May 3, 1960 B. H. KRYZER 2,935,081

FLOAT VALVE MECHANISM

Filed April 17, 1957

FIG. 1

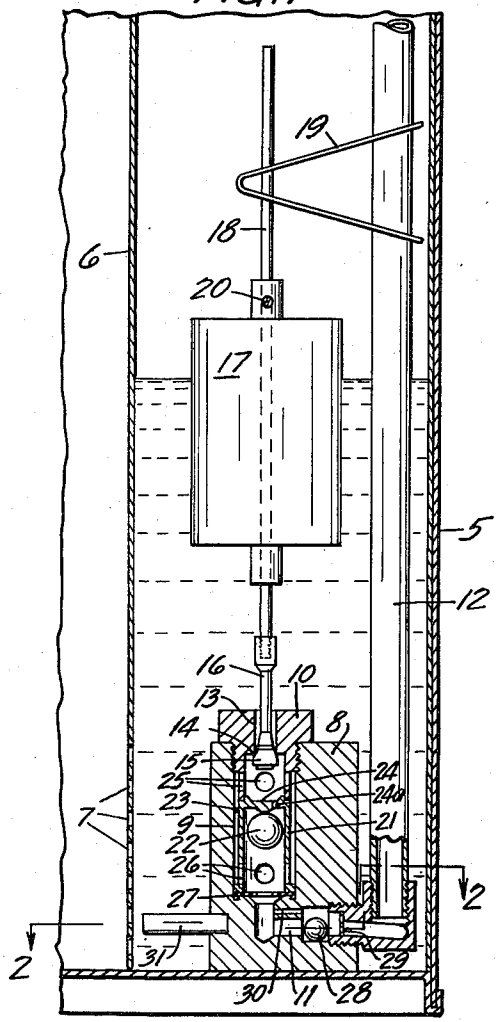


FIG. 3

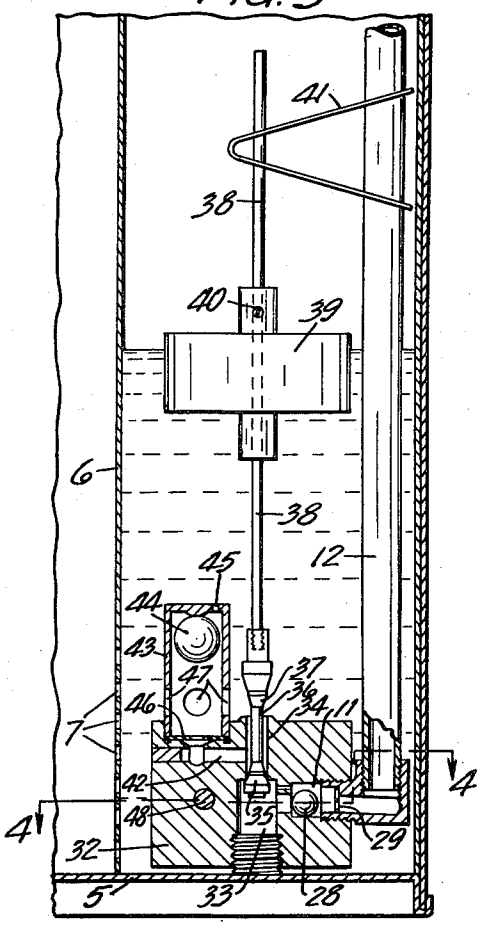


FIG. 2

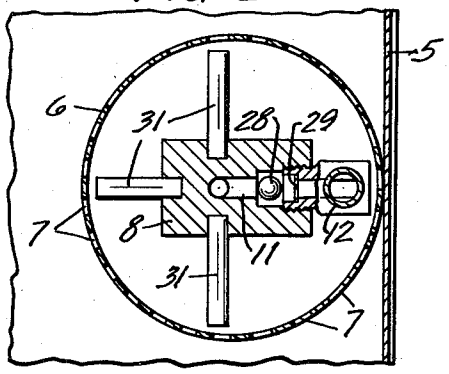
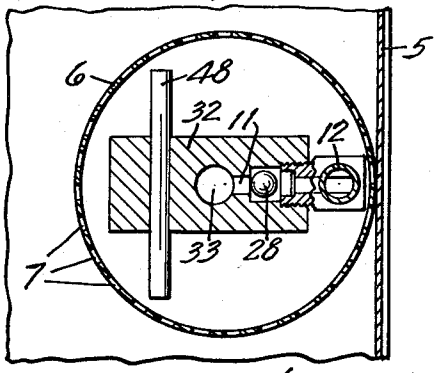


FIG. 4



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FLOAT VALVE MECHANISM

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Application April 17, 1957, Serial No. 653,375

9 Claims. (Cl. 137—391)

This invention relates to improvements in float valve mechanism which is particularly adapted for use in connection with water softening apparatus for controlling the flow of liquid to and from a tank or other container of regenerating material and liquid.

It is an object of my invention to provide float valve mechanism of novel and unusually reliable construction adapted to insure straight line, accurately guided movement of float operated closure means for positively cutting off flow to the tank when the liquid therein has reached a predetermined high level and for cutting off flow out from the tank when the liquid level therein has been reduced to a predetermined low level.

A particular object is to provide float valve mechanism having a novel, compact and simple arrangement of in-flow and out-flow controls, each operated by a float and adapted to perform its function independently of the other control and float.

The invention also includes certain other novel features of construction which will be more fully pointed out in the following specification and claims.

Referring to the accompanying drawing which illustrates, by way of example and not for the purpose of limitation, preferred and modified forms of my invention;

Figure 1 is a vertical sectional view showing a preferred form of the flow control mechanism;

Fig. 2 is a horizontal sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a vertical sectional view showing a modification of the mechanism, and

Fig. 4 is a horizontal sectional view taken on the line 4—4 of Fig. 3.

In the drawing portions of a tank 5 of the type which is open to atmospheric pressure and a relatively small well 6 mounted in the tank to receive liquid therefrom are shown. A multiplicity of openings 7 are formed in the lower portion of the well 6 to provide for flow of liquid between the well 6 and tank 5 while excluding solid regeneration material stored in the tank from entering the well 6. As shown in Figs. 1 and 2, the valve mechanism has a body 8 which is normally submerged in liquid in the well 6. This body is formed with a substantially vertically extending cylindrical chamber 9 having at its upper end a threaded plug 10 and at its lower end a port 11 communicating with a conduit 12 adapted to alternately supply liquid to or withdraw liquid from the port 11 and chamber 9.

Extending upward from the chamber 9 and opening into the well 6 is a first passage 13 formed with a valve seat 14 surrounding its lower end. The passage 13 is adapted to be closed by a first valve member 15 which is movable to and from the seat 14 in the upper portion of the chamber 9. Valve member 15 is secured to a stem 16 extending in axial alignment with the passage 13 and chamber 9. An extension 18 of the stem 16 passes axially through a float 17 in a bearing therein and is free for vertical movement in a guide 19 projecting from the conduit 12. The float 17 is adjustable along

the stem extension 18 and may be secured in selected positions thereon by a set screw 20 or other suitable fastening means.

A tubular cage 21 is confined in the chamber 9 to guide a second float 22 for vertical movement to and from a seat at the lower end of the cage. The side walls of the cage 21 are spaced from the walls of the chamber 9 to form a second passage 23. An upper end wall 24 of the cage limits upward movement of the float 22 and above the wall 24 the cage 21 has an upwardly projecting flange formed with openings 25 so that the passage 23 is in communication with the lower end of the passage 13 when the valve member 15 is in open position. Additional openings 26 are formed in the cage 21 near its lower end so that the second passage 23 includes the openings 26 into the interior of the cage 21.

Interposed in passage 23 at the lower end of the cage 21 is a second valve seat 27 for the float 22. This seat 27 comprises a flexible elastic diaphragm formed with a central opening adapted to be closed by the float 22 when it settles to its low level position.

For some installations, including regenerating tanks, it is desirable to control the rate of flow between the port 11 and conduit 12. A suitable flow control may comprise a check ball 28 confined in an enlargement of the port 11 between a coarse screen 29 and an opposed seat for the ball. When flow starts through the port 11 to the chamber 9, the ball 28 closes at its annular seat and is by-passed by flow through a passage 30 of the required size to afford a predetermined desirable low rate of flow to the wall 6. Flow in the reverse direction at a relatively high rate is permitted when the ball 28 is moved away from its seat in the port 11.

The lower periphery of the cage 21 rests on the periphery of the diaphragm forming the valve seat 27 and the cage is confined in spaced relation to the inner surface of the chamber 9 by a flange on the lower end of the cage and the plug 10 having the threaded connection with the body 8. As indicated in Fig. 2, the body 8 may be provided with horizontally projecting studs 31 to retain it in an approximately centered position in the well 6.

In the operation of the preferred mechanism shown in Figs. 1 and 2, when the liquid in the tank 5 and well 6 is at a predetermined high level, the float 17 retains the valve member 15 in its closed position on its seat 14 and the float 22 is in its elevated position in contact with the top wall 24 of the cage 21. Liquid may be withdrawn from the tank 5 and well 6 through the conduit 12 when sub-atmospheric pressure is created in this conduit and the connected flow passages. For many water softeners the controls include an aspirator device or injector for drawing liquid regenerating material from a tank or reservoir. Such suction producing devices may be connected to the conduit 12 to create suitable sub-atmospheric pressure therein. When the pressure in chamber 9 is reduced, valve member 15 is drawn downward to an open position, thereby establishing flow through the passages 13 and 23 past the valve seat 27 and through port 11 to conduit 12. As liquid is withdrawn from the well 6 the float 17 moves down until valve member 15 rests on the top wall 24 of the cage 21. Thereafter, the withdrawal of liquid from the well may continue until the float 22 contacts its diaphragm seat 27 and closes the passage 23 supplying port 11 the conduit 12. This cuts off the flow of liquid and air to the port 11 from the well 6.

Subsequently the tank 5 and well 6 may be refilled by supplying liquid at pressure above atmospheric pressure to the conduit 12. Backflow through the port 11 lifts the float 22 from its seat 27 thereby allowing flow through

the passages 23 and 13 into the well 6. The rate of flow back through the valve passages to the well is reduced by the closing of the ball 28 at its seat, allowing flow to continue through the restricted passage 30. This flow continues until the float 17 causes valve member 15 to close at its seat 14, thus completing the cycle of operation. During backflow air is allowed to escape from the cage 21 through a small opening 24*a* in the upper wall 24.

Referring to the modified construction shown in Figs. 3 and 4, a valve body 32 has a port 11 connected to conduit 12 as in the preferred construction, Figs. 1 and 2. The body 32, however, is formed with a modified arrangement of chambers and passages which include a chamber 33, a passage 34, hereinafter referred to as the first passage, extending upward from the chamber 33 and a second passage 42 extending from the passage 34 to communicate with the well 6 under control of a second float, as hereinafter described.

A lower valve seat surrounds the lower end of the passage 34 and an upper seat surrounds the upper end thereof. Within the chamber 33 a valve member 35 is movable to and from the seat at the lower end of passage 34 and is connected by a stem 36 to a valve member 37 adapted to move exteriorly of the body 32 to and from the seat at the upper end of passage 34. An extension 38 of the stem 36 extends upward from member 37 and is secured to a float 39. This float, like the float 17, is adjustable along its supporting stem extension 38 and may be secured thereto in adjusted positions by suitable means, e.g., a screw 40. The stem extension 38 is slidable vertically in a guide bracket 41, like the bracket 19.

Passage 42 extends laterally from the passage 34 at a point above the seat for the valve member 35. At its end remote from the passage 34 the passage 42 communicates with the interior of a cage 43 containing a float 44. In its upper end wall the cage 43 is formed with a vent opening 45 and extending across the lower end of this cage is a valve seat 46 which, like the seat 27, is constructed from flexible elastic material adapted to conform to the bottom surface of the float when it is drawn down to its low level position. A central opening in the seat 46 constitutes a port adapted to be closed by the float 44. Openings 47 are formed in the walls of the cage 43 near its lower end to admit fluid from the well 6. It will be evident that the cage 43 and valve body 32 are normally submerged in liquid in the well 6. This liquid may be supplied from the well to the chamber 33 through the passage 42 when the member 35 is in its open position. Valve body 32 may be spaced from the walls of the well 6 by providing studs 48 projecting from opposite sides of the body.

In the operation of the modified mechanism shown in Figs. 3 and 4, when the liquid is at predetermined high level the float 39 causes valve member 35 to close at its seat surrounding the lower end of the passage 34. Passage 42 is open to the interior of the well 6 through the cage 43 since float 44 is in its elevated position at the upper end of the cage so that the port defined by the seat 46 is open to passage 34.

When sub-atmospheric pressure is created in the conduit 12, connected port 11 and chamber 33, valve member 35 is drawn down to open the passage 34. Flow is thus established from the well 6 through passage 34 to chamber 33 and port 11 to conduit 12. This flow into the upper end of the passage 34 stops when float 39 is lowered sufficiently to cause valve member 37 to close the passage 34 at its upper end, but flow continues from the well 6 out through the openings 47 into the cage 43, through the port in the valve seat 46 and passage 42, past the lower seat surrounding the passage 34 to chamber 33 and thence through port 11 to the conduit 12. This withdrawal of liquid from well 6 may continue until the float 44 settles on its seat 46 to close the inlet end of passage 42.

Subsequently when the well 6 and tank 5 are to be refilled, fluid under pressure above atmospheric is supplied to the conduit 12 and flows therefrom through port 11, chamber 33, lower portion of the passage 34 and passage 42 to raise float 44 from its seat 46 and discharge liquid into the well 6 through the openings 47 in the cage 43. As the liquid level rises in the well, the float 46 rises to its upper position in the cage 43 shown in Fig. 3. Thereafter the refill flow may continue until the float 39 is raised to close the valve member 35 at the lower end of the passage 34. This cuts off flow to the well 6 and completes the cycle of operation.

As shown, floats 22 and 44 are spherical in shape but it will be evident that they may have other shapes suitable to be guided to and from a coacting seat at the bottom of the cage.

An important feature of my preferred and modified mechanisms is the provision for discontinuing the flow into the tank or other receptacle by operation of a first float valve and for discontinuing the flow out of the tank by operation of a second float valve. This is advantageous for the reason that the influent pressure and effluent pressure are radically different in many installations. Thus the liquid flowing into the tank is usually supplied at relatively high pressure which makes relatively large floats more efficient for cutting off the in-flow. Flow in the reverse direction, i.e., out of the tank, is induced by sub-atmospheric pressure making a relatively small float better suited to close the exit port.

Movement of both of my floats to and from their closed positions is accurately guided. Each of the larger floats 17 and 39 are rigidly connected by coaxially disposed stems to their respective valve closure members so that the latter are moved and guided in a straight line to and from their seats. My auxiliary floats 22 and 44 of the preferred and modified mechanisms respectively are also guided accurately in line with their diaphragm type seats. These seats of flexible elastic material conform to the lower side of the respective floats under the suction created in the effluent passages. Thus the normally flat diaphragm seats are drawn down to conform to the shape of the floats thereby coacting therewith to afford tight seals against further flow of liquid and to prevent the entry of air into the suction creating device. Such means for stopping the effluent flow independently of the influent flow has been demonstrated to be highly efficient, reliable, compact and economical.

I claim:

1. A float valve mechanism comprising, a body adapted to be submerged in a liquid obtained in a receptacle and having an internal chamber, a conduit communicating with said chamber for alternately withdrawing liquid from said chamber under sub-atmospheric pressure and supplying liquid thereto under pressure above atmospheric, means defining a first passage extending upwardly from said chamber for supplying liquid to said receptacle, a first valve seat surrounding said passage, a first valve member movable to close said first passage at said seat and having an upwardly projecting stem centrally disposed in relation to said seat, a first relatively large float connected to said stem for moving said first valve member to and from said seat in response to changes in the level of the liquid in said receptacle, means defining a second passage extending from said first passage adapted to supply liquid to said conduit when said first valve member is in open position in relation to its seat, an upwardly facing second valve seat interposed in said second passage, a cage forming an elongated float chamber extending upwardly from said second valve seat, and a second relatively small float confined in said float chamber for vertical movement therein independently of the movement of said first float in response to changes in the level of liquid in said receptacle to close at said second seat and stop flow out through said second passage when the liquid reaches a predetermined low level in said receptacle.

2. Float valve mechanism in accordance with claim 1

wherein said second float is substantially spherical and adapted to make direct contact with said second seat to stop flow through said second passage to said conduit.

3. Foat valve mechanism in accordance with claim 1 wherein said second float has an annular surface for contact with said seat and said seat comprises a flexible elastic diaphragm member formed with a central port adapted to be closed by said second float and having an annular portion of substantial width which is free to be deflected laterally to conform to said annular surface of said second float.

4. Float valve mechanism in accordance with claim 1 wherein said second passage extends between the lower end portion of said first passage and said second valve seat.

5. Float valve mechanism in accordance with claim 1 wherein said second passage is in communication at one end with said first passage above said first valve seat and at the other end with said receptacle.

6. Float valve mechanism comprising, a body adapted to be submerged in a liquid contained in a receptacle and having an internal chamber, a conduit communicating with said chamber for alternately withdrawing liquid from said chamber under subatmospheric pressure and supplying liquid thereto under pressure above atmospheric, means defining a first passage extending upwardly from said chamber for supplying liquid to said receptacle, a first downwardly facing valve seat surrounding said passage within said chamber, a first valve member movable to close said passage at said seat and having an upwardly projecting stem centrally disposed in relation to said seat and passage, a first relatively large float connected to said stem for moving said first valve member to and from said seat in response to changes in the liquid level in said receptacle, means defining a second passage extending from said first passage for supplying liquid to said conduit when said first valve member is in open position in relation to its seat, an upwardly facing second valve seat interposed in said second passage, a cage forming an elongated float chamber extending above said second valve seat and having a closed upper end portion, said float chamber being formed with an opening in its side wall adjacent to the upper side of said second seat for flow to and from said second passage, and a second relatively small float confined in said float chamber and movable therein independently of said first float in response to changes in the liquid level in said receptacle from an open position in the closed upper end portion of said cage to a closed position on said second seat whereby flow through said second passage to said conduit is stopped when the liquid reaches a predetermined low level in said receptacle.

7. Float valve mechanism comprising, a body adapted to be submerged in a liquid contained in a receptacle and having a lower end port and an internal chamber extending upwardly from said port, a conduit communicating with said port for alternately withdrawing liquid from said chamber under subatmospheric pressure and supplying liquid thereto under pressure above atmospheric, means defining a first passage extending upwardly from said chamber to said receptacle, a first valve seat surrounding said passage at the lower end thereof, a first valve member movable to close said first passage at said seat and having an upwardly projecting stem centrally disposed in relation to said seat, a first relatively large float connected to said stem for moving said first valve member to and from said seat in response to changes in the level of the liquid in said receptacle, a float cage confined in said chamber at an elevation below said valve seat, a second upwardly facing valve seat disposed at the lower end of said cage and having an opening communicating with said port, a second relatively small float movable independently of said first float within said cage in response to changes in the level of liquid in said chamber and arranged to close at said second seat and stop flow out through said conduit when the liquid in said chamber reaches a predetermined low level in said chamber and a second passage extending from the upper side of said second seat between a wall of said chamber and outer surface of said cage for conducting liquid from the upper portion of said chamber to the upper face of said second valve seat.

8. Float valve mechanism in accordance with claim 7 wherein said cage comprises tubular side walls spaced from the interior surfaces of said chamber and formed with an opening near the lower end of said cage disposed to admit liquid to the upper side of said second seat, said walls being imperforate above said opening and the upper end of said cage being closed.

9. Float valve mechanism in accordance with claim 7 wherein said cage has an upper end wall disposed to limit downward movement of said first valve member and upward movement of said second float.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,935,081 May 3, 1960

Benjamin H. Kryzer

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 66, for "port 11 the" read -- port 11 and --; column 4, line 49, for "obtained" read -- contained --.

Signed and sealed this 22nd day of November 1960.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents