

[54] **APPARATUS AND METHOD FOR REVERSIBLY CLOSING A NATURAL OR IMPLANTED BODY PASSAGE**

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[52] U.S. Cl. 3/1, 128/1 R, 128/346, 128/349 R, 128/350 R, 128/DIG. 25
 [51] Int. Cl. A61f 1/00, A61f 1/24, A61b 17/00
 [58] Field of Search 3/1; 128/346, 350 V, 128/1 R, DIG. 25, DIG. 21, 348-350, 327

[56] **References Cited**

UNITED STATES PATENTS

3,419,008	12/1968	Plishner	128/346
2,455,859	12/1948	Foley	128/346
3,538,917	11/1970	Selker	128/346 X
2,494,393	1/1950	Lamson	128/1 R
3,527,220	9/1970	Summers	3/1 X

FOREIGN PATENTS OR APPLICATIONS

1,174,814	12/1969	Great Britain	128/DIG. 25
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6,701,946	8/1967	Netherlands	3/1
1,546,118	10/1968	France	3/1

OTHER PUBLICATIONS

"A New Miniature Pump For the Treatment of Hydrocephalus" by G. D. Summers et al., *Journal of the Assoc. for the Advancement of Medical Instrumentation*, Vol. 2, No. 3, May/June 1967, pp. 9-15.

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[57] **ABSTRACT**

An apparatus and method for reversibly closing a natural or implanted body passage which utilize an implantable fluid reservoir and a distensible member that is adapted to be connected to the natural or implanted body passage. An implantable pump is connected to the fluid reservoir and the distensible member for pumping fluid from the reservoir to the distensible member to distend the distensible member and cause the reversible closing of the natural or implanted body passage.

9 Claims, 8 Drawing Figures

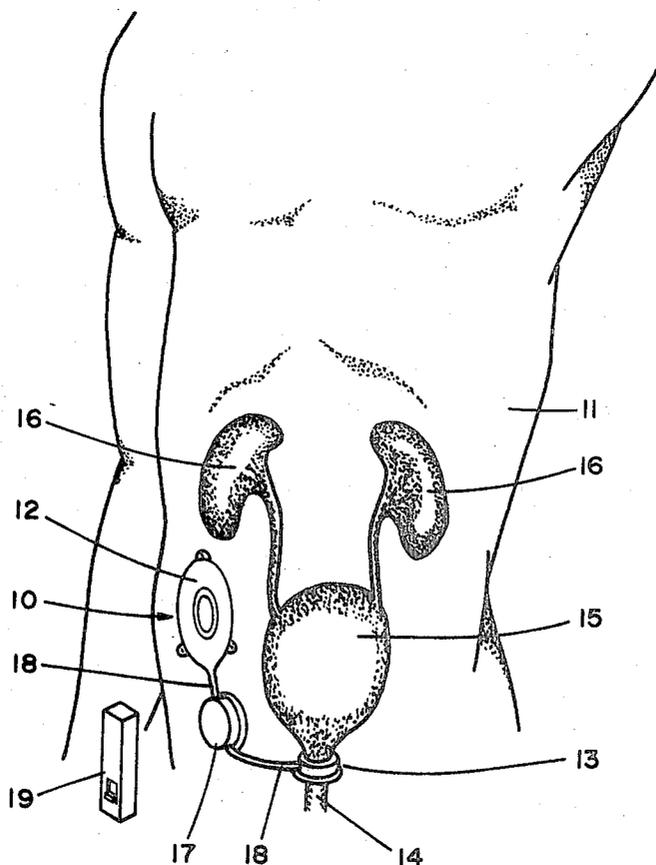


FIG. 1

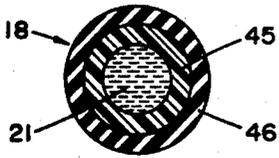
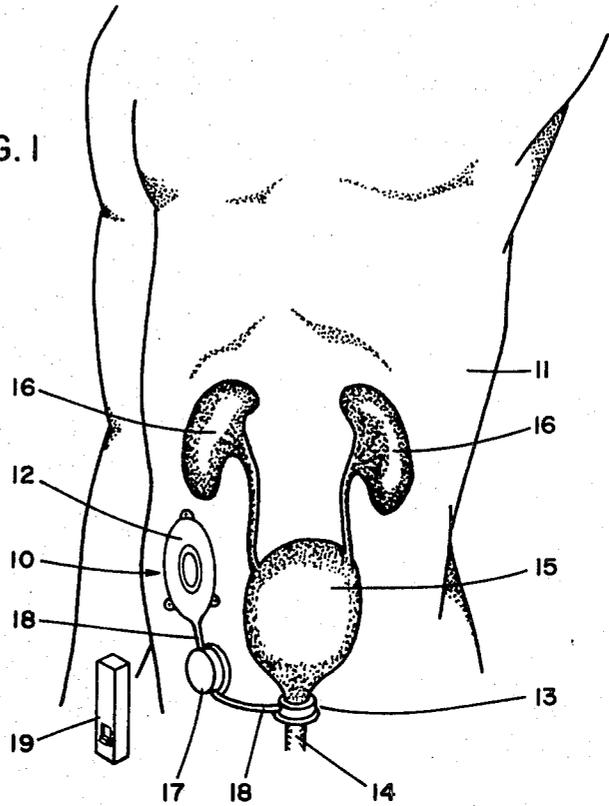
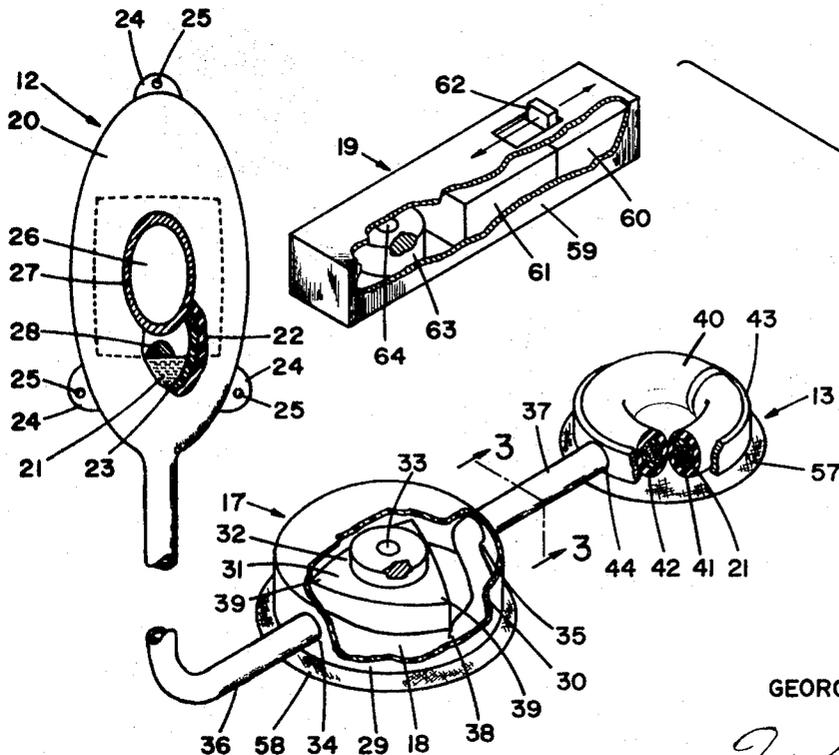


FIG. 3

FIG. 2



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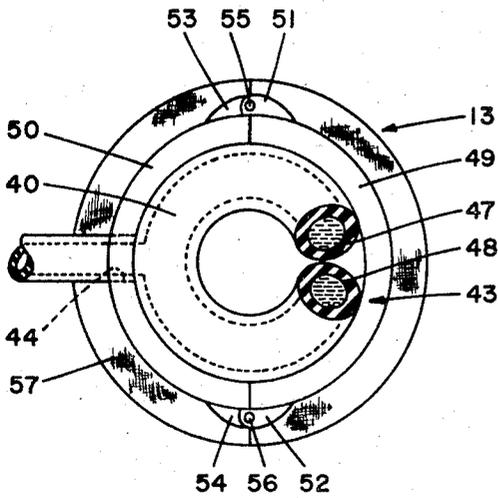


FIG. 4

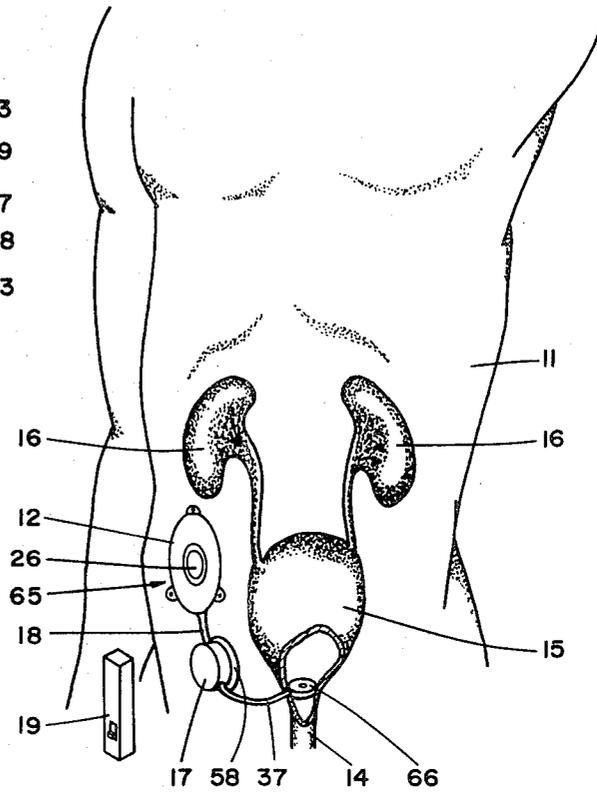


FIG. 5

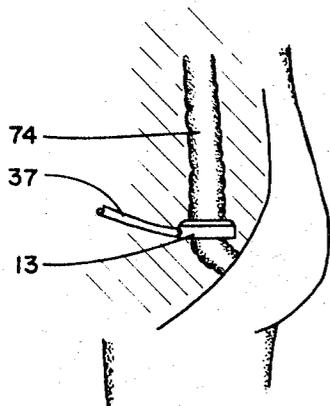


FIG. 8

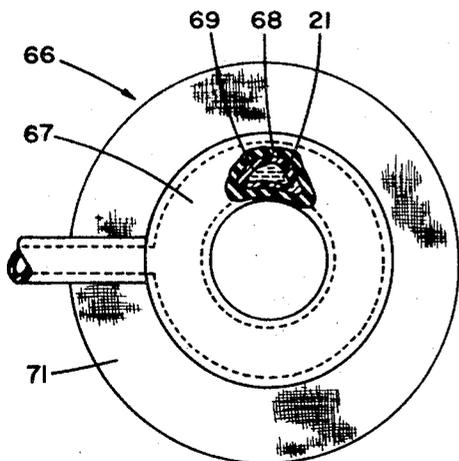


FIG. 7

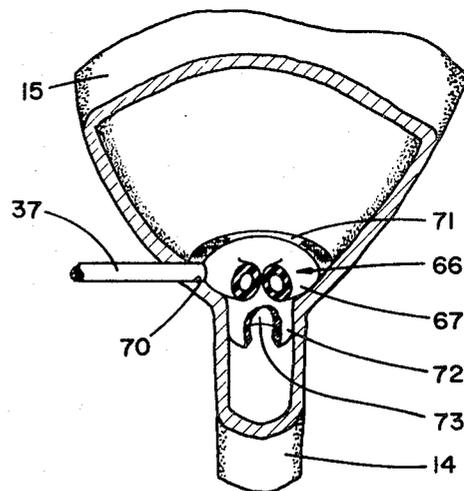


FIG. 6

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APPARATUS AND METHOD FOR REVERSIBLY CLOSING A NATURAL OR IMPLANTED BODY PASSAGE

BACKGROUND OF THE INVENTION

A great many persons suffer from non-functioning or malfunctioning sphincters which are circular bands of voluntarily or involuntarily controlled muscles which encircle an orifice of the body or body canal or one of the body's hollow organs. This condition can be brought on by congenital malformations, trauma to the sphincter nerves or muscles, disease of the sphincter nerves or muscles, or other body pathologies.

Among the most troublesome and embarrassing conditions brought about by the lack of proper control of one or more sphincters are malfunctions of the urethral and anal canals. The urethral sphincter controls the containment of urine in the bladder until the sphincter is relaxed to permit passage of urine from the bladder and the anal sphincter controls the containment of fecal matter in rectum until it is relaxed to permit passage of fecal matter from the rectum. As a result of the malfunction of the anal or urethral sphincters, uncontrolled drainage of fecal matter and urine from the body can occur and this is embarrassing to the individual and can restrict his activities. In addition to malfunctioning sphincters, other individuals have had colostomies and as a result have an artificial opening for the bowels that lacks any sphincters to control the opening.

A number of attempts have been made in the past to provide substitutes for such malfunctioning sphincters or to provide some means for controlling artificial openings that have no natural sphincters. Various types of inflatable devices such as the artificial dam disclosed in U.S. Pat. No. 2,494,393 have been proposed that are insertable into a natural or artificial body canal from outside the body and are inflatable to obstruct the artificial or natural opening so that seepage does not occur from the opening. However, such devices are uncomfortable to wear and are not entirely successful. Various surgical procedures have been attempted to repair damaged and diseased sphincters and electric currents have also been used in attempts to cause the sphincters to either contract or relax. Again such procedures have not been entirely successful and if the electric currents are provided through the use of external electrical devices that are inserted into body orifices this may not be cosmetically or psychologically desirable.

The implantable apparatus and method of the present invention overcomes the disadvantages of such prior devices and techniques and allows a body passage or canal to be reversibly closed in an efficient manner without undue discomfort to the individual whose body passage is being controlled.

SUMMARY OF THE INVENTION

This invention relates to apparatus and methods for reversibly closing a natural or implanted body passage and more particularly to apparatus and methods that utilize a distensible member.

It is an object of the present invention to provide an implantable apparatus that can efficiently reversibly close an implanted or natural body passage.

It is an object of the present invention to provide an implantable apparatus that is readily operable by the

individual in whom it is implanted to reversibly close an implanted or natural body passage.

It is an object of the present invention to provide an implantable apparatus that is cosmetically and psychologically acceptable to the person in whom it is implanted.

It is also an object of the present invention to provide an implantable apparatus that can reversibly close a natural or implanted urinary passage.

It is also an object of the present invention to provide an implantable apparatus that can reversibly close a portion of a natural or implanted alimentary canal.

It is also an object of the present invention to provide a method for reversibly closing a natural or implanted body passage that utilizes implantable distensible means.

It is also an object of the present invention to provide a method for reversibly closing a natural or implanted urinary passage.

It is also an object of the present invention to provide a method for reversibly closing a natural or implanted alimentary passage.

The present invention provides an implantable apparatus for reversibly closing a natural or an implanted body passage that includes an implantable fluid reservoir and implantable distensible means adapted to be operatively connected to the natural or implanted artificial body passage for reversibly closing the passage.

The implantable apparatus also includes implantable pumping means operatively connected to said fluid reservoir and the distensible means for pumping fluid from the fluid reservoir to the distensible means to cause distension of the distensible means to reversibly close the passage and to pump fluid from the distensible means to open the passage. The present invention also provides a method for reversibly closing a natural or artificial body passage that includes the steps of implanting an implantable fluid reservoir, implanting implantable pumping means operatively connected to the implantable fluid reservoir, and implanting distensible means operatively connected to the pumping means in the body and during such implantation operatively connecting the distensible means to the natural or implanted body passage. The method further includes the steps of activating the pumping means to pump fluid from the implantable fluid reservoir to the distensible means to cause distension of the distensible means to reversibly close the natural or implanted body passage when it is desired to close the natural or implanted body passage and activating the pumping means to pump fluid from the distensible means to the implantable fluid reservoir to cause deflation of the distensible means to open the natural or implanted body passage when it is desired to open the natural or implanted body passage.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be hereinafter more fully described with reference to the accompanying drawings in which:

FIG. 1 is a diagrammatic view of the implantable apparatus of the present invention implanted within the body of a human;

FIG. 2 is a perspective view of the implantable apparatus of the present invention and means locatable outside the body for operating the implantable apparatus;

FIG. 3 is a sectional view taken on the line 3—3 of FIG. 2;

FIG. 4 is a plan view of a portion of the structure illustrated in FIG. 2;

FIG. 5 is a diagrammatic view of an alternative embodiment of the implantable apparatus of the present invention implanted within the body of a human;

FIG. 6 is an enlarged view of a portion of the body and the implanted apparatus illustrated in FIG. 5;

FIG. 7 is an enlarged plan view of a portion of the structure illustrated in FIG. 6; and

FIG. 8 is a sectional view of a portion of the human body illustrating the use of the present invention in controlling the alimentary canal.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIG. 1 the implantable portion of the apparatus of the present invention for reversibly closing a natural or an implantable artificial body passage, generally designated by the number 10, is illustrated as being implanted within the body of a human being 11. The implantable apparatus 10 comprises an implantable fluid reservoir 12 and implantable distensible means generally designated by the number 13 illustrated as being adapted to be operatively connected to a natural or implanted body passage which as illustrated is a natural or artificial urethra 14 which is connected to the bladder 15 which is in turn connected to the kidneys 16. The implantable apparatus 10 also comprises implantable pumping means generally designated by the number 17 that is operatively connected to the fluid reservoir 12 and the distensible means 13 by an implantable fluid conduit 18. Pump activating means 19, locatable outside the body 11, for activating the pumping means 17 is illustrated as being in position to operate the pump means 17.

The details of the implantable apparatus 10 and the pump activating means 19 are illustrated in FIGS. 2 through 4. The implantable fluid reservoir 12 comprises a distensible bladder 20 that is adapted to expand or contract due to the action of a fluid 21 that is contained within the bladder. The bladder 20 comprises an outer layer 22 that is compatible with body tissue and an inner layer 23 that is impervious to and compatible with the fluid 21. The bladder 20 has tabs 24 located at intervals around its outer edge that have holes 25 that permit a surgeon to anchor the tabs within the body 11 and thus secure the bladder within the body. Located on the front side of the bladder 20 that is adapted to be located close to the skin of the body 11 is a self sealing membrane 26 that is adapted to be punctured by a hypodermic needle (not shown) that can be inserted into the body and the bladder to either add fluid 21 to the bladder or withdraw fluid from the bladder. Located around the self sealing membrane 26 is a metallic ring 27 that protrudes above the surface of the bladder and permits the person who is administering to the needs of the patient to readily locate the ring by touching the body 11 and thus permit the person to readily locate the self sealing membrane. A polycarbonate plate 28 is located beneath the self sealing membrane 26 and is attached to the inside opposite wall of the bladder 20 to prevent the inadvertent puncturing of the bladder by the hypodermic needle that is inserted into the bladder through the self sealing membrane.

The pumping means 17 comprises a rotary pump that has a generally disc shaped hollow casing 29 that has an outer layer or coating 30 that is compatible with body tissue. Located within the pump casing 29 is a generally triangular shaped pump rotor 31 and a disc shaped magnet 32 that is securely attached to the upper side of the rotor. Both the rotor 31 and the magnet 32 are rotatably mounted within the casing 29 on a shaft 33 that has its lower end secured to inside lower surface of the pump casing. The casing 29 has respective inlet and outlet holes 34 and 35 located in its side walls approximately opposite each other that are adapted to receive respective inlet and outlet sections 36 and 37 of the implantable fluid conduit 18. The outermost end of the inlet section 36 is connected to the lower end of the bladder 20 to permit fluid 21 to be pumped from the bladder through the fluid conduit 18. The center section 38 of the fluid conduit 18 lies along the inside inner wall of the pump casing 29 so that as the rotor 31 rotates its rotor tips 39 pinch the center section of the tube against the adjacent inner wall of the pump casing to cause the fluid 21 to be pushed or pumped through the conduit 18. The outer end of the outlet section 37 is connected to a distensible C-shaped member 40 that forms part of the distensible means 13. The C-shaped member 40 has an inner layer 41 that is impervious to the fluid 21 and an outer layer 42 that is compatible with body tissue. Located around the outer periphery of the C-shaped distensible member 40 is a rigid hoop 43 that prevents the distensible C-shaped member from expanding in an outward direction. The hoop 43 has a hole 44 that receives the outer end of the outlet section 37 and permits the outer end to be connected to the C-shaped member 40. As illustrated in FIG. 3, the fluid conduit 18 also has an inner layer 45 that is impervious to the fluid 21 and an outer layer 46 that is compatible with the tissues of the body.

As best illustrated in FIG. 4, the ends of the C-shaped distensible member 40 have walls 47 and 48 that close the ends of the C-shaped distensible member and seal the fluid 21 within the distensible member. The hoop 43 comprises two semi-circular sections 49 and 50. The section 49 has mounting brackets 51 and 52 located near its ends and the section 50 has mounting brackets 53 and 54 that are adapted to be fastened to the respective mounting brackets 51 and 52 of the semi-circular section 49 by respective pins 55 and 56 that pin the mounting brackets together. The two sections 49 and 50 that are separable and the shape of the C-shaped member 40 permit the surgeon to readily locate the distensible member around the passage 14 without having to cut the passage as will be described hereinafter in greater detail. The hoop 43 of the distensible means 13 and the casing 29 of the pumping means 17 have respective circular cloth skirts 57 and 58 attached to their undersides that can be made from a polyester or other body compatible material and that are adapted to be sewn to body tissue to anchor the pumping means 17 and the distensible means 13 in place within the body 11. These cloth skirts 57 and 58 will also permit body tissue to grow in between the fibers of the cloth with time and thus securely anchor the pumping means 17 and the distensible means in place in the body 11. The cloth skirt 58 is split in half as illustrated in FIG. 4 to permit separation of the two sections 49 and 50. As best illustrated in FIG. 2 the pump activating means 19 comprises a hollow rectangular shaped cas-

ing 59 which houses a battery 60 and a motor 61 that is connected to the battery and operates from electrical power supplied by the battery. A switch 62 is also provided that is adapted to electrically connect and disconnect the battery 59 from the motor 61. The motor 61 is operatively connected to a disc shaped magnet 63 that is rotatably mounted within the casing 59 on a shaft 64 that has its lower end secured to the inside lower inner wall of the casing. The magnet 63 is adapted to be magnetically coupled to the pump magnet 32 when the pump activating means 19 is brought into the vicinity of the pumping means 17 and the magnet 63 is located adjacent to the pump magnet as illustrated in FIG. 2. Upon activation of the pump activating means 19 in this position, the rotating magnet 63 is adapted to cause rotation of the magnet 32 and the connected pump rotor 31 so that the tips 39 of the rotor pinch the center conduit section 38 to pump fluid from the reservoir 12 through the conduit and into the distensible member 40 to cause it to distend and thus close the passage 14. The pump activating means 19 can also be reversed to cause the magnet 63 to rotate in the opposite direction by pushing the switch in the other direction to reverse the electrical polarity of the power supplied by the battery 59 to the motor 61. When this is accomplished, the rotating magnet 63 will then cause the pump magnet 32 and the connected rotor 31 to rotate in the opposite direction to pump fluid from the distensible member 40 through the conduit 18 to the fluid reservoir 12 to cause the distensible member to deflate and return to its normal shape so that the passage 14 is permitted to open.

Another embodiment of the invention is illustrated in FIGS. 5 through 7 that includes an implantable portion of the apparatus of the present invention for reversibly closing a natural or an implantable artificial body passage, generally designated by the number 65, which is illustrated as being adapted to be implanted within the body 11. The implantable portion of the apparatus 65 includes the implantable reservoir 12, the implantable pumping means 17 and the implantable fluid conduit 18 that is connected to the reservoir and passes through the pumping means. However, the outlet section 37 of the conduit 18 is connected at its outer end to a different form of implantable distensible means generally designated by the number 66 which is adapted to be operatively connected to the natural or artificial body passage such as the implanted or natural urethra 14 that is in turn connected to the bladder 15 which is connected to the kidneys 16. The pump activating means 19 for activating the pumping means 17 is also illustrated in FIG. 5 located outside the body 11 in position to activate the pumping means in the same manner as previously described in relation to the embodiment illustrated in FIGS. 1 through 4.

As best illustrated in FIGS. 6 and 7, the distensible means 66 comprises a hollow annular or O-shaped distensible member 67. The O-shaped distensible member 67 has an outer layer 68 that is compatible with body fluids and tissue and an inner layer 69 that is impervious to the fluid 21. The distensible member 67 is adapted to be located within the bladder 15 at the entrance to the urethra 14 and the inlet section 37 is adapted to be inserted through a surgical opening 70 in the bladder 15. A cloth skirt 71 is connected to the distensible member 67 and the cloth skirt is adapted to have its outer edge sewn to the interior of the bladder

15. Connected to the lower surface of the distensible member 67 is a plastic funnel shaped positioning member 72 that has a central channel 73 that extends completely through the funnel shaped member. The funnel shaped member 72 is adapted to fit within the inlet to the urethra 14 and this funnel shaped member assists in keeping the distensible member 67 in position.

An additional embodiment of the present invention is illustrated in FIG. 8. As illustrated in FIG. 8, the distensible means 13 is adapted to be operatively connected to the alimentary canal 74 in the body for reversibly closing the canal in a manner similar to that previously described in relation to the urethra 14 and the embodiment illustrated in FIGS. 1 through 4.

In order to practice the method of the present invention using the apparatus illustrated in FIGS. 1 through 4, the surgeon implants the implantable fluid reservoir 12 in the abdominal region of the body 11 and sews the tabs 24 through the use of the holes 25 in the tabs to body tissue within the body so that the implantable reservoir is secured within the body. The fluid reservoir 12 is implanted close to the skin so that the self sealing membrane 26 faces outward toward the skin of the body and is located close to the skin. At the time of implantation of the fluid reservoir 12, it can contain the fluid 21 or it can be added after implantation in the manner that will hereinafter be described. At the time the implantable reservoir 12 is implanted, the implantable fluid conduit 18 and the implantable pumping means 17 are also implanted in the body 11. The surgeon implants the pumping means 17 close to the skin of the body 11 with the magnet 32 facing outward toward the skin of the body. When implanting the pumping means 17, the surgeon sews the cloth skirt 58 to body tissue within the body so that body tissue will grow between the fibers of the cloth in order that the pumping means will be securely fastened within the body. At the same time the pumping means 17, is implanted in the body the distensible means 13 is also implanted. In implanting the distensible means 13, the surgeon first removes the pins 55 and 56 and separates the two semi-circular sections 49 and 50 and then passes the ends of the C-shaped distensible member around the body passage or urethra 14. The pins 55 and 56 are then reinserted to secure the two semi-circular sections 49 and 50 together so that they encircle the body channel or passage 14. The cloth 57 is then sewed to the body tissue so that body tissue will grow between the fibers of the cloth and securely fasten the distensible means 13 in position within the body 11. After the fluid reservoir 12, the pumping means 17, the fluid conduit 18 and the distensible means 40 have been implanted within the body 11, the patient is given the pump activating means 19 so that he can activate the implanted pumping means in the manner previously described.

If the implantable fluid reservoir 12 was implanted without having the fluid 21 in it, fluid must be added to the reservoir after it has been implanted. In order to add fluid to the implanted reservoir 12, the surgeon locates the self sealing membrane 26 by locating the surrounding ring 27 by feeling the ring through the skin. A hypodermic needle (not shown) is then inserted through the self sealing membrane 26 and the required quantity of fluid 21 is injected into the reservoir 12. It should be noted that penetration of the back surface of the reservoir 12 is prevented by the backing plate 28

that is connected to the inner back surface of the reservoir. After the fluid 21 has been injected, the hypodermic needle is removed so that the self sealing membrane seals the fluid within the reservoir.

In order to practice the method of the present invention utilizing the apparatus illustrated in FIGS. 5 through 7, the surgeon implants the implantable fluid reservoir 12 and the implantable pumping means 17 in the manner previously described in relation to the apparatus illustrated in FIGS. 1 through 4. The surgeon also implants the implantable distensible means 66, however the distensible means is implanted inside the bladder 15 near the inlet to the urethra 14 by surgically opening the bladder so that the funnel shaped member 72 fits within the inlet of the urethra. At the time of implantation, the surgeon also sews the cloth skirt 71 that is attached to the distensible member 67 to the inner surface of the bladder 15. The fluid conduit 18 is also implanted in a manner similar to that previously described, however, the outer end of the outlet section 37 is passed through the surgical opening 70 in the bladder wall. Fluid 21 can then be added to the reservoir 12 with a hypodermic syringe in the manner previously described if the reservoir was implanted without containing any fluid. In addition, the patient is also provided with external pump activating means 19 to activate the implanted pumping means 17 in the manner previously described.

The method of the present invention associated with the structure illustrated in FIG. 8 is practiced in a manner similar to that previously described with reference to the embodiment of the invention illustrated in FIGS. 1 through 4, in that the implantable reservoir 12, the implantable pumping means 17 and the fluid conduit 18 are implanted in the body 11. However, instead of implanting the C-shaped distensible member 40 and connecting the two semicircular sections 49 and 50 around the urethra 14 the C-shaped distensible member and the two semi-circular sections 49 and 50 are implanted around the alimentary canal 74.

In order to utilize the embodiment of the invention illustrated in FIGS. 1 through 4 the individual or the person tending to his needs places the pump activating means 19 against the body 11 so that the magnet 63 is located in close proximity to the magnet 32 in the implanted pumping means 17. The switch 62 is then pushed on to cause fluid to be pumped from the reservoir 12 and this results in electrical energy being provided by the battery 60 to the motor 61 to cause the magnet 63 to rotate in the proper direction. This rotation of the magnet 63, causes the magnet 32 and the connected pump rotor 31 to rotate and as the rotor rotates its rotor tips 39 pinch the center tube section 38 against the adjacent inner wall of the pump casing 29 and this causes fluid 21 to be pumped from the implanted fluid reservoir 12 through the fluid conduit 18 to the C-shaped distensible member 40 to cause the C-shaped distensible member to expand or to become distended. It should be noted that outward expansion of the C-shaped distensible member 40 is prevented by the hoop 43 so that the C-shaped distensible member expands inward to close the natural or artificial body passage 14 and thus prevent urine from flowing from the bladder 15. If desired, the pump activating means 19 can then be slipped conveniently into a pocket in the individual's clothing.

When the individual that has the apparatus 10 implanted in him wishes to empty his bladder 15 when it is becoming filled with urine, he or the individual tending to his needs places the pump activating means 19 against the surface of the body 11 so that the magnet 63 is located in close proximity to the magnet 32 in the implanted pumping means 17. The switch 62 is then pushed on to the reverse position and this results in electrical energy being provided by the battery 60 to the motor 61 to cause the magnet 63 to rotate in a direction that is reverse from that previously described. This rotation of the magnet 63 causes rotation of the magnet 32 and the connected rotor 31 in a reverse direction to cause the rotor tips 39 to pinch the center tube section 38 against the inner pump casing wall and this causes fluid 21 to be pumped from the implanted C-shaped distensible member 40 to the implanted fluid reservoir 12 so that C-shaped distensible member contracts or deflates as illustrated in FIG. 4 and permits the body canal 14 to open so that urine may pass through the canal from the bladder 15. After the bladder is empty, the pumping means is activated in the reverse direction to close the body canal 14 in the manner previously described.

The operation of the embodiment illustrated in FIGS. 5 through 7 is substantially identical to that of the embodiment illustrated in FIGS. 1 through 4, however when fluid is pumped into the O-shaped distensible member 67 it expands both in an outward and inward direction since there is no hoop 43 surrounding the O-shaped distensible member. Expansion of the O-shaped distensible member causes the member to come in contact with the bladder wall and also results in the closing of the opening in the center of the O-shaped distensible member and as a result the lower end of the bladder 15 and the inlet to the body canal 14 are blocked so that urine cannot flow from the bladder. Operation of the pumping means 17 in the reverse direction will cause the O-shaped distensible member to contract so that an opening exists in the center of the O-shaped member as illustrated in FIG. 4 and as a result urine can flow through the opening from the bladder 15.

The operation of the embodiment illustrated in FIG. 8 is similar to that of the embodiment illustrated in FIGS. 1 through 4, however the individual activates the pumping means 17 to open the distensible means 13 when he senses that his alimentary canal 74 is full of fecal matter. After the alimentary canal has been evacuated the distensible means 13 is filled with fluid so that the alimentary canal 74 is closed.

It will be appreciated that fluid 21 can be added or withdrawn from the reservoir 12 by use of a hypodermic needle and the self sealing membrane 26 should this be necessary do to the presence of too much fluid within the reservoir or the lack of a sufficient amount of fluid in the reservoir.

The outer layers of the apparatus of the invention that must be compatible with body tissues and fluids can be made from medical grade silicone rubber such as that which is sold under the trademark Silastic by the Dow Corning Company of Midland, Michigan. The inner layers of the apparatus of the invention that must be impervious to and compatible with the fluid 21 can be made from polyvinyl chloride or some similar material. The fluid 21 is preferably an aqueous NaCl solution that is compatible with the body.

Although the invention has been described with reference to certain preferred embodiments, it should be understood that many variations and modifications may be made without departing from the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. An implantable apparatus for reversibly closing a natural or implanted urethra comprising an implantable fluid reservoir, an implantable O-shaped distensible member, a funnel shaped member for assisting in keeping said distensible member in place when implanted connected to said distensible member, said funnel shaped member having a channel extending there-through and being shaped to fit within the inlet to a urethra in a body, and implantable pumping means operatively connected to said fluid reservoir and said distensible member for pumping fluid from said reservoir to said distensible member to cause distension thereof to close said urethra and to pump fluid from said distensible member to cause deflation thereof to open said urethra.

2. A method for reversibly closing a natural or implanted body passage comprising the steps of: implanting, in the body, an implantable fluid reservoir, implantable pumping means operatively connected to said implantable fluid reservoir, an implantable C-shaped distensible member operatively connected to said pumping means, a hoop member having two separable sections located around said distensible member, and means for fastening the ends of said two separable sections together and during such implantation separating the two separable sections of said hoop member, passing the ends of said C-shaped distensible member around said body passage, and connecting the ends of said two separable sections of said hoop member by said fastening means; activating said pumping means to pump fluid from said implantable fluid reservoir to said C-shaped distensible member to cause distension thereof to reversibly close said body passage when it is desired to close said body passage; and activating said pumping means to pump fluid from said distensible member to said implantable fluid reservoir to cause deflation of said distensible member to open said body passage when it is desired to open said body passage.

3. The method of claim 2 wherein said implanting step further comprises implanting a cloth skirt attached to said hoop member and during such implantation connecting said cloth skirt to body tissue.

4. A method for reversibly closing a natural or implanted body passage comprising the steps of: implanting, in the body, an implantable fluid reservoir, implantable pumping means operatively connected to said implantable fluid reservoir, and an implantable dis-

tensible member operatively connected to said pumping means and during such implantation, implanting said distensible member inside said body passage by surgically opening said body passage; activating said pumping means to pump fluid from said implantable fluid reservoir to said distensible member to cause distension thereof to reversibly close said body passage when it is desired to close said body passage; and activating said pumping means to pump fluid from said distensible member to said implantable fluid reservoir to cause deflation of said distensible member to open said body passage when it is desired to open said body passage.

5. The method of claim 4 wherein implanting said implantable distensible member in said implantation step comprises implanting an O-shaped member.

6. The method of claim 5 wherein said implanting step further comprises implanting means connected to said O-shaped distensible member for assisting in maintaining said distensible member in position inside said body passage and during such implantation, implanting said position maintenance assisting means inside said body passage by surgically opening said body passage.

7. The method of claim 6 wherein implanting said position maintenance assisting means in said implantation step comprises implanting a positioning member having a channel extending therethrough.

8. The method of claim 7 wherein implanting position maintenance assisting means in said implantation step further comprises implanting a cloth skirt and further comprising sewing said cloth skirt to the inner surface of said body passage during such implantation.

9. A method for reversibly closing a natural or implanted urethra comprising the steps of: implanting, in the body, an implantable fluid reservoir, implantable pumping means operatively connected to said implantable fluid reservoir, an implantable distensible member operatively connected to said pumping means, and a funnel shaped member having a channel extending therethrough connected to said distensible member and during such implantation placing said distensible member in the bladder near the inlet to said urethra and fitting said funnel shaped member within the inlet to said urethra; activating said pumping means to pump fluid from said implantable fluid reservoir to said distensible member to cause distension thereof to reversibly close said urethra when it is desired to close said urethra; and activating said pumping means to pump fluid from said distensible member to said implantable fluid reservoir to cause deflation of said distensible member to open said urethra when it is desired to open said urethra.

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