

[54] **METHOD AND APPARATUS FOR BATHING BODY CAVITIES**

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[57]

ABSTRACT

An endoscope and the like comprising a shaft having independent conduit means for delivering and withdrawing fluid extending from its proximal to distal end. Pump means for pump fluid to and from the body cavity. The pump being operated to deliver and withdraw an equal volume simultaneously.

1 Claim, 2 Drawing Figures

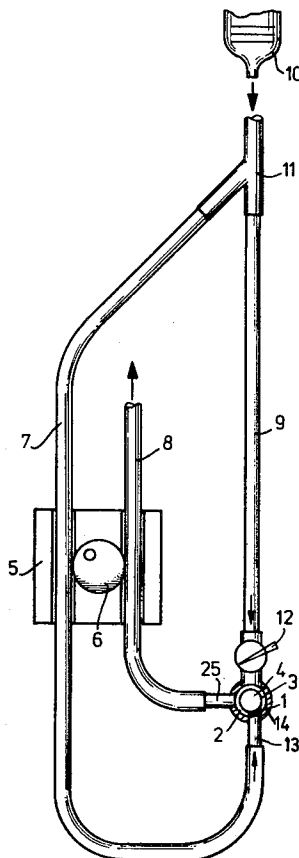


Fig. 1

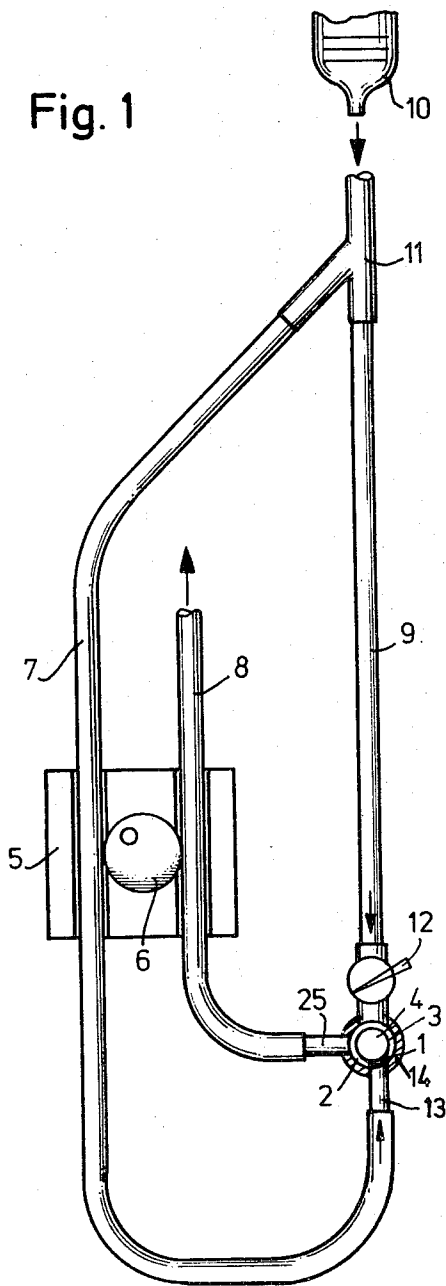
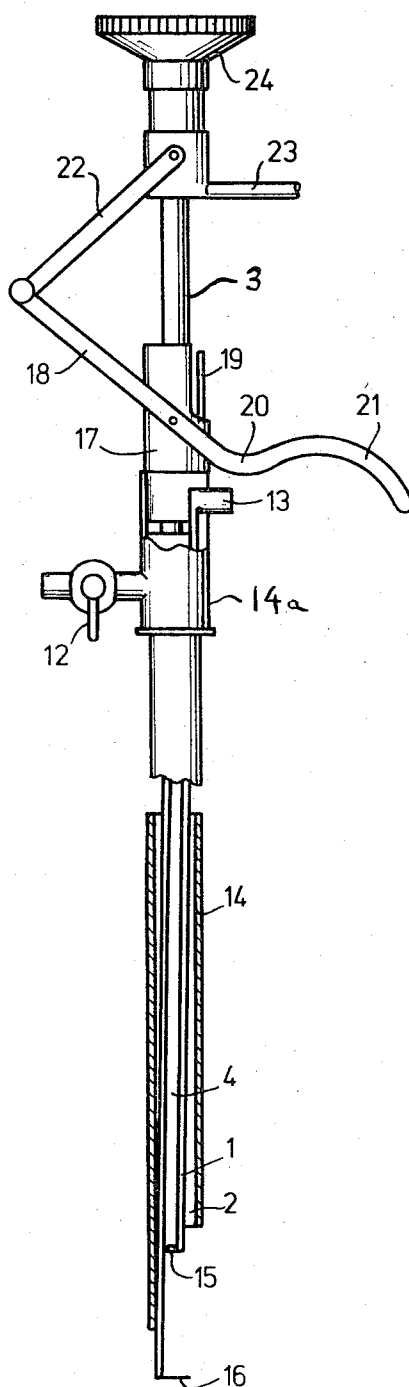


Fig. 2



METHOD AND APPARATUS FOR BATHING BODY CAVITIES

BACKGROUND OF THE INVENTION

The present invention relates to medical operating devices and in particular to a device such as an endoscope employing means for simultaneously bathing a body cavity.

Devices such as endoscopes are well known for performing many types of operations, particularly in transurethral, urinary and bladder sections. In such operations the removal of a bladder tumor or growth in the bladder or bladder-neck is accomplished by employing high frequency current during which it is preferable to first expose the bladder or at least the situs of the operation to view and then to perform the electrical cutting while simultaneously bathing the area with a fluid media, as for example water. In order to maintain the field of vision free of blood and other material a water stream having a measurable pressure must be provided. Accordingly, the endoscope used for the operation has been provided with conduit means for delivering the fluid to the situs of the operation. In the known devices the cross-section of the fluid feeding channel has been so large that about 1 liter of water per minute to the bladder is provided. This results in the rapid filling of the bladder and requires that as much tissue be cut by the doctor as soon as possible, since the filling of the bladder is annoying to the patient, and if it is filled too much, does the patient serious jeopardy. Because of this, it has been necessary when using the known devices, to interrupt the operation as often as 50 times, in order to remove the accumulated water. This drainage of the bathing water takes virtually as much time as the actual operation itself. This disadvantage is so severe that it hampers and reduces the efficiency of the bathing and as well as the display of the bladder to the doctor and also the clearing of the field of vision.

Attempts have been made to overcome the above disadvantages through the provision of a return duct by which the fluid may be removed. In one device the annular chamber within the endoscope shaft is used as the bathing media channel and a connecting socket for the infeed and discharge of the media is fastened to the head portion of the endoscope shaft itself. German Utility Pat. 1,980,836 shows such a device. The limited area wherein both the channel for the infeed and the duct for the discharge are arranged, hinders and prevents the full flow of the media stream. In addition the actual connection for the return flow duct, because of structural imitations, is rather narrow, that is, its cross-section is significantly smaller than the cross section of the infeed channel. As a consequence, much more bathing fluid media flows into the bladder than flows outwardly therefrom so that filling of the bladder occurs, anyway. Therefore, even with the use of this device, the operation must be interrupted periodically in order to remove the accumulated fluid. This situation even occurs in those device in which means are provided to maintain a continuous bathing through an infeed canal which is separated from the return duct.

Devices are also known in which a constant volume of fluid is delivered to and withdrawn from the bladder in a closed system by means of a circulating pump. This system requires that the particulate matter such as bladder-stone particles be removed by some type of filter means. However, since blood clots and blood

masses act to block and close up the filter means very quickly, this system has its limitations. In addition, this system has the disadvantage that fresh bathing liquid is not delivered to the bladder, since the bathing liquid circulates in a closed system.

The present invention has as its object the provision of apparatus and particularly an improved endoscope means which overcomes the disadvantages of the prior art and provides means for performing the operation of the type described without interruption and with the security desired.

SUMMARY OF THE INVENTION

The object of the present invention is obtained by providing an endoscope device in which bathing media is continuously with or intermediate the operative steps in short succeeding intervals simultaneously pumped into and out of the body cavity, the infeed and the discharge being maintained in equal volume. In this manner it is assured that during the operation the delivered bathing media is always equal to the discharged bathing media volume. This prevents the excess filling of the bladder in every instance. It is, therefore, possible for the first time to continue the operation from beginning to end without interruption. The bladder may thus be filled with a standing water column, before the operation is commenced and then the tissue cut can be made with the bladder full of bathing liquid as is most desirable from a medical point of view. Nevertheless, in accord with the present invention, once the operation is commenced, an exchange of equal volume of liquid may be effected, so that while the bladder constantly remains full, the liquid together with tissue, blood, etc., is withdrawn, cleansed and recirculated and fresh liquid added. At no time does excess liquid accumulate in the bladder.

In accordance with the present invention the pumping of the bathing media into and out of the body is accomplished through the use of a tubular pump having a feed and discharge tube arranged in parallel and a rotary actuator eccentrically arranged between them. This structure has the particular advantage that the eccentric actuator can be arranged and connected simultaneously to pressurize the feed tube and to exhaust the discharge leading to the corresponding members in the endoscope device, so that it can control simultaneously both the feeding and discharge of liquid through the device. This arrangement has further advantages in that it is of great simplicity, it is extremely efficient and insures that both the pumping in and exhausting out of the bathing fluid is created from a single source having the same stroke frequency and volume of pumping.

In accordance with a further feature of the present invention the endoscope shaft may be formed having first a nozzle portion at the distal end of the shaft by which the bathing media is delivered directly to the site of the operation, and a second separate discharge channel from the site. The connection for the actual intake and for the discharge of the media may then be arranged on the headportion or proximal end of the endoscope shaft. This arrangement has the advantage that separate channels or ducts can be provided through the endoscope for the intake and for the outlet of fluid. Further, the discharge channel can be made at least equal to or greater in cross-section than the inlet channel. Preferably, the cross-section of the inlet channel is maintained substantially smaller than the discharge

channel so that a high enough pressure is developed to wash the tissue from the lens etc., but accumulation of the liquid in the cavity is avoided. In addition, through the separation of the discharge channel from the inlet channel it is insured that at least the same volume of fluid is pumped out of the body cavity as is pumped into it.

A further feature of the present invention resides in the provision that the inlet channel is formed in the nature of a throat or bulge arranged about the viewing tube of the endoscope whereby the throat provides an annular channel closed with respect to the viewing tube and separate therefrom. Further this construction permits the viewing tube to be independently and removably inserted in the shaft so that it can be withdrawn easily and simply for cleaning and sterilization. In addition, the interior of the shaft is also available by being removable of the viewing tube for cleaning and sterilization. The prior techniques of soldering the inlet channel on the viewing tube, and thus requiring a small cross-section is avoided.

Further details and particulars of the invention are given in the following disclosure and will be seen in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of apparatus embodying the present invention which is connected to an endoscope device, seen extending perpendicularly to the plan of the drawing; and

FIG. 2 is a partially sectional elevational view of the endoscope adapted to receive the apparatus of the present invention.

DESCRIPTION OF THE INVENTION

The Figures show an endoscope adapted for use in transurethral operations, and bladder sections of the known devices and is generally of the construction well known in the art. Similar devices, adapted for body insertion, may be employed. Because of the wide knowledge in the art of such devices, the drawings are schematic only, and of conventional structure, and therefore either not shown or described herein. Reference, however, is made to the inventor's copending applications, Ser. No. 177,349, 177,350 now U.S. Pat. No. 3,791,379, 177,353 now abandoned, all filed Sept. 2, 1971, should details thereof be required for further understanding of this invention.

As seen in the Figures, the device comprises an endoscope shaft 14 carrying at its proximal end a sleeve-like or throat connection 14a for a first inlet 12 having adjustable pet-cock valve and a second inlet 13 through which fluid media may be delivered. As seen in FIG. 1, attached to the inlets 12 and 13 respectively are resilient flexible infeed tubes 7 and 9, which are jointly connected to a Y-connection 11 which is in turn connected to means for storing the liquid media such as a bottle 10. Located above the connection 14a is an outlet 25 to which is connected to the end of a resiliently flexible discharge tube 8. The outlet 25 is not seen in FIG. 2, since it lies at right angles to the inlets 12 and 13, but is adapted to be formed at the upper end of the endoscope and to be in communication with an annular chamber 2 formed internally within the shaft 14, between the viewing tube 4 and the wall of the shaft 14. The inlet 13 is in communication with a channel 1 passing formed by a tube passing through a groove in endo-

scope shaft 14, extending in the longitudinal direction with the guide tube 3.

As seen in FIG. 2 the endoscope comprises an optical eyepiece 24 mounted at the upper end of a viewing tube 4, which extends through a surrounding guide tube 3. At the lower end of the viewing tube 4 there is located an objective lens 15 through which the situs of the operation can be viewed by the doctor. The viewing tube is set within the endoscope shaft 14 and thus forms the annular discharge channel 2. The channel 1 is formed by a tube or tubular section formed along the length of the guide tube 3 and the viewing tube 4. As seen in FIG. 2, a portion of the viewing tube 4 and the exterior endoscope shaft 14 extends beyond the point at which the lens 15 is secured, thus extending the discharge channel 2 below the lens. On the other hand a portion of the shaft 14 terminates above the lens 15 so that the channel 2 opens at a level higher than the lens 15. It will also be observed that the discharge channel 2 has a greater cross-sectional area than the inlet or feed channel 1.

An elongated wire having a loop 16 at its lower end extends between the endoscope shaft 14 and the viewing tube 4 below the lens 15. The wire 16 is secured to a movable sleeve 17 located about the guide tube 3 which is connected via a finger grip 21 and an articulated pair of levers 18 and 22 to a boss at the upper end of the endoscope on which the eye piece is secured. The boss contains a palm or hand grip 23 permitting the carrier sleeve 17 to be movable axially along the tube viewing tube 4 by manipulation of the finger grip 21. In this manner the wire loop 16 may be extended or retracted with respect to the situs of the operation. The wire loop 16 of the course comprises the electrode of the high frequency apparatus and is connected to a suitable power source in known manner. The connection 14a for the inlets 12 and 13 sits above the shaft 14 and has a small conduit which connects the inlet 12 to the annular channel 2. The inlet 12 is provided with the pet-cock so that it can be opened and bathing fluid delivered directly through this discharge channel 2 into the body cavity so that the bladder may be initially filled with a predetermined amount of liquid via the larger discharge channel so that the conductive electrode will have sufficient conducting media and the cavity will be sufficiently bathed, before the moment at which the operation may begin.

Returning to FIG. 1 the inlet tube 7 from inlet 13 and the outlet tube 8 from discharge 25 pass through a pump 5 having a rotatable eccentric actuator 6. The pump 5 comprises a body in which a rotary motor having a shaft on which the actuator 6 is mounted. The tubes 7 and 8 pass through grooves in the body parallel to each other and substantially tangential to the actuator, which is adapted to engage both the tubes 7 and 8 simultaneously. The actuator 6 compresses the tubes in rhythmic sequence so as to pump fluid through tube 7 and exhaust fluid through tube 8. The tubes 7 and 8 and the excenter 6 are positioned relative to each other that the stroke, and the frequency of the pumping action is the same on both tubes, although in opposite phase or direction and the volume of compressed fluid in each of the tubes is the same. Therefore, simultaneously a similar volume of fluid may be pumped into the body cavity as is withdrawn. Actually, during use of the device, the pet-cock connection 12 is opened so that the cavity is initially filled to the most optimal level for the

operation. Thereafter, it is closed so that liquid is delivered only through the smaller inlet 13 and channel 1 by the operation of the pump 5. Simultaneously the same volume of fluid is withdrawn from the site of the operation through the discharge channel 2. The inlet connection 13 passes through a cut in the wall of the endoscope shaft 14 and is soldered or welded to the tubular channel 1 to provide a fluid tight arrangement so that the infeed of liquid is sealed from the connection 12. The feed channel 1 extends the length of viewing tube 4 and opens in the neighborhood of the objective lens 15 so that the liquid pumped through the nozzle-like opening tends to pass over this objective lens 15 maintaining it free of any blood or particles during the operation. The discharge flow of the liquid passes through the opening in the annular discharge channel 2 one portion of which is immediately adjacent the electrode wire loop 16 and the other portion of which is located above the objective lens 15. In this way a current of fluid from the inlet to the outlet is created insuring absolute cleaning of both the situs of the operation and the distal end of the endoscope.

The eye piece 24 and the viewing tube 4 are jointed together to be removable axially from the endoscope shaft 14 by being pulled upwardly through the sleeve 17 and the boss holding the lever 22. By removing the eye piece 24 and the tube 4 on completion of or even during the operation the bladder can be easily and quickly emptied, since the liquid in the bladder will all run quickly through the hollow interior of the endoscope shaft 14 without interruption. This is advantageous particularly should an emergency occur during the operation which requires instantaneous emptying of the bladder. With the present invention, removal of the device permits the eye piece to be cleaned and sterilized and opens the entire exterior of the endoscope to cleaning and sterilization also.

The present device is employed by first inserting the endoscope shaft 14 together with the viewing tube 4 in the body cavity with the pet-cock opened so that the body cavity is filled with the bathing liquid delivered from the reservoir 10 through the annular discharge chamber 2. The pump 5 is arranged so that the discharge tube 8 is closed so that the liquid does not prematurely flow out of the body. A pet-cock or other clamping valve mechanism may be used on the tube 8 rather than using the pump to close the tube 8. Such mechanism may be located either directly on the tube or on the discharge connection 25. The pump 5 is then activated upon the beginning of the operation itself and an additional amount of fluid is directed via the Y-joint 11 into the tube 7, to the site of the operation through the inlet channel 1. Since the inlet channel 1 is of a smaller cross-sectional area than the discharge channel 2 the amount of fluid passed into the bladder in this direction is so great as to cause excess filling of the bladder.

As soon as the body cavity is filled in the described manner, the pet-cock 12 is closed and if a clamp is used the clamp or other device in discharge connection 25 and discharge tube 8 is opened. Thereafter the doctor may begin his work and perform the operation by activating the electrode 16. The pump 5 is continuously operated so as to continuously feed and withdraw a constant amount of fluid from the body cavity during the course of the operation. On the other hand, if desired, the doctor may operate the pump at intervals and only when the doctor considers it necessary to remove blood and tissue from the site of the operation. In either event, the same volume of water is delivered to the body cavity as is simultaneously removed therefrom setting up a circulation of fluid about the objective lens 5, the electrode 16, as well as in the site of the operation so that the site is maintained in clean and suitable condition for the continuation of the operation.

Since the discharge channel 2 is larger in cross-section than the inlet channel 1 it is clear that the body cavity will at no time be filled with an excess of fluid and further the blood particles, tissue particles, and other solid material withdrawn will easily pass through the discharge channel. The bladder is constantly maintained with an optimal amount of fluid providing the necessary conductive media for the electrode as well as suitable bathing and therapeutic media. The smaller inlet cavity has a further advantage in that, while the same volume of fluid is directed into the body as is removed therefrom, the smaller cross-section increases the pressure of the fluid so that the complete and proper washing of the area is obtained. It also should be noted that the mouth of the inlet channel 1 is positioned between the mouth of the outlet channel 2 so that the two are not in close proximity to each other and thus the incoming water can not be diverted to the outlet without further performing its cleaning function.

Various modifications and embodiments will of course be evident to those skilled in this art. Accordingly, the foregoing disclosure is to be taken as illustrative only, and not limiting of the scope of the present invention.

What is claimed:

1. In combination, an endoscope or similar apparatus for operating in a body cavity comprising a substantially hollow shaft having first and second conduit means extending between the proximal and distal ends respectively for the delivery and withdrawal of fluid from said body, and tubular pump means comprising a flexible hose extending respectively from said delivery and withdrawal conduit means and a rotary eccentric actuator acting thereon for simultaneously pumping an equal volume of fluid through said first and second conduit means to and from said body.

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