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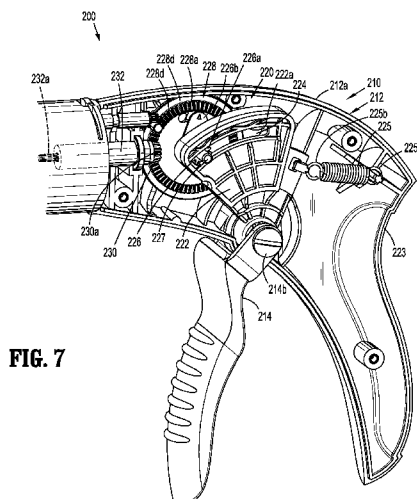


FIG. 7

(57) Abstract: An endoscopic surgical device (200) includes a handle assembly (210) and an endoscopic assembly (300) selectively connectable to the handle assembly (210) and including surgical anchors (100) loaded within a lumen thereof. The handle assembly (210) includes a handle housing (212) and a trigger (214) operatively connected thereto, and a gear train (220) actuable by the trigger (214). The gear train (214) includes: a drive gear (222) keyed to a pivot end (214b) of the trigger (214) and including a plurality of gear teeth (222a); a clutch gear (226) including a plurality of gear teeth (226a) in meshing engagement with the gear teeth (222a) of the drive gear (222); a bevel gear (228) operatively engaged with the clutch gear (226) and rotatable about a pivot axis (227), the bevel gear (228) including gear teeth (228c) formed on a first face (228d) thereof; and a pinion gear (230) non-rotatably secured to a drive shaft (232) extending distally from the handle housing (212), the pinion gear (230) including gear teeth (230a) operatively engaged with the gear teeth (228c) of the bevel gear (228).

SURGICAL FASTENER APPLYING APPARATUS AND METHODS FOR ENDOSCOPIC PROCEDURES

TECHNICAL FIELD

[0001] The present disclosure relates to a surgical apparatus, device, and/or system for performing endoscopic surgical procedures and methods of use thereof. More specifically, the present disclosure relates to a surgical fastener applying apparatus, device, and/or system for performing endoscopic surgical procedures, which is loadable with disposable endoscopic loading units containing absorbable or permanent surgical fasteners, and methods of use thereof.

BACKGROUND

[0002] Various surgical procedures require instruments capable of applying fasteners to tissue to form tissue connections or to secure objects to tissue. For example, during hernia repair it is often desirable to fasten a mesh to body tissue. In certain hernias, such as direct or indirect inguinal hernias, a part of the intestine protrudes through a defect in the abdominal wall to form a hernial sac. The defect may be repaired using an open surgery procedure in which a relatively large incision is made and the hernia is closed outside the abdominal wall by suturing. The mesh is attached with sutures over the opening in the abdominal wall to provide reinforcement.

[0003] Minimally invasive, e.g., endoscopic or laparoscopic, surgical procedures are currently available to repair a hernia. In laparoscopic procedures, surgery is performed in the abdomen through a small incision while in endoscopic procedures, surgery is performed through narrow endoscopic tubes

or cannulas inserted through small incisions in the body. Laparoscopic and endoscopic procedures generally utilize long and narrow instruments capable of reaching remote regions within the body and are configured to form a seal with the incision or tube they are inserted through. Additionally, the instruments must be capable of being actuated remotely, that is, from outside the body.

[0004] Currently, minimally invasive surgical techniques for hernia repair utilize surgical fasteners, e.g., surgical tacks, staples, and clips, to secure the mesh to the tissue to provide reinforcement and structure for encouraging tissue ingrowth. Surgical fasteners are often applied through an elongate instrument for delivery to the mesh, and are manipulated from outside a body cavity.

[0005] In some procedures permanent fasteners may be required, while in other procedures bioabsorbable fasteners may be required, or both. The laparoscopic or endoscopic instruments are typically loaded with either permanent fasteners or bioabsorbable fasteners. Additionally, following a surgical procedure, these laparoscopic or endoscopic instruments are typically disposed.

[0006] Accordingly, a need exists for endoscopic or laparoscopic surgical devices which can be loaded with either permanent fasteners or bioabsorbable fasteners as needed or desired, and which may be at least partially sterilized for re-use following a surgical procedure.

SUMMARY

[0007] The present disclosure relates to surgical devices for performing endoscopic surgical procedures which are loadable with disposable endoscopic

loading units loaded with absorbable or permanent surgical fasteners and methods of use thereof.

[0008] According to an aspect of the present disclosure, an endoscopic surgical device includes a handle assembly and an endoscopic assembly selectively connectable to the handle assembly and including a plurality of surgical anchors loaded within a lumen of the endoscopic assembly. The handle assembly includes a handle housing and a trigger operatively connected thereto, and a gear train actuatable by the trigger. The gear train includes: a drive gear keyed to a pivot end of the trigger and including a plurality of gear teeth; a clutch gear including a plurality of gear teeth in meshing engagement with the gear teeth of the drive gear; a bevel gear operatively engaged with the clutch gear and rotatable about a pivot axis, the bevel gear including gear teeth formed on a first face thereof; and a pinion gear non-rotatably secured to a drive shaft extending distally from the handle housing, the pinion gear including gear teeth operatively engaged with the gear teeth on the first face of the bevel gear.

[0009] The gear teeth of the drive gear may be disposed along an inner, upper edge of an opening defined within the drive gear and extending along an arcuate length of the drive gear. The clutch gear is at least partially disposed in a distal portion of the opening defined within the drive gear. The clutch gear may include an arm extending radially therefrom, the arm including a cam that projects from the arm. The bevel gear may include an arcuate slot formed in the first face for selectively receiving the cam of the clutch gear.

[0010] The handle assembly may include a biasing member having a first end fixedly connected in the handle housing and a second end connected to a stopper extending from a proximal surface of the drive gear. The handle

assembly may include a ratchet mechanism including a spring clip having a resilient finger configured for engagement with ratchet teeth formed on a second face of the bevel gear.

[0011] The endoscopic surgical device may include a ferrule that is rotatably and removably supported on the handle housing. The ferrule defines a distal opening that is operatively aligned with the drive shaft of the handle assembly and configured to receive a proximal end of the endoscopic assembly.

[0012] In embodiments, the ferrule includes a proximal tooth projecting from a proximal surface thereof configured to selectively engage one of a plurality of recesses defined in a distal face of an annular shoulder of the handle housing. In such embodiments, the ferrule has a lock position in which the proximal tooth is positioned within a first recess of the handle housing and an exchange position in which the proximal tooth is positioned within a second recess of the handle housing. In embodiments, the ferrule may include a pin projecting radially inward of a proximal surface thereof and the handle housing may include a slot recessed with an outer surface thereof, wherein the pin and the slot are configured to inter-engage when the ferrule is attached to the handle housing.

[0013] The handle assembly may include a safety lock assembly supported on the housing. The safety lock assembly includes a distal end disposed within the handle housing and being in operative association with the gear train, and a proximal end projecting from the handle housing and being in operative association with the ferrule. In use, when the ferrule is in a lock position, the distal end of the safety lock assembly is disengaged from the gear train to permit operation of the gear train, and when the ferrule is in an exchange position, the

distal end of the safety lock assembly engages the gear train to block operation of the gear train.

[0014] The ferrule is configured to actuate the safety lock assembly between the lock position and the exchange position as the ferrule is rotated about the handle housing. In embodiments, the proximal end of the safety lock assembly is a proximal end of a gear pin having a plurality of gear teeth disposed radially therearound, and the ferrule includes interior teeth disposed within an annular wall of the ferrule. In use, when the ferrule is in the lock position, the gear teeth on the proximal end of the gear pin are meshingly engaged with the interior teeth of the ferrule, and when the ferrule is in the exchange position, the gear teeth on the proximal end of the gear pin are not engaged with the interior teeth of the ferrule.

[0015] In embodiments, the distal end of the safety lock assembly is a surface of a safety pin having a plurality of teeth disposed thereon, and the gear pin includes a plurality of gear teeth disposed radially around a distal end thereof that are meshingly engaged with the teeth of the safety pin. In use, the safety pin is longitudinally translatable into and out of a slot disposed in the bevel gear when the gear pin is rotated by the ferrule when the ferrule is rotated between the exchange position and the lock position.

[0016] The endoscopic assembly may include an outer tube, an inner tube rotatably supported in the outer tube, the inner tube defining the lumen in which the plurality of surgical anchors are loaded, and a connector. The connector has an outer connector member non-rotatably connected to the proximal end of the outer tube and being non-rotatably connectable to the handle assembly, and an inner connector member non-rotatably connected to the proximal end of the

inner tube and being rotatably connectable to the gear train, wherein the outer connector member and the inner connector member are rotatable with respect to one another.

[0017] The drive shaft may be keyed for selective connection to the inner connector member supported at the proximal end of the inner tube. In embodiments, the handle housing includes a tooth projecting radially inward of an annular wall thereof, and the outer connector member includes a channel formed therein. The channel of the outer connector member receives the tooth of the handle housing when the endoscopic assembly is connected to the handle assembly, and the tooth inhibits rotation of the outer connector member when the trigger is actuated to rotate the inner connector member of the endoscopic assembly. In some embodiments, the channel of the outer connector member is formed in an outer radial surface and defines a length, and the ferrule includes a distal tooth disposed within the distal opening of the ferrule, the distal tooth being dimensioned to pass along the channel of the outer connector member. In use, when the endoscopic assembly is connected to the handle assembly, the distal tooth of the ferrule is disposed distally of the channel of the outer connector member, and the ferrule is rotatable to a lock position such that the distal tooth of the ferrule inhibits disconnection of the endoscopic assembly and handle assembly from one another.

[0018] According to another aspect of the present disclosure, an endoscopic surgical device includes a handle housing and a trigger operatively connected to the handle housing, a drive mechanism disposed within the handle housing that is actuatable by the trigger, a ferrule removably and rotatably connected to the handle housing, the ferrule defining a distal opening that is in operative alignment with a drive shaft of the drive mechanism, and a safety lock assembly

supported on the handle housing. The safety lock assembly includes a gear pin axially aligned with the drive shaft of the drive mechanism and a safety pin aligned transverse to the drive shaft of the drive mechanism. The safety pin is translatable along its axis by rotation of the gear pin caused by rotation of the ferrule. In use, when the ferrule is rotated to an exchange position, the safety pin engages the drive mechanism to block operation of the drive mechanism, and when the ferrule is rotated to a lock position, the safety pin is disengaged from the drive mechanism to permit operation of the drive mechanism. In embodiments, the safety pin is translatable into and out of a slot formed in a gear of the drive mechanism when the ferrule is rotated from the exchange position to the lock position.

[0019] The ferrule may include interior teeth disposed within an annular wall of the ferrule, and the gear pin may include a plurality of gear teeth disposed radially around a proximal end of the gear pin. In use, when the ferrule is in the exchange position, the gear teeth on the proximal end of the gear pin are not engaged with the interior teeth of the ferrule, and when the ferrule is in the lock position, the gear teeth on the proximal end of the gear pin are meshingly engaged with the interior teeth of the ferrule. The gear pin may include a plurality of gear teeth disposed radially around a distal end of the gear pin. The gear teeth on the distal end of the gear pin is meshingly engaged with a plurality of teeth disposed on a surface of the safety pin for translating the safety pin along its axis.

[0020] Further details and aspects of exemplary embodiments of the present disclosure are described in more detail below with reference to the appended figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Embodiments of the present disclosure are described herein with reference to the accompanying drawings, wherein:

[0022] FIG. 1 is a perspective view of a surgical anchor for use in an endoscopic surgical device in accordance with the present disclosure;

[0023] FIG. 2 is a side, elevational view of the surgical anchor of FIG. 1;

[0024] FIG. 3 is a distal, end view of the surgical anchor of FIG. 1;

[0025] FIG. 4 is a side, elevational view, partially broken away, of the surgical anchor of FIG. 1;

[0026] FIG. 5 is a perspective view of an endoscopic surgical device according to an aspect of the present disclosure;

[0027] FIG. 6 is a top, plan view of the surgical device of FIG. 5;

[0028] FIG. 7 is a left sectional, perspective view of the surgical device of FIG. 5, illustrating a half-section of the handle assembly removed therefrom;

[0029] FIG. 8 is a perspective view, with parts separated, of a clutch gear and a bevel gear of the surgical device of FIG. 5;

[0030] FIG. 9 is a right sectional, perspective view of the surgical device of FIG. 5, illustrating a half-section of the handle assembly removed therefrom;

[0031] FIG. 10 is an enlarged view of the indicated area of detail of FIG. 6, illustrating the ferrule in the lock position;

[0032] FIG. 11 is an enlarged view of the indicated area of detail of FIG. 6, illustrating the ferrule rotated to the exchange position;

[0033] FIG. 12 is an enlarged view of the indicated area of detail of FIG. 6, illustrating the ferrule rotated to the release position;

[0034] FIG. 13 is perspective view, with parts separated, of a ferrule and a nose cone of the surgical device of FIG. 5;

[0035] FIG. 14 is a perspective view of a safety lock assembly and a bevel gear of the surgical device of FIG. 5, illustrating a ferrule rotated to an exchange position;

[0036] FIG. 15 is a perspective view of the safety lock assembly and the bevel gear of FIG. 14, illustrating the ferrule rotated to the lock position;

[0037] FIG. 16 is a perspective view, with parts separated, of the endoscopic assembly of the surgical device of the present disclosure;

[0038] FIG. 17 is a rear, perspective view of the endoscopic assembly of the present disclosure;

[0039] FIG. 18 is a cross-sectional view of a distal end portion of an endoscopic assembly of the surgical device of FIG. 5, illustrating the endoscopic assembly during a firing stroke of the endoscopic surgical device; and

[0040] FIG. 19 is a perspective view of a connector and a nose cone of the surgical device of FIG. 5, with a ferrule removed therefrom.

DETAILED DESCRIPTION OF EMBODIMENTS

[0041] Embodiments of the presently disclosed endoscopic surgical device is described in detail with reference to the drawings, in which like reference numerals designate identical or corresponding elements in each of the several views. As used herein the term “distal” refers to that portion of the endoscopic surgical device that is farther from the user, while the term “proximal” refers to that portion of the endoscopic surgical device that is closer to the user.

[0042] Referring initially to FIGS. 1-4, a surgical anchor for use with an endoscopic surgical device of the present disclosure is illustrated and generally designated as anchor 100. As illustrated in FIGS. 1-4, anchor 100 includes a head section 110, a mesh retention section 120, and a threaded tissue-snaring section 130. Head section 110 includes a pair of opposing threaded sections 112a, 112b having respective radial outer helical head threads 114a, 114b, and a pair of opposing open or slotted sections 116a, 116b. A distal surface of head section 110 is formed onto or integral with a proximal end of mesh retention section 120.

[0043] Mesh retention section 120 of anchor 100 extends from and between a distal end or surface of head section 110 and a proximal end of tissue-snaring section 130. Mesh retention section 120 functions to lock, anchor, or otherwise retain a surgical mesh (not shown) onto anchor 100 when anchor 100 is screwed into the mesh to a depth past a proximal-most segment 138 of tissue-snaring thread 132 of tissue-snaring section 130. This is achieved because there is no thread located in mesh retention section 120 that would allow anchor 100 to be unscrewed or backed out from the mesh.

[0044] Mesh retention section 120 has a cylindrical or conical transverse cross-sectional profile. Mesh retention section 120 includes a transverse radial dimension, relative to a central longitudinal axis of anchor 100, that is smaller than a transverse radial dimension of head section 110, and smaller than a transverse radial dimension of proximal-most segment 138 of tissue-snaring thread 138.

[0045] Threaded tissue-snaring section 130 of anchor 100 includes helical threads 132 formed onto a tapered truncated body section 134. A distal point or tip 136 defines the terminus of the distal most tissue-snaring thread 132.

[0046] As shown in FIG. 4, body section 134 of tissue-snaring section 130 is tapered, i.e., becoming smaller toward the distal end of threaded tissue-snaring section 130, and terminates or truncates to a distal truncation point “TP”, prior to reaching an apex or tip of anchor 100. Body section 134 includes a concave taper such that, for a given length, a minimum diameter body section 134 is defined upon truncation thereof which, in embodiments, is approximately less than 0.01 inches.

[0047] Anchor 100 includes a transverse dimension “D”, of a distal-most thread in the threaded tissue-snaring section 130 which is as large as design constraints will allow, and in embodiments, approximately greater than 0.040 inches. In accordance with the present disclosure, a small truncated body diameter and a large value of “D” minimizes tissue indentation. The tissue-snaring threads 132 terminate at distal tip 136, which is distal of the truncation point of body section 134.

[0048] By providing a distal tip 136 extending distally of the truncation point of tissue-snaring section 130, a penetration of the mesh, by anchor 100, is

eased; and an indentation of the mesh into relatively soft tissue, by anchor 100, is minimized, as compared to an anchor having a non-truncated body with tapered threads.

[0049] For a given force applied to a surgical mesh by the surgeon, exerting a distal force on a tack applier, the larger the dimension “D” of anchor 100, the less the distal force that needs to be exerted in order to cause indentation of an underlying tissue and surgical mesh.

[0050] Anchor 100 is non-cannulated and is constructed from a suitable bioabsorbable material, such as, for example, polylactide and/or polyglycolide. In embodiments, anchor 100 is formed from a proprietary biocompatible copolymer (Lactomer USS L1, Boehringer Ingelheim LR 704 S, or Boehringer Ingelheim LG-857). Anchor may also be constructed from suitable non-bioabsorbable materials, or permanent material, such as, for example, stainless steel, titanium, and the like.

[0051] Turning now to FIGS. 5 and 6, an endoscopic surgical device, in the form of an endoscopic surgical tack applier or tacker, is shown generally as 200. Tack applier 200 includes a handle assembly 210, and a removable endoscopic assembly 300 (e.g., single use loading unit SULU) extending from handle assembly 210 and configured to store and selectively release or fire a plurality of anchors 100 (FIG. 1) therefrom.

[0052] Handle assembly 210 includes a handle housing 212 formed from a first half-section 212a and a second half section 212b joined to one another. First half-section 212a and second half section 212b of handle housing 212 may be joined to one another using know methods by those of skill in the art, including and not limited to ultrasonic welding, fasteners (i.e., screws), elastic

sealing rubber, adhesives, and the like. First half-section 212a and second half section 212b of handle housing 212 are joined to one another such that a fluid-tight seal is provided therebetween.

[0053] Handle housing 212 defines a fixed handle portion 216 having a free end 216a. Handle assembly 210 includes a trigger 214 pivotably connected to handle housing 212, at a pivot point disposed within handle housing 212. Trigger 214 includes a free end 214a spaced a distance from fixed handle portion 216 when trigger 214 is in an extended or un-actuated condition. Trigger 214 includes a pivot end 214b extending therefrom and extending into handle housing 212 through a side of handle housing 212.

[0054] A fluid-tight seal may be provided between pivot end 214b of trigger 214 and handle housing 212. In accordance with the present disclosure, an X-ring or the like, including an o-ring, etc., (not shown) may be used between pivot end 214b of trigger 214 and handle housing 212.

[0055] As illustrated in FIG. 7, handle assembly 210 supports drive mechanism or gear train 220 within handle housing 212. Gear train 220 includes a trigger or drive gear 222, a clutch gear 226, a bevel gear 228, and a pinion gear 230. Drive gear 222 is keyed, or non-rotatably connected, to pivot end 214b of trigger 214. Drive gear 222, which may be in the form of a quadrant gear or the like, has a plurality of gear teeth 222a formed along an inner, upper edge defined in of an opening 224 defined within, and extending along an arcuate length of, the drive gear 222. Drive gear 222 includes a stem or stopper 223 extending radially therefrom, at a location proximal of the gear teeth 222a.

[0056] The stopper 223 is connected to a biasing member 225 of handle assembly 210. Biasing member 225 is configured for maintaining trigger 214 in

an extended or un-actuated position. Biasing member 225 is also configured to have a spring constant sufficient to return trigger 214 to an un-actuated position following a partial or complete actuation of trigger 214. Biasing member 225 includes a first end 225a fixedly connected in handle housing 212 and a second end 225b connected to stopper 223 extending from drive gear 222.

[0057] Clutch gear 226 is pivotably and slidably supported on a pivot shaft 227, which defines a pivot axis, in handle housing 212. Clutch gear 226 may be in the form of a pinion gear or the like having a plurality of gear teeth 226a formed along a radial outer edge thereof and being in meshing engagement with gear teeth 222a of the drive gear 222. Clutch gear 226 is at least partially disposed within opening 224 of drive gear 222. When trigger 214 is in an un-actuated position, clutch gear 226 is positioned in a distal portion of opening 224 of drive gear 222. Clutch gear 226 includes an arm 226b extending radially therefrom. As shown in FIG. 8, in conjunction with FIG. 7, a cam or ramp 226c extends/projects from arm 226b of clutch gear 226. Cam 226c includes a front end having a height defining a shoulder, and a tail end tapering into arm 226b.

[0058] Bevel gear 228 is pivotably and slidably supported on pivot shaft 227 in handle housing 212. Bevel gear 228 may be in the form of a crown gear or the like. Bevel gear 228 is operatively engaged/associated with clutch gear 226. Bevel gear 228 defines an arcuate slot 228a formed in a first face 228d thereof for selectively receiving and engaging cam 226c of clutch gear 226. Slot 228a includes a front end wall configured to engage the front end of cam 226c of clutch gear 226, and tapers along a length thereof to be flush with first face 228d of bevel gear 228.

[0059] In operation, as trigger 214 of tacker 200 is actuated, trigger 214 causes drive gear 222 to be rotated, in a first direction. As drive gear 222 is rotated in the first direction, drive gear 222 causes clutch gear 226 to be rotated, in a first direction, about a pivot axis thereof. As clutch gear 226 is rotated in the first direction, the front end of cam 226c of clutch gear 226 is rotated in a first direction until the front end of cam 226c engages or contacts the front end wall of slot 228a of bevel gear 228. After the front end of cam 226c of clutch gear 226 engages or contacts the front end wall of slot 228a of bevel gear 228, continued rotation of clutch gear 226, in the first direction, results in concomitant rotation of bevel gear 228 in a first direction. At this point, bevel gear 228 continues to rotate in the first direction so long as trigger 214 is being actuated to a closed or fully actuated condition.

[0060] When actuation of trigger 214 is stopped, either prior to complete actuation or following complete actuation, rotation of bevel gear 228, in the first direction, is also stopped. Upon the completion of a partial or complete actuation of trigger 214 and a release thereof, trigger 214 causes drive gear 222 to be rotated, in a second direction (opposite the first direction). Rotation of drive gear 222 in the second direction causes clutch gear 226 to be rotated, in a second direction, about pivot shaft 227. As clutch gear 226 is rotated in the second direction, the tail end of cam 226c thereof slides along slot 228a of bevel gear 228, and, if the rotation in the second direction is sufficient, slides out of slot 228a of bevel gear 228 and along first face 228d of bevel gear 228.

[0061] If trigger 214 was fully actuated, a complete release of trigger 214, will result in clutch gear 226 making a complete revolution, in the second direction, until the front end of cam 226c of clutch gear 226 clears the front end

wall of slot 228a of bevel gear 228 to thereby re-enter slot 228a of bevel gear 228.

[0062] Pinion gear 230 is rotatably supported in a distal end of handle housing 212. Pinion-bevel gear 230 includes gear teeth 230a operatively engaged or meshed with gear teeth 228c formed on first face 228d of bevel gear 228. Pinion-bevel gear 230 is non-rotatably secured to a drive shaft 232 extending distally from handle housing 212. Drive shaft 232 is configured and dimensioned to engage an inner connector member 344 of endoscopic assembly 300 (FIGS. 16 and 17). In an embodiment, drive shaft 232 defines a plurality of axially extending ribs 232a at a distal end thereof.

[0063] In operation, upon squeezing of trigger 214, gear train 220 causes pinion gear 230 to rotate in a first direction. As pinion-bevel gear 230 is rotated in the first direction, pinion-bevel gear 230 transmits the rotation to inner tube 320 of endoscopic assembly 300 (FIG. 16).

[0064] As shown in FIGS. 8 and 9, handle assembly 210 of tack applier 200 is provided with a ratchet mechanism 260 which is configured to inhibit or prevent inner tube 320 (FIG. 16) from backing-out or reversing after anchor 100 (FIG. 16) has been at least partially driven into tissue. Ratchet mechanism 260 includes a series of ratchet teeth 228f formed on a second face 228b of bevel gear 228. Ratchet mechanism 260 further includes a spring clip 262 secured within handle assembly 210. Spring clip 262 includes a resilient finger 262a configured for engagement with ratchet teeth 228f of bevel gear 228.

[0065] In operation, resilient finger 262a of spring clip 262 engages with ratchet teeth 228f of bevel gear 228 in such a manner that as bevel gear 228 is rotated, in a first direction, resilient finger 262a of spring clip 262 cams over

ratchet teeth 228f and permits rotation of bevel gear 228. Also, if bevel gear 228 starts to rotate in a second direction (opposite to the first direction), resilient finger 262a of spring clip 262 stops along ratchet teeth 228f thereby preventing or inhibiting bevel gear 228 from rotating in the second direction. As such, any reverse rotation or “backing-out” of anchor 100 or inner tube 320 of endoscopic assembly 300 (tending to cause bevel gear 228 to rotate in the second direction), during a driving or firing stroke, is inhibited or prevented.

[0066] With reference again to FIGS. 5 and 6, handle assembly 210 includes a ferrule or collar 234 rotatably and removably supported on handle housing 212. Ferrule 234 defines a distal opening 234a that is axially aligned with drive shaft 232 (FIG. 7). Ferrule 234 includes a proximal tooth 234d that is biased to project from a proximal surface thereof. Proximal tooth 234d is configured to engage a selected one of recesses 212f, 212g of handle housing 212 defined in a distal face of an annular shoulder 212e of handle housing 212, as ferrule 234 is rotated relative to housing 212.

[0067] As shown in FIGS. 10-12, ferrule 234 is rotatable between a lock position (endoscopic assembly 300 is locked to handle assembly 212, and tacker 200 is ready to fire, FIG. 10); an exchange position (endoscopic assembly 300 can be connected/disconnected to/from handle assembly 212, and tacker 200 cannot be fired, FIG. 11); and a ferrule release position (ferrule 234 can be removed from handle housing 212, and handle housing 212 may be cleaned or sterilized, FIG. 12).

[0068] Handle housing 212 and ferrule 234, as illustrated in FIG. 13, also includes complementary inter-engaging features and/or structures which lock or fix a position/orientation of ferrule 234 relative to handle housing 212. Ferrule

234 includes a transverse pin 234c extending radially inward, and handle housing 212 includes an L-shaped slot 212d recessed within an outer surface of a nose 212c thereof. Pin 234c may be diametrically opposed and longitudinally aligned with proximal tooth 234d. Ferrule 234 also includes a distal tooth 234b projecting into distal opening 234a. Distal tooth 234b is dimensioned to slidably pass through an outer radial groove 342a of outer connector member 342 of endoscopic assembly 300 (FIG. 16).

[0069] Turning now to FIGS. 14 and 15, handle assembly 210 includes a safety lock assembly 240 supported on handle housing 212 and configured to permit and inhibit actuation of trigger 214, and for effectuating a loading/retention and a release/removal of endoscopic assembly 300 to handle housing 212. Safety lock assembly 240 is in operative association with ferrule 234 and is actuatable upon a rotation of ferrule 234 relative to handle housing 212. Safety lock assembly 240 includes a gear shaft 242 including a distal end 242a having a plurality of gear teeth 242b disposed radially therearound, and a proximal end 242c projecting proximally from handle housing 212 and having a plurality of gear teeth 242d disposed radially around proximal end 242c. Gear teeth 242d of proximal end 242c are configured to meshingly engage interior teeth 234e disposed within an annular wall 234f of ferrule 234. A safety pin 244 has a plurality of teeth 244a on a surface thereof that are transversely aligned with gear teeth 242b on distal end 242a of gear shaft 242. In an alternate embodiment, it is contemplated that safety lock assembly 240 may include a spring biased gear rack, wherein the gear rack is in meshing engagement with proximal end 242c of gear shaft 242.

[0070] In use, safety pin 244 is caused to be translated along its axis as gear shaft 242 is rotated due to interior teeth 234e of ferrule 234 acting on gear teeth

242d on proximal end 242c of gear shaft 242 when ferrule 234 is rotated relative to handle housing 212. In operation, when ferrule 234 is rotated to the exchange position, with trigger 214 in a fully un-actuated position, safety pin 244 is moved into a radial slot 228g formed in bevel gear 228, thereby preventing bevel gear 228 from rotating (FIG. 14). Moreover, when ferrule 234 is rotated to the lock position or the ready-to-fire position, safety pin 244 is translated out of radial slot 228g of bevel gear 228, thereby allowing bevel gear 228 to rotate (FIG. 15).

[0071] As shown in FIGS. 16-19, endoscopic assembly 300 includes an outer tube 310, an inner tube 320 rotatably disposed within outer tube 310, a guide coil or spring 330 disposed between outer tube 310 and inner tube 320, a plurality of anchors 100 loaded within inner tube 310, and a connector 340 supported at a proximal end of outer tube 310 and inner tube 320.

[0072] Outer tube 310 of endoscopic assembly 300 includes a proximal end 310a and a distal end 310b, and defines a lumen 310c therethrough. As described briefly above, endoscopic assembly 300 further includes a guide coil or spring 330 fixedly disposed within at least a distal portion of outer tube 310.

[0073] Endoscopic assembly 300 also includes an inner tube 320 rotatably disposed within coil 330. Inner tube 320 includes a proximal end portion 320a and a splined distal end portion 320b, and defines a lumen 320c therethrough.

[0074] Distal end portion 320b of inner tube 320 is slotted, defining a pair of opposed tines 320b₁ and a pair of opposed channels 320b₂. Distal end portion 320b of inner tube 320 is capable of accepting a plurality of anchors 100 within inner tube 320. In particular, anchors 100 are loaded into endoscopic assembly 300 such that the pair of opposing threaded sections 112a, 112b of anchors 100 extend through respective channels 320b₂ of distal end portion 320b of inner

tube 320 and are slidably disposed within the groove of coil 330, and the pair of tines 320b₁ of distal end portion 320b of inner tube 320 are disposed within the pair of slotted sections 116a, 116b of anchors 100.

[0075] In use, as inner tube 320 is rotated, about its longitudinal axis, with respect to coil 330, the pair of tines 320b₁ of inner tube 320 transmit the rotation to anchors 100 and advance anchors 100 distally owing to head threads 114a, 114b of anchors 100 engaging with coil 330.

[0076] Endoscopic assembly 300 includes a connector 340 having an outer connector member 342 non-rotatably connected to proximal end 310a of outer tube 310, and an inner connector member 344 non-rotatably connected to proximal end 320a of inner tube 320. Inner connector member 344 is substantially cylindrical and defines at least one longitudinally extending inner rib 344a projecting radially into a lumen thereof. Inner connector member 344 is nested within outer connector member 342. Outer connector member 342 is substantially cylindrical and defines at least one longitudinally extending outer radial groove 342a that extends through a proximal end thereof, and at least one longitudinally extending inner groove 342b. Outer connector member 342 is sized and shaped to be inserted into distal opening 234a of ferrule 234 of handle assembly 210 and into an annular wall 212h of nose 212c of handle housing 212, as shown in FIGS. 19.

[0077] Annular wall 212h of nose 212c of handle housing 212 surrounds the distal end of drive shaft 232. Annular wall 212h includes a tooth 212i projecting radially inward therefrom. When ferrule 234 is in the exchange position, distal tooth 234b of ferrule 234 is radially aligned with tooth 212i of

annular wall 212h. When ferrule 234 is in the lock position, distal tooth 234b of ferrule 234 is radially out of alignment with tooth 212i of annular wall 212h.

[0078] In order to connect endoscopic assembly 300 to handle assembly 210, with ferrule 234 in the exchange position, outer radial groove 342a of outer connector member 342 is first aligned with distal tooth 234b of ferrule 234 and with tooth 212i of annular wall 212h of nose 212c. Then, outer connector member 342 is fully inserted into ferrule 234 and annular wall 212h, tooth 212i of annular wall 212h of nose 212c is disposed within outer radial groove 342a of outer connector member 342, and distal tooth 234b of ferrule 234 is disposed distally of outer connector member 342.

[0079] When outer connector member 342 is fully inserted into ferrule 234 and annular wall 212h, the distal end of drive shaft 232 enters into inner connector member 344 such that the at least one longitudinally extending inner rib 344a of inner connector member 344 mechanically engages or meshes with the plurality of axially extending ribs 232a provided at the distal end of drive shaft 232.

[0080] With outer connector member 342 is fully inserted into ferrule 234 and annular wall 212h, ferrule 234 is rotated from the exchange position to the lock position, whereby distal tooth 234b of ferrule 234 is rotated to a radial position, out of alignment with outer radial groove 342a of outer connector member 342, to block withdrawal of outer connector member 342 from within ferrule 234 and from within annular wall 212h of nose 212c of handle housing 212.

[0081] Endoscopic assembly 300 includes a shipping wedge, plug or cap 350 configured and adapted for selective connection to connector 340. Cap 350

includes an end wall 352, at least one leg 354 extending from end wall 352 and being configured and dimensioned for selective receipt in a respective longitudinally extending outer radial groove 342a of outer connector member 342, and a stem (not shown) extending from end wall 352 and being configured and dimensioned for selective receipt into inner connector member 344 for engagement with longitudinally extending inner rib(s) 344a of inner connector member 344. When cap 350 is secured to connector 340, the at least one leg 354 and the stem of cap 350 engage outer connector member 342 and inner connector member 344 to prevent their rotation relative to one another.

[0082] Cap 350 is used to fix the radial position of inner tube 320 relative to outer tube 310 and thus ensure that the stack of surgical anchors 100 are not prematurely advanced through endoscopic assembly 300 prior to connection of endoscopic assembly 300 to handle assembly 210. If the stack of surgical anchors 100 are advanced through endoscopic assembly 300, prior to connection of endoscopic assembly 300 to handle assembly 210, a timing of the firing of tack applier 200 may be effected, whereby each fully stroke of trigger 214 may either not fully fire a surgical anchor 100 from endoscopic assembly 300 or may begin to fire a second surgical anchor 100 from endoscopic assembly 300.

[0083] In an operation of surgical tacker 200 with endoscopic assembly 300 operatively connected and locked to handle assembly 210, as described above, as drive shaft 232 is rotated due to an actuation of trigger 214, also as described above, said rotation is transmitted to inner tube 320 of endoscopic assembly 300 via the engagement of the plurality of axially extending ribs 232a provided at the distal end of drive shaft 232 with the at least one longitudinally extending inner rib 344a of inner connector member 344.

[0084] Again, as inner tube 320 is rotated, about its longitudinal axis, with respect to coil 330, the pair of tines 320a₁ of inner tube 320 transmit the rotation to the entire stack of anchors 100 and advance the entire stack of anchors 100 distally, owing to head threads 114a, 114b of anchors 100 engaging with coil 330.

[0085] In accordance with the present disclosure, the components of surgical tacker 200, and anchors 100 are dimensioned such that a single complete and full actuation of trigger 214 results in a firing of a single anchor 100 (i.e., the distal-most anchor of the stack of anchors 100 loaded in endoscopic assembly 300) from endoscopic assembly 300.

[0086] Surgical tacker 200 may be repeatedly fired to fire anchors from endoscopic assembly 300 until the surgical procedure is complete or until endoscopic assembly 300 is spent of anchors 100. If endoscopic assembly 300 is spent of anchors 100, and if additional anchors 100 are required to complete the surgical procedure, spent endoscopic assembly 300 may be replaced with a new (i.e., loaded with anchors 100) endoscopic assembly 300. Alternatively, if it is desired to change the types of anchors 100 that are being used in the surgical procedure, non-spent endoscopic assembly 300 (loaded with a first type of anchors 100) may be replaced with another endoscopic assembly 300 (loaded with a second, different type of anchors 100).

[0087] In order to replace an endoscopic assembly 300 with another endoscopic assembly 300, with trigger 214 in the fully un-actuated position, as described above, the surgeon actuates or rotates ferrule 234 from the locked position (FIG. 10) to the exchange position (FIG. 11) to release the loaded or connected endoscopic assembly 300, decouples or withdraws endoscopic

assembly 300 from handle assembly 210, loads or connects a new endoscopic assembly 300 to handle assembly 210, and actuates or rotates ferrule 234 from the exchange position to the locked position to retain the new endoscopic assembly 300 in handle assembly 210.

[0088] Following a surgical procedure, ferrule 234 may be removed or disconnected from handle housing 212 such that the ferrule 234 and the remainder of handle assembly 210 may be cleaned by sterilization, washing, wiping, autoclaving, chemical processing, and the like. In order to disconnect ferrule 234 from handle housing 212, ferrule 234 is rotated from the exchange position (FIG. 11) to the release position (FIG. 12), wherein ferrule 234 is rotated relative to handle housing 212 until pin 234c of ferrule 234 is at the end of L-shaped slot 212d of nose 212c of handle housing 212. At this point, ferrule 234 may be axially separated from handle housing 212.

[0089] In accordance with the present disclosure, it is contemplated that a plurality of different endoscopic assemblies 300 may be provided, wherein endoscopic assemblies may be available which are loaded with surgical anchors fabricated from different materials (e.g., bioabsorbable, permanent, etc.), or endoscopic assemblies may be available having different lengths (e.g., short, medium, long, etc.) wherein the particular length endoscopic assembly is loaded with a respective number of surgical anchors. Accordingly, depending on the particular surgical procedure (i.e., hernia procedure), the surgeon may select any one or combination of endoscopic assemblies desired or needed, and the surgeon may interchange or exchange endoscopic assemblies as needed or desired during the surgical procedure.

[0090] In an embodiment, it is contemplated that all the endoscopic assemblies may have the same length, but be loaded with varying numbers of surgical anchors therein. In this manner, the surgeon may choose an endoscopic assembly loaded with fewer or more surgical anchors depending on the type of surgical procedure to be performed.

[0091] In accordance with the present disclosure, it is also contemplated that handle assembly 100 may be replaced by an electromechanical control module configured and adapted to drive the inner tube of anchor retaining/advancing assembly to fire or actuate the surgical device. The electromechanical control module may include at least one microprocessor, at least one drive motor controllable by the at least one microprocessor, and a source of power for energizing the at least one microprocessor and the at least one drive motor.

[0092] It will be understood that various modifications may be made to the embodiments disclosed herein. For example, the gear teeth of the drive gear may be provided on an inner, lower edge of the opening in the drive gear, or a radial outer edge of the drive gear, and the clutch gear may be positioned about a proximal end of the gear teeth to effect proper rotation of the drive mechanism. Therefore, the above description should not be construed as limiting, but merely as exemplifications of various embodiments. Those skilled in the art will envision other modifications within the scope and spirit of the claims appended thereto.

WHAT IS CLAIMED IS:

1. An endoscopic surgical device, comprising;
a handle assembly including a handle housing and a trigger operatively connected to the handle housing, and a gear train actuatable by the trigger, the gear train including:
a drive gear keyed to a pivot end of the trigger, the drive gear including a plurality of gear teeth;
a clutch gear including a plurality of gear teeth in meshing engagement with the gear teeth of the drive gear;
a bevel gear operatively engaged with the clutch gear and rotatable about a pivot axis, the bevel gear including gear teeth formed on a first face thereof; and
a pinion gear non-rotatably secured to a drive shaft extending distally from the handle housing, the pinion gear including gear teeth operatively engaged with the gear teeth on the first face of the bevel gear;
and
an endoscopic assembly selectively connectable to the handle assembly and including a plurality of surgical anchors loaded within a lumen of the endoscopic assembly.
2. The endoscopic surgical device according to claim 1, wherein the gear teeth of the drive gear are disposed along an inner, upper edge of an opening defined within the drive gear and extending along an arcuate length of the drive gear, and the clutch gear is at least partially disposed in a distal portion of the opening defined within the drive gear.

3. The endoscopic surgical device according to claim 1, wherein the clutch gear includes an arm extending radially therefrom, the arm including a cam that projects from the arm, and the bevel gear includes an arcuate slot formed in the first face for selectively receiving the cam of the clutch gear.

4. The endoscopic surgical device according to claim 1, wherein the handle assembly further includes a biasing member having a first end fixedly connected in the handle housing and a second end connected to a stopper extending from a proximal surface of the drive gear.

5. The endoscopic surgical device according to claim 1, wherein the handle assembly further includes a ratchet mechanism, the ratchet mechanism including a spring clip having a resilient finger configured for engagement with ratchet teeth formed on a second face of the bevel gear.

6. The endoscopic surgical device according to claim 1, further comprising a ferrule rotatably and removably supported on the handle housing, the ferrule defining a distal opening that is operatively aligned with the drive shaft of the handle assembly and configured to receive a proximal end of the endoscopic assembly.

7. The endoscopic surgical device according to claim 6, wherein the ferrule includes a proximal tooth projecting from a proximal surface thereof configured to selectively engage one of a plurality of recesses defined in a distal face of an annular shoulder of the handle housing, wherein the ferrule has a lock position in which the proximal tooth is positioned within a first recess of the

handle housing and an exchange position in which the proximal tooth is positioned within a second recess of the handle housing.

8. The endoscopic surgical device according to claim 6, wherein the handle assembly further includes a safety lock assembly supported on the handle housing, the safety lock assembly including a distal end disposed within the handle housing and being in operative association with the gear train, and a proximal end projecting from the handle housing and being in operative association with the ferrule, wherein:

when the ferrule is in a lock position, the distal end of the safety lock assembly is disengaged from the gear train to permit operation of the gear train; and

when the ferrule is in an exchange position, the distal end of the safety lock assembly engages the gear train to block operation of the gear train.

9. The endoscopic surgical device according to claim 8, wherein the ferrule is configured to actuate the safety lock assembly between the lock position and the exchange position as the ferrule is rotated about the handle housing.

10. The endoscopic surgical device according to claim 8, wherein the proximal end of the safety lock assembly is a proximal end of a gear pin having a plurality of gear teeth disposed radially therearound, and the ferrule includes interior teeth disposed within an annular wall of the ferrule, wherein:

when the ferrule is in the lock position, the gear teeth on the proximal end of the gear pin are meshingly engaged with the interior teeth of the ferrule; and

when the ferrule is in the exchange position, the gear teeth on the proximal end of the gear pin are not engaged with the interior teeth of the ferrule.

11. The endoscopic surgical device according to claim 10, wherein the distal end of the safety lock assembly is a surface of a safety pin having a plurality of teeth disposed thereon, and the gear pin includes a plurality of gear teeth disposed radially around a distal end thereof that are meshingly engaged with the teeth of the safety pin, such the safety pin is longitudinally translatable into and out of a slot disposed in the bevel gear when the gear pin is rotated by the ferrule when the ferrule is rotated between the exchange position and the lock position.

12. The endoscopic surgical device according to claim 6, wherein the ferrule further includes a pin projecting radially inward of a proximal surface thereof and the handle housing includes a slot recessed within an outer surface thereof, wherein the pin and the slot are configured to inter-engage when the ferrule is attached to the handle housing.

13. The endoscopic surgical device according to claim 6, wherein the endoscopic assembly includes:

- an outer tube;

- an inner tube rotatably supported in the outer tube, the inner tube defining the lumen in which the plurality of surgical anchors are loaded; and

- a connector having:

- an outer connector member non-rotatably connected to the proximal end of the outer tube and being non-rotatably connectable to the handle assembly; and

an inner connector member non-rotatably connected to the proximal end of the inner tube and being rotatably connectable to the gear train, wherein the outer connector member and the inner connector member are rotatable with respect to one another.

14. The endoscopic surgical device according to claim 13, wherein the drive shaft is keyed for selective connection to the inner connector member supported at the proximal end of the inner tube.

15. The endoscopic surgical device according to claim 14, wherein the handle housing includes a tooth projecting radially inward of an annular wall thereof, and the outer connector member includes a channel formed therein, wherein the channel of the outer connector member receives the tooth of the handle housing when the endoscopic assembly is connected to the handle assembly, wherein the tooth inhibits rotation of the outer connector member when the trigger is actuated to rotate the inner connector member of the endoscopic assembly.

16. The endoscopic surgical device according to claim 15, wherein the channel of the outer connector member is formed in an outer radial surface and defines a length, and the ferrule includes a distal tooth disposed within the distal opening of the ferrule, the distal tooth being dimensioned to pass along the channel of the outer connector member, wherein when the endoscopic assembly is connected to the handle assembly, the distal tooth of the ferrule is disposed distally of the channel of the outer connector member, and wherein the ferrule is rotatable to a lock position such that the distal tooth of the ferrule inhibits

disconnection of the endoscopic assembly and handle assembly from one another.

17. An endoscopic surgical device, comprising:
a handle housing and a trigger operatively connected to the handle housing;
a drive mechanism disposed within the handle housing and actuatable by the trigger;
a ferrule removably and rotatably connected to the handle housing, the ferrule defining a distal opening that is in operative alignment with a drive shaft of the drive mechanism; and
a safety lock assembly supported on the handle housing, the safety lock assembly including a gear pin axially aligned with the drive shaft of the drive mechanism and a safety pin aligned transverse to the drive shaft of the drive mechanism, the safety pin being translatable along its axis by rotation of the gear pin caused by rotation of the ferrule, wherein:
when the ferrule is rotated to an exchange position, the safety pin engages the drive mechanism to block operation of the drive mechanism; and
when the ferrule is rotated to a lock position, the safety pin is disengaged from the drive mechanism to permit operation of the drive mechanism.

18. The endoscopic surgical device according to claim 17, wherein the safety pin is translatable into and out of a slot formed in a gear of the drive mechanism when the ferrule is rotated from the exchange position to the lock position.

19. The endoscopic surgical device according to claim 17, wherein the ferrule includes interior teeth disposed within an annular wall of the ferrule and

the gear pin includes a plurality of gear teeth disposed radially around a proximal end of the gear pin, wherein:

when the ferrule is in the exchange position, the gear teeth on the proximal end of the gear pin are not engaged with the interior teeth of the ferrule; and

when the ferrule is in the lock position, the gear teeth on the proximal end of the gear pin are meshingly engaged with the interior teeth of the ferrule.

20. The endoscopic surgical device according to claim 17, wherein the gear pin includes a plurality of gear teeth disposed radially around a distal end of the gear pin, the gear teeth on the distal end of the gear pin being meshingly engaged with a plurality of teeth disposed on a surface of the safety pin for translating the safety pin along its axis.

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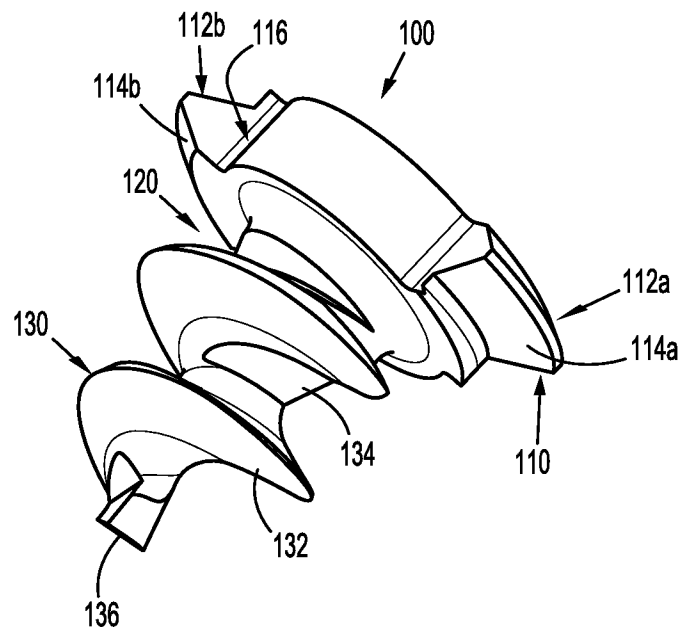


FIG. 1

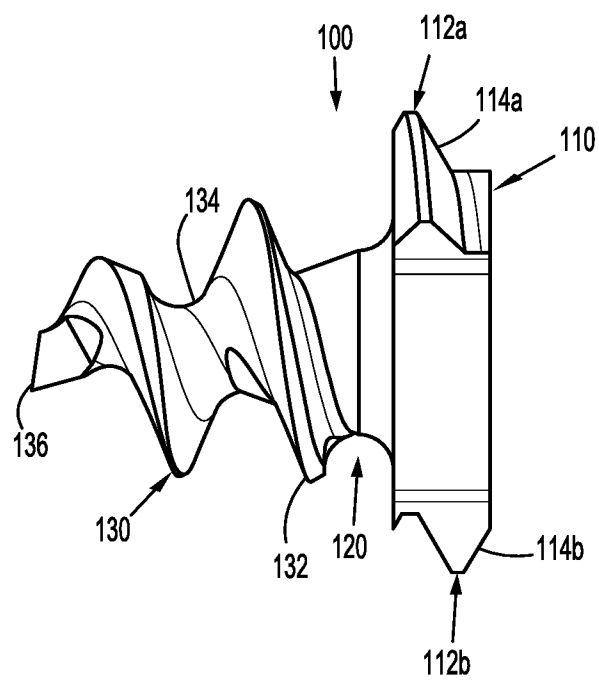
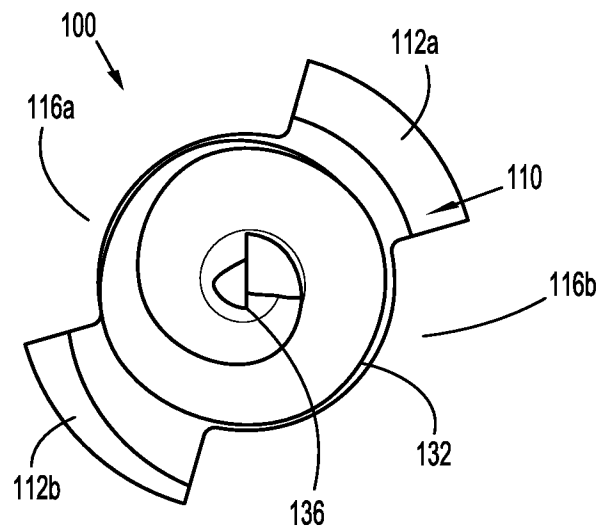
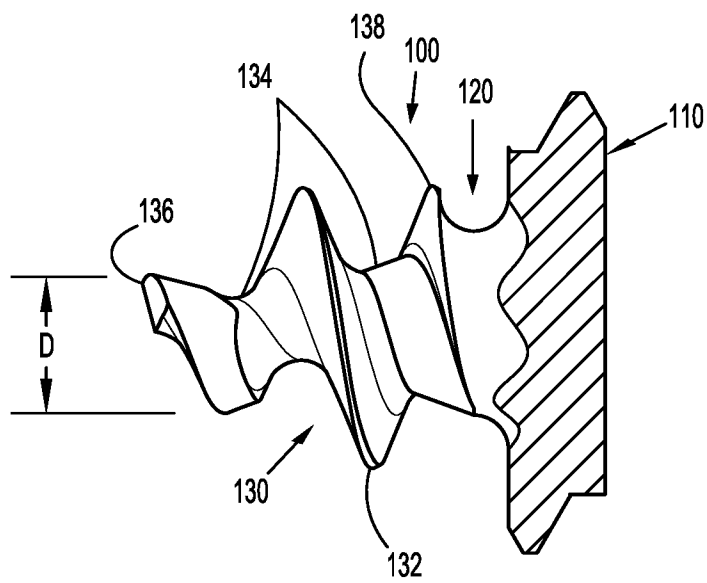
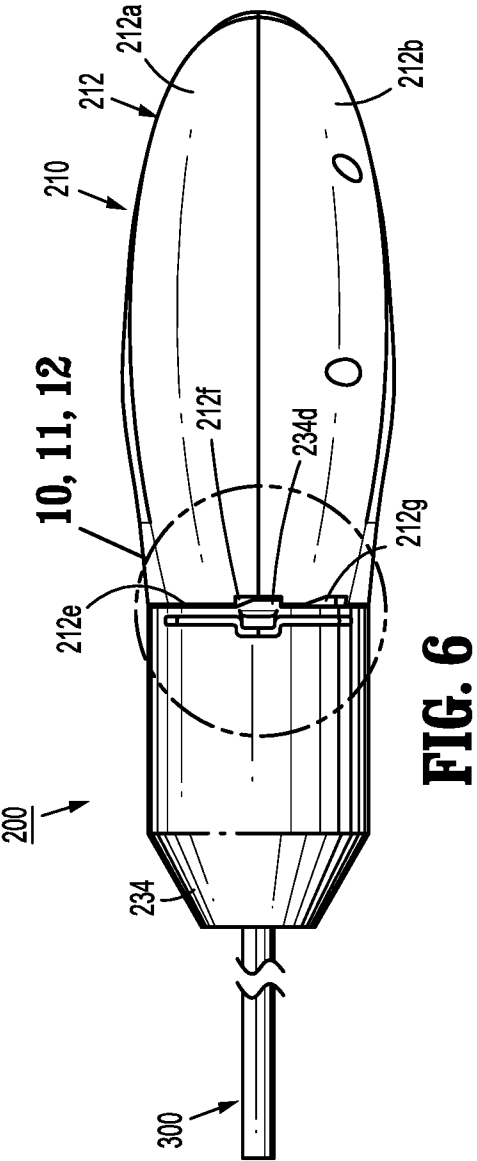
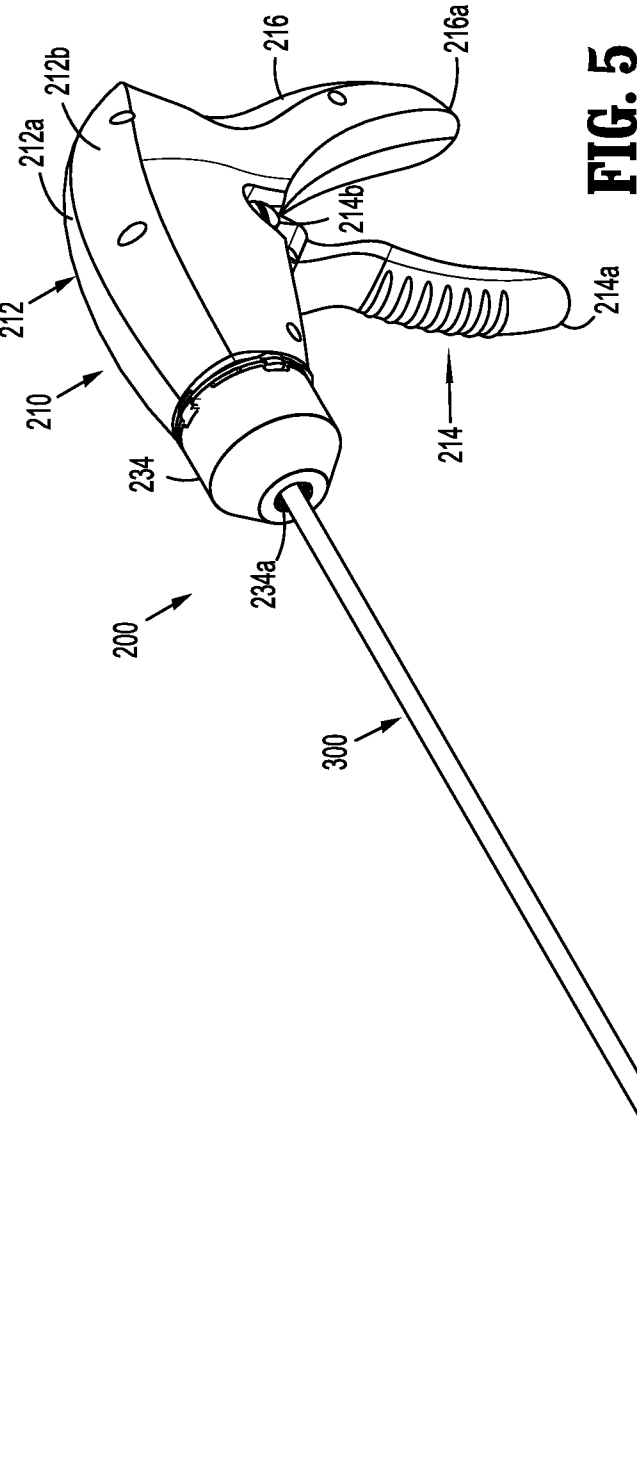


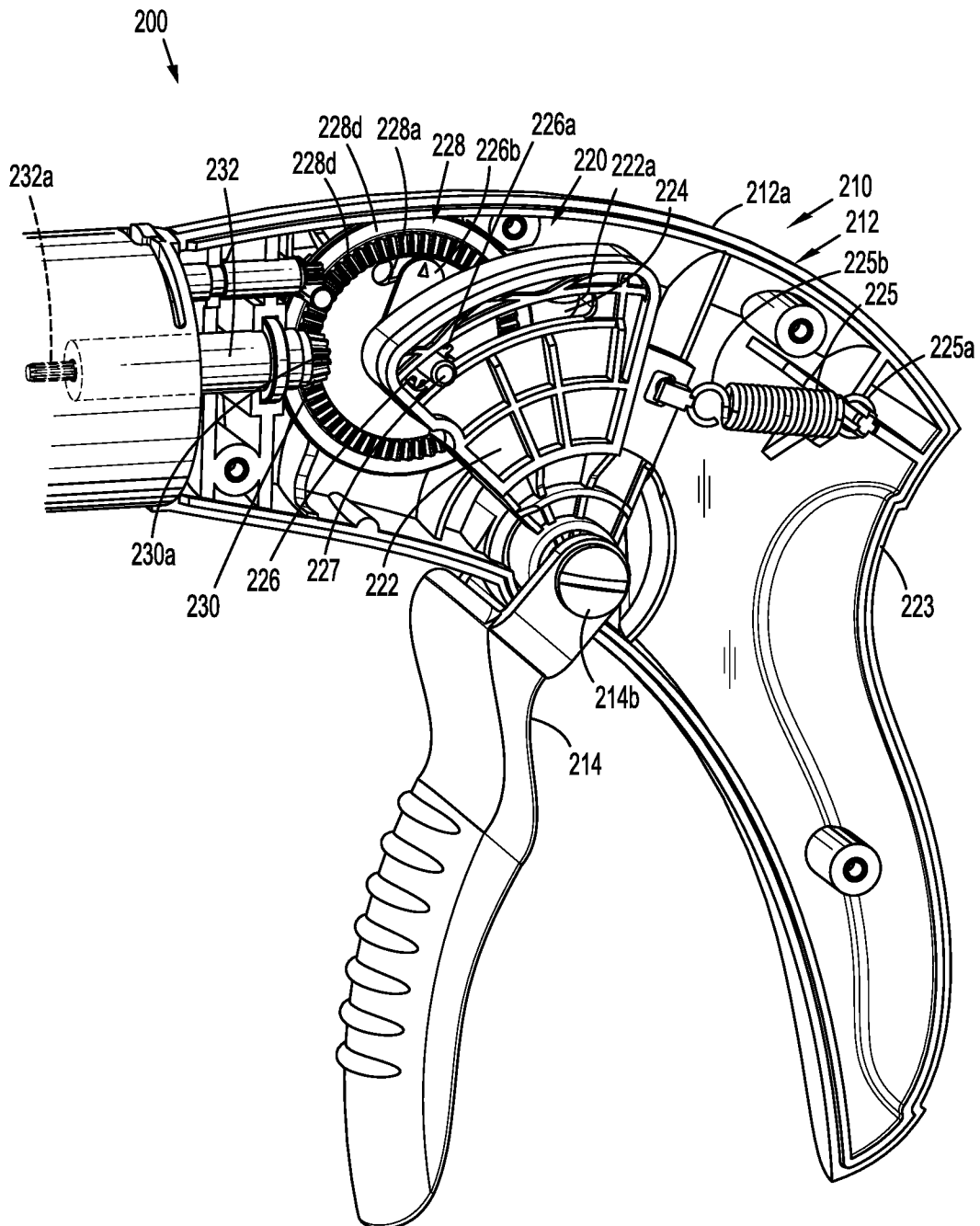
FIG. 2

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**FIG. 3****FIG. 4**



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**FIG. 7**

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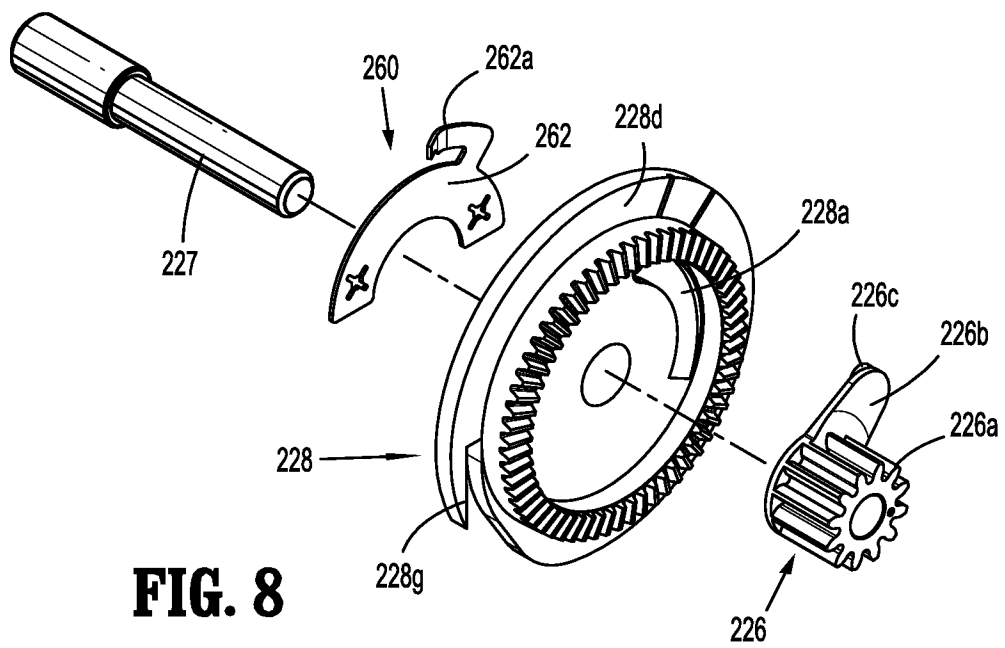


FIG. 8

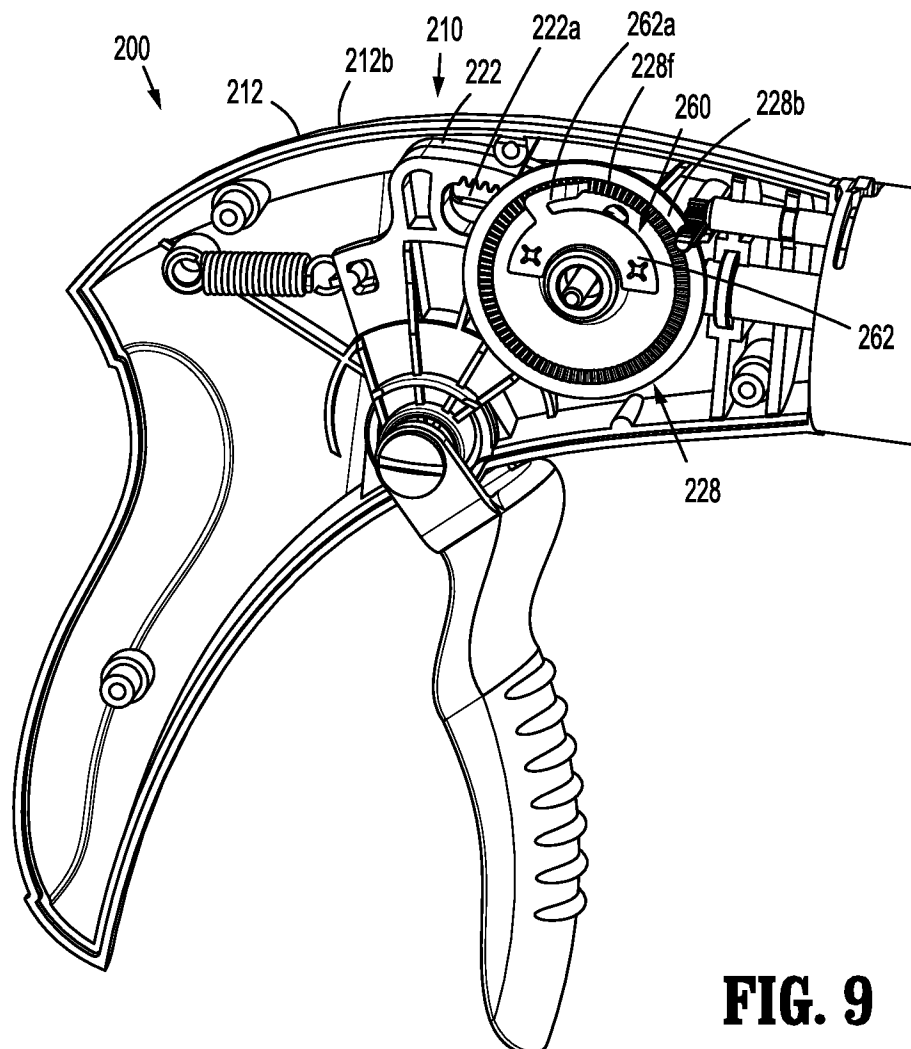


FIG. 9

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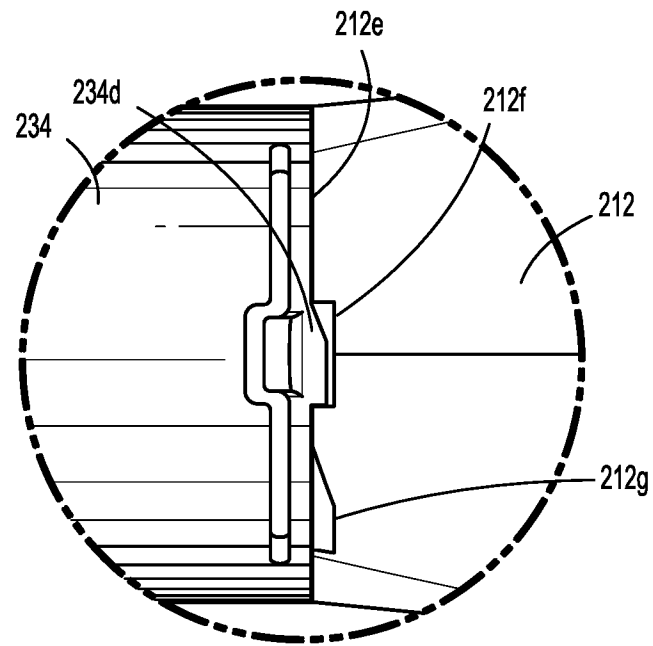


FIG. 10

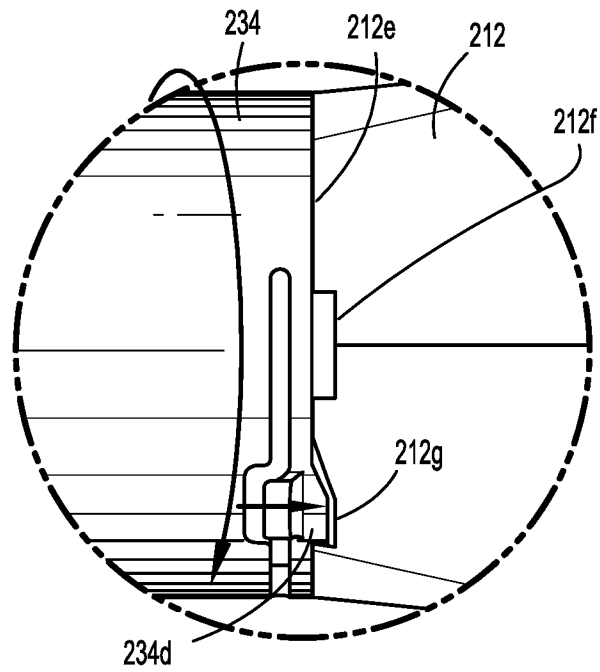


FIG. 11

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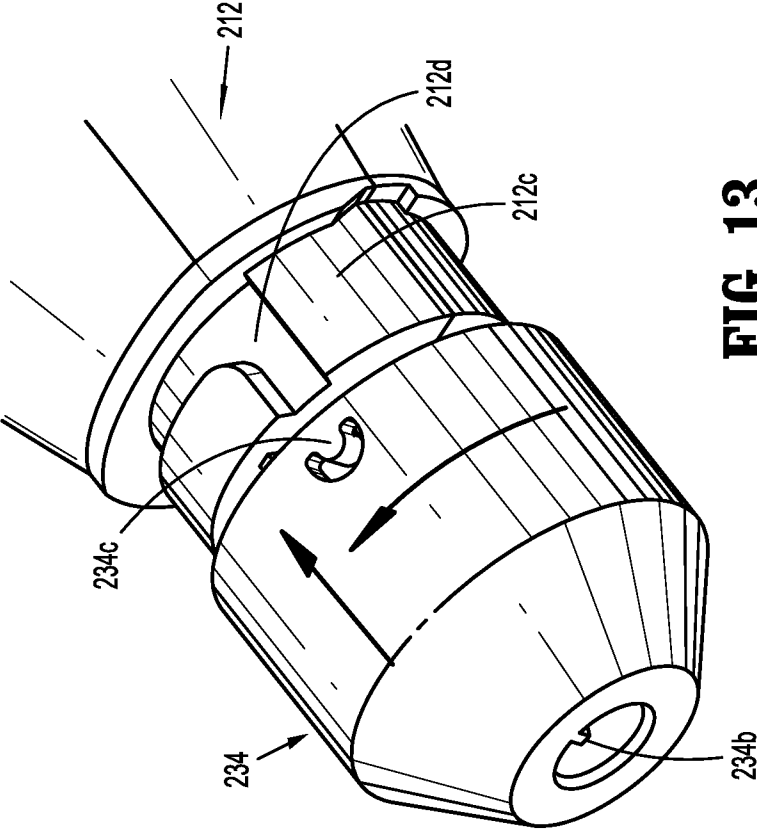


FIG. 13

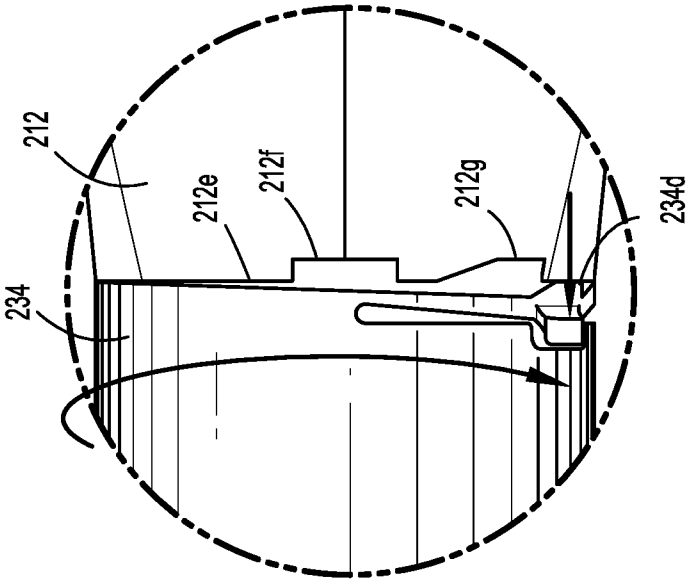


FIG. 12

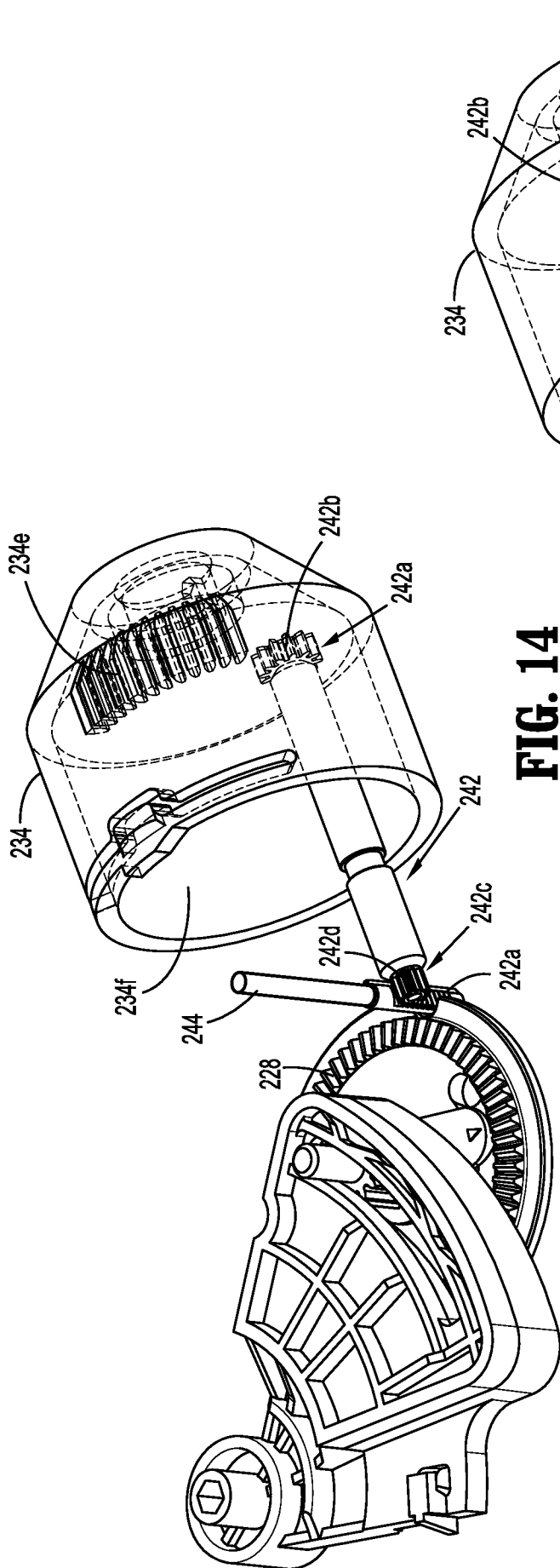


FIG. 14

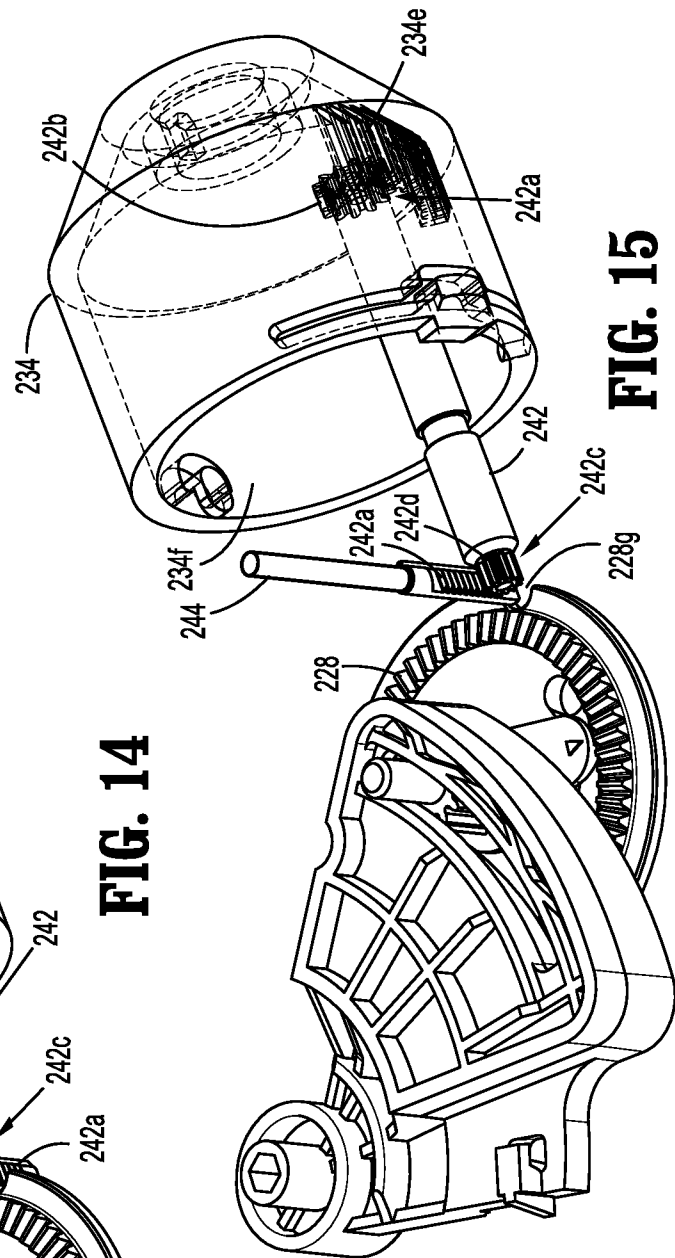
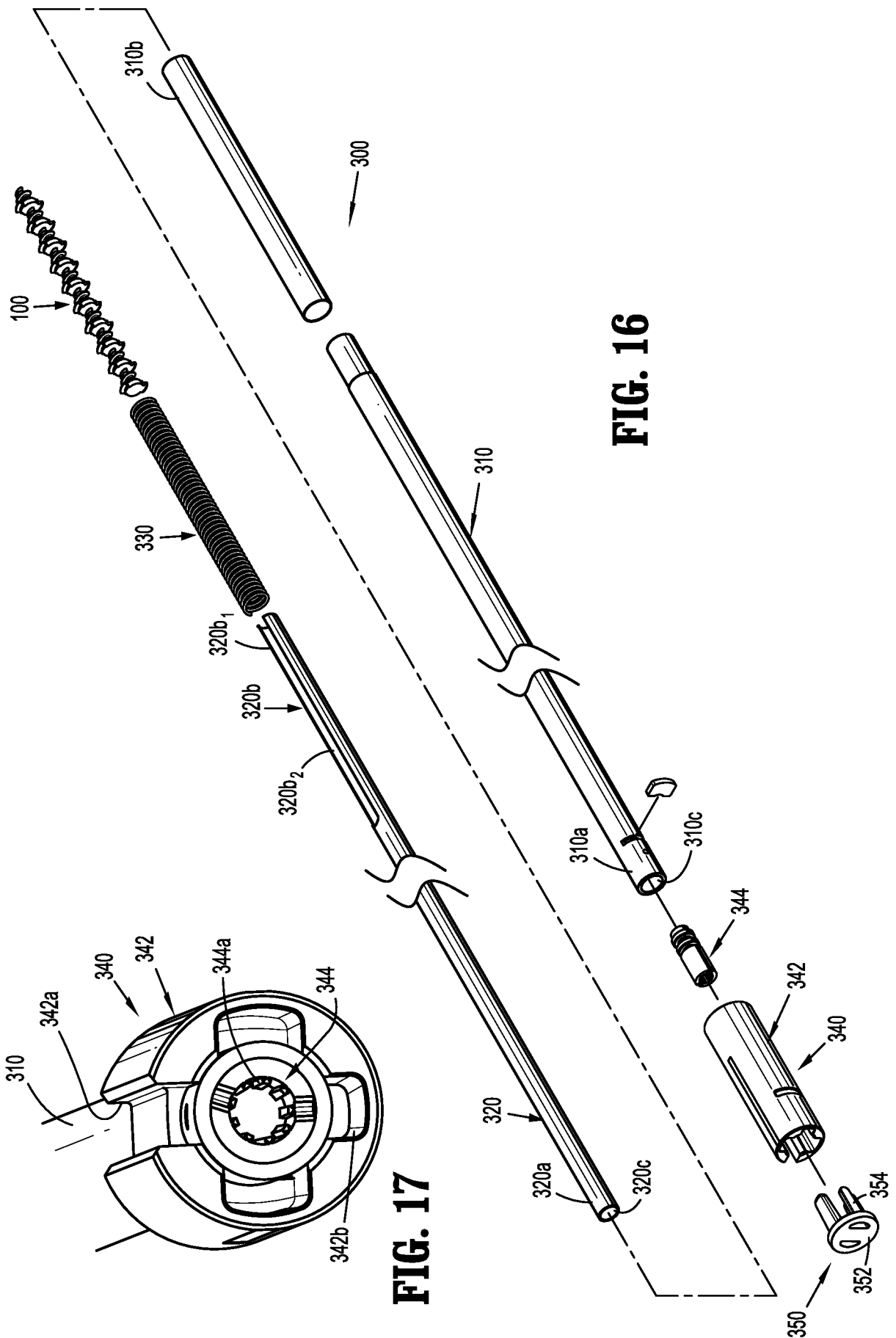


FIG. 15



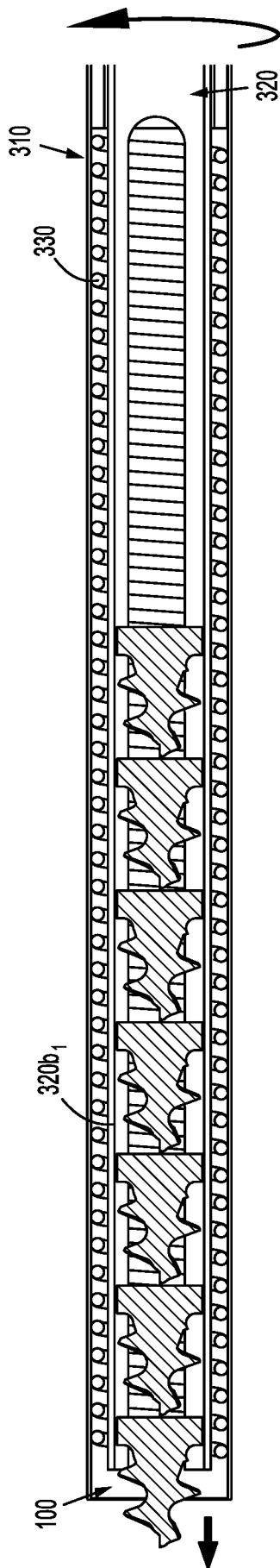


FIG. 18

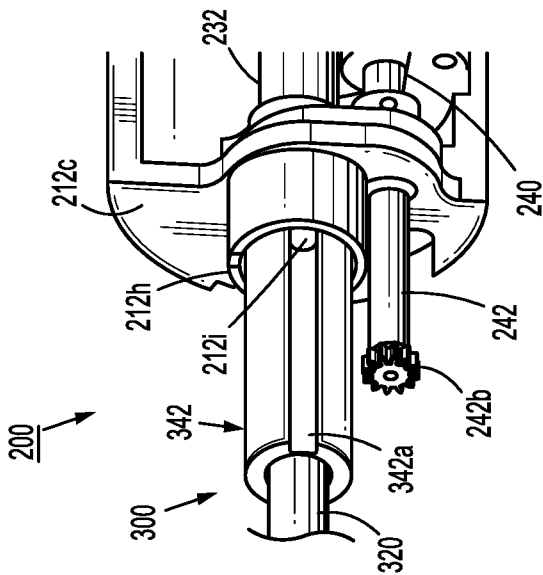


FIG. 19

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2014/081618

A. CLASSIFICATION OF SUBJECT MATTER

A61B 17/068(2006.01)i; A61B 17/94(2006.01)i; A61B 17/115(2006.01)i; A61B 17/064(2006.01)n

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61B 17/-

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)

CNPAT, CNKI, WPI, EPODOC: COVIDIEN LP, fastener?, anchor?, mesh+, applicator, apply+, tacker, saf+, security, lock+, ferrule, collar, endoscopic, gear

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2008/0281336 A1 (ZERGIEBEL, EARL M.) 13 November 2008 (2008-11-13) description, paragraphs [0096] and [0099]-[0128] and figures 1A and 2-18	1-2, 4
X	US 2003/0009441 A1 (HOLSTEN, HENRY E. ET AL.) 09 January 2003 (2003-01-09) description, paragraphs [0081] and [0088]-[0103] and figures 1-20	1-2, 4
X	EP 1908409 A1 (TYCO HEALTHCARE GROUP, LP) 09 April 2008 (2008-04-09) description, paragraphs [0045]-[0059] and figures 1-12	1-2, 4
A	US 2002/0087170 A1 (KUHN, JESSE J. ET AL.) 04 July 2002 (2002-07-04) the whole document	1-20
A	CN 102458268 A (ETHICON INC.) 16 May 2012 (2012-05-16) the whole document	1-20



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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

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

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

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

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

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

“&” document member of the same patent family

Date of the actual completion of the international search

26 February 2015

Date of mailing of the international search report

03 April 2015

Name and mailing address of the ISA/CN

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Facsimile No. (86-10)62019451

Telephone No. (86-10)61648439

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2014/081618

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				US	2013041386	A9	14 February 2013
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