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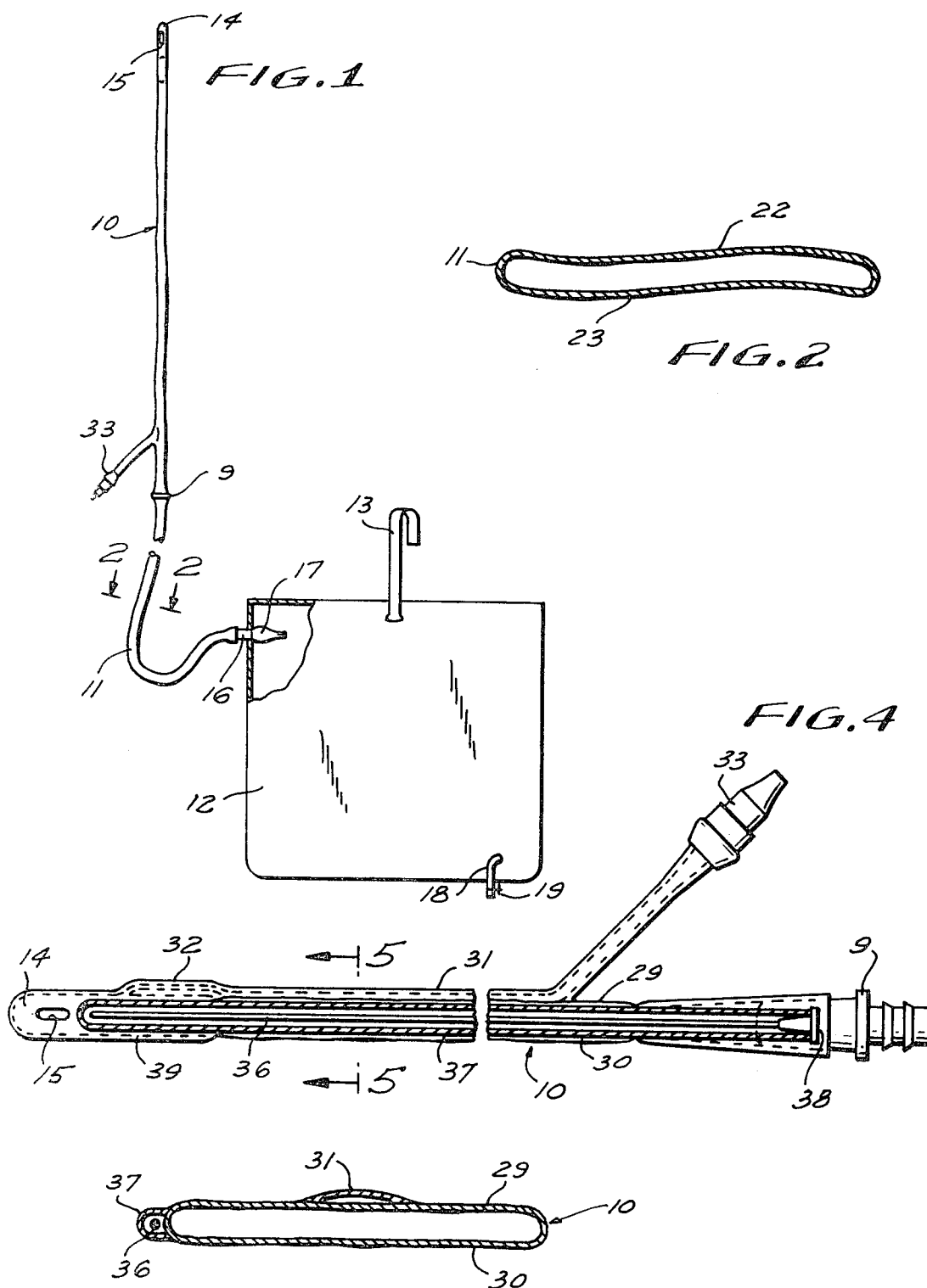
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3,605,749

URINARY DRAINAGE APPARATUS

Filed Nov. 18, 1968

2 Sheets-Sheet 1



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FIG. 6

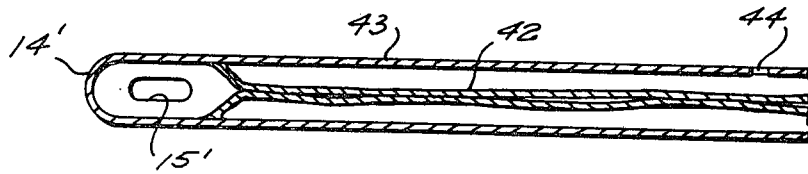


FIG. 3

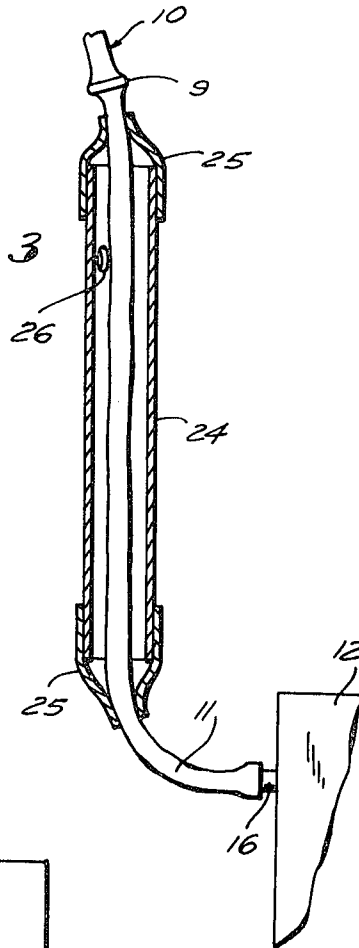
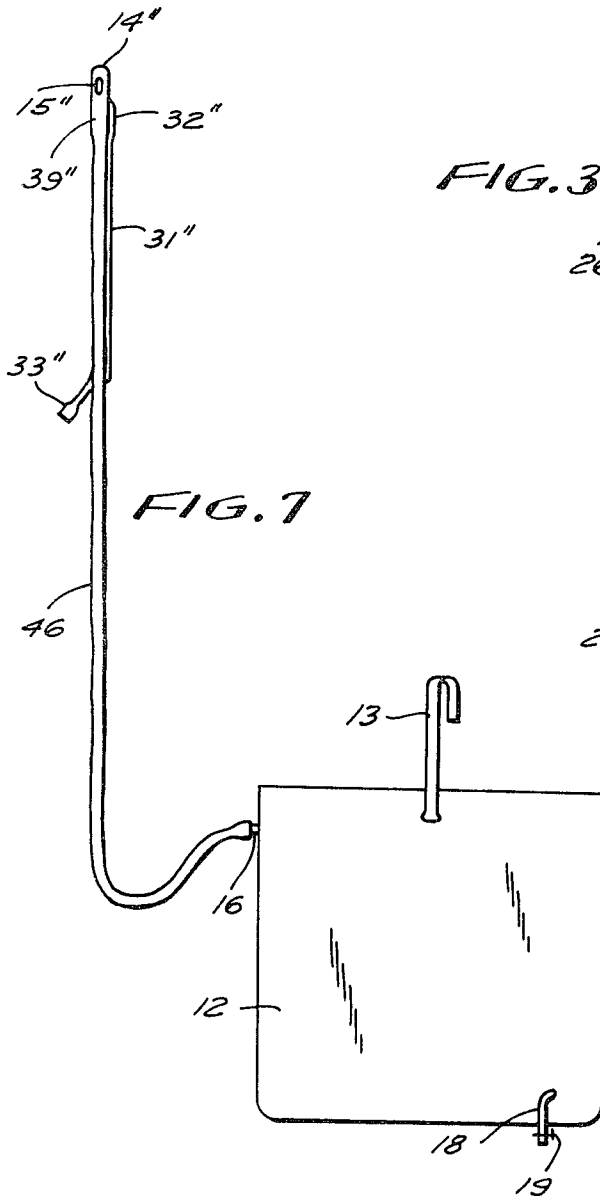


FIG. 7



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3,605,749 URINARY DRAINAGE APPARATUS

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9 Claims

ABSTRACT OF THE DISCLOSURE

Catheter for insertion into patient's bladder connected to tubing which terminates at a urine collection receptacle. Tubing formed of limp material so that it normally assumes a collapsed condition. Portion of catheter may also be formed of limp material, and stiff, flexible rod extends longitudinally along catheter but is separable from it.

This invention relates to urinary drainage apparatus and more particularly to the tubing and catheter forming part of such an apparatus.

A urinary drainage apparatus includes, generally, a catheter for insertion through the patient's urethra into the bladder, a drainage tubing connected at one end to the catheter, and a drainage or collection bag connected to the other end of the tubing. Since the catheter is essentially a tube, the catheter and drainage tubing will sometimes be referred to hereinafter by the term "tubing." Conventionally, the drainage tubing and catheter are formed of material (e.g. rubber or plastic) which is flexible but stiff enough to retain its cross-sectional shape, usually circular, even when no liquid is flowing through it. Use of such tubing presents several problems, two of which stem from the fact that, when the apparatus is in use, the catheter and drainage tube always remain filled with a column of urine.

The column of urine is formed, and retained, because the only opening in the tubing is at the end within the patient's bladder. Hence, no air can enter the tubing above the column of liquid. The presence of the urine within the tubing leads to infection of the bladder, since it remains in direct communication with the urine column. Secondly, the force of gravity acting upon the column of urine produces a partial vacuum, or negative pressure, within the bladder causing trauma to the bladder mucosa.

Another problem caused by use of a catheter of relatively stiff material involves the fact that the meatus, or entrance to the urethra, continually rubs against the exterior of the catheter and thus becomes irritated, and consequently susceptible to infection.

In the past, attempts have been made to diminish the incidence of infection ascending from the drainage bag to the patient by providing air inlets in the bag, thus breaking the continuity between the urine in the tubing and in the bag. This expedient, however, does not solve the problems outlined above since a column of urine remains in the tubing. Furthermore, the mechanism for admitting the air increases the cost of the drainage apparatus, and the air admitted may itself cause contamination of the interior of the apparatus and infection of the patient.

It is an object of the present invention to overcome the problems outlined above by providing tubing, for connecting the patient to the urine receptacle, incapable of supporting a column of urine even though the tubing is not provided with any air inlets.

It is another object of the invention to provide such tubing which moves with the patient's urethra, thereby avoiding the troublesome rubbing contact referred to above.

To accomplish these objectives, the invention employs tubing formed of material without stiffness, and having a degree of limpness such that it cannot maintain any particular cross-sectional shape, but instead collapses when not filled with liquid. A column of urine cannot remain in such a tube, since as the urine enters the tube, the combined forces of gravity acting on the liquid and air pressure acting on the exterior of the tubing, cause the urine to flow through the tubing into the drainage receptacle. Furthermore, such a tube does not have sufficient stiffness to be self-supporting, and therefore it moves with the urethra. To prevent the tubing from becoming occluded should the patient's leg, or some object, come to rest upon it, a protective sheath of more rigid material may surround the limp tubing. If the catheter is formed of the limp material described above, it may be difficult to insert through the urethra. To avoid this problem, a relatively stiff, but flexible, rod may be separably associated with the catheter, the rod being removed after the catheter has been applied to the patient. In the alternative, an outer tubing of stiffer material may surround the catheter.

Additional objects and advantages of the invention will be apparent from the following description in which reference is made to the accompanying drawings.

In the drawings:

FIG. 1 is an elevational view of a urinary drainage apparatus, of the type to which this invention relates, provided with tubing according to the invention;

FIG. 2 is a cross-sectional view taken along line 2—2 of FIG. 1, the tubing being shown substantially larger than actual size;

FIG. 3 is a view, partly in cross-section, of a feature of the invention;

FIG. 4 is a longitudinal cross-sectional view of a catheter according to this invention;

FIG. 5 is a transverse cross-sectional view taken along line 5—5 of FIG. 4;

FIG. 6 is a fragmentary view similar to FIG. 5 showing an alternative catheter construction; and

FIG. 7 is an elevational view of another embodiment of the invention.

An arrangement chosen to illustrate the present invention, and shown in FIG. 1, includes a catheter 10 connected by means of a fitting 9, to one end of a drainage tubing 11, the other end of which is connected to a drainage or collection bag 12. The bag 12 is provided with means, such as a hook 13, for suspending it at a level below the level of the patient to which it is connected. The end 14 of the catheter 10, which is inserted through the patient's urethra into the bladder, is formed with an opening 15 in its wall through which urine enters the catheter. The urine flows through the catheter 10 and tubing 11 into the bag 12. The bag may be furnished with a fitting 16 to which the lower end of tubing 11 is connected, or the tubing 11 and bag 12 may be made integral. Within the bag, the fitting 16 can, if desired support a one-way valve 17, such as a flattened, tubular rubber flutter valve, to prevent reverse flow of urine from the bag should the bag inadvertently be raised above the patient. Near its bottom, the bag may have an outlet tube 18 normally closed by clamp 19. Although a bag 12 has been shown as the urine collection receptacle, it is understood that any suitable receptacle may be employed, including a drain. In fact, the receptacle itself forms no part of the present invention.

According to this invention, the drainage tubing 11 (FIGS. 1 and 2) is formed of a limp material, completely without stiffness. As a result, the tubing is unable to sustain, without support, any preselected cross-sectional shape. Instead, the tubing 11 tends to assume a flattened condition in which its walls 22 and 23 lie against each other

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(a relatively large spacing being shown between the walls in FIG. 2 for the sake of clarity). Any suitable material may be used to form the tubing 11. For example, thin polyethylene film of the type used to make plastic bags in which merchandise is packaged may be employed. Any tendency of the walls 22 and 23 to stick together after their inner surfaces have become wetted with urine can be avoided by making these inner surfaces rough rather than smooth.

No column of urine can exist in the tubing 11 formed of the material described above. The reason is that as urine enters the tubing, temporarily separating the walls 22 and 23, it flows through to the bag 12 under the influence of gravity. Although no air is permitted to enter the tubing from above the urine, a vacuum which might prevent flow of the urine is prevented from forming within the tubing by the collapse of the tube, above the urine, under the influence of atmospheric pressure acting upon the exterior of the tubing.

To prevent the tubing 11 from being inadvertently flattened, and its interior occluded, the tubing may be surrounded for some or all of its length by a sheath 24 (FIG. 3) of stiffer material, such as a suitable plastic. The sheath 24 may be formed of flexible tubing, as long as it has sufficient stiffness so that it will not flatten when, for example, the patient rests his leg on it. The ends of the sheath may be secured to the tubing 11 by bands 25, in which case the sheath is furnished with a hole 26 to permit atmospheric pressure to act on the tubing 11. If the bands 25 are eliminated, or so formed as to leave at least one end of the sheath 24 open to the atmosphere, the hole 26 may be eliminated.

A conventional catheter may be employed with the drainage tube 11 of this invention, but preferably the catheter 10 is also formed of limp material, as described above, and shown in FIGS. 4 and 5. FIGS. 4 and 5 show the catheter on a scale larger than actual size. The catheter includes a main tube formed by walls 29 and 30 of limp material. The catheter illustrated is of the so-called "Foley" type, having an air passageway 31 extending longitudinally along the main tube 29, 30. The passageway 31 terminates at one end in an inflatable "balloon" portion 32, and at its other end in a fitting 33 containing a valve. As is well known, the fitting is adapted to accommodate the end of a hypodermic syringe or needle, and after the end 14 of the catheter has been inserted into the patient's bladder, operation of the syringe causes air to pass through passageway 31 into portion 32 whereby the latter becomes distended. The resultant enlargement on the end of the catheter within the bladder prevents accidental withdrawal of the catheter.

A catheter formed completely of limp material lacks sufficient stiffness to enable its ready insertion through the urethra into the bladder. Therefore, the present invention provides means for stiffening the catheter. In the embodiment of FIGS. 4 and 5, the stiffening means includes a stiff, but flexible, rod or stylet 36 accommodated within a channel or pocket 37 extending longitudinally along the main tube of the catheter. After the catheter has been inserted into its position of use, the rod 36 may be removed by grasping its handle 38 and pulling it out of the pocket 37. If desired, the pocket 37 could be eliminated and the rod 36 carried within the passageway 31, the rod being removable after the catheter is positioned for use. Alternatively, the pocket 37 could be made solid to give the catheter sufficient firmness to allow its insertion.

Another problem presented by a catheter formed completely of limp material is that it is susceptible to being flattened, and its interior occluded, by the prostate gland of male patients. This can be avoided by forming the catheter portion 39 adjacent to the end 14 of a stiffer material, such as the material of which conventional catheters are made. However, the portion 39 should be short enough so that it does not reach the exterior opening to the patient's urethra. Consequently, the portion

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of the catheter passing through the urethra opening will be limp, and therefore will move with, rather than rub against, the opening, thereby avoiding irritation and possible infection of the patient.

The embodiment of the catheter illustrated in FIG. 6 presents another way of providing sufficient stiffness for insertion of the catheter, and preventing occlusion of the catheter within the patient's body. The main tube 42 of the catheter is formed of limp material, as described above, and extends from directly behind the opening 15', at the forward end 14' of the catheter, along the length of the catheter. Surrounding the main tube 42 is an outer tubing 43, which may be of the same stiffness as conventional catheters. The outer tubing is formed with a hole 44 through which atmospheric pressure acts on the tube 42, or in the alternative, the end of the tube 43 remote from the forward end 14' may be open to the atmosphere.

As illustrated in FIG. 7, the invention also contemplates that the catheter 10 and drainage tube 11 may be formed as a single, integral unit 46 of limp material. In FIG. 7, parts similar to those in FIG. 4 have been given the same reference numeral followed by a double prime.

The invention has been shown and described in preferred form only, and by way of example, and it is understood therefore, that many variations may be made in the invention which will still be comprised within its spirit.

What is claimed is:

1. For use with a urinary drainage receptacle intended to receive urine from a patient, a tubing for draining urine from a patient's bladder, said tubing having an interior adapted to communicate with the interior of the drainage receptacle and means at one end to permit introduction of urine into said tubing, at least a portion of the length of said tubing being formed of material having a degree of limpness such that said tubing portion is not self-supporting and cannot by itself maintain any preselected cross-sectional shape and therefore normally assumes a flat collapsed condition in which its walls lie against each other across an entire transverse dimension of said tubing, whereby urine entering said tubing at the patient's bladder will flow through said limp tubing portion to the drainage receptacle and will not remain as a column of liquid in said limp portion despite the fact that air may not enter the tubing between said limp portion and the bladder, and an outer sheath resistant to radial compression surrounding at least a portion of the length of said limp tubing portion, said tubing being devoid of means for permitting fluid flow communication between the interiors of said tubing and sheath, whereby fluid external to said sheath cannot flow from the interior of said sheath into said tubing.

2. A tubing as defined in claim 1 wherein said tubing includes a drainage tube connected to the drainage receptacle, and a catheter connected to said drainage tube and adapted to pass through the patient's urethra.

3. A tubing as defined in claim 2 wherein only said drainage tube is formed of said limp material.

4. A tubing as defined in claim 2 wherein said drainage tube and catheter are both formed of said limp material.

5. A tubing as defined in claim 4 wherein the portion of said catheter adjacent to the end which enters the patient's bladder is formed of a material stiffer than said limp material.

6. A tubing as defined in claim 4 including a rod of stiff flexible material, and means for separably holding said rod alongside said catheter, said rod giving said catheter sufficient stiffness to be inserted through the patient's urethra into the bladder.

7. A tubing as defined in claim 4 wherein said catheter and drainage tube are integral.

8. A urinary drainage catheter for draining urine from a patient's bladder, comprising a length of tubular ma-

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terial having a degree of limpness such that it is not self-supporting and cannot by itself maintain any pre-selected cross-sectional shape and therefore normally assumes a flat collapsed condition in which its walls lie against each other, said tubular material having means at one end to permit introduction of urine into said tubing, and means extending longitudinally along said length of tubular material for providing the latter with sufficient stiffness to permit insertion of the catheter into a patient's bladder, said stiffening means including an outer sheath resistant to radial compression surrounding at least a portion of the length of said limp tubular material, said tubular material being devoid of means for permitting fluid flow communication between the interiors of said tubular material and sheath, whereby fluid external to said sheath cannot flow from the interior of said sheath into said tubular material.

9. A catheter as defined in claim 8 wherein a portion of said catheter adjacent to the end which enters the patient's bladder is formed of a material stiffer than said limp material, said stiffer portion being short enough so as not to reach the exterior opening to the patient's urethra when the catheter is in use.

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