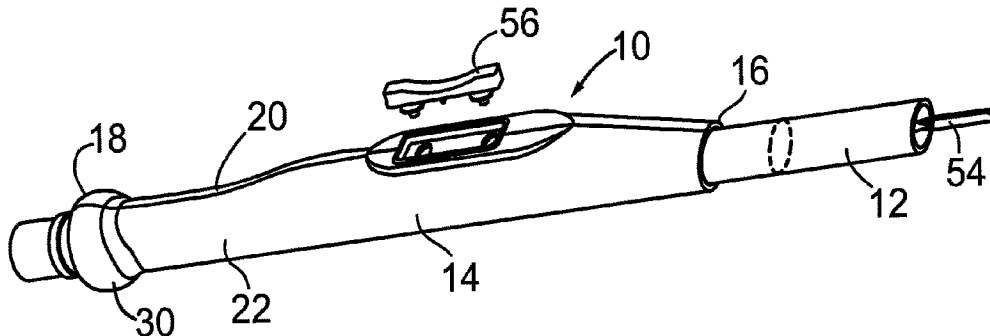




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(54) **Titre : CRAYON ELECTROCHIRURGICAL REGLABLE**
 (54) **Title: ADJUSTABLE ELECTROSURGICAL PENCIL**



(57) **Abrégé/Abstract:**

An electro-surgical pencil for use in performing surgery on a surgical site includes a main body forming a handle grippable by user and having open front and rear ends. The pencil has a vent tube which is open at its forward end, mounted in an airflow vent of the body, and slidable therein. The tube is adjustable in its longitudinal direction from a retracted position to various extended positions. An elongate electrode is mountable in the tube and independently slidable therein. The electrode is adjustable in its longitudinal direction from a retracted position to various extended positions where a forward section of the electrode projects from the open forward end of the tube. The electrode tool is adjustable by manually pulling on a projecting forward section of the electrode.

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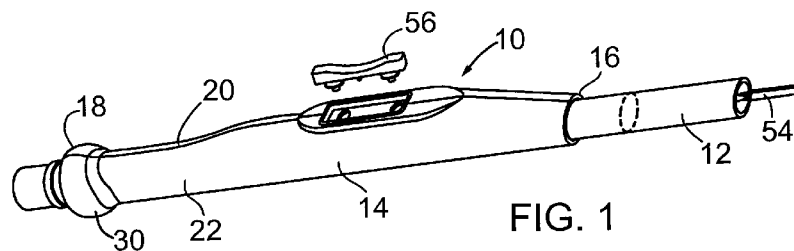


FIG. 1

(57) Abstract: An electrosurgical pencil for use in performing surgery on a surgical site includes a main body forming a handle grip-
pable by user and having open front and rear ends. The pencil has a vent tube which is open at its forward end, mounted in an air-
flow vent of the body, and slidable therein. The tube is adjustable in its longitudinal direction from a retracted position to various ex-
tended positions. An elongate electrode is mountable in the tube and independently slidable therein. The electrode is adjustable in its
longitudinal direction from a retracted position to various extended positions where a forward section of the electrode projects from
the open forward end of the tube. The electrode tool is adjustable by manually pulling on a projecting forward section of the elec-
trode.

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ADJUSTABLE ELECTROSURGICAL PENCIL

The present invention relates to electrosurgical instruments and more particularly to electrical surgical pencils for cauterizing tissue and evacuating smoke from a surgical site.

5

BACKGROUND OF THE INVENTION

The coagulation of blood vessels is a necessary part of medical surgery and can be performed by an electrosurgical tool commonly known as an electrosurgical pencil or coagulator pencil. In this type of pencil, an electrically conductive metal tip either in the form of a blade or a needle extends outwardly from the forward end of the body of the pencil, the latter acting as a hand grip for a surgeon using the pencil. In use, the tissue of a patient is electrically connected to one side of an electrosurgical circuit, and the electrically conductive tip is connected to the other side of this circuit.

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15 When the metal tip touches or is near the tissue at the surgical site, a high frequency electrical current flows from the electrode to the tissue, thus coagulating and cauterizing the tissue. Use of the aforementioned electrosurgical pencil produces small plumes of smoke which generally must be removed from the site. This smoke is offensive because of its odor and it is potentially dangerous to medical personnel. Also evacuation of the smoke is very desirable so that the surgeon's view of the operation site remains relatively unobscured.

20

Recent U.S. patent no. 6,616,658 which issued to the present applicant describes an electrosurgical pencil of the aforementioned type. This known pencil has a main body portion forming a handle grippable by a user and having an electrode end and an exhaust end. This pencil comes with a metal electrode tip having a plastic base and removably mounted in the main body portion. There is an electrical switch in the form of a double-throw rocker switch mounted on a small circuit board that is in turn mounted within a passage formed in the main body. An elongate

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substantial unobstructed airflow vent is disposed within the body portion so as to extend from the electrode end to the exhaust end thereof.

More recent U.S. patent no. 7,537,594 to J.D. Sartor describes an electrosurgical suction coagulator that includes a handle and an elongate
5 tube electrode or conductive suction tube extending from a front end of the handle. The suction tube has a closed distal end and an elongate slot disposed therealong for slidably receiving a needle electrode which is selectively extendable relative to the closed distal end to facilitate precise dissection. An aspiration port is disposed along a side of the suction tube
10 for removing surgical fluids. In one version of this known coagulator the suction tube is slidingly and rotatably received within a channel formed in the handle of the device. A control rod is mechanically coupled to the suction tube and can be manipulated by the user to extend, retract and/or rotate the suction tube. The user can also manipulate the needle electrode
15 via another control rod which operates in a similar manner.

The electrosurgical pencil described herein has both an elongate vent tube which can be readily adjusted in its longitudinal direction manually by the surgeon and also an elongate electrode tool which is adjustable independently in its longitudinal direction by manually pulling on a
20 projecting forward section of the electrode tool.

SUMMARY OF THE DISCLOSURE

In accordance with one aspect of the present invention, an electrosurgical tool for use in performing surgery on a surgical site includes a main body
25 forming a handle for a user and having a first end forming a front opening and an opposite second end forming an exhaust opening. The main body defines an airflow vent extending from the first end to the second end, the latter end being connectable for fluid communication via a flexible tubing to a suction source in order to permit evacuation of surgical smoke and debris.
30 An elongate vent tube is mounted in the airflow vent and slidable therein.

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The position of this tube is adjustable in its longitudinal direction from a retracted position to a selected one of a plurality of extended positions where a forward end of the vent tube is located forwards of the first end of the main body. There is also an elongate electrode suitable for performing
5 electrosurgery mounted in the vent tube and independently slidable therein. The position of this electrode is adjustable in its longitudinal direction between a retracted position and a selected one of a plurality of extended positions where a forward section of the electrode projects forwards from both the first end of the main body and the forward end of the vent tube.
10 The tool includes an electrical switch for the tool connectable to an electrical control for the tool and a wire connector attached to the electrode adapted to electrically connect the electrode to the electrical control. The tool is characterized in that the electrical switch is mounted on the body portion, the position of the electrode is adjustable by pulling on a projecting forward
15 section of the electrode, and the vent tube is open at its forward end.

In an exemplary version of this electrosurgical tool, an electrically insulating electrode support member is mounted on a rear section of the electrode. This support member has radically projecting arms which engage an interior surface of the vent tube in a manner causing a friction fit between the arms
20 and the interior surface.

According to another aspect of the present invention, an electrosurgical tool for use with a power source and a suction source includes an elongate body forming a handle for a user and an airflow vent extending from an open first end to an open second end which is connectable during use of the tool to
25 the suction source. An elongate vent tube having a front end and rear end section open to the airflow vent is slidably mounted in the airflow vent for longitudinal movement. The position of the vent tube is adjustable longitudinally relative to the body. The vent tube has a front end section which projects forwardly from the first end of the body by an amount which
30 is adjustable by a user of the tool. There is also provided an elongate electrode for performing surgery mounted in the vent tube and movable

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longitudinally relative to both the vent tube and the body. The electrode in use has a forward section projecting from the front end of the vent tube and is connected to the power source. This electrosurgical tool is characterized in that the front end of the vent tube is open and a support device is mounted on and slidably supports a rear section of the electrode in the vent tube. The support device engages the vent tube so as to allow limited sliding movement of the support device and the electrode along the vent tube in the longitudinal direction.

In an exemplary version of this tool, the support device is a tubular support having radially projecting arms which engage an interior surface of the vent tube creating a friction fit between the arms and the interior surface.

In a still further embodiment of the present invention, an electrosurgical tool for use with an electrical power source and a suction source includes a body forming a handle for a user and an airflow vent extending rearwardly from an open front end of the body and having an outlet connectable to the suction source. The tool has an elongate vent tube for evacuating smoke or debris from a surgical site, this tube having a front end and outlet opening into the airflow vent. The vent tube is slidably mounted in the airflow vent for longitudinal movement and has a front section projecting forwards from the front end of the body. The length of the front section is manually adjustable by a user of the tool. An elongate electrode device for performing a surgical operation is mounted in the vent tube and slidable therein in the longitudinal direction relative to both the vent tube and the body. The electrode device in use projects from the front end of the vent tube and is operatively connected to the power source. This electrosurgical tool is characterized in that the front end of the vent tube is open and a friction mechanism mounted in the body for causing the vent tube normally to maintain a selected position relative to the body. The friction mechanism includes a friction member having a relatively high friction surface engaging one side of the vent tube. The tool also has a slide restricting mechanism for limiting sliding movement of the electrode device in a longitudinal

- 5 -

direction relative to the vent tube and the body. The slide restricting mechanism acts to restrict movement of the electrode device unless sufficient force is applied to the vent tube in the longitudinal direction.

5 In one exemplary version, the friction member is a rubber or rubber like member mounted in a chamber inside the body portion so that this member is pressed against one side of the vent tube.

10 In one version of this tool, the slide restricting mechanism includes a series of ridges formed on one exterior side of the vent tube. A longitudinal slot to accommodate an attachment device is formed in the vent tube in the region of these ridges. An attachment device extends from one side of a rear section of the electrode and through the slot so as to engage the series of ridges.

15 Other advantages, features and characteristics of the present electrosurgical pencil will become apparent upon consideration of the following detailed description and the accompanying drawings.

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BRIEF DESCRIPTION OF THE DRAWINGS

Reference will now be made, by way of example, to the accompanying drawings which show sample embodiments of the present application, and in which:

- 5 Figure 1 is a perspective view of an electrosurgical pencil constructed according to the present invention, this view being taken from above and from the right side;
- Figure 2 is a top view of the electrosurgical pencil;
- Figure 3 is a longitudinal vertical cross-section of the pencil taken along the
10 line III-III of Figure 2 with the vent tube not shown in cross-section;
- Figure 4 is a longitudinal cross-section similar to Figure 3 but showing the vent tube in cross-section;
- Figure 5 is a top view of the vent tube shown separately;
- Figure 6 is a side view of the vent tube showing interior details in dash lines;
- 15 Figure 7 is a front end view of the vent tube;
- Figure 8 is a detail perspective view of a rear section of the vent tube, this view being taken from above and from the rear of the tube;
- Figure 9 is a perspective view of a tubular support member mounted at the rear end of the electrode;
- 20 Figure 10 is a side view of the support member of Figure 9;
- Figure 11 is a front end view of the support member of Figure 9;
- Figure 12 is a first side view of a metal connector for attaching a wire to the electrode;
- Figure 13 is a second side view of the metal connector as seen from the
25 right side of Figure 12;

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Figure 14 is a detail perspective view of one-half of the inside of the main body of the pencil, this view showing the region where the circuit board and electrical switch are mounted;

5 Figure 15 is another detail perspective view of one-half of the inside of the main body portion of the pencil showing the region where the circuit board and switch are mounted;

Figure 16 is a cross sectional detail showing a ball joint for connecting a rear end socket section of the pencil to flexible tubing;

10 Figure 17 is a detail view in perspective of one-half of the socket section formed at the rear end of the main body portion;

Figure 18 is a detail view in perspective of the other half of a socket section at the rear end of the main body portion; and

15 Figure 19 is a partial cross section of another embodiment of an electrosurgical pencil according to the invention with the right half of the pencil (bottom half as viewed in Figure 19) shown in cross section to show internal features

Figure 20 is a longitudinal side view of the vent tube used in the pencil of Figure 19;

20 Figure 21 is a perspective view of the vent tube shown in Figure 20, this view being taken from above and from the rear end;

Figure 22 is a longitudinal cross section of the second embodiment taken along the line XXII-XXII of Figure 19;

Figure 23 is a perspective view partly in vertical cross section illustrating the mounting of a circuit board and switch in the main body of the pencil;

25 Figure 24 is a detail side view of a spring clip attachment that connects to the rear end of the electrode blade in the embodiment of Figure 19;

Figure 25 is a front end view of the pencil of Figure 19;

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Figure 26 is a detail elevation showing how ratchet teeth on the vent tube are engaged by the spring clip attachment on the blade; and

Figure 27 is a transverse cross section of the pencil of Figure 19, this view being taken along the line XXVII-XXVII of Figure 19.

5

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Figures 1 to 4 illustrate an exemplary embodiment of an electrosurgical pencil 10 constructed in accordance with the invention. Figures 5 to 8
10 illustrate an elongate vent tube 12 for use in the pencil 10. The electrosurgical pencil 10 is for use in performing surgery on a surgical site, this pencil including a main body portion 14 forming a handle grippable by a user, for example a surgeon. The main body portion is shaped for ease of comfort by the user. The body portion 14 includes an open electrode end 16
15 and an open exhaust end 18. The main body portion is made from a suitable plastic material, such as polyethylene, and it can be constructed from two half sections 20,22 that extend the length of the main body portion. These half sections can be rigidly and permanently attached to each other by such known methods as ultrasonic welding or adhesive
20 bonding. It should be noted that the pencil 10 is intended for one time use only and is disposed of after surgery.

The main body portion has an internal longitudinal wall structure 24 that together with outer walls of the half sections 20,22 form an elongate airflow vent 26 extending from the electrode end 16 to the exhaust end 18. As
25 illustrated in Figure 5, the vent 26 has a wider section 28 adjacent to the exhaust end and this section includes a rounded ball socket 30 which receives a separate ball-swivel member 32 shown in greater detail in Figure 16.

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The main body portion includes transverse support walls 36,38,40 viewable in Figure 4 plus a couple of short transverse walls 48,50 visible in Figures 14 and 15. The short transverse walls 48,50 support a circuit board 52 illustrated in Figures 3, 4 and 23. In an alternate construction, the walls 48, 50 can be omitted. The circuit board is for regulating and controlling electrical operation of an elongate, heatable electrode tool 54 which either can be in the form of a scalpel or blade (as shown) or a needle. An electrical switch mechanism 56 is mounted on the main body portion 14 so as to be operable externally on the main body portion and the circuit board is operated by this switch mechanism. The switch 56 can be a rocker switch similar to that used in applicant's prior U.S. Patent 6,616,658. The switch 56 is a single-pole, double-throw rocker type electrical switch mounted on top of the body portion and above the circuit board 52. The illustrated switch has two downwardly projecting pins 58, 60 which project through two holes in a recessed section 62 of the main body portion. Round holes 64, 66 are formed near opposite ends of the recessed section 62. Only one-half of each of these holes is shown in Figures 14 and 15. In use, the forward end of the switch can be pressed by the surgeon to provide a higher frequency signal to the electrode tool 54 for cutting tissue and the rearward end of the switch 56 is pressed to provide a lower frequency signal to the electrode tool for cauterizing tissue. The illustrated exemplary switch shown in Figure 2 has molded lettering CUT and COAG formed thereon to clearly indicate these two switch functions.

As illustrated in Figures 3 and 22, an insulated wire 70 enters an upper section of the main body portion through the ball-swivel member 32 and is connected to the circuit board 52. The wire is electrically connected to one of the terminals operated by the electrical switch mechanism while another terminal is connected electrically to the electrode tool by means of a second insulated wire 72 shown in Figures 4 and 22. The wire 72 is relatively thin so that it is highly flexible and bendable during use of the pencil.

- 10 -

Figures 5 to 8 illustrate an exemplary form of vent tube 12 which is preferably made of transparent plastic and has an open front end 90 and an open rear end at 92. If desired, the front end can be cut or formed at an acute angle to the longitudinal axis of the tube. Smoke from a surgical site can pass through the entire length of this vent tube. Except for a short rear end section, the tube has a circular transverse cross-section. Located at or near the front end of the tube is an eyelet guide 180 having a circular passage 182 through which the electrode tool extends as illustrated in Figure 4. The passage is formed by a cylindrical section 184 which is coaxial with the central longitudinal axis of the tube. Projecting radially outwardly from the cylindrical section are integral connecting webs 186. The illustrated embodiment has three such webs but there could be fewer or more than three. Gaps or openings are formed between the webs to allow for passage of smoke, etc. into and through the vent tube. The illustrated tube is formed with a longitudinal groove 188, the rear end of which is clearly visible in Figure 8. This groove extends a substantial portion of the length of the vent tube and its purpose is explained hereinafter. Its front end at 191 acts as a stop to limit forward movement of the vent tube as explained below. A rear stop member 193 can be mounted in a slot near the rear end of the groove to prevent the electrode from exiting the rear end of the tube.

A tapering slot 190 is formed on a rear end section of the tube as shown in Figure 5 and 8. The slot has a rounded forward end at 192. The function of this slot is to accommodate passage of the insulated wire 72 that is connected to the electrode tool. The slot allows the wire to pass upwardly for connection to the circuit board as illustrated in Figure 4 and prevents the tube from interfering with the wire, particularly when the tube is moved rearwardly. Also the exemplary tube is formed with a downwardly projecting rib 194 that is parallel to and below the aforementioned groove 188. This rib can slide along the matching groove 188 formed along the bottom of the body portion 12 and this engagement both prevents

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rotation of the tube relative to the body portion and also limits outward movement of the vent tube when the front end of the rib meets the front end 191 of the groove.

The rear end of the electrode tool 54 is supported in the tube by an
5 electrode support member 200 shown separately in Figures 9 to 11 and shown mounted on the rear end of the electrode tool in Figure 4. The exemplary support member has a tubular body 202 having a passageway 204 formed therein and extending the length of the tubular body. The tubular body can slide over the rear end section of the electrode and it is
10 rigidly attached to the electrode via a metal connecting sleeve 218(described below) so that it is slidable therewith and will not rotate on the electrode. The support member 200 has radially projecting arms 206,208 and 210 which extend at an acute angle to the longitudinal central axis of the tubular body. The arms are angled rearwardly towards the rear
15 end 212 of the tubular body. The arm engages an interior surface 214 of the vent tube in a manner causing a friction fit between the ends of the arms and the interior surface. The exemplary support member 200 is made of an electrically insulating plastic and this plastic is chosen so that the three arms are somewhat resilient or bendable. This way the arms are made to
20 press against the interior surface of the tube. The result is that the electrode tool normally maintains a selected position in the longitudinal direction thereof relevant to the vent tube. In order words the friction between the ends of the arms and the vent tube must be overcome by the user of the pencil in order to slide the electrode tool relative to the vent
25 tube. It will be understood that although only three arms are shown in the Figures, it is possible for the support member to have more than three arms but the gaps between the arms must be sufficient to allow for proper flow of smoke and fluids through the vent tube.

The exemplary support member 200 has an arm 210 that projects
30 rearwardly and outwardly a greater distance than the other two arms because the arm 210 is intended to slide along the aforementioned groove

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188 in the vent tube. The engagement between the arm 210 and the groove prevents rotation of the electrode about a central longitudinal axis of the vent tube. This can be desirable, particularly if the outer end section of the electrode is not circular, for example if it is blade shaped and the blade
5 is to be maintained in a certain orientation.

Figure 12 and 13 illustrate a metal connecting sleeve 218 which can be used to connect the aforementioned insulated wire 72 to the rear end of the electrode tool. The sleeve 218 can be made of a metal conductor and can be formed from a single sheet of thin metal. The sleeve has a tubular body
10 220 forming a passageway 222 sized to snugly receive a rear end section of the electrode. Formed in two opposite sides of the tubular body are two spring arms 224,226 which are formed to extend slightly into the passageway. The wire 72 is connected to the rear end section 232 of the connecting sleeve. The end of the sleeve opposite the tab can be flared at
15 232 for relatively easy insertion of the connecting sleeve into rear end of the tubular body 202. The U-shaped section 232 is formed so as to be pressed around and clamped to the end of the wire 72. This section has two bendable parallel arms, 234,236. The rear section of the electrode is formed with two flat indentations on opposite sides of the electrode (not
20 shown). The rear section of the electrode is inserted into the connecting sleeve until the arms 224,226 engage their respective flat surfaces of the electrode, thereby holding the connecting sleeve and surrounding support member 200 securely in place.

Reference will now be made to Figure 16 which shows details of the ball
25 socket 30 and the ball-swivel member 32 which can pivot in the ball socket. The ball-swivel member 32 has a ball portion 120 integrally connected to a tubular section 122. A straight internal passage 124 extends the length of the ball-swivel member 32 and this passage has an inner end at 124 which is always open to the airflow vent 26 formed in the main body portion 14.
30 Annular ridges 126 can be formed on the tubular section in order to engage and hold an end section of flexible tubing such as 3/8 inch plastic tubing

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(not shown). Provided on the exterior of the tubular section or nipple 122 is an outwardly projecting annular ridge 130 which acts as a stop for the end of the plastic hose. The ball socket 30 can be provided with two annular ridges 132,134 which project inwardly so as to engage the spherical surface of the ball portion 120. These ridges help to seal the joint between the ball portion and the ball socket 30 as well as facilitate the pivoting motion of the ball portion in the socket.

In one exemplary embodiment of the present pencil 10, the passage 124 in the member 32 has a diameter of 0.32 inch while the ball portion 120 has an external diameter of 0.5 inch. This ball connection enables great flexibility in maneuvering the pencil 10 during an operation which can be important when carrying out a delicate operation.

Figures 17 and 18 illustrate how the two ridges 132,134 are formed by two semi-annular sections, one section on each of the half-sections 20, 22. Also illustrated in these views are integral support formations 140-143 located close to the ball socket. From the two formations 140,141 extend respective plastic pins 144 which can be integrally formed with the half section. Corresponding pin receiving holes 146 are formed in support formations 142 and 143. When the two half-sections are placed together to form the main body portion, the pins 144 extend into the two holes 146 and can be ultrasonically welded in the holes. In addition to this connection there is a tongue and groove connection between the two half sections 20, 22. Tongues 150 can be formed along opposite side edges of the half section 20 while a corresponding, matching groove 152 can be formed along opposite side edges of the half section 22. The tongues 150 are permanently secured in the grooves by the ultrasonic welding operation or by adhesive.

As noted, both the longitudinal position of the electrode tool and that of the vent tube 12 are independently adjustable. It is generally understood that for best evacuation of smoke from an operating site, the front end of the vent tube 12 should be within ½ inch of the operating end portion of the

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tool. This preferred relative position can be obtained with the present pencil 10. As indicated above, insulating plastic material extends for most of the length of the blade but the front end section is exposed for the coagulation of blood vessels.

- 5 Under some circumstances, a surgeon may wish to withdraw the vent tube further away from the exposed front end section of the electrode blade in order, for example, to provide greater visibility of this front end section.

One construction for providing a friction mechanism to hold the vent tube in place is illustrated in Figures 3, 4 and 22. This construction involves the use
10 of a rubber or rubberlike friction member 170 mounted in a chamber of the body portion 14 formed by internal transverse walls 36 and 38, in the body of Figure 3 and 4 and by transverse walls 39,41 in the body of Figure 22. This chamber, which holds the friction member, is open towards the vent tube so that the inner side of the friction member engages the side of the
15 vent tube. In an exemplary version, the inner side of the friction member is formed as a concave surface with a curvature corresponding to the exterior of the vent tube. The vent tube will generally hold the position to which it is pulled or pushed by the user. In an alternate construction, an O-ring is mounted around the vent for providing the friction mechanism.

20 Figures 19, 22 and 23 illustrate a second embodiment of an electrosurgical pencil 10' constructed in accordance with the invention. Figures 20 and 21 illustrate an elongate vent tube 12' for use in the pencil 10'. This pencil also has a main body portion 14 similar to that in the first embodiment described above. The pencil 10' is similar to the electrosurgical pencil 10 except for
25 the differences noted hereinafter with respect to its construction and its method of operation.

In the second embodiment 10' the illustrated wire 72 which is connected to the electrode tool is connected to same by means of a spring clip 74 which is shown separately in Figure 24. The spring clip shown in Figure 24 is formed

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with a passage 76 through which a rear end section of the electrode tool of the second embodiment of the pencil extends.

The spring clip is made of a suitable electrically conductive metal so as to transfer the electrical current from the wire 72 to the electrode tool.

5 Arranged at one end of the spring clip is a wire clamp 78 for securing the end of the wire 72. Arranged on top of the spring clip is a ratchet engaging member 80 having a concave top surface 82 for engaging bumps on a ratchet formation 84 on the exterior of the rear section of the vent tube 12' (see Figures 19, 20 and 22). It will be understood that the manner in which
10 the electrode tool is mounted in the vent tube allows its longitudinal position relative to the vent tube to be adjusted as desired by the user. The ratchet engaging member 80 and the ratchet formation 84 together form a ratchet mechanism for limiting and preventing unwanted sliding movement of the electrode tool 54 relative to the vent tube 12' of the second embodiment.

15 The vent tube 12' used in the pencil 10' will now be described with particular reference to Figures 20 to 23. The illustrated vent tube, which preferably is made of transparent plastic, has an open front end at 90' and an open rear end at 92'. The tube has a front section 94 with a circular transverse cross section and a rear section 96 which has a rounded exterior except for a
20 substantially flat top portion 98. Extending at least most of the length of the top portion 98 is a central longitudinal slot 100 visible in Figure 21. Located near the front end 90' of the tube is an eyelet guide 102 having a circular hole through which the electrode tool extends as illustrated in Figure 22. It will be understood that the eyelet guide 102 provides support for a
25 forward portion of the electrode tool while the rear end of the electrode tool is supported by means of the spring clip 74. As known in the art, the electrode tool is covered by an insulating plastic shown at 103 along a substantial central portion of its length. This insulating cover can extend through the guide 102. In order for the spring clip to provide support, a
30 narrow section of the ratchet engaging member 80 extends through the slot 100 as shown in Figure 26. The top section of the member 80 is wider than

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its bottom section and wider than the width of the slot 100. This arrangement provides a slidable support for the rear end of the electrode tool which is not covered by insulating plastic. The wider upper portion of the member 80 engages the ratchet formation 84 formed on the top of the top portion 98 of the vent tube and thus acts to prevent unwanted sliding movement of the blade while still allowing relative movement between the blade and the tube.

Instead of using the rubber friction member 170 described above, a suitable O-ring (not shown) can be mounted between the outer surface of the vent tube 12' along a rear portion of the front section 94 and the wall of the airflow vent 26 in order to provide both a seal around the vent tube and a friction fit that prevents unwanted relative movement between the vent tube and the main body portion 14. Alternatively there can be a close, friction fit between the vent tube and the airflow passage through which it extends so that the vent tube will not move relative to the main body portion unless manually pulled or pushed by the user.

An optional feature which can be included in either electrosurgical pencil described above is a lighting device to enable the surgeon or other user of the pencil to better see the operating site. Two possible alternatives for providing this lighting are illustrated in Figure 22, the first being the use of one or more LED lights 160 mounted at the electrode end of the main body portion above the vent tube. The light or lights are connected to a small standard battery 162 located in a forward chamber 164 of the body portion 14. A standard electrical switch (not shown) can be used to close the circuit between the battery and the LED light 160.

As an alternate to the aforementioned lighting arrangement, a ring of LED lights 166 can be mounted at the open rear end of the vent tube in a manner so that the lights do not interfere with airflow through the vent tube or with the passage of the wire 72 into the vent tube. The array or ring of lights at 166 can be powered by the battery 162 through a suitable wire

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connection (not shown) or they can be powered by the same electrical source as the circuit board with this power being received through the wire 72 or a branch thereof. If the vent tube is made of clear transparent plastic, the light from the lights 166 will be transmitted down the vent tube to the surgical site.

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While the present invention has been illustrated and described as embodied in an exemplary embodiment, e.g. an embodiment having particular utility in surgical applications, it is to be understood that the present invention is not limited to the details shown herein, since it will be understood that various omissions, modifications, substitutions and changes in the forms and details of the disclosed electrosurgical pencil and its operation may be made by those skilled in the art without departing in any way from the scope of the present invention. For example, those of ordinary skill in the art will readily adapt the present disclosure for various other applications without departing from the scope of the present invention.

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The embodiments of the present invention for which an exclusive property or privilege is claimed are defined as follows:

1. An electrosurgical tool for use in performing surgery on a surgical site, said electrosurgical pencil comprising:

a main body forming a handle for a user, and having a first end forming a front opening and an opposite second end forming an exhaust opening, said main body defining an airflow vent extending from said first end to said second end, said second end of the main body being connectable for fluid communication via flexible tubing to a suction source in order to permit evacuation of surgical smoke and debris;

an elongate vent tube mounted in said airflow vent and slidable therein, the position of said vent tube being adjustable in its longitudinal direction from a retracted position to a selected one of a plurality of extended positions where a forward end of the vent tube is located forwards of said first end of said main body;

an elongate electrode suitable for performing electrosurgery mounted in said vent tube and independently slidable therein, the position of said electrode being adjustable in its longitudinal direction between a retracted position and a selected one of a plurality of extended positions where a forward section of the electrode projects forwards from both the first end of the main body and the forward end of the vent tube; and

an electrical switch for said tool connectable to an electrical control for the tool;
and

a wire connector attached to said electrode adapted to electrically connect said electrode to said electrical control,

said electrosurgical tool characterized in that said electrical switch is mounted on said body portion, the position of said electrode is adjustable by pulling on a projecting forward section of the electrode, and said vent tube is open at its forward end.

2. The electrosurgical tool according to claim 1 further comprising an eyelet guide mounted in said vent tube adjacent its forward end, said electrode extending through a hole in the eyelet guide and slidably supported by the eyelet guide.

3. The electrosurgical tool according to claim 1 or 2 further comprising a ball swivel joint for connecting the second end of the main body to a flexible tubing for evacuation of smoke and debris, said ball swivel joint including a ball socket formed on said second end and a ball-swivel member pivotal in multiple directions relative to said ball socket, mounted in said ball socket, and having a venting passage formed thereon, wherein said venting passage opens into said airflow vent.

4. The electrosurgical tool according to claim 3 wherein said ball socket has two spaced apart, annular ridges formed therein and engaging a spherical exterior surface of the ball-swivel member in order to seal a joint between the ball-swivel member and said ball socket.

5. The electrosurgical tool according to claim 1 wherein said wire connector further includes a metal sleeve member mounted on a rear section of said electrode and an insulated wire connected to said sleeve member at one end and to said electrical control of its opposite end.

6. The electrosurgical tool according to any one of claims 1 to 5 further comprising at least one LED light mounted on a front end section of said main body and a battery source of electrical power electrically connected to said at least one LED light.

7. The electrosurgical tool according to any one of claims 1 to 5 further comprising LED lights mounted at a rear end of said vent tube and wire means for electrically connecting said LED lights to an electrical power source.

8. The electrosurgical tool according to any one of claims 1 to 7 further comprising a friction-causing member mounted in a forward section of the main body and having one side thereof engaging a side of the vent tube, said friction-causing member causing said vent tube normally to maintain a selected position in the longitudinal direction thereof during use of the electrosurgical tool.

9. The electrosurgical tool according to any one of claims 1 to 8 further comprising an electrode support member mounted on a rear section of said electrode and slidable therewith, said support member having radially projecting arms which engage an interior surface of the vent tube in a manner causing a friction fit between said arms and said interior surface, wherein said electrode normally maintains a selected position in the longitudinal direction thereof relative to said vent tube.

10. The electrosurgical tool according to claim 9 wherein said vent tube has a longitudinal groove extending along its interior surface and one of said arms of the support member extends into said groove and thereby prevents rotation of said electrode about a central longitudinal axis of said vent tube.

11. An electrosurgical tool for use with a power source and a suction source, said electrosurgical tool comprising:

an elongate body forming a handle for a user and an airflow vent extending from an open first end to an open second end which is connectable during use of the tool to said suction source;

an elongate vent tube having a front end and a rear end section open to said airflow vent, said vent tube being slidably mounted in said airflow vent for longitudinal movement, the position of said vent tube being adjustable longitudinally relative to said body, said vent tube having a front end section which projects forwardly from said first end of the body by an amount which is adjustable by a user of the tool and the rear end section of the vent tube defining a tapering slot;

an elongate electrode for performing surgery mounted in said vent tube and independently slidable therein, said elongate electrode movable longitudinally relative to both said vent tube and said body, said electrode in use having a forward section projecting from the front end of the vent tube and being connected to said power source;

an insulated wire including:

a first end coupled to the electrode and received in the vent tube;

an intermediate section extending through the tapering slot of the vent tube;

and

a second end configured to be coupled to the power source; and

a support device is mounted on and supports a rear section of said electrode in the vent tube and engages said vent tube so as to allow limited sliding movement of said support device and said electrode along said vent tube in the longitudinal direction.

12. The electrosurgical tool according to claim 11 further comprising an electrical circuit board for controlling electrical operation of the electrode, said circuit board being mounted in said body and connectable to said power source, wherein said support device is a tubular support having radially projecting, resilient arms which engage an interior surface of said vent tube in a manner creating a friction fit between said arms and said interior surface.

13. The electrosurgical tool according to claim 11 or 12 further comprising at least one LED light mounted on a front section of said body and a battery source of electrical power electrically connected to said at least one LED light.

14. The electrosurgical tool according to claim 11 or 12 wherein said vent tube is made of transparent plastic, LED lights are mounted on a rear end of the vent tube, and wire means for electrically connecting said LED lights to said power source are provided in said body.

15. An electrosurgical tool for use with an electrical power source and a suction source, said tool comprising:

a body forming a handle for a user and an airflow vent extending rearwardly from an open front end of the body and having an outlet connectable to said suction source;

an elongate vent tube for evacuating smoke or debris from a surgical site, said vent tube having a front end and an outlet opening into said airflow vent, said vent tube being slidably mounted in said airflow vent for longitudinal movement and having a front section projecting forwards from the front end of the body, the length of said front section being manually adjustable by a user of the tool;

an elongate electrode device for performing a surgical operation mounted in said vent tube and slidable therein in the longitudinal direction relative to both said vent tube and said body, said electrode device in use projecting from the front end of the vent tube and being operatively connected to said power source;

said electrosurgical tool characterized in that said front end of the vent tube is open;

friction means are mounted in the body for causing said vent tube normally to maintain a selected position relative to said body, said friction means including a friction member having a relatively high friction surface engaging one side of the vent tube; and

a slide restricting mechanism for limiting sliding movement of said electrode device in the longitudinal direction relative to said vent tube and said body is provided, wherein said slide restricting mechanism acts to restrict movement of said electrode device unless sufficient force is applied to said electrode device in the longitudinal direction.

16. The electrosurgical tool according to claim 15 wherein said friction member is a rubber or rubberlike member mounted in a chamber inside said body portion so that the rubber or rubberlike member is pressed against said one side of the vent tube.

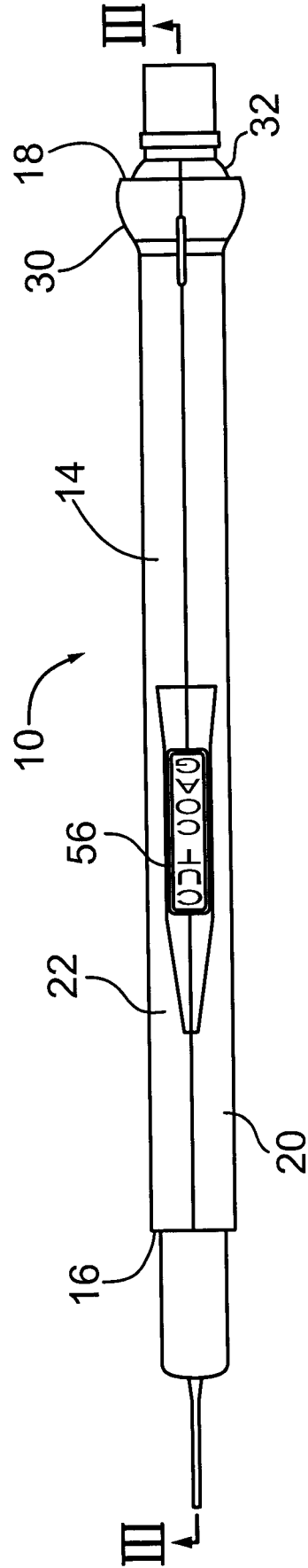
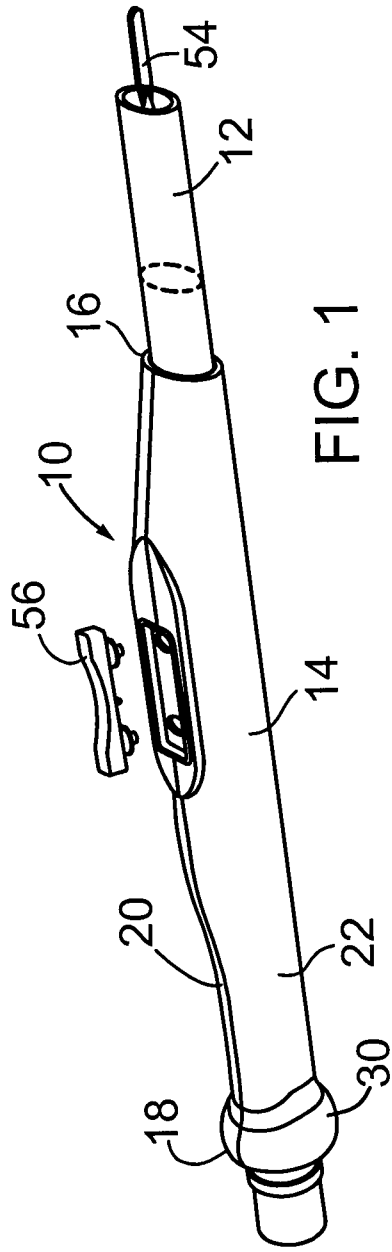
17. The electrosurgical tool according to claim 15 or 16 wherein a ball swivel joint for connecting said open second end of the airflow vent to flexible tubing for evacuation of smoke and debris by and to said suction source, said ball swivel joint including a ball socket provided on a rear end of said body portion and a ball swivel member pivotal in multiple directions relative to said ball socket, mounted in said ball socket, and having a venting passage formed therein and opening into said overflow vent.

18. The electrosurgical tool according to any one of claims 15 to 17 further comprising one or more LED lights mounted on or in said body portion and means for providing electrical power to said one or more LED lights which in use are adapted and positioned to light a surgical site where the tool is to be used.

19. The electrosurgical tool according to any one of claims 16 to 18 wherein said slide restricting mechanism is an electrode support member mounted on a rear section of said electrode and slidable therewith, said support member having radially projecting arms which engage an interior surface of the vent tube in a manner causing a friction fit between said arms and said interior surface.

20. The electrosurgical tool according to claim 19 wherein said vent tube has a longitudinal groove extending along its interior surface and one of said arms of the support member extends into said groove and thereby prevents rotation of said electrode about a central longitudinal axis of said vent tube.

21. The electrosurgical tool according to claim 15 wherein said slide preventing mechanism includes a series of ridges formed on one exterior side of said vent tube, a longitudinal slot formed in said vent tube in the region of said ridges, and an attachment device extending from one side of a rear section of said electrode and through said slot so as to engage said series of ridges.



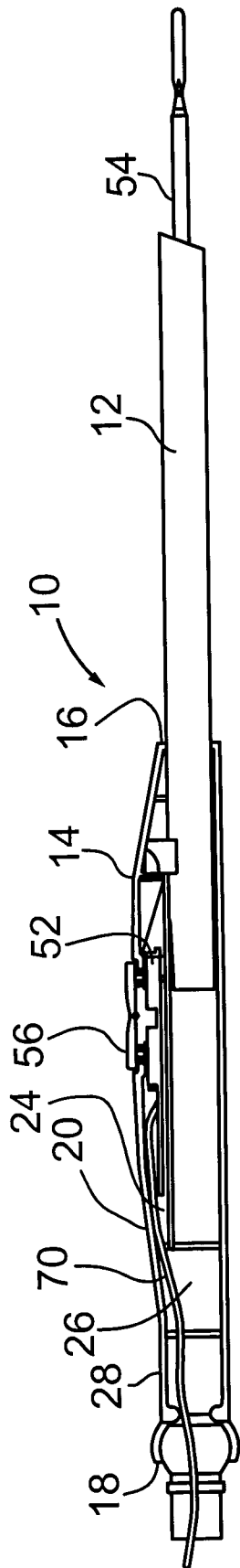


FIG. 3

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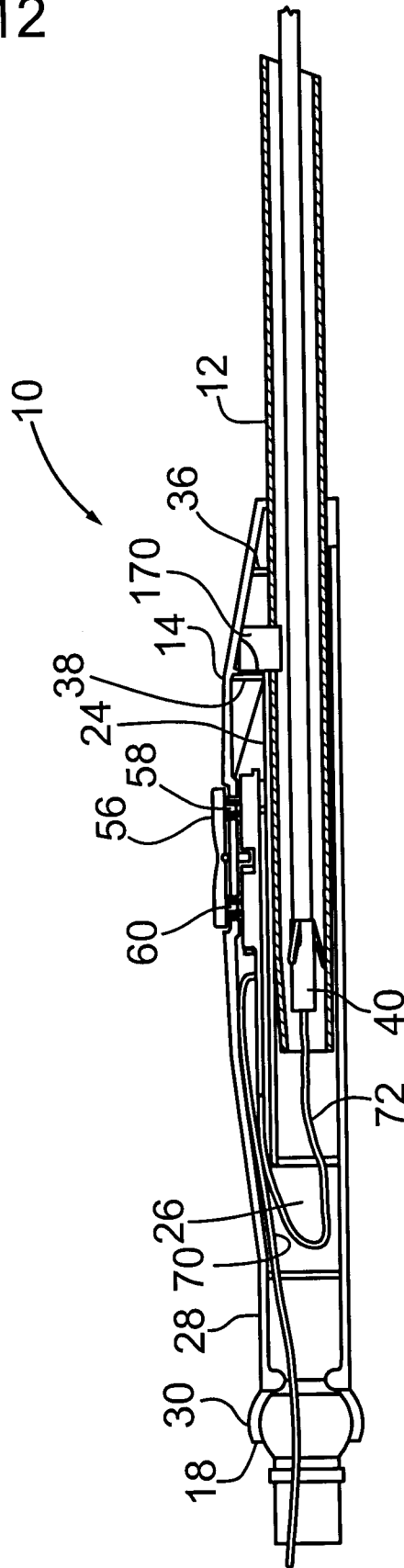


FIG. 4

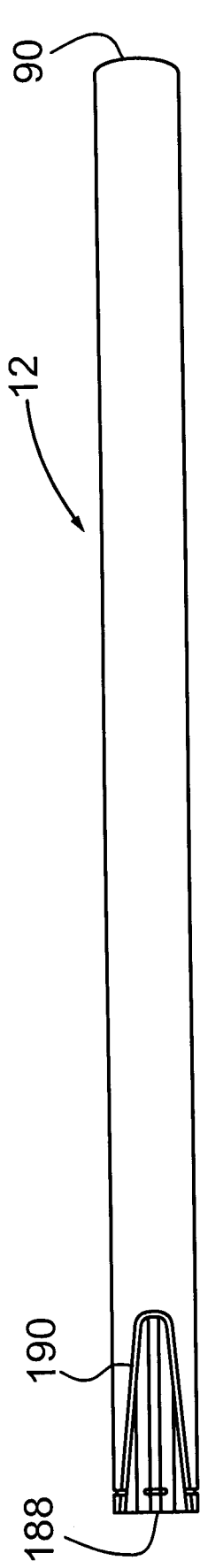


FIG. 5

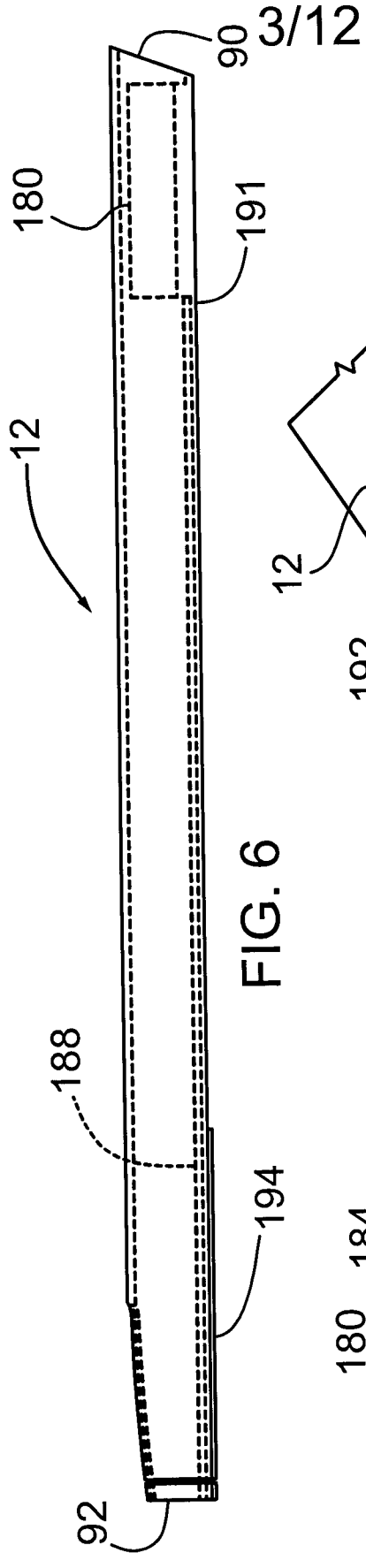


FIG. 6

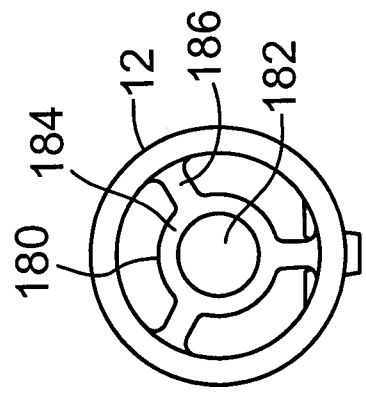


FIG. 7

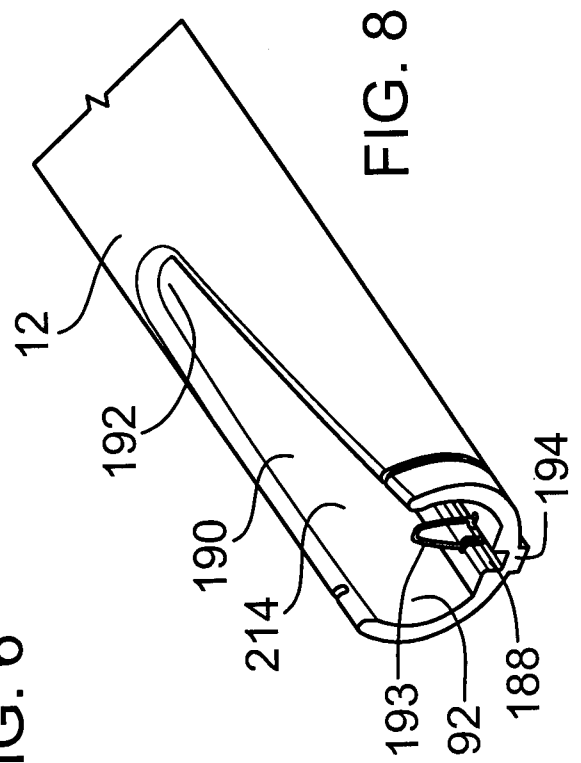
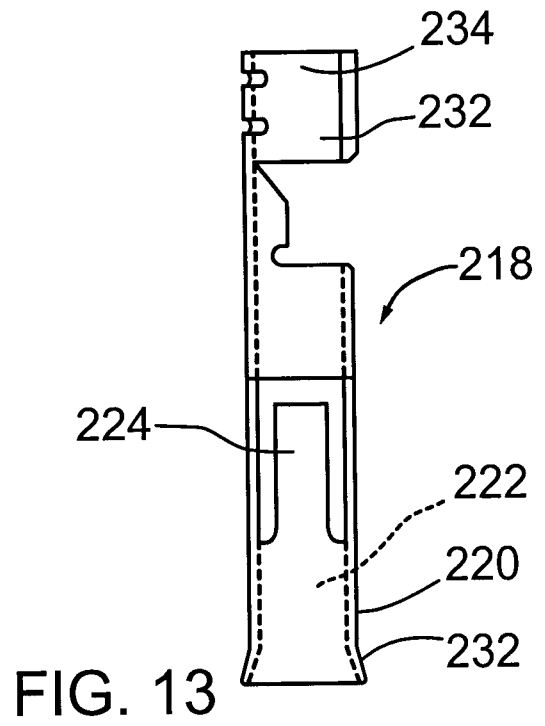
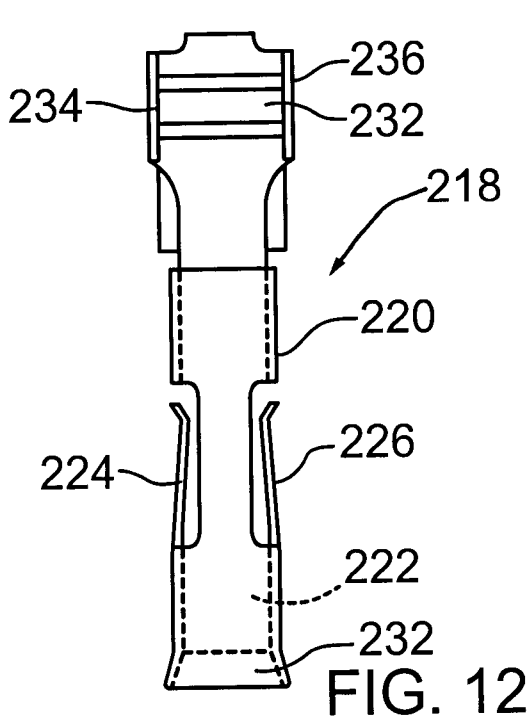
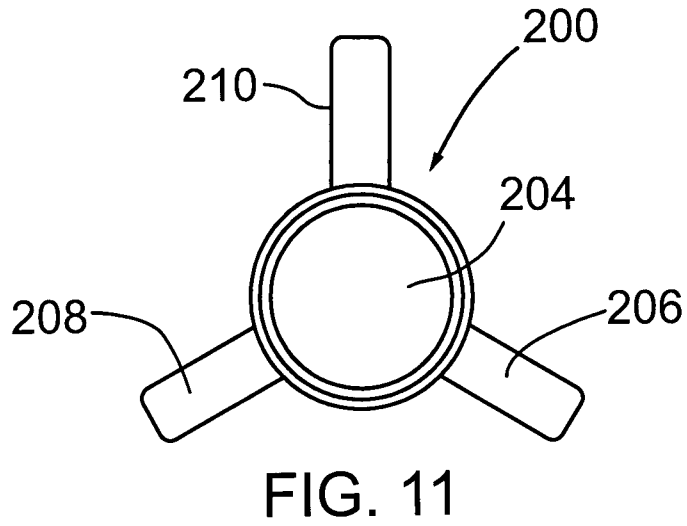
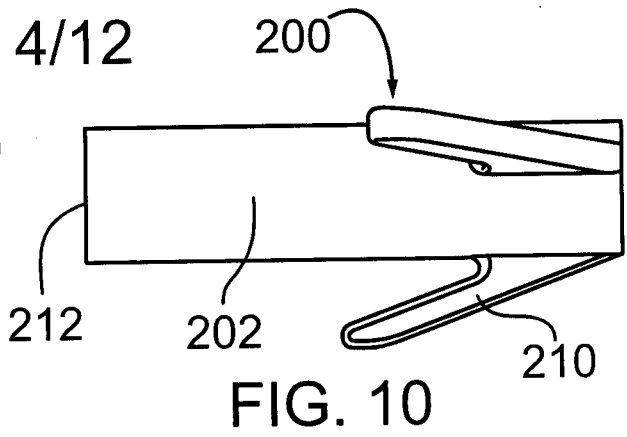
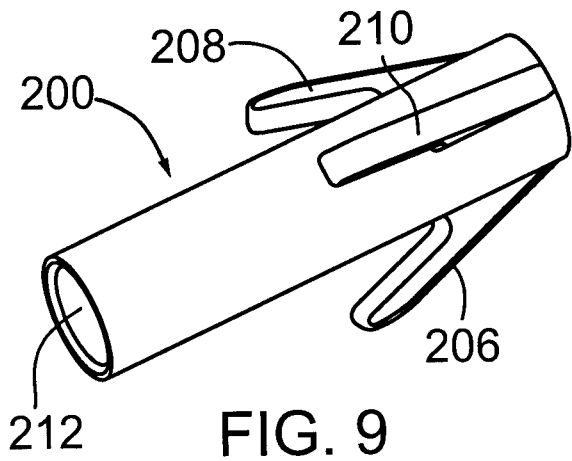


FIG. 8



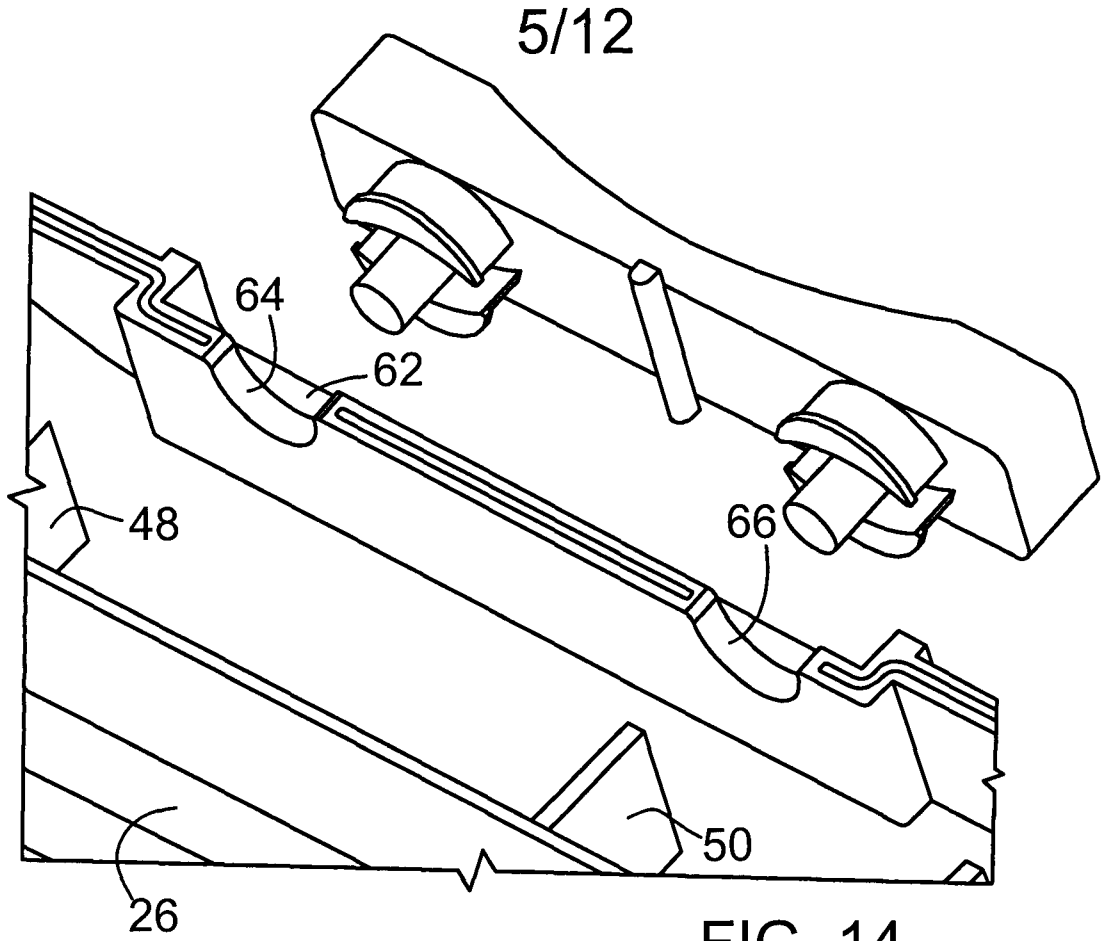


FIG. 14

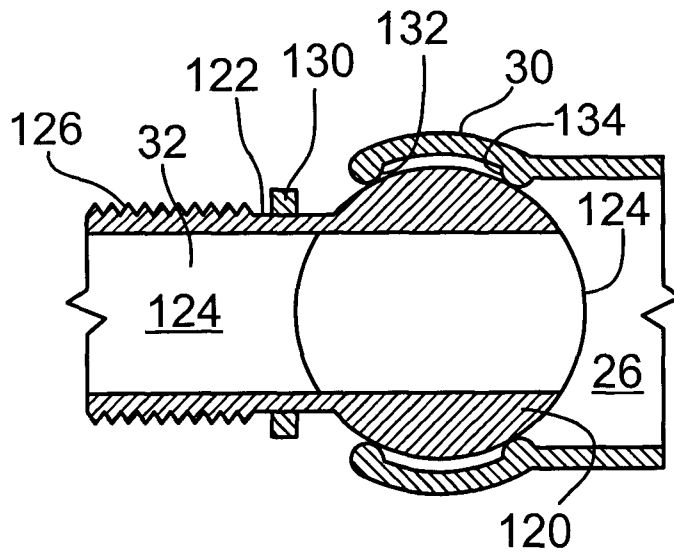


FIG. 16

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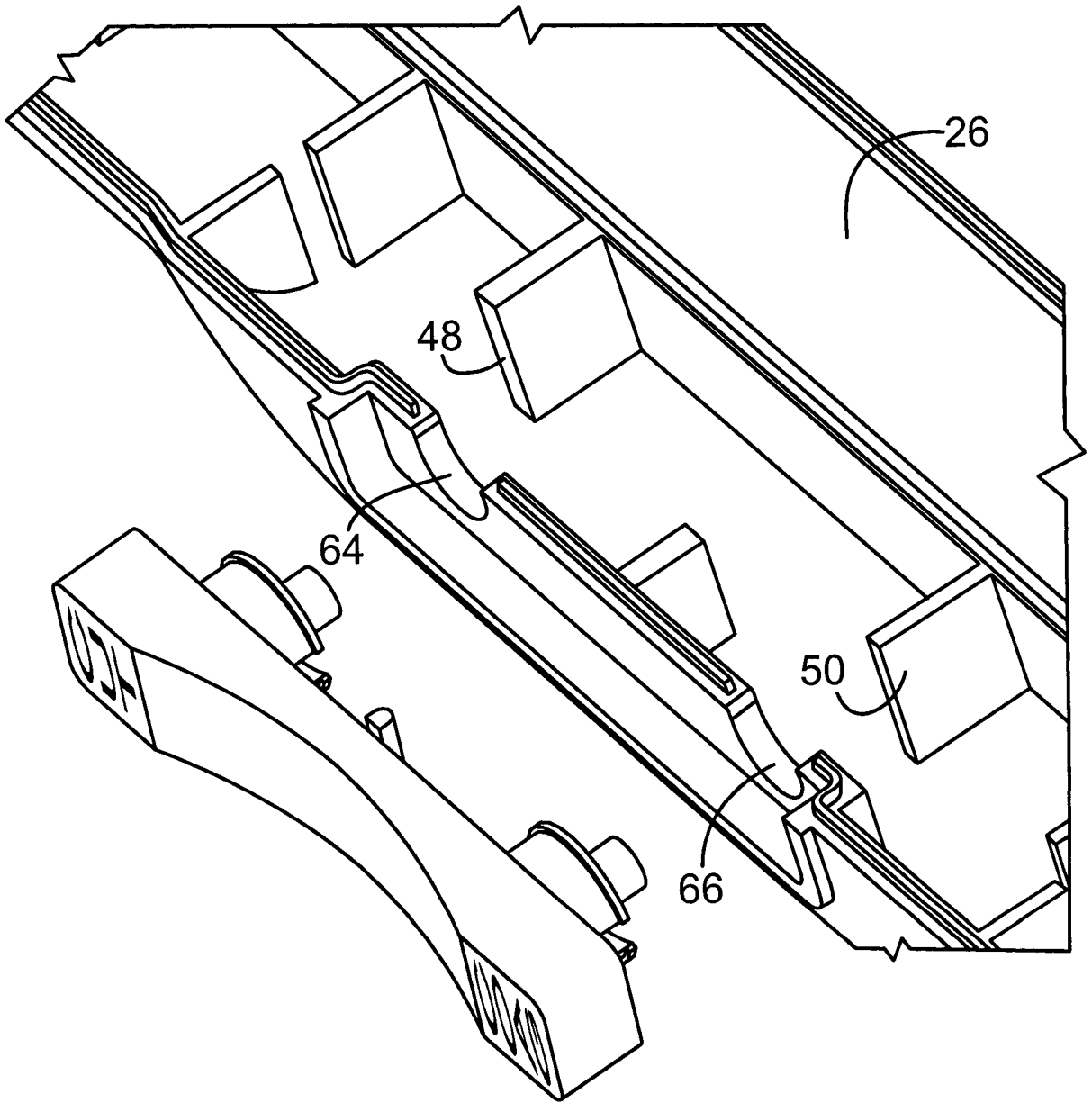


FIG. 15

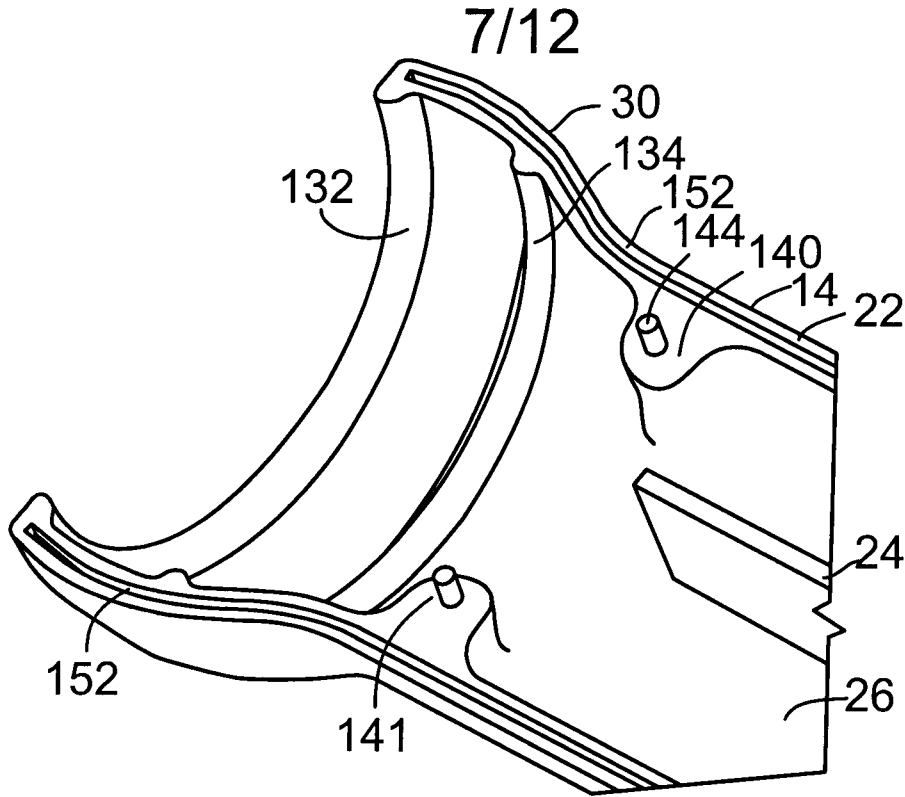


FIG. 17

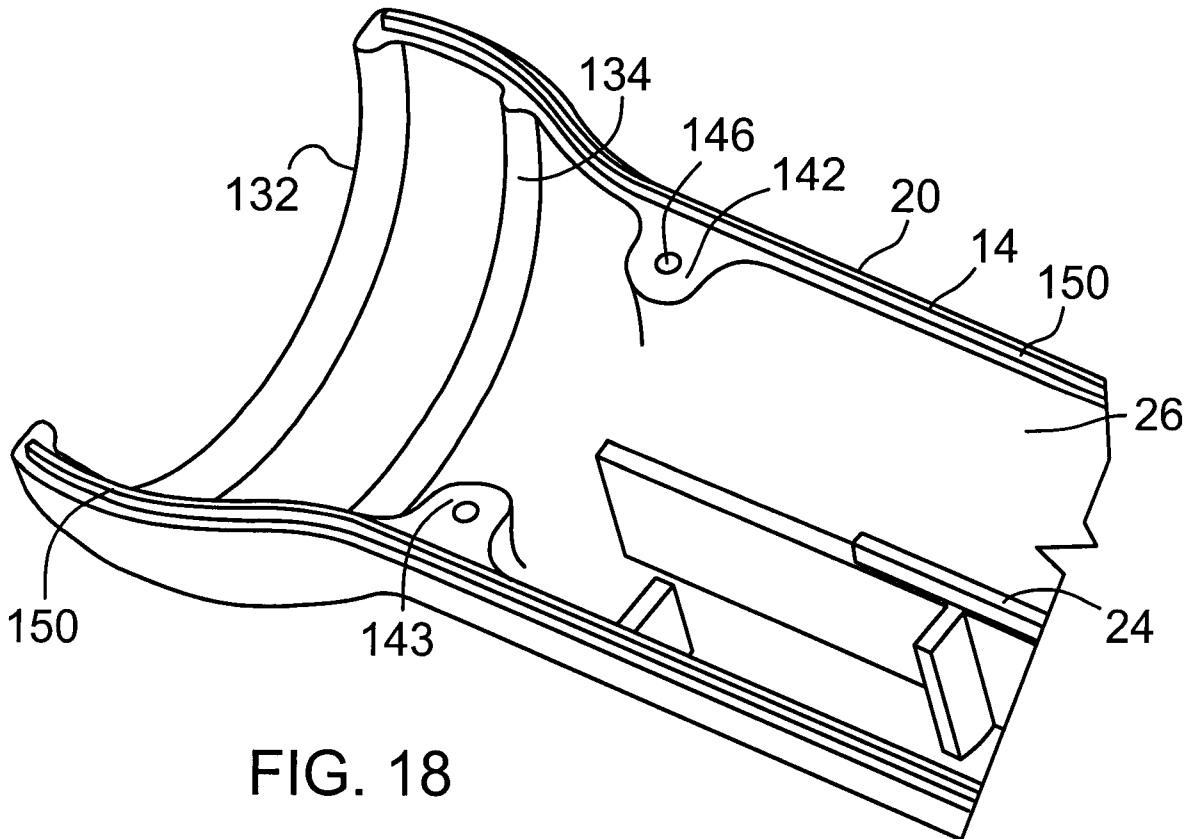


FIG. 18

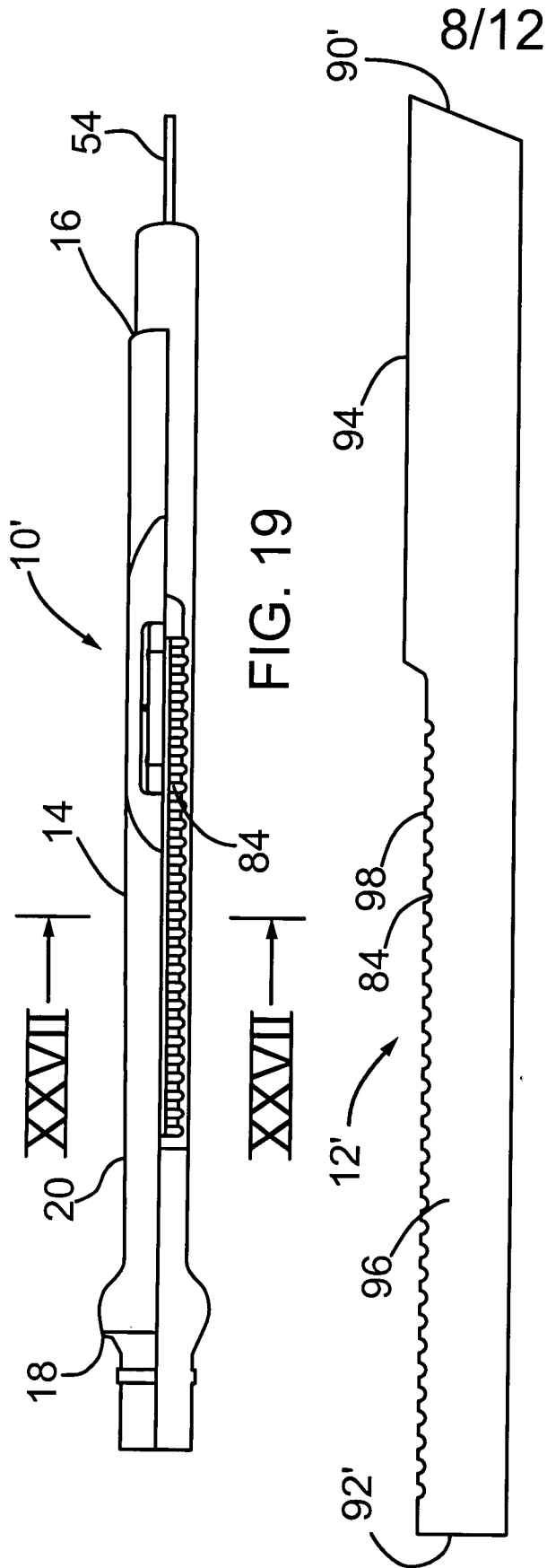


FIG. 20

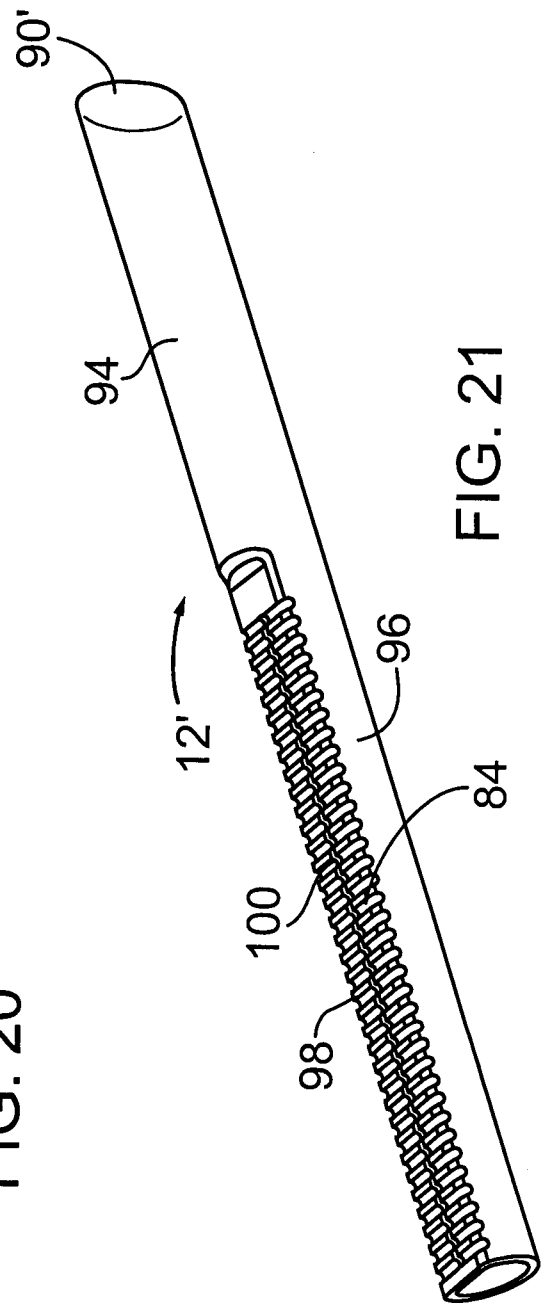


FIG. 21

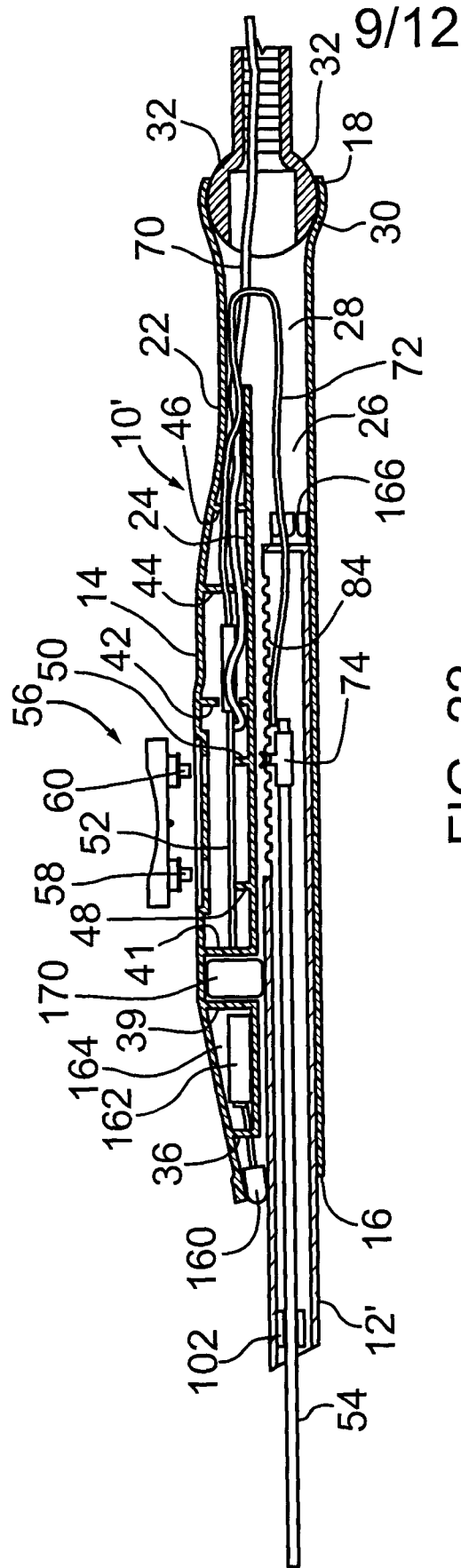


FIG. 22

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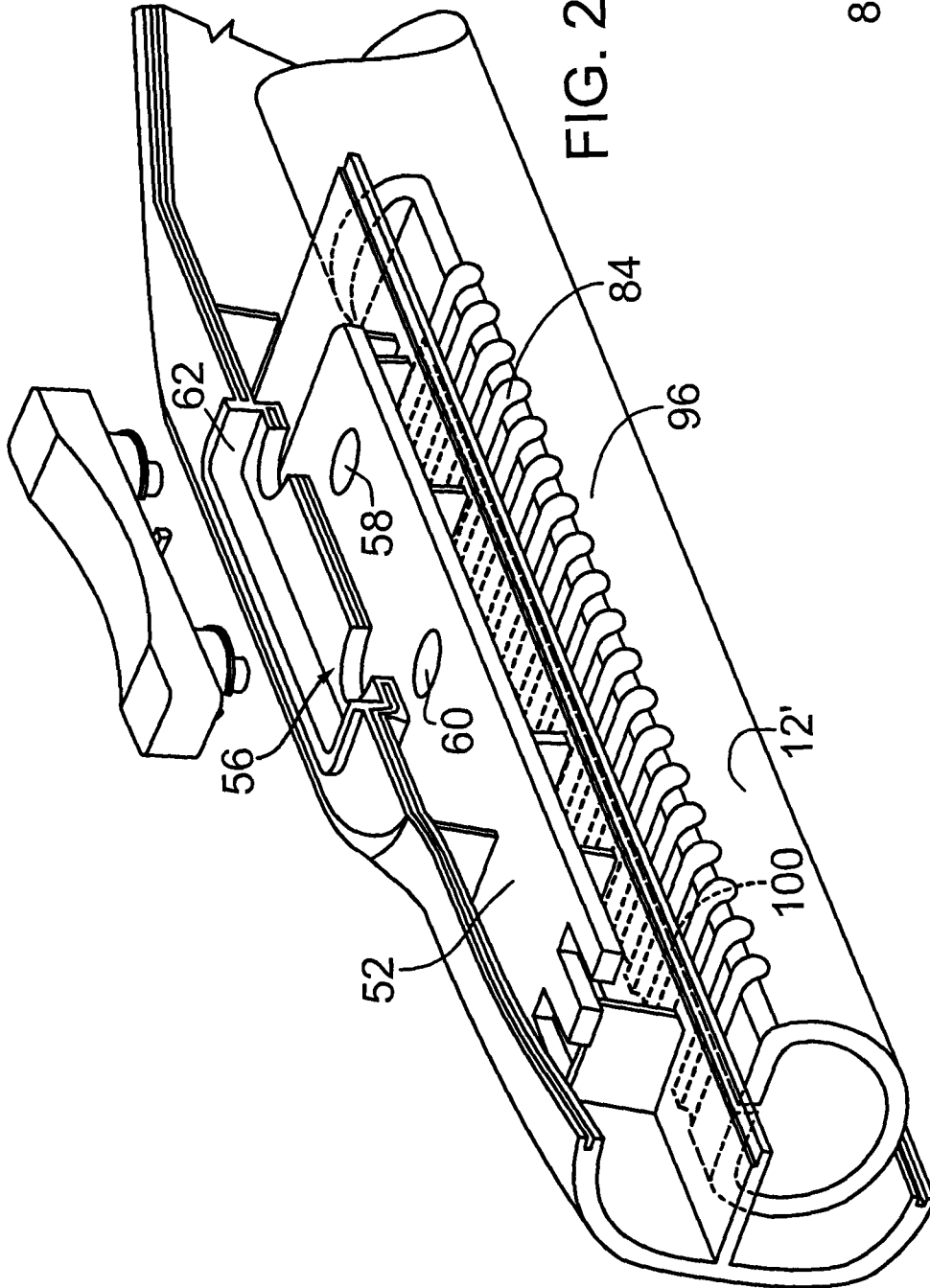


FIG. 23

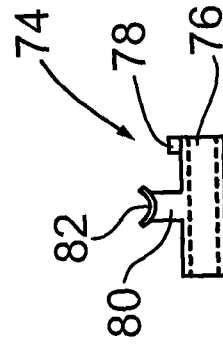
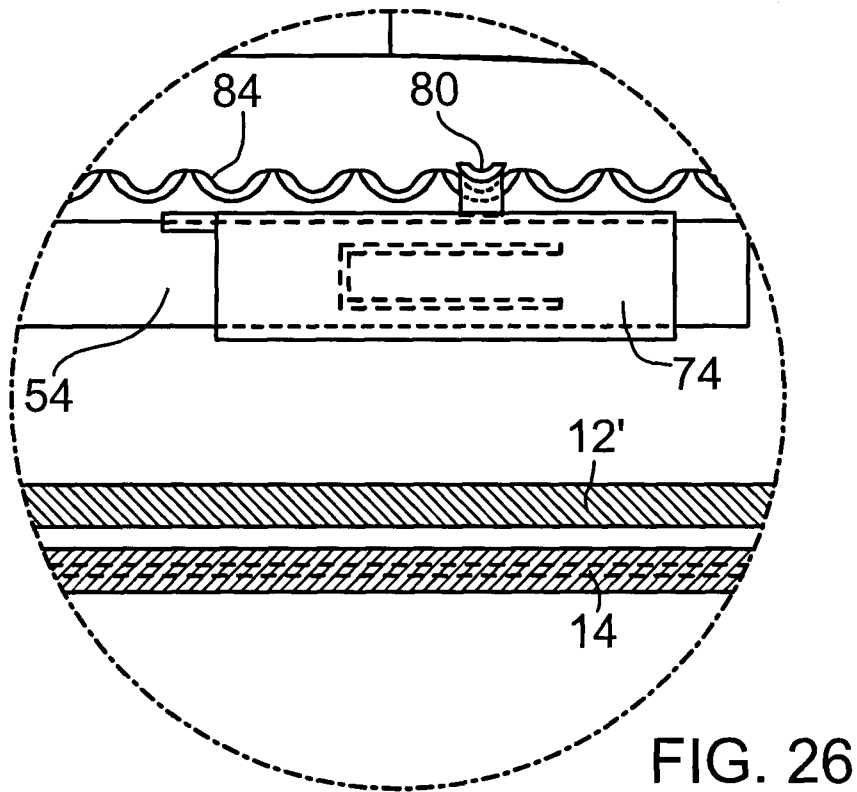
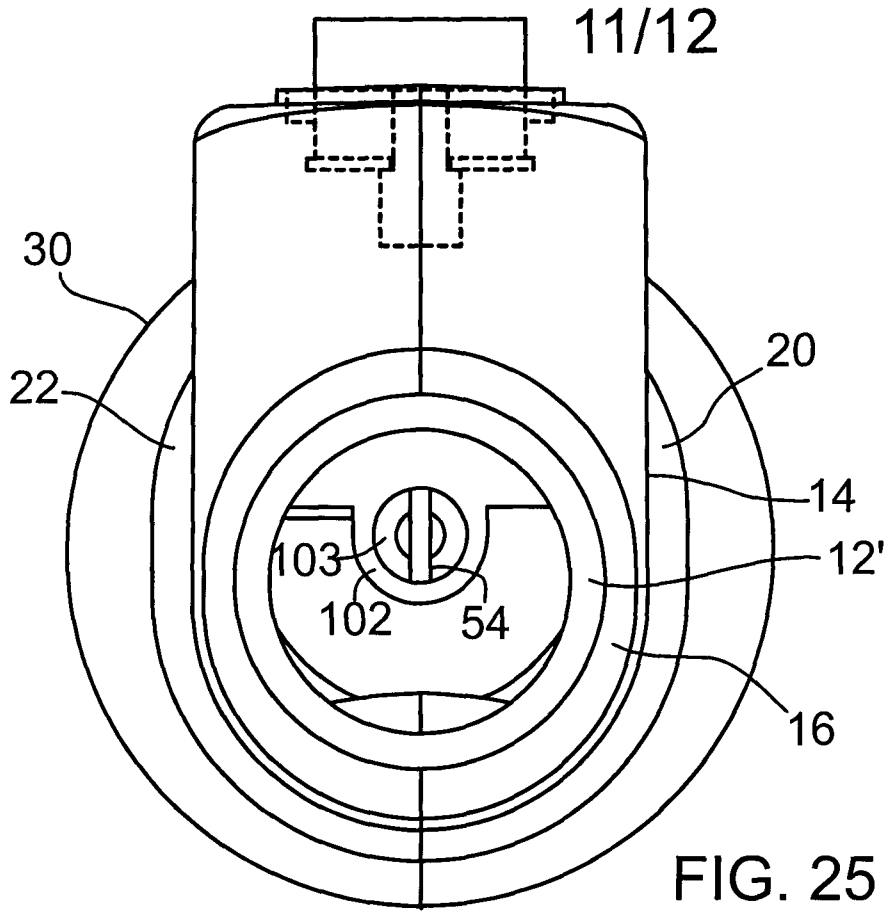


FIG. 24



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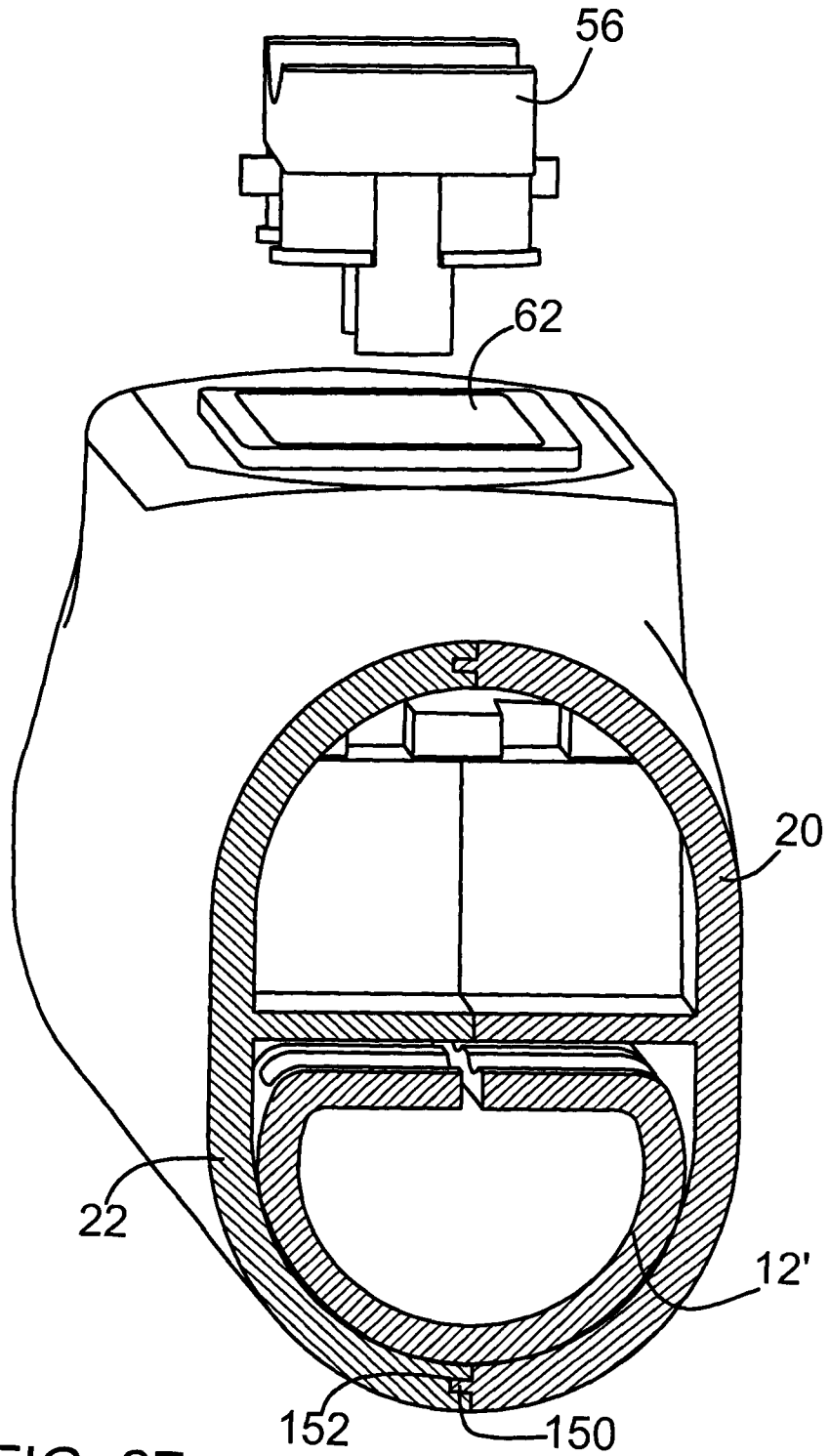


FIG. 27

