Dec. 18, 1934. J. S. CANDEE 1,984,394

SUPPLY AND DISCHARGE MECHANISM FOR WATER CLOSET TANKS

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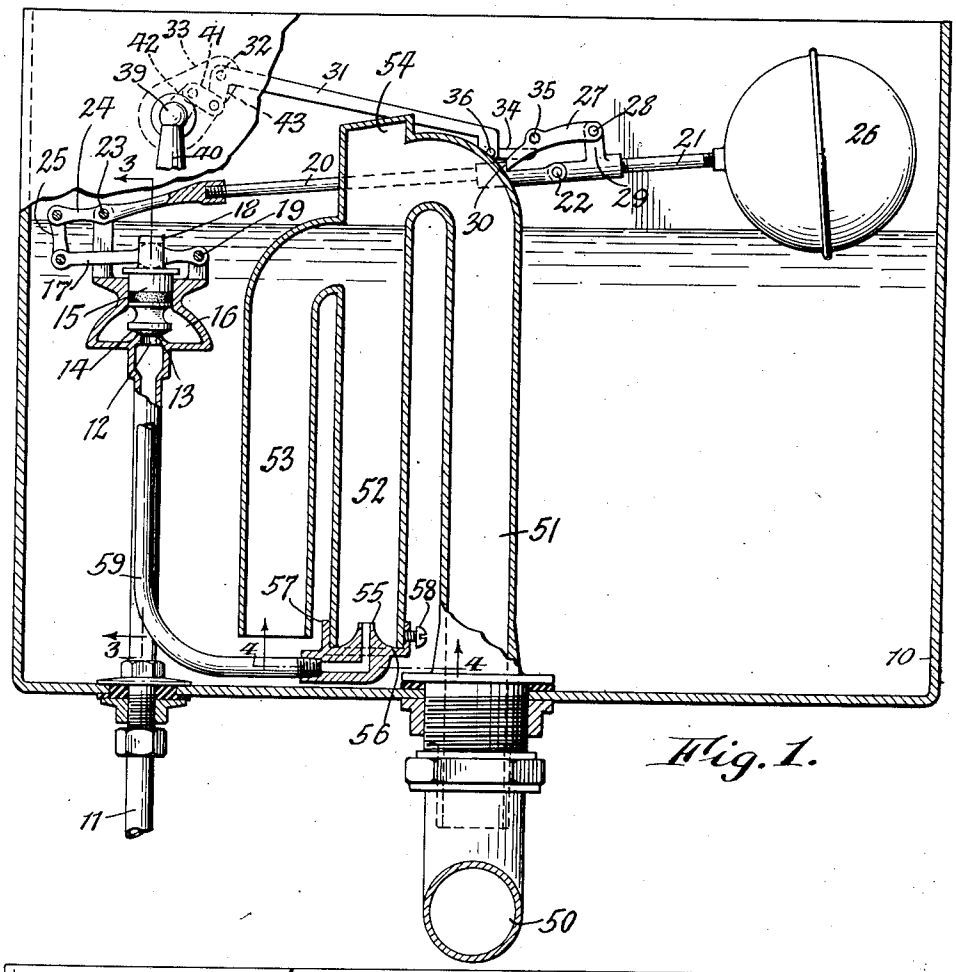

Fig. 1.

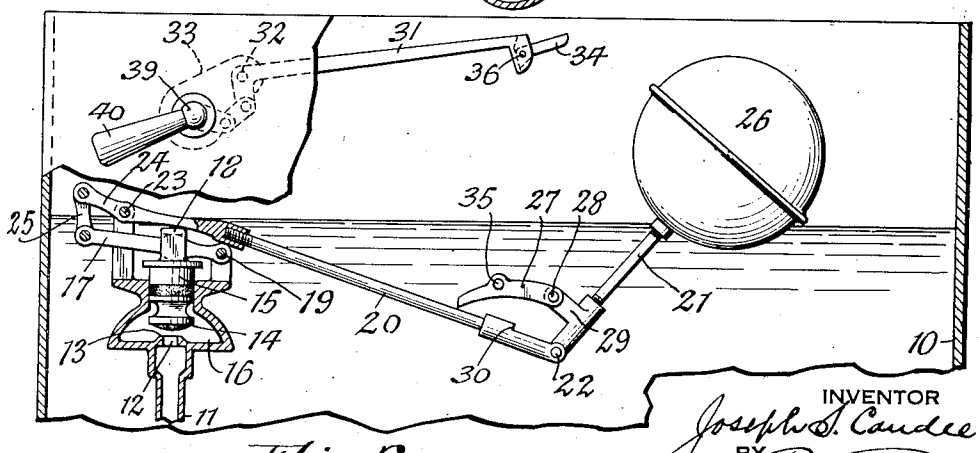

Fig. 2.

INVENTOR
Joseph S. Candee
BY Popp & Powers
ATTORNEYS

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Fig. 3.

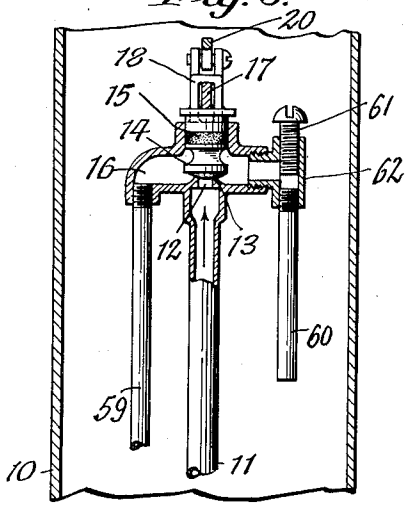
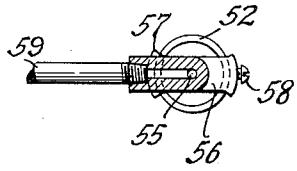


Fig. 4.



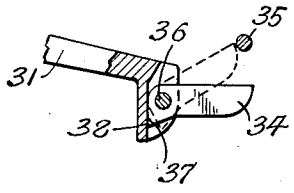


Fig. 5.

Fig. 6.

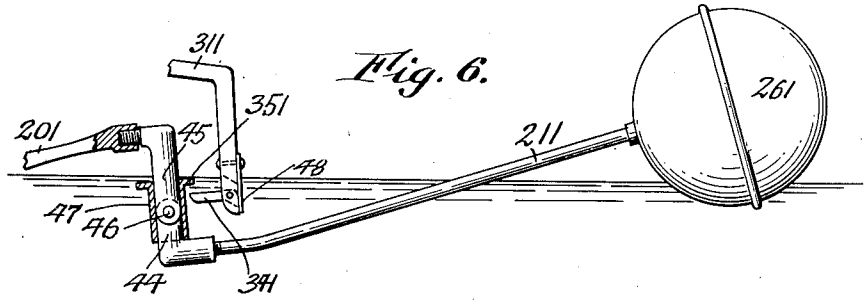
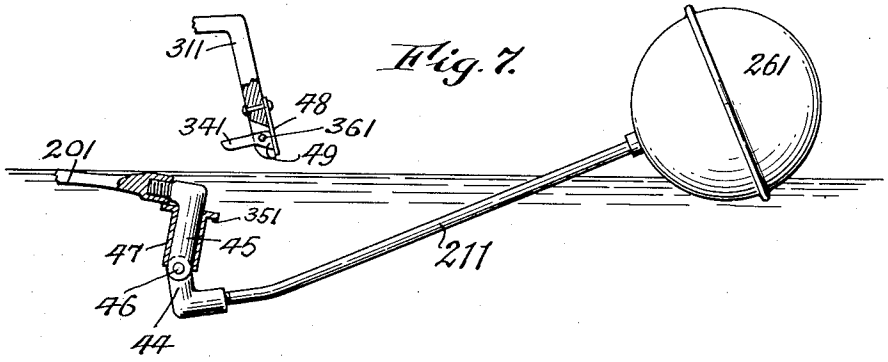


Fig. 7.



Joseph S. Candee INVENTOR

BY Pope & Powers

ATTORNEYS

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1,984,394

SUPPLY AND DISCHARGE MECHANISM FOR WATER CLOSET TANKS

Joseph S. Candee, Buffalo, N. Y., assignor to Catherine T. Candee, Buffalo, N. Y.

Application December 22, 1932, Serial No. 648,393

3 Claims. (Cl. 4—44)

This invention relates to a supply and discharge mechanism for water closet tanks.

The mechanisms for this purpose as heretofore constructed usually contained a valve which was opened to permit the water in the tank to flow through the outlet thereof to the closet bowl, which construction is objectionable inasmuch as the joint between the closing member and seat of such a valve becomes worn in time and causes leakage which necessitates renewal or repairing of this valve in order to restore the same to its proper working condition.

One of the objects of this invention is to provide a supply and discharge mechanism for water closet tanks in which no valve is employed in the outlet of the water tank whereby the possibility of leakage is absolutely avoided and no repairs on this account are required.

Another object of this invention is to provide improved means for opening the stopper or closure member of the valve whereby the supply of water to the tank is controlled so that this valve is opened more rapidly and supplies the necessary ejector jet for starting a siphonic action whereby the water is withdrawn from the tank for flushing the closet and also the necessary water for refilling the tank after the same has been emptied by a flushing action.

In the accompanying drawings:

Figure 1 is a vertical longitudinal section of a water closet tank equipped with my improved supply and discharge mechanism and showing the parts in the position which they occupy when the inlet valve is closed.

Figure 2 is a fragmentary view similar to Fig. 1, but showing the parts in the position which they occupy when the tank is being emptied of water.

Figure 3 is a fragmentary vertical transverse section, taken on line 3—3 Fig. 1.

Figure 4 is a fragmentary horizontal section, taken on line 4—4 Fig. 1.

Figure 5 is a fragmentary vertical section, on an enlarged scale, showing the manner in which the trip dog of the trip lever cooperates with the catch of the latch device which controls the relative position of the sections of the float lever whereby the water inlet valve is actuated.

Figure 6 is a fragmentary side elevation showing a modified form of the sectional float lever and the latch or locking device whereby the sections of this lever may be either locked in an unfolded position relative to each other or permitted to fold one section relatively to the other, this figure showing the locking device in a position in which these sections are locked against relative movement.

Figure 7 is a similar view showing the latch or locking device in a position in which the two sections of the float lever are permitted to fold one relatively to the other.

Similar characters of reference indicate like parts in the several figures of the drawings:

The numeral 10 represents the tank or reservoir of a water closet which is adapted to receive water from any suitable source and deliver the same to a bowl for flushing the latter. The water for this purpose is preferably supplied to this tank by means of a supply pipe 11 which in the present case extends upwardly through the bottom thereof and terminates at its upper end within the tank where the same is provided with a port 12 constituting the water inlet for the tank. Surrounding this inlet port the supply pipe 11 is provided with an upwardly facing valve seat 13. The discharge of water from this pipe into the tank is controlled by a regulating valve having a stopper or closure member 14 which is movable downwardly into engagement with the seat 13 for the purpose of closing the port 12, and also upwardly away from this seat for uncovering the port 12 and permitting the water which is supplied under pressure to the pipe 11 to flow into the tank.

This valve is provided on its upper side with a valve stem 15 which is guided in the upper part of the valve chamber 16 which encloses the regulating valve and communicates with the upper end of the pipe 11 through the medium of the port 12.

Opening and closing of this stopper or closure member is effected by an operating mechanism which in the present case comprises a horizontal operating lever 17 passing with its central part through a loop 18 extending upwardly from the top of the valve stem 15 and pivoted to the upper part of the valve chamber 16 on one side of the axis of the regulating valve by means of a horizontal pin 19.

The numerals 20 and 21 represent the inner and outer sections of a vertically foldable float lever which is arranged in the upper part of the tank and the sections of which are pivotally connected with each other by means of a horizontal transverse pivot or hinge pin 22. The inner or rear section 20 of this float lever is pivoted by means of a horizontal transverse pin 23 on the upper part of the valve chamber 16 on that side of the axis of the regulating valve opposite to the pivot pin 19, and this section of the float lever is pro-

vided with a short arm 24 projecting from the opposite side of the pivot pin 23 and pivotally connected by means of a link 25 with the outer end of the operating lever 17.

On its outer end the outer section 21 of the float lever is provided with a float 26 which is adapted to ride upon the surface of the water within the tank. As this float lever is swung upwardly due to the buoyancy of the float 26 which is raised by the level of the water rising in the tank the arm 24 forming a part of this float lever descends and causes the operating lever 17 to be depressed and the stopper or closure 14 of the regulating valve to be pushed downwardly into engagement with the seat 13, thereby shutting off the further inward flow of water from the supply pipe 11 into the tank. This occurs when the level of the water in the tank has reached the predetermined or normal level which is desired to be maintained in the tank preparatory to discharging a batch of water therefrom for flushing the bowl, as shown in Fig. 1.

As the water from the tank is discharged to the bowl the float lever descends due to the lowering of the level of the water therein thereby causing the arm 24 connected with the float lever to raise the operating lever 17, whereby the stopper or closure 14 of the regulating valve is lifted from the seat 13, aided by the pressure of the water against the underside of this stopper, whereby the inlet port 12 is uncovered, as shown in Fig. 2, and water from the supply pipe 11 is permitted to flow into the tank.

For the purpose of enabling the float lever to open the regulating valve quickly and independently of the descent of the float 26 with the level of the water as the latter is discharged from the tank but to gradually close this regulating valve again during the subsequent operation of refilling the tank, and also to cause this regulating valve to operate effectively in conjunction with the means whereby the water is discharged from the tank, latching or locking means are provided whereby the two sections of the float lever are maintained in an unfolded position relatively to each other during the upward swinging movement of this float lever while the regulating valve is being closed, but which will permit the two sections of this floating lever to fold upwardly relatively to each other and thereby enable the regulating valve to open quickly for cooperation with the water discharge device of the tank, notwithstanding that the float descends at a slower rate with the descending level of the water as it is discharged from the tank.

The latching means for this purpose which are shown in Figs. 1, 2 and 5 are constructed as follows:

The numeral 27 represents a dog, pawl or catch pivoted at one end by means of a horizontal transverse pin 28 on a lug 29 projecting upwardly from the front or outer arm of the float lever adjacent to the hinge pin 22 while the opposite end of this dog is adapted to engage with a forwardly facing shoulder 30 formed on the upper side of the other section 20 of the floating lever adjacent to said hinge pin. Various means may be provided for disengaging this dog 27 from the shoulder 30, those shown in the drawings including a trip lever 31 pivoted by means of a horizontal transverse pin 32 on a bracket 33 secured to the front wall of the tank and provided at its front end with a releasing dog or pawl 34 which is adapted to engage with a lifting or releasing pin 35 on one side of the dog 27. The releasing dog 34 is pivoted by means of a horizontal transverse pin 36 to the outer end of the trip lever 31 and is provided with a stop heel 37 which is adapted to engage with a stop shoulder 38 on the adjacent part of the trip lever. While the float lever is in its elevated position the locking latch or dog 27 engages with the shoulder 30 and holds the two sections of the float lever in an unfolded or straightened position, thereby causing the buoyancy of the float 27 riding on the water level to shift the stopper or closure 14 of the regulating valve into its closed position, as shown in Fig. 1. At this time the releasing dog 34 is arranged in a straightened or unfolded position relative to the trip lever 31 and engages its stop heel 37 with the shoulder 38 of this lever while its free front end is arranged below the trip pin 35 of the latch or dog 27, as shown by full lines in Figs. 1 and 5.

Upon now raising the trip lever 31 the trip dog 34 will engage with the underside of the trip pin 35 and raise the dog 27 out of engagement from the shoulder 30, and when this occurs the weight of the two sections of the float lever will cause the same to drop quickly into a position in which these two lever sections will fold relatively to each other into a V shape or upwardly diverging relation, as shown in Fig. 2. This dropping of the sections of the float lever will cause the operating lever 17 to be raised, together with the stopper of the regulating valve, thereby uncovering the inlet port 12 and permitting water to flow from the supply pipe 11 into the tank. During the subsequent lowering of the water level in the tank as the same is discharged through the outlet of the latter for the purpose of flushing the bowl, the float 26 descends and carries the front section 21 of the float lever into an unfolded or straightened position with reference to the rear section 20 whereby the locking dog or pawl 27 is carried outwardly and its free end is again caused to automatically engage by gravity with the shoulder 30 of the rear section of the float lever. As the water level in the tank again rises due to the admission of water which is supplied through the pipe 11, this float lever rises in a straightened position, this lever at this time being raised by buoy action of the float 26 which rides on the surface of the water.

After the trip lever 31 has been raised for the purpose of disengaging the locking latch or dog 27 from the shoulder 30 the same is permitted to again assume the position shown in Fig. 1, and as the float lever rises in response to the rising level of the water in the tank, the trip pin 35 engages with the underside of the trip dog 34 and lifts the latter from the position shown by full lines in Fig. 5 to the folded position shown by dotted lines in the same figure, and after this trip pin has passed upwardly far enough to clear the dog 34, the latter again drops by gravity into its lowered or straightened position so that it extends underneath the trip pin 35 where it is now held by gravity with its stop tail 37 resting against the shoulder 38 on the trip lever, as shown by full lines in Fig. 5.

Various means may be employed for raising and lowering the trip lever 31, those shown in the drawings being satisfactory for this purpose and comprising a rock shaft 39 journaled in the bracket 31 and extending through the front wall of the tank, a handle 40 arranged on the front end of the rock shaft 39 and adapted to be manually operated, and a link 41 connecting a rock arm 42 on the inner end of the rock shaft 39 with a downwardly projecting rock arm 43 on the inner

end of the trip lever 31, as shown in Figs. 1 and 2.

By this means a rocking movement imparted to the handle 40 will cause the trip lever to be raised and lowered for the purpose of causing the releasing dog 34 to lift the locking latch or dog 27 out of engagement from the shoulder 30 and also permitting this releasing dog to again assume a position below the trip pin 35 in the manner heretofore described.

If desired, the means for locking the sections of the float lever in a straightened or unfolded position and permitting these lever sections to fold relatively to each other, may be constructed as shown in Figs. 6 and 7. In this modified form of the locking and releasing mechanism the front section 211 of the float lever is provided with an upwardly projecting shank 44, and the rear section 201 of this float lever is provided with a downwardly projecting shank 45, which shanks are pivotally connected with each other by means of a hinge or pivot pin 46 extending horizontally and transversely through these shanks.

The numeral 47 represents a locking sleeve or latch which is adapted to slide vertically on the shanks 44 and 45 into and out of a position in which it extends across the hinge joint between these shanks. When this locking sleeve is in its lowered position, as shown in Fig. 6, the same engages with both shanks 44 and 45 and extends across the pivotal connection between the same, and rests with its lower end on the adjacent part of the front section of the float lever, thereby locking the two sections of the float lever in an unfolded or straightened position, and rendering the same practically rigid. Upon raising this locking sleeve so that the same is arranged wholly on the vertical shank 45 of the rear float lever section 201 and above the hinge pin 46 which pivotally connects these shanks, the two sections of the float lever are permitted to fold upwardly into an angular position relatively to each other, as shown in Fig. 7. When the front section 211 of the float lever is again moved downwardly into an unfolded or straightened position relative to the rear section 201 due to the dropping of the float 261 in response to the lowering of the water level, then the locking sleeve 47 drops by gravity across the hinge pin 46 and into engagement with the lower shank 44 of the front section 211 of the float lever, thereby operating to again lock the two float lever sections in a straightened or unfolded position, and cause them to rise in this straightened position with the respective float 261 as the tank is again filled with water.

Disengagement of the locking sleeve 47 from the lower shank 44 is effected by means of a releasing dog 341 which is mounted on the outer end of a trip lever 311 which is the equivalent of the previously described trip lever 31. In the elevated position of the float lever sections 201, 211 the trip dog 341 is arranged below a shoulder 351 on the locking sleeve 47, and upon raising the trip lever 311 this dog 341 engages with the shoulder 351 and shifts the locking sleeve 47 from the position shown in Fig. 6 to the position shown in Fig. 7.

During the subsequent downward movement of the trip lever 311 relative to the locking sleeve 47 the releasing dog 341 trips past the shoulder 351 and assumes a folded position until it has cleared this shoulder 351, after which the dog 341 again straightens out and assumes a position below said shoulder. This function of the releasing dog 341 is permitted by pivoting its inner end to the free end of the trip lever by means of a pin 361 and yieldingly holding this dog in this position by means of a spring 48 secured to the front end of the lever 311 and engaging with a heel 49 on the inner end of the dog 341, as shown in Figs. 6 and 7.

The numeral 50 represents the discharge pipe whereby the water is delivered from the tank to the closet bowl which is to be flushed, this pipe being connected with the bottom of the tank in any suitable and well-known manner, so that its upper end which opens into the lower part of the tank forms the outlet of the tank. Arranged within the tank and communicating with the interior thereof and the outlet or discharge pipe 50 is a siphon which forms part of the means for discharging the water from the tank to the closet. In its preferred form this siphon comprises a downtake discharge leg 51 which is arranged vertically within the tank and connected at its lower end with the upper end of the outlet pipe 50, an uptake ejector leg 52 arranged vertically along side of the downtake leg 51 and communicating at its upper end with the upper end of the downtake leg and opening at its lower end into the lower part of the tank, and an uptake suction leg 53 arranged vertically adjacent to the uptake ejector leg 52 and opening at its lower end into the lower part of the tank slightly above the lower end of the ejector leg, while its upper end communicates with the upper part of the ejector leg at a point below the point of connection between the upper end of the ejector leg 52 and the discharge leg 51. Above the upper end of the ejector leg 52 the siphon is provided with an upwardly extending pocket 54 which is arranged above the point of communication between the upper ends of the ejector leg and the discharge leg.

Projecting upwardly into the lower end of the ejector leg is an ejector nozzle 55 by means of which a jet of water is directed upwardly into the ejector leg of the siphon for the purpose of starting the siphon and causing the same to withdraw the water from the tank and deliver the same to the closet which is to be flushed. This nozzle is mounted on a bridge 56 which extends across the lower end of the ejector leg but does not wholly obstruct the lower opening of the latter, and this bridge is fastened to the lower end of the ejector leg by means of a lug 57 on one end of the bridge engaging with one side of the ejector leg 52, and a clamping screw 58 mounted on the bridge and engaging with the opposite side of this leg, as shown in Figs. 1 and 4.

Water is supplied to this ejector nozzle 55 by means of an intermediate pipe 59 connected at its lower end with this nozzle while its upper end is connected with the valve chamber 16 on one side of the regulating valve, as shown in Figs. 1 and 3.

Assuming that the tank is filled with water and the regulating valve and its operating mechanism are in the position indicated in Fig. 1 so as to shut off further entrance of water from the supply pipe 11 into the tank, the operation of flushing a closet bowl is as follows:—

The operator turns the handle 40 from the position shown in Fig. 1 to the position shown in Fig. 2 whereby the releasing or trip dog 34 will disengage the locking latch or dog 27 from the shoulder 30, thereby permitting the two sections of the float lever to drop into a folded position and cause the regulating valve closure 14 to be lifted and permit the flow of water from the supply pipe 11 to the ejector nozzle 55.

The jet of water which now issues from the nozzle is directed upwardly into the body of wa-

ter contained within the ejector pipe or leg of the siphon whereby this body, together with the water supplied by the ejector, causes the column of water in this leg to be raised and overflow from the upper end of the ejector leg into the downtake discharge leg of the siphon. The instant that sufficient water has been thus transferred from the uptake ejector leg into the downtake discharge leg so that the latter is completely filled, a siphonic action will be produced whereby the greater weight of the column of water in the downtake leg will draw the water upwardly through both uptake legs of the siphon and discharge the water through the delivery pipe 50 to the closet bowl. This siphonic action will continue until the water has been withdrawn from the tank to a point below the lower end of the uptake suction leg or pipe 53 of the siphon, and when the level of the water reaches this point the vacuum or suction effect of the siphon will be broken due to the admission of air at this time to the lower end of the uptake suction pipe.

The water is withdrawn from the tank very rapidly by this siphonic action but while such withdrawal of the water is taking place the regulating valve closure 14 remains in an open position due to the lowered position of the float lever at this time so that the nozzle 55 continues to deliver a jet of water upwardly into the ejector leg of the siphon. After the level of the water has been lowered in the tank to a point below the lower end of the suction leg 53 and the water-delivering operation of the siphon has been arrested, the upward jet of water from the nozzle 55 continues to function and deliver this jet of water into the pocket 54 at the top of the ejector leg so that the same rebounds therefrom and forms a water mass in the upper part of the ejector leg, part of which flows over into the downtake leg 51 for partly filling the bowl after the flushing operation, while the bulk or larger part of this rebounding mass of water which is directed downwardly from the pocket 54 enters the upper end of the suction pipe 53 and flows downwardly through the latter and escapes from the lower end thereof into the tank so as to gradually refill the latter with water.

During this operation of refilling the tank some of the water supplied thereto from the lower end of the ejector leg which is constantly in communication with the lower part of the tank and therefore permits any water under back pressure in the ejector leg to pass into the tank.

Due to the point of connection between the upper end of the ejector leg 52 and the suction pipe 53 being lower than the point of connection between the upper end of the ejector pipe and the downtake pipe 51, the water which is lifted in the ejector pipe by the action of the jet issuing from the nozzle will practically all flow from the ejector pipe into the suction pipe 53 and back into the tank instead of flowing to any substantial extent from the ejector pipe into the downtake or discharge leg, thereby causing the tank to be refilled very rapidly.

By arranging the lower end of the uptake suction pipe or leg 53 above the lower end of the uptake ejector leg 52 the breaking of the vacuum effect in the siphon is definitely located at the lower end of the suction leg 53 and permits the lower end of the ejector leg to remain submerged in water so as to retain a sufficient amount of water therein to permit of resuming the subsequent filling operation of the tank promptly and without interruption at this point.

The operation of replenishing the suppy of water in the tank proceeds in this manner until the level in the same has reached the predetermined normal, at which time the float has raised the float lever while the sections of the latter are in a straightened position as previously described, so as to cause the closure member 14 of the regulating or inlet valve to be closed and thereby stop the further admission of water into the tank.

By this means of withdrawing the water from the tank and discharging the same into the bowl, no discharge valve is employed for controlling the outlet of the tank and instead a permanent connection is maintained between the siphon and the outlet pipe, thereby avoiding the objectionable leakage which occurs in the use of outlet valves which have heretofore been employed for this purpose and which required periodical repairing as well as undue expense for maintaining the same in operative position. The present improvement requires no attention after once being installed inasmuch as there are no working parts which are liable to get out of order and therefore not only avoids the annoyance incident to the use of outlet vaves or joints and the possibility of leaky joints, but also effecting a substantial saving in the cost of maintaining the closet in a satisfactory condition.

Inasmuch as the water pressure which is supplied to the tank varies in different localities it may be necessary to supply water for refilling the tank by means which supplement the water which is supplied by means of the nozzle in order to speed up the refilling operation. For this purpose an auxiliary refilling pipe 60 is provided which communicates at its upper end with the water supply valve chamber 16 and opens at its lower end into the upper part of the tank so that when the supply or regulating valve closure 14 is opened some of the water will be supplied by the pipe 59 to the ejector nozzle 55 for causing the siphon to operate and also to supply water for subsequently filling the tank, and some of the water will also be discharged by the supplemental filling pipe 60 into the tank independently of the nozzle so that between these sources of water supply the tank will be promptly refilled.

In order to permit of varying the amount of water which is supplied to the tank by means of this supplemental filling pipe 60, adjusting means are provided which in effect constitute a valve and which in the present instance consist of an adjusting valve screw 61 having threaded engagement with the upper part of an angle fitting 62 connecting the pipe 60 with the valve casing 16, as shown in Fig. 3. Upon adjusting this valve screw so that its inner end extends more or less across the path of the stream of water passing from the valve casing 16 to the pipe 60 the amount of water delivered through this pipe may be varied to suit the pressure under which water is supplied in the particular locality.

I claim as my invention:

1. A supply and discharge mechanism for a water closet tank having a water inlet and a water outlet, comprising a siphon arranged within the tank and having a downtake discharge leg communicating at its lower end with said outlet, an uptake ejector leg communicating at its upper end with the upper end of said downtake leg and opening at its lower end into said tank, and an uptake suction and filling leg communicating at its upper end with said uptake ejector leg at a point below the point of communication between said uptake ejector leg and said downtake leg, and

a water ejector nozzle projecting upwardly into the lower end of said uptake ejector leg and communicating with said water inlet, said suction and filling leg serving to conduct water upwardly from the tank to said ejector leg during the first operation of the ejector for producing a siphonic discharge of the water from the tank and said suction and filling leg also serving to conduct water downwardly from the ejector leg to the tank for refilling the latter solely by the ejector during the last operation of the same.

2. A supply and discharge mechanism for a water closet tank having a water inlet and a water outlet, comprising a siphon arranged within the tank and having a downtake discharge leg communicating at its lower end with said outlet, a comparatively long uptake ejector leg communicating at its upper end with the upper end of said downtake leg and opening at its lower end into said tank, and a comparatively short uptake suction and filling leg communicating at its upper end with said uptake ejector leg at a point below the point of communication between said uptake ejector leg and said downtake leg, a water ejector nozzle projecting upwardly into the lower end of said uptake ejector leg and communicating with said water inlet, and a float controlled valve arranged in the conduit between said water inlet and said water ejector nozzle, said suction and filling leg serving to conduct water upwardly from the tank to said ejector leg during the first operation of the ejector for producing a siphonic discharge of the water from the tank and said suction and filling leg also serving to conduct water downwardly from the ejector leg to the tank for refilling the latter solely by the ejector during the last operation of the same.

3. A water supply and discharge mechanism for a closet tank having a water inlet and a water outlet comprising a siphon arranged within the tank and having a vertical downtake discharge leg communicating at its lower end with said outlet, a comparatively long vertical uptake ejector leg arranged parallel with said downtake leg and communicating at its upper end with the upper end of said downtake leg and opening at its lower end into the lower part of the tank, and an upright combined filling and suction leg having its lower end opening into the lower part of the tank, a vertical ejector nozzle arranged centrally within the lower end of the ejector leg and adapted to lift the water therein for first filling downtake leg with water to produce a siphon action which withdraws water from the tank through the suction and filling leg and then delivers water through said suction and filling leg into the tank for refilling the latter, and a valve mechanism for controlling the supply of water to said ejector nozzle.

JOSEPH S. CANDEE.