

[54] **CLEARING MEANS FOR A LIQUID DRAINAGE SYSTEM**

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[58] Field of Search **128/349 R, 349 B, 350 R, 128/231, 247, 228, 275-278; 137/217**

[56] **References Cited**

UNITED STATES PATENTS

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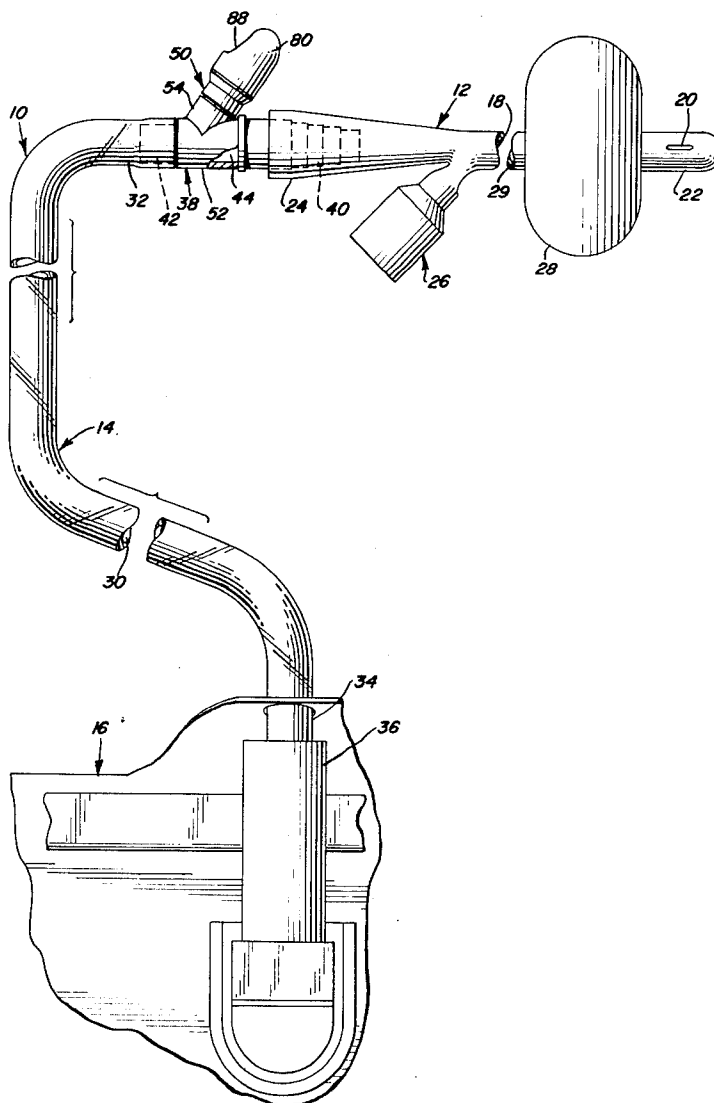
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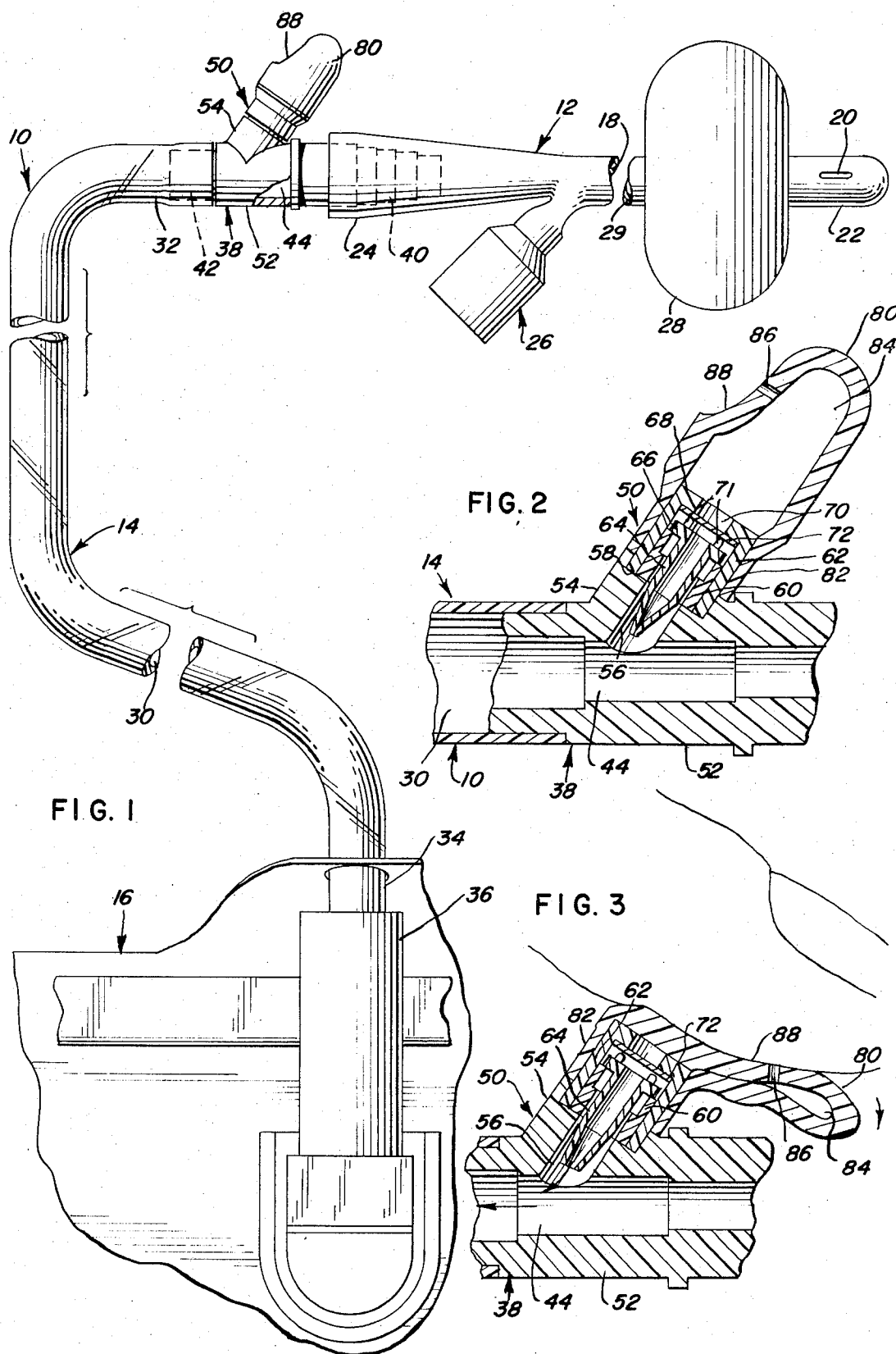
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[57] **ABSTRACT**

Clearing means for a liquid drainage system having a drainage lumen. The clearing means includes one-way valve means which permits the passage of air through the valve means to the drainage lumen, while the valve means prevents passage of fluid from the drainage lumen through the valve means. The clearing means has means for selectively pumping air from the atmosphere through the valve means into the drainage lumen for clearing the drainage lumen of suspended liquid, and air permeable filter means for filtering the pumped air and preventing contamination to the drainage lumen.

8 Claims, 3 Drawing Figures





CLEARING MEANS FOR A LIQUID DRAINAGE SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to liquid drainage systems.

2. Description of the Prior Art

Systems for draining liquid from a body cavity, such as the bladder, are well known. Conventionally, such systems have taken the form of a catheter which has its distal end inserted into the body cavity of a patient such that its proximal end projects outwardly from the patient's body, a drainage tube which has its upstream end connected to the proximal end of the catheter, and a drainage receptacle which is connected to the downstream end of the drainage tube. Thus, liquid drains from the cavity through a drainage lumen in the catheter and drainage tube to the receptacle for collection.

Since the use of the drainage system poses the danger of introducing infection into the body cavity, it is desirable to maintain the system in a sterile condition. However, difficulties have been encountered in draining liquid from the body cavity to the receptacle in such a system. As a column of liquid drains from the catheter, a negative pressure may develop above the liquid column and cause the column to stop in the drainage tube, thus preventing the column from draining into the receptacle. It has also been found that in urinary drainage systems the negative pressure may cause lesions to the bladder as the bladder collapses about the distal end of the catheter.

Ericson U.S. Pat. Nos. 3,419,009, and 3,429,314 disclose that filtered air may be introduced into the catheter to alleviate a negative pressure condition in the drainage system. Vaillancourt et al U.S. Pat. No. 3,583,401, Vaillancourt U.S. Pat. No. 3,604,420, Henkin U.S. Pat. No. 3,661,143, and McWhorter, U.S. Pat. No. 3,683,930 are concerned with the structure of the drainage tube to prevent "hanging up" of liquid in the drainage tube. Carson U.S. Pat. No. 3,417,750 is concerned with a drainage system having a pump in the form of a compressible cylindrical chamber containing a one-way flutter valve.

SUMMARY OF THE INVENTION

A principal feature of the present invention is the provision of means for clearing a drainage lumen in a liquid drainage system of suspended liquid.

The clearing means of the present invention includes one-way valve means which permits the passage of air through the valve means to the drainage lumen, while preventing the passage of fluid from the drainage lumen through the valve means. The clearing means also includes means for selectively pumping air from the atmosphere through the valve means into the drainage lumen, and air permeable filter means for filtering the pumped air.

Thus, a feature of the present invention is that the pumped air clears the drainage lumen of suspended liquid.

Another feature of the present invention is that the filter means filters the pumped air to prevent contamination to the drainage lumen.

Further features will become more fully apparent in the following description of the embodiments of this invention and from the appended claims.

DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a fragmentary perspective view, partly broken away, of a liquid drainage system, showing the clearing means of the present invention as included in an adapter for the drainage system;

FIG. 2 is a fragmentary sectional view of the clearing means of FIG. 1; and

FIG. 3 is a sectional view of the clearing means of FIG. 2 showing a flexible bulb in the clearing means being compressed to force air into a drainage lumen in the liquid drainage system.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1, there is shown a liquid drainage system, generally designated 10, which includes a catheter 12, a drainage tube 14, and a collection receptacle 16. The catheter 12 has a drainage lumen 18 communicating with a drainage eye 20 adjacent the distal end 22 of the catheter and extending through the catheter to its proximal end 24. The catheter 12 also has a valve 26 which is utilized to inflate an inflation balloon 28 through an inflation lumen 29 to retain the catheter in the bladder of a patient. The drainage tube 14 has a drainage lumen 30 extending from its distal or upstream end 32 to the proximal or downstream end 34 of the drainage tube, and the drainage lumen 30 communicates with the inside of the collection receptacle 16 through a drip chamber 36.

Preferably, the drainage system 10 also includes an adapter, generally designated 38, having a distal end 40 received in the proximal end 24 of the catheter 12, and a proximal end 42 secured to the upstream end 32 of the drainage tube 14. The adapter 38 also has a main lumen 44 which communicates with the drainage lumens 18 and 30 of the catheter 12 and drainage tube 14, respectively. Thus, liquid drains in the system 10 through the drainage eye 20, the drainage lumen 18 of the catheter 12, the main lumen 44 of the adapter 38, the drainage lumen 30 of the drainage tube 14 to the receptacle 16 for collection.

As illustrated in FIGS. 1 and 2, clearing means, generally designated 50, is preferably located on the adapter 38. The adapter 38 has a body member 52 defining the main lumen 44 and including a side arm 54. The side arm 54 has a channel 56 extending through the side arm and communicating with the main lumen 44. The side arm 54 also includes an annular recess 58, and inner and outer annular sleeves 60 and 62, respectively, are received in the annular recess 58, as shown. One-way valve means 64 is positioned in the channel to permit the passage of air through the valve means 64 and channel 56 to the main lumen 44, while preventing passage of fluid from the main lumen 44 through the valve means 64 and channel 56. In a preferred embodiment, as shown, the valve means 64 may comprise a flap valve having an outwardly directed upper flange 66 which rests on and sealingly engages against the upper end of the inner sleeve 60 to prevent the valve from falling into the main lumen 44 and prevent leakage in the channel. The outer flange 62 has an inwardly directed flange 68 adjacent its upper end which defines a central opening 70, and the flange 68 retains the valve in position in the channel 56 by compressing protuberances 71 which extend upwardly from the valve

means. An air permeable filter 72 is secured to the under side of the flange 68 and the filter 72 covers the opening 70 to filter bacteria from air passing through the opening 70.

A hollow flexible bulb 80 is connected to the outer end of the side arm 54 and a depending tubular portion 82 of the bulb or pump means 80 may be secured directly to the outer sleeve 62. The bulb 80 has a cavity 84 communicating with the valve means 64 through the filter 72 and an aperture 86 communicating between the cavity 84 and the atmosphere. Preferably, the bulb 80 includes a slanted portion 88 which faces generally outwardly from the drainage system 10, with the slanted portion 88 including the aperture 86 and defining a convenient surface for compression of the bulb with a user's finger, as described below.

The clearing means 50 of the present invention is utilized to clear the drainage tube of liquid which is suspended in the drainage lumen 30. In use, a user's finger or thumb is placed on the slanted portion 88 of the bulb 80 to close the aperture 86 with the finger. Next, as illustrated in FIG. 3, the bulb 80 is compressed with the user's finger, which contracts the cavity 84 in the bulb 80, and forces air through the valve means 64 into the main lumen 44. Since the air which passes into the main lumen 44 also passes through the filter 72, bacteria is filtered from the air, and contamination to the system is prevented by the filter. The bulb 80 is then released by the finger to open the aperture 86 and vent the cavity 84 to the atmosphere. The flexible bulb 80 expands and draws air from the atmosphere through the aperture 86 into the cavity 84, thus resuming its initial configuration as shown in FIG. 2.

As a consequence, when the bulb 80 is compressed, air is driven through the valve means into the main lumen 44 and the drainage lumens of the drainage system, and, in particular, the drainage lumen 30 of the drainage tube 14. The air which is pumped into the lumens of the drainage system serves to break the miniscus formed by suspended liquid in the drainage tube and forces the liquid through the remainder of the drainage tube 14 into the collection receptacle 16. If necessary, the clearing means 50 may be pumped repetitively until the drainage tube 14 is cleared of liquid.

Although a specific structure is shown for the clearing means of the present invention, it is understood that alternative embodiments are within the scope of the invention. For example, other one-way valves may be utilized in lieu of the flap valve shown. Also, other means for pumping through the valve means may be utilized instead of the bulb 80, such as a flexible bellows having an aperture. Additionally, the filter 72 may be located at any position intermediate the atmosphere and the main lumen 44. It is also understood that it is not required to locate the clearing means 50 of the present invention in an adapter; for example, it may be an integral part of the drainage tube 14 or the catheter 12.

The foregoing detailed description is given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, as modifications will be obvious to those skilled in the art.

I claim:

1. In a liquid drainage system having a drainage lumen, clearing means, comprising:

one-way valve means connected to and in fluid communication with said drainage lumen permitting the passage of air through the valve means to the

drainage lumen, while preventing the passage of fluid from the drainage lumen through the valve means;

means connected to the valve means for selectively pumping air from the atmosphere through the valve means into the drainage lumen for clearing the drainage lumen of suspended liquid; and
air permeable filter means within said clearing means intermediate the atmosphere and the drainage lumen for filtering the pumped air and preventing contamination to the drainage lumen.

2. The clearing means of claim 1 wherein said filter means is positioned intermediate said valve means and pump means.

3. The clearing means of claim 1 wherein said valve means comprises a flap valve.

4. The clearing means of claim 1 wherein said pump means comprises, a hollow flexible bulb having a cavity communicating with the valve means and an aperture communicating between the cavity and the atmosphere, said bulb being compressed by a user's finger while closing the aperture to force air from the cavity through the valve means into the drainage lumen, and said bulb being released to open the aperture and permit the bulb to expand, whereby air is drawn from the atmosphere through the aperture into said cavity.

5. In a liquid drainage system including a catheter and a drainage tube having a drainage lumen, an adapter, comprising:

a body member having a main lumen communicating with said drainage lumen and a side arm having a channel extending through the side arm and communicating with said main lumen;

one-way valve means positioned in said channel for permitting the passage of air through the valve means to the main lumen, while preventing passage of fluid from the main lumen through the valve means;

a hollow flexible bulb connected to the outer end of said side arm, said bulb having a cavity communicating with the valve means and an aperture communicating between the cavity and the atmosphere, said bulb being compressed by a user's finger with the aperture closed to force air from the cavity through the valve means into the main lumen, and said bulb being released to open the aperture and permit expansion of the bulb for drawing air from the atmosphere through the aperture into the cavity, whereby air is pumped from the atmosphere into the main lumen for clearing the drainage lumen of suspended liquid; and

air permeable filter means within said system intermediate the atmosphere and the drainage lumen for filtering the pumped air and preventing contamination to the drainage system.

6. The adapter of claim 5 wherein said valve means comprises a flap valve.

7. The adapter of claim 5 wherein said filter means is positioned intermediate the cavity and the valve means.

8. The adapter of claim 5 wherein said bulb includes a slanted portion facing generally outwardly from the drainage system, said slanted portion including said aperture and defining a convenient surface for compression of the bulb with the user's finger.

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