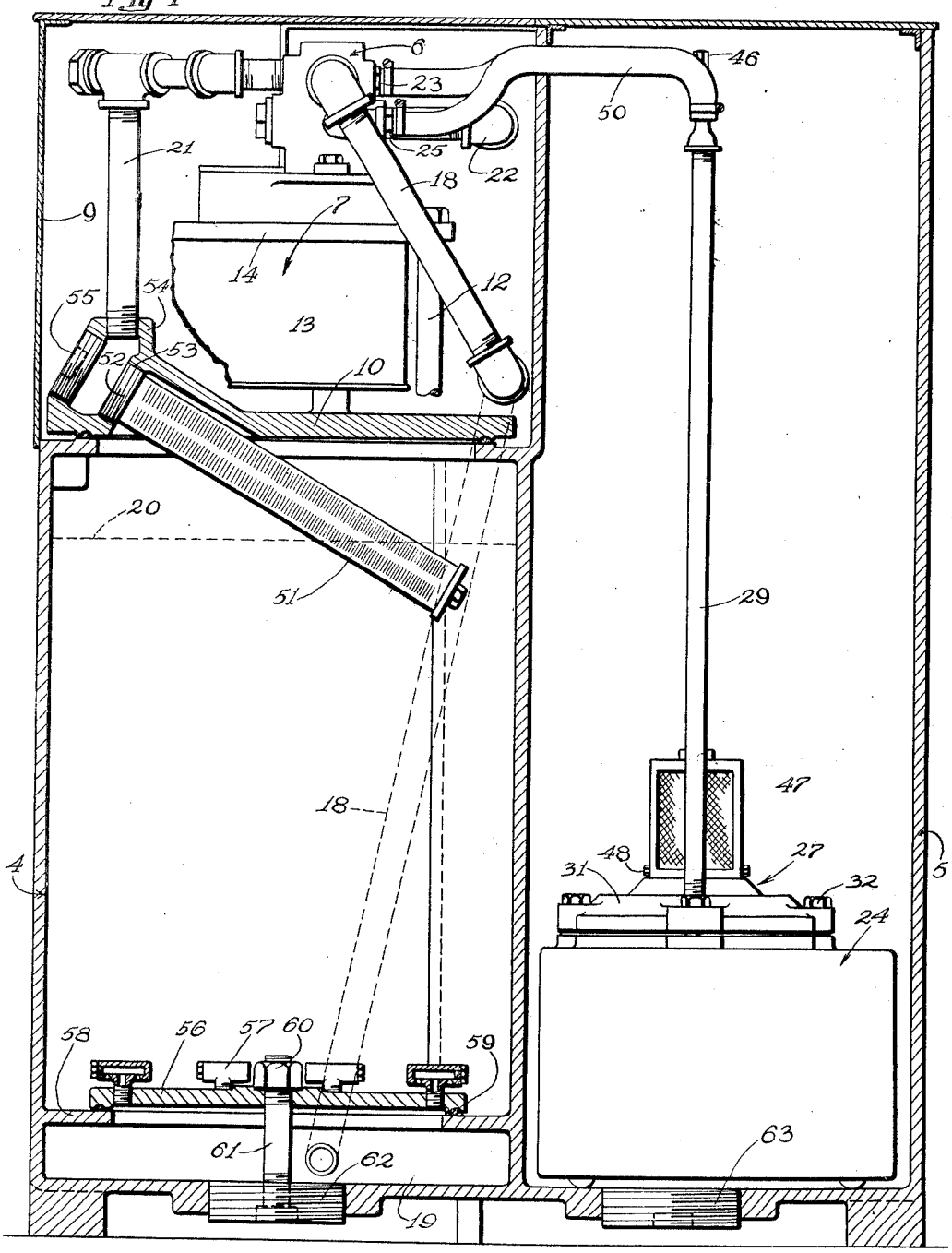
Feb. 23, 1932. S. G. HARWOOD ET AL 1,846,419

AUTOMATIC WATER SOFTENER

Filed Nov. 28, 1927 2 Sheets-Sheet 1

Fig 1



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AUTOMATIC WATER SOFTENER

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Fig 2

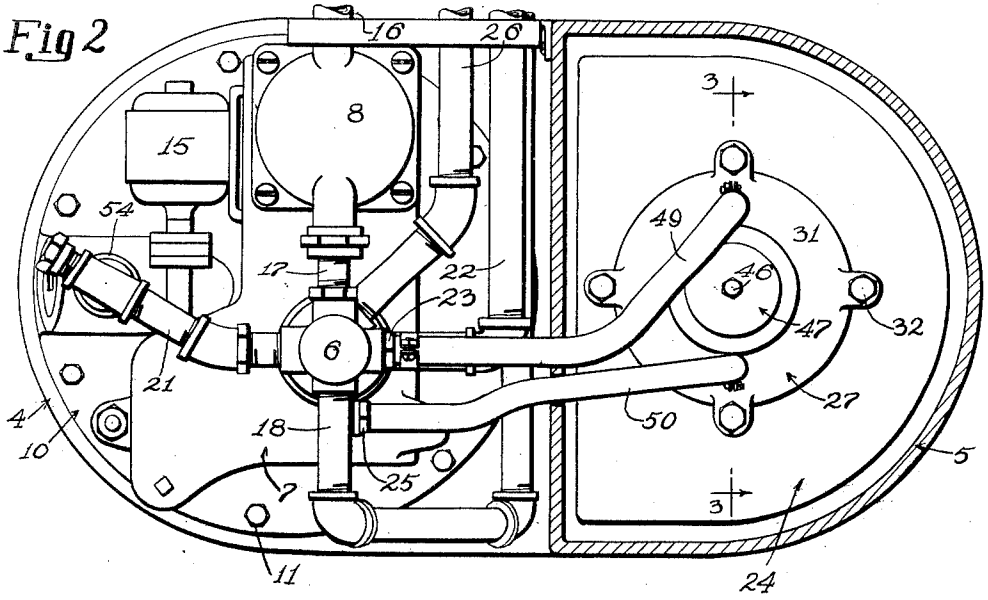
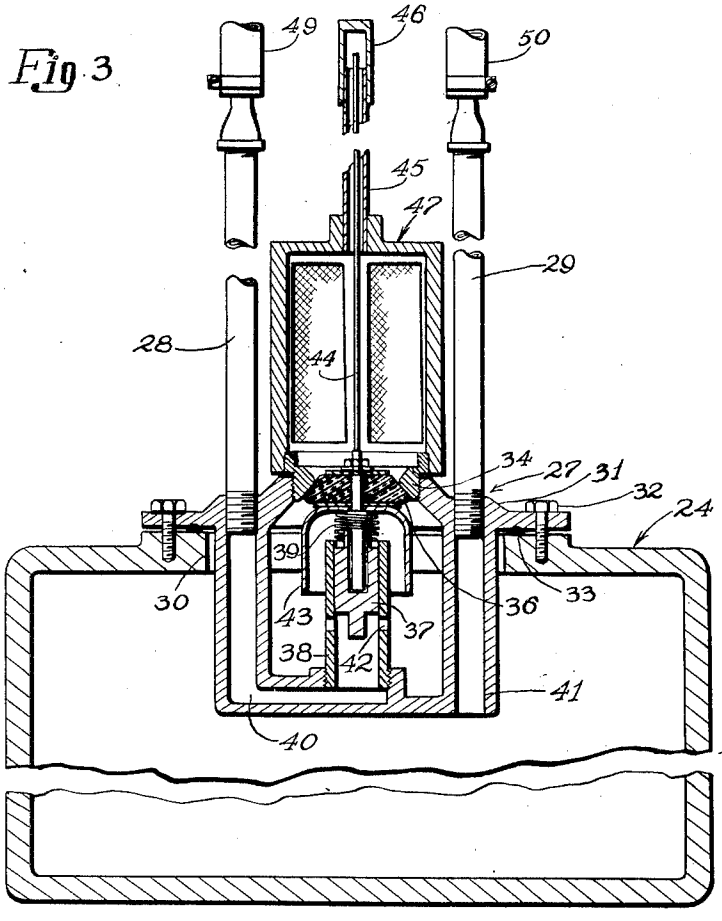


Fig 3



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UNITED STATES PATENT OFFICE

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AUTOMATIC WATER SOFTENER

Application filed November 28, 1927. Serial No. 236,122.

This invention relates to water softeners of the base-exchange type and has more particular reference to automatic or semi-automatic softeners, although certain features of the present softener might be used in a hand operated softener to good advantage.

The principal object of our invention is to provide a softener having a brine tank arranged to be installed removably in the salt tank thereof, the brine tank having its valve and operating mechanism therefor, together with the strainer, all mounted on and removable therewith as a unit. This permits the casting of the brine tank separately and the complete assembly, inspection, and testing of the unit apart from the softener, and has been found to be of special advantage in softeners where the softener tank and salt tank are cast together in a single unit, in which case the casting of a brine chamber in the salt tank involved a very difficult and costly casting operation, attended with the danger of leakage especially in the brine chamber which had to be built water-tight enough to withstand city water pressures. The use, however, of a removable brine tank is not to be regarded as limited to softeners of the cast-in-one-unit type referred to, nor is it limited to use in cast salt tanks, nor to use in salt tanks where only a single unit of the present character may be used, inasmuch as in large industrial units it may be found practical to employ a number of removable brine tank units suitably interconnected for the supply of brine in the larger volumes required.

A feature of special advantage in connection with the removable brine tank is the provision of pipes for the admission of fresh water and the discharge of brine from the brine tank, the said pipes being extended upwardly to a point near the top of the salt tank so that they serve in the lowering of the tank into place as well as in the removal thereof. These pipes have their upper ends connected with the control valve mechanism by means of flexible hoses, the use of which avoids the necessity for the precise location with respect to one another of the parts to be connected so that assembling is greatly facilitated and, at the same time, the cost is kept to a minimum.

Still other features of our invention consists in the provision of a distributor plate bearing strainer nozzles for the uniform distribution of the water flow throughout the cross-sectional area of the bed of water softening material, the said plate serving also as a support for the material and being mounted in the softener tank in a special way which insures a water-tight joint without the use of more than just a single bolt for the fastening thereof, which, of course, makes for reduced cost in manufacture and assembling. Also the provision of a cover for the top of the softener tank cast to provide a hollow boss thereon in which a strainer element may be mounted to serve both as a water distributing medium for the upper end of the bed of water softening material as well as a material retaining medium, the boss having pipe connections with the control valve mechanism and also having a removable plug which affords access to the inside of the boss to permit the removal of the strainer element when desired.

Referring to the accompanying drawings

Figure 1 is a central, vertical section through a water softener constructed in accordance with our invention, the brine tank and its control valve mechanism being shown in side elevation in the salt tank and the mechanism mounted above the softener tank being likewise shown in side elevation with a part thereof broken away so as not to hide the mounting of the strainer element in the cover;

Fig. 2 is a plan view of Fig. 1 with the hood removed from above the softener tank and with the salt tank appearing in horizontal section in a plane slightly below the upper end thereof; and

Fig. 3 is an enlarged vertical cross-section through the brine tank and the control valve mechanism therefor on the line 3—3 of Fig. 2.

The same reference numerals are applied to corresponding parts in the three views.

The softener in which the present improvements are illustrated as embodied is of the type first disclosed in our copending application Serial No. 158,458, filed January 3, 1927,

wherein the softener and salt tanks 4 and 5, respectively, are cast together to form a single self-contained unit with the valve mechanism 6, valve operating mechanism 7 and meter 8 mounted above the softener tank suitably beneath a hood 9 to give a neat symmetrical appearance. The valve mechanism 6 forms the subject matter of our Patent No. 1,593,300, issued July 20, 1926 and will not, therefore, require a detailed description and the same is true of the valve operating mechanism 7, which is fully described and claimed in our copending application Serial No. 123,400, filed July 19, 1926. The mechanism is mounted on the cover 10, bolted as at 11 over the open top of the softener tank. Posts 12 projecting from the cover serve to support the valve operating mechanism 7 which is encased in an oil-tight box 13 beneath a cover plate 14. The mechanism 7 is operated at predetermined intervals by an electric motor 15 to shift the valve 6 whenever the circuit is completed through the motor as fully set forth in our copending application last above referred to. For the purposes of conveying a general understanding of the softener in order that the features of improvement forming the subject matter of the present invention may be fully appreciated, a brief general description of the operation of the softener will be given at this point.

The hard water supplied from the water mains enters the softener through the pipe 16, passing through the meter 8, and a connection 17 for passage through the valve 6 in any one of three different directions depending on the position of the valve. In normal operation the hard water is directed through the pipe connection 18 into a sediment chamber 19 in the bottom of the softener tank 4 for passage upwardly through the bed of water softening material, the top level of which is indicated at 20. The water is thereby softened and is discharged from the tank through the pipe connection 21 and from thence through the valve 6 to the soft water supply pipe 22. The latter has connection with the usual service system. At the end of the softening run the circuit for the motor 15 is completed through the intermediary of the mechanism 7, directly if the operation is fully automatic, and indirectly by a push-button switch, for example, or by a control clock, if the operation is semi-automatic. At any rate, the motor 15 operates the valve 6 to the regenerating position and then is shut off. During regeneration the valve in its new position directs the incoming hard water through a port at 23 communicating, as will hereinafter appear, with a brine chamber provided in a brine tank 24 disposed in the salt tank 5. Brine is displaced from the tank 24 by the injection of the fresh hard water and is discharged into a port of the valve 6, indicated at 25, for passage through the valve 6 into the pipe connection 21 communicating, as stated before, with the top of the softener tank 4. The brine is thus passed through the bed of softening material and is eventually discharged through the pipe connection 18 communicating by way of the valve 6 with the waste pipe 26 leading to the sewer or any other suitable waste water receptacle. At the end of the regeneration the mechanism 7, as described in our copending application, initiates a second operation of the motor 15 to shift the valve from the regeneration position to the rinse or flush position. When the valve is in its new position the incoming hard water is directed to the bottom of the softener tank through the pipe connection 18. Waste water is discharged from the top of the tank through the pipe connection 21 and is conducted through the valve 6 into the waste pipe 26 leading to the sewer. The rinse water is metered the same as the salt-wash water and the mechanism 7 initiates a third operation of the motor after a predetermined amount of water has passed through for the rinse. This third operation of the valve shifts it from the rinse position back to the normal softening position. This brief description is thought to suffice for the present purposes.

The brine tank 24, according to the present invention, is cast separate and is arranged to be removably installed in the bottom of the salt tank 5 in the manner illustrated, the bed of salt being filled in on top thereof. With this construction there is the advantage that the valve assembly, indicated generally by the reference numeral 27, with the fresh water inlet pipe 28 and brine outlet pipe 29 may be completely assembled on the tank outside of the softener and the unit can be subjected to tests before the same is lowered into place in the salt tank. The assembling and testing expenses are accordingly reduced to a minimum. The casting of the brine tank apart from the salt tank is, of course, of very great advantage in that the casting would otherwise be quite complicated and expensive and there would be danger of leaks which might necessitate the discarding of the entire casting. In the present case, if the brine tank casting proves defective very little loss is involved proportionately. Furthermore, the testing of the small brine tank can be carried out with much greater ease and facility than would be the case if the brine tank were cast as a chamber in the salt tank. Whenever it is desired to inspect the valve assembly 27 the brine tank may be lifted out by the pipes 28 and 29. Whether or not the valve assembly has to be removed from the brine tank for inspection, it will be apparent that no difficulties will be met with either in the disassembling or reassembling inasmuch as the parts are handy to get at when the brine tank is removed from the salt tank.

The valve assembly 27 for the brine tank

24 is made up generally along the lines of that described and claimed in a copending application of O. R. Sweeney, Serial No. 134,342, filed September 9, 1926, and accordingly no invention is claimed in the general features thereof, although certain improvements herein specifically referred to form a part of the present invention. The brine tank 24, as illustrated in Fig. 3, has an opening 30 in the top wall thereof closed by a cap 31 forming the frame of the valve assembly. The cap is bolted down, as indicated at 32, over suitable packing 33 to give a watertight joint. A bushing 34 is threaded in a central opening in the cap 31 and provides a valve seat 35 for a rubber disk valve 36. The latter, as described in the Sweeney application, is operated by a piston 37 received in a hydraulic cylinder 38. A compression spring 39 provides a yielding connection between the valve 36 and the piston 37. The cap 31 has the pipes 28 and 29 threading therein, as indicated, the pipe 28 communicating with a passage 40 leading to the lower end of the cylinder 38 while the pipe 29 communicates with a passage 41 opening into the inside of the brine tank or what serves as the brine chamber. The cylinder 38 has ports 42 in the walls thereof arranged to be uncovered by the piston 37 when the latter is forced upwardly under the action of the incoming fresh water, the latter being then discharged through the ports 42 into the brine tank and displacing the brine therefrom out through the passage 41 and into the pipe 29. The valve 36 is closed as a result of the rise of the piston 37 as will be clear from observation of Fig. 3. The tank is, therefore, sealed before the fresh water is admitted to commence the displacement of the brine therefrom. According to our invention we provide a bell-shaped shield 43 for the upper end of the cylinder 38 to exclude dirt and grit therefrom which might otherwise interfere with the easy operation of the piston 37 in the opening and closing of the valve 36. The shield 43 is fixed with the valve 36 and in the open position of the latter comes to rest on top of the cylinder 38 so that any refuse is absolutely excluded from entry into the cylinder. The depending side walls of the shield extend about the sides of the cylinder in the closed position of the valve so that protection is afforded at the sides as well as at the top. This protection of the cylinder is quite important when it is considered that some users of softeners are apt to get low grades of salt having more or less dirt and grit therein which, if it got into the cylinder and worked in about the piston, might result in the sticking of the latter and hence in a failure of the softener to operate properly. The thought in providing this improvement is to avoid likelihood of any such difficulty arising, to the end that the servicing of the softeners will be reduced to a minimum. If, for any reason, the valve fails to open or close, the user may jiggle the valve by operation of the stem 44 provided of elongated form extending upwardly from the valve to a point near the top of the salt tank and appreciably above the salt bed. The stem 44 extends through a tube 45 which serves as a casing therefor, a cap 46 being suitably provided to close the upper end of the tube arranged for easy removal to afford access to the stem 44. The tube 45 is fixed on the upper end of a strainer element 47 fixed on the bushing 34 as by means of screws 48. The strainer element consists of a skeleton frame having screen covering the openings therein and serving to retain the salt against entry into the brine tank while permitting relatively unrestricted fluid communication between the brine tank and the salt tank past the valve 36 when the latter is opened. The provision of the elongated stem 44 for the purpose referred to is another improvement provided with a view to reducing the necessity for service calls, inasmuch as the user can readily attend to the jiggling of the valve to dislodge the same if the same happens to get stuck where it will either fail to open or fail to close, the failure to open being obviously due to a sticking of the valve to its seat coupled with a possible sticking or sluggish action of the piston, while a failure of the valve to close would be due to a possible sticking of the piston alone, either of which conditions are oftentimes quickly remedied by a few reciprocations of the parts in the manner suggested. Where the valve assembly requires removal for inspection or repair, as stated above, the pipes 28 and 29 provide a convenient means for the removal and replacement of the entire brine tank unit. The repairman in removing the unit simply uncouples the hose connections at 49 and 50 at the upper ends of the pipes 28 and 29, respectively. These hose connections avoid the necessity for precise location of the brine tank unit in the salt tank and are, of course, much more economical to provide than pipe connections and easier to assemble.

Referring now more particularly to Fig. 1, it will be observed that novel distributing means are employed at the top and bottom of the softener tank 4. A strainer tube 51 is carried on a plug 52 threading at 53 in a boss 54 cast integral with the cover 10 at one side of the latter, the strainer being accessible upon removal of a plug 55 closing an opening in an adjacent side of the boss. Thus, the strainer may be removed upon occasion for the purposes of cleaning, inspection, or replacement. The strainer communicates with the pipe connection 21 which leads into the boss 54, as shown. The strainer extends downwardly at an acute angle with respect to the cover into the head space above the

bed of water softening material. It is, therefore, disposed transversely with respect to the top of the bed. This, of course, makes for easy access to the strainer for the water leaving the top of the bed during softening operation and also makes for better distribution of the brine to all parts of the bed during regeneration. The fact that the boss 54 is provided in the cover simplifies assembling considerably, inasmuch as a great part of the connections may be completed in one assembly on the cover before the cover is fastened onto the softener tank. Furthermore, when the hood 9 is placed over the softener tank the boss 54 is concealed and with it the pipe connections therefor and, of course, the valve and its operating mechanism and the pipe connections for the valve.

The distributing means at the bottom of the softener tank comprises a distributor plate 56 having a plurality of T-shaped strainer nozzles 57 mounted in openings therein. The plate 56 rests about its edges on top of an annular rim 58 cast integral with the side walls of the tank 4 and defining the top of the sediment chamber 19. A gasket 59 is interposed between the plate 56 and the rim 58 and arranged to be compressed by the tightening of a nut 60 on a stud 61 so that a good water-tight joint is provided. The clamping pressure is equalized at all points about the edges of the plate 56 by reason of the fact that the stud 61 is centrally located with reference to the circular plate 56. The stud 61 is mounted in a plug 62 closing an opening in the bottom wall of the sediment chamber, the opening being necessitated in the coring of the casting, the same as in the case of the plug 63 closing an opening in the bottom of the salt tank 5.

It is believed the foregoing description conveys a complete understanding of our invention and of its advantages over previous types of water softeners known to the art. Although we have described our invention by reference to one specific embodiment it should be understood that it is capable of considerable variation in design and construction as well as in the arrangement of parts. We are, therefore, not to be construed as limited to the details herein illustrated and described, but may avail ourselves of all legitimate modifications, adaptations and variations within the spirit and scope of the appended claims.

Notice is given that our prior copending application Serial No. 158,458, filed January 3, 1927, discloses and claims an apparatus similar in general construction and mode of operation to the apparatus herein disclosed, though not specifically the same, and that the subjects-matter common to the two apparatus are generically claimed in said prior application.

Also notice is given that the brine producing equipment per se which is disclosed in this application is the subject matter of our application Serial No. 347,319, filed March 15, 1929 as a division of this application.

We claim:

1. In a water softener, a tank having a bed of water softening material therein, means for supplying hard water to the lower end of said tank for passage upwardly through said material, a cast cover for the top of the tank having a hollow boss cast integral therewith, a strainer element communicating with the inside of said boss and extending from the cover into the top of the tank, pipe connections with said hollow boss for discharging softened water from the tank, and a removable plug affording access to the inside of said hollow boss and to the strainer element.

2. In a water softener, a tank having a bed of water softening material therein, a cast cover closing the top of said tank, water distributing means beneath the bed in said tank, a water distributing and strainer element above the bed in said tank, said cover having a hollow boss cast integral therewith into which the strainer element affords communication, means affording connections with the bottom of the tank and with the boss at the top of the tank for the passage of water through the bed of softening material therein, and a removable plug affording access to the inside of the hollow boss and to the strainer element.

3. A water softener as set forth in claim 2 wherein the bed of softening material partly fills the tank and leaves a shallow head space therein above the bed, and wherein the hollow boss is provided on the cover at one side thereof with the strainer element extending downwardly therefrom into the aforesaid head space at an acute angle with respect to the cover and transversely of the top of the bed.

4. A water softener as set forth in claim 2 wherein the hollow boss on the cover is provided at one side thereof with the strainer element extending therefrom crosswise of the top of the bed.

5. A water softener as set forth in claim 2 including valve mechanism mounted on top of the softener tank having pipes connected therewith for supplying hard water and discharging softened water, and pipe connections for said valve mechanism providing communication with the bottom of the tank and with the boss in the cover at the top of the tank, and a hood for the top of the softener serving to enclose the cover with its boss and pipe connections as well as the valve mechanism with its pipe connections.

6. In a water softener, a tank containing a bed of water softening material, means for admitting hard water to one end of said tank and for drawing off softened water from the other end thereof, a distributor plate in the lower end of said tank serving to support the

bed of softening material, and means for mounting said plate comprising an annular support within said tank having the plate resting thereon about its edges, there being packing material beneath the plate, and a single bolt passing freely centrally through the plate and threaded into the bottom of the tank whereby to clamp the plate down against the support and compress the packing therebetween for a water-tight joint.

7. In a water softener, a cast tank containing a bed of water softening material, said tank having a sediment chamber cast in the bottom thereof beneath the bed of water softening material, an annular rim cast integral with the tank defining the top of the chamber and affording a shoulder on top thereof, a circular distributor plate for supporting the bed resting on top of the rim about its edges, there being packing material between the rim and the plate, and a single bolt passing centrally through the plate, through the sediment chamber and into the bottom of the tank arranged to clamp the plate down on the rim with substantially uniform pressure at all points about the edges thereof and compress the packing to provide a water-tight joint.

8. In a water softener, a tank for water softening material having made in a unit therewith a salt compartment, a brine tank, valve mechanism on the brine tank normally establishing communication between the brine tank and salt compartment so as to allow accumulation of concentrated brine in the brine tank between regenerations, said valve mechanism being arranged to be closed automatically at the time of regenerating, means for passing water through the softener tank to be softened, and means for establishing communication between the brine tank and the softener tank to cause the passage of brine through the softening material during regeneration, said brine tank being removably received in the salt compartment and having the valve mechanism removable therewith as a unit.

9. In a water softener, a softener tank having softening material therein, the tank having a salt tank made in one unit therewith, means providing communication with the upper and lower ends of the softener tank, valve mechanism associated with said means to control the direction of flow through said tank, a separate brine tank removably installed in the salt tank, valve means normally allowing communication between the salt tank and the brine tank whereby brine is produced in the latter, said valve means being arranged to be closed during regeneration to seal the brine tank from the salt tank, and means providing a fresh water inlet connection and a brine outlet connection for said brine tank, said valve mechanism having connection with said means whereby in regeneration to direct the brine through the softener tank.

10. In a water softener, a softener tank having a salt tank made in one unit therewith in side by side relation, a bed of softening material in the softener tank, valve mechanism, means providing connection between the valve mechanism and the upper and lower ends of the softener tank, a separate brine tank removably installed in the salt tank, a valve mechanism on said brine tank arranged to provide communication between the salt tank and brine tank whereby brine is produced in the latter, the said valve being arranged to be closed during regeneration, fresh water inlet and brine outlet pipes connected with said brine tank and extending upwardly therefrom to the top of the salt tank and arranged to serve in the placing of the brine tank in the salt tank or in its removal, and means providing connections between said pipes and said first mentioned valve mechanism whereby in regeneration to afford communication between the brine tank and the softener tank.

11. A softener as set forth in claim 10 wherein the valve has a stem extending upwardly therefrom to the top of the salt tank to permit manual manipulation thereof.

12. In a water softener brine apparatus, the combination with a softener tank, of a salt tank, a separate brine tank placed in the bottom of said salt tank under a bed of salt therein, said brine tank having an opening affording communication between it and the interior of the salt tank, a frame covering said opening, a valve mounted in said frame normally occupying an open position to permit the formation of brine in said chamber between regenerations, mechanism mounted on said frame having connection with said valve for operating the same to closed position, said mechanism being hydraulically operated, a fresh water inlet pipe attached to said frame and extending therefrom to an appreciable elevation in said salt tank, said pipe having communication with said hydraulically operated mechanism to accomplish the hydraulic operation thereof, a brine outlet pipe for said brine tank attached to said frame and also extending to an appreciable elevation in said salt tank, said frame together with the brine tank being removable and replaceable in the salt tank, and said pipes serving as a means for placing the same in position or removing the same, a hard water supply pipe, a service pipe, a waste pipe, and valve mechanism having connection with said pipes and also connection with the fresh water inlet and brine outlet pipes to control communication for the softener tank with the supply and service pipes in normal softening operation and also communication between the softener tank and

brine tank and waste pipe during regeneration.

13. In a water softening apparatus, a softener tank containing a bed of water softening material, a salt tank, pipes communicating with the upper and lower ends of the softener tank, valve mechanism associated therewith to control the direction of flow through said tank, a separate brine tank removably installed in the salt tank, valve means normally allowing communication between the brine tank and the interior of the salt tank whereby brine is produced in the brine tank, said valve means being arranged to be closed during regeneration to seal the brine tank, and means providing a fresh water inlet connection and a brine outlet connection for said brine tank, said valve mechanism having connection with said means whereby in regeneration to direct fresh water to the brine tank and direct the brine from said tank through the softener tank.

14. In a water softening apparatus, a softener tank containing a bed of water softening material, a salt tank, valve mechanism, pipes providing connection between the valve mechanism and the upper and lower ends of the softener tank, a separate brine tank placed in the bottom of the salt tank beneath a bed of salt therein, a valve mechanism on said brine tank arranged to provide communication between the brine tank and the interior of the salt tank for the production of brine in said brine tank, the said valve mechanism being arranged to be closed during regeneration, fresh water inlet and brine outlet pipes connected with said brine tank and extending upwardly therefrom to a point above the salt level in the salt tank and arranged to serve in the placing of the brine tank in the salt tank or in its removal, and means providing connections between said pipes and the first mentioned valve mechanism whereby in regeneration to afford communication between the brine tank and softener tank.

15. An apparatus as set forth in claim 13 wherein the brine valve has a stem extending upwardly therefrom to a point above the salt level in the salt tank to permit manual manipulation thereof.

16. An apparatus as set forth in claim 14 wherein the brine valve has a stem extending upwardly therefrom to a point above the salt level in the salt tank to permit manual manipulation thereof.

17. A water softening apparatus as set forth in claim 13 including a strainer element mounted on said frame over the brine valve, and an elongated valve stem for the brine valve extending upwardly therefrom through the strainer element to a point above the salt level in the salt tank.

18. A water softening apparatus as set forth in claim 14 including a strainer element mounted on said frame over the brine valve, and an elongated valve stem for the brine valve extending upwardly therefrom through the strainer element to a point above the salt level in the salt tank.

19. In a water softener, a tank having a bed of water softening material therein, a cover on the top of the tank, valve means and controlling mechanism therefor mounted on said cover, said cover having a chamber provided thereon near one side of the tank, said chamber having a removable outer end closure, a strainer element extending from an opening in one wall of said chamber into the top of the tank, said strainer element being removable through said chamber when said closure is removed, and piping controlled by said valve means and having communication with the lower end of said tank and with the chamber in the cover whereby hard water is supplied to one end of the tank and soft water delivered from the other end.

20. A water softener as set forth in claim 19 wherein the chamber is provided on the cover near one side of the tank, and wherein the strainer element extends therefrom crosswise of the top of the bed.

21. A water softener as set forth in claim 19 wherein the bed of water softening material partly fills the tank and leaves a head space therein above the bed, and wherein the chamber on the cover is provided near one side of the tank with the strainer element extending downwardly therefrom into the head space at an acute angle with respect to the cover and transversely of the top of the bed.

22. In a water softener, a tank containing a bed of water softening material, means for admitting hard water to one end of said tank and for drawing off softened water from the other end thereof, a distributor plate in the lower end of said tank serving to support the bed of softening material, and means for supporting and securing the plate comprising an annular support having the plate resting thereon about its edges and holding the plate elevated with respect to the bottom of the tank, and a single fastener element cooperating with the approximate center of the plate for holding the same on the annular support.

23. In a water softener, a tank for water softening material, a salt tank, a brine tank removably disposed in the bottom of the salt tank so that the top wall thereof forms the support for the salt bed in the salt tank, the brine tank having restricted communication with the salt tank to permit the filling of the brine tank with brine between regenerations, means for passing water through the softener tank to be softened, and means for establishing communication between the brine tank and the softener tank during regenera-

tion for the passage of brine through the softener material.

24. In a water softener, a tank for water softening material, a salt tank, a brine tank disposed in the bottom of the salt tank so that the top wall thereof forms a support for the salt bed in the salt tank, a strainer on the top of the brine tank through which communication is afforded between the brine tank and the salt tank for the purpose of filling the brine tank with brine between regenerations, the brine tank together with its strainer being arranged to be removed from the salt tank, means for passing water through the softener tank to be softened, and means for establishing communication between the brine tank and the softener tank during regeneration whereby to cause the passage of brine through the softening material.

25. A structure as set forth in claim 23 wherein the last mentioned means includes a conduit communicating with the brine tank and extending upwardly therefrom toward the top of the salt tank and arranged to be used in the removal or placement of the brine tank in the bottom of the salt tank.

26. A structure as set forth in claim 24 wherein the last mentioned means includes a conduit communicating with the brine tank and extending upwardly therefrom toward the top of the salt tank and arranged to be used in the removal or placement of the brine tank in the bottom of the salt tank.

27. In a water softener, a softener tank having softening material therein, a salt tank, means providing communication with the upper and lower ends of the softener tank, a separate brine tank removably installed in the salt tank, valve means on the brine tank and removable therewith from the salt tank normally allowing communication between the brine tank and the salt tank for the filling of the brine tank with brine between regenerations, said valve means serving to cut off such communication during regeneration, and means providing a fresh water inlet connection and a brine outlet connection for said brine tank, said means being arranged to be placed in communication with the first mentioned means, whereby in regeneration to pass the brine through the softener tank.

28. A structure as set forth in claim 27 wherein the means providing the fresh water inlet connection and the brine outlet connection for the brine tank includes two conduits having communication with the brine tank and extending upwardly therefrom toward the top of the salt tank, the said conduits being arranged to be used in the removal and placement of the brine tank.

29. In a water softener, a softener tank having a bed of water softening material therein, means providing communication with the upper and lower ends of the softener tank for the passage of water therethrough to be softened, a salt tank, a brine tank removably installed in the bottom of the salt tank so that the top wall thereof serves as a support for the bed of salt in the salt tank, a valve in the top wall of the brine tank and removable therewith from the salt tank and controlling communication between the brine tank and the salt tank and permitting the filling of the brine tank with brine between regenerations, said valve having a part for manipulating the same extending upwardly through the salt bed toward the top of the salt tank, and means for withdrawing brine from the brine tank arranged to be placed in communication with the first mentioned means during regeneration to pass the brine through the softener tank.

30. A structure as set forth in claim 29 wherein the last mentioned means includes a conduit extending upwardly from the brine tank toward the top of the salt tank and arranged to be used in the removal and placement of the brine tank.

31. In a water softener, a softener tank having softening material therein, the softener tank having a salt tank made in one unit therewith, means providing communication with the upper and lower ends of the softener tank for the passage of water therethrough, valve mechanism associated with said means, a separate brine tank removably installed in the salt tank and having communication with the salt tank for the filling of the brine tank with brine between regenerations, a conduit rigid with the brine tank and extending therefrom toward the top of the salt tank, said conduit serving as a means for withdrawing brine from the brine tank during regeneration and also as a means to be used in the removal and placement of the brine tank in the salt tank, and a flexible conduit detachably secured to the upper end of the aforesaid conduit and establishing communication with the valve mechanism whereby during regeneration to pass brine through the softener tank.

32. In a water softener, a softener tank having softening material therein, the softener tank having a salt tank made in one unit therewith, means providing communication with the upper and lower ends of the softener tank for the passage of water therethrough, valve mechanism associated with said means, a separate brine tank removably installed in the salt tank and having communication with the salt tank for the filling of the brine tank with brine between regenerations, a pair of conduits rigid with the brine tank and extending therefrom toward the top of the salt tank, the one serving as a fresh water inlet and the other as a brine outlet for the brine tank and either or both being arranged to be used in the removal and placement of the brine tank in the salt tank, and a pair of flexible conduits detachably

connected to the upper ends of the aforesaid conduits and having communication with the valve mechanism whereby in regeneration to introduce fresh water into the brine tank and expel the brine therefrom and pass it through the softener tank.

33. In a water softener, a softener tank having a salt tank made in one unit therewith, the salt tank being disposed alongside the softener tank and provided of a somewhat greater height, valve mechanism mounted above the softener tank alongside the upper portion of the salt tank, means connected with the valve mechanism and having communication with the upper and lower ends of the softener tank for the passage of water therethrough, a brine tank removably installed in the salt tank and arranged to have brine produced therein between regenerations, a conduit rigid with the brine tank and extending therefrom toward the top of the salt tank and serving as a means for withdrawing brine from the brine tank and also as a means whereby the brine tank may be placed in or removed from the salt tank, and a flexible conduit detachably connected with the upper end of the last mentioned conduit and extended laterally therefrom for connection with the valve mechanism whereby during regeneration brine is arranged to be passed through the softener tank.

34. A structure as set forth in claim 33, wherein the flexible conduit is passed through an opening in the wall of the salt tank, the structure including an enclosure for the valve mechanism above the softener tank reaching to the same height as the salt tank and a closure for the open top of the salt tank.

In witness of the foregoing we affix our signatures.

STANLEY G. HARWOOD.
DONALD GRISWOLD.