April 25, 1933. L. G. LINDSAY 1,905,726

METHOD OF AND MEANS FOR SOFTENING WATER

Filed April 1, 1929 2 Sheets-Sheet 1

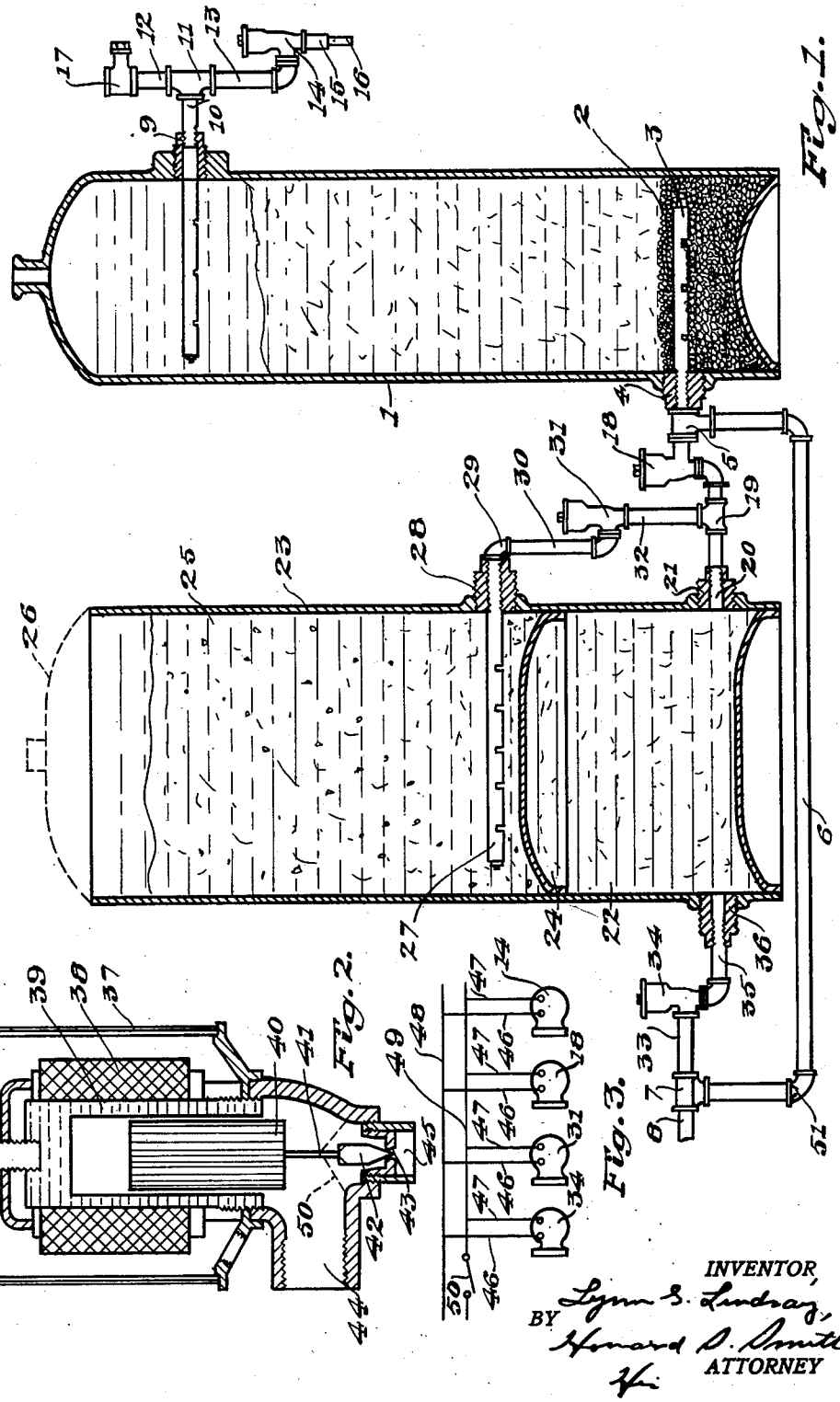


Fig. 1.

Fig. 2.

Fig. 3.

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METHOD OF AND MEANS FOR SOFTENING WATER

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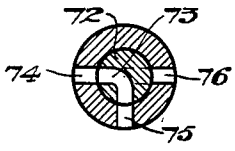


Fig. 6.

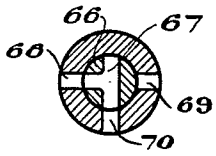


Fig. 5.

Fig. 4.

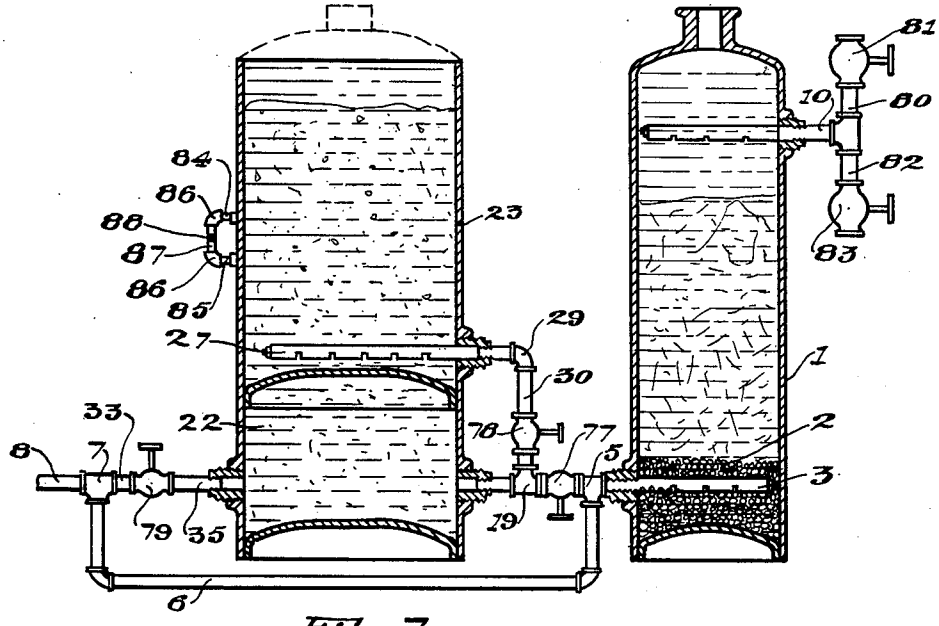


Fig. 7.

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UNITED STATES PATENT OFFICE

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METHOD OF AND MEANS FOR SOFTENING WATER

Application filed April 1, 1929. Serial No. 351,581.

This invention relates to a new and useful method and means for softening water, and is particularly designed to soften the water, usually hard, that is delivered to homes and other buildings from the usual water mains of public or private systems.

It is one of the principal objects of my invention to provide a simple, efficient and economical water softening method and apparatus that is particularly adapted for remote control.

It is another object of the invention to provide a method of regenerating and washing a mineral bed for water softening by preparing a measured quantity of salt brine, introducing the same by the pressure of hard water to a given mineral bed and then washing the latter by said hard water.

It is another object of my invention to provide a water softener in which the measuring reconditioning and washing operations may be effected by the closing of an electric switch. After the switch is closed, nothing further is required of the user until the above operations are completed. This result is achieved by solenoid means for simultaneously setting four valves, one in a closed, and three in an open position, without necessity for change in these valve positions until the regenerating and washing operations are concluded.

It is another object of my invention to provide a glass indicator on the side of the open or closed brine tank, to disclose to the user the specific gravity of the salt solution which it contains. For instance, if the salt is completely exhausted from the tank, the little indicating ball employed will rest on the bottom of the glass indicator.

Other important and incidental objects will be brought out in the following specification and particularly set forth in the subjoined claims.

In the accompanying drawings illustrating my invention, Figure 1 is an elevational view, partly in section, showing my improved water softener equipped with solenoid-operated valves for a single remote control. Figure 2 is a longitudinal sectional view taken through one of these solenoid-operated valves. Figure 3 is a wiring diagram of the electric circuit in which said valves are included, and showing the switch for closing said circuit. Figure 4 is an elevational view, partly in section, showing my improved water softener equipped with three two-way rotary valves. Figure 5 is a cross sectional view taken through the two-way valve provided in the hard water inlet and brine lines. Figure 6 is a cross sectional view taken through the two-way valve provided in the service line, and figure 7 is an elevational view, partly in section, of my improved water softener equipped with an indicator for disclosing to the user, the specific gravity of the salt solution in the brine tank.

Referring to the accompanying drawings for a detailed description of the various forms of embodiment of my invention disclosed therein, the numeral 1 in Figure 1 designates the usual pressure tank having a mineral bed 2 therein to soften the water passed through it. Hard water is delivered to the mineral bed 2 within the tank 1 through a distributor 3 which is threaded at its outer end for connection to a bushing 4 within an inlet hole in the lower part of the tank.

By means of a T coupling 5, the distributor 3 is terminally connected to a U shaped hard water pipe line 6. Connected to the outer end of the latter is a T coupling 7 which receives the hard water supply pipe 8, to which water is delivered under pressure

Secured to a bushing 9 in the upper portion of the mineral tank 1 is a strainer tube 10 to whose outer end there is secured a T coupling 11, with a service line 12 connected to one vertical end and a drain pipe 13 attached to its lower vertical end. Depending from the lower end of the pipe 13 is a solenoid-operated valve 14 which will be hereinafter more fully described. Secured to the valve 14 is a downwardly depending drain tube 15 having a constricted opening 16 to slow up the operation of reconditioning the mineral bed.

Included in the service line 12 is a check valve 17.

A solenoid-operated valve 18 is secured between the T coupling 5 and a T coupling 19, which is connected by a short tube 20 and bushing 21 to the measuring chamber 22 of a brine tank 23. By a partition or horizontal wall 24 the tank 23 is divided into the measuring chamber 22 and the upper chamber 25 adapted to contain a quantity of salt. This chamber 25 may be open as shown by the full lines in Figure 1, or closed as indicated by the dotted top 26 in said figure.

Directly above the partition 24 in the tank 23 is a horizontal distributor 27 which projects through a bushing 28 in a hole in the tank 23 to a bend 29. To the lower end of this bend there is secured a pipe 30 that leads to a solenoid-operated valve 31 which is connected by a short tube 32 to the T coupling 19. (See Figure 1.)

From the T coupling 7 the hard water flows through a horizontal pipe 33, a solenoid-operated valve 34 and a short tube 35 into the measuring chamber 22 of the tank 23, said tube being secured to the latter by a bushing 36. (See Figure 1.)

Referring to Figure 2 for a description of one of the solenoid-operated valves, the numeral 37 designates an outer casing within which there is secured a winding 38 that surrounds a water tight cylindrical member 39. Adapted to be drawn into the latter when current is applied to the winding 38, is an armature 40 having a stem 41 to which a valve 42 is secured. This valve, as shown by the full lines in Figure 2, has a tapered lower end which is adapted to be raised by the armature 40, above a seat 43, to permit a liquid such as hard water or brine to flow from an inlet 44 past the valve into an outlet 45. The latter preferably comprises a tube which carries the valve seat 43. This tube is screwed into a horizontal casting formed with the inlet 44, said casting being in turn screwed onto the lower end of the cylindrical member 39.

Each one of the solenoid-operated valves 14, 18, 31 and 34 has its winding 38 included in an electric circuit by two wires 46 and 47. The wires 46 lead to one wire 48 of an electric circuit, while the wires 47 are connected to the other wire 49 of said circuit. (See Figure 3.) Secured to the last named wire 49 is an electric switch 50 which, when closed by the user, will set these valves for the reconditioning of the mineral bed in the tank 1, whereby that operation and the washing one will be accomplished without further attention. When the mineral bed has been regenerated and cleansed of brine, the valves referred to will be restored to their normal positions by opening the switch.

Preparation for successive regenerations of the mineral bed in the tank 1, is made by placing salt in the water contained in the upper chamber 25 of the tank 23. The brine formed will then flow through the pipes 27 and 30 into the valve casing 31 whose valve 43 is in a raised position to permit the brine to flow through the tube 32, coupling 19 and pipe 20 into the measuring chamber 22 of the tank 23. When this chamber 22 is filled with brine, it will hold an amount of the latter which is correctly proportioned to the mineral bed 2. This means that when the valve 31 is closed, a measured quantity of brine, and no more, will flow into the mineral bed 2.

The valve 31 is constructed with a seat 50 represented by the dotted lines in Figure 2, to permit it to be closed when the valve 42, which in this instance is tapered at the top as shown by dotted lines, is raised by the armature 40. Since all the other valves 14, 18 and 34 are opened when the switch 50 is closed, their construction is exactly the same as that shown by the full lines in Figure 2.

During the softening operation, hard water flows through the line 6, around the closed valves 18 and 34, into and through the mineral bed 2 whence, in a softened condition, it flows from the tank 1 into the service line 12.

When it becomes necessary to recondition the mineral bed 2, the service line is closed by shutting off the check valve 17. The electric switch 50 is then closed, whereupon an electric current will be applied to the armature 40 of the valves 14, 18, 31 and 34. This results in the closing of the valve 31, and the opening of the valves 14, 18 and 34. The latter valves being open, hard water under pressure will flow through the valve 34 into the measuring chamber 22, whose contents, proportioned in quantity to the given mineral bed 2, will be forced by said water through the open valve 18 into said bed to regenerate it. Following this measured quantity of brine into the tank 1, is the hard water under pressure which enters through both the brine line 20 and the hard water line 6. Formed in the latter is a restricted opening 51 to reduce the amount of hard water entering the tank 1 through the line 6 during the reconditioning of the mineral bed 2. This hard water washes and cleanses the mineral bed and is discharged through the open valve 14 into the drain pipe 15.

When the reconditioning operation is concluded, the switch 50 is opened to set the valves 14, 18, 31 and 34 in their normal positions, only one operation of the switch being necessary to accomplish the regenerating and washing operations.

In Figure 4 I have shown a water softener of the same type that I have just described, except that it is further simplified by providing three two-way valves. Referring to this figure, the numeral 52 designates a mineral tank and the numeral 53 a brine tank,

both being similar to the tanks 1 and 23 respectively in Figure 1.

Connected to the hard water line 8 is a two-way valve 54 to which the by-pass hard-water line 6 is secured. This line 6 has its other terminal secured to the T coupling 5, through which hard water passes into the distributor 3 for introduction to the mineral bed 2.

From the valve 54 a pipe 55 leads directly to the measuring chamber 22 within the tank 53, and from the other side of this chamber a bushing 56 projects to receive a short tube 57 secured at its outer end to a two-way valve 58. This valve is in turn connected with the coupling 5 by a pipe 59, and with the distributor 27 in the tank 53 by a pipe 60 and bend 61.

Secured to one side of the tank 52 near its top is an outlet tube or pipe 62 which carries a two-way valve 63 to direct the discharged liquid either to the service line 64 or to the drain line 65.

A detail view of the two-way valves 54 and 58 is shown in Figure 5. Referring to this figure, the numeral 66 designates a rotor member formed with a T shaped passage 67 through it. In the wall of the valve casing there are formed two alined ports 68 and 69 and a port 70 at right angles to them. When the rotor member 66 is turned by a handle 71 to bring the longitudinally alined ends of its passage 67 into registry with the ports 68 and 69, the hard water will flow straight through the valve from the pipe 8 into the pipe 55 for the regenerating operation, and when the member 66 is turned to the position shown in Figure 5, the hard water will flow from the pipe 8 into the by-pass line 6 for the softening action.

The two-way valve 58 is constructed like the valve 54, to pass the measured quantity of brine straight through it from the measuring chamber 22 to regenerate the given mineral bed 2, or to pass the brine from the upper portion of the tank 23 to the measuring chamber 22 after the reconditioning operation is concluded.

The valve 63, shown in detail in Figure 6, contains a rotor member 72 formed with a right-angled passage 73 for registry with the ports 74, 75 and 76 in the wall of the valve casing. A two-way valve similar to the valve 54 may be substituted for the valve 63 if desired.

The three two-way valves 54, 58 and 63 make possible a simplified construction of water softener by reducing the number of its parts.

In Figure 7 I have shown a water softener of the same type as that of the preceding ones hereinbefore described, save that single globe valves are employed. Referring to Figure 7, the hard water by-pass line 6 leads from the coupling 6 to the coupling 5 from which the distributor 3 projects into the mineral bed 2 in the tank 1.

Between the coupling 5 and the coupling 19 a single globe valve 77 is interposed, while between the coupling 19 and the pipe 30 a single globe valve 78 is placed to control the flow of brine from the upper portion of the tank 1 to the measuring chamber 22 in its lower portion. Hard water is admitted to the chamber 22 through a single globe valve 79 interposed between the pipe 33 and the pipe 35.

Secured to the coupling 11 on the discharge pipe 10 is a service pipe 80 carrying a single globe valve 81 and a drain pipe 82 carrying a single globe valve 83.

The disposition of these five single globe valves 77, 78, 79, 81 and 83 also conduce to a simplified arrangement and reduction of parts in a water softener of my improved type.

For the purpose of enabling the user to easily read the specific gravity of the salt solution within the upper portion of the tank 23, I provide the following indicator. Secured to the outer portion of the upper middle part of the tank 23 are two horizontal tubes 84 and 85 which communicate with the interior of the tank and have attached to their outer ends bends 86, 86. Between these bends a vertical glass tube 87 is fitted to contain a ball 88 free to rise and fall within it. Since a part of the solution in the tank 23 passes into the glass tube 87 to fill it, the position of the ball 88 within the tube will disclose to the user the specific gravity of that solution; and when the tank needs to be refilled with salt, the ball will rest on the bottom portion of the tube. Such a gage is a convenient aid to the user in keeping a proper amount of salt in the upper portion of the tank 23.

Having described my invention, I claim:

1. In a water softener, a tank containing water softening material, a brine tank in communication with the latter, a valve for admitting water under pressure to the brine tank, a valve for admitting brine from the brine tank to the softening tank, a valve for draining the latter tank, and means set by a single operation to simultaneously open all of said valves to recondition and wash the water softening material without a further change in said valves.

2. In a water softener, a tank containing water softening material, a brine tank in communication with the latter, a valve for admitting water under pressure to the brine tank, a valve for admitting brine from the brine tank to the softening tank, a valve for draining the latter tank, a solenoid for operating each valve, an electric circuit including the solenoids of said valves, and a switch in said circuit for closing it to open all three of said valves simultaneously to

recondition and wash the water softening material without a further change in said valves.

3. In a water softener, a tank containing water softening material, a brine storage tank, a measuring tank in communication with the brine storage tank and with the softening tank, a valve for admitting brine from the brine storage tank to the brine measuring tank, a valve for admitting water under pressure to the measuring tank, a valve for admitting brine from the measuring tank to the softening tank, a valve for draining the latter tank, and means set by a single operation to close the valve for admitting brine from the brine storage tank to the measuring tank and at the same time to open the remaining three valves to recondition and wash the water softening material without a further change in said valves.

4. In a water softener, a tank containing water softening material, a brine storage tank, a measuring tank in communication with the brine storage tank and with the softening tank, a valve for admitting brine from the brine storage tank to the measuring tank, a valve for admitting water under pressure to the measuring tank, a valve for admitting brine from the measuring tank to the softening tank, a valve for draining the latter tank, a solenoid for operating each valve, an electric current including the solenoids of said valves, and a switch in said circuit for closing it to close the valve for admitting brine from the brine storage tank to the measuring tank and at the same time to open the remaining three valves to recondition and wash the water softening material without a further change in said valves.

5. In a water softener, a tank containing water softening material, a brine storage tank, a brine measuring tank, a line leading from said brine storage tank to the measuring tank, a valve in said line, a second line leading from the first line to the softening tank, a valve in the second line, a third line for delivering water under pressure to the measuring tank, a valve in the third line, a fourth line by-passing said valves between the first line and the second line, a valve for draining the water softening tank, a solenoid for operating each valve, an electric circuit including said solenoids, and a switch for closing said circuit to close the valve in the first line and to simultaneously open the remaining valves to recondition and wash the water softening material without a further change in said valves.

6. In a water softener, a tank containing water softening material, a brine tank, a measuring chamber in the lower portion of the brine tank, a line leading from the upper portion of the brine tank to the measuring chamber, a valve in said line, a second line leading from the first line to the softening tank, a valve in the second line, a third line for delivering water under pressure to the measuring chamber, a valve in the third line, a fourth line by-passing said valves and the brine tank, a valve for draining the water softening tank, a solenoid for operating each valve, an electric circuit including said solenoids, and a switch for closing said circuit to close the valve in the first line and to simultaneously open the remaining valves to recondition and wash the water softening material without a further change in said valves.

7. In a water softener, a mineral tank containing a given mineral bed, a brine storage tank, a brine measuring tank, a communicating passage between the brine storage tank and the brine measuring tank, a valve in said passage, a communicating passage between the brine measuring tank and the mineral tank, a valve in said passage, a line for introducing water under pressure to the measuring tank, a valve in said passage, a valve for draining the mineral tank, a single remote control to simultaneously close the first valve and open the other three valves, to admit water under pressure to the measuring tank to force a measured quantity of brine to the mineral bed, said water following the brine through said bed to cleanse it, said remote control thereafter adapted to be operated to simultaneously open the first valve and close the other three valves, and a by-pass for conducting hard water under pressure from the hard water line around the measuring tank to the mineral tank for softening when the last three valves are closed.

In testimony whereof I have hereunto set my hand this 30th day of March, 1929.

LYNN G. LINDSAY.