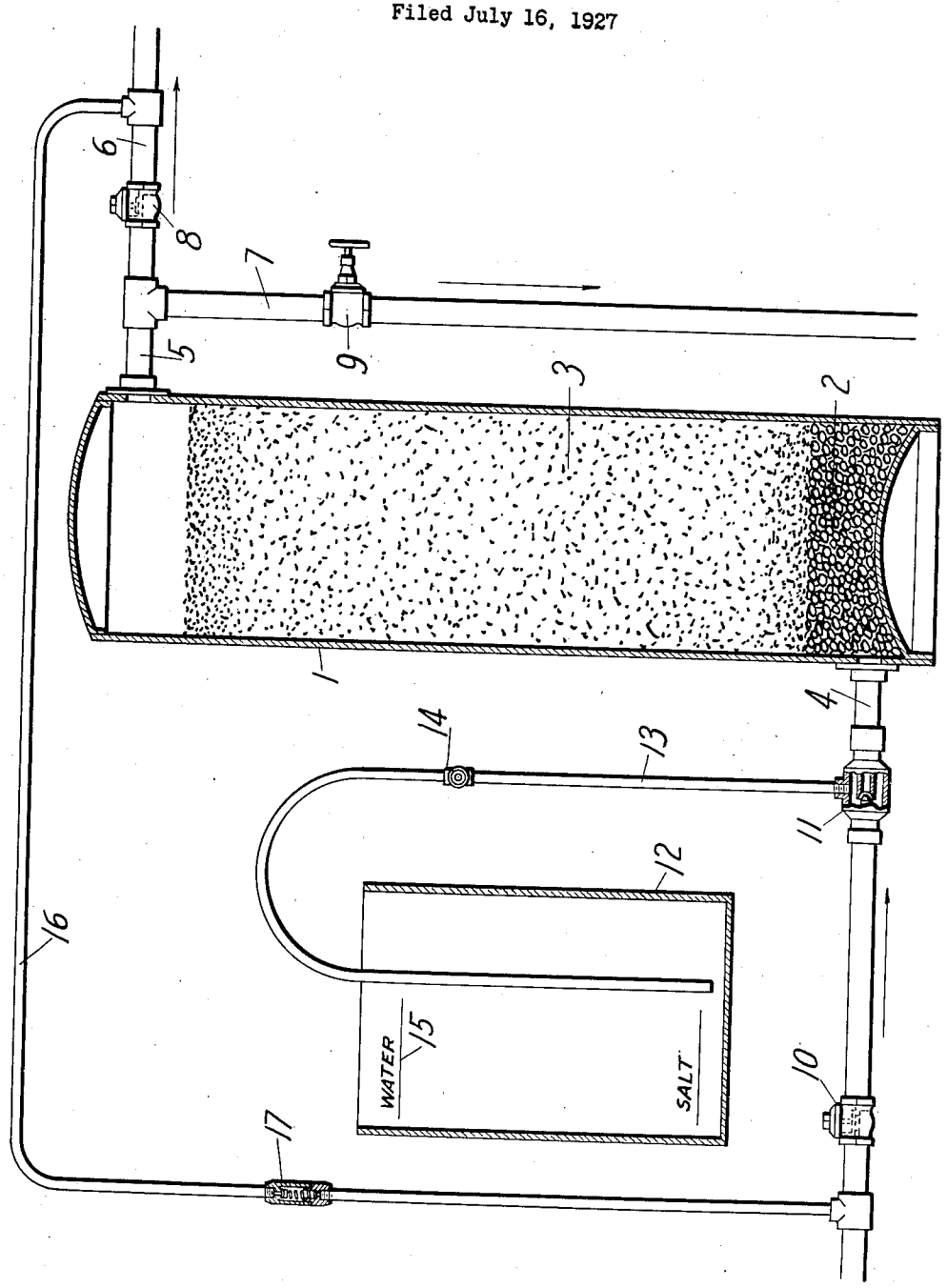
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WATER SOFTENING APPARATUS

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WATER-SOFTENING APPARATUS.

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This invention relates to water softening apparatus and more particularly to a water softening apparatus of that type which employs a base exchange mineral as the water softening agent. In a softening apparatus of this kind the water is passed through the mineral which removes from the water the substances which harden the same. In the course of time, depending upon the quantity of water softened and the hardness of the water, the mineral becomes partially exhausted so that it will no longer properly soften the water and in order to restore its effectiveness it is reconditioned by subjecting it to the action of a regenerating solution, such as salt water, which displaces the substances which have been removed from the hard water and restores the normal base of the mineral. The mineral is then washed with clear water to remove the brine and again place the apparatus in condition for the softening operation. In softening apparatuses of this kind it has been customary to provide a number of pipes to deliver the liquids to and discharge the same from the container for the mineral and these pipes must each be controlled by a separate valve. This requires in some cases a relatively large number of valves which must be operated in a proper sequence in order to cause the three operations of softening, regenerating and washing to take place in the proper order. Because of the number of valves it is an easy matter for the operator to make a mistake and operate the wrong valves. Further, such a construction, with its more or less involved pipe system and its numerous valves, is expensive of production and installation.

One object of the present invention is to provide a water softening apparatus which will be extremely simple in its construction and operation and which can be produced and installed at a low cost.

A further object of the invention is to provide such a water softening apparatus in which the three operations of softening, regenerating and washing may be effected by the manual operation of two valves, which valves are so arranged that there is no likelihood of their being operated in the wrong sequence.

A further object of the invention is to provide in an apparatus of this kind an improved arrangement of relief valve to protect the service line.

Other objects of the invention will appear as the apparatus is described in detail.

The accompanying drawing is a side elevation partly in section, of a softening apparatus embodying my invention.

In this drawing I have illustrated one embodiment of the invention and have shown the same in connection with a softener of a well known type but it will be understood that this embodiment has been chosen for the purpose of illustration only and that the apparatus may take various forms without departing from the spirit of the invention.

As here shown, the apparatus comprises a container or tank 1 for the softening material. Usually a bed of gravel 2 is placed in the bottom of the container and the bed of water softening material or mineral is placed upon the gravel, as shown at 3. In the present apparatus, the water to be softened is delivered to the bottom of the container 1 by means of a supply pipe 4, the gravel in the bottom of the container serving to distribute the water and cause the same to pass up through all parts of the bed of mineral. An outlet pipe 5 leads from the upper end of the container and is connected with a service pipe 6, leading to the faucets or other points of discharge, and with a drain pipe 7. The service pipe may be provided with a check valve, as shown at 8, so arranged that when the drain pipe 7 is open the back pressure of the liquid in the service pipe will maintain the check valve closed, and thus prevent any of the liquid entering the service pipe from the container. The drain pipe is controlled by a valve 9 which may be of any suitable character. If desired, the supply pipe 4 may be provided with a check valve 10 to prevent the back flow of liquid through the container in case of low pressure in the supply pipe. The supply pipe has constant communication with the container so that liquid will flow through the supply pipe to the container whenever a faucet in the service line is opened. The flow of water through the supply pipe is, in the present instance, utilized for the purpose of introducing the regenerating solution into the container and hard water delivered by the supply pipe is utilized for washing purposes, so that the liquid required for each of the three operations is furnished by the supply pipe 4.

Interposed in the supply pipe 4 is an

injector 11 which may be of any suitable character and which is connected with a source of supply for regenerating solution and serves to draw that regenerating solution into the supply pipe, where it is mingled with the hard water and delivered to the container. Mounted in any suitable position with relation to the container 1 is a brine tank 12 which is preferably an open tank and which is adapted to receive a quantity of salt, which may be introduced therein through the open top thereof. A single pipe 13 is connected with this tank and this pipe communicates with the injector 11. In the present construction the pipe 13 is connected with the injector and extends upwardly therefrom and is provided with a goose-neck portion which extends downwardly through the open top of the tank 12 to a point near the bottom of that tank. The flow of water through the pipe 13 is controlled by a valve 14.

During the softening operation the valves 9 and 14 are closed and hard water is introduced through the supply pipe to the container 1 and is discharged therefrom through the service pipe 6. After an interval of operation the length of which may, if desired, be arbitrarily determined according to the average quantity of soft water used, it becomes necessary to regenerate the mineral. To do this a quantity of salt is deposited in the salt tank, 12. The valve 14 in the brine pipe 13 is then opened and water will flow from the supply pipe 4 through the pipe 13 into the salt tank, which is allowed to fill to the desired extent, the tank preferably being provided with a water line, as shown at 15, to indicate the level to which it is to be filled. When the salt tank has been filled to the desired extent the drain valve 9 is opened, thus allowing water from the supply pipe 4 to pass through the container and out through the drain pipe, the service pipe being closed by the check valve 8. The passage of the water through the injector 11 will draw the brine from the salt tank 12 through the brine tank 13 into the supply pipe, which in turn delivers it to the container. This operation continues until the salt tank is empty, and the valve 14 of the brine tank 13 is then closed. After the valve 14 is closed the drain valve 9 is allowed to remain open for a further period of time to permit the hard water from the supply pipe to wash the brine from the container, after which the drain valve is closed and the water softening operation restored.

It will thus be seen that the three operations of softening, regenerating and washing, are all effected through the manipulation of the drain valve and brine valve and that the arrangement of these valves is such that their functions are obvious to the operator and there is no likelihood of the wrong valve being operated. Due to this construction the amount of piping required for the installation of the apparatus is reduced to a minimum and the use of a number of extra valves is avoided, thus reducing the cost of producing and installing the apparatus to a minimum. The timing of the regenerating operation is easily effected because it is only necessary to place in the tank a measured quantity of salt and to then fill the tank with water to the water line. The brine valve is closed when the tank is empty but no harm is done if it is not promptly closed because so long as the drain valve is open no water will flow through the pipe 13 into the tank 12.

It is not necessary that a measured quantity of salt be placed in the salt receptacle and all brine withdrawn each time the apparatus is reconditioned but the receptacle may contain salt enough for several regenerating operations, and the quantity of brine withdrawn may be controlled by the valve in the brine pipe 13.

It is desirable that some means be provided to protect the service pipe against excessive pressures, this being especially true where one branch of the service pipe leads through a water heater. In order to protect the service line I have therefore connected with the pipe 6 a relief valve and to prevent this valve discharging on the floor or into the open I have arranged for it to discharge back into the supply line. To this end I have connected with the service pipe 6, beyond the check valve 8, a small pipe 16 which is connected at its other end with the supply pipe 4 in advance of the check valve 10. Interposed in this pipe 16 is a relief valve 17, which may be of any suitable construction, which will prevent the flow of liquid through the pipe 16 at ordinary pressures but will open to permit the flow of liquid through the pipe 16 in the event of excessive pressures in the service pipe.

While I have shown and described one embodiment of my invention I wish it to be understood that I do not desire to be limited to the details thereof as various modifications may occur to a person skilled in the art.

Having now fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a water softening apparatus, a container for water softening material, a supply pipe for hard water leading to said container, a service pipe and a drain pipe both leading from said container, a tank adapted to receive a quantity of salt, a brine pipe connecting said tank with said supply pipe, and means for causing water to be delivered from said supply pipe in advance of said container through said brine pipe to said

tank and for then causing brine to be delivered from said tank through said brine pipe to said supply pipe.

2. In a water softening apparatus, a container for water softening material, a supply pipe for hard water leading to said container, a service pipe and a drain pipe both leading from said container, a valve for said drain pipe, a tank adapted to receive a quantity of salt, a brine pipe leading from said salt tank to said supply pipe, and means for causing water to flow from said supply pipe in advance of said container through said brine pipe to said tank when the valve in said drain pipe is closed and for causing brine to flow from said salt tank through said brine pipe to said supply pipe when said drain valve is opened.

3. In a water softening apparatus, a container for water softening material, a supply pipe connected with said container, an injector in said supply pipe, a service pipe and a drain pipe connected with said container, a normally closed valve in said drain pipe, a salt receptacle, a brine pipe connecting said salt receptacle with said injector, and a normally closed valve in said brine pipe, the two valves constituting the sole means for controlling the supply of water from said injector to said salt receptacle, and the regenerating and washing operations.

4. In a water softening apparatus, a container for water softening material, a supply pipe having communication with said container during all operating periods of said apparatus, an injector in said supply pipe, a service pipe and a drain pipe connected with said container, a normally closed valve in said drain pipe, a salt receptacle, a brine pipe connecting said salt receptacle with said injector, and a normally closed valve in said brine pipe, the two valves constituting the sole means for controlling the supply of water from said injector to said salt receptacle, and the regenerating and washing operations.

5. In a water softening device, a container for water softening material, a supply pipe for hard water leading to said container, a service pipe and a drain pipe, both leading from said container, a valve in said drain pipe, an injector in said supply pipe, an open tank to receive a quantity of salt, a single pipe to conduct hard water from said injector into said salt tank and to conduct brine from said salt tank to said injector, and a valve in the last mentioned pipe.

6. In a water softening apparatus, a container for water softening material having an inlet and an outlet, a supply pipe having constant open connection with said inlet, an injector in said supply pipe, a service pipe and a drain pipe connected with said outlet, a valve in said drain pipe, means controlled by said drain valve to control the flow of water through said service pipe, a tank to receive a quantity of salt, a brine pipe communicating with the interior of said salt tank and connected with said injector, and a valve in said brine pipe, the two valves constituting the sole means for controlling the softening, regenerating and washing operations.

7. The method of softening water and regenerating water softening material, comprising passing water to be softened from a supply pipe to a container for water softening material and discharging the softened water to a service line, opening a line of communication between said supply pipe and a salt receptacle through which water is delivered from said supply pipe to said salt receptacle to form a salt solution, then connecting said container to a drain and causing the salt solution to be delivered from said salt receptacle to said container through said line of communication, then interrupting the flow of salt solution from said salt receptacle to cause water alone to pass through said container, and then interrupting the connection between said drain and said container to restore the softening operation.

8. The method of softening water and regenerating water softening material, comprising passing water to be softened from a supply pipe to a container for water softening material and discharging the softened water to a service line until the water softening material is partially exhausted, then placing a measured quantity of salt in a receptacle, opening a line of communication between said salt receptacle and said supply pipe, and causing a predetermined quantity of water to be delivered through said line of communication to said receptacle, then connecting said container with a drain, interrupting the connection between said container and said service line and causing brine to be drawn from said salt receptacle through said line of communication, mixed with water in the supply pipe and delivered to said container, then closing said line of communication between said salt receptacle and said supply pipe and continuing the connection between said container and said drain to cause water alone to pass through said container to said drain, and then interrupting the connection between said container and said drain to restore the softening operation.

9. In a water softening apparatus, a container for water softening material, a supply pipe for hard water leading to said container, a service pipe and a drain pipe both leading from said container, a tank adapted to receive a quantity of salt, a brine pipe connecting said tank with said supply pipe, means for causing water to flow from said supply pipe through said brine pipe to said tank and for causing brine to flow from said

tank through said brine pipe to said supply pipe and a by-pass connecting said supply pipe with said service pipe, and a relief valve in said by-pass.

10. In a water softening apparatus, a container for water softening material, a supply pipe for hard water leading to said container, a service pipe and a drain pipe both leading from said container, means for delivering brine to said container, a by-pass connecting said supply pipe with said service pipe and a relief valve to normally close said by-pass but to open under excessive pressure in said service pipe.

In testimony whereof, I affix my signature hereto.

EDWARD T. TURNER.