(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 382 938 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
24.09.2014 Bulletin 2014/39

(51) Int Cl.:
A61B 18/14 *(2006.01)*

(21) Application number: **11164275.7**

(22) Date of filing: **29.04.2011**

(54) **Insulated sealing plate**

Isolierte Versiegelungsplatte

Plaque de scellage isolée

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **29.04.2010 US 770380**

(43) Date of publication of application:
02.11.2011 Bulletin 2011/44

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(56) References cited:
EP-A2- 2 105 104
WO-A1-02/080799
US-A- 5 876 401
US-A- 6 010 516
US-A1- 2010 076 432

EP 2 382 938 B1

Printed by Jouve, 75001 PARIS (FR)

Description

BACKGROUND

1. Technical Field

[0001] The present disclosure relates to an electrosurgical instrument and method for sealing tissue. More particularly, the present disclosure relates to an electrosurgical tool including opposing jaw members having sealing plates with improved electrical insulation.

2. Background of the Related Art

[0002] Electrosurgical forceps utilize mechanical clamping action along with electrical energy to effect hemostasis on the clamped tissue. The forceps (open, laparoscopic or endoscopic) include electrosurgical sealing plates which apply the electrosurgical energy to the clamped tissue. By controlling the intensity, frequency and duration of the electrosurgical energy applied through the sealing plates to the tissue, the surgeon can coagulate, cauterize, and/or seal tissue.

[0003] During an electrosurgical procedure, tissue sealing plates are used to apply electrosurgical energy to tissue. Because the sealing plates conduct electricity, care must be taken to electrically insulate the sealing plates from other electrically conductive components of the electrosurgical forceps and to limit and/or reduce many of the known undesirable effects related to tissue sealing, e.g., flashover, thermal spread, and stray current dissipation. Typically, tissue sealing surfaces are disposed on inner facing surfaces of opposing jaw members such that the tissue sealing surfaces are utilized to seal tissue grasped between the jaw members. Often, the manufacturing of jaw members requires the use of a two-shot molding process that includes a pre-shot overmold of insulative material (e.g., plastic) placed between the underside of the sealing plate and the steel structural support base of the jaw member to provide electrical insulation between the jaw member and the tissue sealing surface.

[0004] Reference is made to US 5 876 401 and EP 2 105 104, both of which disclose an electrosurgical instrument having U-shaped electrodes attached to insulators and which define a knife channel.

SUMMARY

[0005] The invention is defined by the independent claim below. Dependent claims are directed to optional features and preferred embodiments. The embodiments of the present disclosure which do not fall within the scope of said claims are provided for illustrative purposes only and do not form part of the invention.

[0006] In an embodiment of the present disclosure, an end effector assembly including a pair of opposing jaw members is provided. Each of the jaw members includes a support base, an electrical jaw lead, and a sealing plate, which is coupled to the optional electrical jaw lead. The sealing plate has an electrically conductive, stainless steel, layer and an electrically insulative layer bonded to an underside of the sealing plate. That is, the electrically insulative layer is bonded to an underside of the electrically conductive layer relative to a tissue contacting and sealing surface of the sealing plate provided by the electrically conductive layer. Preferably, the underside of the sealing plate, and thus the electrically insulative layer, engages the support base.

[0007] In another embodiment of the present disclosure, an electrosurgical instrument for sealing tissue is provided. The electrosurgical instrument may include a housing having at least one shaft extending therefrom, a handle assembly operably coupled to the housing and including at least one movable handle, optionally a rotating assembly operably coupled to the housing and configured to rotate the at least one shaft, and an end effector assembly including a pair of opposing jaw members. Each of the jaw members includes a support base, an electrical jaw lead, and a sealing plate, which is coupled to the optional electrical jaw lead. The sealing plate has an electrically conductive layer and an electrically insulative, polyimide, layer bonded to an underside of the sealing plate. The sealing plate has a tissue contacting and sealing surface provided by the electrically conductive layer, which is for conducting electrosurgical energy to the tissue. The electrically insulative layer is applied to the underside of the electrically conductive layer relative to the tissue contacting and sealing surface. Preferably, the underside of the sealing plate, and thus the electrically insulative layer, engages the support base. The sealing plate defines a knife channel. The instrument or end effector comprises a knife member that translates along the knife channel to cut tissue held between the jaw members. Part of the knife member slides against the electrically insulative layer when it translates along the knife channel during a tissue cutting stroke. Preferably, the knife member is connected to conduct electrical current and is insulated from the electrically conductive layer by the electrically insulative layer so as to avoid a short circuit between the electrically conductive layer of the sealing plate and the knife member.

[0008] In another embodiment of the present disclosure, a method of manufacturing a jaw member of an electrosurgical end effector assembly includes the steps of providing a support base and bonding a polyimide layer to an underside of a stainless steel tissue sealing surface. The method also includes the steps of engaging the underside of the tissue sealing surface to the support base and coupling an electrical lead to the tissue sealing surface. The electrical lead is adapted to connect the tissue sealing surface to an energy source. The method also includes the step of overmolding an insulative material about the support base to secure the tissue sealing surface to the support base.

[0009] In another embodiment of the present disclo-

sure, a method of manufacturing a sealing plate for a jaw member of an electrosurgical forceps includes the steps of bonding a sheet of polyimide to a sheet of stainless steel and stamping the bonded sheet to form a sealing plate for affixing to a jaw member of an electrosurgical forceps.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The above and other aspects, features, and advantages of the present disclosure will become more apparent in light of the following detailed description when taken in conjunction with the accompanying drawings in which:

Fig. 1 is a perspective view of an endoscopic bipolar forceps in accordance with an embodiment of the present disclosure;

Fig. 2 is a perspective view of an open bipolar forceps according to an embodiment of the present disclosure;

Figs. 3A and 3B are exploded views of opposing jaw members according to an embodiment of the present disclosure; and

Fig. 4 is a cross sectional view of a sealing plate according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0011] Particular embodiments of the present disclosure are described hereinbelow with reference to the accompanying drawings; however, it is to be understood that the disclosed embodiments are merely examples of the disclosure and may be embodied in various forms. Well-known functions or constructions are not described in detail to avoid obscuring the present disclosure in unnecessary detail. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the present disclosure in virtually any appropriately detailed structure.

[0012] Like reference numerals may refer to similar or identical elements throughout the description of the figures. As shown in the drawings and described throughout the following description, as is traditional when referring to relative positioning on a surgical instrument, the term "proximal" refers to the end of the apparatus which is closer to the user and the term "distal" refers to the end of the apparatus which is further away from the user. The term "clinician" refers to any medical professional (i.e., doctor, surgeon, nurse, or the like) performing a medical procedure involving the use of embodiments described herein.

[0013] As described in more detail below with reference to the accompanying figures, the present disclosure is directed to opposing jaw members of a vessel sealer having sealing plates with a bonded electrically insulative bottom layer on an underside thereof. Having a electrically insulative layer between the sealing plate and the jaw member has many advantages. For instance, the need for the above discussed pre-shot overmolding of insulative material about the jaw members is eliminated, thereby simplifying the manufacturing of the vessel sealer. Additionally, bonding a electrically insulative layer to the sealing plate strengthens the structure thereof, thereby allowing for larger or longer sealing plates and/or jaw members to be manufactured without necessarily compromising structural integrity.

[0014] Turning now to Fig. 1, an instrument generally identified as forceps 10 is for use with various surgical procedures and includes a housing 20, a handle assembly 30, a rotating assembly 80, a trigger assembly 70, and an end effector assembly 100 that mutually cooperate to grasp, seal, and divide tubular vessels and vascular tissues. Forceps 10 includes a shaft 12 that has a distal end 16 dimensioned to mechanically engage the end effector assembly 100 and a proximal end 14 that mechanically engages the housing 20. The end effector assembly 100 includes opposing jaw members 110 and 120, which cooperate to effectively grasp tissue for sealing purposes. The end effector assembly 100 is a bilateral assembly, i.e., both jaw members 110 and 120 pivot relative to one another about a pivot pin (not shown). The jaw members 110 and 120 may be curved to facilitate manipulation of tissue and to provide better "line-of-sight" for accessing targeted tissues.

[0015] Examples of forceps are shown and described in commonly-owned U.S. Application Serial No. 10/369,894 (publisched as US 2003/0229344 A1) entitled "VESSEL SEALER AND DIVIDER AND METHOD MANUFACTURING SAME" and commonly-owned U.S. Application Serial No. 10/460,926 (now patent 7,156,846) entitled "VESSEL SEALER AND DIVIDER FOR USE WITH SMALL TROCARS AND CANNULAS".

[0016] With regard to Fig. 2, an open forceps 200 for use with various surgical procedures is shown. Forceps 200 includes a pair of opposing shafts 212a and 212b having an end effector assembly 230 attached to the distal ends 216a and 216b thereof, respectively. End effector assembly 230 includes pair of opposing jaw members 232 and 234 that are pivotably connected about a pivot pin 265 and that are movable relative to one another to grasp tissue. Each shaft 212a and 212b includes a handle 215 and 217, respectively, disposed at the proximal end 214a and 214b thereof and that each define a finger hole 215a and 217a, respectively, therethrough for receiving a finger of the user. Finger holes 215a and 217a facilitate movement of the shafts 212a and 212b relative to one another to pivot the jaw members 232 and 234 from an open position, wherein the jaw members 232 and 234 are disposed in spaced relation relative to one another, to a clamping or closed position, wherein the jaw members 232 and 234 cooperate to grasp tissue therebetween.

[0017] Figs. 3A and 3B are perspective views of opposing jaw members 310 and 320 according to one embodiment of the present disclosure. Similar to jaw members 232 and 234, each of the jaw members 310 and 320 include: sealing plates 312 and 322, respectively; electrical jaw leads 325a and 325b, respectively; and support bases 319 and 329 that extend distally from flanges 313 and 323, respectively. Each of sealing plates 312 and 322 include an underside 328a and 328b, respectively, that has a respective electrically insulative layer 330a and 330b bonded thereto. Electrically insulative layers 330a and 330b operate to electrically insulate sealing plates 312 and 322, respectively, from support bases 319 and 329, respectively. Further, electrically insulative layers 330a and 330b operate to prevent or slow the onset of corrosion of sealing plates 312 and 322, respectively, at least on the undersides 328a, 328b thereof. In one embodiment, electrically insulative layers 330a and 330b may be formed from polyimide. However, in other embodiments, any suitable electrically insulative material may be utilized, such as polycarbonate, polyethylene, etc.

[0018] Support bases 319 and 329 are configured to support electrically conductive sealing plates 312 and 322 thereon. Sealing plates 312 and 322 may be affixed atop the support bases 319 and 329, respectively, by any suitable method including but not limited to snap-fitting, overmolding, stamping, ultrasonic welding, etc. The support bases 319 and 329 and sealing plates 312 and 322 are at least partially encapsulated by insulative housings 316 and 326, respectively, by way of an overmolding process to secure sealing plates 312 and 322 to support bases 319 and 329, respectively, The sealing plates 312 and 322 are coupled to electrical jaw leads 325a and 325b, respectively, via any suitable method (e.g., ultrasonic welding, crimping, soldering, etc.). Electrical jaw lead 325a supplies a first electrical potential to sealing plate 312 and electrical jaw lead 325b supplies a second electrical potential to opposing sealing plate 322.

[0019] Jaw member 320 may also include a series of stop members 390 disposed on the inner facing surface of sealing plate 312 to facilitate gripping and manipulation of tissue and to define a gap between opposing jaw members 310 and 320 during sealing and cutting of tissue. The series of stop members 390 are applied onto the sealing plate 312 during manufacturing. Further, the sealing plates 312 and 322 may include longitudinally-oriented knife slots 315a and 315b, respectively, defined therethrough for reciprocation of a knife blade (not shown). The electrically insulative layers 330a and 330b disposed on the undersides 328a and 328b, respectively, of sealing plates 312 and 322, respectively, allow for various blade configurations such as, for example, t-shaped blades that may contact the underside of the sealing plate during reciprocation through knife slots 315a, 315b. That is, the electrically insulative layers 330a, 330b operate to protect both the knife blade and the undersides 328a and 328b of the sealing plates 312 and 322, respectively, from damage or wearing. Further, in the instance that an electrically conductive knife blade is utilized (e.g., for electric tissue cutting), the electrically insulative layers 330a, 330b help to electrically insulate the sealing plates 312, 322 from the electrically conductive knife blade.

[0020] Turning now to Fig. 4, a cross-sectional view of sealing plate 412 is shown. Sealing plate 412 is similar to sealing plates 312 and 322 described above. As shown in Fig. 4, sealing plate 412 has a stainless steel layer 410 and a electrically insulative layer 430a. Sealing plate 500 may be formed by bonding electrically insulative layer 430a to stainless steel layer 410. Bonding electrically insulative layer 430a to stainless steel layer 410 may be accomplished by any suitable method including, but not limited to, applying adhesive between electrically insulative layer 430a and stainless steel layer 410, using heat treatment to bond electrically insulative layer 430a to stainless steel layer 410. Electrically insulative layer 430a may have a thickness ranging from about 0.025 mm (0.001 inches) to about 0.127 mm (0.005 inches). Sealing plate 412, which includes stainless steel layer 410 and electrically insulative layer 430a, may have a thickness ranging from about 0.127 mm (0.005 inches) to about 0.254 mm (0.010 inches). Sealing plate 412 may be formed by bonding a sheet of electrically insulative to a sheet of stainless steel. Once the two materials are bonded together, sealing plate 412 may be formed by stamping, machining, or any other suitable method used to form a sealing plate.

Claims

1. An end effector assembly (100) including a pair of opposing jaw members (110; 120), each of the jaw members comprising:

   a support base (319; 329);
   a knife member;
   an electrical jaw lead (325a; 325b); and
   on the support base a sealing plate (312; 322) coupled to the electrical jaw lead, the sealing plate having a stainless steel layer (410) and an electrically insulative layer (430a) formed from polyimide bonded to an underside of the sealing plate thereby to electrically insulate the sealing plate from the support base,
   the sealing plates defining a knife channel along which the knife member is translatable, in a cutting stroke, to cut tissue held between the jaw members, the knife member and jaw members being arranged such that part of the knife member slides against the electrically insulative layer when it translates along the knife channel during the cutting stroke.

2. The end effector assembly according to any one of the preceding claims, wherein the electrical jaw lead

is ultrasonically welded to the stainless steel layer of the sealing plate.

3. The end effector assembly according to claim 1 or 2, wherein the electrically insulative layer is bonded to the stainless steel layer by adhesive.

4. The end effector assembly according to claim 1 or 2, wherein the electrically insulative layer is bonded to the stainless steel layer via heat treatment.

5. An electrosurgical instrument for sealing tissue, comprising:

a housing (20) having at least one shaft (12) extending therefrom;
a handle assembly (30) operably coupled to the housing and including at least one movable handle (40);
a rotating assembly (80) operably coupled to the housing and configured to rotate the at least one shaft; and
an end effector assembly according to any one of the preceding claims.

Patentansprüche

1. Endeffektoraufbau (100) einschließlich eines Paars sich gegenüberliegender Backenelemente (110; 120), jedes der Backenelemente mit:

einer Stützbasis (319; 329);
einem Messerelement;
einer elektrischen Backenleitung (325a; 325b); und
an der Stützbasis einer Versiegelungsplatte (312; 322), die mit der elektrischen Backenleitung gekoppelt ist,
wobei die Versiegelungsplatte eine rostfreie Stahlschicht (410) und eine elektrisch isolierende Schicht (430a) aufweist, die aus Polyimid ausgebildet ist, das mit einer Unterseite der Versiegelungsplatte verbunden ist, um dadurch die Versiegelungsplatte von der Stützbasis elektrisch zu isolieren,
die Versiegelungsplatten einen Messerkanal definieren, entlang dem das Messerelement während eines Schneidhubs verschiebbar ist, um zwischen den Backenelementen gehaltenes Gewebe zu schneiden, und das Messerelement und die Backenelemente so angeordnet sind, dass ein Teil des Messerelements entlang der elektrisch isolierenden Schicht verschiebbar ist, wenn es während des Schneidhubs am Messerkanal entlangläuft.

2. Endeffektoraufbau nach einem der vorstehenden Ansprüche, bei dem die elektrische Backenleitung per Ultraschall an der rostfreien Stahlschicht der Versiegelungsplatte angeschweißt ist.

3. Endeffektoraufbau nach Anspruch 1 oder 2, bei dem die elektrisch isolierende Schicht durch ein Haftmittel mit der rostfreien Stahlschicht verbunden ist.

4. Endeffektoraufbau nach Anspruch 1 oder 2, bei dem die elektrisch isolierende Schicht über eine Wärmebehandlung mit der rostfreien Stahlschicht verbunden ist.

5. Elektrochirurgisches Instrument zum Versiegeln von Gewebe, mit:

einem Gehäuse (20), das zumindest einen sich davon erstreckenden Schaft (12) aufweist;
einem Griffaufbau (30), der betriebsfähig mit dem Gehäuse gekoppelt ist und mindestens einen bewegbaren Griff (40) aufweist;
einem Drehaufbau (80), der betriebsfähig mit dem Gehäuse gekoppelt ist und eingerichtet ist, den mindestens einen Schaft zu drehen; und
einem Endeffektoraufbau nach einem der vorstehenden Ansprüche.

Revendications

1. Ensemble effecteur terminal (100) incluant une paire d'éléments de mâchoire opposés (110 ; 120), chacun des éléments de mâchoire comprenant :

une base de support (319 ; 329) ;
un élément de couteau ;
un conducteur de mâchoire électrique (325a ; 325b) ; et
sur la base de support, une plaque de scellement (312 ; 322) couplée au conducteur de mâchoire électrique, la plaque de scellement ayant une couche d'acier inoxydable (410) et une couche électriquement isolante (430a) réalisée en polyimide liée à un côté inférieur de la plaque de scellement pour isoler ainsi électriquement la plaque de scellement de la base de support, la plaque de scellement définissant un canal de couteau le long duquel l'élément de couteau est apte à translater, lors d'une course de coupe, pour couper le tissu retenu entre les éléments de mâchoire, l'élément de couteau et les éléments de mâchoire étant agencés de telle sorte qu'une partie de l'élément de couteau coulisse contre la couche électriquement isolante lorsqu'il translate le long du canal de couteau durant le course de coupe.

2. Ensemble effecteur terminal selon l'une quelconque

des revendications précédentes, dans lequel le conducteur de mâchoire électrique est soudé par ultrasons à la couche en acier inoxydable de la plaque de scellement.

3. Ensemble effecteur terminal selon la revendication 1 ou 2, dans lequel la couche électriquement isolante est liée à la couche en acier inoxydable par un adhésif.

4. Ensemble effecteur terminal selon la revendication 1 ou 2, dans lequel la couche électriquement isolante est liée à la couche en acier inoxydable par un traitement thermique.

5. Instrument électro-chirurgical pour le scellement du tissu, comprenant :

un boîtier (20) ayant au moins un arbre (12) s'étendant de celui-ci ;
un ensemble de poignée (30) couplé fonctionnellement au boîtier et incluant au moins une poignée mobile (40) ;
un ensemble rotatif (80) couplé fonctionnellement au boîtier et configuré pour faire tourner au moins un arbre précité ; et
un ensemble effecteur terminal selon l'une quelconque des revendications précédentes.

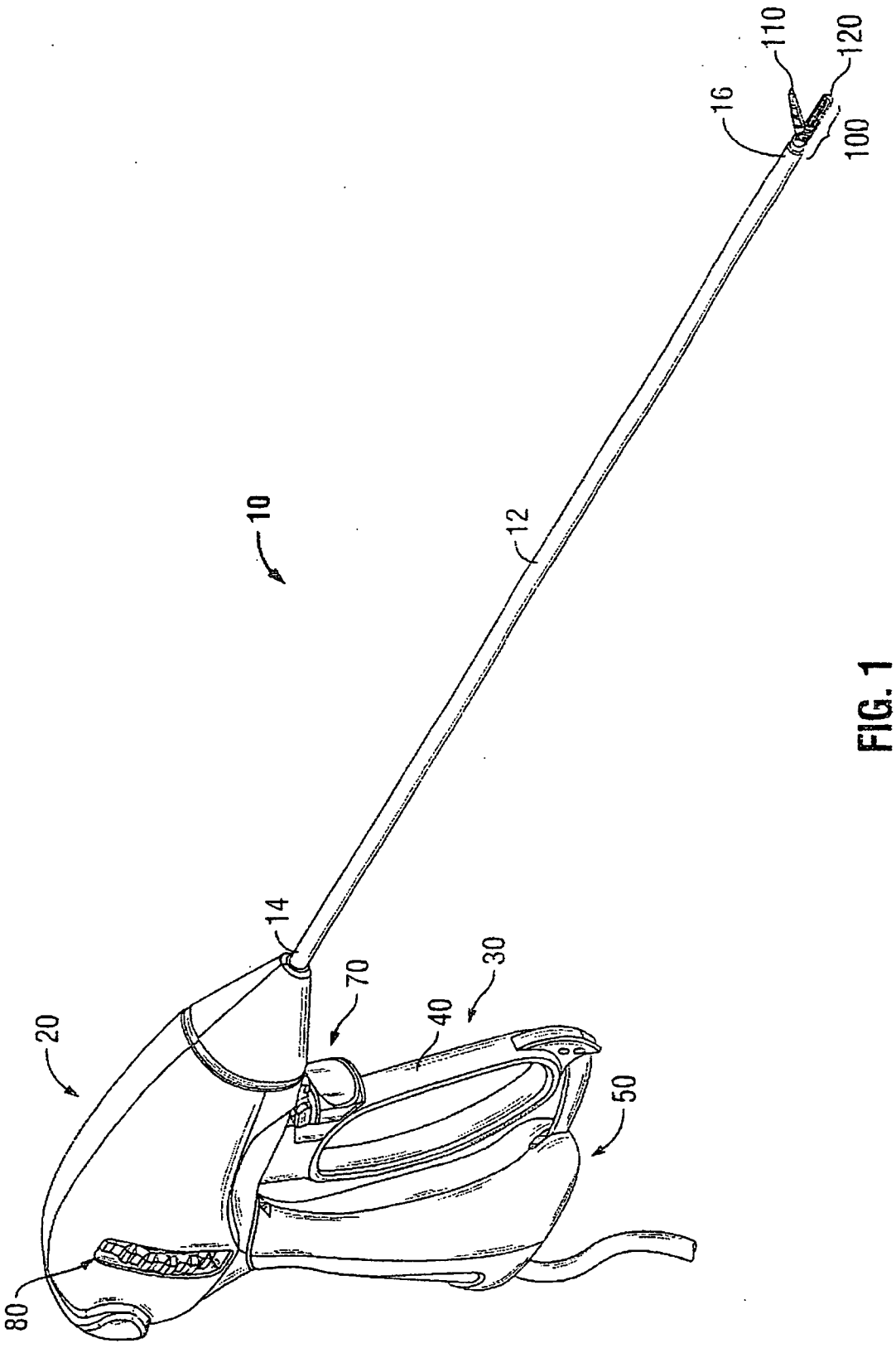

FIG. 1

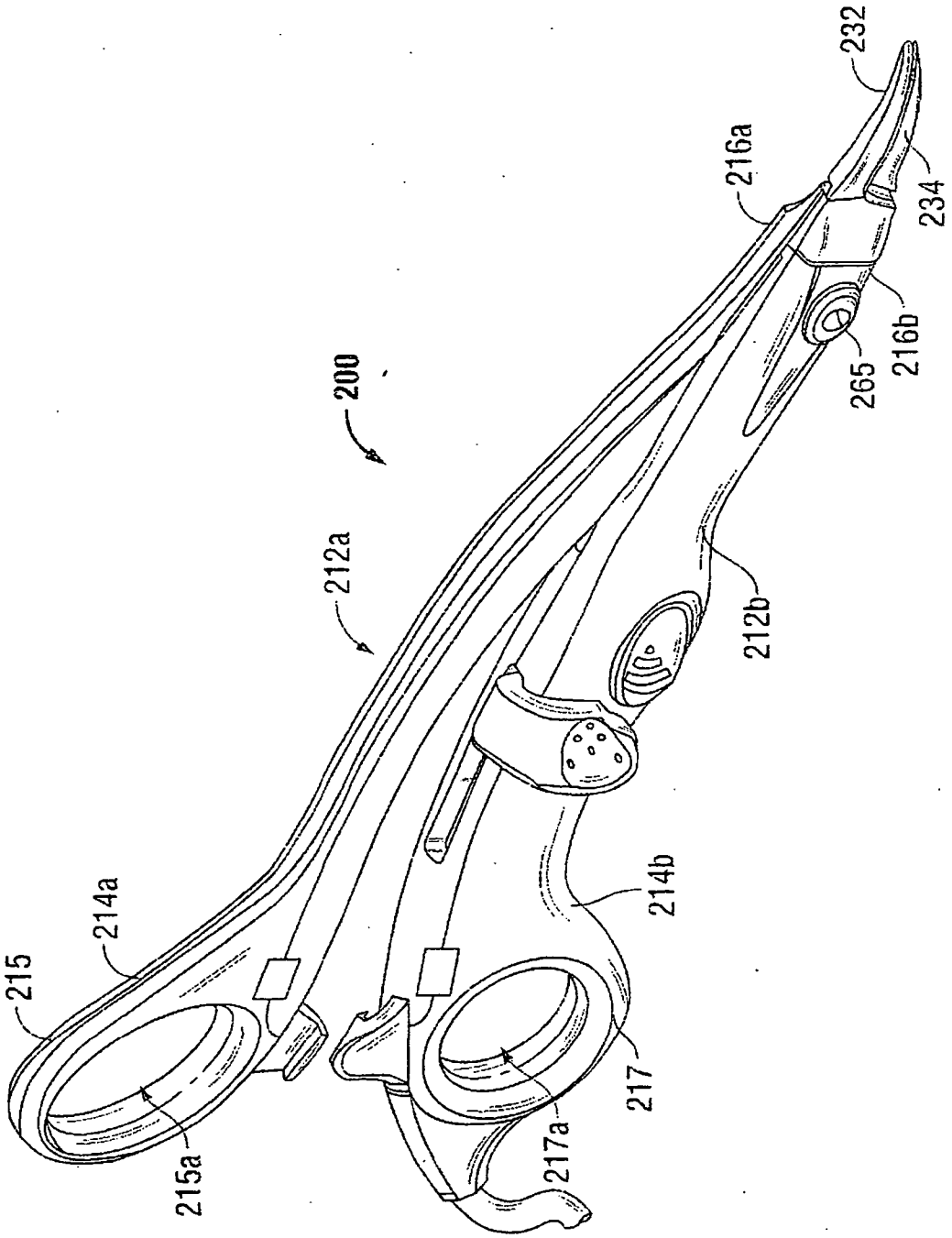
232
216a
234
200
265
216b
212a
212b
214a
214b
215
217
215a
217a

FIG. 2

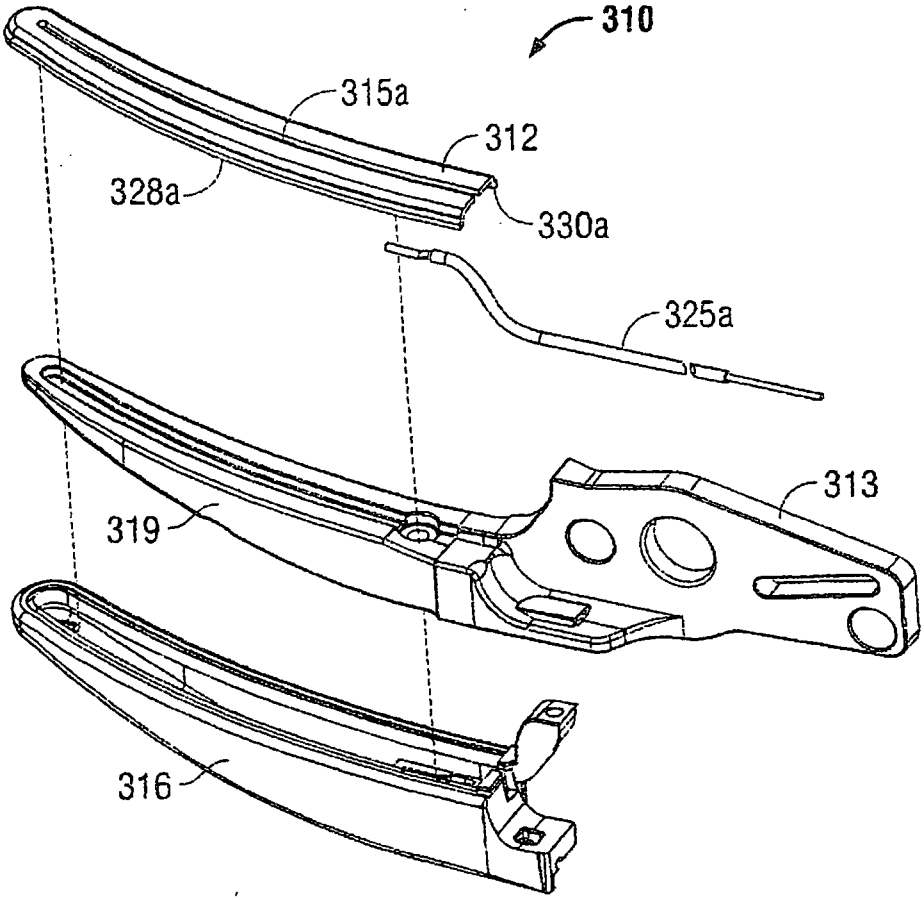

FIG. 3A

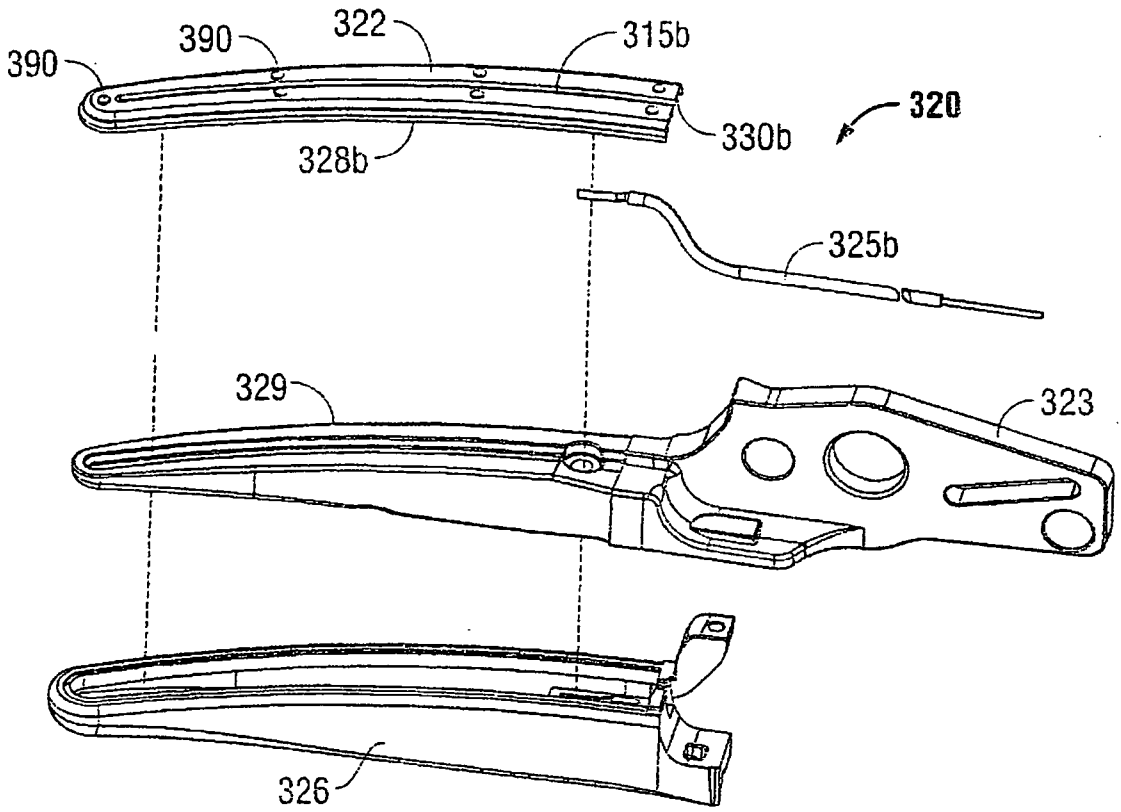

FIG. 3B

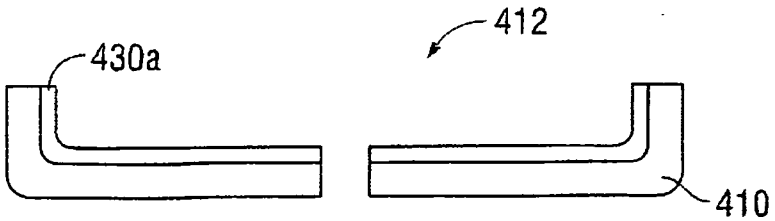

FIG. 4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 5876401 A **[0004]**
- EP 2105104 A **[0004]**
- US 369894 A **[0015]**
- US 20030229344 A1 **[0015]**
- US 460926 A **[0015]**
- US 7156846 B **[0015]**

专利名称(译)	绝缘密封板		
公开(公告)号	EP2382938B1	公开(公告)日	2014-09-24
申请号	EP2011164275	申请日	2011-04-29
[标]申请(专利权)人(译)	柯惠有限合伙公司		
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IPC分类号	A61B18/14		
CPC分类号	A61B18/1445 A61B18/1206 A61B2018/00083 A61B2018/00589 A61B2018/00595 A61B2018/0063 Y10T29/49117 Y10T29/49147		
优先权	12/770380 2010-04-29 US		
其他公开文献	EP2382938A3 EP2382938A2		
外部链接	Espacenet		

摘要(译)

提供了一种用于电外科器械的末端执行器组件。末端执行器组件具有一对相对的钳口构件。每个钳口构件具有支撑基座，电钳口引线和连接到电钳口引线的密封板。密封板具有不锈钢层和电绝缘层。

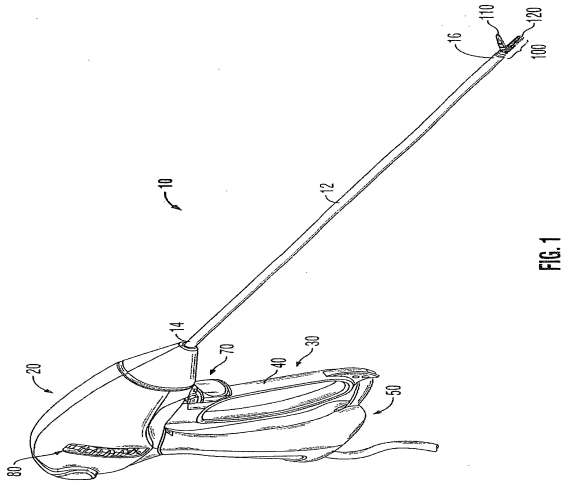

FIG. 1