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| (71) Applicant: CARDICA, INC. [US/US]; 900 Saginaw Drive, Redwood City, California 94063 (US). | (84) Designated States (<i>unless otherwise indicated, for every kind of regional protection available</i>): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, |
| (72) Inventors: FERNANDEZ, Anthony J. ; 577 Laurel Street, Apt. 201, San Carlos, California 94070 (US). KNODEL, Bryan D. ; 6050 Saskan Ranch Circle, Flagstaff, Arizona 86001 (US). | |

[Continued on next page]

- (54) Title:** SURGICAL STAPLING AND CUTTING APPARATUS - DEPLOYMENT MECHANISMS, SYSTEMS AND METHODS

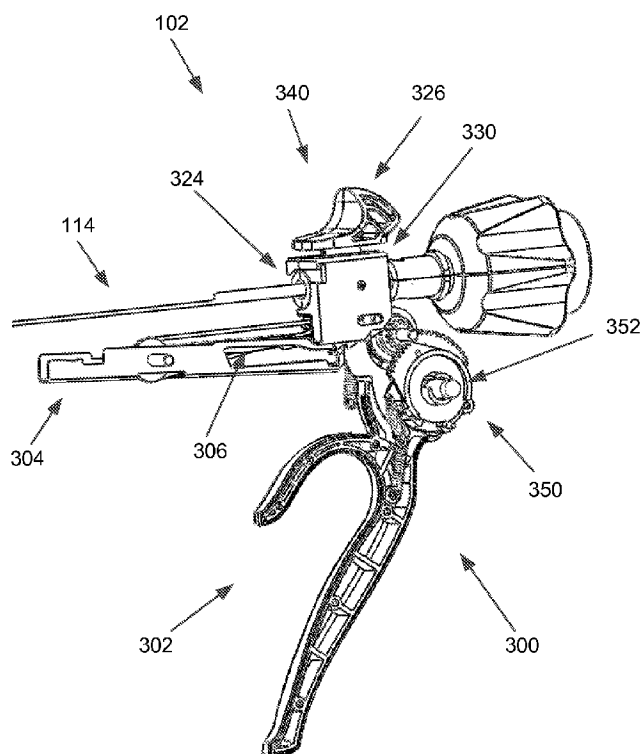


Figure 3A

- (57) Abstract:** A surgical stapling device is configured for use in open and/or laparoscopic surgical procedures. The device includes a handle assembly, a shaft assembly coupled to the handle assembly, and an end-effector coupled to the shaft assembly. The end-effector comprises of a jaw assembly configured to clamp, staple, and/or cut a target tissue. The handle assembly comprises of a trigger element that can activate a drive assembly to advance a deployment assembly to staple and/or cut the aforementioned target tissue. The deployment assembly comprises of a deployment slide member to either advance the deployment assembly in a first direction or retreat the deployment assembly in a second direction.



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SURGICAL STAPLING AND CUTTING APPARATUS - DEPLOYMENT MECHANISMS, SYSTEMS AND METHODS

ANTHONY J. FERNANDEZ

BRYAN D. KNODEL

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] The application claims priority to U.S. Patent Application No. 14/272,285 (Attorney Docket No. 406), filed on May 7, 2014, which claims priority to Provisional U.S. Patent Application No. 61/821,493 (Attorney Docket No. 377), filed on May 9, 2013, both of which are incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates generally to medical devices, and more particularly to surgical stapling and cutting systems, such as endocutters and microcutters.

BACKGROUND

[0003] Traditionally, surgeons use sutures to close wounds and incisions, attach separate tissue structures to one another, and perform other medical or surgical functions in various surgical procedures or operations. However, proper suturing requires significant skills to perform; in particular, complex suturing procedures can be time-consuming and/or very difficult to perform effectively. Furthermore, suturing may be impractical or unfeasible in certain situations. For example, suturing may be very difficult to perform in minimally-invasive surgical procedures where suturing tools may be required to be inserted through a small opening (often referred to as an access port) to gain access into a patient's body, and then the suturing operation is

performed through the small access opening with extension tools to suture the target tissue. In such minimally-invasive surgical procedures, the opening or access port to the surgical site inside the patient may not be large enough to allow effective maneuvering of suturing tools to perform the suturing procedure efficiently and effectively. If access ports were made larger to allow for easier suturing operations, the benefits of minimally-invasive surgery, however, may be significantly reduced or altogether eliminated. Indeed, as surgical technology continues to progress, the size of the access ports required to access surgical sites in the body to perform minimally-invasive procedures correspondingly continues to decrease. Presently, micro-laparoscopy typically utilizes instruments with diameter of about 3 millimeters to about 2 millimeters to perform complex operations; e.g., laparoscopic cholecystectomy and inguinal hernia repair, etc. When instruments of such small diameters are used, the size of the access ports may also be very small. It is common that the access ports can be as small as about 3 millimeters to about 2 millimeters in diameters. The benefits of these advances in surgical technology to the patients are obvious, minimally-invasive procedures can cause less physical trauma to the patient. As such, these minimally-invasive procedures can be performed to greater percentage of patients even if they are not in the best physical condition. In addition, because there is generally less physical trauma involved, the patients may experience less discomfort, the recovery time is typically reduced, and there may be less scarring at the operation site. However, because of restricted access, it can be significantly difficult or nearly impossible sometimes to perform effective manual suturing within a patient's body through these small access ports in minimally-invasive procedures. As such, alternatives to suturing or manual suturing are highly desired.

SUMMARY OF THE INVENTION

[0004] A surgical stapling device is configured for use in open and/or laparoscopic surgical procedures. The device includes a handle assembly, a shaft assembly coupled to the handle assembly, and an end-effector coupled to the shaft assembly. The end-effector comprises of a jaw assembly configured to clamp, staple, and/or cut a target tissue. The handle assembly comprises of a trigger element that can activate a drive assembly to advance a deployment assembly to staple and/or cut the aforementioned target tissue. The deployment assembly comprises of a deployment slide member to either advance the deployment assembly in a first direction or retreat the deployment assembly in a second direction. Furthermore, a swing arm member is movably coupled to the deployment assembly that is configured to reset a clamp lock member to release the jaw assembly to an un-clamp state. The swing arm member additionally configured to reset a deploy release member to allow a mode switch member to be reset to a neutral state to disengage the drive assembly from a deploy mode to the neutral mode.

[0005] A surgical stapling device comprises of a mode switch member to select a drive assembly to a deployment mode and a trigger member to activate the drive assembly to advance a deployment assembly to staple and cut a target tissue. The surgical device also includes a deployment slide member to advance the deployment assembly in a first direction to drive both a wedge assembly to deploy staples into the target tissue and a knife member to cut the target tissue. The surgical device further includes a swing arm member with a reset tab element to release a clamp lock to unclamp a jaw assembly to release the target tissue and to reset the mode switch member to a neutral state to disengage the drive assembly from the deployment mode.

[0006] A surgical stapling device comprises a mode switch member to select a drive assembly to a deployment mode and a trigger member to activate the drive assembly to advance a deployment assembly to staple a target tissue. The surgical stapling device also includes a deployment slide member to advance the deployment assembly in a first direction to drive a wedge assembly to deploy staples into the target tissue. The surgical device further includes a swing arm member with a reset tab element to release a clamp lock to unclamp a jaw assembly to release the target tissue and to reset the mode switch member to a neutral state to disengage the drive assembly from the deployment mode.

[0007] A method of stapling and cutting tissue by a surgical stapling device. The method comprises setting a mode switch member to engage a drive assembly to a deployment mode to initiate deployment. The method also includes activating a trigger member to drive the drive assembly and advancing a deployment slide member of a deployment assembly. The method then involves urging forward by the deployment assembly a wedge assembly to deploy staples in a target tissue and urging forward by the deployment assembly a knife member to cut said target tissue. The method further includes placing a swing arm member with a reset tab element in a first reset position to release a clamp lock to unclamp a jaw assembly, and placing the swing arm member in a second reset position to release a deployment release member to reset the mode switch member to neutral state to disengage the drive assembly from deployment mode.

[0008] A surgical stapling device comprises a handle assembly, a shaft assembly coupled to the handle assembly, and an end-effector coupled to the shaft assembly. The end-effector comprises a jaw assembly configured to clamp, staple, and cut a target tissue. The handle assembly comprises a trigger element to activate a

drive assembly to advance a deployment assembly to staple and cut the target tissue. The deployment assembly comprises a deploy slide member to either advance the deployment assembly in a first direction or retreat said deployment assembly in a second direction, and a reset switch member configured to retread the deployment assembly to a first reset position causing an unclamp tab element of a swing arm member to release a clamp lock member from a clamp lock state. The reset switch member further configured to retreat said swing arm member without displacing said deployment assembly to cause the unclamp tab element to engage a deployment release member to reset a mode switch button from a deployment mode.

[0009] A surgical stapling device comprises a mode switch member to select a drive assembly to a deployment mode and a trigger member to activate the drive assembly to advance a deployment assembly to staple and cut a target tissue. The surgical stapling device further includes a deployment slide member to advance the deployment assembly in a first direction to drive both a wedge assembly to deploy staples into the target tissue and a knife member to cut the target tissue. The surgical device also includes a reset switch member to place a swing arm member with a reset tab element in a first reset position to release a clamp lock member to unclamp a jaw assembly to release the target tissue and to further place the swing arm member in a second reset position without causing displacement of the deployment assembly to release a deployment reset member.

[00010] A surgical stapling device comprises a mode switch member to select drive assembly to a deployment mode and a trigger member to activate the drive assembly to advance a deployment assembly to staple a target tissue. The surgical stapling device also includes a deployment slide member to advance the deployment assembly in a first direction to drive a wedge assembly to deploy staples into the

target tissue and a reset switch member to place a swing arm member with a reset tab element in a first reset position to release a clamp lock member to unclamp a jaw assembly to release the target tissue and to further place the swing arm member in a second reset position without causing displacement of the deployment assembly to release a deployment to release a deployment reset member.

[00011] A method of stapling and cutting tissue by a surgical device comprises of setting a mode switch member to engage a drive assembly to a deployment mode and activating a trigger member to drive the drive assembly. The method further includes advancing a deployment slide member of a deployment assembly, urging forward by the deployment assembly a wedge assembly to deploy staples in a target tissue, and urging forward by the deployment assembly a knife member to cut the target tissue. The method also includes placing a swing arm member with a reset tab element in a first reset position to release a clamp lock to unclamp a jaw assembly and placing the swing arm member in a second reset position, without causing displacement to the deployment assembly, to release a deployment release member to reset the mode switch member to a neutral state to disengage the drive assembly from deployment.

[00012] A surgical stapling device comprises a handle assembly, a shaft assembly coupled to the handle assembly, and an end-effector coupled to the shaft assembly. The end-effector includes a jaw assembly configured to clamp, staple and cut a target tissue. The handle assembly includes a trigger element to activate a drive assembly to advance a deployment assembly to staple and cut the target tissue. The deployment assembly includes a deployment slide member to either advance the deployment assembly in a first direction or retreat the deployment assembly in a second direction. The surgical stapling device further includes a reset switch member

configured to retreat the deployment assembly to a first reset position causing an unclamp tab element of a swing arm to engage a deployment release member to reset a mode switch member from a deployment mode, and the reset switch member further configured to retreat the swing arm member to cause the unclamp tab element to engage a clamp lock member from a clamp lock state to release the jaw assembly from a clamped state.

[00013] A surgical stapling device comprises a mode switch member to select a drive assembly to a deployment mode and a trigger member to activate the drive assembly to advance a deployment assembly to staple and cut a target tissue. The surgical stapling device also includes a deployment slide member to advance the deployment assembly in a first direction to drive both a wedge assembly to deploy staples into the target tissue and a knife member to cut the target tissue. The surgical stapling device also includes a reset switch member to place a swing arm member with a reset tab element in a first reset position to release a deployment reset member and to further place the swing arm member in a second reset position to release a clamp lock member to unclamp a jaw assembly to release the target tissue.

[00014] A surgical stapling device comprises a mode switch member to select a drive assembly to a deployment mode and a trigger member to activate the drive assembly to advance a deployment assembly to staple a target tissue. The surgical device also includes a deployment slide to advance the deployment assembly in a first direction to drive a wedge assembly to deploy staples into the target tissue, and a reset switch member to place a swing arm member with a reset tab element in a first position to release a deployment reset member and to further place the swing arm member in a second reset position to release a clamp lock member to unclamp a jaw assembly to release the target tissue.

[00015] A method of stapling and cutting tissue by a surgical stapling device comprises of setting a mode switch member to engage a drive assembly to deployment mode for deployment and activating a trigger member to drive the drive assembly. The method also includes urging forward by the deployment assembly a wedge assembly to deploy staples in a target tissue, urging forward by the deployment assembly a knife member to cut the target tissue and placing a deployment release member to reset the mode switch member to a neutral state to disengage the drive assembly from deployment. The method may further include placing the swing arm member in a second reset position to release a clamp lock member to unclamp a jaw assembly to disengage the target tissue.

BRIEF DESCRIPTION OF THE DRAWINGS

[00016] The present invention will be readily understood by the following detailed description, taken in conjunction with accompanying drawings, illustrating by way of examples of the invention. The objects and elements in the drawings are not necessarily drawn to scale, proportion, precise orientation or positional relationships; instead, emphasis is focused on illustrating the principles of the invention. The drawings illustrate the design and utility of various features, aspects, or embodiments of the present invention, in which like element are referred to by like reference symbols or numerals. The drawings, however, depict the features, aspects, or embodiments of the invention, and should not be taken as limiting in their scope. With this understanding, the features, aspects, or embodiments of the invention will be described and explained with specificity and details through the use of the accompanying drawings in which:

[00017] Figure 1A and Figure 1B illustrate an example of a surgical stapling and cutting device where the deployment mechanisms in accordance with features, aspects, or embodiments of the present invention may be used to deploy various components to staple and cut tissue at a surgical site of a patient.

[00018] Figure 2A through Figure 2F illustrate an end-effector of a surgical stapling and cutting device where the deployment mechanisms in accordance with features, aspects, or embodiments of the present invention may be used to deploy various components to staple and cut tissue at a surgical site of a patient.

[00019] Figure 3A and Figure 3B illustrate some of the deployment mechanisms of a surgical stapling and cutting device in accordance with features, aspects, or embodiments of the present invention.

[00020] Figure 4A through Figure 4D illustrate deployment mechanisms of a surgical stapling and cutting device in accordance with features, aspects, or embodiments of the present invention.

[00021] Figure 5A through Figure 5H illustrate additional deployment mechanisms of a surgical stapling and cutting device in accordance with features, aspects or embodiments of the present invention.

[00022] As can be appropriated, the use of same or similar symbols or numerals in different figures indicates similar or identical items or features.

DETAILED DESCRIPTION

[00023] In the following detailed description, specific details are set forth in order to provide a thorough understanding of the present invention. However, it will be readily understood by those skilled in the art that the present invention may be practiced without these specific details. Alternatively, some of the well-known parts, component, hardware, methods of operations, and procedures may not be described in detail or elaborated so as to avoid obscuring the present invention; but, nevertheless, they are within the spirit and scope of the present invention.

[00024] As mentioned, surgeons use sutures to close wounds and incisions, attach separate tissue structures to one another, and perform other medical or surgical functions in various surgical procedures or operations. However, proper suturing requires significant skills to perform; in particular, complex suturing procedures can be time-consuming and/or very difficult to perform effectively. Furthermore, suturing may be impractical or unfeasible in certain situations. For example, suturing may be very difficult to perform in minimally-invasive surgical procedures where suturing tools may be required to be inserted through a small opening (often referred to as an access port) to gain access into a patient's body, and then the suturing operation is performed through the small access opening with extension tools to suture the target tissue. In such minimally-invasive surgical procedures, the opening or access port to the surgical site inside the patient may not be large enough to allow effective maneuvering of suturing tools to perform the suturing procedure efficiently and effectively. If access ports were made larger to allow for easier suturing operations, the benefits of minimally-invasive surgery, however, may be significantly reduced or altogether eliminated. Indeed, as surgical technology continues to progress, the size

of the access ports required to access surgical sites in the body to perform minimally-invasive procedures correspondingly continues to decrease. Presently, micro-laparoscopy typically utilizes instruments with diameter of about 3 millimeters to about 2 millimeters to perform complex operations; e.g., laparoscopic cholecystectomy and inguinal hernia repair, etc. When instruments of such small diameters are used, the size of the access ports may also be very small. It is common that the access ports can be as small as about 3 millimeters to about 2 millimeters in diameters. The benefits of these advances in surgical technology to the patients are obvious, minimally-invasive procedures can cause less physical trauma to the patient. As such, these minimally-invasive procedures can be performed to greater percentage of patients even if they are not in the best physical condition. In addition, because there is generally less physical trauma involved, the patients may experience less discomfort, the recovery time is typically reduced, and there may be less scarring at the operation site. However, because of restricted access, it can be significantly difficult or nearly impossible sometimes to perform effective manual suturing within a patient's body through these small access ports in minimally-invasive procedures.

[00025] Figure 1A and Figure 1B illustrate an example of a surgical stapling and cutting device 100 that can be an alternative or replacement to suturing. In particular, this example of surgical stapling and cutting device 100 is especially useful for replacing suturing in minimally-invasive surgical procedures. Similarly, it can also be used in open surgeries. While this example of surgical stapling and cutting device is designed and constructed to perform stapling and cutting of tissue, the design and construction can easily be altered to include more or less functions. For example, the design and construction can be altered to perform stapling function without cutting of tissue (e.g., a knife element can be removed and/or replaced). As

illustrated in the figures, the operation of stapling and cutting is performed through a long slim shaft 104 and a similarly slim end-effector 106. The actual operations of clamping, stapling, and cutting of tissue are performed at the distal-end 106 of the shaft 104. Further illustrated, a portion of the shaft 104 at the distal-end may be substantially flexible and may be articulated. Various versions of the endo-cutter or micro-cutter stapling systems may have non-articulated rigid shafts, while other versions may include substantially flexible or flexible portions that can be articulated. These and other features allow such examples of surgical stapling and cutting devices (e.g., MICROCUTTER XPRESS[®] and MICROCUTTER XCHANGE[®], which are designed and manufactured by Cardica Inc. of U.S.A.) to be ideally suited as alternatives or replacements to suturing. Greater detailed discussions of surgical stapling and cutting systems are described in U.S. Patent Application Serial No. 12/323,309, filed on 11/25/2008; U.S. Patent Application Serial No. 12/400,760, filed on 03/09/2009; U.S. Patent Application Serial No. 12/400,790, filed on 03/09/2009; U.S. Patent Application Serial No. 12/477,065, filed on 06/02/2009; U.S. Patent Application Serial No. 12/787,708, filed on 05/26/2010; U.S. Patent Application Serial No. 13/093,791, filed on 04/25/2011; U.S. Patent Application Serial No. 12/477,302, filed on 06/03/2009; U.S. Patent Application Serial No. 12/489,397, filed on 06/22/2009; U.S. Patent Application Serial No. 12/612,614, filed on 11/04/2009; U.S. Patent Application Serial No. 12/840,156, filed on 06/20/2010; U.S. Patent Application Serial No. 13/028,148, filed on 02/15/2011; U.S. Patent Application Serial No. 13/048,674, filed on 03/15/2011; U.S. Patent Application Serial No. 13/094,716, filed on 04/26/2011; U.S. Patent Application Serial No. 13/094,805, filed on 04/26/2011; U.S. Patent Application Serial No. 13/093,743, filed on 04/25/2011; U.S. Patent Application Serial No. 13/105,799, filed on 05/11/2011;

and U.S Patent Application Serial No. 13/294,160, filed on 11/10/2011, all of which are incorporated herein by reference.

[00026] Still referring to Figure 1A and Figure 1B, the surgical stapling and cutting device 100 includes a handle assembly 102, a shaft assembly 104, and an end-effector 106 coupled to the shaft assembly 104. During a deployment operation, a knife element 116 is advanced by a deployment strip 114 to cut tissue. Figure 1B illustrates an exposed view of the surgical stapling and cutting device 100 to show some of the deployment mechanisms and components involved with effecting stapling and cutting operations of the surgical device 100. In an alternative configuration, the knife element 116 can be removed and/or replaced such that device 100 can perform stapling functions without cutting tissue.

[00027] Figure 2A through Figure 2F illustrate an end-effector 106 of a surgical stapling and cutting device 100 where the deployment mechanisms in accordance with features, aspects, or embodiments of the present invention may be used to deploy various components to staple and cut tissue at a surgical site of a patient. As illustrated in Figure 2A, the end-effector 106 comprises of a jaw assembly which includes a staple channel member 204 for holding a staple cartridge member 206 where staples 218 are delivered and deployed, and an anvil member 202 for receiving and deforming the deployed staples 218. For additional details of the anvil member 202, Figure 2B and Figure 2C illustrate an anvil insert 202-1, which is part of the anvil member 202, which interacts with an I-beam pin 116-1 of the knife member 116 to maintain a clamp gap between the anvil member 202 and the staple channel member 204. Figure 2D illustrates an exposed view of the staple cartridge member 206 to show the staples 218 and a wedge assembly 220 with one or more wedge elements 224 for deploying the staples 218. The anvil member 202 may include

staple forming pockets on its under-surface to encounter and deform the deployed staples 218 from the staple cartridge member 206. As will be discussed in more detail, the wedge assembly 220 is advanced by the deployment strip member 114 (typically with the knife member 116 coupled to the distal portion of the deployment strip member 114) to act against each of the respective staples 218 to cause each of the staples 218 to be deployed in a substantially forward and upward motion to engage tissue that is positioned and/or clamped between the staple cartridge member 206 and the anvil member 202. As can be appreciated from the illustrated figures, as the wedge assembly 220 is advanced by the deployment strip member 114, the wedge element 224 acts against a staple 218 and pushes it forward and upward in an arcuate path, see Figure 2B through Figure 2F. Unlike conventional stapling systems, the wedge element 224 acts directly on a staple 218. For example, conventional stapling systems include a staple driver member that holds a staple, and a wedge member acts on the staple driver member. The conventional wedge member drives the staple holder and the staple in a substantially linearly upward direction into tissue and against an anvil member that deforms the conventional staple. As should be noted further, unlike conventional stapling systems, each of the staples 218 undergoes an arcuate motion as it is being deployed, not a linear motion. The forced motion of the staple 218 by the wedge element 224 causes each of the staples 218 to be frangibly separated from its connection or attachment point. Each of the deployed staples 218 encounters a corresponding staple forming pocket on the under-surface of the anvil member 202, in which each of the deployed staples 218 will be deformed into a closed configuration securing the target tissue and leaving it in a hemostasis condition (after it has been cut by the knife member 116).

[00028] Figure 3A and Figure 3B illustrate the deployment mechanisms of the surgical stapling and cutting device 100. The deployment mechanisms may include a trigger assembly 300 coupled to a gear assembly 350 to drive various handle and shaft mechanisms, components, and elements for clamping, stapling, and cutting of tissue. Typically, the surgical stapling and cutting device 100 can be put into at least two modes of operation; a clamp mode and a deployment mode. The modes of operation can be selected by a mode switch button 352. The clamp mode usually involves operating the various mechanisms, components, and elements for clamping a target tissue prior to or in preparation of stapling and cutting the target tissue by the surgical device 100. The deployment mode usually involves operating the various mechanisms, components, and elements for stapling and cutting the target tissue by the surgical device 100.

[00029] Referring to Figure 3A and Figure 3B, the mode switch button 352 may be selected to place the surgical device 100 into a clamp mode or a deployment mode. In the deployment mode, a ratchet member 310 is selected or activated to engage with a trigger member 302 and a gear member 312. Upon activation of the trigger member 302 by the attending surgeon, the trigger member 302 drives the gear assembly 350 which involves starting the gear member 312, gear member 314, gear member 316, and pulley member 318 to activate a deployment cable member 322 to advance the deployment assembly 340. The deployment assembly 340 comprises of a deployment slide member 320, a deployment spool member 324, a reset switch member 326, and a deployment strip member 114. The slide member 320 may be configured as a carrier member for the spool member 324 and reset switch member 326. The deployment cable 322 may advance the deployment assembly 340 in a first direction by pulling onto the slide member 320. For example, the attending surgeon

may activate the trigger member 302, during deployment mode, to advance the deployment assembly 340 to a first deployment position. The attending surgeon may activate the trigger member 302 again to advance the deployment assembly 340 to a second deployment position. Alternatively, the attending surgeon may retract the deployment assembly 340 in a second direction by pulling onto the reset switch member 326 to reset the deployment assembly 340, instead of continuing deployment (e.g., stapling additional portion of the target tissue and cutting additional portion of the target tissue). The retraction or retreat of the deployment assembly 340 from a first deployment position to a first retracted position may cause the unclamp tab element 328 to engage and release the deployment release member 306 to release the drive assembly 350 from the deployment mode. The deployment release member 306 may include stepwise features or ramp-wise features (as illustrated in Figure 3A) to facilitate engagement with the unclamp tab element 328 in a retraction or retreat motion, but not in the deployment or forward motion of the deployment assembly 340.

[00030] Furthermore, the deployment spool member 324 and deployment reset switch member 326 may have independent degrees of movement separate from the deployment slide member 320, such that at least some portion of the deployment assembly 340 may be “drawn back” further by pulling onto the reset switch member 326 depressing the spool member 324. For example, the reset switch member 326 may not be directly linked or coupled to the spool member 324. As such, the reset switch member 326 may have one or more independent degrees of movement separate from the spool member 324 and/or the deployment slide member 320. The spool member 324 may include a spring element to allow further movement of a portion of the deployment assembly 340 that may be independent of deployment slide

member 324 (e.g., the reset switch member 326). The deployment assembly 340 may include a cover member 330 (which may be detachable) that allows a swing arm member 332 (illustrated in Figure 4D) with an unclamp tab element 328 to move or rotate in a substantially unrestricted or a directed path to engage or disengage with certain members or elements (e.g., the clamp lock member 304, deployment reset member 306) to reset clamping and/or deployment, especially when the reset switch member 326 is drawn back further – depressing the spool member 324. For example, the reset switch member 326 may be used to pull the deployment assembly 340 back to a reset position. The swing arm member 332 and the unclamp tab element 328 may be in a first reset position to engage the clamp lock member 304 to release it from a clamp lock state. A second pull of the reset switch member 326 may depress the spool member 324 to draw the reset switch member 326 and the cover member 330 back further without causing movement or displacement of the deployment assembly 340. The additional movement of the reset switch member 326 and the cover member 330 may cause the swing arm member 332 and the unclamp tab element 328 to be placed in a second reset position to engage the deployment release member 306, which then engages with the ratchet member 310 to cause reset of the mode switch button 352. Alternatively, placing the deployment assembly 340 in the first reset position by the reset switch member 326 may not cause the unclamp element tab 328 to engage with the clamp lock member 304 and/or the deployment release member 306. Instead, it may require the reset switch member 326 to be pulled and compressed the spool member 324 to place the unclamp tab element 328 in a second reset position in order to engage and release both the clamp lock member 304 and the deployment release member 306.

[00031] The advancement of the deployment strip member 114 drives a knife member 116 and a wedge assembly 220 into motion. The advancement of the deployment strip member 114 causes the wedge member 224 of the wedge assembly 220 to engage and deploy the staples 218 in the cartridge member 206 and the knife member 116 to cut the clamped tissue between the staple cartridge 206 and anvil 202.

[00032] Figure 4A illustrates the surgical device 100 in a ready deployment position. In this ready deployment position, the deployment assembly 340 may be in a first initial position. In this first initial position, the swing arm member 332 and the unclamp tab element 328 may be in their neutral states (e.g., hanging substantially freely). As such, the unclamp tab element 328 does not engage with the clamp lock member 304 or the deployment release member 306. Figure 4B further illustrates that the clamp mechanism assembly 410 is placed in a clamp lock position on the clamp lock member 304. In this configuration, the jaw assembly has clamped on a target tissue by the anvil member 202 and staple cartridge member 206. The clamp lock member 306 is maintaining the jaw assembly in a clamped configuration by maintaining the clamp mechanism assembly 410 in the clamp lock pocket element 412. Also illustrated in Figure 4B, the deployment assembly 340 is in a second position, for example, after a first activation of the trigger member 302 by the operating surgeon. In this second position, the swing arm member 332 and the unclamp tab element 328 are in their neutral states (e.g., hanging substantially freely). As such, the unclamp tab element 328 does not engage with the clamp lock member 304 or the deployment release member 306. To be more clear, typically, a target tissue is clamped by the jaw assembly prior to deployment of the deployment assembly 340. Figure 4C illustrates the deployment assembly 340 in a third position, for example, after a second activation of the trigger member 302 by the operating

surgeon. In this third position, the swing arm member 332 and the unclamp tab element 328 are in their neutral states (e.g., hanging substantially freely). As such, the unclamp tab element 328 does not engage with the clamp lock member 304 or the deployment release member 306. Figure 4D illustrates the deployment assembly 340 without the deployment assembly cover member 330. As illustrated, the swing arm member 332 and the unclamp tab element 328 are in their neutral states (e.g., hanging substantially freely). As such, the unclamp tab element 328 does not engage with the clamp lock member 304 or the deployment release member 306. However, as illustrated, the swing arm member 332 may pivot about pivot pin 420. When pivoted about pin 420, the unclamp tab element 328 may engage and release the clamp lock member 304 and the deployment release member 306. As will be described in more detail, when the unclamp tab element 328 engages and releases the deployment release member 306, the deployment release member 306 engages with the ratchet member 310 to allow the mode switch button to reset and disengages the deployment drive assembly 350 from the deployment mode.

[00033] Figure 5A through Figure 5H illustrate the deployment assembly 340 being reset to its first position and the mode switch 352 being reset to a neutral state or non-mode position. Starting this discussion with the deployment assembly 340 at the third position of deployment, the unclamp tab element 328 of the swing arm member 332 does not contact or engage with the clamp lock member 304, as illustrated in Figure 5A. In Figure 5B, the deployment assembly is retracted or pulled back by way of the reset switch handle 326 to a reset position. The deployment assembly 340 is in a first retracted or reset position. In this position, the reset tab 328 of the swing arm member 332 engages with the proximal portion of the clamp lock member 304 and lifts the proximal portion of the clamp lock member 304 “upward”.

The upward movement of the proximal port of the clamp lock member 304 causes the distal portion of the clamp lock member 304 to dip “downward, which releases the clamp mechanism assembly 410 from the clamp lock pocket 412. The release of the clamp mechanism assembly 410 from the clamp lock pocket 412 allows the jaw assembly to be freed from the clamp state. A closer view of the reset tab element 328 is illustrated in Figure 5C. Also illustrated in Figure 5C, in this first retracted or reset position, the deployment reset member 306 has not been engaged or reset by the reset tab element 306. The deployment reset member 306 has not engaged the ratchet member 310 and the mode switch button 352 has not been reset to neutral.

[00034] Referring to Figure 5D, upon further retraction or pull of the reset handle 326 urges the deployment assembly 340 to a second retracted or reset position, compressing the spool member 324 spring element. In this second retracted or reset position, the swing arm member 332 is pivoted about the pivot pin 420 to a substantial horizontal position or orientation engaging the deployment reset member 306 which lifts the reset member 306 substantially upward. Figure 5F illustrates that the deployment assembly cover member 330 includes various cut-outs, slots, or pathways to allow or facilitate pivoting or movement of the switch arm member 332. The upward movement of the reset member 306 engages with the ratchet member 310, as illustrated in Figure 5E, which causes the ratchet member to shift or deflect. The movement of the ratchet member 310 allows the mode switch member 352 to reset to a neutral mode, which disengages the drive assembly 350 from the deployment mode to a neutral or un-deployment mode. The mode switch member may be spring loaded so that it can be self-actuated. The deployment assembly 340 may be maintained in a neutral mode by engagement of the mode switch member

standoff element 512 with a ratchet standoff element 514, as further illustrated in Figure 5G and Figure 5H.

[00035] The various deployment systems, assemblies, components, and elements as described allow the surgical stapling and cutting device 100 to be set by a mode switch member 352 to select a deployment mode to engage a drive assembly 350 for deployment. A surgeon using the surgical device 100 can activate the trigger assembly 300 by squeezing the trigger 302 to drive the various gears, pulleys, cable, etc. of the drive assembly 350 to advance a deployment slide member 320 of a deployment assembly 340 and then to urge forward by the deployment assembly 340 a wedge assembly 220 to deploy staples 218 in a target tissue by a wedge element 224. The deployment assembly 340 also urges forward a knife member 116 to cut the target tissue. To reset deployment, a reset switch member 326 can pull or retract the deployment assembly 340 backward to place a swing arm member 332 in a first reset position to release a clamp lock member 304 to unclamp a jaw assembly. The deployment assembly 340 can be retracted or pulled back further to place the swing arm member 332 in a second reset position to release a deployment release member 306 to reset a mode switch member 352 to a neutral state to disengage the drive assembly 350 from deployment or the deployment mode. The surgical device is then placed in a neutral state, reset from the deployment mode, and is ready to be selected to a desired operational mode, such as a clamp mode or a deployment mode.

[00036] Multiple features, aspects, and embodiments of the invention have been disclosed and described herein. Many combinations and permutations of the disclosed invention may be useful in minimally invasive surgical procedures, and the invention may be configured to support various endo-cutters and/or stapling systems. One of ordinary skill in the art having the benefit of this disclosure would appreciate

that the foregoing illustrated and described features, aspects, and embodiments of the invention may be modified or altered, and it should be understood that the invention generally, as well as the specific features, aspects, and embodiments described herein, are not limited to the particular forms or methods disclosed, but also cover all modifications, equivalents and alternatives. Further, the various features and aspects of the illustrated embodiments may be incorporated into other embodiments, even if not so described herein, as will be apparent to those ordinary skilled in the art having the benefit of this disclosure.

[00037] Although particular features, aspects, and embodiments of the present invention have been shown and described, it should be understood that the above discussion is not intended to limit the present invention to these features, aspects, and embodiments. It will be obvious to those skilled in the art that various changes and modifications may be made without departing from the spirit and scope of the present invention. Thus, the present invention is intended to cover alternatives, modifications, and equivalents that may be within the spirit and scope of the following claims and their equivalents.

CLAIMS

What is claimed is:

1. A surgical stapling device, comprising:
 - a handle assembly;
 - a shaft assembly coupled to the handle assembly; and
 - an end-effector coupled to the shaft assembly,wherein the end-effector comprises:
 - a jaw assembly configured to clamp, staple, and cut a target tissue,wherein the handle assembly comprises:
 - a trigger element to activate a drive assembly to advance a deployment assembly to staple and cut said target tissue,wherein the deployment assembly comprises:
 - a deployment slide member to either advance said deployment assembly in a first direction or retreat said deployment assembly in a second direction, and
 - a swing arm member movably coupled to said deployment assembly configured to reset a clamp lock member to release the jaw assembly to an un-clamp state, and said swing arm member to further reset a deploy release member to allow a mode switch member to be reset to a neutral state disengaging said drive assembly from a deploy mode.
2. The surgical stapling device of Claim 1 wherein said swing arm member includes a reset tab element to engage said clamp lock member to reset said clamp lock member and said reset tab element also configured to engage said deploy release member.
3. A surgical stapling device, comprising:
 - a mode switch member to select a drive assembly to a deployment mode;
 - a trigger member to activate said drive assembly to advance a deployment assembly to staple and cut a target tissue; and
 - a deployment slide member to advance said deployment assembly in a first direction to drive both a wedge assembly to deploy staples into said target tissue and a knife member to cut said target tissue.

4. The surgical stapling device of Claim 3, further comprising:
 - a swing arm member with a reset tab element to release a clamp lock to unclamp a jaw assembly to release said target tissue and to reset said mode switch member to a neutral state to disengage said drive assembly from the deployment mode.
5. A surgical stapling device, comprising:
 - a mode switch member to select a drive assembly to a deployment mode;
 - a trigger member to activate said drive assembly to advance a deployment assembly to staple a target tissue; and
 - a deployment slide member to advance said deployment assembly in a first direction to drive a wedge assembly to deploy staples into said target tissue.
6. The surgical stapling device of Claim 5, further comprising:
 - a swing arm member with a reset tab element to release a clamp lock to unclamp a jaw assembly to release said target tissue and to reset said mode switch member to a neutral state to disengage said drive assembly from the deployment mode.
7. A method of stapling and cutting tissue by a surgical stapling device, comprising:
 - setting a mode switch member to select a drive assembly to a deployment mode;
 - activating a trigger member to drive said drive assembly;
 - advancing a deployment slide member of a deployment assembly;
 - urging forward by the deployment assembly a wedge assembly to deploy staples in a target tissue;
 - urging forward by the deployment assembly a knife member to cut said target tissue; and
 - placing a swing arm member with a reset tab element in a first reset position to release a clamp lock to unclamp a jaw assembly.
8. The method of Claim 7, further comprising:

placing said swing arm member in a second reset position to release a deployment release member to reset said mode switch member to a neutral state to disengage said drive assembly from deployment.

9. A surgical stapling device, comprising:
- a handle assembly;
 - a shaft assembly coupled to the handle assembly; and
 - an end-effector coupled to the shaft assembly,
- wherein the end-effector comprises:
- a jaw assembly configured to clamp, staple, and cut a target tissue,
- wherein the handle assembly comprises:
- a trigger element to activate a drive assembly to advance a deployment assembly to staple and cut said target tissue,
- wherein the deployment assembly comprises:
- a deployment slide member to either advance said deployment assembly in a first direction or retreat said deployment assembly in a second direction, and
 - a reset switch member configured to retreat said deployment assembly to a first reset position causing an unclamp tab element of a swing arm member to release a clamp lock member from a clamp lock state.

10. The surgical stapling device of Claim 9, wherein said reset switch further configured to retreat said swing arm member without displacing said deployment assembly to cause said unclamp tab element to engage a deployment release member to reset a mode switch member from a deployment mode.

11. A surgical stapling device, comprising:
- a mode switch member to select a drive assembly to a deployment mode;
 - a trigger member to activate said drive assembly to advance a deployment assembly to staple and cut a target tissue;
 - a deployment slide member to advance said deployment assembly in a first direction to drive both a wedge assembly to deploy staples into said target tissue and a knife member to cut said target tissue; and

a reset switch member to place a swing arm member with a reset tab element in a first reset position to release a clamp lock member to unclamp a jaw assembly to release said target tissue.

12. The surgical stapling device of Claim 11, wherein the reset switch member further places the swing arm member in a second reset position without causing displacement of the deployment assembly to release a deployment reset member.

13. A surgical stapling device, comprising:

a mode switch member to select a drive assembly to a deployment mode;

a trigger member to activate said drive assembly to advance a deployment assembly to staple a target tissue;

a deployment slide member to advance said deployment assembly in a first direction to drive a wedge assembly to deploy staples into said target tissue; and

a reset switch member to place a swing arm member with a reset tab element in a first reset position to release a clamp lock member to unclamp a jaw assembly to release said target tissue.

14. The surgical stapling device of Claim 13, wherein the reset switch member further place the swing arm member in a second reset position without causing displacement of the deployment assembly to release a deployment reset member.

15. A method of stapling and cutting tissue by a surgical stapling device, comprising:

setting a mode switch member to engage a drive assembly to a deployment mode;

activating a trigger member to drive said drive assembly;

advancing a deployment slide member of a deployment assembly;

urging forward by the deployment assembly a wedge assembly to deploy staples in a target tissue;

urging forward by the deployment assembly a knife member to cut said target tissue; and

placing a swing arm member with a reset tab element in a first reset position to release a clamp lock to unclamp a jaw assembly.

16. The method of Claim 15, further comprising:
placing said swing arm member in a second reset position, without causing displacement to the deployment assembly, to release a deployment release member to reset said mode switch member to a neutral state to disengage said drive assembly from deployment.
17. A surgical stapling device, comprising:
a handle assembly;
a shaft assembly coupled to the handle assembly; and
an end-effector coupled to the shaft assembly,
wherein the end-effector comprises:
a jaw assembly configured to clamp, staple, and cut a target tissue,
wherein the handle assembly comprises:
a trigger element to activate a drive assembly to advance a deployment assembly to staple and cut said target tissue,
wherein the deployment assembly comprises:
a deployment slide to either advance said deployment assembly in a first direction or retreat said deployment assembly in a second direction, and
a reset switch member configured to retreat said deployment assembly to a first reset position causing an unclamp tab element of a swing arm member to engage a deployment release member to reset a mode switch button from a deployment mode.
18. The surgical stapling device of Claim 17, wherein said reset switch further configured to retreat said swing arm member to cause said unclamp tab element to engage a clamp lock member from a clamp lock state to release said jaw assembly from a clamped state.
19. The surgical stapling device of Claim 17, wherein said deployment release member include stepwise features or ramp-wise features to engage with said unclamp tab element of said swing arm member.
20. A surgical stapling device, comprising:
a mode switch member to select a drive assembly to a deployment mode:

a trigger member to activate said drive assembly to advance a deployment assembly to staple and cut a target tissue;

a deployment slide member to advance said deployment assembly in a first direction to drive both a wedge assembly to deploy staples into said target tissue and a knife member to cut said target tissue; and

a reset switch member to place a swing arm member with a reset tab element in a first reset position to release a deployment reset member.

21. The surgical stapling device of Claim 20, wherein the reset switch member further places the swing arm member in a second reset position to release a clamp lock member to unclamp a jaw assembly to release said target tissue.

22. A surgical stapling device, comprising:

a mode switch member to select a drive assembly to a deployment mode;

a trigger member to activate said drive assembly to advance a deployment assembly to staple a target tissue;

a deployment slide member to advance said deployment assembly in a first direction to drive a wedge assembly to deploy staples into said target tissue; and

a reset switch member to place a swing arm member with a reset tab element in a first reset position to release a deployment reset member.

23. The surgical stapling device of Claim 22, wherein the reset switch member further places the swing arm member in a second reset position to release a clamp lock member to unclamp a jaw assembly to release said target tissue.

24. A method of stapling and cutting tissue by a surgical stapling device, comprising:

setting a mode switch member to engage a drive assembly to a deployment mode for deployment;

activating a trigger member to drive said drive assembly;

advancing a deployment slide member of a deployment assembly;

urging forward by the deployment assembly a wedge assembly to deploy staples in a target tissue;

urging forward by the deployment assembly a knife member to cut said target tissue; and

placing a swing arm member with a reset tab element in a first reset position to release a deployment release member to reset said mode switch member to a neutral state to disengage said drive assembly from deployment.

25. The method of Claim 16, further comprising:

placing said swing arm member in a second reset position release a clamp lock to unclamp a jaw assembly to disengage said target tissue.

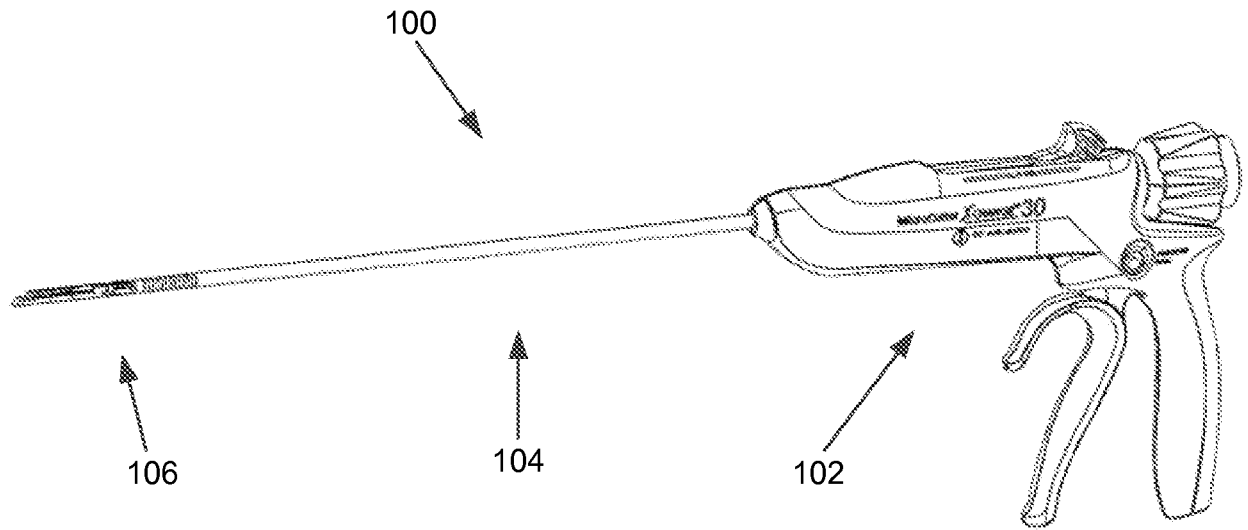


Figure 1A

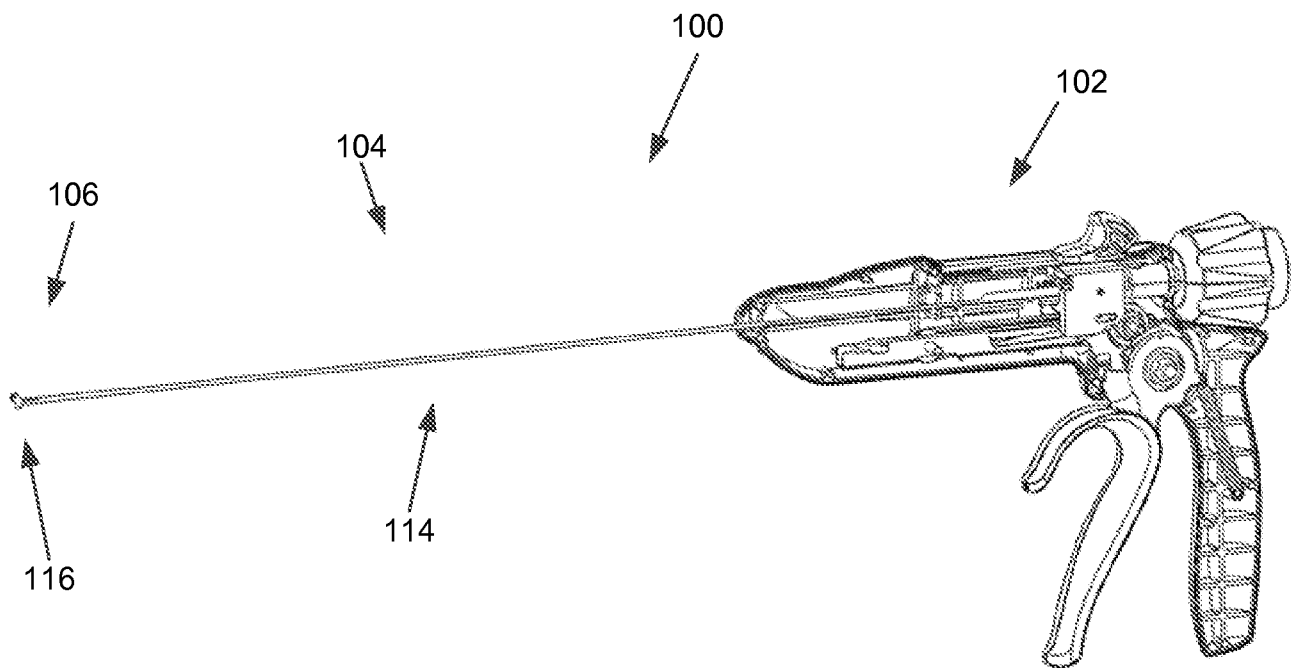


Figure 1B

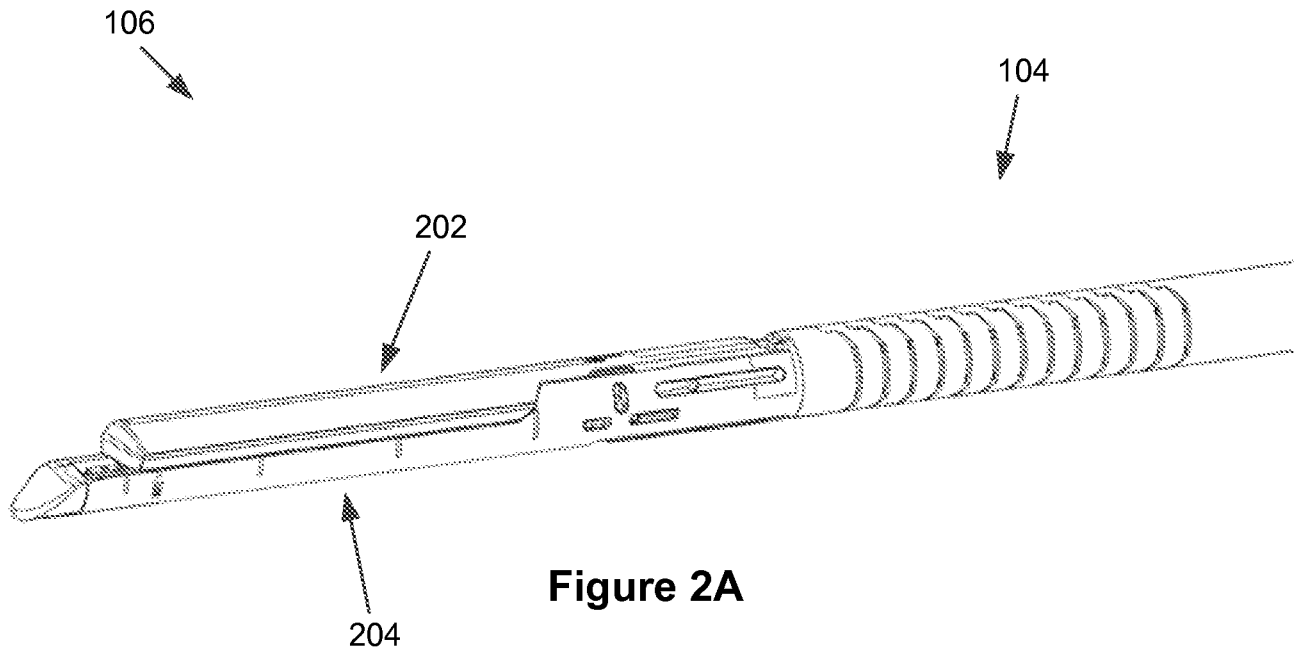


Figure 2A

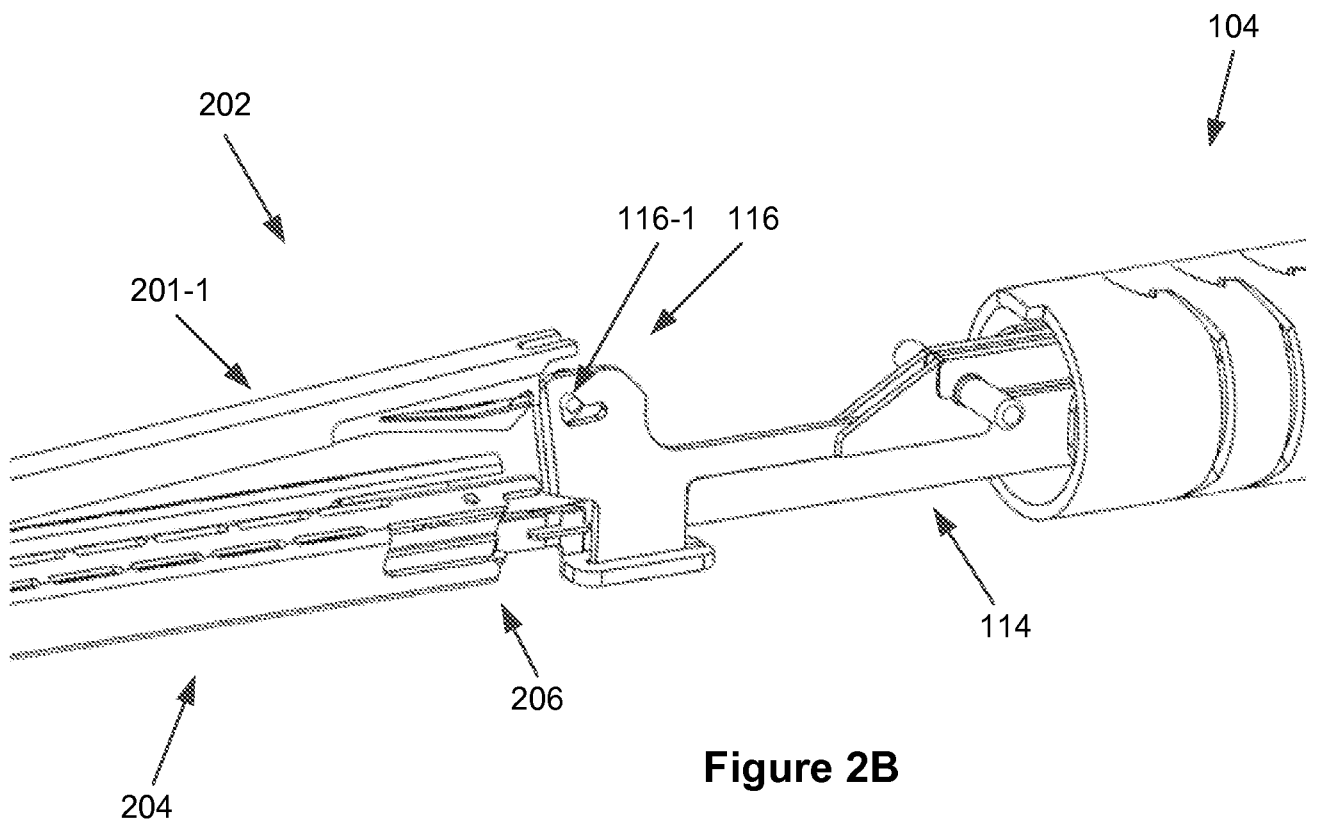


Figure 2B

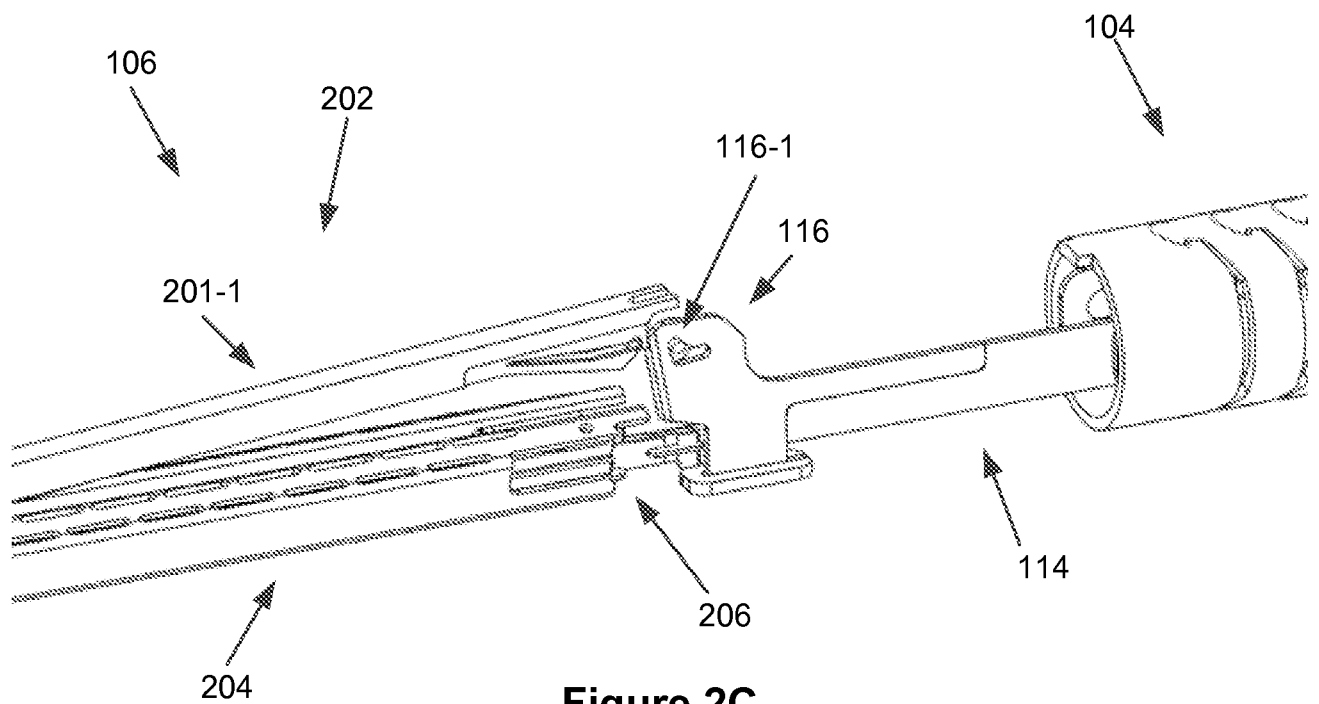


Figure 2C

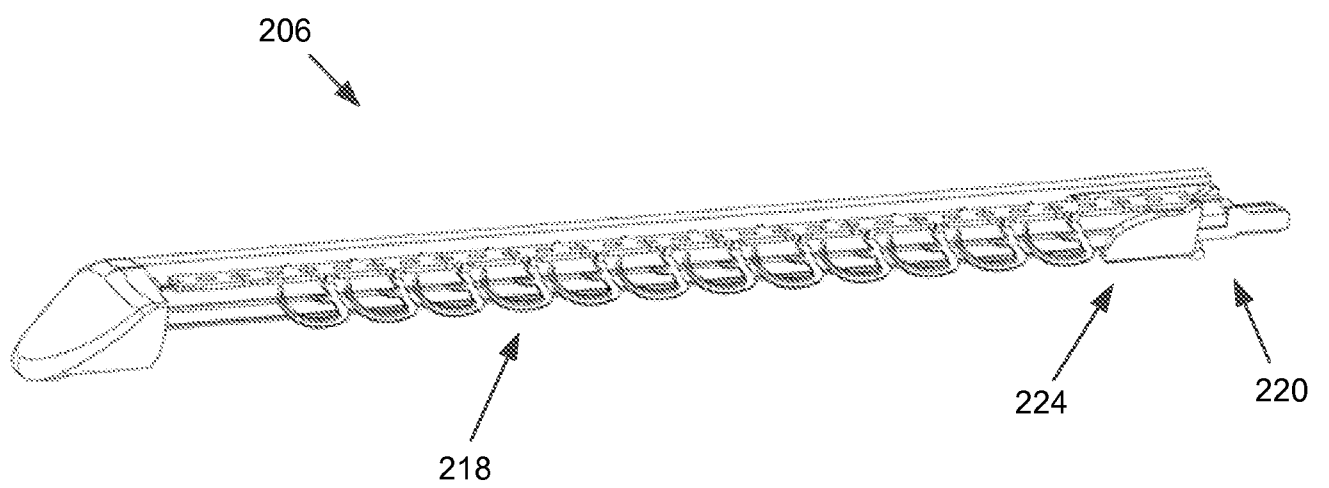


Figure 2D

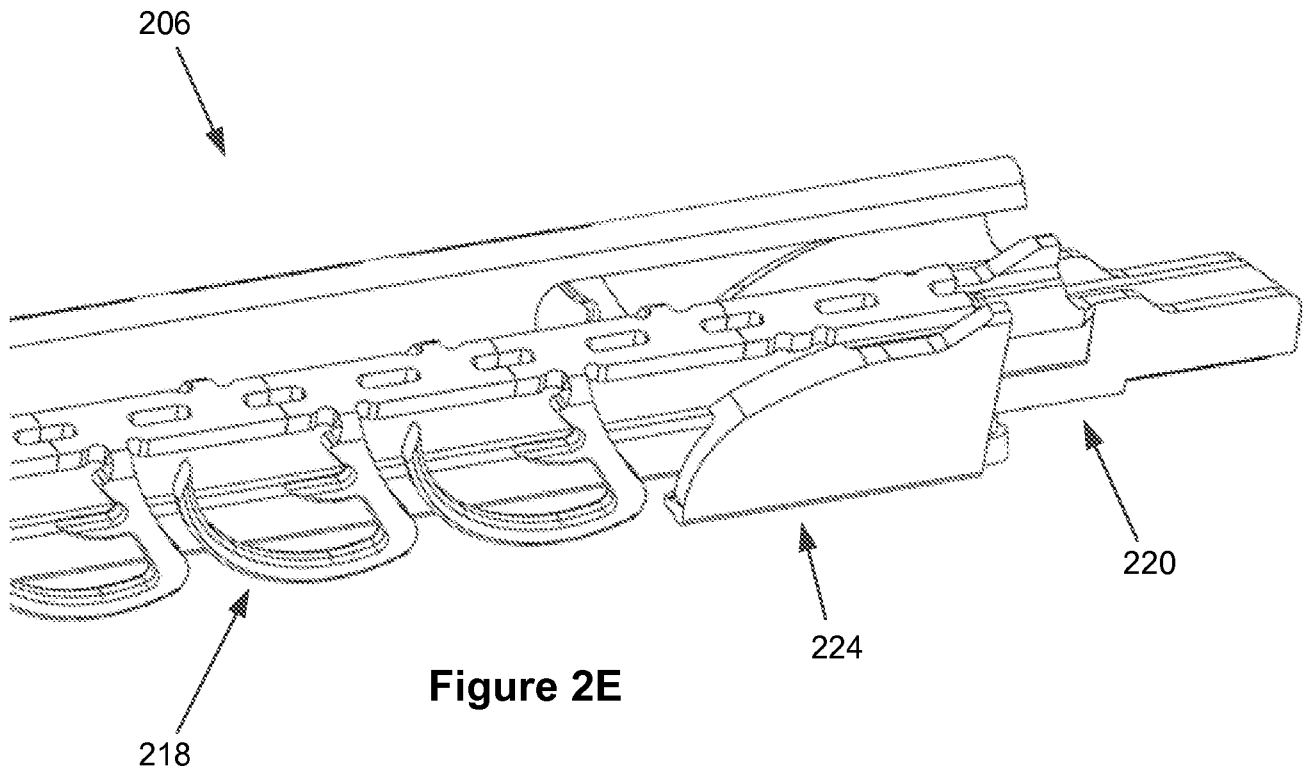


Figure 2E

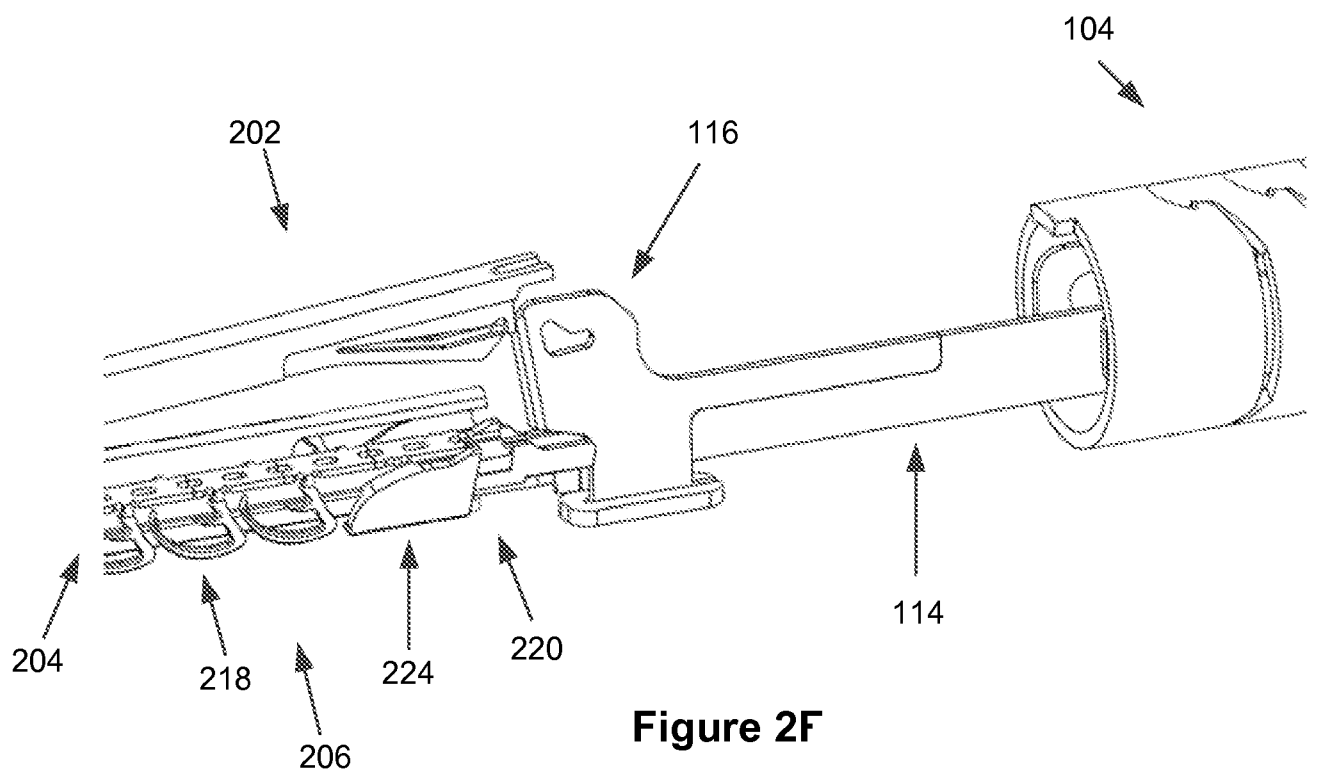


Figure 2F

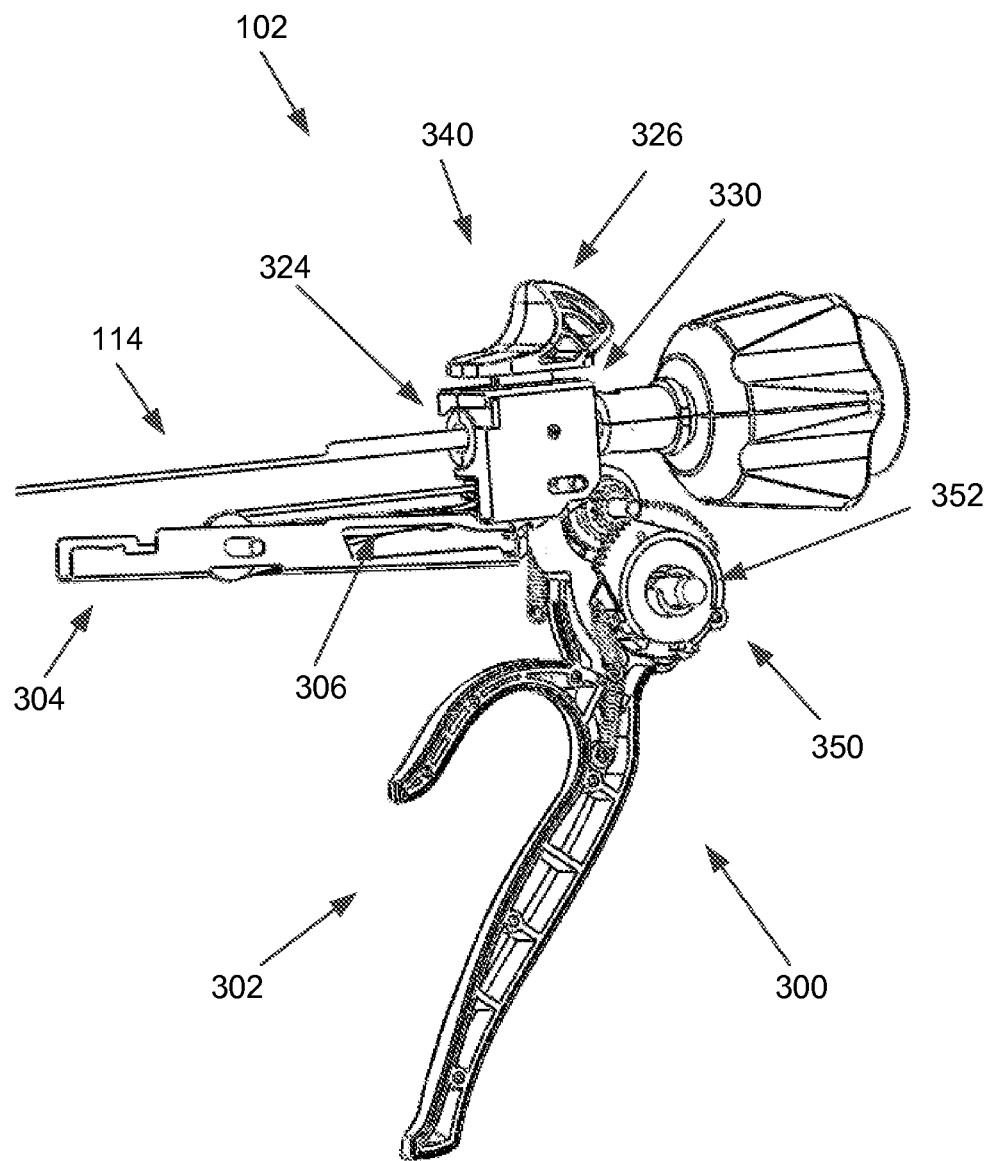


Figure 3A

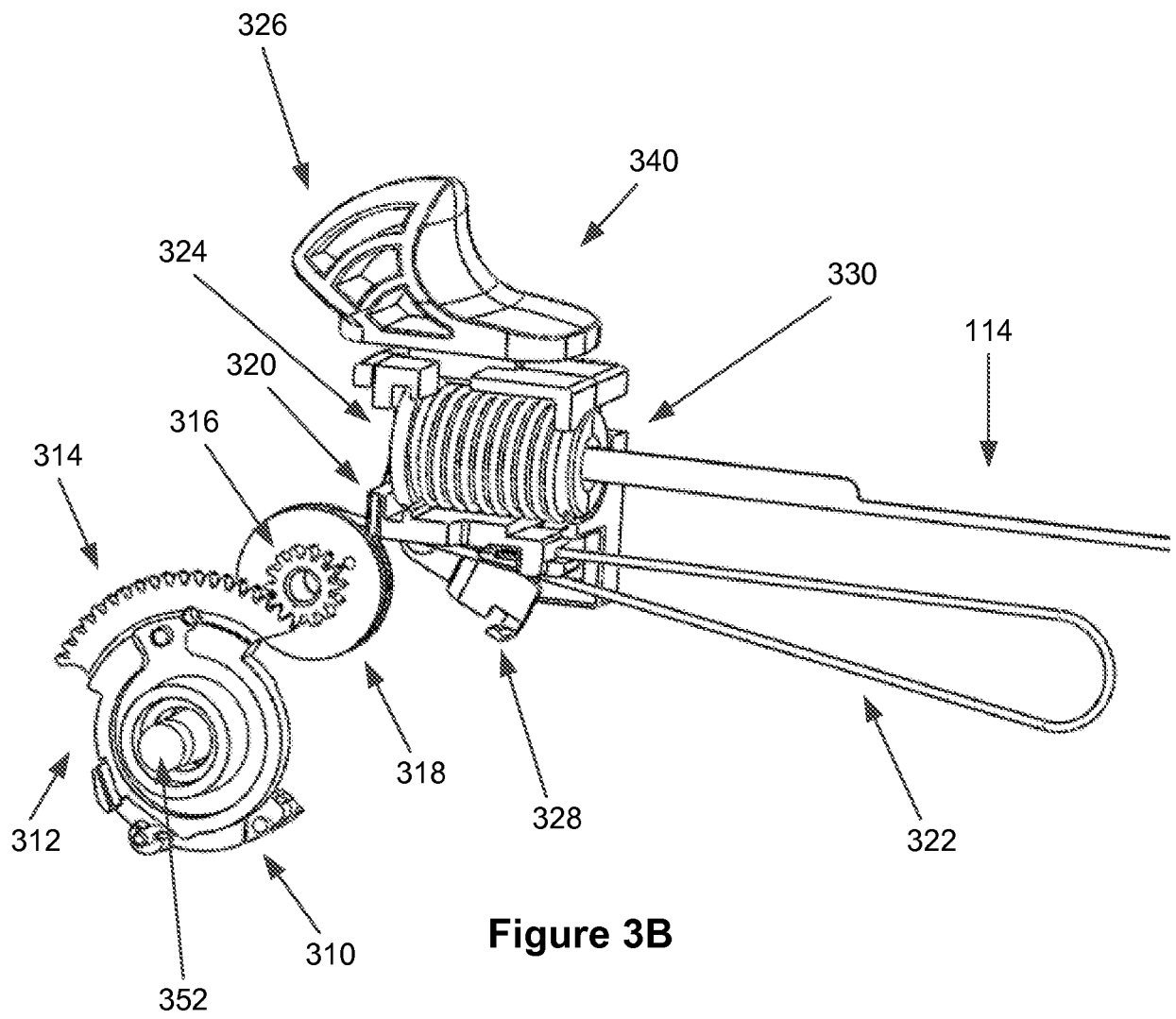
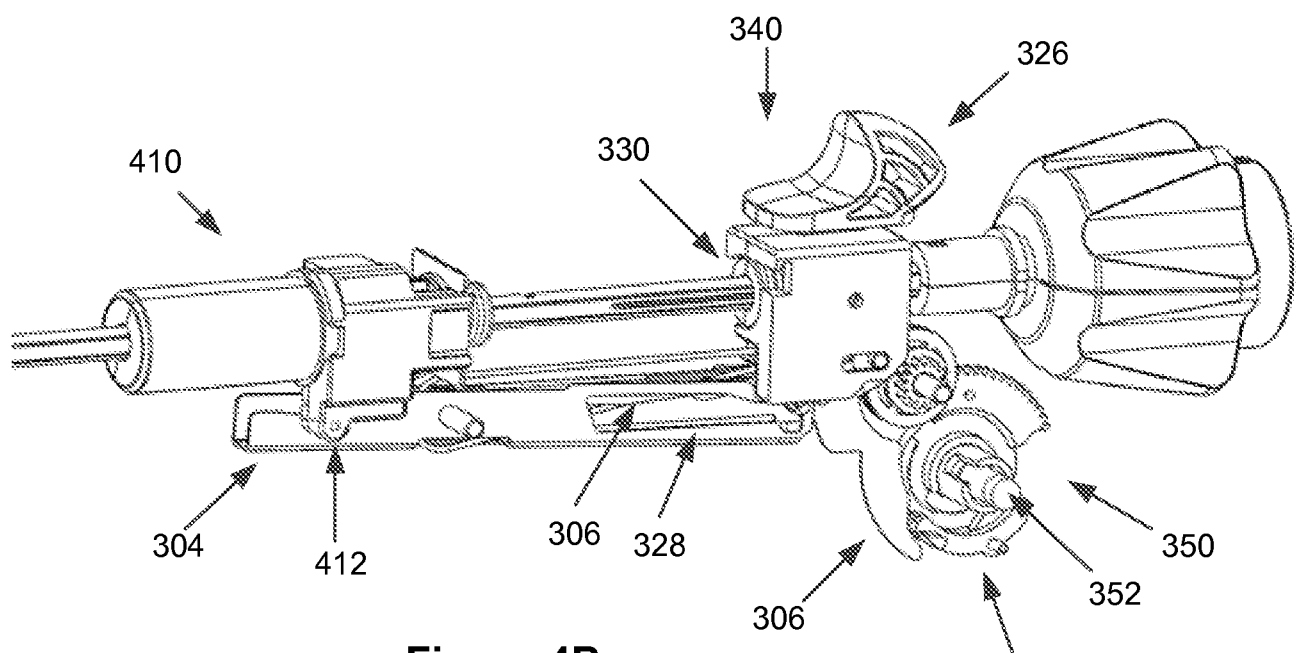
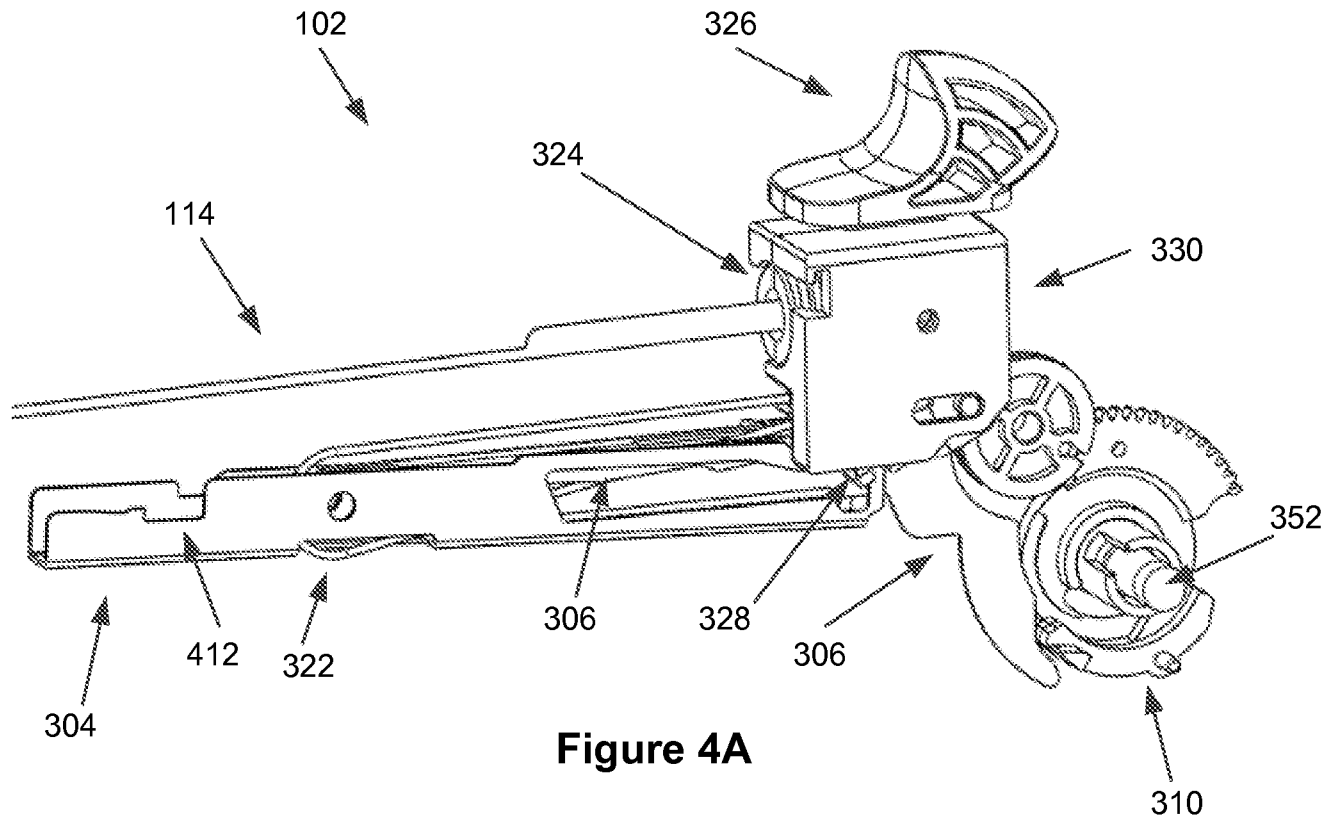
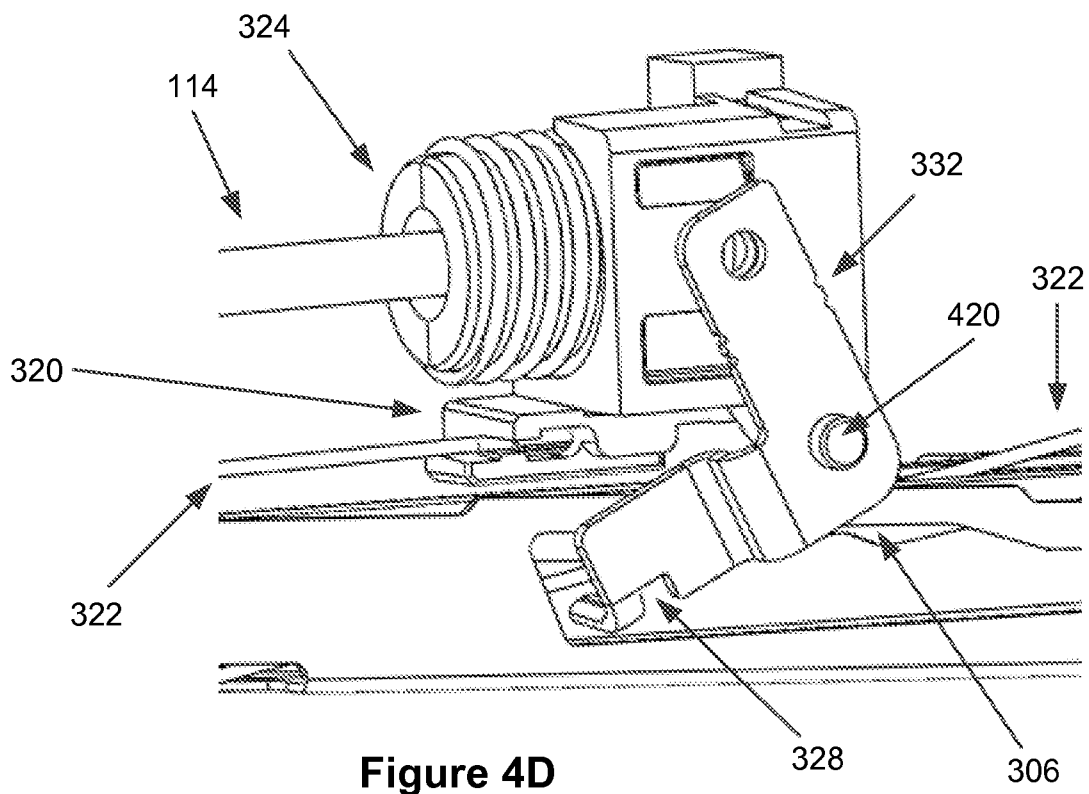
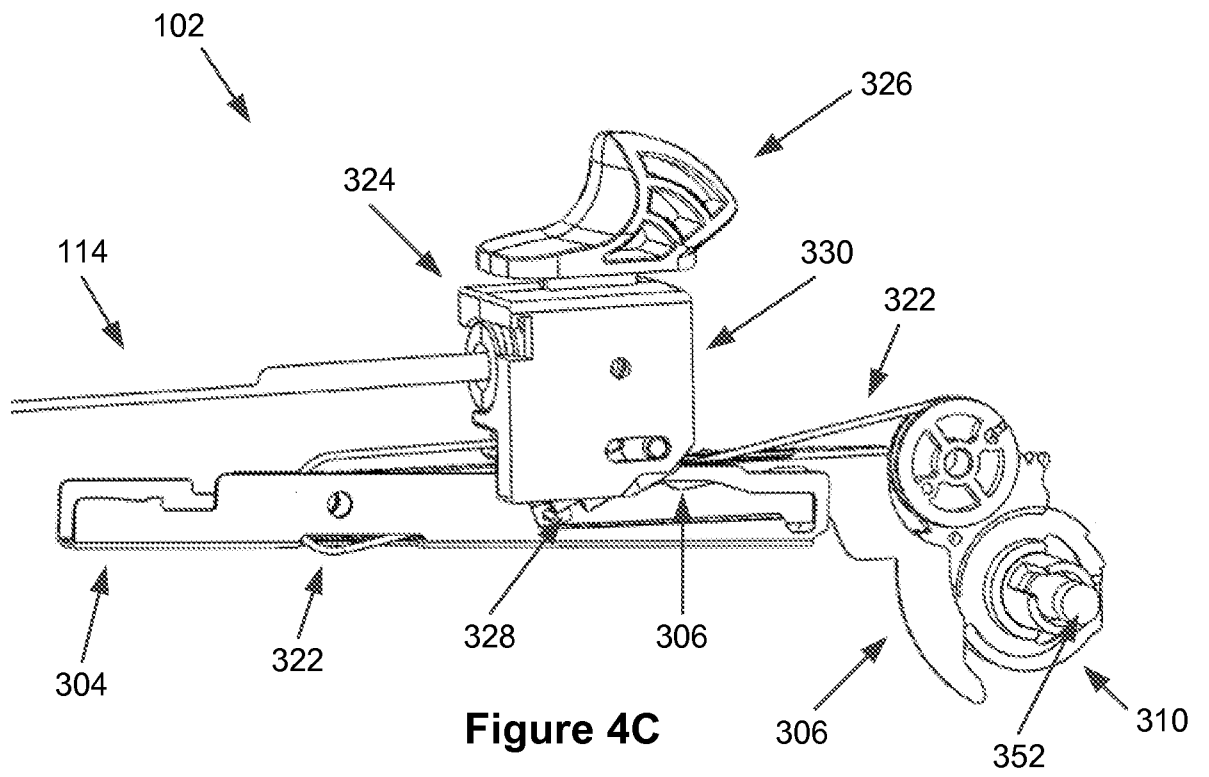


Figure 3B





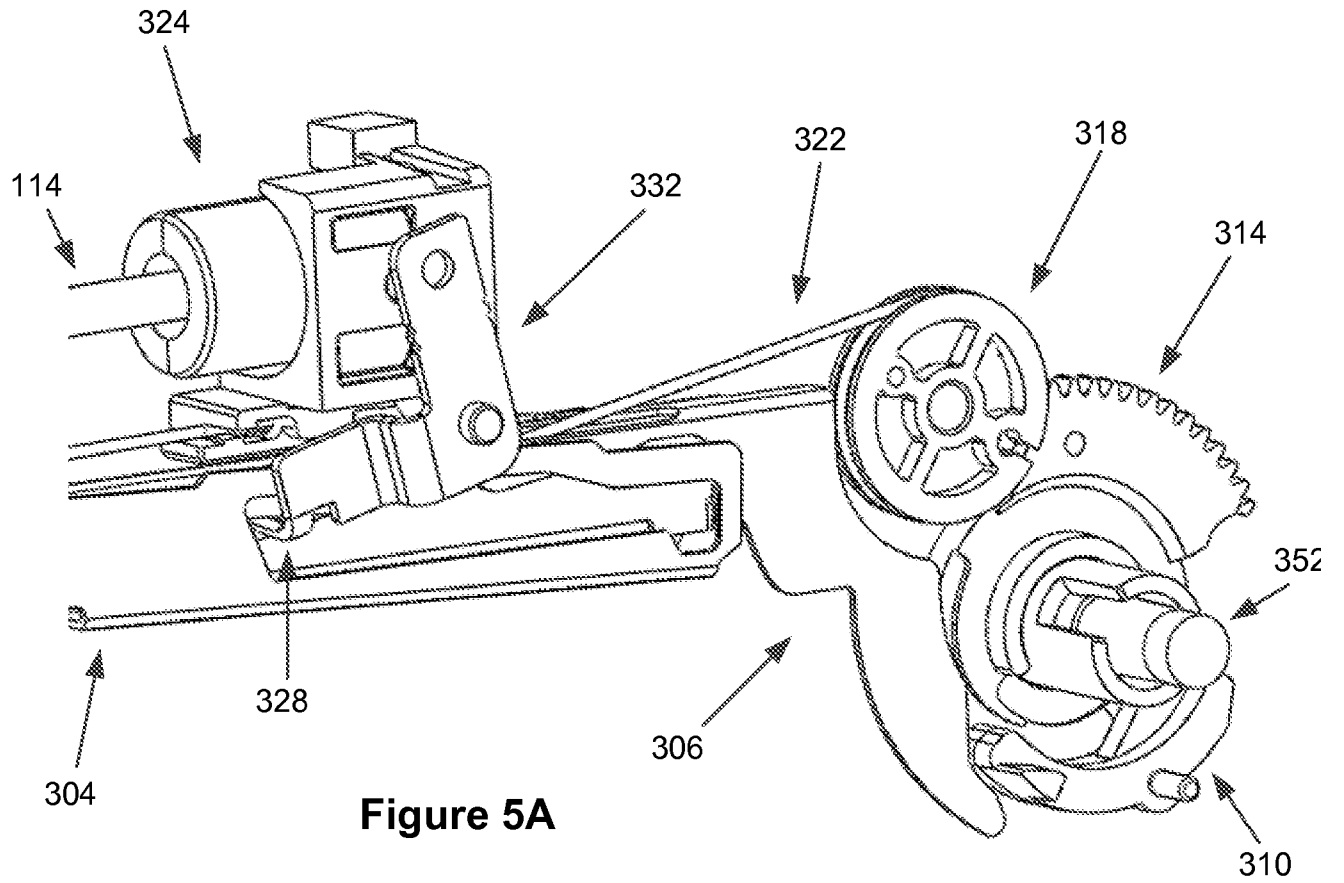


Figure 5A

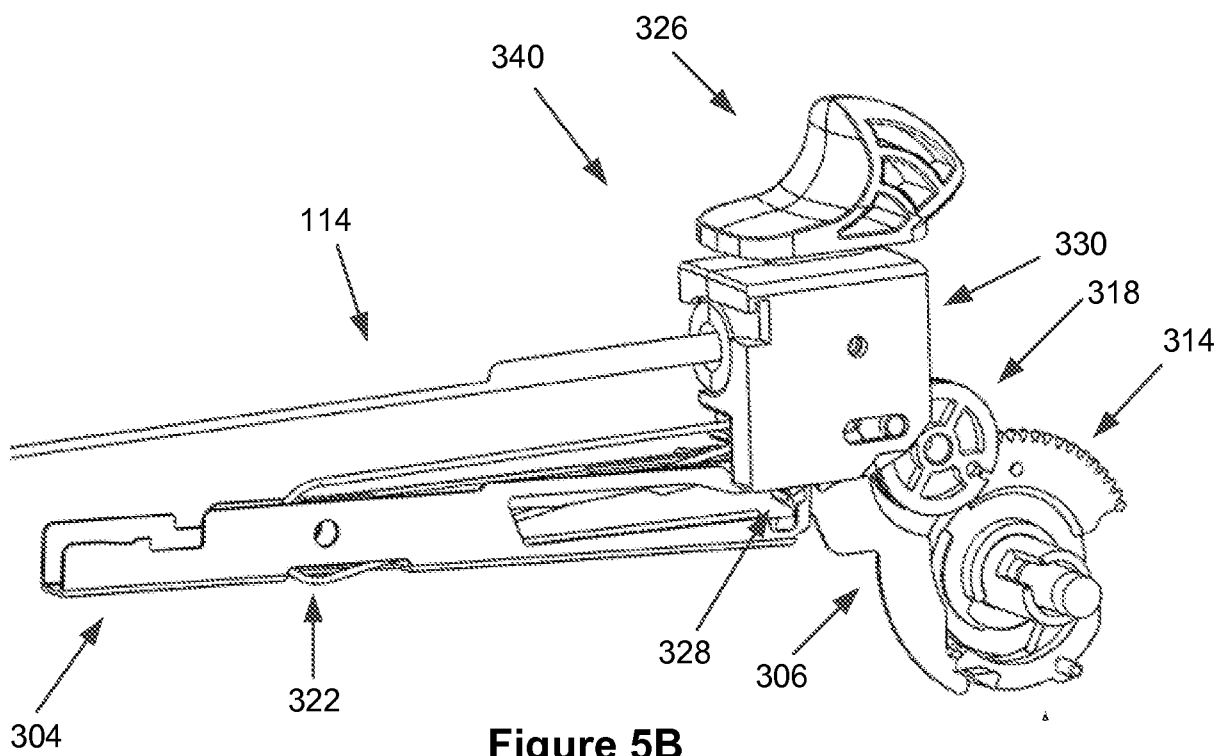


Figure 5B

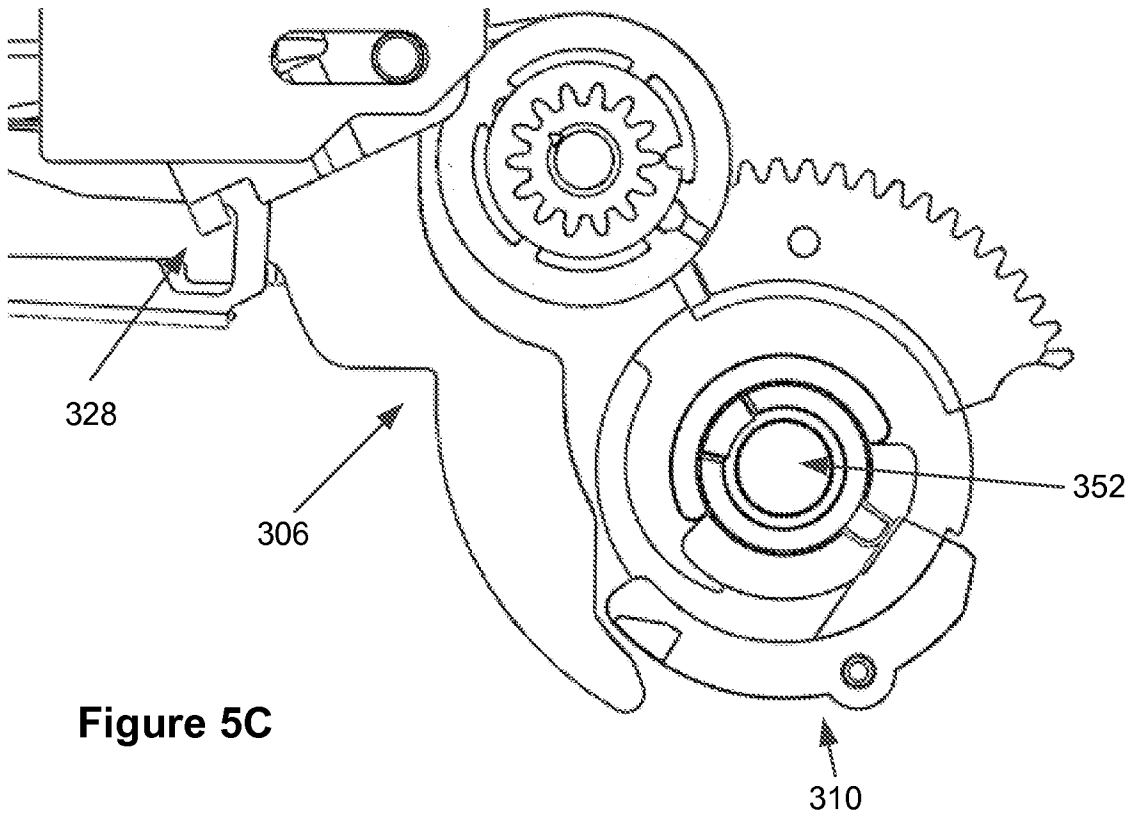


Figure 5C

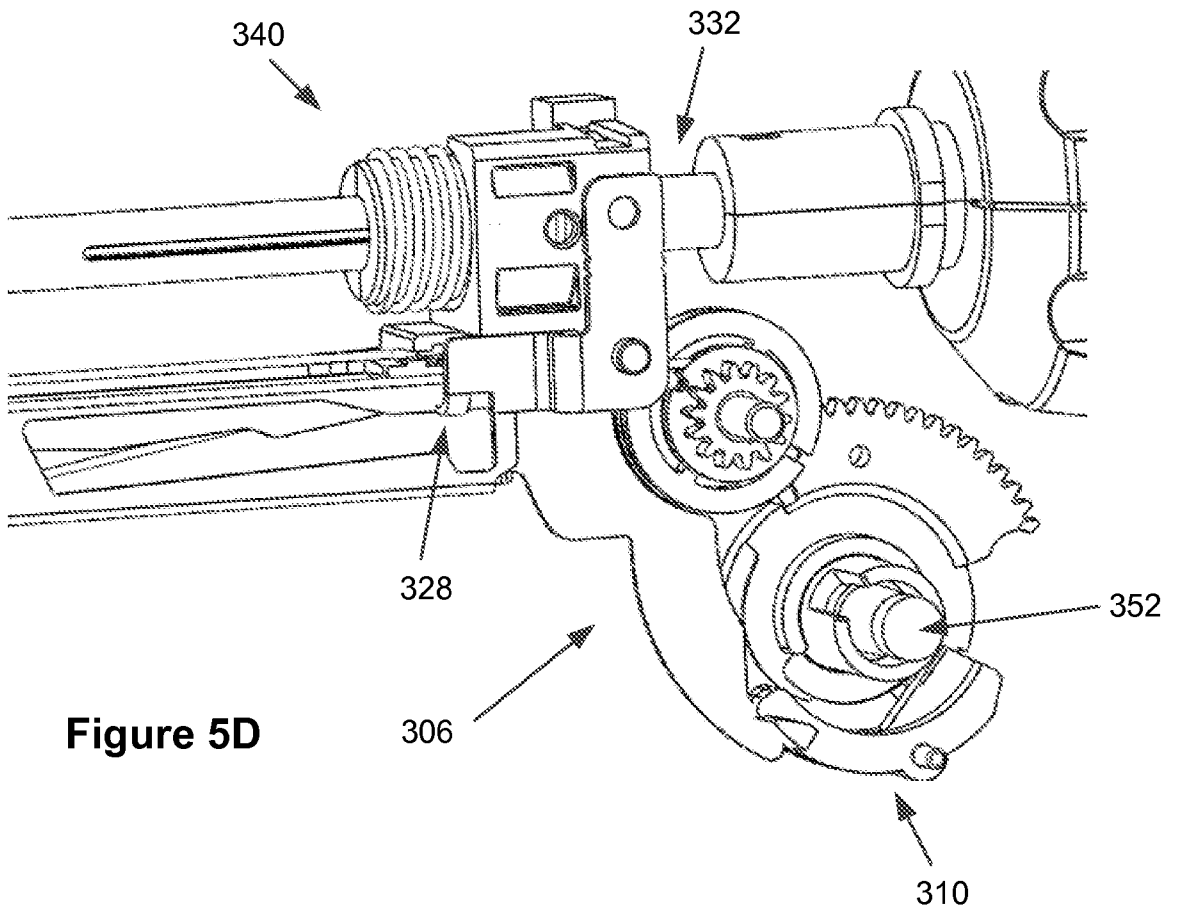


Figure 5D

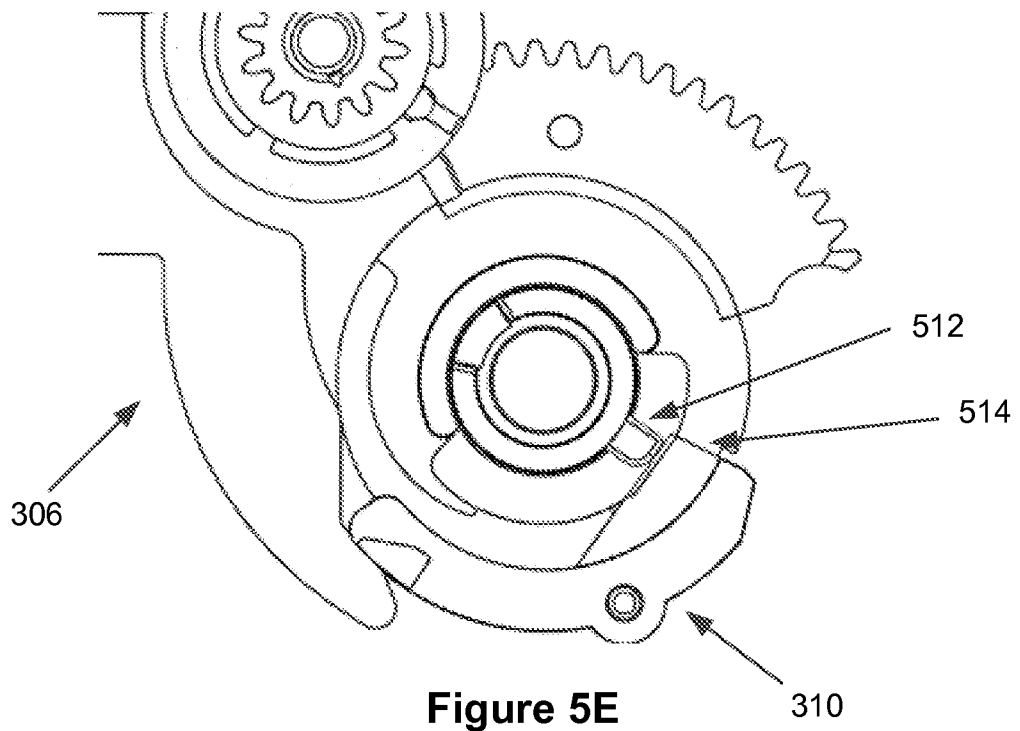


Figure 5E

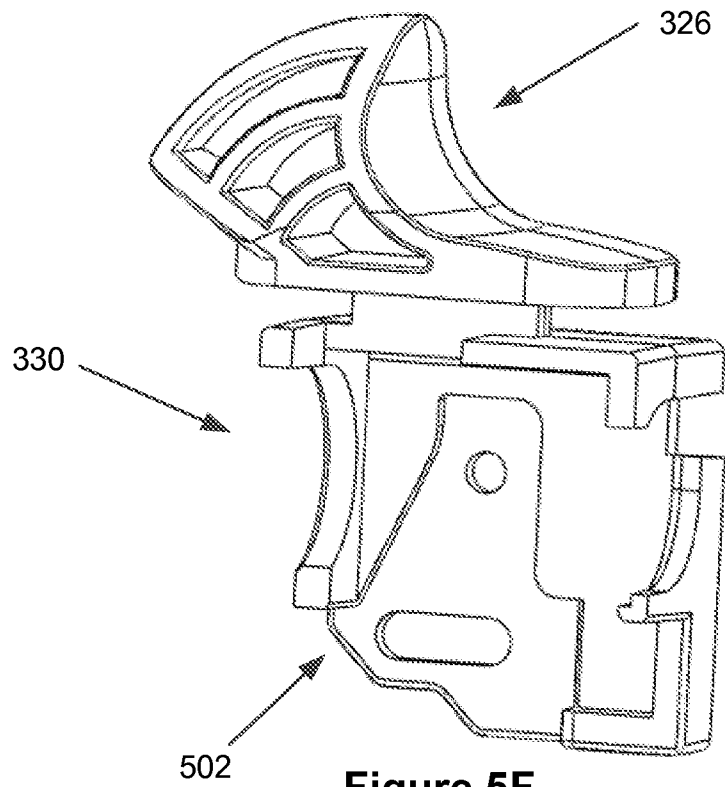


Figure 5F

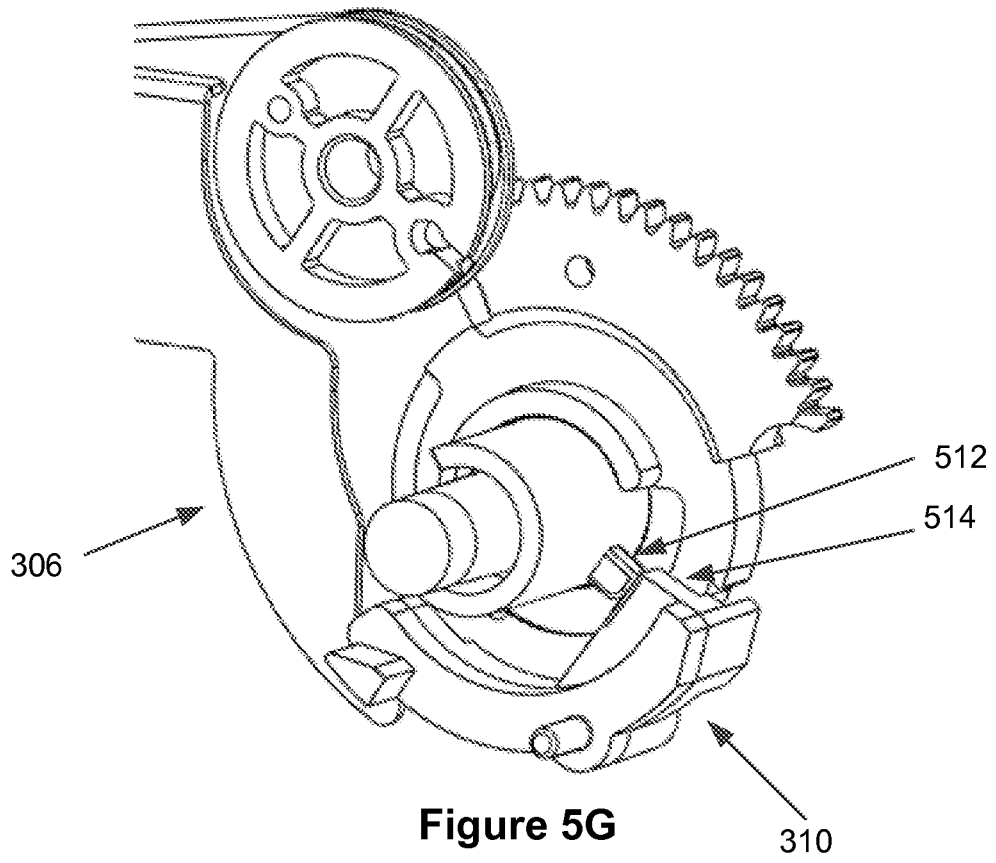


Figure 5G

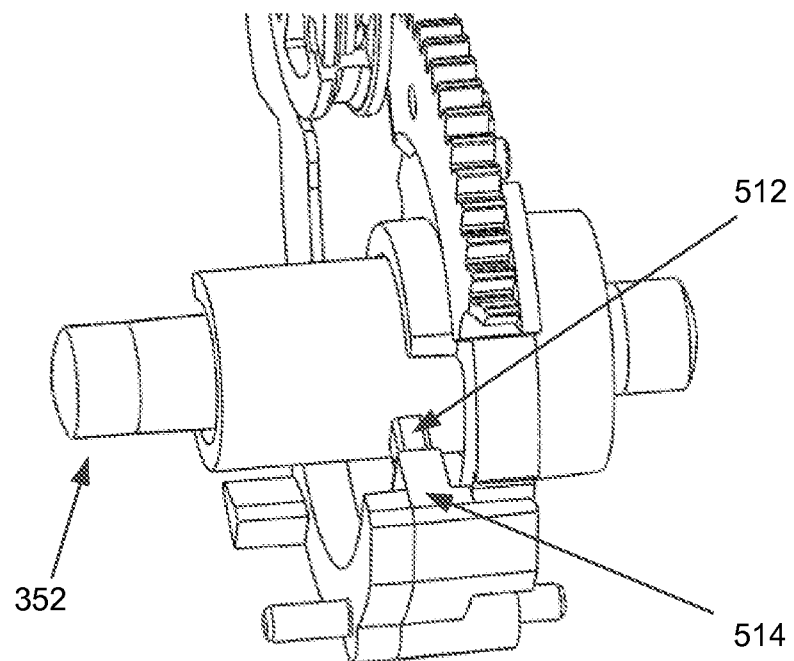


Figure 5H

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/037582**A. CLASSIFICATION OF SUBJECT MATTER****A61B 17/068(2006.01)i, A61B 17/115(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61B 17/068; A61B 17/10; A61B 18/12; A61B 17/115

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & keywords: stapling device, handle, shaft, end-effector, mode switch member, deployment slide member, swing arm member, reset switch member

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2006-0124689 A1 (ARAD, M. et al.) 15 June 2006 See abstract; claims 1-5; figures 2 and 7-15.	1-6, 9-14, 17-23
A	US 2009-0145947 A1 (SCIRICA, P. et al.) 11 June 2009 See abstract; claims 1 and 5-8; figures 1-2 and 12-18.	1-6, 9-14, 17-23
A	US 2008-0296347 A1 (SHELTON, IV, F. E. et al.) 4 December 2008 See abstract; paragraph [0011]; claims 1-3 and 11-12; figures 1-6.	1-6, 9-14, 17-23
A	US 2011-0036892 A1 (MARCZYK, S. et al.) 17 February 2011 See abstract; paragraphs [0022]-[0023]; claims 1-10; figures 1-4.	1-6, 9-14, 17-23
A	US 7384421 B2 (HUSHKA, D.) 10 June 2008 See abstract; claims 1 and 10; figures 1-3.	1-6, 9-14, 17-23

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

12 September 2014 (12.09.2014)

Date of mailing of the international search report

12 September 2014 (12.09.2014)

Name and mailing address of the ISA/KR

International Application Division
Korean Intellectual Property Office
189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan City, 302-701,
Republic of Korea

Facsimile No. +82-42-472-7140

Authorized officer

Han, Inho

Telephone No. +82-42-481-3362



INTERNATIONAL SEARCH REPORTInternational application No.
PCT/US2014/037582**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 7-8,15-16,24-25
because they relate to subject matter not required to be searched by this Authority, namely:
Claims 7-8, 15-16 and 24-25 are directed to a treatment method of the human body by surgery, and thus relate to a subject matter which this International Searching Authority is not required, under PCT Article 17(2)(a)(i) and PCT Rule 39.1(iv), to search.
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of any additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2014/037582

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006-0124689 A1	15/06/2006	US 2006-0219752 A1 US 7121446 B2 US 7328829 B2 WO 2006-064491 A1 WO 2007-141777 A2 WO 2007-141777 A3	05/10/2006 17/10/2006 12/02/2008 22/06/2006 13/12/2007 22/04/2010
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专利名称(译)	外科缝合和切割设备 - 部署机构，系统和方法		
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[标]发明人	FERNANDEZ ANTHONY J KNODEL BRYAN D		
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摘要(译)

外科缝合装置构造成用于开放和/或腹腔镜外科手术中。该装置包括手柄组件，联接到手柄组件的轴组件，以及联接到轴组件的端部执行器。端部执行器包括构造夹持，缝合和/或切割靶组织的钳夹组件。手柄组件包括触发元件，其可以激活驱动组件以推进部署组件以缝合和/或切割上述靶组织。部署组件包括部署滑动构件，以沿第一方向推进部署组件或沿第二方向撤回部署组件。