

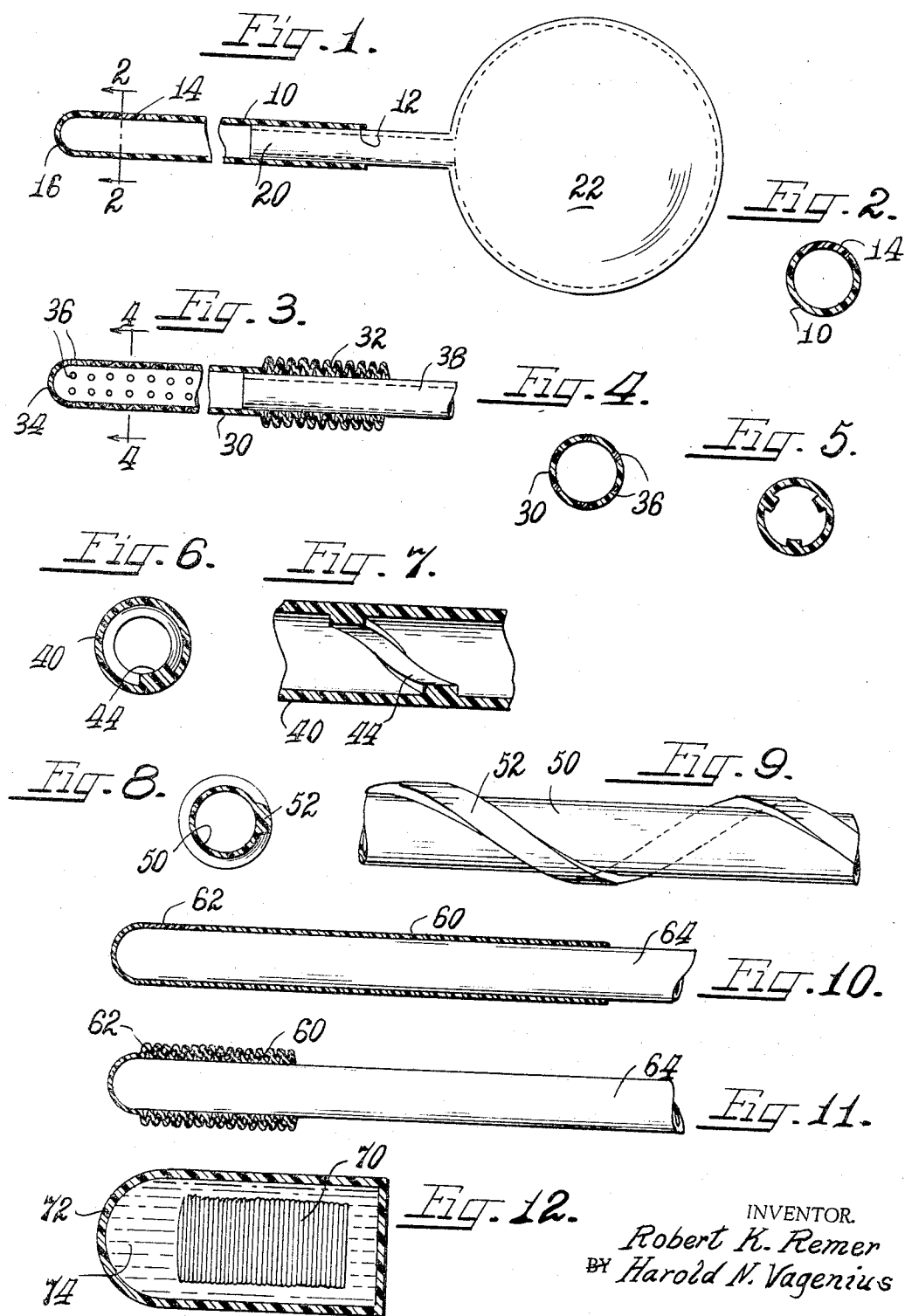
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CATHETER

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CATHETER

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ABSTRACT OF THE DISCLOSURE

This invention provides a catheter made of self-lubricating plastic material including a finely divided solid lubricant. The catheter comprises an open-ended thin walled flexible tube capable of having its leading end sealed with a urine-soluble adhesive. When thus sealed the catheter is filled with a rigidifying fluid under pressure and the catheter is introduced into the urethra thus filled.

This invention relates to a novel catheter or cannula and to methods of using this catheter.

The present catheter or cannula is fashioned in the form of a thin-walled tube having openings at both ends. This tube is not sufficiently rigid, by itself, for introduction into the urethra or other body orifice or cavity. For this purpose, the opening or openings in the distal or leading end or end portion of my catheter are closed by the application of a urine (or other body fluid) soluble sealing material (such as methyl cellulose or polyvinyl alcohol) and the catheter is then rigidified by being filled, through its open proximal or trailing end, with a fluid under pressure, for instance, carbon dioxide or air or a concentrated solution of salt in water at body temperature in which salt solution the sealing material is insoluble. When so filled with fluid under pressure, the catheter or cannula is rendered sufficiently rigid for introduction into the urethra or other body cavity but will still yield or change its configuration to conform with the shape of the urethra or other body cavity. After the catheter has been introduced into the urethra or other body cavity, the rigidifying fluid is vented or permitted to drain out through the trailing catheter end. The soluble sealing material will dissolve to permit free outflow of urine or other body fluid through the catheter, and also to permit introduction into the bladder or other body cavity of therapeutic liquids or gases.

The preferred material of construction of our catheter is a natural or synthetic plastic or resinous material which is hydrophilic or easily wetted with water. For best results, this material is made self-lubricating by incorporating therewith a finely divided solid lubricant such as molybdenum disulfide, or graphite, or tungsten disulfide, or molybdenum selenide, or titanium disulfide. Such materials greatly facilitate the displacement of our catheter over a mucous surface.

Examples of preferred materials of construction are cellulose acetate, cellulose acetate butyrate, nylon, ethyl cellulose and, specifically, regenerated cellulose or viscose. Cellulose acetate or acetate butyrate may be treated as disclosed in U.S. Patent No. 2,774,679 to make it more hydrophilic.

The catheter may be formed by extrusion into tubular form, cutting the extruded tube into suitable lengths, and forming the desired aperture in the leading end of the tube, or the catheter may be molded or formed upon a suitable mandrel. After being formed, the catheter may be shirred, to reduce the apparent length of the tube to about 10%, whereby the storage space is reduced.

The catheter is easily heat sterilized. It may also be

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sterilized by exposure to sterilizing agents such as gamma rays, ethylene oxide gas, solutions of mercuric chloride, and the like. Or the catheter may be permanently sterilized by having incorporated therewith antiseptic dye-stuffs (which may be substantive to the material of construction), antiseptic quaternary compounds (if desired, of the type used as textile softening agents), phenyl mercuric chloride or acetate and many other antiseptic compositions.

Examples of the present catheter are illustrated diagrammatically in the appended drawings, in which:

FIG. 1 is a sideview of a catheter threaded over a syringe having a rubber bulb, the catheter being shown in longitudinal section;

FIG. 2 is a cross sectional view taken along the line 2—2 of FIG. 1;

FIG. 3 is a view similar to FIG. 1 but showing a catheter of different construction;

FIG. 4 is a cross sectional view taken along the line 4—4 of FIG. 3;

FIG. 5 is a view similar to that of FIG. 4 but showing a catheter of different construction;

FIG. 6 is a view similar to that of FIG. 5 but showing a catheter of still different construction;

FIG. 7 is a longitudinal cross sectional view of the catheter of FIG. 6;

FIG. 8 is a view similar to that of FIG. 6 but showing a catheter of still different construction;

FIG. 9 is a longitudinal cross sectional view of the catheter of FIG. 8;

FIG. 10 is a longitudinal cross sectional view showing the molding on a mandrel (shown in elevation) of the catheter of FIGS. 1 and 2;

FIG. 11 is a view similar to FIG. 10 showing the molded catheter in shirred form; and

FIG. 12 is a cross sectional view of an envelope or container surrounding a shirred catheter according to the present invention.

FIGS. 1 and 2 show a tubular catheter 10 having at its leading end 16 a generally elliptical aperture sealed with urine soluble material 14. A syringe 20 is threaded through the open trailing end 12 of the catheter and has a rubber bulb 22 filled with air or with a warm salt solution. Compression of the bulb 22 forces air or salt solution into the catheter 10 to rigidify the same.

FIGS. 3 and 4 show another tubular catheter 30 provided originally in shirred form. Behind the leading end 34 the catheter is formed with numerous pin holes 36 (for instance, 65 to 85 per square inch) filled with urine soluble sealing material. The catheter is threaded over a tube 38 connected to a source of carbon dioxide or air or other gas under pressure. This gas has been admitted into the catheter, to expand the leading portion from its original shirred form, the trailing portion 32 still being shirred. On admission of additional gas under pressure, the catheter 30 will be completely expanded from its shirred form and rigidified.

FIG. 5 shows a tubular catheter having three axial internal ribs serving to preserve an axial channel even when the catheter is somewhat compressed radially.

FIGS. 6 and 7 show a tubular catheter 40 having a leading end opening sealed with sealing material 42 and provided with a single helical internal rib 44 serving to preserve an internal axial channel even when the catheter is somewhat compressed radially.

FIGS. 8 and 9 show a tubular catheter 50 having a helical external rib 52 serving to strengthen the catheter against radial compression and to facilitate introduction of the catheter into the urethra. The external groove defined by the rib 52 can be filled with lubricant.

FIG. 10 shows a tubular catheter 60 similar to the catheter of FIGS. 1 and 2 and having at its leading end

an opening sealed with urine soluble sealing material 62. The catheter 60 has been molded over a hollow mandrel 64, the opening at the leading end has been made, and the sealing material 62 has been applied before the catheter 60 is stripped from the mandrel. This stripping may be preceded by shirring, as shown in FIG. 11. The mandrel 64 may be made of flexible, inflatable and expandable material such as rubber or polypropylene which is inflated and expanded for the molding operation and deflated for the stripping operation, which is greatly facilitated by such deflation.

The molding on the mandrel 64 may consist in dipping the mandrel in a ripe cellulose xanthate solution followed by cellulose regeneration by dipping in sulfuric acid solution.

FIG. 12 shows a shirred catheter immersed in a sterilizing solution 74 within a sealed envelope or container 72. Such a package preserves the catheter against contamination.

It should be understood that the term "catheter" is used in this specification and in the claims in its broadest sense to mean a tubular member to be introduced into any body cavity or orifice lined with mucous membrane (such as the urethra, the rectum and the intestine, the esophagus and the stomach, the vagina and the uterus) to withdraw a fluid or to introduce some therapeutic material, or for diagnostic purposes.

By way of examples, the present catheter may be used to introduce an enema into the large intestine and/or colon; when introduced into the esophagus and stomach, expanded or ballooned into contact with the stomach wall and filled with a barium sulfate suspension or other X-ray contrast medium, to outline the stomach walls on X-ray exposure; when having a radioactive material incorporated therewith and introduced into a body cavity, for therapeutic irradiation of the cavity walls; and for many other purposes.

The specific shape and length of our catheter depends obviously on the specific cavity in which the catheter will be used. Generally, the tube may be one-sixteenth to one-eighth to one-quarter inch in diameter and may have a wall thickness of one to thirty mills.

When the catheter of the present invention is introduced through the urethra into the bladder the leading catheter end portion may be inflated or ballooned into contact with the bladder wall, to strengthen and support the latter, which may be particularly helpful when the bladder wall is paralyzed. Such ballooning also serves to keep the catheter in position. In such case, I prefer to have the

catheter end formed with pin holes as shown in FIGS. 3 and 4. If desired, electrically conductive ink lines can be printed on such a catheter to permit electrical stimulation of the paralyzed bladder wall by means of a low amperage current.

Many details of this invention may be varied without departing from the principles of this invention which are defined in the appended claims.

We claim:

1. A urethral catheter comprising a thin-walled flexible elongated tube having proximal and distal ends, said tube being initially in a limp condition, said tube provided with at least one opening at both ends, said distal end having its opening initially sealed with a urine-soluble adhesive, said tube when filled with a fluid in which said adhesive is insoluble being rigidified by said fluid for easy introduction into the urethra whereafter when said tube is introduced into the bladder and said adhesive is dissolved upon contact with the urine a drainage channel is established from the bladder and through the urethra, said catheter when empty of said fluid being sufficiently flexibly limp so as to prevent its introduction into the urethra.

2. A catheter according to claim 1 made of regenerated cellulose and shirred to shorten its axial extension while preserving the axial passage therethrough.

References Cited

UNITED STATES PATENTS

692,102	1/1902	Bachrach	106—191
1,379,156	5/1921	Acheson	106—204
2,016,493	10/1935	Haas	106—193
2,109,592	3/1938	Macht	106—193
2,237,221	4/1941	Flynn	128—349 X
2,736,700	2/1956	Graham et al.	106—193
2,850,015	9/1958	Baxter	128—227
2,863,453	12/1958	Gewecke	128—227
797,676	8/1905	Flowers	128—344 X
1,596,754	8/1926	Moschelle	128—350
2,508,690	5/1950	Schmerl	128—276
2,707,471	5/1955	Koff	128—341
3,155,097	11/1964	Barron	128—350
3,292,627	12/1966	Harautuneian	128—349

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128—239, 344