Feb. 3, 1953 E. F. ANDERSON 2,627,503

WATER SOFTENER

Filed Feb. 24, 1948 2 SHEETS—SHEET 1

FIG. 1

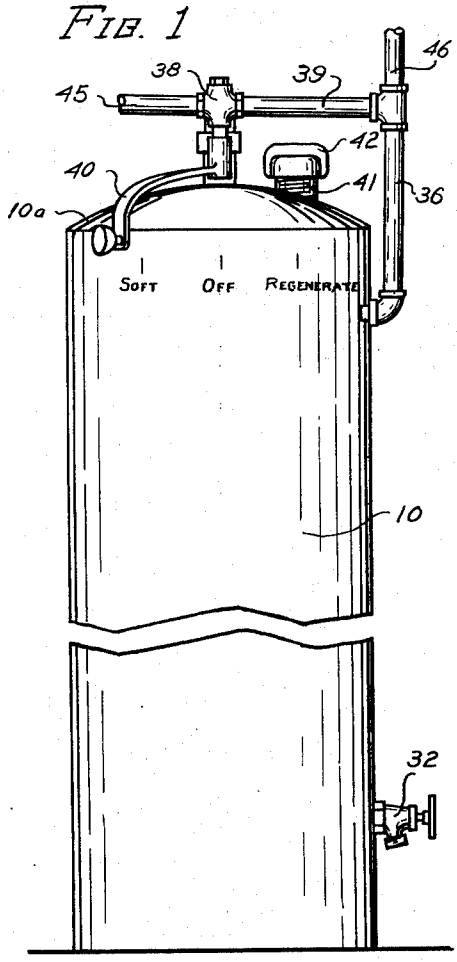


FIG. 2

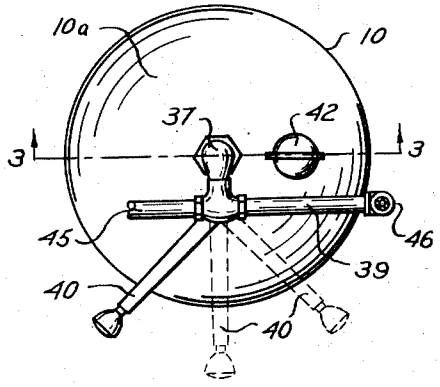
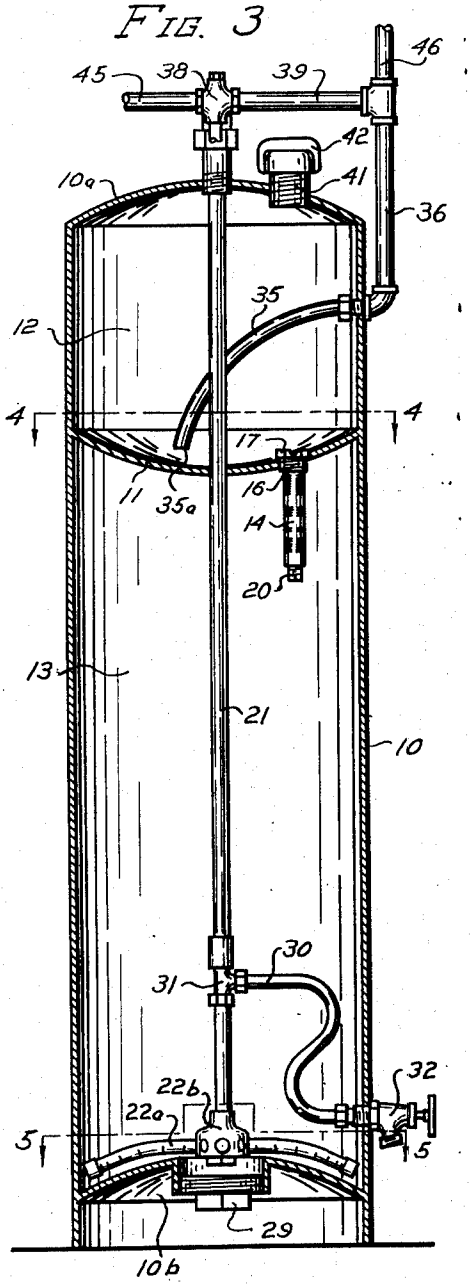


FIG. 3



Inventor:
EDWIN F. ANDERSON
By Philip A. Wallinckrodt and
Philip A. Wallinckrodt.
Attorneys.

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FIG. 6

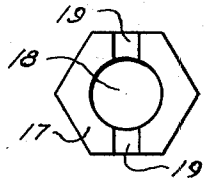


FIG. 4

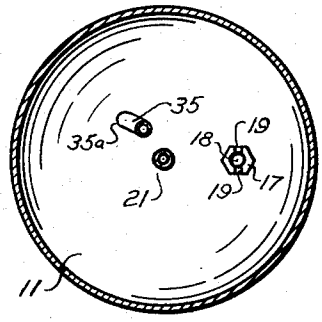


FIG. 5

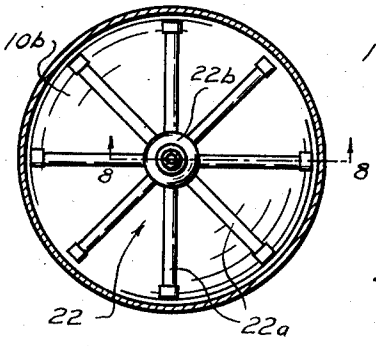


FIG. 7

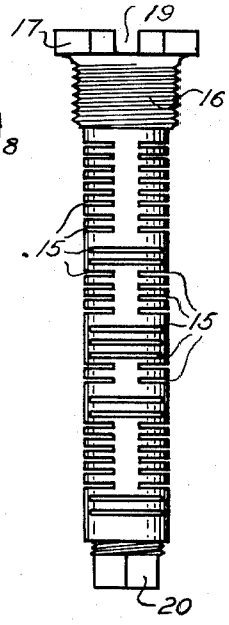


FIG. 8

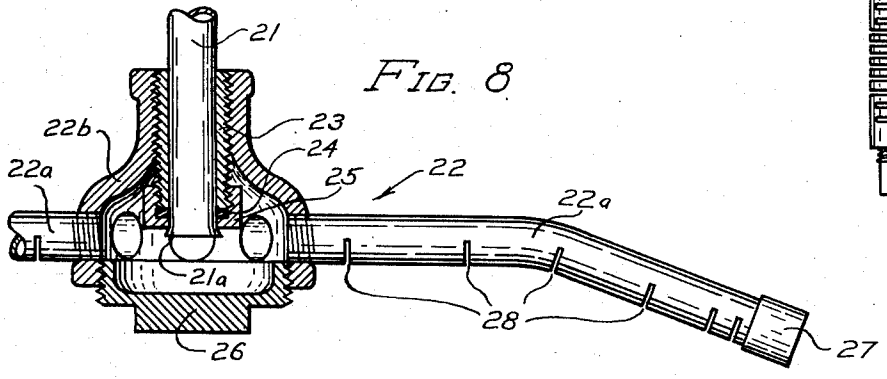
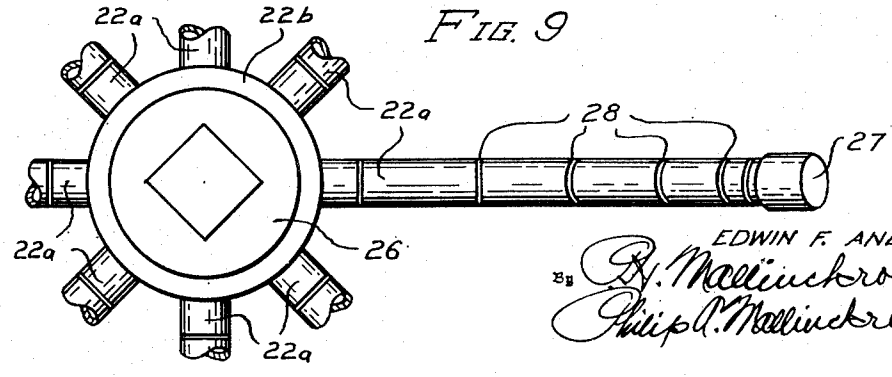


FIG. 9



Inventor:
EDWIN F. ANDERSON
By R. Mallinckrodt and Philip A. Mallinckrodt
Attorneys.

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UNITED STATES PATENT OFFICE

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WATER SOFTENER

Edwin F. Anderson, Salt Lake City, Utah, assignor to Antone D. Elmer and Florence G. Elmer, as joint tenants

Application February 24, 1948, Serial No. 10,259

5 Claims. (Cl. 210—24)

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This invention relates to water softening equipment, and particularly to apparatus of zeolitic type adapted for interposition in plumbing systems to soften water as it is drawn through the system from an outside source of supply.

The use of zeolite is well known in the water softening art, and many different types of apparatus have been developed to exploit its property of exchanging sodium ions for the calcium and magnesium ions of hard water and to take advantage of the relatively quick regeneration possible by the use of common salt brine. Such apparatus has, however, been more expensive and more trouble to operate than has been found generally acceptable for domestic use. The most successful softeners have included two separate tanks arranged side by side, one for the softening agent and one for the regenerative brine solution.

Pursuant to the present invention, I provide a very efficient zeolitic type of water softener which is capable of fabrication in a single tank of unusually low initial cost, and which may be quickly regenerated, and easily, with attendant advantages not found in known apparatus of the type concerned.

Principal objects of the invention are therefore:

To provide a water softener of unusually low cost which can be quickly and easily installed, and which can be inexpensively maintained in good working order;

To provide a water softener embodying facilities whereby the regeneration cycle, including a thorough backwash, i. e., reversing flow in order to cleanse the softening agent, can be accomplished with a minimum of manual effort and attention, and with which normal pressure may be maintained in the service lines during the regenerative process without danger of contamination by brine.

To provide a construction whereby inefficient, costly, cumbersome, and after inaccesible diffusion means, such as sand and gravel beds or baffle plates, are safely eliminated, and wherein therein is no possibility of salt pockets forming, or of undue channeling of the softening agent;

To provide a water softener which may be used as either a downflow softener or an upflow softener by merely reversing the inlet and outlet connections;

To provide a water softener, as above, which is advantageously fabricated as a single tank.

In attaining the above objects I provide preferably a single tank divided into two compartments to form an upper brine chamber and a lower softening chamber, the two chambers being connected to each other by a screen advantageously in the form of a finely slotted brass pipe, which prohibits passage of zeolite upwardly during the softening process, as well as the passage of undissolved salt downwardly during the regenerative interval. Furthermore, I position a flow-diffusing means, preferably in the form of a nozzle having a spider formation, immediately adjacent the bottom of the softening chamber. This eliminates salt pockets which tend to form at the bottom of the tank. I further provide means conducive to form a velocity jet within the brine chamber, such velocity jet means permitting flow therethrough inwardly or outwardly of the chamber, as may be required.

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For upflow purposes the hard water supply is connected directly to the flow-diffusing spider nozzle of the softening chamber, and the soft water service lines of the system are connected to the velocity jet of the brine chamber, it being understood that, except during the regenerative process, no brine or salt is present in such brine chamber.

For downflow purposes, the connections as just described, are reversed. Ordinarily, except where a special process of filtering arises, the upflow method is preferred.

For regenerative purposes the flow-diffusing spider nozzle is connected to the drainage outlet located on the outside of the tank, provision being made for introducing crystallized salt into the brine chamber. During the regenerative process the velocity jet serves to introduce water into the brine chamber in such a manner as to insure maximum agitation of crystallized salt previously introduced, thus producing a brine which flows downwardly through the softening agent prior to discharge by way of the flow-diffusing spider nozzle of the softening chamber. Because of the fact that the brine flow through the apparatus goes directly to drainage, the service lines as well as the softener proper draw from the water supply during the regenerative procedure, thereby insuring an uninterrupted line pressure of hard water during the regenerative interval.

Further objects and features of the invention will become apparent from the following detailed description of the preferred specific embodiment illustrated in the accompanying drawings.

In the drawings:

Fig. 1 represents an elevation, condensed somewhat, vertically, for convenience of illustration;

Fig. 2, a top plan showing the valve control panels in different positions;

Fig. 3, a central, vertical section taken on the line 3—3, Fig. 2;

Fig. 4, a horizontal section taken on the line 4—4 in Fig. 3;

Fig. 5, a horizontal section taken on the line 5—5 in Fig. 3;

Fig. 6, a top plan, drawn to an enlarged scale, of the connection between the brine chamber and softener chamber;

Fig. 7, an elevation corresponding to Fig. 6;

Fig. 8, a fragmentary section taken on the line 8—8, Fig. 5, somewhat enlarged, the view illustrating only the flow diffusing spider nozzle arrangement; and

Fig. 9, a bottom plan of the fragmentary structure of Fig. 8.

Referring to the drawings: the illustrated specific embodiment of the invention comprises a single upright tank 10, sectionalized by the transverse partition or dividing plate 11, Fig. 3, to form an upper brine chamber 12 and a lower softening chamber 13. The plate 11 is advantageously downwardly convex, as illustrated, and imperforate except for screened passage between the two chambers, the latter being accomplished by means of a laterally slotted brass pipe 14 plugged at its lower end and open at its upper end.

The screen 14 is preferably of brass, with a plurality of slits 15 (see especially Fig. 7) cut at closely spaced intervals throughout its length. A threaded shank 16 above the slitted portion of the tube terminates in a head 17 having an opening 18, Fig. 6, leading into the hollow interior of the pipe screen. A cross-cut 19 may be made in the head 17 to provide a recess for receiving a wrench to be used for either inserting or removing screen after salt cap 42 has been removed. A plug 20 is preferably threaded into the lower end of the tube.

The screen 14 is installed in the tank 10 by threading the shank 16 thereof into a correspondingly threaded receiving recess of the partition plate 11, so that the head 17 is within the upper chamber 12 adjacent the floor thereof and the elongate slitted portion or screen extends downwardly into the lower chamber 13.

A standpipe 21 extends through the top 10*a* of the tank and through the partition plate 11, axially of the tank, to a termination short of the tank bottom 10*b*. A flow diffusion spider nozzle 22 provided by the spokes 22*a* radiating outwardly from the hub 22*b*, Fig. 5, is connected to the lower end of the standpipe 21 by a coupling, permitting positioning of the nozzle arrangement immediately adjacent the tank bottom 10*b*, thus eliminating salt pockets.

The tank bottom is advantageously inwardly or upwardly convex as shown, Fig. 3, and the spokes 22*a* of the spider nozzle 22 are curved downwardly in substantial conformity therewith. The coupling between nozzle and standpipe desirably comprises a sleeve 23, Fig. 8, to which the bell-shaped hub 22*b* is threaded, the same being slidably mounted on the lower portion of the standpipe 21 above the outwardly-flared end 21*a* thereof, which serves as a limit stop. A slip nut 24 and gasket 25 make the coupling secure. The bottom of hub 22*b* is closed by a threaded plug 26, so that the interior thereof—into which the inner ends of hollow spokes 22*a* open—acts as a water distributing chamber.

The spokes 22*a* of the spider nozzle 22 are advantageously threaded into respective receiving openings provided in the hub 22*b* and have their outer ends closed by respective caps 27. The undersides of the respective spokes are slit transversely along their lengths to provide nozzle openings 28 directed downwardly toward the bottom 10*b* of the tank.

A removable plug 29 is provided in the bottom of the tank to facilitate coupling of the diffusion nozzle 22 to the standpipe 21, and to afford passage into the lower chamber 13 from the outside, for the initial insertion of the water softening agent, normally zeolite.

The standpipe 21 is connected to drainage intermediate its length or height. For this purpose a length of copper tubing 30 may be appropriately bent to connect a T-fitting 31 of the standpipe with a drain faucet 32 at the exterior of the tank.

To provide a velocity jet in the upper or brine chamber 12, a length of piping 35 is installed within the chamber so that one open end 35*a* thereof is directed toward and spaced closely above the concave bottom of the chamber and so that the other end provides connection outside the tank for external piping 36.

Standpipe 21 carries at its upper end an elbow 37 which makes connection with a three-way valve 38. The latter connects with piping 36 by means of piping 39. A handle 40 enables valve 38 to be manually set to any one of the three positions, the two flow positions and a closed or no-flow position intermediate the two flow positions, as illustrated in Fig. 2.

A normally closed passage for introducing salt into the upper or brine chamber 12 from time to time is provided. For this purpose an externally threaded nipple 41 of suitably wide diameter is threaded through the top 10*a* of the tank, and is provided with a winged screw cap 42.

The apparatus may be used as either an upflow softener or a downflow softener, the former being ordinarily preferred where no unusual filtering problems exist.

For use as an upflow softener the hard water-supply line 45 is connected to the valve 38, and the main service soft-water line 46 is connected to the T-fitting connecting piping 36 and 39. In operation, assuming the lower or softener chamber to be supplied with a suitable quantity of zeolite or equivalent softening agent, the drain faucet 32 to be closed, and the valve handle 40 set so that valve 38 permits flow from water-supply line 45 into standpipe 21, but not into piping 39, whenever water is drawn from a service line of the system, hard water from the water supply line 45 will flow down standpipe 21 and into the softening chamber 13 by way of the flow-diffusing spider nozzle 22, whence it will flow upwardly and through the brass pipe screen 14 into upper chamber 12 and out through jet orifice 35*a* and piping 35 and 36 into the main soft water supply line 46. The hard water delivered by spider nozzle 22 forcefully against bottom 10*b* of the tank will percolate upwardly through the bed of softening chemical without channeling, and will lose calcium and magnesium ions in the process.

When time for regeneration of the compound arrives, as determined by hard rather than soft water being drawn from the service lines, handle 40 of control valve 38 is moved to "Off" position and drain valve 32 is opened somewhat. Cap 42 is then removed from the salt-supply passage 41, and enough water allowed to drain from the tank to permit insertion of the requisite quantity of preferably rock salt pursuant to customary regenerative practice. Then the salt cap

is replaced and with drain valve **32** partially open, handle **40** of control valve **33** is moved to "Regenerate" position, whereupon water from supply line **45** will flow through piping **39**, **36**, and **35**, and discharge as a velocity jet within upper chamber **12**. By its force the velocity jet will agitate the contents of the chamber **12**, producing a brine which flows down through the brass screen pipe **14** and so through the bed of softening compound and out of the apparatus by way of spider nozzle **22**, the lower portion of standpipe **21**, drain piping **30**, and drain valve or faucet **32**.

Approximately 45 to 60 minutes of the above-described regenerative back-flow through the apparatus will accomplish complete regeneration and thorough flushing of both softening compound and tank. Drainage valve **32** is then shut off and handle **40** of control valve **38** moved to "Soft Water" position.

It should be noted that during practically the entire regenerative procedure, hard water uncontaminated by brine may be drawn from the service lines, the flow being direct from water supply line **45** to main service line **46** by way of the interconnecting piping **39**.

The apparatus may be used as a down-flow softener by introducing hard water supply through pipe **46** and by connecting soft-water service lines to pipe **45**. Regeneration is then accomplished by merely inserting salt at the appropriate time in accordance with the procedure outlined above. Also when used as a downflow softener, hard water uncontaminated by brine may be drawn from the service lines during the regenerative interval.

It is to be noted that any tendency of the diffusing spider nozzle, the tubular screen grid, or the velocity jet to clog is greatly minimized, if not completely eliminated, because of the fact that the direction of flow through these members is reversed at each regeneration, thereby washing any accumulation of foreign matter away to drainage, either by the softener proper or through the service lines.

Whereas a preferred form of this invention is herein illustrated and described, it should be understood that various changes may be made therein and various other forms may be constructed without departing from the scope of the following claims.

What is claimed is:

1. A water softener, comprising two closed tank chambers disposed one above the other, the lower serving to contain the softening agent, and the upper serving to supply a regenerative brine solution; a screened passage establishing liquid flow communication between the two chambers; a conduit extending into the lower part of the lower chamber from the exterior of the softener; flow diffusing spider nozzle at the interior end of said conduit, said conduit being in the form of a valved standpipe extending axially through both chambers to a termination short of the bottom of the lower chamber, and connecting with the spider nozzle centrally thereof; a valved drainage pipe leading to the exterior of the softener from a connection with said standpipe above said spider nozzle; a second conduit extending into the upper chamber from the exterior of the softener; an opening into the lower chamber from the exterior of the softener, for the introduction of a softening agent; means normally closing said opening; an opening into the upper chamber from the exterior of the softener for permitting the introduction of a regenerative salt into said chamber from time to time; and means normally closing said opening.

2. The combination recited in claim 1, wherein there is a three-way valve at the upper end of the standpipe, being adapted for connection with water supply and with the main service line, and wherein the second conduit is adapted for connection with the main service line, and has its inner end directed against the bottom of the upper chamber as a velocity jet.

3. The combination recited in claim 2, wherein a tubular screen fitting, which depends into the lower chamber, provides the screened passage between the two chambers.

4. The combination recited in claim 3, wherein the spider nozzle is affixed to the standpipe by means of a slip-nut connection providing close placement of the nozzle members with respect to the bottom of the tank, and wherein a removable plug in the bottom of the tank affords access to said slip-nut connection and provides for the introduction of the water-softening agent.

5. A water softener, comprising a single tank partitioned transversely of its height to provide a lower zeolite chamber and an upper brine chamber; a standpipe extending through the top of the tank and through the two chambers axially thereof to a termination inside, but adjacent the bottom of, the tank; a water-supply connection at the upper end of said standpipe; a flow-diffusing spider connected with the lower end of said standpipe and having its discharge directed downwardly; a valved drainage pipe connected with said standpipe intermediate its height; an' elongate tubular screen extending down into the lower chamber from the upper chamber through the partition between the two; a pipe extending into the upper chamber from the exterior thereof, said pipe having its inner end open, directed toward the bottom of said upper chamber, and spaced closely relative to said bottom as a jet orifice, said pipe having service-line connection outwardly of the tank; piping establishing communication between said water-supply connection of the standpipe and said service-line connection of the jet pipe; valve means controlling flow between water supply and standpipe, and between water supply and service line; an opening leading from the outside into said brine chamber for the introduction of salt thereinto from time to time for regenerative purposes; and means normally closing said opening.

EDWIN F. ANDERSON.

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