May 14, 1929. V. L. TANNEHILL 1,713,105

AUTOMATIC AND SEMIAUTOMATIC WATER SOFTENER

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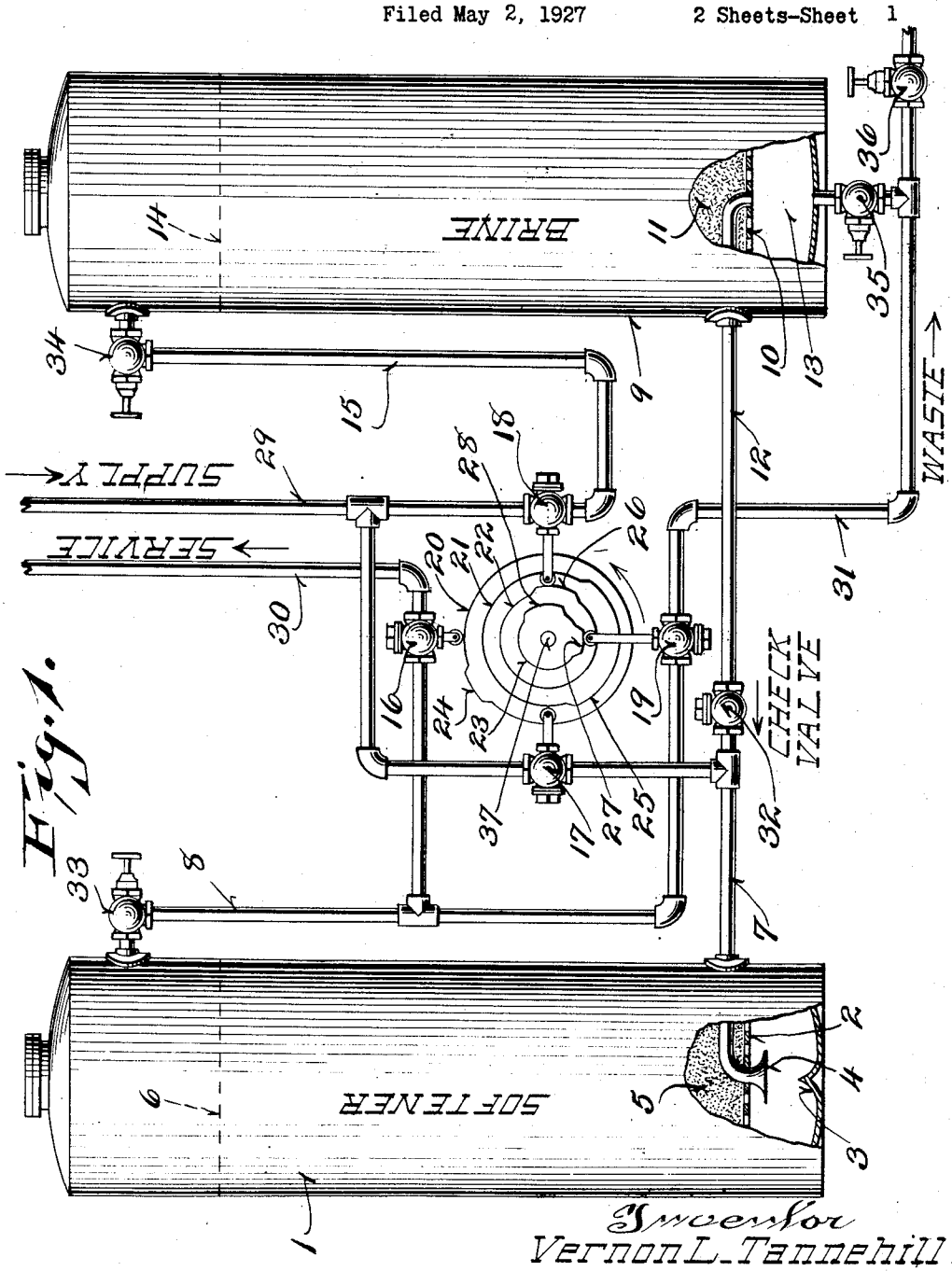


Fig. 1.

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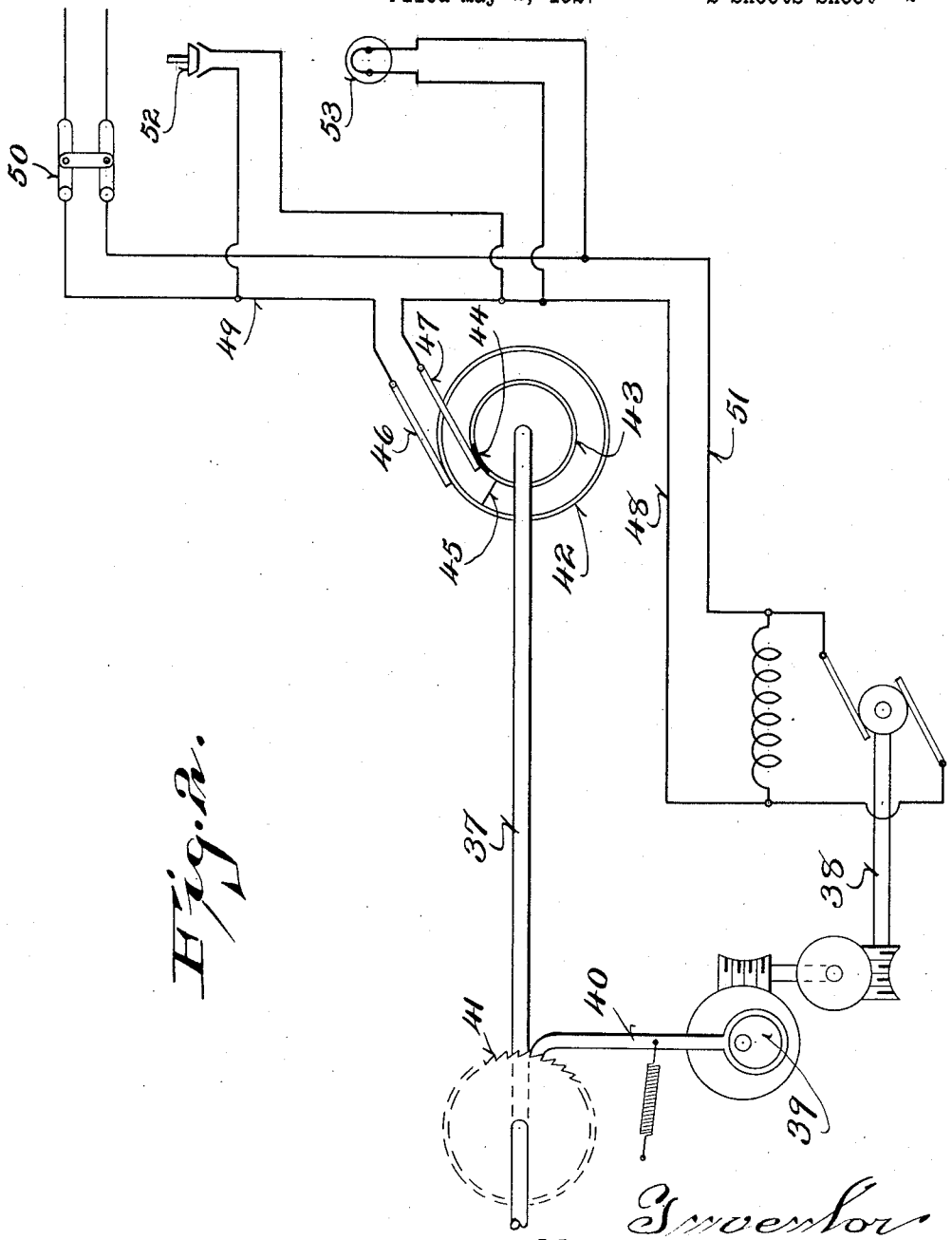


Fig. 2.

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UNITED STATES PATENT OFFICE.

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AUTOMATIC AND SEMIAUTOMATIC WATER SOFTENER.

Application filed May 2, 1927. Serial No. 188,174.

This invention relates to automatic and semi-automatic water softeners, and is an improvement over that disclosed in my co-pending application for automatic water softener, filed August 13, 1926, Serial No. 128,958, and in general has the same objects as those disclosed in such application.

Further objects are to provide an automatic water softener in which mechanism is provided whose operation may be initiated by a push button or other manual means to regenerate the zeolites or similar material by the passage therethrough of a brine or regenerating solution, and which after regeneration and washing, will automatically restore or connect itself in its normal condition to the system, the mechanism being so constructed that the automatic cut-off of the mechanism is secured without any thought on the part of the operator, after a complete cycle has been passed through.

Further objects are to provide a very simple mechanism which may be remotely controlled, as stated, by a push button or similar switch and which gives an indication of the operation of the motor adjacent the switch, so that the operator is apprised of the actual starting of the apparatus and may thereafter release the switch or push button with assurance that the device is supplied with energy for its operation, and also that it will automatically stop after it has passed through a complete cycle.

Further objects are to provide a water softener in which a small number of valves and cams are employed to effect the different connections, and in which the mechanism is such that it is extremely compact and simple, and is substantially fool-proof in its operation.

Further objects are to provide a water softener in which a salt tank is employed and connected with the water mains, so that water under pressure is forced through the salt tank and the brine collected at a portion of the tank and forced through the water softener to thus insure a complete regeneration of all portions of the softening material as the water is forced under pressure through all portions thereof.

More specifically, it is an object of this invention to provide manually adjustable or controlled means for predetermining the amount of salt solution that will be passed through the softener by controlling the rate at which the water is forced through the brine tank.

The apparatus forming the subject matter of this invention may cooperate with softeners of any suitable type, such, for instance, as that disclosed in my copending application for water softener, filed August 9, 1926, Serial No. 128,065, or with other similar types of water softeners.

An embodiment of the invention is shown in the accompanying drawings in which:

Figure 1 is a view of the system, such view being partly diagrammatic and having parts broken away for the sake of clearness.

Figure 2 is a diagrammatic view of the wiring and of a portion of the automatic cam operating mechanism.

Referring to the drawings, particularly Figure 1, it will be seen that a water softener 1 has been illustrated as provided with a bottom supporting screen or perforated plate 2 and a deflector or bottom 3 for deflecting the water upwardly from the bell-shaped mouth or end 4 of the normal inlet pipe for the softener. A bed of zeolites or similar material, indicated by the reference character 5, rests upon the screen or plate 2, and extends to approximately the height indicated by the dotted line 6, thereby leaving the upper portion of the tank free for the collection of the softened water. The inlet pipe 7 communicates with the bell-shaped portion 4 and thereby opens adjacent the lower portion of the softener. The outlet pipe 8 communicates with the upper portion.

The brine tank 9 is somewhat similar to the softener tank and is closed top and bottom. It is provided with a screen-like bottom 10 upon which the bed of salt 11 rests. The outlet pipe 12 opens into the lower portion of the tank and passes through the screen-like bottom, so that it communicates with the space 13 for the collection of the brine. The salt extends to approximately the dotted line indicated by the reference character 14 to leave a free space at the upper portion of the tank. The inlet pipe 15 opens through this upper portion.

Four automatically controlled valves 16, 17, 18, and 19 are arranged about a set of cams indicated by the reference characters 20, 21, 22, and 23. The valves are each controlled by means of cam followers which are operated

by the cams in the manner indicated in Figure 1. The valve stems, of course, are spring pressed so as to hold the cam followers in contact with the cams, as set forth in my co-pending application. The cam 20 associated with the valve 16 is provided with a raised portion 24 of relatively small extent. The cam 21 is provided with a raised portion 25 of relatively great extent. The cam 22 is provided with a raised portion 26 which is of relatively small extent, and the cam 23 is provided with two raised portions 27 and 28. The purpose of this construction of cams and arrangement of valves will appear hereinafter.

The supply pipe 29 is provided with branches which are controlled by the valves 17 and 18. The valve 17 controls the supply of water to the inlet pipe 7 for the water softener, and the valve 18 controls the supply of water to the pipe 15 to the brine tank. The valve 16 is interposed between the outlet pipe 8 leading from the upper portion of the water softener and the service pipe 30. It is to be noted also that the outlet pipe 8 from the water softener passes to the valve 19 which controls communication from this pipe to the waste pipe 31. It is to be noted also that the outlet pipe 12 of the brine tank is connected to the inlet pipe 7 of the water softener through a check valve 32 which opens in the direction of the arrow in Figure 1, that is to say, towards the water softener.

It is also preferable to provide manually controlled valves between the outlet pipe 8 and the upper end of the water softener, as indicated by the reference character 33, and between the inlet pipe 15 and the upper portion of the brine tank, as indicated by the reference character 34. For the purpose of cleaning or other operations upon the salt tank or brine tank, it is also preferable to provide a manually controlled normally closed valve 35 between the bottom of the brine tank and the waste pipe 31. If desired, a manually controlled valve 36 may be placed in the waste pipe at a point just in advance of the sewer.

The automatic mechanism for operating the cams will be described hereinafter, but it is believed at this point it may be desirable to give a brief outline of the operation of the apparatus which is as follows:

Under normal conditions, the water flows through the supply pipe 29 past the valve 17, through the inlet pipe 7, to the lower portion of the water softener. The shape of the bottom of the water softener is such that channeling of the material is prevented, as described in my second mentioned co-pending application. The softened water flows from the upper portion of the water softener through the outlet pipe 8, past the valve 16 to the service pipe. The position of the cams for this portion of the cycle of operations is such that the raised portion 24 is adjacent the valve 16 and the raised portion 23 is adjacent the valve 17.

When the operator has judged that the material has been in use a sufficient length of time he initiates the operation of the cams in a manner hereinafter described and the cams which were previously at rest during the normal service of the softener are now slowly rotated. The first change is that the valves 16 and 17 close and that the valves 18 and 19 open as the raised portions 26 and 27 are positioned adjacent such valves and engage their cam followers or operating portions. This is the position shown in Figure 1. The water now flows from the supply pipe 29 past the valve 18 through the inlet pipe 15 to the upper portion of the brine tank 9. From the lower portion of the brine tank or the collecting chamber 13 thereof the water flows through the pipe 12 past the check valve 32 through the inlet pipe 7 of the water softener and the brine is positively forced upwardly through every portion of the softening material. The waste water and any excess brine passing through the outlet pipe 8 of the water softener passes the valve 19 to the waste pipe 31, the valve 36 remaining open and the valve 35 remaining closed under all normal operations of the apparatus. After a certain interval has elapsed, determined by the length of the members 26 and 27, the valves 18 and 19 close and further flow of the brine is stopped. A soaking period is allowed to elapse before any further operation of the valves occurs, although the cams slowly and continuously rotate. The next step after the soaking period occurs when the raised portion 25 of the cam 21 passes beneath the cam follower of the valve 17 and when the portion 28 of the cam 23 passes beneath the cam follower of the valve 19. When this occurs the water from the supply pipe flows past the valve 17 into the inlet pipe 7 of the water softener and upwardly through the water softener. The used washing water passes from the upper portion of the water softener downwardly through the outlet pipe 8 thereof past the valve 19 to the waste pipe 31 and thus the water softener is thoroughly washed of all excess brine or accumulated material.

Further rotation of the cams positions the raised portion 24 of the cam 20 adjacent the valve 16 while the trailing end of the raised portion 25 is still adjacent the valve 17. At this point, the operation of the apparatus is automatically arrested as will hereinafter appear, and the water now flows in its normal course from the supply pipe 29 past the valve 17 to the lower portion of the softener. The softened water passes from the upper portion of the softener through the outlet pipe 8, past the valve 16 to the service pipe 30.

The automatic mechanism for operating the cam shaft 37 will now be described. This

automatic mechanism comprises any step by step or reduction mechanism for driving the shaft 37 from the driving shaft 38 of the electric motor, as indicated diagrammatically in Figure 2. The mechanism shown consists of worm reduction mechanism operating an eccentric 39 which by means of a spring pressed pawl 40 drives a ratchet wheel 41 in a step by step manner, such ratchet wheel being rigidly secured to the shaft 37. The shaft 37 also carries a pair of slip rings 42 and 43, or other suitable mechanism of this type. The slip ring 42 is continuous and the slip ring 43 has a broken or open portion provided with an insulator 44. The two slip rings are electrically connected by means of the conductor 45. Brushes 46 and 47 bear upon the slip rings, as indicated.

One of the terminals of the motor is connected by means of a conductor 48 to the brush 47. The brush 46 is connected by means of the conductor 49 to the main cut-off switch 50, and from thence to the supply mains. The other side of the motor is connected by means of the conductor 51 to the main control switch 50 and from thence to the other supply main. It is to be noted that a push button or switch member 52 is provided and is bridged around the brushes 46 and 47, so that although the motor circuit may be automatically opened by the position of the parts shown in Figure 2, nevertheless energy may be supplied the motor to initiate its operation by merely depressing the push button 52. When this is done, the motor starts to operate and the insulating portion 44 is moved from beneath the brush 47. Thereafter the push button 52 may be released and the motor will continue to operate and slowly drive the cam through a complete cycle until the insulating portion 44 again is positioned beneath the brush 47 at which time the motor will be automatically stopped.

A tell-tale lamp or indicator 53 is positioned adjacent the push button 52 and is bridged across the motor terminals so that when the motor is supplied with energy the lamp will be lighted.

It is intended that the motor mechanism and water softening and regenerating mechanism be positioned wherever desired as, for instance, in the cellar, and that the push button and tell-tale lamp 52 and 53, respectively, may be positioned in the kitchen or other convenient place to thereby provide a remote control and indicating device for initiating the operation of the motor.

It is to be noted particularly that the cam mechanism, reduction gearing, and motor are a unitary structure so that it constitutes a unitarily driven means for cutting off the supply of water to the softener, passing brine from the pressure brine tank through the softener and thereafter flushing out the softener for washing with the final reestablishment of the normal connections for the softener. In other words, this mechanism is actually built as a unit to facilitate its ready installation and manufacture, as well as to vastly simplify the connected pipe system and valve operating mechanisms.

It will be seen that a novel form of water softener has been provided by this invention which is manually thrown into operation at the desired time, which automatically passes water under pressure through salt and thereafter forces the brine through every portion of the softening material, and which subsequently thoroughly washes the rejuvenated softening material and finally connects the water softener in the main service line.

It will be seen that although these operations are relatively complicated that nevertheless they are accomplished by a very simple, compact and substantially foolproof apparatus, which may be thrown into operation by an unskilled operator without any chance of damage to the apparatus or to the operator.

Although the invention has been described in considerable detail such description is intended as illustrative rather than limiting as the invention may be variously embodied and as the scope of such invention is to be determined as claimed.

I claim:

A water softener comprising a softener tank, a closed salt tank, a supply pipe, a service pipe, a waste pipe, a plurality of separate and distinct valves each having an independent inlet and outlet separate from all other valves, cams for operating said valves, remote controlled, manually started and automatically stopped power means for operating said cams, one of said valves connecting said supply pipe and the upper end of the salt tank, a check valve connecting the lower portion of said salt and softener tanks, a second of said cam controlled valves connecting said waste pipe and the upper end of said softener tank, a third of said cam controlled valves connecting one end of said softener tank with said supply pipe, a fourth of said cam controlled valves connecting the other end of said softener tank and said service pipe.

In testimony that I claim the foreging I have hereunto set my hand at Fort Wayne, in the county of Allen and State of Indiana.

VERNON L. TANNEHILL.