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WATER SOFTENER

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FIG. 1

FIG. 2

FIG. 3

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This invention relates to new and useful improvements in water softeners, particularly designed for use to soften the water delivered to homes and other buildings from the usual water mains of public or private systems, which water is usually hard, and more particularly relates to such a structure which is an improvement over the forms shown in my prior pending applications Ser. No. 35,374, filed June 6, 1925, and Ser. No. 41,657, filed July 6, 1925.

An object of this invention is to provide a water softener of the above type adapted for automatic control to recondition the usual mineral bed therein and which is simple in construction and operation and comprises a minimum number of parts, thereby providing such a structure which may be manufactured at a minimum cost.

The particular object of the invention, therefore, is to provide an improved water softening apparatus.

Other objects of the invention will appear from the following description and the accompanying drawings and will be pointed out in the annexed claims.

In the drawings there has been disclosed a structure designed to carry out the various objects of the invention, but it is to be understood that the invention is not to be confined to the exact features shown, as various changes may be made within the scope of the claims which follow.

In the accompanying drawings forming part of this specification

Figure 1 is an elevational view, partially in section, showing my improved water softener as arranged for remote control;

Figure 2 is a similar view showing a modified construction;

Figure 3 is a detail sectional view of the control valve shown in Figure 2.

The novel water softener featured in the invention comprises the usual pressure tank 4 having a mineral bed 5 therein, which functions to soften the water as it is passed therethrough. A hard water inlet pipe 6 is connected with the lower portion of the tank and has a distributor 7 terminally connected thereto within the tank through which the hard water is delivered. A quantity of gravel 8 is preferably placed in the bottom of the tank 4 to substantially cover the distributor 7. This gravel functions to prevent the material of the mineral bed from being discharged from the tank through the pipe 6 during the re-condition period of the apparatus. The usual soft water outlet pipe 9 is connected to the upper portion of the pressure tank 4 through which the soft water is delivered to the usual house line or pipes throughout the building. A check valve 11 is interposed in the outlet pipe 9 to prevent the water in the house line from returning to the tank when the water pressure therein is released by draining the water therefrom during the process of re-conditioning the mineral bed.

An important feature of this invention resides in the novel construction of the means provided for supplying brine to the pressure tank 4 for the purpose of re-conditioning the mineral bed 5. Such means preferably consists of a tank 12 having a partition or horizontal wall 13 interposed therein for the purpose of dividing the tank into two chambers. The upper chamber 14 is adapted to contain a quantity of salt and has a filler cap 15 through which the salt may be introduced therein. The lower chamber 16 will hereafter be referred to as the brine chamber and is in communication with the salt chamber through a relatively small duct 17 provided in the wall 13, as shown. A pipe connection 18 connects the brine chamber 16 with the upper portion of the pressure tank 4. A check valve 19, of ordinary construction, is interposed in this pipe 18 to prevent the soft water from flowing into the brine tank during the normal operation of the apparatus.

Another feature of the invention resides in the construction and arrangement of the control mechanism or means provided for automatically controlling the flow of water and brine through the apparatus during the process of re-conditioning the mineral bed. As shown in Figure 1, the hard water pipe 6 connected with the lower portion of the pressure tank, has one end connected to a
pipe section 21 by means of a fitting 22. A control valve 23 is connected to the pipe 21 and to a hard water supply pipe 24. This valve 23 controls the flow of hard water to the lower portion of the pressure tank 4. During the normal operation of the apparatus the valve 23 will be open and hard water will flow from the pipe 24 through the pipes 21 and 6 and into the distributor 7 in the lower portion of the pressure tank. The water will then upwardly flow through the mineral bed, as indicated by the arrows, whereby the hardness in the water will be absorbed so that the resultant flow of water from the upper portion of the pressure tank will be soft.

A pipe 25 is connected at one end to the hard water supply pipe 24 by means of a fitting 26. The other end of the pipe is connected to a control valve 27 which has a pipe connection 28 leading from the upper side thereof to the lower portion of the brine chamber 16. The valve 27 controls the flow of hard water to the brine chamber 16 as will hereinafter be described.

A third control valve 29 is also provided and has one side connected with the fitting 22. A drain pipe 31 is connected with the opposite side of the valve 29 and leads to a suitable receiving means such as a sewer. The operating levers of the valves 27 and 29 are preferably connected together for simultaneous operation by means of a connecting link 32 which has its upper end connected to a suitable control motor 33 by means of a connection 34. The control valve 23 is similarly connected to the opposite side of the control motor by the connection 35 as shown.

In the normal operation of this novel water softener, after the mineral bed in the pressure tank has been re-conditioned, the control valve 23 will be opened and the hard water will flow from the pipe 24 through the valve, thence through the pipe section 6 and into the lower portion of the pressure tank, after which it will flow upwardly through the mineral bed which functions to remove the hardness from the water, as is customary in structures of this type, so that the resultant flow of water from the pipe 9 of the pressure tank will be soft. After the apparatus has been in operation for a period of time, the mineral bed exhausts its water softening characteristics and it becomes necessary to re-condition or revivify it, which is accomplished by passing a solution of salt water or brine therethrough and subsequently rinsing the brine from the material of the mineral bed, after which it again is ready for use.

When the mineral bed has thus exhausted its water softening characteristics and it becomes necessary to recondition it, the switch 36, which may be placed at a remote point from the control motor such as in an upstairs room, is manipulated, thereby causing the control motor 33 to automatically close the control valve 23 to interrupt the flow of hard water to the pressure tank and to simultaneously open the two control valves 27 and 29. Such actuation of the three control valves will cause the hard water from the supply pipe to flow through the pipe connection 25, valve 27, pipe 28 and into the lower portion of the brine chamber 16, thereby causing the brine to be forced out of the chamber 16 and into the pipe connection 18, from which it will flow through the check valve 19 and into the upper portion of the pressure tank 4. When the valves have been positioned as above described, it will also be noted that the lower portion of the pressure tank 4 will be open to the discharge pipe 31 as a result of the valve 29 being open, thereby permitting the brine solution delivered to the upper portion of the pressure tank to flow downwardly through the mineral bed and into the pipe section 6, through the open valve 29 and into the discharge or drain pipe 31 to the sewer.

During such operation of the apparatus hard water will flow into the lower portion of the brine chamber 16, thereby gradually flushing all of the brine out of the chamber 16 and delivering it to the pressure tank through which it will downwardly flow through the mineral bed and be discharged through the drain pipe 31. The valves will be positioned as above described until all of the brine has been removed from the chamber 16, after which hard water will continue to flow therethrough until the mineral bed has been thoroughly rinsed and cleansed of brine, after which the control motor will again function to actuate the valves to interrupt the flow of hard water to the brine chamber and to again establish normal upward circulation of water through the pressure tank.

As soon as the apparatus has thus been restored to normal operation, the salt water in the salt chamber 14 in the upper portion of the tank 12 will be precipitated into the brine chamber 16 through the orifice 17 until the hard water contained therein is transformed into a comparatively strong salt solution or brine. During normal functioning of the apparatus the pressures in the salt and brine chambers 14 and 16 will be substantially equal, thereby permitting the salt solution in the upper portion of the tank 12 to pass through the orifice 17 and into the lower chamber 16 to thoroughly saturate or impregnate the hard water contained therein with salt resulting in the formation of a comparatively strong salt solution or brine.

From the foregoing, therefore, it will be noted that only three control valves are em...
ployed to control the flow of water and brine through the apparatus during the period of re-conditioning the mineral bed. It will also be noted that the brine will be discharged from the chamber 16 by pressure, and not by gravity or siphoning, as shown in my above mentioned pending applications. The operation of the apparatus, therefore, will be positive. In the structure shown in Figure 1, the normal flow through the pressure tank will be upward, while the flow therethrough during the reconditioning of the mineral bed will be downward. This, however, may be reversed, if desired, by slightly modifying the construction shown so that the normal flow of water through the pressure tank will be downward while the flow therethrough during the reconditioning period will be upward. The brine chamber 16 may be of a pre-determined size to contain the proper quantity of brine required depending upon the size of the mineral bed and also the necessary quantity of salt to re-condition the bed. The size of the orifice 17 is also preferably such that the element of time governs the delivery of the salt to the chamber 14 and permits of the resulting brine working into the chamber below so that in re-conditioning, after the salt has been forced by pressure through the mineral bed, it will be followed by fresh water. The means provided for operating the control valves 23, 27 and 29 may be automatic, or, if desired, they may be operatively connected together for simultaneous operation by manual control. Various other types of control motors may also be employed in place of the one shown without departing from the invention. Figure 2 illustrates a modified construction wherein the three control valves 23, 27 and 29 have been dispensed with and a single valve substituted therefor. In the structure here shown, the flow of brine through the mineral bed during the period of re-conditioning the bed will be upward instead of downward, as shown in Figure 1, while the normal flow of water through the pressure tank will be upward similar to that shown in the previous figures.

The control valve shown in Figure 2 preferably comprises a casing 37 having a plunger 32 reciprocally mounted therein. A pipe connection 39 connects the lower portion of the valve 37 with the pressure tank while a pipe connection 41 connects the opposite side of the valve with the brine chamber 16. The hard water supply pipe 24 is connected to the pipe connection 41 so that hard water may be delivered through the valve to the pressure tank 2 and also to the brine tank during each cycle of operation. Pipe connections 39 and 41 are preferably connected to the valve in such a manner as to be in axial alignment as shown. A connection 42 connects the pipe section 39 with the central portion of the valve casing 37, which also has a connection 43 leading from the opposite side thereof to the upper portion of the brine chamber as shown. When the plunger 38 is in the position shown in Figure 2, the pipe connections 39 and 41 will be in communication with each other through the valve, while communication between the pipe sections 42 and 43 will be interrupted as a result of the plunger being positioned therebetween. The upper portion of the valve casing 37 also has a pipe connection 44 connecting it with a soft water outlet pipe 2, while a discharge or drain pipe 45 is connected to the opposite side of the casing preferably in axial alignment with the pipe connection 44. An annular groove 46 is provided in the plunger 38 so that when the plunger is downwardly moved to the position shown in Figure 3, communication will be established between the pipe connections 42 and 43 and also between the pipes 44 and 45 as a result of the upper portion 47 of the plunger having passed beyond the opening in the two cases 44 and 45 thereby permitting free circulation between the pipes 42 and 43 and also the pipes 44 and 45. When the valve is thus positioned, circulation between the pipe connections 39 and 41 will be interrupted as a result of the lower portion 38 of the plunger being positioned as shown in Figure 3.

An extension 48 is provided on the upper portion 47 of the plunger to provide means for connecting a control device thereto which device may be adapted for either automatic or manual operation. Suitable ducts 49 and 51 are provided in the plunger 19 to permit the fluid to escape from each end of the plunger during the operation of the device.

I claim as my invention:

1. In a device of the class described, a pressure tank, a brine tank, a valve casing, a pipe connecting the valve casing with the pressure tank, a pipe connecting said valve casing with the brine tank, and a slidable valve in said casing to put said pipes in communication with each other for the purpose specified.

2. In a device of the class described, a pressure tank, a brine chamber, a valve casing, a pipe connecting the valve casing with the pressure tank, a second pipe connecting the opposite side of said valve casing with the brine chamber, a third pipe connecting the first pipe and the central portion of the valve casing, a fourth pipe leading from the opposite side of the central portion of the valve casing to the upper portion of the brine chamber, and a plunger reciprocable in said casing to put the first and second pipes in communication with each other while interrupting commu-
cation between the third and fourth pipes for the purpose specified.
3. A device of the class described including a pressure tank, a brine tank, cold water connections to each tank including a cold water by-pass connection to the brine tank, a drain connection for the pressure tank, and a single valve arranged to separately control the flow through each connection and adapted when at one position to prevent flow in the by-pass and brine connections and to permit flow in the cold water connection, and when in the other position to permit flow through the drain and by-pass connections and prevent flow through the cold water connection, said brine tank having a partition dividing the same into an upper salt chamber and a lower brine chamber, the by-pass and hard water connections communicating with the lower chamber, said partition having an opening therein establishing communication between the chambers.

4. A device of the class described including a pressure tank, a brine tank, a cold water connection to each tank including a cold water by-pass connection to the brine tank, a drain connection for the pressure tank, and a single translatable valve arranged to separately control the flow through each connection and adapted when at one position to prevent flow in the by-pass and brine connections and to permit flow in the cold water connection, and when in the other position to permit flow through the drain and by-pass connections and prevent flow through the cold water connection, said brine tank having a partition dividing the same into an upper salt chamber and a lower brine chamber, the by-pass and hard water connections communicating with the lower chamber, said partition having a small opening therein establishing communication between the chambers.

5. Brine tank for the purpose described providing two chambers respectively a storage chamber for salt, and a brine delivery chamber, a passage establishing communication between the chambers so that water in the delivery chamber can communicate with and dissolve a predetermined amount of salt out of the salt chamber, and hard water supply and brine delivery pipes communicating only with the brine delivery chamber.

7. In a water softener, a mineral tank containing a mineral bed of a given size, a fresh water inlet thereto, a brine storage tank, a brine measuring tank communicating with the brine storage tank and with the mineral tank, a fresh water inlet to the brine measuring tank, and a single control valve which in one position allows the flow of fresh water through the mineral tank and in another position shuts off this flow of fresh water to the mineral tank but permits the flow of fresh water through the measuring tank so as to introduce a given quantity of brine into the mineral bed from the brine measuring tank and subsequently washes this brine out of the mineral bed by a continuing flow of fresh water.

In witness whereof, I have hereunto set my hand this 5th day of September, 1925.

LYNN G. LINDSAY.