

March 6, 1928.

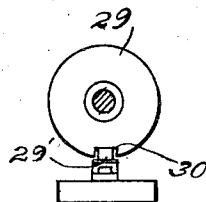
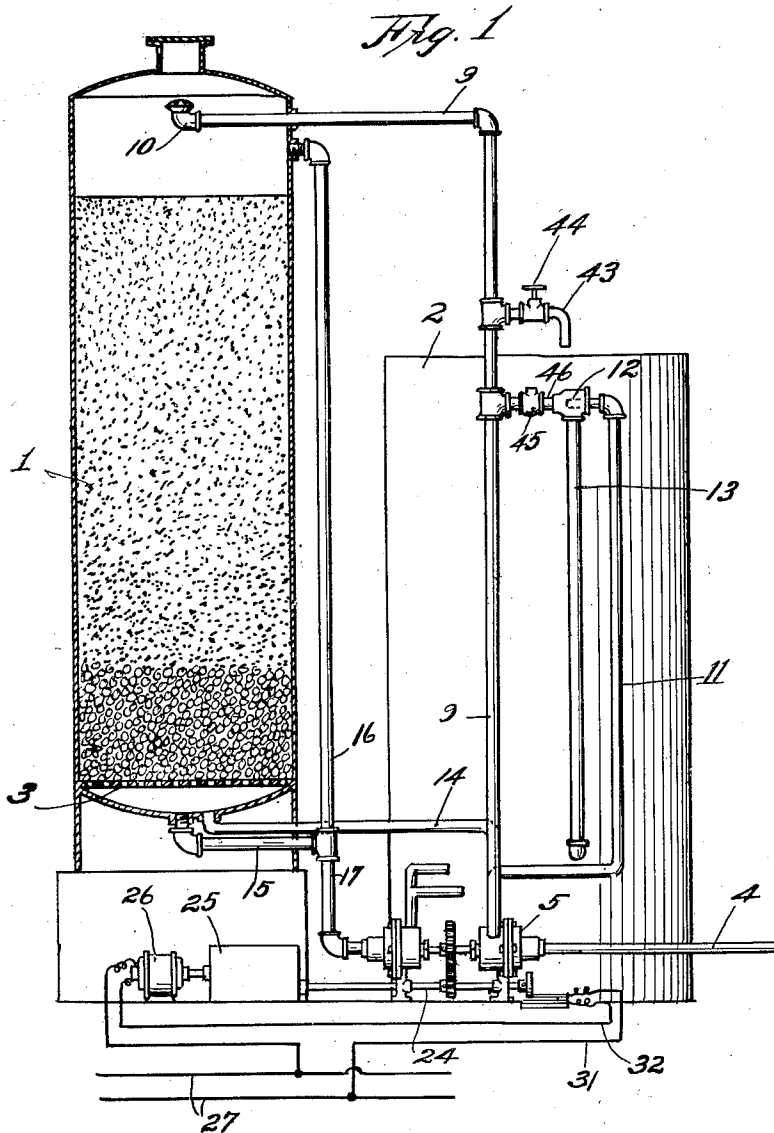
1,661,675

V. C. NORQUIST

WATER SOFTENER

Filed May 3, 1926

2 Sheets-Sheet 1



Witness:

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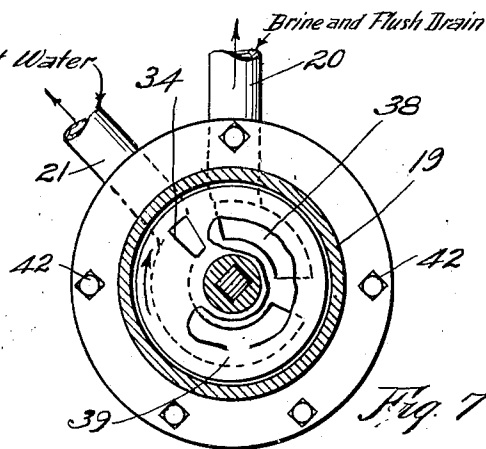
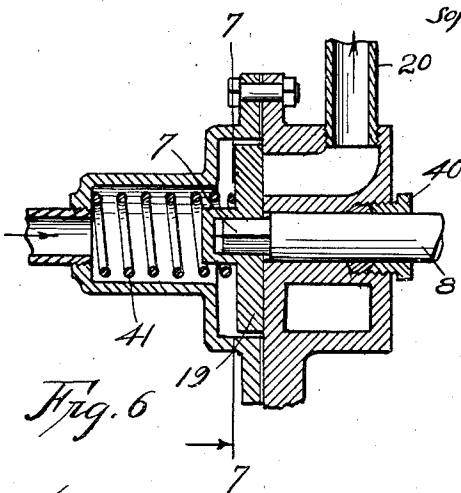
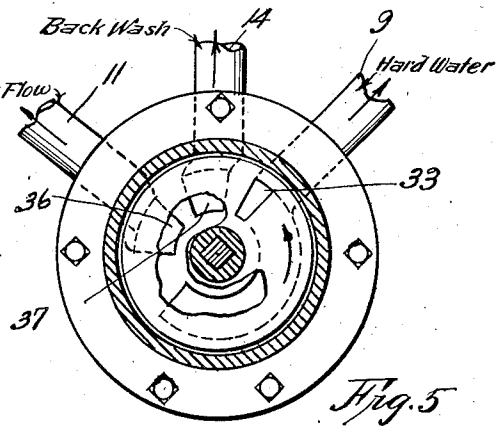
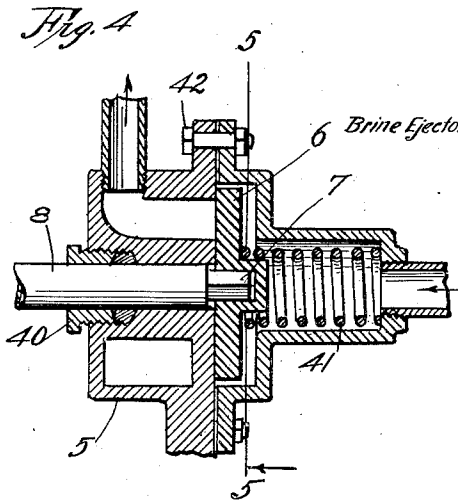
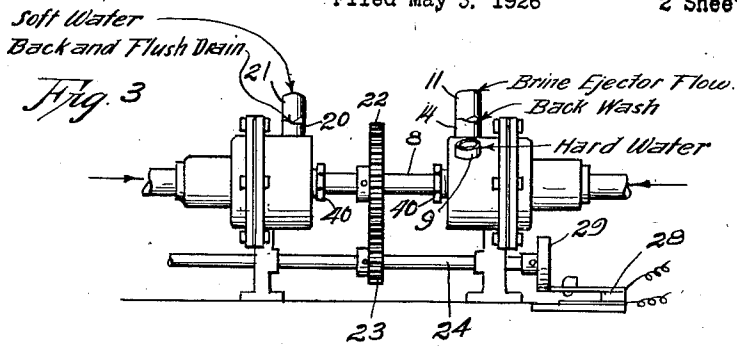
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WATER SOFTENER

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2 Sheets-Sheet 2



Witness:

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UNITED STATES PATENT OFFICE.

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WATER SOFTENER.

Application filed May 3, 1926. Serial No. 106,189.

This invention relates to improvements in water-softeners, and refers more particularly to water-softeners of the semi-automatic type in which the regenerating of the softener is accomplished by the simple manipulation of a switch whereafter the regeneration of the softening mechanism is automatically accomplished and the softening apparatus again put into service.

Among further objects of the invention are to provide a regenerating mechanism driven by motor and reduction gear arrangement functioning two valves, one interposed in the hard water supply line having discharge connections to the softener or through a brine tank to the softener and a second valve interposed in the drain line from the softener having discharge connections to the soft water delivery line, and the drain or sewer; to provide a construction in which the automatic manipulation of the valves serves to divide the regenerating period into back washing, salting, and flushing stages; to provide dual valve mechanisms interposed in the inlet and drain lines which have rotary discs controlling the passage of the liquid therethrough, said discs being seated in the direction of the greatest liquid pressure and in general to provide a mechanism herein-
after described in more detail.

Fig. 1 is an elevational side view of the construction with parts shown in section.

Fig. 2 is a detail of the starting and stopping mechanism.

Fig. 3 is a detailed view of the valves and starting mechanism.

Fig. 4 is a sectional view through the valve connected into the hard water supply pipe.

Fig. 5 is a view taken along the line 5-5 in Fig. 4.

Fig. 6 is a sectional view through the valve interposed in the drain line.

Fig. 7 is a view taken along the line 7-7 in Fig. 6.

Referring to the drawings, at 1 is shown a tank containing a filtering material which has the ability to soften hard water. Materials of this character are certain types of zeolites, green sand and other aluminum silicates in which certain constituents of the softening material are replaced by the salts of the water which tend to make it hard and which when regenerated with a salt brine revert to its original condition. The water softening action which takes place in the mechanism shown has no part in the present

invention other than being the process or method in connection with which the particular apparatus or arrangement for semi-automatic regeneration is connected.

At 2 is shown a brine tank in which a brine solution is kept for salting the softening material contained in the tank 1 and supported in the tank on a perforated plate such as that shown at 3. A pipe 4 is connected with the hard water main, not shown, and serves to supply the hard water to the softening system. At 5 is shown a valve casing enclosing a rotary valve 6 mounted upon the squared end 7 of a shaft 8. The discharge lines from this valve casing are a hard water supply line 9, connected into the top of the softener and terminating in a screened or spray pipe 10. A line 11, terminating in an ejector 12 adapted to draw the brine from the tank 2 through the line 13, and deliver it through the pipe 9 to the tank 1 and finally a back wash line 14 connected into the bottom of the tank 1. A draw-off line 15 which serves both as a drain and a soft water draw-off line connects with the back wash drain line 16 to form a single drain pipe 17. This latter line is connected into the valve casing 18 containing the rotary valve 19 and from this valve casing are the discharge pipes 20 and 21. Through this discharge pipe 20 flows the drain water during the salting and the flushing of the softening material contained in the tank 1. Through the pipe 21 is discharged the soft water for use.

The plates 6 and 19 are mounted upon the opposite squared ends 7 of the shaft 8. This shaft also carries a gear 22 which meshes with a gear 23 upon the drive shaft 24. The driving shaft 24 is connected through a series of worm and gear drives, the details of which are not shown, but which are enclosed in the reduction gear box 25 with the driving shaft of the motor 26. The motor receives its power through the power lines 27 in which is interposed a switch 28.

Let us assume that hard water has been filtering through the tank 1 and the softening material has substantially lost its effect so that it is advisable to regenerate. The starting mechanism which comprises a starting disc 29 affixed to the end of the shaft 24 is prevented from rotating by the engagement of the contacting arm 29' which fits into the slot 30 in the starting disc. This contacting arm when pushed down-

wardly to contact and close the circuit produced by the lines 31 and 32 in which is interposed the motor 26, the latter is started and with the starting of the motor whose rotation is transmitted through the shaft 24 by means of the reduction gears. The starting disc is moved so that the contacting lever or arm rides upon the periphery of the starting disc in which position it is held in contact with the opposite terminal maintaining a completed circuit and the motor in continuous operation until it has executed a complete revolution at which time the spring lever again drops into the slot 30 in the disc breaking the circuit and stopping the motor.

This period of rotation is timed to constitute the period of regeneration or a period of time during which the softening material contained in the tank 1 is first back washed, salted and flushed of the brine solution.

These successive periods, or stages into which the period of regeneration is divided, are determined by the registration of apertures 33 and 34 in the valve discs 6 and 19 respectively. The aperture 33 in the valve disc 6 registers successively with compartments 35, 36, and 37 in the valve casing 5. To the compartment 35 is connected the hard water inlet pipe 9 through which the water is introduced into the top of the tank 1. The compartment 36 is connected into the brine ejector flow pipe 11 by means of which the hard water introduced through the line 4 is supplied to the ejector 12 to draw the brine through the line 13 from the tank 2. The compartment 37 has connection with the back wash inlet line 14, through which the material in the tank 1 is back washed during which period the drain is taken from the top of the tank through the line 16. The stages of operation during regeneration are as follows: with the rotation of the valve disc 6 with the starting of the motor by means of the starting mechanism the wedged shaped aperture 33 is rotated into registration with the compartment 37 communicating with the back wash pipe 14, at which time hard water is introduced through the line 4, thence through the line 14 into the bottom tank 1. Simultaneously the aperture 34 in the following disc 19 is rotated into registration with the compartment 38, which has connection with the drain 20. The flow of water during this period then is through the line 4 and aperture 33 in the valve disc 6 into the compartment 37 and back wash inlet pipe 14 into the bottom of the tank and out through the top of the tank through the back wash drain line 16, thence through line 17 and aperture 34 of the valve disc 19 into the compartment 38 and out through the drain pipe 20 to a sewer line, not shown. This

back washing operation is timed by the slow rotation of the shaft 8, driven through the gears 22 and 23 from the shaft 24. At the expiration of this stage, or when the apertures in the valves have rotated to a second position, or to registration with the next successive compartments, the aperture 33 will now come in registration with the compartment 36, permitting the hard water through the line 4 to be introduced through the line 11 and ejector 12, and to draw with it the brine from the tank 2 for introduction into the top of the tank 1. Simultaneously with the registration of the aperture 33 of the compartment 36 in the valve 5 the aperture 34 on the valve disc 19 will continue in registration with the compartment 38, permitting the brine solution percolating through the softening material in the tank to flow out through the drain pipe 15 and line 17 to the compartment 38 and into the sewer through the line 20 as before. The final period of regeneration is a stage in the rotation of the valve disc 6 when it arrives in registration with the compartment 35, permitting the supply of hard water to be introduced through the line 4 directly through the line 9 into the top of the tank 1. For a definite period of time this supply of water is used as a flushing medium to remove the brine solution from the tank 1, and during this period the aperture 34 in the valve disc 19 is in registration with the compartment 38, so that the brine solution flush water is carried off through the sewer through the line 20. When, however, the brine solution has been completely washed from the softening material, the valve plate or disc 19 will have advanced to a position where the flush drain will be cut off and the compartment 39 brought in registration with the aperture 34, so that the soft water discharged from the bottom of the tank 1 through the line 15 is now directed through the line 17 and into the compartment 39 through the aperture 34 to be discharged into the service line 21 which supplies soft water for use.

Concerning the details of the valves contained within the casings 5 and 18, they are identical in so far as they consist of valve plates 6 and 19, having wedge shaped apertures 33 and 34. These valve plates are mounted upon the squared ends 7 of the shafts 8. Between the casings and the shaft 8 are stuffing boxes or packing nuts, designated as 40, to prevent water leakage. The valve plates or discs are seated against the casings in which the compartments are situated by means of compression springs 41. The two sections of the casing are held together by bolts 42, which extend through the flanges of the sections of the casing and between which flanges is positioned water tight gaskets.

It will be noted that the valves are so connected into the system that the water main pressure and the pressure of the head of water contained in the tank 1, assist the compression springs in holding the valve plates or discs upon their seats and facilitate maintaining a water tight connection between the valve plates and the sections of the casings containing the compartments to which the different draw-off lines communicate.

Briefly then, it is obvious that when the motor is started by pushing the contacting lever out of the slot in the starting disc, that the motor will run continuously during the regenerating period, which is timed by the disc through a system of reduction and worm gears in the box 25 to rotate the two valve discs mounted on the shaft 8 at a slow speed timed and synchronized with relation to each other, that the stages of regeneration will proceed in orderly sequence.

The inlet and the drain connections in the separate valves being covered and uncovered in proper relation to produce successive stages of back washing, salting and flushing, and to return to service of the entire mechanism with the simple manipulation of a manually operated switch, the successive stages of regeneration and the returning of the mechanism to service position being entirely automatic.

A secondary line 43 is connected into the line 9 for supplying water to the brine tank. This line is either controlled by a manually operated valve 44, or by an automatically functioned valve manipulated by a liquid level device positioned in the brine tank, not shown, and used in place of the valves shown at 44. A check valve 45 is interposed in the line 46 through which the brine solution is introduced into the line 9.

I claim as my invention:

1. A regenerating apparatus for water softeners, in combination with a water softening mineral receptacle, having inlet and drain connections, of a brine tank communicating with the receptacle through the water inlet, separate rotary valves in the inlet and drain connections, unitary driving means for manipulating said valves, timing mechanism controlling the driving means for regulating the period of regeneration, said valves automatically functioning to divide the regenerating period into back washing, salting and flushing stages.

2. A regenerating apparatus for water softeners, in combination with a water softening mineral receptacle, having inlet and drain connections, of a brine tank communicating with the water inlet, dual rotary valves, unitary driving mechanism rotating said valves in unison and means for timing the regenerating period, said valves automatically functioning the connections to di-

vide the regenerating period into back washing, salting and flushing stages.

3. A regenerating apparatus for water softeners, in combination with a water softening mineral receptacle, having inlet and drain connections, of a brine tank communicating with the receptacle through the water inlet, separate rotary valves interposed in the inlet and drain connections, unitary driving mechanism for the valves, timing mechanism for regulating the regenerating period, said valves functioning during said period through said driving mechanism to establish automatic stages of back washing, salting and flushing and service conditions of the water softening system.

4. A regenerating apparatus for water softeners, in combination with a water softening mineral receptacle, having inlet and drain connections, of a brine tank communicating with the receptacle through the water inlet, separate rotary valves interposed in the inlet and drain connections, seating in the direction of the greatest water pressure imposed thereon, unitary driving mechanism for the valves, timing mechanism for regulating the regenerating period, said valves functioning during said period through said driving mechanism to establish automatic stages of back washing, salting and flushing and service conditions of the water softening system.

5. A control for water softening systems including inlet and outlet fluid conduits, comprising a single valve governing the inflow of liquid to the system and a single valve governing the outflow therefrom, said valves being operated in unison by a unitary rotating driven means integral with the valves.

6. A control for water softening systems including inlet and outlet fluid conduits, comprising a single valve governing the inflow of liquid to the system, a single valve governing the outflow therefrom, a unidirectional rotary driving means common to said valves for functioning the valves to effect stages of regeneration and service.

7. A control for water softening systems including inlet and outlet connections to the system, a valve connected in the inlet connections, a rotary valve connected in the outlet connections and a rotating operator for positively and synchronously manipulating said valves to effect stages of regeneration and service.

8. A control for water softening systems including inlet and outlet lines to the system, a rotary valve connected in the inlet line, a rotary valve connected in the outlet line and an optionally operated rotatable means for positively and synchronously manipulating said valves to effect stages of regeneration and service.

9. A control for water softening systems

- including inflow and outflow connections communicating therewith, a single rotary valve having a plurality of apertures governing the inflow of liquid through certain
5 of the connections, and a single rotary valve having a plurality of apertures governing the outflow of liquid therefrom said valves being operated in unison by a common rotor.
10. A control for water softening systems including inlet and outlet connections communicating therewith, dual rotary valves mounted for simultaneous unidirectional rotation on a common shaft, one of said valves governing the inflow of liquid to the system and the other of said valves governing
15 the outflow therefrom.
11. A control for water softening systems including inlet and outlet connections communicating therewith, dual unidirectional rotary valves operatively associated with the
20 connections and mounted on a single shaft to govern the separate stages of regeneration and means cooperating with the shaft and valves to control the entire period of regeneration.

VICTOR C. NORQUIST.