

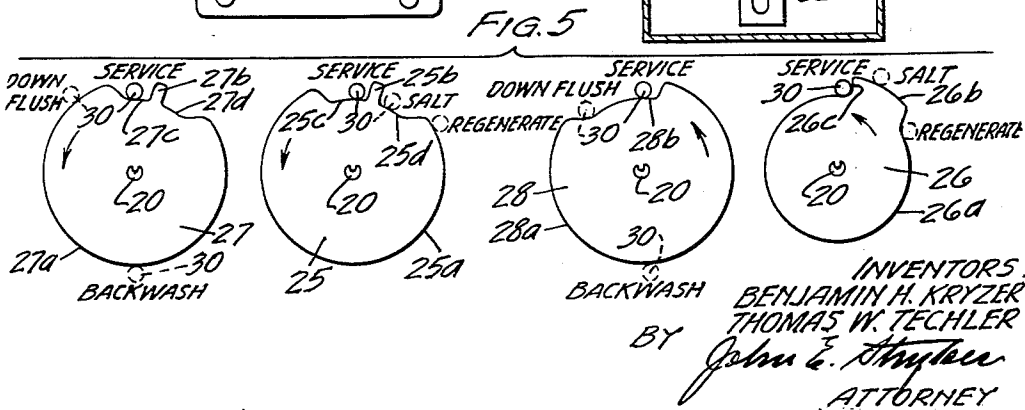
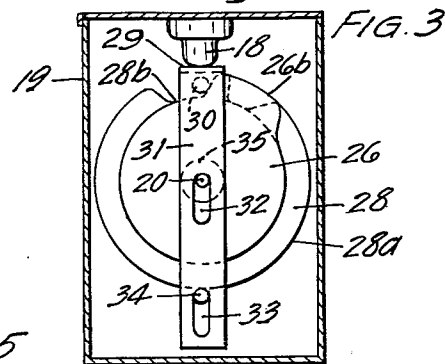
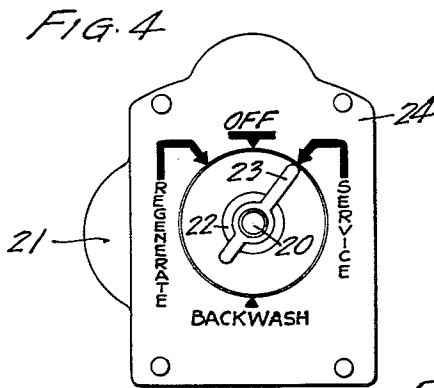
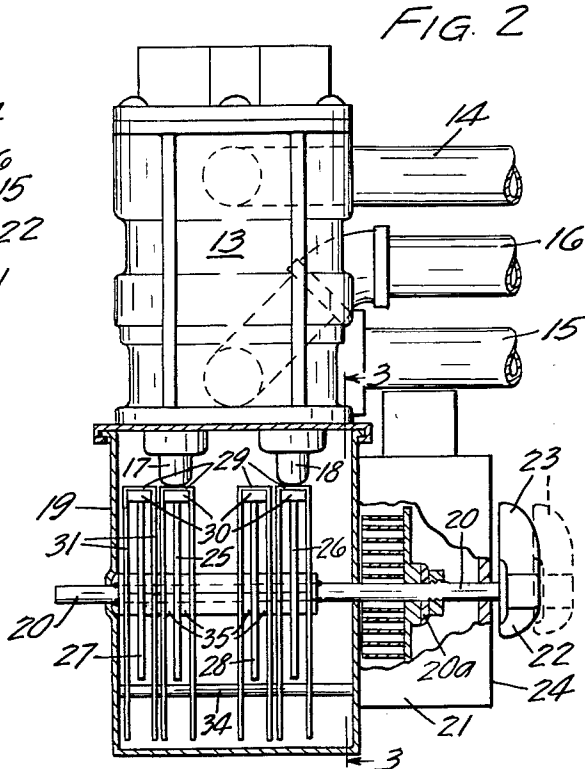
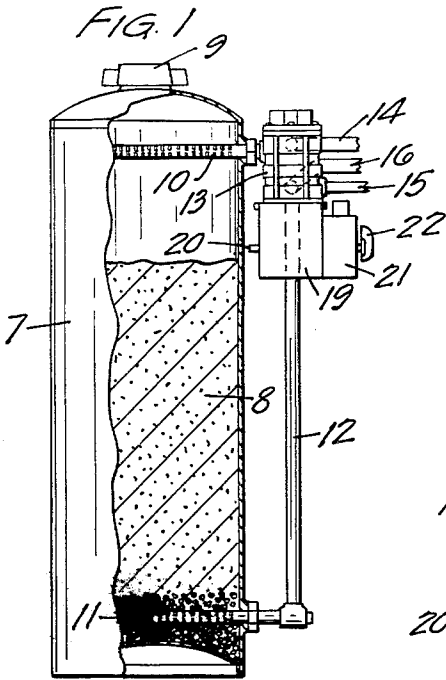
May 3, 1960

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2,935,198

CONTROL FOR WATER SOFTENERS

Filed May 20, 1955



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2,935,198

CONTROL FOR WATER SOFTENERS

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Application May 20, 1955, Serial No. 509,936

4 Claims. (Cl. 210—138)

This invention relates to controls for water softeners requiring periodic regeneration and particularly to improved semi-automatic controls adapted to be set to determine the duration and sequence of the several treatment steps including the regenerating and backwashing, when required, and the automatic return of the apparatus to water softening operation.

An object of our invention is to provide improved control apparatus of the class described, which is adapted to be manually set to cause operation of the softener through various selected sequences including automatically timed regeneration followed by flushing and return to water softening operation, or automatically timed backwash followed by down flush treatment and return of the apparatus to water softening operation.

A particular object is to provide in a control of the class described a pair of valves which are operative to control the flow through the softening material for water softening, backwashing, flushing and regenerating operations in combination with improved time control means for actuating said valves including pairs of cams formed to control the duration of the backwashing, flushing and regenerating operations.

Another object is to provide such a control with a single timer having a dial and pointer adapted to be manually set by reference to the dial to cause the softener to operate through any selected sequence of treatment steps including those hereinbefore described and to return the apparatus automatically to service.

Our invention also includes certain other novel features of construction which will be more fully pointed out in the following specification and claims.

Referring to the accompanying drawing which illustrates, by way of example and not for the purpose of limitation, a preferred embodiment of our improved control:

Figure 1 is a part side elevational view and part sectional view showing one of our improved controls in place on a water softener of common type;

Fig. 2 is a part side elevational and part vertical sectional view showing details of our improved cam mechanism;

Fig. 3 is a fragmentary sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is a front elevational view showing the dial and manual control for the apparatus, and

Fig. 5 is a diagrammatic elevational view showing the several cams in their relative angular positions in relation to the several cam follower rollers.

As shown in Fig. 1, our improved control may be operatively connected to a water softener of the conventional type having a tank 7 containing a body of granular or particulate softening material 8. A cap 9 closes an opening in the top of the tank and is removable to permit solid particles or pellets of common salt or other suitable regenerating material to be charged into the tank. Extending into the upper portion of the tank is a distributor 10 and another distributor 11 extends into the

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lower portion of the tank. From the distributor 11 a pipe 12 rises to our control housing indicated generally by the numeral 13. This housing is supplied with hard water under pressure through a pipe 14 and is connected to the distributor 10, to a drain or waste pipe 15 and to a soft water outlet or service pipe 16.

Details of the valve mechanism and passages and ports in the housing 13 communicating with the distributor 10 and with the several pipes 12, 14, 15 and 16 are described in our co-pending application for patent serial No. 491,452, filed March 1, 1955, and now abandoned, and constitute no part of the present invention. There are two plunger type valves in the housing 13. These are provided respectively with valve actuating members 17 and 18 which project downward from the bottom of the housing 13 into a casing 19 containing a plurality of pairs of cams mounted on a common supporting shaft 20. Clock mechanism contained in a casing 21 is operatively connected to the shaft 20. One end of the shaft 20 projects from the casing 21 and has fixed thereon a handle 22 formed with a pointer 23. The latter, by reference to a dial 24 on the face of the casing 21, is adapted to indicate the several positions of the cams in the casing 19. Calibrations and legends are provided on the dial 24. As shown in Fig. 4, the indicated positions may include an "off" position, a "service" position, a "backwash start" position, and a "regeneration start" position. The clock mechanism in the casing 21 is of the conventional type having a friction clutch connection 20a with the shaft 20 whereby the latter may be turned in a counterclockwise direction automatically from either the backwash or regeneration positions indicated on the dial or turned by hand to any selected angular position. The clock mechanism, which may be either spring actuated or synchronous motor actuated, is stopped when the pointer 23 reaches the "service" position and also when the pointer is turned to the "off" position.

A first pair of cams 25, 26 formed to determine the duration of the regenerating and flushing period are fixed on the shaft 20. There is also a second pair of cams 27, 28 formed and arranged to determine the duration of the backwash and down flush periods respectively. Associated with each of the four cams is a lift 29 carrying a cam follower roller 30 and the upper surface of each of these lifts engages the lower end of one of the valve actuating members 17 and 18. The lifts 29 are generally of U-shape, each having parallel side members 31 formed with vertically elongated slots 32 and 33 adapted to slidably fit the shaft 20 and a guide pin 34 respectively. Thus limited, substantially vertical, movement of each lift 29 is provided for independently of the other lifts. Each of the valve actuating members 17 and 18 is biased downward so that the lifts 29 in engagement with these members are pressed down and hold the rollers 30 in engagement with the peripheries of the cams associated therewith.

The shaft 20 is supported for limited longitudinal movement in bearings formed in the casings 19 and 21 and the several cams are held on the shaft in suitably spaced relation to the lift arms 31 by spacers 35. The spacers and lift arms are fastened against movement along the shaft 20. When the time control is to be set for regeneration and flushing, the handle 22 is pushed toward the dial 24 thereby moving the cams 25 and 26 to operative relation to the valve actuating members 17 and 18 respectively, i.e., to the full line position indicated in Fig. 2. When backwashing is required, the handle 22 is pulled out the broken line position (Fig. 2) thereby bringing the cams 27 and 28 into operative relation with the valve actuating members 17 and 18 respectively.

As shown in Fig. 5, the cams 25, 26, 27 and 28 are

formed with segments of suitable arcuate length to determine the duration of the several treatment periods. Cam 25, for example, has a segment 25a of relatively large radius and length and a stop finger 25b projecting between two segments 25c and 25d of shorter radius and length. Cam 26 has a relatively long segment 26a of smaller radius and a shorter segment 26b of greater radius at the end of which a stop shoulder 26c is formed for engagement with its follower roller 30. Cam 27 has a long segment 27a of relatively large radius and a stop finger 27b projecting between segments 27c and 27d of shorter length and radius. Cam 28 has a long segment 28a of relatively large radius and a shorter segment 28b of smaller radius.

As more fully pointed out in our application Serial No. 491,452, filed March 1, 1955, and now abandoned, the valve mechanism in the housing 13 may be so constructed as to cause flow during service operation from the hard water supply pipe 14 to the distributor 10, downward through the material 8, while the soft water is withdrawn through the distributor 11, pipe 12, valve housing and service pipe 16. Such flow is established when both of the valve actuating members 17 and 18 are in the "down" position, the cam follower rollers 30 being in the full line positions indicated in Fig. 5.

To effect backwashing, the cams 27 and 28 are disposed to raise both member 17 and member 18. Following the backwash period down flush is established by returning the actuating member 18 to its "down" position while the member 17 remains in its "up" position for at least a short period of time. The apparatus is then returned to water softening operation by allowing the actuating members 17 and 18 to move to their "down" positions. To charge the tank with regenerating material, the handle 22 is turned to the "off" position thereby raising the actuating member 18 on the cam segment 26b and allowing the actuating member 17 to move down on the segment 25d. This cuts off the flow of water to the tank and allows flow by gravity to waste while the cap 9 is removed and a charge of regenerating material is placed in the top of the tank.

During regeneration the actuating member 17 is raised and the member 18 is in the "down" position. This causes flow from the hard water supply pipe 14 downward through the material 8 and then out to the waste pipe 15 through the distributor 11, pipe 12 and housing 13.

Summary of operation

In Fig. 5 the follower roller 30 for each cam is shown in the service position in full lines. The broken line positions of the rollers 30 represent their positions relative to the cam peripheries at the start of the regeneration, down flush and backwash periods, as indicated by the legends. As hereinbefore indicated, the cams 25 and 26 are operative to control the duration of the regenerating and flushing operation and the cams 27 and 28 are operative to control the duration of the backwashing and down flush operations. Rotation of the shaft 20 is stopped during service operation and also when pointer 23 is set in the "off" position, Fig. 4, which corresponds to the position indicated by the legend "salt" in Fig. 5.

When backwashing is required, the timer control handle 22 is pulled out to the broken line position indicated in Fig. 2 wherein the cams 27 and 28 are in position to actuate the valve members 17 and 18. As the next operation, the handle 22 is turned clockwise from the service position indicated in Fig. 4 to the backwash position. From this backwash start position, the clock mechanism turns the several cams counter-clockwise while backwash continues. During backwashing water from the hard water supply pipe 14 flows through the valve housing 13, pipe 12, distributor 11, upwardly through the bed of softening material 8, and out through the distributor 10, valve housing 13 and waste pipe 15.

At the end of the backwash period for which the mech-

anism is set the follower roller 30 drops off the end of the segment 28a of the cam 28 to the down flush position on the segment 28b, indicated in broken lines, while the follower roller 30 engaging the cam 27 moves to the broken line position marked "down flush," Fig. 5. The clock mechanism continues to turn the cams for a further short period during which flow is established downward through the softening material 8, and, finally to waste. This period is terminated when the follower rollers 30 reach the service position on the periphery of the cams. At the end of the down flush period during which turbidity is removed from the water, the valve members 17 and 18 are automatically returned to the service position.

When regeneration is required, the operator actuates the handle 22 to its full line position, Fig. 2, wherein the cams 25 and 26 are in operative position in relation to the valve actuating members 17 and 18. Thereupon the handle 22 is turned clockwise from the "service" position indicated in Fig. 4 to the "off" position indicated therein. This raises the valve member 18, returns the valve member 17 to its down position and thereby cuts off the supply of hard water to the softener tank and allows water to drain from the tank to the elevation of the waste pipe 15. The requisite amount of salt is then poured into the softener tank, after removing the cap 9, and the cap is replaced. The timer handle 22 is then turned counter-clockwise to the "regenerate" position indicated in Fig. 4, whereupon the clock mechanism is operative to effect timed regeneration and flushing under control of the cams 25 and 26. Thus the follower roller 30 starts in the broken line position in engagement with the leading end of the segment 25a and the follower roller 30 for the cam 26 starts in engagement with the leading end of the segment 26a. The clock mechanism rotates the cams 25 and 26 in a counter-clockwise direction for a period of time which is predetermined for the particular installation. The regenerating and flushing period may continue, for example, while the cams 25 and 26 are turned through an angle of 300 degrees or more whereupon one follower roller 30 drops from the segment 25a to the segment 25c of the cam 25 and the other roller 30 engages the stop shoulder 26c of the cam 26. This stops the rotation of the cams and returns the apparatus to service operation. During regeneration water enters the upper portion of the tank 7 through the distributor 10, dissolves the salt upon the upper surface of the material 8 and carries the brine downward through this material at a controlled rate, thereby effecting regeneration. The spent brine is discharged through the distributor 11, pipe 12, housing 13 and waste pipe 15.

It will be evident that our time control including the cams 25, 26, 27 and 28 may be designed and adjusted to effect regeneration, backwashing and down flushing of any selected or desirable duration and that the adjustment of the backwash treatment time is independent of the other treatment times. Since there is only one control member, namely, the handle 22 having the pointer 23, to be manually actuated and only the simplest directions are required for proper manipulation of this member, the present invention is particularly adapted for domestic softeners where the users are seldom technically trained or skilled in the art.

We claim:

1. In a control for water softening apparatus having a tank containing a bed of water softening material and valve housing means connected respectively to a source of water, the upper and lower portions of said tank and to waste and service outlets, the improvements which comprise, two multiway valves movable in said housing means for controlling the flow through the bed during regenerating, backwashing and service operations, a first pair of cams formed to control the duration of the regeneration period and movable to and from an operative position in relation to said valves respectively, a second pair of cams

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formed to control the duration of the backwashing period and movable to and from an operative position in relation to said valves respectively, manually operable means for selectively moving the respective pairs of cams to and from operative relation to said valves, and time control means operatively connected to said cams to rotate the same automatically.

2. A control in accordance with claim 1 wherein said time control means comprise clock mechanism having a dial and pointer adapted to be manually set by reference to the dial to control the duration of the backwashing and regeneration operations.

3. In a control for water softening apparatus having a tank containing a bed of water softening material and valve housing means having chambers connected respectively to a source of water, the upper and lower portions of said tank and to waste and service outlets, the improvements which comprise, two multiway valves movable in said housing means for controlling the flow through the bed during regenerating, backwashing and service operations, a first pair of cams formed to control the duration of the regeneration period, a second pair of cams formed to control the duration of the backwashing period, a shaft supporting both pairs of cams, said pairs of cams being fixed on said shaft and said shaft being movable longitudinally to place either pair of cams in position to operate the valves, and time control means operatively connected to said shaft to rotate the same together with the cams through a predetermined cycle of operations.

4. In a control for water softening apparatus having a tank containing a bed of water softening material and

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valve housing means having chambers connected respectively to a source of water, the upper and lower portions of said tank and to waste and service outlets, the improvements which comprise, two multiway valves movable in said housing means for controlling the flow through the bed during regeneration, backwashing and service operations, a first pair of cams formed to control the duration of the regeneration period, a second pair of cams formed to control the duration of the backwashing period, means for selectively moving said pairs of cams to positions wherein the cams of either pair are in operative relation to the respective valves, a shaft operatively connected to said cams for rotating the same in unison, time control means operatively connected to said shaft to rotate the same, said shaft having a friction drive connection with said time control means, and a handle operatively connected to said shaft for manually turning it and the cams to selected angular positions in relation to said valves.

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