A toilet tank flush valve assembly to enable a selected quantity of water to be discharged from a tank comprises a straight length of upstanding pipe having lower and upper inlets normally closed by lower and upper valves connected by flexible operating chains to manually rockable crank means capable of moving one or the other, or both, of the valves to open the respective inlets and permit a predetermined quantity of water to be discharged through the lower end of the pipe.

5 Claims, 4 Drawing Figures
TOILET TANK FLUSH VALVE ASSEMBLY

The invention disclosed herein relates to a toilet tank flush valve assembly having a plurality of vertically spaced valves by means of which the quantity of water discharged from a flush tank may be controlled.

In many areas of the world water is either scarce, expensive, or both. It is desirable, therefore, to conserve the quantity of water used for toilet flushing purposes.

There are many instances in which considerably less than the entire capacity of a toilet tank is effective for a flushing operation, but conventional toilet flush mechanisms are such that substantially the entire contents of the toilet tank are discharged from the latter each time the toilet is flushed. An excessive discharge of water not only is wasteful, but it also unnecessarily burdens sewage treatment facilities.

Various proposals have been made heretofore for the purpose of conserving water by providing selectively operable flush valves which enable different quantities of water to be discharged from the tank. Typical of such proposals are the mechanisms disclosed in U.S. Pat. Nos. 2,351,672; 2,803,833; 3,237,211; and 3,574,866. All of the previously known constructions have certain objectionable characteristics. For example, the prior constructions have specially constructed discharge pipes with laterally offset portions. Such pipes are expensive and frequently are composed of multiple parts, thereby making it difficult to prevent leakage. Furthermore, in many of the prior devices the laterally offset portion is adjacent the bottom of the tank with the result that the hydrodynamic effect of the water which must traverse the offset portion is insufficient to effect flushing of the toilet. Moreover, the valve operating members in some of the prior constructions include rod-like parts which are subjected to bending forces during operation of the flushing mechanism, thereby frequently resulting in improper opening or closing, or both, of the valves associated therewith.

According to the invention a single, straight, upstanding pipe constitutes both the overflow pipe and the water discharge pipe and is provided with vertically spaced inlets which normally are closed by selectively operable valves that may be opened in such manner as to permit relatively smaller or relatively larger quantities of water when discharged from the tank. Regardless of which of the inlets is opened, water admitted to the straight pipe has a sufficient head and, consequently, sufficient hydrodynamic energy to effect flushing of the toilet.

An object of this invention is to provide a selectively operable flush tank valve mechanism for regulating the quantity of water discharged from a toilet tank and which overcomes the disadvantages of previously known constructions adapted for similar purposes.

Another object of this invention is to provide a toilet tank flush valve mechanism of the character described which is universally adaptable and which may replace the flush mechanisms with which many existing toilets are provided.

Another object of the invention is to provide a variable flush tank valve mechanism composed of relatively few parts which are virtually free of adverse distortion during operation.

Other objects and advantages of the invention will be pointed out specifically or will become apparent from the following description when it is considered in conjunction with the appended claims and the accompanying drawings, in which:

FIG. 1 is a front elevational view, with parts broken away, of a toilet tank equipped with a valve mechanism constructed in accordance with one embodiment of the invention;

FIG. 2 is a sectional view taken along the line 2—2 of FIG. 1;

FIG. 3 is a view similar to FIG. 1, but illustrating a second embodiment of the invention and with the valves in their closed positions; and

FIG. 4 is a view similar to FIG. 3, but illustrating the valves in their open positions.

Apparatus constructed in accordance with each embodiment of the invention is adapted for use with a conventional, hollow toilet tank 1 having a bottom 2, front and rear walls 3 and 4, respectively, and end walls 5. The top of the tank preferably is open and may be closed by a removable cover 6. The bottom wall 2 of the tank has an outlet opening 7 therein in alignment with an inlet 8 leading to a toilet (not shown). The bottom wall 2 also preferably has an opening therein for the reception of a filler pipe (not shown) by means of which water may be introduced automatically under the control of a conventional float operated valve (not shown), as is customary.

The valve assembly of the embodiment shown in FIGS. 1 and 2 comprises an upstanding, straight length of pipe 9 which may be formed either of metal or of a suitable plastic material, the lower end of the pipe extending through the opening 7 and being exteriorly threaded for the accommodation of clamping collars 10. The pipe preferably is cylindrical and has a diameter of such size as to fit freely into the opening 7 and into the inlet 8. In the disclosed embodiment, both ends of the pipe 9 are open, thereby enabling the pipe to function not only as a water discharge pipe, but also as an overflow pipe.

Adjacent the lower end of the pipe 9 is an upwardly oblique inlet tube 11 which communicates with the interior of the pipe 9 and is open at its free end. The free end of the tube 11 constitutes a seat for a valve 12 having a hollow body 13 carried by a disc 14 of such size as to seat on and seal the open end of the tube 11. A pair of parallel mounting arms 15 extend from one side of the disc 14, each arm having an opening 16 adjacent its free end for pivotal reception of a mounting pin 17 fixed on the exterior of the pipe 9. On the outer face of the disc 14 is an ear 18 to which is secured one end of a flexible operating chain 19.

The pipe 9 also has a second inlet tube in communication with the interior of the pipe 9, but at a higher level than that of the tube 11. The tube 20 also extends obliquely upwardly from the pipe 9 and is open at its free end. Seated on the free end of the tube 20 is a second valve 12a that is similar in all respects to that described earlier. Accordingly, corresponding reference characters are used, but followed by the suffix a, for the valve 12a. An operating chain 22 is secured at its lower end to the ear 18a.

Independently operable actuating means is provided for each of the valves 12 and 12a. The actuating means for the valve 12 comprises a crank arm 24 connected at one end to the upper end of the operating chain 18. The other end of the arm 24 is bent to form a shaft 25 which extends through a bushing 26 fitted into an opening in the front wall 3 of the tank and on which is fixed
a handle 27 by means of which the crank arm 24 may be rocked counterclockwise from the position shown in FIG. 1.

The actuating means for the valve 12a comprises a crank arm 28, one end of which is connected to the operating chain 22 and the other end of which is bent to form a shaft 29 which extends through a bushing 30 fitted into the tank wall 3. Fixed to the shaft 29 is a handle 31 by means of which the crank arm 28 may be rocked counterclockwise from the position shown in FIG. 1.

The handles 27 and 31 preferably are mounted one behind the other and with the handle for operating the valve 12 positioned rearwardly of the handle for actuating the valve 12a.

The embodiment shown in FIGS. 3 and 4 is similar to the previously described embodiment, but differs from the latter in certain important respects. In the modified embodiment the pipe 9 has its vertically spaced inlet tubes 11 and 20 arranged on the same side of the pipe 9, and each inlet tube is provided with a valve 12 and 12a similar in all respects to those described earlier. In the modified construction an operating chain 32 is connected at one end to the ear 18 of the lower valve 12 and is connected at its other end to the ear 18a of the upper valve 12a. The length of the chain 32 is greater than the distance between the ears 18 and 18a, thereby enabling the chain to be slack when the valves are in their closed positions. An operating chain 33 is connected at one end to the ear 18a and is fixed at its other end to one end of an actuating crank arm 34, the opposite end of which is bent to form a shaft 35 that extends through a bushing fitted into an opening in the tank wall 3. Fixed to the free end of the shaft 35 is a handle 36. In the modified embodiment only one crank arm 34 and one handle 36 are provided.

In the embodiment shown in FIGS. 1 and 2, counterclockwise rotation of the actuating handle 31 will cause corresponding rotation of the crank arm 28 so as to lift the valve 12a from its seat and enable water to be discharged from the tank into the pipe 9 via the inlet 20. Release of the handle 31 will enable the arm 28 to return by gravity to its initial position, but the hollow body 13 of the valve will enable the latter to remain in its open position until the water level in the tank has fallen to that of the inlet 20, whereupon the valve 12a will reseat itself by gravity. The chain 22 is incapable of transmitting any forces other than a tensile force, so return movement of the arm 28 to its initial position prior to closing of the valve 12a will have no adverse effect on the latter.

Counterclockwise rotation of the actuating handle 27 will cause corresponding rotation of the crank arm 24 so as to lift the valve 12 off the seat of the inlet 11 and permit the contents of the tank to be discharged through the pipe 9 via the inlet 11. Again, the hollow body 13 of the valve will enable the latter to remain in its open position until such time as the water level of the tank reaches that of the lower inlet 11.

Opening of the higher level valve 12a results in a lesser quantity of water being discharged from the tank than occurs upon opening of the valve 12. Thus a selected quantity of water may be discharged from the tank according to which of the handles 27 and 31 is selected for operation. In either case, however, all of the water discharged from the tank falls vertically through the pipe 9 with sufficient hydrodynamic energy to effect flushing of the toilet.

The handle 31, which controls the relatively low volume control valve 12a, preferably is positioned forwardly of the other handle 27 so as to facilitate selection of the low volume flush. However, either of the valves may be operated or, if preferred, both may be operated simultaneously.

In the operation of the embodiment shown in FIGS. 3 and 4, counterclockwise rotation of the handle 36 through a portion only of its maximum permissible travel will cause corresponding rotation of the crank arm 34 so as to lift the valve 12a off its seat and permit water to be discharged from the tank through the pipe 9 via the upper inlet 20. The slackness of the operating chain 32 enables the valve 12a to move to its open position without opening the valve 12. Further counterclockwise rotation of the handle 36, however, will cause corresponding further rotation of the arm 34 and tensioning of the chain 32 via the valve 12a to effect opening of the valve 12, whereupon both of the valves 12 and 12a will be in their open positions and enable substantially the entire contents of the tank to be drained through the pipe 9 via the lower inlet 11. In this embodiment, however, the upper, or low volume, valve 12a always will be opened first, thereby facilitating a relatively low volume of discharge of water from the tank upon operation of the flush actuating mechanism.

The disclosed embodiments are representative of presently preferred forms of the invention, but are intended to be illustrative rather than definitive thereof. The invention is defined in the claims.

1. A toilet tank flush valve assembly comprising a straight, upstanding pipe operable at least at its lower end; a first inlet in communication with said pipe at a level above its lower end; a second inlet in communication with said pipe at a level adjacent its lower end; first valve means; means mounting said first valve means for movement from a first position in which said first inlet is closed to a second position in which said first inlet is open; second valve means; means mounting said second valve means for movement from a first position in which said second inlet is closed to a second position in which said second inlet is open; first valve operating means connected to said first valve means; actuating means connected to said first valve operating means and operable to move said first valve means from its first position to and beyond its second position; and second valve operating means connecting said first valve means and said second valve means for moving the latter from its first position to said second position in response to movement of said first valve means beyond its second position.

2. The assembly according to claim 1 wherein the mounting means for each of said valve means mounts the latter for return movement from said second position to said first position by gravity.

3. The assembly according to claim 1 wherein each of said valve operating means comprises a flexible member capable of transmitting tensile forces only.

4. The assembly according to claim 1 wherein said actuating means comprises rockable crank means connected to said second operating means only.

5. The assembly according to claim 1 wherein each of said valve means comprises a buoyant body.