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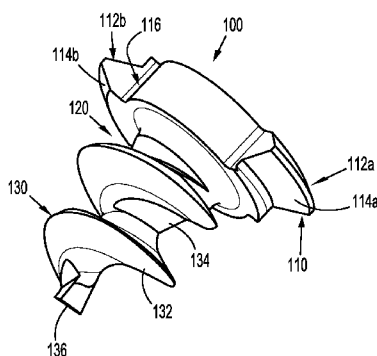


FIG. 1

(57) **Abstract:** An endoscopic surgical device is provided and includes a handle assembly including a handle housing and a trigger operatively connected to the handle housing, and a drive mechanism actuatable by the trigger; an endoscopic assembly selectively connectable to the handle assembly and configured to releasably house a plurality of tacks therein; a tacker counter mechanism; and an endoscopic assembly counter mechanism. The tacker counter mechanism includes a counter gear disposed in mechanical cooperation with the drive mechanism, and a tacker counter configured to display a number. Actuation of the trigger changes the number displayed by the tacker counter. At least one of engagement and disengagement between the endoscopic assembly and the handle assembly changes the number displayed by the endoscopic assembly counter mechanism.



SURGICAL FASTENER APPLYING APPARATUS, KITS AND METHODS FOR ENDOSCOPIC PROCEDURES

BACKGROUND

1. 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, to kits, and methods of use thereof.

2. Background of Related Art

[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 configured to 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 re-used for continuing the surgical procedure and/or for a following 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, kits, and methods of use thereof.

[0008] According to an aspect of the present disclosure, an endoscopic surgical device is provided and includes a handle assembly including a handle

housing and a trigger operatively connected to the handle housing, and a drive mechanism actuatable by the trigger, an endoscopic assembly selectively connectable to the handle assembly and configured to releasably house a plurality of tacks therein, a tacker counter mechanism, and an endoscopic assembly counter mechanism. The tacker counter mechanism is disposed in mechanical cooperation with the handle assembly and includes a counter gear disposed in mechanical cooperation with the drive mechanism, and a tacker counter configured to display a number. Actuation of the trigger changes the number displayed by the tacker counter. The endoscopic assembly counter mechanism is disposed in mechanical cooperation with the handle assembly, and includes a rack gear disposed in mechanical cooperation with an endoscopic assembly counter configured to display a number. At least one of engagement and disengagement between the endoscopic assembly and the handle assembly changes the number displayed by the endoscopic assembly counter mechanism.

[0009] The endoscopic surgical device may be configured such that removal of the endoscopic assembly from the handle assembly causes the tacker counter to display zero.

[0010] The tacker counter may include numbers between zero and ten. The tacker counter mechanism may include a counter spring which biases the counter gear to its initial position where the tacker counter displays zero. The tacker counter mechanism may further include a counter stop disposed in at least partially within the handle assembly. The counter stop is configured to prevent the counter gear from rotating toward its initial position under the bias of the counter spring when the handle assembly is engaged with the endoscopic assembly. Further, removal of the endoscopic assembly from the handle assembly may cause the counter spring to biases the counter gear to its initial position such that the tacker counter displays zero.

[0011] The endoscopic surgical device may be configured such that disengagement between the endoscopic assembly and the handle assembly changes the number displayed by the endoscopic assembly counter mechanism.

[0012] The rack gear of the endoscopic assembly counter mechanism may physically limit the number of times the handle assembly is able to engage the endoscopic assembly.

[0013] The present disclosure also relates to a handle assembly for use with a surgical device. The handle assembly includes a handle housing, a trigger operatively connected to the handle housing, a drive mechanism disposed at least partially within the handle housing and being actuatable by the trigger, a tacker counter mechanism disposed in mechanical cooperation with the handle assembly, and an endoscopic assembly counter mechanism disposed in mechanical cooperation with the handle assembly. The tacker counter mechanism includes a counter gear disposed in mechanical cooperation with the drive mechanism, and a tacker counter configured to display a number. Actuation of the trigger changes the number displayed by the tacker counter. The endoscopic assembly counter mechanism display a number. At least one of engagement and disengagement between an endoscopic assembly and the handle assembly changes the number displayed by the endoscopic assembly counter mechanism.

[0014] In the disclosed handle assembly, removal of an endoscopic assembly from the handle assembly causes the tacker counter to display zero. The tacker counter may include the numbers between zero and ten. The tacker counter mechanism may include a counter spring which biases the counter gear to its initial position where the tacker counter displays zero. Here, the tacker counter mechanism may include a counter stop disposed in at least partially within the handle assembly. The counter stop is configured to prevent the

counter gear from rotating toward its initial position under the bias of the counter spring when the handle assembly is engaged with an endoscopic assembly. In this disclosed handle assembly, removal of an endoscopic assembly from the handle assembly can cause the counter spring to biases the counter gear to its initial position such that the tacker counter displays zero.

[0015] In embodiments of the handle assembly, disengagement between an endoscopic assembly and the handle assembly changes the number displayed by the endoscopic assembly counter mechanism.

[0016] It is further disclosed that the endoscopic assembly counter mechanism includes a rack gear which physically limits the number of times the handle assembly is able to engage an endoscopic assembly.

[0017] The present disclosure also relates to a surgical kit including a handle assembly, and at least one endoscopic assembly selectively connectable to the handle assembly. The handle assembly includes a handle housing and a trigger operatively connected to the handle housing, a drive mechanism actuatable by the trigger, a tacker counter mechanism configured to display a number, and an endoscopic assembly counter mechanism configured to display a number. Actuation of the trigger changes the number displayed by the tacker counter mechanism, and at least one of engagement and disengagement between an endoscopic assembly and the handle assembly changes the number displayed by the endoscopic assembly counter mechanism.

[0018] It is further disclosed that the kit includes a plurality of tacks configured to be releasably housed within the at least one endoscopic assembly. It is disclosed that the at least one endoscopic assembly includes ten disposable endoscopic assemblies. It is further disclosed that the endoscopic assembly counter mechanism prevents the handle assembly from engaging with more

endoscopic assemblies than the number of endoscopic assemblies included in the kit.

[0019] 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

[0020] Embodiments of the present disclosure are described herein with reference to the accompanying drawings, wherein:

[0021] FIG. 1 is a perspective view of a surgical anchor for use in an endoscopic surgical device in accordance with the present disclosure;

[0022] FIG. 2 is a side, elevational view of the surgical anchor of FIG. 1;

[0023] FIG. 3 is a distal, end view of the surgical anchor of FIGS. 1 and 2;

[0024] FIG. 4 is a side, elevational view, partially broken away, of the surgical anchor of FIGS. 1-3;

[0025] FIG. 5 is a perspective view of an endoscopic surgical device according to an aspect of the present disclosure;

[0026] FIG. 6 is a top, plan view of the surgical device of FIG. 5;

[0027] FIG. 7 is a side, elevational view of the surgical device of FIGS. 5 and 6;

[0028] FIG. 8 is a rear, perspective view of the surgical device of FIGS. 5-7, illustrating a handle assembly and an endoscopic assembly thereof separated from one another;

[0029] FIG. 9 is a right, front, perspective view of the surgical device of FIGS. 5-8, illustrating a first half-section of the handle assembly removed therefrom;

[0030] FIG. 10 is a left, front, perspective view of the surgical device of FIGS. 5-8, illustrating a second half-section of the handle assembly removed therefrom;

[0031] FIG. 11 is a left, front, perspective view, with parts separated, of the surgical device of FIGS. 5-8, illustrating a second half-section of the handle assembly removed therefrom;

[0032] FIG. 12 is a front, perspective view of the surgical device of FIGS. 5-8, illustrating a ferrule removed therefrom;

[0033] FIG. 13 is an enlarged view of the indicated area of detail of FIG. 12;

[0034] FIG. 14 is an enlarged view of the indicated area of detail of FIG. 5, illustrating the ferrule in a lock position;

[0035] FIG. 15 is an enlarged view of the indicated area of detail of FIG. 6, illustrating the ferrule in the lock position;

[0036] FIG. 16 is a cross-sectional view as taken through section line 16-16 of FIG. 6;

[0037] FIG. 17 is a front, perspective view of a lock out assembly and a first bevel gear of a gear train of the present disclosure;

[0038] FIG. 18 is a rear, perspective view of the lock out assembly and the first bevel gear of the gear train of the present disclosure;

[0039] FIG. 19 is a front, plan view of the lock out assembly and the first bevel gear of the gear train of the present disclosure;

[0040] FIG. 20 is a perspective view, with parts separated, of the endoscopic assembly of the surgical device of the present disclosure;

[0041] FIG. 21 is a rear, perspective view of the endoscopic assembly of the present disclosure;

[0042] FIG. 22 is a rear, perspective view of the endoscopic assembly of the present disclosure, illustrating a shipping plug connected thereto;

[0043] FIG. 23 is a perspective view of the shipping plug of the present disclosure;

[0044] FIG. 24 is a perspective view of a distal end portion of the endoscopic assembly with an outer tube and a coil removed therefrom, shown with surgical anchors loaded therein;

[0045] FIG. 25 is a perspective view of the distal end portion of the endoscopic assembly with the outer tube and the coil removed therefrom, shown with surgical anchors separated therefrom;

[0046] FIG. 26 is a side elevational view of the handle assembly, with a housing half-section removed therefrom, illustrating the handle assembly during a firing stroke of the endoscopic surgical device;

[0047] FIG. 27 is an enlarged view of the indicated area of detail of FIG. 26;

[0048] FIG. 28 is a cross-sectional view of the distal end portion of the endoscopic assembly, as taken through section line 28-28 of FIG. 8, illustrating the endoscopic assembly during a firing stroke of the endoscopic surgical device;

[0049] FIG. 29 is an illustration of surgical anchors of the present disclosure fixing a surgical mesh in place;

[0050] FIG. 30 is an enlarged view of the indicated area of detail of FIG. 6, illustrating the ferrule being rotated from the lock position to an exchange position;

[0051] FIG. 31 is a cross-sectional view as taken through section line 31-31 of FIG. 6, illustrating the ferrule being rotated from the lock position to the exchange position;

[0052] FIG. 32 is an enlarged view of the indicated area of detail of FIG. 6, illustrating the ferrule rotated to the exchange position;

[0053] FIG. 33 is a cross-sectional view as taken through section line 33-33 of FIG. 6, illustrating the ferrule rotated to the exchange position;

[0054] FIG. 34 is a rear, perspective view of the lock out assembly and the first bevel gear of the gear train of the present disclosure, illustrating the ferrule rotated to the exchange position;

[0055] FIG. 35 is a front, plan view of the lock out assembly and the first bevel gear of the gear train of the present disclosure, illustrating the ferrule rotated to the exchange position;

[0056] FIG. 36 is a front, perspective view of the handle assembly, illustrating the ferrule rotated to the exchange position;

[0057] FIG. 37 is a front, perspective view of the handle assembly and the endoscopic assembly, illustrating a connection of the endoscopic assembly to the handle assembly;

[0058] FIG. 38 is a front, perspective view of the handle assembly and the endoscopic assembly, illustrating the endoscopic assembly fully connected to the handle assembly;

[0059] FIG. 39 is a front, perspective view of the handle assembly (with the ferrule removed therefrom) and the endoscopic assembly, illustrating the endoscopic assembly fully connected to the handle assembly;

[0060] FIG. 40 is a front, perspective view of the handle assembly and the endoscopic assembly, illustrating the endoscopic assembly fully connected to the handle assembly, and illustrating the ferrule being rotated to the lock position;

[0061] FIG. 41 is an enlarged view of the indicated area of detail of FIG. 6, illustrating the ferrule rotated to a release position;

[0062] FIG. 42 is a cross-sectional view as taken through section line 42-42 of FIG. 6, illustrating the ferrule rotated to the release position;

[0063] FIG. 43 is a rear, perspective view of the lock out assembly and the first bevel gear of the gear train of the present disclosure, illustrating the ferrule rotated to the release position;

[0064] FIG. 44 is a front, plan view of the lock out assembly and the first bevel gear of the gear train of the present disclosure, illustrating the ferrule rotated to the release position;

[0065] FIG. 45 is a front, perspective view of the surgical device of FIGS. 5-8, illustrating a ferrule removed therefrom;

[0066] FIG. 46 is a rear, perspective view of the ferrule, illustrating internal features thereof;

[0067] FIG. 47 is an enlarged, plan view (with portions in phantom) illustrating the ferrule in the release position relative to a handle housing of the handle assembly;

[0068] FIG. 48 is a perspective view of an endoscopic surgical device according to another aspect of the present disclosure;

[0069] FIG. 49 is a cross-sectional view of a portion of the endoscopic surgical device of FIG. 48;

[0070] FIGS. 50A-50C are cross-sectional views of a portion of the endoscopic surgical device of FIG. 48 shown during different stages of actuation;

[0071] FIG. 51 is an enlarged view of the area of detail depicted in FIG. 49;

[0072] FIG. 52 is a combination side view and end view of a proximal portion of the endoscopic surgical device of FIGS. 48-51;

[0073] FIG. 53 is an enlarged view of the area of detail depicted in FIG. 49; and

[0074] FIG. 54 is a top view of the area of detail depicted in FIG. 53.

DETAILED DESCRIPTION OF EMBODIMENTS

[0075] 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.

[0076] Referring initially to FIGS. 1-4, a surgical anchor for use with the surgical tack applier 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 radially, 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.

[0077] 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) on to 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.

[0078] 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.

[0079] 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.

[0080] 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 is approximately less than 0.01 inches.

[0081] 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 or 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 “TP” of body section 134.

[0082] By providing a distal tip 136 extending distally of truncation point “TP” 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.

[0083] 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.

[0084] Anchor 100 is non-cannulated and is constructed from a suitable bioabsorbable material, such as, for example, polylactide, polyglycolide. Anchor 100 is formed from a proprietary biocompatible co-polymer (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.

[0085] Turning now to FIGS. 5-47, 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 therefrom and into mesh “M” overlying tissue “T”. (FIG. 29).

[0086] As illustrated in FIGS. 5-15, 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) 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.

[0087] 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.

[0088] 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.

[0089] As illustrated in FIGS. 9-19, handle assembly 210 supports a gear train 220 within handle housing 212. Gear train 220 includes a trigger or drive gear 222 keyed to or non-rotatably connected to pivot end 214b of trigger 214. Drive gear 222 is a two tiered gear including a first drive gear 222a, and a second drive gear 222b. First drive gear 222a may be in the form of a quadrant gear or the like having a plurality of gear teeth 222a₁ formed along a radial outer edge thereof and extending along an arcuate length of first drive gear 222a. First drive gear 222a includes a stem or stopper 223a extending radially therefrom, at a location proximal of gear teeth 222a₁. Second drive gear 222b defines a plurality of gear teeth 222b₁ formed along a radial outer edge thereof.

[0090] Gear train 220 further includes a transmission gear assembly 224 pivotably supported in handle housing 212. Transmission gear assembly 224 is a three tiered gear including a first transmission gear 224a, a second transmission gear 224b, and third transmission gear 224c each rotatably supported on a common pivot axis. First transmission gear 224a may be in the form of a pinion gear or the like having a plurality of gear teeth 224a₁ formed along a radial outer edge thereof and being in meshing engagement with gear teeth 222a₁ of first drive gear 222a. Second transmission gear 224b may be in the form of a quadrant gear or the like having a plurality of gear teeth 224b₁ formed along a radial outer edge thereof and extending along an arcuate length of second transmission gear 224b. Third transmission gear 224c may be in the form of a pinion gear or the like having a plurality of gear teeth 224c₁ formed

along a radial outer edge thereof and being in meshing engagement with gear teeth 224b₁ of second transmission gear 224b.

[0091] Gear train 220 also includes a clutch gear 226 pivotably and slidably supported on a pivot axis 227a 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 226a₁ formed along a radial outer edge thereof and being in meshing engagement with gear teeth 224b₁ of second transmission gear 224b. Clutch gear 226 is biased into meshing engagement with second transmission gear 224b by a biasing member 227b (FIGS. 10 and 11). Clutch gear 226 includes an arm 226b extending radially therefrom, and a cam or ramp 226c (FIG. 11) extending/projecting from arm 226b. Cam 226c includes a front end having a height defining a shoulder, and a tail end tapering into arm 226b.

[0092] Gear train 220 further includes a first bevel gear 228 pivotably and slidably supported on pivot axis 227a in handle housing 212. First bevel gear 228 may be in the form of a crown gear or the like. First bevel gear 228 is operatively engaged/associated with clutch gear 226. First bevel gear 228 defines an arcuate slot 228a formed in 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 the first face of first bevel gear 228.

[0093] 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 first transmission gear 224a and second transmission gear 224b to be rotated, in a first direction, about the pivot axis thereof. As second transmission gear 224b is rotated in the first direction, second transmission gear 224b causes clutch gear 226 to be rotated, in a first direction, about a pivot axis thereof.

[0094] 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 first 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 first bevel gear 228, continued rotation of clutch gear 226, in the first direction, results in concomitant rotation of first bevel gear 228 in a first direction. At this point, first 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.

[0095] When actuation of trigger 214 is stopped, either prior to complete actuation or following complete actuation, rotation of first 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). As drive gear 222 is rotated in the second direction, drive gear 222 causes first transmission gear 224a and second transmission gear 224b to be rotated, in a second direction, about the pivot axis thereof. As second transmission gear 224b is rotated in the second direction, second transmission gear 224b causes clutch gear 226 to be rotated, in a second direction, about pivot axis 227a. As clutch gear 226 is rotated in the second direction, the tail end of cam 226c thereof slides along slot 228a of first bevel gear 228, and, if the rotation in the second direction is sufficient, slides out of slot 228a of first bevel gear 228 and along first face 228d of first bevel gear 228. As cam 226c of clutch gear 226 slides along slot 228a of first bevel gear 228, clutch gear 226 slides axially along pivot axis 227a and compresses biasing member 227b.

[0096] 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 228b of first bevel gear 228 to thereby re-enter slot 228b of first bevel gear 228. Specifically, as the front end of cam 226c of clutch gear 226 clears the front end wall of slot 228b of first bevel gear 228, biasing member 227b forces clutch gear 226 axially along pivot axis 227a and cam 226c of clutch gear 226 back into slot 228b of first bevel gear 228.

[0097] As illustrated in FIGS. 11 and 26, handle assembly 210 includes a biasing member 225 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 the 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 stem 223a extending from first drive gear 222a.

[0098] With reference to FIGS. 9-11, 26 and 27, handle assembly 210 includes an audible/tactile feedback mechanism 250 supported within handle housing 212 and in operative association with drive gear 222. Specifically, audible/tactile feedback mechanism 250 includes a dial 252 rotatably supported in handle housing 212. Dial 252 includes a tooth 252a extending therefrom. Dial 252 is spring biased to a home position. Audible/tactile feedback mechanism 250 further includes a tooth or stem 223b extending from second drive gear 222b. In operation, as trigger 214 is actuated and second drive gear 222b rotated, stem 223b of second drive gear 222b contacts tooth 252a of dial 252 causing dial 252 to rotate against the bias of a spring member 254. When stem 223b of second drive gear 222b clears tooth 252a of dial 252, dial 252 is returned to or snapped back to the home position thereof due to the bias of spring member 254. When dial 252 is snapped back to the home position thereof, dial 252 creates an audible and/or tactile response.

[0099] As shown in FIGS. 9, 11, 18 and 19, handle assembly 210 of tack applier 200 is provided with a ratchet mechanism 260 which is configured to inhibit or prevent inner tube 320 (FIGS. 20, 24 and 25) from backing-out or reversing after anchor 100 has been at least partially driven into tissue. Ratchet mechanism 260 includes, as seen in FIGS. 9 and 11, a series of ratchet teeth 228f formed on a rear or second face of first bevel gear 228.

[00100] 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 formed on rear surface of first bevel gear 228.

[00101] In operation, resilient finger 262a of spring clip 262 engages with ratchet teeth 228f of first bevel gear 228 in such a manner that as first 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 first bevel gear 228. Also, if first 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 first 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 first bevel gear 228 to rotate in the second direction), during a driving or firing stroke, is inhibited or prevented.

[00102] With reference to FIGS. 10, 11 and 26, handle assembly 210 further includes a second or pinion-bevel gear 230 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 the front face of first 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. 20 and 21). In an embodiment, drive shaft 232 defines a plurality of axially extending ribs 232a at a distal end thereof.

[00103] In operation, upon squeezing of trigger 214, gear train 220 causes pinion-bevel 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.

[00104] With reference to FIGS. 5-16, 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. Ferrule 234 includes a stopper or tooth 234b extending radially into distal opening 234a.

[00105] Ferrule 234 is rotatable between a lock position (anchor retaining/advancing assembly 300 is locked to handle assembly 212, and tacker 200 is ready to fire, FIGS. 14-16); an exchange position (anchor retaining/advancing assembly 300 can be connected/disconnected to/from handle assembly 212, and tacker 200 can not be fired, FIGS. 30-33); and a ferrule release position (ferrule 234 can be removed from handle housing 212, and handle housing 212 may be cleaned or sterilized, FIGS. 41 and 42).

[00106] Handle housing 212 and ferrule 234, as illustrated in FIGS. 45-47, may include 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 opposed radially inwardly extending nubs 234c and handle housing 212 includes a pair of L-shaped slots 212d formed in an outer surface of a nose 212c thereof. Housing defines an annular shoulder 212e around a proximal end of nose 212c. Shoulder 212e defines a pair of recesses 212f, 212g formed in a distal face of shoulder 212e.

[00107] Turning now to FIGS. 10, 12, 13 and 36-40, nose 212c of handle housing 212 includes a distally extending annular wall 212h surrounding 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, stopper or tooth 234b of ferrule 234 is radially aligned with tooth 212i of annular wall 212h. When ferrule 234 is in the lock position, stopper or tooth 234b of ferrule 234 is radially out of alignment with tooth 212i of annular wall 212h.

[00108] Ferrule 234 includes a second tooth 234d projecting from a proximal surface thereof. Tooth 234d is configured to engage a selected one of recesses 212f, 212g of housing 212 as ferrule 234 is rotated relative to housing 212. Tooth 234d is biased to project from proximal end of ferrule 234.

[00109] As shown in FIGS. 9-13, 16-19, 30-35 and 42-44, handle assembly 210 includes a safety lock assembly 240 supported on handle housing 212 and being 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 lock pin 242 slidably supported in and projecting distally from handle housing 212. Pin 242 includes a transverse head 242a extending therefrom. Head 242a of lock pin 242 is operatively disposed within or between internal walls 234e (FIGS. 16, 31, 33, 42 and 46) provided in ferrule 234.

[00110] Safety lock assembly 240 includes a lock plate 244 supported on a proximal end 242b of lock pin 242. Lock plate 244 has a generally pie-shaped profile. In use, lock plate 244 is caused to be rotated as lock pin 242 is rotated, due to internal walls 234e of ferrule 234 acting on head 242a of pin 242 as ferrule 234 is rotated relative to handle housing 212. In operation, when ferrule

234 is rotated to the exchange position or the ready-to-fire position, with trigger 214 in a fully un-actuated position, lock plate 244 is rotated into a radial slot 228g formed in first bevel gear 228, thereby preventing first bevel gear 228 from rotating. Moreover, when ferrule 234 is rotated to the lock position, lock plate 244 is rotated out of radial slot 228g of first bevel gear 228, thereby allowing first bevel gear 228 to rotate.

[00111] Safety lock assembly 240 further includes a biasing member 246 configured to bias head 242a of pin 242 and lock plate 244 to the rotated lock position.

[00112] Turning now to FIGS. 5, 8-10 and 20-25, as illustrated therein, 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.

[00113] 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.

[00114] 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.

[00115] 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.

[00116] 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.

[00117] As illustrated specifically in FIGS. 20 and 21, 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 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 annular wall 212h of nose 212c of handle housing 212.

[00118] Inner connector member 344 is substantially cylindrical and defines at least one longitudinally extending inner rib 344a projecting radially into a lumen thereof.

[00119] 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 stopper or 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 stopper or tooth 234b of ferrule 234 is disposed distally of outer connector member 342.

[00120] 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.

[00121] 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 stopper or 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.

[00122] As illustrated in FIGS. 20-23, 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 (FIG. 21) 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.

[00123] 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 applicator 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.

[00124] In an operation of surgical tacker 200, as illustrated in FIGS. 26-28, 36 and 37, 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.

[00125] 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.

[00126] 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.

[00127] 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).

[00128] As shown in FIGS. 14-19 and 30-33, 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 (FIGS. 14-19) to the exchange position (FIGS. 30-33) 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.

[00129] 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. With reference to FIGS. 30-33 and 41-47, in order to disconnect ferrule 234 from handle housing 212, ferrule 234 is rotated from the exchange position (FIGS. 30-33) to the release

position (FIGS. 41-44), wherein ferrule 234 is rotated relative to handle housing 212 until radially inwardly extending nubs 234c of ferrule 234 are at the end of a long leg of L-shaped slots 212d of nose 212c of handle housing 212. At this point, ferrule 234 may be axially separated from handle housing 212.

[00130] Referring now to FIGS. 48-54, a surgical tacker or tack applicator 200a in accordance with disclosed embodiments is shown. Similar to surgical tacker 200 discussed above, surgical tacker 200a includes a handle assembly 210a, and a removable endoscopic assembly 300a (e.g., a single use loading unit) extending from handle assembly 210a and configured to store and selectively release or fire a plurality of anchors 100 therefrom and into mesh “M” overlying tissue “T”. In the present embodiment of surgical tacker 200a, handle assembly 210a is configured to count and display the number of anchors 100 that have been fired from an engaged endoscopic assembly 300a, and is configured to count and display the number endoscopic assemblies 300a that have been engaged with handle assembly 210a.

[00131] With reference to FIGS. 48 – 50C, handle assembly 210a of surgical tacker 200a includes a safety lock assembly 240a supported on a handle housing 212a and being configured to permit and inhibit actuation of a trigger 215a, and for effectuating a loading/retention and a release/removal of endoscopic assembly 300a to handle housing 212a. Safety lock assembly 240a is in operative association with a ferrule 234a and is actuatable upon a rotation of ferrule 234a relative to handle housing 212a. It is envisioned that safety lock assembly 240 as described above in connection with handle assembly 210 of surgical tacker 200 is usable with handle assembly 210a of surgical tacker 200a.

[00132] Alternatively, safety lock assembly 240a includes a fire lock 250a, a pusher 260a, a slider 270a and a locking cam 280a, as shown in FIGS. 49-50C (pusher 260a is omitted in FIGS. 50A-50C for clarity). Here, when loading or

engaging endoscopic assembly 300a with handle assembly 210a, rotation of ferrule 234a causes fire lock 250a to engage a portion of pusher 260a (e.g., a cam slot therein), which causes proximal movement of pusher 260a. Pusher 260a is mechanically coupled to slider 272a, such that proximal movement of pusher 260a causes a corresponding proximal movement of slider 272a. Proximal movement of slider 270a causes a camming or partial rotation of locking cam 280a, such that locking cam 280a moves from a first position where locking cam 280a is engaged with a first bevel gear 228a and prevents rotation of first bevel gear 228a (FIG. 50A), to a second position where locking cam 280a is out of engagement with first bevel gear 228a thus allowing rotation of first bevel gear 228a (FIG. 50B).

[00133] Accordingly, rotation of ferrule 234a causes locking cam 280a to move out of engagement with first bevel gear 228a, thus unlocking first bevel gear 228a and enabling actuation of trigger 215a. Additionally, with further regard to the engagement between slider 270a and locking cam 280a, it is envisioned that a proximal portion 272a of slider 270a includes a slot 274a therein. Here, an upper portion of locking cam 280a is situated between a proximal end of slot 274a and a distal end of slot 274a, such that proximal movement of slider 270a causes the distal end of slot 274a to contact, and rotate locking cam 280a in a first direction (e.g., clockwise and out of engagement with first bevel gear 228a), and distal movement of slider 270a causes the proximal end of slot 274a to contact, and rotate locking cam 280a in a second direction (e.g., counter-clockwise and into engagement with first bevel gear 228a).

[00134] It is further envisioned that slider 270a is mechanically engaged with a lower portion 282a of locking cam 280a, i.e., a portion of locking cam 280a that is below its pivot 284a. Here, proximal movement of slider 270a causes lower portion 282a of locking cam 280a to pivot distally (i.e., out of engagement

with first bevel gear 228a), and distal movement of slider 270a causes lower portion 282a of locking cam 280a to pivot proximally (i.e., into engagement with first bevel gear 228a).

[00135] Referring now to FIGS. 49, 51 and 52, a tacker counter mechanism 400a of surgical tacker 200a is shown. Tacker counter mechanism 400a is disposed within handle assembly 210a and is configured to count and display the number of anchors 100 fired from endoscopic assembly 300a. Tacker counter mechanism 400a includes a counter gear 410a, and a counter stop 420a. Counter gear 410a is mechanically engaged with first bevel gear 228a. Counter stop 420a is engaged with slider 270a and counter gear 410a.

[00136] More particularly, a counter tooth 229a of first bevel gear 228a is configured to engage teeth 412a of counter gear 410a. Trigger 215a, first bevel gear 228a and counter gear 410a are sized and configured such that actuation of trigger 215a in the general direction indicated by arrow “A” in FIG. 49, causes first bevel gear 228a to rotate in the general direction indicated by arrow “B” in FIG. 49 (e.g., counter-clockwise), which causes counter gear 410a to rotate in the general direction indicated by arrow “C” in FIG. 49 (e.g., clockwise).

[00137] With particular reference to FIGS. 51 – 52, counter gear 410a includes a counter 430a thereon. Counter 430a includes a plurality of numbers, which indicate the amount of times trigger 215a has been actuated, which also corresponds to the number of anchors 100 that have been fired. It is envisioned that counter 430a includes numbers between zero and 20, for example. In particular embodiments, counter 430a includes each number between and inclusive of zero and 10. Referring to FIGS. 48 and 52, a rear face 217a of handle assembly 210a includes a window 219a thereon. Window 219a is aligned with a portion of counter 430a, such that a single number is visible through window 219a. In FIG. 52, a “0” is displayed on counter 430a.

[00138] In use, a full actuation of trigger 215a causes counter gear 410a to rotate an amount which corresponds to increasing the number (incrementing) on counter 430a by one number. That is, when counter 430a reads “0” (i.e., through window 219a), a full actuation of trigger 215a causes counter gear 410a to rotate a predetermined amount such that counter 430a reads “1”, which indicates that *one* anchor 100 has been fired, for example. Similarly, counter 430a may be configured to decrement by *one* each time *one* anchor 100 is fired, wherein the reading on counter 430a would decrease by *one* from a maximum of 10 or 20 to zero.

[00139] Additionally, counter gear 410a is biased toward its initial position (e.g., counter clockwise) where counter 430a reads zero. A counter spring 440a is disposed in mechanical engagement with counter gear 410a and provides the bias (FIG. 51). It is envisioned that counter spring 440a is disposed in mechanical engagement with an axel (about which counter gear 410a rotates) and a radially inner portion of counter gear 410a.

[00140] Counter stop 420a is included to prevent counter gear 410a from rotating toward its initial position (e.g., counter clockwise) under the bias of counter spring 440a when handle assembly 210a is engaged with endoscopic assembly 300a. Counter stop 420a includes a distal portion 422a that engages proximal portion 272a of slider 270a, and a proximal portion including a counter lock 426a (FIG. 51). After proper engagement between endoscopic assembly 300a and handle assembly 210a, slider 270a is moved proximally (as discussed above). Proximal movement of slider 270a causes a corresponding proximal movement of counter stop 420a, such that counter lock 426a engages counter gear 410a, or is disposed in a position to be engaged by counter gear 410a upon rotation of counter gear 410a. Moreover, counter lock 426a is pivotable to a

certain degree, such that a clockwise rotation of counter gear 410a is enabled, while counter clockwise rotation of counter gear 410a is prevented.

[00141] Once endoscopic assembly 300a and handle assembly 210a are disengaged from each other, slider 270a is moved distally, which causes counter stop 420a to move distally. Distal movement of counter stop 420a moves counter lock 426a out of engagement with counter gear 410a, thus allowing counter spring 440a to move counter gear 410a in a counter clockwise direction until the zero on counter 430a is displayed through window 219a. That is, counter 430a displays the zero through window 219a both when endoscopic assembly 300a and handle assembly 210a are disengaged from each other, and when endoscopic assembly 300a and handle assembly 210a are engaged and prior to any anchors 100 be fired.

[00142] Referring now to FIGS. 49, 53 and 54, a loading unit or endoscopic assembly counter mechanism 500a of surgical tacker 200a is shown. Loading unit counter mechanism 500a is disposed within handle assembly 210a and is configured to count and display the number of times a loading unit or endoscopic assembly 300a has been disengaged from handle assembly 210a. Loading unit counter mechanism 500a includes a counter lock 510a, a rack gear 520a, a counter pusher 530a, and a counter or endoscopic assembly counter 540a.

[00143] Counter 410a includes a plurality of numbers, which indicate the amount of the number of the tacks used. It is envisioned that counter 410a includes numbers between zero and 20 inclusively, for example. Referring to FIG. 48, a top face 218a of handle assembly 210a includes a window 219a thereon. Window 219a is aligned with a portion of counter 410a, such that a single number is visible through window 219a. Gear 228a rotate 1 once with each firing, the feature 229a engaging counter 410a once per rotation causing

counter 228a to index and advance the counter 410a one number to indicate use of a tack.

[00144] Counter 540a includes a plurality of numbers, which indicate the amount of times an endoscopic assembly 300a has been disengaged with handle assembly 210a. It is envisioned that counter 540a includes numbers between zero and 10 inclusively, for example. Referring to FIG. 48, a top face 218a of handle assembly 210a includes a window 221a thereon. Window 221a is aligned with a portion of counter 540a, such that a single number is visible through window 221a. In use, prior to engagement between endoscopic assembly 300a and handle assembly 210a, counter 540a displays “0” (as shown in FIG. 54), indicating that zero endoscopic assemblies 300a have been disengaged (e.g., used) from handle assembly 210a.

[00145] After removal of endoscopic assembly 300a from handle assembly 210a (e.g., after anchors 100 have been fired from endoscopic assembly 300a), counter 540a displays “1,” indicating that *one* endoscopic assembly 300a has been disengaged from handle assembly 210a.

[00146] Additionally, loading unit counter mechanism 500a may be configured to only permit a certain number (e.g., ten) of disengagements between endoscopic assembly 300a and handle assembly 210a. As can be appreciated, this feature limits that amount of times handle assembly 210a is usable/re-usable. when used a certain number of times (e.g., ten), the counter 540a is stopped by the edge of the body shell 212a, at the same time the slider 272a is stopped by the counter 540a, so the ferrule 234a cannot be loaded again, causing the handle assembly 210a to be unusable.

[00147] The present disclosure also includes a surgical kit, which includes a handle assembly 210a, a plurality of endoscopic assemblies 300a, and a plurality of anchors 100. It is envisioned that the kit includes the number of endoscopic

assemblies 300a that loading unit counter mechanism 500a limits handle assembly 200a to engaging with. For example, it is envisioned that the kit includes a single handle assembly 210a, and ten endoscopic assemblies 300a. It is further envisioned that each endoscopic assembly 300a is pre-loaded with anchors 100. Further, the disclosure includes endoscopic assemblies 300a that include no more anchors 100 than as permitted by tacker counter mechanism 400a (or components thereof). For instance, it is envisioned that one kit includes up to thirty anchors 100 in each endoscopic assembly 300a.

[00148] In accordance with the present disclosure, it is contemplated that a plurality of different endoscopic assemblies 300, 300a 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 (e.g., 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.

[00149] In disclosed embodiments, it is contemplated that all the endoscopic assemblies have the same length, but are 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.

[00150] In accordance with the present disclosure, it is also contemplated that handle assembly 210, 210a 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.

[00151] It will be understood that various modifications may be made to the embodiments disclosed herein. For example, the length of the linear row of staples or fasteners may be modified to meet the requirements of a particular surgical procedure. Thus, the length of the linear row of staples and/or fasteners within a staple cartridge assembly may be varied accordingly. 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.

IN THE CLAIMS:

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 drive mechanism actuatable by the trigger;
 - an endoscopic assembly selectively connectable to the handle assembly and configured to releasably house a plurality of tacks therein;
 - a tacker counter mechanism disposed in mechanical cooperation with the handle assembly, the tacker counter mechanism including a counter gear disposed in mechanical cooperation with the drive mechanism, and including a tacker counter configured to display a number, wherein actuation of the trigger changes the number displayed by the tacker counter; and
 - an endoscopic assembly counter mechanism disposed in mechanical cooperation with the handle assembly, the endoscopic assembly counter mechanism including a rack gear disposed in mechanical cooperation with an endoscopic assembly counter configured to display a number, wherein at least one of engagement and disengagement between the endoscopic assembly and the handle assembly changes the number displayed by the endoscopic assembly counter mechanism.
2. The endoscopic surgical device according to claim 1, wherein removal of the endoscopic assembly from the handle assembly causes the tacker counter to display zero.
3. The endoscopic surgical device according to claim 1, wherein the tacker counter includes the numbers between zero and ten.

4. The endoscopic surgical device according to claim 1, wherein the tacker counter mechanism includes a counter spring which biases the counter gear to its initial position where the tacker counter displays zero.
5. The endoscopic surgical device according to claim 4, wherein the tacker counter mechanism includes a counter stop disposed at least partially within the handle assembly, the counter stop being configured to prevent the counter gear from rotating toward its initial position under the bias of the counter spring when the handle assembly is engaged with the endoscopic assembly.
6. The endoscopic surgical device according to claim 5, wherein removal of the endoscopic assembly from the handle assembly causes the counter spring to biases the counter gear to its initial position such that the tacker counter displays zero.
7. The endoscopic surgical device according to claim 1, wherein disengagement between the endoscopic assembly and the handle assembly changes the number displayed by the endoscopic assembly counter mechanism.
8. The endoscopic surgical device according to claim 1, wherein the rack gear of the endoscopic assembly counter mechanism physically limits the number of times the handle assembly is able to engage the endoscopic assembly.
9. A handle assembly for use with a surgical device, the handle assembly comprising:
 - a handle housing;
 - a trigger operatively connected to the handle housing;
 - a drive mechanism disposed at least partially within the handle housing and being actuatable by the trigger;
 - a tacker counter mechanism disposed in mechanical cooperation with the handle assembly, the tacker counter mechanism including a counter gear disposed in mechanical cooperation with the drive mechanism, and including a

tacker counter configured to display a number, wherein actuation of the trigger changes the number displayed by the tacker counter; and

an endoscopic assembly counter mechanism disposed in mechanical cooperation with the handle assembly, the endoscopic assembly counter mechanism configured to display a number, wherein at least one of engagement and disengagement between an endoscopic assembly and the handle assembly changes the number displayed by the endoscopic assembly counter mechanism.

10. The handle assembly according to claim 9, wherein removal of an endoscopic assembly from the handle assembly causes the tacker counter to display zero.

11. The handle assembly according to claim 9, wherein the tacker counter includes the numbers between zero and ten.

12. The handle assembly according to claim 9, wherein the tacker counter mechanism includes a counter spring which biases the counter gear to its initial position where the tacker counter displays zero.

13. The handle assembly according to claim 12, wherein the tacker counter mechanism includes a counter stop disposed at least partially within the handle assembly, the counter stop being configured to prevent the counter gear from rotating toward its initial position under the bias of the counter spring when the handle assembly is engaged with an endoscopic assembly.

14. The handle assembly according to claim 13, wherein removal of an endoscopic assembly from the handle assembly causes the counter spring to biases the counter gear to its initial position such that the tacker counter displays zero.

15. The handle assembly according to claim 9, wherein disengagement between an endoscopic assembly and the handle assembly changes the number displayed by the endoscopic assembly counter mechanism.

16. The handle assembly according to claim 9, wherein the endoscopic assembly counter mechanism includes a rack gear, the rack gear physically limits the number of times the handle assembly is able to engage an endoscopic assembly.

17. A surgical kit, comprising:

a handle assembly including a handle housing and a trigger operatively connected to the handle housing, a drive mechanism actuatable by the trigger, a tacker counter mechanism configured to display a number, wherein actuation of the trigger changes the number displayed by the tacker counter mechanism, and an endoscopic assembly counter mechanism configured to display a number, wherein at least one of engagement and disengagement between an endoscopic assembly and the handle assembly changes the number displayed by the endoscopic assembly counter mechanism; and

at least one endoscopic assembly selectively connectable to the handle assembly.

18. The surgical kit according to claim 17, further comprising a plurality of tacks configured to be releasably housed within the at least one endoscopic assembly.

19. The surgical kit according to claim 17, wherein the at least one endoscopic assembly includes ten disposable endoscopic assemblies.

20. The surgical kit according to claim 17, wherein the endoscopic assembly counter mechanism prevents the handle assembly from engaging with more endoscopic assemblies than the number of endoscopic assemblies included in the kit.

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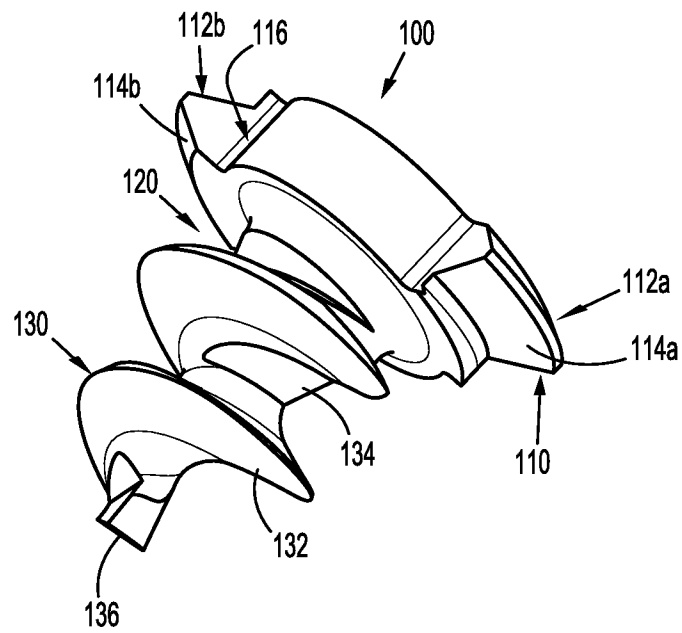


FIG. 1

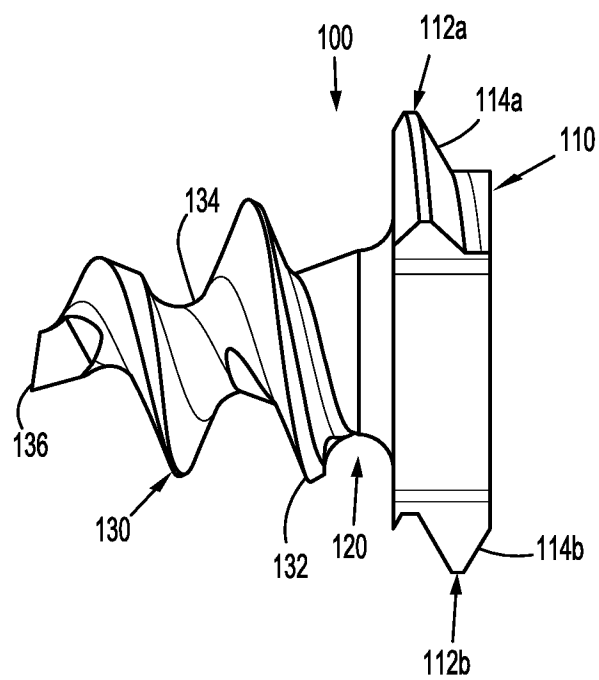


FIG. 2

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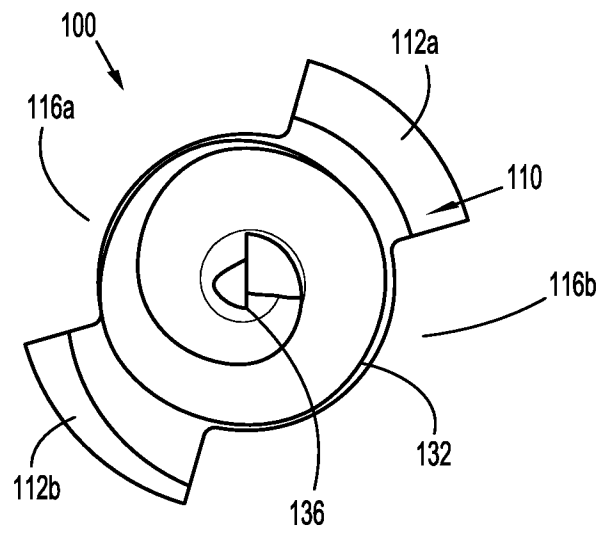


FIG. 3

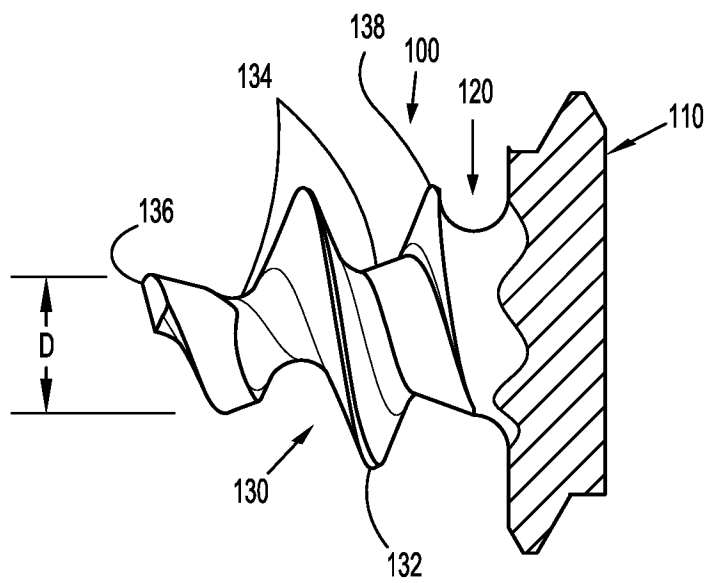


FIG. 4

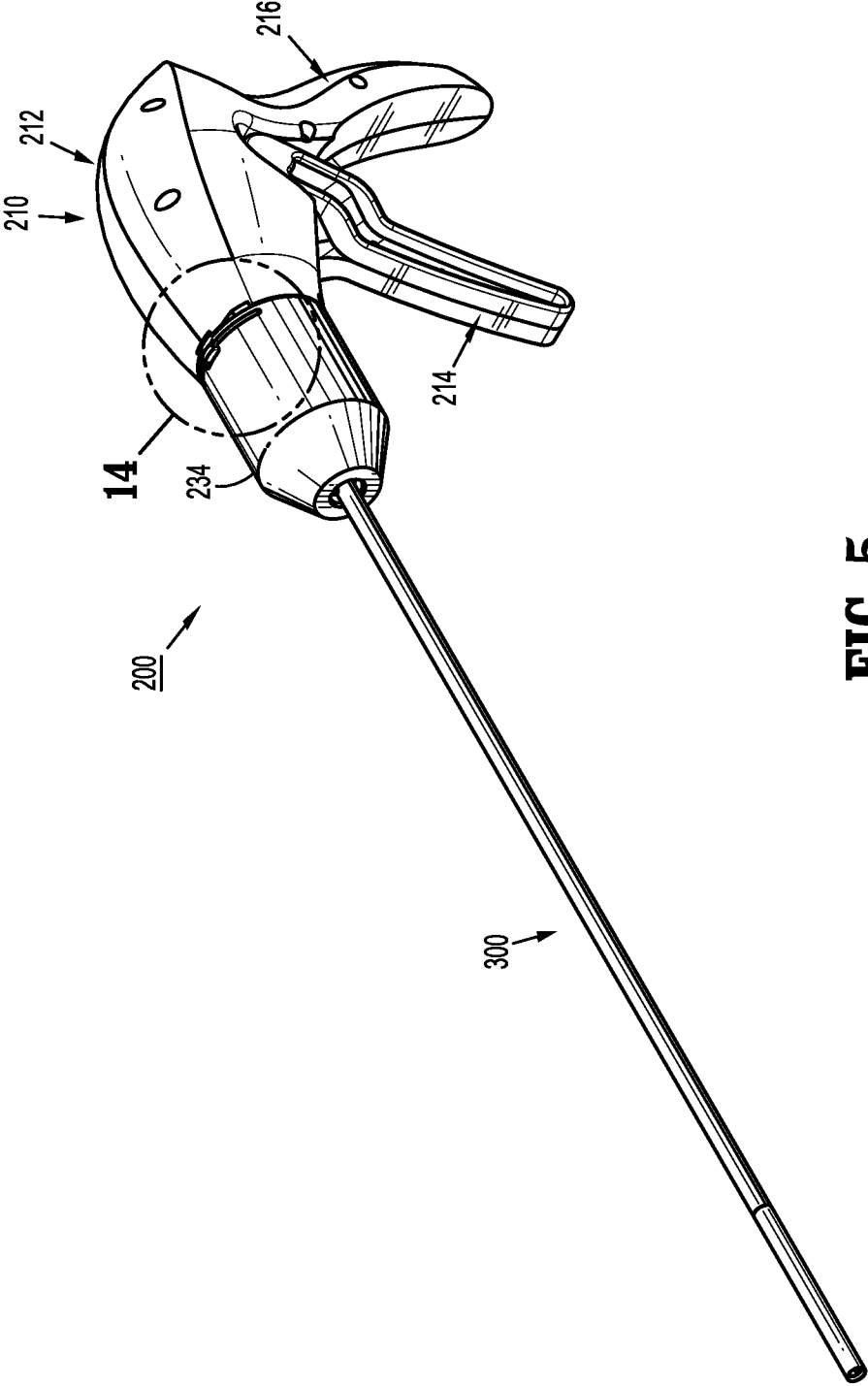


FIG. 5

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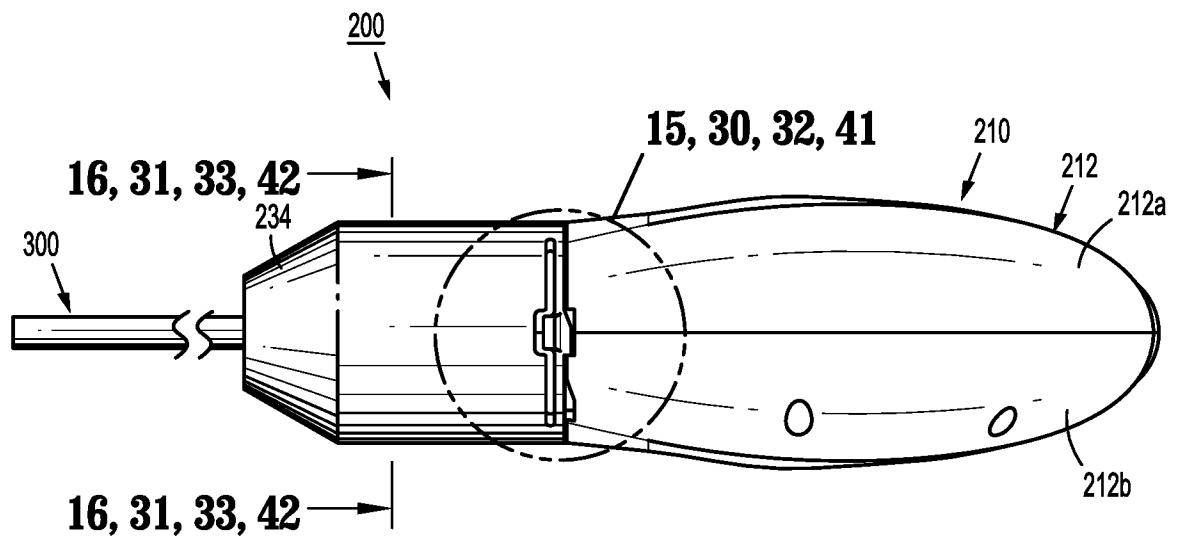


FIG. 6

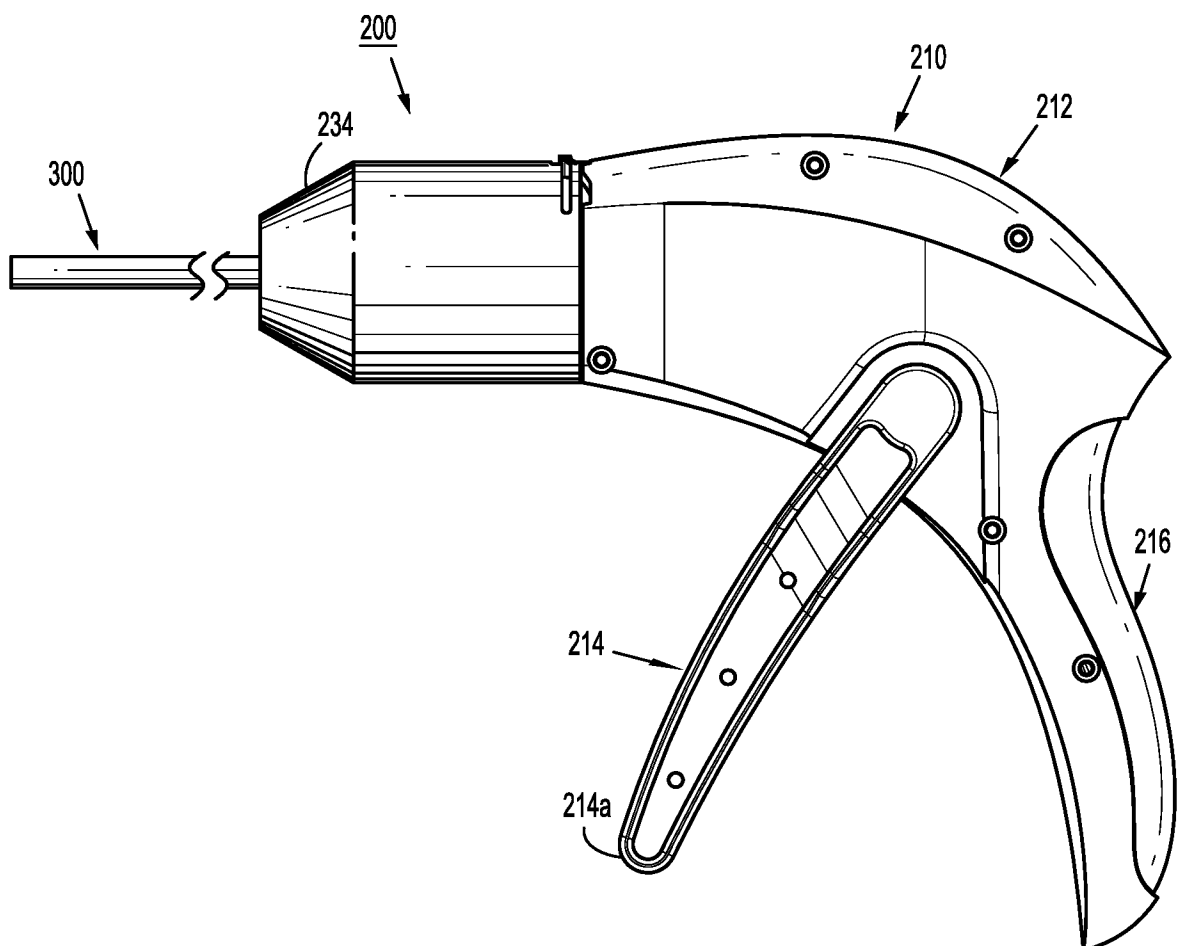


FIG. 7

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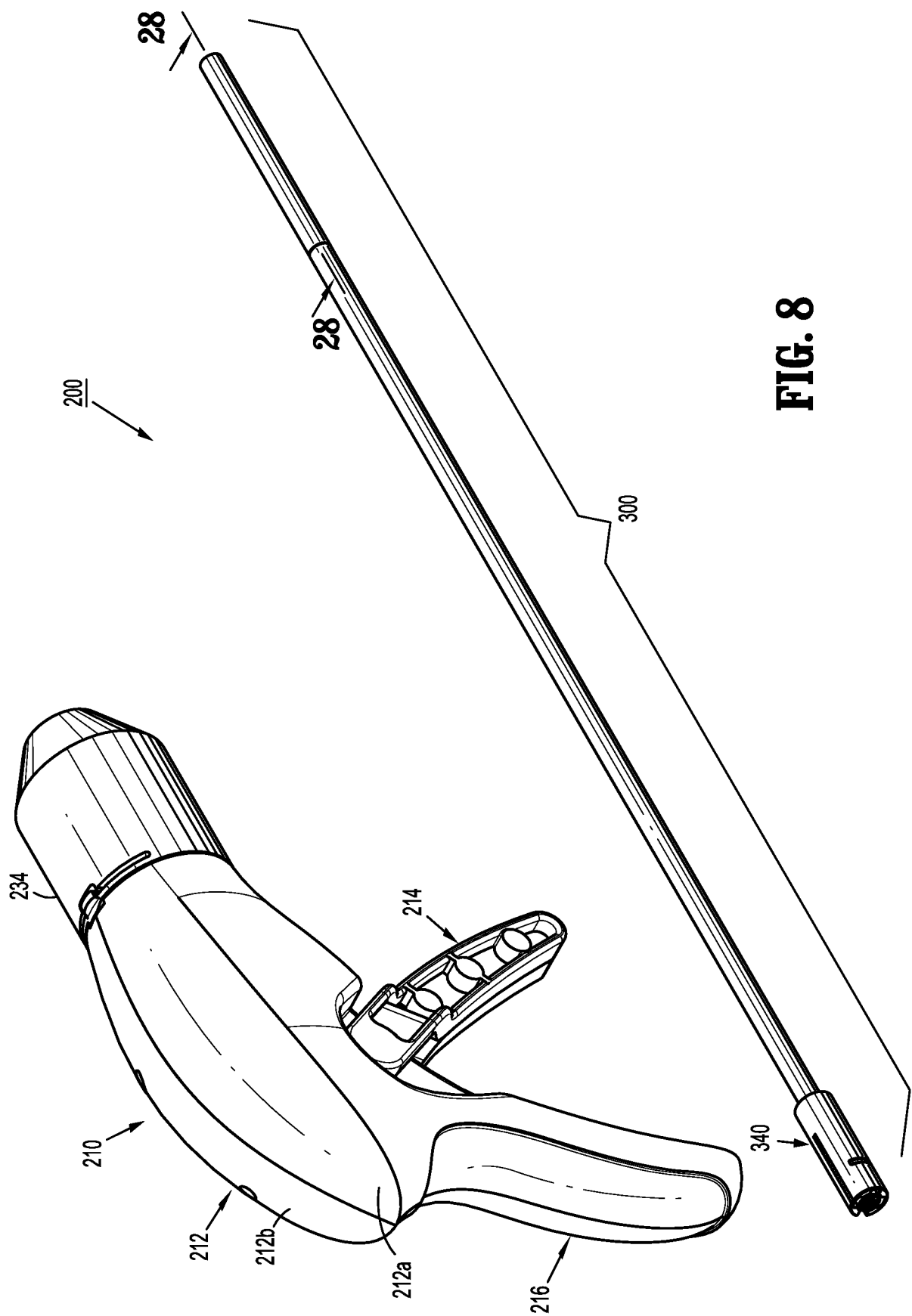


FIG. 8

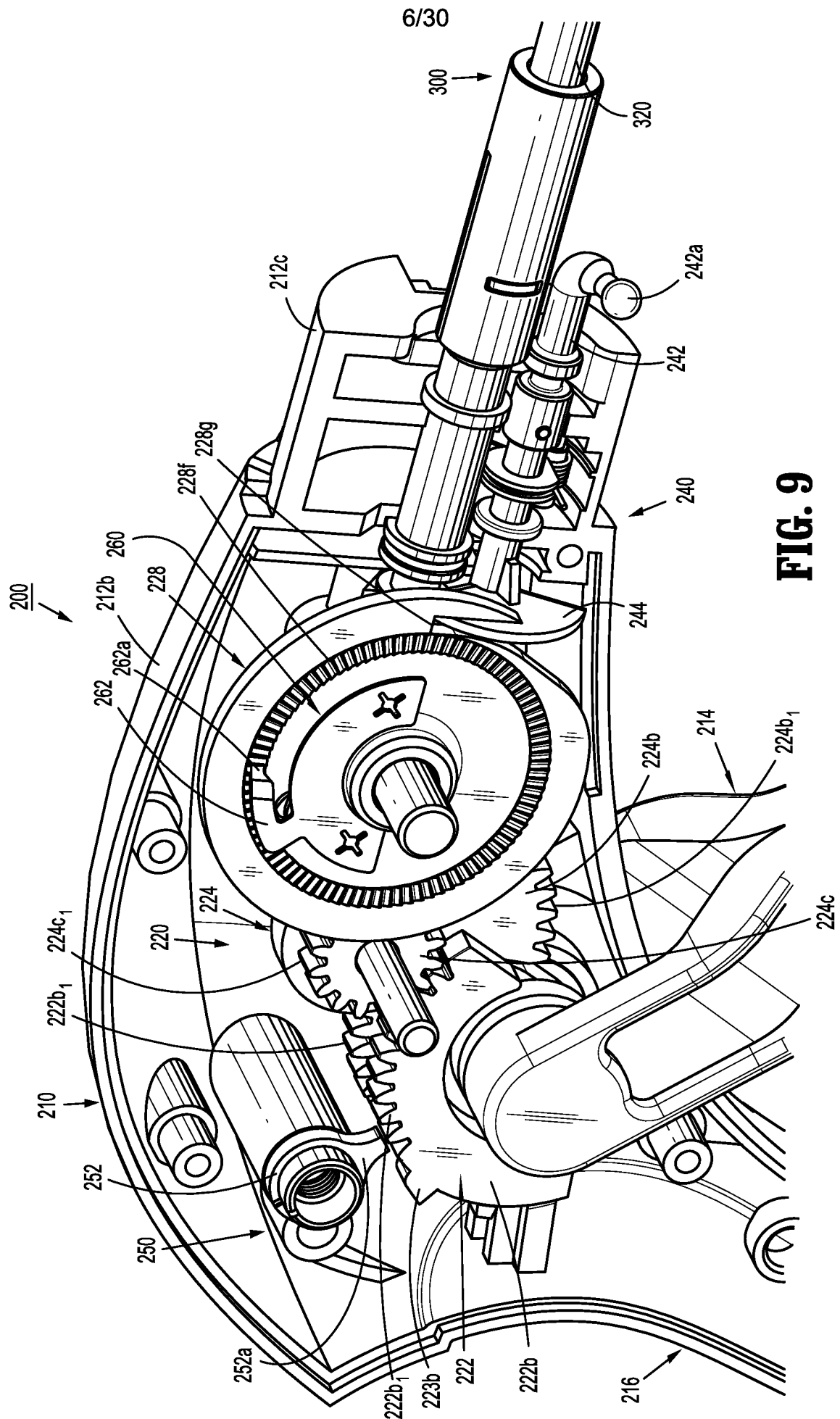


FIG. 9

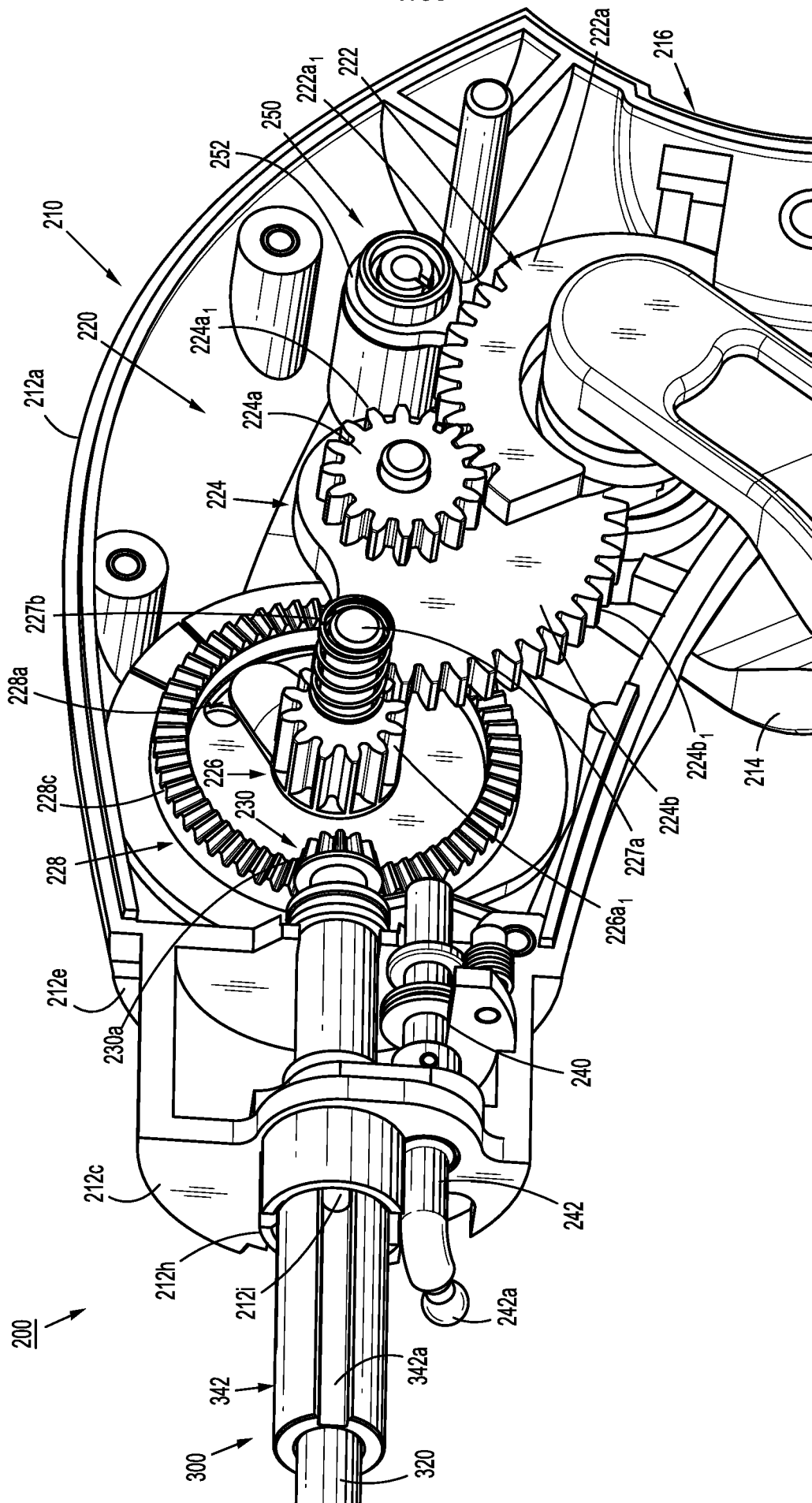


FIG. 10

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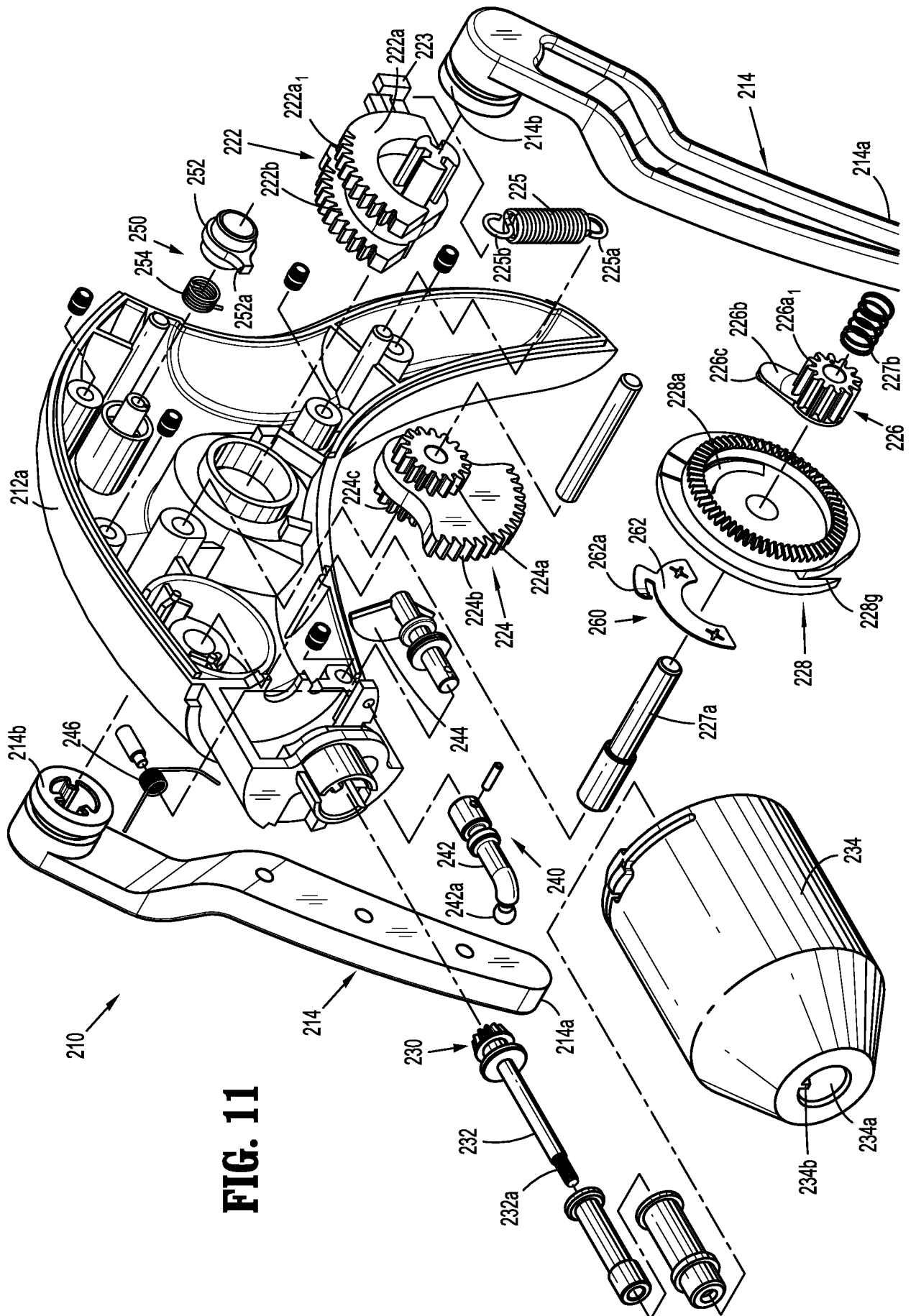


FIG. 11

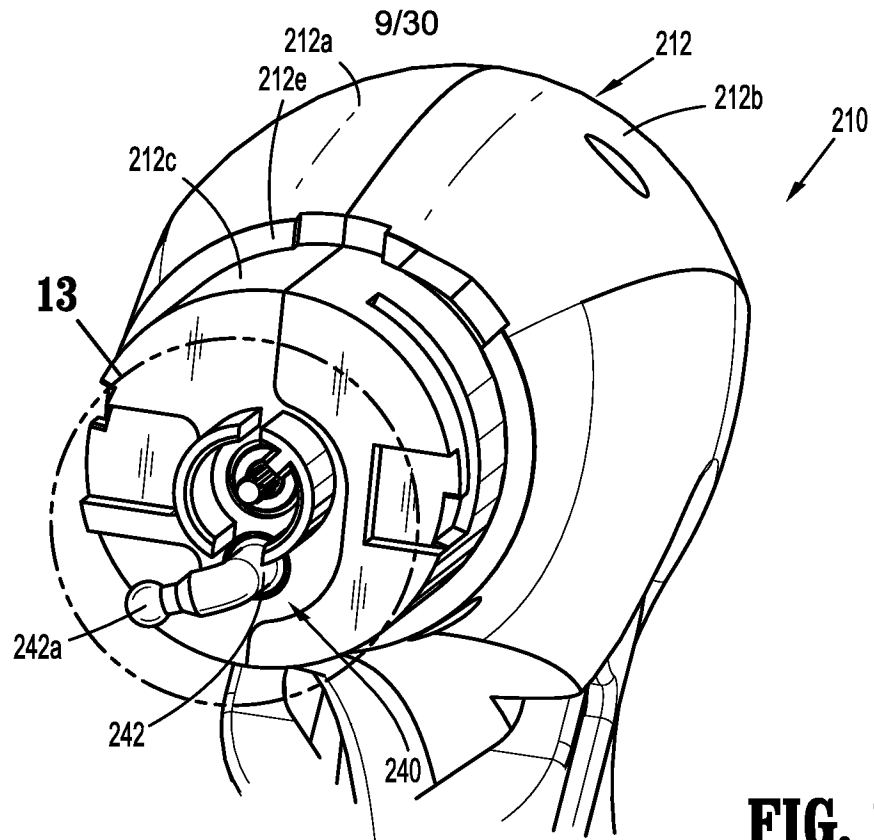


FIG. 12

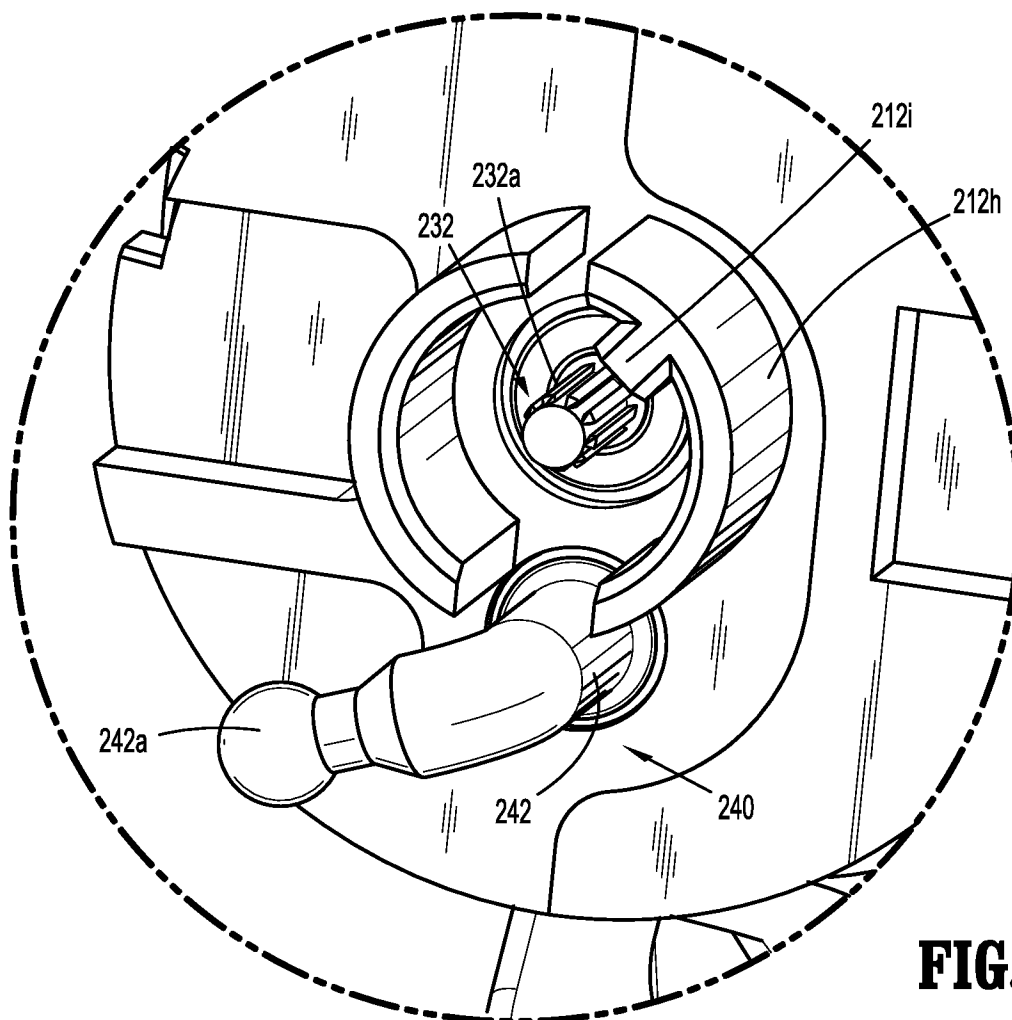


FIG. 13

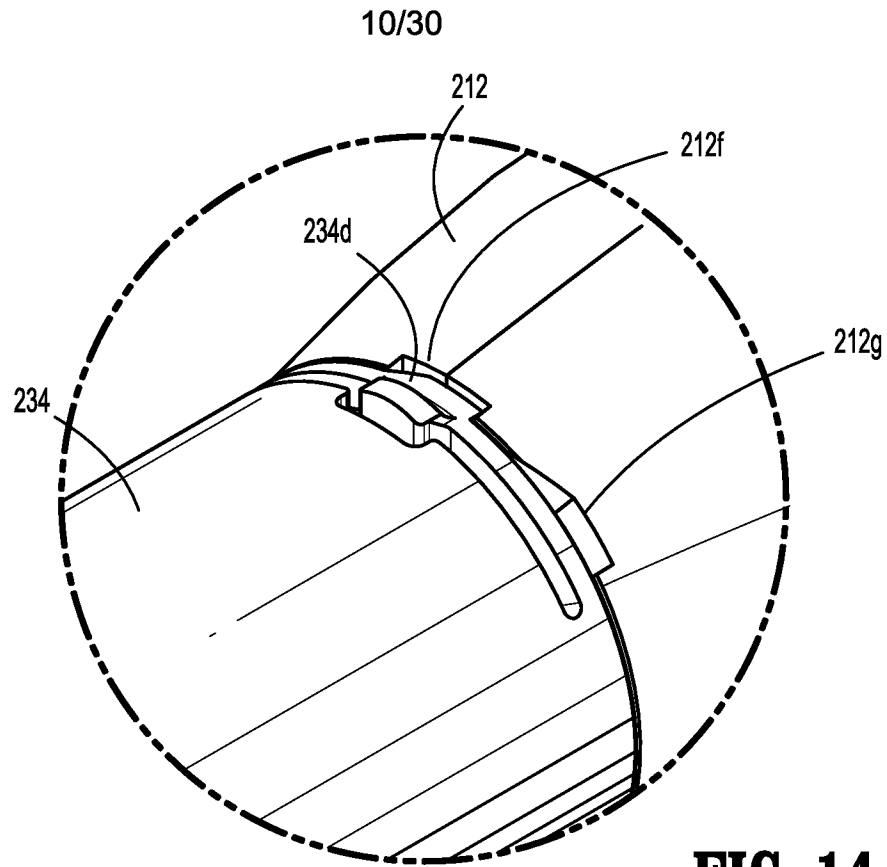


FIG. 14

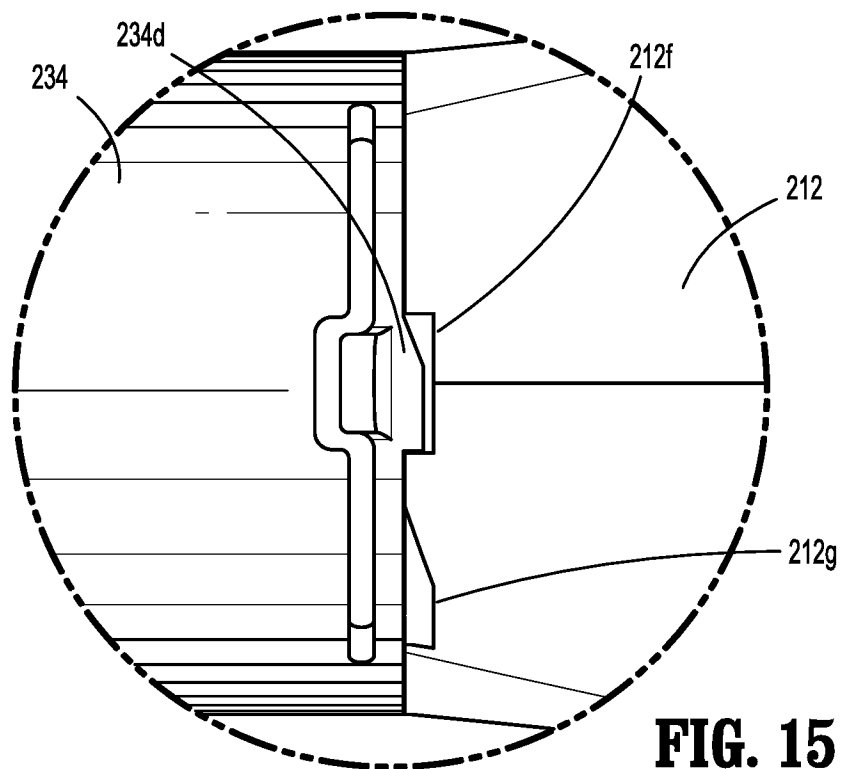


FIG. 15

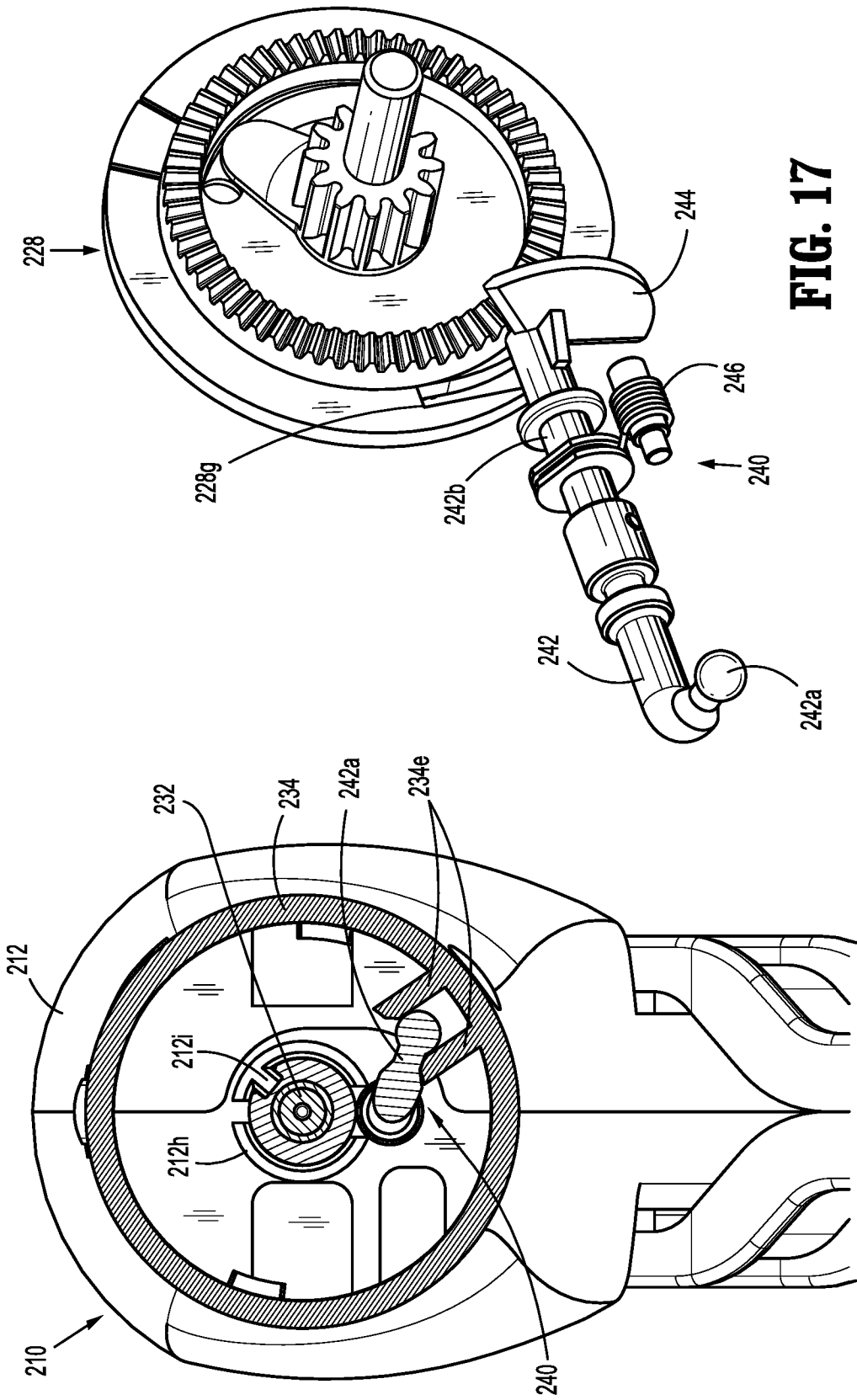


FIG. 17

FIG. 16

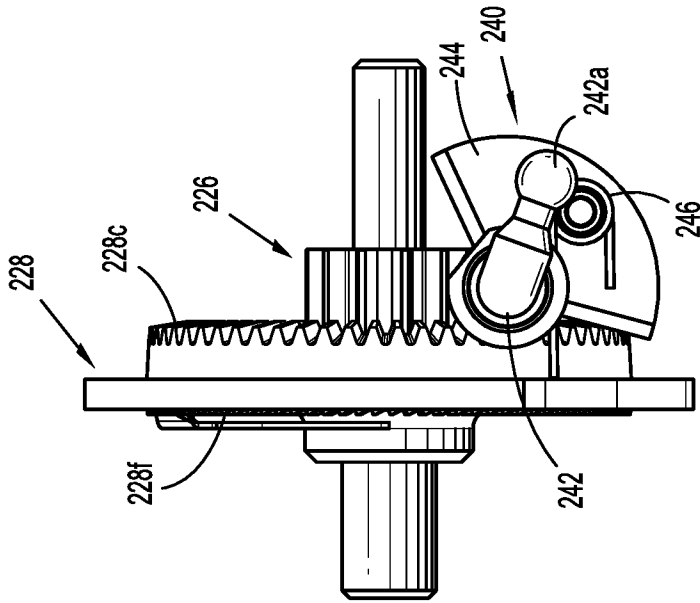


FIG. 19

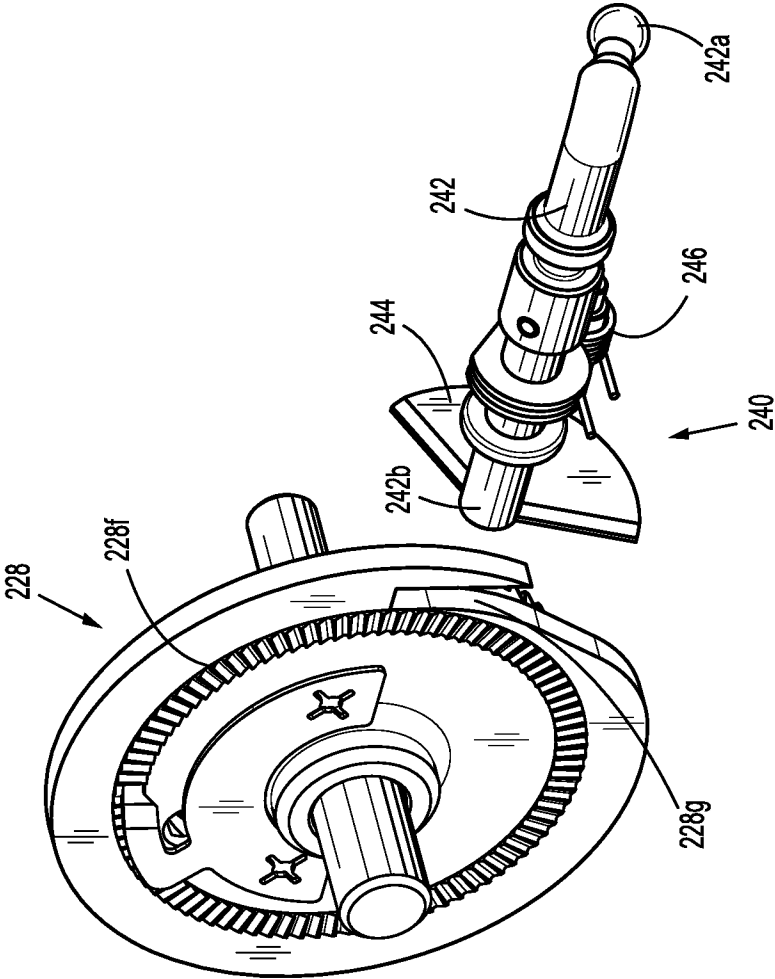


FIG. 18

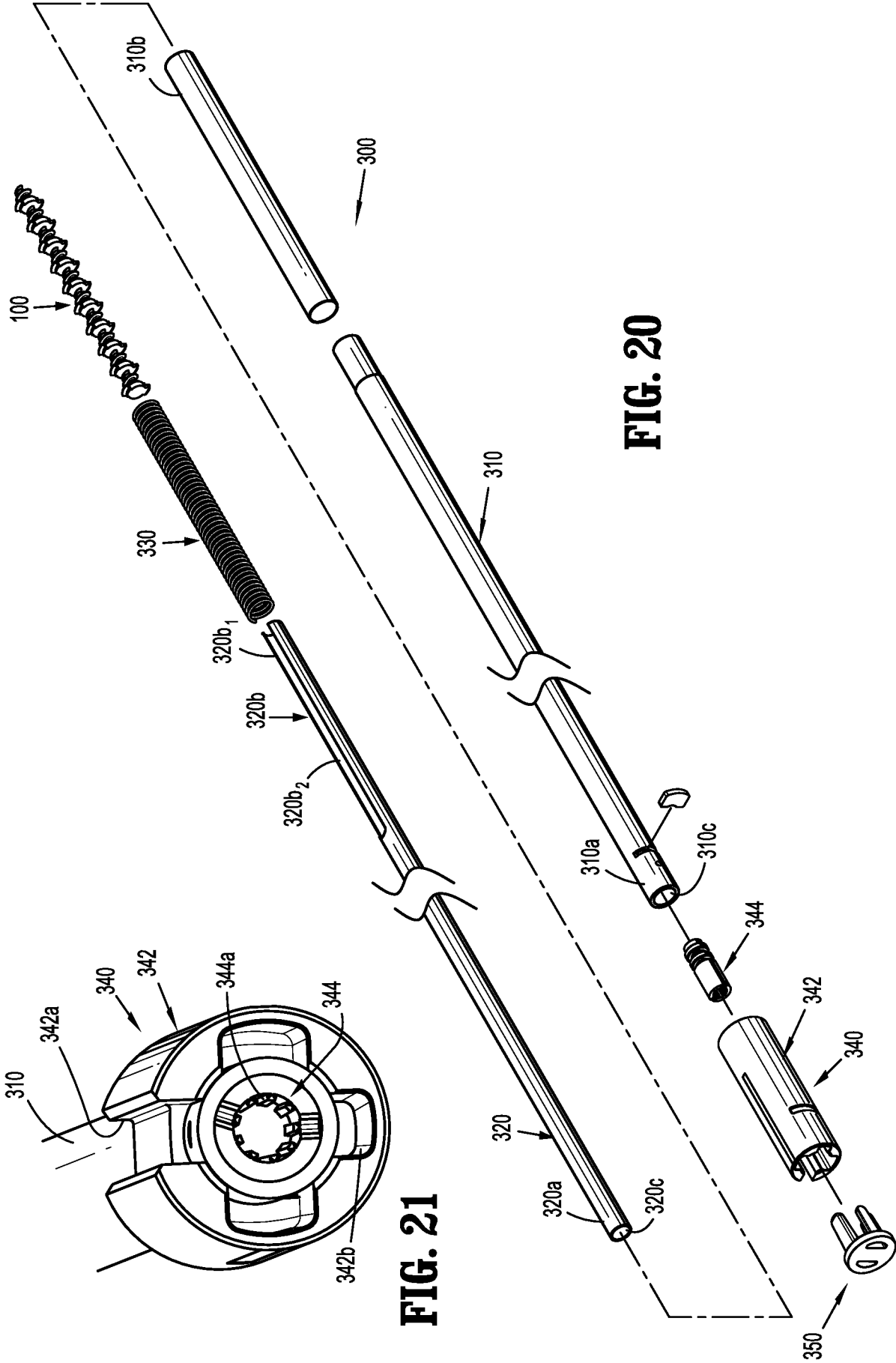


FIG. 20

FIG. 21

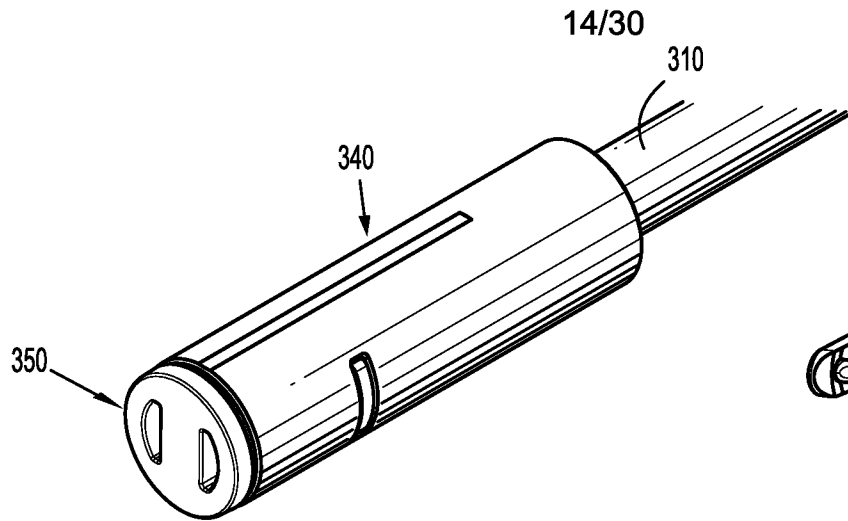


FIG. 22

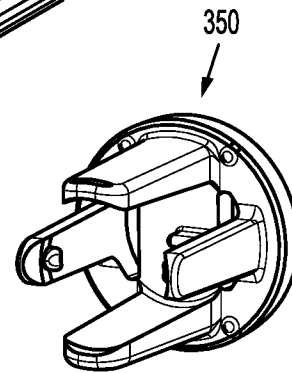


FIG. 23

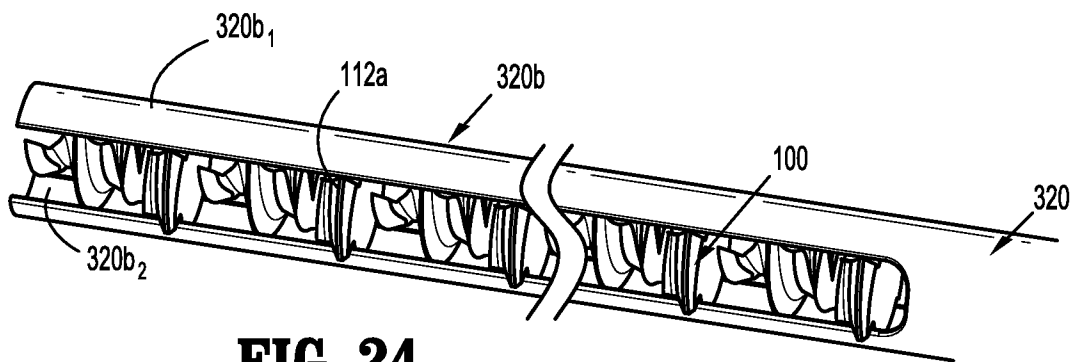


FIG. 24

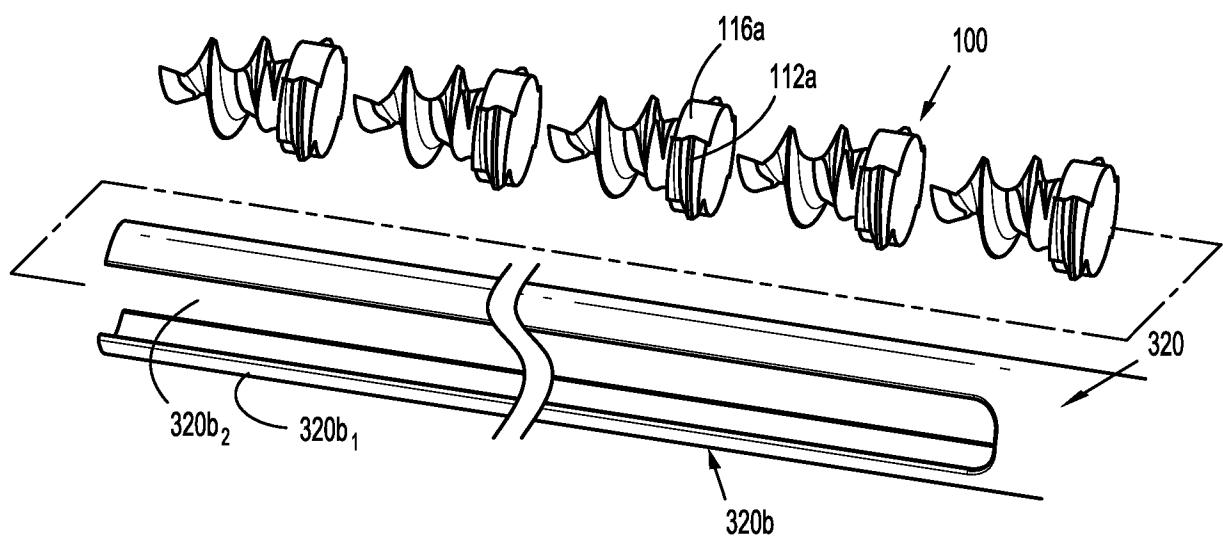
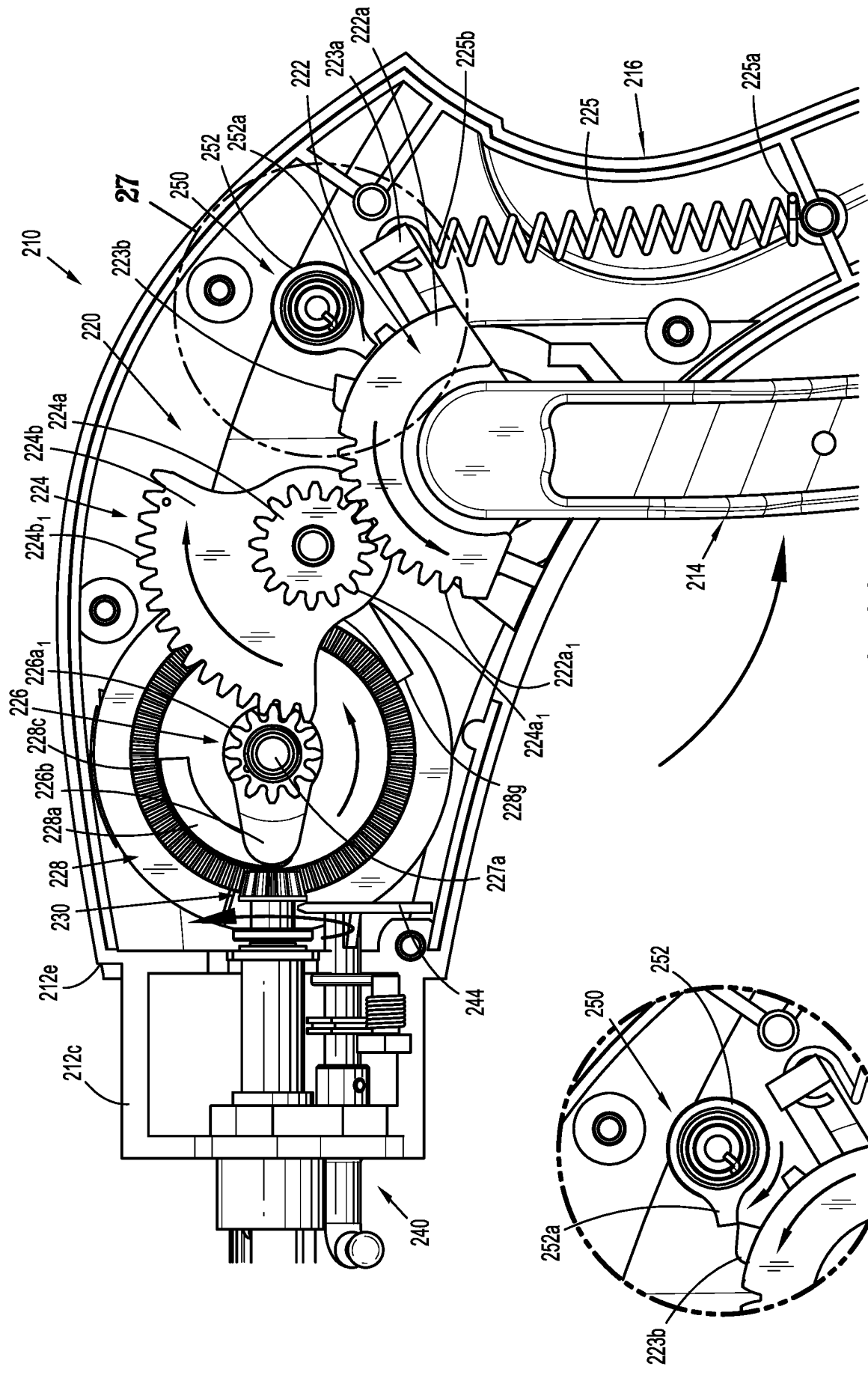


FIG. 25



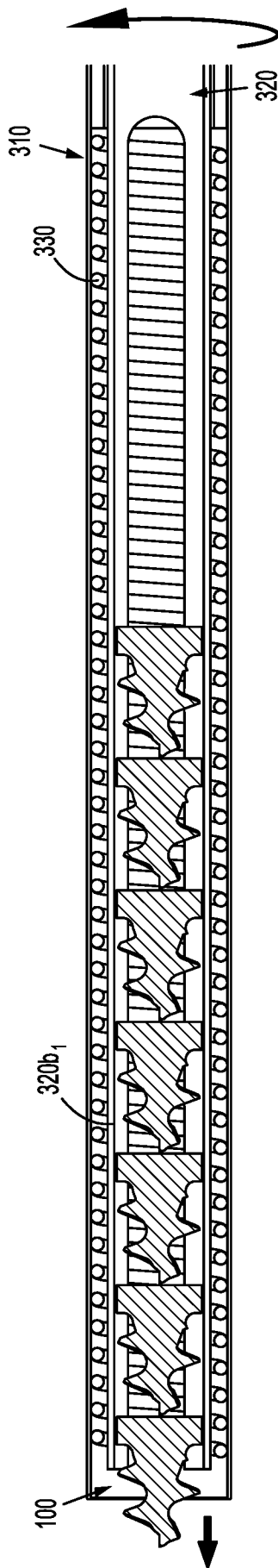


FIG. 28

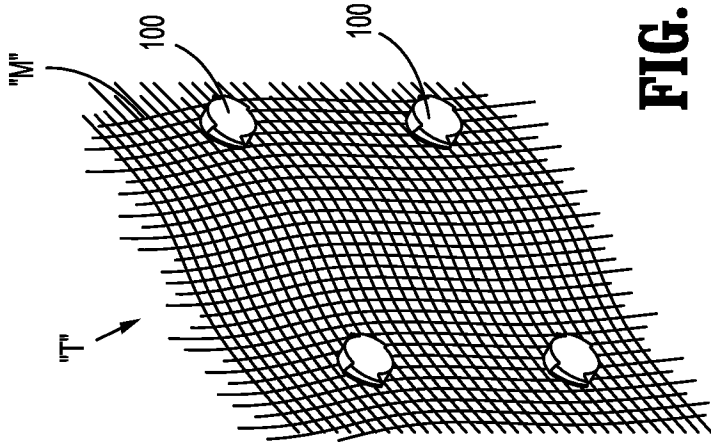


FIG. 29

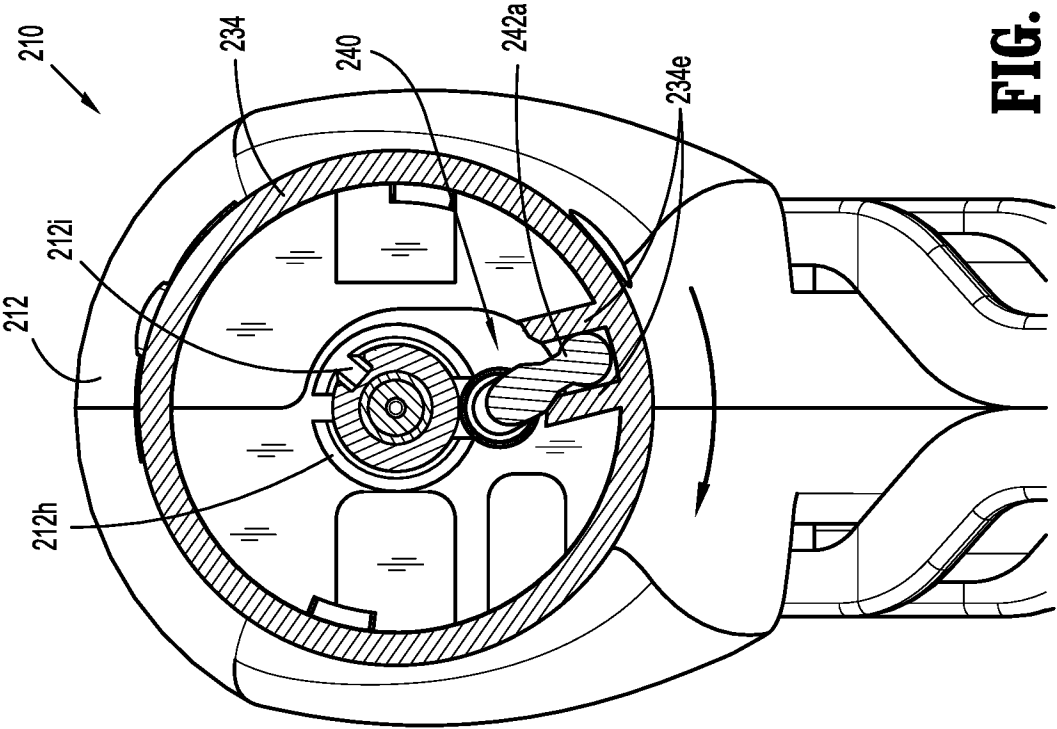


FIG. 31

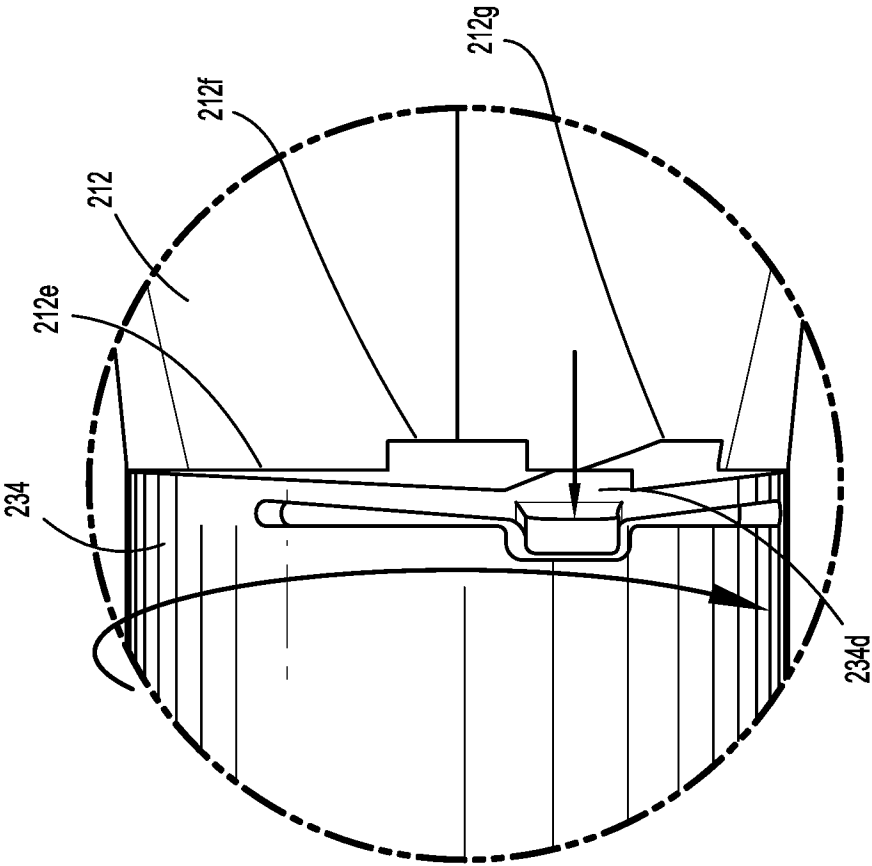


FIG. 30

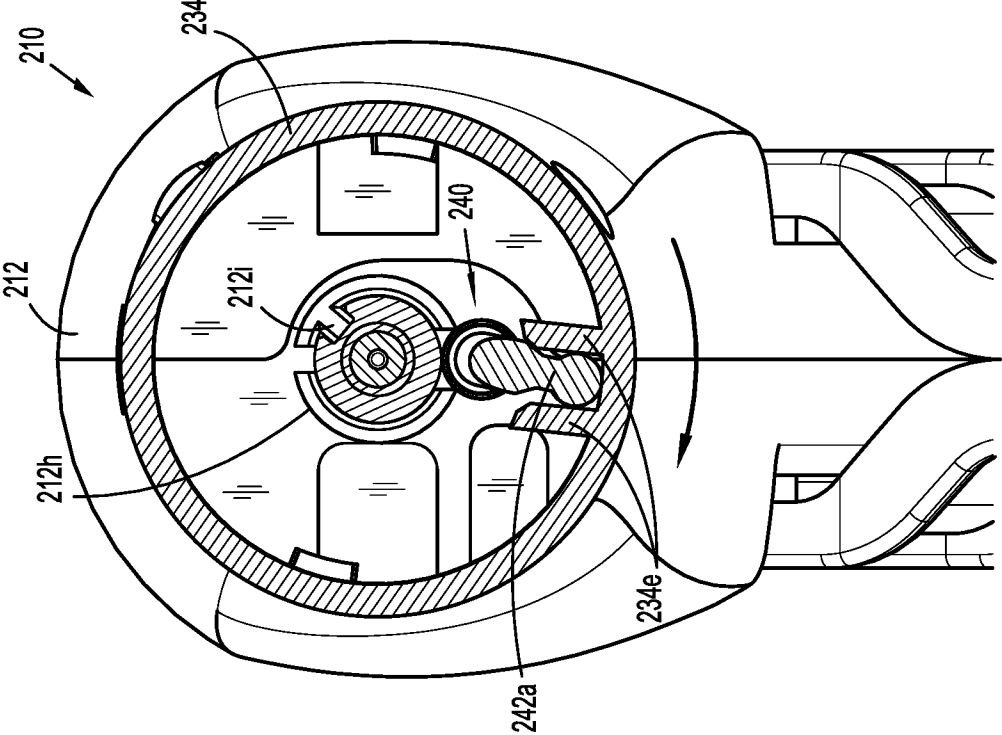


FIG. 33

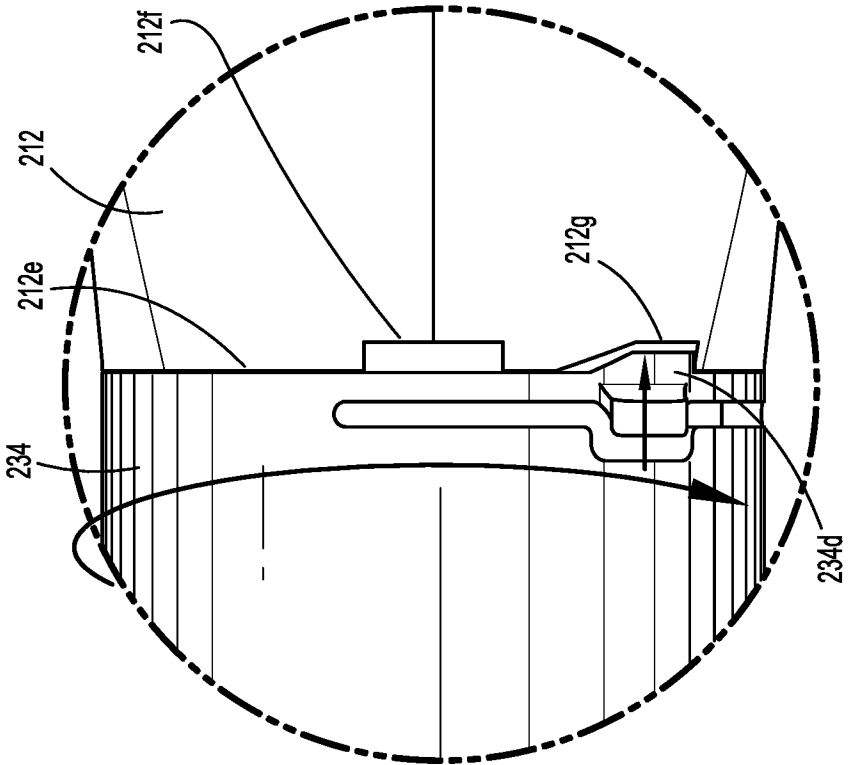


FIG. 32

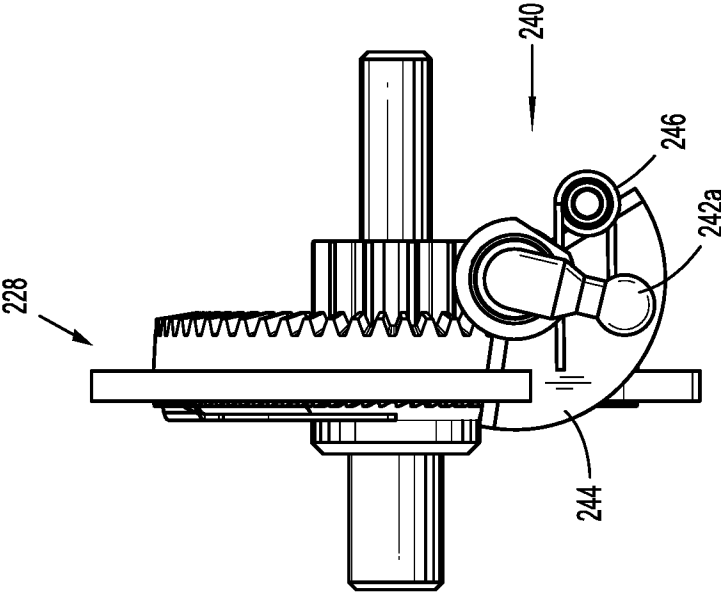


FIG. 35

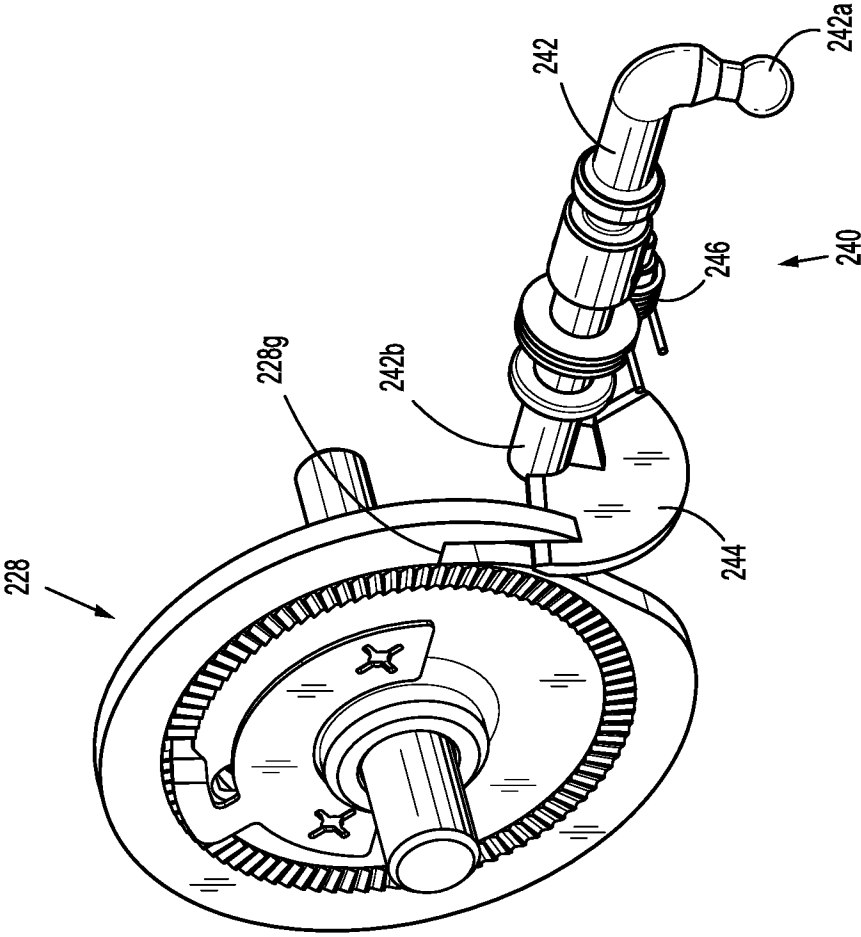


FIG. 34

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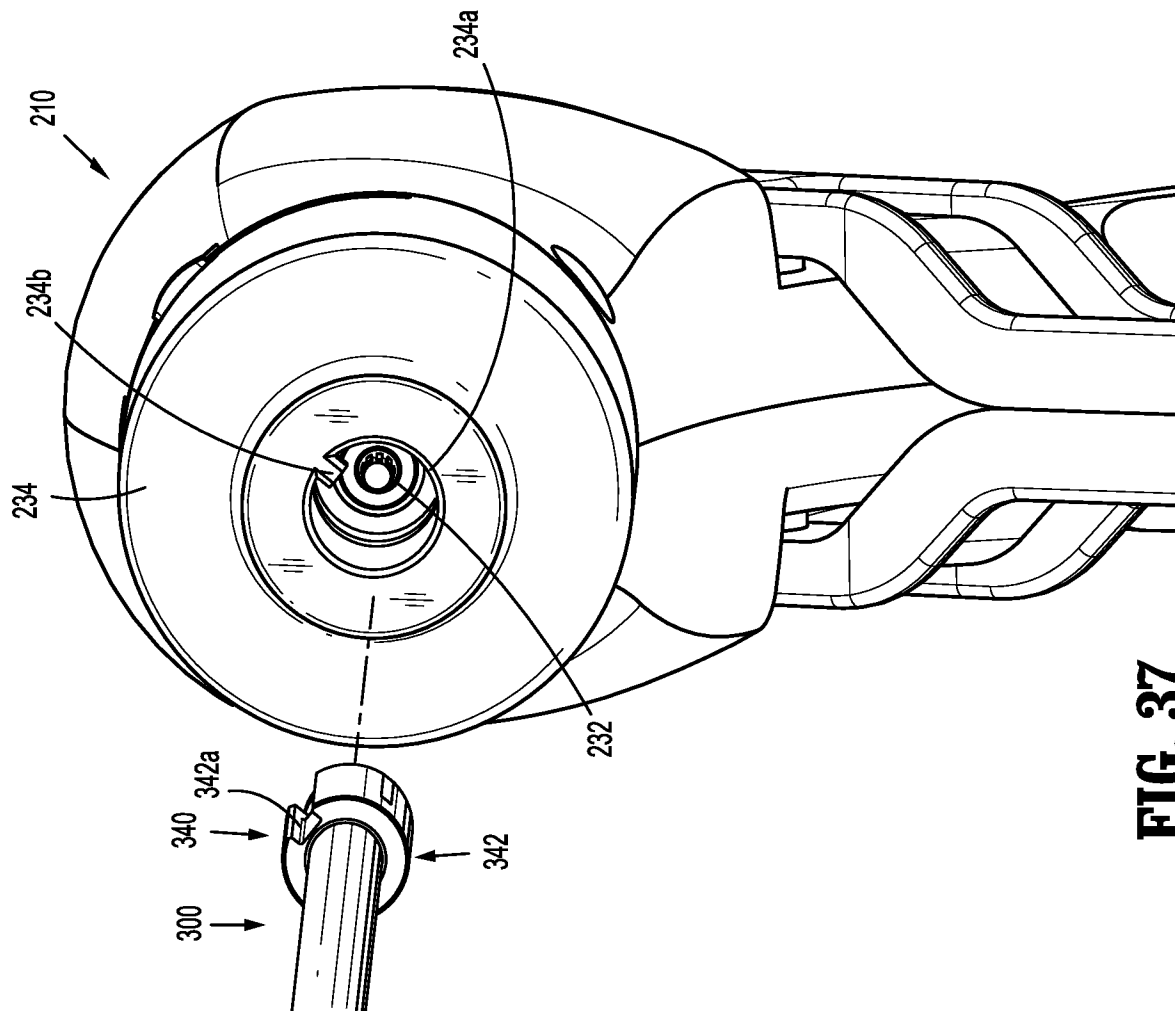


FIG. 37

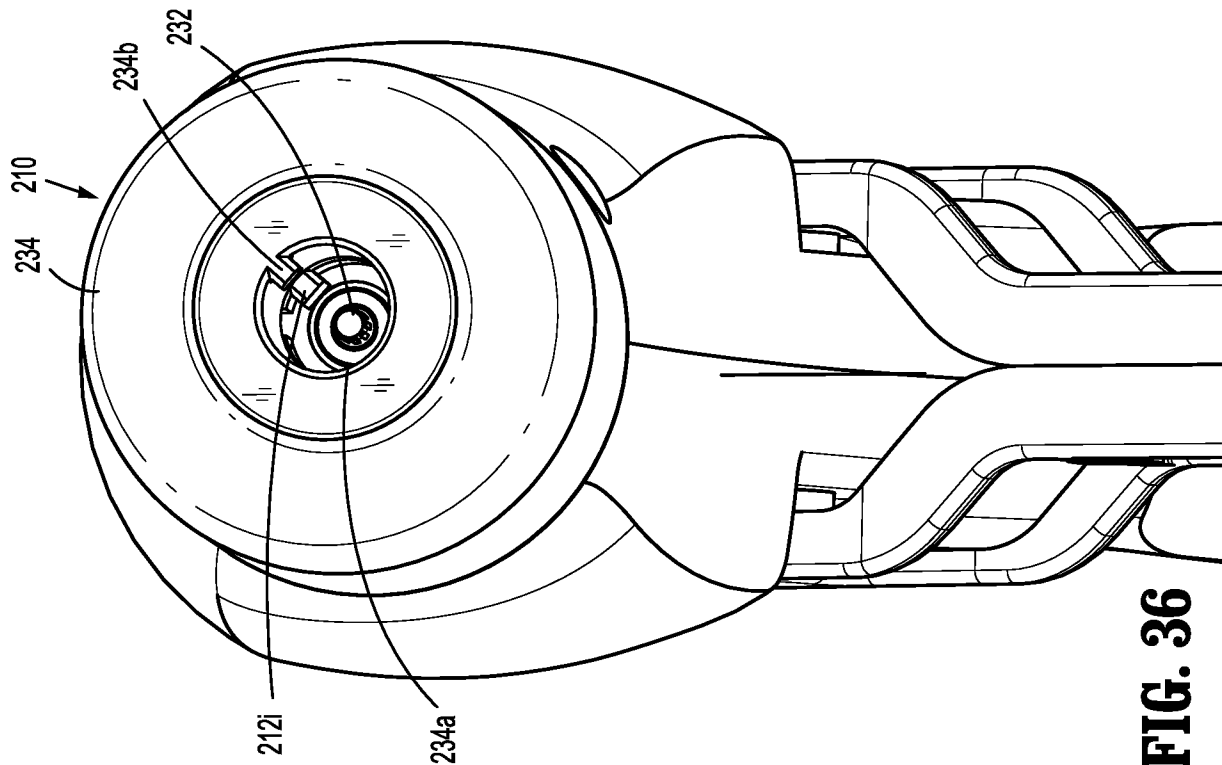


FIG. 36

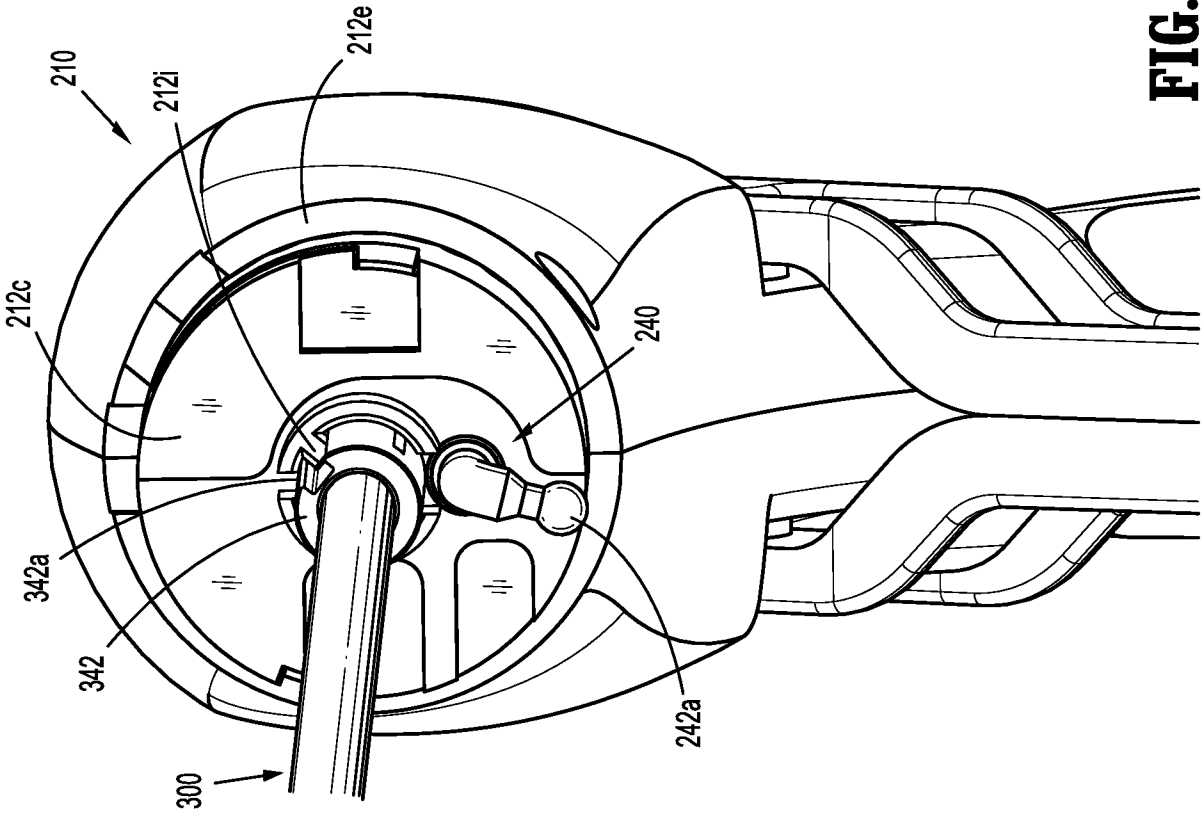


FIG. 38

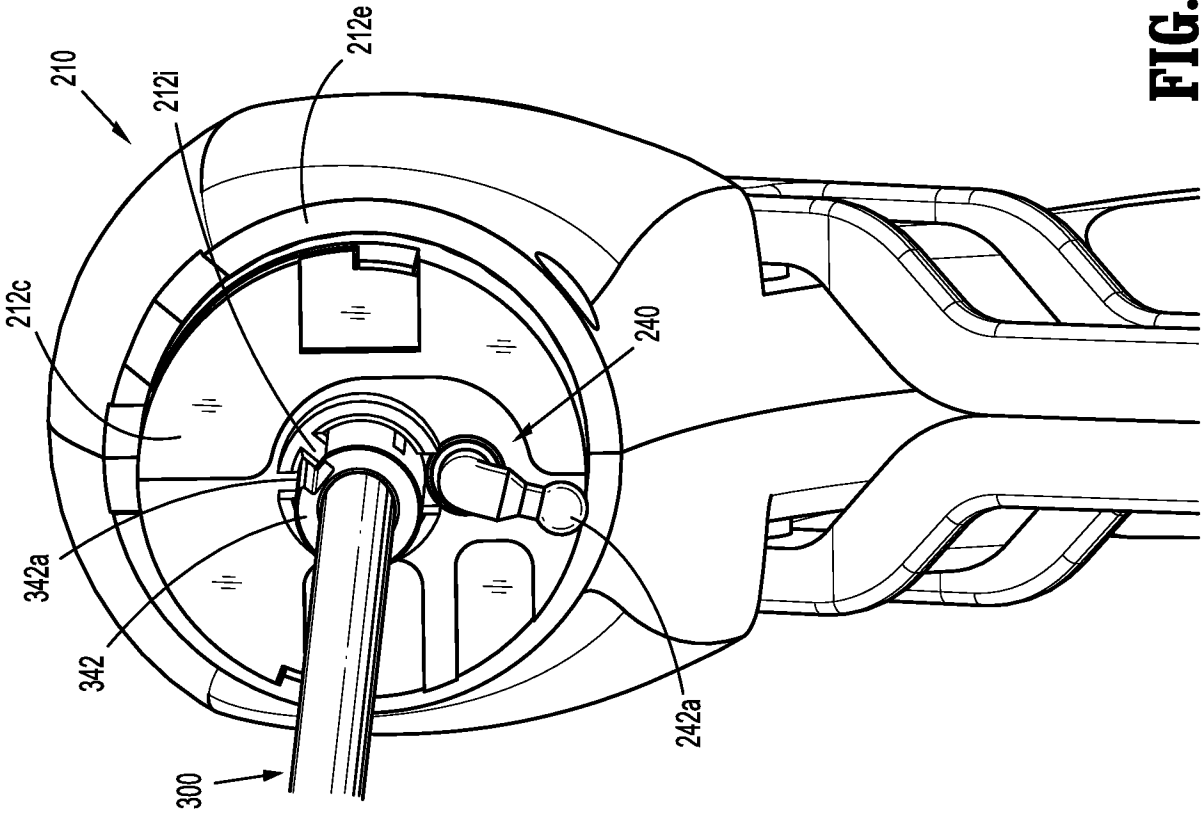


FIG. 39

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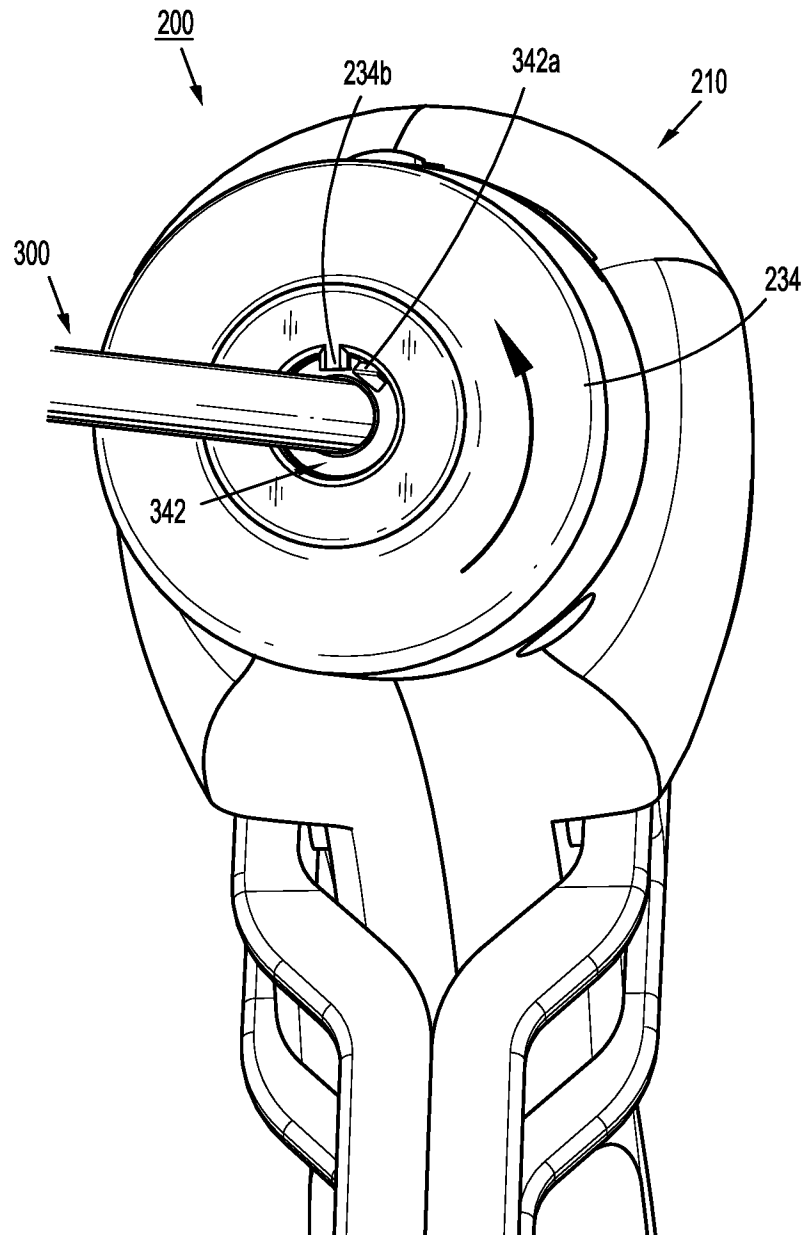


FIG. 40

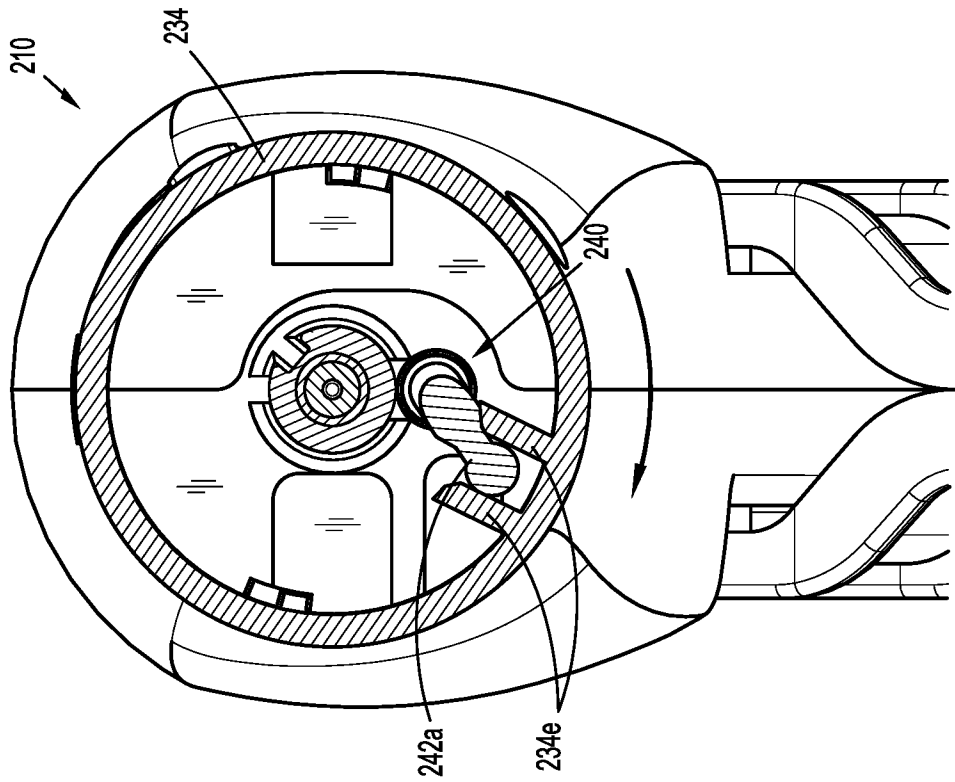


FIG. 42

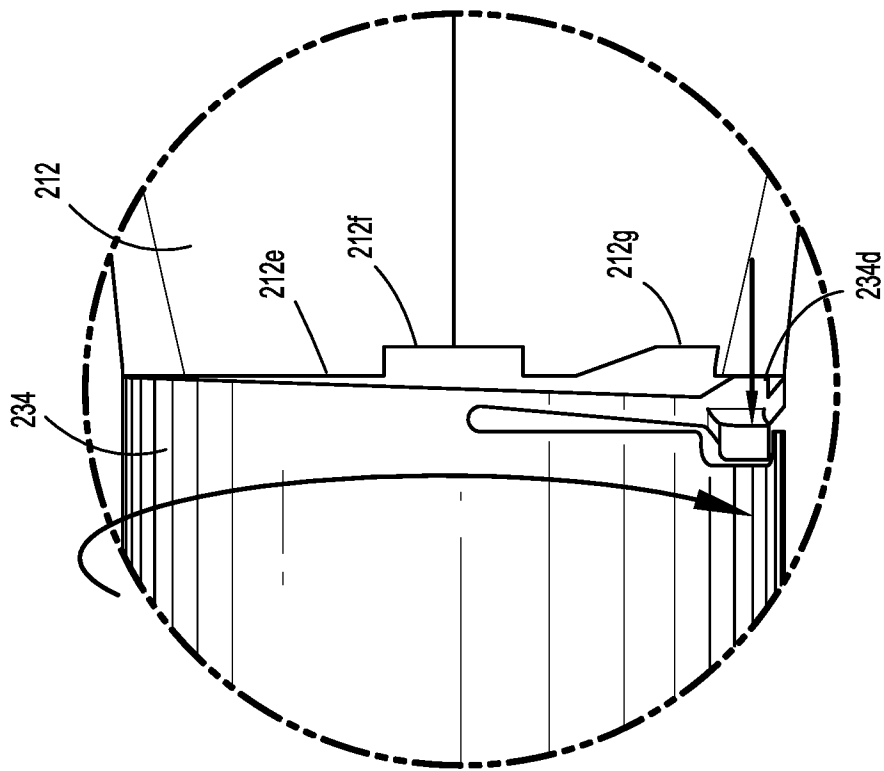


FIG. 41

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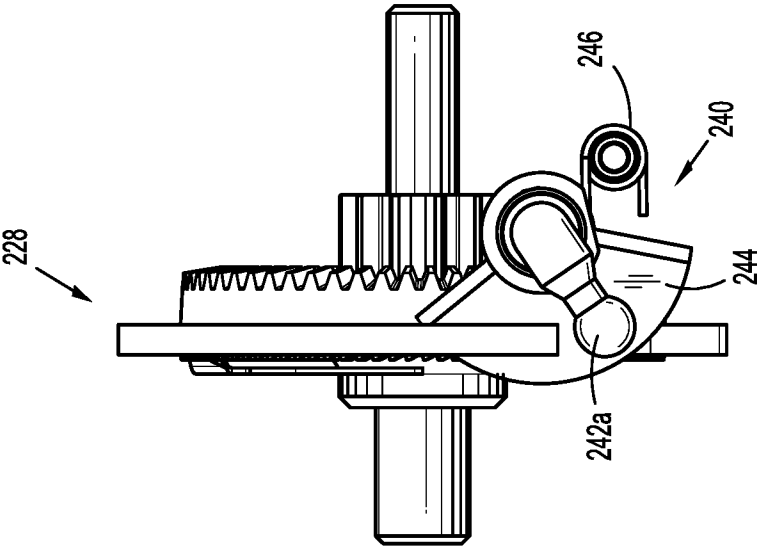


FIG. 44

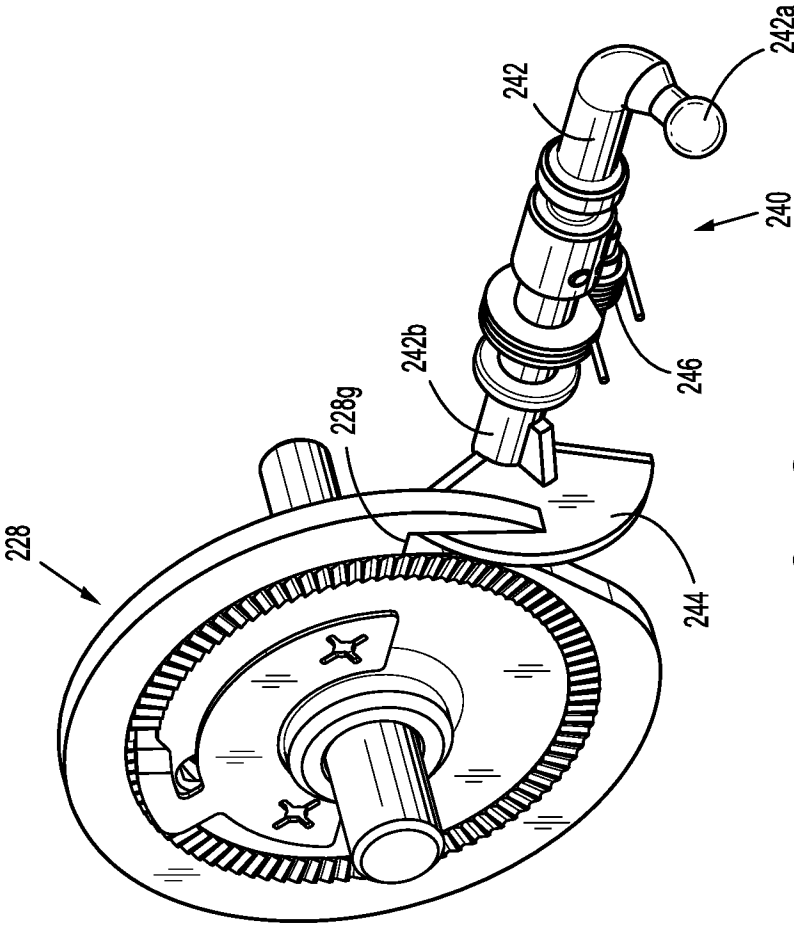


FIG. 43

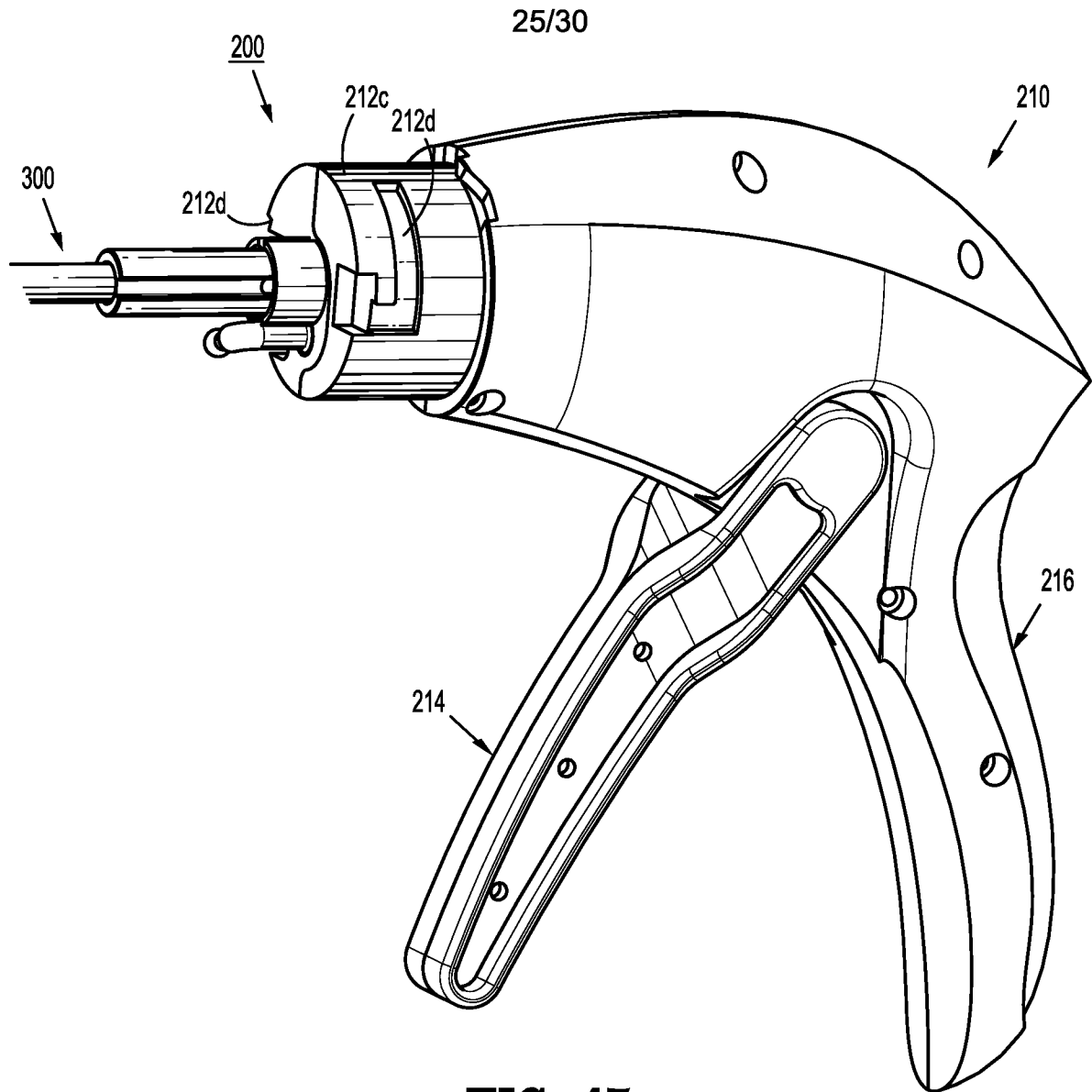


FIG. 45

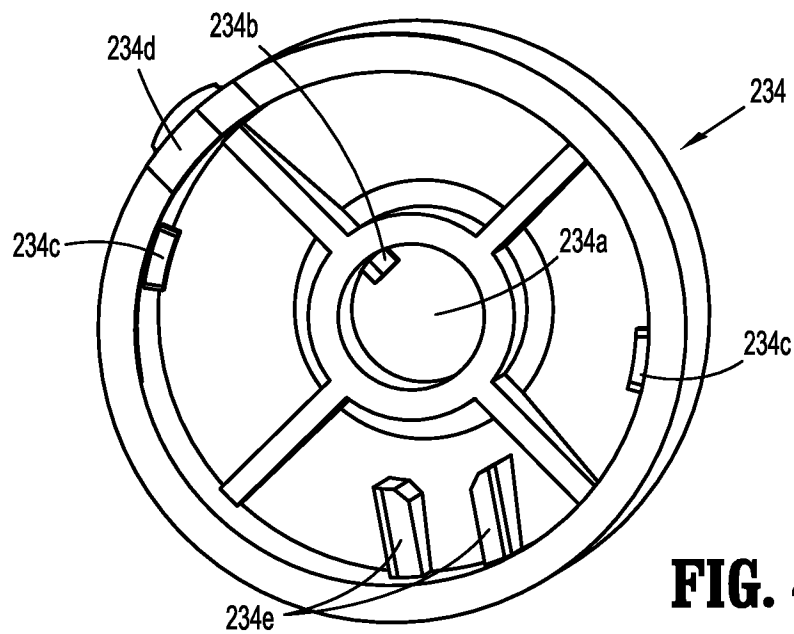


FIG. 46

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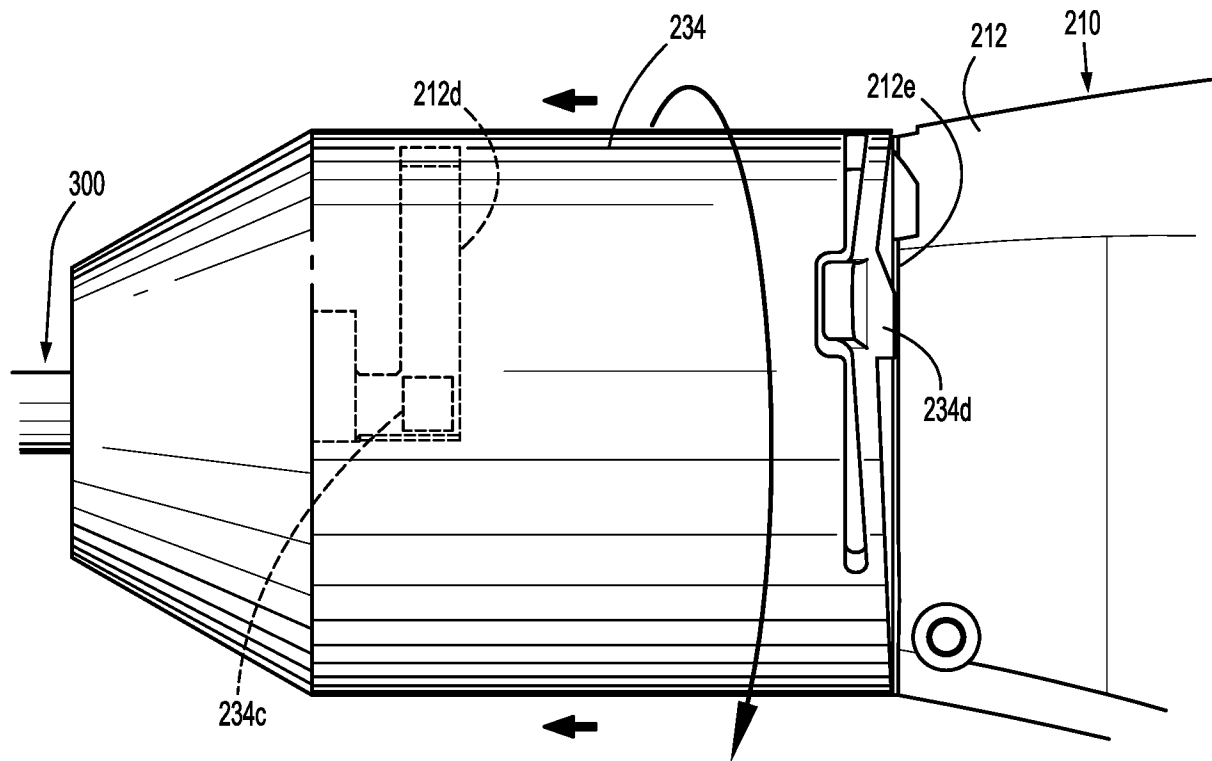


FIG. 47

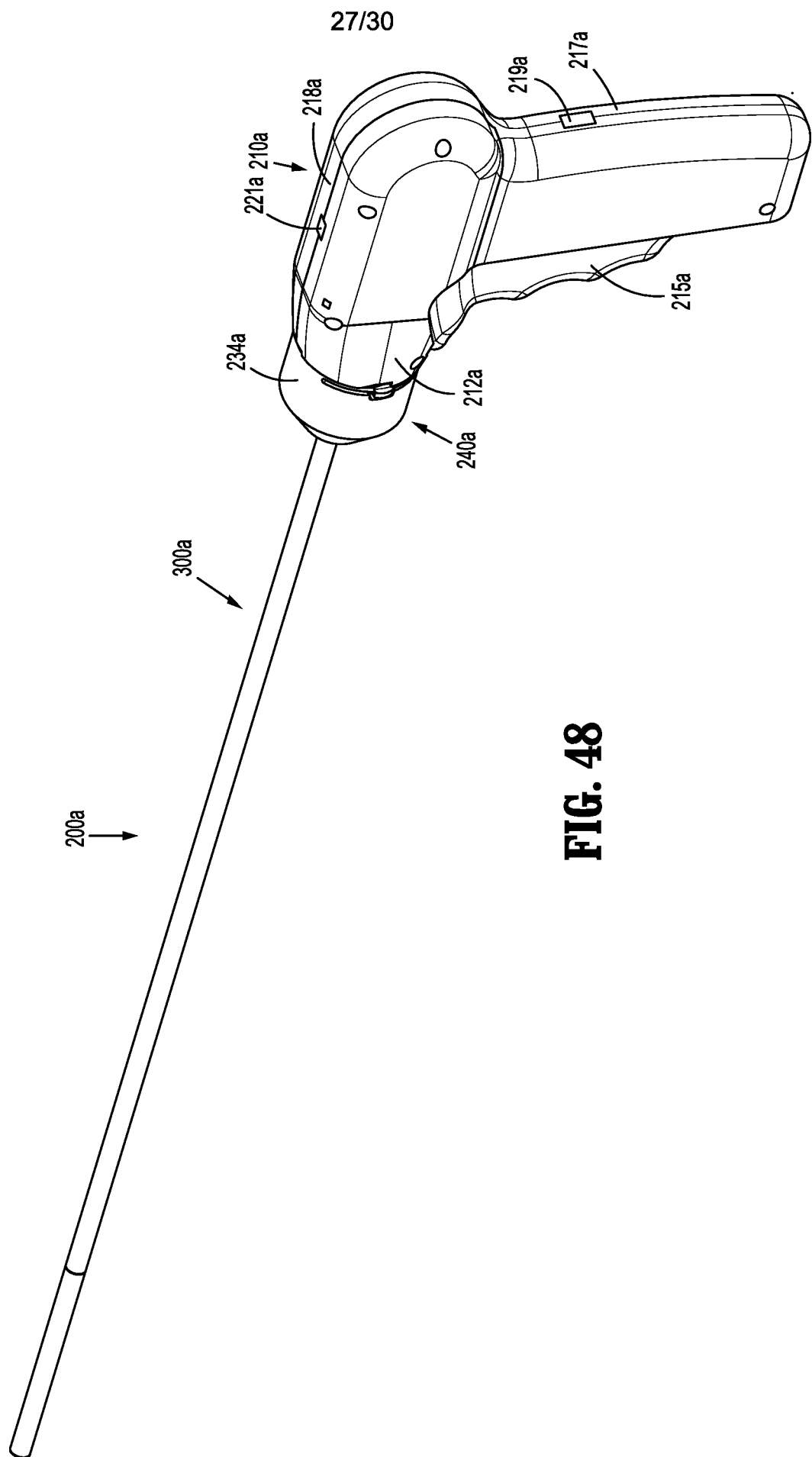


FIG. 48

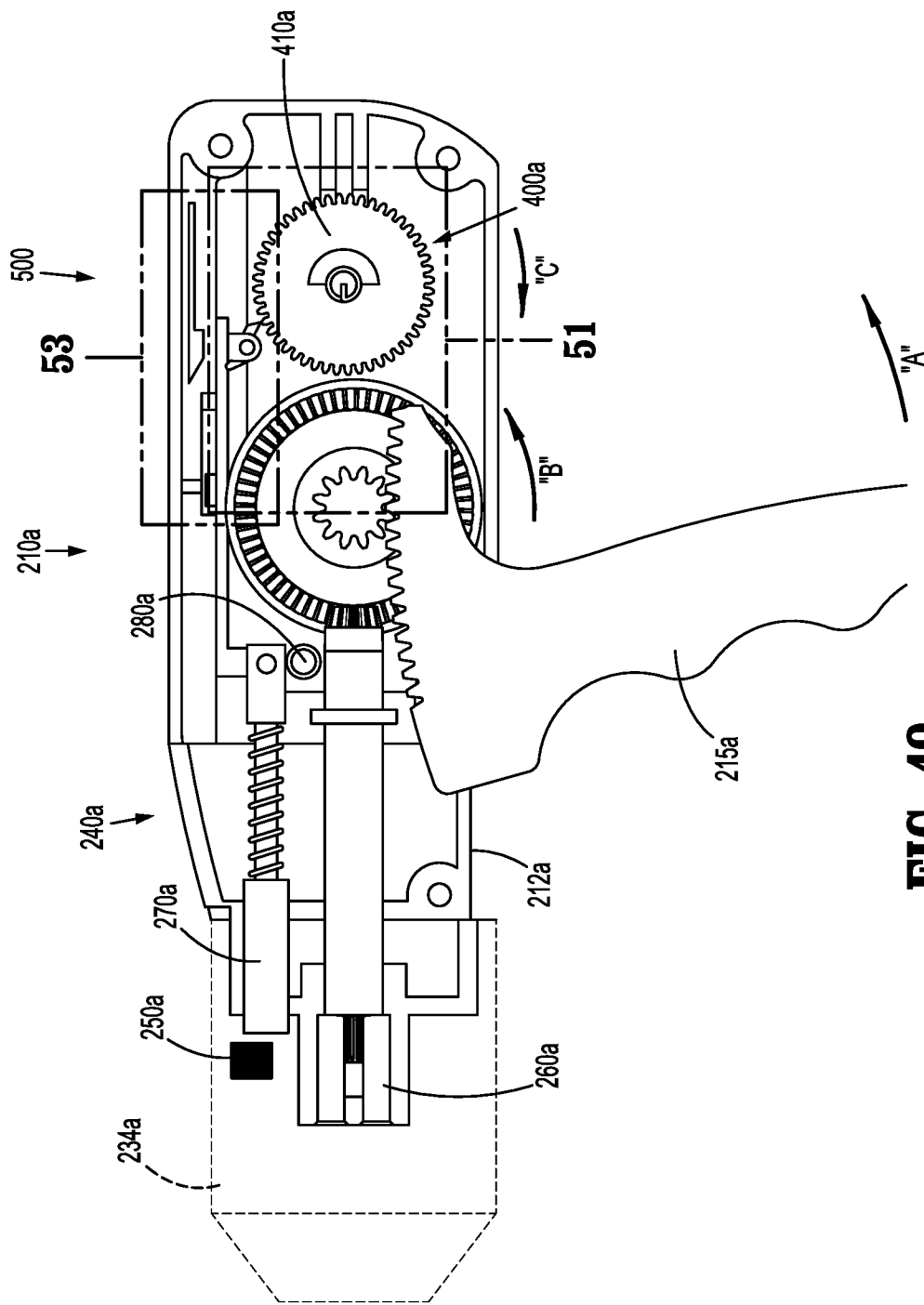
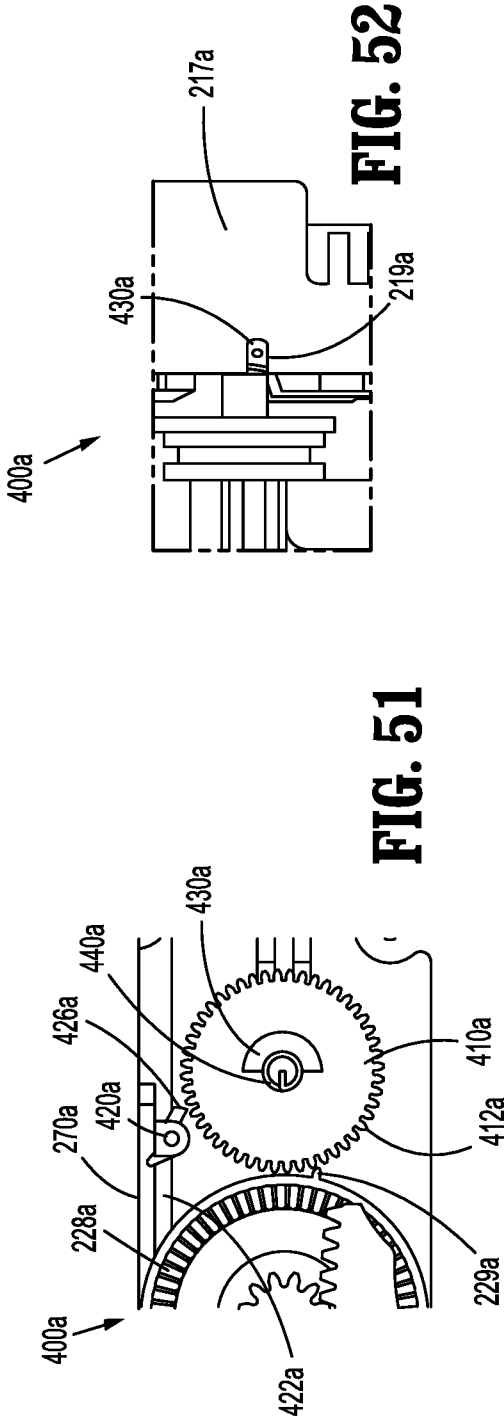
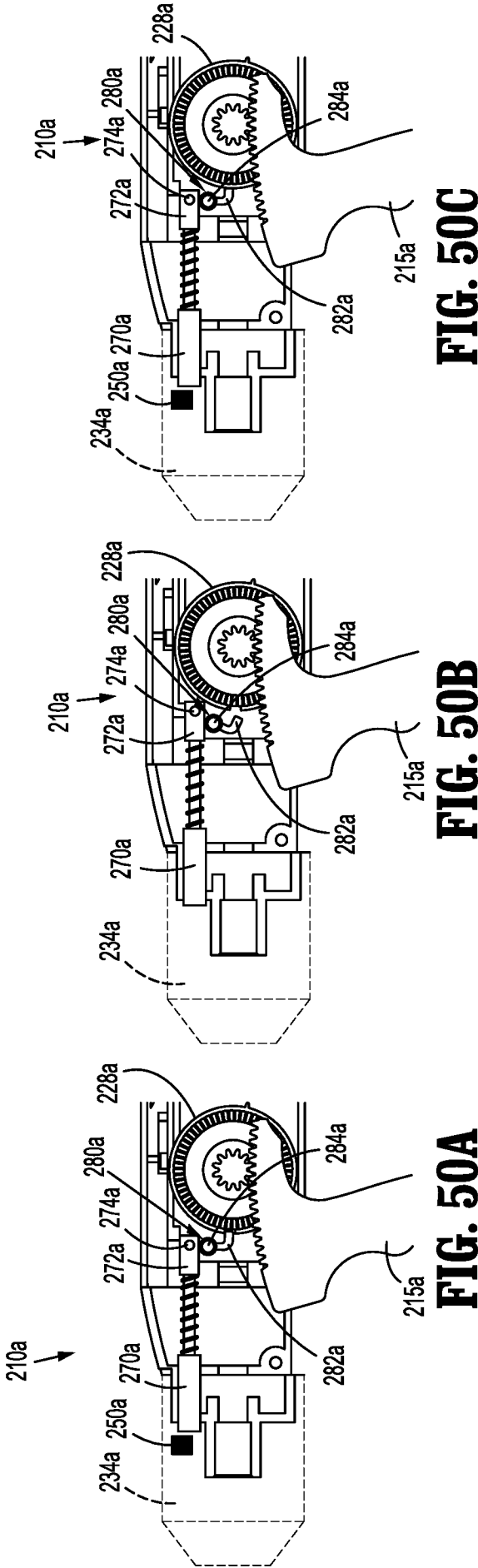


FIG. 49



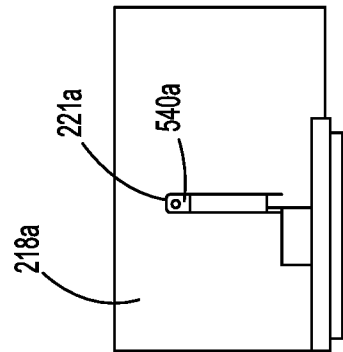


FIG. 54

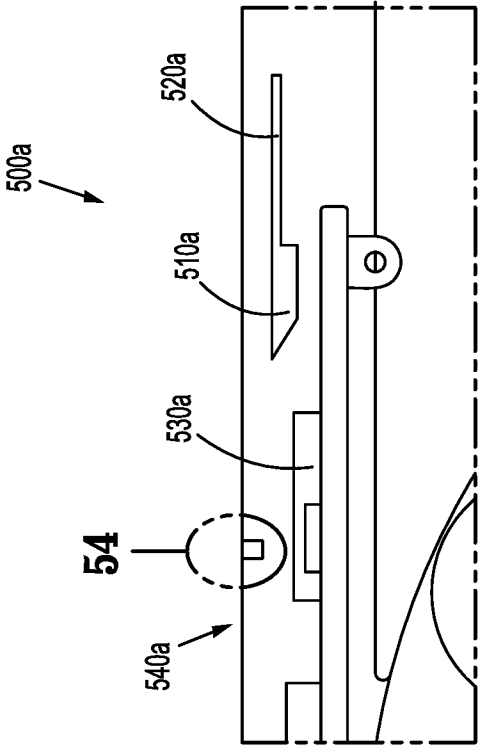


FIG. 53

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2014/082675

A. CLASSIFICATION OF SUBJECT MATTER

A61B 17/068(2006.01)i; A61B 17/072(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)

CNKI CNPAT WPI EPODOC: endoscopic, surgi+, tack?, pin, clip?, anvil, number, amount, quantity, counter?, count+, comput+, engag+, gear?, transmission, driv+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2005/0049616 A1 (RIVERA, CARLOS ET AL) 03 March 2005 (2005-03-03) description, paragraphs [0089]-[0104], [0133]-[0140], figures 1-6, 30-37	1-20
A	CN 102835979 A (ETHICON ENDO-SURGERY, INC.) 26 December 2012 (2012-12-26) the whole document	1-20
A	EP 0646354 A2 (UNITED STATES SURGICAL CORPORATION) 05 April 1995 (1995-04-05) the whole document	1-20
A	CN 102217961 A (TYCO HEALTHCARE GROUP LP) 19 October 2011 (2011-10-19) the whole document	1-20
A	US 5313935 A (SYMBIOSIS CORPORATION) 24 May 1994 (1994-05-24) the whole document	1-20
A	US 2010/0057104 A1 (SORRENTINO, GREGORY ET AL) 04 March 2010 (2010-03-04) the whole document	1-20
A	US 2008/0164296 A1 (SHELTON, FREDERICK E. ET AL) 10 July 2008 (2008-07-10) the whole document	1-20

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Date of the actual completion of the international search

31 March 2015

Date of mailing of the international search report

24 April 2015

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2014/082675

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2014/082675

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