March 5, 1935. E. E. JOHNSON 1,993,142

WATER SOFTENER DEVICE

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Fig. 1.

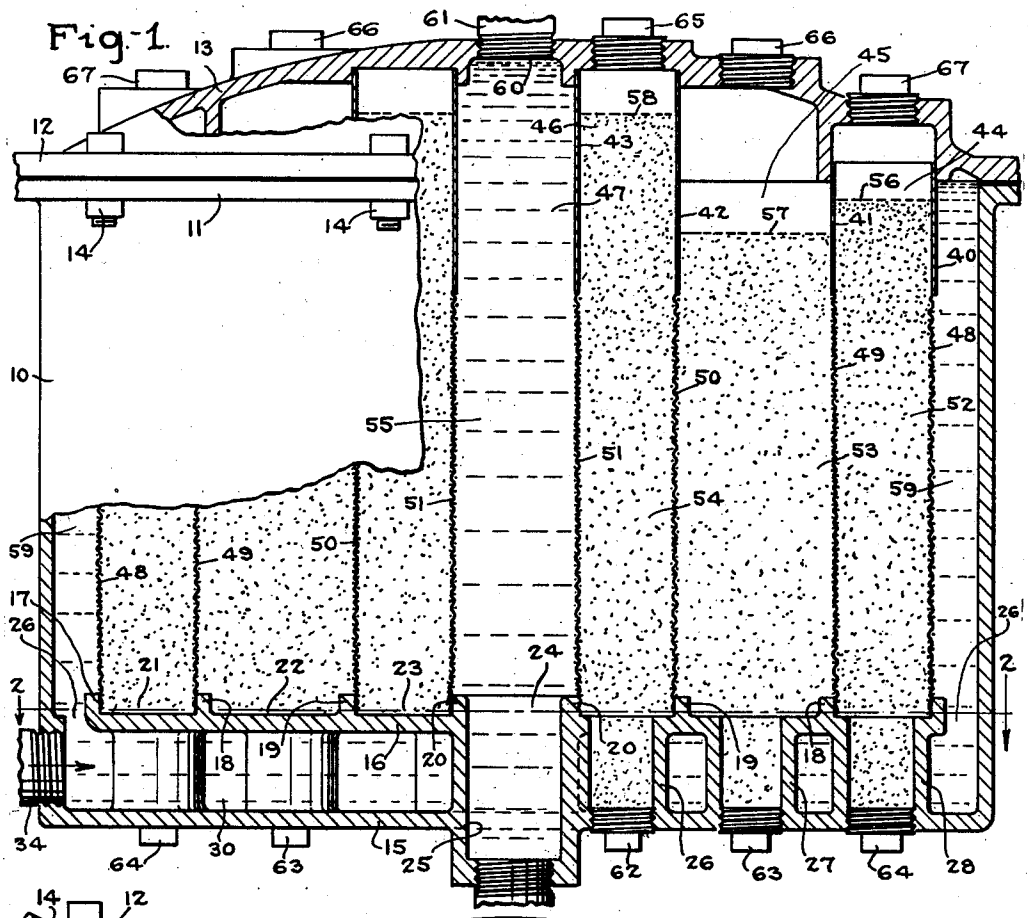


Fig. 1-A

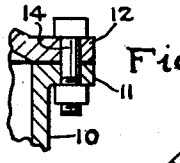
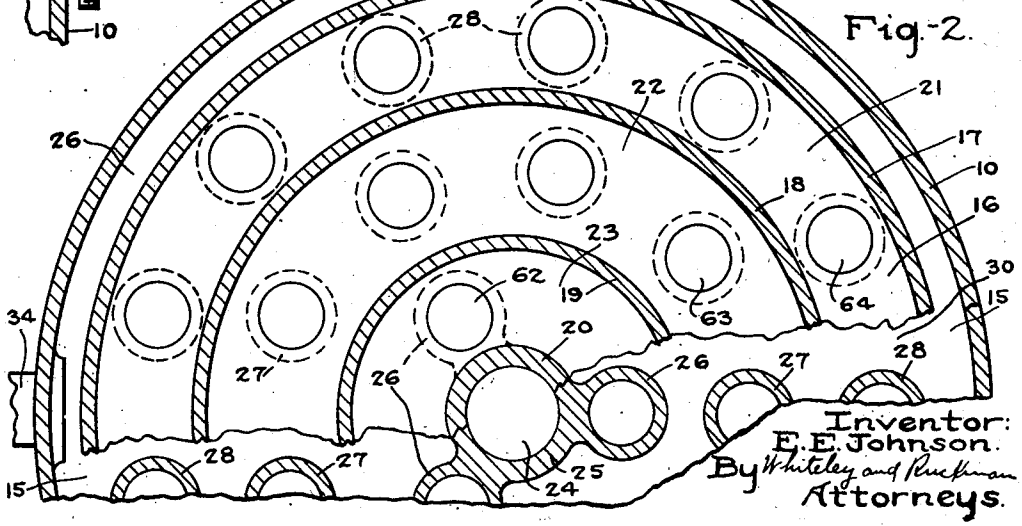


Fig. 2.



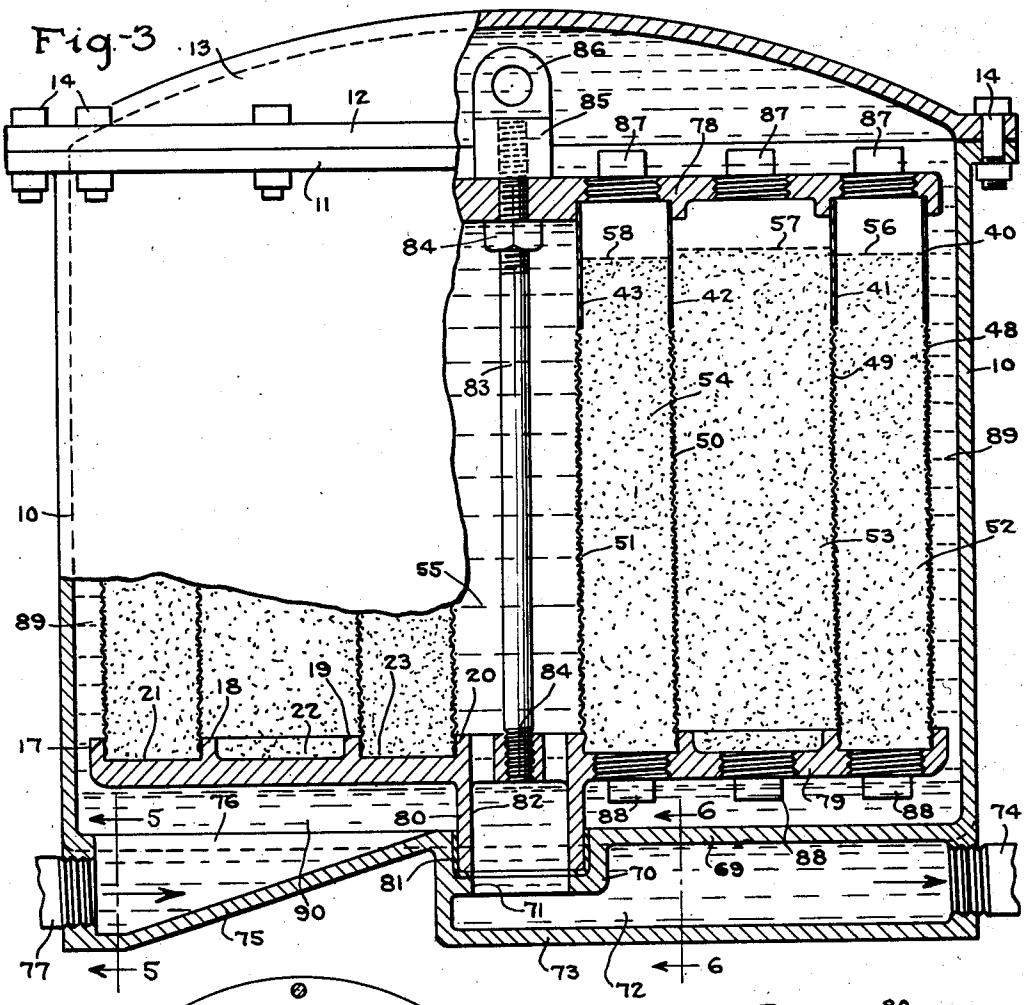
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WATER SOFTENER DEVICE

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Fig-3



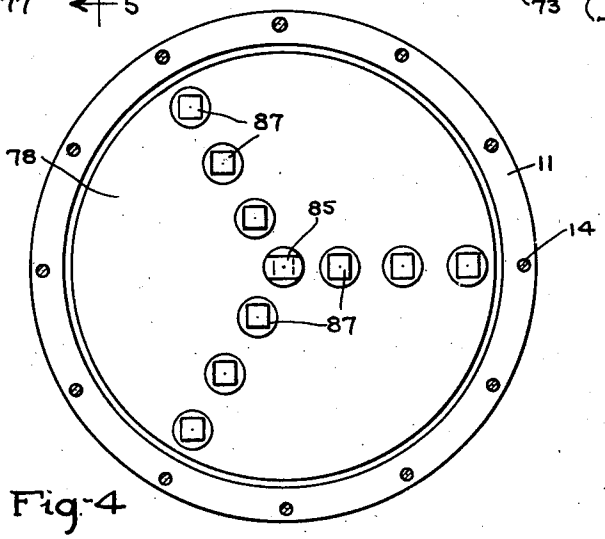


Fig-4

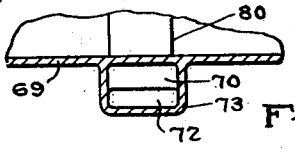


Fig-6

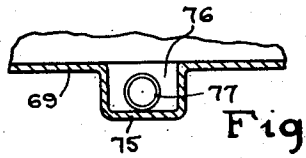


Fig-5

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1,993,142

WATER SOFTENER DEVICE

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Application August 20, 1931, Serial No. 558,223

5 Claims. (Cl. 210—24)

My invention relates to water softener devices, and has for its object to provide a simple and efficient construction for holding the zeolite softening material and controlling the flow of water through it, whereby under conditions of high pressure and large flow, for example, in industrial water softener plants, there will be no abrasion or destruction of screens, the flow will be continuously effective and adapted for any size of water softening appliance, and the various zones are subject to ready and simple cleaning.

As heretofore constructed, it has been customary to build large water softeners in the form of extensive cylinders with layers of gravel, zeolite and more gravel extending as horizontal beds across the interior of the cylinder, and to cause the water to flow down through this material to be discharged from the bottom thereof, or, where up flow of the water has been used, similar cylinders and beds of material have been employed except that the water is taken out from the top and ordinarily a screen is provided above the beds to prevent carrying with the water either zeolite or filtering material.

In either of these forms of water softening devices, there is a tendency toward abrasion of the screens, wastage of filtering and zeolite materials and clogging of the system from sliming, with entirely inadequate means of cleaning the same. My invention overcomes these several defects by the means hereinafter recited, and provides simple, economical and efficient means of holding filtering and zeolite material and of permitting large flow of water therethrough, so as to avoid any of the above defects, and also to avoid channeling and unequal activity in the zeolite mineral, which is one of the difficulties encountered with such devices as now constructed.

The full objects and advantages of my invention will appear in connection with the detailed description thereof, and its novel features are particularly pointed out in the claims.

In the drawings illustrating the application of my invention in one form,—

Fig. 1 is a part sectional elevation view of a water softener embodying my invention showing details of its construction and arrangement of filter and mineral. Fig. 1—A is a sectional detail view showing the manner of securing the cap to the upper rim of the casing. Fig. 2 is a sectional plan view on line 2—2 of Fig. 1. Fig. 3 is a sectional elevational view similar to Fig. 1 of a modified form in which the mineral and filter material holding unit may be independently withdrawn from the machine. Fig. 4 is a top plan view of what is shown in Fig. 3 with the cover plate removed. Fig. 5 is a sectional view on line 5—5 of Fig. 3. Fig. 6 is a sectional view on line 6—6 of Fig. 3, part of the last figure being viewed in the direction of the arrows.

As illustrated, I provide a cylindrical casing member 10 formed with an annular lip 11 about its upper portion adapted to receive a similar annular lip 12 and cap member 13 and which can be secured thereto by means of bolts 14. This casing is provided with a cylindrical bottom 15 of the same diameter as the casing 10, as clearly shown in Figs. 1 and 2. Supported upon the bottom 15 by means hereinafter described is a member 16 of smaller diameter than the bottom 15 which is formed with a circular opening or passage 26 extending between its outer flange 17 and the wall of casing 10. The member 16 is provided with concentric upstanding circular flanges 17, 18, 19 and 20 forming, respectively, annular channels 21, 22 and 23 and a cylindrical central opening 24, which, as shown in Fig. 1, may be carried out of the apparatus in a pipe 25. The circular member 16 is supported upon bottom member 15 by a multiplicity of rows of tube pieces 26, 27 and 28, all of which, including the members 15 and 16, may be integrally cast together. The space between the pieces 15 and 16 forms a chamber 30 which extends about all of tube members 26, 27 and 28 and opens at its outer margin uniformly into an annular opening 26. An inlet pipe 34 conveys water under pressure into the chamber 30 by which means water is uniformly distributed to the outer annular chamber within the casing 10, which will now be described.

Concentric annular cylindrical partitions 40, 41, 42 and 43 extending downwardly from the cap member 13 form annular channels 44, 45, 46 and the central cylinder 47 above, spaced from and having their walls in vertical alinement with the walls of channels 21, 22 and 23 and central cylinder 24. The walls 40, 41, 42 and 43 are imperforate and their lower edges are connected to the circular flanges 17, 18, 19 and 20 respectively by cylindrical screens 48, 49, 50 and 51 which provide annular screen walled chambers 52, 53 and 54 and a central screen walled chamber 55. The annular chamber 52 is filled with some filtering material such as sand of proper fineness. The annular chamber 53, which will preferably be wider than chambers 52 and 54 and have a width sufficient so that the water traveling across it will be properly softened, is filled with some kind of zeolite mineral, either green sand or artificial zeolite composed of a

double silicate of sodium and aluminum. The annular chamber 46 will be filled with a coarser filtering aggregate, as coarse sand or very fine gravel. Each of these chambers 44, 45 and 46 will be filled to points above the bottoms of partitions 40, 41, 42 and 43, as indicated by dotted lines at 56, 57 and 58. By these means uniform compression on the annular body of material will be maintained and uniform flow rate through all parts of it, and also if there should be any losses, particularly from the last chamber 46, these losses can be compensated for some considerable time without changing the annular bed exposed to the flow of water, which flow will take place in the following manner: Water entering chamber 30 from pipe 34 will distribute and flow upwardly through annular opening 26 into the annular cylindrical chamber or passageway 59 surrounding the outer screen member 48. There will thus be presented to the entire outer cylindrical surface of said screen 48 uniform pressure of water which will move inwardly at a relatively slow rate because of the great area, first through the filtering material in annular chamber 52, then through the water softening zeolite mineral in annular chamber 53, then through the retaining and filtering material in annular chamber 54, finally reaching the central chamber 55 from which the softened water may escape, either downwardly through cylinder 24 and pipe 25 or upwardly through an opening 60 and pipe 61, as may be desired.

The zeolite is adapted to be regenerated simply by reverse operation of flow, that is, water or brine charged with a suitable amount of salt is introduced through pipe 25 or pipe 61, passes outwardly through the filter bed 54, then through the zeolite bed 53, then through the filter bed 52, then through the annular passageway 59 from which it will finally go through chamber 30 through the pipe 34 and be discharged from the system, all being controlled by well known valve mechanism. It is to be noted the above arrangement is peculiarly adapted to take care of large quantities of water which, when the device is used for softening the water, may be passed through the system. Also since the pressure of the water under such circumstances is radially inward in all directions, and hence, the flow rate continuously increases toward the center, the tendency will be to pack the mineral and the filter bed material and effectively prevent channeling.

It has been found in practice that the filter bed first contacted by the water being softened, particularly in industrial plants, may quite rapidly accumulate clogging material such as would come from suspended organic and inorganic material, and more particularly slimes from mineral bacteria. In water softener plants as at present constructed, this difficulty has caused a great deal of trouble, particularly expensive and time-consuming where it is necessary to open the entire upper surface of the water softener, and generally requires removal of the entire contents, although the blocking slime and material is principally in the outer layer of filtering material. Simple means of cleaning the various layers of material are provided herein by means of screw plugs 62, 63 and 64 at the bottoms of tube members 26, 27 and 28, which will readily discharge the contents of those chambers below the water softener; and corresponding plugs 65, 66 and 67 in the top 12 give access for admission of a hose or leveling instrument to aid in the removal. In general practice, however, there will rarely be need to clean more than the outer annular chamber 52. The cleaning out of material from this chamber can be effected very quickly and new material substituted for that which is withdrawn, thus putting the water softener out of operation only a few minutes. Because of this practicability of quick cleaning of the outer filtering shell, material from it will be removed and cleaned much more frequently than with the ordinary water softener construction, thus greatly increasing efficiency over a given period of time, since in the ordinary construction flow is very much checked and hampered by sliming before the tedious time-consuming and expensive operation of cleaning is undertaken.

In the form of my invention shown in Fig. 4, the cylindrical casing 10, top cover 13 and flanges 11 and 12 and bolts 14 do not materially differ from those in the form shown in Fig. 1 except that the cover 13 is a plain cover entirely dissociated from the annular filtering and softening chambers, and a bottom 69 is directly connected with the walls of cylinder 10 and provided with a depressed central nipple 70 which has a central opening 71 leading into a chamber 72 formed by a casing extension 73 from which leads discharge pipe 74. There is a diametrically oppositely positioned casing depression 75 opening through an elongated opening 76 which is connected with inlet pipe 77 by means of which water is introduced within the casing 10.

Set within the chamber formed by the cylinder 10 is a separate member which is removable and comprises top and bottom plates 78 and 79 each formed with ribs, channels, cylindrical screens and annular and central chamber identical and similarly numbered with those heretofore described. At the central portion of the plate 79 coextensive with the circular flange 20 is a circular flange 80 which forms in effect a hollow boss, and this seats against a packing 81 in a circular depression formed in the boss 70 with the interior 82 of the boss 80 coextensive with the aperture 71 in boss 70. In addition to the screens 48, 49, 50, 51, the plates 78 and 79 are held together by a powerful bolt 83 which is threaded at 84 into a bar extending across the opening 82 in the double boss formed by flanges 20 and 80, and which is secured in position upon plate 78 by a nut 84 bearing against the top plate, and a second nut 85 screwed down upon the top of the plate which carries a hasp 86 adapted to receive a hook for lifting the assembly from within the casing 10. Upper cleanout plugs 87 positioned as shown in Fig. 5 and lower cleanout plugs 88 enable the material to be withdrawn and cleaned when the water softening cage or cartridge has been withdrawn, the advantages of this form being that when the cartridge which is rendered unusable is withdrawn another may immediately be put in its place and no time will be lost because of the change. The cartridge when removed can be both cleaned and regenerated while out of the system. The back-flow for regeneration may be made sufficiently strong to remove slime and accumulations from the outer portions of the outer filter bed, and this may be further aided by mechanical means such as brushes.

The cartridge is spaced as indicated at 89 from the cylindrical shell 10, and as indicated at 90 from the bottom plate 69. Water comes through

channel 76 into the space between bottom wall 69 and bottom plate 79 and distributes through the annular space 89 passing uniformly inwardly through screen 48 across the filtering material in chamber 52, through screen 49, across the water softening material in chamber 53, through screen 50, across the final filtering material in chamber 54, and through screen 51 to circular passageway 55 from which it goes through openings 82 and 71 and passageway 72 to discharge pipe 74.

The advantages of my invention will be apparent from the foregoing description. The incoming water is distributed over a very great area of screen surface moving rapidly inwardly and consequently increasing in speed which tends to hold the material in chambers 52, 53 and 54 in stationary position and effectively prevents any channeling. Furthermore, because of the relatively large area through which the water must pass compared with the area of the inlet and exit pipes the rate of movement inwardly will be slow, even where a large volume of water is carried through. The outer barrier of filtering material acts to filter out suspended matter from the water, and because of its uniformly permeable character delivers the water at the outer cylindrical surface of the zeolite bed with a constant speed and uniformity over its entire area. This in conjunction with the fact that the inwardly-moving streams of water are continually being concentrated, results in the flow rate through the zeolite being constant across any circumferential zone thereof, although gaining in velocity as it passes from zone to zone, which not only obviates channeling but insures thorough contact of all of the water with the zeolite for the requisite length of time to produce maximum efficiency. In the inner barrier of filtering material the flow rate will, of course, be relatively higher than through the zeolite bed, but will continue uniform throughout any circumferential zone thereof. This filter bed will entrap any particles of zeolite that may be carried into it through the screen 50 and will hold that zeolite adjacent the screen so that through the reverse flow during regeneration such particles may be carried back into the zeolite bed, all of which results in very definite improvements in the filtering and water softening operation. Finally, my water softening device in its entirety is adapted for very large installments and provides for very rapid and efficient cleaning, so as to maintain it in operation for the maximum amount in any given period of use.

I claim:

1. A water softener comprising a cylindrical casing, a member within the casing forming a multiplicity of annular concentric chambers extending about a vertical axis and formed with reticulate walls part way up the chambers, and imperforate walls the rest of the way up the chambers, zeolite mineral in some of said chambers and filtering material in other of said chambers, the surface of said mineral and material being carried to points above the bottoms of the imperforate portions of the chamber walls, and means for admitting water about the entire outer area of the outer screen wall, and for withdrawing water from the central chamber.

2. A water softener comprising a casing formed with an annular vertical chamber surrounding a central vertical chamber, said chambers having cylindrical walls perforate part way up and imperforate for the remaining distance, zeolite mineral filling the annular chamber to a point above the bottoms of the imperforate portions of the walls, and means for admitting water about the entire outer area of the perforate portions of the outer wall and for withdrawing water from the central chamber.

3. A water softener, comprising a cylindrical casing having a bottom wall and a second wall spaced therefrom and from the wall of the casing to form a bottom chamber with an annular opening all around it, concentric cylindrical perforate members supported by said second wall and forming an annular chamber between them filled with zeolite, and means extending between said bottom walls to support the upper thereof providing passages across said space into said annular chamber for withdrawal of zeolite therefrom.

4. A water softener, comprising a cylindrical casing having a bottom wall and a second wall spaced therefrom and from the wall of the casing to form a bottom chamber with an annular opening all around it, concentric cylindrical perforate members supported by said second wall and forming an annular chamber between them filled with zeolite, means extending between said bottom walls to support the upper thereof providing passages across said space into said annular chamber for withdrawal of zeolite therefrom, and means for admitting water under pressure directed across said bottom chamber between the bottom walls for uniform delivery therefrom to and about the outer cylindrical perforate member.

5. A water softener comprising a cylindrical casing having a bottom wall, a second wall spaced therefrom and from the wall of the casing to form a bottom chamber with an annular opening all around it, concentric cylindrical perforate members supported by said second wall and forming an annular chamber between the greater member and the casing and several annular chambers between successive pairs of perforate members, one of said last-named chambers being filled with zeolite and the others with filtering material, tubular members between the bottom walls for supporting the upper thereof and providing passages across said bottom space connected with the several interiors of the annular chambers above said second wall, and removable means closing the tubes at the bottom wall to permit withdrawal of material from said annular chambers.

EDWARD E. JOHNSON.