

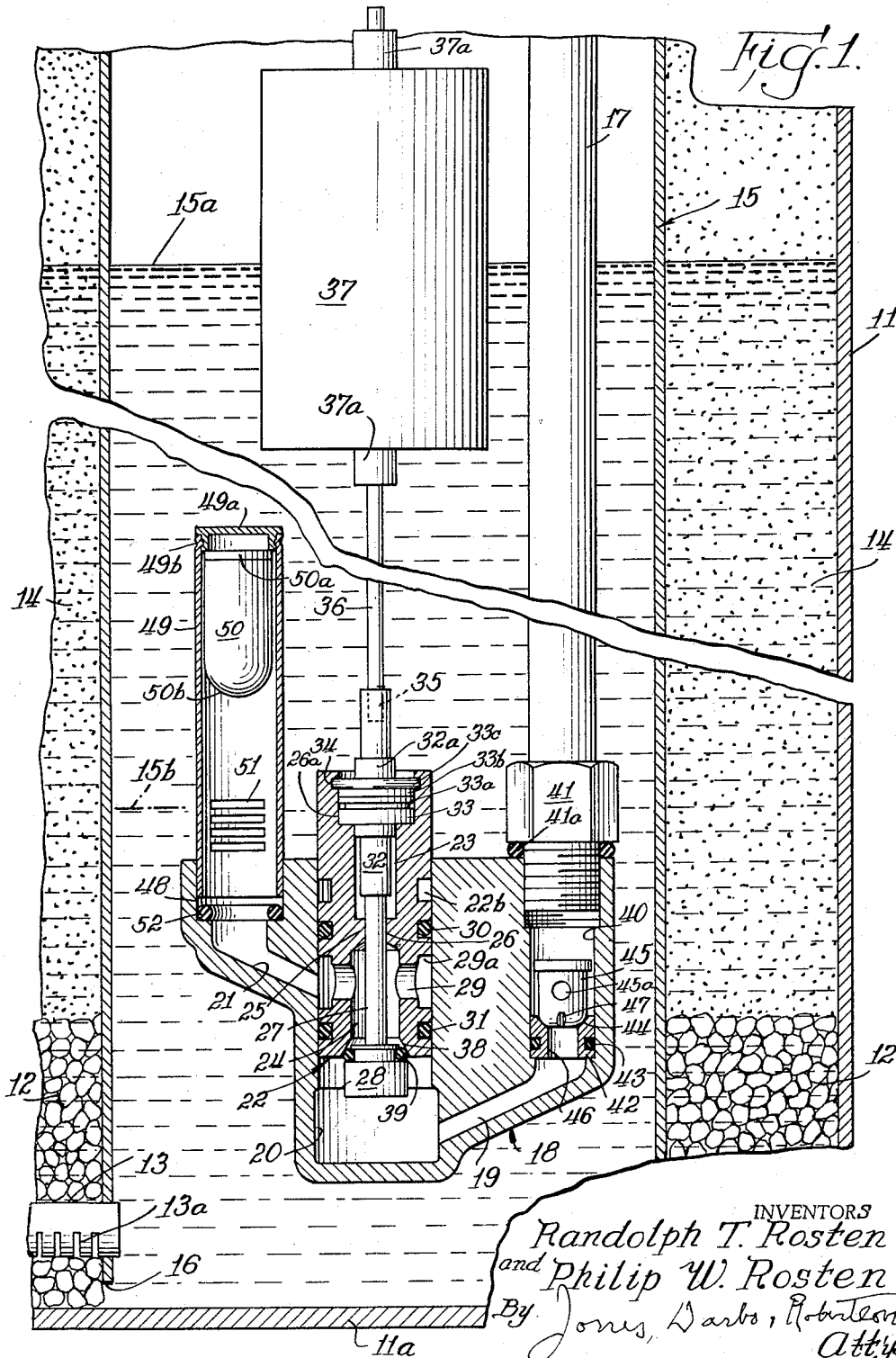
Sept. 29, 1959

R. T. ROSTEN ET AL
SUBMERGED VALVE MECHANISM, MORE PARTICULARLY
FOR WATER SOFTENER BRINE TANK

2,906,285

Filed Oct. 7, 1957

2 Sheets-Sheet 1



Sept. 29, 1959

R. T. ROSTEN ET AL
SUBMERGED VALVE MECHANISM, MORE PARTICULARLY
FOR WATER SOFTENER BRINE TANK

2,906,285

Filed Oct. 7, 1957

2 Sheets-Sheet 2

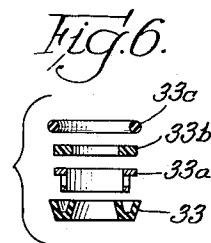
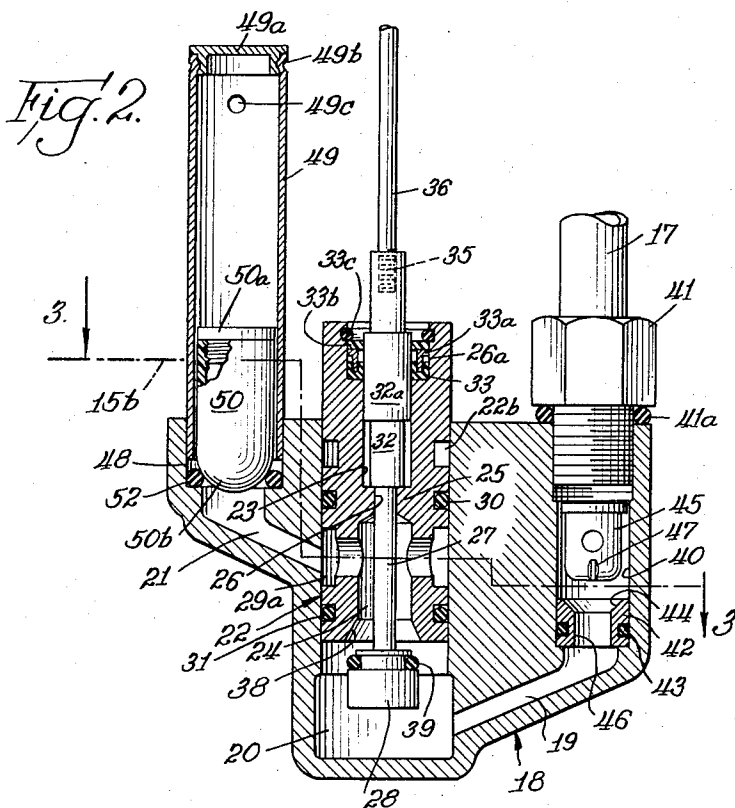


Fig. 5.

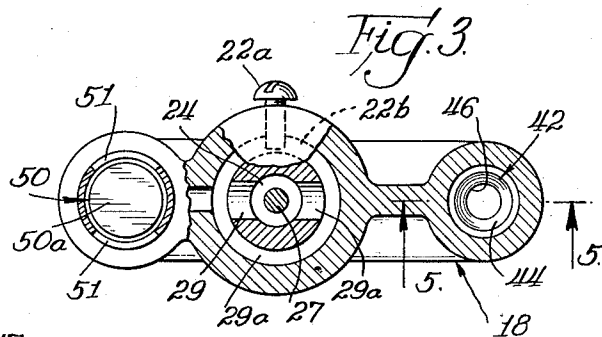
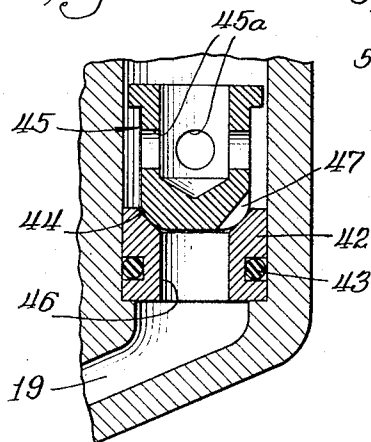
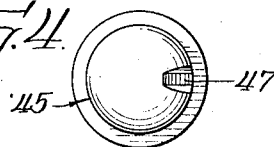


Fig. 4.



INVENTORS
Randolph T. Rosten
and Philip W. Rosten
By Jones, Darbo & Robertson
Att'ys.

1

2,906,285

SUBMERGED VALVE MECHANISM, MORE PARTICULARLY FOR WATER SOFTENER BRINE TANK

Randolph T. Rosten and Philip W. Rosten, Madison, Wis., assignors to Capital Plating & Machine Co., Madison, Wis., a partnership

Application October 7, 1957, Serial No. 688,739

3 Claims. (Cl. 137—391)

This invention relates to valve mechanism more particularly intended for submersion in the brine tank of an exchange water softener system to automatically control the inflow thereto and outflow therefrom.

The invention provides an improved valve mechanism for this purpose, arranged for immersion in the liquid of the tank and for connection to an ejector for drawing brine from the tank when a suction exists in the pipe line, until a predetermined lower brine level is reached, at which time the valve mechanism is automatically and positively closed until the suction is relieved and subsequently raw water reenters the tank through the mechanism until a float controlled valve stops the flow at a predetermined upper level.

An important object of the invention is the provision of means by which passage of brine through the mechanism is shut off independently of the said float controlled valve by a gravity and suction controlled valve to prevent the entry of excess brine or air into the system, said gravity and suction controlled valve being automatically opened upon the termination of a sub-atmospheric pressure in the mechanism for the entry therein of raw water under pressure to refill the brine tank.

A further object is the provision of improved valving means for the purposes above referred to, to guard against overflow of the tank and to provide self-cleaning functions.

The foregoing and other objects and advantages will be apparent from the following description, taken together with the accompanying drawings, showing an illustrative embodiment of the invention, and in which drawings:

Figure 1 is a vertical sectional view of a valve mechanism embodying the present invention showing its use in the brine tank of a conventional exchange water softener system, the valves being shown in the positions occupied when the brine is at its upper level in the tank;

Figure 2 shows the valves of the mechanism of Fig. 1 in the positions occupied when the brine is at its lower level, this being at the end of the ejector step and the beginning of the refill step;

Figure 3 is a cross-section taken on the staggered line 3—3 of Figure 2;

Figure 4 is a bottom view of the check valve showing the by-pass groove therein;

Figure 5 is an enlarged fragmentary vertical section taken on the line 5—5 of Fig. 3 showing the check valve on its seat; and

Figure 6 is a so-called exploded view showing the elements of the valve stem packing gland.

It will be understood that the tank 11 customarily contains a bed of gravel 12 in which is embedded a perforated distributor pipe 13 over which there is a fill of salt 14, the pipe 13 communicating with the brine well 15 that is surrounded by the salt in the brine tank so as to have a predetermined upper liquid brine level such as 15a therein and a predetermined lower liquid brine level such as 15b, the brine being employed in the

2

regeneration phase of the water softener system which conventionally involves the passing of the brine solution through a zeolite mass for chemical exchange purposes, at the end of which phase the brine tank is refilled with water in preparation for a subsequent regeneration phase in the cycle. The brine well 15 is spaced from the tank bottom 11a as at 16 at its lower end and the pipe 13 has perforations 13a that permit the flow of liquid in either direction. The valve mechanism of the present invention is within the casing 15 and immersed in the liquid therein, the conduit 17 connecting the valve mechanism with the ejector and refill expedients (not shown) of the system, conduit 17 serving as a conduit both for the brine from the brine tank and for the refill water to the tank, as is well known in the art and need not here be further described, the present invention having to do with the structure and function of the novel automatic valve mechanism herein next described.

Referring in detail to the present illustrative construction, as here shown, the valve body 18 of the invention has a continuous passageway therethrough that is made up of a first branch 19, a central cavity 20 and a second branch 21, the branches 19 and 21 being vertically spaced apart with respect to and communicating with the cavity 20 at vertically spaced apart spaces therein, the branch 19 being here shown adjacent the lower end of the cavity 20 at vertically spaced apart spaces therein, the branch

For selectively closing the passageway comprising the branches 19 and 21 and cavity 20 the latter has fixed therein a cylindrical plug 22, the latter terminating short of the lower end of the cavity 20 and extending thereabove. Plug 22 has an upper hollow interior 23 and a lower hollow interior 24 separated by a partition 25 that has a bore 26 therein for the valve stem 27 of the valve 28 that depends below the plug 22, the valve stem moving upwardly and downwardly in the plug 22 which forms a valve stem guide and valve seat member as presently more particularly described.

Plug 22 makes a close fit with the cavity 20 of the valve body and for further sealing purposes carries in peripheral grooves O-rings 30 and 31 that are pressed into the cavity 20 with the plug 22, set screw 22a passing through the wall of valve body 18 to enter groove 22b in plug 22 to secure the (Fig. 3) assembly in any rotational position of the plug in the valve body. Radial ports 29 in plug 22, of which there are four here shown, opening into its peripheral recess 29a communicate and place the hollow lower interior 24 of the plug in communication with the branch 19 when the valve 28 is moved downwardly with respect to the plug 22. At its upper end, plug 22 passes snugly but slidably therethrough the valve stem enlargement 32 that carries a further enlarged portion 32a, desirably taking the form of (Fig. 6) a plastic sleeve, that is encircled by an annular elastomeric sealing cup 33 held in place by a backing ring 33a, plastic follower ring 33b and elastomer O-ring 33c that seats in groove 34 in the upper end of plug 22 thus providing a packing gland for the vertical reciprocation therein of the valve stem enlargement 32a. Cup ring 33 seats in counterbore 26a in the plug 22. Attached by a screw connection 35 to the valve stem enlargement 32 is a rigid vertical rod 36 at the upper end of which is mounted the float can 37 that rises and falls with the brine level in the tank and moves with it the valve 28 which cooperates with downwardly facing tapered valve seat 38 at the lower end of the hollow interior 24 of valve guide 22. Valve 28 closes on the valve seat 38 desirably through the intermediation of O-ring 39. Float can 37 has a slip friction connection 37a at each end by which its position is adjustable on rod 36 to vary and predetermine the upper liquid level 15a in the brine well 15. Abut-

ment of valve stem enlargement 32 with the plug partition 25 limits downward movement of valve 28.

Valve body passageway branch 19 has an opening 40 therein that receives the screw nipple 41, desirably of plastic, that connects conduit 17 with the valve body. O-ring 41a enhances the seal at nipple 41. Also in the opening 40 is a valve seat member 42 that has a force fit in the opening 40 with a peripheral sealing O-ring 43. Member 42 provides a tapered valve seat 44 for a check valve 45 that seats thereon to partially close the opening 46 through the member 42, there being however a restricted by-pass or bleed port 47 in the check valve 45 which is open for communication of liquid between the conduit 17 and the passageway branch 19 of the valve body even when the check valve 45 is on seat 46. Bleed port 47 is desirably in the form of V-notch in the edge of the lower end of the check valve, as best seen in Fig. 4, so as to be self-cleaning. Check valve 45 is desirably cup-shape as shown and has the radial ports 45a permitting the flow of water to the by-pass groove 47, and of brine in the other direction.

At the opposite side of the valve body the branch 21 of the passageway thereof has an opening 48 therein in which is rigidly mounted an upstanding vertically elongated cylindrical tube or cage 49 that confines for vertical movement therein a gravity and suction controlled valve, here shown in the form of a buoyant hollow imperforate vertically elongated bob 50, that moves up and down in the cage 49 under the influence of the liquid level in an upward direction and under the influence of gravity and suction in a downward direction. Bob valve 50 may be of molded hollow plastic material and may have a sealing closure 50a at its upper end, its lower end being hemispherical as at 50b. At the lower end of the opening 48 is a valve seat provided in this instance by another O-ring 52 upon which the hemispherical lower end 50b of the bob valve 50 seats to close the opening 48. A cover 49a limits upward movement of bob 50 in cage 49. Cover 49a may be staked to cage 49 as at 49b and the cage may have air vents 49c adjacent said cover to prevent formation of an air cushion in the upper end of the cage. A series of restricted apertures here shown in the form of vertically spaced horizontal slits 51 in the cage 49 admit liquid to the interior of the cage but serve to screen out particles of salt or dirt therefrom.

Operation of the mechanism is as follows:

Brine stands in the brine well 15, the liquid level 15a of which may be slightly higher than the liquid level in the rest of the tank. At a selected period in the operation of the water softener system, the ejector of the latter creates a sub-atmospheric pressure in the conduit 17 and consequently in the passageway of the valve body 18 that lifts the check valve 45 off its valve seat 44 and also opens the valve 28, moving the latter downwardly from its valve seat 38, valve float 37 moving at this time with valve 28 under said suction influence. At the beginning of the ejector action, bob valve 50 is not influenced by the sub-atmospheric pressure being at this time at the upper end of the cage 49 by reason of the influence of the liquid level. Brine in the brine well 15 is drawn into the valve body opening 48 through the slits 51 in the cage 49 and passes through the valve body and through the conduit 17 into the exchange tank of the water softener system. When the liquid level of the brine in the valve casing 15 drops to that indicated by the line 15b, for example, and as best seen in Fig. 2, the bob valve 50 drops first by gravity and then quickly, by reason of the suction in the valve body, onto the valve seat 52, thereby terminating the flow of brine from the brine tank while at the same time preventing the drawing of air thereinto. At some subsequent point in the cycle, as determined by the controls of the water softener system, the suction is relieved and raw water is directed into the conduit 17 which forces the check valve 45 onto its valve seat 44 but by reason of the by-pass or bleed port 47 admits the

new water slowly through the valve body, the valve 28 now being open, and into the branch passageway 21 where it passes by the bob valve 50, lifting the latter off its seat 52, so that the refill water flows out through the slits 51 into the brine well 15 and through the distributor pipe 13 into the brine tank 11 to replenish the water therein in contact with the salt. As soon as the water in the brine tank 11 has risen to the level 15a, the valve 28, under the influence of the valve float 37, rises to seat on the valve seat 38 and thus close the passageway through the valve body 18. No fluid then passes through the valve body 18 until in the next cycle of operation of regeneration, suction is again created in the pipe 17 and thereby in the valve body 18 to open the check valve 45 and the valve 28, at the end of which cycle the bob valve 50 will again drop under the influence of gravity and suction, and, predetermining the lower level of liquid in the brine well, will again seat on its valve seat 52. Thus the flow of brine from the brine tank and refill water into the brine tank respectively is automatically and positively terminated in each instance while permitting desired withdrawal of brine and reentry of water to the extent of predetermined respective levels.

The valving mechanism represented by the valve 28 and its associated parts, constructed and arranged as hereinabove described and as shown in the drawings provides self cleaning functions at the valve seat and on the valve stem so as to guard against sticking which might cause overflow of the brine tank, one of the common faults found in prior mechanisms.

It will be understood that the O-rings above referred to are made of the usual elastomer material such as natural or synthetic rubber of a composition to desirably resist deterioration from the action of the salt.

While the valve mechanism herein disclosed is primarily adapted for the brine tank of a soft water system, it is to be understood that the mechanism may find other uses as may be apparent to those having the benefit of the present disclosure.

Such changes may be made as fall within the scope of the appended claims without departing from the invention.

What is here claimed is:

1. In unitary valve mechanism for use in a liquid container having a normal upper liquid level for refill and a normal lower liquid level for discharge and adapted to open on suction at the upper liquid level to begin discharge and to close on suction at the lower liquid level to terminate discharge, that improvement, comprising, a valve body having a closed bottom central cavity and a pair of branch conduits including a first branch and a second branch communicating with the central cavity at vertically spaced places therein, a plug in the central cavity, means for sealing said plug therein, a valve stem bore through said plug, a valve stem in the bore, an enlargement on the valve stem, sealing means carried in the upper end of said plug for effecting a seal with said enlargement to prevent passage of fluid through the plug at its upper end during suction, a valve seat at the lower end of the plug, a plug valve carried on the lower end of said valve stem for closing on said valve seat, said first branch communicating with said cavity below said valve seat, a peripheral recess in said plug, said second branch communicating with said recess, a radial port in the plug communicating with said recess, the plug bore above the valve seat being of enlarged diameter to provide communication between the port and the central cavity below said valve seat, a check valve in said first branch, a valve seat for said check valve in said first branch between said check valve and said central cavity, said check valve having a bleed passage for refill liquid therethrough, a bob valve seat in the second branch, a bob valve above said bob valve seat normally responsive to the level of liquid in the container but adapted to close on said bob valve seat to terminate

5

discharge on suction at a relatively low liquid level but while the liquid level is still above said bob valve seat, a strainer enclosing said bob valve, and a float member normally fixed on the upper end of said valve stem and in controlling relation with said plug valve to close said plug valve on its seat when a predetermined upper liquid level is reached while being responsive to suction to open said plug valve to permit discharge and while said bob valve is raised from its seat by the liquid level, and whereby, when the lower liquid level is reached, to effect a seal to prevent passage of air by suction into the central cavity either through said plug upper end or through said second branch.

5

10

6

2. The structure of claim 1 wherein the check valve has an upwardly facing open hollow interior.

3. The structure of claim 1 wherein the strainer has a plurality of narrow slits therein.

References Cited in the file of this patent

UNITED STATES PATENTS

583,736	Eppich	June 1, 1897
2,056,249	Bystricky	Oct. 6, 1936
2,695,626	Riche	Nov. 30, 1954
2,716,422	Whitlock	Aug. 30, 1955
2,778,598	Bolling	Jan. 22, 1957
2,784,733	Martinez	Mar. 12, 1957
2,827,915	Mitchell	Mar. 25, 1958
2,828,763	McKay	Apr. 1, 1958