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(56) Related Art
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EEA TILT TOP ANVIL WITH RATCHET/LOCKING MECHANISM

Abstract

A tilt anvil assembly (30) is disclosed which includes a center rod (114) and a head assembly (112) pivotally mounted to the center rod (114). The head assembly (112) includes a housing (118), a post (116) and an anvil plate (124). The head assembly (112) is pivotally secured to the center rod (114) and pivotal in relation to the center rod (114) in discrete steps between a non-tilted position and a fully tilted position via a plurality of partially tilted positions. The head assembly (112) is configured to maintain a partially tilted position.

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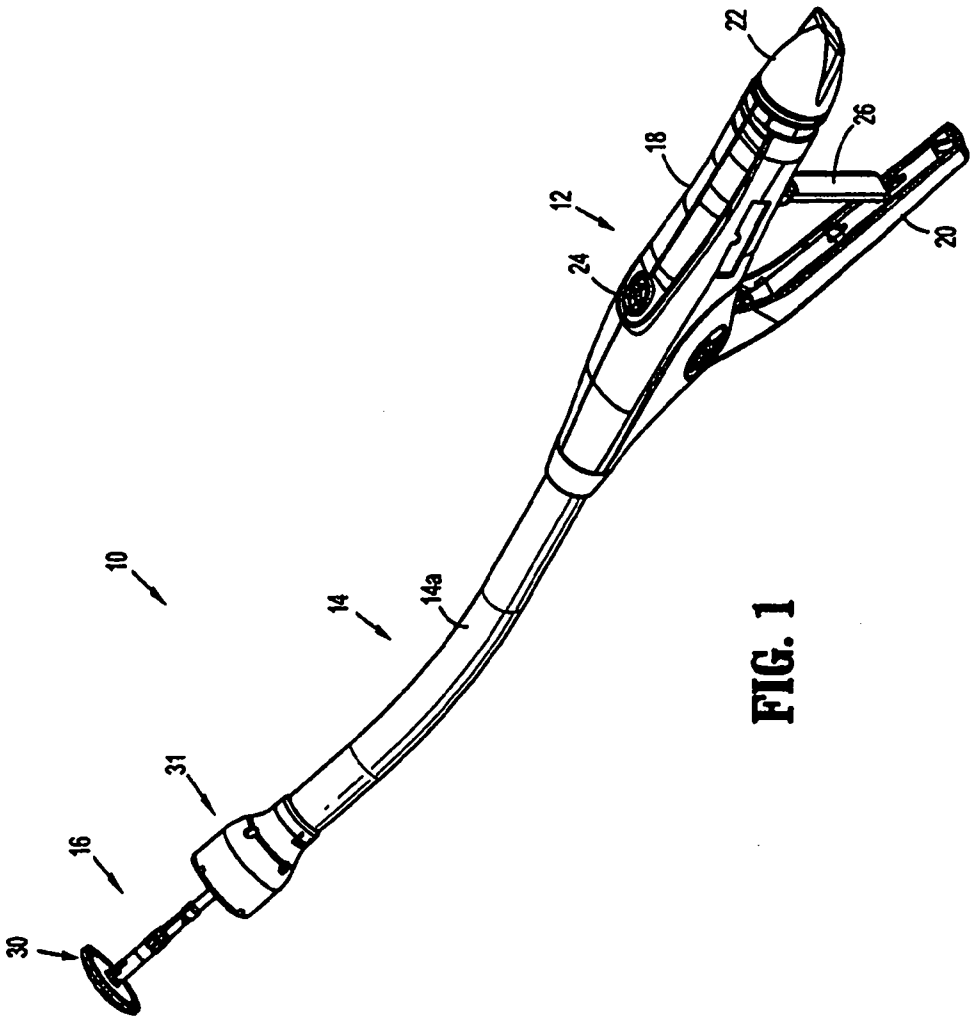

FIG. 1

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PATENTS ACT 1990

COMPLETE SPECIFICATION

FOR A STANDARD PATENT

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Invention Title:	EEA tilt top anvil with ratchet/locking mechanism

The following statement is a full description of this invention, including the best method of performing it known to me/us:

EEA TILT TOP ANVIL WITH RATCHET/LOCKING MECHANISM

Technical Field

[0001] The present disclosure relates generally to an anvil assembly which is suitable for use with a circular anastomosis stapler. More specifically, the present disclosure relates to an anvil assembly having a tiltable head which is suitable for use with a circular anastomosis stapler.

Background

[0002] Circular anastomosis staplers which include an anvil assembly having a tiltable anvil head are known in the art. Such tiltable anvil heads have been disclosed in U.S. Publication No. 2010/0038401 to Milliman and U.S. Publication No. No. 2008/0230581 to Marczyk, the contents of which are incorporated herein by reference in their entirety. The tiltable anvil head normally includes a spring loaded tilting mechanism which tilts the anvil head to its maximum rotation degree as allowed by the stapler geometry. For instance, the tiltable anvil head normally has an operative position at which the anvil head is generally perpendicular to the axis of the stapler, and a fully tilted position at which the anvil head is generally aligned with the axis of the stapler. The tiltable anvil head is pivotable from the operative position to the fully tilted position, but is not able to be maintained at any intermediate positions therebetween. Currently, if excess tissues are placed under the anvil, e.g., when the anvil is manipulated through the colon/bowel or through the anastomotic ring, the excess tissue can inhibit the anvil from being tilted to its maximum rotation degree.

[0003] Based on the foregoing, a need still exists for an anvil head that may be partially tilted and maintained at an intermediate position between the operative and fully tilted positions.

Object of Invention

[0003a] It is an object of the present invention to substantially overcome or at least ameliorate one or more of the disadvantages of the prior art, or to at least provide a useful alternative.

Summary of Invention

[0004] The present disclosure features a tilt anvil assembly for incrementally pivoting an anvil in discrete steps between a non-tilted position and a fully tilted position.

[0005] In one aspect of the present disclosure, there is provided a tilt anvil assembly comprising:

a center rod defining a longitudinal axis; and

a head assembly including a housing, a post, and an anvil plate having staple deforming pockets, the post including a ratchet mechanism engaging the center rod during pivotal movement of the head assembly, the ratchet mechanism including a plurality of teeth, the head assembly being pivotally secured to the center rod, wherein the plurality of teeth of the ratchet mechanism engage the center rod to selectively maintain an off-axis angular orientation of the head assembly in relation to the longitudinal axis of the center rod in increments between a non-tilted position and a fully tilted position.

[0006] The head assembly may have a plurality of partially tilted positions relative to the center rod between the non-tilted position and the fully tilted position. The head assembly may be configured to maintain a partially tilted position.

[0007] In another aspect of the present disclosure, there is provided a tilt anvil assembly comprising:

a center rod assembly including a collar member having a spring member hingedly attached thereto, the center rod assembly defining a longitudinal axis; and

a head assembly including a housing, a post, and an anvil plate having staple deforming pockets, the head assembly being pivotally secured to the center rod assembly and pivotal in relation to the longitudinal axis of the center rod assembly between a non-tilted position and a fully tilted position, the post including a plurality of teeth disposed at least partially along one side thereof;

wherein the spring member of the collar member is configured to selectively engage the teeth of the post during pivotal movement of the head assembly.

[0008] In at least a preferred embodiment of the present disclosure, there is provided a method for pivoting an anvil head assembly of a surgical anvil assembly including the steps of: providing an anvil assembly including a rod and a head assembly pivotally secured to the rod. The head

assembly is movable between a non-tilted operative position and a fully tilted position via a plurality of partially tilted positions. The method also includes locking the head assembly in a partially tilted position.

Brief Description of Drawings

[0009] Various embodiments of the presently disclosed tilt anvil assembly are disclosed herein, by example only, with reference to the drawings, wherein:

[0010] FIG. 1 is a perspective view of a surgical stapling device including an embodiment of an anvil assembly according to the present disclosure;

[0011] FIG. 2 is a front perspective view of the presently disclosed tilt anvil assembly with the anvil head untilted;

[0012] FIG. 3 is a rear perspective view of the tilt anvil assembly shown in FIG. 2;

[0013] FIG. 4 is a perspective view, with parts separated, of the tilt anvil assembly shown in FIG. 2;

[0014] FIG. 5 is a perspective view of the head assembly of the tilt anvil assembly shown in FIG. 3;

[0015] FIG. 6 is an enlarged view of the area 6 indicated in FIG. 5;

[0016] FIG. 7 is a perspective view of the collar member of the tilt anvil assembly;

[0017] FIG. 8 is a side cross-sectional, schematic view of the tilt anvil assembly shown in FIG. 2 with the anvil head in a locked, non-tilted position;

[0018] FIG. 9 is a side cross-sectional, schematic view of the tilt anvil assembly shown in FIG. 2 with the anvil head in an unlocked, non-tilted position;

[0019] FIG. 10 is a side cross-sectional view of the tilt anvil assembly shown in FIG. 2 with the anvil head in an unlocked, non-tilted position;

[0020] FIG. 11 is an enlarged view of the area 11 indicated in FIG. 10;

[0021] FIG. 12 is a side cross-sectional view of the tilt anvil assembly shown in FIG. 2 with the anvil head in a partially tilted position;

[0022] FIG. 13 is an enlarged view of the area 13 indicated in FIG. 12;

[0023] FIG. 14 is a side cross-sectional view of the tilt anvil assembly shown in FIG. 2 with the anvil head in a fully tilted position;

[0024] FIG. 15 is an enlarged view of the area 15 indicated in FIG. 14;

[0025] FIG. 16 is a cut-away view of the tilt anvil assembly shown in FIG. 14;

[0026] FIG. 17 is an enlarged view of the area 17 indicated in FIG. 16.

Detailed Description

[0027] Embodiments of the presently disclosed anvil assembly will now be described in detail with reference to the drawings in which like reference numerals designate identical or corresponding elements in each of the several views. Throughout this description, the term "proximal" will refer to the portion of the instrument closest to the operator and the term "distal" will refer to the portion of the instrument furthest from the operator.

[0028] FIG. 1 illustrates an embodiment of a surgical stapling device configured for use with a tilt anvil assembly according to the present disclosure. Briefly, surgical stapling device 10 includes a proximal handle assembly 12, an elongated central body portion 14 including a curved elongated outer tube 14a, and a distal head portion 16. Alternately, in some surgical procedures, e.g., the treatment of hemorrhoids, it is desirable to have a substantially straight, shortened, central body portion. The length, shape and/or the diameter of body portion 14 and distal head portion 16 may also be varied to suit a particular surgical procedure.

[0029] With reference still to FIG. 1, handle assembly 12 includes a stationary handle 18, a firing trigger 20, a rotatable approximation knob 22 and an indicator 24. A pivotally mounted trigger lock 26 is fastened to handle assembly 12 and is manually positioned to prevent inadvertent firing of stapling device 10. Indicator 24 is positioned on the stationary handle 18 and includes indicia, e.g., color coding, alpha-numeric labeling, etc., to identify to a surgeon whether the device is approximated and is ready to be fired. Head portion 16 includes an anvil assembly 30 and a shell assembly 31. For a more detailed discussion of surgical stapler 10, please refer to U.S. Patent No. 7,431,191 ("the '191 Patent") to Milliman, the contents of which are incorporated herein by reference in its entirety.

[0030] Referring now to FIGS. 2-17, an embodiment of the present disclosure is shown generally as anvil assembly 30. As illustrated in FIGS. 2-3, the anvil assembly 30 includes a head assembly 112 and a center rod assembly 114 which defines an axis "A" along its length. The anvil assembly 30 has a non-titled or operative position, at which the head assembly 112 is generally perpendicular to the center rod assembly 114. The anvil assembly 30 also has a fully tilted position, at which the head assembly 112 is substantially coaxially aligned with respect to the center rod assembly 114, as shown in FIG. 14. The head assembly 112 is pivotable with respect to the center rod assembly 114 between the non-tilted position and the fully tilted position.

[0031] With reference to FIG. 4, the head assembly 112 includes a post 116, a housing 118, a backup member or plate 120, a cutting ring cover 122 that covers a cutting ring (not shown), an anvil plate 124 having staple deforming pockets 130, a cam latch member 126, and a retainer member 127.

[0032] With reference to FIGS. 5-6, the post 116 defines an axis "B" along its length. When the anvil assembly 30 is in its non-tilted, operative position, the axis "B" is generally aligned with respect to the axis "A" of the center rod assembly 114. The post 116 includes two support members 160 symmetrically arranged with respect to each other. Each support member 160 includes a distal end 162 which may be monolithically formed with and centrally positioned within housing 118 of the head assembly 112, or may be fastened to the housing 118 using a known fastening technique, e.g., welding. Each support member 160 also includes a proximal end 164 having a planar surface 166, which is generally perpendicular to the axis "B" of the post 116. Furthermore, the post 116 includes a first side surface 168 extending between the distal end 162 and the proximal end 164. The first side surface 168 is generally parallel to the axis "B," and perpendicular to the planar surface 166.

[0033] With continued reference to FIGS. 5-6, the post 116 also includes a second side surface 170 diametrically opposed to the first side surface 168. The side surface 170 defines a curved profile, generally inclined with respect to the axis "B" of the post 116. In one example as illustrated in FIG. 6, the second side surface 170 defines an obtuse angle "θ" with respect to the planar surface 166 at the proximal end 164. The side surface 170 may include interlocking ratchet features. For instance as illustrated in FIG. 6, the side surface 170 includes a plurality of teeth 172 disposed immediately adjacent to the proximal end 164 of the post 116 and at least

partially along the length of the side surface 170. A notch 174 exists between each pair of adjacent teeth 172. Each tooth 172 extends in a direction traverse or perpendicular to the lengthwise direction of the side surface 170.

[0034] The support members 160 are laterally spaced apart from each other with a transverse slot 176 defined therebetween. The transverse slot 176 is dimensioned to receive the cam latch member 126 therein. Further, the support members 160 define a pair of transverse throughbores 178 axially aligned with respect to a pivotal axis "C", and the cam latch member 126 defines a throughbore 126b, such that when the cam latch member 126 is disposed within the transverse slot 176, the throughbores 178 and 126b are coaxially aligned along the pivotal axis "C".

[0035] With reference to FIG. 4, the center rod assembly 114 includes a center rod 152, a plunger 154, a plunger spring 156 and a collar member 190. The center rod assembly 114 includes a first end 155 defining a bore 155a therein dimensioned to releasably engage an anvil retainer (not shown) of the surgical stapling device 10. One such surgical stapling device having an anvil retainer and with which the anvil assembly 30 may be used is disclosed in the '191 Patent. The center rod assembly 114 also includes a second end 157 having a pair of arms 159 which define a cavity 159a dimensioned to accommodate the plunger 154, the plunger spring 156, the collar member 190, the post 116 of the head assembly 112, and the cam latch member 126 therein.

[0036] The center rod 152 defines a pair of throughbores 158. When the post 116 and the cam latch member 126 are positioned within the cavity 159a, the throughbores 158, 178 and 126b of the center rod 152, the post 116 and the cam latch member 126, respectively, are coaxially aligned along the axis "C", and a pivot member 126 is disposed through the throughbores 158, 178 and 126b. As such, the cam latch member 126 is pivotally mounted within the transverse slot 172 of the post 116 about the pivotal axis "C", and the post 116 is pivotally secured to the center rod 152 about the pivotal axis "C", which, in turn, causes the head assembly 112 to be pivotally mounted to the center rod assembly 114 about the pivotal axis "C."

[0037] When assembled, the plunger 154, the plunger spring 156 and the collar member 190 are together disposed with the cavity 159a, proximally with respect to the post 116 and the cam latch member 126. The plunger 154 includes a cylindrical main body 154a dimensioned to be disposed in a longitudinal port 156a defined by the plunger spring 156. The plunger 154 also

includes an engagement finger 154b extending distally beyond the plunger spring 156. The engagement finger 154b is offset from the pivotal axis "C" of the post 116, and is biased into engagement with an edge 126c of the cam latch 126. Engagement of finger 154b with edge 126c of cam latch 126 presses a leading portion of edge 126f against an inner periphery of the backup plate 120 to urge the head assembly 112 to an operative or non-tilted position on the center rod 152.

[0038] The collar member 190 is distally mounted over the plunger 154, and disposed between the plunger 154 and the post 116 when assembled. As illustrated in FIG. 7, the collar member 190 exhibits a generally annular configuration, including two "C"-shaped walls 192 which are diametrically opposed and spaced apart from each other. The collar member 190 further includes a planar wall 194 interconnecting the two "C"-shaped walls 192. The collar member 190 defines a longitudinal opening 196 therethrough and a side opening 198 dimensioned to accommodate the engagement finger 154b of the plunger 154 therein. The collar member 190 further includes two spring members 199 hingedly attached to a distal end 194a of the planar wall 194. The spring members 199 extend radially inwardly towards the axis "A" of the center rod assembly 114. It is envisioned that the spring members 199 are made of deformable, elastic or resilient materials, such that the spring members 199 may be biased relative to the planar wall 194 when placed under pressure, and may resume their original shape and configuration upon removal of the pressured.

[0039] The anvil assembly 30 includes a locking mechanism that limits tilting of the head assembly 112 relative to the center rod assembly 114, and secures the anvil assembly 30 in the non-tilting position. Specifically, as illustrated in FIG. 4, the backup plate 120 of the head assembly 112 includes a pair of fingers 138 protruding radially inwardly towards a central opening 134 defined therein. The center rod 152 includes protrusions 152a extending from a distal surface 152b thereof. The protrusions 152a and the distal surface 152b are configured to selectively engage the fingers 138 of the backup plate 120 to inhibit the head assembly 112 from pivoting about the center rod assembly 114.

[0040] As illustrated in FIG. 8, before firing the stapling device 10 to advance surgical staplers into tissue, the head assembly 112 is in a pre-fired non-tilted position, in which fingers 138 formed on the backup plate 120 engage protrusions 152a adjacent the distal surface 152b of the center rod 152 to inhibit head assembly 112 from pivoting about the pivot member 162. When

the anvil assembly 30 is in its pre-fired non-tilted position, the backup plate 120 is spaced from the backwall 118a of the housing 118 by retainer 127.

[0041] With reference to FIGS. 4 and 9, the firing of surgical stapling device 10 causes a knife blade (not shown) to engage a cutting ring (not shown) to move the cutting ring and the backup plate 120 into annular recess 136 of housing 118 of the head assembly 112. When such movement occurs, deformable tabs 127a of retainer 127 are deformed against the backwall 118a of housing 118 and fingers 138 of the backup member 120 move away from protrusions 152b of center rod 152, unlocking the head assembly 112 from its non-tilted position. Further, inner periphery 120b of backup plate 120 moves past edge 126f of cam latch member 126 such that cam latch member 126 is urged to pivot about pivot member 162 by plunger 154. Engagement of plunger 154 with cam latch member 126 and subsequently with the post 116 urges the head assembly 112 to tilt as illustrated in FIGS. 10-17.

[0042] It is noted that the head assembly 112 will not immediately tilt upon firing of a stapling device 10 because, upon firing, the head assembly 112 is in an approximated position, i.e., the anvil head assembly 112 is in close alignment with the shell assembly 31 of the stapling device10. As such, the head assembly 112 will only begin to tilt when the head assembly 112 and the shell assembly 31 of the stapling device 10 are being unapproximated.

[0043] With reference to FIGS. 10-17, subsequent to firing, and when the head assembly 112 and the shell assembly 31 are sufficiently unapproximated, the plunger 154 interacts with the post 116 to incrementally tilt the head assembly 112 from the non-tilted position to the fully titled position.

[0044] FIGS 10-11 illustrate the anvil assembly 30 in a post-firing non-tilted position, at which the spring member 199 abuts the proximal end 164 of the post 116, lying against the planar surface 164 of the post 116.

[0045] FIGS. 12-17 illustrate that as the plunger 154 urges the post 116 to pivot about the pivotal axis "C", the spring member 199 passes up and over each tooth 172 along the side surface 170 of the post 116. After an appropriate tilting angle is reached, the spring member 199 locks against a notch 174 to maintain the head assembly 112 at the desired tilting position. Each notch 174 represents a tilted position of the head assembly 112 at a particular rotation angle

relative to the center rod assembly 114. The interlocking ratchet features of the anvil assembly 30, i.e., the teeth 172 and notches 174 of the post 116 and the spring member 199 of the collar member 190, enables incremental pivotal movement of the head assembly 112 relative to the center rod assembly 114 in discrete steps. By selectively engaging and/or disengaging the notches 174 along the side surface 170 of the post 116, the spring member 199 provides locking mechanism to selectively maintain the head assembly 112 at any partially tilted position.

[0046] As illustrated in FIGS. 12-13, the spring member 199 engages a particular notch 174a to maintain a partially tilted position between the non-tilted position and the fully tilted position. FIGS. 14-17 illustrates that the head assembly 112 is in its fully tilted position at which that the spring member 199 engages the distal-most notch 174b of the post 116.

[0047] It will be understood that various modifications may be made to the embodiments disclosed herein. The above description should not be construed as limiting, but merely as exemplifications of preferred embodiments. Those skilled in the art will envision other modifications within the scope and spirit of the disclosure herein.

CLAIMS

1. A tilt anvil assembly comprising:

a center rod defining a longitudinal axis; and

a head assembly including a housing, a post, and an anvil plate having staple deforming pockets, the post including a ratchet mechanism engaging the center rod during pivotal movement of the head assembly, the ratchet mechanism including a plurality of teeth, the head assembly being pivotally secured to the center rod, wherein the plurality of teeth of the ratchet mechanism engage the center rod to selectively maintain an off-axis angular orientation of the head assembly in relation to the longitudinal axis of the center rod in increments between a non-tilted position and a fully tilted position.

2. The tilt anvil assembly according to claim 1, wherein the head assembly is transitionable to a plurality of partially tilted positions relative to the longitudinal axis of the center rod between the non-tilted position and the fully tilted position.

3. The tilt anvil assembly according to claim 1, wherein the center rod includes a collar member configured to selectively engage the post during pivotal movement of the post.

4. The tilt anvil assembly according to claim 3, wherein the post includes a side surface defining a curved profile and forming an obtuse angle with respect to a proximal surface of the post.

5. The tilt anvil assembly according to claim 4, wherein the plurality of teeth of the ratchet mechanism are disposed, at least partially, along the length of the side surface, and each tooth extends in a direction traverse or perpendicular to a lengthwise direction of the side surface.

6. The tilt anvil assembly according to claim 5, wherein the side surface includes a notch between each pair of adjacent teeth.

7. The tilt anvil assembly according to claim 3, wherein the collar member includes a spring member configured to selectively engage the post.

8. The tilt anvil assembly according to claim 7, wherein the spring member comprises deformable, elastic and resilient materials.

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9. A tilt anvil assembly comprising:

a center rod assembly including a collar member having a spring member hingedly attached thereto, the center rod assembly defining a longitudinal axis; and

a head assembly including a housing, a post, and an anvil plate having staple deforming pockets, the head assembly being pivotally secured to the center rod assembly and pivotal in relation to the longitudinal axis of the center rod assembly between a non-tilted position and a fully tilted position, the post including a plurality of teeth disposed at least partially along one side thereof;

wherein the spring member of the collar member is configured to selectively engage the teeth of the post during pivotal movement of the head assembly.

10. The tilt anvil assembly according to claim 9, wherein the head assembly is transitionable to a plurality of partially tilted positions relative to the longitudinal axis of the center rod assembly between the non-tilted position and the fully tilted position.

11. The tilt anvil assembly according to claim 9, wherein the head assembly further includes a pivotal latch member positioned to prevent movement of the head assembly from the non-tilted position.

12. The tilt anvil assembly according to claim 9, further including a plunger which is urged by a biasing member into engagement with the post to effect pivotal movement of the head assembly relative to the center rod assembly.

13. The tilt anvil assembly according to claim 5, wherein the head assembly further includes a pivotal latch member positioned to inhibit movement of the head assembly from the non-tilted position.

14. The tilt anvil assembly according to claim 9, further including a plunger which is urged by a biasing member into engagement with the post to effect pivotal movement of the head assembly relative to the center rod assembly.

Covidien LP

Patent Attorneys for the Applicant/Nominated Person

SPRUSON & FERGUSON

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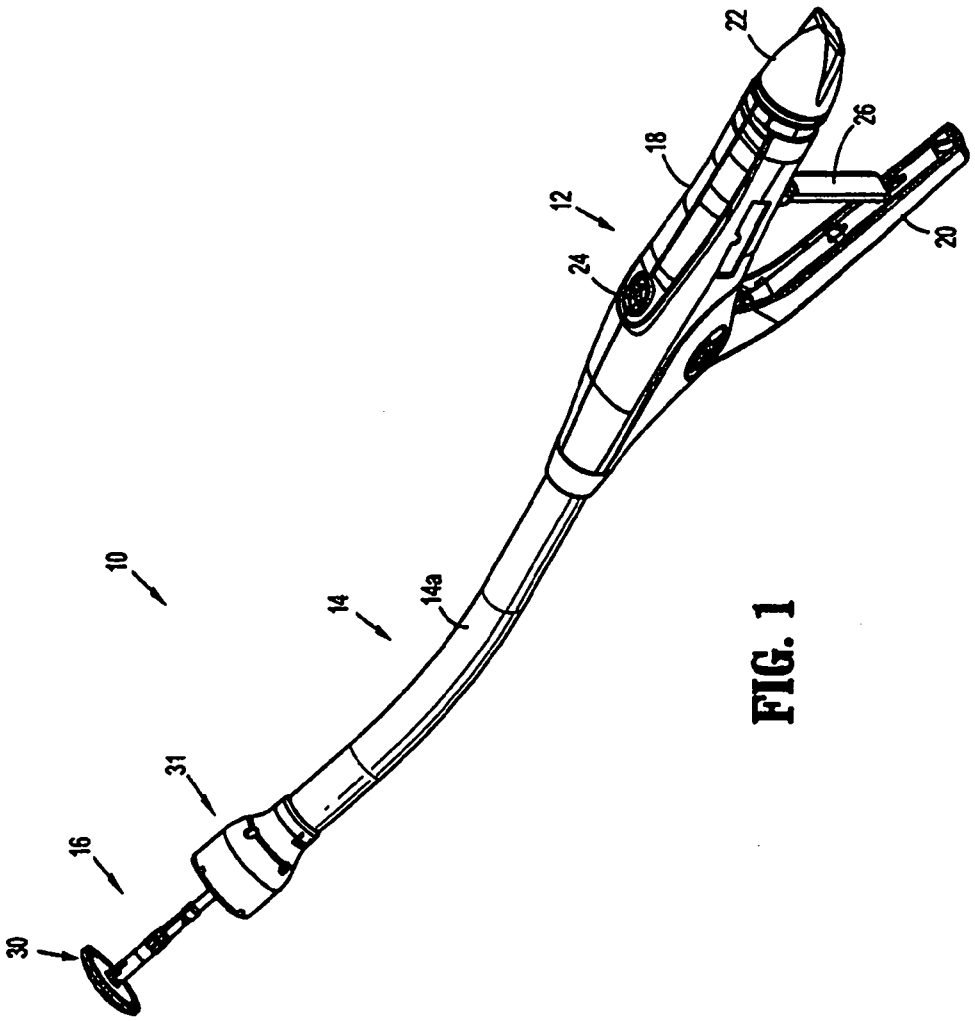

FIG. 1

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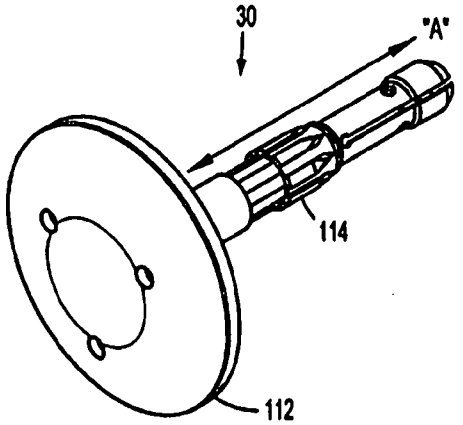


FIG. 2

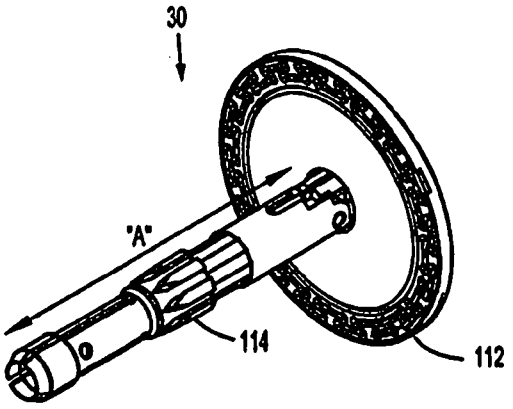
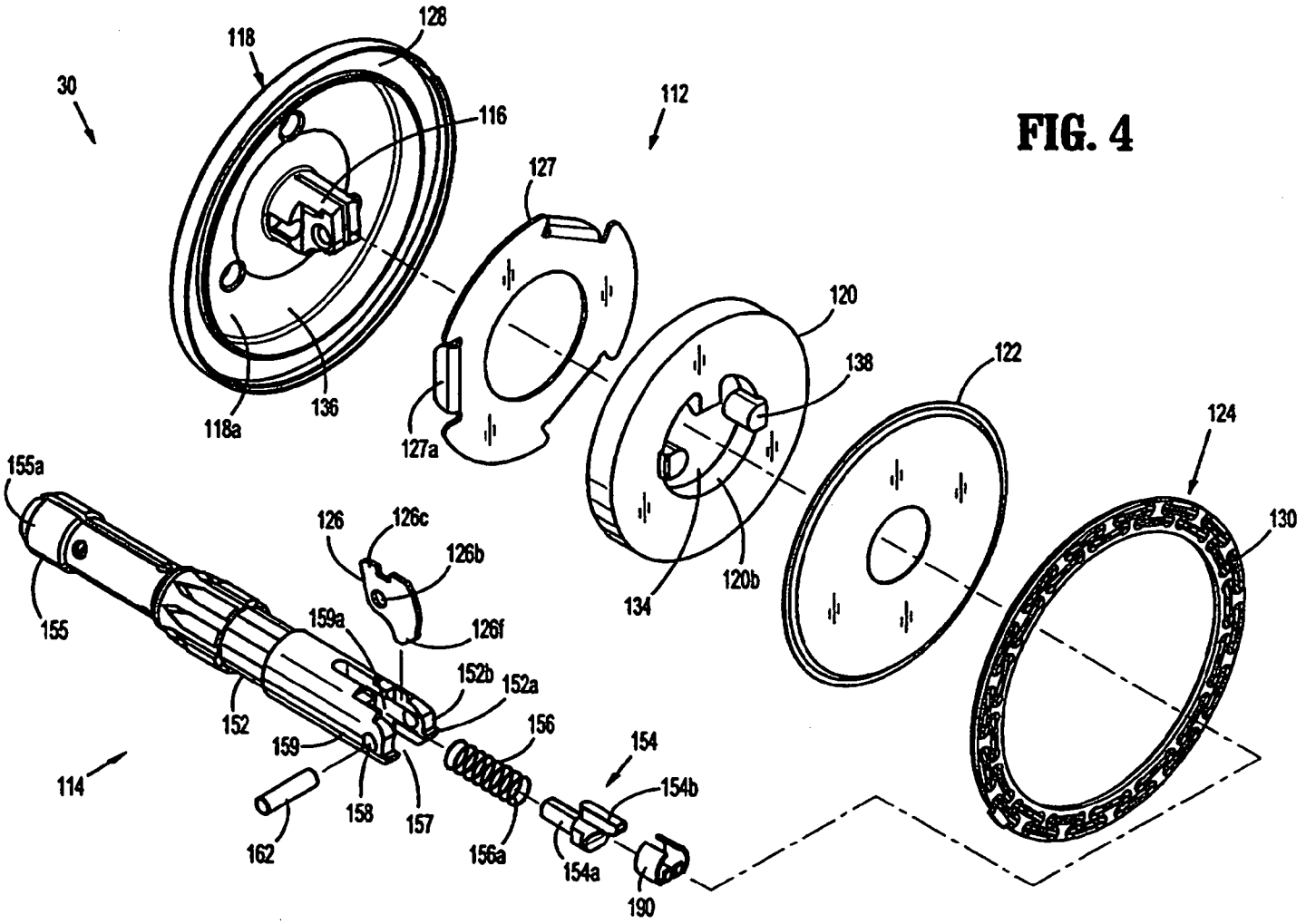


FIG. 3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118
128
116
112
127
120
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118a
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127a
134
120b
155a
126
126c
126b
155
159a
126f
152b
152a
152
156
159
154
154b
114
158
157
162
156a
154a
190

FIG. 4

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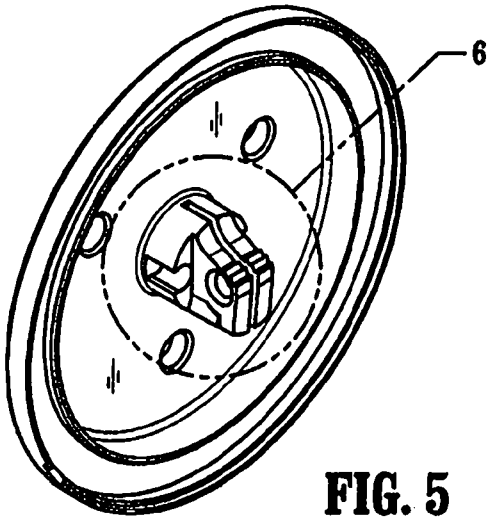

FIG. 5

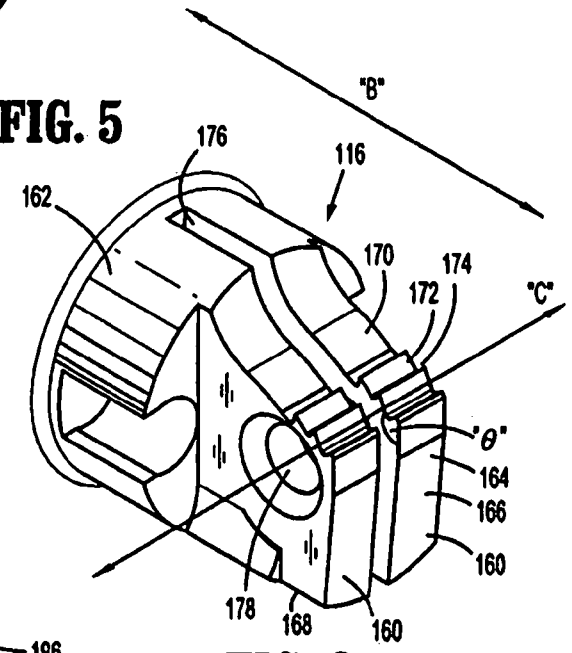

FIG. 6

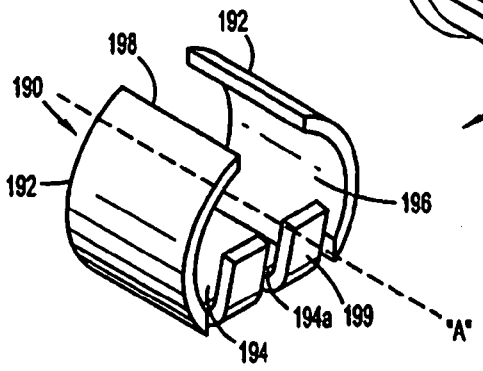

FIG. 7

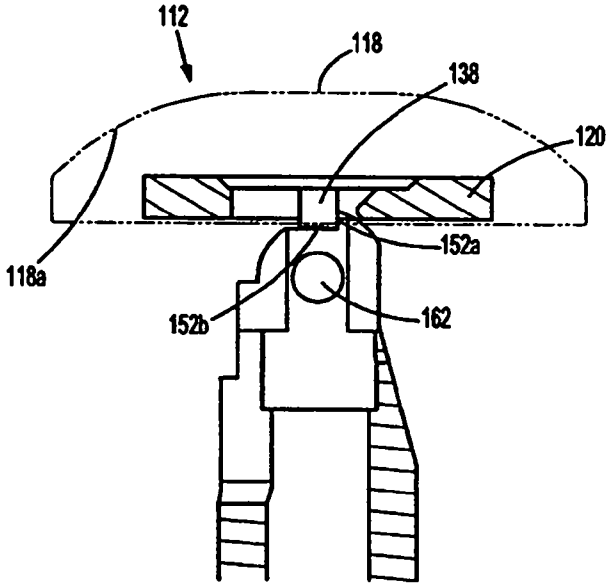

FIG. 8

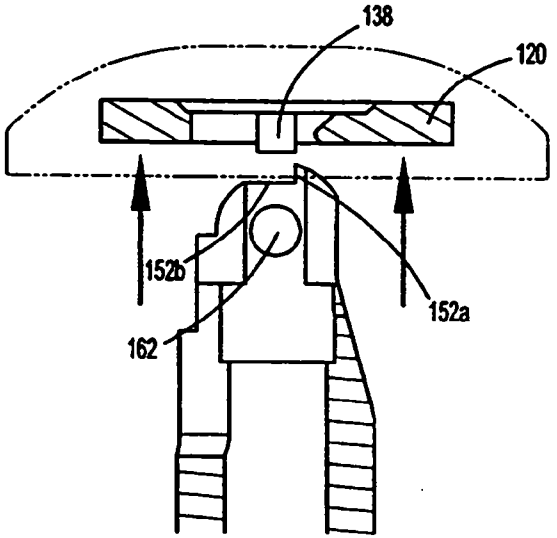

FIG. 9

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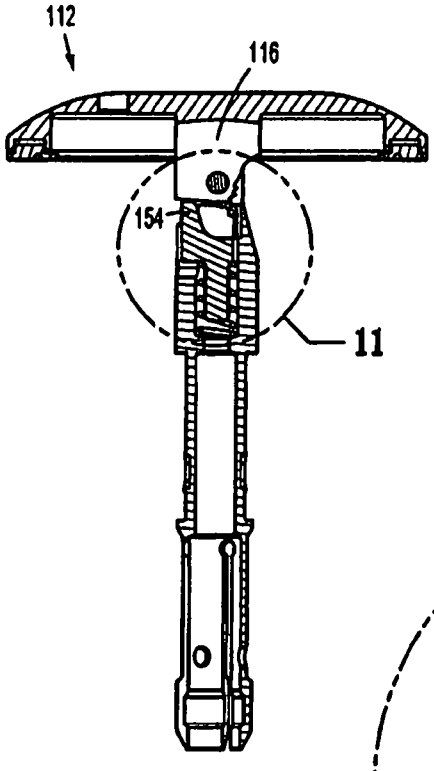

FIG. 10

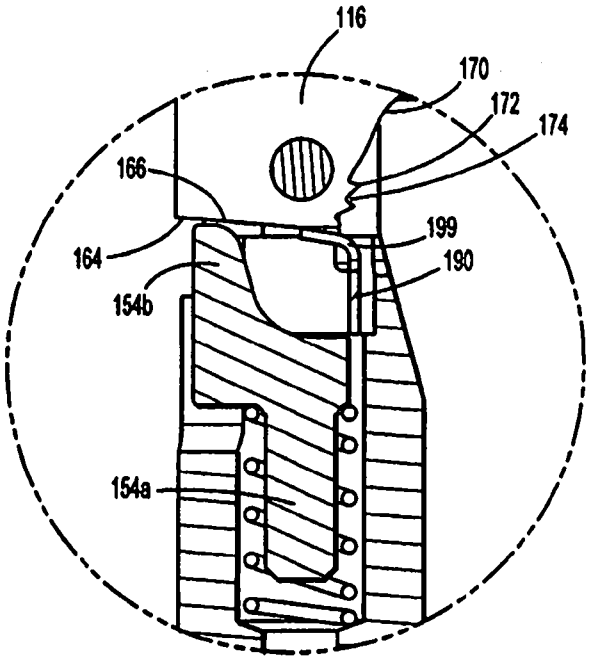

FIG. 11

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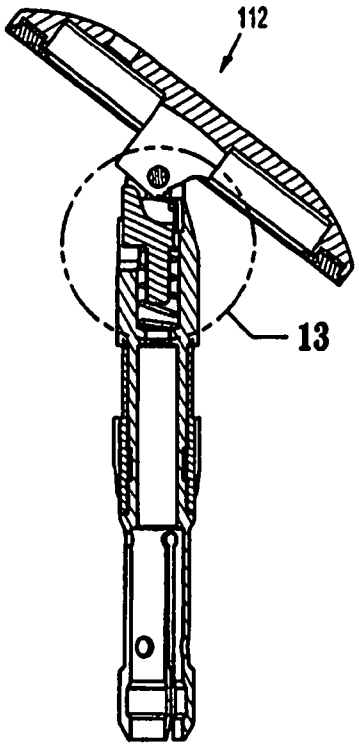

FIG. 12

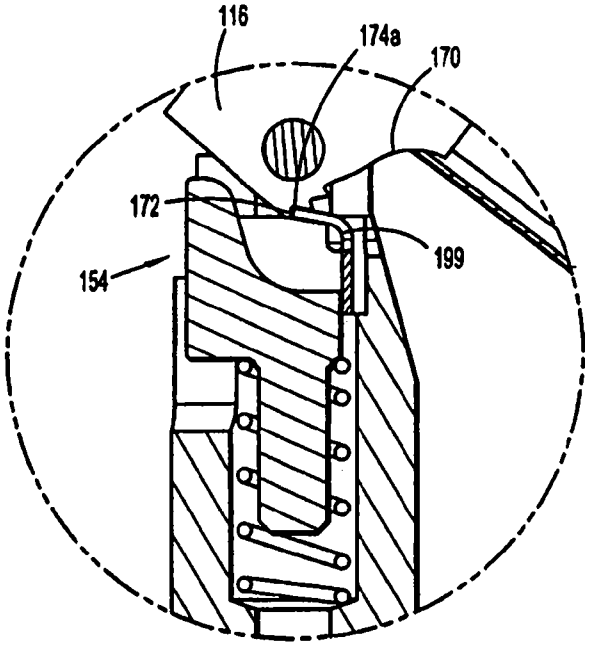

FIG. 13

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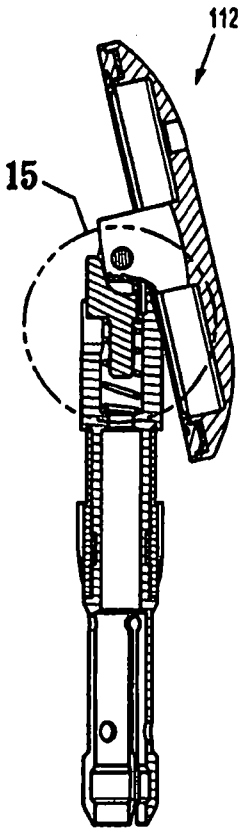

FIG. 14

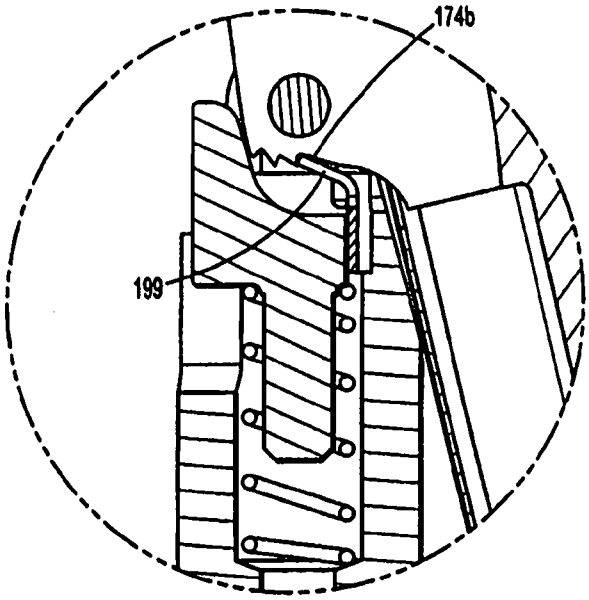

FIG. 15

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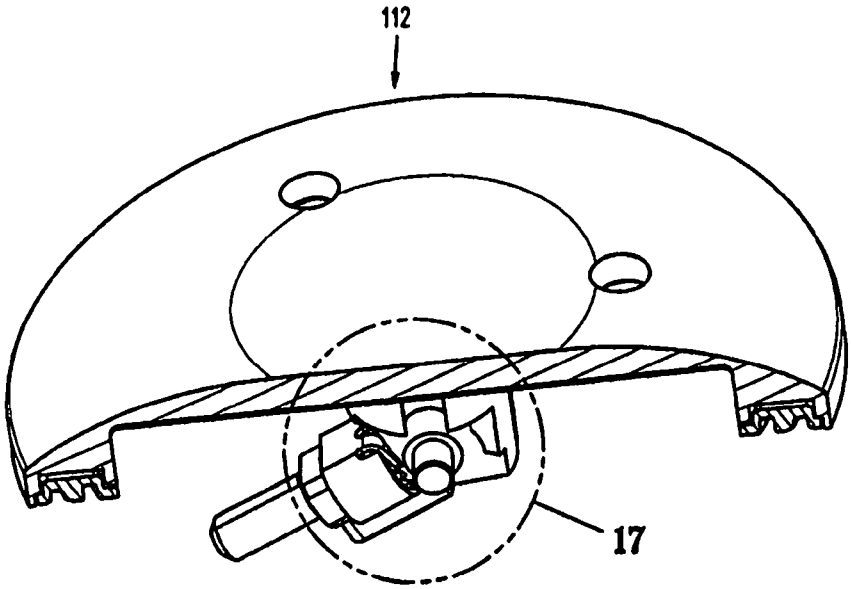

FIG. 16

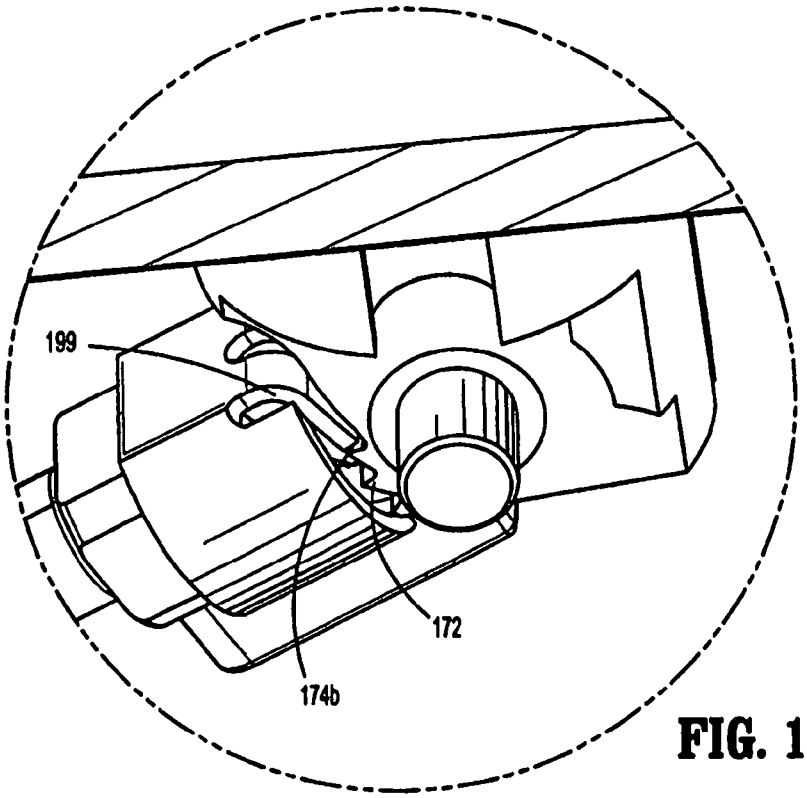

FIG. 17