April 13, 1954 E. F. HOWE 2,675,023

VALVE CONSTRUCTION

Original Filed July 31, 1951 3 Sheets-Sheet 1

Fig. 1.

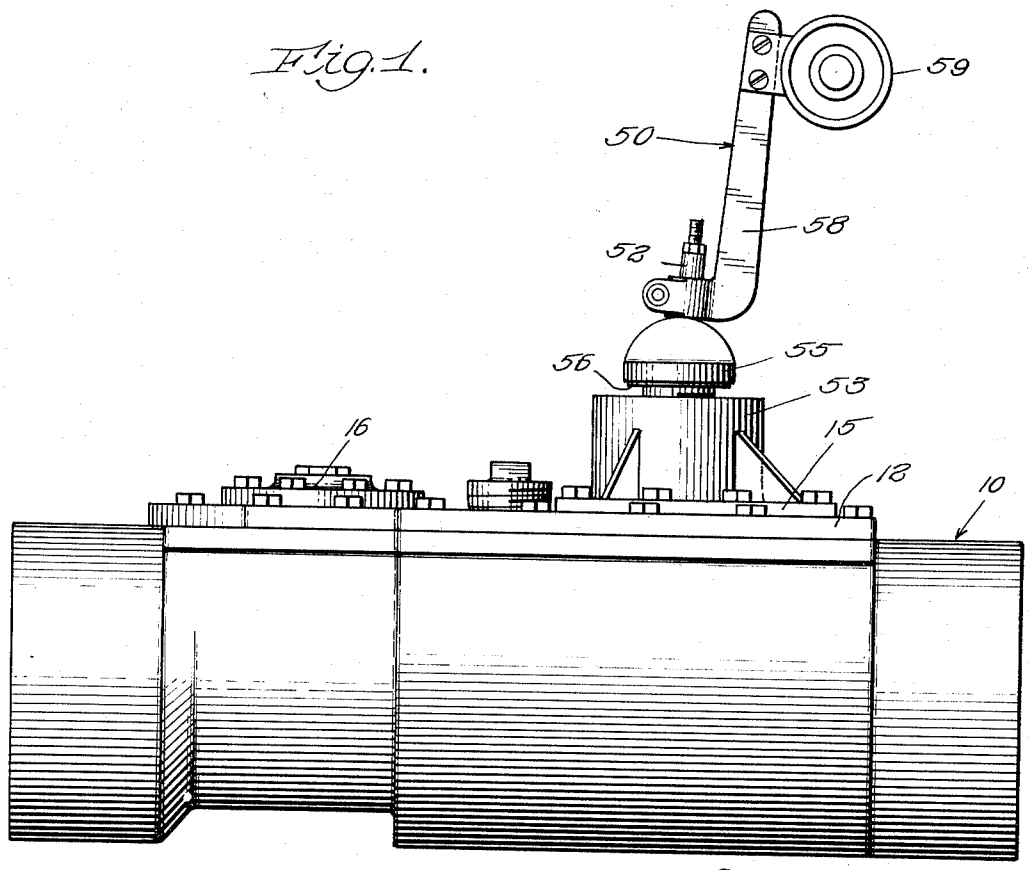
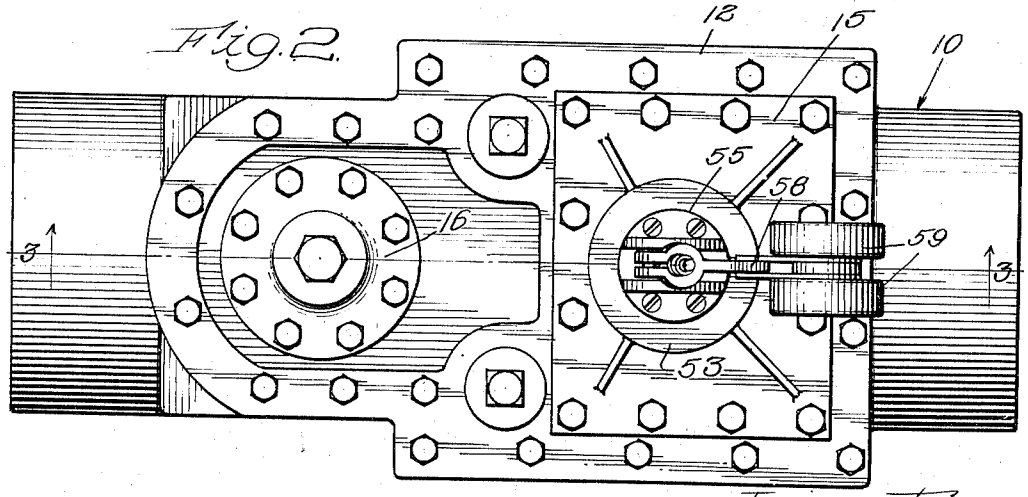


Fig. 2.



Inventor:
Elra F. Howe,
By Schroeder, Merriam,
Hofgren & Brady, Attys.

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Fig. 3.

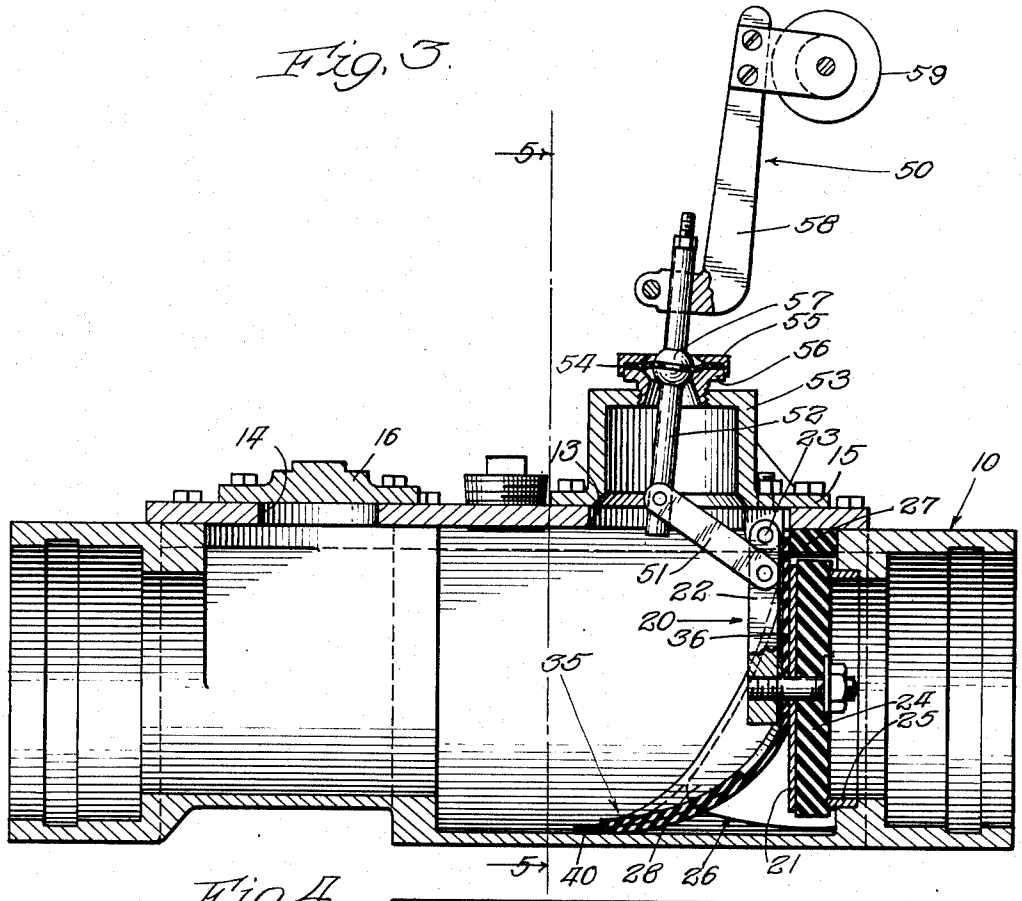
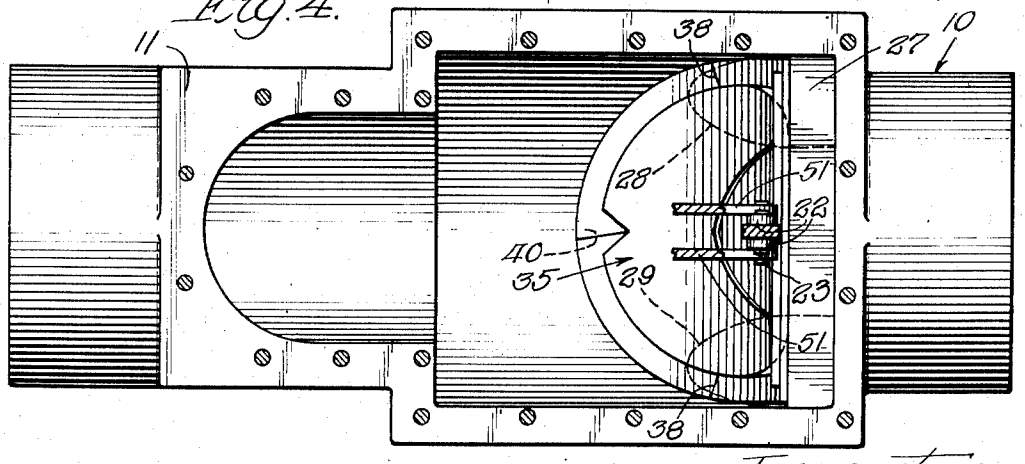


Fig. 4.



Inventor:
Elra F. Howe,
By Schroeder, Merriam,
Hofgren & Brady, Attys.

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Fig. 5.

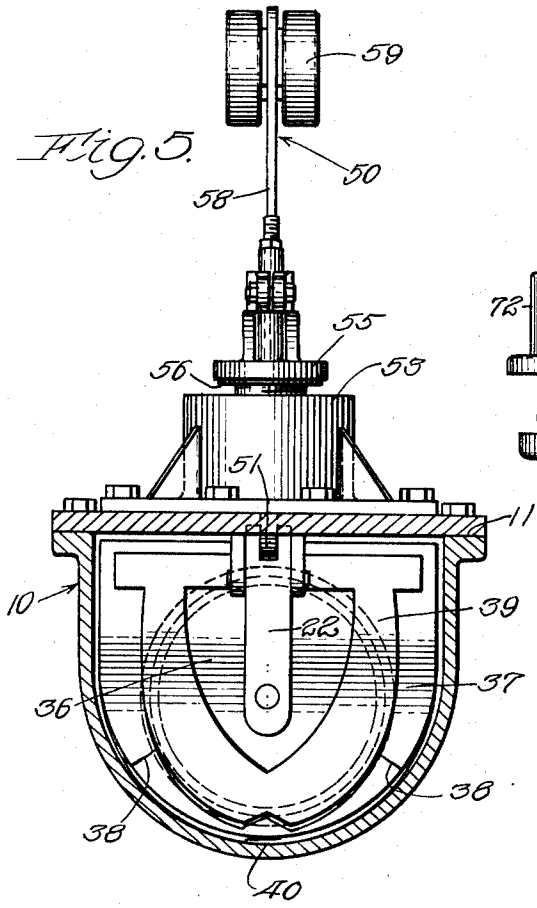
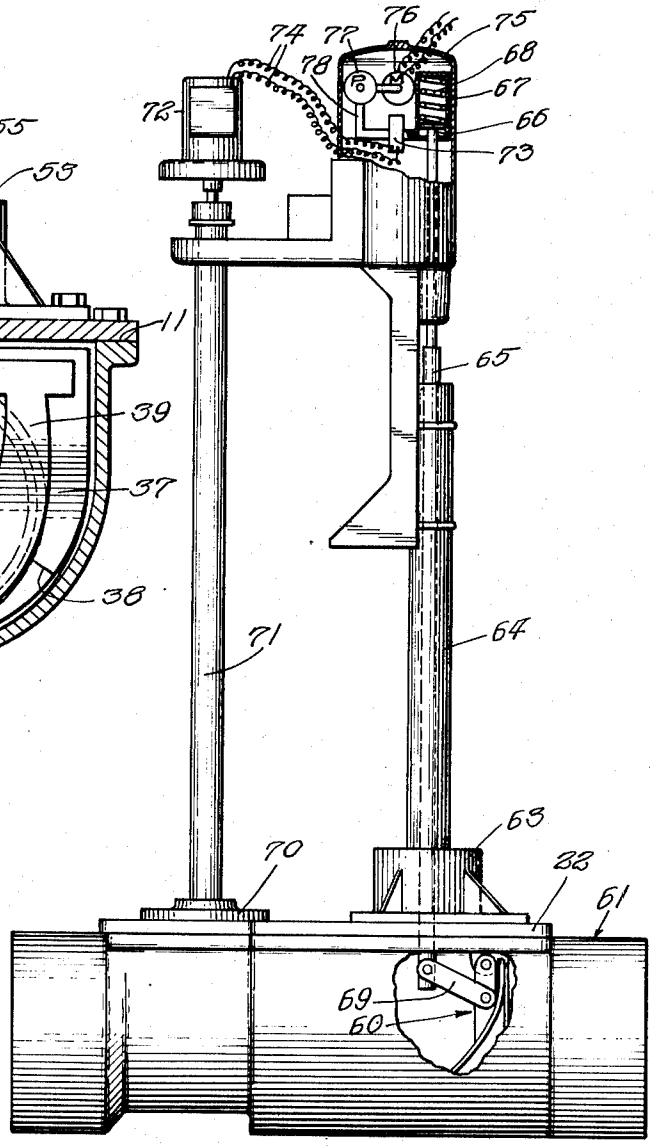


Fig. 6.



Inventor:
Elra F. Howe,
By Schroeder, Merriam,
Hofgren & Brady, Attys.

Patented Apr. 13, 1954 2,675,023

UNITED STATES PATENT OFFICE

2,675,023

VALVE CONSTRUCTION

Elra F. Howe, Chicago, Ill.

Original application July 31, 1951, Serial No. 239,611. Divided and this application September 18, 1952, Serial No. 310,181

9 Claims. (Cl. 137—614.11)

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This invention relates to a valve construction and more particularly to a valve construction which is particularly adaptable for use in a flood control system to be associated with a drainage or disposal pipe leading to a sewer connection.

This application is a division of my copending application Serial No. 239,611, filed on July 31, 1951.

It is the principal object of this invention to produce a new and improved valve construction.

In my Patent No. 2,421,066 and in my copending application Serial No. 112,587, filed August 26, 1949, now Patent No. 2,569,102 and the above mentioned application, there is shown a flood control system which includes a disposal pipe connecting the drainage facilities of a house or building with a sewer.

The purpose of the flood control systems shown in my above mentioned patent and applications is of course to prevent sewage from backing up into the house or building disposal system during periods of heavy precipitation or under conditions which overload the sewage system. The complete units shown in my said patent and applications include not only valve means for blocking off the connection to the sewer to prevent sewage from backing up, but also include means for pumping effluent around the valve means so that the normal facilities of the house or building may continue to be used even while flood conditions prevail.

The valve means of the present application, while admirably suited for use as the main valve means in flood control systems of the type above described, may also be used by itself as a simple and yet efficient means of preventing the back-up of sewage into the disposal system of a building during flood conditions, although it does not by itself provide means for by-passing sewage from the building.

One of the principal features of this invention is the provision of valve means which includes a main valve pivotally mounted in the disposal pipe and adapted to seat against a main valve seat in the pipe, with the main valve being provided with a secondary valve attached thereto and adapted to seat against a secondary valve seat. A further feature of the invention is the provision of a secondary valve seat which is slanted with respect to the disposal pipe in which it is installed so that a closure of the pipe is effected between the secondary valve seat and the secondary valve before the main valve is seated on the main valve seat. Thus there is provided a secondary valve and seat designed so as to effect

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a closure of the disposal pipe even though complete closure of the main valve is prevented by reason of an obstruction, such as a foreign object on the main valve seat. A further feature of the invention is the provision of a secondary valve of the type just described which is provided with a flexible feather edge to seat on the secondary valve seat and a flexible center attached to the main valve to permit the main valve to move to completely closed position even after the secondary valve has seated, together with stiffening means for the secondary valve located intermediate the center portion and the edge to hold the secondary valve in the form of a flexible cup.

A further feature of the invention is the provision of valve means effective positively to close the disposal pipe of a sewage disposal system even in the presence of solid objects lodged on the valve seat. Another feature of the invention is the provision of closing means for the valve which will operate even though electrical current has been interrupted.

Another feature of the invention is the provision of motor means for opening the main valve wherein opening movement of the valve tensions or potentiates an independent means biasing the valve toward closed position. The valve is held in open position by an electrical device which releases, when de-energized, to permit the biasing means to move the valve to closed position. The electrical device may be energized through the operation of a float in the disposal pipe which moves in response to the existence of flood conditions or by the operation of a pressure operated switch or upon the failure of electrical means, in whichever event the biasing means thereupon serves to move the valve to closed position.

Yet another feature of the invention is the provision of a main and secondary valve of the type previously described herein together with gravity operated means for lightly holding the valve in closed position so that should flood conditions occur downstream of the valve, the pressures generated thereby serve firmly to seat the valve upon its seat, while a slight head of liquid on the upstream side of the valve will serve to open the valve in the absence of flood conditions.

Other and further features of the invention will be readily apparent from the following description and drawings, in which:

Fig. 1 is a side elevational view of an apparatus embodying the invention;

Fig. 2 is a top plan view of the apparatus shown in Fig. 1;

Fig. 3 is a sectional view taken substantially along line 3—3 of Fig. 2;

Fig. 4 is a view like Fig. 2 with the cover plates for the disposal pipes shown therein removed to illustrate the parts therebeneath;

Fig. 5 is a vertical section taken along line 5—5 of Fig. 3; and

Fig. 6 is a view like Fig. 1 showing a modified form of control for the valve.

While this invention is susceptible of embodiments in many different forms, there are shown in the drawings and will herein be described in detail two specific embodiments, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiments illustrated. The scope of the invention will be pointed out in the appended claims.

Referring now to the drawings, the valve device of this invention is mounted within a pipe section 10, preferably of cast iron, with the pipe section having the same dimensions as the normal sewage disposal pipe so that the unit may be installed simply by removing a section of a disposal pipe and replacing the removed section with pipe section 10 embodying the valve of this invention. The upper portion of the section 10 is flat so as to provide an area 11 to which a cover plate 12 may be bolted. The cover plate 12 is provided with a pair of openings 13 and 14 (Fig. 3) covered by secondary cover plates 15 and 16. By providing two such cover plates the valve may be arranged for gravity operation as in the embodiment shown in Figs. 1–5 or for motor operation as shown in Fig. 6, in which latter event the cover plate 16 may be removed and replaced by motor actuating means hereinafter to be described. By providing two cover plates of this nature the unit is readily adaptable for motor or gravity control or may easily be changed from motor control to gravity control and vice versa should such a change be desired after installation.

Referring now to Figs. 3–5, pivotally mounted within the pipe is a main valve means generally designated 20 which includes a main body member in the form of circular plate 21 to the back of which is secured an arm 22 pivoted at its upper end to a pin 23 secured adjacent the upper portion of the disposal pipe section 10. The body member 21 carries on its upstream face an annular main valve member 24 preferably of rubber or other similar material adapted to seat against an annular brass valve seat 25 fixed in the end of the pipe section. The valve portion 24 and seat 25 constitute the main closure means for the disposal pipe and under the usually encountered conditions effectively seal off the disposal pipe so as to prevent backing up of sewage past the valve means (to the right as shown in Fig. 3) when flooding conditions occur. It can be seen, however, that should a large solid object happen to be located on the valve seat 25 at the time the main valve is moved to closed position, such solid object would serve to hold the valve in open position and thus permit flooding of the premises. To prevent such failure of the main valve means, secondary valve means are provided which serve effectively to close off communication between the portions of the pipe section 10 downstream and upstream of the valve means even should the main valve be unable to close because of the presence of obstructing solids.

The secondary valve includes a secondary valve seat 26 which is preferably made of rubber and in somewhat the shape of a horseshoe. The toe portion 27 of the horseshoe is located adjacent the top of the pipe section 10 while the heels 28 and 29 of the shoe are located adjacent the bottom of the pipe section and extend away from the valve seat 26 so as to provide a secondary valve seat which is slanted with respect to the axis of the pipe 10 and with respect to the plane of the valve seat 25.

Secured to the back or downstream side of the body member 21 is a secondary valve 35 of resilient material which is adapted to seat on the secondary valve seat 26. The secondary valve 35 includes a central portion 36 secured to the body member 21 and made of flexible material such as rubber. The outer edge 37 is feathered, that is tapered off to a very fine edge, and provided with slits 38 to permit the edge portion intermediate the slits to overlap when the valve is moved to seated position. Stiffening means 39 is provided on the secondary valve intermediate the central portion 36 and the edge portion 37, which stiffening means serves to hold the entire secondary valve 35 in the shape of a cup. The stiffening means therefore provides a means for maintaining the secondary valve in the desired shape without the necessity of molding the same to that shape, which molding of course would entail an operation of some expense. The edge portion 37 is made flexible in order that it may seat properly on the face 26 of the secondary valve seat while the central portion 36 is made flexible so that the main valve means may move to fully closed position. Thus as the main valve means is moved toward closed position the secondary valve seats on the secondary valve seat and is effective to seal off communication between the upstream and downstream side of the pipe section. Should some solid matter prevent complete closure of the main valve means, fluid is prevented from entering the pipe section upstream of the main valve means by the secondary valve. In the event no solid matter is present on the main valve seat, the valve means may continue its closing movement until it reaches fully closed position, and the secondary valve offers little resistance to such further closing movement because of the resilient connection of the central portion 36 of the secondary valve. It will be noted that the portion 40 of the pipe section lying between the heel portions 28 and 29 of the secondary valve seat forms a part of the valve seat in that the lower portion of the edge 37 engages the portion 40 of the pipe section as the secondary valve is moved to closed position.

In the form of the invention illustrated in Figs. 1–5, means generally designated 50 are provided for holding the main valve 24 lightly against the valve seat 25. The weight of the valve means is suspended from the pivot point 23 and would, if no other means were provided, hold the valve means against the valve seat 25 and would tend to prevent the valve from opening until a substantial hydrostatic head had been built up in the upstream section of the pipe. To, in effect, counterbalance the valve, the means 50 are provided so that the valve means 20 is normally in closed position but is balanced so as to permit the passage of sewage downstream through the pipe section as soon as a very slight amount accumulates upstream of the valve.

To this end a link 51 is pivotally connected at one end to the arm 22 and at the other end to the

lower end of an arm 52. The arm 52 is rockably mounted on a housing portion 53 forming a part of the cover plate 15. The rockable mounting for the arm is provided by a diaball assembly which includes a flexible diaphragm 54 held between a pair of cover members 55 and 56 and secured to a ball portion 57 on the arm 52. A bracket 58 is secured at one end to the upper end of the arm 52 exteriorly of the housing 53 and carries at its other end a weight 59. The weight is so positioned so as to urge the arm 52 out of the vertical position and toward a horizontal position and thus by the linkage described serves to urge the valve means 20 toward open position, with the cumulative effect of the weight 59 being just slightly less than the amount required to move the valve toward open position. By the counterbalancing mechanism described the valve means, while normally remaining in closed position, may be opened to pass sewage downstream by a relatively slight hydrostatic head on the upstream side of the valve. Should flooding conditions occur the pressure generated thereby on the downstream side of the valve serves only more firmly to seat the secondary valve and (in the absence of solid matter on the valve seat 25) the main valve means on their respective seats and thus the backing up of the sewage system is quite effectively prevented.

If it is desired to provide motor operated means for controlling the valve, the valve means of this invention may be readily adapted to be used therewith as shown in Fig. 6. As illustrated therein the valve means 60 includes a main and secondary valve, and seats therefor, of the same type as described in detail in conjunction with the first embodiment. The valve means is pivotally mounted within a pipe section 61 which is provided with a main cover plate 62 similar to the cover plate 15 previously described. The cover plate 62 carries a hollow column 64 which encloses an actuating rod 65 connected at its upper end to a piston 66 reciprocable in a cylinder 67. A spring 68 within the cylinder serves to urge the piston, and hence the piston rod, downwardly to move the valve means 60 to closed position through the provision of an interconnecting link 69. The cover plate 16 described with the previous embodiment is, for the purposes of the electrical control herein described, removed and replaced by a secondary cover plate 70 which carries a column 71 supporting a pump actuating mechanism 72. The mechanism 72 is preferably a pressure operated switch which is energized through the accumulation of pressure within the pipe section 70 downstream of the valve. Such pressures may be delivered to the switch through the column to operate the switch, thus to de-energize a solenoid valve 73 which is connected thereto by the wires 74. Clearly a float operated switch could be substituted for the switch 72.

The piston and cylinder device 67—68 is enclosed within a housing 75 which also encloses an electric motor 76 suitably connected to a hydraulic pump 77 which operates to pump hydraulic fluid through a conduit 78 controlled by the solenoid valve 73 into the lower end of the cylinder 67 to raise the piston therein and thus to move the valve means 60 to open position. Means (not shown) are provided for de-energizing the motor 76 when the piston has reached the top of the cylinder 67 and thus the motor is stopped when the valve is in fully open position. When the motor 76 is de-energized the solenoid valve 73 is energized so as to close off the conduit 78 and thus retain the piston 66 in its uppermost position against the compression of the spring 68 which tends to urge the piston downwardly. In the event flood conditions arise within the disposal system, the back pressures generated thereby serve to operate the pressure switch 72 which, in operating, de-energizes the solenoid 73, permitting fluid to escape from the cylinder 67 and allowing the piston to move downwardly under the urging of the spring 68. In the event flooding conditions are accompanied by electrical disturbances which may interrupt electrical service to the building in which the unit is contained, again the solenoid 73 will be de-energized and the valve will be moved to closed position by the spring 63 in the absence of available electrical power. Thus the valve means described will "fail safe" in that failure of the electrical system allows the valve to close and thus prevent flooding. Should there be a failure of the electrical system in the absence of a storm or in the absence of flooding conditions, suitable manual means may be provided for moving the valve to open position and retain it in such position until electrical current has been restored.

I claim:

1. Valve means for a flood control system associated with a disposal pipe comprising a main valve mounted for pivotal movement in said pipe, a main valve seat in the pipe adapted sealingly to engage the main valve when the same is pivoted to closed position, a secondary valve seat in the pipe and extending away from the first valve seat in a direction longitudinally of the pipe, and a secondary valve carried by the main valve, said secondary valve being of flexible material and adapted to engage the secondary valve seat in sealing relationship before the main valve engages the main valve seat as the valve is moved toward closed position.

2. Valve means for a flood control system associated with a disposal pipe comprising a main valve mounted for pivotal movement in said pipe, a main valve seat in the pipe adapted sealingly to engage the main valve when the same is pivoted to closed position, a secondary valve seat in the pipe surrounding the main valve seat, said secondary valve seat being slanted with respect to the axis of the pipe so as to be substantially parallel with the main valve as the latter approaches but before it reaches closed position, and a secondary valve carried by the main valve, said secondary valve being of flexible material and adapted to engage the secondary valve seat in sealing relationship before the main valve reaches closed position.

3. Valve means for a flood control system associated with a disposal pipe comprising a main valve in said pipe mounted for pivotal movement about an axis substantially at right angles to the axis of the pipe and adjacent one side of the pipe, a main valve seat in the pipe adapted sealingly to engage the main valve when the same is pivoted to closed position, a secondary valve seat in the pipe surrounding the main valve seat and having a portion substantially in the shape of a horseshoe with the toe of the secondary seat lying along the side of the pipe adjacent said axis and with the heels of the secondary seat being adjacent the opposite side of the pipe and extending away from the main valve seat longitudinally of the pipe to provide a seat slanted with respect to the axis of the pipe and including the portion of said opposite side of the pipe lying between said heels, and a secondary valve carried by the main valve, said

secondary valve being of flexible material and adapted to engage the secondary valve seat in sealing relationship before the main valve engages the main valve seat as the valve is moved toward closed position.

4. Valve means for a flood control system associated with a disposal pipe comprising a main valve including a body portion mounted for pivotal movement about an axis substantially at right angles to the axis of the pipe and adjacent one side of the pipe, an annular valve face of resilient material mounted on one side of the body portion, a main valve seat in the pipe adapted sealingly to engage the main valve face when the same is pivoted to closed position, a secondary valve seat in the pipe surrounding the main valve seat, said secondary valve seating being of resilient material and having a portion substantially in the shape of a horseshoe with the toe of the secondary seat lying along the side of the pipe adjacent said axis and with the heels of the secondary seat being adjacent the opposite side of the pipe and extending away from the main valve seat longitudinally of the pipe to provide a seat slanted with respect to the axis of the pipe and including the portion of said opposite side of the pipe lying between said heels, and a secondary valve mounted on the side of the body portion of the main valve opposite to the side carrying the annular valve seat, said secondary valve being of flexible material and adapted to engage the secondary valve seat in sealing relationship before the main valve engages the main valve seat as the valve is moved toward closed position.

5. Valve means for a flood control system associated with a disposal pipe comprising a main valve including a body portion mounted for pivotal movement about an axis substantially at right angles to the axis of the pipe and adjacent one side of the pipe, an annular valve face of resilient material mounted on one side of the body portion, a main valve seat in the pipe adapted sealingly to engage the main valve face when the same is pivoted to closed position, a secondary valve seat in the pipe surrounding the main valve seat, said secondary valve seat being of resilient material and having a portion substantially in the shape of a horseshoe with the toe of the secondary seat lying along the side of the pipe adjacent said axis and with the heels of the secondary seat being adjacent the opposite side of the pipe and extending away from the main valve seat longitudinally of the pipe to provide a seat slanted with respect to the axis of the pipe and including the portion of said opposite side of the pipe lying between said heels, and a secondary valve mounted on the side of the body portion of the main valve opposite to the side carrying the annular valve seat, said secondary valve being of flexible material shaped to correspond to the shape of the secondary valve seat and having a maximum length greater than the diameter of the pipe whereby to engage the secondary valve seat in sealing relationship before the main valve engages the main valve seat as the valve is moved toward closed position.

6. Valve means for a flood control system associated with a disposal pipe comprising a main valve including a body portion mounted for pivotal movement about an axis substantially at right angles to the axis of the pipe and adjacent one side of the pipe, an annular valve face of resilient material mounted on one side of the body portion, a main valve seat in the pipe adapted sealingly to engage the main valve face when the same is pivoted to closed position, a secondary valve seat in the pipe surrounding the main valve seat, said secondary valve seat being of resilient material and having a portion substantially in the shape of a horseshoe with the toe of the secondary seat lying along the side of the pipe adjacent said axis and with the heels of the secondary seat being adjacent the opposite side of the pipe and extending away from the main valve seat longitudinally of the pipe to provide a seat slanted with respect to the axis of the pipe and including the portion of said opposite side of the pipe lying between said heels, and a secondary valve secured adjacent its center to the side of the body portion of the main valve opposite to the side carrying the annular valve seat, said secondary valve having a flexible feather edge provided with a plurality of slits to permit the edge to conform to the secondary valve seat and having a flexible center portion to permit the main valve to close, and stiffening means secured to the secondary valve intermediate the center and the edge thereof and adapted to hold the secondary seal in the shape of a cup.

7. Back water valve apparatus for insertion in a disposal pipe comprising a pipe section adapted to replace a pre-existing pipe portion in said disposal pipe, a main valve mounted for pivotal movement in said pipe section, a main valve seat in the pipe section adapted sealingly to engage the main valve when the same is pivoted to closed position, a secondary valve seat in the pipe section surrounding the main valve seat and being slanted with respect to the axis of the pipe section so as to be substantially parallel with the main valve as the latter approaches but before it reaches closed position, a secondary valve carried by the main valve, said secondary valve being of flexible material and adapted to engage the secondary valve seat in sealing relationship before the main valve reaches closed position, and means constantly biasing the main valve toward closed position.

8. Back water valve apparatus for insertion in a disposal pipe comprising a pipe section adapted to replace a pre-existing pipe portion in said disposal pipe, a main valve mounted for pivotal movement in said pipe section, a main valve seat in the pipe section adapted sealingly to engage the main valve when the same is pivoted to closed position, a secondary valve seat in the pipe section surrounding the main valve seat and being slanted with respect to the axis of the pipe section so as to be substantially parallel with the main valve as the latter approaches but before it reaches closed position, a secondary valve carried by the main valve, said secondary valve being of flexible material and adapted to engage the secondary valve seat in sealing relationship before the main valve reaches closed position, a cover plate removably secured to the pipe section, an arm movably carried by the cover plate and extending therethrough with the inner end of the arm being connected to the main valve, and a weight carried by the other end of the arm exteriorly of the pipe section and positioned on the arm to urge the main valve toward open position whereby the resultant forces on the main valve lightly bias the same toward closed position.

9. Back water valve apparatus for insertion in a disposal pipe comprising a pipe section adapted to replace a pre-existing pipe portion in said disposal pipe, a main valve mounted for pivotal

movement in said pipe section, a main valve seat in the pipe section adapted sealingly to engage the main valve when the same is pivoted to closed position, a secondary valve seat in the pipe section surrounding the main valve seat and being slanted with respect to the axis of the pipe section so as to be substantially parallel with the main valve as the latter approaches but before it reaches closed position, a secondary valve carried by the main valve, said secondary valve being of flexible material and adapted to engage

the secondary valve seat in sealing relationship before the main valve reaches closed position, a pair of cover plates removably secured to the pipe section, and valve operating mechanism mounted on one of said cover plates.

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