

June 19, 1934.

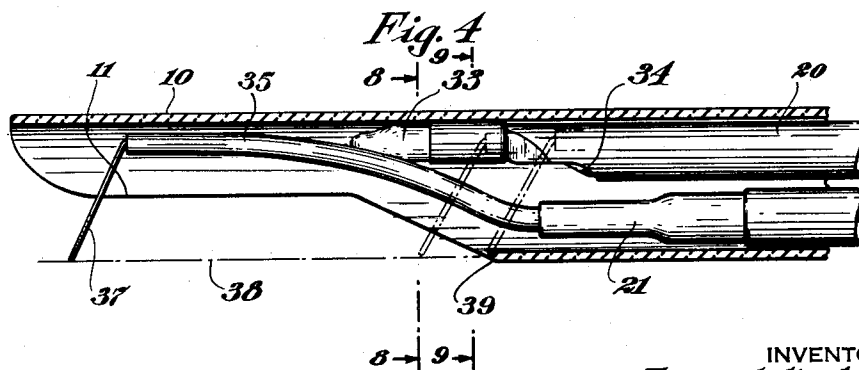
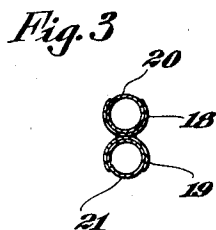
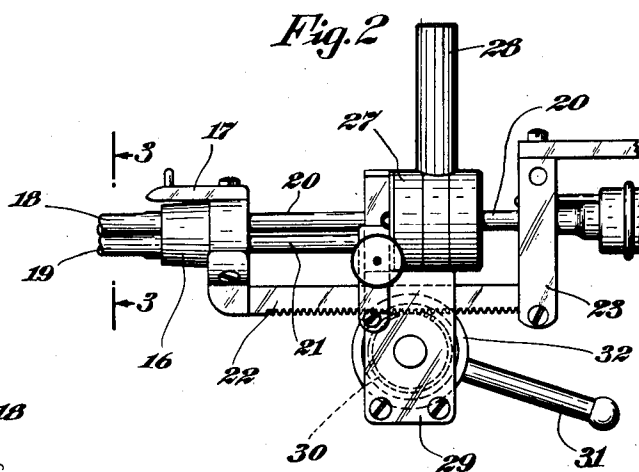
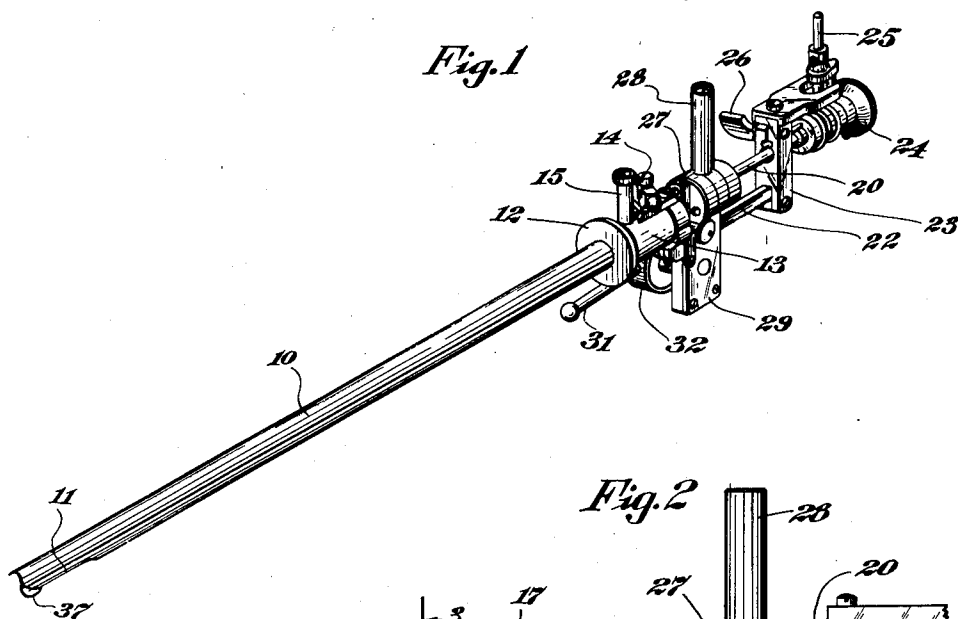
F. C. WAPPLER

1,963,636

ENDOSCOPIC INSTRUMENT AND ELECTRODE ELEMENT THEREFOR

Filed June 17, 1932

2 Sheets-Sheet 1



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ENDOSCOPIC INSTRUMENT AND ELECTRODE ELEMENT THEREFOR

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2 Sheets-Sheet 2

Fig. 5

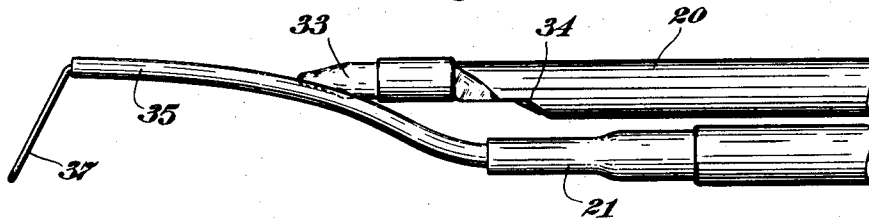


Fig. 6

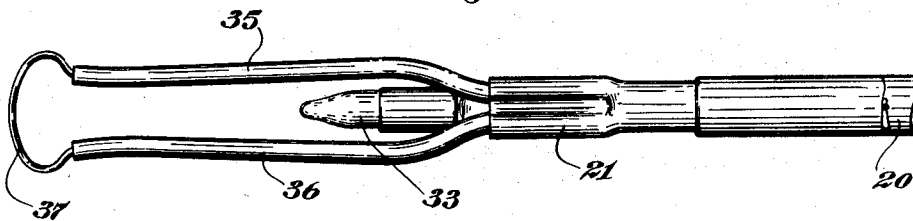


Fig. 7

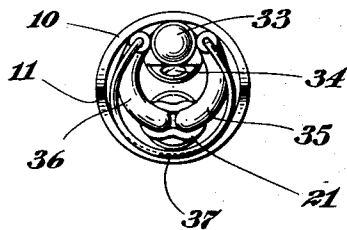


Fig. 8

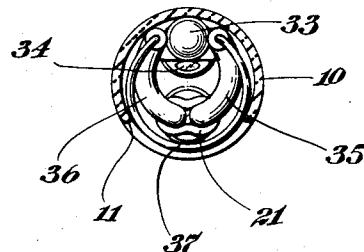
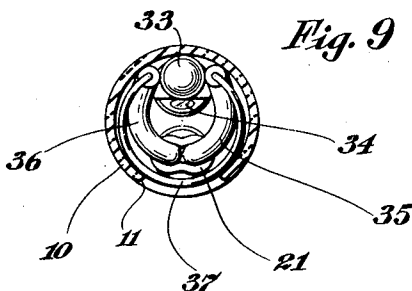


Fig. 9



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1,963,636

ENDOSCOPIC INSTRUMENT AND ELECTRODE ELEMENT THEREFOR

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Application June 17, 1932, Serial No. 617,755

5 Claims. (Cl. 174—89)

My present invention relates generally to surgical instruments, and has particular reference to an improved endoscopic instrument and to a new type of electrode element to be used there-
5 with.

It is a general object of my invention to provide an improved instrument of the type wherein a longitudinally movable electrode rod is provided with an operative loop at its forward end, the loop being arranged substantially transversely to the axis of the instrument and being adapted to project laterally out of a fenestra in an outer endoscopic tube.

It is a more particular object to provide an improved device wherein a transversely arranged electrode loop may be caused more efficiently to fulfill a contemplated cutting or resecting function in connection with internal operations. For example, where an instrument of the present type is used to resect a longitudinal channel or the like through an internal protrusion, the operative electrode loop of the present construction resects the desired channel in a more expeditious and reliable manner when the electrode
25 rod is moved longitudinally.

A further object of my invention lies in providing a device of greatly simplified character, necessitating the employment of a minimum number of parts and mechanisms, and constructed and assembled in a manner which results in economy of manufacture, compactness, ruggedness, and extreme reliability.

A particular feature of my invention lies in the provision of an arrangement whereby the operative loop is constructed to complete its cutting or resecting operation in shearing relationship with an end edge of the endoscopic fenestra through which it projects. The shearing action thus provided for is of great advantage in efficiently and reliably finishing off the cutting operation which is being performed.

A further and more particular feature of my invention lies in providing a yieldable means which constantly urges the operative loop laterally out of the fenestra, in conjunction with a means for guiding or camming the operative loop inwardly during the completion of its cutting operation, whereby the loop is brought into shearing relationship with an edge of the fenestra.

In accordance with my present invention, the yieldable means which urges the operative loop laterally out of the fenestra is associated with the operative loop itself, to the rear of the latter, and is adapted to bear against the rear wall of the
55 endoscopic tube. The term "rear wall" as used

herein and in the appended claims is intended to designate the wall of the endoscopic tube opposite the fenestra.

Another feature of my invention lies in providing an endoscopic tube of a novel character particularly designed for use in conjunction with an electrode rod and operative loop of the present character. The tube has a lateral fenestra whereof at least one edge is of insulating material; and in a preferred embodiment, it is the rear edge of the fenestra which is insulated so that the shearing operation takes place at the conclusion of a rearward sweep or movement of the electrode rod. Preferably, the entire endoscopic tube is of insulating material, so that the shearing engagement of the uninsulated operative loop with the edge of the fenestra may be effected without any interference with the desired or necessary electrical connections.

A further feature of my invention lies in the provision of an arrangement whereby the resecting operation may be constantly retained under efficient illuminated vision. More particularly, I provide an instrument wherein an illuminating telescope may be efficiently arranged along the rear wall of the endoscopic tube, with its objective positioned to command an obliquely forward field of illuminated vision out of the fenestra; and the yieldable means for urging the operative loop laterally out of the fenestra is provided in a novel and improved manner which does not interfere with unimpaired continuous visibility of the entire field of vision and of the operative loop itself.

The embodiment herein illustrated by way of example is characterized by an electrode rod which consists of an elongated body and a pair of divergent springy arms arching forwardly from the elongated body and carrying at their forward ends an operative loop of substantially U-shaped configuration. These arms are adapted to bear against the rear wall of the endoscopic tube on opposite sides of the telescope, thereby fulfilling their contemplated functions without impairing the visibility or illumination.

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 drawings, wherein—

Figure 1 is a perspective view of one type of endoscopic instrument embodying the features of my present invention;

Figure 2 is an enlarged fragmentary elevational view of a portion of the mechanism controlling the movements of the electrode rod;

Figure 3 is a fragmentary cross-sectional view taken substantially along the line 3—3 of Figure 2;

Figure 4 is an enlarged elevational cross-section of the forward end of the instrument;

Figure 5 is a view similar to Figure 4, showing the telescope and the electrode element independently of the endoscopic tube;

Figure 6 is a view taken from the bottom of Figure 5; and

Figures 7, 8, and 9 are cross-sectional views taken along the corresponding lines indicated in Figure 4, and illustrating the manner in which the operative loop is guided into shearing relationship with the fenestra.

The endoscopic tube 10 is provided at its forward end with a lateral fenestra 11. I have shown it combined with the more or less conventional type of associated parts. Thus, at its rear end it is provided with the collar 12 and with the sleeve 13, the latter being provided with an attachment means 14 of any desired character for facilitating the engagement of the inner bundle of parts. I have also shown the sleeve 13 provided with the outlet 15 which may be used for irrigation purposes.

The operative parts of the device are removably insertable into the tube 10 in the conventional manner, and those portions of the device which have a more or less material bearing upon the present invention are illustrated most clearly in Figures 2 and 3. A plug 16 is adapted to be snugly inserted into the sleeve 13, and the bifurcated projection 17 is adapted to be engaged by the device 14 to hold the parts together. Projecting forwardly from the plug 16 are the tubes 18 and 19 which need not be completely circular but may be substantially U-shaped in cross-section, as indicated most clearly in Figure 3. The tube 18 is adapted snugly and removably to accommodate the telescope 20; and the tube 19 serves as a guide for the electrode rod or elongated body 21 which is adapted to slide axially therein.

It will be understood that the bores of the tubes 18 and 19 have continuations extending through the plug 16, and in Figure 2 I have shown the manner in which the telescopic tube 20 and the rod 21 project rearwardly from this portion of the device.

Rigidly associated with the plug 16 and extending rearwardly is the rack 22; and at its rear end this rack is secured to the block 23 having an opening adapted to permit the telescopic tube 20 to pass rearwardly therethrough. The telescope terminates at its rear end in the conventional eye-piece 24, and with suitable terminal rings and insulating rings which form no material part of the present invention and which are adapted to receive a terminal post such as that indicated at 25 in Figure 1 for the purpose of permitting suitable electrical connections to be made to the illuminating lamp at the forward end of the telescope. Preferably, a thumbscrew 26 engages with an upper slit portion of the block 23 so as to clamp the telescopic tube 20 in position and prevent axial movement thereof after it is once adjusted.

The rod 21 terminates at its rear end in the assembly 27 which carries the electric terminal or binding post 28, it being understood that a suitable connection may be made to this binding post in conventional manner to establish an electrical connection between a suitable source of high-frequency resecting current and the opera-

tive electrode loop at the forward end of the rod 21. The assembly 27 is provided with a bore which permits it to slide freely on the telescope tube 20 between the limits imposed by the block 23 and the rear portion of the plug 16, the telescope tube 20 thus serving as a guide rail.

The assembly 27 is also provided with a depending portion 29 in which a pinion 30 is mounted for meshing engagement with the rack 22. A radial lever or handle 31 projecting from a control wheel 32 permits the operator to rotate the pinion 30, since the wheel 32 is mounted on the same shaft as the pinion 30, and in this way the entire assembly 27, carrying the electrode rod 21, may be shifted axially under the guidance and control of the operator. During this shifting, the lever 31 travels only through approximately 180°, the forward position being indicated in Figure 1, and the rearmost position being approximately indicated in Figure 2.

The telescope which I employ is preferably of the character illustrated and described in United States Letters Patent No. 1,680,491, having an electric lamp 33 at its forward tip and provided with an objective lens 34 slightly behind the lamp 33 and commanding an obliquely forward field of vision. The telescope is arranged closely adjacent to the rear wall of the tube 10, as illustrated most clearly in Figure 4, it being understood that the term "rear wall" relates to that portion of the endoscopic tube which is opposite the fenestra 11, as hereinbefore explained. Thus, the objective lens 34 is adapted to command an illuminated field of vision extending forwardly and laterally out of the fenestra 11.

The electrode rod consists of the elongated body 21; and at its forward end it is provided with a pair of spaced spring arms 35 and 36 whose rear portions diverge forwardly from the forward end of the body 21. These arms arch forwardly away from the body 21, as illustrated in Figures 4 and 5, so that under normal conditions, with the endoscopic tube 10 removed, the forward ends of the arms 35 and 36 lie on the opposite side of the telescope axis as compared with the side along which the rod 21 is arranged. This relationship is shown most clearly in Figure 5.

At the forward ends of the arms 35 and 36, the operative U-shaped loop 37 is mounted, and this electrode loop is arranged substantially transverse with respect to the axis of the instrument as a whole. In the embodiment illustrated, the loop 37 lies in a plane which forms an angle of approximately 60° with the axis of the rod 21, as indicated most clearly in Figures 4 and 5. It will be understood, however, that this angle may be modified to suit differing requirements, and that the term "transverse", as the same is used herein and in the appended claims with respect to the operative loop, refers to any disposition of the loop in a substantially transverse plane.

When the electrode and the telescope, and the associated parts, are inserted into the endoscopic tube 10, the parts assume the relationship shown in Figure 4, wherein it will be noted that the arms 35 and 36 bear against the rear wall of the tube 10. The loop 37 is thus constantly urged laterally out of the fenestra 11. While the electrode rod is advanced, and during most of the longitudinal movement of the loop 37, the mid-portion of the loop, constituting its outermost point, travels along a line or plane 38 which is slightly outside of the imaginary continuation of the inner surface of the fenestrated wall of the tube 10.

In the absence of my present construction and arrangement, the rearward longitudinal movement of the electrode 37, for example, during the resecting of a longitudinal channel in a protrusion or the like, would be ultimately impeded by the forward edge 39 of the fenestrated wall of the tube 10, this forward edge being the rear edge of the fenestra 11. Further rearward movement of the loop 37 would thus be impeded and no shearing action of any character would be accomplished by the loop.

In accordance with my present invention, the loop is so shaped as to be capable of effecting a shearing action in connection with the rear edge 39 of the fenestra 11; and the arms 35 and 36, in conjunction with the specially configured walls and edges of the fenestra 11, afford a means for automatically camming the loop 37 inwardly during the latter part of the retraction of the rod 21, whereby the loop is brought successively into the position shown in dot-and-dash lines in Figure 4 during the rearward movement thereof. It is to be noted that in the extreme right dot-and-dash position of Figure 4, indicated also in Figure 9, the loop 37 has been brought into direct shearing relationship with respect to the edge 39. This efficiently and reliably completes and finishes off any cut which the operative loop has been engaged in resecting, and leaves no resected matter hanging or attached to the wall from which it is supposed to be removed.

The manner in which this desirable effect is achieved is indicated most clearly in Figures 4, 7, 8, and 9. While the rod 21 is in an advanced position, the loop 37 is permitted to assume the laterally projecting positions of Figures 4 and 7, being positively urged into this position by means of the arms 35 and 36, these arms bearing against the rear wall of the tube 10 on opposite sides of the telescopic tube 20. Toward the end of the retracting movement of the rod 21, the sides of the U-shaped loop 37 engage slidably with the side walls of the fenestra 11, whereby a camming action takes place. This is due to the fact that the sides of the fenestra 11, at the rear thereof, converge rearwardly. This camming action is indicated in Figures 7, 8, and 9, and results from the fact that the loop automatically seeks to accommodate itself in the wider portion of the tube 10. In other words, as the rod 21 is retracted, the sides of the loop must either yield or the loop must move radially into the tube 10 against the yielding action of the arched springy arms 35 and 36.

As a result, the loop 37 does not terminate its rearward movement in abutting encounter with the edge 39, but, on the contrary, is guided or cammed inwardly in a gradual manner so that the rearward movement terminates in a shearing action between the loop 37 and the edge 39.

Although I have illustrated this desirable effect as being accomplished during a retraction of the rod 21, nevertheless it will be understood that under certain circumstances the parts may be so arranged that this action will take place under a forward movement of the rod 21. In such an event, the lateral fenestra 11 would not flare forwardly into the oblique relationship illustrated, but would terminate in a forward edge corresponding to the rear edge 39.

Furthermore, it will be understood that although I prefer to construct the entire tube 10 of insulating material, only the edge portion, and especially the end edge portion, of the fenestra need be of insulating material.

One of the advantages of my present arrangement lies in the constant illuminated visibility which is permitted. Although the arms 35 and 36 extend across the tube 10, from the fenestrated wall toward and into engagement with the opposite or rear wall, the visibility through the telescope is never impaired, the field of vision extending obliquely forwardly through the space between the arms 35 and 36 and out of the fenestra 11. During the rearward movements of the arms 35 and 36, they do not interfere in the least with the telescope, and bear against the rear wall of the tube on opposite sides of the telescope. The device is thus devoid of all but a minimum number of parts; the individual parts are relatively simple in structural nature; and yet a highly efficient and reliable cut, terminating in a definite shearing action, is capable of accomplishment with great facility.

It will be understood that, from certain aspects, my invention is not restricted to the type of control movement illustrated in Figures 2 and 3, and that the rack and pinion arrangement, while preferable, has not vital bearing upon the advantages achieved by my invention at the operative end of the device.

In general, it will be obvious 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. An instrument of the character described, comprising an endoscopic tube having a lateral fenestra, a longitudinally movable electrode rod in said tube and provided at its forward end with a transverse cutting loop, yieldable means carried by said rod behind said loop and adapted to bear against the rear tube wall for urging the midportion of said loop laterally out of said fenestra, the loop being so shaped that the tube wall adjacent to the rear portion of the fenestra will cam said loop inwardly against the action of said yieldable means when the electrode rod is retracted, so as to bring the midportion of the loop into shearing relationship with the rear edge of said fenestra.

2. An instrument of the character described, comprising an endoscopic tube having a lateral fenestra, a longitudinally movable electrode rod in said tube and provided at its forward end with a transverse cutting loop, a pair of spaced yieldable arms extending rearwardly from said loop and adapted to bear against the rear tube wall for urging the midportion of said loop laterally out of said fenestra, the loop being so shaped that the tube wall adjacent to the rear portion of the fenestra will cam said loop inwardly against the action of said arms when the electrode rod is retracted, so as to bring the midportion of the loop into shearing relationship with the rear edge of said fenestra.

3. An instrument of the character described, comprising an endoscopic tube having a lateral fenestra, a longitudinally movable electrode rod in said tube and provided at its forward end with a transverse cutting loop, a telescope in said tube, a pair of spaced yieldable arms arching rearwardly from said loop and adapted to bear against

- the rear tube wall on opposite sides of said telescope for urging the midportion of said loop laterally out of said fenestra, the loop being so shaped that the tube wall adjacent to the rear portion of the fenestra will cam said loop inwardly against the action of said arms when the electrode rod is retracted, so as to bring the midportion of the loop into shearing relationship with the rear edge of said fenestra. 80
- 5 4. An instrument of the character described, comprising an endoscopic tube having a lateral fenestra, a longitudinally movable electrode rod in said tube and provided at its forward end with a transverse cutting loop, yieldable spring arms carried by said loop and adapted to bear against the rear tube wall for urging the midportion of said loop laterally out of said fenestra, the sides of the loop being shaped to engage the side walls of the fenestra when the electrode rod is retracted, so as to cam the loop inwardly against the action of said arms and bring the midportion of the loop into shearing relationship with the rear edge of the fenestra. 85
- 10 5. An electrode element of the character described, comprising an elongated body, a pair of divergent springy arms arching forwardly from the forward end of said body, and an uninsulated, U-shaped, cutting loop carried between the forward ends of said arms, said loop being arranged in a plane forming an angle of approximately 60° with the axis of said body. 90
- 15 FREDERICK CHARLES WAPPLER.

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