

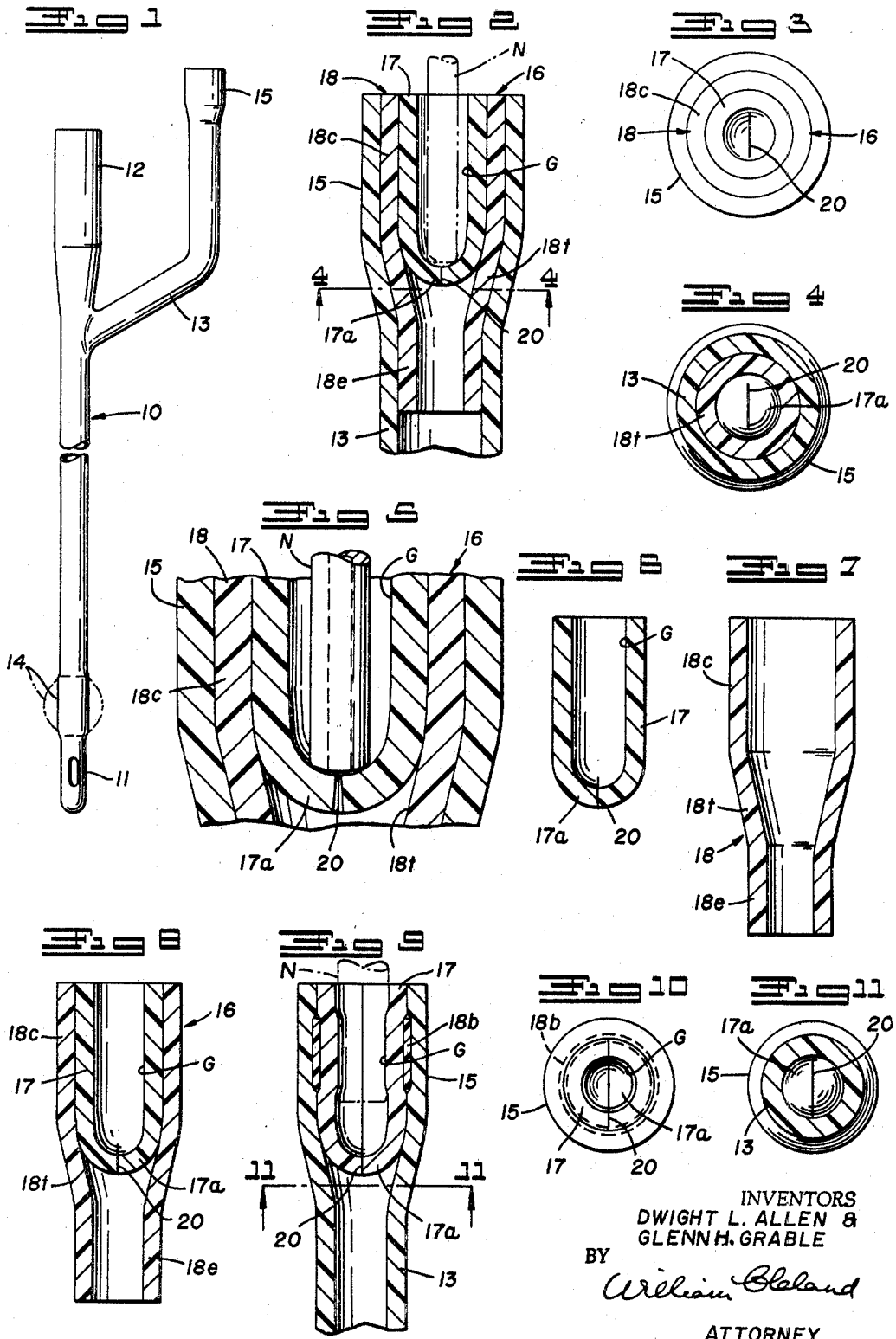
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CATHETER HAVING ONE-WAY INFLATIONS VALVE

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CATHETER HAVING ONE-WAY INFLATIONS VALVE

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8 Claims

ABSTRACT OF THE DISCLOSURE

Valve means and method for inflating or deflating retention balloons of a Foley-type surgical catheter, without necessarily using a hypodermic needle, employing a novel plug affixed in a side-arm of the catheter. Plug has an integral normally closed self-sealing apertured inner end portion having a guide passage therethrough. The end portion is yieldingly distended either by direct inward engagement thereof by a blunt end on a syringe nozzle or by fluid pressure exerted against the end wall, to provide a substantial opening for quick passage of fluid therethrough.

Background of invention

The invention relates to a Foley-type catheter having an inflatable retention balloon at the distal end thereof and, in particular, relates to valve means in a side-arm at the proximal end of the catheter for inflating a retention balloon at the distal end. Applicant's prior U.S. Patent No. 3,138,161 discloses a catheter of this general type having a resilient valve plug therein, but in the patented structure use of the resilient valve is limited because a hypodermic needle is required to be pierced completely through an inner end wall of the plug. Accordingly, this type of valve could not be used in some areas of the United States and in certain foreign countries, where the practice was to use syringes having blunt-ended nozzles of varying diameters and thereby requiring use of catheters having special types of valves provided with spring-loaded closure means, for example.

Summary of invention

In accordance with the present invention, the improved catheter valve may comprise a hollow plug of rubber-like elastic material affixed within the outer end of the catheter side-arm, said plug having a guide passage for axially inward reception of a syringe nozzle until a blunt end thereof forcibly engages a closed inner end wall of the plug to distend the same against resilient tension means provided for applying compressive stresses to said end wall. The end wall is provided with a slit therethrough, defining opposing surfaces which are normally yieldingly held in tight smooth sealing contact by the aforesaid compressive stresses. Accordingly, varying sizes of syringe nozzles are insertable in the guide passage in the manner described, yieldingly to separate said opposing surfaces for free passage of fluid in either direction therebetween.

One object of the present invention is to provide a catheter of the character described having improved valve means having an elastic closure portion, by which the catheter balloon may be syringe inflated and deflated without injection of a hypodermic needle through said closure portion.

Another object of the invention is to provide a catheter valve of the character described, adapted for use with syringes having blunt-ended nozzles of varying lengths and/or diameters.

Other objects of the invention will be manifest from the following brief description and the accompanying drawings.

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Of the accompanying drawings:

FIGURE 1 is a front elevation of the catheter embodying the improved valve means in the side-arm thereof.

FIGURE 2 is an enlarged fragmentary cross-section through the outer side-arm of the catheter shown in FIGURE 1, and illustrating incorporation of one form of the improved valve means therein.

FIGURE 3 is a top plan view of FIGURE 2, on the same scale.

FIGURE 4 is a cross-section taken on the line 4—4 of FIGURE 2, on the same scale.

FIGURE 5 is a fragmentary cross-section, corresponding to a portion of the FIGURE 2 structure, further enlarged to illustrate resilient actuation of the valve means by pressure of a blunt-ended syringe nozzle to open the valve opening means for passage of fluid therethrough.

FIGURES 6 and 7 are cross-sections, on the same scale as FIGURE 2, illustrating two parts of the improved valve unit or plug for assembly and incorporation in the side-arm of FIGURE 2.

FIGURE 8 is a view illustrating assembly of the two valve parts shown in FIGURES 6 and 7, and on the same scale, to form the improved valve unit or plug.

FIGURE 9 is a view corresponding to FIGURE 2, illustrating a modified form of the invention shown in FIGURES 1 to 6.

FIGURE 10 is a top plan view of FIGURE 9, on the same scale.

FIGURE 11 is a cross-section taken on the line 11—11 of FIGURE 9.

Referring to FIGURES 1 to 8 of the drawings in general, and to FIGURES 2 to 4 in particular, the catheter of the present invention is of the type including a flexible rubber tube 10 provided with a drainage passage therethrough from an apertured distal end 11 to a proximal end 12 which usually is attached to a glass tube (not shown). The rubber tube 10, at its proximal end, has a flexible rubber side-arm 13 for connection through a separate inflation passage (not shown) in the tube 10, with a retention balloon 14 at said distal end.

As best shown in FIGURES 2 to 4, the side-arm 13 has an enlarged and/or distended free end portion 15 opening axially outwardly, and within which a self-closing valve unit or plug 16 is adhesively affixed. Valve unit 16 may comprise a cup-shaped compression member 17 of suitably molded or formed latex or like elastic material similarly adhesively affixed within a yieldingly distended tubular end portion 18c of an elongated tension member 18 of similarly molded or formed latex or like elastic material. The tension member 18 may have axially inwardly tapering extension 18t which terminates in a constricted tubular end portion 18e adapted to extend partially into the reduced portion of the arm 13, thereby to increase localized compressive stresses applied to the closed rounded inner end wall portion 17a of the compression member 17 to requisite extent for purposes to be described. That is, the tension member 18, being yieldingly expanded over the compression member 17, serves to maintain the rubber of the compression member 17 under strong compressive stress, and this condition is further aided by the tension applied to the valve unit 16 as a whole by the outer end of the yieldingly distended side-arm tubular part 15. Either before or after the valve unit 16 is affixed within said tubular part 15, the compression member 17 may have a slit 20 cut therein, as by means of a sharp blade, as shown in FIGURES 2, 3, and 4, without removal of any of the material from the end wall 17a. This slit 20, extending in a plane axially through the end wall 17a, defines opposed, mating planar surfaces which are yieldingly maintained in flatwise, fluid-sealing contact, by the radially inward compressive stresses particularly applied to the rounded end wall 17a by the tapered

portion 18 of tension member 18, aided by tension maintained in distended portions of the side-arm 13.

This construction is such that inward pressure of blunt-ended syringe nozzle N against the inner, convex side of the rounded concavo-convex wall portion 17a to overlie the mating surface portions defined by the slit, as shown in chain-dotted lines in FIGURE 2, will distend said wall portion to separate the mating faces of slit 20, and thereby provide an opening between the same for free passage of fluid therethrough, as shown in full lines in FIGURE 5.

FIGURES 6 and 7 separately illustrate the compression member 17 and tension member 18, respectively, and FIGURE 8 illustrates the valve unit, including the compression member 17 cemented or otherwise adhered within the tubular end of tension member 18 as described.

In use of the improved catheter, described above in connection with FIGURES 1 to 8, to obtain a specimen of urine from the bladder, for example, the distal end of the catheter is inserted through the urethra in known manner. To inflate the balloon 10 to retain the distal end in proper position, the surgeon or other operator inserts a blunt-ended syringe nozzle into the guide passage of the valve compression member 17 and exerts relatively slight amount of force against the rounded end wall 17a, sufficient to distend the elastic material thereof and separate the mating faces of the slit 20 in the manner illustrated in FIGURE 5. While maintaining this condition, the operator may then feed fluid from the syringe through the nozzle end, the slit opening thus formed, and the side-arm 13 and the tube 10, to inflate balloon 14. When inflation has been completed by injection of the necessary amount of fluid, the syringe is withdrawn to allow the mating faces of the slit portion 20 to be closed by the aforesaid compressive stresses applied thereto, thereby to seal the slit portion against reverse flow of the inflation fluid. The slit portion 20 is maintained in closed fluid-sealing condition by the strong compressive forces applied by the tension member 18, assisted by the expanded tubular portions 15 of the side arm 13. When it becomes necessary to deflate the balloon 14, for removal of the catheter from the urethra, the same procedure is followed except that the syringe nozzle end is used to open the slit portion 20 for withdrawal of the previously injected fluid from the catheter balloon 14.

Referring to FIGURES 9 to 11, there is illustrated a modified form of valve means which is in all respects similar to the construction best shown in FIGURES 2 to 5, except that in place of the tubular compression member 18, as best shown in FIGURE 8, the compression member 17 is cemented within the tubular part 15 of the side-arm 13 with a strong elastic band 18b adhesively affixed between the tubular part 15 and the compression member 17, as best shown in FIGURE 9. With this particular construction, the use of the elastic band compression device 18b lends itself to economical manufacture of the valving device, and may employ a compression member 18 which is either slit lengthwise along one side thereof, or is made in two halves as shown in FIGURE 9. In either instance, the elastic band 18b compresses the compression member to retain the lengthwise slit or slits normally in tight fluid-sealing relationship, including the slit portion 20 of end wall 17a, that is, without cementing the slitted portions of the compression member together above the slitted portion 20. Accordingly, this form of the invention may be used substantially in the manner described above for FIGURES 1 to 8. Additionally, however, certain syringes having short stubby nozzles or stems N are yieldingly insertable in the guide passage G of compression member 17, as shown in chain-dotted lines in FIGURE 9, thereby to seal passage G against possible reverse flow of inflation fluid being fed from a syringe. Accordingly, trapped fluid at the normally sealed inner end of the passage G will distend the end wall 17a and open the extended slit portion 20 for quick passage of pressure fluid

to the retention balloon 14 (FIGURE 1). It is contemplated that this extended slit idea, functioning as just described, may be incorporated in the FIGURES 2 to 8 forms of the invention.

Other modifications of the invention may be resorted to without departing from the spirit thereof or the scope of the appended claims.

What is claimed is:

1. In a retention catheter having a tubular fluid injection side-arm of elastic material opening outwardly, a valve comprising: a hollow, cup-shaped compression plug of elastic material affixed within the open end of the side-arm to have a normally closed concavo-convex end wall presented inwardly thereof, and providing a guide passage for endwise inward reception of a blunt-ended syringe nozzle against the concave portion of said end wall within said passage; tension means acting upon said plug for maintaining said end wall under substantial radially inward compression stresses peripherally around the same; said end wall having aperture means axially therethrough defining radially opposed, mating surface portions, normally yieldingly held in fluid-sealing contact by said radially inward compressive stresses of said tension means; whereby axially inward engagement of the blunt end of said nozzle with said concave portion of the end wall, to overlie said mating surface portions yieldingly distends the end wall to separate said mating portions and open said aperture means for passage of fluid therethrough.

2. A catheter as in claim 1, said aperture means being a slit through said end wall defining normally yieldingly contacting flatwise said mating surface portions.

3. A catheter as in claim 2, wherein said tension means includes a peripheral elastic tension member interposed between said plug and said side-arm to amplify the yielding compressive stresses about said closed inner end wall.

4. A catheter as in claim 3, wherein said tension member has a constricted extension axially inwardly of the end wall to concentrate said compressive stresses closely adjacent the end wall of the plug.

5. A catheter as in claim 4, wherein the effective separable extent of said slit is confined to the area of said end wall freely exposed inwardly thereof.

6. A catheter as in claim 5, wherein said compression plug is split along at least one side thereof, and the mating edges formed by the split are permanently maintained in fluid-sealing relation with the exception of said separable extent of said slit.

7. A catheter as in claim 6, wherein said compression plug is in two halves defined by a said split.

8. A catheter as in claim 1 wherein said compression plug is split along at least one side edge thereof, and the mating surface portions formed by the split are permanently maintained in fluid-sealing relation with the exception of said separable extent of said slit.

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