March 5, 1957 A. W. STURMAN 2,783,475

FLUSHING MECHANISM FOR WATER CLOSETS

Filed Aug. 13, 1953 2 Sheets-Sheet 1

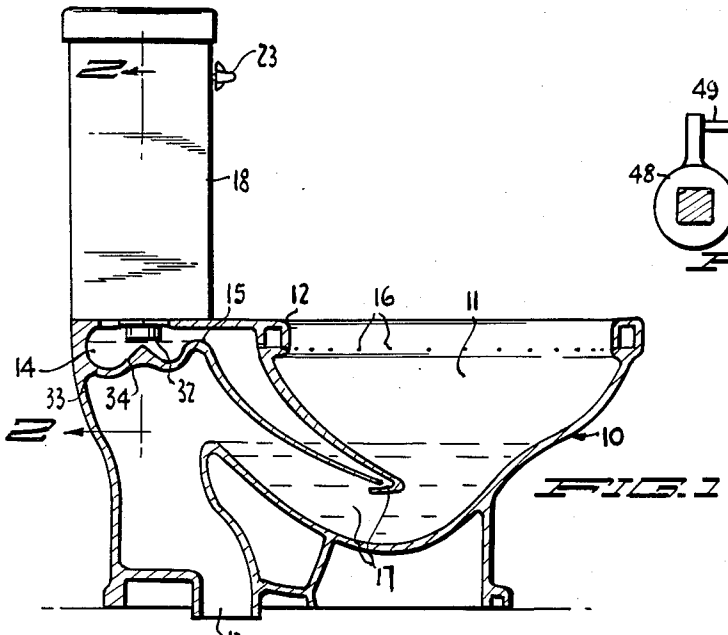


FIG. 1

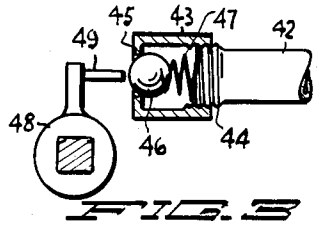


FIG. 3

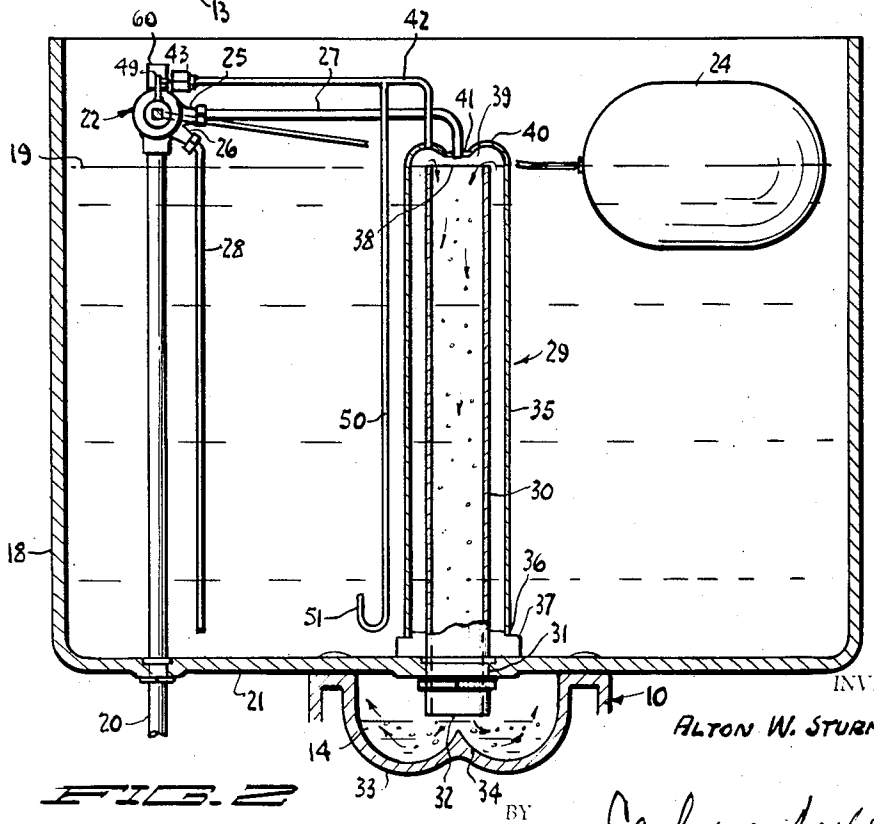


FIG. 2

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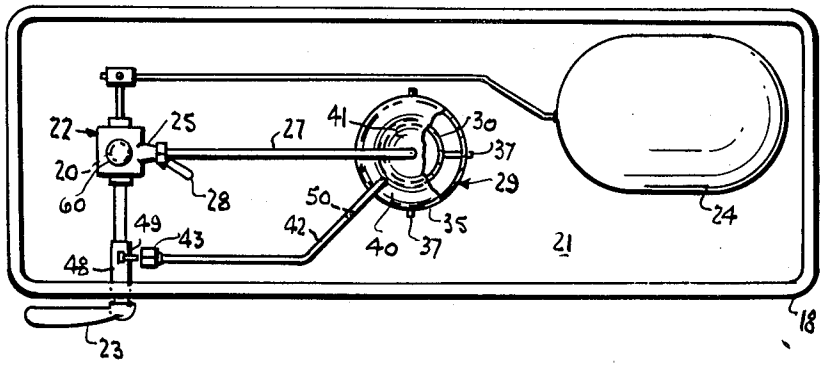
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FLUSHING MECHANISM FOR WATER CLOSETS

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FIG. 4



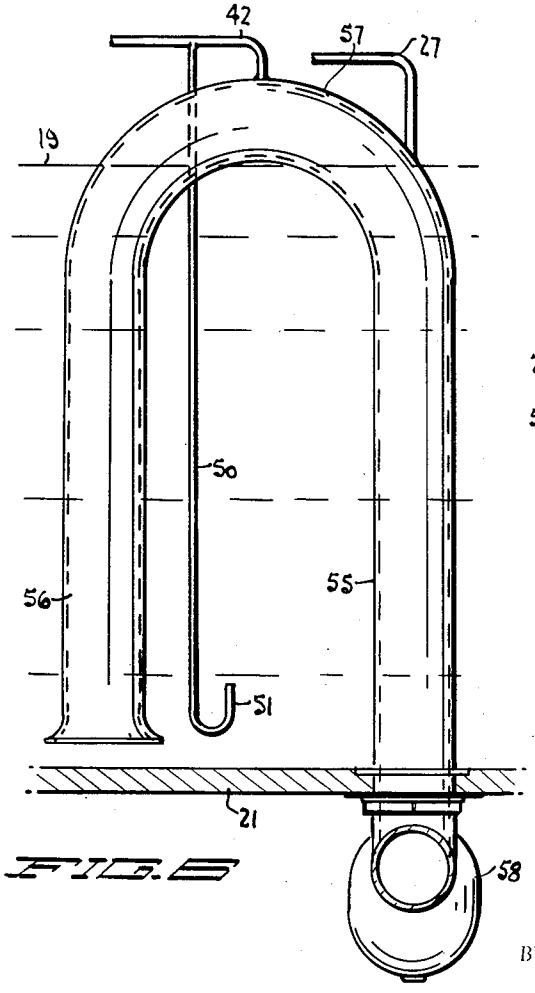


FIG. 6

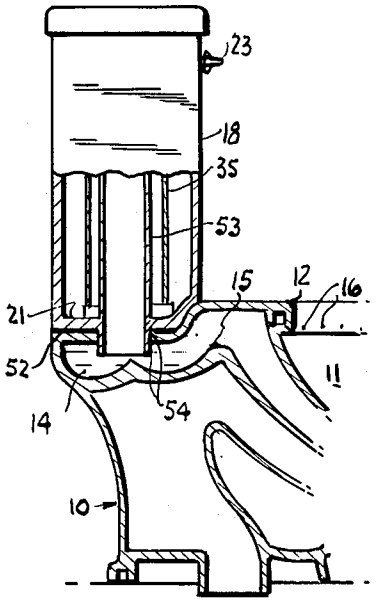


FIG. 5

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2,783,475

FLUSHING MECHANISM FOR WATER CLOSETS

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6 Claims. (Cl. 4—43)

This invention relates to improvements in siphonic flushing mechanisms for water closets.

The primary object of my present invention is to provide an improved flushing mechanism of this general nature so constructed and arranged that the usual troublesome ball valve is completely eliminated and so that flushing action may be initiated by a comparatively extremely small amount of water supplied to the siphon tube under control of a simple, manually and float actuated control valve. I find by actual demonstration that it is possible in the flushing mechanism of my invention to initiate the siphonic action by the use of less than a quart of water for entraining and ejecting a sufficient amount of the air trapped in the siphon and further find that the siphon will operate satisfactorily on static heads of water from as little as one foot to two-hundred feet or more. The initiation of the flushing action by this very small quantity of water, and the successful operation with widely varying static heads, is, of course, extremely desirable since in many cases the load upon city water systems is such that the available water pressure is greatly reduced from normal.

A further object of my invention is to provide an improved siphonic flushing mechanism which is operated in conjunction with a water seal loacted between the inlet of the siphon and the usual apertures around the rim of the bowl which seal I find plays an extremely important part in the successful operation of the system. As a related object I further provide an improved trap and an improved siphon construction, per se, such that the siphon inhibiting air trapped in the upper part of the siphon is very readily discharged and is of very low initial volume both of which factors contribute materially to the initiation of the siphon action with a minimum amount of starting water.

As a further object of my invention I provide means whereby the siphoning action may be interrupted at any time during its progress, in an emergency, under the control of the usual valve operating handle which is back rotated, or rotated in opposite to normal direction, in order to open a check valve and re-admit air into the siphon air chamber whenever required or desired.

These and other more detailed and specific objects will be disclosed in the course of the following specification, reference being had to the accompanying drawings, in which—

Fig. 1 is a vertical sectional view and side elevational view of a water closet according to my invention.

Fig. 2 is an enlarged vertical sectional view taken substantially along the line 2—2 in Fig. 1.

Fig. 3 is a still further enlarged detail sectional view of the check valve and the means by which the same is operated for halting the siphoning action.

Fig. 4 is a top plan view of the system as shown in Fig. 2.

Fig. 5 is a fragmentary sectional view similar to that of Fig. 1 but showing a modification.

Fig. 6 is an elevation of a modified form of siphon tube and water seal with a portion of the tank bottom shown in section.

The present application is a continuation-in-part from my copending application Serial No. 302,547, filed August 4, 1952, now Patent No. 2,700,163, for Water Closet Flushing Mechanism to which attention is invited for comparative purposes.

Referring now more particularly and by reference characters to the drawings, I have chosen for the illustration of what may be regarded as a preferred embodiment of my invention a water closet made up of the usual stool, designated generally at **10**, having a bowl **11** with a hollow rim **12** and an outlet **13**. According to my invention a seal **14** is formed in the upper rear part of the stool and it is important to note that this seal includes a discharge lip or dam **15** which makes a water seal between the water line in the tank and the usual flushing apertures **16** in the rim **12**. In addition to the seal **14** thus formed there is, of course, the customary intake and trap system **17** in the lower portion of the bowl **11**. The operation of this type of bowl is, of course, well known and needs no further description herein.

Also forming part of the water closet is a tank **18** and as here shown the same is illustrated as seated upon the upper rear part of the stool **10**, this also being a well known and modern type of arrangement, but it is to be understood that the tank may as well be wall mounted. The tank **18**, of course, contains a level of flushing water, as indicated in Fig. 2 at **19**, and water is supplied to the tank from the water system by means of a supply pipe **20** extending upwardly through the tank bottom **21** to a point above the aforesaid water level **19**. Mounted upon the upper end of the supply pipe **20** is a rotary valve, designated generally at **22**, the construction and operation of which is very similar to the corresponding valve of my prior application. Since the present invention relates entirely to the flushing mechanism or system it is sufficient to note that the valve **22** includes a rotor which is turned in one direction by means of the usual handle **23** and back-rotated by the usual float **24** in order first to initiate the flushing action and then, as the same is completed, to refill the tank and shut off the flow of refill water when the same returns to the level **19**. For this purpose the valve **22** has two separate outlets **25** and **26** from which there lead pipes **27** and **28**, with the latter as usual extending downward to a point adjacent the tank bottom **21**. This is, of course, the refill pipe which is opened at the proper time for refilling the tank and the flow through which is closed off as the float **24** ascends toward the top of the tank. The operation of the valve **22** by the handle **23** causes the valve **22** to connect the pipes **20** and **27** and the water thus issuing from the pipe **27** is led to the top of a siphon structure, designated generally at **29**, which will next be described.

The siphon includes an upright outlet tube **30** extending from the bottom of the tank up to the water level **19** and, as shown in Fig. 2, also extending downwardly through an opening **31** in the tank bottom wherein the tube is firmly affixed by any suitable means. The discharge or outlet end **32** of the tube **30** is thus brought down into the seal **14** and it will be noted that the bottom **33** of the seal is provided with a substantially conical or upwardly pointed and outwardly, downwardly radially flaring surface **34** located immediately adjacent the outlet **32** and centered with respect thereto. This siphon structure is completed by a relatively larger coaxially mounted inlet tube **35** seated down over the tube **30** and having an open lower end **36** which is held a short distance above the tank bottom **21**. For the latter purpose radial fins **37** may be provided upon the tube **30** or the tank

bottom to center and hold the tube **35** in the proper position. The upper end of the inlet tube **35** is closed and is also located at a level above the corresponding end **38** of the outlet tube and above the water level **19**. There is thus formed an air chamber **39** in which siphon inhibiting air will be trapped and an air gap formed with the tank in its filled condition. The aforesaid pipe **27** leads from the valve **22** to the interior of the chamber **39** at a point immediately over the adjacent upper end **38** of the outlet tube.

In operation, the movement of the handle **23** in one direction will, as aforesaid, actuate valve **22** to admit water through the pipe **27** to the center of the air chamber **39** and the admission of this water, which of course is driven directly down into the outlet tube **30** of the siphon, entrains a part of the air in the chamber **39**, carrying the same downward in the form of bubbles as indicated in the drawing. This entrained air must, of course, escape and the aforesaid conical surface **34** is found to assist materially at low static heads in this in that the air bubbles are directed or diverted outwardly and upwardly with the water, as indicated by the arrows in the water seal **14** in Fig. 2. The diversion of the air bubbles outward and upward overcomes any tendency for them to rise through the siphon and thus having to be entrained for the second time, and I find by actual and repeated demonstration that the admission of less than a quart of water to the chamber **39** will almost immediately evacuate sufficient air therefrom so that the siphonic action is induced and the flushing water flows out through the water seal **14** and into the bowl. The time element varies with the static head of water and not to any degree with the amount thereof. Obviously the smaller the chamber **39** the less water will be required for entrainment and ejection of the air and for this reason the closed upper end of the outlet tube **35** is curved annularly inward and downward, as designated at **40**, and the center **41** is depressed so that the chamber **39** is almost toroidal in shape and its volume is correspondingly held to a minimum. Not only will the siphon as thus constructed and arranged operate with a quart of starting water or less, but I also find that the siphon will operate effectively on static heads of from approximately one foot up to two-hundred feet or any reasonable available maximum. The water seal **14** and its association with the outlet **32** of the siphon is also found to be extremely important in the successful operation of this type of siphon, and without this seal enough starting water must be supplied to seal between the siphon outlet and the apertures **16**, obviously a considerable amount.

My invention further includes provision for overriding or halting the siphon action once it has been induced and for this purpose an air tube **42** is connected to the high point **40** of the closed end of the siphon and thence leads toward the valve **22**, whereat the pipe is provided with a cap **43**, as best seen in Fig. 3. This cap **43** may be screwed at **44** upon the pipe and has an opening **45** in which is normally seated a check valve ball **46** urged to the seat by a spring **47**. Preferably, although not necessarily, the ball **46** is of rubber or analogous material with the spring **47** embedded therein and in any case the ball serves to normally isolate the pipe **42** and, of course, the chamber **39** from the atmosphere. The shaft **48** of the handle **23** is, however, provided with a valve operating pin **49** located immediately adjacent the exposed surface of the ball **46**. As usual there is sufficient play in the association of the handle **23** with the rotor of the valve **22** so that the handle may be turned backward a short distance without affecting the valve. For example, assuming in Figs. 2 and 3 that the handle and its shaft are turned in a counterclockwise direction in order to operate the valve **22** to set the siphon in action then the handle and shaft may be freely back-rotated in a clockwise direction the short distance necessary to cause the pin **49** to engage and unseat the ball **46**. Also connected to the pipe **42** and thence to the high point of the air chamber **39** is a vent tube, or siphon stopping tube, **50** extending downward into the tank to a point adjacent the bottom **21** thereof, with the lower end **57** of the tube provided with a reverse or U-bend clearly shown in Fig. 2.

When the siphon is in operation and the water level is dropping in the tank this siphonic action will normally be brought to a halt when the water level falls below the bottom of the U-shaped end **51** of the tube **50** at which time air may reenter the chamber **39**, as will be readily understood. At any time during the flushing cycle, however, an emergency stopping of the siphoning action may be brought about by the aforesaid back-rotation of the handle **23**, which action unseats the check valve ball **46** so that air may enter the chamber **39** as will also be understood. The reverse or U-bend **51** is important in that it allows sufficient time for the siphonic action to completely break before the water, in refilling the tank, will reach the top of short arm of U-bend designated at **51**.

Any conventional automatic anti-siphoning device such as that shown at **60** in Figs. 2 and 4 may be used.

In Fig. 5 I illustrate a modification wherein the seal **14** is again formed at the upper rear part of the stool **10** but the latter is downwardly recessed at **52** to seat the bottom **21** of the tank **18**. In this case also the center tube or outlet tube **53** of the siphon is cast as an integral part of the tank bottom **21** as clearly shown and the tank bottom and the adjacent upper part of the stool has an opening **54** for the discharge of the flushing water immediately into the trap. The structure is otherwise the same as that previously described and corresponding reference numerals are used for corresponding parts.

In Fig. 6 I illustrate a modification of the siphon tube itself which in this case is of inverted U-shape with an upright outlet leg **55** and spaced therefrom an inlet leg **56**, the two of which are connected by a bight portion **57** above the water level **19**. The starting water supply pipe **27** is then connected to the outlet leg **55** on the upright axis thereof immediately adjacent the water level **19** so as to entrain the air trapped in the bight **57** and initiate the siphon action exactly as previously described. The siphon is broken either automatically or emergency controlled by an air pipe **42**, as previously described, which leads to the check valve mechanism of Fig. 3 and by the vent pipe **50**, as will be understood. Also in this case I show, as a modification, the connection of the outlet leg or pipe **55** to a separate form of water seal **58** for use where the trap may not be conveniently built into the stool itself. In all cases the valve **22** may be provided with a small orifice (not here shown) to let a small stream of water into the tube **27**, when the tank is being refilled through tube **28**, in order to refill the trap in the stool if this is necessary.

It is understood that suitable modifications may be made in the structure as disclosed, provided such modifications come within the spirit and scope of the appended claims. Having now therefore fully illustrated and described my invention, what I claim to be new and desire to protect by Letters Patent is:

1. For flushing a water closet having a bowl and a tank containing a level of flushing water, means forming a water seal immediately below the tank, a siphon structure having upright inlet and outlet legs the inlet leg opening into the tank and the outlet leg extending through the bottom of the tank and opening directly into the seal and extending above the water level to trap a quantity of siphonic inhibiting air, means for supplying water under pressure to the upper part of the siphon structure to entrain and eject the air through the outlet leg and seal and induce a siphonic flushing action, and means operated by the last named means for admitting air to the upper end of the siphon structure to halt siphoning action.

2. In a water closet having a bowl, a tank for containing a flushing level of water, a water supply pipe, and a

valve mechanism connected to the pipe and including a manually operative handle for actuating the valve to supply water for initiating flushing action and a float also connected to the valve for actuating the same to refill the tank; the improvement which consists of a siphon tube connected between the tank and bowl and having an air gap normally trapping air inhibiting siphonic flushing outflow of the water in the tank, said valve mechanism having an outlet connected to the tube to deliver water thereto on actuation of the handle in one direction and for entraining and ejecting the air and thereby inducing a siphoning action, a check valve between the air gap and atmosphere, means operated on movement of the handle in another direction to force open the said check valve to re-admit air to the chamber and halt the siphoning action, and a vent tube leading from the air gap to the lower part of the tank.

3. In a water closet having a bowl, a tank for containing a flushing level of water, a water supply pipe, and a valve mechanism connected to the pipe and including a manually operative handle for actuating the valve to supply water for initiating flushing action and a float also connected to the valve for actuating the same to refill the tank; the improvement which consists of a siphon tube connected between the tank and bowl and having an air gap normally trapping air inhibiting siphonic flushing outflow of the water in the tank, said valve mechanism having an outlet connected to the tube to deliver water thereto on actuation of the handle in one direction and for entraining and ejecting the air and thereby inducing a siphoning action, a siphon halting means including an air tube connected to the air chamber and having a check valve, and means operated by the said handle on movement in another direction to open said check valve and admit air to the gap.

4. In a water closet having a bowl, a tank for containing a flushing level of water, a water supply pipe, and a valve mechanism connected to the pipe and including a manually operative handle for actuating the valve to supply water for initiating flushing action and a float also connected to the valve for actuating the same to refill the tank; the improvement which consists of a siphon tube connected between the tank and bowl and having an air chamber normally trapping air inhibiting siphonic flushing outflow of the water in the tank, said valve mechanism having an outlet connected to the tube to deliver water thereto on actuation of the handle in one direction and for entraining and ejecting the air and thereby inducing a siphoning action, a siphon halting means including an air tube connected to the air chamber and having a check valve, means operated by the said handle on movement in another direction to open said check valve and admit air to the chamber, and a vent tube leading from the air chamber downward to a point adjacent the bottom of the tank.

5. In a water closet having a bowl, a tank for containing a flushing level of water, a water supply pipe, and a valve mechanism connected to the pipe and including a manually operative handle for actuating the valve to supply water for initiating flushing action and a float also connected to the valve for actuating the same to refill the tank; the improvement which consists of a siphon tube connected between the tank and bowl and having an air chamber normally trapping air inhibiting siphonic flushing outflow of the water in the tank, said valve mechanism having an outlet connected to the tube to deliver water thereto on actuation of the handle in one direction and for entraining and ejecting the air and thereby inducing a siphoning action, a siphon halting means including an air tube connected to the air chamber and having a check valve, means operated by the said handle on movement in another direction to open said check valve and admit air to the chamber, and a vent tube leading from the air chamber downward to a point adjacent the bottom of the tank, said vent tube having a reverse upward bend at its lower end to provide a time interval for stopping the siphoning action.

6. In a water closet having a bowl, a tank for containing a flushing level of water, a water supply pipe, and a valve mechanism connected to the pipe and including a manually operative handle for actuating the valve to supply water for initiating flushing action and a float also connected to the valve for actuating the same to refill the tank; the improvement which consists of a siphon tube connected between the tank and bowl and having an air gap normally trapping air inhibiting siphonic flushing outflow of the water in the tank, said valve mechanism having an outlet connected to the tube to deliver water thereto on actuation of the handle in one direction and for entraining and ejecting the air and thereby inducing a siphoning action, a check valve between the air gap and atmosphere, and means operated on movement of the handle in another direction to open said check valve to readmit air to the chamber and halt the siphoning action.

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