March 26, 1935. C. E. MACE 1,995,358

TOILET FLUSHING DEVICE

Filed Oct. 12, 1933 3 Sheets-Sheet 1

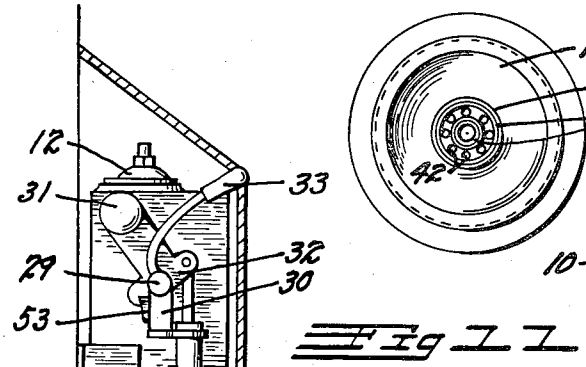


Fig 1

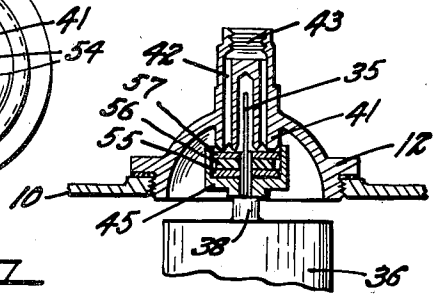


Fig 3

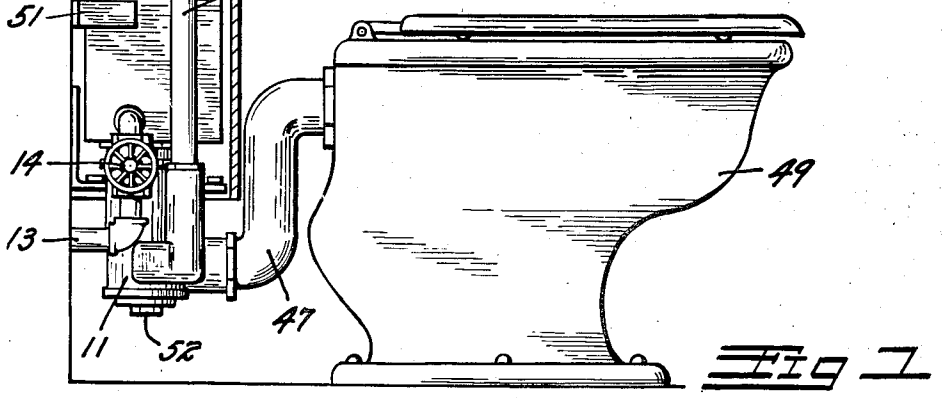


Fig 7

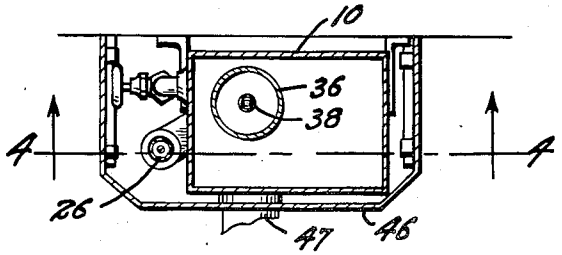


Fig 2

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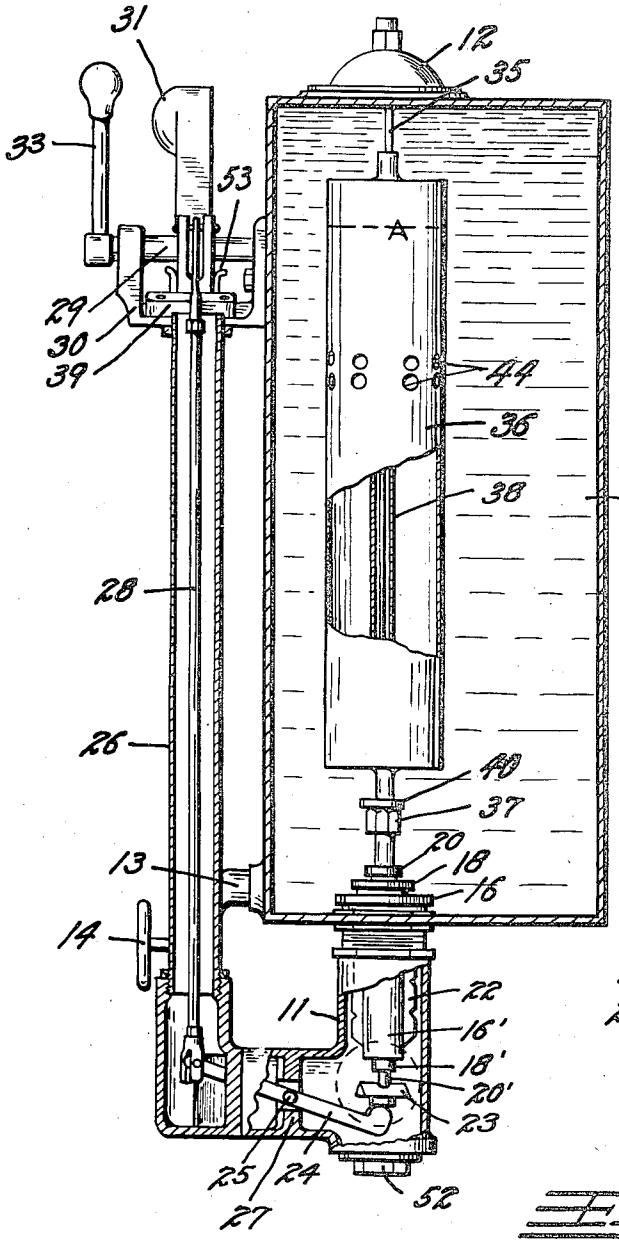


Fig 4

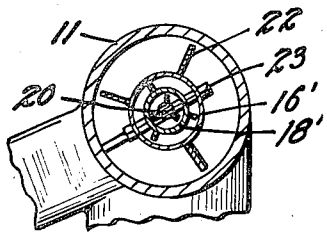


Fig 5

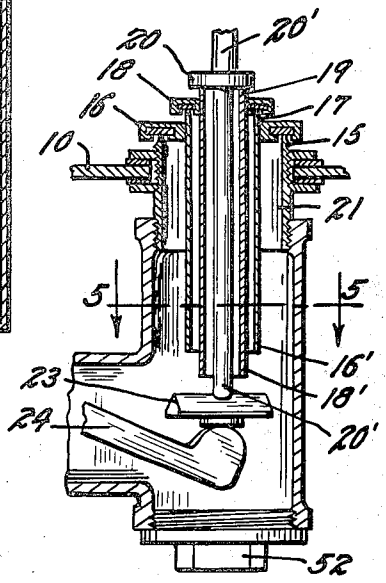


Fig 6

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TOILET FLUSHING DEVICE

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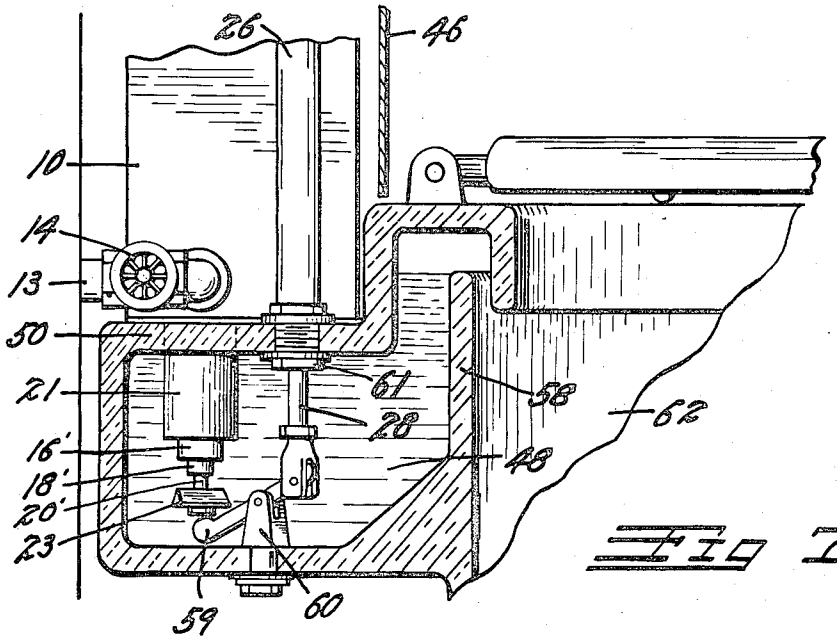


Fig 7

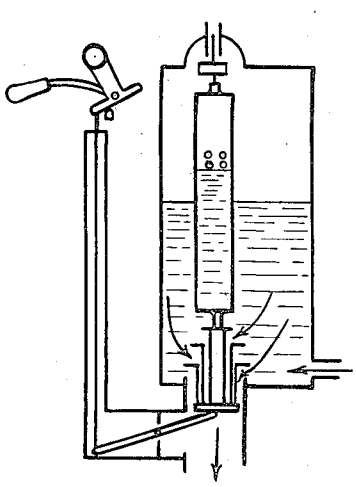


Fig 8

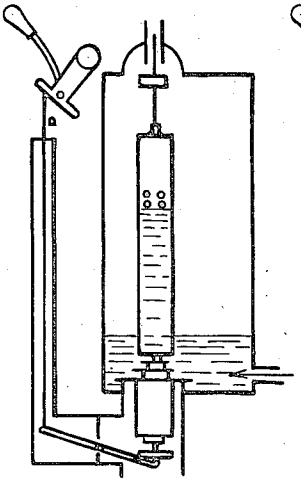


Fig 9

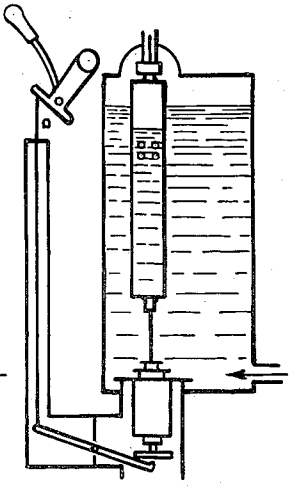


Fig 10

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UNITED STATES PATENT OFFICE

1,995,358

TOILET FLUSHING DEVICE

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Application October 12, 1933, Serial No. 693,292

15 Claims. (Cl. 4—28)

This invention relates to a toilet flushing device and has for its principal object the provision of means for flushing a toilet which will be absolutely silent in its operation; which will require but a minimum of parts; which will reduce upkeep to a minimum; which will be economical in the consumption of water; and in which any parts requiring renewal or replacement will be readily and conveniently accessible.

Another object of the invention is to so construct the device that a variety of different shapes and styles of external coverings may be applied to a single type of operating mechanism to match any design of toilet fixtures.

A further object of the invention is to provide a device of this character in which only a portion of the water in the flush tank may be discharged if desired so that it is not necessary to discharge the entire contents at each flushing as with present tanks.

Other objects and advantages reside in the detail construction of the invention, which is designed for simplicity, economy, and efficiency. These will become more apparent from the following description.

In the following detailed description of the invention reference is had to the accompanying drawings which form a part hereof. Like numerals refer to like parts in all views of the drawings and throughout the description.

In the drawings:

Fig. 1 illustrates a side view of the operating mechanism attached to a toilet bowl. The enclosing covering or shell in this view is shown in section.

Fig. 2 is a cross section through the complete device, taken on the line 2—2, Fig. 1.

Fig. 3 is a detail section through the air relief valve.

Fig. 4 is a vertical section through the tank and operating mechanism taken on the line 4—4, Fig. 2 with the outer shell removed.

Figs. 5 and 6 are enlarged detail sections through the valve mechanism.

Fig. 7 is a detail view of an alternate modification of the invention as applied directly to a modified toilet bowl.

Figs. 8, 9 and 10 are diagrams illustrating various phases of the operation of the invention.

Fig. 11 is a detail bottom view of the air vent cap.

A typical toilet bowl is illustrated at 49.

The invention comprises: a tank 10, preferably but not necessarily, rectangular in shape. A valve guide nipple 21 is secured in the bottom of the tank 10, and an air vent cap 12 is threaded into the top of the tank 10. A valve housing 11 is secured on the guide nipple 21. Water is supplied to the tank 10, adjacent the bottom, through a suitable supply pipe 13 and supply valve 14. Water discharges to the toilet bowl 49 through a flush pipe 47 opening through the side of the valve housing 11.

The upper extremity of the guide nipple 11 forms a main valve seat 15. The valves which close this seat are described in detail in applicant's Patent No. 1,730,374, their construction will be but briefly outlined here.

The main valve seat 15 is closed by means of a disc valve 16 from which depends a guide sleeve 16'. The main valve 15 carries an intermediate valve seat 17 which is closed by an intermediate valve disc 18, from which depends a guide sleeve 18'. The second valve 18 carries a third valve seat 19 closed by means of a third disc valve 20, from which a guide rod 20' depends. The rod 20' fits within the sleeve 18'; the latter fits within the sleeve 16'; and the sleeve 16' fits within the guide nipple 21. Suitable spacing ribs, as shown at 22, may be projected outwardly from each of the sleeves and from the rod 20' so as to maintain them in concentric relation with each other.

It will be noted that the sleeve 18' projects below the sleeve 16' and the rod 20' projects below the sleeve 18'. A cross bar 23 is secured on the projecting below portion of the rod 20'. An operating lever 24 is pivoted at 25 in the valve housing 11. The inner extremity of the lever 24 terminates beneath the valve rod 20' and the cross bar 23. The outer extremity is connected by means of a connecting rod 28 to the manual operating mechanism. The connecting rod 28 extends upwardly to the manual mechanism through a riser tube 26. A partition 27 is formed in the valve housing 11 at the pivot point of the lever 24.

The manual mechanism comprises: a shaft 29 journalled in a bracket 30 extending from the tank 10. A counter-weight 31 is secured to the shaft 29. The counter-weight is carried on a T-shaped arm from which two short lever arms 32 project. One of the lever arms is connected to the connecting rod 28. The extremity of the shaft 29 terminates in an operating handle 33. A rubber bumper 39 is carried by the bracket 30 to limit the downward movement of the handle 33 and spring clips 53 are provided to receive the other short lever arm to hold the handle in the raised position and prevent rebound of the counterweight 31.

A vertical slide rod 35 is supported in the tank 10

between a universal joint 37 on the upper extremity of the guide rod 20' and a socket in the air vent cap 12. A relatively long, cylindrical float 36 surrounds, and is arranged to reciprocate on, the slide rod 35. The float 36 is perforated intermediate its ends as shown by perforations 44. The float 36 is described and claimed in applicant's Patent No. 1,778,114. It is provided with an axial tube 38 through which the slide rod 35 passes. The tube 38 preferably projects from the upper and lower extremities of the float 36 as illustrated. A cushion washer 40 is positioned between the universal joint 37 and the bottom of the tube 38 to support the float.

The air vent cap 12 is provided with a downwardly extending cylindrical portion 41 on the bottom of which two concentric valve seats 54 are formed, against which an air valve cup 45 seats. A series of air passages 42 communicate with the interior of the air vent 12, between the two annular seats 54. The top of the vent is provided with a threaded nipple 43 through which the air may discharge.

The entire structure may be enclosed in a suitable ornamental housing or shell 46.

Operation

Let us assume that the tank 10 is filled with water under the natural water pressure of the supply, at which time the float 36 will be at its lowest position, as illustrated in Fig. 4, and the water level in the float 36 will be approximately at the line "A", Fig. 4. To flush the toilet, the operator depresses the handle 33, causing the lever 32 to act through the connecting rod 28, and the lever 24, to lift the rod 20' and with it the cross bar 23. The initial movement of the rod 20' opens the relatively small third valve 20, which immediately relieves the pressure in the tank 10. It then, through the cross bar 23, opens the valve 18 and the large valve 16 in rapid succession. The total open capacity of all the valves now exceeds the volume of the flush pipe 47 and allows the water to freely flow from the tank 10, into the toilet bowl 49.

The depression of the handle 33 swings the counter-weight 31 forward of its dead center position so that its weight supports the valves and the float after the handle 33 has been released by the hand. As the tank 10 empties, the water will discharge from the upper part of the float 36 through the perforations 44, but will remain in the lower part thereof. The effective weight of this remaining water in the float gradually increases as the water level in the tank 10 descends as indicated in the diagram of Fig. 8. When the water level in the tank reaches a predetermined level, the weight of the undisplaced water in the float will exceed the weight of the counter-weight 31 causing the float to descend and close the valves. In closing, they will, through the lever 24 and the connecting rod 28, swing the counter-weight 31 rearwardly so that it will relieve the upward pressure of the cross bar 23 and allow the valves to remain closed, as shown in the diagram of Fig. 9.

It will be noted that the valves close in succession. The small valve closes first, followed immediately by the medium valve 18, thence by the large valve 16 so that there is no sudden stoppage of the discharging water to cause objectional noises. Noise is also eliminated by the fact that the valves close at a time of no pressure in the tank.

Since both the air vent valve 45 and the feed pipe 13 are wide open, the tank will immediately begin to fill with water to displace the air through the vent cap 12. The rising water will entrap air in the top of the float 36 and, when the water reaches the level approximately indicated in the diagram of Fig. 10, the water displacement will equal the weight of the float and the float will rise upwardly, pushing the air valve cup 45 to its seat in the air vent cap. The water continues to rise, however, and in so doing, compresses the air in the top of the tank 10 and also in the top of the float 36.

The rising water in the float gradually increases the weight of or decreases the displacement of the float so that when the water level in the tank 10 approaches the top of the float, the air in the latter will be so compressed that it will not displace sufficient water to support the float. The float therefore sinks to the position of Fig. 4 and the pressure of the air in the tank 10 maintains the air valve cup 45 against its seats. The descending float will, of course, be cushioned by the surrounding water so that no sound thereof can be heard. When the pressure in the tank equals the pressure in the feed pipe 13 no further water will flow into the tank although the feed pipe remains fully open at all times.

In order to assure still further quietness in the operation of the device, it is preferred to install it so that there is a constant water level in the flush pipe 47 at approximately the height of the valve 16. This eliminates any air pockets between the valve and the bowl which might cause splashing and noise. This may be accomplished with the present toilet bowls by setting the tank 10 sufficiently low so that the valve 16 and the bowl intake are approximately on a level as illustrated in Fig. 1.

The entire tank 10, and its operating mechanism may be completely enclosed in an ornamental shell 46 such as illustrated, which may have any suitable design to match the toilet fixtures. The only projecting part of the mechanism would be the operating handle 33. The tank 10 may be supported in any desired manner, such as by means of suitable brackets 51 extending from the wall.

It is desired to call especial attention to the ease with which the various parts may be removed for inspection or repairs. The entire float and valve assembly may be removed by simply unscrewing the air vent cap 12 and lifting the rod 20' from the tank. A screw plug 52 may be provided in the bottom of the valve housing to facilitate the insertion and assembly of the lever 24.

The principal source of noise in the conventional toilet flushing mechanism results from the gradual closing or restricting of the supply pipe as the flushing tank fills. This closing must be done against high pressure and, as the valve opening becomes more and more restricted, it results in a long drawnout whistling noise. In the present invention, however, the supply pipe is fully opened and unrestricted at all times. There is no closing thereof. The inflow of water will gradually and quietly cease as the pressure in the air cushion at the top of the tank reaches the pressure of the incoming water.

It would be extremely difficult to open the third valve against the water pressure in the tank were it not for the fact that there is at all times an air cushion at the top of the tank and at the

top of the float which will supply space for compression when this valve is lifted.

The usual toilet tank requires the entire tank contents to be discharged before the flush valve can again be closed. In the present invention, however, it is possible for the operator to discharge only a small amount of water if a large amount is not required. By simply lifting the handle 33 the valves may be closed at any time, and will remain closed until another flushing is desired.

It is preferred to employ a square rod for the slide rod 35 since a round rod fitting snugly in the round guide tube 38 might become wedged from foreign materials entering between the tube and the rod. A square rod, however, contacts only along its four edges and allows ample space for foreign materials to become dislodged.

It is preferred to form the air valve, as illustrated in Fig. 3, that is, a flexible rubber gasket 55 is placed in the bottom of the cup, on the top of this rests a metal washer 56 which in turn is covered by means of a rubber valve seat 57. The under rubber allows the metal disc to rock so as to automatically align the top rubber with the double valve seats in the air vent cap 12.

The valves 16, 18, and 20 are preferably formed as discs with annular, undercut, washer depressions therein. A resilient rubber washer is held in this depression as shown in Fig. 6.

In Fig. 7, an alternate adaptation of the invention is illustrated. In this form a special bowl is employed having a water pocket 48 formed on the rear thereof. This pocket is closed over by a depressed shelf 50 for supporting the tank 10. A partition 58 maintains a water level in the pocket 48 above the valves in the tank 10. In this form the guide nipple 21 is extended downwardly into the pocket 48 and an operating lever 59 is mounted in a suitable pedestal 60 on the floor of the pocket. The riser tube 26 is secured to the pocket top by means of suitable lock nuts 61.

The operation of the alternate form is similar to the previously described form. It eliminates the necessity for the flush pipe 47, however, since this is replaced by the pocket 48.

While a specific form of the improvement has been described and illustrated herein, it is desired to be understood that the same may be varied, within the scope of the appended claims, without departing from the spirit of the invention.

Having thus described the invention, what is claimed and desired secured by Letters Patent is:—

1. A toilet flushing device comprising: a sealed tank; an air relief valve in the top of said tank; a water discharge valve in the bottom of said tank; a float reciprocating between said air relief valve and said water discharge valve so that when rising it will close the air relief valve and when falling it will close the water discharge valve; an inlet supplying water under pressure to said tank; and means for manually opening said water discharge valve, said float being closed at its top and bottom and provided with openings intermediate its extremities so that air will be contained in the upper portion thereof and water in the lower portion thereof.

2. A toilet flushing device comprising: a sealed tank; an air relief valve in the top of said tank; a water discharge valve in the bottom of said tank; a float reciprocating between said air relief valve and said water discharge valve so that when rising it will close the air relief valve and when falling it will close the water discharge valve; an inlet supplying water under pressure to said tank; means for manually opening said water discharge valve; a valve housing extending below said water discharge valve; a riser tube extending upwardly from said valve housing on the exterior of said tank; an operating lever in said valve housing for opening said water discharge valve; and a connecting rod extending downwardly within said riser pipe to a connection with said operating lever.

3. A toilet flushing device comprising: a sealed tank; an air relief valve in the top of said tank; a water discharge valve in the bottom of said tank; a float reciprocating between said air relief valve and said water discharge valve so that when rising it will close the air relief valve and when falling it will close the water discharge valve; an inlet supplying water under pressure to said tank; a valve housing extending below said water discharge valve; a riser tube extending upwardly from said valve housing on the exterior of said tank; an operating lever in said valve housing for opening said water discharge valve; a connecting rod extending downwardly within said riser pipe to a connection with said operating lever; an operating handle for manually depressing said connecting rod; and means for holding said connecting rod depressed for a predetermined period.

4. A toilet flushing device comprising: a closed tank; means for supplying water under pressure to said tank; an air relief valve in the top of said tank; a water discharge valve in the bottom of said tank; a slide rod extending between said air relief valve and said discharge valve; a vertically elongated float surrounding said slide rod; a tube extending through said float about said slide rod, said float being closed at its top and bottom and provided with openings intermediate its extremities so that the upper portion thereof will fill with air to raise said float against said air relief valve and so that the lower portion thereof will fill with water so as to depress said float against said water discharge valve; and means for raising said water discharge valve.

5. A toilet flushing device comprising: a closed tank; means for supplying water under pressure to said tank; an air relief valve in the top of said tank; a water discharge valve in the bottom of said tank; a slide rod extending between said air relief valve and said discharge valve; a vertically elongated float surrounding said slide rod; a tube extending through said float about said slide rod, said float being closed at its top and bottom and provided with openings intermediate its extremities so that the upper portion thereof will fill with air to raise said float against said air relief valve and so that the lower portion thereof will fill with water so as to depress said float against said water discharge valve; a valve housing positioned below said water discharge valve so as to receive the water therefrom; a riser pipe extending upwardly from said valve housing; a manual control extending downwardly in said riser pipe to actuate said water discharge valve; and a water discharge from said valve housing, said discharge being positioned at a sufficiently high elevation to maintain water in said valve housing at all times.

6. In a toilet flushing device having a pressure tank and a water discharge in the bottom of said tank; means for opening said water discharge valve comprising: a lever; a counterweight actuated by said lever so that when said counter-

weight is in one position it will allow said valve to close and when in another position will hold said valve open; and automatic means for swinging said counter-weight in one direction.

7. In a toilet flushing device having a pressure tank and a water discharge in the bottom of said tank: means for opening said water discharge valve comprising: a lever; a counter-weight actuated by said lever so that when said counter-weight is in one position it will allow said valve to close and when in another position will hold said valve open; a float of sufficient weight to swing said counter-weight when the water in said tank lowers to a predetermined position.

8. A toilet flushing device comprising: a sealed tank; a valve housing communicating through the bottom of said tank; a discharge valve sealing said housing from said tank; and extending within said housing; a lever pivoted within said housing; and contacting with said valve at its one extremity to open the latter; a riser tube extending upwardly from said housing and opening to the atmosphere at its top; a connecting rod extending downwardly within said riser pipe to a hinged connection with the other extremity of said lever; and means for depressing said connecting rod to actuate said valve.

9. A toilet flushing device comprising: a sealed tank; a valve housing communicating through the bottom of said tank; a discharge valve sealing said housing from said tank; and extending within said housing; a lever pivoted within said housing and contacting with said valve at its one extremity to open the latter; a riser tube extending upwardly from said housing and opening to the atmosphere at its top; a connecting rod extending downwardly within said riser pipe to a hinged connection with the other extremity of said lever; a shaft positioned adjacent the upper extremity of said riser tube; a lever projecting from said shaft and hingedly connected with said connecting rod; and a manual handle secured on said shaft so as to actuate the latter.

10. A toilet flushing device comprising: a sealed tank; a valve housing communicating through the bottom of said tank; a discharge valve sealing said housing from said tank and extending within said housing; a lever contacting with said valve at its one extremity to open the latter; a riser tube extending upwardly from said housing and opening to the atmosphere at its top; a connecting rod extending downwardly within said riser pipe to a hinged connection with the other extremity of said lever; a shaft positioned adjacent the upper extremity of said riser tube; a lever projecting from said shaft and hingedly connected with said connecting rod; a manual handle secured on said shaft so as to actuate the latter; and means for temporarily holding said shaft in one position so as to maintain said valve open a predetermined period.

11. A toilet flushing device comprising: a sealed tank; a water discharge in the bottom of said tank; a discharge valve closing said water discharge; an air relief valve in the top of said tank over said discharge valve; a stem extending upwardly from said water discharge valve, there being a socket provided in said air relief valve for the reception of said stem; a valve member positioned to close said air relief valve; and a float vertically movable on said stem so as to close said valve member when it moves upwardly and to close said discharge valve as it moves downwardly.

12. A toilet flushing device comprising: a sealed tank; an air relief valve in the top of said tank; a water discharge valve in the bottom of said tank; a float reciprocating between said air relief valve and said water discharge valve so that when rising it will close the air relief valve and when falling it will close the water discharge valve; an inlet supplying water under pressure to said tank; means for manually opening said water discharge valve; a valve housing extending below said water discharge valve; a stem extending downwardly from said water discharge valve into said housing; and manually operated means for contacting said stem to open said discharge valve.

13. A toilet flushing device comprising: a sealed tank; an air relief valve in the top of said tank; a water discharge valve in the bottom of said tank; a float reciprocating between said air relief valve and said water discharge valve so that when rising it will close the air relief valve and when falling it will close the water discharge valve; an inlet supplying water under pressure to said tank; means for manually opening said water discharge valve; a valve housing extending below said water discharge valve; a stem extending downwardly from said water discharge valve into said housing; manually operated means for lifting said stem to open said discharge valve; and means for supporting said stem in the lifted position a predetermined period.

14. A toilet flushing device comprising: a sealed tank; a water discharge in the bottom of said tank; a discharge valve closing said water discharge; an air relief valve in the top of said tank over said discharge valve; a stem extending upwardly from said water discharge valve; a valve member positioned to close said air relief valve; and a float vertically movable on said stem so as to close said valve member when it moves upwardly and to close said discharge valve as it moves downwardly.

15. A toilet flushing device comprising: a sealed tank; a water discharge in the bottom of said tank; a discharge valve closing said water discharge; an air relief valve in the top of said tank over said discharge valve; a stem extending upwardly from said water discharge valve; a valve member adjacent the upper extremity of said stem for closing said air relief valve; a float support adjacent the lower extremity of said stem; and a float slidably mounted on said stem so as to contact said valve member as it moves upwardly and said float support as it moves downwardly.

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