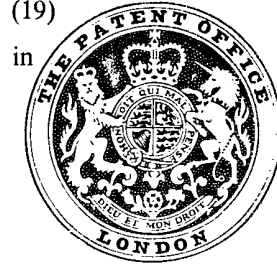


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(54) WATER PURIFICATION APPARATUS

(71) We, TELEDYNE INDUSTRIES INC., a corporation organised and existing under the laws of the State of California, United States of America, of 1901 Avenue of the Stars, Los Angeles, California 90067, United States of America, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

The present invention pertains to water purification apparatus, and disclosed herein is an internally by-passable water purifier apparatus. More particularly an apparatus that permits the selective distribution from a common source of either purified or non-purified water has been devised and is disclosed herein.

Surveys have indicated that a significant percentage of water samples obtained from individual taps in the home and the like contain one or more bacteriological or chemical constituents that exceed limits set forth in standards issued by public health services or authorities. In some cases, such samples evidence a potential danger. Various studies have identified a need for improved systems to control at least aesthetically undesirable concentrations of various minerals and other constituents, as well as to control color, taste and odor. The problem is one of both preventing the transmission of disease or the like as well as in overcoming effects that may be adverse to the sensibilities of the user.

One answer has been a steadily increasing usage of bottled water. At the same time, there have been a number of entries into the marketplace of point-of-use purification devices. The latter have included in-line filters, under-the-sink filters, free-standing drink-size separate filter units and filter devices that attach to the conventional sink faucet or to the typical aerator secured thereto.

In general, a somewhat limited number of processes have been found to be capable of removing undesired materials from water. These include reverse osmosis, freezing, filtration, chemical oxidation, distillation, adsorption on powdered charcoal and adsorption on granular activated carbon. Carbon filtration has been found to be particularly effective in removing some detergents, insecticides, viruses, specific chemical pollutants and taste and odor pollutants. For example, carbon has long been used for the removal of chlorine from water in the brewing and soft drink manufacturing industries. Activated carbon removes tastes and odors from water by an adsorption process in which substances of one kind are accumulated on the surface of another. The activated carbon has extremely large surface areas that make it efficient. The activation process produces pores that contribute substantially to increased surface area of treatment. In some cases, the activated carbon has been treated with silver which acts oligodynamically as a bactericide and self-sanitizing agent.

One obviously desirable location for a water purifier is in the vicinity of the kitchen sink. The usual kitchen sink will have one or two faucets for dispensing hot and cold tap water. In addition, many sinks now include a so-called vegetable spray attached to a hose for usage as its name implies. The addition of a water purifying apparatus has

frequently meant the undesired occupation of counter space, under-sink space or interference to convenient utilization because of the need for flexible hoses. In fact, an objective by some manufacturers, to achieve comparatively low cost in such apparatus, has led to the production of units which attain that end only at the expense of interference with space utilization or aesthetic unattractiveness.

It is, accordingly, a general object of the present invention to provide water-purifying apparatus in which the occurrence of the aforementioned disadvantages or otherwise undesirable features is eliminated or at least minimized.

In accordance with the present invention, there is provided a water purifying device, for operation with a water purifying cartridge, which has a water inlet, a housing including valve means selectively operable to allow purified or unpurified water to exit the housing through respective, spaced-apart water exit openings in a first portion of the housing, a second portion of the housing being releasably connected to the first portion thereof and having a chamber for receiving the cartridge, the housing further including means for conveying water from the inlet (i) to a first of the exit openings along a filtering path including the cartridge when received in the chamber and (ii) to the second of the exit openings along a path bypassing the cartridge, the said valve means being manually actuatable from the outside of the housing to control the passage of water along the filtering and bypass paths.

In a preferred embodiment of the invention, the cartridge is enclosed in a housing, between water admission and water discharge regions thereof, which housing includes means for conveying water towards the discharge region along a filtering path and along a bypass path that communicates with the said route established by the tubular member, the housing further including valve means for controlling passage of water along the said paths. The valve means can comprise two valves, the first for controlling water flow exclusively along the filtering path and the second for controlling water flow exclusively along the by-pass path. The valves can be located upstream or downstream of the filtering material.

The invention will now be described by way of example only with reference to the accompanying drawings in which,

Figure 1 is a perspective view of a preferred embodiment of water purifier apparatus;

Figure 2 is an enlarged vertical cross-sectional view of the apparatus of *Figure 1*;

Figure 3 is an enlarged cross-sectional view taken along the line 3-3 in *Figure 1*;

Figure 4 is an enlarged cross-sectional view taken along the line 4-4 in *Figure 2*;

Figure 5 is an enlarged cross-sectional view taken along the line 5-5 in *Figure 2*;

Figure 6 is an enlarged cross-sectional view taken along the line 6-6 in *Figure 2*; and

Figure 7 is an enlarged cross-sectional view taken along the line 7-7 in *Figure 2*.

The illustrated internally by-passable water purifier 20 includes a housing 22 which has an inlet 24 for admitting a flow of water and an outlet arrangement 26 for discharging a flow of water. The inlet 24 can embody a sealed swivel joint (not shown) for coupling the purifier to a water supply hose. Extending all of the way from inlet 24 to outlet 26 is a continuous channel 28 that defines a path for the flow of water from the inlet to the outlet. Channel 28 includes a chamber 30 that is shaped to receive a water-purifying cartridge 32 that is disposed in the path of water flow. A first valve 34 is disposed in channel 28 to control the flow of water from inlet 24 through cartridge 32 to outlet 26. A second valve 36 is disposed also within channel 28 for controlling the flow of water from inlet 24 to outlet 26 in by-pass of cartridge 32. It will be observed that chamber 30 is located upstream from valves 34 and 36. Moreover, chamber 30 and cartridge 32 together define a passage 37 (see *Figure 5*) for the flow of water around cartridge 32 so as to be under the control of valve 36.

As specifically shown, housing 22 includes a first portion 38 that contains outlet 26 and valves 34 and 36. Housing 22 also includes a second portion 40 that is threaded into first portion 38 so as to secure the two portions together as well as to seat cartridge 32 securely within chamber 30. Portion 40 downwardly depends from one end of portion 38 so as to serve as a handle which is dimensioned to be gripped by the human hand. Inlet 24 is internally threaded so as to form a coupling that desirably conforms to those which are now standard for connection to the conventional vegetable-spray hose associated with many ordinary kitchen sinks.

Each of valves 34 and 36 includes a respective manually-operable valve actuator 42 and 44 that projects from the end of portion 38 above the upper end of portion 40 and opposite outlet 26. The outlet includes a first opening 46 that is in communication with valve 34. At least one additional opening 48 is in communication with valve 36. Preferably, however, there are a plurality of openings 48, as shown spaced individually apart to collectively encircle opening 46, so as to permit usage of water delivered from openings 48 in the manner of the ordinary vegetable spray associated with

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the typical kitchen sink.

Directing attention more specifically to cartridge 32, it includes a tubular shell 50 having at one end an inlet wall 52 and at the other end an outlet wall 54. An opening 56 is formed in inlet wall 52, while an opening 58 is formed in outlet wall 54. A water filtering material 60 is disposed within shell 50 between inlet and outlet walls 52 and 54 and in a position between openings 56 and 58. In correspondence with filters as described in the introduction hereto, filter material 60 is primarily of granulated activated carbon. Preferably, the carbon is mixed with silver zeolite so as to inhibit bacterial growth within the filter. Externally of the cartridge 32 is a rib structure including ribs 62, these ribs projecting outwardly from the external surface of shell 50, running lengthwise of the shell for guiding water from the vicinity of inlet wall 52 to the vicinity of outlet wall 54, so as to define a water flow path which is exclusive of filter material 60. Ribs 62 are laterally-spaced from one another so as to define a plurality of mutually-adjacent water-flow channels. At least one pair of such ribs 62 are required, but more than two are preferred spaced around the circumference of the shell 50 so as to provide adequate support for and centering of the shell 50 within the receiving structure defined by chamber 30, while avoiding an equivalent plurality of the water flow channels.

The rib structure also extends into the inlet end. That is, it defines a plurality of outwardly-projecting ribs 64, aligned with ribs 62, that accommodate the flow of water around inlet wall 52 into the longitudinal passages 37 defined by ribs 62.

At the upper end of cartridge 32 is seal 66 of resilient material, such as rubber, that encircles and projects outwardly from around opening 58. Filter material 60 is sandwiched between a pair of layers 68 of fibrous sheet, such as ordinary felt, individually disposed adjacent to a respective one of end walls 52 and 54. Layers 68 serve to hold the carbon granules in place as well as, at the upstream end, to remove ferrous oxides that tend to become jelly-like and, therefore, would tend to clog the carbon granules. At the downstream end layers 68 removes so-called carbon "fines" which are a powder-like derivative from the main granular filter. Also desirably included are ribs 70 that project inwardly from each of inlet and outlet walls 52 and 54 in a position to hold layers 68 spaced from the respective ones of the end walls and thereby permit distribution of the flowing water through the entirety of the filter material.

Valves 34 and 36 each include a valve stem 72 upon the inner end of which is a valve head 74 which captivates an 0-ring 76

that, upon closing of the valve, presses into an opening in an internal wall 78 of housing portion 38 and in which such opening therein defines the valving flow path. Valve actuators 42 and 44 are buttons secured on the other end portion of valve stems 72, with a compression spring 80 encircling each valve stem between the valve actuators and another internal wall 82 formed as part of housing portion 38. An 0-ring 83 secures the other end portion of each valve stem within a receiving boss formed in wall 82. Valve 34 permits water from within the associated portion of channel 28 defined by opening 58 to be delivered through a sleeve 84, secured by studs 86 centrally within the bore of portion 38, and preferably through a mesh screen 88, for delivery from central outlet 46. Depression of valve actuator 42 on valve 34 thus permits the delivery through the device and from outlet 46 of water purified by passage through cartridge 32.

On the other hand, depression of valve actuator 44 on valve 36 permits the delivery through apertures 48 of water that flows alongside the exterior of cartridge 32, through an opening 89 in the bottom of portion 38 and along the exterior of sleeve 84. Water passing along sleeve 84 is emitted from apertures 48 as a spray of ordinary unpurified, tap water. This extends the life of cartridge 32 by obviating its use when it is unnecessary for the purpose at hand to employ the purification capabilities of the unit.

Other detailed ramifications of the unit include the formation of outlets 46 and 48 in a cap 90 that is threadably secured into the discharge end of housing portion 38 and sealed thereto by means of an 0-ring 92. Downwardly-depending housing portion 40 is threadably secured into the other housing portion 38 by means of threaded section 92. An 0-ring 94 seals the joint between portions 38 and 40. In addition, a collar 96 preferably is ultra-sonically-welded at the entrance to the portions of channel 28 defined in housing portion 38. Collars 96 cooperates with outlet wall 54 of cartridge 32, along with seal 66, so as to ensure the formation of a water-tight seal between the outlet end of cartridge 32 and the entrances into housing portion 38. When greater sealing effect is desired, collar 96 may be formed to include a downwardly-depending boss that carries an external 0-ring dimensioned to fit sealingly into opening 58. Still further, seal 66 may project from the outer perimeter of opening 58 so as to fit upwardly into the opening in collar 96.

The overall shape of the device in Figures 1 to 7 is particularly attractive in that it closely resembles that of the conventional vegetable spray device ordinarily found in connection with many kitchen sinks. Yet of

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course, it represents a significant improvement in that it also provides for selection of a stream of purified water. The conformation of the components is such as to enable a user very readily to replace cartridge 32 simply by unscrewing housing portions 38 and 40, removing the expended cartridge and substituting a new one.

The illustrated unit is in the form of a hand-held water-discharge device that is capable of functioning exactly like the conventional vegetable spray attendant to so many kitchen sinks. Yet, by the simple operation of a pushbutton, it also serves to deliver purified water. The unit itself is so constructed as to be quite inexpensive. In addition, its active element for purification is in the form of a simple cartridge that also is inexpensive and readily replaceable. One end result is that of a very simple and comparatively inexpensive unit that fully performs in the manner of predecessor devices that require significantly more space and expense. By having the actual outlets for either purified or by-passed water at a common site, the unit is enabled to be quite compact.

As described hereinbefore, the filter cartridge, is in the form of a tubular shell that has inlet and outlet walls with at least one opening being defined in each. A water filtering material is disposed within the shell. Running lengthwise of the shell is an arrangement for guiding water from the inlet to the outlet regions and exclusive of, i.e. by-passing, the filtering material. The guiding arrangement is external of the shell and is formed by three ribs thereon in the illustrated embodiment.

In the housing of the device, a channel defines the path of water flow from the inlet to the outlet, and a chamber is provided in the channel in the path of the flow. One valve disposed in the channel controls the flow of water from the inlet through the cartridge to the outlet. The other valve disposed in the channel controls the flow of water from the inlet to the outlet along the path externally of the cartridge that bypasses the cartridge.

The present water purifying apparatus can be permanently installed with great ease in most plumbing installations and does not call for the services of an expert engineer for commissioning it. Selection of purified or unpurified tap water is particularly simple for the user. The apparatus is aesthetically pleasing when installed in the home or even in a commercial or manufacturing area.

Both the water purifier and the replaceable filter cartridge therefor may be manufactured from readily-available materials, and yet both are economical of production and reproduction. Replacement of the cartridge is easily and readily accomplished by

the non-expert user, inter alia because the cartridge is in the form of an expendable package.

Divided out of this application is application No. 79/03686 (Serial No. 1564140) which also discloses the purifying apparatus shown in the accompanying drawings, and claims a water purifying apparatus comprising a housing having an inlet and an outlet and defining a chamber in which a water purifying device is accommodated, said device comprising a tubular shell, and an inlet wall at one end of the tubular shell having an inlet opening for admitting incoming water to the tubular shell, water filtering material in the tubular shell for filtering water admitted through the inlet opening, an outlet wall at the other end of the tubular shell having an outlet opening for water filtered by the filtering material, there being a space between the tubular shell and an internal wall of the housing defining the chamber which provides a passage for water to bypass the filtering material, and there being in the passage water directing ribs means which extends from the vicinity of the inlet wall to the vicinity of the outlet wall for guiding incoming water along the bypass passage towards the outlet wall.

Also divided from the present application is our co-pending divisional application No. 79/03685 (Serial No. 1564139) which discloses and claims a water purifying device comprising a tubular shell having a first end wall and an opposite second end wall, spaced apart first and second openings in the first end wall, spaced apart third and fourth openings in the second end wall, a conduit extending through the tubular shell between the first and third openings, and water filtering material contained in the tubular shell between the second and fourth openings, the conduit being devoid of water filtering material.

WHAT WE CLAIM IS

1. A water purifying device, for operation with a water purifying cartridge, which has a water inlet, a housing including valve means selectively operable to allow purified or unpurified water to exit the housing through respective, spaced-apart water exit openings in a first portion of the housing, a second portion of the housing being releasably connected to the first portion thereof and having a chamber for receiving the cartridge, the housing further including means for conveying water from the inlet (i) to a first of the exit openings along a filtering path including the cartridge when received in the chamber and (ii) to the second of the exit openings along a path bypassing the cartridge, the said valve means being manually actuatable from the outside of the housing to control the passage of water along the filtering and bypass

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paths.

2. A water purifying device as claimed in claim 1, wherein the first and second portions are threaded to each other.

3. A water purifying device as claimed in claim 1 or 2, wherein the second portion is dimensioned to be grippable by a hand.

4. A water purifying device as claimed in claim 1, wherein the second portion is a handle and the water purifying device is manually portable via said handle.

5. A water purifying device as claimed in claim 4 wherein the handle is releasably connected to the first portion of the housing by a threaded coupling.

6. A water purifying device as claimed in claim 4 or 5, wherein the bypass path extends inside the handle.

7. A water purifying device as claimed in any of the claims 1 to 6 wherein one of the two exit openings comprises a plurality of apertures that encircle the other exit opening.

8. A water purifying device as claimed in any of claims 1 to 7, wherein the valve means has a manual push-button actuator.

9. A water purifying device as claimed in claim 8, wherein the said actuator projects from an end of the first portion.

10. A water purifying device as claimed in any of the claims 1 to 7, wherein the valve means include a first valve for controllably passing water exclusively through the said filtering path and a second valve for controllably passing water exclusively along the said bypass path.

11. A water purifying device as claimed in claim 10, wherein the first valve has a first manually operable valve actuator and the second valve has a second manually operable valve actuator.

12. A water purifying device as claimed in claim 11, wherein the first and second manually operable valve actuators are of a push-button type.

13. A water purifying device as claimed in any of the claims 1 to 12, wherein the valve means are located downstream of the said chamber.

14. A water purifying device as claimed in any of the claims 1 to 13, wherein a valve guide is formed in the housing and the valve means include a valve stem received in the valve guide.

15. A water purifying device as claimed in any of the claims 1 to 14, wherein the said bypass path is defined by a space between the interior of the second portion and the exterior of said cartridge when received in the chamber.

16. A water purifying device as claimed in any of the preceding claims, wherein a wall of said first portion has spaced apart first and second apertures respectively for conducting towards the said first and second

exit openings unfiltered water received from the said water inlet, and filtered water received from the cartridge when located in said chamber.

17. A water purifying device as claimed in any of the preceding claims 1 to 15, wherein a wall of said first portion has an aperture located in said filtering path for conducting filtered water from said cartridge towards the first opening.

18. A water purifying device as claimed in claim 17, including sealing means encircling the said aperture to form a seal between the first portion and the cartridge when located in said chamber.

19. A water purifying device substantially as herein described with reference to and as shown in Figures 1 to 7 of the accompanying drawings.

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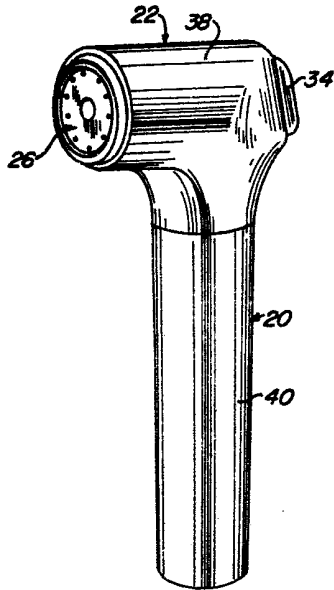


Fig - 1

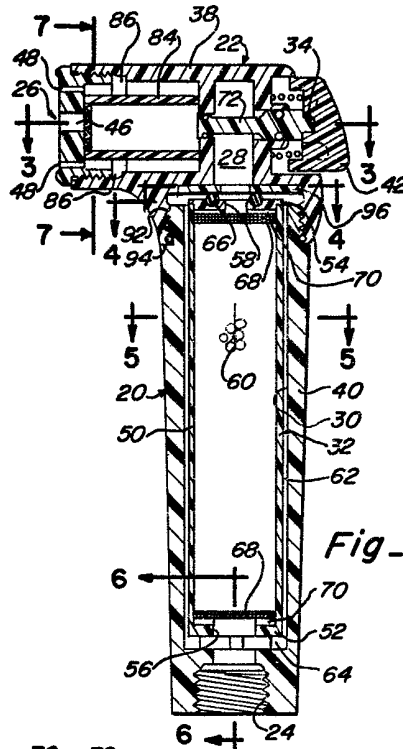


Fig - 2

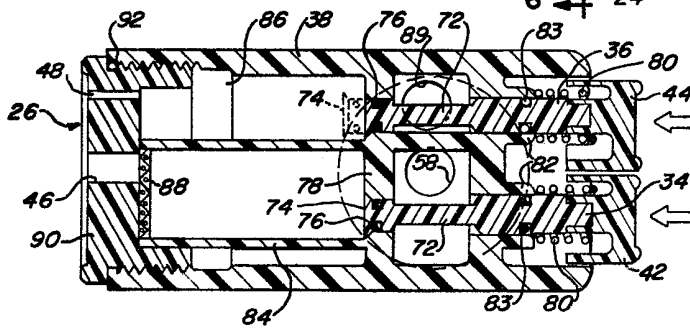


Fig - 3

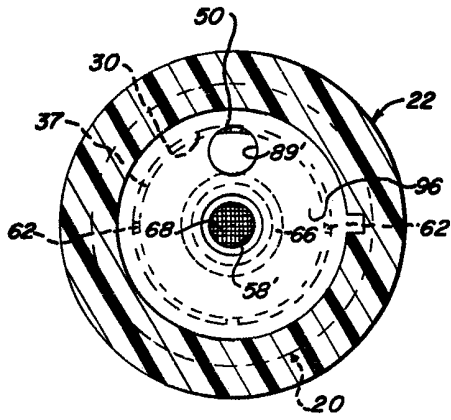


Fig - 4

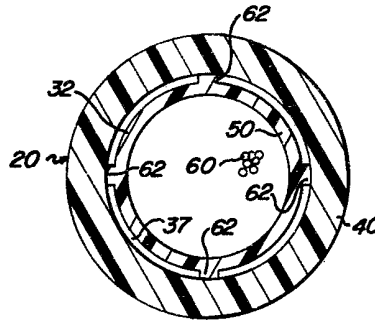


Fig - 5

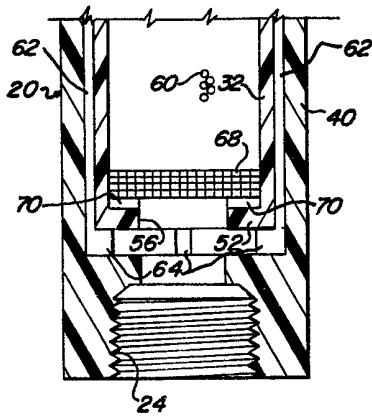


Fig - 6

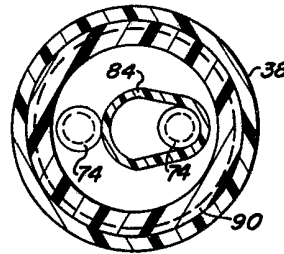


Fig - 7