

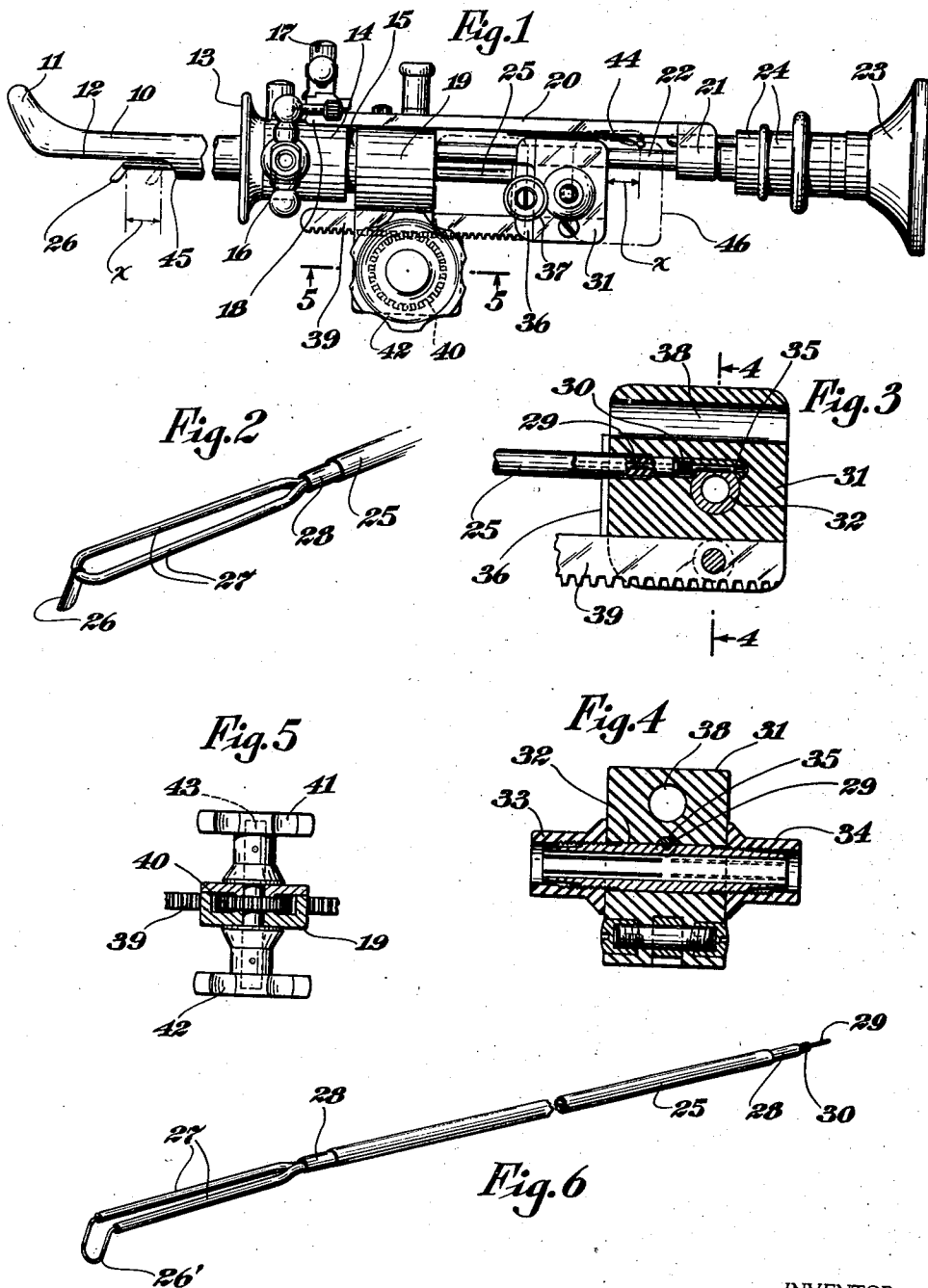
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F. C. WAPPLER

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ELECTRODIC ENDOSCOPIC INSTRUMENT

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INVENTOR,
Frederick Charles Wappler,
BY
Frederick Breitenfeld
ATTORNEY.

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ELECTRODIC ENDOSCOPIC INSTRUMENT

Frederick Charles Wappler, New York, N. Y.

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9 Claims. (Cl. 128—303.15)

My present invention relates generally to surgical instruments, and has particular reference to certain improvements in an electrodic instrument.

5 It is a general object of my invention to improve the efficiency and facility of employment of the type of instrument in which a fenestrated endoscopic sheath is provided with means for longitudinally advancing and retracting an electrode rod therein, the rod having an operative electrode at its forward end protruding from the fenestra.

While I have herein illustrated and shall hereinafter describe an instrument designed primarily for the resection of channels or the like in the prostate gland, nevertheless it will be understood that the various phases of my invention are not necessarily restricted to an instrument having this specific purpose.

20 One of the features of the present improved instrument lies in the provision of a yieldable means for impeding the actuation of the electrode rod as the operative electrode approaches close to an end edge of a lateral fenestra. With the eye of the operator usually maintained at the objective of a telescope, with which the operator is observing the functioning of the electrode, a construction of the type mentioned functions to warn the operator that the electrode is approaching close to the end of the fenestra. Where the fenestra is of metal, this warning permits the longitudinal movement of the electrode to be stopped prior to the time when a short-circuiting might occur.

35 Another feature of my invention lies in an improved assembly of those parts controlling the reciprocal movements of the electrode rod. More particularly, I provide an arrangement whereby a rack-and-pinion association may be employed with greater facility and with more accurate control of the electrode movements.

A further feature of the invention lies in a construction which permits electrical connections to be established from either side of the instrument, and also permits the actuation of the electrode to be accomplished from either side of the instrument. This facilitates the use of the instrument under differing conditions, and avoids cumbersome electrical connections and clumsy manual operations under the varying conditions in which the instrument is used.

A still further feature of my invention lies in providing an improved arrangement for establishing electrical connection between a terminal block and the operative electrode.

I achieve the foregoing objects, and such other objects as may hereinafter appear or be pointed out, in the manner illustratively exemplified in the accompanying drawing, wherein—

Figure 1 is a side elevational view of an instrument constructed in accordance with my present invention;

Figure 2 is a perspective view of the forward end of the electrode rod;

Figure 3 is an enlarged cross-sectional view taken substantially in the same direction as Figure 1, showing the connection between the rear of the electrode rod and the electric terminal;

Figure 4 is a cross-sectional view taken substantially along the line 4—4 of Figure 3;

Figure 5 is a fragmentary cross-sectional view taken substantially along the line 5—5 of Figure 1; and

Figure 6 is a perspective view of an alternative form of electrode rod.

The sheath 10 may be of metal or other suitable material, and is provided with the forward beak 11 and the lateral fenestra 12. At its rear end, the sheath is provided with the collar 13 and with the sleeve 14, the latter being adapted, in conventional manner, to accommodate a plug 15 forming part of the bundle of elements that are to be mounted in the sheath.

One or more petcocks 16 may be carried by the sleeve 14, to establish communication with suitable irrigating tubes which form no direct part of the present invention. Similarly, an attaching clamp 17 is carried by the sleeve 14 and is adapted to engage removably with the forked portion 18 carried by the inserted bundle of elements.

This bundle is built up around a bearing member 19 which carries the plug 15 and the rearwardly extending, rigid bar 20. At the rear end of the bar 20 is a secondary bearing 21 adapted to facilitate the support of a telescopic tube 22. The latter has the usual eye-piece 23 at its rear end, projects through a suitable bore in the bearing 19, and has at its forward end (not shown) an electric lamp and an objective which commands a view of the fenestra 12. Connections for the lamp are established at the mutually insulated terminal rings 24. The telescope is removable as a unit by sliding it rearwardly out of the instrument.

An electrode rod 25 is also slidably mounted in the bearing 19, a suitable bore being provided in the bearing for this purpose. At its forward end the electrode rod carries the operative electrode 26 which is shown, in Figure 2, in the form of a

transverse, knife-like projection. This electrode is electrically connected with two ensheathed wires 27 which extend rearwardly from the head 26 in spaced, substantially parallel relationship, so that the telescope may command a view of the head 26 through the space between the wires. At the rear, the ensheathed wires 27 merge and project into a sheath 28 of insulation, within which a wire 29 extends rearwardly through the length of the electrode rod. The sheath 28 may, itself, be enclosed throughout almost its entire length by a metallic sheath, to which the reference numeral 25 is applied. This numeral, however, is intended to designate, generally, the electrode rod as a unit.

In accordance with my invention, the rear end of the wire 29 is bare and has secured thereto, close to the extreme tip, a coiled spring 30 which is preferably soldered into position. Because of the fact that the insulation 28 terminates short of the rear end, the electrode rod may be said to have an uninsulated, attenuated rear end.

The electrode rod is adapted to be removably inserted into an insulating block 31, which is shown most clearly in Figures 3 and 4. This block has a transverse bore which accommodates an electric terminal 32. This terminal projects from opposite sides of the block, as shown most clearly in Figure 4; and the projecting ends are enclosed within removable sleeves or tubes 33 and 34, composed of insulating material. The block 31 is also provided with a longitudinal bore which intersects, tangentially, with the transverse bore. The longitudinal bore accommodates at its inner end a conductive bushing 35 which is in electrical contact with the terminal 32. The bushing is adapted to receive the attenuated, uninsulated, rear end of the electrode rod, as shown most clearly in Figure 3, thereby establishing an insulated electrical connection between the terminal 32, at the rear, and the operative electrode 26, at the front.

When the electrode rod is inserted rearwardly into the block 31, the coil spring 30 is compressed against the front end wall of the bushing 35, and this insures a firm electrical connection at all times. The rod is held in place by a pair of jaws 36 whose tightening and loosening is accomplished by the knob 37.

The block 31 is substantially rectangular in contour, and through its upper portion there is provided a bore 38 which permits the telescope 22 to pass through it. At the bottom, the block 31 carries a rack 39 which is thus mounted in offset relation to the axis of the electrode rod 25. The rack extends forwardly through the bearing 19, as shown most clearly in Figure 1.

Within the lower portion of the bearing 19, I mount a pinion 40 which meshes with the rack 39; and on opposite sides, respectively, of the bearing I mount a pair of hand wheels 41 and 42 which are aligned with each other and which are operatively connected with the pinion 40. I have illustratively shown the wheels 41, 42 and the pinion 40 mounted upon a common shaft 43. Thus, manipulation of either of the wheels 41, 42 controls the actuation of the pinion and hence of the rack 39 and the electrode rod 25.

When the instrument is used, the block 31 moves back and forth underneath the bar 20, and in accordance with my present invention this bar carries a resiliently yieldable abutment or finger 44 so positioned as to be encountered by the upper rear edge of the block 31 at a predetermined point. More particularly, the

parts are so arranged that when the electrode 26 is moved rearwardly, and approaches close to the rear edge 45 of the fenestra 12, i. e., to the dot-and-dash position of Figure 1, the block 31 abuts against the yieldable finger 44. This serves as a means for impeding the actuation of the electrode rod, and although the finger 44 will yield to permit the block to move rearwardly to the dot-and-dash position 46 if such movement is desired, the encounter with the finger 44 serves as a convenient warning to the operator that the electrode 26 has reached the dot-and-dash position of Figure 1. To illustrate this mode of operation, I have indicated by the reference numeral x and by the accompanying arrows the equality between the respective movements of the electrode 26 and of the insulating block 31.

The electrode rod of Figure 6 is exactly the same as that hereinbefore described, and the reference numerals are, therefore, the same, except that the operative tip is not in the form of a knife-like element 26 but in the form of a transverse, U-shaped loop 26'. These electrodes, and others, may be selectively employed because of the removable manner in which they may be associated with the block 31, as hereinbefore described. Regardless of which electrode is used, the abutment of the block 31 against the yieldable means 44 serves as a convenient warning to the operator that the operative electrode has approached close to the rear edge 45 of the fenestra. Where the sheath 10 is of conductive material, this preliminary warning prevents electrical short circuits that might otherwise take place. I wish to point out that the provision and mounting of the two hand wheels 41 and 42, together with the transversely projecting relation of the terminal 32, permits the instrument to be used under varying conditions without having connection wires interfere with its operation. In other words, a lead wire may be connected, as desired, either to one or the other side of the insulating block 31. Similarly, the electrode rod may be reciprocated from either side of the instrument and with either hand of the operator.

In general, it will be understood that changes in the details, herein described and illustrated for the purpose of explaining the nature of my invention, 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 these details be interpreted as illustrative, and not in a limiting sense.

Having thus described my invention, and illustrated its use, what I claim as new and desire to secure by Letters Patent is—

1. In an instrument of the character described, a conductive sheath having a lateral fenestra, an insulated electrode rod mounted for longitudinal movement in said sheath, an operative electrode carried at the end of said rod and protruding from said fenestra, control means for moving said rod, and a yieldable means impeding the actuation of said control means as the electrode approaches close to an end edge of said fenestra.

2. In an instrument of the character described, a conductive sheath having a lateral fenestra, an insulated electrode rod mounted for longitudinal movement in said sheath, an operative electrode carried at the end of said rod and protruding from said fenestra, control means for moving said rod, and a yieldable means im-

peding the actuation of said control means as the electrode approaches close to an end edge of said fenestra, said yieldable means comprising a resilient, yieldable abutment mounted in fixed relation to the sheath and so positioned as to be encountered by a rear portion of the electrode rod.

3. In an instrument of the character described, a conductive sheath having a lateral fenestra, a telescope in the sheath commanding a view of the fenestra, a bar projecting rearwardly from the sheath and having a bearing for the telescope at its rear end, an insulated electrode rod mounted for longitudinal movement in said sheath, an operative electrode carried at the end of said rod and protruding from said fenestra, control means for moving said rod, and a yieldable means carried by said bar and encounterable by a rear portion of the electrode rod for impeding the actuation of said control means as the electrode, during its retractive movement, approaches close to the rear edge of said fenestra.

4. In an instrument of the character described, a conductive sheath having a lateral fenestra, an insulated electrode rod mounted for longitudinal movement in said sheath, an operative electrode carried at the forward end of said rod and protruding from said fenestra, an insulating block carried at the rear end of the electrode rod, an electric terminal on said block, a wire establishing an insulated electrical connection between said terminal and electrode, control means for moving said rod, and a yieldable means mounted in fixed relation to the sheath and encounterable by said block for impeding the rearward movement of the electrode rod as the electrode approaches close to the rear edge of said fenestra.

5. In an instrument of the character described, a conductive sheath having a lateral fenestra, a bearing at the rear end of the sheath, an insulated electrode rod mounted for longitudinal movement in said bearing, an operative electrode carried at the forward end of said rod and protruding from said fenestra, an insulating block carried at the rear end of the electrode rod, an electric terminal on said block, a wire establishing an insulated electrical connection between said terminal and electrode, a rack carried by said block in offset relation to the axis of the rod and extending through said bearing, a pinion mounted in said bearing and meshing with

said rack, and a control means on the exterior of said bearing for actuating said pinion.

6. In an instrument of the character described, a conductive sheath having a lateral fenestra, a bearing at the rear end of the sheath, an insulated electrode rod mounted for longitudinal movement in said bearing, an operative electrode carried at the forward end of said rod and protruding from said fenestra, an insulating block carried at the rear end of the electrode rod, an electric terminal on said block, a wire establishing an insulated electrical connection between said terminal and electrode, a rack carried by said block in offset relation to the axis of the rod and extending through said bearing, a pinion mounted in said bearing and meshing with said rack, and a pair of aligned hand wheels mounted on opposite sides of said bearing, respectively, and operatively connected to said pinion so that either wheel may be manipulated to actuate said pinion.

7. In an instrument of the character described, an electrode rod having an uninsulated rear end, an insulating block having a transverse bore and having also a longitudinal bore adapted to accommodate said rod, an electrical terminal in said transverse bore and projecting from opposite sides of said block, and a bushing in the longitudinal bore in contact with said terminal.

8. In an instrument of the character described, an electrode rod having an uninsulated rear end, an insulating block having a transverse bore and having also a longitudinal bore intersecting the transverse bore tangentially, an electric terminal in the transverse bore and projecting from opposite sides of said block, and a bushing in the longitudinal bore in contact with said terminal and adapted to receive the uninsulated rear end of said rod when the latter is inserted into the longitudinal bore.

9. In an instrument of the character described, an electrode rod having an uninsulated rear end, a coil spring secured around said end, an insulating block carrying an electrical terminal and provided with a bore in communication with said terminal, and a bushing in said bore in contact with said terminal, said rod end being insertable into said bore and bushing so as to compress said spring against the front end wall of the bushing.

FREDERICK CHARLES WAPPLER,