The present invention relates to a valve for water closets and the like. Particularly the present invention relates to a float valve disposed in the discharge conduit of a water closet and which is responsive to backflow of fluid in the discharge conduit to preclude flow of fluid from the discharge conduit into the water closet and overflow of the latter.

Water closets are conventionally provided with a soil pipe which underlies and communicates with the water closet bowl and through which the contents of the bowl are discharged. The reverse or backflow of fluid through the soil pipe into the water closet bowl such that the latter overflows is an always present possibility having undesirable consequences. This is particularly true in water closets located in the basements of dwellings where flooding conditions exist and/or the water table is relatively high. There is thus a need for an effective device for preventing reverse or backflow of fluid into the soil or discharge pipe.

To this end, the present invention provides a unique backwater valve which automatically and effectively seals the passage between the soil pipe and the water closet in response to a rise of fluid in the soil pipe. Particularly, the present backwater valve comprises a frusto-conical, eccentrically-extending sleeve having an annular flange extending about its upper end, the sleeve depending within the soil pipe with the flange clamped between the water closet bowl collar and the floor about the soil pipe opening. A valve member is pivotally mounted at the lower end of the eccentrically-extending sleeve and on the side thereof, spaced furthest from the soil pipe wall. The valve member comprises a float which normally pivotally depends in a valve open position. The valve member is adapted to seat and seal against the lower end of the valve sleeve in response to a rise of fluid in the soil pipe. Thus, in operation, the contents of the water closet bowl normally flow freely through the sleeve and through the lower open end of the sleeve past the open valve into the soil pipe. In the event that fluid should rise in the soil pipe to a level adjacent the lower discharge opening of the sleeve, the valve member is buoyed by the back flow of fluid and pivot upwardly into sealing engagement about the lower end of the sleeve. Thus, this reverse flow of fluid through the soil pipe into the water closet bowl is automatically prevented and the valve will remain closed for so long as the fluid in the soil pipe obtains a sufficiently high level as to buoyantly maintain the valve member in sealing engagement against the lower end of the sleeve. When the fluid recedes below the level of the lower sleeve opening, the valve member automatically pivots downwardly under its own weight to thus open the valve and again provide normal free communication between the water closet bowl and the soil pipe.

It is a particular feature of the present invention that the valve member in the valve open position is located such that the buoyant force of the fluid in the soil pipe and acting on the valve body always tends to pivot the valve member toward and into the valve closed position. To this end, the valve member is hinged to the side of the eccentrically-extending sleeve which is spaced furthest from the soil pipe wall. The center of buoyancy of the valve member in the depending position is laterally spaced from its pivotal axis in a direction toward the axis of the sleeve such that the upward buoyant force acting on the valve member through the center of buoyance thereof is always applied to the valve member in a direction to pivot and seat the valve member against the lower end of the sleeve. Additionally, a bumper is provided on the lower side of the valve member below its pivot so as to be engageable against the soil pipe wall and further preclude downward pivotal movement of the valve member past its normal depending portion. The area of contact between the bumper and the soil wall pipe is small and this prevents sticking of the valve member in the valve open position. A further feature of the invention includes a substantially all-plastic construction thereby facilitating manufacture of the valve at low cost. Moreover, the valve hereof is configured for ready and easy installation in existing water closets as well as in newly constructed water closets.

Accordingly, it is a primary object of the present invention to provide an improved backwater valve for water closets and the like.

It is another object of the present invention to provide an improved backwater valve for water closets and the like which is automatic in operation.

It is still another object of the present invention to provide an improved automatically actuated backwater valve which is readily and easily installed in both existing water closets as well as newly constructed water closets.

It is a further object of the present invention to provide an improved backwater valve constructed of plastic materials, and which may be readily and easily installed.

It is a still further object of the present invention to provide an improved backwater valve which is substantially free from sticking in the valve open position over extended use.

It is still another object of the present invention to provide an improved backwater valve which can be installed in any directional orientation about a vertical axis and thereby accommodate variations in the direction in which the soil pipe extends from the water closet such that the float member will not obstruct the outflow of fluid.

These and further objects and advantages of the present invention will become more apparent upon reference to the following specification, appended claims and drawings wherein:

FIG. 1 is a schematic illustration of a water closet employing a backwater valve constructed in accordance with the present invention;

FIG. 2 is an enlarged plan view of the backwater valve illustrated in FIG. 1; and

FIG. 3 is an enlarged side elevational view of the backwater valve with portions broken out and in cross section for ease of illustration.
Referring now to the drawings, particularly to FIG. 1, there is illustrated a water closet generally indicated at 10 comprised of the usual water closet bowl 12 and a wall mounted flush tank 14 connected to the bowl 12 via a pipe and elbow connection indicated at 16. The operation of the water closet 1 is conventional and further description of the parts forming the water closet bowl and flush tank and their function and cooperation is believed unnecessary. It is believed sufficient to state only that the bowl 12 has a lower collar or flange 18 which seats against the floor indicated at F and through which is received a plurality of bolts, not shown, for retaining bowl 12 in fixed position over a soil pipe 20. Soil pipe 20 lies in communication with bowl 12 as will be shown, whereas the contents of bowl 12 are discharged into soil pipe 20 for ultimate delivery to a septic tank or the like, also not shown.

The backwater valve of the present invention is disposed in soil pipe 20 adjacent the inlet thereto and is generally indicated at 22. Specifically, backwater valve 22 comprises a generally inverted, frusto-conical, eccentrically extending sleeve 24 having an annular flange 26 projecting outwardly about its upper end. The frusto-conically shaped sleeve 24 extends eccentrically for reasons as will become clear such that its lower end opening 28 is laterally offset from the soil pipe 20 as best seen in FIG. 2 with the front wall portion 32 (the right hand wall portion seen in FIG. 3) preferably extending normal to flange 26 and floor F. The diametrically opposite rear wall portion 34 (the left wall seen in FIG. 3) thus has the greatest taper and a pair of rearwardly-projecting laterally spaced arms 36 are integrally formed with sleeve 24 at its lower end adjacent rear wall portion 34. A bore 37 is provided through each of arms 36.

Pivoting depending from the arms 36 is a valve body 38 comprising a frusto-conically shaped float member 40. A bracket 42 extends from one side of body 38 and is suitably bored adjacent its upper end as at 43. The upper end of bracket 42 is disposed between arms 36, and a pin 44 is inserted through the aligned holes 37 and 43 of arms 36 and bracket 42 whereby float body 40 pivotally depends from the lower end of sleeve 24. Float member 40 comprises upper and lower walls 46 and 48, respectively, joined by conically extending side walls 50 defining a chamber 52 within the body 38. Chamber 52 is preferably evacuated but may be filled with a closed cellular foam as desired to insure the buoyancy of member 40. The upper wall 46 of float member 40 is flat, and, as seen in FIG. 2, wall 46 is beveled to seat against the lower end of sleeve 24. Bracket 42 carries a bumper surface 56 adjacent its lower side for engagement against the side wall of soil pipe 20 for purposes as will presently become clear.

It will be appreciated that the back water valve hereof may be readily and easily manufactured as the sleeve 24 including flange 26 and arms 36 is integrally molded of an acid resistant plastic material. Stainless steel may also be utilized although the cost of the unit would thus be increased. Valve body 38 is integrally molded of a like plastic material, with sufficient rib or web reinforcing, not shown, to maintain a permanent form, the molding in such instance being accomplished by known processes, such as injection molding. This provides a low cost valve and facilitates installation thereof, particularly where the valve is installed on existing water closets.

To install the valve hereof, the orientation of the valve about a vertical axis is selected as to accommodate variations in the configuration of the soil pipe such as slight bends in same. Where any portion is not shown in the drawings, the valve is positioned such that the valve body 38 opens toward the flow outlet of the fitting. Slots indicated at 58 in FIG. 2 are then cut in flange 26 at the job site in accordance with the bolt locations through the bowl collar 18 so that, when finally assembled, the bolts extend through the collar 18 and slots 58 into floor F. Mastic is then applied to the marginal surfaces of the floor about the soil pipe opening and about the underside of flange 26 whereupon sleeve 24 and body 38 are disposed within the soil pipe opening. The flange 26 bears against the floor F with the mastic sealing between the opening and flange 26. The water closet bowl 21 may then be disposed over the valve and bolted to floor F with the bolts extending through collar 18 and the slots 58 of flange 26, it being understood that a conventional bowl seat is provided between bowl 21 and flange 26. When the valve is thus secured in the soil pipe opening, it will be seen that the valve body 38 pivots under its own weight to assume a valve open position as illustrated by the dash lines in FIG. 3 while, when fully assembled, the contents of bowl 12 and the valve body 38 in its position in usage. In this position, open communication between water closet bowl 12 and soil pipe 20 through the sleeve 24 is thus provided. Note also that in the preferred form hereof, the lower opening 28 through sleeve 24 is at least as great as to preferably slightly larger than the outlet diameter of the water closet bowl discharge opening indicated at 58 in FIG. 1 and therefore facilitates the syphon action when flushing the water closet. The angle of the float body 38 when in the open position is such that waste material cannot collect thereon, thereby affording a float body which will be substantially clean at all times and ready to float into the closed sealing position as will now be described.

Where reverse or back flow of fluid in soil pipe 20 occurs, valve body 40 has a displacement in the fluid sufficient to subject it to an upward buoyant force tending to pivot the valve body about axis 44 into the illustrated full line position in FIG. 3 seating about the lower end of sleeve 24. Thus, when the fluid rises in soil pipe 20, the valve automatically closes preventing ingress of water into sleeve 24 and into the water closet bowl 12. When the fluid recedes and no longer exerts a buoyant upward force on float body 40, the body 40 pivots under its own weight to the dashed line position illustrated in FIG. 3 again providing free communication between bowl 12 and soil pipe 20.

It is a particular feature hereof that the float body 38 always tends to pivot about its axis toward the valve closing position when the fluid rises to a point just below or adjacent to the lower end of sleeve 24. By locating the pivotal axis of the valve body 38 at one side of but within the vertical confines defined by the larger inlet opening to sleeve 24, and by configuring the float member 40 such that the backflow of fluid first acts on the side of the valve member laterally remote from the hinge but below the lower sleeve end opening, it will be seen that the force acting on float member 40 always tends to pivot valve body 38 into the valve closing position. To further insure that the buoyant forces on the valve body tend to pivot it into or toward a valve closed position and to preclude sticking of the valve in the open position, the bumper area 56 on bracket 42 projects from valve body 38 as to engage the side wall of the soil pipe 20. The bumper area has a very small contact area and this prevents the valve body from sticking in the open position while simultaneously locating the float member 40 such that the buoyant force tends to pivot valve body 38 toward the closed position.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A valve for preventing backflow of fluid through the inlet opening of a generally vertically disposed dis-
charge pipe comprising: a sleeve comprised of an inverted generally frusto-conical section, said section extending eccentrically such that the center of the smaller opening through the lower end of said sleeve is laterally offset in one direction from the center of the larger opening through the upper end of the sleeve, means carried by said sleeve adjacent the upper end thereof for mounting the valve in the discharge pipe opening with said sleeve extending within the pipe, said mounting means including an annular flange projecting outwardly about the upper end of said sleeve for overlying the pipe opening, a member pivotally carried by said sleeve adjacent the lower end thereof, said member being carried for pivotal movement between a normally depending valve open position providing free communication between said sleeve and the discharge pipe and a valve closed position with said member sealing about a lower end portion of said sleeve, said member including a float having a displacement in the fluid sufficient to pivot said member into said valve closed position to effect said seal in response to back flow of fluid through the discharge pipe, said float member being offset in substantially the opposite lateral direction when in the depending valve open position to provide for substantially unobstructed outflow through the smaller lower opening into the discharge pipe.

2. A valve according to claim 1 including means extending externally of said sleeve adjacent the lower end thereof for pivotally mounting said member, said member mounting means being offset in substantially the opposite lateral direction and lying within the vertical confines of said larger upper opening.

3. A valve according to claim 1 wherein said section and flange are formed integrally of plastic material.

4. A valve according to claim 1 wherein said member includes an abutment for engagement against the wall of the discharge pipe when in the depending valve open position.

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