Sept. 30, 1969 R. M. PETRUCCI ETAL 3,469,696

FILTRATION APPARATUS

Filed Jan. 22, 1968

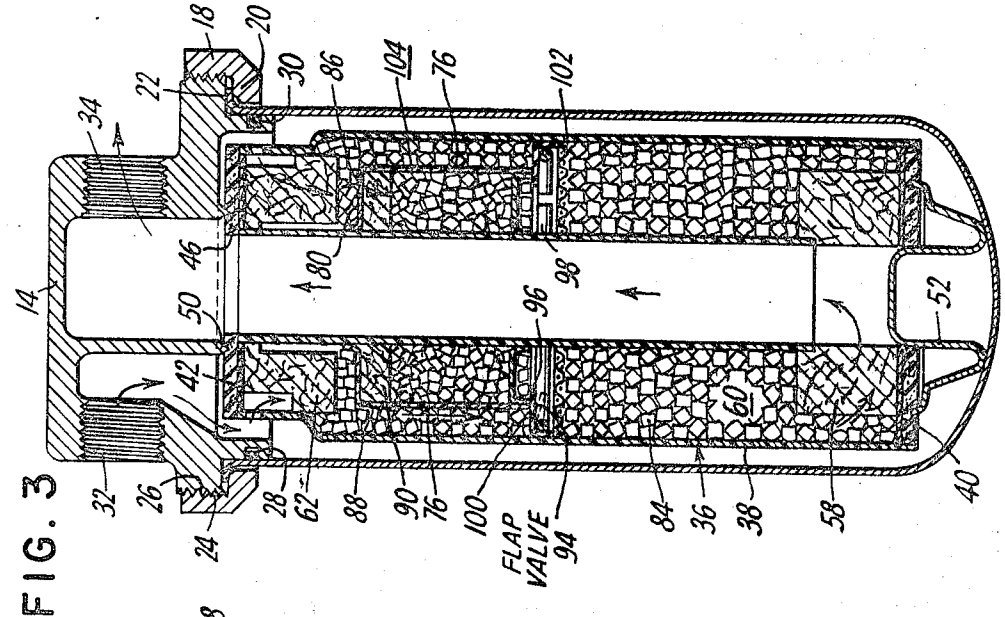

FIG. 3

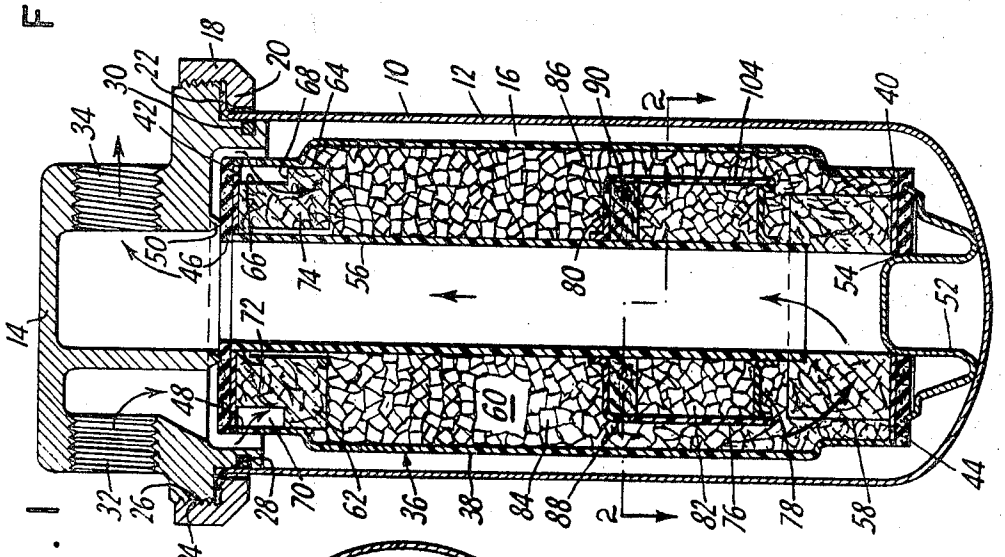

FIG. 1

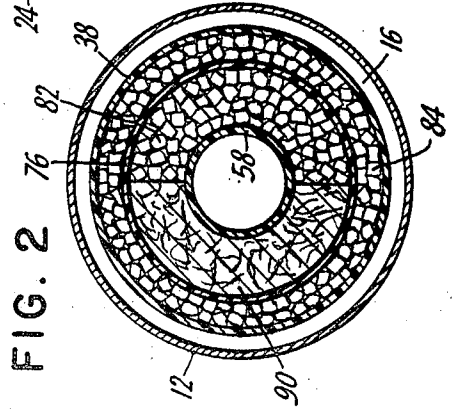

FIG. 2

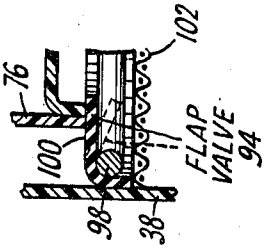

FIG. 4

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ABSTRACT OF THE DISCLOSURE

A cartridge type water treatment device employing means for selectively removing solid, taste and odor and scale forming agents including means for controlling flow through the scale forming agent.

The invention presently disclosed concerns the treatment of fluids and more specifically equipment for and processes of simultaneously purifying, and importing desirable additives to, potable water particularly when used in apparatus such as coffee vending machines.

A common problem with the above mentioned apparatus in addition to filterable impurities, is the deleterious effect of scale deposited from the water onto the surfaces of pipes, tanks and especially the orifices and seats of automatic valves. The type of machine in case must, of economic necessity, function with an absolute minimum of skilled maintenance; the financial burden of such maintenance, which is commonly needed where conventional scale controllers are employed is, when added to the first cost of such devices, commonly prohibitive. With the above mentioned conditions in mind we have devised as an answer to the problem an inexpensive, simple and reliable apparatus needing only the most elementary skill to maintain and which is entirely automatic and completely reliable in operation. In brief, one object of our invention is to provide a simple means of dispensing a scale suppressing medium into a water supply. Another object is to incorporate dispensing means into a water purifying device without complicating operating or maintenance procedures. How these and other desiderata are achieved will be apparent to those versed in the art on examination of the following specification and claims, together with the drawings of which

FIGURE 1 is a vertical center-line section of a preferred embodiment of the invention,

FIGURE 2 is a cross-section of the device taken on the line 2—2 of FIGURE 2,

FIGURE 3 is a vertical center-line section showing a modified form of the embodiment shown in FIGURE 1,

FIGURE 4 is a detail view of the flap valve of FIG. 3.

In FIGURE 1 a complete operative organization is shown. It comprises a pressure-tight housing 10, incorporating a container or sump 12 and a head 14 which, together, describe a cavity 16. The said sump 12 and head 14 are secured to each other by a coupling ring 18 having a radially inwardly extending flange 20 engaging a cooperating flange 22 on sump 12 and further having a screw thread 24 cooperative with a mating thread 26 on head 14; an elastomeric O-ring 28 is carried in a suitable groove 30 formed in the said head and engages the inner surface of sump 12 to afford a leak-proof joint at that point. The head 14 has a suitably threaded inlet port 32 giving access to the cavity 16; it also has a suitable threaded outlet port 34 affording an exit passage from the said cavity. The organization further comprises a unitized fluid treating element 36 which, as shown, is located within cavity 16 and interposed between the said inlet port and the said outlet port so that all fluid flowing

from one to the other must pass through the element. FIGURE 1 bears a series of arrows indicating the direction of such flow.

The element 36 is cylindrical in shape; it has a substantially impervious longitudinally extending outer wall 38 and end walls 40 and 42 to which are attached respectively, resilient gaskets 44 and 46. The wall 38 is pierced adjacent end wall 42 by one or more openings 48 to allow fluid to flow from the outside of the element to its interior, as will later be explained in more detail. As may be seen by reference to FIGURE 1, the gasket 46 has sealing engagement with the ring 50 which projects downwardly from the underside of head 14 and surrounds the entrance to outlet port 34. The other gasket 44 has a similar sealing engagement with pedestal 52 which closes the opening 54 in the center of end wall 40 and because of the approximately spherical curvature of the bottom of sump 12 holds the element substantially central therein. The force applied axially of said unit, which affords the compressive effort needed to effect the sealing engagement just mentioned, results from the telescopic load applied to sump 12 and head 14 by tightening coupling ring 18. Located centrally within element 36 is a substantially impervious tube or core 56 which is secured at one end in an opening in end wall 42 and which is supported at its other end by a thick-walled tubular foraminous filter member 58 secured, in sealing engagement, to end wall 40; this arrangement affords a central discharge passage for fluid flowing radially inwardly through filter member 58 and also provides an annular chamber 60. A second thick-walled tubular foraminous filter member 62 is located within the chamber 60 with one end abutting wall 42; it has two outer diameters, the larger of these, 64, has close engagement with the inner surface of wall 38 while the smaller diameter 66, together with shoulder 68 forms an annular space 70 as shown, which provides a distribution channel for fluid which may enter the element 36 through openings 48; additionally, member 62 has a smaller inner diameter 72 that closely engages the outer surface of core 56 while the larger inner diameter 74 affords a drainage area for fluid flowing through the member from space 70 to chamber 60. It may here be remarked that the first mentioned filter member 58 is smaller in diameter than the adjacent wall 38 affording adequate access to the outer surface of said member.

The additive desired (in this case polyphosphate which, when dissolved in the water being treated, combines with the scale forming materials therein and holds them in suspension) is most conveniently stored in a container 104 carried within the element 36. The container is preferrably arranged so that the water flows past an orifice in its wall, or alternatively, in one orifice and out of another one axially adjacent to it so that, in either case, the water does not flow through a granular bed of additive but, instead, picks some of a saturated solution of additive from a "quiescent pool" thereof within the container. A mathematically precise proportion of additive to water being treated may be obtained if effort is taken to calculate the size of the orifices, flow rates and pressures. Various valve means and movable dispensing devices may also be employed if desired. We however, have found that the orifices as described are eminently satisfactory and preferable because of their simplicity.

Considering next the preferred construction; within the chamber 60 and adjacent the filter member 58 is a shell 76 which surrounds the core 56 and is closed by end walls 78 and 80 which are sealed to said core and form an annular space for the expendable additive 82. The remainder of the chamber 60 is tightly packed with granular activated carbon 84, of which more later. An opening 86 is formed

in end wall 80 facing toward the fluid flowing through the element 36, i.e. it faces upstream. A second opening 88 is located in the side wall of shell 76 very slightly below the said end wall 80 and is spaced approximately 180° from the opening 86; a pad 90 of foraminous material, which may be similar to that forming the filter members 58 and 62, is placed over the additive 82 to prevent water that enters opening 86 impinging directly thereon. Instead, it flows transversely through the said pad and out of the container via opening 88. In so doing the water encounters the saturated solution dispersing, from the earlier mentioned "quiescent pool" 92 in which the additive 82 lies, into the pad 90 and dilutes and entrains some of the solution so that it passes from the container into the main stream of water flowing through the element and on, via the interior of core 56 to outlet port 34.

In normal commercial service the slight diffusion of dissolved poly-phosphate, used as an additive, which may occur during non-use is of no importance. It may however, be objected to where there are very long periods of disuse which could permit an undesirable diffusion of solute material down stream. The construction of FIGURE 3 is arranged to take care of a condition of that nature. The device is very similar to that of FIGURE 1 and accordingly reference numerals are applied only to those parts which are mentioned in relation to the modifications involved. To prevent such undesired diffusion we locate the additive container 104, without change, adjacent to upper filter member 62. Immediately below the said container is a flexible disc or circular flap valve 94 made of any convenient elastomeric material in the form of a cup having a central aperture 96 and held in place by an expansive spring ring 98. The cup 94 is so placed that its upper surface 100 bears on the lower edge of shell 76 and, when there is no flow, closes off that part of the chamber 60 which is above it, from the part below. A slight differential pressure across the valve 94 will flex it downward to permit fluid flow. A suitable screen disc 102, secured in any convenient manner, serves to keep the granular carbon 84, away from the valve seat. Alternatively, valves may be applied direct to openings 86 and 88 but the low differential pressure across them is not conducive to reliability.

The above described device provides a water-treating means having three functions. The filter members 58 and 62 will remove filterable impurities and the second member, 86 is effective in holding back the activated carbon 84 which adsorbs objectionable taste and odor transporting elements from the water being treated. The dispensed additive is effective in guarding the equipment which the device serves, against the deposition of scale. Additionally, the filter members, being in series, may and preferably do have their relative porosities arranged so that the dirt load is shared between them. It is also of interest to note that the carbon, by its property of adsorbing and subsequently releasing the solute additive helps to keep the proportion thereof uniform.

What is claimed:

1. Apparatus for treating water comprising a substantially impervious envelope having water inlet and outlet means, said envelope having therein a fibrous filter media located adjacent said inlet for removal of solids from said water, a bed of activated carbon granules located downstream of said fibrous filter for removal of taste and odor from said filtered water, a cohesive mass of scale formation inhibiting media located adjacent said bed of activated carbon granules and means for controlling passage of said water through said scale forming inhibiting means to permit only a selected portion thereof to pass therethrough prior to the existing of the filtered water from said envelope.

2. The apparatus according to claim 1 wherein said scale forming inhibiting means comprise a bed of polyphosphate crystal contained in a second envelope having means to disperse said polyphosphate within said water.

3. The apparatus according to claim 1 having a valve on the downstream side of said cohesive mass for controlling the dispersion of said scale forming inhibiting media in response to the flow of water within said apparatus thereby preventing excess dispersion during periods of non-flow.

4. Apparatus for treating liquid passed therethrough, said device comprising a first filter member, a bed of adsorptive material and a second filter member arranged in an envelope for the passage of liquid being treated through said members and said material in the order named, said device further comprising a container containing a soluble media for inhibiting the deposition of scale from said liquid, said container being situate within said envelope for diffusion of said media into said liquid, and valve means for permitting a selected proportion only of said liquid to pass through said scale inhibiting media, said device being effective to treat said liquid by substantially simultaneously removing at least a part of any solids therein by filtration, removing at least a part of any noxious taste and odor creating components therein by absorption and combining at least part of any scale forming matter therein with a scale deposition inhibiting media.

5. The apparatus according to claim 4 wherein said envelope comprise a tube having a first end wall having an aperture, a tubular core inside and co-directional with said tube and having one end secured to said first end wall in said aperture, said first filter member embracing said core and having peripheral contact with the inner surface of said tube to form a foraminous partition dividing the cavity surrounding said core and within said envelope into two parts; said second filter member being located within said tube, secured to the end of said core remote from said first end wall and affording a filtering passage from said cavity to the interior of said core, said tube having a second end wall at the end remote from said first end wall, affording support to said second filter member and closing one end of said cavity; said bed of adsorptive material and said container being in said cavity between said first and said second filter members, said container comprising a wall defining a chamber containing said media, an opening affording access for liquid within said cavity to said media and a valve on the downstream side of said container for controlling the dispersion of said scale forming inhibiting media in response to the flow of water within said apparatus thereby preventing excess dispersion during periods of non-flow.

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210—57, 282, 503; 23—272.7