extending up to just above the normal water-level and an air bell or tube with a closed top arranged over the stand-pipe, so as to form an annular passage between the two, extending down nearly to the valve and fastened to the stand-pipe, so that both are lifted together. The annular passage constitutes the short leg and the interior of the stand-pipe the long leg. This type of siphon-valve is subject to the disadvantage that the column of water ascending through the short leg has its direction of motion suddenly and abruptly reversed at the crown of the siphon, where it flows over the top of the stand-pipe and where the water converges from all sides toward the center of the latter, whereby owing to the momentum of the water and its friction in the passage the flow is choked and retarded, so that the capacity of the siphon is materially reduced.

Siphon-valves have also been devised consisting of a cylindrical tube extending upwardly from the valve, closed at its top and divided diametrically by a vertical partition extending nearly from top to bottom and having two water-passages on its opposite sides, one of which, constituting the short leg of the siphon, opens at the bottom through the side of the cylindrical tube of the tank, while the other passage communicates at its bottom through the valve with the flushing-pipe. This construction is open to the same disadvantage as that of the stand-pipe and siphon, in that the column of water is forced to suddenly reverse its direction of motion, sweeping around the thin edge of a sheet-metal partition.

Siphon outlet-valves as heretofore made have invariably been made with a water-passage the area of which has been either smaller than or the same as that of the flushing-pipe, and it has been found that such a siphon will not deliver as large a stream when the water has to flow through the siphon as it will during the time that the valve is lifted and the water flows directly down the flushing-pipe. This has proved disadvantageous in the case of water-closets, which require a strong and full flush in order to effectually carry out the contents of the bowl and traps—such, for example, as "washout" and "short-hopper" closets, and for such closets the use of siphon flushing-tanks has been in great part abandoned, other constructions of tanks being substituted for them wherein the outflow is sudden, rapid, and of large volume.

My present invention provides an improved construction of siphon outlet-valve which is free from the disadvantages just recited. The siphon consists of a round tube, through which the column of water can flow with a minimum of friction, and the area of which is considerably in excess of that of the flushing-pipe, whereby the advantage is gained that the flow through the siphon after the seating of the valve is fully as rapid and of as large volume as during the time that the valve is held lifted. The round tube constituting the siphon is curved with bends of large radius, so that the

direction of motion of the column of water flowing through it is changed gradually and easily, and all obstruction of the flow is thereby avoided. The siphon is suspended from the usual operating-lever at a point directly over and in line with the center or axis of the outlet or valve-seat, and is itself so shaped and balanced that its center of gravity is intersected, or approximately so, by this axis, so that the lifting of the siphon has no tendency to tilt or displace it laterally, and thereby the easy working and perfect seating of the valve is assured. To accomplish this balancing of the siphon, the shorter or up leg is arranged entirely on one side of the axis, and the longer or down leg is carried clear to the opposite side thereof during part of its descent, and subsequently curves inwardly to the axis, and turns thence downwardly to its junction with the valve, at which point it is concentric with the axis.

In order to insure the starting of the siphon by the rise of the water-level to the point of overflow through it, I provide an auxiliary siphon consisting of a relatively very small pipe with its bend or crown somewhat beneath that of the main siphon and with its down leg entering the down leg of the main siphon in such position that when the overflow occurs through the auxiliary siphon a stream will thereby be directed down the axis of the flushing-pipe, whereby the suction created by this stream will serve to start the siphonic outflow through the main siphon. The double siphon thus provided may be used either for the purpose of a pull-tank for flushing water-closets or a periodical tank for flushing urinals and the like, requiring no alteration to convert it from one use to the other.

Figure 1 of the accompanying drawings is a vertical longitudinal section of a flushing-tank for flushing water-closets, provided with my improved siphon-valve, and constructed either to be operated by a pull or to discharge itself periodically. Fig. 2 is a transverse section cut in the plane of the line 2 2. Figs. 3 and 4 are views showing the siphon in section and in two different phases of its operation, the outflow taking place in Fig. 3 through the valve and in Fig. 4 through the siphon. Fig. 5 is a side elevation of the siphon-valve removed and showing a modified construction wherein the auxiliary siphon is omitted. Fig. 6 is a diagram illustrating the relative cross-sectional areas of the siphon and the flushing-pipe. Fig. 7 is an elevation of the main siphon and a section through the auxiliary siphon, the shape of the latter being varied to bring its axis in the plane of the section. Fig. 8 is a vertical longitudinal section of a periodical flushing-tank constructed according to my invention.

Referring to the drawings, let A designate the tank; B, the service-pipe or water-inlet pipe thereto; C, the float-valve by which (except in the construction shown in Fig. 8) the tank is refilled; D, the flushing-pipe leading downward from the tank to the water-closet, urinal, &c., to be flushed; E, the siphon, and F the operating-lever.

The lever F is fulcrumed on a standard fixed to the tank. Its inner end is connected by a chain *a* or otherwise to the siphon and its outer end is connected by a chain, wire, or other connection *b* to a pull or to the seat of the water-closet or to other device for pulling or operating the lever. The flushing-pipe D is joined to the usual connection, which passes through the bottom of the tank and the upper part of which within the tank constitutes the valve-seat *g*, on which seats the valve G, which is attached to the long leg of the siphon. The valve G has a suitable soft packing to enable it to make a tight joint with the seat *g*, and is guided in its lifting and seating movements by means of a skeleton tube *c*, which projects from it downwardly and enters freely or loosely into the tube *d* of the flushing-pipe connection, the interior of which latter tube constitutes the outlet-opening from the tank.

The siphon E consists of a round tube of approximately inverted-U shape, its long leg terminating within the valve G and its short leg terminating near the bottom of the tank to one side of the valve G. The tube is curved in the manner best shown in Fig. 5, where the line *x x* represents the vertical axis of the outlet opening or valve. From this figure it is seen that the two legs join each other at the upper part or crown of the siphon with a bend or curve *e* of large radius, the center of which is approximately intersected by the axial line *x x*, thereby bringing the short leg I and the long leg J equally on opposite sides of the axial line. Both legs descend from the curve E in approximately vertical direction, the short leg I extending, preferably, in a straight line to its terminus and the long leg J descending in a straight or more or less curved direction part of the way down, and having its lower portion carried inwardly toward the axis by a gentle curve *f* and directed thence downwardly by another gentle curve *h* to its junction with the valve G. At this point the long leg is concentric with the axis *x x*. This shape of the siphon accomplishes an equal distribution of its weight on opposite sides of the axis, so that the latter intersects, or approximately so, the center of gravity of the siphon, and also insures the avoidance of any sharp or abrupt bends in the siphon, so that the stream or column of water flowing through it to the valve is given a full, sweeping, and unobstructed flow without any sudden changes of direction and without encountering any obstacles in the nature of contractions or abrupt surfaces against which the stream must impinge.

The siphon is formed with an eye *j* at the top of its bend *e*, which eye is arranged in the axis *x*, so that when the siphon is suspended by means of the chain *a* engaging this eye, it is

balanced and suspended in line with the central axis of the movement of the valve G, so that all tendency of the siphon to tilt and thereby prevent the proper and free lifting and descent of the valve, and the proper and tight seating of the latter, is obviated.

The siphon is formed with a round water-way of preferably circular cross-section, so that the greatest area is afforded for the stream of water with the least friction or other resistance to its passage. The tube may be made more or less elliptical or otherwise varied from a circular cross-section without materially impairing the operation of the siphon, but a circular cross-section is preferable.

Any material departure from a circular water-way will be found to produce a corresponding retardation or diminution of the outflow.

Instead of being made with an area for the water-way of somewhat less than that of the flushing-pipe, or at greatest of equal area therewith, as has been the case with siphons heretofore, I construct my siphon of considerably greater area than the flushing-pipe, and I find that by so doing an important advantage is gained—viz., that the flow after the valve is seated, as in Fig. 4, is as full and rapid as it was while the valve remained lifted, as shown in Fig. 3, whereas heretofore the flow has been retarded and diminished upon the release of the pull and the consequent dropping of the siphon.

In practice with a flushing-pipe of one and one-fourth inch diameter I make the siphon of one and one-half inch diameter, (inside measurements,) giving the relative areas shown in Fig. 6. These proportions give excellent results, but some departure from them is permissible.

The combination of new features embodied in my improved siphon results in securing a very strong and abundant flow of flushing-water through the siphon, there being no retardation due to a restricted area of the siphonic outflow-passage, nor to choking at the crown of the siphon, nor to the sudden reversal of the direction of flow of the column of water, as in previous siphon-valves. By preference I form the siphon with a minute hole *i* at or near its crown, and with a large hole *k* near the bottom of the short leg, the purpose of the latter being to admit air at the end of the flush and reduce the siphonic suction gradually, thereby preventing any gurgling or sucking noise. These, however, are common features in siphon-valves.

The operation of this siphon-valve is the same in general as that of siphon-valves as heretofore constructed. When the parts are at rest and the tank full, as shown in Fig. 1, the pulling of the lever F lifts the siphon and the outflow starts through the valve G, as shown in Fig. 3, after which the lever may be released and the valve is seated, whereupon the suction generated by the downflow in the flushing-pipe draws the water through the siphon, as shown in Fig. 4, which continues until the tank is emptied, after which the tank is refilled by water coming through the float-valve. The auxiliary siphon H consists of a small tube—say, for example, of one-half inch bore—bent to form a short leg *m* and a long leg *n*, joined by a bend or crown *l*, which comes just beneath the overflow level through the siphon E, as shown in Figs. 1, 2, and 5. The long leg *n* is trapped at its lower portion by being bent upwardly at *p*, so that a small quantity of water is normally held in this trapped portion. The long leg *n* enters the long leg J of the siphon E at *q*, in a position, preferably, in line with the axis *x* of the flushing-pipe, so that when the small auxiliary siphon acts the small stream passing through it will be discharged down the flushing-pipe for some distance in the center thereof, so that the flowing water will more effectually carry the air along with it, and thereby create a suction in the long leg of the siphon E, which will be effective for the purpose of starting the siphonic outflow through the latter. The auxiliary siphon having its bend *l* at a lower level than the bend of the main siphon, will, upon the rise of the water-level, be started before the main siphon is started, and by its action, as just described, it will insure the starting of the main siphon. This is advantageous in every case where it is desired to start the siphon by the mere rise of the water-level to a point where the water overflows the siphon. In a full flushing-tank, such as shown in Figs. 1, 2, and 3, this action will not ordinarily occur, and in fact will only take place when, through some derangement of the float-valve, the tank is filled above the normal level, so that the siphon acts as an overflow to carry off the excess of water. In such case it is desirable that the water, instead of trickling off only as fast as it enters the tank in excess, as is the case with ordinary overflows, shall be carried out of the tank with a rush, the same as when the tank is operated to flush the closet, as thereby the abnormal action is certain to be noticed by the occupants of the premises, who are thus enabled to take steps for the repair or readjustment of the deranged float-valve.

The auxiliary siphon enables my improved siphon-valve to be used for giving a periodical flush, as well as for flushing when the tank-lever is pulled. To effect this no alteration of the siphon is required; but the float-valve must either be replaced by a faucet or cock to admit a continual reduced stream of water, as shown at K in Fig. 8, or else the float must be so fastened that a continual stream shall enter through the float-valve. In either case the tank will slowly refill, and when full will overflow the siphon and start the siphonic outflow. The auxiliary siphon insures the starting of the main siphon even when the water enters the tank so slowly as to produce the most infrequent flushes that

are employed in practice, since a minute stream, which would be insufficient to start the main siphon, will amply suffice to start the auxiliary siphon, and this, when it is in full flow, is sufficient to start the main siphon; hence a large main siphon may be used, so that the tank may be discharged suddenly and a flush of great volume be secured, which is an important desideratum.

The trap or pocket *p* of the auxiliary siphon may be omitted, although I consider its use preferable. Its action is to somewhat retard the outflow through the auxiliary siphon until the water-level shall be sufficiently above the bend *l* to overflow it in a large enough stream to certainly start the siphon. This is desirable more especially with periodical tanks, which are refilled very slowly in order to flush at long intervals. The action of the trap *p* is to confine some air within the long leg *n*, so that this air, on being compressed by the rise of the water in the leg *m*, will somewhat hold back the water-level in the latter leg, as indicated in Fig. 5.

Fig. 8 shows a tank designed to give periodical flushes only, it being unprovided with any operating-lever for manually lifting the siphon and having no float-valve. The tank is refilled by a small stream entering through an adjustable cock or faucet K, as usual in periodical tanks. The precise radius of the curve or bend *e* is not essential further than that it shall be sufficient to give a free sweep to the flowing column of water. Since the two legs constitute distinct portions of a round tube, this bend is necessarily of a radius greater than the diameter of the tube.

I am of course aware that siphons have been made of round tubes bent into inverted-U shape, and that balanced siphon-valves have been made, but the legs of which did not consist of a round tube, and I make no claim to either of these features by itself.

I claim as my invention the following-defined improvements in siphon flushing tanks or valves, substantially as hereinbefore specified:

1. A flushing-tank having a siphon outlet-valve consisting of a round tube of greater area than the flushing-pipe, extending upwardly within the tank to form the short leg of the siphon, carried over at its crown in a sweeping curve, descending thence to form the long leg, and terminating in a valve in communication with the flushing-pipe.

2. In a flushing-tank, the combination, with the tank, operating-lever, valve-seat, and flushing-pipe, of a siphon-valve consisting of a round tube of greater area than the flushing-pipe, extending upwardly within the tank to form the short leg of the siphon, carried over at its crown in a sweeping curve, and descending thence to form the long leg, terminating in a valve fitting said valve-seat and in communication with the flushing-pipe, and connected to the operating-lever from a point of suspension in line approximately with its center of gravity.

3. A siphon-valve for flushing-tanks, consisting of a round tube the longer leg of which terminates in a valve, said tube being suspended from a point directly over and in line with the axis of the valve and having its short and long legs joined by a sweeping curve at the crown, and arranged on opposite sides of said axial line in such manner as to balance the weight of the siphon equally and bring the center of gravity thereof in line with the axis of the valve.

4. In a flushing-tank, the combination, with the flushing-pipe, of a siphon consisting of a round tube of greater area than the flushing-pipe, extending upwardly within the tank to form the short leg of the siphon, carried over at its crown in a sweeping curve, and descending thence to form the long leg, and an auxiliary siphon consisting of a small tube with its crown-bend at a lower level than that of the main siphon and with its long leg discharging into the long leg of the main siphon.

5. In a flushing-tank, the combination, with the flushing-pipe, of a siphon consisting of a round tube of greater area than the flushing-pipe, extending upwardly within the tank to form the short leg of the siphon, carried over at its crown in a sweeping curve, and descending thence to form the long leg, and an auxiliary siphon consisting of a small tube with its crown-bend at a lower level than that of the main siphon, with its long leg discharging into the long leg of the main siphon and formed with a trap in its long leg, whereby the charging of the auxiliary siphon is retarded.

6. A siphon-valve for flushing-tanks, consisting of a round tube the long leg of which terminates in a valve and provided with an auxiliary siphon consisting of a small tube with its crown-bend at a lower level than that of the main siphon, and with its long leg discharging into the long leg of the main siphon, whereby the siphon-valve is adapted for use in either a manually-operated or periodical flushing-tank.

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