Dec. 26, 1933. J. A. W. MADSEN 1,940,720

WATER SOFTENER

Filed March 16, 1931 2 Sheets-Sheet 1

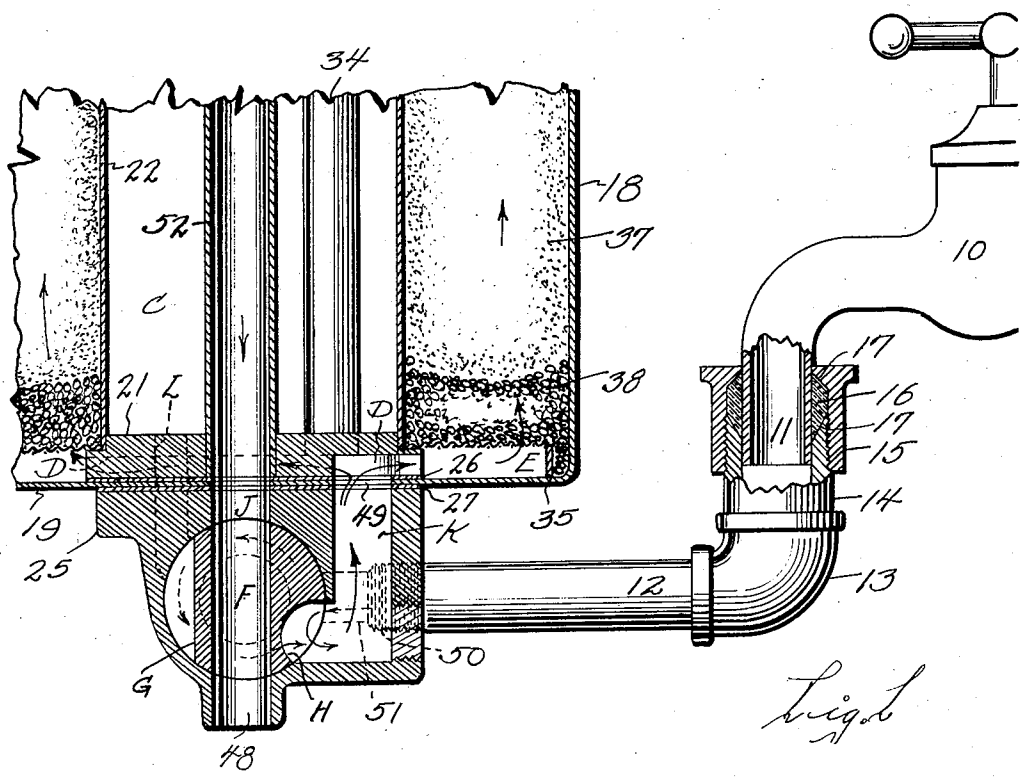

Fig. 1

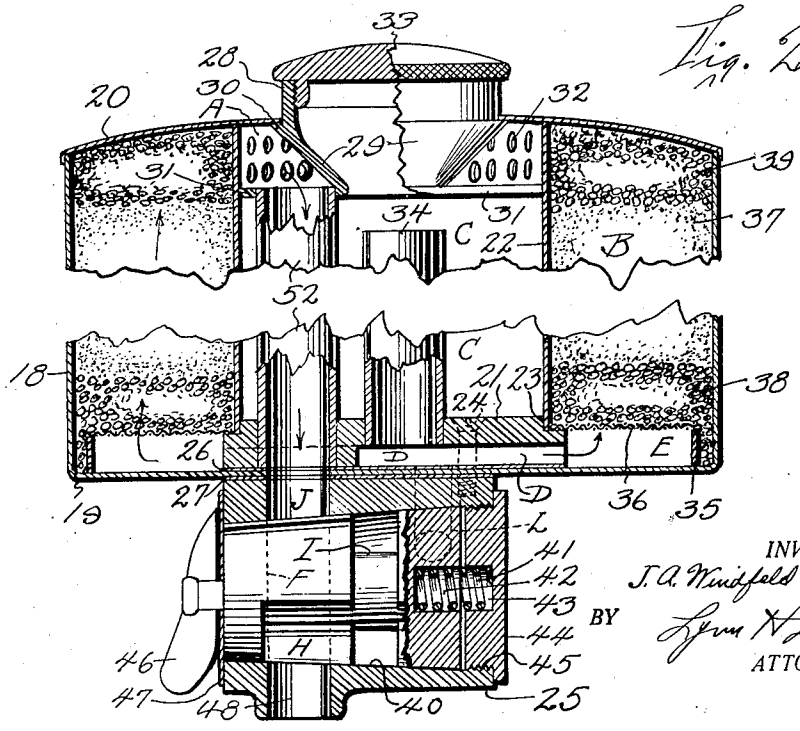

Fig. 2

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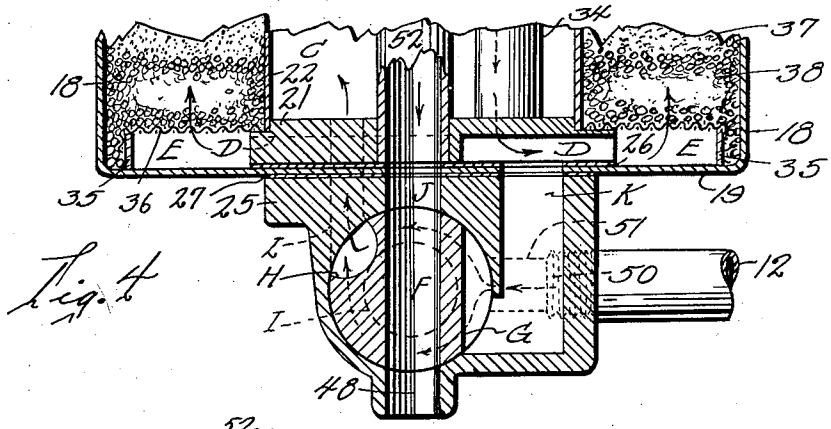

Fig. 4

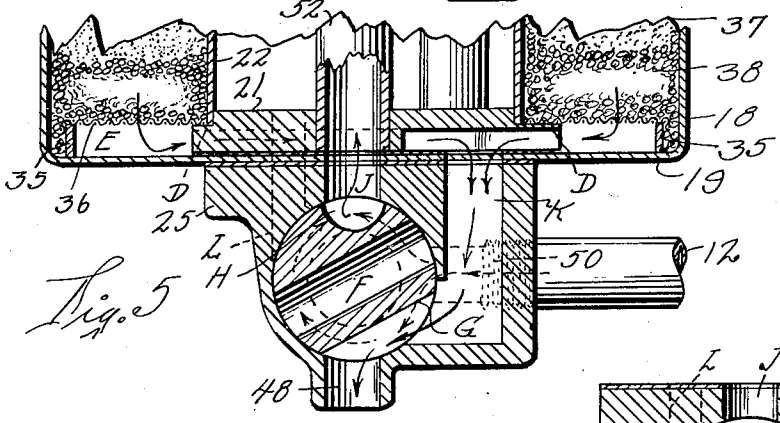

Fig. 5

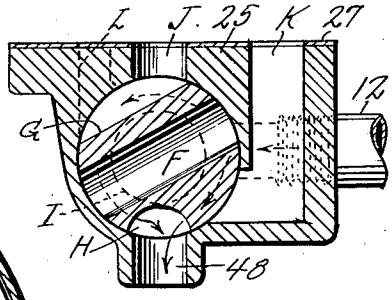

Fig. 6

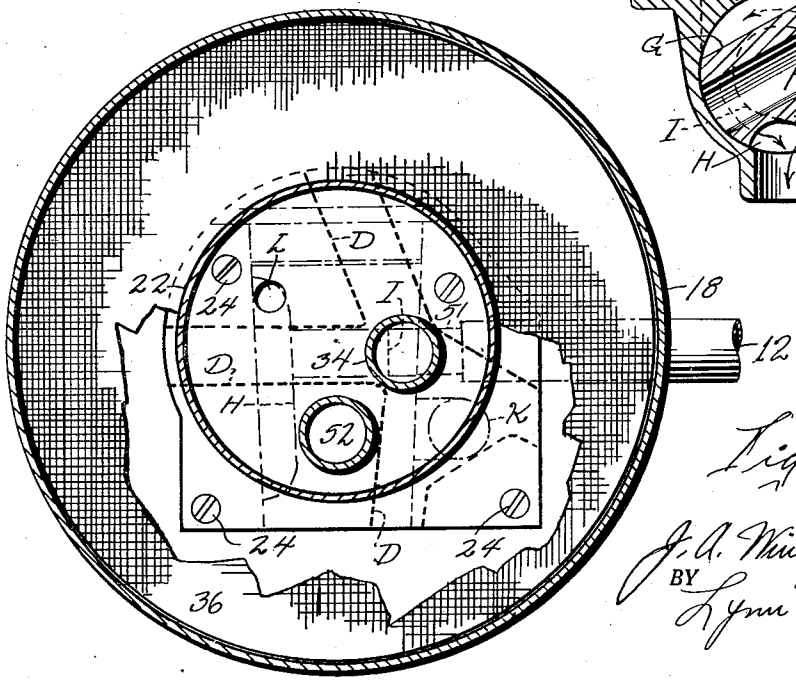

Fig. 3

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UNITED STATES PATENT OFFICE

1,940,720

WATER SOFTENER

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Application March 16, 1931. Serial No. 523,023

15 Claims. (Cl. 210—24)

My invention relates to water softeners and has for its object to provide a small water softening unit in combination with an ordinary water outlet such as a single faucet.

An object of the invention is to provide a softening unit which is of simple, durable, and inexpensive construction, and yet which may be constructed of relatively light material without being subject to the danger of rupture from the pressure of water flowing through it.

To this end, my invention comprises, in combination with a water outlet, a softening unit attached to the outlet, and a valve associated with the water outlet and the softening unit in such a position that it serves to regulate the flow of water into the softening unit but cannot restrict the flow of water out of the softening unit.

One element of my invention in this respect is the provision of a softening unit which in itself embodies a discharge nozzle or discharge port which appropriates the function of the water outlet in delivering water to a dish-pan, wash-basin, or the like.

Another element having an important bearing on this phase of the invention is the provision of a discharge port or nozzle having greater cross-sectional area than that of the inlet port in the casing of the softening unit. By combining this feature with an arrangement wherein the valve which controls the flow of water through the softening unit is located between the water outlet and the casing portion of the softening unit, i. e., located so as to act against the flowing water before the latter reaches the softener casing, it is possible to insure that very little pressure will be built up within the softener casing.

In order to build an inexpensive water softener having sufficient capacity, it is highly advantageous that it be constructed of relatively light, rust-resisting sheet material of the type which can easily be drawn in a press to considerable depth. Furthermore, it is quite desirable to reduce the weight of a softener of the type which is supported by a water outlet, in order that there may be no danger of the unit sagging or breaking any of its connections by which it is supported.

My invention further has for its object to provide, in combination with the features above mentioned, an arrangement embodying a softening unit having a softening mineral chamber and a salt regeneration chamber, together with a valve which may direct the water through the softening unit in any of the several paths necessary for causing soft water to flow from the discharge port of the unit, for regeneration of the softening mineral, and for back-washing or cleansing the softening mineral of excess brine after regeneration is complete. In this phase of the invention, the valve which controls the flow is arranged so that in any of its several positions wherein it admits water to the softening unit casing, it is so arranged as to give a greater freedom of flow of the water from the casing than into the casing. In any position in which the valve could restrict the water from the casing, it will also equally or to a greater extent restrict the flow of water into the casing.

Another element of the present invention is the arrangement of the various passage-ways in the softening unit so that there will be a constant flow of water from the discharge nozzle of the unit and so that the softening operation, the regeneration operation, or the back-wash operation (for cleansing the mineral after regeneration) can any of them be accomplished by a continuous flow of water through the softener and out of the discharge nozzle.

Another object of the invention is to provide a softening unit which can be very easily recharged with regeneration salt.

Another object of the invention is to provide a softener having the foregoing functions embodied in a very compact unit.

With these and other objects in view, my invention consists in the construction, arrangement, and combination of the various parts of my device, whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims, and illustrated in the accompanying drawings, in which:

Figure 1 is a vertical, sectional view through a portion of the softener, the faucet and the connecting pipe being shown partly in elevation and partly in section,

Figure 2 is a vertical, sectional view through upper and lower portions of the softener, a portion of the cover and associated parts being shown in elevation,

Figure 3 is a horizontal, sectional view through the softener, portions of the bottom screen being broken away and the mineral being removed to better show the construction,

Figure 4 is a sectional view similar to Figure 1, showing the valve in position for regeneration,

Figure 5 is a similar view showing the valve in back-wash position, and

Figure 6 is a sectional view of the valve in position for delivering hard water.

In Figure 1, I have used the reference character 10 to indicate an ordinary faucet having

the downwardly extending discharge nozzle 11.

The water softener of my invention is supported upon a connecting pipe 12 which is connected by means of an elbow 13 to a short pipe section 14. The pipe section 14 in turn is attached to the nozzle 11 by means of a packing nut 15 and a packing ring 16 of soft metal.

The nut 15 and pipe section 14 are reamed out conically as at 17 to exert inward pressure against the ring 16 so that when the nut 15 is screwed down tight, the ring 16 will be pressed tightly against the nozzle 11 for the double purpose of closing the joint against any possible water leak and also providing sufficient friction to support the pipe 12 and the weight of the water softener upon the faucet nozzle.

Referring now to Figure 2, the softening unit comprises generally a cylindrical, outer casing having the side wall 18, the bottom wall 19, and the cover or top wall 20. The latter is attached after the interior mechanism has been assembled, and is preferably brazed, rolled, or lap-welded in place.

The member 21, which will hereinafter be referred to as a distribution plate, serves both to provide a number of channels for the circulation of water through the softener and as a base or support for the inner cylindrical wall 22, secured to the distribution plate 21 by welding or soldering against the shoulder 23 formed on the plate. To this end, the plate is provided with an upwardly protruding circular portion of less diameter than the plate proper.

The plate proper is in plan, shaped substantially as shown in Figure 3, and is secured by means of screws 24 to the bottom of the casing. The screws 24 are extended through the bottom of the casing and are threaded into the valve housing 25. (See Figure 2.)

Gaskets 26 and 27 of any suitable gasket material are received between the plate 21, the valve housing 25, and the upper and lower faces of the bottom wall 19 of the casing.

The upper edge of the inner wall 22 simply rests against the lower face of the top wall 20, since there is necessity for making a liquid-tight joint therebetween.

The filling neck 28 is formed integrally with a conical throat member 29 which terminates in a shoulder 30 against which the top wall 20 is brazed, rolled, or welded. The throat member 29 terminates in an outwardly flaring flange 31 which is ring-shaped, and which rests in substantial contact around its entire periphery with the inner surface of the wall 22.

Between the throat member 29, the flange 31, and the portion of the wall 22, there is formed a concentration chamber A which communicates with the softening mineral chamber B by a series of perforations 32 in the upper portion of an inner wall 22.

A cap 33 is threadedly associated with the neck 28, and serves to close the salt chamber C with which the neck 28 communicates.

The throat 29, being funnel-shaped, serves to direct the stream of salt during recharging to the center of the salt chamber C so that the salt will not enter the overflow pipe 34 which is mounted within the chamber C. The upper end of the pipe 34 is positioned beneath the flange 31 and is covered thereby against the admission of salt from the neck 28.

The overflow pipe 34 at its lower end is secured in the plate 21 and supported thereby. The lower end of the overflow passage thus formed communicates with a series of distribution passages D which radiate from the overflow passage to the periphery of the plate 21.

A distribution space E is formed between the edge of the plate 21, a ring 25 positioned close to the side wall 18, and a screen 36 which is supported upon the ring 36 and the outer portion of the plate 21.

Above the space E, the mineral chamber B is filled with mineral 37 of any approved material, such as, sodium aluminum silicate, layers of coarse sand or gravel 38 and 39 separating the mineral from the screen 36 at the bottom and from the perforated wall 22 at the top.

The valve element is shown partly in side elevation in Figure 2. The valve element is generally conical-shape and is mounted in a conical valve seat or bore 40 in the valve housing 25. A compression spring 41 is mounted in a cavity 42 in the valve element and in a cavity 43 in the valve cap 44 which is threaded as at 45 into the housing 25.

The spring 41 urges the valve element snugly against the valve seat 40 and keeps it tight.

To the smaller end of the valve is secured a combined handle and pointer 46, by means of which the valve may be rotated to any of its four positions as will be indicated on the scale 47. Since pointers and scales for determining the position for rotary valves are quite common, the face of the scale and the markings thereon have not been illustrated in the accompanying drawings but it will be understood that the markings on the scale will permit the valve to be accurately set at any one of its four several positions.

The valve element is provided with a diametrical port F, a chordial port G which is co-extensive with the port F in a direction longitudinal of the valve element, with a longitudinal port H, and with an annular peripheral port I communicating with the longitudinal port H.

The longitudinal port H terminates in the common plane of the outer extremities of the ports F and G in a direction longitudinal of the valve.

The valve housing 25 is provided with a port J positioned to register with the ports F, and H, with a discharge port 48 aligned with the port J, a distribution port K communicating at its upper end with the distribution passages D through opening 49 in the gaskets 26 and 27 in the bottom wall 19, and communicating at its lower end with the valve bore 40 as shown in Figure 1. The port K is positioned in the common plane of the ports F and G whereby either the ports F, G, or H may communicate with the port K.

The connecting pipe 12 is threaded as at 50 into the valve housing 25, and there communicates with a port 51 in the housing 25. The port 51 is in constant communication with the annular port I of the valve element.

A salt chamber port L is formed in the valve housing 25 behind the plane of the annular port I and extends through the gasket 27 and 26 in the bottom 19 and thence through the distribution plate to the salt chamber.

A return pipe 52 is secured at its upper end in the flange 31 and at its lower end in the plane 21 and provides a return passage communicating with the port J in the valve housing 25.

Before proceeding to a detailed description of the various positions of the valves and of the distribution of water through the various channels of the water softener, it may be noted briefly

that water from the connecting pipe 12 flows into the annular port I of the valve element and from thence through the longitudinal port H to the various ports with which the latter communicates, namely, J, K, L, and 48.

Turning now to Figure 1, in which the most common position of the valve is shown, I will describe in detail the operation of the device in

Delivering soft water

Assuming the valve to have been set in position as shown in Figure 1, the faucet 10 may then be opened and water will flow through the connecting pipe 12 and the inlet port 51 into the annular port I of the valve element. Passing around the annular port I, the water will flow through the longitudinal port H to the distribution port K through which it will ascend to the distribution passages D. From the distribution passages D, the water will be distributed in all directions into the distribution space E from which it will rise through the screen 36, through the layer 38 of the gravel, through the body of mineral 37, and through the layer 39 of gravel to the openings 32 in the inner wall 22.

While passing through the mineral, the water will be softened, the mineral absorbing from the water the calcium and other compounds which ordinarily make the water hard. This chemical reaction is well known in the water softening art and need not be gone into in detail herein.

The water thence passes into the concentration chamber A and flows around the exterior of the throat 29 to the return pipe 52 through which it will pass downwardly to the return port J and thence through the valve port F and the discharge port 48 to the exterior of the softener.

It may be noted that the arrangement is such that the discharge port 48 is directed downwardly. This is the handiest position for ordinary use since it allows the water to be discharged downwardly into a dishpan, wash-basin, or the like.

It may also be noted at this point that the connection with the faucet 10 is such as to allow adjustment of the softener around the axis of the nozzle 11 to the most convenient position relative to the sink or lavatory with which the device is associated.

After the softening mineral has become loaded with the minerals from the water, it is necessary, in order to return it to its original condition, to go through the process of

Regeneration

The position of the valve for regeneration is shown in Figure 4. By simply turning the valve to the regeneration position, and thence allowing water from the faucet to flow through the softening unit, regeneration is accomplished. To this end, the water flows first through the inlet port 51 into the annular port I thence around the annular port I to the longitudinal port H thence upwardly through the salt chamber port L thence upwardly through the salt in the salt chamber thence downwardly through the overflow pipe 34 in the form of a brine solution thence outwardly through the distribution passages D and into the space E thence upwardly through the screen 36 and through the mineral 37 thence through the opening 32 into the concentration chamber A thence downwardly through the return pipe 52, the return port J, the valve port F, and the discharge port 48.

It is to be noted that this position of the valve is diametrically opposite to the soft water position.

The brine solution interacts with the softening mineral in a manner which is well understood in the water softening art, returning the mineral to its original form and carrying away the minerals which were taken out of the water during the softening process.

After regeneration is complete, it is necessary that all traces of the brine solution be washed out of the softening mineral, before the apparatus is ready again for use. This operation is known as

Back-washing

The position of the valve for the back-washing operation is shown in Figure 5. In this operation, water is again taken from the faucet through the pipe 12 and the inlet port 51 into the annular port I of the valve element. The water thence flows through the longitudinal port H directly into the return port J and passes this time upwardly through the return pipe 52 to create a flow of water through the softener in an opposite direction to the normal flow.

From the upper end of the return pipe 52 the water flows out through the openings 32 into the softening mineral and thence downwardly through the mineral and through the screen 36 to the space E.

In thus flowing downwardly, the water will not carry any of the mineral away with it because of the layer of coarse sand or gravel 38 which protects the mineral body from below. The layer of gravel also serves to protect the screen against clogging, since there is a tendency for the mineral to coagulate, whereas the gravel, which is in the form of insoluble particles of generally spherical shape, remains perfectly loose and porous at all times and will not clog the screen.

It may be noted at this point also that the gravel at the top of the outer chamber B serves to prevent the mineral being washed through the openings 32.

From the space E the back-wash current flows through the distribution passages D to the distribution port K and thence downwardly through the port K, the chordial port G, and the discharge port 48.

Thus the water circulates but once through the device and the last vestiges of the salt solution are carried out through the discharge nozzle by a fresh stream of water.

The device is then ready for use again for producing soft water, or if desired, by simply turning the valve to a fourth position, may be regulated so that the discharge port 48 will deliver

Hard water

The hard water position is shown in Figure 6, and comprises simply the by-passing of the water from the pipe 12 through the inlet port 51, the annular port I, the longitudinal port H, and the discharge port 48. Since there is no circulation through the softener, the valve only is shown in Figure 6.

Adjustment of the tension in the valve element may be made by rotating the cap 44 to increase or decrease pressure on the spring 41.

In view of the fact that in each of the several positions of the water softener the water has free passage from the connecting pipe 12 to the return port 48, there will be no pressure exerted against the interior of the walls of the softener

except what small pressure is produced by the resistance of the mineral and the various passages within the softener to the flow of water.

Consequently, the softener may be built of relatively thin sheet material, and may be thus produced in a fairly inexpensive manner.

The arrangement is such that during the softening operation, the water travels upwardly through the outer chamber B. The water is distributed to the chamber B through substantially its entire cross-sectional area at the bottom, and as a consequence thereof, the water as it passes through the chamber B is dispersed uniformly through the body of the mineral. This is due to the natural law that water seeks its own level and creates an added efficiency over the passing of the water downwardly. Should the softening operation occur while the water was traveling downwardly, there would be a tendency for the stream of water to flow downwardly against the inner wall 22 as rapidly as it could descend through the mineral and there would not be a uniform distribution of the water through the mineral, especially where the water is allowed to flow rather slowly from the faucet.

The construction of the neck 28, the throat 29, flange 31, inner and outer cylindrical walls 22 and 18, and cover or top wall 20, is such as to render the assembling operation quite simple. The salt chamber is placed in the center of the device, thus leaving a majority of the space within the softener for the mineral, and the neck is thus made co-axial with the casing of the softener, facilitating the construction of the device.

The valve assembly is quite simple, and the distribution plate serves not only as a means for providing water passages but also as a clamp or hold-down plate to secure the bottom of the casing to the valve housing. This insures a very substantial and rigid construction which will not easily get out of order.

The discharge passages including the return pipe 52, the return port J, the diametrical port F and the discharge port 48, are all slightly larger than the inlet port 51, in order to relieve pressure within the softener.

A very cheap form of the softener can be constructed without the employment of a softener valve. In this case, the faucet 10 will serve as the sole means of control of water flowing through the softener, and regeneration would have to be accomplished by adding salt on top of the mineral during each regeneration operation.

Where the softening unit valve is employed, it is possible to eliminate the faucet 10 and to connect the softener directly to a water outlet pipe devoid of any valve. The softener valve then must serve not only as a means for directing the course of the water through the softener but also as a cut-off valve. Referring to Figure 1, if it be assumed that the pipe 12 is the end of a water outlet pipe, it will be seen that by turning the valve element to a position wherein the longitudinal passage H is closed against the semi-cylindrical wall portion of the valve housing lying between the discharge port 28 and the salt chamber passage L, that the flow of water into any of the various passage-ways communicating with the interior of the softening unit casing is cut-off. This position can be reached by turning the valve in a clockwise direction through approximately 45° from the position shown in Figure 6.

As soon however, as the valve is turned to any of the positions wherein water is allowed to enter the softener, it will also provide a passage to the discharge nozzle which will be equal to or greater than the inlet passage in area.

Thus the softener valve serves not only as a means for guiding the flow of water through the softener but also may be used as a cut-off valve if so desired, and will be so used where it is employed in an installation omitting the faucet 10, the arrangement being such that it never restricts the flow of water from the unit.

It will be understood that it is not entirely essential, in order to secure the beneficial results of my invention, that the discharge port be of greater area than the inlet port. The essence of the invention is the provision of an arrangement wherein there can be no cutting off of the discharge port while the inlet port is open. The provision of a discharge port of the same size, or even slightly smaller than the inlet port would, to a greater or less degree, secure the result, inasmuch as it would be impossible for the full pressure of the head of water in the water distribution system to be built up within the softener. The increasing of the diameter of the discharge port partially compensates for whatever pressure will be built up within the softener by the resistance of the softener to the flow of water therethrough or, to state it in a different manner, the internal resistance of the softener, which is composed of the several resistances of the various passages within the softener and the mineral, can be reduced by enlarging some of those passages, and particularly by enlarging those passages through which the water must escape from the softener.

Some changes may be made in the construction and arrangement of the parts of my invention without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims any modified forms of structure or use of mechanical equivalents, which may be reasonably included within their scope.

I claim as my invention:

1. In combination with an outlet of a water distribution system, a water softener attached to said outlet and comprising a casing providing in its interior a softening mineral chamber and a regeneration salt chamber and having inlet and discharge ports and a plurality of passages, and a valve having four positions in one of which positions it connects the passages so that water entering the softener through the inlet port will pass through the softening mineral and thence be discharged through the discharge port, said valve in another position serving to connect the passages so that water will flow through the salt chamber and from thence through the softening mineral and thence be discharged through the discharge port, said valve in another position serving to connect the passages so that water will flow in a direction reverse to its normal flow through the softening mineral and thence be discharged through the discharge port, and in its fourth position serving to by-pass hard water from the inlet port to the discharge port without passing through either the salt chamber or the mineral chamber, the arrangement being such that in each of its four positions, the valve will allow a free channel for the passage of water from the inlet port to the discharge port.

2. In a softener, a casing providing in its interior a softening mineral chamber, a valve positioned near the bottom of the casing, a screen spaced from the bottom of the casing to provide a distribution space communicating with the

valve, a return pipe communicating at its lower end with the valve and at its upper end with the mineral chamber, a perforated wall separating the return pipe from the mineral chamber, the softener including inlet and discharge ports associated with the valve so that water from the inlet port may first enter the distribution space and thence pass upwardly through the mineral and return through the return pipe to the discharge port.

3. In a water softener, a casing including a bottom wall and providing in its interior a mineral chamber and a regeneration salt chamber, a valve housing secured beneath the bottom wall of the casing, a distribution plate secured above the bottom wall of the casing and substantially registering with the valve housing, the valve housing being provided with an inlet port, an outlet port, a valve chamber, a salt chamber passage extending through the bottom of the casing and through the distribution plate and communicating with the salt chamber, with a return port extending through the bottom of the casing, and with a distribution port extending through the bottom wall of the casing, the distribution plate being provided with a distribution passage communicating with said distribution port with the mineral chamber, and with the salt chamber, the softener being provided with a return passage communicating with said return port, and a valve element seated in the valve chamber and movable to any of several positions in one of which it serves to allow the passage of water from the inlet port to the distribution passage thence through the mineral chamber and through the return passage and through the valve housing to the discharge port, and in another of which it serves to allow the passage of water from the inlet port to the salt chamber passage thence through the salt chamber and the distribution passage to the mineral chamber thence through the mineral chamber and the return passage back to the valve, and thence through the valve to the discharge port.

4. In a water softener, a casing, an inner wall spaced from the side wall of the casing to provide between it and the casing wall a mineral chamber and within it a regenerating salt chamber, a screen spaced from the bottom of the casing to provide a distribution space, the upper portion of the inner wall being perforated, a top wall covering the mineral chamber and provided with an opening to give access to the salt chamber, means separating the space communicating with said perforations from the salt chamber and from said opening to provide a concentration space, a return pipe communicating with said means and with said concentration space at its upper end, and at its lower end, communicating with the exterior of the casing, and an overflow tube within the salt chamber communicating therewith at its upper end and communicating with the distribution space at its lower end.

5. In a water softener, a casing, an inner wall spaced from the side wall of the casing to provide between it and the casing wall a mineral chamber and within it a regenerating salt chamber, a screen spaced from the bottom of the casing to provide a distribution space, the upper portion of the inner wall being perforated, a top wall covering the mineral chamber and provided with an opening to give access to the salt chamber, means separating the space communicating with said perforations from the salt chamber and from said opening to provide a concentration space, a return pipe communicating with said means and with said concentration space at its upper end, and at its lower end communicating with the exterior of the casing.

6. In a water softener, a casing, an inner wall spaced from the side wall of the casing to provide between it and the casing wall a mineral chamber and within it a regenerating salt chamber, a screen spaced from the bottom of the casing to provide a distribution space, the upper portion of the inner wall being perforated, a top wall covering the mineral chamber and provided with an opening to give access to the salt chamber, means separating the space communicating with said perforations from the salt chamber and from said opening to provide a concentration space, a return pipe communicating with said means and with said concentration space at its upper end, and at its lower end communicating with the exterior of the casing, an overflow tube within the salt chamber communicating therewith at its upper end and communicating with the distribution space at its lower end, and a valve provided with inlet and discharge ports and communicating with the distribution space, the overflow tube, and the return pipe.

7. In a water softener, a casing including a top wall, an outer wall, and an inner wall spaced from the outer wall to provide an inner regeneration salt chamber and an outer softening mineral chamber outside of said salt chamber, the inner wall engaging the upper wall at its upper edge, and being perforated near said upper edge, the softener being provided with a distribution passage communicating with the lower extremity of the mineral chamber and with a return pipe communicating at its upper end with the space inclosed by said perforated wall portion, and a member serving to separate said space from the salt chamber.

8. In a water softener, a casing including a top wall, an outer wall, and an inner wall spaced from the outer wall to provide an inner regeneration salt chamber and an outer softening mineral chamber outside of said salt chamber, the inner wall engaging the upper wall at its upper edge, and being perforated near said upper edge, the softener being provided with a distribution passage communicating with the lower extremity of the mineral chamber and with a return pipe communicating at its upper end with the space inclosed by said perforated wall portion, and a member serving to separate said space from the salt chamber, said separating member embodying a throat portion in a filling neck extending through the top and providing means for access to the salt chamber for filling the same.

9. In a water softener, a casing, a cylindrical inner wall mounted within the casing and serving to form therewith an inner salt regeneration chamber and an outer mineral chamber outside of said salt chamber, a top wall secured to the casing and to the inner wall and serving to close the upper extremity of the mineral chamber, a conical throat member in the salt chamber provided with a filling neck extending through the top wall, and with an annular flange at its lower extremity, the periphery of which is engaged with the inner surface of the inner wall.

10. In a water softener, a casing providing in its interior a mineral chamber and a regenerating salt chamber, a valve housing provided with a valve chamber to receive a rotatable valve element, with an inlet port, an outlet port, a return port diametrically aligned with the inlet

port, a distribution port, and a salt chamber port, all of said ports communicating with the valve chamber, the distribution port, outlet port, and return port being positioned substantially in the same plane transverse to the valve chamber axis, the softener being provided with a distribution passage communicating with the distribution port and with the mineral chamber, and with a return passage communicating with the mineral chamber at a point remote from said distribution port and at its other end with the return port, and a valve element rotatably mounted in the valve chamber, provided with an annular port communicating with the inlet port, with a longitudinal port communicating with the annular port, and extending so as to communicate with either the outlet port, the salt chamber port, or the return port, and with a chordial port adapted to communicate with the discharge port and with the distribution port.

11. In a water softener, a casing including a bottom wall, a distribution plate secured to the bottom wall, an inner wall secured at its lower end to the distribution plate, said inner wall being tubular and forming together with the casing a mineral chamber and within its interior a salt chamber, and a screen encircling the inner wall and resting upon the distribution plate, being thereby spaced from the bottom wall to provide a distribution space.

12. In a water softener, a casing including a bottom wall, a distribution plate secured to the bottom wall, an inner wall secured at its lower end to the distribution plate, said inner wall being tubular and forming together with the casing a mineral chamber and within its interior a salt chamber, a screen encircling the inner wall and resting upon the distribution plate, being thereby spaced from the bottom wall to provide a distribution space, and a valve secured beneath the bottom of the casing and communicating with the distribution plate through said bottom wall.

13. In a water softener, means for attaching the softener to a household faucet, a casing, an inner wall spaced from the side wall of the casing to provide between it and the casing wall a mineral chamber and within it a regenerating salt chamber, and valved means for controlling the flow of water from the faucet either from the faucet directly to the salt chamber and thence downwardly through the mineral chamber and thence out of the casing, or directly to the mineral chamber and thence downwardly through the salt chamber, and thence out of the casing; or directly through the valved means.

14. In a water softener means for attaching the softener to a household faucet, an outer mineral chamber, an inner salt chamber, and means for softening of a hard water supply comprising a valve having ports positioned to control the flow of hard water through the mineral chamber, said valve and said mineral chamber including means to allow regulation of the rate of flow of liquid from the softener so that undue pressure is not built up in the softener.

15. In a water softener means for attaching the softener to a household faucet, an outer mineral chamber, an inner salt chamber, and means for softening of a hard water supply comprising a valve having ports positioned to control the flow of hard water through the mineral chamber, said valve and said mineral chamber including means to allow regulation of the rate of flow of liquid from the softener so that undue pressure is not built up in the softener, and regenerating means comprising ports in the valve arranged to allow the hard water to first pass through salt in the salt chamber and thence through the mineral chamber.

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