Sept. 22, 1964 F. G. ZINGALE 3,149,633

RESECTOSCOPE

Filed June 15, 1961 2 Sheets-Sheet 1

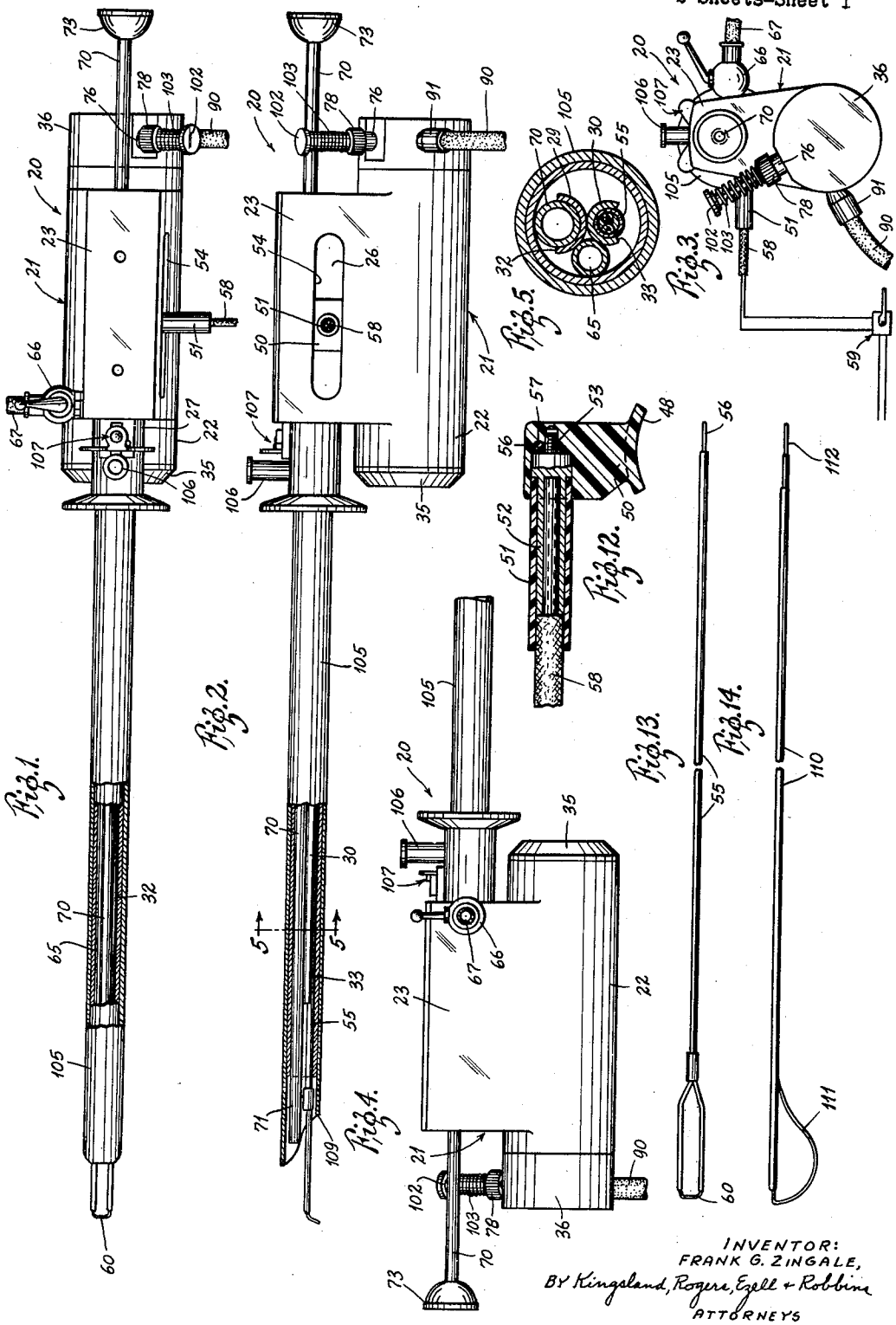

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 12.

Fig. 13.

Fig. 14.

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Fig. 6.

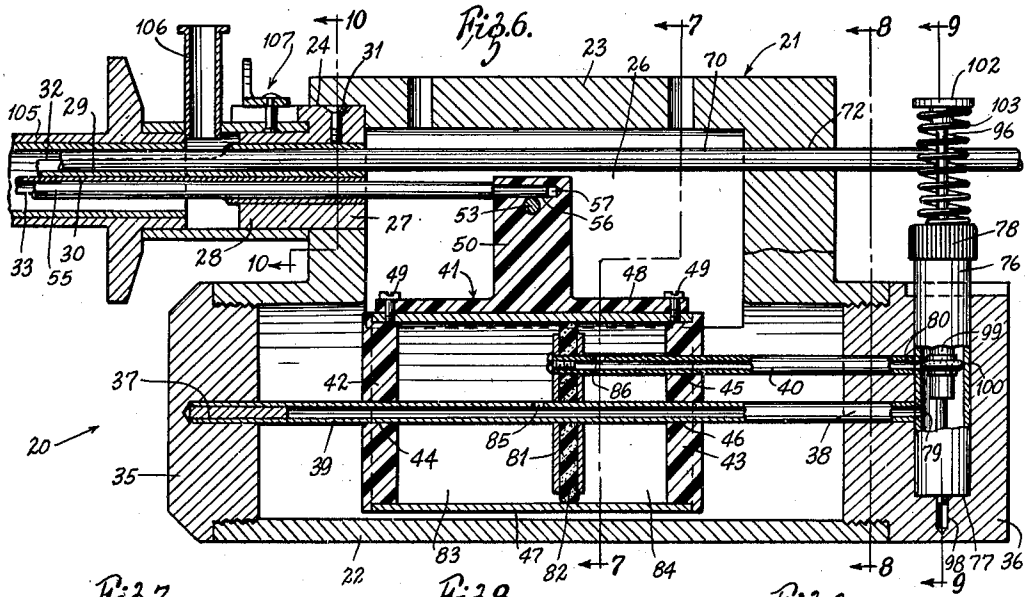


Fig. 7.

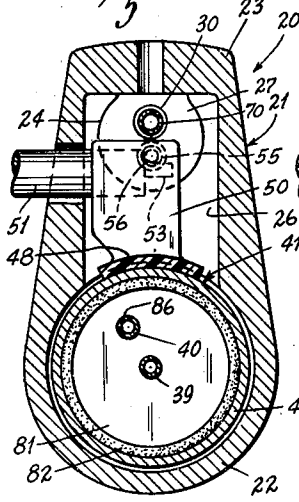


Fig. 8.

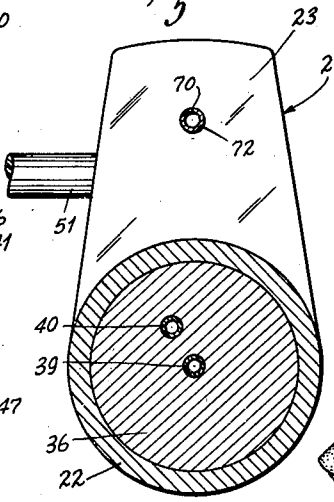


Fig. 9.

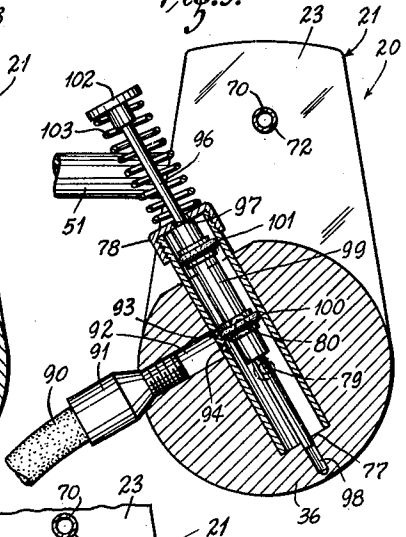


Fig. 10.

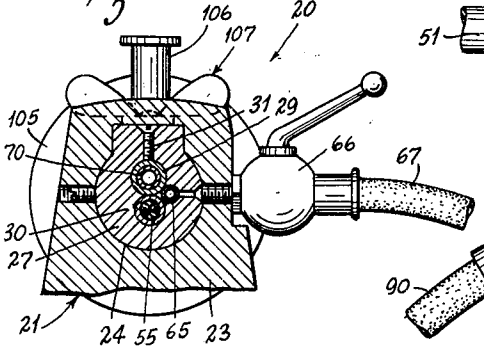
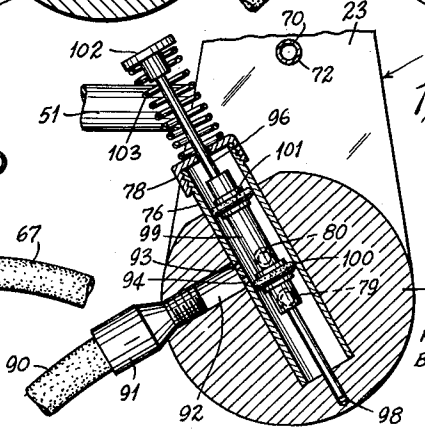


Fig. 11.



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RESECTOSCOPE

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This invention relates to a resectoscope and more particularly to a pneumatically operated and easily controlled resectoscope that can be held and operated with one hand.

The resectoscope includes a body having a reciprocable cutting loop in the form of a tungsten electrode that is supplied with a high frequency current. There is also a telescope extending through the resectoscope so that the operator can watch his work, and there is a water tube for applying fluid to the affected area. All resectoscopes have these elements.

This resectoscope, however, provides a pneumatic valve controlled power supply for reciprocating the cutting loop. The valve is operable by the finger of the hand that supports the body of the resectoscope, so that both holding and operating of the resectoscope can be accomplished with one hand.

A prostatic operation using a resectoscope is an extremely tedious operation. The movements of the tungsten cutting loop must be as accurately controlled as possible, because it is this cutting loop that sears and cuts away the affected, enlarged, obstructing parts of the prostate. This resectoscope provides a highly sensitive control for the movement of the tungsten cutting loop. It is, therefore, an object of the invention to provide a resectoscope having a reciprocable tungsten cutting loop with a pneumatic power supply for reciprocating the cutting loop and a highly sensitive control for transmitting the pneumatic power into movement of the cutting loop.

Another very important object of the invention is to provide a resectoscope having a reciprocable tungsten cutting loop with control means for reciprocating the cutting loop that are readily accessible to the finger of a hand holding the body of the resectoscope. The importance of this object will be apparent to those familiar with the art, who recognize the desirability of a resectoscope that can be completely operated and controlled by one hand. This leaves the other hand of the doctor free to manipulate the prostate into position for cutting.

Yet another object of the invention is to provide a resectoscope having a pneumatic power supply and a control valve therefor with an operating element on the control valve that is movable by the finger of a hand holding the resectoscope to control the position of the tungsten cutting loop at any point between its limits of reciprocating. A particular object is to provide a resectoscope with a reciprocable cutting loop that can be halted at any point in its excursions.

Still another object of the invention is to provide a pneumatically operated and controlled surgical instrument having a reciprocable element, the movement of which is controlled by a valve member operable by a hand holding the instrument, wherein the instrument may be adapted to a variety of uses, such as for removal of urinary bladder tumors and the crushing of urinary bladder stones, and other surgical operative procedures involving the unopened urinary bladder.

Still another object of the invention is to provide a resectoscope that reduces the required time for performing a prostatic operation. This reduction in operating time produces a reduction in risk to patients who have prostatic obstructions. Such patients are usually aged (up to ninety-five years old) and, because of concomitant physical defects, are usually poor anesthetic subjects.

Other objects and advantages will be apparent to those skilled in the art.

In the drawings:

FIGURE 1 is a plan view, partly in section, of the resectoscope;

FIGURE 2 is a side elevation view, partly in section, of the resectoscope;

FIGURE 3 is a rear elevation view of the resectoscope;

FIGURE 4 is a side elevation view of the rear part of the resectoscope showing the side opposite that shown in FIGURE 2;

FIGURE 5 is an enlarged view in section taken along the line 5—5 of FIGURE 2;

FIGURE 6 is an enlarged side elevation view in longitudinal section of the resectoscope;

FIGURE 7 is a view in section taken along the line 7—7 of FIGURE 6;

FIGURE 8 is a view in section taken along the line 8—8 of FIGURE 6;

FIGURE 9 is a view in section taken along the line 9—9 of FIGURE 6;

FIGURE 10 is a view in section taken along the line 10—10 of FIGURE 6 showing one position of the control valve;

FIGURE 11 is a view in section similar to the view of FIGURE 9, but showing the valve in a different position;

FIGURE 12 is an enlarged view in section showing the connection of the electrical conductor;

FIGURE 13 is a bottom view of the tungsten cutting loop; and

FIGURE 14 is a side elevation view of a bladder tumor snare that may be used instead of the tungsten cutting loop.

Referring now to the drawings, the resectoscope 20 has a hollow molded plastic body 21 with a generally cylindrical lower side 22 with a somewhat rectangular shaped upper side 23. The general shape of the body 21 is illustrated in FIGURES 1, 2 and 4, but it should be understood that this shape is not especially critical.

At the front end of the upper part 23 of the body 21 there is a recess 24. Rearwardly of the recess 24, the body 21 is hollow, as indicated by the chamber or space 26. A connecting sleeve 27 having a cylindrically shaped forward portion 28 is pressfitted into the recess 24.

A pair of metal tubes 29 and 30 that are welded, soldered or otherwise fixed together, are secured to the inside of the sleeve 27 by a setscrew 31 prior to insertion of the sleeve 27 into recess 24. Forward of the sleeve 27, the upper side 32 of the tube 29 is cut off and the lower side 33 of the tube 30 is cut off. These tubes 29 and 30 receive certain operating parts of the resectoscope as will be explained.

The lower part 22 of the body 21 has a forward end cap 35 threaded into it and a rearward end cap 36 threaded onto it. These forward and rearward end caps are molded onto the ends 37 and 38 of a hollow shaft 39. There is another hollow shaft 40 with an end 41 embedded in the rearward cap 36, but the hollow shaft 40 extends only about half of the distance toward the forward cap 35.

A cylindrical slide 41 having end caps 42 and 43 is slidably supported by the shafts 39 and 40. The end cap 42 has a hole 44 through it and the end cap 43 has two holes 45 and 46 through it. The shaft 39 extends through the holes 44 and 46 and the shaft 40 extends through the hole 45. The end caps 42 and 43 are molded of Teflon or other material that will provide a substantial seal with the shafts 39 and 40 while yet providing a slight amount of air leakage for a purpose to appear.

The slide 41 has a cylindrical side wall 47 that extends

between the end caps 42 and 43. The end caps 42 and 43 are sealed to the cylindrical side wall 47.

A connecting mount 48 is fastened by a pair of screws 49 (or other convenient means of attachment) to the top of the slide 41. This connecting mount 48 has an upwardly projecting portion 50 with a laterally extending handle 51. As shown in FIGURE 12, the handle 51 is in the form of a hollow plastic sleeve surrounding an electrically conductive brass terminal 52. The terminal 52 has a threaded end 53 to fasten it securely to the mount 50. The handle passes through a longitudinal slot 54 in the side of the body portion 23.

A tungsten cutting loop 55 is slidably received within the lower tube 30 that extends forwardly of the resectoscope body 21. This cutting loop 55 is conventional in the resectoscope art. As such, the cutting loop 55 is electrically conductive and has a bared rearward end 56. The upper portion 50 of the connecting mount 48 has a recess 57 in it and the bared end 56 is pressed into this recess 57 and into electrical contact with the terminal post 52. The cutting loop shaft is held in contact with the external electrical source by the terminal post which is threaded and locks the loop in position when tightened. The cutting loop 55 may be removed from the recess 57 by loosening the terminal post.

An electrical conductor 52 is connected into the hollow handle 51 and establishes an electrical connection with the bared end 56 of the tungsten cutting loop 55. The cable 58 is connected through a foot pedal 59 to a source of high frequency current (not shown) so that upon depression of the foot pedal 59, the forward end 60 of the tungsten cutting loop 55 will be heated. As is conventional, this forward end 60 of the cutting loop 55 is bent downwardly.

Conventionally, there is a water tube 65 that extends alongside the tubes 29 and 30. This water pipe extends forwardly to near the cutting end 60 of the cutting loop 55. Its rearward end is connected to a valve 66 and a water supply hose 67 is also connected to the valve 66. Hence, operation of the valve 66 controls the supply of water to the water tube 65.

A long telescope 70 is received within the upper tube 29. The forward end 71 of the telescope 70 is positioned so that a downwardly depending wide angle lens will cover the excursion distance of the cutting end 60 of the cutting loop 55. The body of the telescope passes through a hole 72 in the body 21 and extends rearwardly of the rear end of the body 21. An eye piece 73 is affixed to the rear end of the telescope. This telescope is conventional in the resectoscope art.

The most important aspects to this invention relate to the mechanism for operating the slide 48 to reciprocate the tungsten cutting loop 55. As shown in FIGURE 6, there is a cylindrical chamber 76 about which the end cap 36 is molded. The lower end 77 of this chamber 76 is closed by virtue of the end cap 36. A threaded cap 78 closes the upper end of the chamber 76.

The chamber 76 has a pair of outlet ports or openings 79 and 80 and these openings communicate with the interior of the hollow shafts 39 and 40, respectively. Connected to the other end of the hollow shaft 40 is a piston member 81.

An O ring 82 surrounds the piston 81 to provide a substantial seal with the side wall 47 of the slide 41. Thus there are two chambers 83 and 84 on opposite sides of the piston 81.

There is an opening 85 through the hollow tube 39 and in communication with the chamber 83. A similar opening 86 establishes communication between the hollow tube 40 and the chamber 84.

An air hose 90 that is connected to an air compressor (not shown) is also connected by a threaded fitting 91 into a passage 92 through the end cap 36. This passage 92 terminates at the side wall of the chamber 76 and there are two small pin holes 93 and 94 that establish communication between the air hose 90 and the interior of the chamber 76. An elongated shaft 96 extends through a hole 97 in the cap 78 at one end of the chamber 76 and into a recess 98 in the end cap 36 at the other end of the chamber 76. This shaft 96 has an enlarged body portion 99 within the chamber 76. An O-ring seal 100 surrounds the portion 99 of the shaft adjacent the two pin holes 93 and 94. Another O-ring seal 101 surrounds the portion 99 of the shaft and provides a seal with the side wall of the chamber 76.

At the upper end of the shaft 96 there is a finger button 102 and between this finger button and the end cap 78 there is a compression spring 103 that biases the shaft 96 in an upward direction. The extreme upward position of the shaft 96, with the enlarged portion 99 bearing against the cap 78 is illustrated in FIGURE 9. In this position of the shaft 96, the O-ring 100 covers the outlet port 80 while being positioned between the two pin holes 93 and 94. Thus, in this position of the O-ring seal 100, there is air communication from the compressor hose 90 through the pin hole 94 to the outlet port 79 and through the hollow shaft 39 and the outlet port 85 into the chamber 83. There is no compressed air communication into the chamber 84 so the slide 41 is driven forwardly by the pressure of the compressed air against the piston 81 and the forward end of the slide. Hence, the normal position of the slide is forward because the compression spring 103 normally holds the shaft 96 in an upward position. In this normally forward position of the slide 41, the tungsten cutting loop 55 is held in a forward position.

FIGURE 11 illustrates an extreme downward position. In this position of the shaft 96, the O-ring seal 100 blocks communication between the outlet port 79 and either of the inlet pin holes 93 and 94. On the other hand, both of these pin holes 93 and 94 communicate with the outlet port 80. Therefore, in this lowermost position of the shaft 96 and the O ring seal 100, compressed air is delivered through the outlet port 80 and the hollow shaft 40 to the chamber 84 by way of the hole 86 from the hollow shaft 40, and there is no compressed air delivered to the chamber 83. Consequently, the slide 41 is driven rearwardly under the pressure of the compressed air against the piston 81 and the rear end 43 of the slide.

The slide 41 can be modulated between its extreme positions by intermediate movement of the shaft 96. Thus, if the finger button 102 is depressed less than its maximum amount, the O-ring seal 100 will move free of its blocking position as illustrated in FIGURE 9, and the outlet port 80 will be exposed to communication with the inlet pin hole 93. However, if the O-ring seal 100 is not moved far enough, the inlet pin hole 94 will still communicate with the outlet port 79. In this position of the O-ring seal 100, compressed air is delivered to both the chambers 83 and 84. Therefore, the slide 41 will move from its normal forwardmost position to some intermediate position or held stationary.

The exact position of the slide can be controlled by the movement or position of the O-ring seal 100 according to whether it completely or partially blocks the outlet port 80 or whether it completely or only partially blocks the inlet pin hole 94. It has been found that in actual practice, the movements of the shaft 96 by a finger depressing finger button 102 produces immediate and accurate response in the position of the slide 41.

It has already been mentioned that there is some air leakage allowed through the holes 44 and 46 in the end caps 42 and 43 of the slide 41. This leakage is not great, but it is present, so that when one of the chambers 83 or 84 is under the influence of compressed air and is then blocked and compressed air is delivered to the other chamber, the air can escape from the first chamber. This escape of air is not rapid, and, therefore, the slide will not bang back and forth between its extreme positions. In

other words, the slow escape of air provides a cushion for the movement of the slide 41.

A Teflon sheath 105 covers the tungsten cutting loop 55, the water tube 65, and the telescope 70 forward of the connecting sleeve 27. This sheath 105, which is not specifically a part of this invention, has a post 106 for drawing it rearwardly over the sleeve mount 27. There is a thumb screw locking connection 107 that releasably secures the sheath 105 in position.

As is true with other resectoscopes, the sheath 105 has a forward edge 109 that cooperates with the tip 60 of the cutting loop 55 to block the escape of the affected prostate area during an excursion of the cutting loop 55.

FIGURE 14 illustrates a urinary bladder tumor snare 110. This snare 110 may be substituted for the tungsten cutting loop 55. It has a wire loop 111 at its forward end that extends through the body of the carrying tube 110 with an end 112 projecting from the body of the carrying tube. This end 112 is pressed into the recess 57 of the connecting mount 50 while the body of the snare 110 is held in a fixed position within the tube 30. Therefore, as the slide 41 is moved rearwardly by operation of the finger button 102, the wire loop 111 is drawn toward the body of the snare to produce the snaring action desired.

Various changes and modifications may be made within the process of this invention as will be readily apparent to those skilled in the art. Such changes and modifications are within the scope and teaching of this invention as defined by the claims appended hereto.

What is claimed is:

1. A resectoscope comprising a body including a control assembly; the control assembly comprising a cylinder member and a piston member in the cylinder, one of said members being mounted in fixed relation with respect to said body, means for providing relative sliding movement between the cylinder and piston members, a cutting loop supported by the other of the members for sliding movement therewith relatively to said one of said members, a high frequency current conductor for connection to a high frequency current source and to the cutting loop to supply current to the cutting loop to heat the cutting loop, means for delivering high pressure fluid to alternate sides of the piston member, and valve means for controlling the delivery of the fluid, the valve means having an operating member supported by the body and positioned for access by the finger of a hand holding the body, the operating member being movable between first and second positions corresponding to the extremes of sliding movement of the cutting loop, the valve means having means to regulate the delivery of fluid in response to movement of the operating member to any selected intermediate position to cause the cutting loop to move to a corresponding intermediate position.

2. The resectoscope of claim 1 wherein the operating member is spring biased in one direction and finger operable in the opposite direction and the opposite directions of movement of the operating member determine the side of the piston to which the fluid is supplied.

3. In a resectoscope having a cutting loop, a high frequency current source, and conductor means connected between the current source and the cutting loop to conduct current to the cutting loop to heat the cutting loop, the improvement comprising a body defining a fluid chamber member, a piston member within the chamber member, means for providing relative sliding movement between the chamber member and piston member, means supporting said loop on one of said members for reciprocating movement with respect to the other member when the chamber member and piston member slide relative to one another, the piston

member having opposed sides, a first fluid conduit to the chamber adjacent one side of the piston member, a second fluid conduit to the chamber adjacent the opposite side of the piston member, a valve means for alternatively opening one fluid conduit and closing the other and for throttling both conduits in varying relative amounts, the valve means comprising a housing, the first and second fluid conduits communicating with the housing at spaced ports through a side wall of the housing, a fluid supply conduit connected into the housing, piston means slidable within the housing between selected positions, means on said piston means for communicating a selective one of the ports with the fluid supply conduit when said piston is in one of the selected positions and to intermediate positions between the last-named positions, the intermediate positions providing various areas of communication between the ports and the fluid supply conduit to provide selective positioning of the cutting loop at any position between its limits of reciprocating movement, and means for sliding the valve member.

4. The resectoscope of claim 3, wherein the means for sliding the valve member comprises a shaft connected to the valve member and extending through the housing, a finger engageable member connected to the shaft, and a spring for biasing the shaft in a direction away from the housing.

5. The resectoscope of claim 4 wherein the finger engageable member is accessible to the finger of a hand holding the body of the resectoscope.

6. A resectoscope comprising a body, a piston fixed to the body, a cylinder enclosing the piston and slidable relative thereto, a cutting loop supported by the piston, means for heating the cutting loop, a first fluid conduit communicating with the interior of the cylinder on one side of the piston, a second fluid conduit communicating with the interior of the cylinder on the opposite side of the piston, and valve means for controlling the flow of fluid through the conduits, the valve means comprising a valve chamber with a valve member slidable therein, a pair of outlet ports from the chamber and an inlet port to the chamber, each of the fluid conduits communicating with an outlet port and a fluid supply conduit communicating with the inlet port, and a valve member slidable within the chamber for controlling the communication of the inlet port with the outlet ports, the inlet port comprising at least two tiny openings and the valve member comprising a piston member slidable within the chamber while maintaining substantial sealing engagement with the side wall of the chamber; the tiny openings being sufficiently close together and the outlet ports being sufficiently far apart to allow the piston member to establish communication with one of the outlet ports and a selective number of the tiny openings according to the position of the piston member.

7. The resectoscope of claim 6 wherein the piston member has an operating shaft connected to it and extending through an end of the chamber, a spring biasing the piston member in one direction, the shaft being positioned for depression by a finger of a hand holding the resectoscope body to move the piston member in the other direction.

References Cited in the file of this patent

UNITED STATES PATENTS

41,586	Wright	Feb. 9, 1864
2,733,506	Wild	Feb. 7, 1956

FOREIGN PATENTS

452,125	Canada	Oct. 26, 1948