

Feb. 28, 1961

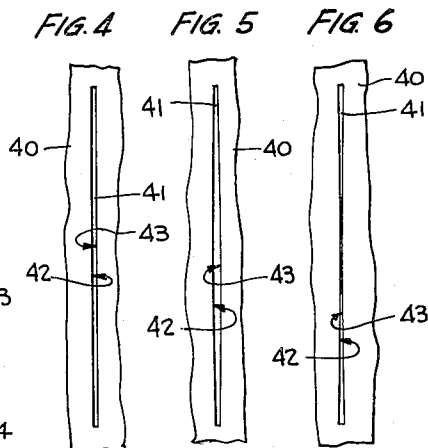
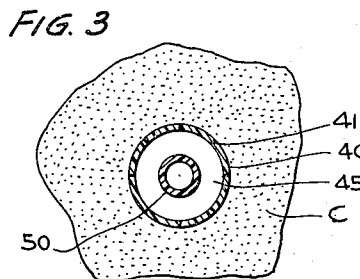
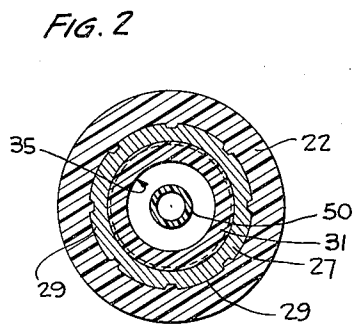
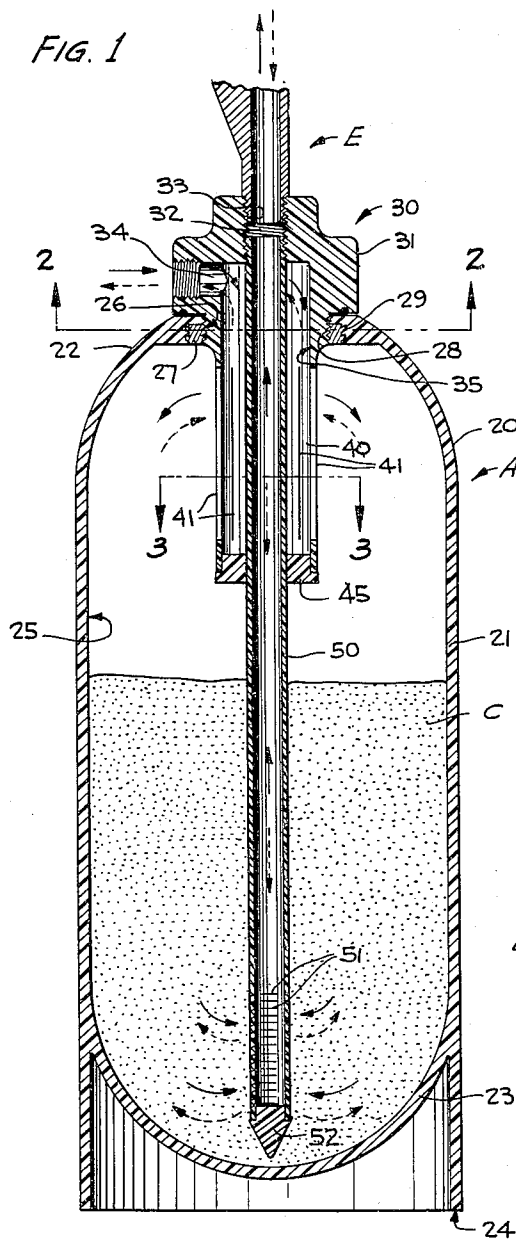
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2,973,097

APPARATUS FOR THE PURIFICATION, NEUTRALIZATION, CLARIFICATION
AND SOFTENING OF LIQUIDS

Filed March 16, 1959

2 Sheets-Sheet 1



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FIG. 7

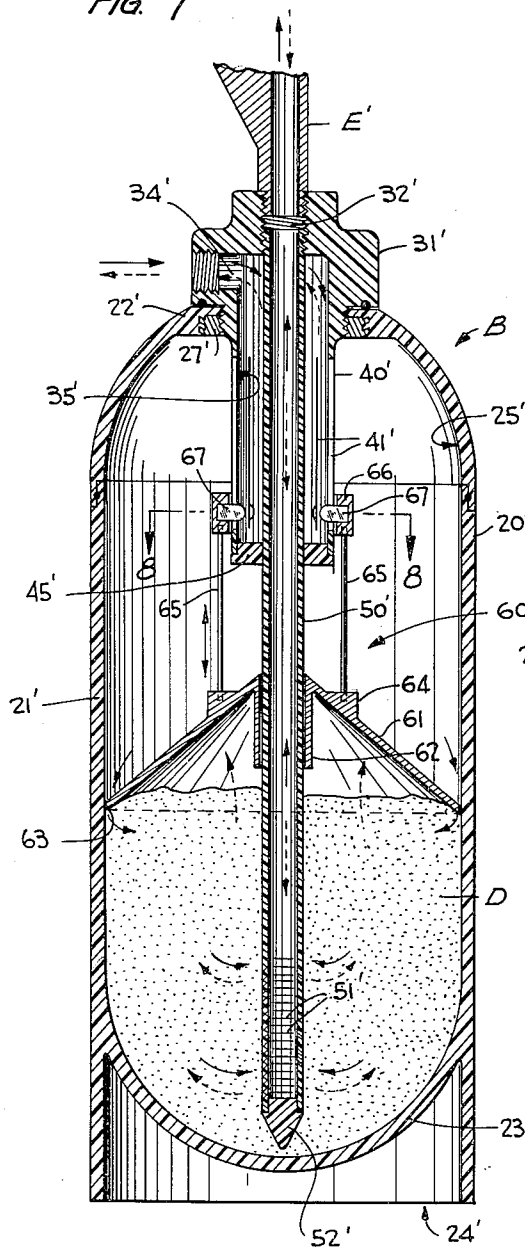


FIG. 8

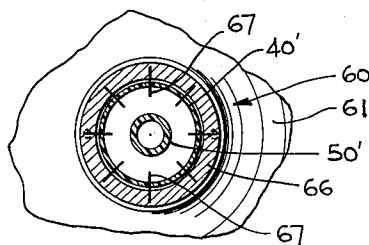


FIG. 9

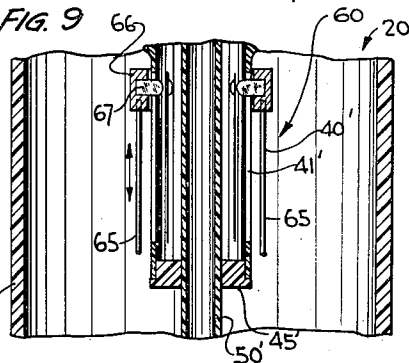
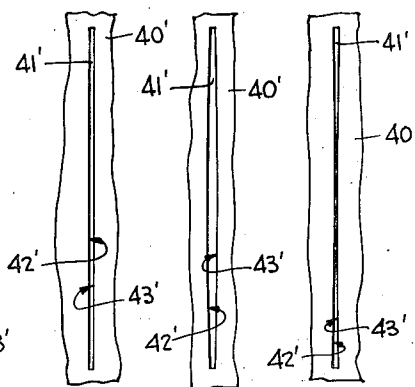


FIG. 10

FIG. 11

FIG. 12



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2,973,097

APPARATUS FOR THE PURIFICATION, NEUTRALIZATION, CLARIFICATION AND SOFTENING OF LIQUIDS

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8 Claims. (Cl. 210-279)

This invention relates to apparatus for the treatment of liquids for their purification, neutralization, clarification, softening and the like.

An important object of the invention is to provide such apparatus which includes means for self cleaning of the apparatus after periods of use.

Another important object is to provide apparatus for the treatment of liquids which includes means to self clean the same, simply by reversal of liquid flow through the apparatus without the need of manually removing or rearranging any portion of the interior structure of the apparatus.

A further important object is to provide apparatus for liquid treatment which includes liquid flow passageways which are adapted to automatically vary in width so as to force out entrapped foreign matter.

An additional important object is to provide apparatus for liquid treatment which includes liquid flow passageways which are adapted to automatically vary in width so as to force out entrapped foreign matter and through which passageways cleaning elements project and automatically move to aid in the cleaning of the passageways.

Still another important object is to provide apparatus for liquid treatment which includes elongated liquid flow passageways which are adapted to automatically vary in width so as to force out entrapped foreign matter and through which passageways cleaning elements project and automatically reciprocate to aid in the cleaning of the passageways.

Other objects and advantages of the invention will be apparent during the course of the following detailed description of the invention, taken in connection with the accompanying drawings, forming portions of this disclosure and in which drawings:

Fig. 1 is a vertical sectional view of one form of the apparatus of this invention.

Figs. 2 and 3 are horizontal sectional views, substantially on their respective lines of Fig. 1.

Figs. 4, 5 and 6 are fragmentary elevational views, on greatly enlarged scales, of a wall area of the apparatus of Figs. 1, 2 and 3 illustrating three positions of the wall surfaces of a slot or passageway therethrough.

Fig. 7 is a vertical sectional view of another form of the apparatus of this invention.

Fig. 8 is a horizontal sectional view substantially on the line 8-8 of Fig. 7.

Fig. 9 is a fragmentary vertical sectional view of a portion of the apparatus of Fig. 7 illustrating a change in the position during the cleaning operations of the apparatus of Fig. 7.

Figs. 10, 11 and 12 are fragmentary elevational views, on greatly enlarged scales, of a wall area of the apparatus of Figs. 7, 8 and 9 illustrating, like Figs. 4, 5 and 6, three positions of the wall surfaces of a slot or passageway therethrough.

In the drawings, wherein for the purpose of illustration are shown two forms or embodiments of the invention and wherein similar reference characters designate corre-

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sponding parts throughout the several views, the letters A designates one form and the letter B a second form of the invention, the letters C and D designate treating material within the apparatus of forms A and B respectively and the letters E and E' designate conventional reverse flow valves.

The form A of the invention, illustrated in Figs. 1 to 6 inclusive, includes a housing 20 which preferably comprises a cylindrical side wall 21 and outwardly convex end walls 22 and 23, with the end wall 23 preferably inwardly of the edge 24 of the side wall so as to provide a base for disposing the housing 20 upright. These walls define a major chamber 25, the lower end part of which provides a treating material containing part. The end wall 22 is provided with an axially-disposed opening 26 for a closure to be subsequently described. This end wall is enlarged in thickness at and adjacent the opening 26 as may be seen in Fig. 1. The part of the chamber 25 adjacent this opening 26 may be termed the outer end part thereof. It is preferred that the housing walls be of Fiberglas or like material which resists the actions of acids and alkalis and provides walls of sufficient strength against rupturing to withstand hydraulic pressures encountered in conventional water purification and filtering systems.

Since Fiberglas is not wholly suitable for being provided with screw threads of conventional size and pitch, I prefer to reinforce at least the intermediate part of the wall of the opening 26 with a metallic (as bronze, for example) insert 27 which may be in the shape of a ring having conventional screw threads 28 in its inner periphery, and a plurality of outwardly and upwardly projecting lugs or projections 29, shown in Figs. 1 and 2, imbedded in the material of the wall of the opening 26, which prevent dislodgment or turning of the insert relative to the wall of the opening 26. The screw threads 28 mate with screw threads of a combined closure, sleeve support and ports or liquid passageways means 30 next to be described.

The combined closure, sleeve support and ports or liquid passageways means 30 preferably includes a body portion 31 preferably of a modified polyvinyl chloride-acetate resin elastomer such as a polyvinyl chloride-acetate resin compounded with a plasticizer, such as dioctyl phthalate, to render the same flexible. Of course the desirable properties of the resin are retained, such as its chemical inertness which provides for good stability when subjected to the acids and alkalis generally encountered in treatments of liquids as brought out in the initial portion of this disclosure. The body portion 31 may be formed by extrusion or molding to provide an outermost or upper body part of the body portion 31 having a first or liquid passageway 32 opening from its outermost face and provided with screw threads 33, and there is an intermediate body part having a side-opening second port or liquid passageway 34 opening exteriorly of the intermediate body part and extending to a preferably cylindrical space or chamber 35 in the intermediate body part. At its outer end portion, the port 34 is screw threaded in order to be coupled to a screw threaded conduit (not shown) for liquid. The outermost of the screw threads of the body portion at the port 32 are provided to connect a conventional reverse flow valve E to the body portion 31, and the innermost of the screw threads 33 are adapted to mate with those of a tubular conduit 50 to be subsequently described.

Preferably integral with the body portion 31 is a depending sleeve 40 which is carried by the housing 20 by way of the body portion 31 and surrounds the tubular conduit 50 (which, as stated above, will be subsequently described). This sleeve 40 is preferably of the same

flexible material as that of the body portion 31 and its upper part opens into the space or chamber 35 to form a continuation thereof.

Normally extending substantially parallel with the longitudinal axis of the body of the sleeve 40 are a plurality of slots or passageways 41, rather long but normally minutely narrow, with the side surfaces 42 and 43 normally substantially in parallelism as in Fig. 4. The normal width of the slots 41 may be, for example, a thousandth of an inch or less. However, this width is not so important as are the widths when the apparatus A is in operation as will be described later.

At the inner end portion of the sleeve 40 is a ring-shaped closure 45 to close the inner end of the chamber 35. This closure 45 is preferably of the same material as that of the sleeve 40 and may be cemented to or have a press fit with the sleeve body or be integral therewith, but it preferably has a slip fit with the outer face of the tubular conduit 50 to be next described.

The elongated tubular conduit 50 may be of Fiberglas and is preferably rigid. It is carried by the housing 20 by way of the means 30, depends from the body portion 31 at the upper or outer end portion of the former and extends into the chamber 25 through the sleeve 40 and ring closure 45 and, of course, is surrounded along the upper end portion of the conduit by the sleeve, although spaced therefrom, so that this upper end portion defines one wall of the chamber 35. The ring closure 45 preferably has only a slip fit with the outer surface or face of the conduit 50, whereby it may slide along this surface or face. The inner end portion of the conduit 50 is provided with a plurality of spaced apart slots 51 extending partly around and through the wall of the conduit 50. The slots are minutely narrow and may be but one-thousandth of an inch or less in width. Their combined area is preferably about the same as the combined area of the normal widths of the slots 41. This width prevents nearly all of the particles of the treating material C from entering the bore of the tubular conduit 50, but permits liquids to enter this bore. The inner end of the tubular conduit is closed by a suitable closure 52 which closure may be termed the first closure, while the ring closure 45 may be termed the second closure. This closure 52 may be of polyvinyl chloride and have a press fit with the inner surface of the conduit. It is preferably pointed at its outer end portion so as to more readily enter the bed of the treating material C, to extend preferably closely adjacent the wall 23.

With a suitable bed of treating material C, which may be, by way of example, activated charcoal granules, the liquid to be treated substantially follows a course defined by the full-line arrows, and is introduced under suitable pressure into and through the port 34 and thence into the chamber 35 where the pressure will bulge outwardly the wall of the sleeve 40 causing the closure 45 to slip along the tubular conduit 50 so as not to cause rupture of the sleeve wall. This bulging will cause the slots 41 to enlarge or widen as in Fig. 5 and any treating material C which has entered the chamber 35 will be washed through the enlarged or widened slots. Of course the liquid will also flow through the slots 41 and it and the washed out treating material will then flow into the chamber 25 and, due to gravity and pressure, will enter the bed of treating material C to be treated by the material, while the washed out treating material will be retained in the bed and the treated liquid will enter and then flow through the slots 51 and flow up the bore of the tubular conduit 50, finally flowing out the port 32, as treated liquid.

In the event it is desired to clean the apparatus of deposits left by the liquid in the bed of treating material C, a flow of suitable liquid under pressure takes the path shown by the dotted arrows, i.e., through the port 32, down the bore of the conduit 50, out of the slots 51 and

into the bed of contaminated treating material, where the liquid will stir up the material and carry with it the embedded contaminations and some of the granules and flow from the bed through the chamber 25 and, impinging on the outer face of the sleeve 40, will force the wall thereof inwardly, but to a lesser extent than the outward bulge of the wall, since the force of the pressure has been partly spent, and this will cause the slots 41 to narrow in width substantially as in Fig. 6 so that, while the fine microscopic contaminations will pass through, the slots, the washed granules or other bodies of treating material cannot do so and, when the flow of liquid ceases, they will settle back upon the bed of cleaned treating material. From the slots 41 the liquid with the microscopic contaminations will flow through the chamber 35 and out the port 34.

The movements of the wall of the sleeve 40 will also tend to cause deposits of granules, clinging to the outer face of the sleeve wall, to be shaken loose to drop back upon the bed.

Referring now to the form B of the invention, illustrated in Figs. 7 to 12 inclusive, this form is much like the form A and similar reference characters, employing an exponent ('') will be employed to designate portions of the structure of the apparatus of form B corresponding to like portions of the form A, which portions function in the same way in both apparatus.

However, the form B of the invention includes slot cleaning means 60, not included in the form A of the apparatus for self cleaning the slots 41'. The means 60 preferably includes an inverted substantially funnel-shaped member 61 having a collar 62 slidable along the outer face of the tubular conduit 50' and disposed with the lower edge 63 of the member 61 normally seated lightly upon the top of the bed of treating material D. The edge does not extend in contact with the inner face of the wall 21' but is adjacent thereto, being spaced a sufficient distance so that the treating material may pass between the edge 63 of the member and the inner face of the wall 21'.

The member 60 also includes a boss 64 preferably circling the outer part of the member at the upper end thereof and rigidly supporting a plurality of spaced-apart supports 65 which, in turn, rigidly supports a collar 66 which encircles a portion of the outer face of the sleeve 40' for vertical reciprocation along this face. Carried by the collar 66 are a plurality of radially extending exceedingly narrow blades 67 which extend into the slots 41' and move longitudinally thereof upon movement of the collar in order to scrape deposits from the slots 41'. All of the elements 60 to 67 may be of suitable hardened plastic material, such as polyvinyl chloride, or other chemicals resistant material. The respective end portions of the supports 65 may be imbedded in the boss 64 and collar 66 respectively and the inner ends of the blades 67 also imbedded in the collar 66. The edges of the blades are not employed for cutting purposes.

The path of flow of liquid for treatment in the apparatus of form B is shown by full line arrows and the path of the flow of cleaning liquid is shown by dotted arrows, both paths being substantially similar to those of the liquids in the apparatus of form A, and the outward bulging and movement inwardly of the wall of the sleeve 40' and changes in the widths of the slots 41' are substantially like the movements of the wall of the sleeve 40 and slots 41 and the slip of the slip closure 45' is like that of the ring 45. However, it should be noted that the means 60 does not operate during flow of the liquid for treatment but only when liquid is introduced for cleaning the bed of treating material D. During this cleaning operation, the wall of the sleeve 40' is, of course, forced inwardly so that there will be no binding of the collar 66 on the wall of the sleeve. Upon the flow of cleaning liquid upwardly through the bed, the mate-

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rial D is agitated and swirls upwardly and, with the pressure liquid, raises the means 60 as a unit so that the blades 67 will scrape the side surfaces 42' and 43' of the slots 41' and, as the means 60 settles back at the end of the cleaning operation at which time the flow of cleaning liquid stops, a final scraping of the slots 41' will be effected. The means 60 also tends to prevent treating material D from getting into the chamber 35' above the member 60.

It is preferred that the member 60 be an inverted funnel shaped one, rather than in the form of a flat plate, because I discovered that there should be a space beneath the member 60 and spaced from the top of the bed of treating material D in order to effect proper lifting of the member and, if the member 60 were a plate, the treating material which might escape over the edges of the plate would deposit on the plate and, in time, prevent proper functioning (raising) thereof. In the case of the inverted funnel-shaped member 60, this escaped material will roll or slide down the face of the member 60 and join the material of the bed.

I discovered that it was important to provide substantially vertical slots 41 extending substantially parallel with the longitudinal axes of the respective sleeves 40 and 40' not simply, in the case of the vertical slots 41' of sleeve 40' which receive the vertically reciprocating blades 67, but because, if they were disposed as are the slots 51 and 51' there would not be sufficient length of slot to permit proper functioning of the wall surfaces of the slots 41 and 41' as in Figs. 5 and 6, in the one case, and in Figs. 11 and 12 in the other case. Of course, this proper functioning is also predicated upon the flexibility of the walls of the sleeves 40 and 40' and, to a lesser degree, but important, in the use of the slip ring closures 45 and 45'.

Various changes in the size, shape and arrangement of parts may be made to the forms of invention herein shown and described, without departing from the spirit of the invention or scope of the claims.

What is claimed is:

1. Apparatus for the treatment of liquids, including a housing, having a closure provided with a first port and a second port, defining a major chamber containing a treating material-containing chamber part and an outermost chamber part; a tubular conduit carried by said housing and in communication with said first port extending into said chamber with the inner end portion of said conduit within said treating material-containing chamber part and provided with a first end closure and a minutely narrow slot spaced from said end closure; a sleeve depending from said closure and extending into said chamber at said outermost chamber part and surrounding a portion of said tubular conduit, with said sleeve and the portion of said tubular conduit surrounded thereby providing a space in liquid communication with said second port, said sleeve being of flexible material and provided with an elongated, minutely narrow slot in the wall thereof, extending substantially parallel to the longitudinal axis of said sleeve and opening to said space, and a second end closure encircling an outer portion of the periphery of said tubular conduit and having a slip fit therewith and being secured to the inner periphery of said sleeve to slip along said tubular conduit upon movements of said sleeve, whereby upon flow of liquid under pressure through said first port, and thence through said tubular conduit, said first mentioned slot, said major chamber, including said treating material-containing chamber part, said second mentioned elongated slot, said space and out of said second port, the flexible walls of said sleeve will be forced inwardly, said second end closure will move and the width of said second mentioned elongated slot will narrow so that foreign matter in said chamber exteriorly of said sleeve will not enter said space, and upon flow of liquid under pressure through said second port and thence through said space, said

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second mentioned elongated slot, said major chamber, said first mentioned slot, said tubular conduit and said first port, the flexible wall of said sleeve will be forced outwardly, said second end closure will move and the width of said second mentioned elongated slot will enlarge so that foreign matter collected in said space will exit through said second mentioned elongated slot into said chamber exteriorly of said sleeve.

2. Apparatus for the treatment of liquids, including a housing, having a closure provided with a first port and a second port, defining a major chamber containing a treating material-containing chamber part and an outermost chamber part; a tubular conduit carried by said housing and in communication with said first port extending into said chamber with the inner end portion of said conduit within said treating material-containing chamber part and provided with a first end closure and a plurality of minutely narrow slot spaced from said end closure; a sleeve depending from said closure and extending into said chamber at said outermost chamber part and surrounding a portion of said tubular conduit, with said sleeve and the portion of said tubular conduit surrounded thereby providing a space in liquid communication with said second port, said sleeve being of flexible material and provided with elongated, minutely narrow slots in the wall thereof, extending substantially parallel to the longitudinal axis of said sleeve and opening to said space, and a second end closure encircling a portion of said tubular conduit, whereby upon flow of liquid under pressure through said first port, and thence through said tubular conduit, said first mentioned slots, said major chamber, including said treating material-containing chamber part, said second mentioned elongated slots, said space and out of said second port, the flexible walls of said sleeve will be forced inwardly and the width of said second mentioned elongated slots will narrow so that foreign matter in said chamber exteriorly of said sleeve will not enter said space, and upon flow of liquid under pressure through said second port and thence through said space, said second mentioned elongated slots, said major chamber, said first mentioned slots, said tubular conduit and said first port, the flexible wall of said sleeve will be forced outwardly and the width of said second mentioned elongated slots will enlarge so that foreign matter collected in said space will exit through said second mentioned elongated slots into said chamber exteriorly of said sleeve.

3. Apparatus according to claim 2 characterized in that the combined length of said first mentioned slots is substantially equal to the combined areas of mouths of said first mentioned slots and is substantially equal to the combined normal areas of said second mentioned elongated slots.

4. Apparatus for the treatment of liquids, including a housing, substantially vertically-disposed, having a closure provided with a first port and a second port, defining a major chamber containing a treating material-containing chamber part at the lower end of said major chamber, and an outermost chamber; a substantially vertically-disposed tubular conduit carried by said housing and in communication with said first port extending into said chamber with the inner end portion of said conduit within said treating material-containing chamber part and provided with a first end closure and a minutely narrow slot spaced from said end closure; a substantially vertically-disposed sleeve depending from said closure and extending into said chamber at said outermost chamber part and surrounding a portion of said tubular conduit, with said sleeve and the portion of said tubular conduit surrounded thereby providing a space in liquid communication with said second port, said sleeve being of flexible material and provided with an elongated, minutely narrow slot in the wall thereof, extending substantially parallel to the longitudinal axis of said sleeve and opening to said space, and a second end closure encircling a portion of said tubular con-

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duit, whereby upon flow of liquid under pressure through said first port, and thence through said tubular conduit, said first mentioned slot, said major chamber, including said treating material-containing chamber part, said second mentioned elongated slot, said space and out of said second port, the flexible walls of said sleeve will be forced inwardly and the width of said second mentioned elongated slot will narrow so that foreign matter in said chamber exteriorly of said sleeve will not enter said space, and upon flow of liquid under pressure through said second port and thence through said space, said second mentioned elongated slot, said major chamber, said first mentioned slot, said tubular conduit and said first port, the flexible wall of said sleeve will be forced outwardly and the width of said second mentioned elongated slot will enlarge so that foreign matter collected in said space will exit through said second mentioned elongated slot into said chamber exteriorly of said sleeve to drop by gravity to said treating material-containing chamber part.

5. Apparatus according to claim 1 characterized in that said apparatus also includes vertically-reciprocating slot-cleaning means within said housing to clean said second mentioned elongated slot upon flow of cleaning liquid under pressure from said first mentioned slot into and upwardly through said treating material-containing chamber part.

6. Apparatus according to claim 5 characterized in that said slot cleaning means includes a reciprocating member for normal disposal upon the surface of a bed of treating material within said treating material-containing chamber part and having a face facing said bed, a collar slidable over the outer face of said sleeve and secured to said member and provided with a radially-disposed blade extending into said second mentioned elongated slot to slide along the wall surfaces of said slot upon reciprocation of said member when liquid under pressure presses upon said face of said member and when said pressure is released, whereby said blade will scrape treating material from the wall surfaces of said second mentioned elongated slot.

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7. Apparatus according to claim 5 characterized in that said slot cleaning means includes a reciprocating member for normal disposal upon the surface of a bed of treating material within said treating material-containing chamber part and having a face facing said bed, a collar slidable over the outer face of said sleeve, a rigid connection between said member and said collar, said collar being provided with a radially-disposed blade extending into said second mentioned elongated slot to slide along the wall surfaces of said slot upon reciprocation of said member when liquid under pressure presses upon said face of said member and when said pressure is released, whereby said blade will scrape treating material from the wall surfaces of said second mentioned elongated slot.

8. Apparatus according to claim 5 characterized in that said slot cleaning means includes an inverted funnel-shaped reciprocable member for normal disposal upon the surface of a bed of treating material within said treating material-containing chamber part and having a face facing said bed, a collar slidable over the outer face of said sleeve and secured to said member and provided with a radially-disposed blade extending into said second mentioned elongated slot to slide along the wall surfaces of said slot upon reciprocation of said member when liquid under pressure presses upon said face of said member and when said pressure is released, whereby said blade will scrape treating material from the wall surfaces of said second mentioned elongated slot and treating material scraped from said wall will slide over said member to the edge thereof and into said treating material-containing chamber part.

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