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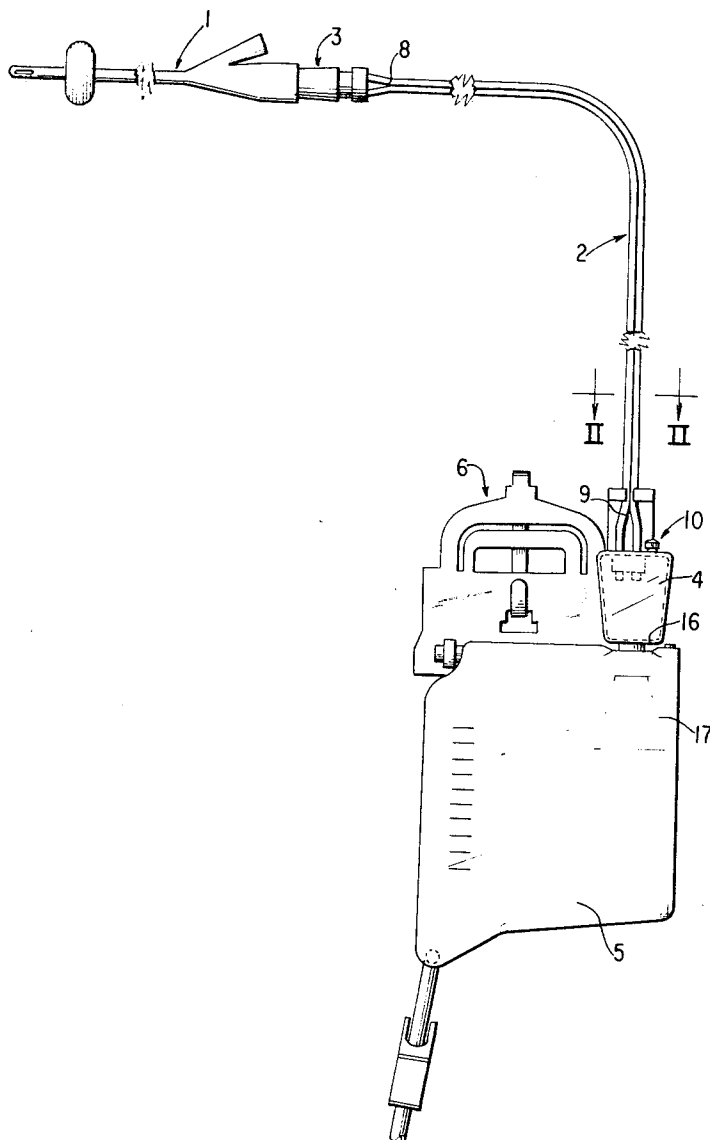
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[54] **VENTED CLOSED DRAINAGE SYSTEM WITH
DOUBLE LUMEN TUBE**
6 Claims, 4 Drawing Figs.

[52] U.S. Cl..... **128/275,**
128/350
[51] Int. Cl..... **A61f 5/44**
[50] Field of Search..... **128/214,**
275—278, 294—295, 348—350

ABSTRACT: Means for eliminating the negative pressure problem in a closed urinary (or other) drainage system by use of a drainage tube having two lumens, in communication adjacent the upstream end of the tube and also adjacent the lower end where the tube lumens open into a drip chamber having a vent, the drip chamber preferably being formed with an enlarged base and large flutter valve extending into a drainage receptacle such as a bedside bag.



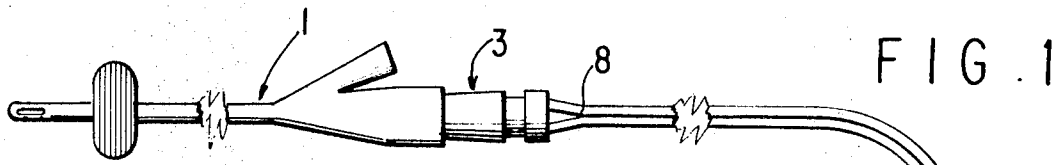


FIG. 1

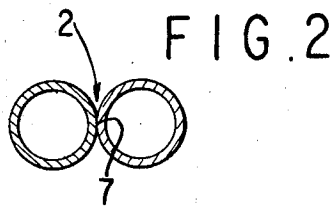


FIG. 2

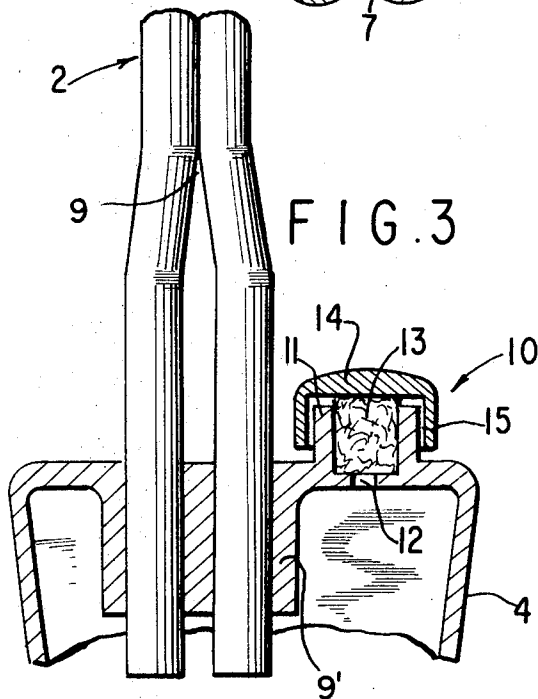


FIG. 3

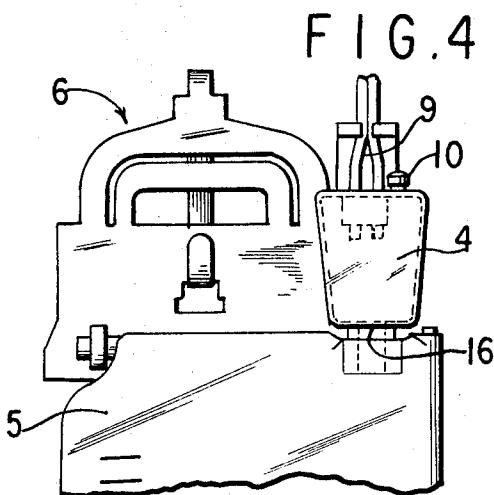
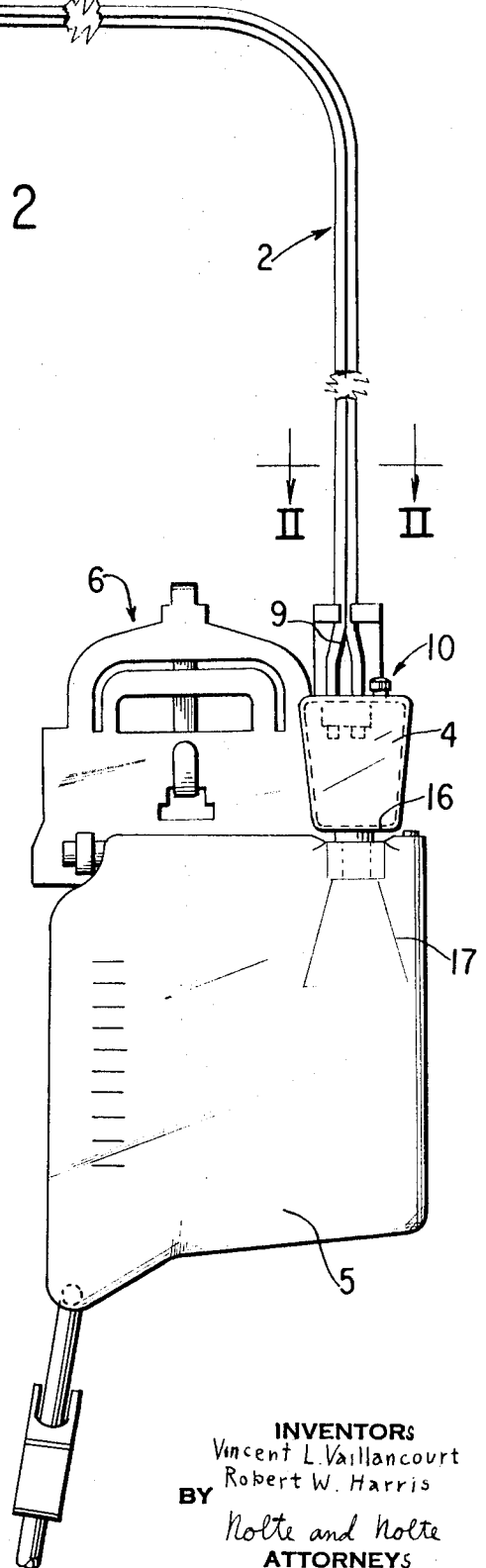


FIG. 4



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VENTED CLOSED DRAINAGE SYSTEM WITH DOUBLE LUMEN TUBE

A major problem in the operation of a closed urinary drainage system is the "hang-up" of the liquid column in the drainage tube, which tube normally extends generally downward from the level of the patient's bladder to a receptacle some distance lower. The weight of such a column results in the development of negative pressure in the bladder, not only emptying it, but also tending to draw the bladder wall against the end of the catheter and even partly into the eyes thereof, with serious adverse effects on the patient.

Methods heretofore proposed to alleviate or eliminate this condition include venting the system at a suitable point in its upper portion and use of abnormally large diameter tubes. As for the latter a tube of more than eleven-thirtyseconds in. I. D. will release its liquid column if vigorously shaken and it is believed that tubing larger than one-half inch will allow free flow of the liquid as air enters the outlet and bubbles up through the descending liquid, but most closed systems actually use tubing in the range of three-sixteenths in. to nine-thirtyseconds in. I. D. and substitution of larger tubing is not considered practical or convenient.

The entry of air into the lower end of a small single tube is prevented by the surface tension of the liquid column at that point and the fact that there is normally no place for air to enter at the upper end of the tube. It has been discovered that the provision of a tube having two parallel lumens, of the same or different sizes, in communication at both ends, prevents the development of any detrimental negative pressure at the upper end. The liquid being drained may enter both lumens and form columns therein but such columns have no tendency to be or remain of equal weight and the heavier one thus automatically siphons the lighter one up through the connecting passage (in or adjacent to the adapter) and into the lumen of the heavier, descending column followed by air following up from the vented drip chamber in any quantity needed to replace the downward flowing liquid.

A practical embodiment of the invention is shown in the accompanying drawing, wherein:

FIG. 1 represents an elevation of a complete closed urinary drainage system;

FIG. 2 represents a cross-sectional view of the tubing on the line II-II of FIG. 1;

FIG. 3 represents a detail vertical section through the upper part of the drip chamber;

FIG. 4 represents a detail elevation showing a drip chamber without flutter valve.

Referring to the drawings, a urinary drainage system is shown as comprising the normal basic elements of catheter 1, drainage tube 2, adapter 3, drip chamber 4 and collection receptacle 5 in the form of a bedside bag supported in any customary manner, as by means of the hanger 6. In the present case the drainage tube is constituted by dual lumen tubing, preferably formed by extruding a pair of tubes joined together tangentially along the line 7 (FIG. 2). Alternatively, separate tubes could be cemented together, if desired. The upper ends of the tubes may be separated slightly, as indicated at 8, in order to facilitate fixing them securely in the adapter 3, the interior of which constitutes a connecting passage between the lumens of the tubes. The lower ends of the tubes are shown as being similarly separated, as shown at 9, and extended into the upper portion of the drip chamber 4 through supporting and reinforcing collars 9'.

Air is permitted to enter the drip chamber (or leave it) through a vent 10, shown as including a collar 11 projecting upward from the top of the chamber 4, a vent hole 12 passing through said top, a small wad of cotton 13, acting as a filter, and a cap 14 with inwardly projecting fins 15 between which air may pass. The form of the recess within the collar 11 per-

mits easy insertion of the cotton filter, and the cap 14 prevents the cotton from being wetted in the event that the patient carries the receptacle 5 into a shower.

Liquid enters the drip chamber at a rate which necessarily averages the same as the rate of flow from the bladder, but it passes down the drainage tube, through either lumen, in discontinuous slugs of varying volume but each with the velocity due to a head of 2 to 3 feet. Since the interior of the drip chamber is vented to atmosphere the head of liquid accumulated therein can never exceed the height of the chamber, so that the base 16 of the drip chamber must be substantially larger than the inlet. It is preferably fitted with a wide flutter valve 17 within the bag 5, designed to permit emptying of the chamber at a rate fast enough to prevent flooding under all conditions.

The flutter valve 17 physically closes off the drainage bag 5 from the drip chamber 4 and drainage tube 2 so that there is no open air path for airborne bacteria to ascend from the bag into the drip chamber, tube and eventually the patient. The drip chamber breaks the liquid path but no provisions have been made heretofore to break also the air path. Although highly desirable, as just noted, the flutter valve could be omitted, leaving the drip chamber to open directly into the bag, as illustrated in FIG. 4.

In operation, liquid from the patient's bladder (or possibly an other body cavity being drained) flows from the catheter 1 to the adapter 3 where it is free to enter either or both of the drainage tube lumens. As a column of liquid accumulates in a given lumen its weight tends to create a negative pressure condition at the catheter, which, upon emptying of the bladder, may cause discomfort and injury to the patient. In the present system the negative pressure at the upper end of one lumen is communicated, within the adapter, to the other lumen; if there is no liquid in said other lumen it acts as a vent, supplying air from the vented drip chamber to the upper end of the first lumen and permitting the liquid (column or slug) therein to descend freely with only such negative pressure as may result from the resistance in the air conduit. If the second lumen contains some liquid (less, by definition, than in the first lumen) this liquid will be drawn up and over into the first lumen, again with only a slight or temporary increase in negative pressure.

What I claim is:

1. A closed system for drainage of liquid from a body cavity comprising a tubular conduit having a single liquid inlet opening in the cavity and a downwardly extending section, and a drainage receptacle in a position to receive liquid from said conduit, the downwardly extending section including a drainage tube having two lumens which are in communication at the upstream end of the tube and adjacent the downstream end of the tube.

2. A system according to claim 1 which includes a drip chamber into which projects the lower end of the tube, communication between the lumens being through said drip chamber and said chamber being vented to atmosphere.

3. A system according to claim 1 in which the tubular conduit comprises a catheter and an adapter connecting the catheter to the drainage tube, communication between the lumens being through a passage within said adapter.

4. A system according to claim 3 which includes a drip chamber into which projects the lower end of the tube, communication between the lumens being through said drip chamber and said chamber being vented to atmosphere.

5. A system according to claim 2 in which the drip chamber is provided with a flutter valve on its outlet.

6. A system according to claim 2 in which the lower portion of the drip chamber is enlarged and is provided with a wide flaring flutter valve on its outlet.