June 17, 1958 O. W. HOSKING 2,838,765

LIQUID DISCHARGING CONTROL

Filed Aug. 12, 1955 2 Sheets-Sheet 1

Fig. 1

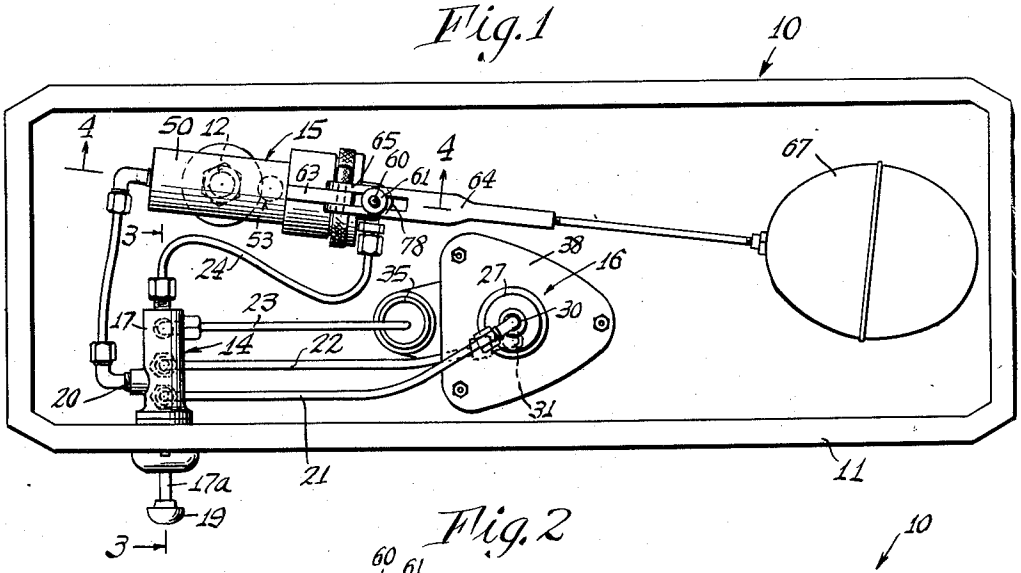
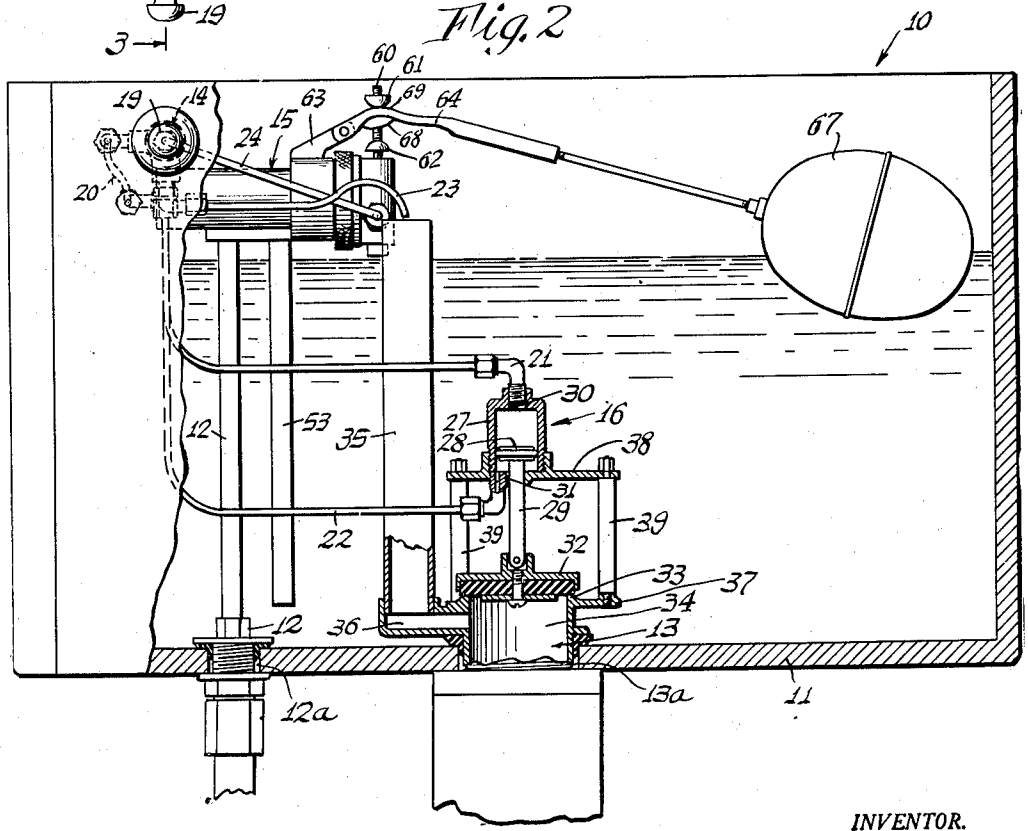


Fig. 2



INVENTOR.
Oakley W. Hosking
BY
Johnson and Kline
ATTORNEYS

June 17, 1958 O. W. HOSKING 2,838,765

LIQUID DISCHARGING CONTROL

Filed Aug. 12, 1955 2 Sheets-Sheet 2

Fig. 3

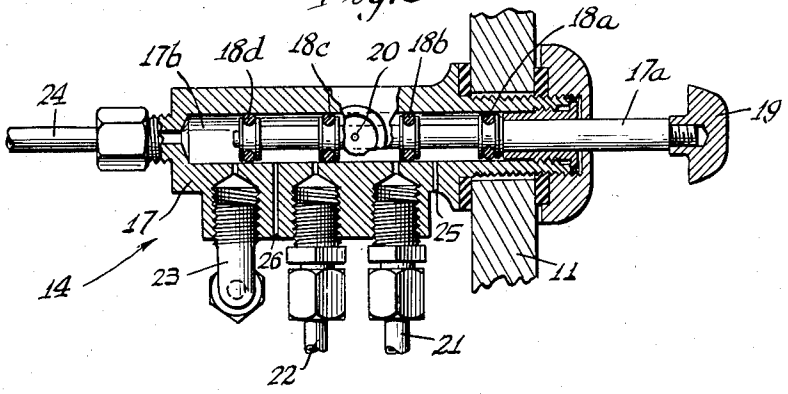


Fig. 4

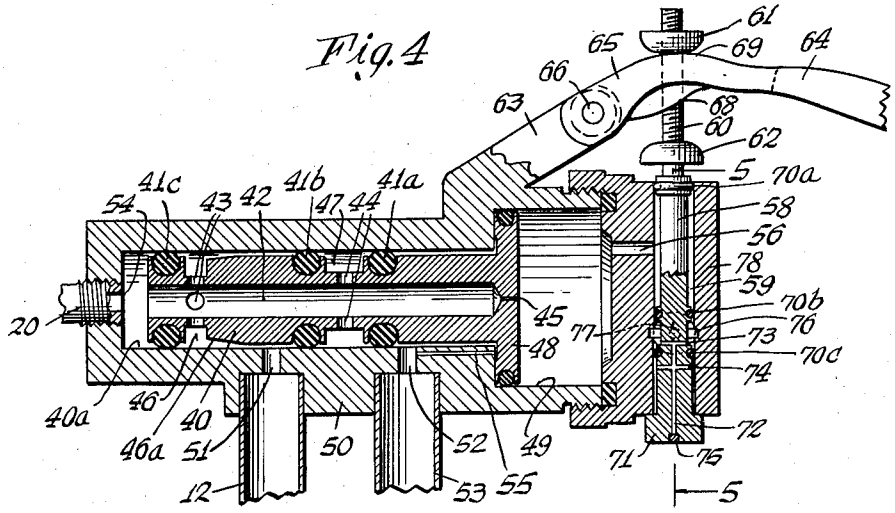
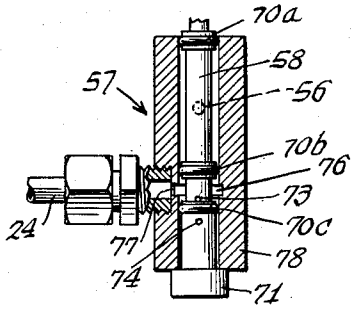


Fig. 5



INVENTOR.
Oakley W. Hosking
BY
Johnson and Klein
ATTORNEYS

United States Patent Office 2,838,765 Patented June 17, 1958

2,838,765

LIQUID DISCHARGING CONTROL

Oakley W. Hosking, Monroe, N. Y., assignor to Hosking Patent Corporation, New York, N. Y., a corporation of New York

Application August 12, 1955, Serial No. 528,001

15 Claims. (Cl. 4—41)

This invention relates to a dispensing device for liquids in which a predetermined volume of liquid is discharged from a tank and then an equal amount of liquid from a source is permitted to enter the tank to be stored for the next discharging cycle.

An object of the invention is to provide a device dispensing a predetermined amount of liquid stored within a tank which is positive in operation and is independent of any mechanical resetting mechanisms.

A further object of this invention is to provide a dispensing device of the above type which is connectible to the source of liquid under pressure for dispensing a predetermined amount thereof through a discharge valve in which the discharge valve is hydraulically operated and maintained both in its open and closed positions by the pressure of the liquid from the source in order to positively eliminate any leakage when the valve is closed, and trouble and faulty operation during movements of the valve.

An additional object of this invention is to provide a dispensing apparatus having a tank in which the tank is always filled with a volume of liquid equal to that discharged, and in which the amount discharged may be positively and easily adjusted.

Still yet an object of this invention in its most specificness, is to provide a manually operable mechanism having a hydraulically controlled discharge valve which is interchangeable with the usually mechanically controlled valve of the conventional water closet used with a toilet bowl without alteration of the water closet tank and which is economical to manufacture, automatic in operation and positively prevents leakage through the discharge valve.

Other objects and advantages reside in the details of construction and operation as more hereinafter described and claimed. Though the automatic liquid dispensing device is illustrated as being positioned within a water closet, it is to be understood that the invention is not limited to being used solely with a water closet but may be used with other tanks and in other installations where it is desired to dispense an accurate volume of liquid. Furthermore, though the liquid is set forth as being water, in the specific embodiment described my invention is not to be limited to being used solely with water but that other fluids having the physical characteristics of a liquid may be used therewith.

Referring to the accompanying drawings forming a part hereof wherein like numerals refer to like parts throughout, and in which—

Figure 1 is a plan view of a tank in which my invention is disposed.

Fig. 2 is a side elevation of Fig. 1, partly in section, showing the parts as positioned when the tank has stored therein a predetermined amount of liquid.

Fig. 3 is a cross section taken on the line 3—3 of Fig. 1 showing details of the manually operable multiple spool valve.

Fig. 4 is a cross section taken on the line 4—4 of Fig. 1 showing details of the water level control valve, and Fig. 5 is a view taken on the line 5—5 of Fig. 4 illustrating details of the water level control valve effectuating mechanism.

The volumetric liquid dispensing apparatus of my invention is indicated generally by the reference numeral 10. Though the apparatus is shown as being incorporated in a water closet, it is obvious that it may be used in other devices where it is desired to store a predetermined volume of a liquid and then to dispense the same by gravity.

A tank 11, which may be made of metal, plastic, etc. but, in the specific embodiment described is a somewhat conventional water closet made of vitreous china, has an opening 12*a* in which there is positioned a conduit 12 which is adapted to be connected with a source of liquid under pressure (not shown) such as water. There is also provided an aperture 13*a* containing a discharge or outlet pipe 13 which may be connectible with a toilet bowl (not shown) to be flushed. Positioned within the tank there are three operating valves, a manually operable multiple spool valve 14, a liquid level control valve 15 and a discharge valve 16, all hydraulically interconnected for controlling the admitting, storing and discharging of a predetermined amount of a liquid.

As shown in Fig. 3, the manually operable multiple spool valve 14 has a plunger 17*a* on which are positioned spaced O-ring washers 18*a*, 18*b*, 18*c* and 18*d* (reading respectively from right to left). This plunger 17*a* operates in the casing 17 having a cylindrical bore 17*b*. On the right-hand end of the plunger 17*a* is secured an operating knob 19 which is located outside the tank 11 and is operable to initiate the cycle. There are provided, leading into the cylindrical bore of the casing 17, a liquid inlet conduit 20, an upper discharge valve conduit 21, a lower discharge valve conduit 22, a spool valve leakage vent conduit 23, a spool valve operating conduit 24, a vent for the upper discharge valve conduit 25 and a vent for the lower discharge valve conduit 26. The vents 25 and 26 relieve into the tank while the vent 23 emits into the overflow drain 35.

In Fig. 3 the parts are positioned ready for discharging the liquid in the tank. As shown, the liquid inlet conduit 20 is connected to the upper discharge valve conduit 21 by the cylindrical chamber formed by the difference in diameters between the bore 17*b* and the plunger 17*a*, and the O-ring washers 18*b* and 18*c* prevent passage of the liquid from conduit 20 to the other openings. Upon movement of the plunger 17*a* to the left to the "in" position, the liquid inlet conduit 20 would be connected to the lower discharge valve conduit 22 and again O-ring washers 18*b* and 18*c* would prevent passage of the liquid through the other openings. In the "in" position the upper discharge valve conduit 21 is connected with its vent 25 between O-ring washers 18*b* and 18*a* and the washer 18*c* blocks off passage between the lower conduit 22 and its vent 26. It should be noted that at all times the pressure of the liquid flowing through the liquid inlet conduit 20 is that of the source less the small line loss in the liquid level control valve 15.

The discharge valve 16 as shown in Fig. 2 has a cylinder 27 provided with a bore in which is positioned a piston 28 attached to a connecting rod 29. On the top portion of the cylinder 27 is an opening 30 connected with the upper discharge valve conduit 21 and on the lower portion or opposite end of the cylinder 27 is an opening 31 connected with the lower discharge valve conduit 22. On the other end of the connecting rod 29 remote from the piston 28 a removably mounted resilient valve disk 32 is secured. This valve disk presses against

a seat 33 formed on an end of the tubular discharge conduit 34 to close off the same to liquid passage. An overflow drain 35 is connected through a passageway 36 to the discharge conduit 34. The discharge conduit inside the tank adjacent the seat 33 is provided with a flange 37 which positions frame member 38 carrying the cylinder 27 by means of spacers 39.

It will be apparent that water pressure exerted through the conduit 21 then through the opening 30 will force the piston 28 and the disk 32 down against the seat 33 to close off the discharge opening. Conversely, water pressure from the lower discharge valve conduit 22 through the opening 31 will force the piston 28 upwardly and open the discharge valve.

In Fig. 4 is shown a cross section of the liquid level control valve. This valve is formed in two parts, the main operating valve plunger 40 and the effectuating mechanism 57, a view of the latter being also shown in Fig. 5. The casing 50 has a cylindrical chamber 40*a* in which the plunger 40 is located. The main valve plunger 40 has spaced O-ring washers carried thereby and indicated as 41*a*, 41*b* and 41*c*, from right to left, respectively. This plunger 40 has a hollow bore 42 in which are provided a plurality of apertures 43, a plurality of apertures 44 and at the right-hand end a reduced diameter aperture 45 axially aligned with the bore. Peripheral grooves 46 and 47, radially aligned with the apertures 43 and 44 respectively, reduce the length of these apertures and also increase the tubular chamber formed about the piston in order to permit a larger flow of liquid. The end of the plunger in which is located the reduced diameter aperture 45 has an enlarged piston 48 operating in a cylinder 49 integral with the casing 50.

The casing 50 has an opening 51 extending into the cylindrical chamber 40*a* and attached thereto is the conduit 12, which is adapted to be connected to a source of liquid under pressure. Adjacent the opening 51 to the right thereof is another similar opening 52 connected to the closet filling tube 53. As shown in Fig. 2, this tube 53 extends downwardly with its open end spaced from the bottom of the tank in order to prevent splashing of the liquid and noise when the tank is filling by discharging beneath the surface of the liquid stored in the tank. These is also provided on the left-hand end (Fig. 4) of the casing 50 an axially aligned opening 54 which is connected with the liquid inlet conduit 20. Interconnecting with the tube 53 and the cylinder 49 is a bore 55 for venting the cylinder 49.

With the plunger in the position shown in Fig. 4, in which no liquid is flowing into the tank 11, the source of liquid in the conduit 12 is connected with the liquid inlet conduit 20 through the opening 51, the groove 46, apertures 43, bore 42 and opening 54. Liquid may also flow from the conduit 12 through the bore 42 to the reduced diameter aperture 45 and into the cylinder 49. The O-ring washer 41*a* prevents flow to the closet filling tube 53 from the bore 42. With the valve plunger 40 positioned to the right, that is, with the enlarged piston 48 proximate to the right-hand end of the cylinder 49, liquid can flow from the source conduit 12, through the opening 51, groove 46, apertures 43, bore 42 and through the apertures 44, groove 47 into the tube 53 to fill the tank. The periphery of the plunger 40 adjacent the groove 46 is beveled as at 46*a* to facilitate the flow of the liquid. The device for effecting movement of the plunger 40 is located to the right of the cylinder 49 and is hydraulically connected therewith.

The effectuating mechanism 57 for the plunger 40 is hydraulically connected to the cylinder 49 through a passageway 56. This mechanism has a spindle 58 operable in an internal cylindrical cavity 59. The upper end portion 60 of the spindle 58 is threaded and has adjustably positioned thereon upper and lower effectuating plunger control members 61 and 62 respectively, the members being complementally threaded. For operating the spindle 58, the casing 50 has an upwardly projecting integral arm 63 which is connected to the lever 64 by a pivot 66. The lever 64 has a bifurcated end portion 65 through which the pivot 66 transversely passes for permitting movement of the lever 64. The threaded end portion 60 is straddled by the bifurcated end portion 65. The outer end of the lever remote from the pivot carries the float ball 67. For accurately operating the plunger 58, the bifurcated end portion 65 has cam surfaces 68, integral with the lower edges of each bifurcated end portion, cooperable with an arcuate surface on the top of the lower effectuating plunger control member 62, while the top portion of the bifurcated end portion 65 is arcuately curved as at 69 for cooperation with a conversely curved portion of the upper effectuating plunger control member 61.

Since the control members 61, 62 are threaded onto the portion 60 they are adjustably positioned thereon and with the camming surfaces 68 and 69 provide a lost motion connection between the float ball 67 and the spindle 58. The distance between the members 61 and 62 is greater than the distance between the camming surface 68 and the arcuately curved surface 69. The spindle 58 is only moved when the float is substantially at the upper and lower water levels. By adjustment of members 61 and 62, on the threaded end portion 60 of the spindle 58, the upper and lower water levels can be changed at will and consequently the amount of liquid discharged per cycle.

The spindle 58 has spaced O-ring washers 70*a*, 70*b* and 70*c*, the washer 70*a* being positioned near the threaded end portion 60 (Fig. 5), and the washer 70*c* being positioned the more remote therefrom and adjacent the other end portion of the spindle 58. The spindle 58 has an enlarged lower end 71 which abuts the lower end of the casing 78 for providing a positive stop therefor. The spindle 58 operates in the bore 59 formed in the casing 78. The spindle 58 has an axial bore 72 and upper and lower diametric bores 73 and 74 between which the O-ring washer 70*c* is located. The end of the bore 72 is closed with a plug 75 and serves as a passageway between the two diametric bores. An enlarging groove 76 is formed in the bore 59 and facilitates the flow of fluid through the opening 77 formed in the casing 78 to the spool valve operating conduit 24 which is in engagement with the opening 77.

As shown in Figs. 4 and 5, when the closet is full, the surface 69 of the lever 64 abuts the upper control member 61 and locates the spindle 58 in its "up" position. In this position no liquid can flow from the cylinder 49 through the passageway 56 by reason of the O-rings 70*b* and 70*a* blocking an exit. Upon the tank emptying the cam surface 68 of the lever 64 abuts the control member 62 and forces the spindle 58 downward. In this "down" position with the O-ring 70*b* located below the groove 76 the cylinder 49 through the passageway 56 is connected by the enlarging groove 76 to the passageway 77 and thusly to the spool valve operating conduit 24. The O-ring washer 70*b* blocks off passage of any liquid into the upper diametric bore 73.

The operation of the device is as follows: Manual operation of the knob 19 forces the plunger 17*a* to the left. The liquid located between the O-ring 18*d* and end of the casing 17 proximate to the conduit 24 is first emitted through the spool valve leakage vent conduit 23 and after the O-ring 18*d* blocks this outlet, the rest of the liquid is discharged through the conduit 24, opening 77, groove 76, bore 73, bore 72 and bore 74 into the tank. The flow from the bore 74 to the tank is somewhat restricted by the enlarged end 71 and consequently a greater force is necessitated on the knob 19 to initiate the cycle. With the plunger 17*a* to the left the O-ring washer 18*b* is positioned between the liquid inlet 20 and the upper discharge valve conduit 21, preventing flow through conduit 21, and connects the inlet 20 to the lower discharge

valve conduit 22 for flow therethrough. Liquid will then flow through the opening 31 in the cylinder 27 forcing the piston 28 upwardly and opening the valve 16. The upper portion of the valve is vented through the vent 25 via the conduit 21 and the chamber between O-ring washers 18*b* and 18*a*.

The parts remain in this position with the discharge valve open until substantially the desired amount of liquid is discharged, when the camming surface 68 operating on the lower effectuating plunger control member 62 forces the spindle 58 downwardly. This connects the cylinder 49 through passageway 56, groove 76 and spool valve operating conduit 24 to the spool valve. In the "down" position of the spindle 58, the O-ring washer 70*b* is located below the groove 76. Upon movement of the enlarged piston 48 to the right, liquid will flow into the valve 14 via the conduit 24 and will force the plunger 17*a* and the knob 19 back to the position shown in Fig. 3 in which the upper discharge valve conduit 21 connects the valve 16 to the conduit 20 to force the piston 28 downwardly and close the valve 16. The lower discharge valve conduit 22 is vented through the vent 26. Any surplus fluid passing through the conduit 24 is discharged through the spool valve leakage vent conduit 23 after a predetermined movement of the plunger 17*a*.

Movement of the piston 48 to the right is caused by the hydraulic pressure (which is the source pressure) in the bore 42 acting on the end of the bore adjacent the reduced diameter aperture 45 creating a force greater than that force opposing it and acting on the other side of the piston 48. This opposing force is the product of the area of the piston 48 and the pressure in the cylinder 49. The pressure is minute since the cylinder 48 via the passageway 56, groove 76 and conduit 24 only has to be sufficient to overcome the inertia of the plunger 17*a* and the energy needed to move it to the position shown in Fig. 3. After sufficient movement of the plunger 17*a* to allow communication between the conduit 24 and the leakage vent conduit 23, there is substantially no opposing pressure.

With the piston 48 at the right-hand end of the cylinder 49, the tank filling tube 53 is connected to the source conduit 12 via groove 46, aperture 43, bore 42, aperture 44, groove 47 and opening 52. This valve will remain in this position until the liquid in the tank approaches the desired level which then forces the float ball 67 upwardly and the arcuate surface 69 abuts the upper effectuating plunger control member 61 to move the spindle 58 upwardly. Upon upward movement of the spindle 58 passage of liquid through the passageway 56 is prevented by the O-ring 70*b* being positioned above the groove 76, and liquid from the bore 42 will pass through the reduced diameter aperture 45 into the cylinder 49. This liquid creates a force moving the piston 48 to the left. The liquid located in the cylinder on the left-hand side of the piston is vented through the vent 55 to relieve any pressure opposing the leftward movement. Completion of the movement of the piston 48 positions the parts again as shown in Fig. 4.

The upper and lower bores 73 and 74 interconnected by axial bore 72 to circumvent the O-ring washer 70*c* are provided for the dual purpose of venting the conduit 24 when the O-ring washer 18*d* blocks off passage between the conduit 24 and the spool valve leakage vent conduit 23.

The tank 11 in the specific embodiment described is the conventional water closet with which mechanically operated discharge devices are generally used. My hydraulically operated discharging mechanism is interchangeable with the usual mechanical devices without any changes or alterations in the water closet.

It is to be further noted that my liquid discharging control mechanism will store the same amount of liquid even with a considerable fluctuation and variation in the source pressure. The minimum amount of pressure necessary is that needed to lift the disk 32 off the seat 33 which is only opposed by the negligible force created by the height of water in the tank acting on the top surface of the disk 32. This source pressure is also sufficient to actuate the liquid level control valve.

Variations and modifications may be made within the scope of the claims and portions of the improvements may be used without others.

I claim:

1. A dispensing mechanism for discharging by gravity a predetermined volume of a liquid comprising a tank for storing the liquid, a conduit for connecting the tank to a source of liquid under pressure and having an inlet valve associated therewith, a discharge valve operable to permit flow of the liquid from the tank, and hydraulic means operatively connected to the inlet and discharge valves which, upon actuation, hydraulically opens said discharge valve while maintaining said inlet valve closed to permit discharge of a predetermined amount of liquid from the tank, then closes said discharge valve and opens said inlet valve to permit an amount of liquid substantially equal to the amount discharged to enter said tank and maintains said discharge valve closed by utilizing the pressure of the source.

2. The invention as defined in claim 1 in which the means for actuating the discharge valve includes a piston operable in a cylinder having openings on each end connectible to the source of liquid under pressure to provide hydraulic force for positively actuating the valve and maintaining it at both opened and closed positions.

3. A dispensing mechanism for discharging by gravity a predetermined volume of a liquid comprising a tank for storing the liquid, a conduit for connecting the tank to a source of liquid under pressure and having an inlet valve associated therewith, a discharge valve operable to permit flow of the liquid from the tank, and means operatively connected to the inlet and discharge valves which, upon actuation, automatically opens said discharge valve while maintaining said inlet valve closed to permit discharge of a predetermined amount of liquid from the tank, then closes said discharge valve and opens said inlet valve to permit an amount of liquid substantially equal to the amount discharged to enter said tank, said means including a movable element for controlling the flow of liquid into said tank and effectuating means for varying the hydraulic pressure on said movable element in order to control movement of said element.

4. The invention as defined in claim 3 in which said movable element is a piston operable in a cylinder and said effectuating means is a valve for releasing hydraulic pressure in the cylinder in which the piston moves.

5. The invention as defined in claim 4 in which the effectuating means is actuated by a float and adjustable connections are provided between said float and effectuating means for permitting adjustment of said effectuating mechanism for actuation at predetermined levels of liquid in the tank.

6. A dispensing mechanism for discharging by gravity a predetermined volume of a liquid comprising a tank for storing the liquid, a conduit for connecting the tank to a source of liquid under pressure and having an inlet valve associated therewith, a discharge valve having a piston movable in a double acting cylinder and operable to permit flow of the liquid from the tank, and means including a manually operable multiple valve interconnecting said source conduit and said double acting cylinder which upon manual actuation of said multiple valve automatically opens said discharge valve while maintaining said inlet valve closed to permit discharge of a predetermined amount of liquid from the tank, then closes said discharge valve and opens said inlet valve to permit an amount of liquid substantially equal to the amount discharged to enter said tank.

7. A flushing apparatus comprising a tank having an inlet conduit connectible with a source of water under

pressure and an outlet, an inlet valve, an outlet valve, and hydraulic means including a pressure operated movable element interconnecting said valves for opening and closing said discharge valve and synchronously maintaining closed and then opening said inlet valve upon actuation thereof by the pressure of the source to discharge a predetermined amount of water from said tank, and an effectuating mechanism for varying the pressure operating said movable element.

8. The invention as defined in claim 7 in which the movable element is a piston operable in a cylinder and the effectuating mechanism vents one side of said cylinder to permit movement of said piston.

9. The invention as defined in claim 8 in which the effectuating mechanism is controlled by a float in said tank and there is provided an adjustable interconnection between said float and effectuating mechanism to operate same at various liquid levels in the tank.

10. A flushing apparatus comprising a tank having an inlet conduit connectible with a source of water under pressure and an outlet, an inlet valve, a fluid pressure operated outlet valve, a manually operated multiple valve connecting said source pressure with said discharge valve, and hydraulic means interconnecting said valves which, upon actuation of said multiple valve, opens and then closes said discharge valve and synchronously maintains closed and then opens said inlet valve to discharge a predetermined amount of water from said tank.

11. A water closet for connection to a toilet bowl comprising a tank having a source conduit with an inlet valve connectible with a source of water under pressure, an outlet valve connectible with the toilet bowl and having a piston operable in a cylinder for operating said outlet valve, and means interconnecting one end of the cylinder to said source conduit for subjecting one side of the piston to the fluid pressure in said source conduit to positively maintain said valve in its closed position, and vent means connected to the other end of the cylinder for providing substantially less pressure on the other side of the piston than the source pressure when the first mentioned side is subjected to the source pressure.

12. The invention as defined in claim 11 in which in the interconnecting means there is provided a movable

element which effectuates closure of said discharge valve after a predetermined amount of water has been discharged.

13. The invention as defined in claim 12 in which the movable element is operated by an effectuating mechanism which has adjustable means therein for operating said element at any desired water level.

14. A water closet for connection to a toilet bowl comprising a tank having a source conduit with an inlet valve connectible with a source of water under pressure, an outlet valve connectible with the toilet bowl having a piston operable in a cylinder with opposed ports, and a two-position multiple valve interconnected between said cylinder and said source conduit for in one position connecting said source conduit with one port of said cylinder and venting the other port, and in the other position connecting said source conduit with said other port and venting said one port to open and close said discharge valve.

15. A dispensing mechanism for permitting discharge of a fluid comprising a tank having a source conduit connectible with a source of fluid under pressure, an outlet in said tank having an outlet valve, a piston operable in a cylinder and connected to the outlet valve to operate same, means interconnecting one end of said cylinder to said source conduit for subjecting one end of the piston to the fluid pressure in said source conduit to positively maintain said valve in its closed position, and vent means connected to the other end of the cylinder for providing substantially less pressure on the other side of the piston than the source pressure when the first mentioned side is subjected to the same pressure.

References Cited in the file of this patent

UNITED STATES PATENTS

1,119,137	Cornaggia	Dec. 1, 1914
1,203,538	Hamilton	Oct. 31, 1916
1,440,827	Handy	Jan. 2, 1923
2,341,116	Owens	Feb. 8, 1944
2,587,901	Robinson	Mar. 4, 1952

FOREIGN PATENTS

447,056	Great Britain	May 6, 1936