## FLUSHING DEVICE

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## Related U.S. Application Data

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E03d 1/36
Field of Search $\qquad$ $4 / 45,41,47,72,44,48$, $4 / 49,50,60 ; 137 / 145,424$

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## ABSTRACT

A flushing device for toilets having a float directly connected to the movable part of an inlet valve to form a unitary moving element. A siphon empties the flush tank and becomes inactive until a full tank is flushed again. When the float, which is slidably mounted in a chamber, is forced down for flushing, it forces water from the float chamber into the siphon either alone or with water from the inlet valve, to start a siphoning action to empty the flush tank. At the same time the float opens the inlet valve to supply additional water to start the siphon and to keep the valve open until the flush tank is refilled at which time the float has been raised to its normal position. Provisions are made for preventing a reverse flow from the tank into the inlet pipe during failure of the water supply and for filling the toilet bowl to the desired level at the end of the flushing operation. Provision is also made for conserving water by flushing a predetermined quantity of water for solids and considerably less water for liquids and by providing means for regulating the amount of water to be flushed by the flushing unit.

6 Claims, 15 Drawing Figures

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## SHEET 4 OF 5




## FLUSHING DEVICE

This is a continuation of application Ser. No. 200,343 filed Nov. 19, 1971 which in turn is a division of application Ser. No. 053,170 filed July 8, 1970.

## BACKGROUND OF THE INVENTION

The present invention relates to a flushing device and more particularly to a flushing device for use in tanks for flushing toilets.
Commercial flush tanks at the present time generally utilize one float controlled valve for the inlet and a second float controlled valve for the outlet. The outlet valve is much larger than the inlet valve in order to discharge a large volume of water in a short time for flushing purposes. Such large outlet valves are difficult to seat, are subject to excessive wear and leakage, cause noise and waste water and necessitate frequent repairs and replacements. The repair or replacement of these valves is expensive and troublesome, and usually requires the services of a skilled plumber. The inlet valve usually performs satisfactorily for long periods of time if the valve is seated quickly and with uniform pressure about its periphery.
Attempts have been made to avoid the use of the outlet valve by the use of a siphon but the results have not been satisfactory and siphons are not in general use for flushing purposes.
The present invention is directed to an improved flushing device which will eliminate the outlet valve and which will improve the float controlled operation of the inlet valve.
An object of the present invention is to provide an improved flushing device substantially free of valve and float problems.
A nother object of the invention is to provide a flushing device utilizing a single valve.
Another object of the invention is to provide an improved float operation of the inlet valve.
Another object of the invention is to provide an improved siphon combination for flushing purposes.
Another object of the invention is to provide improved means for initiating the siphon action.
Another object of the invention is to provide a flushing unit which may be readily molded in two parts from an inexpensive plastic material and welded or bonded together to form a unitary structure for the inlet conduit, the float chamber and the siphon.
Another object of the invention is to provide an inlet valve where water pressure tends to hold it to its seat giving fast position shutoff.
A further object is to conserve water in flushing operations by providing a simple and convenient means for regulating the amount of water flushed which may be easily changed for each flushing operation.
Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

## BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the invention has been chosen for purpose of illustration and description and is shown in the accompanaying drawings, forming a part of the specification, wherein:

3 is a perspective view of a molded part forming half of the inlet conduit, float chamber and siphon and showing the hollow side of the part;
FIG. $3 a$ is an enlarged fragmentary perspective view showing a fin or rib on the edge of one of the two 5 molded halves to facilitate welding;

FIG. 4 is a top plan view of the unit shown in FIG. 1;
FIG. 5 is a horizontal sectional view along the line $5-5$ of FIG. 1 slightly above the open end of the siphon;

FIG. 6 is a horizontal sectional view along the line $6-6$ of FIG. 1 intermediate the inlet valve and the bottom of the float chamber;

FIG. 7 is a horizontal view along the line $7-7$ of FIG. $25 \mathbb{1}$ slightly above the bottom of the float chamber;

FIG. 8 is a vertical sectional view through a tank and centrally through a flushing unit illustrating another embodiment of the invention;

FIG. 9 is a perspective view of the part forming the 0 bottom of the float chamber shown in FIG. 8 with a discharge outlet under the open end of the siphon,

FIG. 10 is an enlarged fragmentary sectional view illustrating the attachment of the valve stem to the upper part of the float as shown in FIG. 8;

FIG. 11 is a vertical sectional view through another embodiment of the invention illustrating the operation of the flushing unit;
FIG. 12 is a partial sectional view illustrating the operation of the float and the valve stem in the embodiment shown in FIG. 11;

FIG. 13 is a sectional view through the tank and centrally through a flushing unit mounted in the tank illustrating another embodiment of the invention; and

FIG: 14 is a sectional view of another means of con5 necting the siphon to the outlet of the tank.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings illustrating a preferred embodiment of the invention and more particularly FIGS. 1,2 and 3, a flush tank 1 of the usual type is shown having a bottom 2, sides 3 and a cover 4 for containing water for flushing purposes. The unit in the flush tank for effecting the flushing operation has an inlet pipe 5 that connects with the usual pressure water supply systems in general use. The lower end $5 a$ is secured in the opening $5 b$ in the bottom of the tank by an attachment which will be described later.

A valve seat $11 b$ is formed in the upper end of a relatively rigid cylindrical insert 13 mounted in the inlet pipe 5 to seat inlet valve 11. The insert 13 also serves to reinforce the portion of the inlet pipe 5 below the inlet valve which is the only portion of the unit exposed to the usual tap water pressure. The water in the remainder of the unit is at the low tank water pressure. Thus the insert 13 permits the entire unit to be molded of thin plastic material.

A float chamber 6 preferably is integrally mounted on the offset side of the inlet pipe 5 and houses a float 9 which is preferably cylindrical in form with its upper rim above the water level. The clearance of float 9 in float chamber 6 is kept to a minimum that is compatible to manufacturing techniques, since the float acts as a pump when flushing is initiated. The float chamber also acts as a guide for the float. The float may be of any suitable hollow or light material and is shown in its upper position which indicates that the tank is filled to its upper level. The valve 11 has a stem 11c which extends upwardly through the opening $11 a$ in the upper end of the insert 13 through the bottom of the float chamber and through tube 18 and is anchored in the upper end of the float as shown at $\mathbf{2 0}$. A disc $\mathbf{1 2}$ is secured to the stem and adapted to seat on the upper end of the tube 18 which is secured at its lower end in a cylindrical holder 19 integral with the bottom of the float chamber.

A siphon tube 7 is integrally connected to the float chamber and to the inlet pipe 5 to form an integral structure with them. The siphon comprises an outlet leg $7 a$ having an attachment 14 secured to it and adapted to be mounted in the outlet 15 in the bottom of the flush tank. The upper portion of the siphon is curved into the shape of an inverted U with a leg $7 b$ extending downwardly with its lower end open and located at the lowest level of water desired in the flushing tank at the end of the flushing operation.

The inlet pipe 5 continues above the valve 11 through conduit $5 d$ which extends upwardly along the outer side of the bottom of the float chamber 6 and integral with it. The inlet conduit then continues vertically intermediate the side of the float chamber and the side of the leg $7 b$ of the siphon and integral with both the float chamber and the siphon. The upper end $5 e$ of the inlet conduit is also integral with both the float chamber 6 and the siphon leg $7 b$. The water from the inlet valve 11 flows through the conduits 5 d and $5 e$ up over a dam 22 and is directed downwardly onto the inner side of the inverted $U$ at 23. The dam is spaced slightly to the left of the vertical center line of the siphon so that the water flowing over the dam will for the most part travel down the leg $7 b$ when the tank is being filled to the proper level. A small part of the water being filled to the proper level. A small part of the water being delivered flows over the opposite side of the siphon down through the leg $7 a$ into the toilet bowl. This fills the toilet bowl to the proper level, and any excess water passes down into the sewer. This assures a proper level of water in the closet bowl after each flushing.
In connection with flushing the tank a J-shaped conduit 10 is provided with an open end 10 directly under the inilet $7 c$ to the leg $7 b$ of the siphon. The conduit forming the longer leg of the J-part 10 connects with the bottom of the float chamber by a pair of conduits or passages 26 (see FIGS. 3 and 6) and 27 which straddle the conduit $5 d$ and connect with the bottom of the float chamber 6.

In operation, with the tank full as indicated in the drawing and with the float in its upper position as shown, the trip handle $44 a$ at the side of the tank is turned to force the float downwardly toward its lower position as shown in dotted lines. The downward movement of the float expels from the float chamber the water which is in the bottom of the float chamber and
which as indicated fills it to about half its height. This water from the bottom of the float chamber is forced through the conduits 26 and 27, which straddles the conduit $5 d$, and delivers water into the J-shaped con5 duit 10 and gushes it into the open end of the siphon to start the siphon action.

Simultaneously the forcing of the float down opens the inlet valve 11 admitting tap water under pressure into the conduit $5 d$ and up through the upwardly ex10 tending portion $5 e$ of the conduit over the dam 22 to join with the water being forced up the leg $7 b$ to add to the volume of water passing over and down the leg $7 a$ of the siphon to start the siphon action. Once started the action continues until the water in the tank is below 5 the level of the lower end of the leg $7 b$ of the siphon. At this point air entering the lower end of the leg $7 b$ of the siphon breaks the flow of water and the flushing stops.

However the float is in its low position at the end of 20 the flushing operation and the inlet valve 11 is in its low position. With the valve 11 open water flows from the supply system into the upwardly extending portions $5 d$ and $5 e$ of the inlet pipe over the dam 22 and into the upper portion of the siphon. As indicated previously the major part of the water flows down through the leg $7 b$ to fill the tank, and a very minor part flows down the leg $7 a$ to fill the toilet to the proper level.
It will be noted that the dam 22 in the upper part of the siphon 7 is well above the upper level of the water in the tank. This prevents any reverse flow of water from the tank to the water supply system if the water supply system should fail for any reason.
The lower end of the inlet pipe 5 has, as indicated previously, an insert 13 which may be friction-fitted into the pipe. The annular rib $5 f$ at the upper end of the insert 13 on the inside of the inlet pipe 5 limits the distance the insert 13 extends into the pipe inlet. A shoulder $13 b$ forms a seat for a rigid member 25 with a small opening aligned with a similar opening in a resilient rubber member 24.

The rubber member 24 may be purchased from Taco Inc., 1160 Cranston Street, Providence, R.I. and is for the purpose of maintaining a nearly constant pressure below the inlet valve 11 which is slightly less than the pressure of the tap water supply. The pressure from the water supply entering the inlet pipe may raise the valve 11 and the float upwardly sufficient to influence the water level at the completion of the filling operation without the pressure reducing member 24. This is because the pressure area of the bottom of the inlet valve is greater than the area of the upper end since the valve stem reduces the pressure area of the top of the valve. This is accomplished by the water pressure on the lower end of the member 24 compressing the member to constrict the central opening $24 a$ through it and thereby reduce the pressure in the inlet pipe above the member 25 and below the valve 11.
The water pressure on the bottom of the valve 11 , after it is seated in closed position, is sufficient to support the float in its upper position if the tank should break or form a leak which would permit the water to drain out of it. In such an emergency the loss of water capable of doing damages would be limited to the amount in the tank and would not result in a continuous flow from the inlet pipe which could cause extensive water damage if the occupants were asleep or away.

The disc or supporting member 12 on the upper end of the valve stem $11 c$ limits the lower movement of the valve stem and the valve 11 by resting on the top of the cylindrical tube 18 and closing it. It also provides a means of retaining the valve 11 with rod $11 c$ during assembly.
The shapes of the various parts of the embodiment in a vertical plane are shown more particularly in FIG. 3 showing a perspective view of one-half of the unit and horizontal sectional views are shown in FIGS. 5, 6 and 7 through the flushing unit. In addition, the top view in FIG. 4 gives further information as to the shape of the parts. The unit, except for the float and the inserts in the inlet pipe, is preferably molded in two parts and the two parts have their edges welded or bonded together to form a unitary structure which will be leakproof and which will stand the water pressures to which they may be subjected with ample leeway for excess pressures.
FIG. 5 is a section along the line $5-5$ of FIG. 1 just above the outlet $10 a$ of the J-member 10. The section shows the top of the opening $10 a$ of the J -member 10 and a section across the inlet pipe 5 and across the length $10 b$ of the J-member which is integral with the inlet pipe 5.
FIG. 6 is a horizontal sectional view along the line $6-6$ of FIG. 1 which is taken slightly above the valve seat $11 b$ in the inlet conduit 5 qnd shows the inlet pipe with the junction of the conduit $5 d$ and also shows passages 26 and 27 from the bottom of the float chamber which straddle the conduit $5 d$ which receives water from the inlet valve 11 and delivers the water from the inlet valve to the vertical conduit $5 a$ and to the upper end of the siphon.
These passages 26 and 27 may be formed in any suitable manner but preferably slides are used in the mold cores forming the inside of the float chamber. These slides pass through the bottom of the chamber and form the core for the passages 26 and 27 opening into the upper end of the long leg $10 b$ of the J-shaped part (see FIG. 3) so that water can flow freely from the lower part of the float chamber into the J-shaped conduit or member 10 for starting the siphon operation.
FIG. 7 is a sectional view along the line $7-7$ of FIG. 1 which is taken at the lower end of the cylindrical part of the float chamber. This figure shows the open upper ends of the passages 26 and 27 at the bottom of the float chamber. The cylindrical shape of the float chamber 6 is also shown together with the supporting tube 18 and the valve stem 11c. At the center of the figure the vertical portion of the conduit $5 e$ is shown which receives the water from the inlet valve and delivers it to the top of the siphon. The section of the siphon leg $7 b$ is also shown and the upper end of the opening $10 a$ of the J-member 10 is shown.
The top plan view shown in FIG. 4 shows the top and sides of the siphon 7 , the enlargement $22 a$ at the top of siphon 7 for housing the dam 22, the top of the float chamber 6 and the passages 26 and 27 in the bottom of the chamber for delivering water to the J-member 10.

The flushing unit is mounted on the bottom of the tank 1 . The lower end of the inlet pipe 5 passes through the opening $5 b$ in the bottom 2 of the tank and a flange $5 c$ on the inlet pipe 5 limits the downward movement. Gaskets 32 and 34 extending about the inlet pipe on opposite sides of the tank bottom 2 form a water-tight seal. A suitable nut 35 is threaded to the end of the inlet
pipe to hold the flange $5 c$ and the gaskets 32 and 34 securely in position on the bottom of the tank thus supporting the left side of the flushing unit in position.
The outlet opening 36 in the bottom of the tank is adapted to receive a fitment 37 which in turn has an opening 38 for receiving the lower end of the leg $7 a$ of the siphon 7. An annular rib $37 a$ on the outside of the leg $7 a$ limits the downward movement of the siphon leg. The siphon leg $7 a$ and the fitment 37 may be bonded together if desired. The fitment 37 has a flange $37 b$ which rests on a gasket 39 intermediate the flange and the bottom 2 of the tank. A gasket 40 is mounted on the lower end of the fitment 37 and is compressed and held against the bottom of the tank by a nut 41 to form a liq-uid-tight seal. The nuts 35 and 41 hold the inlet pipe 5 and the siphon 7 in position, respectively, and permits the unit to be readily installed.
The means for forcing the float down to open the inlet valve 11 and to initiate the siphon cycle is shown more particularly in FIGS. 1 and 2. A rod 44 is mounted for rotation in the opening 45 in the side 3 of the tank and has a trip handle $44 a$ on one end for rotating the rod 44 and an arm $44 b$ preferably curved along its length for forcing the float downward when the trip handle $44 a$ is operated to rotate the rod 44.
The rod 44 is mounted in a bearing formed in the hollow cylindrical member 46 to permit free rotation of the rod 44 . The member 46 is held in position by a nut 49 on the inside of the tank and the enlarged knob $46 b$ is spaced from the outside of the tank by a sleeve $46 c$. A gasket $46 d$ permits the application of sufficient friction to permit the bearing member 46 from rotating freely and at the same time prevents its being rotated by the operation of the trip handle $44 a$ to start the flushing cycle. The friction is not sufficiently great to prevent the knob $46 b$ on the cylindrical member 46 from being rotated manually without substantial effort.

Means may be provided for varying the amount of water used in each flushing operation. Referring to FIGS. 1 and 2, there is provided a conduit 80 having one end connected at 81 on the leg $7 b$ of the siphon and opening into the side of the leg so that air or water may pass from the outer end of the conduit 80 into the leg $7 b$ of the siphon. The conduit 80 may be a flexible tube so that it may be flexed upwardly or it may have a pivoted connection with the leg $7 b$ to permit its free end to be raised and lowered.
The opposite end of the conduit $\mathbf{8 0}$ may be connected by a cord or wire 82 to the bearing member 46 and coiled about it as shown. The member 46, as indicated previously, may be rotated by the knob $46 b$ and the rotation of it will wind or unwind the cord or wire 82 about the member 46 either to raise the outer end of the conduit 80 or to lower it, depending upon the direction of rotation of bearing member 46. Thus, the height of the outer end of the conduit 80 may be changed as desired. The height of the outer end of the conduit 80 determines the amount of water left in the tank at the finish of a flushing operation. As soon as the water level drops below the outer end of the conduit 80 in the tank, air will be drawn into the leg $7 b$ of the siphon 7 which will break the column of water and permit the siphon to draw air instead of water which will terminate the siphon operation.

Suitable stops may be provided for upper and lower limits of the movement of the tube $\mathbf{8 0}$ so that the flush-
ing operation can be changed quickly from one position to the other to flush a predetermined amount of water for solids and substantially less water for liquids in order to conserve water. The cord or wire $\mathbf{8 2}$ may be operated independently of the tripping mechanism if desired. Likewise a lever and rod may be substituted for the pulley cord.

In the operation of the preferred embodiment of the flushing unit starting with the tank filled with water to 'a level which is slightly below the lower horizontal curve $7 d$ of the siphon tube, the trip handle $44 a$ is turned to rotate the rod 44 which forces down the arm $44 b$ inside the tank to depress the float from the full line position shown in FIG. 1 to the dotted line position where the bottom of the float is at the bottom of the float chamber.

The movement of the float 9 downward forces the water in the bottom of the float chamber out through the passageways 26 and 27 leading from the bottom of the float chaamber as shown more particularly in FIGS. $1,3,6$ and 7 into the long leg of J-shaped member 10 and through the outlet opening $10 a$ of the J-shaped member into the inlet of the inlet leg $7 b$ of the siphon. This forces water up one leg of the siphon and down the other to start the siphon action.

At the same time the movement of the float downwardly forces the valve stem $11 c$ and the valve 11 downwardly opening the inlet valve and permitting water to flow under pressure from a city or town water system through the inlet pipe 5, inlet valve 11 and the connecting conduits $5 d$ and $5 e$ to the upper apex of the siphon 7. At the upper end of the conduit 5 e the water passes over a dam 22 and flows down into the siphon. This inlet water joins with the water being forced into the siphon from the float chamber to assure the starting of the siphon and the starting of the flushing cycle.

When the water reaches the level of the open lower end of the siphon leg $7 b$ the siphon receives air instead of water which stops the siphon operation in those cases where the tube $\mathbf{8 0}$ is at the level of the bottom of the leg $7 b$ of the siphon and also in those cases where the siphon unit does not include the conduit $\mathbf{8 0}$ for regulating the amount of water in each flushing operation.

Since the float is in its lower position and the inlet valve is open, water continues to flow through the inlet valve and into the top of the siphon 7. The dam 22 is located at the left of the crest of the curved apex on the inside of the siphon so that the major part of the water which flows over the dam will go down the leg $7 b$ to fill the tank and a minor portion of the water will flow down the leg $7 a$ to fill the bowl of the toilet to the desired level.
While the siphon unit may be made in any desired manner, in the preferred embodiment the unit is made of a thermoplastic material and molded in two parts which are preferably substantially identical. The two molded halves are then bonded, cemented or welded together at their free edges to form a closed water-tight unit.
Referring to one of the molded parts one of which is shown in perspective in FIG. 3 and to the other drawings of the preferred embodiment, it will be noted that half may be molded in the usual molds. The parts may also be cemented, bonded or welded together in the usual manner, preferably the free edges of the halves are welded together and are formed as shown in FIG.
$3 a$ with a small continuous fin or rib 16 protruding outward from the edge of one to facilitate the bonding operation. The use of a fin or rib 16 provides a narrow thin portion which may be quickly melted and spread over the rest of the edge. In this way the welding can be performed in less time and at lower temperatures of the hot plate or other heated member utilized for melting the surface of the edge with minimum change of dimensions. The two parts may also be bonded together with a solvent or secured together with glue or cement.

In the molding of the float chamber 6 , it is desirable to form the two passages 26 and 27 opening into the bottom of the float chamber which pass on opposite sides of the inlet conduit $5 d$ and extending down into the J-shaped member $\mathbf{1 0}$. One way to accomplish this is to provide a slidable mold part for the cores forming the respective halves of the float chamber. The slidable mold part may have a projection on its lower end to project downwardly from the bottom of the mold core to form the passageway 26 on one mold core and the passageway 27 on the other. Before the mold is opened to remove the half, the sliding member is raised or moved parallel to the central axis of the core until the end of the projection is flush with or above the bottom end of the core so that the mold plastic part may be removed without interference by the slidable projection which forms the passageways 26 or 27 , as the case may be, to the J-shaped member 10.
The embodiment of the invention illustrated in FIGS. 8,9 and 10 utilizes a flush tank 1 with an inlet opening $5 a$ in the bottom and an outlet opening 36. An inlet pipe 84 is secured to a fitment 85 mounted in the inlet opening. The fitment 85 which has an enlarged upper end $85 a$ is passed through an opening 86 in the bottom of the float chamber 87 to hold the float chamber in position. Suitable gaskets 88 and 89 seal the parts in position on the sides of the bottom 2 of the tank adjacent to the inlet, and the gaskets are compressed and the fitment 85 held in position by a nut 90 threaded on the end of the fitment 85 . The resilient rubber member 24 described in connection with the preferred embodiment of the invention seats against a shoulder $85 b$ on the inside of the fitment 85 to reduce the pressure below the inlet valve 96 in the same manner as described above in connection with the preferred embodiment.
The inlet pipe 84 extends above the upper level of the water in the tank. A float $\mathbf{8 8}$ made of any suitable light material or with a hollow interior as shown is mounted in the float chamber. The upper end of the float 88 has an opening 89 (see FIG. 10) with a part 95 extending across the opening. The part 95 has a central opening $90 a$ for receiving a fitment 91 for holding the upper end of the valve stem 92. The enlarged head of the fitment 91 may be forced through the opening $90 a$ before the valve stem is assembled with it. Likewise, the fitment may be forced through the sealing disc 95 to snap the disc on the reduced portion of the fitment. The valve stem is then forced into an opening in the fitment and enlarges the fitment so that the fitment is rigidly held in position and the parts cannot be disassembled until the valve stem is removed.
The inlet valve 96 is mounted on the lower end of the valve stem 92 and seats against the valve seat 97 when the float is in its upper position. A cross member 98 having apertures $98 a$ is provided a short distance above
the valve seat in the inlet pipe. A conduit 99 connects with the space intermediate the valve seat and the cross member 98 which has the small apertures $98 a$ permitting water to flow through it. The conduit 99 goes down toward the bottom of the float chamber and is bent upwardly along the side of the leg $101 a$ of a siphon 101. The conduit 99 terminates as shown shortly before it reaches the apex of the siphon.
The part 100 forming the bottom of the float chamber has a conduit 102 which has an opening 104 directly under the open end of the leg $101 a$ of the siphon. The bottom conduit 102 has a top opening 105 which fits and supports the body of the float chamber 87. A suitable trip handle 105 mounted on the end of a rod 107 rotatably secured in an aperture 104 in the side of the tank, presses the float down by means of the arm $103 a$ on the rod 107.
The other leg $101 b$ of the siphon 101 has its lower end securely fitted in a fitment 109 having a flange $109 a$ larger than the opening 36 in the bottom of the tank. A gasket 110 fits under the flange and over the corner of the outlet opening 36 . A second gasket $\mathbb{1 1}$ fits on the underside of the bottom 2 of the tank, and the parts are secured in position, and the fitment and siphon are held securely in position by a nut 112 threaded to the lower end of the fitment.
In operation the trip handle 106 rotates the rod 107 to tilt the arm $103 a$ downwardly to force the float 88 downwardly. The disc 95 serves as a check valve to prevent the air from escaping from the upper part of the float when the float is forced downwardly. The downward movement of the float 88 and the trapped air in the float force the water in the float chamber 87 downwardly and out of the bottom of the chamber through the outlet 104 upwardly through the lower end of the leg 101a. The rush of water into the siphon leg $101 a$ forces the water over the crest at the top of the siphon and starts the siphon
In addition, and at the same time, the downward movement of the float opens the inlet valve 96 and part of the inlet water is forced into the conduit 99 and adds to the volume of water that is being supplied from the float chamber to the siphon. The rest of the inlet water flows out the upper end of the inlet 84 into the float chamber. When the flushing is completed the inlet valve 96 and the float 88 are still down and water continues to flow from the pressure source to fill the tank. At the same time water will continue to flow through the conduit 99 and from the upper end of it into the outlet leg $101 b$ of the siphon for filling the bowl of the toilet to the proper level.
The inlet pipe 84 extends upwardly above the level of the water in the tank when the tank is full. In this way water cannot flow back into the inlet pipe. If the water supply should fail and if the inlet valve 96 opens and a partial vacuum tends to form in the inlet pipe 84 the disc 95 will be in its lower position and vent the space in the upper part of the float to atmosphere, thus preventing the formation of a vacuum in the inlet pipe 84. If the float 88 should be in its lower position the disc 95 will close the upper end of the inlet pipe to prevent reverse flow of water in the event the water pressure fails. Thus, the sealing disc 95 prevents any partial vacuum from forming within the float when the float is in its upper position and seals the opening 89 when the float is forced downwardly to trap the air and expel the water from the float chamber and also closes the upper
end of the inlet pipe 84 when the float is in its lower position until the pressure of the inlet water in the inlet pipe 84 raises the disc 95 and the float.

The embodiment illustrated in FIGS. 11 and 12 has the usual inlet opening 115 and outlet opening 116 in the bottom 2 of the tank 1 . An inlet pipe 117 has its lower end formed with a flange 118 and with the threaded end below the flange. The flange 118 is seated in the opening 115 in the bottom 2 of the tank. A suitable gasket 121 on the upper side of the bottom 2 and another 123 on the lower side of the bottom 2 of the tank are held in position by a nut 122 threaded to the bottom of the inlet pipe 117 which form a water-tight connection for the inlet pipe with the opening 115 in the bottom of the tank. The upper end of the inlet pipe 117 extends upwardly above the level of the water in the tank 1 and into the inside of the float 127.
The float chamber 119 comprises a cylindrical upper portion and a bottom part 120 which has a peripheral flange $120 a$. A member 124 fits in the peripheral flange of the bottom part $120 a$ and has an outlet opening 125 leading to the entrance to the siphon 126 having legs $126 a$ and $126 b$. The cylindrical bottom of the float chamber 119 fits into and rests upon the flange $124 a$ about the upper part of the member 124.

A float 127 is formed with an annular hollow space 128 to give it proper buoyancy and a center flanged cover 129 is forced into the upper portion of the hollow central portion of the float 127. A valve stem 131 extends through the opening 130 and is bent over at its upper end at 132 with sufficient space between the bent end 132 and the resilient member 134 to permit the opening 130 to be opened and closed. A resilient member 134 is mounted on the upper end of the valve stem 131 to serve as a check valve to close the opening 130 when the float is forced downwardly to trap the air in the float and to expel the water from the float chamber.
The lower end of the valve stem has an inlet valve 135 adapted to seat on the inside of the restricted upper end $135 a$ of the inlet pipe 117. A cylindrical member 137 encloses the upper end of the inlet pipe. The lower portion of the cylindrical hook 137 is open and extends down near the bottom of the float chamber 119. The upper end of the cylindrical hood 137 rests upon the top of the inlet pipe when the inlet valve 135 is closed as shown in FIG. 11. The inlet pipe has a resilient sealing member 140 which is fitted in the opening of the upper end of the cylindrical member 137.
A conduit 141 has its lower end passing between the outside of the inlet pipe 117 and the inside of the enclosing cylindrical hood 137. The conduit 141 passes through the side of the float chamber into the open end of the leg $126 a$ of the siphon and follows the inner side of the leg and ends after passing over the crest $126 c$ of the siphon 126.

FIG. 12 shows the parts of the float and float chamber and the enclosing hood when the inlet valve is about to close as the tank becomes almost filled and shortly before the inlet valve closes. The inlet valve is still open and the pressure of the inflowing water keeps the cylindrical member 137 raised above the inlet pipe. Water is flowing between the inside of the cylindrical hook 137 and the outside of the inlet pipe 117. The resilient member 134 is spaced from the opening 130 in FIG. 12 due to the unbalanced upward water pressure on the bottom of the valve member 135 and the buoy-
ancy of the float 127 raising the stem 131 and valve 135.

The siphon 126 has its outlet leg $126 b$ secured in a fitment 145. The fitment 145 fits into the outlet opening 116 in the bottom of the tank and has a flange 146. A gasket 147 seals the upper side of the bottom of the tank with the flange 146 of the fitment and a second gasket 148 seals the lower side of the bottom of the tank through the intermediation of a nut 149 which is threaded onto the lower end of the fitment to secure the parts tightly in place.
In the operation of the embodiment shown in FIGS. 11 and 12 , water under pressure is delivered to the inlet pipe 117 whose upper end is above the level of the water in the tank. When the float is pressed down by the operation of the handle as described in previous embodiments, water is forced from the float chamber down through the bottom part of the float chamber and through the opening 124 beneath the opening of the siphon leg 126a. The water forced from the float chamber forces the column of water in the leg $126 a$ up over the crest and down the opposite leg $126 b$ to start the siphon. At the same time the inlet valve 135 is opened and water is forced down between the outside of the inlet pipe 117 and the inside of the enclosure 137 into the bottom of float chamber and through opening 125, thus adding to the water supplied by the downward movement of the float for starting the siphon.

The flow of water is under sufficient pressure to force water through the conduit 141 whose lower end is between the outside of the inlet pipe and the inside of the cylindrical hood 137 . The force of the water entering the conduit 141 is sufficient to discharge water at the other end of the conduit 141 into the leg $126 b$ of the siphon. This adds further to the water being flushed in from the float chamber and also serves to fill the bowl of the toilet to the proper level after the flushing cycle is completed and the tank is being filled to its proper level.

In the embodiment of the invention shown in FIG. 13, the inlet opening 57 in the flush tank I may be the same as the one in the previous embodiments. An inlet pipe fitment 50 has a flange 51 resting on the bottom 2 of tank 1 with a threaded portion below the flange passing through the bottom opening with a gasket 52 forming a seal between the flange 51 and the bottom 2 of the tank to prevent leakage between the flange and the bottom of the tank.
A valve seat 53 for the movable valve member 54 is formed in the fitment 50 . A conduit 55 passes laterally through the upper part of the fitment with one end $55 a$ connecting directly with the tank and the other end $55 b$ connecting with an elbow-shaped pipe 56 having a vertical portion open at its upper end beneath the open end of one leg 28 of the siphon 30 . The upper end of the fitment 50 has a central opening 59 for the value stem $54 a$ connected to the bottom of a float 60.

The float 60 is preferably a hollow cylinder partly filled with water or any other suitable weighting substance to obtain the desired buoyancy. The float may be made of any suitable material such as sheet metal or a plastic. A cylindrical float chamber 61 open at its upper end slidably fits about the float. The open lower end of the float chamber is force-fitted over the reduced cylindrical portion 64 at the upper outer periphery of the fitment 50.

When the float is forced down for the flushing operation for example by means similar to FIG. 2, the valve member 54 opens and delivers water to tank 1 through one end 55a of conduit 55 and through the other end to the open end of the leg 28 of the siphon 30 . Simultaneously the downward movement of the float forces water from the lower part of the float chamber 61 through opening 66 and pipe 56 into leg 28 of siphon 30. The two sources of water give a thrust to the water in leg 28 of the siphon which is ample to force enough water through the upper part of the siphon to produce a column sufficiently far down the leg $28 a$ to start the siphon and empty the tank. The siphon will start as soon as the column of water in the leg $28 a$ is below the level of the water in the tank and will continue to flow until the water in the tank is at its lower level.
The lower end of the leg $28 a$ of the siphon fits into the upper end of a fitment 67 mounted in an outlet opening 42 in the bottom of the tank. The fitment has a flange $67 a$ seating on a gasket 68 for forming a watertight joint. A nut 69 is threaded or otherwise secured to the lower end of the fitment 67 to hold the fitment securely in place for supporting the siphon.

In FIG. 14 another outlet fitment is shown in which the leg $28 a$ of the siphon 30 shown in FIG. 13 is forced into a plastic fitment 70 until it seats on the shoulder 71. The outer lower part of the fitment is tapered inwardly and downwardly and provided with alternate grooves and ridges below the shoulder 72.

A second fitment 74 has a flange or shoulder 75 which seats upon a gasket 76 to securely seal the second fitment 74 in the opening 42. The lower end of the first fitment 70 is forced into the upper end of the second fitment 74. The shoulder $\mathbf{7 2}$ of the fitment $\mathbf{7 0}$ seats on the rim 78 of the second fitment 74 and the annular grooves and ridges 79 are force-fitted into place to secure and seal the fitments together and to securely hold the siphon leg $28 a$ and fix the siphon in position.
It will be seen that the present invention provides an inexpensive flushing unit for flush tanks which may be readily installed in existing tanks as a substitute for existing units which are causing difficulty or may be sold for new installations. The float and inlet valve are directly connected as a unit to move vertically together for opening and closing the inlet valve. This assures a long life and satisfactory operation of the float and inlet valve. A cooperating siphon eliminates the usual outlet valve which is the cause of most of the trouble in flushing systems. The unit is simple in construction and may be molded from an inexpensive thermoplastic material. Only two molded parts are required for the combined single unit inlet pipe, float chamber and siphon. The tripping of the trip handle forces water from the float chamber to start the flushing operation. Water from the inlet valve supplements the amount of water furnished from the float chamber.

Provisions are made for preventing a reverse flow from the tank into the inlet pipe during failure of the water supply and for filling the toilet bowl to the desired level at the end of the flushing operation. Provision is also made for conserving water by flushing a predetermined quantity of water for solids and considerably less water for liquids and by providing means for regulating the amount of water to be flushed by the flushing unit.

As various changes may be made in the form, construction and arrangement of the parts herein without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim:

1. In a flushing device for toilets, in combination, an inlet conduit for filling a reservoir with water, a valve for controlling the flow of water through the inlet, a float connected to the inlet valve for operating the inlet valve, means for actuating said float, a siphon adapted to be connected to the outlet of the reservoir for flushing a toilet, a conduit having one end connected to the siphon and its other end operatively connected to a conduit-adjusting means to admit air to the siphon to stop the flushing when said other end of said conduit is above a predetermined water level and means for operating said conduit-adjusting means to raise and lower the said other end of the conduit to change the water level at which the flushing stops.
2. In a device as claimed in claim 1 in which the raising and lowering means has two predetermined positions, one for flushing a large quantity for solids and another for flushing a small quantity of water for liquids.
3. In a flushing device for toilets, in combination, an inlet conduit for filling a reservoir with water, a valve
