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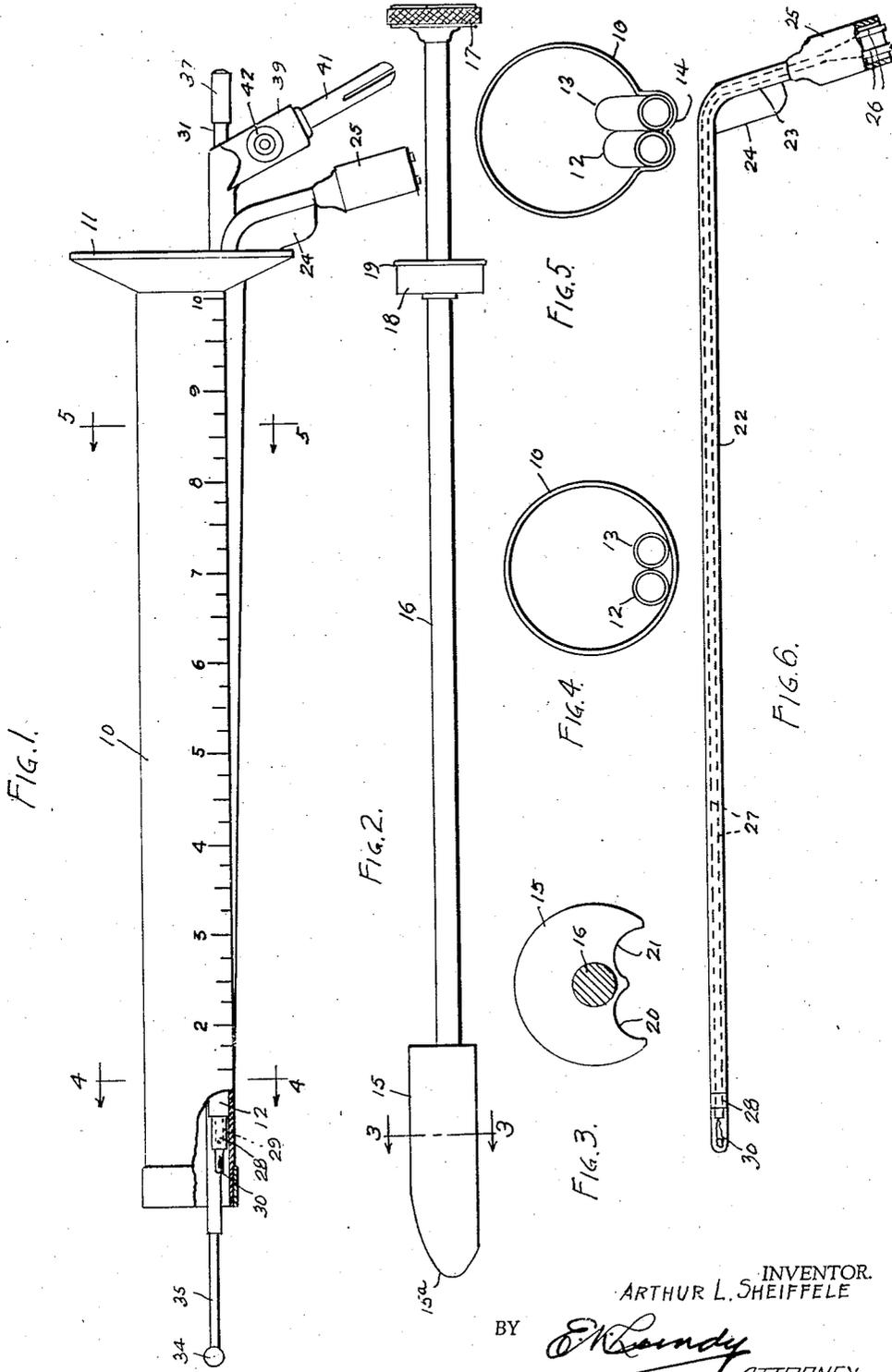
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DIAGNOSTIC AND ELECTRO-SURGICAL APPLIANCE

Filed Aug. 6, 1943

2 Sheets-Sheet 1



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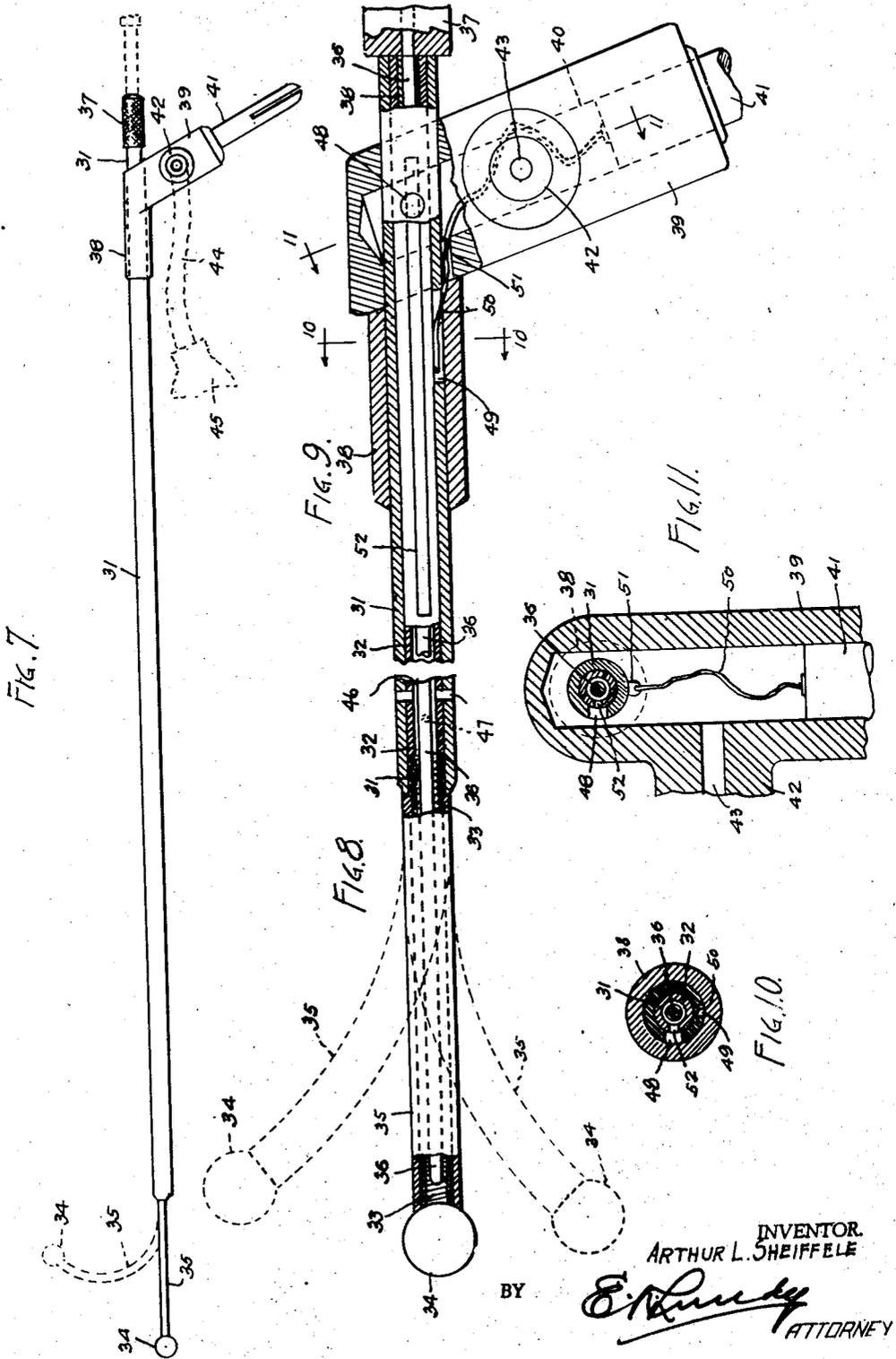
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DIAGNOSTIC AND ELECTRO-SURGICAL APPLIANCE

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2 Sheets-Sheet 2



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2,382,109

DIAGNOSTIC AND ELECTROSURGICAL APPLIANCE

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Application August 6, 1943, Serial No. 497,639

3 Claims. (Cl. 128-4)

My present invention relates generally to surgical appliances. Although this device is adapted to be used for a variety of purposes, it has been especially devised for examination, treatment and surgical procedure at the sigmoid flexure or region of the colon in the human body, and it preferably employs a radio high-frequency current which may be readily controlled by the operator at all times.

The appliance which I have invented comprises a tubular body having a suitable guideway that is adapted to receive an elongated semi-rigid conductor which carries an electrode at its distal end, said electrode being connected to the conductor by means of a readily flexible extension of conductive material which renders it capable of universal movement or adjustment within certain limits. This permits the electrode, when it is projected beyond the distal end of the tubular body, to be controlled to such an extent that it may be placed in proximity to the tissues comprised with a relatively large area within the colon. Means also are provided in connection with my surgical appliance whereby the area being examined or treated may be illuminated for observation by the operator. The electrode is adapted, among other things, to sear or coagulate the tissue in a relatively short period of time and sterilize the same, and this is performed while the wall of the colon is in a distended position and under observation by the operator who has full vision of the area under treatment. Provision is made whereby vapors, which are frequently created during treatment or operations of this character, may be vented from the cavity through the medium of a suction passageway and thus avoid any fogging of the walls of the appliance or of the lenses in an observation telescope when the latter is employed in connection with this appliance.

One of the special features of this appliance is the electrode and its associated elements. This embodies a normally curved flexible conductor member extending from the distal end of the semi-rigid conductor member, which latter member constitutes the major portion of an elongated structure. Both of these members are hollow, and there is a small rod that is moved longitudinally within the conductors and is adapted, while it is moving in the flexible conductor towards the electrode, to straighten said curved distal conductor, thereby adjusting the electrode into a variety of operating positions. Thus it will be seen that the electrode has a universal adjustment within certain limits so that it may be disposed in any posi-

tion about the axis of the semi-rigid and straight major portion of the conductor structure.

One of the aims of my improvements is to provide a surgical appliance of a novel character, and which is adapted to perform its required functions in an effective manner. Another object or aim is to provide a surgical appliance of the kind described herein that is made of sturdy and dependable parts that are capable of withstanding heavy duty and which may be readily sterilized by boiling or by other methods. The improvements which I have described herein are of compact arrangement; they are convenient to operate and adjust to the desired positions; and the appliance is economical to produce so that it may be manufactured and sold at a competitive retail price to the user.

The before-mentioned and other objects, aims, and advantages of my improvements will be obvious to persons who are skilled in the art after the construction and operation of this appliance is understood from the within description. It is preferred to practice my invention in substantially the manner hereinafter fully described and as more particularly enumerated in the appended claims, and for a better understanding of my said improvement, reference is now made to the accompanying drawings that form a part of this specification.

In the drawings:

Figure 1 is a view in longitudinal side elevation of the surgical appliance which is shown with suitable instrumentalities in cooperation therewith.

Figure 2 is a longitudinal side-elevation of the obturator device which is used in connection with this surgical appliance, the device being removed from the tubular body of the appliance.

Figure 3 is an end view of the obturator head 40 looking at the same on the transverse plane of line 3-3, Figure 2.

Figure 4 is a transverse section of the main tubular body member of the appliance, the view being on the plane of line 4-4, Figure 1, with the several parts omitted.

Figure 5 is a view similar to Figure 4, taken on the plane of line 5-5, Figure 1.

Figure 6 is a longitudinal side elevation of means for providing illumination at the distal end of the appliance.

Figure 7 is a longitudinal side elevation of the electrode and its carrier removed from the main tubular body member.

Figure 8 is an enlarged detail in longitudinal

section of the electrode and the distal portion of the unit of which it forms a part.

Figure 9 is a similar longitudinal section of the proximal portion of the unit in which the electrode is comprised, being enlarged to the same scale as Figure 8, the axis of the structure shown in Figure 9 being in longitudinal alinement with the axis of the distal portion which is shown in Figure 8.

Figure 10 is a transversical section taken on the plane of the broken line 10—10 in Figure 9.

Figure 11 is a fragmentary vertical section taken on the plane of the broken line 11—11 in Figure 9, portions of the head at the proximal end of the electrode and its carrier being broken away to simplify the showing.

The surgical appliance which has been shown herein is especially designed for examination, treatment and surgical procedure in cavities of the human body, particularly in the intestinal tract, and this appliance is adapted to illuminate the area in question. It will be understood that this is but one of a number of uses to which the appliance may be put without modification of its general structure and assembly.

The accompanying drawings are to be understood as being more or less schematic for the purpose of illustrating a typical or preferred embodiment of my improved surgical appliance and its various parts, and in said drawings the same reference characters are employed for the purpose of identifying the same parts wherever such parts appear in the different views thereof.

My surgical appliance, as shown in the accompanying drawings, comprises an elongated body 10 in the form of a tube that is provided at its proximal end with an annular flared flange 11 that may be utilized for detachably mounting a suitable handle, or telescope, or other accessory which is not shown. The lower segment of this tubular body is provided with a pair of longitudinally extending pipes 12 and 13 that are preferably disposed alongside each other with their axes parallel to each other. These pipes 12 and 13 are of different diameters and constitute guides to receive certain instrumentalities that are constituent parts of the appliance and are adapted for cooperative use as will later be explained herein. The axes of these guide pipes are not parallel with the axis of the tubular body but they are oblique thereto and are convergent in a direction towards the distal end of the body so that at the proximal portion of the body the pipes 12 and 13 are disposed outside the circumference of the body while at the distal portion said pipes are inside or within the tubular body as shown respectively in Figures 5 and 4. In order to take care of this particular arrangement, the tubular body is provided with a gradually tapering longitudinal enlargement or channel 14 extending outwardly from its circumference to provide a convenient seat in which the pipes 12 and 13 are placed side by side and brazed or soldered in their respective permanent positions.

The use of this appliance in the colon requires that its distal end be inserted through the anus and rectum and inwardly to the sigmoid flexure where the surgical procedure takes place, and this insertion should be readily accomplished without injury to the membrane or tissue past which it is moved. To accomplish this, the distal end of the tubular body is closed by an obturator which comprises a head 15 having an acorn-shaped apical end 15a. Said head has an outside

diameter but slightly less than the inside diameter of the tube 10, and it is carried upon the end of an elongated rod 16, while the other end of this rod, which is long enough to protrude beyond the proximal end of the tube, is provided with a knurled handle 17 for easy manipulation. At the proper location on the rod there is a stopper or plug 18 that will enter the proximal end of the tubular body and has an annular bead or flange 19 that is adapted to abut the end of the tube or its flange 11 to maintain the obturator in a proper position with its conical end projected beyond the end of said tube. Parallel concave grooves 20 and 21 are made in the circumference of the head 15 to permit the latter to move in the tubular body and escape or accommodate itself to the portions of the pipes 12 and 13 where the latter project into the tube 10. It will be understood, that after the appliance has been inserted to the desired location, the obturator is withdrawn from the tubular body 10 which will leave the latter free for the operator to inspect and operate upon or treat the tissue in the cavity when the latter has been illuminated.

I have shown, in Figure 6, one of several means which may be employed for illuminating the tissue or membrane that is contiguous the distal end of the appliance, but it will be understood that other similar devices may be used for this purpose, such for example as a lamp which may be mounted upon the flared flange 11 on the main tube 10. This illuminator device consists of a pipe 22 having a laterally bent end portion 23 that is reinforced by a web 24, said bent portion terminating in a cylindrical bell-shaped end 25 that is open at its outer end where it houses a pair of electric terminals 26, 26, which are separated from each other by insulation and are connected to the ends of small electric conductor wires 27, 27. At the other end of the pipe 22, a sleeve 28 of insulating material projects axially therefrom and envelops a small electric socket 29 in which a miniature electric light lamp 30 is mounted. The terminals of the socket are electrically connected to the conductors 27, 27, and the latter are maintained in spaced relation to each other within the tube 22 by means of suitable insulation. As seen in Figure 6, the lamp 30 preferably projects out of and beyond the insulation sleeve and when the tube 22 is inserted its full distance into the larger guide 12 said lamp will be disposed a slight distance inside the distal end of the tubular body 10 of the appliance as shown in Figure 1, and the rays of light from the lamp will be emitted from the body to illuminate the membrane or tissue adjacent thereto. It will be understood that the lateral end portion 23 of the tube 22 affords a convenient handle to be grasped in inserting the lamp and its mounting into the guide 12 and for removing the lamp therefrom, and it also will be noted that the leading or free edge of the web 24 constitutes a stop that limits the inward movement of the lamp to position the latter at its desired location within the tubular body 10.

The guide pipe 13 is adapted to receive and hold an instrument or accessory that is supplied with an electric current of the high-frequency radio type which is fed to the proximal end of the instrument by a suitable feed cord (not shown) and it is utilized at the distal end of the instrument by means of an electrode which is heated thereby. A device such as above suggested is illustrated in elevation in Figure 7, and the de-

tails thereof are shown in enlarged form in Figures 8, 9, etc.

The device which is shown comprises an elongated tube 31 of insulation such as hard rubber, Bakelite (a resinous or phenolic condensation product), or any other suitable material that may be adapted for the purpose desired. The diameter of the tube 31 is such that said tube may be readily inserted into the guide pipe 13, and it is of such length that its ends will protrude beyond the ends of the tubular body 10 preferably in the manner shown in the drawings (Figure 1), wherein the protruding portion of the proximal end is considerably longer than at the distal end so that said proximal portion may be provided with instrumentalities for manipulating the instrument.

As shown in enlarged detail in Figure 8, the hard rubber or Bakelite tube telescopes upon and envelops an elongated tube 32 of suitable conductive material, or metal, and its end (to the left in Figures 7 and 8), carries a flexible member 33 that is adapted to be moved or adjusted into a variety of positions relative to and about the axis of the instrument. This member 33 is preferably a wire of fine or small gauge that is wound in a spiral to form a flexible hollow cylinder. The wire is preferably spring metal, and prior to being tempered, and after the spiral has been formed, the member is shaped into an arcuate or curved form which will become permanent after the tempering process has been completed, with the result that said member has a normally curved axis such as suggested in dotted lines in Figure 8 of the drawings.

One end of the flexible member 33 is inserted into the bore of the metal tube 32 and is brazed, soldered or otherwise permanently attached so that the hollow interior of the coil forms a continuation of the bore of the metal tube 32, the other or free end of the flexible member has an electrode 34 anchored to it in any suitable manner to close the outer free end and also to be in electrical connection with the metal coil 33 that forms the flexible member, so that the electric current is transmitted from the metal tube 32 to the electrode 34. As illustrated in the drawings, the electrode 34 is spherical or globular in shape, but it will be appreciated that other shapes may be used if it should be dictated for a particular type of use. The high-frequency radio current which is transmitted along the metal tube 32 and through the flexible extension (coil) 33 to the electrode 34, heats the latter to the desired temperature for the surgical procedure for which the instrument has been designed, and when said electrode is placed in contact with or close to the tissue it will cause a desiccation or coagulation thereof. In order to protect and insulate the coiled wire extension 33, it is preferably surrounded by a jacket or sleeve 35 of relatively soft or elastic rubber between the terminal electrode 34 and the end edge of the hard-rubber or Bakelite tube 31 so that said sleeve will readily conform to the shape of said flexible extension 33 and move with it when the latter is adjusted.

The normally curved or arcuate extension or flexible member 33 which carries the electrode 34 at its end is adapted to be adjusted, by a warping action, into a variety of positions around the axis of the instrument and it is therefore capable of universal movement within certain limits. This adjustment or warping is accomplished by inserting a straight element longitudinally through the metal tube 32 and into the hollow

flexible extension which will progressively straighten the curve or arc of said extension beginning at its anchored end near the distal end of the inner metal tube 32 of the instrument and moving towards the electrode carried at the end of the flexible member 33. This warping will move the electrode 34 towards the axis of the instrument until it has been aligned therewith.

The element which I prefer to employ for performing the function of warping the flexible extension 33 is an elongated wire or small rod 36 that is of less diameter than the inside diameter of the tube 32, and it is of such length that it will extend from the free end portion of the flexible extension 33 and project from the proximal end of said tube 32 where it is provided with an enlargement 37 of suitable insulating material which constitutes a finger-grip by which the rod is manipulated. An elongated tubular gasket 38 surrounds the portion of the rod 36 adjacent the finger-grip enlargement 37, which gasket is of pliable material of a diameter to snugly fit within the proximal end portion of the tube 32 and thereby close the latter but at the same time permit the rod to be inserted into the tube and to be adjusted longitudinally therein while it is performing its function of warping the flexible extension 33.

The end of the instrument opposite the electrode is inserted longitudinally through and anchored in the lateral horizontally disposed arm 38 of a substantially L-shaped holder or handle formed of hard-rubber or Bakelite, the other or longer arm 39 of said holder being disposed oblique to the arm 38 and being provided with a longitudinal axial bore 40 that extends to near the top thereof. The lower open end of said bore 40 has an electric terminal connector 41 inserted and anchored in it with a portion projecting axially therefrom. There is a laterally disposed vent stub 42 integral with the arm 39 of the L-shaped holder, which said stub has a relatively small bore 43 that communicates at its inner portion with the bore 40 of the holder arm 39, and the tube 44 of a suction-bulb 45 is adapted to be engaged over said stub 42, the purpose of which will later be explained herein.

The tubular portion of this instrument, which comprises the telescoped outer insulating tube 31 and the inner metal tube 32, is of a length so that, when the instrument has been inserted into its guide-pipe 13 until the holder arm 38 abuts the flange 11 on the obturator cylinder 10, the opposite ends of said tubes 31 and 32 will project out of the guide-pipe 13 and protrude slightly beyond the adjacent end of the obturator cylinder 10. There is a suitable clearance between the rod 36 and the inner metal tube 32, so that a passageway 46 is provided within the elongated portion of the instrument which said passageway 46 is utilized to effectively vent the vapor, smoke, and the like, which may be created in performing the surgical procedure within the cavity. In order that this passageway 46 may communicate with the cavity, the tubes 31 and 32 are provided with one or more transversely disposed bores 47 at a location beyond the end of the guide-pipe 13. The opposite or outer end portions of the tubes are provided with a discharge port 48 through which the vapor, etc., is emitted into the bore 40 of the arm 39 of the holder, and from thence said vapor is withdrawn through the hollow vent stub 42 by the manipulation of the suction bulb.

A recess or slot 49 is formed longitudinally in the insulating outer tube 31, which said slot extends with the holder arm 38 and the latter covers said slot. A conductor wire 50 is placed in said slot in contact with and is anchored to the portion of the metal inner tube 32 which has been exposed through said slot, and the other end of said conductor wire extends into the bore 40 of the holder arm 39 and is suitably anchored to the terminal connector or plug 41 at the inner end of the latter. In order to accommodate this conductor wire 50, the interior of the holder, alongside the tubular members 31 and 32 of the instrument, is channeled or grooved as at 51 to provide for the disposition of the said wire 50. In this arrangement the electric current received by the terminal plug 41 passes through successive portions of the instrument, such as the wire 50, the metal inner pipe 32, and the flexible conductor 33, to the electrode 34.

Communication between the passageway 46 and the bore 40 of the arm 39 of the proximal head is established by forming a long longitudinal slot 52 in the conductor tube 32, which slot registers at one end with the small discharge port 48 in the insulating tube which leads into bore 40 of the head. At its other end said slot 52 extends beyond the inner end of the tubular gasket so that the vapor or the like will be by-passed alongside said gasket to the port 42.

What I claim as new is:

1. In a surgical appliance, a flexible hollow conductor of normally arcuate form; a hollow rigid conductor anchored at one end of said arcuate conductor in tangent relation thereto, said rigid conductor having vent ports at its distal portion; an electrode at the free end of said arcuate conductor and normally eccentric to the axis of said rigid conductor; a rod movable longitudinally in said conductors, said rod during movement in said flexible conductor adapted to straighten the latter to move said electrode towards the axis of said rigid conductor, said rod having less diameter than the bore of said rigid conductor to provide an air-passageway therebetween communicating with said vent ports; and suction means communicating with said air-passageway at the proximal portion of said rigid conductor, said means adapted to exhaust vapor and the like from said air-passageway.

2. A surgical appliance embodying a cylindrical body normally open at its ends; guideways within said body; a flexible hollow conductor normally of arcuate form; a hollow rigid conductor anchored at one end to said arcuate conductor and extending tangent thereto; insulation enveloping said conductors and providing a unit removably inserted in one of said guideways; vent ports in said unit adjacent the distal portion of said cylindrical body; an exposed electrode at the free end of said arcuate conductor and normally concentric to the axis of said rigid conductor; a rod movable longitudinally in said conductors and in spaced relation to said rigid conductor to provide a passageway therebetween, said rod during movement in said flexible conductor adapted to straighten the latter to thereby move said electrode towards the axis of said rigid conductor; suction means communicating with said passageway at the proximal portion of said unit, said means adapted to exhaust vapor and the like from said passageway; and a light unit removably inserted in the other guideway, said light unit embodying an insulating tube; an electric lamp at the distal end of said tube; and electric conductors within said insulating tube and in circuit with said lamp.

3. A surgical appliance comprising a cylindrical body normally open at its ends; a tubular guideway in said body; a bowed hollow conductor of flexible material; a tubular conductor anchored at one end to said bowed conductor; insulation enveloping said conductors for effecting a unit removably inserted in said guideway to project the flexible conductor out of the distal end of said body; means venting said unit adjacent said flexible bowed conductor; an electrode at the outer end of said bowed conductor; a rod in said conductors, there being a passageway between said rod and said tubular conductor, said rod adapted for movement into said bowed conductor to effect a radial movement of said electrode towards the axis of said unit; means for evacuating said passageway through the proximal portion of said unit; and means removably inserted in said body for providing illumination adjacent the distal end thereof.

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