Oct. 7, 1958 B. H. KRYZER 2,855,042

CONTROL FOR WATER SOFTENING APPARATUS

Filed June 11, 1954

FIG. 1

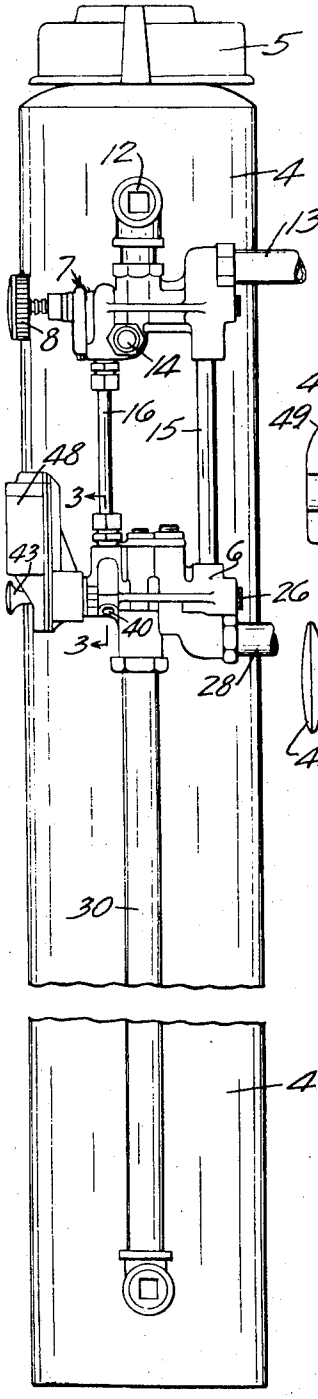


FIG. 2

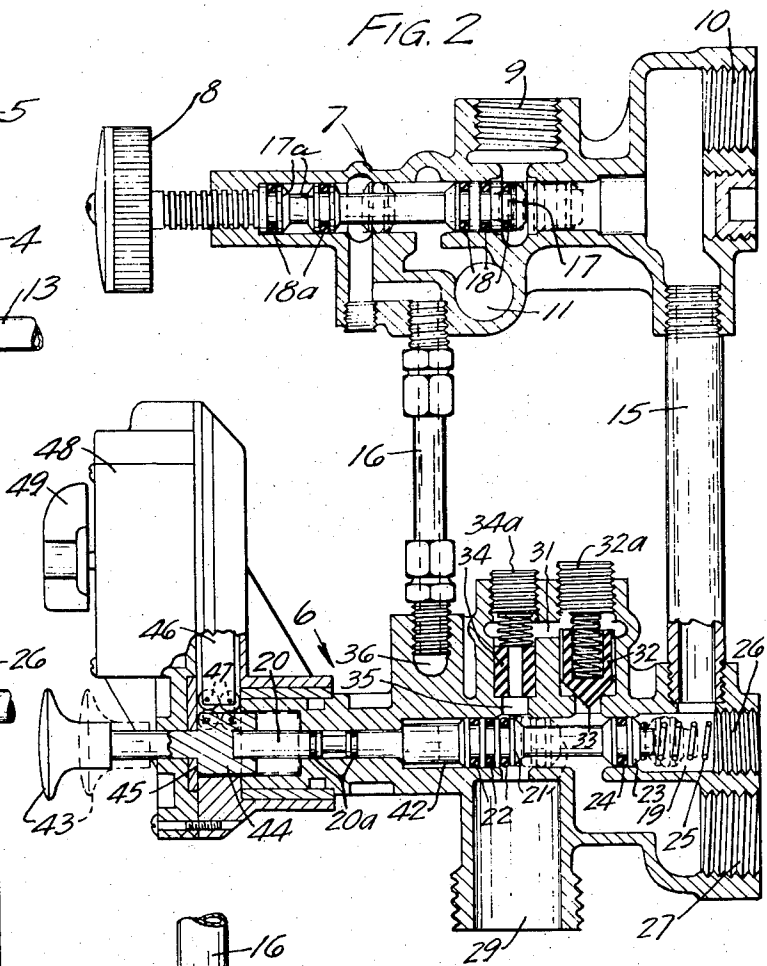
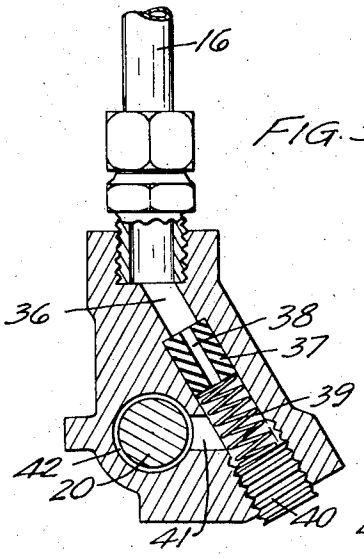


FIG. 3



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United States Patent Office

2,855,042

Patented Oct. 7, 1958

2,855,042

CONTROL FOR WATER SOFTENING APPARATUS

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Application June 11, 1954, Serial No. 435,998

5 Claims. (Cl. 161—7)

This invention relates to an improved control of the semi-automatic type which is particularly adapted for the control of a water softener having a tank containing a body of zeolite or base exchange material through which the hard water is passed to a service outlet and wherein the softening material requires periodic backwashing and regeneration.

It is an object of my invention to provide for a softener of the class described a semi-automatic control including a time control adapted to be selectively set manually to cause either a regenerating operation or a backwashing operation to continue for a pre-selected period of time, at the end of which the apparatus is returned to water softening operation automatically.

A particular object is to provide a semi-automatic control adapted to be manually set to terminate, automatically, either a regenerating operation or a backwashing operation at the end of pre-selected periods of time and having means under control of a manually operable valve for causing flow of wash water in the reverse direction in relation to the normal direction of flow through the water softening material during the backwashing operation.

The 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, one embodiment of my invention:

Figure 1 is a side elevational view showing my improved control in operative relation to a water softener of common type;

Fig. 2 is a part side elevational view and part vertical sectional view showing my improved control, and

Fig. 3 is a fragmentary sectional view taken on the line 3—3 of Fig. 1.

As shown in Fig. 1, the water softener is of the common type having a tank 4 containing a body of water softening material and a top closure 5 for an opening through which regenerating material, usually common salt, is charged into the tank when regeneration is required. My control mechanism comprises a semi-automatic valve indicated generally by the numeral 6 and a manually operable valve indicated at 7 and having a handle 8. The valve 7 has ports 9, 10 and 11 which are connected respectively to the upper portion of the tank through fittings 12 (Fig. 1), to a source of hard water through a pipe 13 and to a waste outlet 14 which may comprise a hose or other conduit. The valve 7 is connected to the valve 6 by pipes 15 and 16 and the upper end of the pipe 15 is in continuous communication with the port 10, and the upper end of the pipe 16 may be placed in communication with the port 11 under control of the valve 7. Slidably mounted in a bore of the valve 7 is a head 17 carrying a series of sealing rings 18. This valve is also provided with a pair of spaced heads 17*a* carrying sealing rings 18*a* for controlling the flow to waste port 11 from either the pipe 16 or port 9. When

in the position shown in Fig. 2, the heads 17 and 17*a* place the port 10 in communication with the port 9 and the pipe 16 in communication with the port 11. When in another position, indicated in broken lines in Fig. 2, the valve 7 cuts off communication between the ports 9 and 10, places the port 9 in communication with the drain outlet through the port 11 and closes the passage from the pipe 16 to the port 11.

At its lower end the pipe 15 communicates with a chamber 19 formed in the valve 6. This chamber is an enlargement of a longitudinally extending bore containing a plunger indicated generally by the numeral 20. This plunger has a head 21 carrying sealing rings 22 and a head 23 carrying a sealing ring 24 and is movable from the position indicated in full lines to the position indicated in broken lines in Fig. 2. A helical spring 25 is mounted in the chamber 19 and is confined between a closure plug 26 and an end of the plunger 20 to bias the latter toward its full line position. Sealing rings 20*a* fit in annular grooves in the plunger 20 to prevent leakage toward the left end of the plunger.

A port 27 of the valve 6 is disposed to supply water to a service pipe 28 (Fig. 1) and a port 29 is connected by a pipe 30 with the lower portion of the tank 4. A passage indicated generally by the numeral 31 is preferably formed in an extension of the casing for the valve 6 and is arranged to by-pass the head 21 when the latter is in the position indicated in broken lines in Fig. 2. This passage 31 contains a check valve 32 which is spring biased to normally close a port 33 at the inlet end of the passage. Also mounted in the passage 31 is a pressure responsive flow regulating device 34 having a restricted opening communicating with a port 35 at the outlet end of the passage. The device 34 is constructed from compressible, resilient material, e. g., suitable soft rubber or rubber-like composition which will be compressed to restrict the passage approximately in inverse proportion to the fluid pressure on the up-stream end of the device. Access to the check valve and flow regulating device may be obtained by the removal of screw-threaded closure plugs 32*a* and 34*a*.

As shown in Fig. 3, the lower end of the pipe 16 is in communication with a bore 36 in the casing for the valve 6. This bore contains a flow regulating device 37, like the device 34, forming a restricted passage 38 for flow to the waste outlet during regenerating operation. The device 37 is held in place by a spring 39 which is confined in the bore 36 by a removable plug 40. Extending laterally from the bore 36 is a passage 41 which communicates with an annular passage 42 surrounding the plunger 20.

The plunger 20 projects to the exterior of the valve 6 and carries a manually operable knob 43. Spaced along the plunger from the knob 43 is a member 44 formed with an annular shoulder 45 adapted to be engaged by a latch member 46 carrying anti-friction rollers 47. The latch member 46 carrying the rollers 47 is movable downward from the full line position indicated in Fig. 2 for engagement with the shoulder 45 when the plunger is thrust inward to the position indicated in broken lines. Mounted on the casing of the valve 6 and extending above the outer end portion of the plunger 20 is a housing 48 containing time control mechanism. This mechanism may comprise a control such as that described and claimed in Patent No. 2,689,000 to Lynn G. Lindsay, granted September 14, 1954. It includes suitable clock mechanism in the housing 48 and a manually operable pointer 49 which is fixed on a spindle of the clock mechanism and adapted to be turned in relation to a dial on the face of the housing 48. When the pointer 49 is turned in one direction it winds the clock mechanism and, by reference to the dial, indicates pre-selected periods of time for the

regenerating and backwashing operations. The clock mechanism is operatively connected to the latch member 46 which is vertically movable and spring biased upward, as more fully described in said Patent No. 2,689,006.

Operation

During water softening operation, the valves 6 and 7 are in the positions shown in full lines in Fig. 2. Hard water supplied through the pipe 13 is conducted from the port 10 to the port 9 and thence through the fittings 12 into the upper portion of the tank 4. The water filters downward through the body of softening material in the tank, and soft water is conducted by the pipe 30 to the port 29 of the valve 6 and then through the passages extending to the port 27 and service pipe 28.

To regenerate, the manual valve 7 is actuated to close communication between the supply pipe 13 and upper portion of the tank and to connect the upper portion of the tank through the fittings 12 to the waste outlet 14. This relieves pressure in the tank and allows excess water to drain off to the waste outlet. Thereupon the cap 5 is removed, a charge of regenerating material is placed in the upper portion of the tank and the cap 5 is replaced. As the next step, the valve 7 is actuated to its normal, full line position in which hard water from the pipe 13 is caused to flow through the valve 7 and fittings 12 into the upper portion of the tank where it dissolves the regenerating material and carries the solution or brine down through the body of softening material.

After thus setting the valve 7, the operator thrusts the plunger 20 inward to the position indicated in broken lines in Fig. 2 and, while holding the plunger in this position, the hand 49 of the timing mechanism is turned to such position in relation to the dial as to indicate a regenerating period of suitable duration. Such setting of the hand 49 causes the latch member 46 to be forced downward and to be retained in the path of the shoulder 45 thereby securing the plunger 20 in the time control position indicated in broken lines. This places the pipe 15 in communication with the port 27 and service pipe 28 and cuts off communication between the ports 27 and 29 by means of the head 21 carrying the sealing rings 22. When in this position, the plunger also places the port 29 in communication with the passages 42, 41 and 38, bore 36, pipe 16 and waste outlet port 11. Water now flows downward through the body of softening material and carries the spent brine and impurities up through the pipe 30 to port 29 and thence through passages 41, 42 and 38, bore 36, pipe 16 and port 11 to the waste outlet. Ordinarily the rate of flow during regeneration should be relatively slow. The restriction afforded by the passage 38 is such as to give the required low rate of flow irrespective of the pressure of the liquid in the passage 41. At the end of the predetermined period for regenerating, the time control causes the latch member 46 to be withdrawn automatically from the path of the shoulder 45 so that the spring 25 returns the plunger to its initial water softening position.

To backwash, assuming that the valves are in position for water softening operation, i. e., the position indicated in full lines in Fig. 2, the valve 7 is actuated to the position indicated in broken lines to thereby cut off direct communication between the pipe 16 and waste port, to cut off flow from the supply pipe 13 to the upper portion of the tank 4, and to establish communication between the upper portion of the tank and the waste outlet port 11. To set the timing mechanism for backwashing, the plunger 20 is actuated to its time control position indicated in broken lines and the hand 49 is turned to a position indicating the time required for backwashing. This causes the latch member 46 to engage the shoulder 45 on the plunger and to retain the plunger in the position indicated in broken lines. Thereupon water from the pipe 13 flows through the pipe 15 to the chamber 19 and thence past the head 23 to the port 33. The fluid pressure being sufficient to unseat the check valve 32, flow is now established through the passage 31 and flow regulating device 34 to the port 35 and thence through port 29 and pipe 30 to the lower portion of the tank 4 and upward through the body of softening material. Solid impurities that have previously been deposited in the softening material are thereby entrained in the backwash stream and carried out from the upper portion of the tank through the fittings 12, port 9 and passages in the valve 7 leading to the waste outlet port 11. The rate of flow during backwashing is determined by the size of the passage through the flow regulating device 34. The restriction of this passage is approximately inversely proportional to the fluid pressure upon the up-stream end of the resilient, compressible member 34.

At the end of the backwashing period, the time control causes the latch member 46 to be withdrawn from engagement with the shoulder 45 with the result that the spring 25 returns the plunger 20 to its water softening position. This cuts off the supply of water to the service pipe 28. In order to furnish soft water after backwashing, the valve 7 is returned to its normal water softening position wherein hard water is caused to flow into the upper portion of the tank through the fittings 12 and flow from the upper portion of the tank to the waste outlet 14 is cut off.

My automatic control of the duration of the backwashing treatment, as determined by the setting of the time control mechanism greatly facilitates uniformly efficient and thorough backwashing treatment because it eliminates the need for close attention and skill on the part of the users of the apparatus. My improved control has the further advantages of simplicity, low cost and adaptability for use where local water supplies vary widely in pressure and in the nature and quantities of the impurities that should and can be removed by the softening treatment.

I claim:

1. A two position valve comprising, a casing defining an elongated chamber having a supply port, a service port, a tank port, a waste outlet port and by-pass inlet and outlet ports; a passage connecting the by-pass inlet port to the by-pass outlet port; a plunger movable longitudinally in said chamber; and valve heads spaced along said plunger and movable therewith to a first position in which said supply and waste ports are closed, the tank port is connected to the service port and the by-pass ports are open one to the other, said plunger and heads being movable to a second position in which the supply port is connected to the by-pass inlet port, the by-pass outlet port is connected to the tank port and the waste port is connected to the tank port.

2. A valve in accordance with claim 1 in which a check valve is interposed in said passage to permit flow through said passage in one direction only.

3. A semi-automatic control for a water softener comprising, a valve casing defining an elongated chamber having a supply port, a service port, a tank port, a waste port and by-pass inlet and outlet ports, a passage connecting the by-pass inlet port to the by-pass outlet port, a plunger movable longitudinally in said chamber; valve heads spaced along said plunger and movable therewith to a first position in which said supply and waste ports are closed, the tank port is connected to the service port, and the by-pass ports are in communication one with the other through said chamber, said plunger and heads being movable to a second position in which the supply port is connected to the by-pass inlet port, the by-pass outlet port is connected to the tank port and the waste port is connected to the tank port; time control means adapted to be set to retain said plunger and heads in said second position for predetermined periods of time, and means operatively connecting said time control means to said plunger.

4. A control for a water softener comprising, a valve casing defining an elongated chamber having a supply port, a service port, a tank port, a waste port and by-pass inlet and outlet ports; a passage connecting the by-

pass inlet port to the by-pass outlet port, a plunger movable longitudinally in said chamber, valve heads spaced along said plunger and movable therewith to a first position in which said supply and waste ports are closed, the tank port is connected to the service port and the by-pass ports are in communication one with the other through said chamber, said plunger and heads being movable to a second position in which the supply port is connected to the by-pass inlet port, the by-pass outlet port is connected to the tank port and the waste port is connected to the tank port; and independently operable valve means for controlling flow from said waste port to waste and for selectively supplying fluid under pressure to said tank port or supply port.

5. A semi-automatic control in accordance with claim 4 having spring means biasing said plunger toward said first position, time control means adapted to be set to retain said plunger and heads in said second position for

preselected times and means operatively connecting said time control means to said plunger.

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