

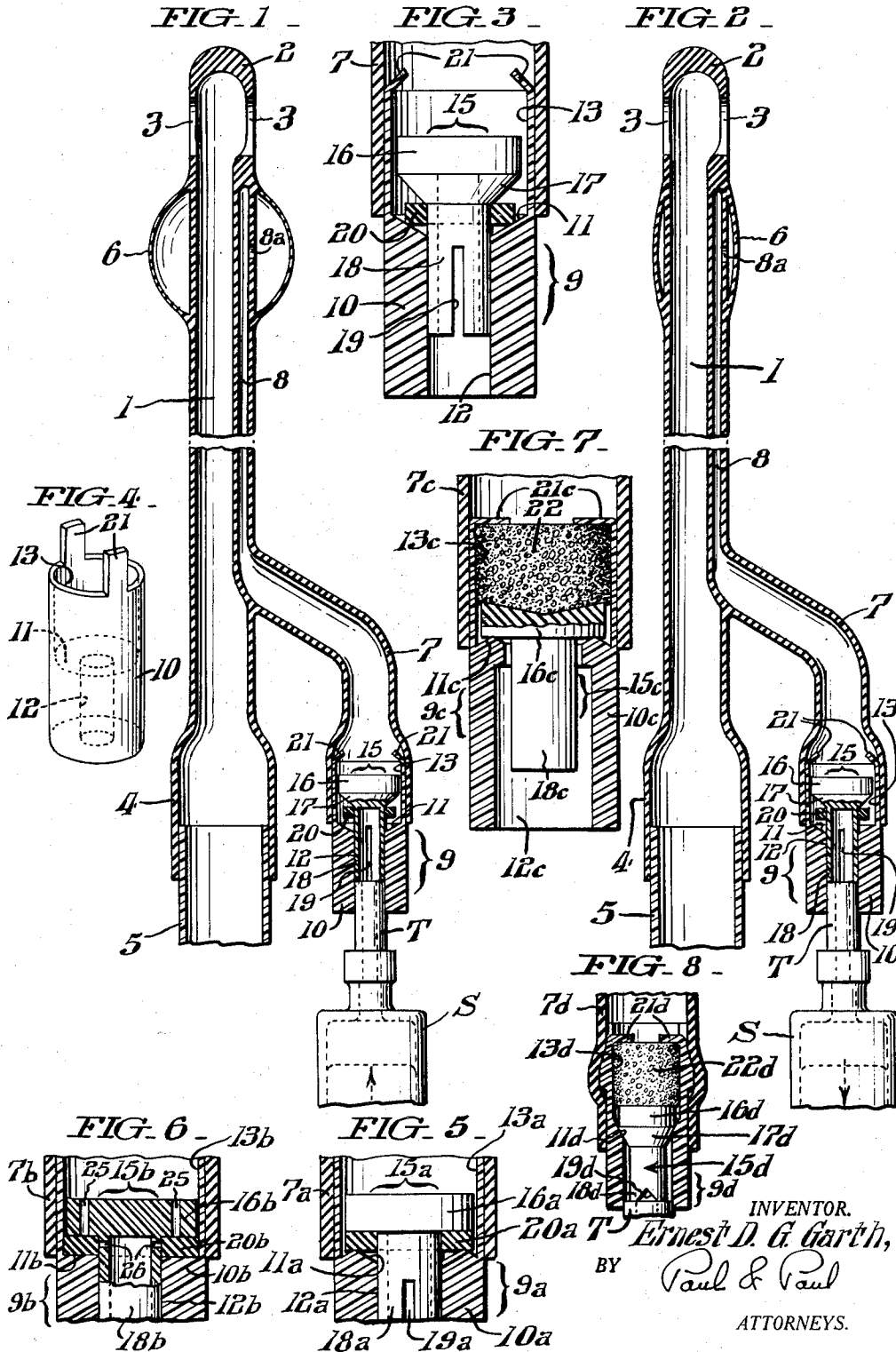
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VALVED CATHETERS

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VALVED CATHETERS

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7 Claims. (Cl. 128—350)

This invention relates to catheters such as are used by physicians and surgeons in hospitals to drain internal organs of patients. More particularly, the invention is concerned with a catheter in the form of a flexible tube of which a portion adjacent the distal end is capable of being dilated with air, water or other fluid through an inflation tube beside or within the wall of the catheter by means of a syringe or the like, to form a bulb by which the catheter is constrained against withdrawal from the body of the patient during drainage. In such a catheter, as ordinarily made heretofore, the end of the inflation tube is closed off by the operator or by a rubber plug which is adapted to be punctured by a hypodermic needle on a syringe and to seal off itself upon removal of the needle. For deflation it has also been necessary to puncture the plug with a needle. The use of the required size needle is inconvenient and is attended at times in puncturing the wall of the inflation tube by the operator and occasionally jabbing of the needle into the operator's fingers.

My invention has for its chief aim to overcome the above and other difficulties heretofore experienced with catheters. This objective is realized in practice, as hereinafter more fully disclosed, through provision of a valve in the inflation tube of the catheter, which valve is automatically opened when the syringe is applied and which automatically closes upon withdrawal of the syringe after the retaining bulb is inflated or dilated as the case may be.

Other objects and attendant advantages will appear from the following detailed description of the attached drawings, wherein:

FIG. 1 is a broken out view in section on a magnified scale of a catheter with a valve conveniently embodying my invention in one form and showing the manner in which the bulb is expanded with the aid of a syringe or the like;

FIG. 2 is a view corresponding to FIG. 1 showing how the balloon of the catheter is collapsed in preparation for removal of the catheter from the patient;

FIG. 3 is a fragmentary view in section drawn to a still larger scale showing the construction of the valve to better advantage;

FIG. 4 is a view in perspective showing one of the components of the valve;

FIGS. 5, 6, 7 and 8 are views similar to FIG. 2 showing modified forms of the valve.

Generally speaking, the catheter illustrated in FIGS. 1-4 for the purpose of exemplifying my invention is of a well known conventional type, it being formed throughout from rubber or other suitably flexible material and characterized by having a main flow tube 1 which is closed and round ended at the top as at 2 and there provided with lateral openings 3, and of which the bottom end portion 4 is flared for connection of an extension tube 5 of somewhat larger diameter. Surrounding the tube 1 immediately below the openings 3 is a thin walled jacket 6 capable of being expanded as in FIG. 1 to form a bulb for retainment of the catheter within an internal organ of the patient to be flushed or drained, by forcing air, water or other fluid thereinto by way of a laterally offset inflation tube 7 and a small continuing duct 8 longitudinally within the main tube 1 in communication, by way of an aperture 8a, with said bulb.

To facilitate introduction of the fluid utilized in expanding the jacket 6 or subsequently releasing the fluid when

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the catheter is to be withdrawn, I have devised a valve which is comprehensively designated 9 in FIGS. 1, 2 and 4. As shown, this valve comprises a non-metallic corrosion-resistant cylindrical body component 10 (separately illustrated in FIG. 4) which may be of a suitably hard plastic, such as nylon or polypropylene for example, and is force-fitted into or otherwise permanently secured to the open end of the inflation branch tube 7 of the catheter. In this instance, the body 10 of the valve is formed internally with a beveled seat 11 between a main axial lower bore 12 and a larger counter bore 13. The closure element 15 of the valve is preferably fashioned likewise from non-metallic corrosion-resistant material such as neoprene, and has a head 16 of which the bottom is beveled as at 17 and of which the diameter is somewhat less than that of the counter bore 13 in the valve body 10, and a pendent hollow stem 18 which has a free sliding fit in the main bore 12 of the body. A diametral slit 19 extends up from the bottom end of the stem 18 to a point somewhat below the head to provide a lateral flow port; and surrounding the stem beneath the head is a ring 20 of rubber or other suitably soft resilient non-metallic material which is adapted to normally seal downwardly upon the seat 11 within the valve body as best shown in FIG. 3. In order to limit the extent of upward movement of the closure element 15, the top edge rim of the body 10 is turned inwardly or is provided with inwardly bent stop lugs 21.

To expand the jacket 6 to form the retaining bulb after the catheter has been introduced into the patient, the tip of the syringe or pump S is inserted into the open bottom end of the lower bore 12 of the valve body from beneath as in FIG. 1. As a consequence, the closure element 15 is raised with incidental lifting of the sealing ring 20 from the seat 11 and establishment of communication between the upper bore 13 of the valve body 10, and the hollow in the stem 18 of said closure element by way of the slot 19 in said stem. With this accomplished, the syringe or pump S is operated to force air or liquid into the duct 8 to expand the jacket 6 to the extent desired or required, as shown in FIG. 1. Thereafter, as the syringe or pump is removed, it will be seen, that under the pressure created by the stretched rubber of the jacket 6, the element 15 of the valve is forced to closed position automatically, with attendant sealing of the ring 20 against the seat 11 as in FIG. 3 to prevent escape of the air or fluid from the bulb. In preparation for withdrawal of the catheter, the tip of the empty syringe or pump is again introduced into the bore 12 of the valve and the closure element 15 raised as before to clear the ring 20 from the seat 11 and establish communication between the upper bore 13 of the valve body and the hollow of the stem 18 of the closure element by way of the slot 19. Then, by operating the syringe or pump, the air or other dilating fluid will be sucked through the inflation tube to permit collapse of the bulb.

In the modification of FIG. 5 the head 16a of the closure element 15a has a flat bottom which is directly engaged by the resilient sealing ring 20a surrounding the stem 18a, and the seat 11a is formed with an upstanding sharp annular ridge against which the ring normally seals. In all other respects the construction and the manner of its operation of the valve here is the same as set forth above in connection with the embodiment of FIGS. 1-3. Accordingly, in order to dispense with repetitive description, all features of this modification not particularly referred to but having their counterparts in the first described embodiment, have been identified by the same reference numerals with the addition however in each instance, of the letter "a" for convenience of more ready distinction.

In the modification illustrated in FIG. 6, the head

16b of the closure element 15b is flat bottomed, and is provided somewhat inward of its periphery with vertical through apertures 25. Further departures to be noted in this modification are that the seat 11b is flat; that in lieu of slots, lateral ports 26 are provided in the stem 18b of the closure element 15b immediately below the head 16b. When, in FIG. 6, the closure element 15b is raised, communication is established between the upper bore 13b of the valve body 10b and the hollow of the stem 18b by way of the holes 25 in the head 15b and the ports 26 of said stem.

In the alternative embodiment illustrated in FIG. 7, the head 16c of the closure element 15 has a dished top face. Instead of being hollow as in the previously described embodiments, the stem 18c of the element 15c is solid and, moreover, has a loose fit in the bore of the body 10c. Disposed above the head 16c of the closure element 15c, in this instance, and held in place by inwardly directed tabs 21c at the top of the body 10c, is a cushioning insert 22 of porous resilient non-metallic corrosion-resistant material such as polyurethane which is fluid penetrable and, by reason of its resiliency, acts as a spring to yieldingly maintain the head of the closure element normally in effective sealing engagement with the seat 11c in the body. It is to be understood that, notwithstanding being compressed slightly as the closure element 15c is raised upon introduction of the tip of the pump or syringe into the bottom end of the valve body 10c, the insert 22 will permit flow of liquid through it by reason of its porosity.

Referring now to FIG. 8, the modification there shown is generally like that of FIG. 7 in that the closure element 15d is depressed by an insert 22d of porous resilient non-metallic corrosion-resistant material which is held in place by inwardly-directed tabs 21d on the valve body 9d. Here however, the head 16d of the closure element 15d is beveled at the bottom as at 17d to seal against a correspondingly beveled seat 11d in the valve body 9d. In this instance, moreover, the pendent stem 18d of element 15d is provided at the bottom with a transverse V notch 19d by way of which fluid can flow to or from the tip T of the syringe or pump when said element is raised.

While in accordance with the provisions of the statutes, I have illustrated and described the best forms of embodiment of my invention now known to me, using specific terminology for clearness, it will be apparent to those skilled in the art that various changes including substitution of equivalents, may be made in the form of the catheters herein described without departing from the spirit and scope of the invention as set forth in the appended claims, and that, in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

Having thus described my invention, I claim:

1. A catheter comprising a drainage tube having an inlet at the upper end for receiving body fluids and an outlet at the lower end for discharging such body fluids, said drainage tube being provided along an intermediate portion of its length with a parallel duct for inflation fluid, said inflation-fluid duct being isolated from communication with said drainage tube, said inflation-fluid duct terminating at its upper end in a thin-walled jacket adapted to be expanded by applied fluid pressure into a generally round bulb encompassing but isolated from said drainage tube, said inflation-fluid duct terminating at its lower end in a branch tube; a valve in the extreme lower terminal portion of said branch tube, said valve comprising a tubular body having a larger upper bore and a smaller bore forming therebetween an annular valve seat, and a movable closure element in said valve body having a head in the upper bore and a dependent stem in the lower bore, said head having an annular undersurface forming a shoulder adapted normally to seat on said annular valve seat to close said valve, said stem extending

sufficiently into the lower end of said lower bore to be engageable and movable upward by the tip of a syringe inserted therein, whereby said shoulder of said head may be lifted off said seat to open said valve, the cross-sectional area of said head being less than that of said upper bore, the cross-sectional area of said stem being slightly less than that of said lower bore leaving a narrow annular space therebetween for passage of inflation fluid, the lower tip of said stem having a radially extending passage for providing communication between said annular space and the passage in the tubular tip of a syringe inserted into said lower bore.

2. A catheter as claimed in claim 1 characterized in that the upper portion of said tubular valve body is provided with at least one inward projection to prevent upward escape of said closure element.

3. A catheter as claimed in claim 2 further characterized in that a mass of non-metallic fluid-porous resilient material is provided in the upper bore filling the space between the head and the inward projection tending to hold said closure element in valve-closing position.

4. A catheter as claimed in claim 2 further characterized in that the radially extending passage at the lower tip of said stem is a diametric notch.

5. A catheter as claimed in claim 4 still further characterized in that said annular valve seat is inclined inwardly from said upper bore to said lower bore and in that the annular undersurface of said head is inclined approximately at a corresponding angle.

6. In combination, a catheter and a syringe, said syringe having a tubular tip portion, said catheter comprising a drainage tube having an inlet at the upper end for receiving body fluids and an outlet at the lower end for discharging such body fluids, said drainage tube being provided along an intermediate portion of its length with a parallel duct for inflation fluid, said inflation-fluid duct being isolated from communication with said drainage tube, said inflation-fluid duct terminating at its upper end in a thin-walled jacket adapted to be expanded by applied fluid pressure into a generally round bulb encompassing but isolated from said drainage tube, said inflation-fluid duct terminating at its lower end in a branch tube; a valve in the extreme lower terminal portion of said branch tube, said valve comprising a tubular body having a larger upper bore and a smaller lower bore forming therebetween an annular valve seat, and a movable closure element in said valve body having a head in the upper bore and a dependent stem in the lower bore, said head having an annular undersurface forming a shoulder adapted normally to seat on said annular valve seat to close said valve, said stem extending sufficiently into the lower end of said lower bore to be engageable and movable upward by the tip of said syringe inserted therein, whereby said shoulder of said head may be lifted off said seat to open said valve, the cross-sectional area of said head being less than that of said upper bore, the cross-sectional area of said stem being slightly less than that of said lower bore leaving a narrow annular space therebetween for passage of inflation fluid, the lower tip of said stem having a radially extending passage for providing communication between said annular space and the passage in the tubular tip of said syringe inserted into said lower bore.

7. A catheter and syringe, in combination, as claimed in claim 6 further characterized in that the radially extending passage at the lower tip of said stem is a diametric notch.

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