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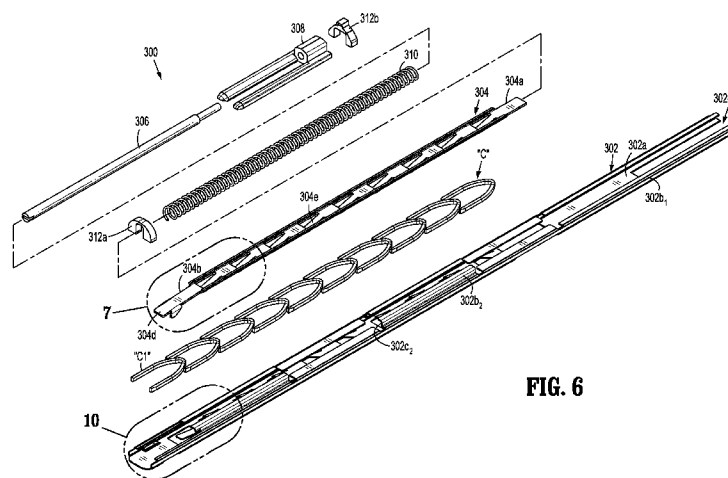


FIG. 6

(57) Abstract: A surgical clip applier (100) comprises a housing (104) including a drive bar (112); at least one handle (106) pivotally connected to the housing (104) and configured to actuate the drive bar (112); a channel assembly (108) extending distally from the housing (104); a clip cartridge assembly (300) selectively loadable in the channel assembly (108). The clip cartridge assembly (300) is in mechanical communication with the at least one handle (106) and includes a clip tray (302) configured to be selectively loadable in the channel assembly (108) of the surgical clip applier (100).



SURGICAL CLIP APPLIER WITH MULTIPLE CLIP FEEDING MECHANISM

BACKGROUND

1. Technical Field

[0001] The present disclosure relates to surgical clip appliers. More particularly, the present disclosure relates to reusable surgical clip appliers having a disposable clip cartridge assembly for use in open or endoscopic surgical procedures.

2. Discussion of Related Art

[0002] Surgical clip appliers are known in the art and have increased in popularity among surgeons by offering an alternative to conventional suturing of body tissues and vessels. Typical instruments are disclosed in U.S. Pat. No. 5,030,226 to Green et al. and U.S. Pat. No. 5,431,668 to Burbank, III et al. These instruments generally provide a plurality of clips which are stored in the instrument and which are fed sequentially to the jaw mechanism at the distal end of the instrument upon opening and closing of the handles at the proximal end of the instrument. As the handles are closed, the jaws close to deform a clip positioned between the jaw members, and as the jaws are opened to release the deformed clip, a new clip is fed from the series of clips to a position between the jaws. This process is repeated until all the clips in the series of clips have been used.

[0003] During open, endoscopic, or laparoscopic procedures, it may be desirable and/or necessary to use different size surgical clips depending on the underlying tissue or vessels to be ligated. In order to reduce overall costs of a surgical clip applier, it is desirable for a single surgical clip applier to be loadable with and capable of firing different size surgical clips as needed.

[0004] Accordingly, a need exists for surgical clip appliers that include disposable clip cartridge assemblies and reusable handle assemblies.

SUMMARY

[0005] The present disclosure relates to reusable endoscopic surgical clip appliers.

[0006] According to an aspect of the present disclosure, a clip cartridge assembly is provided and includes a clip tray configured to be selectively loadable in a channel assembly of a surgical clip applier. The clip tray includes a first channel defined by a base wall and a pair of first side rails extending along longitudinal sides of the base wall; a second channel, adjacent to the first channel, defined by a pair of second side rails supported on respective ones of the pair of first side rails; and a first plurality of distally oriented, deflectable, resilient fingers projecting from the base wall and into the first channel.

[0007] The clip cartridge assembly further includes a cartridge clip pusher bar slidably disposed within the second channel and interposed between the pair of second side rails of the clip tray. The cartridge clip pusher bar includes a second plurality of distally oriented, deflectable, resilient fingers projecting from a base wall thereof and extending into the first channel of the clip tray. Each

resilient finger of the cartridge clip pusher bar terminates in a distal shoulder. A proximal end of the cartridge clip pusher bar is configured for selective engagement with a drive bar of the surgical clip applier, such that the cartridge clip pusher bar is in mechanical communication with a handle assembly of the surgical clip applier.

[0008] The clip cartridge assembly also includes a plurality of surgical clips loaded within the first channel of the clip tray and interposed between the base wall defining the first channel of the clip tray and the base wall of the cartridge clip pusher bar. A surgical clip is disposed distally of each resilient finger of the clip tray and each resilient finger of the cartridge clip pusher bar when the cartridge clip pusher bar is at a proximal-most position relative to the clip tray.

[0009] According to another aspect of the present disclosure, a surgical clip applier is provided and includes a housing including a drive bar; at least one handle pivotably connected to the housing and configured to actuate the drive bar; a channel assembly extending distally from the housing; and a clip cartridge assembly selectively loadable in the channel assembly. The clip cartridge assembly is in mechanical communication with the at least one handle and includes a clip tray configured to be selectively loadable in a channel assembly of a surgical clip applier.

[0010] As above, the clip tray includes a first channel defined by a base wall and a pair of first side rails extending along longitudinal sides of the base wall; a second channel, adjacent to the first channel, defined by a pair of second side rails supported on respective ones of the pair of first side rails; and a first plurality of distally oriented, deflectable, resilient fingers projecting from the base wall and into the first channel.

[0011] The clip cartridge assembly includes a cartridge clip pusher bar slidably disposed within the first channel and interposed between the pair of first side rails of the clip tray. The cartridge clip pusher bar includes a second plurality of distally oriented, deflectable, resilient fingers projecting from a base wall thereof and extending into the first channel of the clip tray. Each resilient finger of the cartridge clip pusher bar terminates in a distal shoulder, a proximal end of the cartridge clip pusher bar being configured for selective engagement with the drive bar, such that the cartridge clip pusher bar is in mechanical communication with the handle assembly.

[0012] A plurality of surgical clips are loaded within the first channel of the clip tray and interposed between the base wall defining the first channel of the clip tray and the base wall of the cartridge clip pusher bar. A surgical clip is disposed distally of each resilient finger of the clip tray and each resilient finger of the cartridge clip pusher bar when the cartridge clip pusher bar is at a proximal-most position relative to the clip tray.

[0013] The surgical clip applier further includes a pair of jaws supported on a distal end of the channel assembly, the pair of jaws configured to receive a single, unformed surgical clip therein.

[0014] The clip cartridge assembly may further include a drive sled slidably disposed within the first channel of the clip tray, the drive sled being positioned proximal of the plurality of surgical clips; a cartridge pusher rod extending distally from the drive sled, the cartridge pusher rod having a distal end connected to a proximal end of the cartridge clip pusher bar; and a biasing member supported on the cartridge pusher rod and tending to bias the drive sled and the cartridge clip pusher bar to a proximal-most position.

[0015] In use, distal actuation of the cartridge clip pusher bar may cause each distal shoulder of the cartridge clip pusher bar to contact a backspan of a respective surgical clip, to thereby distally advance all of the surgical clips simultaneously.

[0016] Also in use, following distal actuation of the cartridge clip pusher bar, upon a proximal actuation of the cartridge clip pusher bar, each of the second plurality of distally oriented, deflectable, resilient fingers may contact a distal surface of the backspan of a respective remaining one of the surgical clip to proximally move all of the remaining surgical clips until the backspans of all of the remaining surgical clips contacts a respective finger of the first plurality of distally oriented, deflectable, resilient fingers of the clip tray to block any further proximal movement of the remaining surgical clips.

[0017] In use, distal actuation of the cartridge clip pusher bar may result from a distal movement of the drive sled that distally advances the cartridge pusher rod, wherein distal advancement of the drive sled may bias the biasing member.

[0018] The clip tray may further include a spaced apart pair of distally oriented, deflectable, resilient fingers projecting from a distal end of the base wall thereof. The spaced apart pair of fingers may be configured to contact a distal surface of a backspan of a surgical clip being distally urged by the cartridge clip pusher bar, to thereby inhibit any further distal movement of the surgical clip.

[0019] The distal-most finger of the first plurality of distally oriented, deflectable, resilient fingers may be a rectangular configuration.

[0020] Each remaining finger of the first plurality of distally oriented, deflectable, resilient fingers may include a V-shaped notch formed in a distal end thereof.

[0021] A distal end of the cartridge clip pusher bar may include a pusher disposed thereon. The pusher may define a pair of spaced apart prongs configured to engage a backspan of a surgical clip.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] The present clip applier will be more fully appreciated as the same becomes better understood from the following detailed description when considered in connection with the following drawings, in which:

[0023] FIG. 1A is a top, perspective view, of a surgical clip applier loaded with a clip cartridge according to an embodiment of the present disclosure;

[0024] FIG. 1B is a top, perspective view, of an endoscopic surgical clip applier loaded with a clip cartridge according to an embodiment of the present disclosure;

[0025] FIG. 2 is a top, perspective view, of a clip cartridge assembly of the present disclosure, with a cover removed therefrom;

[0026] FIG. 3 is an enlarged view of the indicated area of detail of FIG. 2;

[0027] FIG. 4 is a bottom, perspective view, of the clip cartridge assembly of FIG. 2;

[0028] FIG. 5 is an enlarged view of the indicated area of detail of FIG. 4;

[0029] FIG. 6 is a perspective view, with parts separated of the clip cartridge assembly of FIGS. 2-5;

[0030] FIG. 7 is a top, perspective view of a distal end of a cartridge clip pusher bar of the clip cartridge assembly of FIGS. 2-6;

[0031] FIG. 8 is a bottom perspective view of the cartridge clip pusher bar of the clip cartridge assembly of FIGS. 2-6;

[0032] FIG. 9 is an enlarged view of the indicated area of detail of FIG. 8;

[0033] FIG. 10 is a top, perspective view of a distal end of a clip tray of the clip cartridge assembly of FIGS. 2-6;

[0034] FIG. 11 is a bottom, perspective view of the distal end of the clip tray of the clip cartridge assembly of FIGS. 2-6;

[0035] FIG. 12 is a longitudinal, cross-sectional view of the clip cartridge assembly of FIGS. 2-6, as taken through 12-12 of FIG. 2;

[0036] FIG. 13 is an enlarged view of the indicated area of detail of FIG. 12, illustrating the cartridge clip pusher bar in an initial position;

[0037] FIG. 14 is an enlarged view of the indicated area of detail of FIG. 12, illustrating the cartridge clip pusher bar following a complete distal advancement thereof;

[0038] FIG. 15 is an enlarged view of the indicated area of detail of FIG. 12, illustrating the cartridge clip pusher bar during a retraction thereof from a complete distal position thereof back to the initial position thereof;

[0039] FIG. 16 is an enlarged view of the indicated area of detail of FIG. 12, illustrating the cartridge clip pusher bar fully retracted to the initial position thereof and with a surgical clip loaded into the pair of jaws;

[0040] FIG. 17 is an enlarged view of the indicated area of detail of FIG. 12, illustrating the cartridge clip pusher bar locked out in a fully spent clip cartridge assembly; and

[0041] FIG. 18 is a bottom, perspective view of the cartridge clip pusher bar locked in the clip tray of the clip cartridge assembly.

DETAILED DESCRIPTION OF EMBODIMENTS

[0042] Embodiments of reusable surgical clip appliers, in accordance with the present disclosure, will now be described in detail with reference to the drawing figures wherein like reference numerals identify similar or identical structural elements. As shown in the drawings and described throughout the following description, as is traditional when referring to relative positioning on a surgical instrument, the term “proximal” refers to the end of the apparatus which is closer to the user and the term “distal” refers to the end of the apparatus which is further away from the user.

[0043] Referring initially to FIG. 1A, a surgical clip applier in accordance with an embodiment of the present disclosure is generally designated as 100. It is contemplated that any of the components of surgical clip applier 100 may be formed from any suitable biocompatible material such as stainless steel, titanium, or the like. Surgical clip applier 100 generally includes a handle assembly 102 including a housing 104 having upper housing half 104a and lower housing half 104b. Handle assembly 102 further includes a pair of handles 106 pivotably

secured to housing 104 and extending outwardly therefrom. A channel assembly 108 is fixedly secured to housing 104 and extends outwardly therefrom, terminating in and supporting a jaw assembly 110.

[0044] Handles 106 are pivotably secured to housing 104 and axially translate a drive bar or channel or the like 112 (FIGS. 3, 5 and 12), via link members 122, through housing 104 and/or channel assembly 108 to effectuate a loading of a surgical clip into the jaw assembly, and a formation of the loaded clip within the jaw assembly.

[0045] With continued reference to FIG. 1A, channel assembly 108 includes an outer or lower channel 132 having a proximal end retained in housing 104, between upper and lower housing halves 104a, 104b. Outer channel 132 of channel assembly 108 is configured for selective receipt of a clip cartridge assembly 300 therein, which clip cartridge assembly 300 is actuatable by handle assembly 102 to fire and form the surgical clips loaded therein onto underlying tissue and/or vessels.

[0046] Jaw assembly 110 of clip applier 100 includes a pair of jaws 120 mounted on or at a distal end of channel assembly 108 and actuatable by handles 106 of handle assembly 102. The pair of jaws 120 is formed of a suitable biocompatible material such as, for example, stainless steel or titanium. The pair of jaws 120 may include a first jaw member 120a, and a second jaw member 120b, which define a channel therebetween for receipt of a surgical clip “C” therein (FIG. 5). For a detailed discussion of the construction and operation of an exemplary jaw assembly, reference may be made to U.S. Patent Application Publication No. 2014/0194903, the entire contents of which is incorporated herein by reference.

[0047] Turning momentarily to FIG. 1B, it is contemplated that surgical clip cartridge assembly 300 may be mated to a surgical clip applier 200 configured for use in endoscopic surgical procedures. Surgical clip applier 200 generally includes a handle assembly 202, and an endoscopic assembly 208 including a shaft assembly 210 selectively connectable to and extendable distally from handle assembly 202, wherein the surgical clip cartridge assembly 300 is selectively loadable into shaft assembly 210 of endoscopic assembly 208. For a detailed discussion of exemplary endoscopic surgical clip appliers configured for use with surgical clip cartridge assembly 300, reference may be made to PCT Application Serial No. PCT/CN2015/070733, filed on January 15, 2015, (Atty. Docket: 355677 (203-10414), the entire contents of which are incorporated by reference herein.

[0048] Turning now to FIGS. 2-11, clip cartridge assembly 300 of surgical clip applier 100 is shown. Clip cartridge assembly 300 is configured to be selectively loadable into outer channel 132 of channel assembly 108, and to be actuated upon an actuation of handle assembly 102 to fire and form the surgical clips loaded therein onto underlying tissue and/or vessels. Each clip cartridge assembly 300 may be loaded with a particularly sized set of surgical clips (e.g., relatively small surgical clips, relatively medium surgical clips, or relatively large surgical clips).

[0049] Clip cartridge assembly 300 includes a clip tray 302 including base wall 302a and a pair of spaced apart lower side walls or rails 302b₁ supported on base wall 302a. Base wall 302a and lower rails 302b₁ define a clip channel 302c₁ (FIG. 6). Clip channel 302c₁ is configured and dimensioned to slidably support a plurality of surgical clip “C” therein. Clip tray 302 further includes at least a pair of spaced apart upper side walls or rails 302b₂ supported on lower

side walls 302b₁. Lower rails 302b₁ and upper rails 302b₂ define a pusher bar channel 302c₂ (FIGS. 6 and 10). Pusher bar channel 302c₂ is configured and dimensioned to slidably support a cartridge clip pusher bar 304 therein.

[0050] Clip tray 302 includes a linear array of distally extending resilient, deflectable fingers 302d projecting up from base wall 302a and into lower clip channel 302c₁ at a location between side rails 302b. A distal-most deflectable finger 302d₁ forms a single, rectangular finger configured to engage a backspan or crown of the distal-most clip “C1” and nest between the spaced apart prongs 304d₁, 304d₂ (FIG. 5) of cartridge clip pusher bar 304, as discussed below. A pair of channels 302f are disposed or formed on either side of the distal-most finger 302d₁ and are configured to selectively receive engage each of the spaced apart prongs 304d₁, 304d₂ (FIG. 18) of clip pusher bar 304 when all of the surgical clips “C” have been formed, as will be discussed in further detail below. Each of the remaining proximal deflectable fingers 302d define a V-shaped configuration adapted to engage opposing sides of a backspan of each remaining clip of the stack of surgical clips “C”, as illustrated in FIGS. 4 and 5.

[0051] As shown in FIGS. 4 and 5, clip tray 302 further includes a pair of spaced apart, distally extending resilient deflectable prongs 302e projecting up from the distal end of base wall 302a and into lower clip channel 302c₁ at a location between side rails 302b₁. Each of the prongs 302e is spaced apart such that they are in slidable engagement with a surface of a respective leg of the distal-most clip “C1”. Prongs 302e are dimensioned to engage the legs of the distal-most clip “C1” and frictionally press the distal-most clip “C1” against each side rail 302b₁, such that prongs 302e help to prevent the distal-most clip “C1”, proximal to the distal-most clip “C1”, from advancing distally past prongs 302e when the distal-most clip “C1” is being loaded into the pair of jaws 120.

The biasing force provided by the prongs 302e is overcome when the distal-most clip “C1” is urged distally by the cartridge clip pusher bar 304, and once the distal-most clip “C1” has been loaded into the pair of jaws 120, each of the prongs 302e returns to their initial position to prevent the next clip “C” from advancing any further.

[0052] Clip cartridge assembly 300 includes, as shown in FIGS. 6-9, a cartridge clip pusher bar 304 slidably disposed between and within the pair of spaced apart upper side walls or rails 302b₂ of clip tray 302. Cartridge clip pusher bar 304 includes a proximal end 304a engagable with or by a distal end of a cartridge pusher rod or shaft 306 (FIGS. 2 and 6), as will be described in greater detail below. Cartridge clip pusher bar 304 further includes a distal end portion 304b defining a pusher 304d configured to engage a distal-most clip “C1” of a stack of surgical clips “C” for loading the distal-most clip “C1” into the pair of jaws 120 of clip applier 100. Pusher 304d includes, as described above, a pair of spaced apart prongs 304d₁, 304d₂ (FIGS. 5, 7 and 9) configured to engage a backspan of the distal-most clip “C1”, as illustrated in FIGS. 3 and 5.

[0053] As illustrated in FIGS. 6-9, cartridge clip pusher bar 304 further includes a linear array of distally extending resilient, deflectable fingers 304e, with each finger 304e defining a rectangular profile including a distal shoulder 304f disposed on a distal end thereof, which shoulder extends substantially parallel to base wall 302a of clip tray 302. In use, when cartridge clip pusher bar 304 overlays or is disposed between the pair of spaced apart upper rails 302b₂ of clip tray 302, each of the deflectable fingers 302d of clip tray 302 is disposed axially between each deflectable finger 304e of cartridge clip pusher bar 304, such that each of deflectable fingers 302d, 304e are arranged in a tandem configuration when the clip pusher bar 304 is in a proximal position relative to

clip tray 302. Additionally, when cartridge clip pusher bar 304 overlays or is disposed between the pair of spaced apart upper rails 302b₂ of clip tray 302, each deflectable finger 304e of cartridge clip pusher bar 304 extends across clip channel 302c₁ of clip tray 302 such that distal shoulders 304f of deflectable fingers 304e are in axial planar registration with the stack of surgical clips “C”.

[0054] In use, the V-shaped configuration of the proximal deflectable fingers 302d of clip tray 302 permits each proximal deflectable finger 304e of the cartridge clip pusher bar 304 to nest within the V-shape of the proximal deflectable fingers 302d such that distal shoulders 304f of deflectable fingers 304e engage a backspan of each of the remaining surgical clips of the stack of surgical clips “C” as the cartridge clip pusher bar 304 is driven distally.

[0055] As shown in FIGS. 2-6, clip cartridge assembly 300 further includes a stack of surgical clips “C” interposed between clip tray 302 and cartridge clip pusher bar 304. The stack of surgical clips “C” is supported on or loaded in clip tray 302 such that a crown or backspan of each surgical clip “C” is disposed distal of a respective deflectable finger 302d of clip tray 302. Further, when cartridge clip pusher bar 304 is in a proximal position relative to clip tray 302, each deflectable finger 304e of cartridge clip pusher bar 304 is also disposed proximal of the crown or backspan of a respective clip of the stack of surgical clips “C” as discussed above.

[0056] Clip cartridge assembly 300 may be loaded with 10 surgical clips “C”, or, in embodiments, clip cartridge assembly 300 may be loaded with any number of surgical clips “C”, provided clip cartridge assembly 300 and channel assembly 108 or 208 are appropriately configured and dimensioned. Surgical clips “C” may be fabricated from materials known by those skilled in the art,

including and not limited to stainless steel, titanium, or other metal alloys. In an embodiment it is contemplated that at least a final surgical clip of the stack of surgical clips “C” may be dyed a particular color to indicate to the user when a final surgical clip of clip cartridge assembly 300 is loaded into the pair of jaws 120.

[0057] Once all of the surgical clips “C” are loaded into the clip tray 302 and cartridge clip pusher bar 304 is placed adjacent thereto, a channel cover (not shown), configured and adapted for connection and support on clip tray 302, may be snapped into engagement with lower rails 302b₁ of clip tray 302, or, for example, outer channel 132 of channel assembly 108, such that the channel cover is detachably secured thereto.

[0058] With reference to FIGS. 2, 4 and 6, clip cartridge assembly 300 includes a cartridge pusher rod or shaft 306 slidably supported within clip tray 302. Cartridge pusher rod 306 includes a distal end connected to a proximal end of cartridge clip pusher bar 304, and a proximal end fixedly connected to a drive sled 308 with drive sled 308 being slidably supported within clip tray 302.

[0059] Clip cartridge assembly 300 includes a biasing member 310 disposed about cartridge pusher rod 306 and interposed between a distal stop block 312a and drive sled 308. A proximal stop block 312b is provided near proximal end of clip tray 302 to limit movement of drive sled 308. The distal end of cartridge pusher rod 306 extends distally past distal stop block 312a for engagement with the proximal end of cartridge clip pusher bar 304.

[0060] In operation, as will be described in greater detail below, as handles 106 are actuated, handles 106 effect actuation of a drive bar or channel 112 (FIGS. 3, 5 and 12) of handle assembly 102 to move drive bar or channel 112 in

an axially distal direction. As drive bar or channel 112 is moved in a distal direction drive bar or channel 112 engages, abuts or acts on drive sled 308 to move drive sled 308 in a distal direction. As drive sled 308 is moved in a distal direction, drive sled 308 acts on cartridge clip pusher bar 304 to distally advance cartridge clip pusher bar 304, and effectuates compression of biasing member 310 to a biased condition.

[0061] Generally, once clip cartridge assembly 300 is fully assembled, as shown in FIGS. 2 and 4, clip cartridge assembly 300 is available to be loaded into channel assembly 108. Clip cartridge assembly 300 may be frictionally retained within channel assembly 108, retained within channel assembly 108 by a snap-fit connection, or some other connecting arrangement known by one of skill in the art, for example, such as by detents, lips, or wings. In one exemplary embodiment, wings extending along the side edges of outer channel 132 of channel assembly 108 and extending towards one another snap over or otherwise engage the lateral sides of clip tray 302 such that clip tray 302, and therefore, clip cartridge assembly 300, are detachably secured thereto.

[0062] With continued reference to FIGS. 1-11, and with additional specific reference to FIGS. 12-18, an exemplary mode of operation of clip applier 100 is shown and described. As shown in FIGS. 12 and 13, clip applier 100 is illustrated with clip cartridge assembly 300 loaded in channel assembly 108 (as described above). The operation of clip applier 100 is substantially similar to that of the exemplary clip applier referenced hereinabove in U.S. Patent Application Publication No. 2014/0194903, and therefore, in the interest of brevity, only the differences therebetween will be discussed hereinbelow.

[0063] As the drive bar or channel 112 of handle assembly 102 is distally advanced, due to an actuation of handles 106, the drive bar or channel 112 acts on drive sled 308 of cartridge assembly 300 to move drive sled 308 in a distal direction. As drive sled 308 is moved in a distal direction, drive sled 308 acts on cartridge clip pusher bar 304 to distally advance cartridge clip pusher bar 304 by an amount or distance “X”, and effectuates compression of biasing member 310 to a biased condition.

[0064] As cartridge clip pusher bar 304 of clip cartridge assembly 300 is moved in a distal direction, as shown in FIGS. 13 and 14, the spaced apart prongs 304d₁, 304d₂ of pusher 304d of cartridge clip pusher bar 304 engages the backspan of distal-most clip “C1” and pushes distal-most clip “C1” distally, by the amount or distance “X”, out of clip cartridge assembly 300 and into the pair of jaws 120.

[0065] As mentioned above, the distal movement of the distal-most clip “C1” compresses each of the spaced apart prongs 302e of the clip tray 302, thereby permitting the distal-most clip “C1” to be loaded within the pair of jaws 120, as described above. Once the distal-most clip “C1” is loaded into the pair of jaws 120, the prongs 302e return to their initial position and prevent the clips “C”, proximal to the distal-most clip “C1”, from advancing further distally.

[0066] Additionally, and simultaneously with a distal movement of the distal-most clip “C1”, as cartridge clip pusher bar 304 of clip cartridge assembly 300 moves in a distal direction, distal shoulder 304f of each finger 304e of cartridge clip pusher bar 304 abuts against a respective backspan of a respective surgical clip of the remaining surgical clips “C” to also urge the remaining surgical clips “C” in a distal direction, by the amount or distance “X”. In so

doing, fingers 302d of the clip tray 302 are deflected, permitting each of the remaining surgical clips “C” to advance distally to replace each respective surgical clip of the stack of surgical clips “C”. Once distal advancement of cartridge clip pusher bar 304 is completed, distal advancement of the stack of surgical clips “C” is also completed. Once the clips of the remaining stack of surgical clips “C” has distally advanced beyond respective fingers 302d of clip tray 302, fingers 302d of clip tray 302 spring back or return to their original position, thereby preventing each surgical clip “C” from any movement thereafter in a proximal direction.

[0067] Cartridge clip pusher bar 304 distally advances the remaining surgical clips “C” until each remaining surgical clip “C” is advanced distally, by the amount or distance “X”, past a next adjacent resilient, deflectable finger 302d of clip tray 302.

[0068] Following movement of cartridge clip pusher bar 304, by the amount or distance “X”, to load the distal-most clip “C1” into the pair of jaws 120, a release or reversing mechanism (not shown) of handle assembly 102 is actuated to effectuate a reversal of the direction of travel of the drive bar or channel 112 of handle assembly 102, from the distal direction to a proximal direction. The release or reversing mechanism cause the distally directed forces acting on cartridge clip pusher bar 304 to be removed, and thus biasing member 310 is free to re-expand. As biasing member 310 is free to re-expand, biasing member 310 urges or moves drive sled 308 proximally to thereby withdraw cartridge clip pusher bar 304 proximally.

[0069] As cartridge clip pusher bar 304 is moved in a proximal direction, a proximal surface of fingers 304e thereof abut against a distal surface of the

backspans of the remaining surgical clips “C” to also urge the remaining surgical clips “C” in a proximal direction. Fingers 304e of cartridge clip pusher bar 304 proximally retract the remaining surgical clips “C” until each remaining surgical clip “C” is retracted, by an amount or distance less than “X” (e.g., “X – Y”), into contact with a respective distal tip of a respective resilient, deflectable finger 302d of clip tray 302, which blocks or stops further proximal retraction of the remaining surgical clips “C”, while cartridge clip pusher bar 304 continues to move proximally to the proximal-most position thereof, e.g., an amount or distal “X”.

[0070] As cartridge clip pusher bar 304 continues to be drawn proximally, concurrently, the spaced apart prongs 304d₁, 304d₂ of pusher 304d and fingers 304e of cartridge clip pusher bar 304 are deflected up and over each of the remaining surgical clips “C” until cartridge clip pusher bar 304 returns to a proximal-most position.

[0071] When clip cartridge assembly 300 is loaded with at least one clip “C”, and when cartridge clip pusher bar 304 is in a proximal-most position, a nose 304g (FIGS. 13 and 16) disposed on a distal-most end of cartridge clip pusher bar 304 is biased towards, and is supported by, an upper surface of a backspan of the distal-most surgical clip “C1”, preventing each of the spaced apart prongs 304d₁, 304d₂ of pusher 304d from engaging or entering the pair of channels 302f of clip tray 302.

[0072] The operations described above can be repeated, as required, until all of the surgical clips “C” have been formed.

[0073] In operation, during an actuation or closing of handles 106 of handle assembly 102, following a loading of a distal-most surgical clip “C1” into the

pair of jaws 120, and following a retraction of cartridge clip pusher bar 304 to the proximal-most position, a jaw closure feature which may surround the pair of jaws 120, e.g., a jaw closing channel or the like (not shown), may cam the pair of jaws 120 to an approximated or closed position to form the surgical clip loaded therein. For an exemplary jaw closure feature and operation thereof, reference may be made to U.S. Patent Application Publication No. 2014/0194903, identified hereinabove, or Attorney Docket: H-EM-00252 (203-10415), the entire content of which is incorporated herein by reference.

[0074] With reference to FIGS. 17 and 18, an exemplary mode of operation of a lockout safety mechanism of surgical clip applier 100 is illustrated. Once the final clip of the stack of clips “C” is formed and cartridge clip pusher bar 304 is retracted proximally, the nose 304g of cartridge clip pusher bar 304 is no longer supported by any surgical clip “C”. Thus, the bias of the distal end 304b of cartridge clip pusher bar 304 downward toward clip tray 302 causes each of the spaced apart prongs 304d₁, 304d₂ of pusher 304d to engage the pair of channels 302f of clip tray 302. Once the spaced apart prongs 304d₁, 304d₂ of pusher 304d are engaged with or disposed within the pair of channels 302f of clip tray 302, any distal movement of the cartridge clip pusher bar 304, e.g., upon an actuation of handles 106 as described above, is inhibited. Further, and as described in detail in U.S. Patent Application Publication No. 2014/0194903, referenced above, since handles 106 cannot be squeezed further beyond an initial amount, and due to the engagement of at least one pawl (not shown) with a rack member (not shown) of handle assembly 102, handles 106 cannot be reopened to any unsqueezed position, thereby locking the cartridge clip pusher bar 304 in place.

[0075] In use, surgical clip applier 100, as mentioned above, is capable of loading different surgical clip cartridge assemblies 300 in channel assembly 108. Specifically, channel assembly 108 may be loaded with a surgical clip cartridge assembly 300 that is loaded with a stack of surgical clips “C” having a first size, or channel assembly 108 may be loaded with a surgical clip cartridge assembly 300 that is loaded with a stack of surgical clips “C” having a second size different than the first size.

[0076] In this manner, the user or surgeon may load a surgical clip cartridge assembly 300, loaded with a particular size of surgical clips, depending on the particular surgical procedure to be performed. Additionally, during a surgical procedure, if the need arises to use a different sized surgical clip, the user or surgeon may eject or unload the surgical clip cartridge assembly 300 that is loaded in channel assembly 108 and then load a new surgical clip cartridge assembly 300 (having a different sized stack of surgical clips loaded therein as compared to the unloaded surgical clip cartridge assembly 300) into channel assembly 108.

[0077] Also in accordance with the present disclosure, it is further contemplated that a surgical kit may be provided including a surgical clip applier 100 and a plurality of clip cartridge assemblies 300 including at least a first set of clip cartridge assemblies loaded with a stack of surgical clips having a first size and a second set of clip cartridge assemblies loaded with a stack of surgical clips having a second size different than the first size. The kit may include instructions for the assembly or surgical clip applier 100, the use of surgical clip applier 100, and the processing of surgical clip applier assembly 100 following use, a surgical clip applier 100 including a single handle assembly 102 and a

single clip cartridge assembly 300, and a package, container or box configured to retain the same.

[0078] It should be understood that the foregoing description is only illustrative of the present disclosure. Various alternatives and modifications can be devised by those skilled in the art without departing from the disclosure. Accordingly, the present disclosure is intended to embrace all such alternatives, modifications and variances. The embodiments described with reference to the attached drawing figures are presented only to demonstrate certain examples of the disclosure. Other elements, steps, methods and techniques that are insubstantially different from those described above and/or in the appended claims are also intended to be within the scope of the disclosure.

CLAIMS

What is claimed is:

1. A clip cartridge assembly, comprising:

a clip tray configured to be selectively loadable in a channel assembly of a surgical clip applier, the clip tray including:

a first channel defined by a base wall and a pair of first side rails extending along longitudinal sides of the base wall;

a second channel, adjacent to the first channel, defined by a pair of second side rails supported on respective ones of the pair of first side rails; and

a first plurality of distally oriented, deflectable, resilient fingers projecting from the base wall and into the first channel;

a cartridge clip pusher bar slidably disposed within the second channel and interposed between the pair of second side rails of the clip tray, the cartridge clip pusher bar including a second plurality of distally oriented, deflectable, resilient fingers projecting from a base wall thereof and extending into the first channel of the clip tray, each resilient finger of the cartridge clip pusher bar terminating in a distal shoulder, a proximal end of the cartridge clip pusher bar being configured for selective engagement with a drive bar of the surgical clip applier, such that the cartridge clip pusher bar is in mechanical communication with a handle assembly of the surgical clip applier; and

a plurality of surgical clips loaded within the first channel of the clip tray and interposed between the base wall defining the first channel of the clip tray and the base wall of the cartridge clip pusher bar,

wherein a surgical clip is disposed distally of each resilient finger of the clip tray and each resilient finger of the cartridge clip pusher bar when the cartridge clip pusher bar is at a proximal-most position relative to the clip tray.

2. The clip cartridge assembly according to claim 1, further comprising:

a drive sled slidably disposed within the first channel of the clip tray, the drive sled being positioned proximal of the plurality of surgical clips;

a cartridge pusher rod extending distally from the drive sled, the cartridge pusher rod having a distal end connected to a proximal end of the cartridge clip pusher bar; and

a biasing member supported on the cartridge pusher rod and tending to bias the drive sled and the cartridge clip pusher bar to the proximal-most position.

3. The clip cartridge assembly according to claim 2, wherein distal actuation of the cartridge clip pusher bar causes each distal shoulder of the cartridge clip pusher bar to contact a backspan of a respective surgical clip, thereby distally advancing all of the surgical clips simultaneously.

4. The clip cartridge assembly according to claim 3, wherein following distal actuation of the cartridge clip pusher bar, upon a proximal actuation of the cartridge clip pusher bar, each of the second plurality of distally oriented, deflectable, resilient fingers contacts a distal surface of the backspan of a respective remaining one of the surgical clips to proximally move all of the remaining surgical clips until the backspans of all of the remaining surgical clips contacts a respective finger of the first plurality of distally oriented, deflectable,

resilient fingers of the clip tray to block any further proximal movement of the remaining surgical clips.

5. The clip cartridge assembly according to claim 2, wherein distal actuation of the cartridge clip pusher bar results from a distal movement of the drive sled that distally advances the cartridge pusher rod, wherein distal advancement of the drive sled biases the biasing member.

6. The clip cartridge assembly according to claim 1, wherein the clip tray further includes a spaced apart pair of distally oriented, deflectable, resilient fingers projecting from a distal end of the base wall thereof, the spaced apart pair of fingers configured to contact a distal surface of a backspan of a surgical clip being distally urged by the cartridge clip pusher bar, thereby inhibiting any further distal movement of the surgical clip.

7. The clip cartridge assembly according to claim 1, wherein the distal-most finger of the first plurality of distally oriented, deflectable, resilient fingers has a rectangular configuration.

8. The clip cartridge assembly according to claim 7, wherein each remaining finger of the first plurality of distally oriented, deflectable, resilient fingers includes a V-shaped notch formed in a distal end thereof.

9. The clip cartridge assembly according to claim 1, wherein a distal end of the cartridge clip pusher bar includes a pusher disposed thereon, the pusher defining a pair of spaced apart prongs configured to engage a backspan of a surgical clip.

10. A surgical clip applier, comprising:

a housing including a drive bar;

at least one handle pivotably connected to the housing and configured to actuate the drive bar;

a channel assembly extending distally from the housing; and

a clip cartridge assembly selectively loadable in the channel assembly, the clip cartridge assembly being in mechanical communication with the at least one handle, the clip cartridge assembly including:

a clip tray configured to be selectively loadable in a channel assembly of the surgical clip applier, the clip tray including:

a first channel defined by a base wall and a pair of first side rails extending along longitudinal sides of the base wall;

a second channel, adjacent to the first channel, defined by a pair of second side rails supported on respective ones of the pair of first side rails; and

a first plurality of distally oriented, deflectable, resilient fingers projecting from the base wall and into the first channel;

a cartridge clip pusher bar slidably disposed within the first channel and interposed between the pair of first side rails of the clip tray, the cartridge clip pusher bar including a second plurality of distally oriented, deflectable, resilient fingers projecting from a base wall thereof and extending into the first channel of the clip tray, each resilient finger of the cartridge clip pusher bar terminating in a distal shoulder, a proximal end of the cartridge clip pusher bar being configured for selective engagement with the drive bar, such that the

cartridge clip pusher bar is in mechanical communication with the handle assembly; and

a plurality of surgical clips loaded within the first channel of the clip tray and interposed between the base wall defining the first channel of the clip tray and the base wall of the cartridge clip pusher bar,

wherein a surgical clip is disposed distally of each resilient finger of the clip tray and each resilient finger of the cartridge clip pusher bar when the cartridge clip pusher bar is at a proximal-most position relative to the clip tray; and

a pair of jaws supported on a distal end of the channel assembly, the pair of jaws configured to receive a single, unformed surgical clip therein.

11. The surgical clip applier according to claim 10, wherein the clip cartridge assembly further comprises:

a drive sled slidably disposed within the first channel of the clip tray, the drive sled being positioned proximal of the plurality of surgical clips;

a cartridge pusher rod extending distally from the drive sled, the cartridge pusher rod having a distal end connected to a proximal end of the cartridge clip pusher bar; and

a biasing member supported on the cartridge pusher rod and tending to bias the drive sled and the cartridge clip pusher bar to a proximal-most position.

12. The surgical clip applier according to claim 11, wherein distal actuation of the cartridge clip pusher bar causes each distal shoulder of the

cartridge clip pusher bar to contact a backspan of a respective surgical clip, thereby distally advancing all of the surgical clips simultaneously.

13. The surgical clip applier according to claim 12, wherein following distal actuation of the cartridge clip pusher bar, upon a proximal actuation of the cartridge clip pusher bar, each of the second plurality of distally oriented, deflectable, resilient fingers contacts a distal surface of the backspan of a respective remaining one of the surgical clip to proximally move all of the remaining surgical clips until the backspans of all of the remaining surgical clips contacts a respective finger of the first plurality of distally oriented, deflectable, resilient fingers of the clip tray to block any further proximal movement of the remaining surgical clips.

14. The surgical clip applier according to claim 13, wherein distal actuation of the cartridge clip pusher bar results from a distal movement of the drive sled that distally advances the cartridge pusher rod, wherein distal advancement of the drive sled biases the biasing member.

15. The surgical clip applier according to claim 10, wherein the clip tray further includes a spaced apart pair of distally oriented, deflectable, resilient fingers projecting from a distal end of the base wall thereof, the spaced apart pair of fingers configured to contact a distal surface of a backspan of a surgical clip being distally urged by the cartridge clip pusher bar, thereby inhibiting any further distal movement of the surgical clip.

16. The surgical clip applier according to claim 10, wherein the distal-most finger of the first plurality of distally oriented, deflectable, resilient fingers has a rectangular configuration.

17. The surgical clip applier according to claim 16, wherein each remaining finger of the first plurality of distally oriented, deflectable, resilient fingers includes a V-shaped notch formed in a distal end thereof.

18. The surgical clip applier according to claim 10, wherein a distal end of the cartridge clip pusher bar includes a pusher disposed thereon, the pusher defining a pair of spaced apart prongs configured to engage a backspan of a surgical clip.

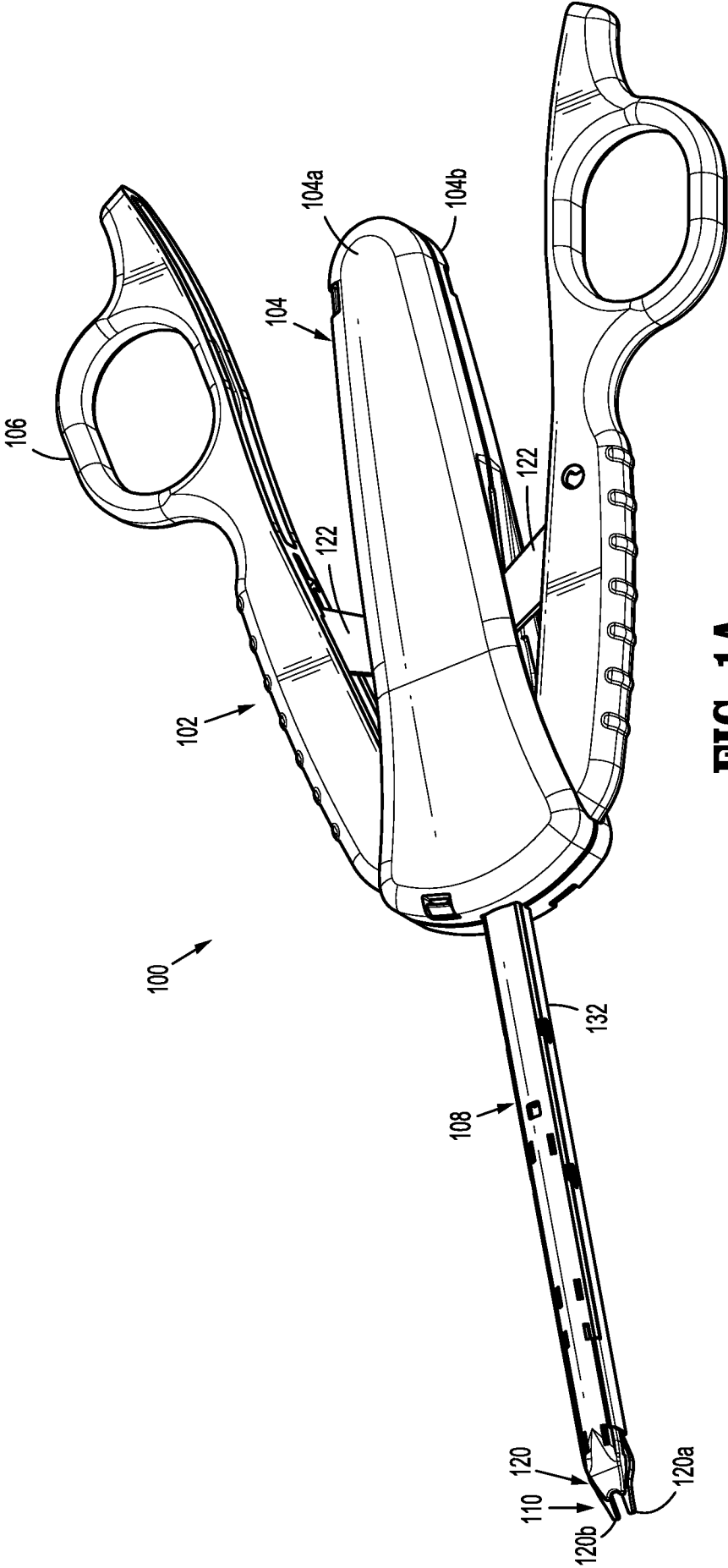


FIG. 1A

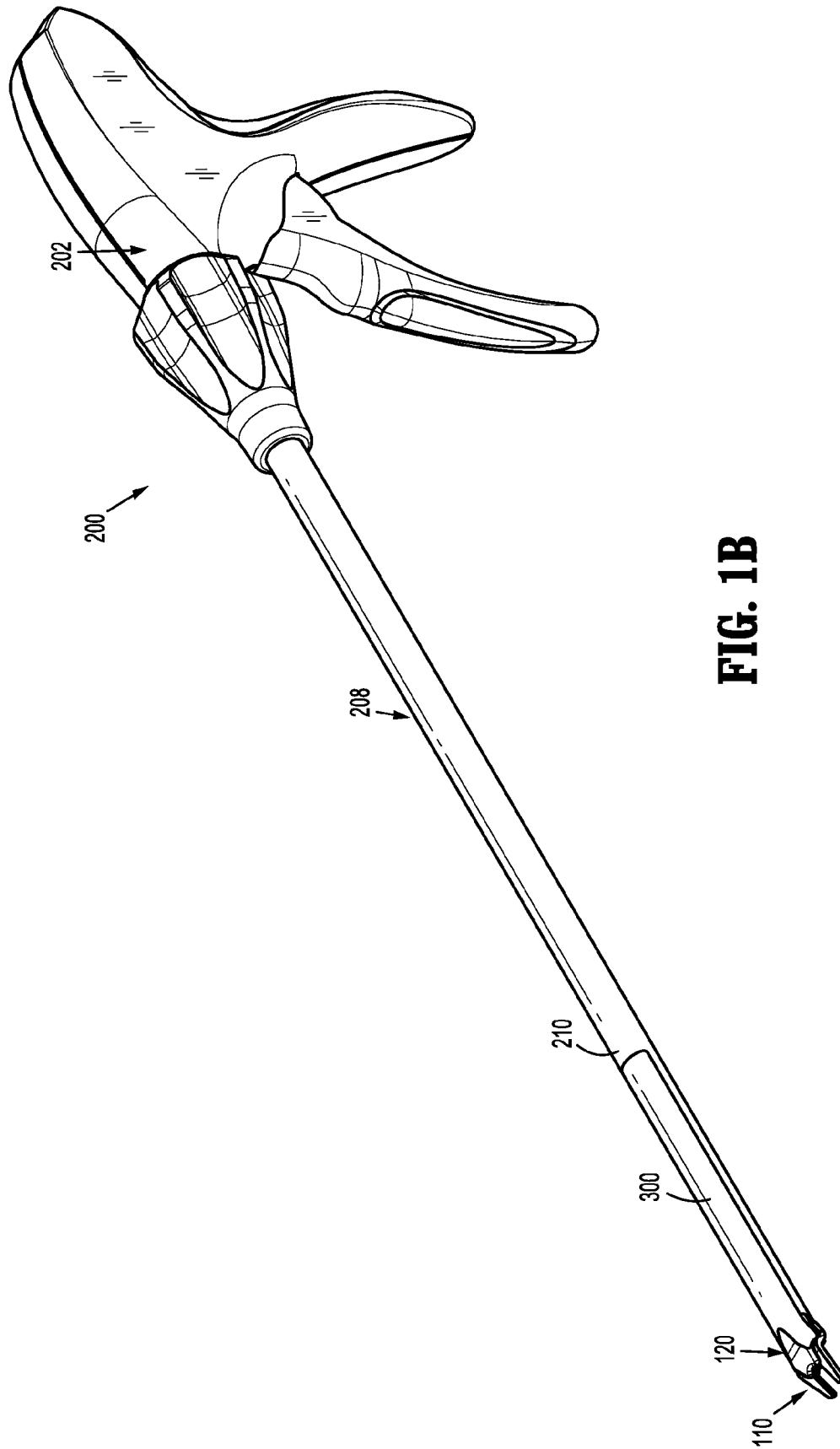
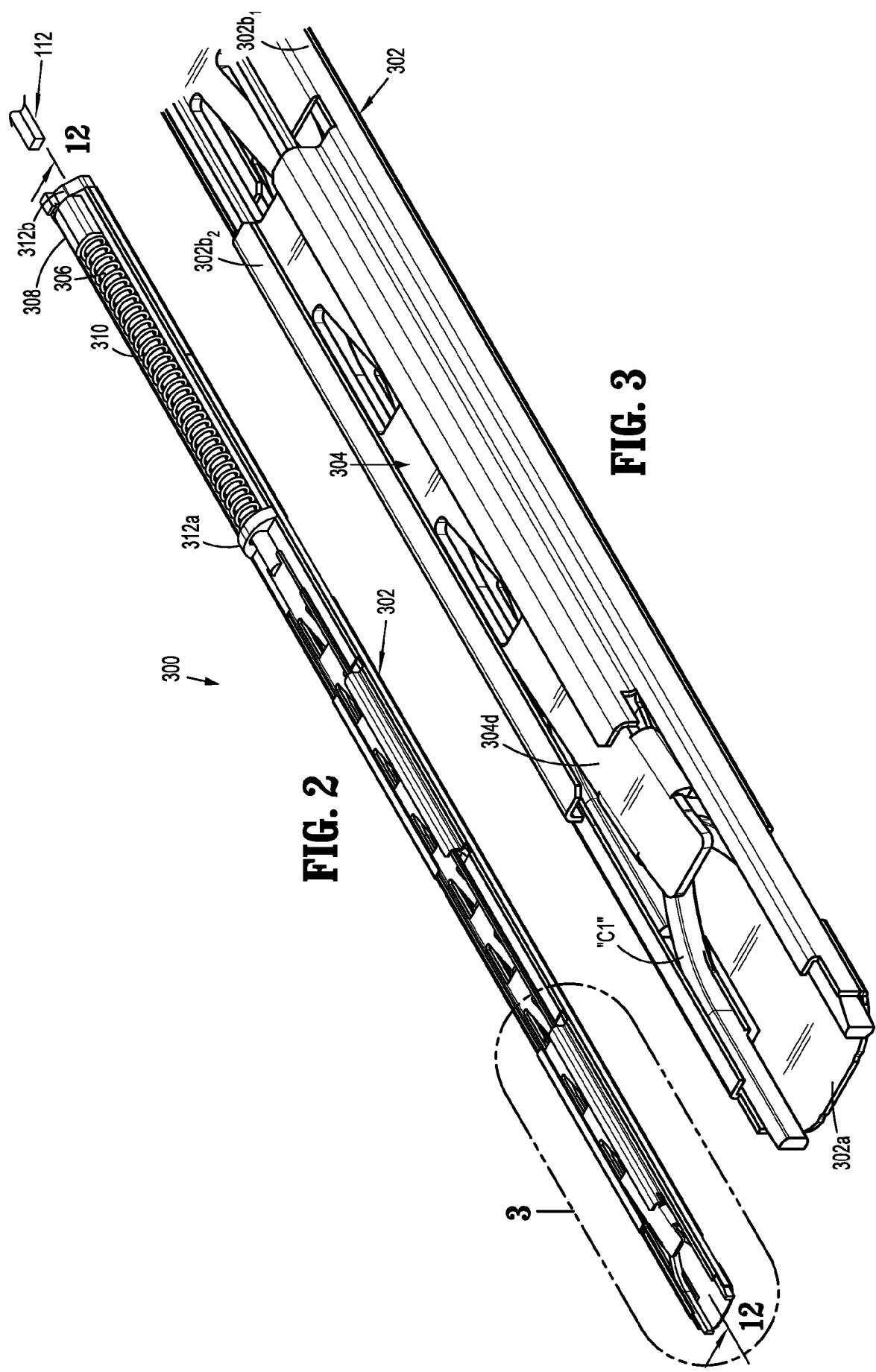
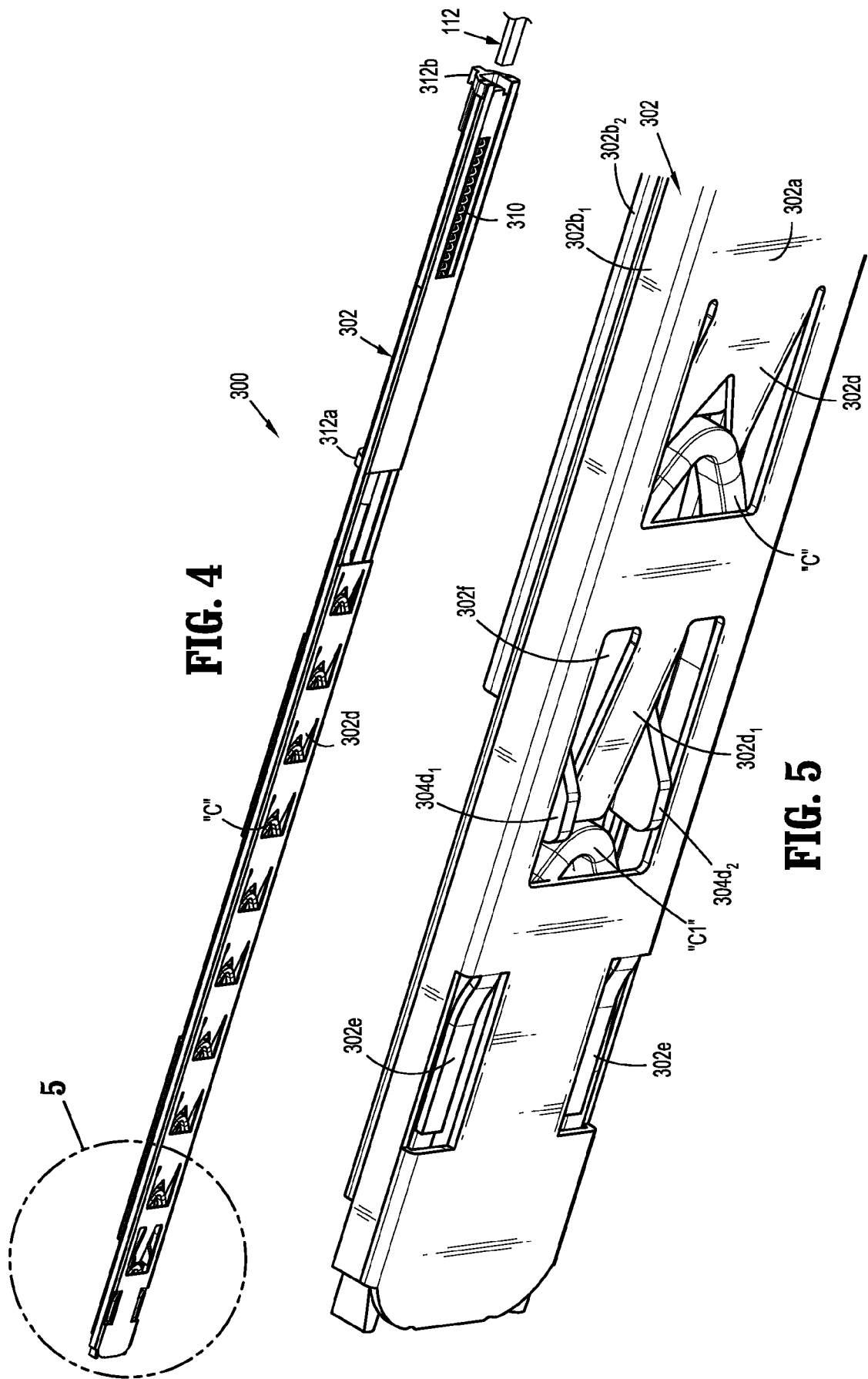


FIG. 1B





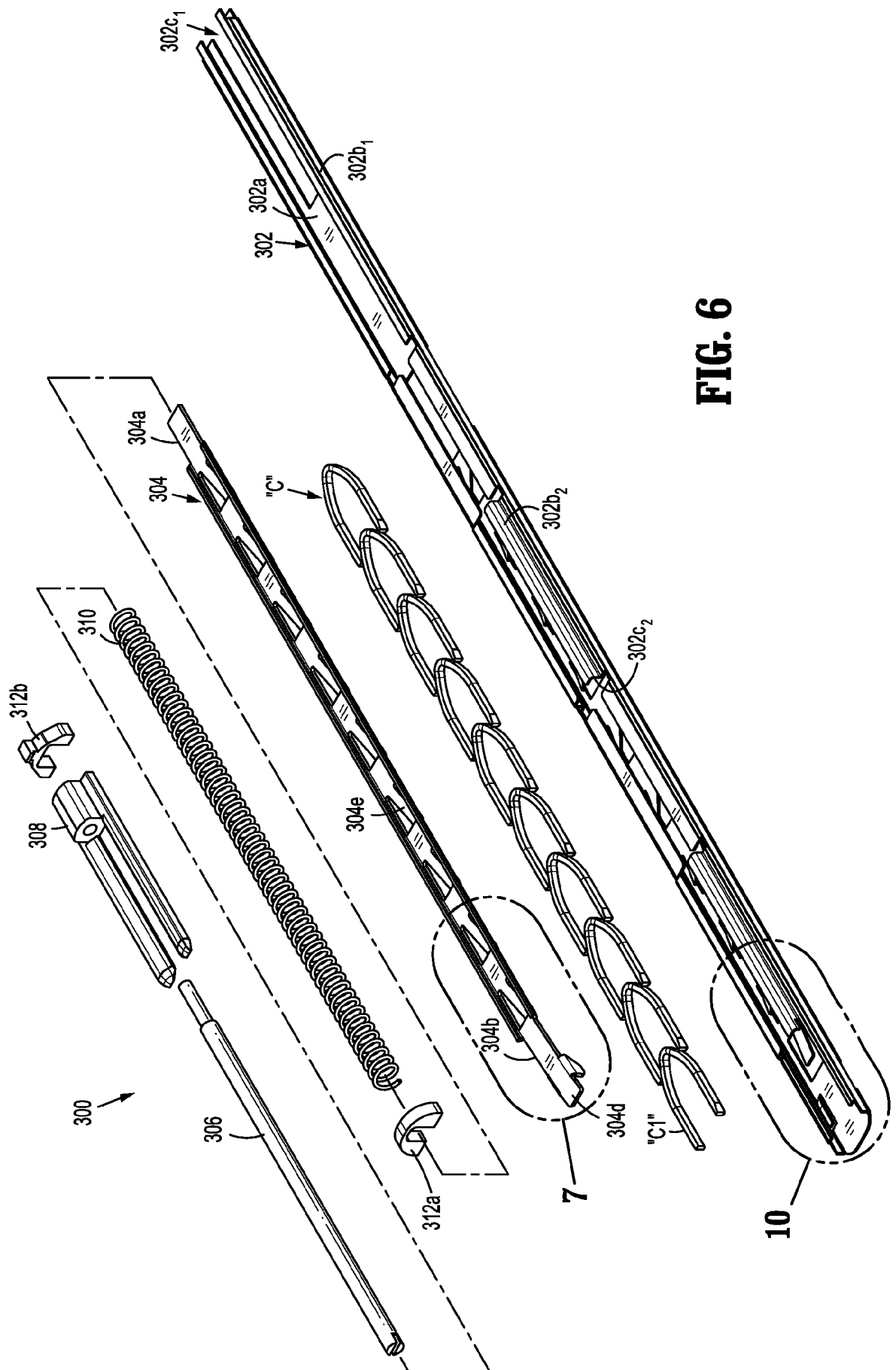


FIG. 6

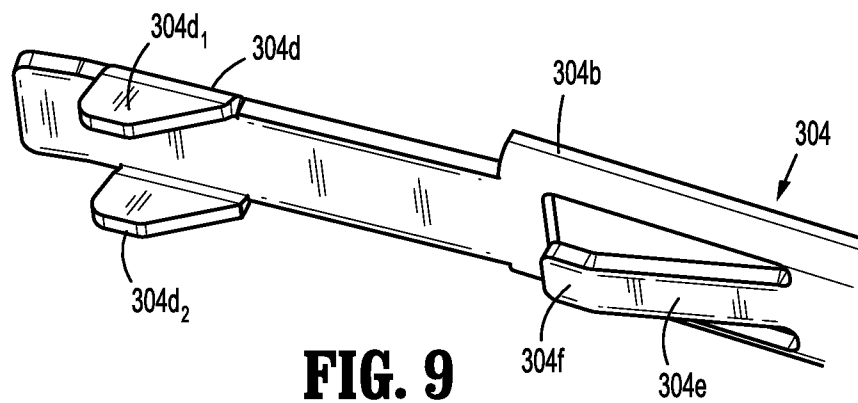
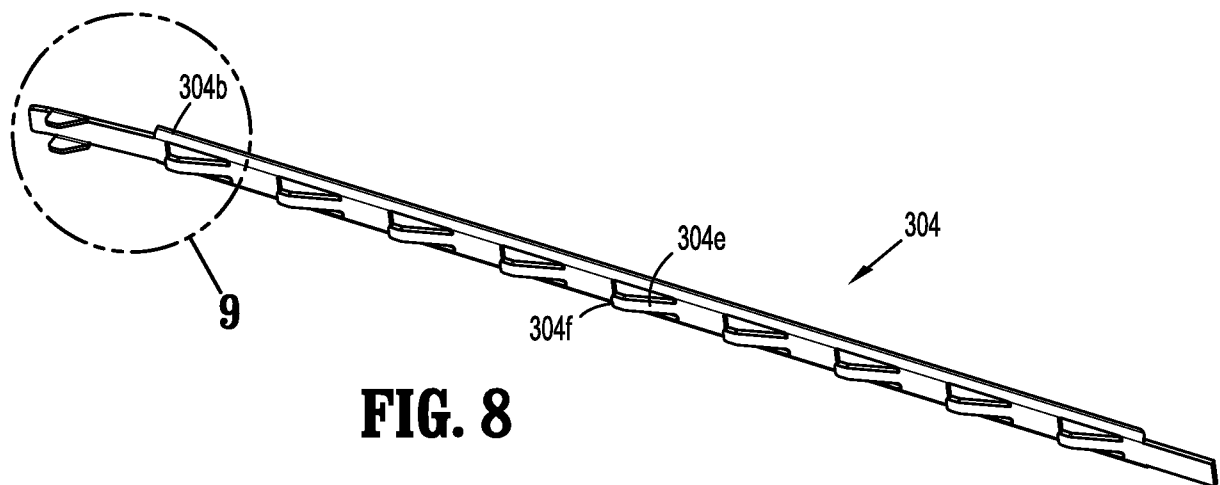
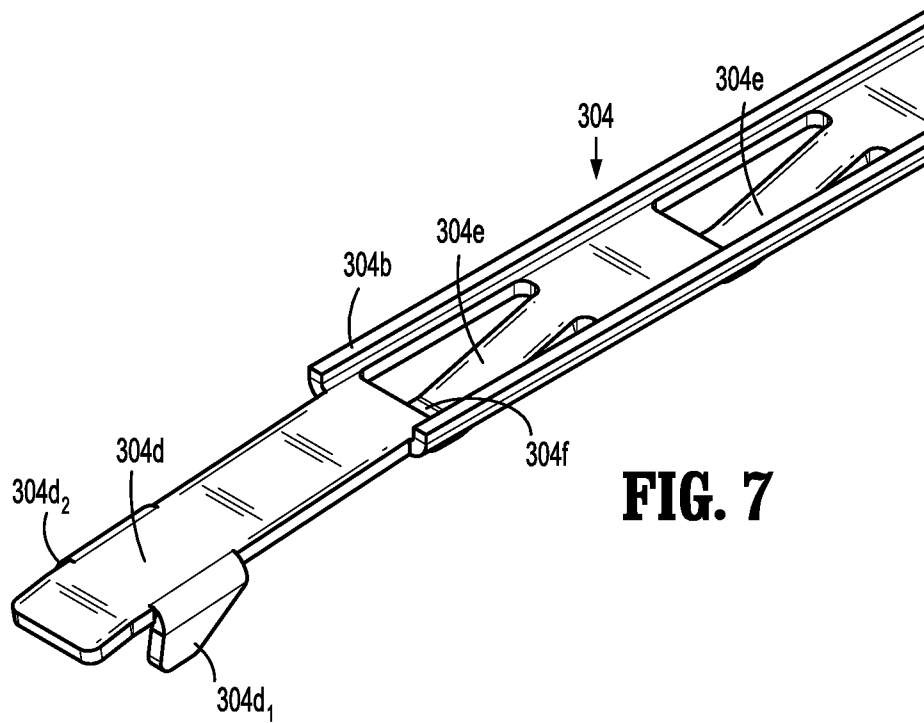


FIG. 10

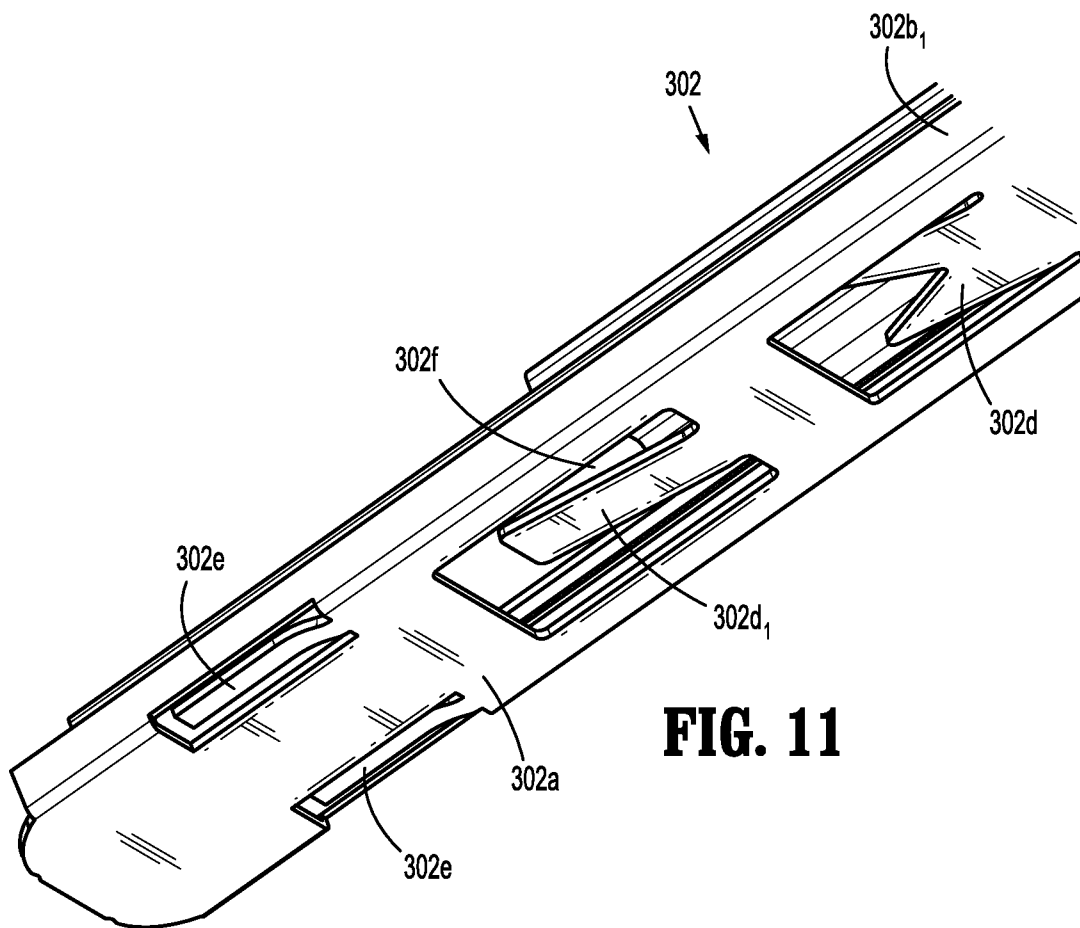
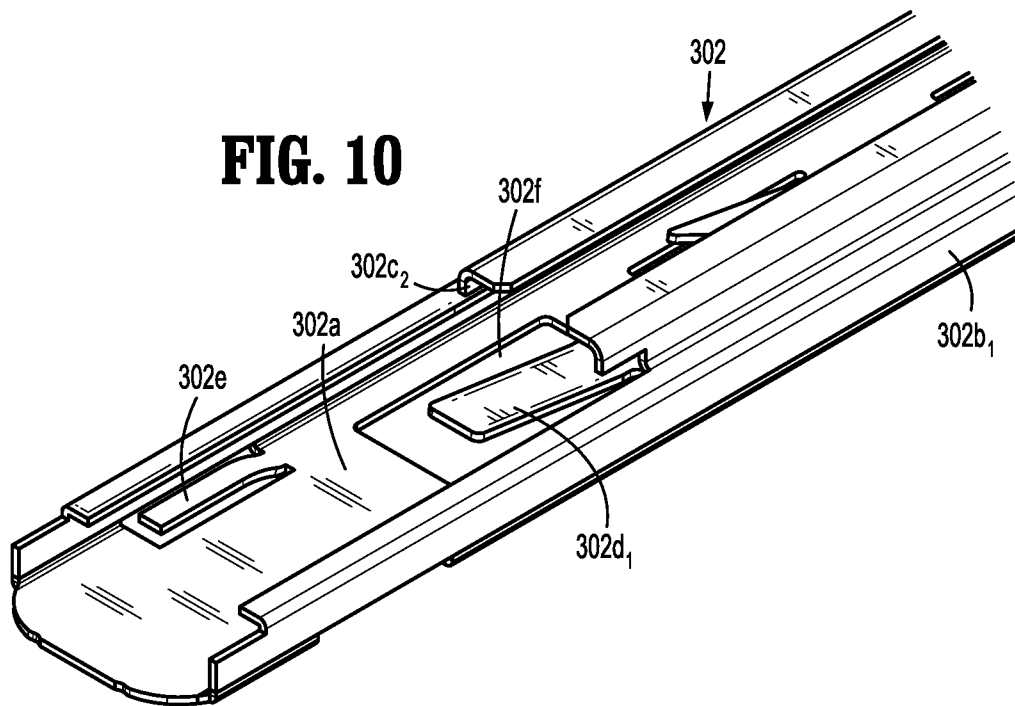


FIG. 11

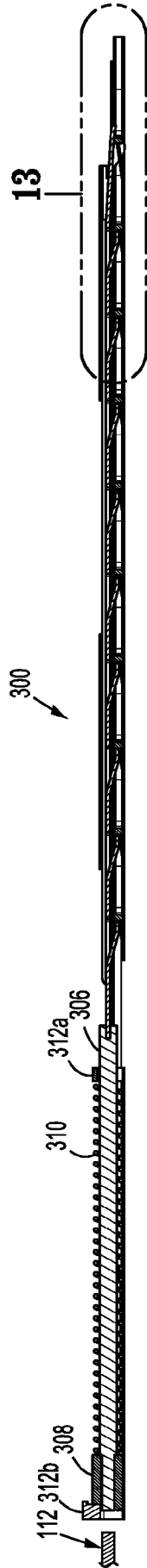


FIG. 12

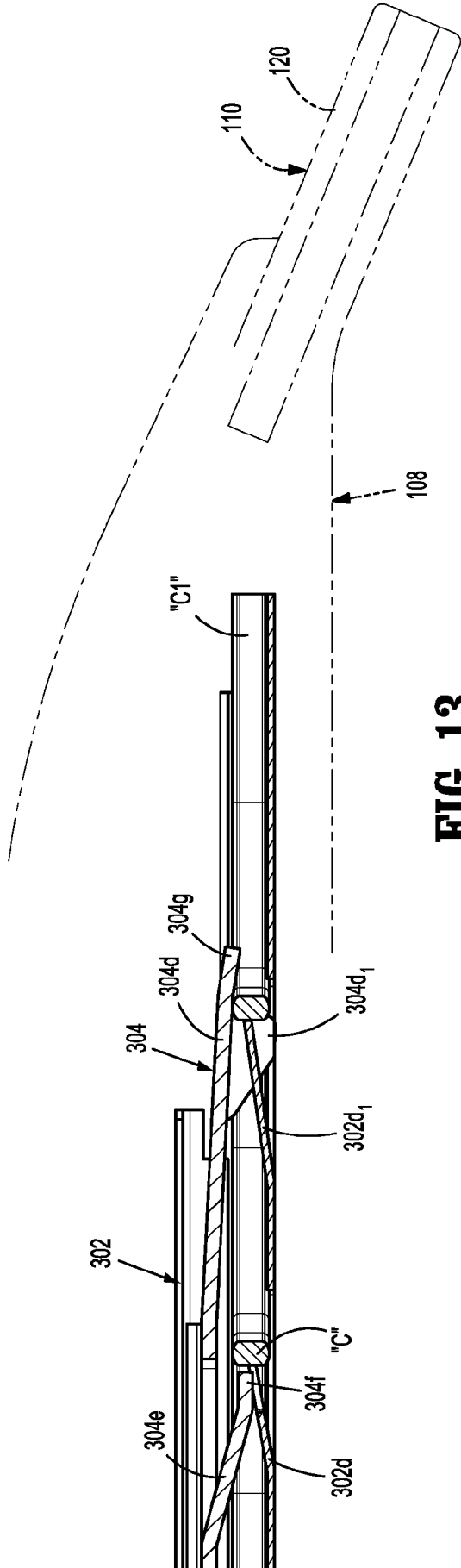


FIG. 13

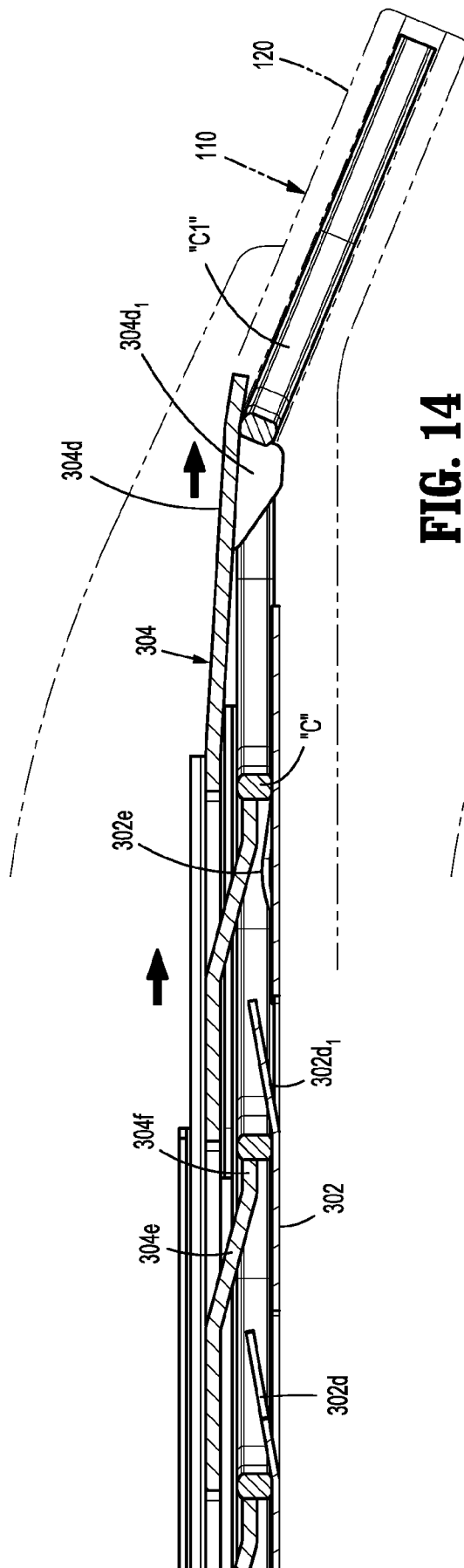


FIG. 14

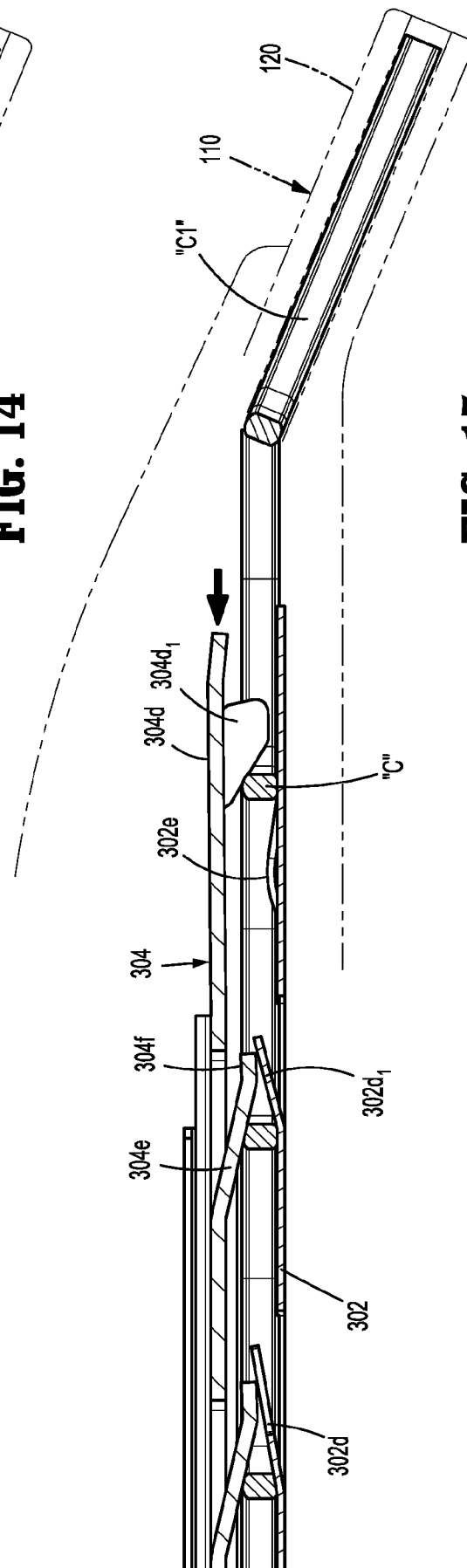


FIG. 15

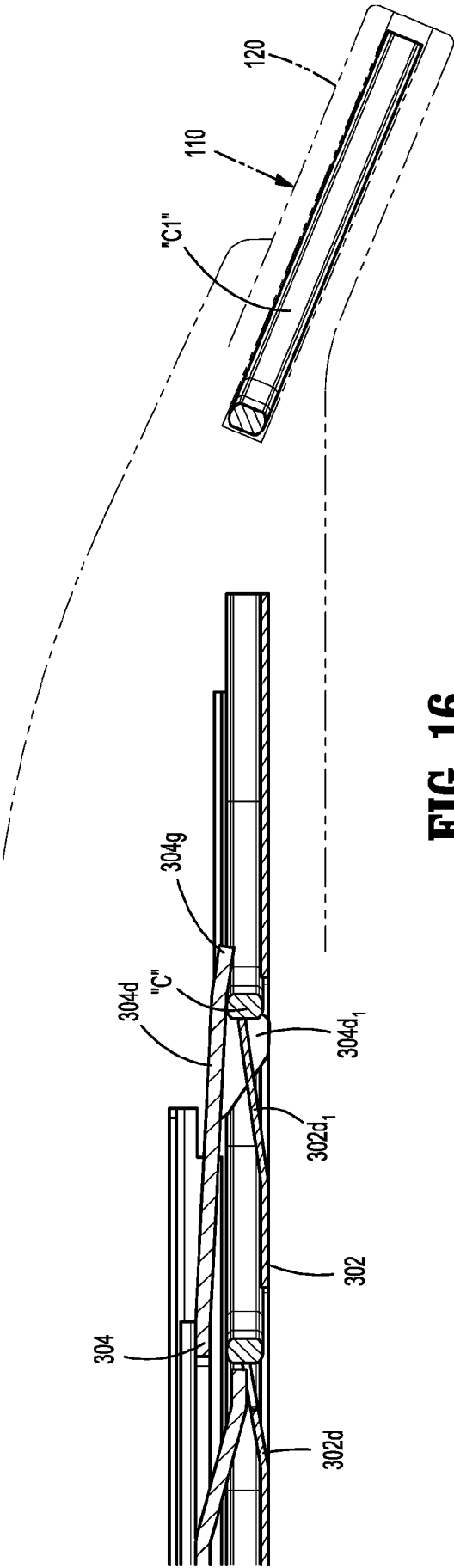


FIG. 16

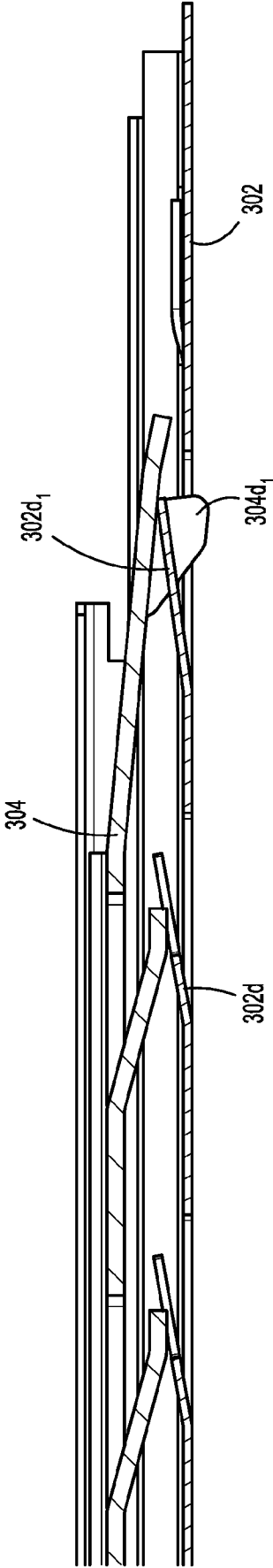


FIG. 17

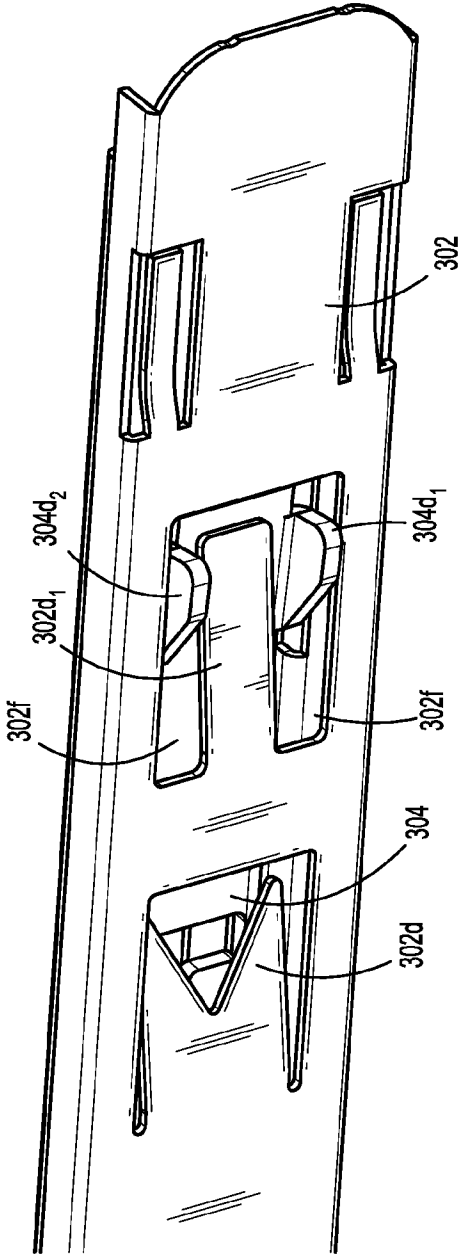


FIG. 18

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2015/082199

A. CLASSIFICATION OF SUBJECT MATTER

A61B 17/128(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

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

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

CNABS, CNTXT, CNKI, VEN: clip?, carriage, push+, driv+, advanc+, finger?, spring?, project+, protrud+, channel?, rail?, slot?, resilien+, deflect+, elast+, flexib+, backspan, mov+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 103181809 A (COVIDIEN LP CO) 03 July 2013 (2013-07-03) description, paragraphs [0110] to [0168] and figures 1-55	1-18
Y	CN 103181810 A (COVIDIEN LP CO) 03 July 2013 (2013-07-03) description, paragraphs [0110] to [0168] and figures 1-55	1-18
Y	US 5904693 A (AMERICAN CYANAMID COMPANY) 18 May 1999 (1999-05-18) description, column 7, line 17 to column 8, line 55 and figure 3	1-18
A	US 5626585 A (UNITED STATES SURGICAL CORPORATION) 06 May 1997 (1997-05-06) the whole document	1-18
A	US 5197970 A (UNITED STATES SURGICAL CORPORATION) 30 March 1993 (1993-03-30) the whole document	1-18
A	CN 101664331 A (TYCO HEALTHCARE GROUP) 10 March 2010 (2010-03-10) the whole document	1-18



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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

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“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

21 March 2016

Date of mailing of the international search report

31 March 2016

Name and mailing address of the ISA/CN

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2015/082199

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Information on patent family members

International application No.

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		EP 2335614 A1	22 June 2011
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