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(54) **Surgical instrument with clips having transecting blades**

Chirurgisches Instrument mit Klammern mit Schneidklingen

Instrument chirurgical avec des clips de lames de coupe

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Description

BACKGROUND

[0001] During some surgical procedures, it may be necessary to cut a portion of tissue. When tissue is cut, bleeding may occur, which the physician may wish to stop at about the same time the tissue is cut. Endocutters with surgical staples provide a way of cutting tissue and stapling tissue in a substantially simultaneous manner, with the staples being applied adjacent to the tissue transection to hold together transected layers of tissue and provide hemostasis. Endocutters may include reloadable staple cartridges, which in some instances may be undesirable as the operator may need to repeatedly reload staple cartridges to transect and staple along a long transection path. Furthermore, the use of reloadable cartridges may also require that the user remove the endocutter from the patient between actuations to reload the device.

[0002] Examples of surgical staplers are described in U.S. Pat. No. 4,805,823, entitled "Pocket Configuration for Internal Organ Staplers," issued February 21, 1989; U.S. Pat. No. 5,415,334, entitled "Surgical Stapler and Staple Cartridge," issued May 16, 1995; U.S. Pat. No. 5,465,895, entitled "Surgical Stapler Instrument," issued November 14, 1995; U.S. Pat. No. 5,597,107, entitled "Surgical Stapler Instrument," issued January 28, 1997; U.S. Pat. No. 5,632,432, entitled "Surgical Instrument," issued May 27, 1997; U.S. Pat. No. 5,673,840, entitled "Surgical Instrument," issued October 7, 1997; U.S. Pat. No. 5,704,534, entitled "Articulation Assembly for Surgical Instruments," issued January 6, 1998; U.S. Pat. No. 5,814,055, entitled "Surgical Clamping Mechanism," issued September 29, 1998; U.S. Pat. No. 6,978,921, entitled "Surgical Stapling Instrument Incorporating an E-Beam Firing Mechanism," issued December 27, 2005; U.S. Pat. No. 7,000,818, entitled "Surgical Stapling Instrument Having Separate Distinct Closing and Firing Systems," issued February 21, 2006; U.S. Pat. No. 7,143,923, entitled "Surgical Stapling Instrument Having a Firing Lockout for an Unclosed Anvil," issued December 5, 2006; U.S. Pat. No. 7,303,108, entitled "Surgical Stapling Instrument Incorporating a Multi-Stroke Firing Mechanism with a Flexible Rack," issued December 4, 2007; U.S. Pat. No. 7,367,485, entitled "Surgical Stapling Instrument Incorporating a Multistroke Firing Mechanism Having a Rotary Transmission," issued May 6, 2008; U.S. Pat. No. 7,380,695, entitled "Surgical Stapling Instrument Having a Single Lockout Mechanism for Prevention of Firing," issued June 3, 2008; U.S. Pat. No. 7,380,696, entitled "Articulating Surgical Stapling Instrument Incorporating a Two-Piece E-Beam Firing Mechanism," issued June 3, 2008; U.S. Pat. No. 7,404,508, entitled "Surgical Stapling and Cutting Device," issued July 29, 2008; U.S. Pat. No. 7,434,715, entitled "Surgical Stapling Instrument Having Multistroke Firing with Opening Lockout," issued October 14, 2008; and U.S. Pat. No. 7,721,930, entitled "Disposable Cartridge with Adhesive for Use with a Stapling Device," issued May 25, 2010. While the surgical staplers referred to above are described as being used in endoscopic procedures, it should be understood that such surgical staplers may also be used in open procedures and/or other non-endoscopic procedures.

[0003] WO 2012/129317 A2 discloses a jaw tool formed from two separable units and which includes a fastening device that attaches the two units together. Each unit comprises a pair of jaws connected at one end by a hinge, and with a locking mechanism at its other end. The jaws include serrated clamping surfaces and have a cutting blade positioned adjacent the serrated surfaces along the length of the jaws. The tool may be used to simultaneously clamp and cut an object, such as the umbilical cord.

[0004] The present invention provides an apparatus as recited in the claims. While several surgical instruments have been made and used, it is believed that no one prior to the inventors has made or used the invention described in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] While the specification concludes with claims which particularly point out and distinctly claim this technology, it is believed this technology will be better understood from the following description of certain examples taken in conjunction with the accompanying drawings, in which like reference numerals identify the same elements and in which:

FIG. 1 depicts a top, perspective view of an exemplary applier for applying transecting fasteners;

FIG. 2 depicts a top, perspective view of a pair of exemplary transecting fasteners for use with the applier of FIG. 1;

FIG. 3 depicts a side, elevational view of an end effector of the applier of FIG. 1;

FIG. 4 depicts a side, cross sectional view of the end effector of FIG. 3;

FIG. 5 depicts a front, cross sectional view of the end effector of FIG. 3 taken along the line 5-5 of FIG. 3;

FIG. 6A depicts a side, cross sectional view of the end effector of FIG. 3 in a first position, with transecting fasteners positioned in a guide channel;

FIG. 6B depicts a side, cross sectional view of the end effector of FIG. 6A in a second position, with the end effector opened;

FIG. 6C depicts a side, cross sectional view of the

end effector of FIG. 6A in a third position, with the end effector closed and transecting fasteners advanced;

FIG. 7A depicts a top, perspective view of the transecting fasteners of FIG. 2 inserted into tissue;

FIG. 7B depicts a top, perspective view of the transecting fasteners of FIG. 7A after cutting tissue and separating the tissue;

FIG. 7C depicts a top, perspective view of the transecting fasteners of FIG. 7A with the tissue separated and applying a second pair of transecting fasteners;

FIG. 8 depicts a front, elevation view of one of the transecting fasteners of FIG. 2, cutting through tissue;

FIG. 9 depicts a front, cross sectional view of an exemplary alternative transecting fastener that is ultrasonically activated, cutting through tissue; and

FIG. 10 depicts a front, elevation view of another exemplary alternative transecting fastener that is activated through RF electrical energy, cutting through tissue.

[0006] The drawings are not intended to be limiting in any way, and it is contemplated that various embodiments of the technology may be carried out in a variety of other ways, including those not necessarily depicted in the drawings. The accompanying drawings incorporated in and forming a part of the specification illustrate several aspects of the present technology, and together with the description serve to explain the principles of the technology; it being understood, however, that this technology is not limited to the precise arrangements shown.

DETAILED DESCRIPTION

[0007] The following description of certain examples of the technology should not be used to limit its scope. Other examples, features, aspects, embodiments, and advantages of the technology will become apparent to those skilled in the art from the following description, which is by way of illustration, one of the best modes contemplated for carrying out the technology. As will be realized, the technology described herein is capable of other different and obvious aspects, all without departing from the technology. Accordingly, the drawings and descriptions should be regarded as illustrative in nature and not restrictive.

[0008] It is further understood that any one or more of the teachings, expressions, embodiments, examples, etc. described herein may be combined with any one or more of the other teachings, expressions, embodiments, examples, etc. that are described herein. The following-described teachings, expressions, embodiments, examples, etc. should therefore not be viewed in isolation relative to each other. Various suitable ways in which the teachings herein may be combined will be readily apparent to those of ordinary skill in the art in view of the teachings herein. Such modifications and variations are intended to be included within the scope of the claims.

[0009] For clarity of disclosure, the terms "proximal" and "distal" are defined herein relative to a robotic surgical driver comprising a proximal housing having an interface that mechanically and electrically couples with a surgical instrument having a distal surgical end effector. The term "proximal" refers the position of an element closer to the robotic surgical driver housing and the term "distal" refers to the position of an element closer to the surgical end effector of the surgical instrument and further away from the housing.

I. Exemplary Surgical Instrument

[0010] FIG. 1 depicts an exemplary surgical instrument (100) that is operable to cut and seal tissue. In particular, in many instances, such tissue may include tissue having multiple layers that the user wishes to cut and seal. For instance two or more layers of tissue may need to be cut and fastened together. In other instances, just a single layer of tissue may be cut and sealed at the cut. Surgical instrument (100) may be hand held by a user and then actuated to simultaneously cut and seal tissue. In some instances, surgical instrument (100) may be inserted through a trocar to access a portion of the patient's body, but in other instances, surgical instrument (100) may be inserted directly into a surgical region for cutting and stapling tissue in an open procedure. Generally, a user may access a surgical site and position surgical instrument (100) to cut and seal tissue. To cut and seal tissue, one or more transecting fasteners (110) may be advanced through surgical instrument (100) toward the surgical site and thereafter clamped onto tissue. Surgical instrument (100) may then actuate to close fasteners (110), to thereby simultaneously transect and fasten tissue. This process will be described in further detail below.

[0011] Surgical instrument (100) comprises a handpiece (102), shaft (104), and end effector (106). Handpiece (102) has a pistol grip shape operable to be hand held by the user, but it will be appreciated that handpiece (102) may have any suitable shape as would be apparent to one of ordinary skill in the art in view of the teachings herein. For instance, rather than a pistol grip, handpiece (102) may have a scissor grip, may be shaped as a hand held shaft, or may even be configured for integration into a mounted machine or robotic arm for controlling surgical instrument (100). Handpiece (102) comprises a cord or cable (112), closure trigger (116), a grip (117), an energy trigger (114), and rotation knob (118). In some instances, examples of which will be described below, handpiece (102) may also comprise an RF generator (170) or ultra-

sonic transducer (180). Cord (112) and energy trigger (114) may be optional depending on whether RF generator (170) and ultrasonic transducer (180) are used.

[0012] Cord (112) is operable to provide energy to surgical instrument (100) in the event that surgical instrument (100) uses energy either to provide RF energy to the surgical site through RF generator (170) or to power ultrasonic transducer (180) to provide ultrasonic vibrations to the surgical site. It will be understood that surgical instrument (100) need not necessarily be electrically driven. Furthermore, in some instances, rather than having cord (112) to deliver power for surgical instrument (100), surgical instrument (100) may incorporate a battery pack or other similar portable power source operable to deliver power. In some versions, surgical instrument (100) is powered solely by user actuation (e.g., by the user manipulating closure trigger (116)), such that surgical instrument (100) may lack cord (112), a battery, or other source of electrical power.

[0013] Energy trigger (114) is operable to be actuated by the user to selectively activate a feature at end effector (106). For instance, squeezing energy trigger (114) may be used to power a portion of surgical instrument (100) through cord (112). While the exemplary version shows energy trigger (114) having a trigger structure, it will be understood that any suitable structure for energy trigger (114) may be used as would be apparent to one of ordinary skill in the art in view of the teachings herein. In some instances, as was mentioned above, energy trigger (114) and cord (112) need not be included at all if surgical instrument (100) is entirely mechanically operated.

[0014] Closure trigger (116) is in communication with end effector (106) such that the user squeezing closure trigger (116) causes end effector (106) to close. In the exemplary version, closure trigger (116) is operable to be actuated by squeezing closure trigger (116) toward grip (117). However, it will be understood that closure trigger (116) may take any suitable form including a button, knob, etc. Other suitable structures for closure trigger (116) will be apparent to those of ordinary skill in the art in view of the teachings herein.

[0015] Rotation knob (118) is in communication with handpiece (102) and is further in communication with shaft (104). Rotation knob (118) may be manually rotated by a user and is shaped to facilitate gripping by the user. Rotation knob (118) is rotationally coupled with shaft (104) as well as end effector (106) such that rotating rotation knob (118) is operable to rotate end effector (106). Furthermore, shaft (104) rotates with end effector (106) such that rotating rotation knob (118) causes both shaft (104) and end effector (106) to rotate. More specifically, knob (118), shaft (104), and end effector (106) all rotate about the longitudinal axis defined by shaft (104). For instance, in the event that the user may wish to position end effector (106) differently in relation to tissue to be cut and sealed, the user may rotate rotation knob (118) to rotate end effector (106).

[0016] Shaft (104) extends distally from handpiece (102). In the exemplary version, shaft (104) is shown with a straight profile extending outward from handpiece (102) without a curve, but it will be appreciated that in some versions, shaft (104) may have a curved profile or any other suitable shape as would be apparent to one of ordinary skill in the art in view of the teachings herein. Shaft (104) is further operable to house a plurality of transecting fasteners (110), which will be described in further detail below. Shaft (104) also comprises an outer tube (120). Outer tube (120) is operable to longitudinally translate relative to the rest of shaft (104) as a result of the user actuating closure trigger (116). By way of example only, closure trigger (116) may be in communication with shaft (104) through a plurality of internal linkages, a rack and pinion system, or any other suitable ways of mechanically coupling closure trigger (116) and shaft (104) as would be apparent to one of ordinary skill in the art in view of the teachings herein. Outer tube (120) is in further communication with end effector (106). Outer tube (120) is operable generally to control the opening and closing of end effector (106), which will be described in further detail below.

II. Exemplary End Effector

[0017] End effector (106) comprises an upper jaw (122) and lower jaw (124). FIG. 3 shows an enlarged view of end effector (106), which more clearly shows upper and lower jaws (122, 124). In the exemplary version, lower jaw (124) is pivotally stationary in relation to shaft (104). In some versions, lower jaw (124) may be unitarily constructed with shaft (104) or a portion of shaft (104) to ensure such static positioning. In other versions, lower jaw (124) may be affixed to shaft (104) through bolts, screws, fasteners, etc. such that lower jaw (124) does not pivot in relation to shaft (104). Upper jaw (122) is operable to pivot in relation to lower jaw (124), such that upper jaw (122) is able to move between an open and close position relative to lower jaw (124). In the exemplary version, the pivot (126) between upper and lower jaw (122, 124) is positioned such that pivot (126) is closer to lower jaw (124), but it will be understood that any suitable position for pivot (126) may be used as would be apparent to one of ordinary skill in the art in view of the teachings herein. Furthermore, while upper jaw (122) is movable relative to lower jaw (124), it will be understood that in some versions, lower jaw (124) may be movable relative to upper jaw (122). In yet other versions, both upper jaw (122) and lower jaw (124) may be movable about pivot (126).

[0018] Outer tube (120), as mentioned above, is operable to slide along the outside of shaft (104) toward end effector (106). Outer tube (120) is operable to contact upper jaw (122) such that when upper jaw (122) is in an open position, outer tube (120) can be urged against upper jaw (122) to close upper jaw (122) relative to lower jaw (124). Furthermore, outer tube (120) defines a slot (128) operable to couple with a hook (130), which is de-

fined at a proximal end of upper jaw (122). As a result, when outer tube (120) translates proximally, hook (130) catches slot (128) and pulls upper jaw (122) away from lower jaw (124), thereby opening upper jaw (122). Thus, outer tube (120) is operable generally to advance distally in order to close upper jaw (122) against lower jaw (124) and retract proximally to open upper jaw (122) away from lower jaw (124).

III. Exemplary Transecting Fasteners

[0019] It will be appreciated that the closing motion of upper jaw (124) is operable to close transecting fasteners (110) by deforming fasteners (110) shut. Furthermore, fasteners (110) are malleable such that they maintain a closed configuration when deployed. FIG. 2 shows a pair of transecting fasteners (110). It will be appreciated that transecting fasteners (110) may be used in adjacent pairs as seen in the exemplary version; or may be used one at a time. In yet other versions, more than two transecting fasteners (110) may be used. Indeed, any suitable combination of transecting fasteners (110) may be used as would be apparent to one of ordinary skill in the art in view of the teachings herein.

[0020] Fasteners (110) comprise legs (132), a crown (134), blades (136), anchors (138), and front teeth (140). Fasteners (110) are operable generally to cut, compress, and seal tissue in a substantially simultaneous manner. In particular, blades (136) are operable to cut tissue, while anchors (138) and front teeth (140) are operable to seal and grip tissue. Legs (132) are operable to compress tissue therebetween in response to squeezing legs (132) together. Once legs (132) compress tissue, crown (134) is operable to maintain fasteners (110) in a closed and/or clamped configuration around tissue. As mentioned above, it will be appreciated that the stapling and cutting happens in a substantially simultaneous manner. However, it will further be understood that the cutting and stapling may occur at slightly different times based on the relative lengths of blades (136), anchors (138) and front teeth (140). For instance, if blades (136) are much longer relative to anchors (138) and front teeth (140), tissue can be cut and sealed in one motion, but tissue will be cut first immediately followed by being sealed. In the event that anchors (138) and front teeth (140) are much longer relative to blades (136), then it will be appreciated that the stapling action may occur slightly ahead of the cutting action.

[0021] Legs (132) and crown (134) form the body of fastener (110). It will be appreciated that crown (134) comprises a malleable material operable to deform to open and close in response to the opening and closing of upper jaw (122) and lower jaw (124). It will be appreciated that crown (134) is sufficiently malleable such that once fastener (110) is bent or otherwise deformed, fastener (110) maintains its bent or deformed shape, sufficient to hold tissue in a clamped configuration. Legs (132) and crown (134) form a generally elongated C-shape profile, but it will be understood that other shapes for fastener (110) may be used as would be apparent to one of ordinary skill in the art in view of the teachings herein.

[0022] Anchors (138) have a sharp, hook-like shape. However, it will be understood that any shape operable to anchor into tissue may be used for anchors (138) as would be apparent to one of ordinary skill in the art in view of the teachings herein. Anchors (138) of the exemplary version further extend symmetrically from legs (132) toward each other. While one such positioning of anchors (138) relative to legs (132) is shown in the exemplary version, other suitable positions (e.g., staggered, etc.) may also be used as would be apparent to one of ordinary skill in the art in view of the teachings herein. When inserted into tissue, it will be understood that anchors (138) may grip tissue and may additionally supplement gripping by front teeth (140).

[0023] Front teeth (140) have a sharp, hook-like shape. It will be appreciated that any shape suitable for gripping tissue may be used for front teeth (140). As fasteners (110) close from an open position, front teeth (140) pierce tissue and anchor fasteners (110) into the tissue. It will be understood that anchoring in tissue by front teeth (140) may be operable to supplement anchoring by anchors (138). Both front teeth (140) and anchors (138) are constructed such that once anchored into tissue, fasteners (110) are secured into place and maintain their position in the tissue.

[0024] Fasteners (110) further comprise blades (136), which are operable to cut tissue as fasteners (110) close against tissue. Blades (136) include an upper blade (142) and a lower blade (144). In particular, blades (136) form a sharp edge operable to slice tissue through shearing. In the exemplary version, blades (136) have a straight cutting edge, but it will be understood that in other versions, any suitable edge or surface may be used to cut tissue as will be apparent to one of ordinary skill in the art in view of the teachings herein. Furthermore, blades (136) of the exemplary version span substantially the length of legs (132). However, in some versions, it will be understood that blades (136) may span only a portion of legs (132). Blades (136) of the exemplary version also have a tapered trapezoid-like shape, but it will be understood that blades (136) may have any suitable shape operable to cut tissue as will be apparent to one of ordinary skill in the art in view of the teachings herein.

[0025] Jumping to FIG. 8, upper blade (142) and lower blade (144) are positioned slightly offset relative to each other such that once upper blade (142) and lower blade (144) meet, they shear tissue (150), thereby providing the cut. In yet other versions, upper blade (142) and lower blade (144) may be configured in any suitable manner operable to cut tissue as will be apparent to one of ordinary skill in the art in view of the teachings herein. For instance, upper blade (142) and lower blade 9144) may be positioned directly in line with each other along a common plane.

[0026] Returning to FIGS. 4-5, end effector (106) is

shown in a cross sectional view to show a plurality of fastener channels (147, 148, 151, 152) of end effector (106). Additionally, shaft (104) includes an inner member (164) that defines fastener channels (145, 146, 153, 154). It will be appreciated that inner member (164) is unitarily formed with lower jaw (124). Furthermore, in relation to shaft (104), inner member (164) is operable to rotate with outer tube (120) relative to handpiece (102) as knob (118) is rotated. Thus, inner member (164) is rotationally coupled with outer tube (120). However, inner member (164) and outer tube (120) are not longitudinally coupled, thereby allowing outer tube (120) advance distally and retract proximally in relation to inner member (164) while inner member (164) stays longitudinally stationary. Fastener channels (145, 146, 153, 154) extend longitudinally through shaft (104) and are operable to guide fasteners (110) through inner member (164). Fastener channels (145, 146, 147, 148, 151, 152, 153, 154) are shaped to complement fasteners (110) as seen in the front, cross sectional view shown in FIG. 5. Furthermore, channels (145, 146, 147, 148, 151, 152, 153, 154) are in communication with each other as follows. Fastener channel (145) is in communication with fastener channel (147); fastener channel (146) is in communication with fastener channel (148); fastener channel (154) is in communication with fastener channel (152); and fastener channel (153) is in communication with fastener channel (151).

[0027] As also seen in FIG. 5, a split axis plane (161) is defined in between channels (145, 146, 147, 148) and channels (151, 152, 153, 154). It will be understood that when fasteners (110) grip and cut tissue, the line of tissue transection lies approximately along split axis plane (161) such that any cuts made by fasteners (110) will be aligned along the longitudinal axis of shaft (104), which overlaps split axis plane (161). Furthermore, fasteners (110) are positioned to exhibit opposing symmetry about axis (161). Fasteners (110) are positioned in a parallel, end to end, arrangement within shaft (104) and end effector (106). More specifically, fasteners (110) are positioned as adjacent pairs with anchors (138) of fasteners (110) oriented outwardly in a manner perpendicular or substantially perpendicular to blades (136). Fasteners (110) are initially positioned in fastener channels (145, 146, 153, 154) of inner member (164) during use of surgical instrument (100), fasteners (110) advance from fastener channels (145, 146, 153, 154) to fastener channels (147, 148, 151, 152) of end effector (106) prior to cutting and sealing tissue. In particular, moving to FIG. 6A, fasteners (110) are shown within fastener channels (145, 146, 153, 154) as well as fastener channels (147, 148, 151, 152). One fastener (110) is shown positioned in end effector (106) whereas another fastener (110) is shown in shaft (104) prior to end effector (106). It will be appreciated that the length of end effector (106) is dimensioned as shown to fit one fastener at a time in end effector (106). It will be understood that in other versions, end effector (106) may be dimensioned to hold more than one fastener (110).

[0028] As also seen in FIG. 6A, fastener (110) initially starts in a closed position along with end effector (106). Outer tube (120) does not apply sufficient pressure distally or proximally along shaft (104) to cause upper jaw (122) to open relative to lower jaw (124). Once end effector (106) is positioned in an appropriate place in tissue, the user may then actuate closure trigger (116) to open end effector (106). It will be appreciated that closure trigger (116) may be operable to actuate in more than one direction in order to separately open and close upper jaw (122) against lower jaw (124). In the alternative, rather than a single closure trigger (116), more than one closure trigger (116) may be used to separately control the opening and closing of upper jaw (122).

[0029] In the exemplary version, the user actuates closure trigger (116) to cause outer tube (120) to proximally retract. Outer tube (120) catches hook (130) as outer tube (120) retracts and further retracts to pull upper jaw (122) open as seen in FIG. 6B. As upper jaw (122) opens, fasteners (110) positioned in fastener channels (147, 148, 151, 152) of end effector (106) are urged open by upper jaw (122), which separates blades (136) such that fastener (110) is ready for application to tissue.

[0030] Once end effector (106) is positioned properly around tissue that the user wishes to seal and cut, user may actuate closure trigger (116), which thereby causes outer tube (120) to advance distally as seen in FIG. 6C. The distal edge of outer tube (120) presses against a proximal edge of upper jaw (122), thereby causing upper jaw (122) to pivot toward upper jaw (122) to a closed position. As upper jaw (122) closes, fastener (110) is also urged closed by end effector (106) thereby deforming fastener (110) to a clamped position. As fastener (110) closes, blades (136) cut tissue positioned between upper jaw (122) and lower jaw (124), and furthermore, anchors (138) and front teeth (140) penetrate and anchor themselves into tissue. As outer tube (120) advances to urge upper jaw (122) closed, it will be appreciated that outer tube (120) or some other component of shaft (104) may be coupled with closure trigger (116) to advance a component within shaft (104), such as a rod, etc., which may be used to advance fasteners (110) within shaft (104). For instance, a proximally mounted spring within handpiece (102), a rack and pinion with a ratcheting spring-loaded pawl, or any other suitable means of distally biasing fasteners (110) may be used as would be apparent to one of ordinary skill in the art in view of the teachings herein.

[0031] It will be understood that advancement of outer tube (120) is also operable to advance fasteners (110) out of end effector (106) in addition to advancing fasteners (110) within end effector (106). For instance, since fasteners (110) are positioned serially within shaft (104) and end effector (106) in an end-to-end relationship, fasteners (110) may be advanced one pair at a time. Once one pair of fasteners (110) has closed, cut, and anchored into tissue, the next pair of fasteners (110) advances and prepares for opening and closing upon a new portion of tissue. It will be appreciated that the user may repeat the

process shown in FIGS. 6A-6C to continuou In some instances, a cartridge of staples may be loaded into handpiece (102) to deliver staples. In some instances, the length of shaft (104) and handpiece (102) may be such that the user can cut and seal tissue with fasteners in an effectively indefinitely continuous manner. In some instances, handpiece (102) may be entirely replaceable acting effectively as a reloadable cartridge while shaft (104) and end effector (106) may remain in the surgical site. In yet other instances, handpiece (102) may receive a replaceable cartridge, similar to a handgun ammunition clip, to feed end effector (106) with an effectively indefinite supply of fasteners (110). In addition or in the alternative, a resilient member (e.g., a coil spring, foam, elastomer, etc.) may resiliently bias fasteners (110) distally in shaft (104). As yet another merely illustrative example, one or more features in one or both of jaws (122, 124) may be configured to advance fasteners (110), one pair of fasteners (110) at a time in a side-by-side relationship, each time jaws (122, 124) are pivoted to an open configuration. As yet another merely illustrative example, a twist-pen type of mechanism (e.g., similar to advancement in a ballpoint pen by rotation of concentric tubes, etc.) may be employed to advance fasteners (110) distally. For instance, a rotatable outer tube may be coupled with features on fasteners (110) that convert rotation of the outer tube into distal translation of fasteners (110). Such a rotatable outer tube may be rotated manually or may be automatically rotated each time jaws (122, 124) are pivoted to an open configuration. Other suitable ways in which fasteners (110) may be loaded and/or advanced distally will be apparent to those of ordinary skill in the art in view of the teachings herein.sly cut and seal more portions of tissue.

IV. Transection Fasteners Applied to Tissue

[0032] FIG. 7A shows an exemplary application of fasteners (110) to tissue (150) without showing end effector (106). A transection line (160) is shown merely for demonstrative purposes to show where blade (136) would create a cut within tissue (150). Anchors (138) penetrate tissue (150), thereby securing fasteners (110) in tissue (150). Fasteners (110) are shown cutting and gripping tissue as a matched pair as seen in the illustrative version such that tissue (150) ultimately splits along transection line (160), as shown in FIG. 7B. It will be appreciated that paired fasteners (110) may be split apart as seen in FIG. 7B due to the user forcibly urging apart fasteners (110) after fasteners (110) have cut and anchored tissue (150). In yet other versions, blades (136) of fasteners (110) may cut tissue (150) in a sufficiently clean manner that tissue tension may provide sufficient enough force to pull apart tissue (150) along transection line (160). It will be appreciated that splitting fasteners (110) may be able to provide user visibility of tissue for subsequent stapling. Thereafter, the user may cut and seal another portion of tissue (150), which can be seen in FIG. 7C. While only two pairs of fasteners (110) are shown in the illustrated versions, it will be understood that any suitable number of fasteners (110) may be applied to tissue (150). In fact, fasteners (110) may be continuously added to tissue (150) in order to continue cutting along transection line (160), without having to remove surgical instrument (100) from the patient. It will be understood that to enable continuous application of fasteners (110) to tissue (150), a large number of fasteners may be preloaded such that fasteners (110) can subsequently be delivered along a longer transectional path of any desirable length. For instance, handpiece (102) may be equipped with a continuous feeding mechanism involving a reloadable cartridge, canister, etc. of fasteners (110) that will allow the user to continuously cut and seal tissue with fasteners (110) positioned in an end to end configuration along tissue (150) such that surgical instrument (100) does not need to be removed from the surgical site while completing a substantially long transection (e.g. having a length that would require one or more reloads of a staple cartridge in a conventional endocutter device).

[0033] It will be appreciated that in some instances, it may be desirable for fastener (110) to cut tissue (150) through the shearing action of sharp edges of blades (136) of fastener (110). In yet other instances, it may be desirable to cut tissue (150) using electrical assistance. FIG. 9 shows an exemplary alternative fastener (210) having a similar cross section of fastener (110) of FIG. 8. Fastener (210) has legs (232) that are substantially similar to legs (132) of fastener (110). However, fastener (210) comprise a blunt blade (236) operable to cut tissue. In particular, fastener (210) is acoustically coupled with ultrasonic transducer (180) or any other suitable vibrational transducer operable to deliver ultrasonic vibrations to fastener (210). As a result, as blades (236) close upon tissue (150), ultrasonic vibrations of blades (236) facilitate cutting and hemostasis of tissue (150). It will be understood that a particular frequency may be selected for cutting and sealing tissue (150), or a variety of frequencies may be operable to be delivered to tissue (150) for cutting and sealing. It will also be understood that ultrasonic vibrations of blades (236) may include longitudinal vibration, axial or rotational vibration, linear vibration side to side, or any combination thereof as would be apparent to one or ordinary skill in the art in view of the teachings herein.

[0034] During an exemplary use, the user could position surgical instrument (100) of FIG. 1 at an appropriate position for cutting tissue (150). Thereafter, energy trigger (114) may be actuated to power ultrasonic transducer (180) within handpiece (102). The transducer could then provide ultrasonic vibrations to end effector (106) and accordingly to fasteners (210) such that closing end effector (106) on tissue (150) is operable to enable the user to cut tissue (150) using ultrasonic vibrations as well as simultaneously anchor fasteners (210) into tissue (150). Furthermore, ultrasonic vibrations could be applied to the surgical site to cause hemostasis of tissue (150), thereby

halting tissue bleeding.

[0035] In yet other instances, it will be appreciated that it may be desirable to use RF energy applied to the surgical site to facilitate cutting tissue. FIG. 10 shows an alternative exemplary fastener (310) operable to cut tissue (150) through use of RF energy applied to fastener (310). Fastener (310) comprises legs (332) substantially similar to legs (132) of fastener (110). Fastener (310) comprises a blunt blade (336) operable to cut tissue (150) and deliver RF energy to tissue (150). In the exemplary version, fastener (310) is in communication with RF generator (170) in handpiece (102), which is operable to provide RF energy to fastener (310). As a result, when blades (336) are applied to tissue (150), RF energy is operable to promote cutting and sealing of tissue (150). Furthermore, in some instances, RF energy may also be operable promote coagulation of tissue (150) to prevent or stop bleeding. In some instances, RF energy applied to fastener (310) may include monopolar energy or in other instances bipolar energy. By way of example only, in the case that monopolar energy is applied to the surgical site, a ground pad may be placed on the patient's body or under the patient to provide the electrical ground for delivering monopolar energy. In the case that bipolar energy is applied to the surgical energy, the bipolar energy may be applied directly through fastener (110) where fastener (110) may be constructed such that crown (134) is made of plastic or other suitable insulating material, thereby allowing bipolar RF energy to be applied through legs (132) without shorting at crown (134).

[0036] It will be appreciated that RF energy or ultrasonic vibrations as applied to fasteners (210, 310) as described above with respect to FIGS. 9 and 10 may also be applied to end effector (106) or any other suitable portion of surgical instrument (100) as would be apparent to one of ordinary skill in the art in view of the teachings herein.

V. Miscellaneous

[0037] Versions of the devices described above may have application in conventional medical treatments and procedures conducted by a medical professional, as well as application in robotic-assisted medical treatments and procedures. By way of example only, various teachings herein may be readily incorporated into a robotic surgical system such as the DAVINCI™ system by Intuitive Surgical, Inc., of Sunnyvale, California.

[0038] Versions described above may be designed to be disposed of after a single use, or they can be designed to be used multiple times. Versions may, in either or both cases, be reconditioned for reuse after at least one use. Reconditioning may include any combination of the steps of disassembly of the device, followed by cleaning or replacement of particular pieces, and subsequent reassembly. In particular, some versions of the device may be disassembled, and any number of the particular pieces or parts of the device may be selectively replaced or removed in any combination. Upon cleaning and/or replacement of particular parts, some versions of the device may be reassembled for subsequent use either at a reconditioning facility, or by a user immediately prior to a procedure. Those skilled in the art will appreciate that reconditioning of a device may utilize a variety of techniques for disassembly, cleaning/replacement, and reassembly. Use of such techniques, and the resulting reconditioned device, are all within the scope of the present application.

[0039] By way of example only, versions described herein may be sterilized before and/or after a procedure. In one sterilization technique, the device is placed in a closed and sealed container, such as a plastic or TYVEK bag. The container and device may then be placed in a field of radiation that can penetrate the container, such as gamma radiation, x-rays, or high-energy electrons. The radiation may kill bacteria on the device and in the container. The sterilized device may then be stored in the sterile container for later use. A device may also be sterilized using any other technique known in the art, including but not limited to beta or gamma radiation, ethylene oxide, or steam.

[0040] Having shown and described various embodiments of the present invention, further adaptations of the methods and systems described herein may be accomplished by appropriate modifications by one of ordinary skill in the art. Several of such potential modifications have been mentioned, and others will be apparent to those skilled in the art. For instance, the examples, embodiments, geometries, materials, dimensions, ratios, steps, and the like discussed above are illustrative and are not required. Accordingly, the scope of the present invention should be considered in terms of the following claims and is understood not to be limited to the details of structure and operation shown and described in the specification and drawings.

Claims

1. An apparatus operable to cut and secure tissue comprising a transecting fastener (110) wherein the transecting fastener (110) comprises:

   (a) a pair of legs (132) configured to grip tissue therebetween, each of the pair of legs having a first end and second end;
   (b) a crown portion (134) joining the pair of legs (132) at their first ends, wherein the crown portion (134) is deformable and made of a malleable material configured to allow and maintain deformation of the crown; and
   (c) at least one blade (136) positioned on each of the pair of legs (132), wherein the at least one (136) blade positioned on each of the pair of legs (132) is dimensioned to span at least a portion of the length of the respective leg of the pair of

legs, and forms a pair of opposingly facing blades (136) which are operable to cooperatively cut the tissue between the pair of legs when the fastener is closed against the tissue; wherein:
each of the pair of legs (132) comprises a tooth (140) and an anchor (138), wherein each of the teeth (140) and the anchors (138) are configured to penetrate, anchor themselves into, and grip tissue, and each of the teeth (140) and anchors (138) comprises a sharp, hook-like shape, wherein each tooth (140) extends towards the other tooth (140) from the second end of the respective leg of the pair of legs (132), and each anchor (138) extends towards the other anchor (138) from a portion of the respective leg of the pair of legs (132) between its first and second end.

2. The apparatus of claim 1, wherein each at least one blade (136) is dimensioned to span substantially the entire length of the respective leg of the pair of legs (132).

3. The apparatus of claim 1, wherein the pair of legs (132) are made of a malleable material configured to allow and maintain deformation of the pair of legs (132).

4. The apparatus of claim 1, wherein the pair of legs (132) and the crown portion (134) form an elongated C shape.

5. The apparatus of claim 1, wherein the at least one blade comprises a blunt edge (236) configured to deliver ultrasonic vibrations to a surgical site.

6. The apparatus of claim 1, wherein the at least one blade comprises a blunt edge (336) configured to deliver RF energy to a surgical site to coagulate tissue.

7. The apparatus of claim 1, further comprising a surgical instrument (100) comprising:

(i) a handpiece (102),
(ii) a shaft (104) extending from the handpiece (102), and
(iii) an end effector (106), wherein the end effector (106) is configured to hold at least one of the pair of legs (132), wherein the end effector (106) is further configured to drive at least one of the pair of legs (132) into tissue.

8. The apparatus of claim 7, wherein the shaft (104) comprises an outer tube (120) configured to open and close the end effector (106).

9. The apparatus of claim 7, wherein the handpiece (102) further comprises an RF generator (170) configured to deliver RF energy to the at least one blade (336) through the shaft (104).

10. The apparatus of claim 7, wherein the handpiece further comprises an ultrasonic generator (180) configured to deliver ultrasonic vibrations to the at least one blade (236) through the shaft (104).

11. The apparatus of claim 7, wherein the end effector (106) comprises an upper jaw (122) and lower jaw (124), wherein the upper jaw (122) is pivotable relative to the lower jaw (124).

12. The apparatus of claim 7, wherein the handpiece (102) has one or more triggers (114, 116) operable to actuate the end effector (106) using a single-handed operation.

13. A plurality of the apparatuses of any of claims 1 to 6 further comprising a surgical instrument (100) comprising:

(a) a handpiece (102) including an actuation feature (114, 116);
(b) the shaft (104) extending distally from the handpiece (102); and
(c) an end effector (106) extending distally from the shaft (104); wherein

the plurality of transecting fasteners (110) is positioned in an end to end configuration along the length of the shaft (104) of the surgical instrument (100) and wherein the plurality of transecting fasteners is operable to be delivered through the end effector (106).

14. The apparatus of claim 13, wherein the plurality of transecting fasteners (110) comprises at least one pair of fasteners (110) symmetrically facing each other, and adjacent to each other within the end effector (106).

15. The apparatus of claim 14, wherein the end effector (106) comprises a fastener channel (145, 146, 147, 148, 151, 152, 153, 154) shaped to complement the at least one transecting fastener (110), wherein the at least one transecting fastener (110) is operable to advance within the fastener channel.

16. A plurality of the apparatuses of any of claims 1 to 6, further comprising a surgical instrument (100) comprising:

(a) a handpiece (102) including an actuation feature (114, 116);
(b) a shaft (104) extending distally from the

handpiece (102), wherein the shaft (104) defines a split axis plane (161) extending longitudinally through the shaft (104); and
(c) an end effector (106) extending distally from the shaft (104), wherein the end effector (106) defines two parallel channels (145, 146, 147, 148, 151, 152, 153, 154) positioned on opposing sides of the split axis plane (161), wherein the two parallel channels are adjacently positioned within the end effector (106); wherein

the plurality of transecting fasteners (110) is operable to be delivered through the end effector (106), wherein the fasteners (110) are operable to close along respective planes that are laterally offset from and parallel to the split axis plane (161).

Patentansprüche

1. Vorrichtung zum Schneiden und Befestigen von Gewebe, aufweisend ein durchschneidendes Befestigungselement (110), wobei das durchschneidende Befestigungselement (110) aufweist:

(a) ein Paar von Beinen (132), die dazu ausgelegt sind, Gewebe dazwischen zu greifen, wobei jedes von dem Paar von Beinen ein erstes Ende und ein zweites Ende hat;
(b) ein Kronenteil (134), das das Paar von Beinen (132) an deren ersten Enden verbindet, wobei das Kronenteil (134) verformbar ist und aus einem verformbaren Material hergestellt ist, das dazu ausgelegt ist, eine Verformung der Krone zu ermöglichen und aufrechtzuerhalten; und
(c) mindestens eine Klinge (136), auf jedem der Beine (132) positioniert, wobei die mindestens eine (136) Klinge, die auf jedem der Beine (132) positioniert ist, so bemessen ist, dass sie mindestens einen Abschnitt der Länge des jeweiligen Beins des Paars von Beinen überspannt und ein Paar einander gegenüberliegender zugewandter Klingen (136) bildet, die dazu dienen, zusammen das Gewebe zwischen dem Paar von Beinen zu schneiden, wenn das Befestigungselement gegenüber dem Gewebe geschlossen ist; wobei:

jedes von dem Paar von Beinen (132) einen Zahn (140) und einen Anker (138) aufweist, wobei jeder von den Zähnen (140) und den Ankern (138) dazu ausgelegt ist, in das Gewebe eindringen, sich darin zu verankern und Gewebe zu greifen, und jeder von den Zähnen (140) und den Ankern (138) eine scharfe, hakenartige Form aufweist, wobei sich jeder Zahn (140) von dem zweiten Ende des jeweiligen Beines des Paares von Beinen (132) zu dem anderen Zahn (140) hin erstreckt, und jeder Anker (138) sich von einem Teil des jeweiligen Beines des Paares von Beinen (132) zwischen dessen ersten und zweiten Ende zu dem anderen Anker (138) hin erstreckt.

2. Vorrichtung nach Anspruch 1, wobei jede mindestens eine Klinge (136) so dimensioniert ist, dass sie im Wesentlichen die gesamte Länge des jeweiligen Beines des Paares von Beinen (132) überspannt.

3. Vorrichtung nach Anspruch 1, wobei das Paar von Beinen (132) aus einem verformbaren Material hergestellt ist, das dazu ausgelegt ist, eine Verformung des Paares von Beinen (132) zu ermöglichen und aufrechtzuerhalten.

4. Vorrichtung nach Anspruch 1, wobei das Paar von Beinen (132) und das Kronenteil (134) eine längliche C-Form bilden.

5. Vorrichtung nach Anspruch 1, wobei die mindestens eine Klinge eine stumpfe Kante (236) aufweist, die dazu ausgelegt ist, Ultraschallschwingungen an eine Operationsstelle zu liefern.

6. Vorrichtung nach Anspruch 1, wobei die mindestens eine Klinge eine stumpfe Kante (336) aufweist, die dazu ausgelegt ist, HF-Energie an eine Operationsstelle zu liefern, um Gewebe zu koagulieren.

7. Vorrichtung nach Anspruch 1, ferner aufweisend ein chirurgisches Instrument (100), aufweisend:

(i) ein Handstück (102),
(ii) eine Welle (104), die sich von dem Handstück (102) erstreckt, und
(iii)einen Endeffektor (106), wobei der Endeffektor (106) dazu ausgelegt ist, mindestens eines von dem Paar von Beinen (132) zu halten, wobei der Endeffektor (106) ferner dazu ausgelegt ist, mindestens eines von dem Paar von Beinen (132) in Gewebe zu treiben.

8. Vorrichtung nach Anspruch 7, wobei die Welle (104) ein Außenrohr (120) aufweist, das dazu ausgelegt ist, den Endeffektor (106) zu öffnen und zu schließen.

9. Vorrichtung nach Anspruch 7, wobei das Handstück (102) ferner einen HF-Generator (170) aufweist, der dazu ausgelegt ist, HF-Energie an die mindestens eine Klinge (336) durch die Welle (104) zu liefern.

10. Vorrichtung nach Anspruch 7, wobei das Handstück ferner einen Ultraschallgenerator (180) aufweist, der dazu ausgelegt ist, Ultraschallschwingungen an die mindestens eine Klinge (236) durch die Welle (104) zu liefern.

11. Vorrichtung nach Anspruch 7, wobei der Endeffektor (106) eine obere Backe (122) und eine untere Backe (124) aufweist, wobei die obere Backe (122) relativ zu der unteren Backe (124) schwenkbar ist.

12. Vorrichtung nach Anspruch 7, wobei das Handstück (102) einen oder mehrere Auslöser (114, 116) aufweist, die betätigbar sind, um den Endeffektor (106) unter Verwendung einer Einhandbedienung zu betätigen.

13. Mehrere Vorrichtungen nach einem der Ansprüche 1 bis 6, ferner aufweisend ein chirurgisches Instrument (100), das aufweist:

(a) ein Handstück (102) mit einem Betätigungsmerkmal (114, 116);
(b) die Welle (104), die sich distal von dem Handstück (102) erstreckt; und
(c) einen Endeffektor (106), der sich distal von der Welle (104) erstreckt; wobei

die mehreren durchschneidenden Befestigungselemente (110) in einer Ende-an-Ende-Konfiguration entlang der Länge der Welle (104) des chirurgischen Instruments (100) positioniert sind und wobei die mehreren durchschneidenden Befestigungselemente betreibbar sind, durch den Endeffektor (106) geliefert zu werden.

14. Vorrichtung nach Anspruch 13, wobei die mehreren durchschneidenden Befestigungselemente (110) mindestens ein Paar von Befestigungselementen (110) aufweisen, die symmetrisch zueinander sind und innerhalb des Endeffektors (106) einander benachbart sind.

15. Vorrichtung nach Anspruch 14, wobei der Endeffektor (106) einen Befestigungskanal (145, 146, 147, 148, 151, 152, 153, 154) aufweist, der komplementär zu dem mindestens einen durchschneidenden Befestigungselement (110) geformt ist, wobei das mindestens eine durchschneidende Befestigungselement (110) betreibbar ist, sich innerhalb des Befestigungskanals vorwärtszubewegen.

16. Mehrere der Vorrichtungen nach einem der Ansprüche 1 bis 6, ferner aufweisend ein chirurgisches Instrument (100), das aufweist:

(a) ein Handstück (102) mit einem Betätigungsmerkmal (114, 116);
(b) eine Welle (104), die sich distal von dem Handstück (102) erstreckt, wobei die Welle (104) eine Teilungsachsenebene (161) definiert, die sich in Längsrichtung durch die Welle (104) erstreckt; und
(c) einen Endeffektor (106), der sich distal von der Welle (104) erstreckt, wobei der Endeffektor (106) zwei parallele Kanäle (145, 146, 147, 148, 151, 152, 153, 154) definiert, die auf gegenüberliegenden Seiten der Teilungsachsenebene (161) angeordnet sind, wobei die zwei parallelen Kanäle benachbart innerhalb des Endeffektors (106) positioniert sind; wobei

die mehreren durchschneidenden Befestigungselemente (110) durch den Endeffektor (106) hindurchgeführt werden können, wobei die Befestigungselemente (110) betreibbar sind, entlang jeweiliger Ebenen, die seitlich von und parallel zu der Teilungsachsenebene (161) versetzt sind, zu schließen.

Revendications

1. Appareil conçu pour couper et fixer un tissu comprenant un élément de fixation de coupe (110), l'élément de fixation de coupe (110) comprenant :

(a) deux branches (132) conçues pour saisir un tissu entre elles, chacune des deux branches ayant une première extrémité et une seconde extrémité ;
(b) une partie couronne (134) reliant les deux branches (132) au niveau de leurs premières extrémités, la partie couronne (134) étant déformable et constituée d'un matériau malléable configuré pour permettre et maintenir la déformation de la couronne ; et
(c) au moins une lame (136) positionnée sur chacune des deux branches (132), ladite au moins une lame (136) positionnée sur chacune des deux branches (132) étant dimensionnée de manière à s'étendre sur une portion de la longueur de la branche respective des deux branches, et formant une paire de lames opposées (136) qui sont conçues pour couper conjointement le tissu entre les deux branches lorsque l'élément de fixation est fermé contre le tissu ;

chacune des deux branches (132) comprenant une dent (140) et un ancrage (138), les dents (140) et les ancrages (138) étant chacun conçu pour percer, s'ancrer dans, et saisir le tissu, et les dents (140) et les ancrages (138) comprenant chacun une forme pointue de type crochet, chaque dent (140) s'étendant vers l'autre dent (140) à partir de la seconde extrémité de la branche respective parmi les deux branches (132), et chaque ancrage (138) s'étendant vers l'autre ancrage (138) à partir d'une partie de la branche respective parmi les deux branches (132) entre sa première et sa seconde extrémité.

2. Appareil selon la revendication 1, dans lequel cha-

cune desdites au moins une lame (136) est dimensionnée pour traverser sensiblement la longueur entière de la branche respective parmi les deux branches (132).

3. Appareil selon la revendication 1, dans lequel les deux branches (132) sont constituées d'un matériau malléable configuré pour permettre et maintenir la déformation des deux branches (132).

4. Appareil selon la revendication 1, dans lequel les deux branches (132) et la partie de couronne (134) forment une forme allongée en C.

5. Appareil selon la revendication 1, dans lequel ladite au moins lame comprend un bord arrondi (236) configuré pour transmettre des vibrations ultrasonores à un site chirurgical.

6. Appareil selon la revendication 1, dans lequel ladite au moins une lame comprend un bord arrondi (336) configuré pour transmettre une énergie RF à un site chirurgical pour faire coaguler un tissu.

7. Appareil selon la revendication 1, comprenant en outre un instrument chirurgical (100) comprenant :

(i) une pièce à main (102),
(ii) un arbre (104) s'étendant à partir de la pièce à main (102), et
(iii) un effecteur terminal (106), l'effecteur terminal étant conçu pour supporter au moins l'une des deux branches (132), l'effecteur terminal (106) étant en outre conçu pour entraîner au moins l'une des deux branches (132) dans le tissu.

8. Appareil selon la revendication 7, dans lequel l'arbre (104) comprend un tube extérieur (120) conçu pour ouvrir et fermer l'effecteur terminal (106).

9. Appareil selon la revendication 7, dans lequel la pièce à main (102) comprend en outre un générateur RF (170) conçu pour transmettre une énergie RF à ladite au moins une lame (336) à travers l'arbre (104).

10. Appareil selon la revendication 7, dans lequel la pièce à main comprend en outre un générateur ultrasonore (180) configuré pour transmettre des vibrations ultrasonores à ladite au moins une lame (236) à travers l'arbre (104).

11. Appareil selon la revendication 7, dans lequel l'effecteur terminal (106) comprend une mâchoire supérieure (122) et une mâchoire inférieure (124), la mâchoire supérieure (122) pouvant pivoter par rapport à la mâchoire inférieure (124).

12. Appareil selon la revendication 7, dans lequel la pièce à main (102) comporte un ou plusieurs déclencheurs (114, 116) destinés à actionner l'effecteur terminal (106) à l'aide d'une opération à une seule main.

13. Une pluralité d'appareils selon l'une quelconque des revendications 1 à 6 comprenant un instrument chirurgical (100) comprenant :

(a) une pièce à main (102) comportant un élément d'asservissement (114, 116);
(b) l'arbre (104) s'étendant distalement depuis la pièce à main (102); et
(c) un effecteur terminal (106) s'étendant distalement depuis l'arbre (104); la pluralité d'éléments de fixation de coupe (110) est positionnée selon une configuration extrémité à extrémité le long de la longueur de l'arbre (104) de l'instrument chirurgical (100) et la pluralité d'éléments de fixation étant destinée à être transmise à travers l'effecteur terminal (106) .

14. Appareil selon la revendication 13, dans lequel la pluralité d'éléments de fixation de coupe (110) comprend au moins une paire d'éléments de fixation (110) opposés l'un à l'autre de manière symétrique, et adjacents l'un par rapport à l'autre à l'intérieur de l'effecteur terminal (106).

15. Appareil selon la revendication 14, dans lequel l'effecteur terminal (106) comprend un canal pour éléments de fixation (145, 146, 147, 148, 151, 152, 153, 154) façonné de manière à correspondre audit au moins élément de fixation de coupe (110), à l'au moins un élément de fixation de coupe (110) étant destiné à avancer à l'intérieur du canal pour éléments de fixation.

16. Une pluralité d'appareils selon l'une quelconque des revendications 1 à 6 comprenant un instrument chirurgical (100) comprenant :

(a) une pièce à main (102) comportant un élément d'asservissement (114, 116);
(b) un arbre (104) s'étendant distalement depuis la pièce à main (102), l'arbre (104) définissant un plan d'axe fractionné (161) s'étendant longitudinalement à travers l'arbre (104); et
(c) un effecteur terminal (106) s'étendant distalement depuis l'arbre (104), l'effecteur terminal (106) définissant deux canaux parallèles (145, 146, 147, 148, 151, 152, 153, 154) positionnés sur des côtés opposés du plan d'axe fractionné (161), les canaux parallèles étant positionnés de manière adjacente à l'intérieur de l'effecteur terminal (106);

la pluralité d'éléments de fixation de coupe (110)

étant destinée à être transmise à travers l'effecteur terminal (106), les éléments de fixation (110) étant destinés à se fermer le long de plans respectifs qui sont décalés latéralement par rapport au plan d'axe fractionné (161) et parallèles à celui-ci.

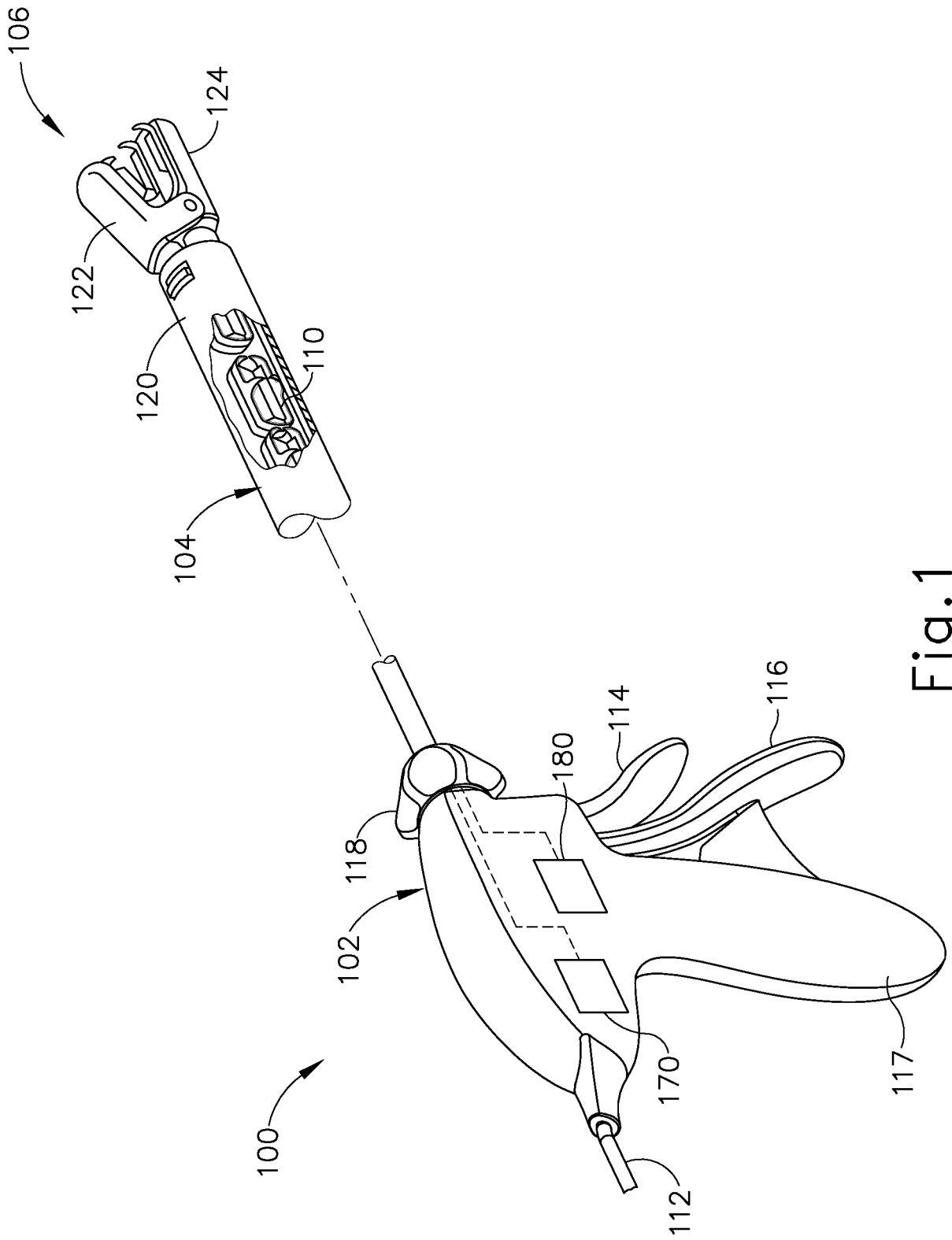

Fig. 1

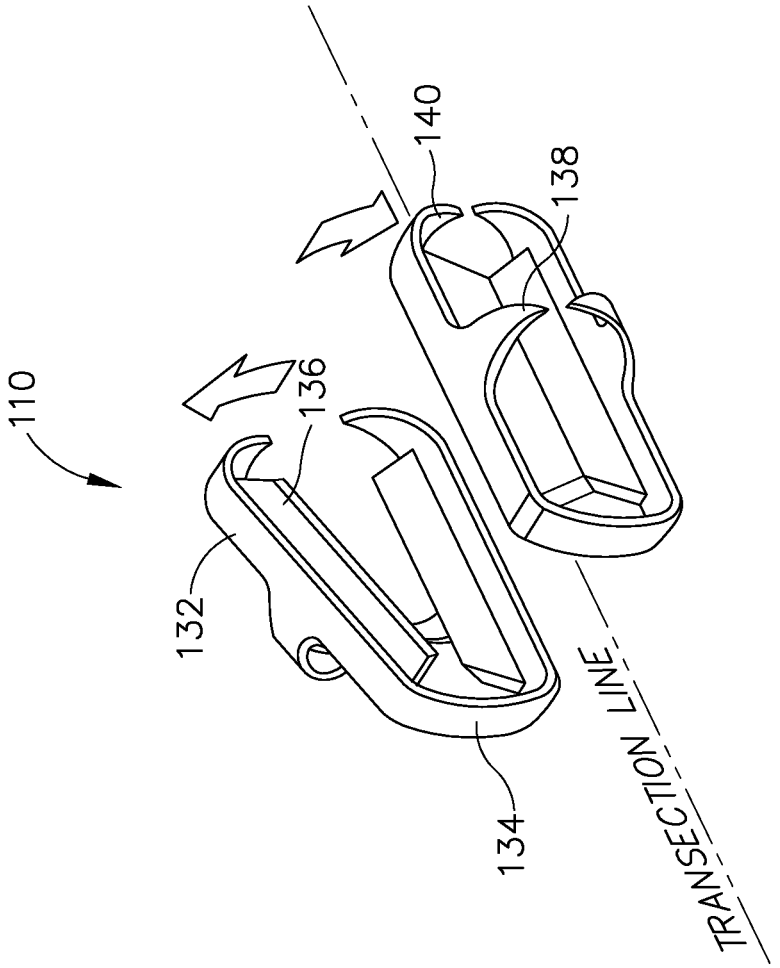

Fig.2

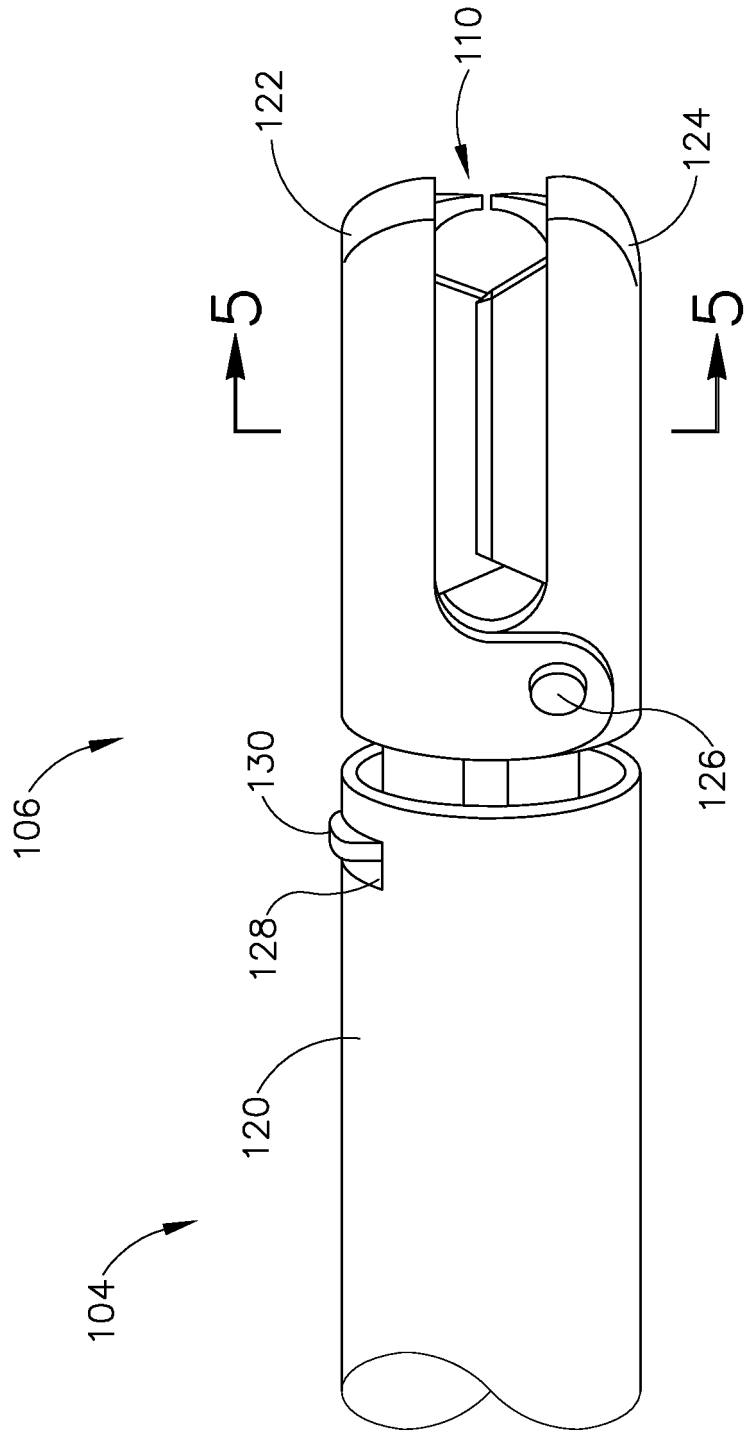

Fig.3

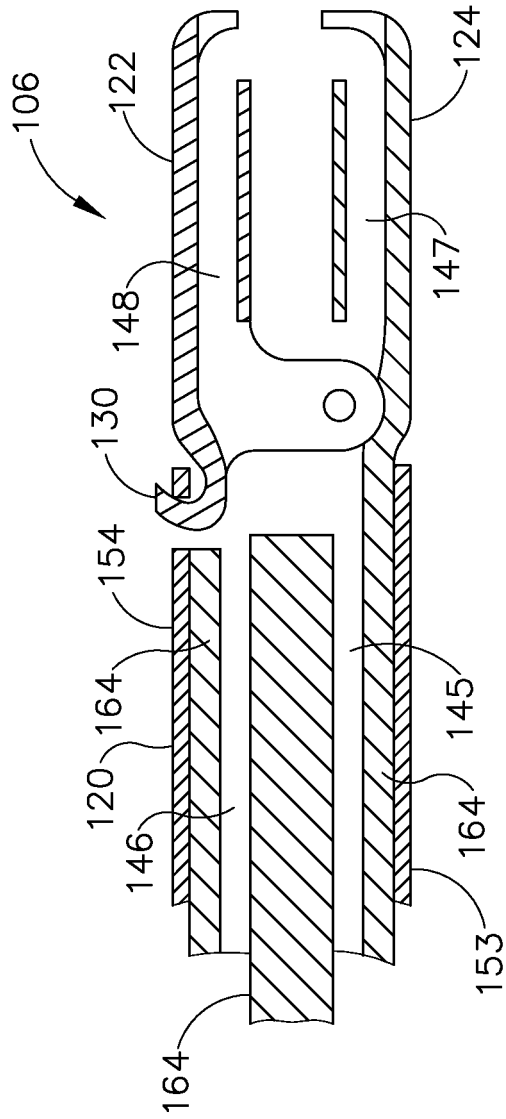

Fig.4

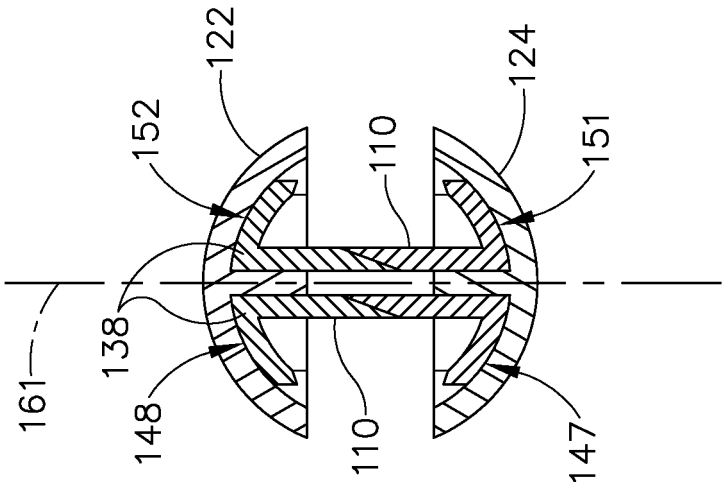

Fig.5

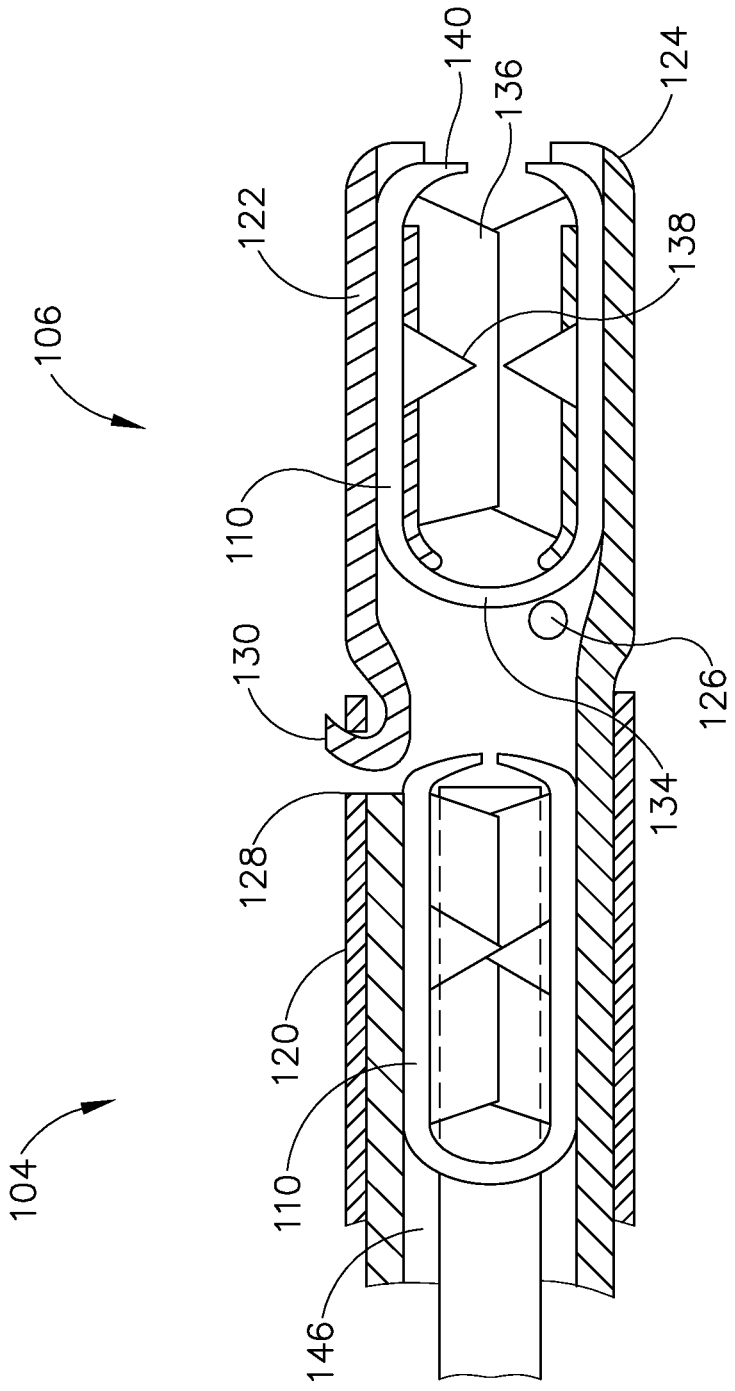

Fig.6A

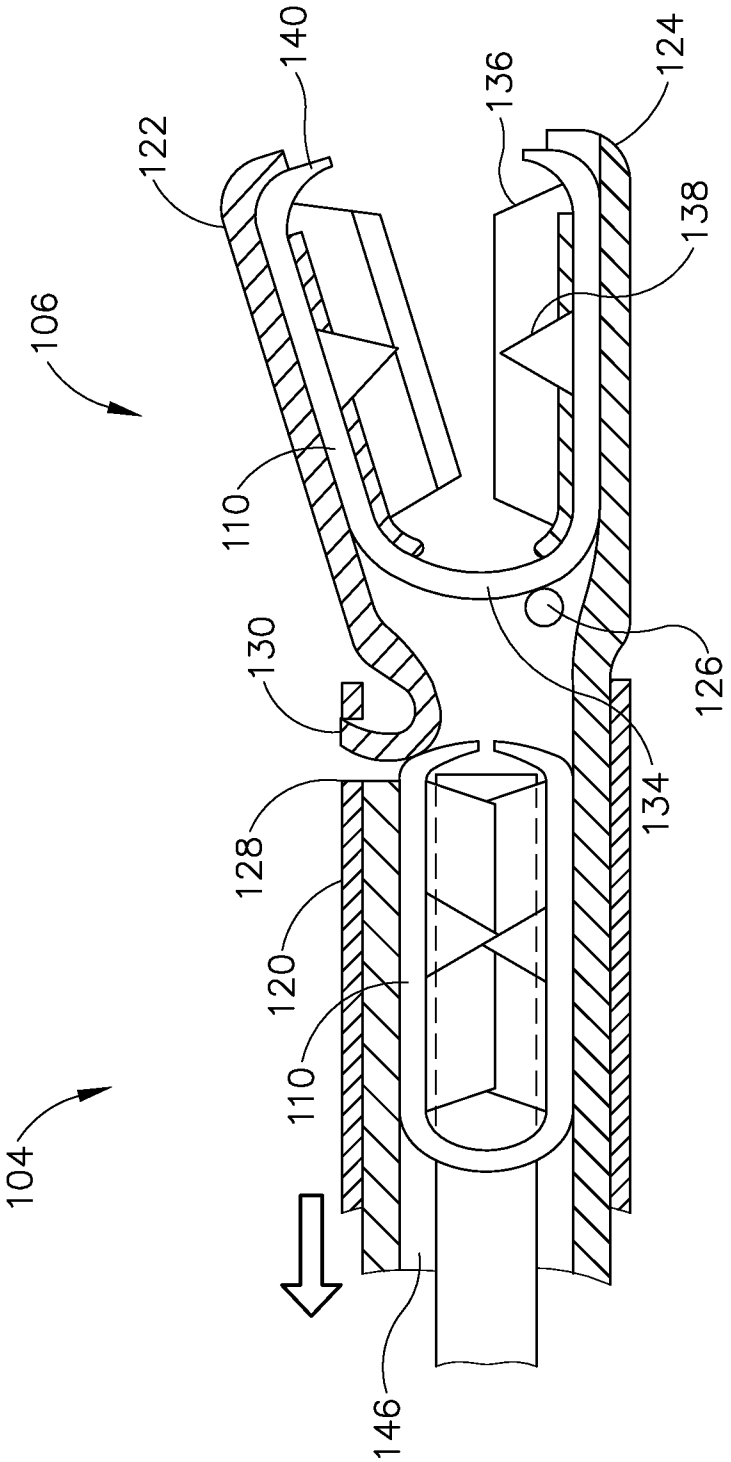

Fig.6B

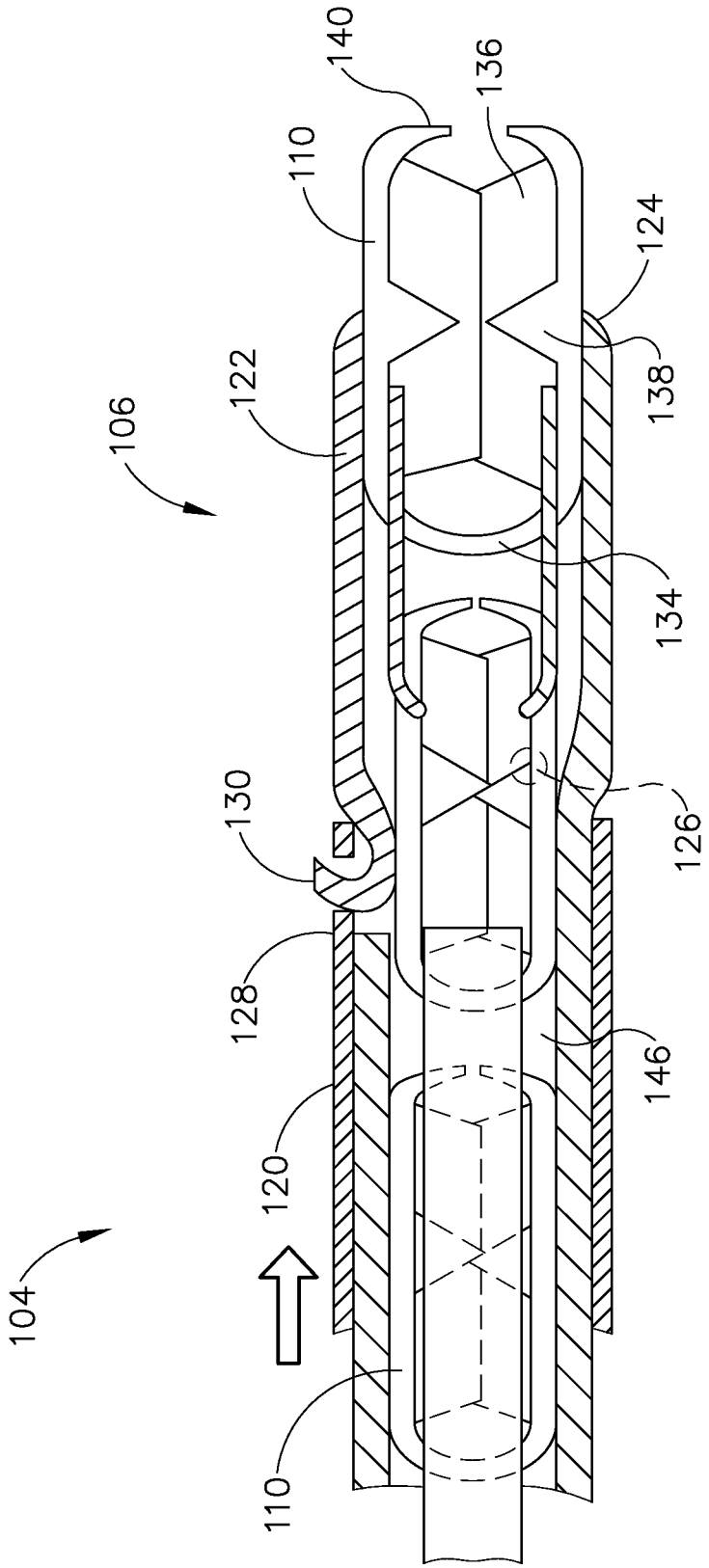

Fig.6C

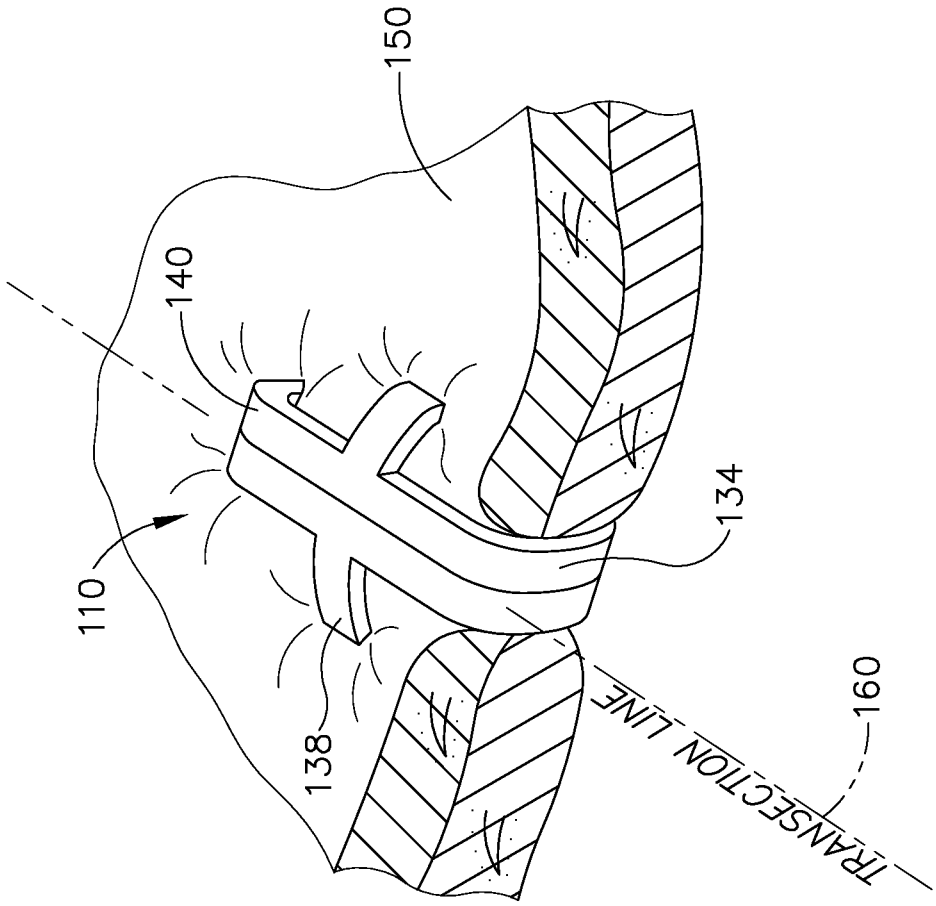

Fig.7A

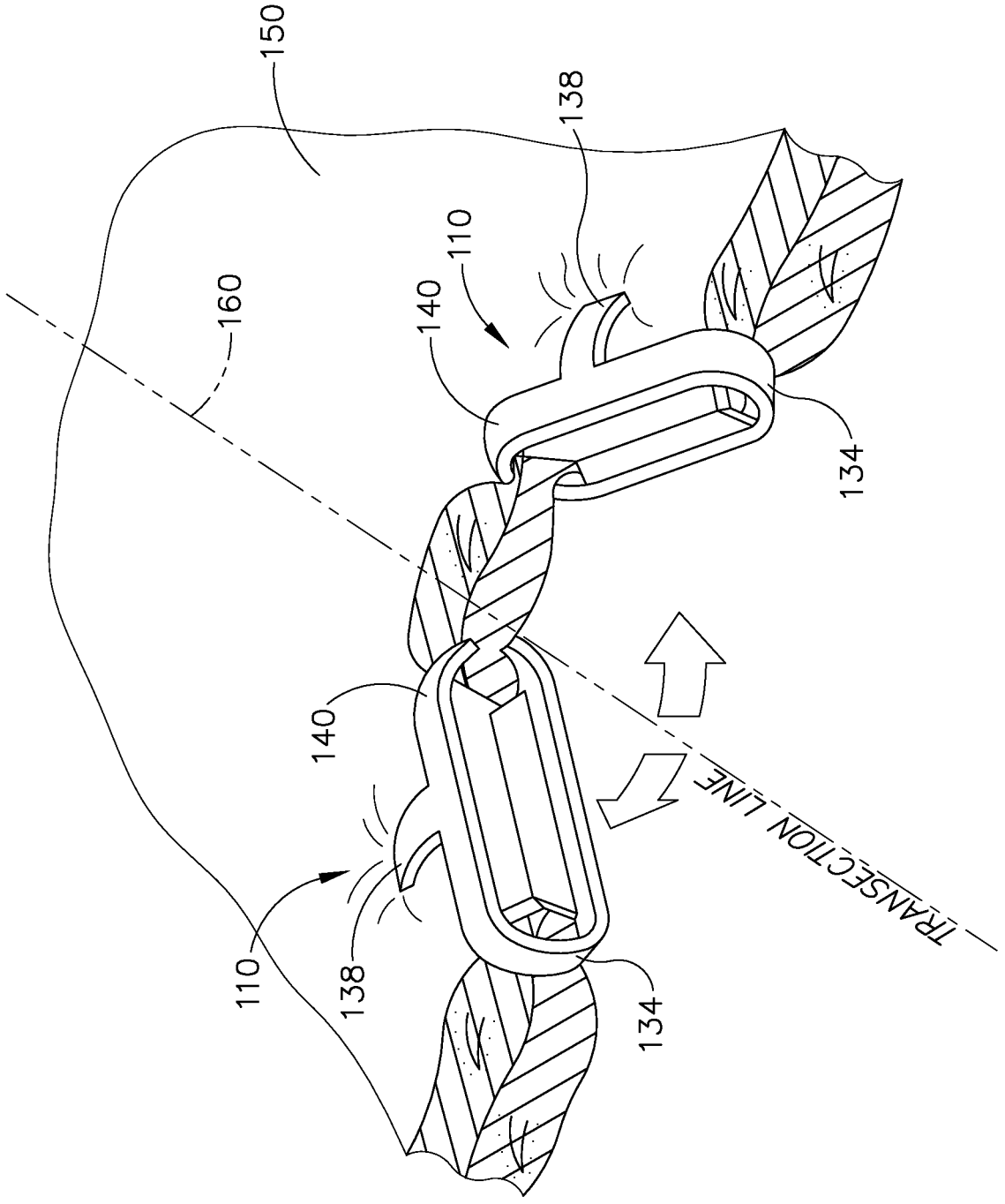

Fig.7B

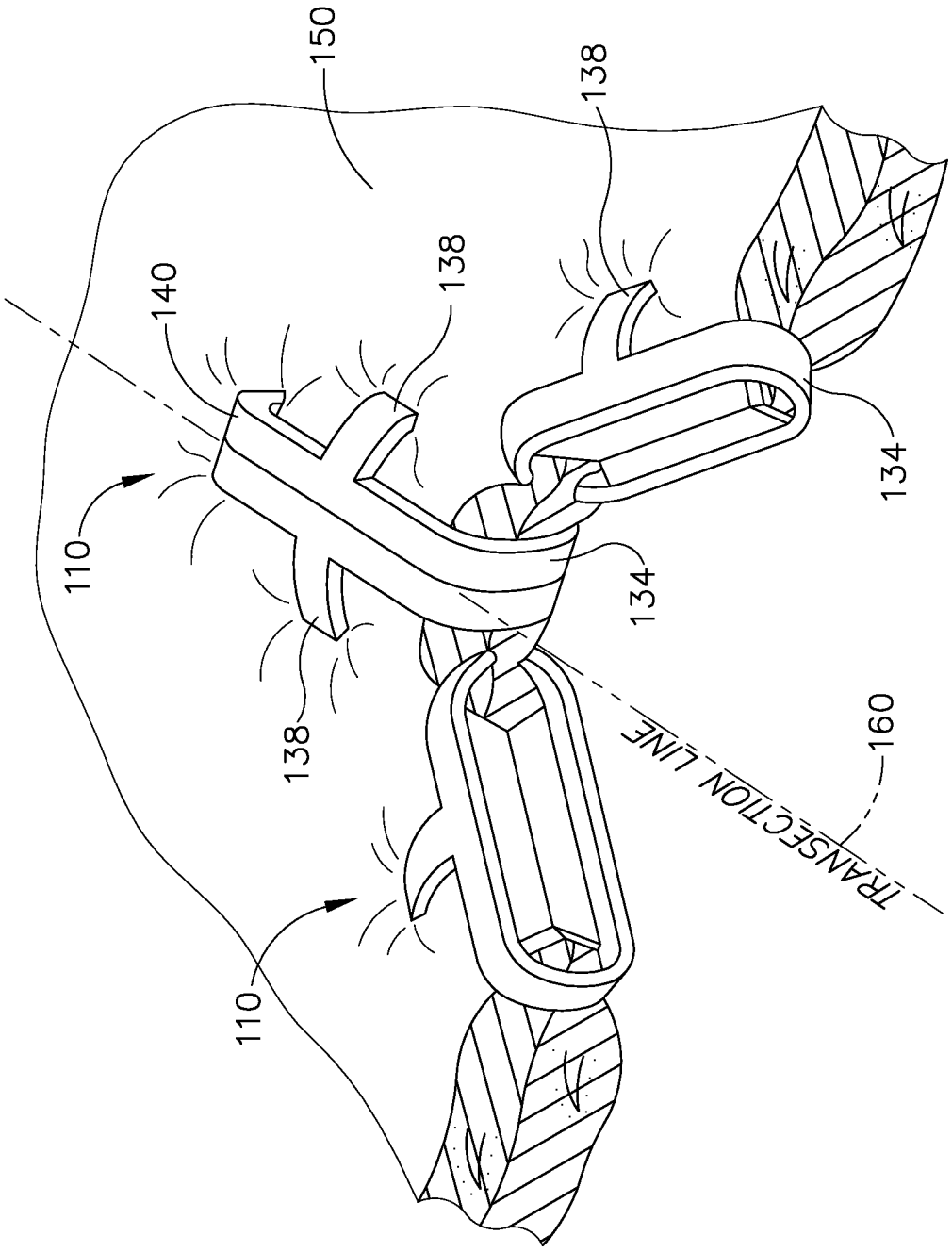

Fig.7C

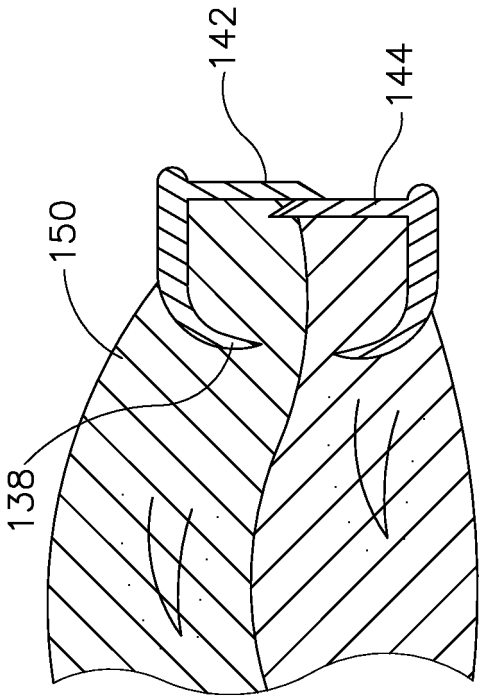

Fig.8

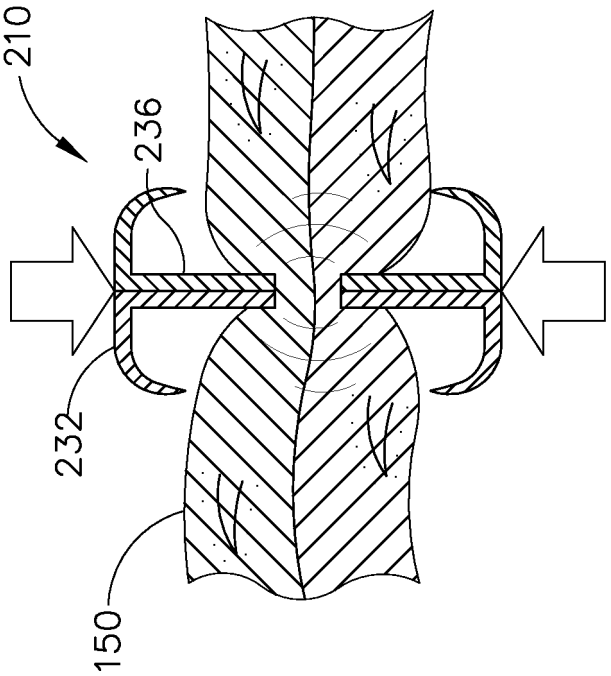

Fig.9

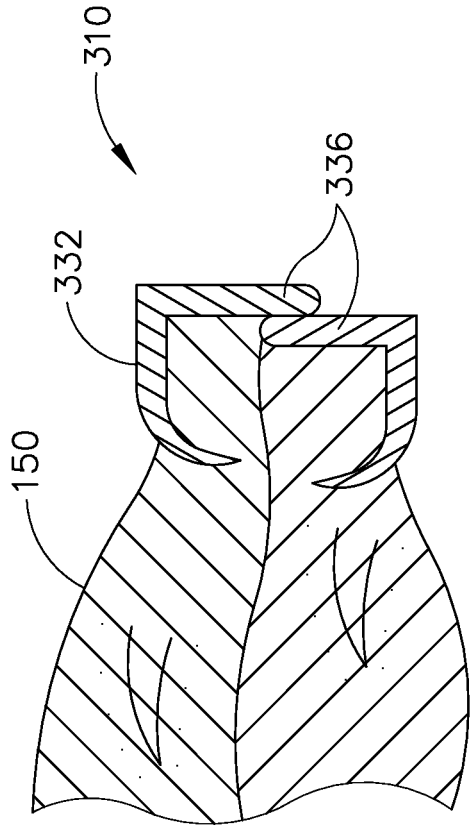

Fig.10

REFERENCES CITED IN THE DESCRIPTION

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专利名称(译)	具有横切刀片的夹子的手术器械		
公开(公告)号	EP2837338B1	公开(公告)日	2019-04-03
申请号	EP2014181055	申请日	2014-08-14
[标]申请(专利权)人(译)	伊西康内外科公司		
申请(专利权)人(译)	爱惜康内镜手术，INC.		
当前申请(专利权)人(译)	ETHICON LLC		
[标]发明人	SCHEIB CHARLES J OVERMYER MARK D		
发明人	SCHEIB, CHARLES J. OVERMYER, MARK D.		
IPC分类号	A61B17/122 A61B17/064 A61B17/32 A61B17/128 A61B17/068 A61B18/14 A61B18/00		
CPC分类号	A61B17/064 A61B17/068 A61B17/122 A61B17/1285 A61B17/320092 A61B18/1445 A61B2017/0641 A61B2017/0645 A61B2017/1225 A61B2017/320071 A61B2017/320093 A61B2017/320094 A61B2017/320097 A61B2018/00601 A61B2018/0063 A61B2018/1415		
优先权	13/967578 2013-08-15 US		
其他公开文献	EP2837338A2 EP2837338A3		
外部链接	Espacenet		

摘要(译)

横切紧固件（110,210,310）可操作以切割和固定组织（150）。横切紧固件包括构造成夹持组织的多个腿（132,232,332）。横切紧固件还包括冠部（134）和至少一个刀片（136,236,336）。冠部连接多个腿并且是可延展的。至少一个刀片定位在多个腿中的每个腿上。至少一个刀片可操作以切割组织。紧固件展开器械（100）可用于展开横切紧固件。紧固件展开器械可以以端对端的方式平行地展开紧固件。

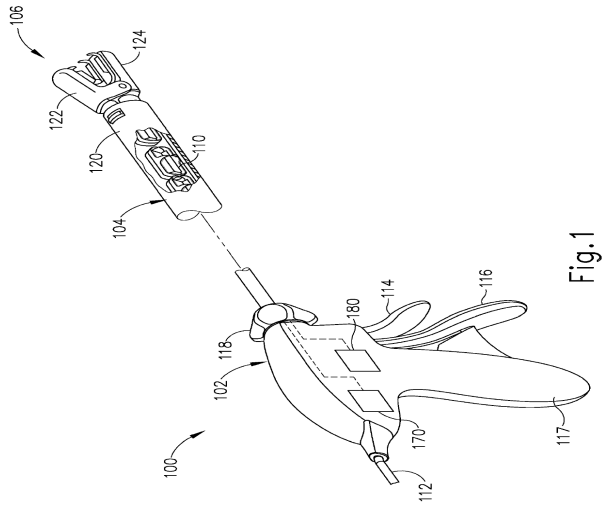

Fig.1