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(54) SURGICAL STAPLING AND CUTTING APPARATUS

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EP 2 996 579 B1

Description

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] This application claims priority to U.S. Patent Application No. 14/278,493 (Attorney Docket No. 408), filed on May 15, 2014, which claims priority to Provisional U.S. Patent Application No. 61/823,656 (Attorney Docket No. 378), filed on May 15, 2013.

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.

[0004] EP1943959 A1 discloses a surgical instrument. The instrument includes an end effector comprising a moveable cutting instrument to cut an object and a motor coupled to the end effector. The motor actuates the cutting instrument in response to a current therethrough, causing the cutting instrument to move between a proximal-most position and a distal-most position.

[0005] US2012/228358 A1 discloses a surgical stapling apparatus and includes a housing, an elongated member, an end effector, and a staple formation circuit. The elongated member extends from the housing. The end effector is disposed on an end of the elongated member and has first and second jaws. The first jaw includes a staple cartridge having a plurality of staples. Each of the staples has first and second legs. The second jaw has a plurality of staple forming pockets. The staple formation circuit may be disposed on the second jaw. The staple formation circuit communicates a signal to a controller coupled to the staple formation circuit. The signal is representative of one or more of a formation, a malformation, and a nonformation of one or both of the first and second legs of one or more of the staples within one or more of the staple forming pockets.

[0006] US2008/296347 A1 discloses a surgical instrument including a switching mechanism. In various embodiments, the surgical instrument can include a handle, a trigger operatively coupled to the handle, a firing drive, and an end effector. The firing drive can include a first ratchet assembly configured to advance a cutting member in the end effector and a second ratchet assembly configured to retract the cutting member. The trigger can include first and second pawls pivotably mounted thereon which are configured to be selectively engaged with the first and second ratchet assemblies, respectively. In at least one embodiment, the trigger can be configured to slide between a first position in which the first pawl is engaged with the first ratchet assembly and a second position in which the second pawl is engaged with the second ratchet assembly.

SUMMARY OF THE INVENTION

[0007] According to the invention, there is provided a surgical stapling device, comprising: a handle assembly; a clamp drive assembly; a clamp 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 having (i) an anvil member and (ii) a staple channel member or a staple cartridge holder member, the jaw assembly configured to perform clamping operations, wherein the handle assembly comprises: a trigger member to activate the clamp drive assembly to drive the clamp assembly to cause said jaw assembly to perform clamping operations, wherein the clamp assembly comprises: a clamp slide member to either advance said clamp assembly in a proximal direction or retreat said clamp assembly in a distal direction, and a clamp driver member movably coupled to the clamp assembly, wherein proximal movement of the clamp driver member causes the jaw assembly to clamp and distal movement of the clamp driver member causes the jaw assembly to un-clamp.

[0008] According to an embodiment not forming part of the invention, 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 surgical stapling device also includes a mode switch member to selectively place the device in a clamping mode to operate a clamp drive assembly. The clamp drive assembly is configured to drive a clamp assembly to operate the surgical stapling device. The clamp assembly includes a slide member to either advance the clamp assembly in a first direction or retreat the clamp assembly in a second direction. A clamp driver member is movably coupled to the clamp assembly, wherein movement of the clamp driver causes a jaw assembly of the surgical stapling device to execute clamp or un-clamp operations.

[0009] According to an embodiment not forming part of the invention, there is provided a method of treating tissue with a surgical stapling device. The method includes setting a mode switch member to select a clamp drive assembly to place the surgical stapling device in a clamp mode. The method includes the steps of activating a trigger member to drive the clamp drive assembly, advancing a clamp slide member of a clamp assembly, causing displacement or movement of a clamp driver member, placing the clamp assembly in a first clamp lock feature in a clamp lock member, and placing the clamp driver member in a second clamp lock feature of the clamp lock member to set the surgical stapling device in a clamp mode. The method further includes the steps of activating a reset switch member, causing a swing arm member to engage and reset the claim lock member, releasing the clamp assembly from the first clamp lock feature of the clamp lock member, releasing the clamp driver member from the second clamp lock feature of the clamp lock member, and releasing the surgical stapling device from the clamp mode.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] 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 figures are merely exemplary and not limiting. 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. Descriptive terms such as "upper," "lower," "upward," "downward", "forward", "backward", and the like are intended for the convenience of the reader and refer to the orientation and/or motion of parts as illustrated and described; they do not necessarily limit the orientation or operation of the features, aspects, or embodiments 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:

Figure 1A and Figure 1B illustrate an example of a surgical stapling and cutting device where the clamp mechanisms in accordance with features, aspects, or embodiments of the present invention that may be used to clamp a target tissue at a surgical site.

Figure 1C through Figure 1E illustrate closer views of the clamp mechanisms in accordance with features, aspects, or embodiments of the present invention that may be used to clamp a target tissue at a surgical site.

Figure 2A through Figure 2C illustrate the clamp mechanisms and the end-effector of the surgical stapling and cutting device at their initial neutral unclamp state.

Figure 3A through Figure 3C illustrate the clamp mechanisms and the end-effector of the surgical stapling and cutting device at their activated trocar state.

Figure 4A through Figure 4F illustrate the clamp mechanisms and the end-effector of the surgical stapling and cutting device at their activated clamp state.

Figure 5A through Figure 5C illustrate the clamp mechanisms with fail-safe feature when the surgical stapling device encounters thick tissue at a target surgical site.

Figure 6A through Figure 6E illustrate the unclamp or clamp reset mechanisms of the surgical device.

[0011] As can be appropriated, the use of same or similar symbols or numerals in different figures indicates similar or identical items or features.

[0012] 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.

[0013] 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 or modified so as not to include a sharp edge for cutting). 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.

[0014] Still referring to Figure 1A and Figure 1B, the surgical stapling and cutting device 100 includes a handle assembly 102 with a trigger element 302, a shaft assembly 104 coupled to the handle assembly 102, and an end-effector 106 coupled to the shaft assembly 104. Figure 1B illustrates an exposed close-up view of the handle assembly 102. In this exposed view, some of the clamp and deployment components are readily discernible. For example, the clamp drive assembly 600, clamp assembly 700, deployment assembly 340, and reset switch member 326 are all readily discernible in the exposed view of Figure 1B. As illustrated, the handle assembly 102 comprises of a clamp drive assembly 600 that includes various gears, pulleys, springs, drive links (e.g., cables, belts, or the like), trigger elements (e.g., trigger member 302), and mode selection switch members (e.g., mode switch member 352) to operate the clamp assembly 700 and deployment assembly 340. Figure 1C illustrates an isolated view of the handle assembly 102 which comprises of drive mechanisms 600 that includes various gears, pulleys, springs, drive links (e.g., cables, belts, or the like), trigger elements (e.g., trigger member 302), and mode selection switch members (e.g., mode switch member 352) to operate the clamp assembly 700 and deployment assembly 340. Figure 1C illustrates the handle assembly 102 without the cover or housing so as to highlight the clamp drive mechanisms 600, the deployment assembly 340, and clamp assembly 700. Figure ID illustrates selection of a mode switch member 352 by engagement or disengagement of the mode switch member standoff element 512 with the ratchet member stand-

off element 514. Depending on the selection of the mode switch member 352, a ratchet member 310 will either engage the drive mechanisms for the deployment assembly 340 or the drive mechanisms 600 for the clamp assembly 700. The details of this disclosure will focus on the selection of the mode switch member 352 being selected to engage and/or activate the drive mechanisms of the clamp drive assembly 600 for the operation of the clamp assembly 700. When the mode switch member 352 is selected to engage or activate the drive assembly 600 for the operation of the clamp assembly 700, the ratchet member 310 engages with a first gear member 602 of the clamp drive assembly 600. The engagement may involve a drive-tooth element 310-1 of the ratchet member 310 engaging with a drive-tooth element 602-1 of the first gear 602 of the clamp drive assembly 600, as illustrated in Figure 1E.

[0015] Figure 2A through Figure 2C illustrate the clamp mechanisms 700 and the end-effector 106 of the surgical stapling and cutting device 100 at their initial or neutral unclamp state. At the start of the clamp operational cycle, the surgical device 100 starts at a neutral unclamp state for its jaw assembly 200, see Figure 2C. In the neutral unclamp state, the jaw members of the end-effector 106 are in their open positions. The jaw members of the end-effector 106 comprise of an anvil member 202 and a staple channel member or staple cartridge holder member 204, as illustrated in Figure 2C. The staple channel member or staple cartridge holder member 204 is configured for holding or retaining a staple cartridge where staples may be deployed to staple target tissues. As discussed in this disclosure, a knife member may be included in the construction of the surgical device 100 or a knife member may not be included or that it may be replaced with a non-cutting member. As such, the surgical device 100 may be a surgical stapling and cutting device or it may be only a surgical stapling device depending on various options of constructions.

[0016] To place the surgical device 100 into operation, clamp mode selection may be activated through the mode switch member 352 to engage the clamp drive assembly 600, refer to Figure 2A. A trigger element 302 may be activated (e.g., the attending surgeon may provide an initial first squeeze of the trigger element 302 of the surgical device 100). This activation of the trigger element 302 starts the clamp drive assembly 600. The drive mechanisms of the drive assembly "pull" on the clamp cable member 612 which draws the clamp slide member 702 and clamp spool cover member 704 "backward" toward the proximal portion of the handle assembly 102, refer to Figure 2B. A clamp slide pin member 706 of the clamp slide member 702 rides along a first edge or first support of the clamp lock member 304. The first edge of the clamp lock member 304 includes a ramp feature 304-1 (see Figure 3B) that may resist the "backward" movement of the slide pin 706, which translates to providing positive feedback or resistance to the attending surgeon who is operating the trigger element 302 of the surgical device 100. The backward movement of the clamp slide member 702 and the clamp spool over member 704 applies a compressive force onto a clamp limit member 708 (see Figure 4B - the clamp limit member 708 may be a spring element), which translates the compressive force to the clamp driver member 710. The clamp driver member 710 is coupled to a clamp strip member 712 by way of a clamp connection bar member 714. To be discussed further, the clamp connection bar member 714 may translate laterally about a substantially lateral opening or slot on the clamp slide member 702, which allows the clamp slide member 702 to be decoupled with the clamp driver member 710, see Figure 2B.

[0017] Referring back to the clamp driver 710, Figure 3A through Figure 3C illustrate the clamp mechanisms and the end-effector of the surgical stapling and cutting device at their activated trocar state. The compressive force may drive the clamp driver member 710 backward towards the proximal portion of the surgical device 100. The backward movement of the clamp driver member 710 pulls on the clamp strip 712, which is coupled to the jaw assembly 200 of the end-effector 106, causing the jaw assembly to close, as illustrated in Figure 3C. As mentioned, as the clamp cable element 612 pulls the clamp slide member 702 back, the clamp slide pin 706 encounters a ramp feature 304-1 that provides positive resistance or feedback to the operating surgeon. At this stage or phase of operation, the surgeon can release the trigger element 302. The unclamp member 720 (see Figure 3A - the unclamp member 720 may be a spring element) may provide sufficient restoration force to drive the clamp slide member 702 forward along with the clamp slide pin 706 "down" the ramp feature 304-1 (see Figure 3B for the ramp feature 304-1). The forward movement may be translated through the clamp strip member 712 to release or open the jaw assembly 200 back to a neutral state. Alternatively, the operating surgeon can hold on to the trigger element to maintain the jaw assembly in a closed state, as illustrated in Figure 3C. In this configuration, the surgeon can insert the end-effector 106 through an opening, a port, or a trocar to introduce the working portion of the surgical device 100 into a cavity of a patient to perform stapling and cutting of tissue at a target surgical site. In this initial closed configuration, the jaw assembly 200 may be in its smallest cross-sectional diameter or profile in which the end-effector 106 can fit through a small opening. This configuration for the jaw assembly 200 may be referred as the "trocar" mode. In addition, in this configuration, the anvil member 202 and staple channel 204 may be oriented substantially horizontally. Also, the anvil member 202 and staple channel 204 may be substantially parallel to one another in the trocar mode.

[0018] Figure 4A through Figure 4F illustrate the clamp mechanisms and the end-effector of the surgical stapling and cutting device at their activated clamp state. After the first activation of the clamp drive assembly 600, an additional activation of the trigger element 302 may

cause the mechanisms of the clamp drive assembly 600 to tension the clamp cable member 612 to pull on the clamp slide member 702. As the clamp slide member 702 is pulled backward, the clamp slide pin element 706 is also pulled along backward into a first clamp lock pocket element or first clamp lock pocket feature 304-11. The clamp limit clip tab element 722-1 of the clamp limit clip member 722, moving substantially in concert with the clamp slide member 702 and clamp slide pin element 706, slides into or clicks into a second clamp lock pocket element or second clamp lock pocket feature 304-12. As both the clamp slide pin 706 and the clamp limit clip tab 722-1 are resting in their respective first clamp lock retainer element 304-11 and clamp lock retainer element 304-12, the jaw assembly 202 is placed into a clamp mode configuration, as illustrated in Figure 4E and Figure 4F. As should be noted in Figure 4E and Figure 4F, the proximal region of the anvil member 202 may be slightly elevated. This configuration allows the anvil member 202 to exert greater leverage in clamping a target tissue between the anvil member 202 and the channel member 204 (containing a staple cartridge or staple holder). Although not illustrated, the channel member 204 will hold a staple cartridge or staple holder for deployment of staples onto a target tissue. As such, the target tissue may be considered as being clamped between the anvil member 202 and the staple cartridge or staple holder (held by the channel member 204).

[0019] Figure 5A through Figure 5C illustrate the clamp mechanisms with fail-safe features to avoid malfunctions when the surgical stapling device encounters thick tissue or overly thick tissue that causes ineffective clamping and/or stapling. As illustrated in Figure 5A, when the surgical device 100 encounters and attempts to clamp down onto thick tissue or overly thick tissue, the mechanisms of the clamp assembly 700 prevents the jaw assembly from being placed into a clamp mode, a secured clamp mode, or a locked clamp mode. As illustrated in Figure 5A, Figure 5B, and Figure 5C, the clamp limit clip tab member 722-1 may be sitting on the cusp of the second clamp lock pocket feature 304-12, instead of sitting in the second clamp lock pocket element 304-12. If both the clamp slide pin member 706 and clamp limit clip member 722-1 are sitting in their respective first clamp lock retainer pocket feature 304-11 and second clamp lock retainer pocket feature 304-12, then the jaw assembly may be in a clamp lock mode. However, if the clamp limit clip tab member 722-1 is not placed into the second clamp lock retainer feature 304-12, then the jaw assembly 200 of the surgical device is not placed into a clamp mode. Instead, as the clamp cable member 612 asserts tension to pull on the clamp side member 702, the clamp spool member 704 is pulled back and exerts a compressive force onto clamp limit member 708, which may be a spring element that deforms or deflected and absorbs the compressive force. Under typical scenarios, the clamp limit member 708 is not sufficiently compressed or deflected; instead, the compressive force is transferred substantially directly to the clamp driver member 710 to drive close the jaw assembly 200 into a clamped configuration, e.g., a clamp lock mode. However, when sufficiently thick tissue or overly thick tissue is encountered, the jaw members of the jaw assembly 200 cannot clamp down sufficiently into a proper clamping configuration, even though the clamp slide member 702 is being pulled backwards to draw the jaw assembly close into a clamping configuration. In this particular scenario, the clamp limit element 708 absorbs the compressive force exerted by the clamp cable element 612. As such, even though the clamp slide member 702 is pulled back by the clamp cable member 612 and the clamp slide pin member is pulled back into the first clamp lock retainer pocket feature 304-11, the clamp driver member 710 along with the clamp limit clip member 722 do not move back. As such, correspondingly, the clamp limit clip tab element does not move back into the second clamp lock retainer pocket feature 304-12. In other words, the clamp slide member 702 can be decoupled with the clamp driver member 710. As such, the clamp slide member 702 can translate or move independently from the clamp drive member 710. As illustrated in Figure 5A through Figure 5C, for this example, the clamp limit clip tab element 722-1 remains on the edge or support of the clamp lock member 304. The clamp limit clip tab element 722-1 does not move into the second clamp lock retainer pocket feature 304-12.

[0020] In typical operation, the jaw assembly 200 of the surgical device 100 is placed in a clamp mode, as illustrated in Figure 4A through Figure 4F. The clamped target tissue is ready to be stapled or stapled and cut. The next phase of operation for the surgical device 100 involves the deployment mode. That is, the mode of operation for the surgical device 100 can be switched or place into deployment mode by activating the mode switch button 352. In the deployment mode, various mechanisms are operated to deploy staples to staple a target tissue or various mechanisms are operated to deploy staples and a knife to staple and cut a target tissue at a surgical site of a patient. Once the target tissue has been stapled or stapled and cut, the jaw assembly 200 can be reset and placed into unclamp state. For example, at the end of a final deployment stroke in the deployment mode, the ratchet member 310 may be raised or reset by a bump-like feature on a deploy gear of the deployment drive assembly causing the mode switch member 352 to center or reset to place the surgical device 100 back into clamp mode. The mode switch member 352 may be spring loaded to allow for self-reset. Proceeding further, the user then pulls back on the reset switch member 326, which in turn pulls back the clamp strip 712. The clamp strip member 712 may include an I-Beam element or coupled to an I-Beam member. The I-Beam element operates to maintain a desired clamp gap between the jaw members of the jaw assembly 200 (e.g., the anvil member 202 and the staple cartridge held by the staple channel 204). Once the reset switch member 326 is back

in its initial position, it can still be pulled back further, compressing a deployment spool member 324 which causes an unclamp tab element 328 of the swing arm member 332 to cam up and lift the clamp lock member 304, see Figure 6A, Figure 6B, and Figure 6C. As illustrated further in Figure 6D and Figure 6E, the deployment spool member 324 may include a reset element 324-1 (e.g., a coil spring and the like) to allow the deployment spool unit some degrees of freedom of movement that may be separate or independent of the deployment assembly. Further, as an 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 of the deployment assembly 340. Also, the spool member 324 may include a spring element, as mentioned, to allow further movement of a portion of the deployment assembly 340 that may be independent of the deployment slide member (e.g., the reset switch member 326) or portions of the deployment assembly 340. When the clamp lock member 304 is lifted by the unclamp tab element 328, it rotates and releases the clamp slide pin 706 and clamp limit clip tab element 722-1 (e.g., released from being respectively contained or retained in the first clamp lock pocket feature 304-11 and the second clamp lock pocket feature 304-12). Because the clamp lock member 304 is no longer holding the clamp limit clip member 722 and the clamp slide pin member 706, the unclamp element 720 then drives the clamp driver member 710 and clamp slide member 702 along with the clamp spool member 704 forward into their most distal position. In turn, the clamp strip 712 is driven forward to place the jaw members of the jaw assembly into an unclamp state.

[0021] In addition, it is possible to unclamp and abort deployment after the target tissue is clamped by the jaw assembly 200. In this scenario, the attending surgeon would pull back on the reset switch member 326, compressing the deployment spool member 324 causing the unclamp tab element 328 of the swing arm member 332 to rotate and lift the clamp lock member 304, see Figure 6C, releasing the clamp slide pin member 706 and clamp limit clip tab 722-1. The operation of abort and unclamp is substantially similar to the normal unclamp operation, except the reset switch member 326 may be in its initial undeployed position, instead of the most distal position at the end of the deployment operation.

[0022] 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, as long as they fall within the scope of the claims. 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.

Claims

1. A surgical stapling device (100), comprising:

a handle assembly (102);
a clamp drive assembly (600);
a clamp assembly (700);
a shaft assembly (104) coupled to the handle assembly (102); and
an end-effector (106) coupled to the shaft assembly (104),
wherein the end-effector (106) comprises:

a jaw assembly (200) having (i) an anvil member (202) and (ii) a staple channel member or a staple cartridge holder member (204),
the jaw assembly (200) configured to perform clamping operations,
wherein the handle assembly (102) comprises:

a trigger member (302) to activate the clamp drive assembly (600) to drive the clamp assembly (700) to cause said jaw assembly (200) to perform clamping operations,
wherein the clamp assembly (700) comprises:

a clamp slide member (702) to either advance said clamp assembly (700) in a proximal direction or retreat said clamp assembly (700) in a distal direction, and
a clamp driver member (710) movably coupled to the clamp assembly (700), **characterized in that** proximal movement of the clamp driver member (710) causes the jaw assembly (200) to clamp and distal movement of the clamp driver member (710) causes the jaw assembly (200) to un-clamp.

2. The surgical stapling device (100) of claim 1, further

comprising:
a clamp lock member (304) to lock the clamp slide member (702) in a first clamp lock pocket feature (304-11) and a second clamp lock pocket feature (304-12) to lock the clamp driver member (710) to place the jaw assembly (200) in a clamp lock mode.

3. The surgical stapling device (100) of claim 2, wherein when the clamp assembly (700) moves or translates independently of the clamp driver member (710), the clamp driver member (710) is prevented to place the jaw assembly (200) in a clamp lock mode.

4. The surgical stapling device (100) of claim 1, further comprising:
a clamp lock ramp feature (304-1) on the clamp lock member (304) to provide a positive resistance to the clamp slide member (702) prior to locking the clamp slide member (702) in the first clamp lock pocket feature (304-11) to place the jaw assembly (200) in the clamp lock mode.

5. The surgical stapling device (100) of claim 1, further comprising:
a mode switch member (352) to selectively place the surgical stapling device (100) in a clamping mode to operate the clamp drive assembly (600).

6. The surgical stapling device (100) of claim 2, further comprising:
a reset switch member (326) configured to activate a swing arm member (332) to reset the clamp lock member (304) to release the clamp slide member (702) from the first clamp lock pocket feature (304-11) and release the clamp driver member (710) from the second clamp lock pocket feature (304-12) to reset the jaw assembly (200) from the clamp lock mode.

7. The surgical stapling device (100) of claim 6, wherein the swing arm member (332) includes an unclamp tab element (328) to engage and reset the clamp lock member (304).

Patentansprüche

1. Chirurgische Klammervorrichtung (100) mit:

einer Griffanordnung (102);
einer Klammerantriebsanordnung (600);
einer Klammeranordnung (700);
einer Schaftanordnung (104), die mit der Griffanordnung (102) gekoppelt ist; und
einem Endeffektor (106), der mit der Schaftanordnung (104) gekoppelt ist,
wobei der Endeffektor (106) Folgendes umfasst:

eine Backenanordnung (200) mit (i) einem Ambosselement (202) und (ii) einem Klammerkanalelement oder einem Klammermagazinhalterelement (204),
wobei die Backenanordnung (200) für die Durchführung von Klemmvorgängen konfiguriert ist,
wobei die Griffanordnung (102) Folgendes umfasst:

ein Auslöseelement (302) zum Aktivieren der Klammerantriebsanordnung (600), um die Klammeranordnung (700) anzusteuern, um die Backenanordnung (200) dazu zu veranlassen, Klemmvorgänge durchzuführen,
wobei die Klammeranordnung (700) Folgendes umfasst:

ein Klammerschlittenelement (702), um die Klammeranordnung (700) entweder in einer proximalen Richtung vorzuschieben oder die Klammeranordnung (700) in einer distalen Richtung zurückzuziehen, und
ein Klammerantriebselement (710), das beweglich mit der Klammeranordnung (700) gekoppelt ist,
dadurch gekennzeichnet, dass
eine proximale Bewegung des Klammerantriebselements (710) bewirkt, dass sich die Backenanordnung (200) festklemmt, und eine distale Bewegung des Klammerantriebselements (710) bewirkt, dass sich die Backenanordnung (200) die Klemmung löst.

2. Chirurgische Klammervorrichtung (100) nach Anspruch 1, ferner mit:
einem Klammerverriegelungselement (304) zum Verriegeln des Klammerschlittenelements (702) in einem ersten Klammerverriegelungsfachmerkmal (304-11) und einem zweiten Klammerverriegelungsfachmerkmal (304-12) zum Verriegeln des Klammerantriebselements (710), um die Backenanordnung (200) in einen Klammerverriegelungsmodus zu versetzen.

3. Chirurgische Klammervorrichtung (100) nach Anspruch 2, wobei, wenn sich die Klammeranordnung (700) unabhängig von dem Klammerantriebselement (710) bewegt oder verschiebt, das Klammerantriebselement (710) daran gehindert wird, die Backenanordnung (200) in einen Klammerverriegelungsmodus zu versetzen.

4. Chirurgische Klammervorrichtung (100) nach Anspruch 1, ferner mit:
einem Klammerverriegelungsrampenmerkmal (304-1) auf dem Klammerverriegelungselement (304), um dem Klammerschlittenelement (702) vor dem Verriegeln des Klammerschlittenelements (702) in dem ersten Klammerverriegelungsfachmerkmal (304-11) einen positiven Widerstand zu geben, um die Backenanordnung (200) in den Klammerverriegelungsmodus zu versetzen.

5. Chirurgische Klammervorrichtung (100) nach Anspruch 1, ferner mit:
einem Modusschaltelement (352), um die chirurgische Klammervorrichtung (100) selektiv in einen Klemmmodus zu versetzen, um die Klammerantriebsanordnung (600) zu betätigen.

6. Chirurgische Klammervorrichtung (100) nach Anspruch 2, ferner mit:
einem Rückstellschaltelement (326), das so konfiguriert ist, dass es ein Schwenkarmelement (332) aktiviert, um das Klammerverriegelungselement (304) zurückzustellen, um das Klammerschlittenelement (702) von dem ersten Klammerverriegelungsfachmerkmal (304-11) zu lösen und das Klammerantriebselement (710) von dem zweiten Klammerverriegelungsfachmerkmal (304-12) zu lösen, um die Backenanordnung (200) aus dem Klammerverriegelungsmodus zurückzustellen.

7. Chirurgische Klammervorrichtung (100) nach Anspruch 6, wobei das Schwenkarmelement (332) ein Entklammerungszungenelement (328) aufweist, um in das Klammerverriegelungselement (304) einzugreifen und dieses zurückzusetzen.

Revendications

1. Dispositif d'agrafage chirurgical (100) comprenant :

un ensemble poignée (102) ;
un ensemble d'entraînement de clamp (600) ;
un ensemble clamp (700) ;
un ensemble arbre (104) couplé à l'ensemble poignée (102) ; et
un effecteur terminal (106) couplé à l'ensemble arbre (104),
dans lequel l'effecteur terminal (106) comprend :

un ensemble mâchoire (200) ayant (i) un élément formant enclume (202) et (ii) un élément formant canal d'agrafe ou un élément formant support de de cartouche d'agrafes (204),
l'ensemble mâchoire (200) étant configuré pour réaliser des opérations de clampage, dans lequel l'ensemble poignée (102) comprend :

un élément de déclenchement (302) pour actionner l'ensemble d'entraînement de clamp (600) pour entraîner l'ensemble clamp (700) pour amener ledit ensemble mâchoire (200) à réaliser des opérations de clampage,
dans lequel l'ensemble clamp (700) comprend :

un élément coulissant de clamp (702) soit pour faire avancer ledit ensemble clamp (700) dans une direction proximale, soit pour faire reculer ledit ensemble clamp (700) dans une direction distale, et
un élément entraîneur de clamp (710) couplé de manière mobile à l'ensemble clamp (700), **caractérisé en ce qu'**un mouvement proximal de l'élément entraîneur de clamp (710) provoque le serrage de l'ensemble mâchoire (200) et qu'un mouvement distal de l'élément entraîneur de clamp (710) provoque le desserrage de l'ensemble mâchoire (200).

2. Dispositif d'agrafage chirurgical (100) selon la revendication 1, comprenant en outre :
un élément de verrouillage de clamp (304) pour verrouiller l'élément coulissant de clamp (702) dans une première caractéristique de poche de verrouillage de clamp (304-11) et une seconde caractéristique de poche de verrouillage de clamp (304-12) pour verrouiller l'élément entraîneur de clamp (710) pour placer l'ensemble mâchoire (200) dans un mode de verrouillage de clamp.

3. Dispositif d'agrafage chirurgical (100) selon la revendication 2, dans lequel, lorsque l'ensemble clamp (700) se déplace ou se déplace par translation indépendamment de l'élément entraîneur de clamp (710), l'élément entraîneur de clamp (710) ne peut pas placer l'ensemble mâchoire (200) dans un mode de verrouillage de clamp.

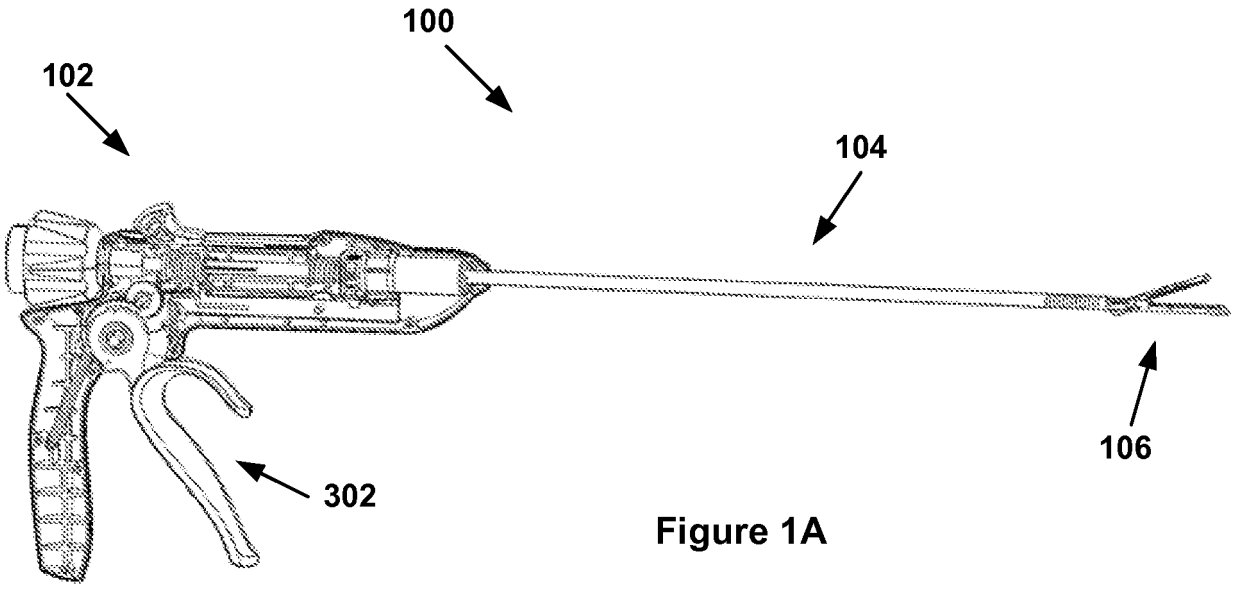
4. Dispositif d'agrafage chirurgical (100) selon la revendication 1, comprenant en outre :
une caractéristique de rampe de verrouillage de clamp (304-1) sur l'élément de verrouillage de clamp (304) pour fournir une résistance positive à l'élément coulissant de clamp (702) avant de verrouiller l'élément coulissant de clamp (702) dans la première caractéristique de poche de verrouillage de clamp

(304-11) pour placer l'ensemble mâchoire (200) dans le mode de verrouillage de clamp.

5. Dispositif d'agrafage chirurgical (100) selon la revendication 1, comprenant en outre :
un élément commutateur de mode (352) pour placer de manière sélective le dispositif d'agrafage chirurgical (100) dans un mode d'agrafage pour faire fonctionner l'ensemble d'entraînement de clamp (600).

6. Dispositif d'agrafage chirurgical (100) selon la revendication 2, comprenant en outre :
un élément commutateur de remise en place (326) configuré pour actionner un élément formant bras oscillant (332) pour remettre en place l'élément de verrouillage de clamp (304) pour libérer l'élément coulissant de clamp (702) de la première caractéristique de poche de verrouillage de clamp (304-11) et pour libérer l'élément entraîneur de clamp (710) de la seconde caractéristique de poche de verrouillage de clamp (304-12) pour remettre en place l'ensemble mâchoire (200) à partir de la position de verrouillage de clamp.

7. Dispositif d'agrafage chirurgical (100) selon la revendication 6, dans lequel l'élément formant bras oscillant (332) comprend un élément de patte de desserrage (328) pour venir en prise avec l'élément de verrouillage de clamp (304) et pour remettre en place celui-ci.



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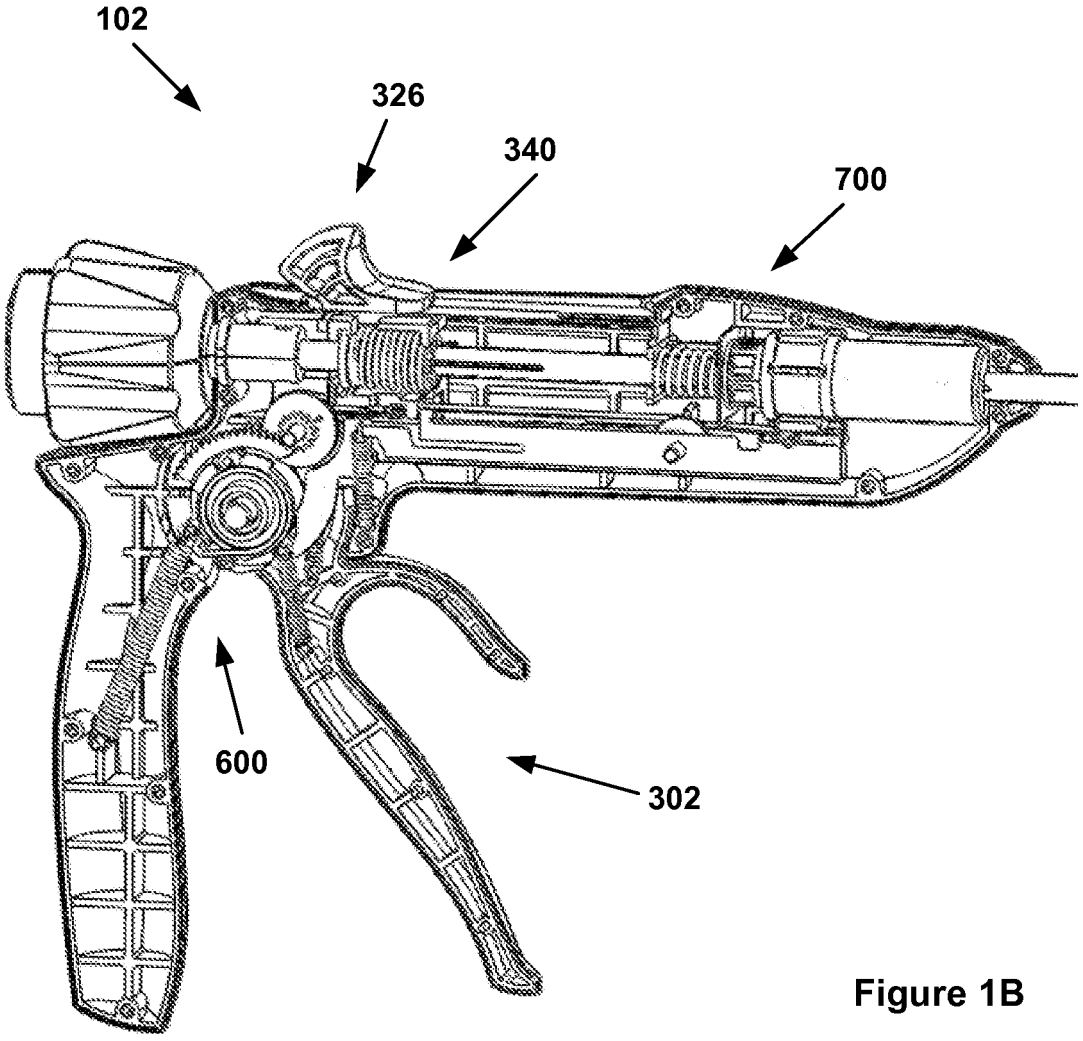


Figure 1B

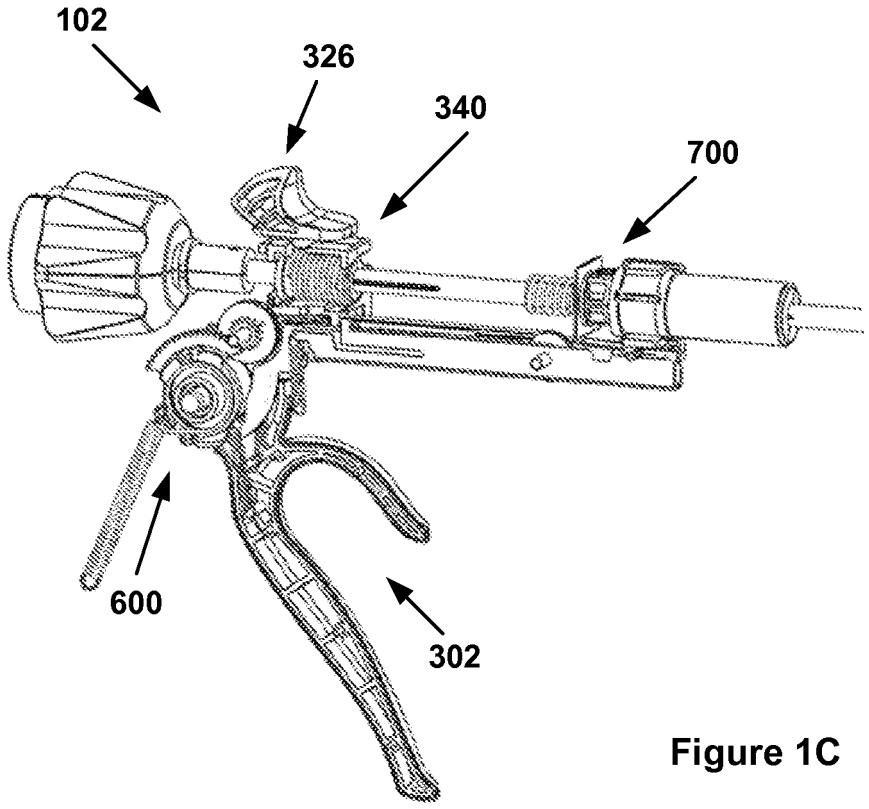


Figure 1C

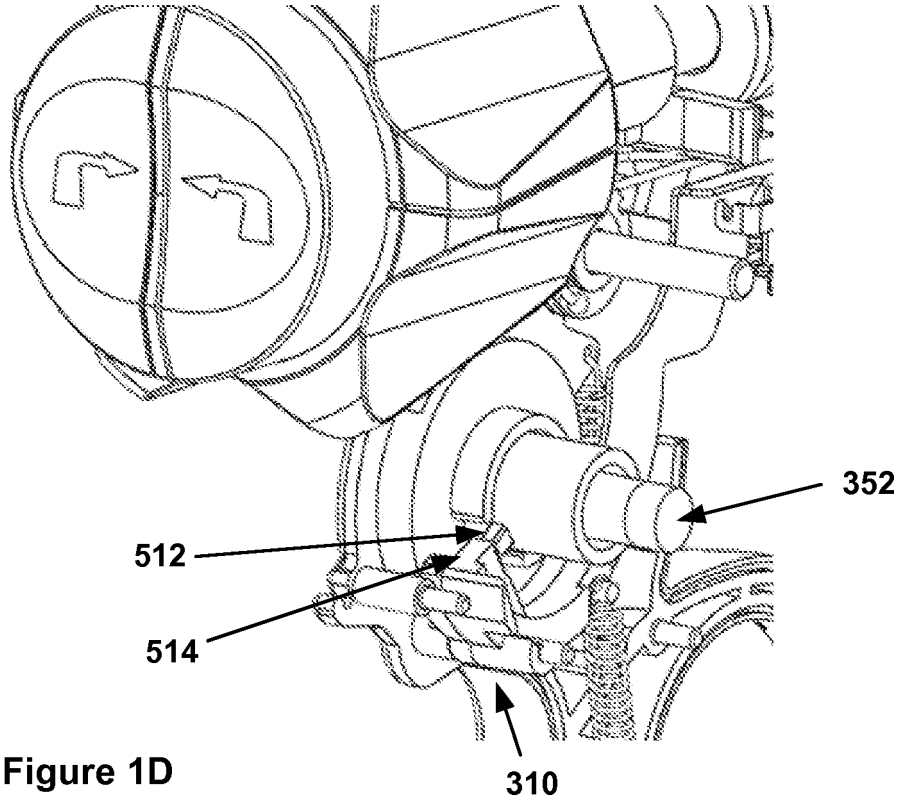


Figure 1D

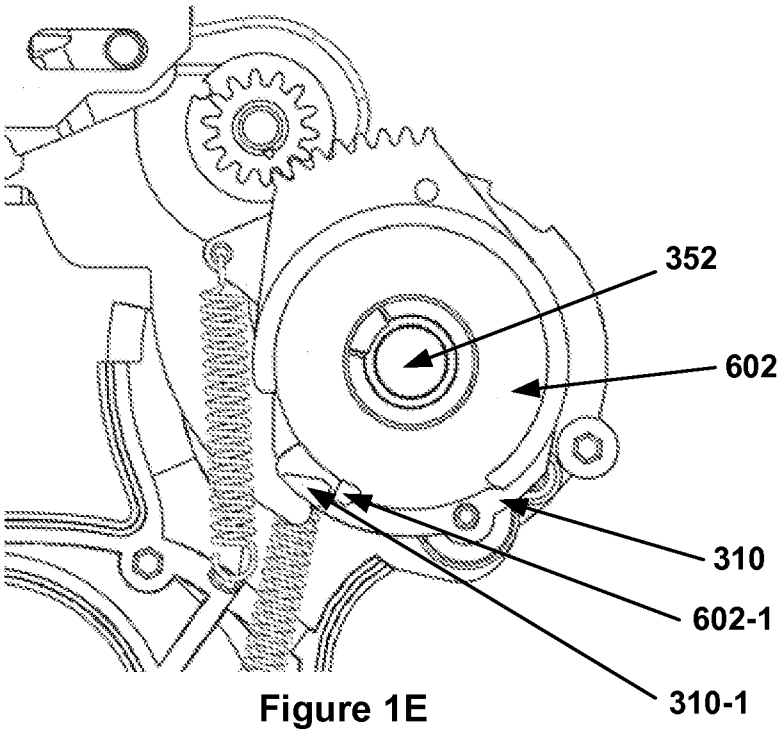


Figure 1E

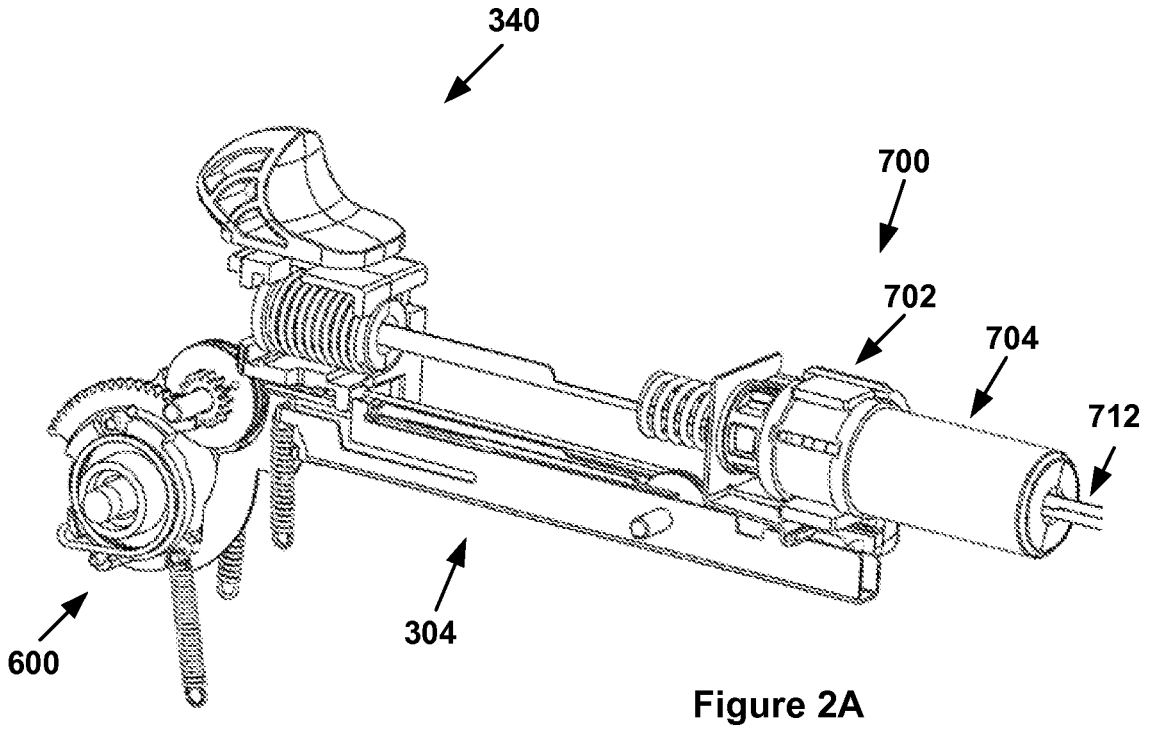


Figure 2A

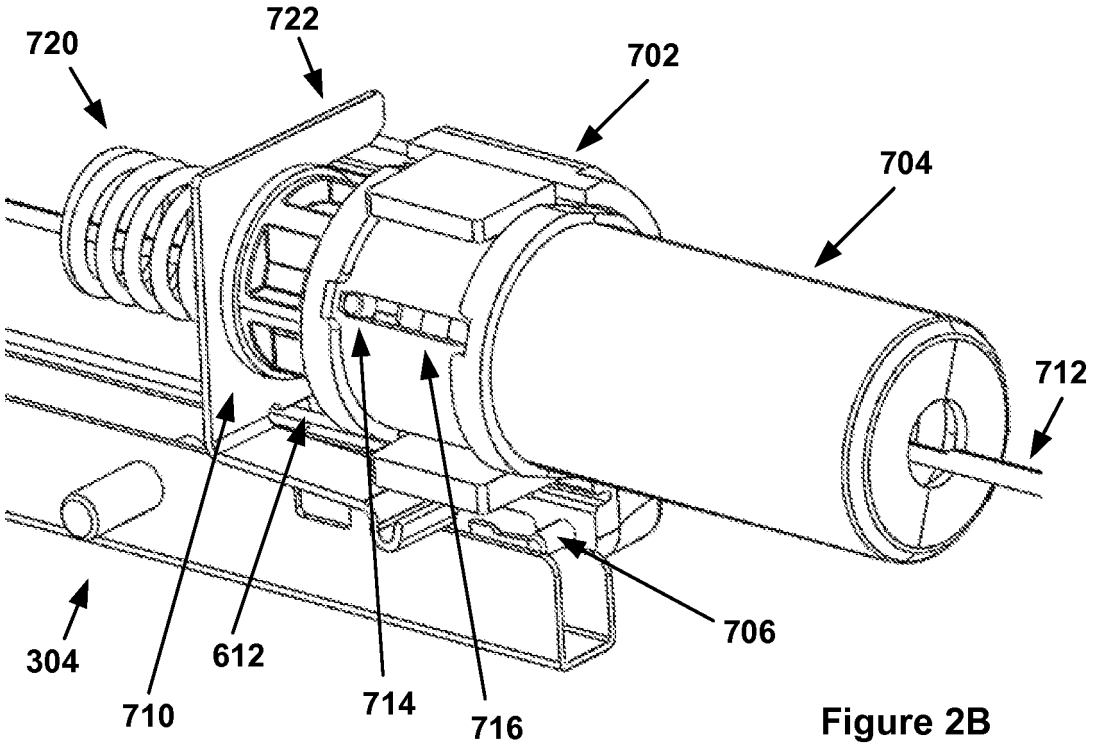
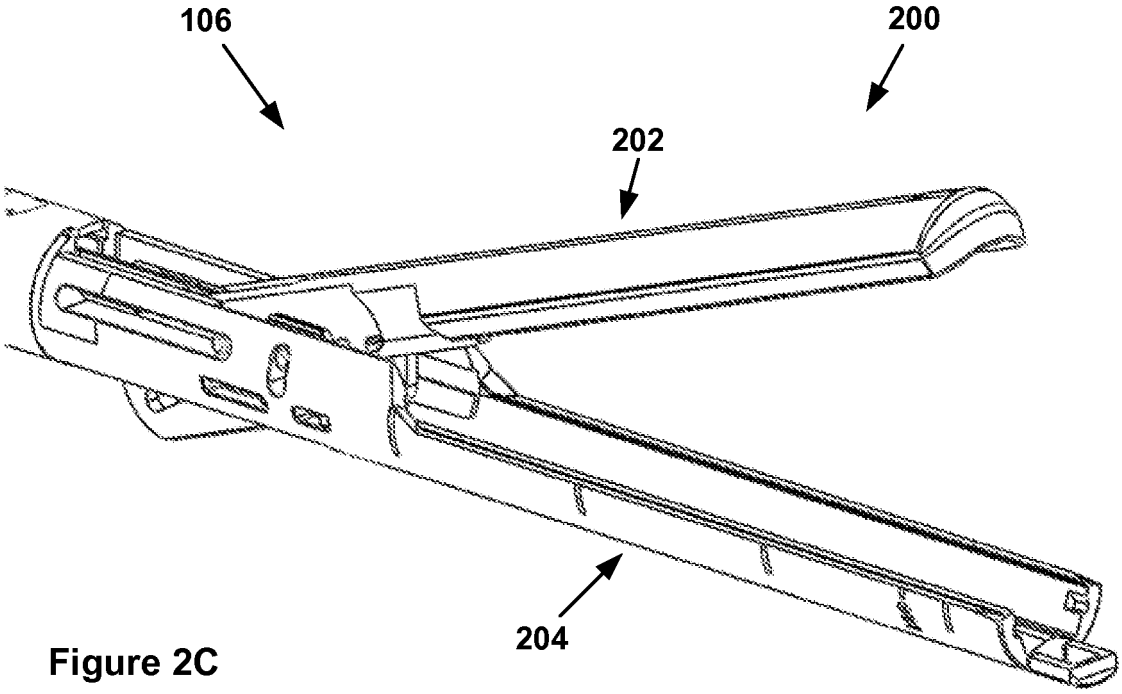


Figure 2B



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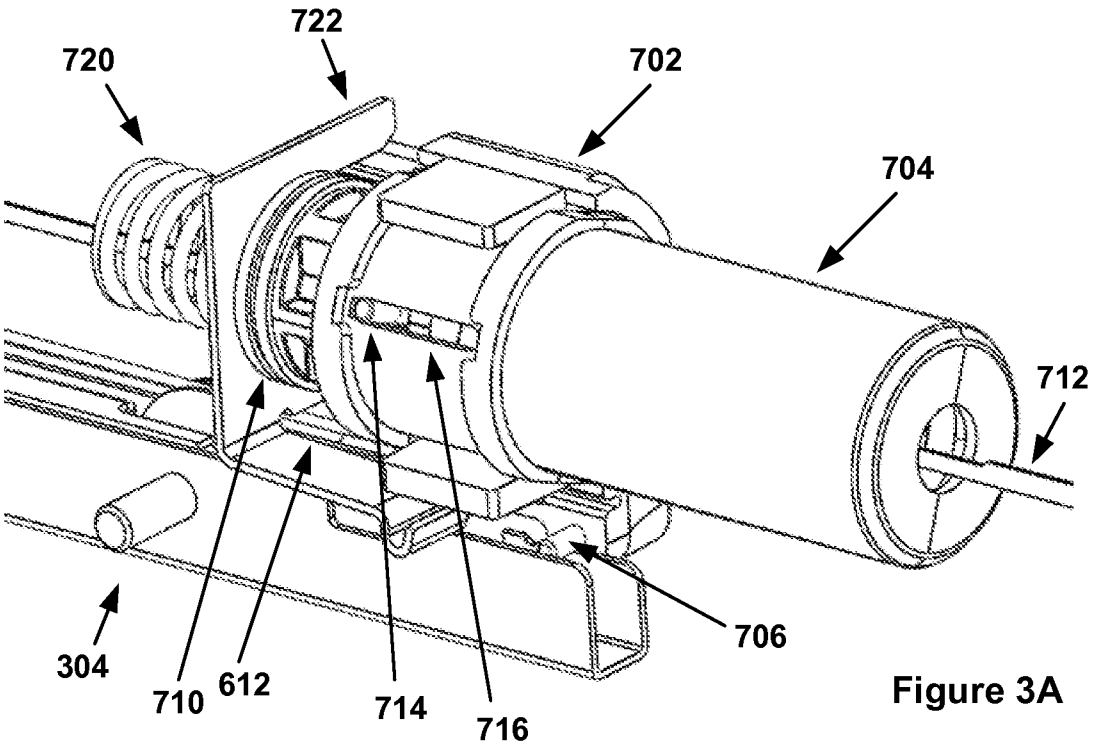


Figure 3A

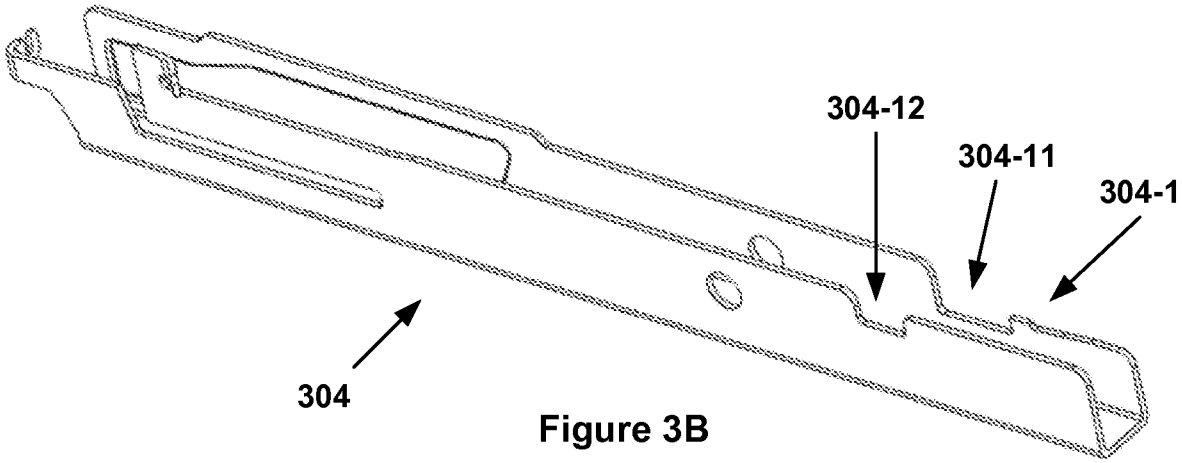


Figure 3B

Figure 3C

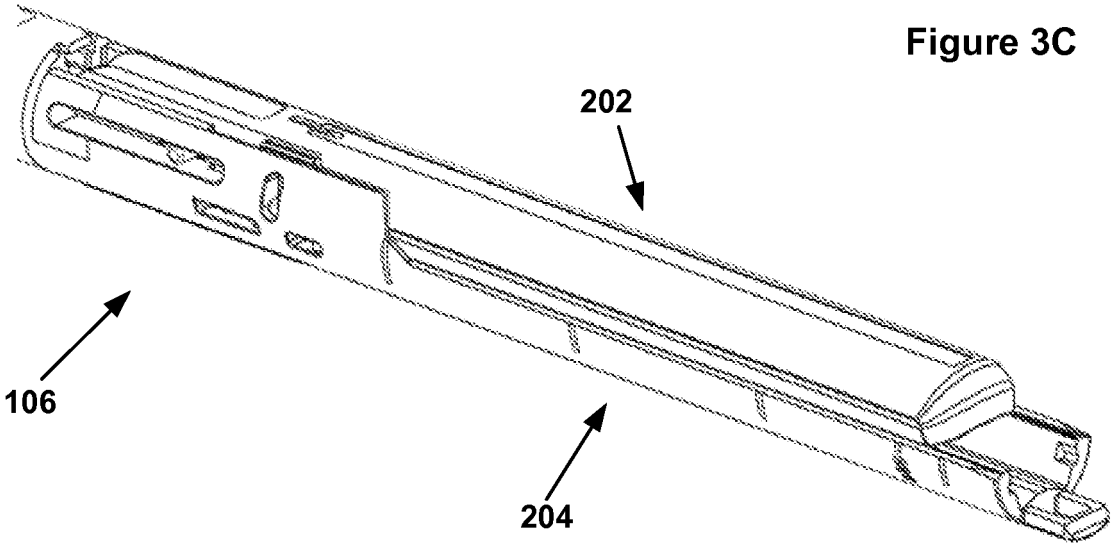
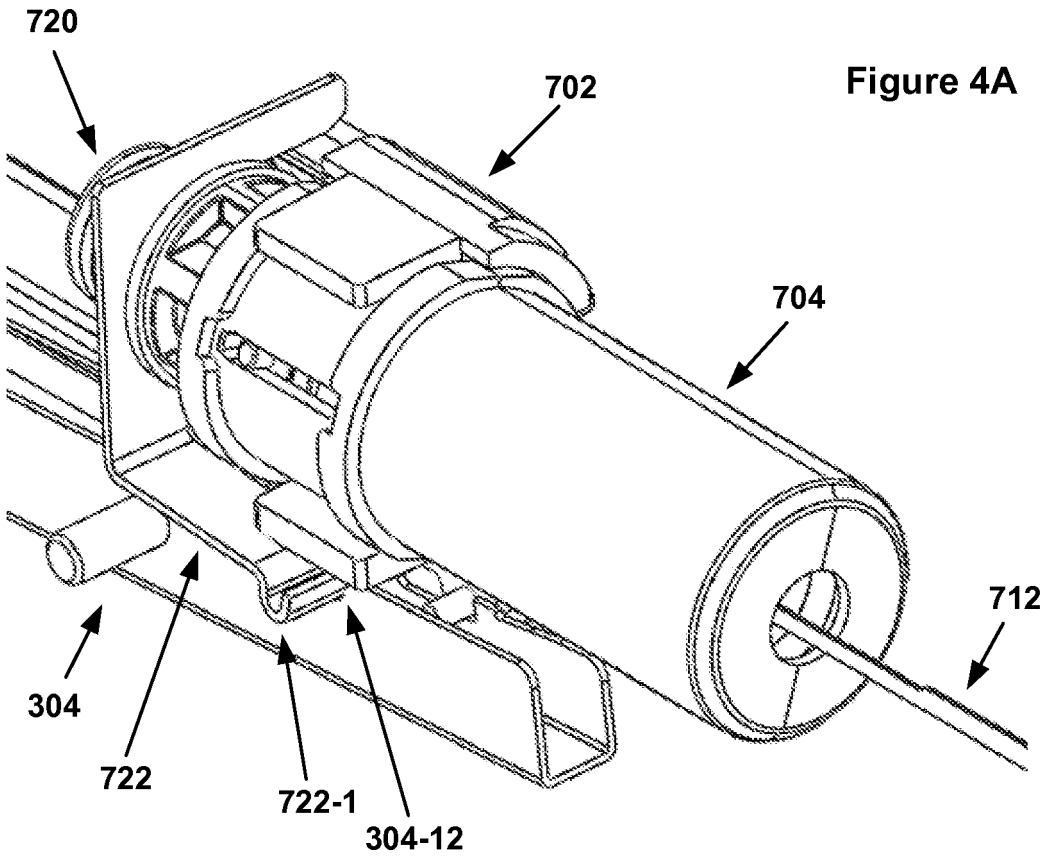
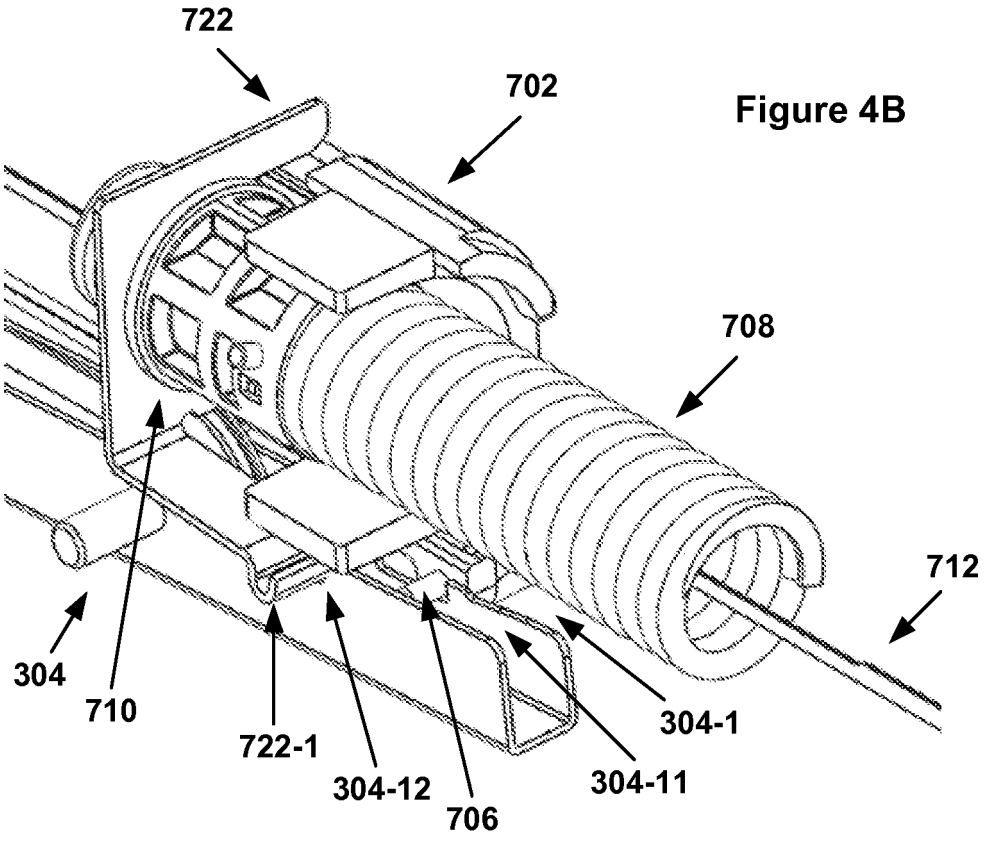


Figure 4A





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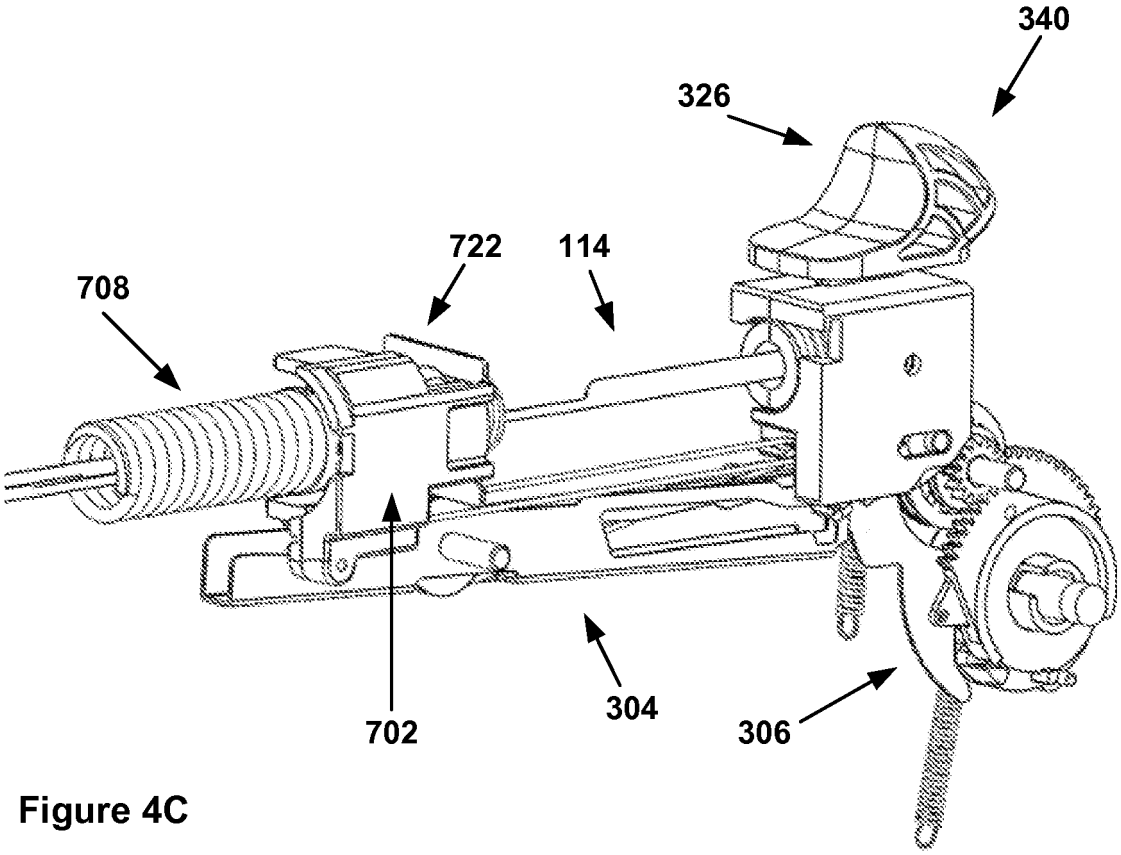


Figure 4C

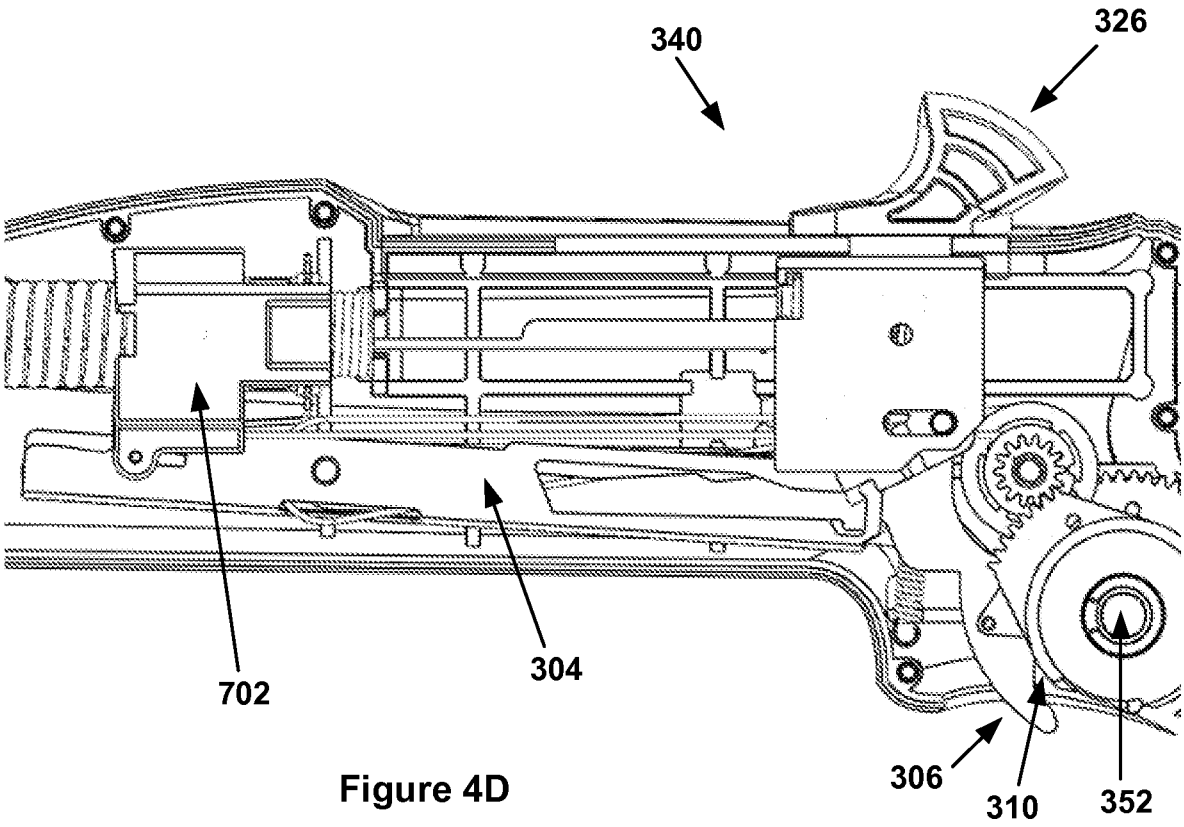


Figure 4D

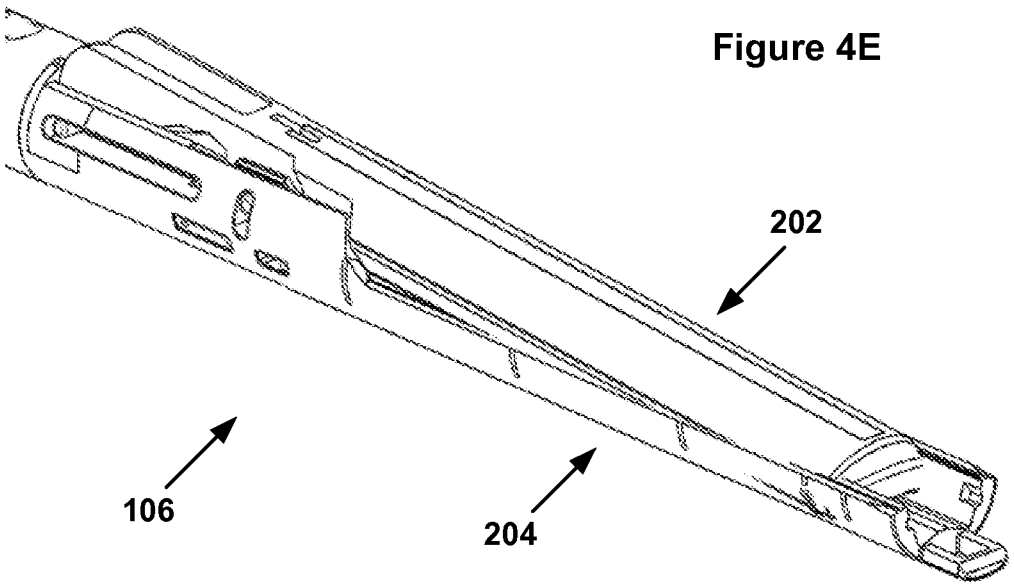


Figure 4E

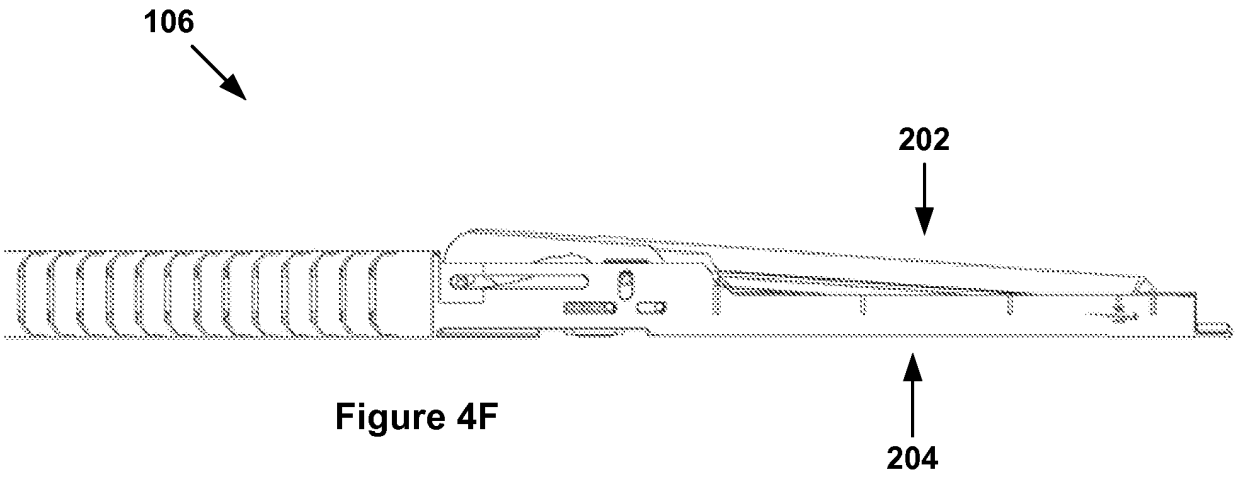


Figure 4F

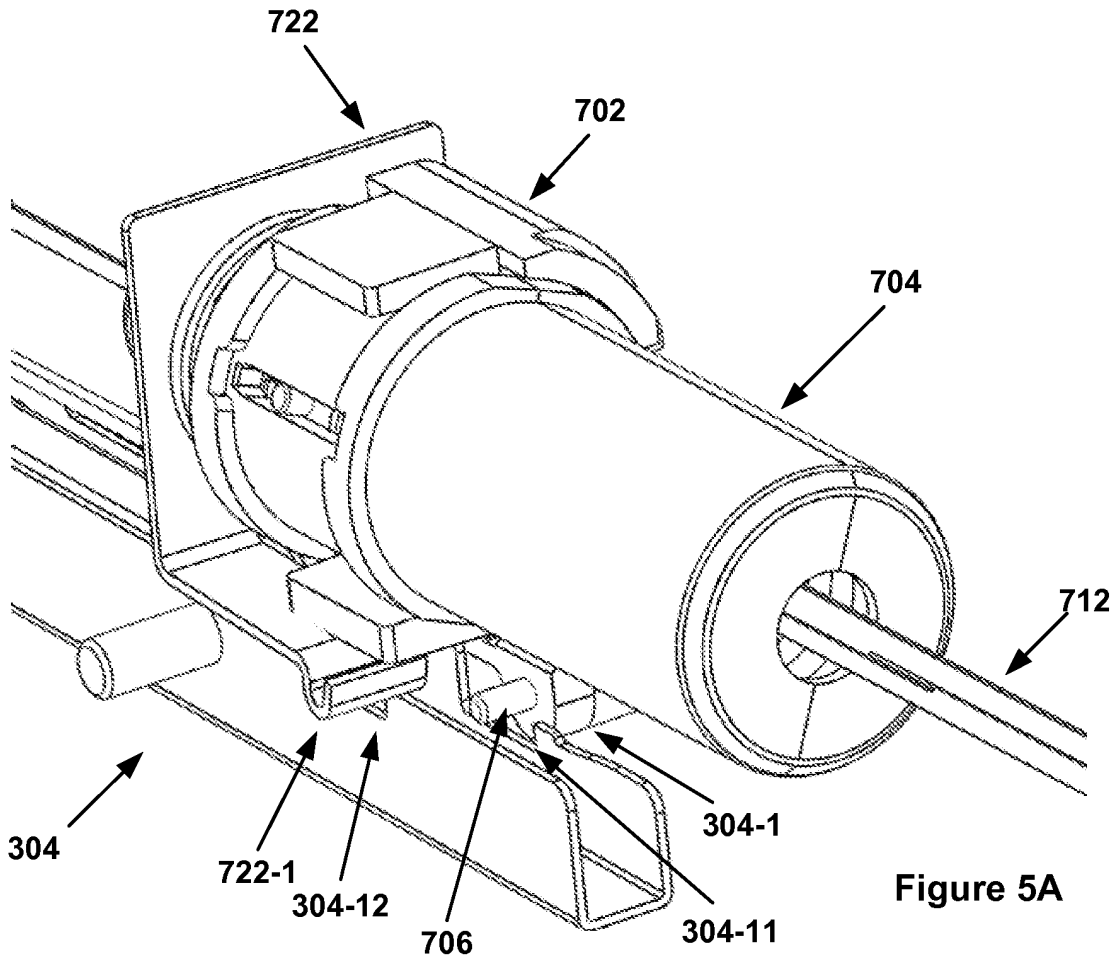


Figure 5A

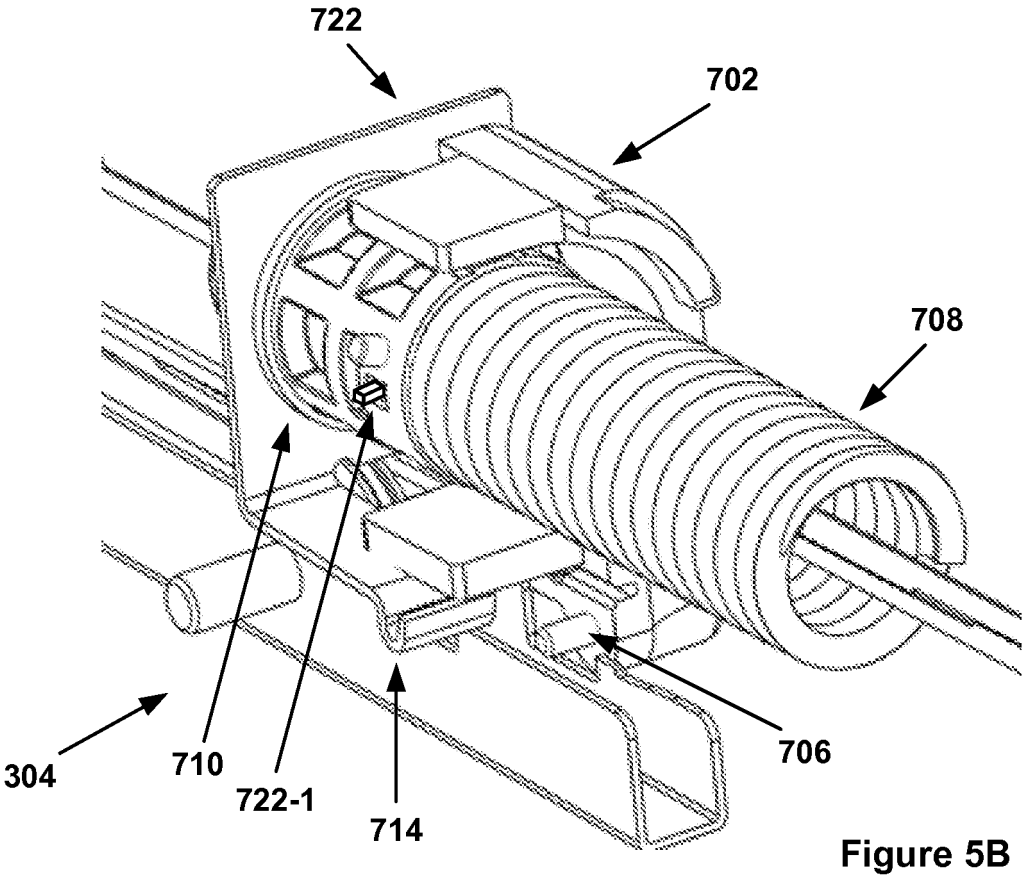


Figure 5B

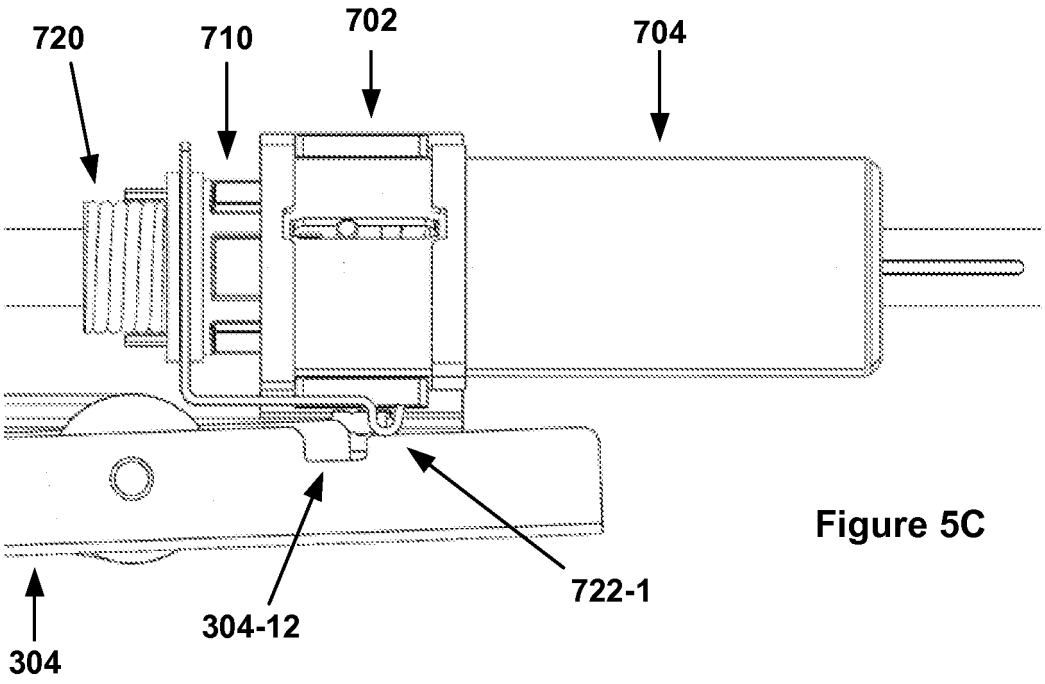


Figure 5C

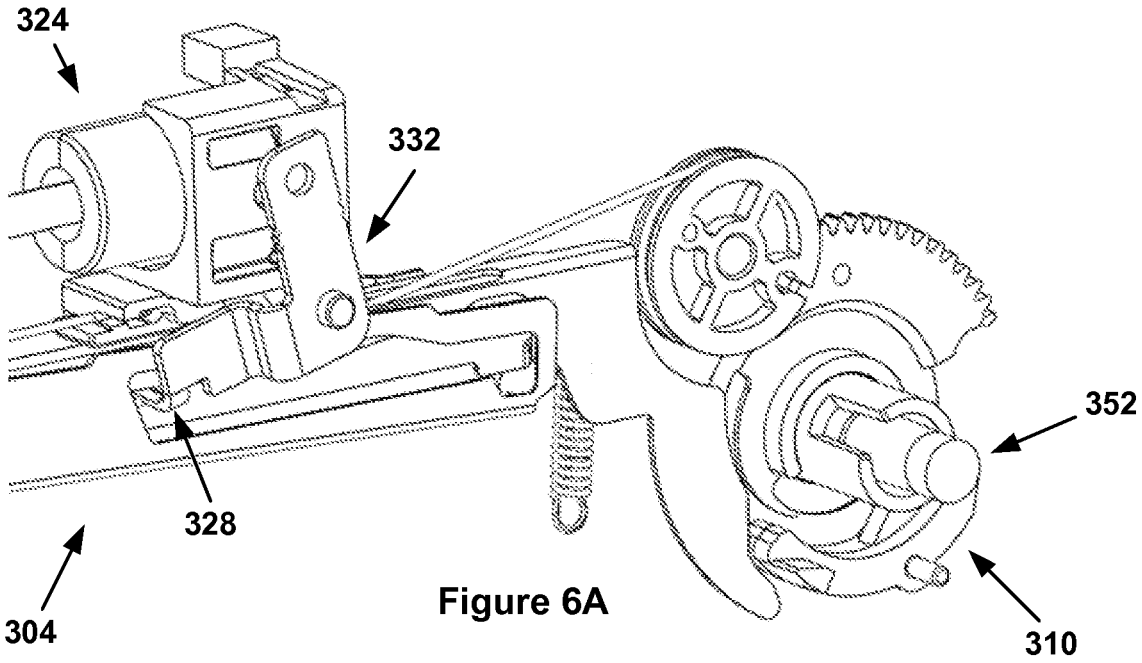


Figure 6A

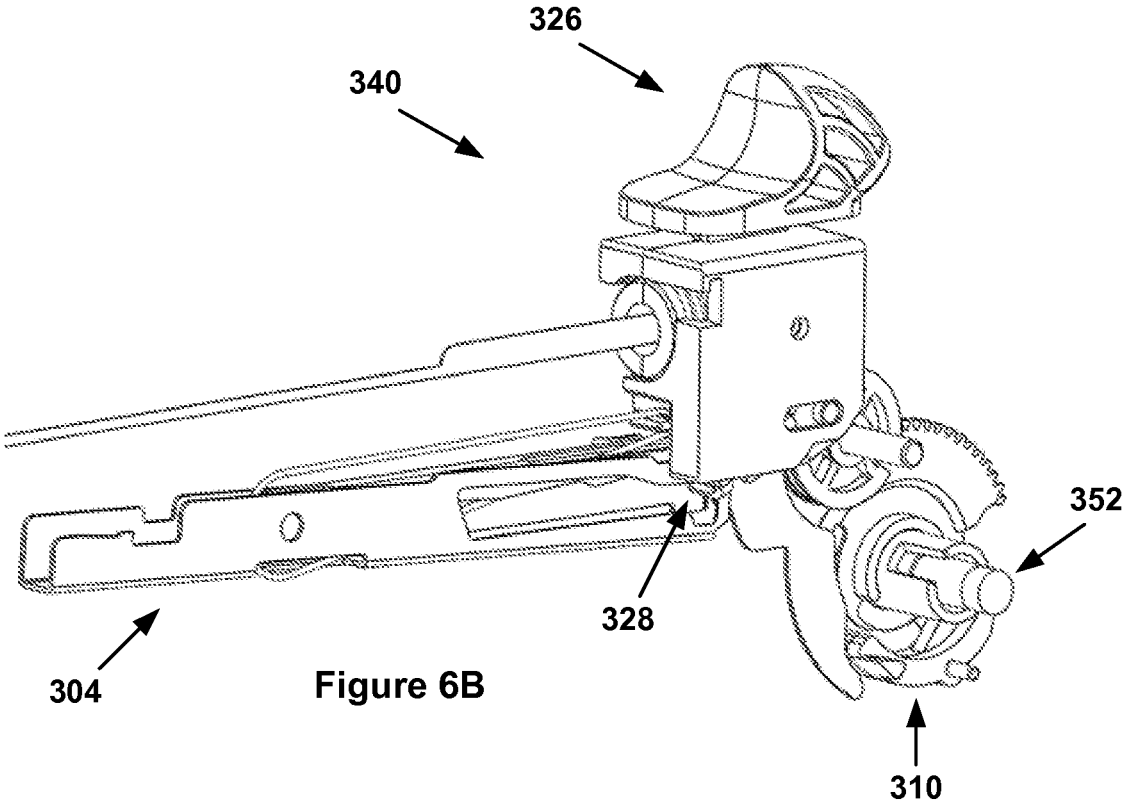
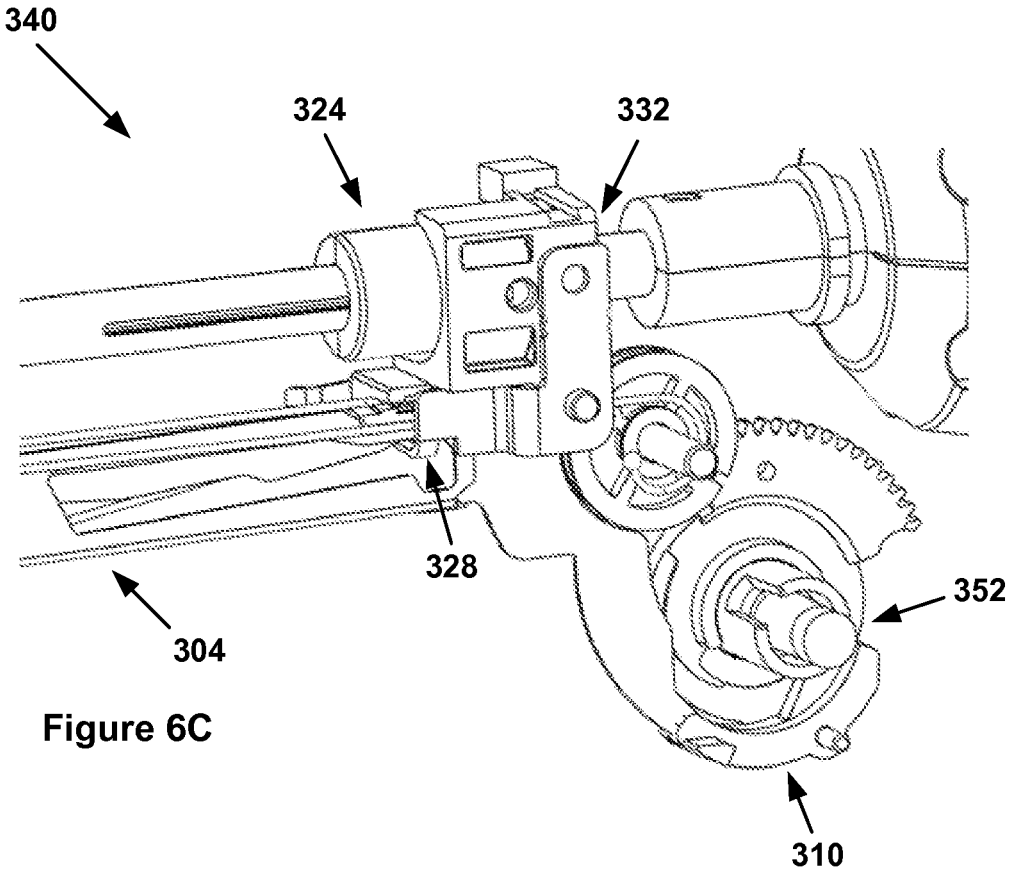


Figure 6B



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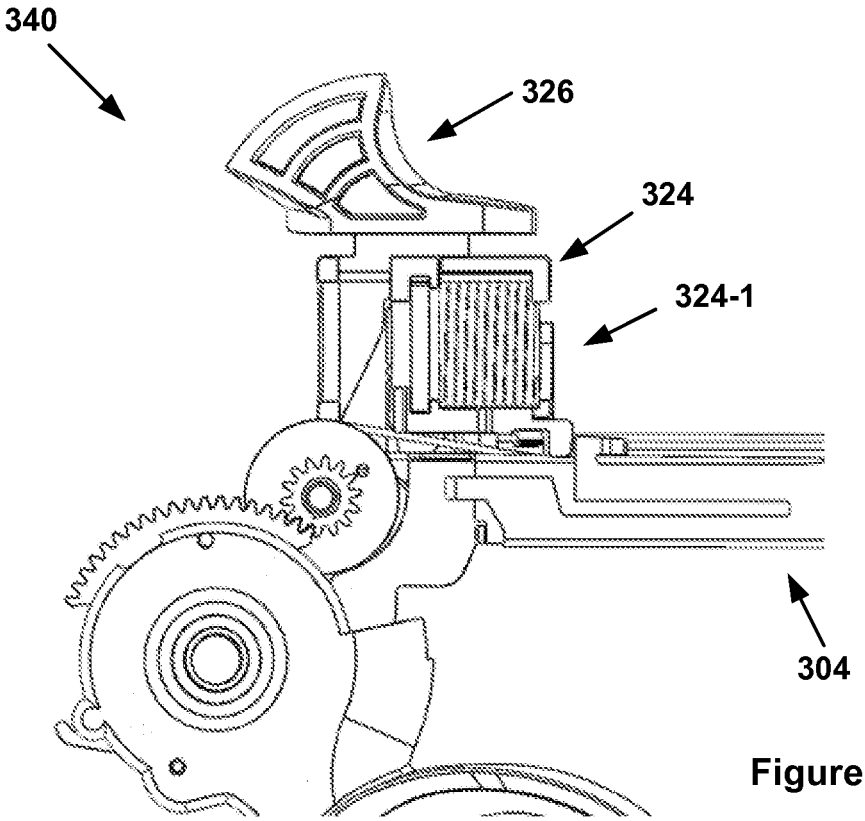
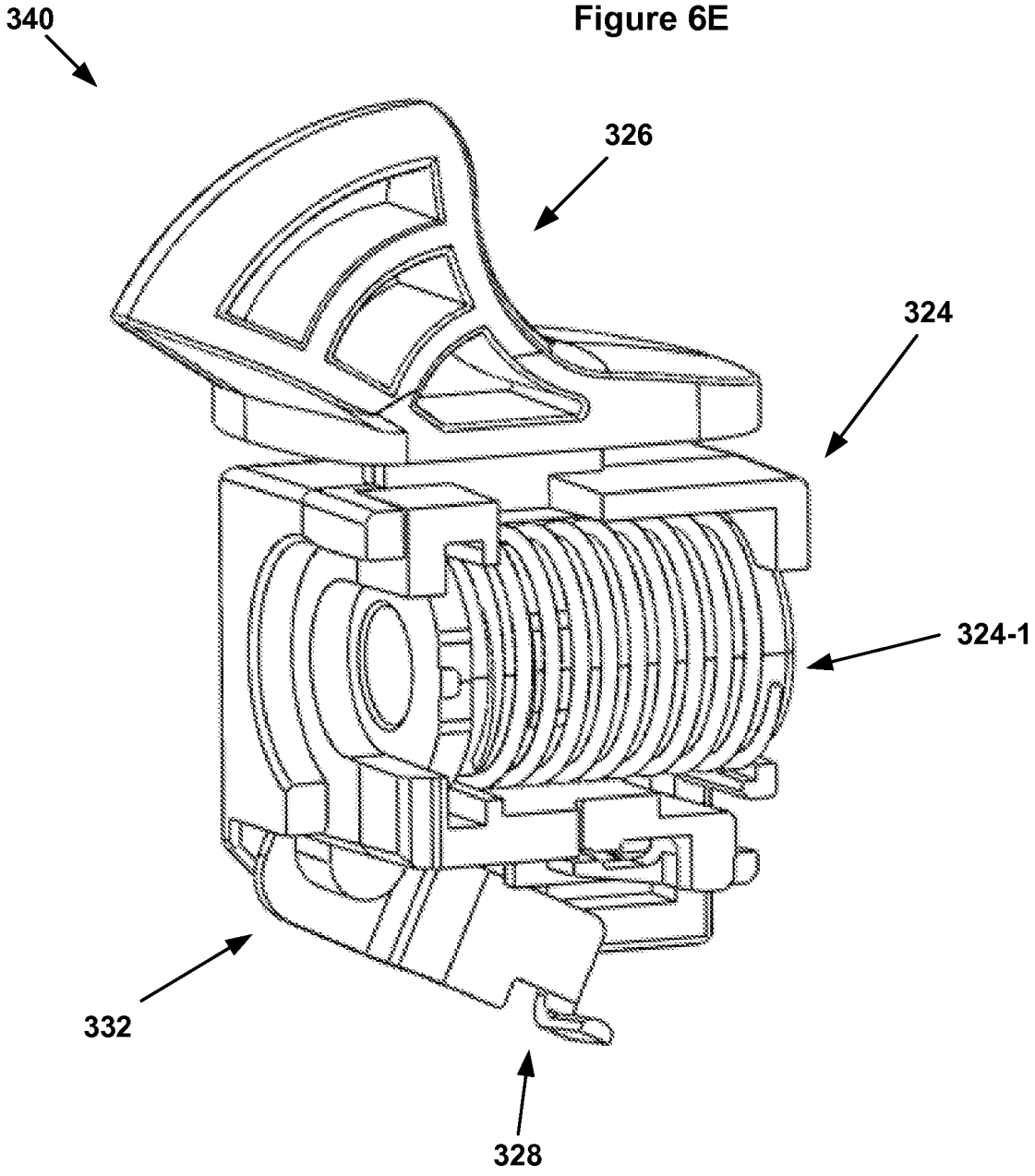


Figure 6D

Figure 6E



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- US 61823656 **[0001]**
- EP 1943959 A1 **[0004]**
- US 2012228358 A1 **[0005]**
- US 2008296347 A1 **[0006]**

专利名称(译)	手术夹钳		
公开(公告)号	EP2996579B1	公开(公告)日	2020-04-22
申请号	EP2014797187	申请日	2014-05-15
[标]申请(专利权)人(译)	CARDICA		
申请(专利权)人(译)	CARDICA INC.		
当前申请(专利权)人(译)	AESCULAP AG		
[标]发明人	MOTOOKA CARA C H DONOHOE BRENDAN M KNODEL BRYAN D		
发明人	MOTOOKA, CARA C. H. DONOHOE, BRENDAN M. KNODEL, BRYAN D.		
IPC分类号	A61B17/072 A61B17/00		
CPC分类号	A61B17/07207 A61B2017/00393 A61B2017/2923		
优先权	61/823656 2013-05-15 US		
其他公开文献	EP2996579A1 EP2996579A4		
外部链接	Espacenet		

摘要(译)

外科缝合器械被配置用于开放和/或腹腔镜外科手术。 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末端执行器。 末端执行器包括被构造成夹持，钉合和/或切割目标组织的钳口组件。 手柄组件包括触发元件，该触发元件可以致动驱动组件以推进夹持驱动组件以夹持上述目标组织。 夹具驱动组件包括夹具滑动构件，以沿第一方向推进夹具驱动组件或沿第二方向后退夹具驱动组件。 夹具驱动组件可移动地联接至夹具驱动器构件。 夹具驱动器构件的运动操作外科缝合装置的钳口组件的夹持操作。

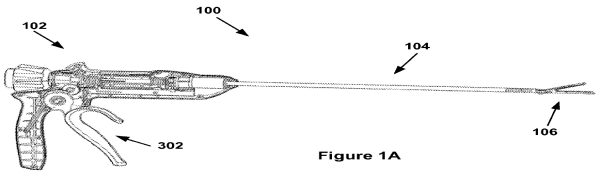

Figure 1A

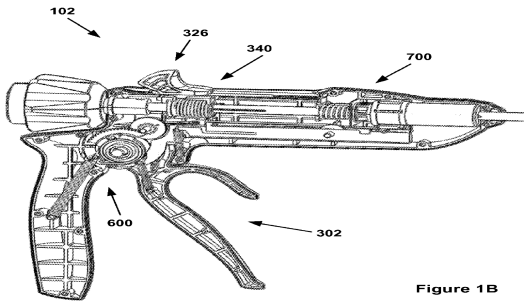

Figure 1B