Fig. 2.

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[Signature]
This invention relates to the construction of jet pump systems operating in conjunction with water softeners to supply brine for reconditioning a softener bed. The process of softening water by the ion-exchange method results in a gradual depletion of the ability of the mass of particles, constituting the softening bed to perform their function. To restore this ability, the bed is periodically regenerated by chemical treatment which renews the desired ionic condition at the surface of the particles. The most common chemical treatment involves the use of a measured quantity of brine drawn from a storage source.

In most current brine-storage devices, the withdrawal of the desired quantity of brine substantially emulates the device. Further action of a withdrawal pump results in pulling air, and delivering it into the softener tank. This injection of air is not only undesirable in the plumbing system, but also tends to oxidize any iron ions in the softening bed, and thereby produce a troublesome precipitate.

Brine-delivery valves controlled by floats that function to shut off before air can be drawn are known in this art. Such an arrangement requires extra equipment, and the present invention provides the same function with a rearrangement and a revised construction of components already present in conventional installations. It is standard practice to withdraw the brine from storage and deliver it into the softener tank by the action of a jet pump. In the present invention, the position and arrangement of the pump components results in the removal of the ability of this device to pump air without impairing its ability to pump liquid brine solution.

The several features of the invention will be analyzed in further detail through a discussion of the particular embodiment illustrated in the accompanying drawings.

In the drawings:

FIGURE 1 presents a perspective view of a water-softener mechanism at the top of a conventional water-softener tank.

FIGURE 2 is a sectional elevation on an enlarged scale on the plane 2—2 of FIGURE 1.

FIGURE 3 is a fragmentary sectional view on the scale of FIGURE 2, showing the action of the jet pump when liquid is not present in the throat of the pump.

The water-softener tank indicated generally at 10 is equipped with a valve mechanism 11 that regulates the flow to and from the tank in the pipes 12 and 13. The functioning of the valve 11 is determined by the timer-controlled mechanism indicated generally at 15 which selectively energizes the motor unit 16 to position the interior structure of the valve 11. This portion of the structure is not shown, and forms no part of the present invention. Suction is applied to the conduit 14 by the jet pump illustrated in FIGURES 2 and 3, with the jet pressure being delivered by the line pressure in the supply pipe 13. The end of this pipe engages the body 17, which includes the chamber 18.

Referring particularly to FIGURE 2, the body 17 has a threaded opening 19 occupied by the plug 20, with a sealing gasket 21 interposed to prevent leakage. The opening 19 provides access for machining the interior threaded bore 22 which receives the nozzle 23. The filter screen 24 is conveniently positioned between the plug 20 and the nozzle 23, and it is obvious that the assembly of this series of components is easily accomplished through the opening 19. Preferably, a screwdriver slot is incorporated in the nozzle 23 as shown at 25 to facilitate the installation of the nozzle. It is also preferable to incorporate the sealing gasket 26 between the nozzle and the body 17 as shown.

The undersurface of the body 17 is exposed to the interior of the tank 10, and a threaded hole 27 is incorporated which receives the throat insert 28, the inside bore 29 of this member functioning as a passage communicating between the chamber 30 and the interior of the tank 10. It should be noted that the diameter of the head 31 of the throat insert is also receivable within the threaded hole 22 for assembly purposes. A screwdriver slot is preferably incorporated at 32 to facilitate installation.

During the process of withdrawing brine through the conduit 14, the presence of water pressure in the chamber 18 will result in delivering a quantity of water pressure to the nozzle 23, and will project a high-velocity stream down through the bore 29. The diameter of the nozzle at the point of ejection indicated at 33 is selected so that the corresponding diameter of the stream occupies a minor portion of the cross-section of the bore 29. FIGURE 2 is drawn approximately to the scale of a satisfactory device, in which the nozzle bore 33 was established by a number 57 drill (.043), and the throat bore 29 by a number 39 (.0995) drill. When the bore 29 is occupied by liquid, the presence of a high-velocity stream from the discharge opening 33 will induce movement of liquid downwardly into the tank 10, thus inducing suction in the chamber 30 and in the brine-supply conduit 14. As the available supply of brine is withdrawn, a point is ultimately reached in which liquid is not supplied from the chamber 30 into the bore 29. There is usually some collection of air underneath the body 17 within the tank 10, and these two conditions result in a complete absence of liquid in the bore 29, except for that being projected by the nozzle. Normally, the bore 29 is oriented in a vertical direction, and the axis of the chamber 30 and the brine conduit 14 are substantially horizontal at this portion of the device.

Under these circumstances, the pumping system assumes a condition similar to that shown in FIGURE 3. The stream 34 does not occupy the full cross-section of the bore 29, and an annular space is left as shown at 35 under which the gas pressure conditions at the top of the tank under the body 17 may communicate with the chamber 30, and consequently with the brine-delivery conduit 14. Since the pressure conditions are thus equalized, the pumping device becomes incapable of establishing a pressure differential which will draw any substantial quantity of air. Under most conditions, the pressure conditions established by the combination of pipes 12 and 13 will result in at least atmospheric pressure being present in the tank, and normally a pressure considerably in excess of that. The presence of such air pressure, backing into the brine-delivery system through the annular space 35 will therefore remove any tendency for the pumping system to communicate the softener with air from the brine-storage device.

The particular embodiments of the present invention which have been illustrated and discussed herein are for illustrative purposes only and are not to be considered as a limitation upon the scope of the appended claims.

In these claims, it is my intent to claim the entire invention disclosed herein, except as I am limited by the prior art.

1. In combination with a water-softener tank having a cover provided with an opening in the normally upper portion thereof, a jet pump for supplying liquid exclusively to said tank comprising:

 means forming a normally vertical passageway communicating with said opening;
a supply conduit communicating with said passageway, and having a normally horizontal portion adjacent the point of communication with said passageway; said nozzle and passageway having a diameter ratio of approximately 43:96; said nozzle being adapted to project a liquid jet into said passageway whereby the presence of liquid in said passageway will produce a tendency for said jet to induce movement of said liquid in said passageway, but the absence of liquid other than said jet in said passageway will cause substantial equalization of gas pressure in said tank and said supply conduit, the bottom of said portion being below the level of the entrance to said passageway;

jet means including a nozzle disposed to direct a stream into said passageway toward said opening, said nozzle being adapted to project a liquid jet into said passageway which occupies a minor portion of the cross-sectional area of said passageway whereby the presence of liquid in said passageway will produce a tendency for said jet to induce movement of said liquid in said passageway, but the absence of liquid other than said jet in said passageway will cause substantial equalization of gas pressure in said tank and said supply conduit.

2. In combination with a water-softener tank having a cover provided with an opening in the normally upper portion thereof, a jet pump for supplying liquid to said tank comprising:

means forming a normally vertical passageway communicating with said opening;

a supply conduit communicating with said passageway, and having a normally horizontal portion adjacent the point of communication with said passageway.