

Aug. 7, 1928.

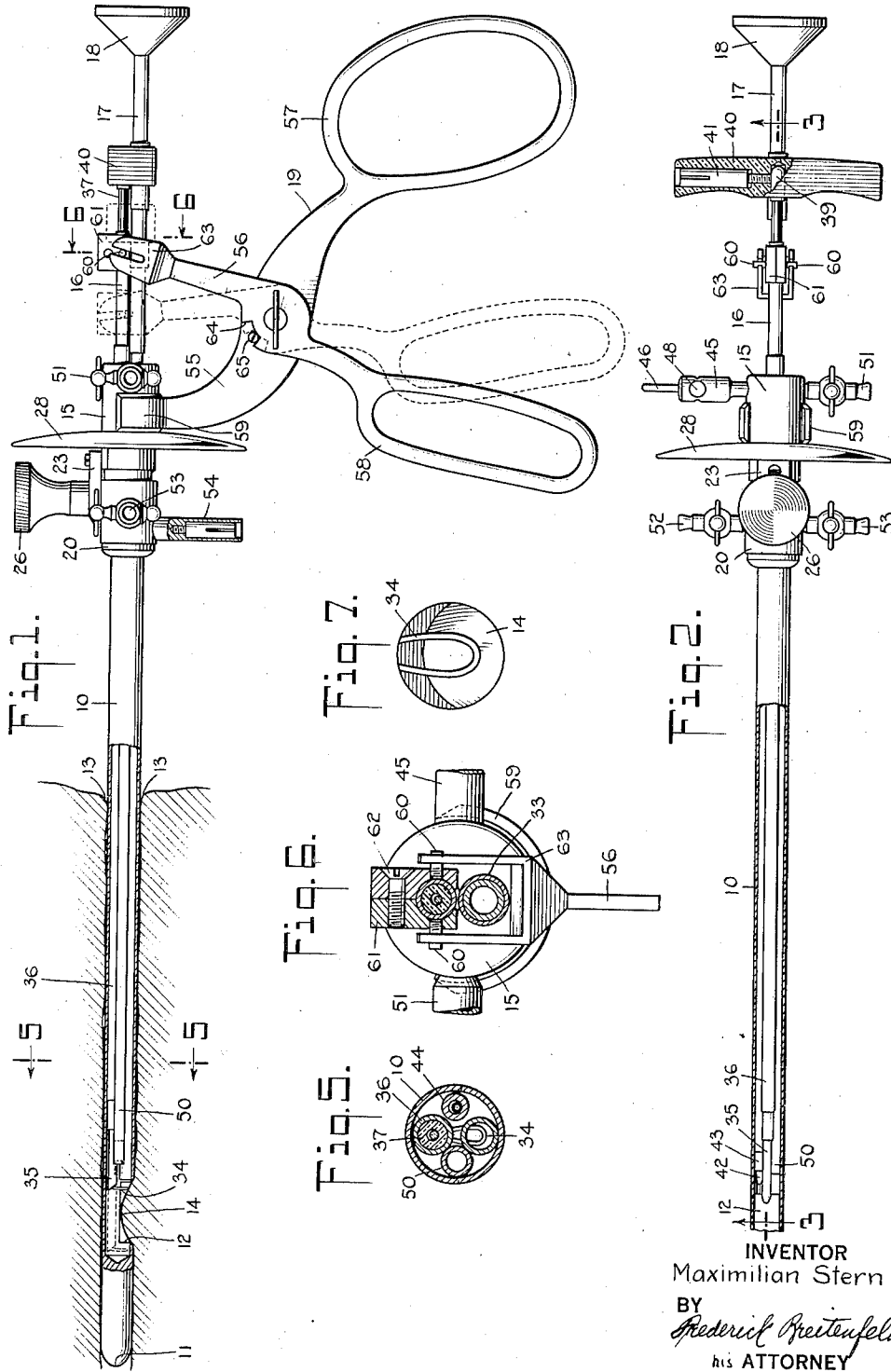
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1,679,950

METHOD AND APPARATUS FOR SURGICAL RESECTION.

Filed Dec. 18, 1925

2 Sheets-Sheet 1



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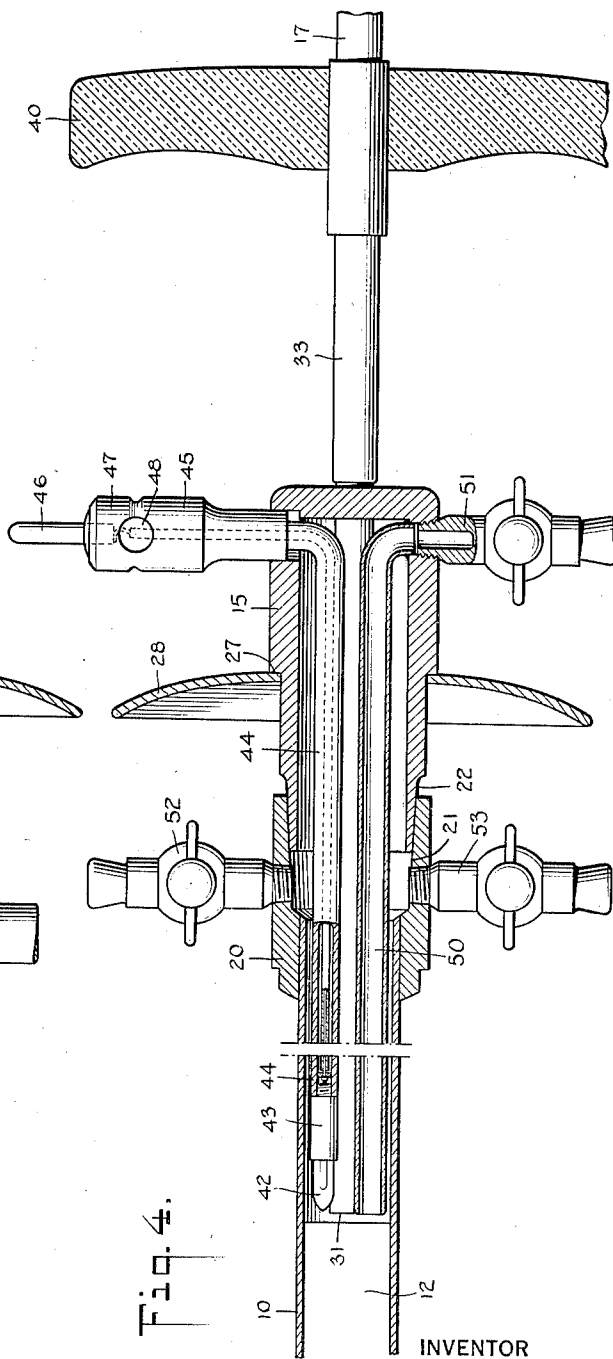
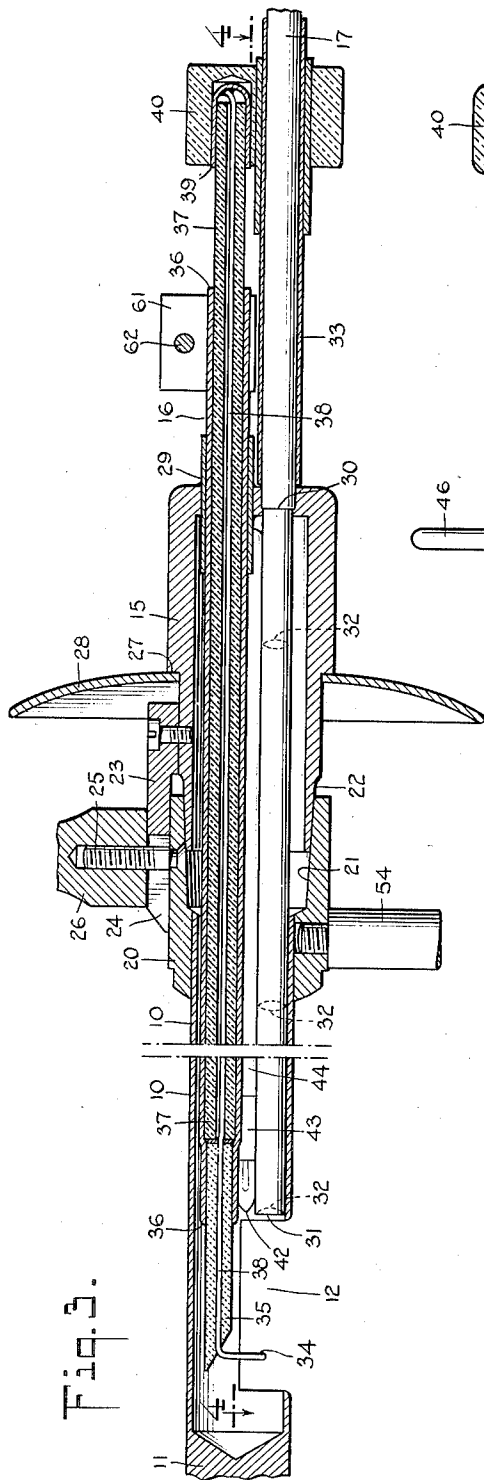
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METHOD AND APPARATUS FOR SURGICAL RESECTION

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

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METHOD AND APPARATUS FOR SURGICAL RESECTION.

Application filed December 18, 1925. Serial No. 76,140.

My present invention relates generally to surgery, and has particular reference to a method for alleviating obstructing protrusions of body cavities, involving coordinately an instrument for carrying out the method.

My invention has a particular application to protrusions caused by the swelling of prostate glands, wherein the usual procedure heretofore has entailed the entire surgical removal of the swollen glands. Inasmuch as ailments of this character are most common in elderly people, the surgical method of alleviation has been found poorly successful and often inadvisable because of the inability of the patients to undergo the severe shock entailed, not to speak of the well-known depressing effect which the total removal of this gland has.

Although my invention is designed primarily for the treatment of disorders of this character, nevertheless it will find wide applicability to ailments in general, wherein the obstruction of vital cavities by inward protrusions or neoplasms of the cavity walls must be alleviated.

An object of the invention is to provide a method for performing this function wherein a comparatively simple operation, capable of performance under only local anesthesia, practically bloodless, and of extremely short duration, will lessen the extent of the obstruction to a degree which has been found utterly successful in reestablishing normal freedom of the particular cavity.

A feature of my invention lies in resecting by electrical means a channel or groove through the protrusion.

Another feature of the invention lies in submersing the protrusion under a fluid, preferably water, prior to and during the resection, whereby numerous advantages to be described more fully hereinafter, are obtained.

Coordinately, it is an object of the invention to provide an instrument of the speculum type embodying features of construction which permit the method to be easily and expeditiously carried out.

According to one feature of my invention, I provide an endoscopic tube in which there is mounted for longitudinal movement an active electrode, and which is provided with means for constituting the tube itself as the indifferent electrode, of a suitable resecting electric current.

Another feature of the invention lies in providing the endoscopic tube with an opening in a side thereof wherethrough the protrusion may be made to extend so as to be presented in the path of the movable active electrode.

According to another feature of the invention, the endoscopic tube is enclosed and is provided with means for supplying a fluid such as water to the interior thereof, whereby the entire resetting operation may be carried out under submersion.

Other features of the invention lie in providing in association with the endoscopic tube and the electrode, and with the water supply means, means for rendering the entire operation clearly visible to the operator; and more particularly I provide a periscopic tube and an electric lamp suitably associated and positioned for the purpose specified.

For the attainment of the foregoing objects and such other objects as may hereinafter appear or be pointed out, I have described hereinafter a preferred method of carrying out my invention, and I have illustrated one embodiment of the instrument in the accompanying drawings, in which

Fig. 1 is an elevational view, showing the assembled instrument in position within a body cavity, that portion of the instrument lying within the cavity, and other portions, being shown in cross-section;

Fig. 2 is a top view of the instrument as shown in assembled condition in Fig. 1;

Fig. 3 is an enlarged cross-sectional view taken along the line 3—3 of Fig. 2;

Fig. 4 is an enlarged cross-sectional plan view taken along the line 4—4 of Fig. 3;

Fig. 5 is a cross-sectional view, on an enlarged scale, taken along the line 5—5 of Fig. 1;

Fig. 6 is a view similar to Fig. 5, taken along the line 6—6 of Fig. 1; and

Fig. 7 is a view representing the view obtained by the operator upon looking through the periscope.

Referring to the drawings and particularly to Fig. 1, it will be observed that I have provided an endoscopic tube 10 having a closed inner end 11 and an opening 12 in a side thereof and adjacent to the end 11, so that the tube may be inserted into a body cavity 13 in a manner which will permit an inward protrusion 14 of the body cavity to project into the tube 10 through

the opening 12. The tube comprises a body portion adapted to extend into the body cavity and a neck portion 15, the construction of which will be more fully described hereinafter. Mounted within the tube 10 is an electrode comprising a conducting element and a rod; a periscopic tube; an electric lamp; and a water conduit. The electrode rod is mounted for longitudinal movement within the tube 10 and projects outwardly through the end of the neck portion 15, its projecting portion 16 being clearly visible in Fig. 1. The periscopic tube also projects outwardly through the end of the neck portion 15 and its projecting portion 17 carrying the eye-piece 18 at the end thereof is also clearly shown in Fig. 1. Cooperating between the neck portion 15 and the projecting portion 16 of the electrode rod is a device for manually controlling from a relatively remote point, the movement of the electrode rod, and this device is indicated generally in Fig. 1 by the reference numeral 19, this device being also more fully described hereinafter.

Referring now to Fig. 3, the construction and mounting of the electrode and the periscopic tube are more clearly observed. Carried by the outer end of the body portion 10 is an enlarged endpiece 20 having an axial bore in the end thereof and tapering slightly for a purpose presently to be described. The neck portion 15 comprises a cylindrical element whose forward end 22 is slightly tapered to conform to the tapered walls of the bore 21. The end 22 is of a size snugly and frictionally to engage within the bore 21, and the tapered construction insures a tight joint between the body and neck portions of the tube. Carried by a side of the neck portion 15 is a forwardly projecting bifurcated arm 23 whose forks 24 define an open-ended slot adapted to register with and to receive a bolt 25 carried by and projecting radially from a portion of the end piece 20. Mounted for engagement with the bolt 25 is a hand knob 26 having an internally threaded bore adapted to engage with the threads of the bolt 25. By tightening this knob 26, its base may be made to bear against the outer surface of the arm 23 and thereby lock the neck portion 15 firmly to the body portion 10. Similarly, when it is desired to separate the neck portion from the body portion, the knob 26 is loosened, and with a slight exertion, the frictional engagement between the tapered walls 21 and 22 may be sufficiently loosened so that the neck portion 15 may be removed from the body portion 10 by relative longitudinal movement of these portions.

It will thus be observed that the bolt 25 and the arm 23 serve the additional function of insuring the union of the neck por-

tion 15 and the body portion 10 in proper circumferential relation to each other. The necessity for this provision will become more apparent after a more detailed description of the relative dispositions and mountings of the electrode, periscope, lamp, and water conduit, has been given.

An enlargement of the outer end of the neck portion 15 provides a shoulder 27 against which a peripherally mounted water shield 28 may bear. The shield 28 comprises preferably a concave disc having a central opening of a size to permit the shield to be mounted over the inner end 22 of the neck portion 15. The shield is applied in this manner, with the concave surface disposed toward the body portion 10, and is suitably fastened to the periphery of the neck portion 15 and against the shoulder 27.

The outer end of the neck portion 15 is entirely closed with the exception of two superposed bores through which the electrode rod and the periscopic tube project. The former is mounted for longitudinal movement within the endoscopic tube 10, and accordingly the opening through which the electrode rod passes is provided with a washer or bearing surface 29 which serves not only to guide the rod in its longitudinal movement but to render the mounting of the rod water-tight within the end of the neck portion 15. The periscopic tube is not mounted for free longitudinal movement with respect to the tube 10, and may therefore be mounted within the end of the neck portion 15 in any desired manner. However, for the purpose of rendering the periscopic tube removable for the sake of repair and inspection, and for the further purpose of limiting and fixing the inner disposition of the innermost end of the periscopic tube during its assembly, I prefer to provide the bore in the end of the neck portion 15 with a shoulder, and the periscopic tube with a corresponding shoulder 30; and I prefer to design the relative sizes of the periscopic tube and the bore in the neck portion so that the tube will be frictionally mounted therein.

Referring now more particularly to the construction of the periscopic tube, it will be seen that it is of a length to position its inner end 31 just short of the outer end of the opening 12. The periscopic tube may be of any suitable construction, embodying a plurality of lenses 32; and I prefer to mount the eye-piece 18 upon an elongated hollow sleeve 33 slidably and frictionally mounted upon the outer projecting portion of the tube. I have found a construction of this character preferable from the standpoint of assembly and disassembly.

With reference to the electrode, I provide a transverse conducting element 34, preferably in the form of a looped or U-shaped

wire, which is so mounted as to be capable of limited longitudinal movement between limits defined by the ends of the opening 12. The electrode is so disposed within the tube 10 that the element 34 projects transversely into the space bounded by the edges of the opening 12, whereby the electrode element 34 may be made to encounter the protrusion 14 during its longitudinal movement. Although the element 34 may be mounted in a number of ways, just so long as it is longitudinally movable with respect to the tube 10 and insulated from the latter, I prefer to mount the element 34 within a non-conducting end-piece 35 mounted within the end of an elongated sleeve 36 extending rearwardly through the endoscopic tube and outwardly through the bearing 29. Within the sleeve 36 is a bored rod 37, preferably of insulating material, and practically abutting at its forward end, the rear end of the end-piece 35. The end-piece 35 is similarly bored so that a continuous electrical connection in the form of a wire 38, preferably insulated, may be made to extend from the element 34 through the bores in the end-piece 35 and the rod 37 to the outer end of the latter. It will be obvious that although I have specified a preference for constructing the rod 37 of insulating material, nevertheless the insulating medium may be arranged in a number of ways, as desired, such as by making the sleeve 36 of insulating material, or by insulating only the continuous conducting element 38.

For the purpose of establishing electrical connection between the element 34 and a suitable electric terminal carried at the outer end of the rod 37, I prefer to provide a conducting cap 39 snugly fitting over the outer end of the rod 37 and having a hemispherical end providing a chamber within which the end of the wire conducting element 38 may be soldered or otherwise suitably electrically connected to the conducting cap 39. The cap 39 is designed to fit snugly and frictionally within a recess formed for this purpose within a guide bracket 40 which is slidably mounted upon the periscopic tube. For the latter purpose, the guide bracket 40 is provided with a suitably positioned bore arranged and constructed to constitute a slidable bearing for the end of the periscope. The guide bracket 40 is further provided with an electrical terminal or binding post wherethrough electrical connection may be made with the conducting cap 39 from an outside source. This electrical terminal is more clearly shown in Fig. 2, wherein a preferred construction is illustrated embodying a split socket 41 disposed within a radial bore in the bracket 40. At its base the socket 41 is provided with a threaded extension capable of being screwed into a threaded bore which extends inwardly to the

cap 39 whereby electrical contact can be made between the socket 41 and the cap 39. The socket 41 is of a type which is adapted to receive a suitable contact plug therein.

The guide bracket 40, in addition to carrying the electric terminal just referred to, serves by virtue of its slidable mounting upon the periscopic tube to impart staunchness and mutual support to the electrode rod and the periscope.

Referring now to Fig. 4, the disposition and construction of the water conduit and the electric lamp will be clear. Whereas the electrode rod and the periscopic tube are arranged one above the other, as more clearly disclosed in Fig. 5, the electric lamp and the water conduit are disposed side by side within those portions of the endoscopic tube 10 which are still unoccupied. The electric lamp may be of any suitable construction, and comprises briefly a bulb 42 mounted within a suitable socket 43 carried at the inner end of a bored tube 44 extending rearwardly to the outward end of the neck portion 15. Adjacent the end of the latter, the tube 44 is preferably turned through a right angle and is associated at its end with a suitable bipolar electrical terminal 45 extending and projecting laterally from the neck 15. Although this terminal 45 may be of any desired type or construction, I prefer to utilize that type in which one terminal 46 projects outwardly in the form of a pin from a body portion 47 of insulating material and carrying the other terminal 48 in the form of lateral plugs or inserts. The latter are preferably disposed along a peripheral groove 49 in the body portion 47 so that a properly designed connecting terminal may be applied to the terminal 45 by positioning it first over the pin 46 and then rotating it slightly so as to bring properly designed terminals into contact with the plugs 48. It will be understood that the terminal 46 is electrically connected with one terminal of the electric lamp socket 43, while the terminal 48 is electrically connected in an insulated manner with the other terminal of the socket 43.

The water conduit comprises a plain cylindrical tube 50 similarly turned through 90 degrees adjacent to the outer end of the neck 15 and terminating there in a suitable pet-cock 51.

The lengths of the tubes 44 and 50 are preferably such as will dispose the lamp 42 and the inner end of the tube 50 at points just short of the opening 12.

The end-piece 20 of the body portion 10 is preferably provided with lateral openings therethrough in which two further pet-cocks 52 and 53 are disposed, preferably in a manner projecting radially from each side of the end-piece 20. It will be understood that these pet-cocks 52 and 53 estab-

lish communication with the interior of the endoscopic tube.

The end portion 20 is further provided with an electric terminal 54 (see Figs. 1 and 3) substantially similar in construction to the terminal 41, and mounted within a suitably threaded bore in the end-piece 20 so that electrical connection may be established between an outside circuit and the end-piece 20 itself.

Referring again to Fig. 1, and also to Fig. 6, it will be seen that the device which I prefer to employ for the purpose of controlling the longitudinal movement of the electrode rod comprises two pivoted members 55 and 56 provided at their free ends with grip portions 57 and 58 respectively which are designed to receive the fingers of the hand of an operator much in the manner of a pair of shears. At their other ends, the pivoted members 55 and 56 are suitably constructed to engage respectively with the neck portion 15 and the projecting end of the electrode rod. With this object in view, I prefer to provide the end of the pivoted member 55 with a semi-circular clamp 59 adapted to frictionally engage about the neck portion 15; and I prefer to provide the corresponding end of the pivoted member 56 with a fork arrangement adapted to engage oppositely disposed pins 60 fixedly mounted upon the electrode rod. More particularly, the pins 60 are mounted within a carrier 61 comprising split portions having recesses therein adapted to register to constitute a grip bearing for the electrode rod, the split portions of the carrier 61 being removably connected to each other by a suitable screw 62. The forked arrangement at the end of the pivoted member 56 comprises preferably a U-shaped strap 63 each of whose arms is bifurcated to provide an open-ended slot slidably engageable over one of the pins 60. I have found an arrangement of this character desirable for the purpose of compensating for the arcuate movement of the end of the pivoted member 56, and for the purpose of transmitting this arcuate movement in the form of straight longitudinal movement to the electrode rod.

For the purpose of limiting the longitudinal movement of the electrode rod, and hence of the electrode element 34, I prefer to provide a slot or recess 64 in an edge of one of the pivoted members, viz., the member 56, within which a projecting pin constituting a stop 65 carried by the other pivoted member is disposed, whereby the engagement of the ends of the slot 64 with the fixed pin 65 will limit the relative pivotal movement of the pivoted members, and accordingly the longitudinal movement of the electrode rod.

In carrying out my invention, I prefer to

use the instrument hereinbefore described in the following manner. After the instrument has been properly assembled, and the necessary connections to the pet-cocks and to the electrical terminals have been made, I insert the body portion of the endoscopic tube into the body cavity which is to be treated. This insertion may be made while the operator's eye is disposed at the eye-piece 18, so that the instrument can be so positioned as to bring the protrusion 14 which it is desired to alleviate into a position projecting into the tube 10 through the opening 12. The electrode rod is disposed in its outermost position, that is, in the position illustrated in Fig. 1, during this step. After the instrument has been properly positioned, so that the protrusion 14 lies in the path of movement of the electrode element 34 (see Fig. 7), the endoscopic tube is filled with liquid, preferably water, by proper and desired manipulation of the various pet-cocks. Preferably, a stream of flowing water is employed, the stream being directed into the tube through the pet-cock 51 and the conduit 50, and the out-flow being arranged to pass through either or both of the pet-cocks 52 and 53. Generally, there will be no leakage of water from the cavity because of the snug fit therein of the tube 10. The additional precautions which have been incorporated with the instrument lie in the tight fitting joint between the end-piece 20 and the neck portion 15, the packing or bearing 29 for the electrode rod, and the water shield 28. The protrusion being now in a submersed condition, a suitable resecting current, preferably a high frequency alternating current, is properly initiated and associated with the terminals 54 and 41 so that the endoscopic tube 10 will itself constitute the indifferent electrode and the conducting element 34 will constitute the active electrode. Careful and slow manipulation of the pivoted members 55 and 56 will now advance the active electrode 34 into engagement with the protrusion 14. Reference to Fig. 7 will show clearly that this engagement occurs along a U-shaped line by virtue of the U-shaped construction of the conducting element 34. When the element 34 encounters the protrusion 14, the resecting current circuit will be completed through the protrusion 14 and accordingly the tissue encountered by the electrode 34 will be destroyed. This destruction of tissue will permit the element 34 to be advanced further and further so that as a result, a U-shaped channel will have been cut through the protrusion 14. The electrode is then retracted, the supply water disconnected, and the instrument withdrawn. Generally, the portion of the protrusion 14 which has been resected to form the channel will be withdrawn with the element 34, or at any rate with the tube 10; and it will be obvious

that this excision will have resulted in alleviating the obstruction which the protrusion has caused.

I have found that the destruction of tissue by the resecting current may be accompanied by the occurrence of miniature explosions and the formation of fumes and minute particles of steam or vapor which would ordinarily becloud the view obtained through the periscope. By submersing the protrusion which is being operated upon, these visibility-impairing results are dissipated, and as a result my method and instrument have proven extremely satisfactory and efficient in permitting the operator continued clear vision throughout the course of the operation. The utilization of water has another very important function in that it distends the cavity which is being operated upon prior to and during the actual operation. When the cavity is in collapsed or undistended position, the numerous folds and convolutions prevent careful inspection and examination which is prerequisite to properly ensnaring the protrusion or neoplasm. By filling the cavity with water, the distention serves to flatten out the walls so that the actual location of the protrusion (or others, if any) can be properly ascertained. Once located, the distending effect of the water facilitates the positioning of the instrument so as to locate the opening 12 around the protrusion. Furthermore, the protrusion would collapse into contact with, and over the end of the periscope if it were not held in a position slightly spaced therefrom by the flowing water. In this connection, it is to be noted that the end of the conduit is positioned closely adjacent to the end of the periscope so that the inflow of water is directed in a manner which holds the flabby protrusion away from the end of the periscope; and similarly, beclouding instrumentalities, such as those hereinbefore referred to, are carried away from the sight range of the periscope. It will be understood that the water serves also to soothe and cool the operated portions, and carries off any traumatic blood, pus, or other exudates which may have resulted from the insertion or presence of the instrument. The water serves also to cool the active electrode 34, it being understood that the invention does not involve cauterization wherein a heated electrode is required. For these numerous reasons, I consider the utilization of water a very important feature of the invention, resulting in numerous advantages and rendering the method extremely efficient.

By utilizing a suitable and proper resecting current, the operation may be made entirely bloodless by nature, the destruction of the tissue apparently being accompanied by an immediate healing of the resected por-

tion; and for this additional reason, my invention has proven extremely satisfactory.

I have, for the sake of convenience, designated the movable element 34 as an "active" electrode, and the tube 10 as an "indifferent" electrode. These terms are purely relative, as will be understood. Furthermore, it will be understood that a second or return electrode other than the tube 10 itself may if desired be employed, although the illustrated embodiment renders the device compact, devoid of unnecessary parts, and extremely efficient. I have also referred to the electrode elements as being mutually insulated. This is of course not strictly so when the operation is performed under submersed conditions, but the amount of short circuiting due to the presence of water—even when ordinary tap water is employed—is negligible. Also, this negligibility is increased by virtue of the fact that the water is preferably continuously flowing.

It will be understood that the shape and disposition of the active electrode 34, or the method of passing the resecting current through the protrusion, or other numerous details of construction and arrangement of parts may be made by those skilled in the art without departing from the spirit and scope of the invention as expressed in the appended claims. It is therefore intended that the details herein described and illustrated for the purpose of explaining the nature of my invention be interpreted as illustrative, and not in a limiting sense.

I claim:—

1. In a speculum of the character described, an endoscopic tube, and a movable electrode mounted therein for reciprocating longitudinal movement with respect thereto, said electrode comprising a conducting element arranged and constructed to lie substantially in a plane perpendicular to the tube axis and hence perpendicular to its line of travel.

2. In a speculum of the character described, an endoscopic tube, a movable longitudinal electrode rod extending thereinto, a loop electrode carried by the inner end of said rod, and means for moving said rod so as to cause the electrode to move perpendicularly to the plane of the loop.

3. In a speculum of the character described, an endoscopic tube, a movable longitudinal electrode rod extending thereinto, a loop electrode carried by the inner end of said rod and arranged with its plane perpendicular to the tube axis, and means for moving said rod longitudinally so as to cause the electrode to move perpendicularly to the plane of the loop.

4. In a speculum of the character described, an endoscopic tube, a movable longitudinal electrode rod extending thereinto,

an electrode carried by the inner end of the rod and comprising a transverse conducting element arranged and constructed to lie substantially in a plane perpendicular to the tube axis, and means for moving said rod longitudinally, whereby the electrode will be made to travel perpendicularly to its plane.

5. In a speculum of the character described, an endoscopic tube, a movable longitudinal electrode rod extending thereinto, a loop electrode carried by the inner end of said rod, means for moving said rod so as to cause the electrode to move perpendicularly to the plane of the loop, and a conducting element extending through said rod and arranged to establish electric connection between said electrode and the exterior end of said rod.

6. In a speculum of the character described, an endoscopic tube, a movable longitudinal electrode rod extending thereinto, a loop electrode carried by the inner end of said rod and spaced from the walls of said tube, means for moving said rod so as to cause the electrode to move within the tube in a direction perpendicular to the plane of the loop, said rod comprising insulating material, and a conducting element extending through said rod and arranged to establish electric connection between said electrode and the exterior end of the rod.

7. In a speculum of the character described, in combination, an endoscopic tube for insertion into a body cavity and constituting an indifferent electrode, and an active electrode mounted therein in non-contacting and hence insulated relation thereto and for longitudinal movement with respect thereto, whereby an electric circuit may be established through a portion of the body contacting with both electrodes.

8. In a speculum of the character described, in combination, an endoscopic tube for insertion into a body cavity and constituting an indifferent electrode, and an active electrode comprising a U-shaped transverse wire mounted therein in non-contacting and hence insulated relation thereto and for longitudinal movement with respect thereto, whereby an electric circuit may be established through a portion of the body contacting with both electrodes.

9. In a speculum of the character described, an endoscopic tube for insertion into a body cavity and provided with means for permitting the projection into the tube of an obstructing protrusion of the cavity wall, an electrode mounted within the tube for reciprocating movement therein, said electrode being so constructed and arranged as to encounter said protrusion during its movement, means for establishing electrical connection between said electrode and one terminal of an exterior source of current, and

means for establishing electrical connection between said protrusion and the opposite terminal of said source, whereby movement of the electrode to encounter said protrusion will establish an electrical circuit through the electrode and the protrusion.

10. In a speculum of the character described, an endoscopic tube for insertion into a body cavity and having an opening through which an obstructing protrusion of said cavity wall may extend, and a movable electrode mounted in the tube for reciprocating movement across the span of said opening, said electrode comprising a looped wire element arranged and constructed to lie in a plane substantially perpendicular to its path of movement.

11. In a speculum of the character described, an endoscopic tube for insertion into a body cavity and having an opening through which an obstructing protrusion of said cavity wall may extend, and a movable electrode mounted in the tube for reciprocating longitudinal movement across the span of said opening, said electrode comprising a looped wire element arranged and constructed to lie in a plane substantially perpendicular to the tube axis, and said element being so positioned as to encounter said protrusion during its movement.

12. In a speculum of the character described, in combination, an endoscopic tube for insertion into a body cavity and having a closed inner end and an opening in a side thereof through which an inward protrusion of said cavity wall may extend, said endoscopic tube constituting an indifferent electrode, and an active electrode in and insulated from said tube and mounted for longitudinal movement with respect thereto, whereby the active electrode may be brought into engagement with said protrusion to complete an electric circuit through said protrusion.

13. In a speculum of the character described, in combination, an endoscopic tube, a longitudinal periscopic tube extending thereinto through an end thereof, an electrode mounted for longitudinal movement with respect to the endoscopic tube and comprising a longitudinal rod extending through said end, and a guide bracket carried by the outer end of the rod and slidably mounted with respect to said periscopic tube, whereby mutual support is imparted to the latter and said rod.

14. In a speculum of the character described, in combination, an endoscopic tube, a longitudinal periscopic tube extending thereinto through an end thereof, an electrode mounted for longitudinal movement with respect to the endoscopic tube and comprising a longitudinal rod extending through said end, and a conducting element carried

at the inner end of the rod, a guide bracket carried by the outer end of the rod and slidably mounted with respect to said periscopic tube, an electric terminal carried by said bracket, and means for establishing insulated electrical connection between said terminal and said element through said rod.

15 15. In a speculum of the character described, in combination, an endoscopic tube, a longitudinal periscopic tube extending thereinto, and an electrode mounted for longitudinal movement within said endoscopic tube, said electrode comprising a transverse conducting element disposed within the sight
20 range of said periscope.

16. In a speculum of the character described, in combination, an endoscopic tube, a longitudinal periscopic tube extending thereinto, and an electrode mounted for longitudinal movement with respect to the endoscopic tube, said electrode comprising a longitudinal rod extending thereinto and a transverse conducting element carried by the inner end of the rod and disposed within the sight range of said periscope, and a guide bracket carried by the outer end of the rod and slidably mounted with respect to said periscopic tube whereby mutual support is imparted to the latter and said rod.

30 17. In speculum of the character described, in combination, an endoscopic tube, an electrode mounted therein for longitudinal movement with respect thereto, said electrode comprising a longitudinal rod extending through an end of said tube, and means cooperating between said rod and tube for limiting the range of relative longitudinal movement of the rod.

40 18. In a speculum of the character described, in combination, an endoscopic tube, an electrode mounted therein for longitudinal movement with respect thereto, said electrode comprising a longitudinal rod extending through an end of said tube, means cooperating between said rod and tube for normally controlling the relative longitudinal movement of the rod, and means associated with said first named means for limiting the range of said movement.

50 19. In a speculum of the character described, in combination, an endoscopic tube, an electrode mounted therein for longitudinal movement with respect thereto, said electrode comprising a longitudinal rod extending through an end of said tube, and a manual grip comprising pivoted members associated with and cooperating between said rod and tube for controlling the relative longitudinal movement of the rod.

60 20. In a speculum of the character described, in combination, an endoscopic tube, an electrode mounted therein for longitudinal movement with respect thereto, said electrode comprising a longitudinal rod extending through an end of said tube, a manual

grip comprising pivoted members associated with and cooperating between said rod and tube for controlling the relative longitudinal movement of the rod, and means cooperating between said pivoted members for
70 limiting said movement.

21. In a speculum of the character described, in combination, an endoscopic tube having an opening in a side thereof, an electrode mounted in said tube for longitudinal
75 movement with respect thereto, said electrode comprising a transverse element adjacent said opening, and means for imparting a limited movement to said electrode to produce a limited movement of said element
80 between limits defined by the ends of said opening.

22. In a speculum of the character described, in combination, an endoscopic tube comprising separable body and neck portions, the body portion being adapted to be inserted into a body cavity, an electrode mounted for longitudinal movement in said tube and comprising a longitudinal rod slidably mounted in and extending through said
90 neck portion, a longitudinal periscopic tube in said endoscopic tube and mounted in and extending through said neck portion, a guide bracket carried by the outer end of said rod and slidably mounted on said periscopic tube, and means cooperating between said rod and said neck portion for imparting limited longitudinal movement to said rod, said electrode comprising a transverse element carried at the inner end of said rod and disposed to lie within the sight range of the periscope throughout its movement.

23. In a speculum of the character described in combination, an enclosed endoscopic tube having a side opening, said tube being insertible into a body cavity whereby a protrusion of the cavity wall may extend into the tube through said opening, and means for supplying a fluid to the interior of said tube and directing it toward said
110 protrusion.

24. In a speculum of the character described, in combination, an enclosed endoscopic tube having a side opening, said tube being insertible into a body cavity whereby a protrusion of the cavity wall may extend into the tube through said opening, and means for supplying a fluid to the interior of said tube, said means comprising inlet and outlet cocks, and a conduit associated with one thereof and extending toward the inner end of the tube.

25. In a speculum of the character described, in combination, an enclosed endoscopic tube having a side opening, said tube being insertible into a body cavity whereby a protrusion of the cavity wall may extend into the tube through said opening, and means for supplying a fluid to the interior of said tube and directing it
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toward said protrusions, said means comprising inlet and outlet cocks, and a conduit associated with one thereof and extending inwardly to a point short of said opening.

26. In a speculum of the character described, in combination, an enclosed endoscopic tube having a side opening, said tube being insertible into a body cavity whereby a protrusion of the cavity wall may extend into the tube through said opening, an electrode mounted for longitudinal movement in said tube and disposed to encounter said protrusion, and means for supplying water to the interior of said tube and directing it toward said protrusion whereby said encounter will take place under submersed conditions.

27. In a speculum of the character described, in combination, an enclosed endoscopic tube having a side opening, said tube being insertible into a body cavity whereby a protrusion of the cavity wall may extend into the tube through said opening, an electrode mounted for longitudinal movement in said tube and disposed to encounter said protrusion, a periscope extending into said tube and arranged to include the entire movement of the electrode within its sight range, and means for supplying water to the interior of the tube whereby said encounter will occur under submersed conditions and whereby visibility-impairing results of said encounter will be eliminated.

28. In a speculum of the character described, in combination, an enclosed endoscopic tube having a side opening, said tube comprising separable body and neck portions of which the former is insertible into a body cavity whereby a protrusion of the cavity wall may be made to extend into the tube through said opening, means for supplying water to the interior of said tube, said means comprising inlet and outlet cocks carried by the body and neck portions respectively, a conduit associated with the neck portion cock and extending into the body portion, and a water shield peripherally carried by the neck portion.

29. The herein described method of alleviating an internal protrusion of a body cavity, which comprises the steps of establishing electrical connection between said protrusion and one terminal of a resecting electric current, establishing electrical connection between a movable electrode and the other terminal of the current, and moving the electrode against the protrusion in a direction substantially longitudinal with respect to the cavity axis to resect a channel through the protrusion.

30. The herein described method of alleviating internal protrusions of body cavities, which comprises applying one electrode of an electric current to the cavity wall and applying a second electrode to said protrusion

in the direction of the cavity axis whereby the completion of the electric circuit through the protrusion will resect a channel therethrough.

31. The herein described method of alleviating internal protrusions of body cavities, which comprises applying one electrode of an electric circuit to the cavity wall and applying a second U-shaped electrode to said protrusion in the direction of the cavity axis and perpendicularly to the plane of the U, whereby the completion of the electric circuit through the protrusion will resect a U-shaped channel therethrough.

32. The herein described method of alleviating internal protrusions of body cavities, which comprises submersing the protrusion under water, establishing electrical connection between the protrusion and one terminal of an electric circuit, and applying an electrode which is in electric connection with the opposite terminal of the electric circuit to said protrusion in the direction of the cavity axis whereby the completion of the circuit through the protrusion will resect a channel therethrough.

33. The herein described method of alleviating internal protrusions of body cavities, which comprises inserting an endoscopic tube having a side opening therein into the cavity in a manner to project said protrusion into said tube through said opening, filling the tube with water to submerge said protrusion, electrically connecting said tube to one terminal of an electric circuit, applying a second electrode which is in electric connection with the opposite terminal but insulated from said tube to the protrusion whereby a circuit will be completed through the protrusion, and moving the second electrode longitudinally of the axis of the cavity and against the protrusion whereby a channel will be resected out of the protrusion.

34. The herein described method of alleviating internal protrusions of body cavities, which comprises applying opposite electrodes of a resecting current circuit to portions of the protrusion to pass a resecting current therethrough, and moving at least one of the electrodes to resect a portion of the protrusion defined by the portions encountered by the moving electrode.

35. The herein described method of alleviating internal protrusions of body cavities, which comprises applying one electrode of a resecting electric current circuit to the cavity wall, applying a second electrode to said protrusion whereby a resecting electric circuit will be completed through the protrusion, and moving said last named electrode in the direction of the tissue encountered and destroyed thereby.

36. The herein described method of alleviating internal protrusions of body cavities,

which comprises filling the cavity with water to distend the walls thereof and to submerge the protrusion, applying opposite electrodes of a resecting current circuit to spaced portions of the protrusion whereby a resecting current will pass therethrough, and moving at least one of the electrodes in the direction of the tissue encountered and destroyed thereby.

In witness whereof, I have signed and sealed this specification this 12th day of December, 1925.

MAXIMILIAN STERN.