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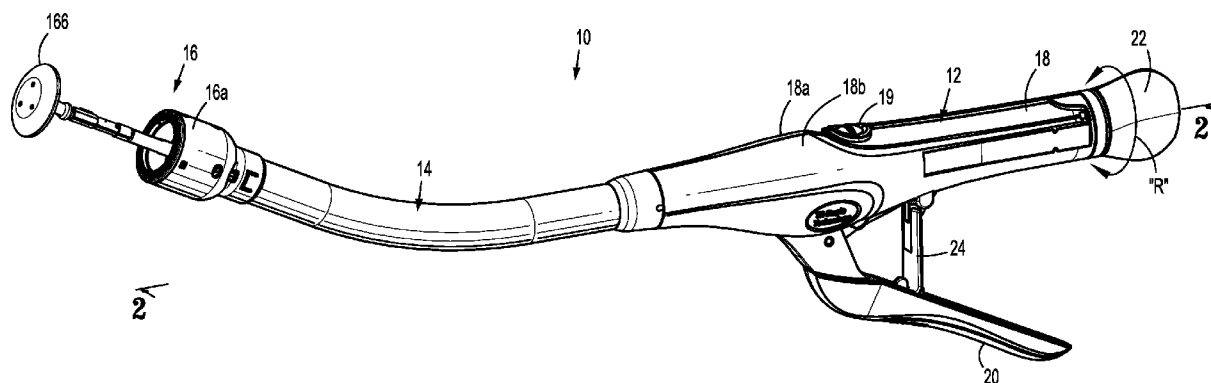


FIG. 1

(57) Abstract: A surgical stapling device (10) includes a proximal handle assembly (12), an elongated central body portion (14) that extends distally from the proximal handle assembly (12) to a distal end portion, a tool assembly (16) supported on the distal end portion of the elongated central body portion (14), and an audible indicator mechanism (100) supported by the proximal handle assembly (12). The proximal handle assembly (12) includes a contact arm (129) and the audible indicator mechanism (100) includes a cam member (108). The cam member (108) contacts the contact arm (129) of the proximal handle assembly (12) as the cam member (108) moves between distal and proximal positions to generate an audible sound that indicates that the tool assembly (16) was fired.



# **SURGICAL STAPLING DEVICE WITH AUDIBLE INDICATOR MECHANISM**

## **TECHNICAL FIELD**

[0001] The present disclosure is directed to a surgical stapling device with an audible indicator mechanism and, more particularly, to a circular stapling device including an audible indicator mechanism that provides a notification to a clinician after firing is complete and after anvil tilt.

## **BACKGROUND**

[0002] Surgical stapling devices are known to include visual, tactile and audible indicators that provide notice to a clinician that a certain event (or certain events) has taken place. For example, in circular stapling devices, it is known to provide an audible indication or notification to a clinician that firing of the stapling device is complete and that a tool assembly has been unapproximated a sufficient distance to allow an anvil head of the tool assembly to tilt to a low profile position (e.g., anvil tilt). In such devices, the audible indication may be faint or of a volume that may not be easily detected by the clinician.

[0003] A continuing need exists in the art for a surgical stapling device having an audible indicator mechanism that produces an audible indication that can be easily identified by clinician.

## **SUMMARY**

[0004] According to one aspect of the present disclosure, a surgical stapling device is provided. The surgical stapling device includes a proximal handle assembly, an elongated central body portion that extends distally from the

proximal handle assembly to a distal end portion, a tool assembly supported on the distal end portion of the elongated central body portion, and an audible indicator mechanism supported by the proximal handle assembly. The proximal handle assembly includes a contact arm and the audible indicator mechanism includes a cam member. The cam member is configured to contact the contact arm of the proximal handle assembly as the cam member moves between distal and proximal positions to generate an audible sound that indicates that the tool assembly was fired.

**[0005]** In some embodiments, the cam member may include a cam fin that is positioned to contact the contact arm of the proximal handle assembly to generate the audible sound. The contact arm may include an upper segment and a lower segment. The cam fin may be configured to contact one of the upper and lower segments to indicate that the distal tool assembly was fired.

**[0006]** In certain embodiments, the audible indicator mechanism may include a mounting body defining a cam channel. The cam member may include a cam pin that is slidably positioned within the cam channel to enable the cam member to move between the proximal and distal positions. The cam channel may include a plurality of legs. The cam pin may be receivable within each of legs as the cam member moves between the proximal and distal positions.

**[0007]** The mounting body may define an elongated channel that supports a spring. The spring may be coupled to a support bracket by a support pin. The spring may be a compression spring that urges the cam member into contact with the contact arm in response to tension in the compression spring. The spring may be coupled to the cam member by an elbow that extends from the cam member. The cam member may define a central channel through which the support pin extends to enable the cam member to move vertically and axially

relative to the support pin as the cam member moves between the proximal and distal positions.

**[0008]**In some embodiments, the distal tool assembly includes a circular anvil and a circular shell assembly that are positioned to move between unapproximated and approximated positions.

**[0009]**In certain embodiments, the cam member may be positioned to move from the distal position to the proximal position to generate the audible sound.

**[0010]**According to yet another aspect, an audible indicator mechanism for a surgical stapling device is provided. The audible indicator mechanism includes a mounting assembly, a spring assembly supported by the mounting assembly, a support bracket mounted to the mounting assembly, and a cam member coupled to the spring assembly and supported between the support bracket and the mounting assembly. The cam member is supported for movement between distal and proximal positions relative to the support bracket to generate an audible sound that indicates that the surgical stapling device was fired.

**[0011]**In some embodiments, the cam member may include a cam fin that is positioned to generate the audible sound as the cam member moves from the distal position to the proximal position.

**[0012]**In certain embodiments, the mounting assembly may include a mounting body that defines a cam channel. The cam member may include a cam pin that is slidably positioned within the cam channel to enable the cam member to move between the proximal and distal positions. The cam channel may include a plurality of legs. The cam pin may be receivable within each leg as the cam member moves between the proximal and distal positions.

**[0013]**The spring assembly may include a spring and the mounting body

may define an elongated channel that supports the spring. The spring may be coupled to the support bracket by a support pin. The spring may be a compression spring that urges the cam member toward the proximal position in response to tension in the compression spring. The spring may be coupled to the cam member by an elbow that extends from the cam member.

[0014] In some embodiments, the cam member may define a central channel through which the support pin extends to enable the cam member to move vertically and axially relative to the support pin as the cam member moves between the proximal and distal positions.

[0015] The cam member may be positioned to move from the distal position to the proximal position to generate the audible sound.

[0016] Other aspects, features, and advantages will be apparent from the description, the drawings, and the claims that follow.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

[0017] Various embodiments of the presently disclosed surgical stapling devices are described herein below with reference to the drawings, wherein:

[0018] FIG. 1 is a perspective view of a surgical stapling device in accordance with the principles of the present disclosure;

[0019] FIG. 2 is a cross-sectional view of the surgical stapling device of FIG. 1 as taken along section line 2-2 shown in FIG. 1;

[0020] FIG. 2A is an enlarged view of the indicated area of detail shown in FIG. 2 illustrating a tool assembly of the surgical stapling device of FIG. 1 in an unapproximated position;

[0021] FIG. 2B is an enlarged view of the tool assembly of FIG. 2A showing the tool assembly in an approximated position;

[0022] FIG. 3 is an enlarged perspective view of a portion of a handle

assembly of the surgical stapling device of FIG. 1 with a handle section of the handle assembly removed;

[0023] FIG. 4 is an enlarged perspective view of a portion of the handle assembly of the surgical stapling device of FIG. 1 with portions of an audible indicator mechanism of the handle assembly shown separated from the handle assembly;

[0024] FIG. 5 is a perspective view illustrating a portion of the handle assembly shown in FIG. 3 showing a first side of the audible indicator mechanism of FIG. 4;

[0025] FIG. 6 is a perspective view illustrating a portion of the handle assembly shown in FIG. 3 showing a second side of the audible indicator mechanism of FIG. 4;

[0026] FIG. 7 is a perspective view showing a shell assembly of the surgical stapling device of FIG. 1 supported on a distal portion of an elongated central body portion of the surgical stapling device;

[0027] FIG. 8 is a perspective view, with parts separated, of the shell assembly of FIG. 7;

[0028] FIG. 8A is an enlarged perspective view of a distal portion of a pusher of the shell assembly of FIG. 8;

[0029] FIG. 9 is a front view of a staple from each of inner, middle, and outer rows of staples of the shell assembly of FIG. 8;

[0030] FIGS. 10-12 are progressive views illustrating operation of the audible indicator mechanism of FIG. 4 as the surgical stapling device of FIG. 1 is fired; and

[0031] FIGS. 13-16 are progressive views illustrating operation of the audible indicator mechanism of FIG. 4 as the anvil and shell assemblies of the surgical stapling device of FIG. 1 are unapproximated.

## **DETAILED DESCRIPTION**

[0032] The presently disclosed device 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. In this description, the term “proximal” is used generally to refer to that portion of the device that is closer to a clinician, while the term “distal” is used generally to refer to that portion of the device that is farther from the clinician. Further, directional terms such as upwardly, downwardly, laterally and the like are used simply for convenience of description and are not intended to limit this disclosure. In addition, the term “endoscopic” is used generally used to refer to endoscopic, laparoscopic, arthroscopic, and/or any other procedure conducted through small diameter incision or cannula. In addition, the term clinician is used generally to refer to medical personnel including doctors, nurses, and support personnel.

[0033] In the following description, well-known functions or constructions are not described in detail to avoid obscuring the present disclosure in unnecessary detail.

[0034] As seen in FIG. 1, a surgical stapling device 10 includes a proximal handle assembly 12, an elongated central body portion 14 that extends distally from the proximal handle assembly 12, and a distal tool assembly 16 supported on a distal end portion of the elongated central body portion 14. The distal tool assembly 16 includes a shell assembly 16a and an anvil assembly 16b that cooperate to fasten tissue together.

[0035] The handle assembly 12 of the surgical stapling device 10 includes a stationary handle 18, a firing trigger 20, and a rotatable approximation knob 22. The stationary handle 18 of the handle assembly 12 is formed from handle sections 18a and 18b, which, when secured together, define a housing for the internal components of the handle assembly 12. The handle assembly 12

further includes a pivotally mounted trigger lock 24 fastened to the handle sections 18a and 18b that is manually positioned to obstruct movement of the firing trigger 20 to prevent inadvertent firing of the stapling device 10. The stationary handle 18 includes a bulbous indicator 19 that is supported on an upper surface of the stationary handle 18 to provide an indication to the clinician when the shell assembly 16a and the anvil assembly 16b of the distal tool assembly 16 of the stapling device 10 are approximated and in a fire-ready position.

#### Approximation Mechanism

[0036] With reference to FIG. 2, a distal end portion of the approximation knob 22 of the handle assembly 12 is rotatably fixed to a proximal end portion of a rotatable sleeve 26 such that rotation of the knob 22 causes concurrent rotation of the sleeve 26. The rotatable sleeve 26 extends distally from the approximation knob 22 and has a cylindrical hollow body portion 26a and a collar 26b that together define a central bore 26c. The central bore 26c of the rotatable sleeve 26 receives a drive screw 28 having an outer surface that defines a helical channel 28a. The helical channel 28a of the screw 28 receives a pin 30 that extends radially through the collar 26b of the sleeve 26. The rotatable sleeve 26 is axially fixed with respect to the stationary handle 18 via a flange/recess interconnection (not shown) such that rotation of the sleeve 26 about the screw 28 causes the pin 30 to move along the channel 28a of the screw 28 to effect axial movement of the screw 28 within the central bore 26c of the rotatable sleeve 26.

[0037] A distal portion of the drive screw 28 is secured to proximal end portions of screw extensions 34, 36 using, e.g., a pin 32. The screw extensions 34, 36 are flexible and extend distally through the central body portion 14 of the surgical stapling device 10 to an anvil retainer 38. The anvil retainer 38 has a



proximal end portion that is secured to a distal portion of the screw extensions 34 and 36 using, e.g., pins 39a, 39b, and a distal end portion that is configured to be releasably coupled to the anvil assembly 16b of the distal tool assembly 16, whereby rotation of the knob 22 effectuates axial movement of the anvil assembly 16b relative to the shell assembly 16a of the distal tool assembly 16. The knob 22 can be rotated, as indicated by arrows “R” (FIG. 1) to selectively move the anvil assembly 16b relative to the shell assembly 16a, as indicated by arrow “Z” (FIG. 2A), between an unapproximated position (FIG. 2A) and an approximated position (FIG. 2B).

#### Firing Mechanism

[0038] With continued reference to FIG. 2, the central body portion 14 of the surgical stapling device 10 supports an elongated pusher link 40. The elongated pusher link 40 has a proximal end portion that supports a coupling portion 40a and a distal end portion including resilient engagement fingers 40b, 40c. The fingers 40b, 40c of the elongated pusher link 40 are configured to lockingly engage with a proximal end portion of a pusher 50 of the shell assembly 16a. The firing trigger 20 of the handle assembly 12 has a proximal portion 20a and a distal portion 20b. The distal portion 20b of the firing trigger 20 is pivotally connected to the coupling portion 40a of the elongated pusher link 40 by a pivot member 42 to facilitate pivotal movement of the firing trigger 20 relative to the stationary handle 18 of the handle assembly 12. The firing trigger 20 of the handle assembly 12 is pivotally connected to a first end portion 44a of a firing link 44 by a pivot member 46. The firing link 44 includes a second end portion 44b that is pivotally secured to the stationary handle 18 by a pivot member 48 that is vertically movable within a slot 18c (FIG. 10) defined in the stationary handle 18. The firing link 44 further includes a wing member 44c (FIG. 3) that extends laterally from the firing link 44. The elongated pusher link

40 is slidably supported within the central body portion 14 of the surgical stapling device 10 about the drive screw 28 along the central body portion 14 between a retracted, nonfired position and an advanced, fired position. The elongated pusher link 40 supports a spring 52 (FIG. 3). The spring 52 is positioned about an outer surface of the elongated pusher link 40 between the stationary handle 18 and the coupling portion 40a of the elongated pusher link 40 to bias the elongated pusher link 40 proximally toward the retracted, non-fired position.

#### Trigger Lockout

[0039] Referring also to FIG. 3, the handle assembly 12 of the surgical stapling device 10 slidably supports a lockout member 54 (FIG. 2) within the handle assembly 12 between retracted and advanced positions. The lockout member 54 is biased by a coil spring 56 toward the advanced position to maintain the trigger lock 24 in a locked position to prevent actuation of the firing trigger 20 of the handle assembly 12. The drive screw 28 includes a screw stop 58 that is axially fixed thereon, and that is movable from an advanced position located adjacent to the elongated pusher link 40 to a retracted position located adjacent to the collar 26b of the rotatable sleeve 26 (FIG. 10) to control the degree of movement of the anvil assembly 16b of the distal tool assembly 16 in relation to the shell assembly 16a of the distal tool assembly 16 such as disclosed in U.S. Patent No. 6,945,444, U.S. Patent No. 9,307,994, and U.S. Patent No. 9,492,168, the contents of each of which are incorporated by reference herein in their entirety.

[0040] With reference also to FIG. 13, the screw stop 58 includes a body 60 having a wing 60a that extends laterally from the body 60 of the screw stop 58, a stem 61 that extends downwardly from a distal portion of the body 60 of the screw stop 58, and a tab 63 that extends laterally from a proximal portion of the

body 60 of the screw stop 58. The stem 61 defines a first abutment surface 58a that is configured to engage the firing link 44, the wing 60a defines a second abutment surface 58b that is configured to engage an audible indicator mechanism 100, and the tab 63 defines a third abutment surface 58c configured to engage the lockout member 54.

[0041] Referring again to FIGS. 1 and 3, in order to unlock the firing trigger 20, the drive screw 28 and the screw stop 58 are drawn proximally by rotation of the approximation knob 22. During approximation of the shell assembly 16a and the anvil assembly 16b, the screw stop 58 moves proximally so that the third abutment surface 58c of the screw stop 58 contacts the lockout member 54 and drives the lockout member 54 proximally against the bias of (e.g., tension in) the coil spring 56. Proximal movement of the lockout member 54 separates the lockout member 54 from contact with an upper end portion 24a of the trigger lock 24 and enables a lower end portion 24b of the trigger lock 24 to pivot away from the firing trigger 20. Once the trigger lock 24 is pivoted away from the firing trigger 20, the firing trigger 20 can be actuated.

#### Shell Assembly

[0042] With reference to FIGS. 2-2B and 7-9, the shell assembly 16a of the distal tool assembly 16 includes a shell 62, the pusher 50, a cylindrical knife 64, and a staple guide 66. The shell 62 is secured to a distal end portion of the elongated body 14 and includes an outer housing portion 62a and an inner guide portion 62b.

[0043] The pusher 50 of the shell assembly 16a is slidably positioned about the inner guide portion 62b of the shell 62 and defines a central throughbore 50a. The proximal end portion of the pusher 50 includes arms 50b, 50c that are configured to lockingly engage with the fingers 40b, 40c of the pusher link 40 to fasten the pusher link 40 to the pusher 50. The distal end portion of the pusher

50 includes annular arrays of distally extending fingers 68 that are configured to be slidably received within corresponding annular arrays of slots 70 formed through a tissue contact surface 66a of the staple guide 66. In embodiments, the tissue contact surface 66a of the staple guide 66 slopes downwardly as the tissue contact surface 66a extends radially outward. The fingers 68 of the pusher 50 support an array of staples 72 that are positioned within the annular arrays of slots 70 of the staple guide 66. The annular arrays of distally extending fingers 68 include an outer array 68a of fingers 68, a middle array 68b of fingers 68, and an inner array 68c of fingers 68 that are arranged radially outward from the inner array 68c to the outer array 68a with the middle array 68b disposed between the inner and outer arrays 68c, 68a. In embodiments, the annular arrays 68a-68c of the distally extending fingers 68 are positioned in descending height order in a radial outward direction from the inner array 68c to the outer array 68a such that the inner array 68c has the largest height and the outer array 68a has the smallest height.

**[0044]** The annular arrays of slots 70 of the staple guide 66 of the shell assembly 16a include outer, middle, and inner arrays of slots 70a, 70b, 70c that are also arranged radially outward from the inner array 70c to the outer array 70a, and that are configured to house respective outer, middle, and inner annular arrays of staples 72a, 72b, 72c.

**[0045]** Also arranged radially outward from the inner array to the outer array, the respective outer, middle, and inner annular arrays of staples 72a, 72b, 72c are configured to correspond to the respective outer, middle and inner arrays of the annular arrays of slots 70 and the annular arrays of fingers 68. Although the staples may have any suitable length and/or dimension, the staples of the inner annular array of staples 72c may have 3.0mm lengths, the staples of the middle annular array of staples 72b may have 4.0mm lengths, and the staples of

the outer annular array of staples 72a may have 5.0mm lengths.

[0046] The cylindrical knife 64 of the shell assembly 16a is frictionally retained within the central throughbore 50a of the pusher 50 of the shell assembly 16a to fixedly secure the knife 64 in relation to the pusher 50. The distal end portion of the knife 64 includes a circular cutting edge 64a.

[0047] In operation, when the pusher link 40 of the central body portion 14 is advanced distally in response to actuation of the firing trigger 20 of the handle assembly 12, the pusher 50 of the shell assembly 16a is advanced distally within the shell 62 of the shell assembly 16a. Advancement of the pusher 50 advances the fingers 68 of the pusher 50 through the respective slots 70 of the staple guide 66 to eject the staples 72 positioned within the slots 70 from the staple guide 66. Since the knife 64 of the shell assembly 16a is secured to the pusher 50, the knife 64 is also advanced distally to core tissue positioned radially inward of the knife 64 within the shell 62.

#### Anvil Assembly

[0048] With reference to FIG. 2A, the anvil assembly 16b of the distal tool assembly 16 includes an anvil head assembly 80 and an anvil center rod assembly 90. The anvil head assembly 80 of the anvil assembly 16b includes a post 82, an anvil head 84, and an anvil 86. The anvil 86 is supported on the anvil head 84 of the anvil head assembly 80 and includes a tissue contact surface 86a that defines three annular arrays of pockets 140 arranged to correspond to the annular arrays of slots 70 formed in the staple guide 66. The annular arrays of pockets 140 of the anvil 86 are arranged to receive and deform the staples 72 when that staples 72 are ejected from the slots 70 of the staple guide 66. The anvil center rod assembly 90 of the anvil assembly 16b includes an anvil center rod 92 that defines a bore 94 and has flexible arms 96a, 96b. The anvil retainer 38 is received within the central bore 94 of the anvil center rod 92 such that the

flexible arms 96a, 96b of the anvil center rod 92 releasably engage the anvil retainer 38 and couple the anvil retainer 38 to the center rod 92. A pivot member 98 secures the post 82 of the anvil head assembly 80 to the center rod 92 of the anvil center rod assembly 90 such that the anvil head assembly 80 is pivotably mounted to the anvil center rod assembly 90, for example, to achieve anvil tilt in which the anvil head assembly 80 is tilted relative to the anvil center rod assembly 90. Anvil tilt provides a reduced anvil profile and simplifies removal of the surgical stapling device after an anastomosis procedure has been performed. For a more detailed description of anvil tilt, reference can be made to, for example, U.S. Patent No. 6,945,444, U.S. Patent No. 9,307,994, and U.S. Patent No. 9,492,168, the entire contents of each of which are incorporated by reference above.

#### Firing

[0049] Referring to FIGS. 2 and 3, when the anvil assembly 16b and the shell assembly 16a of the distal tool assembly 16 are fully approximated (FIG. 2B) and the trigger lock 24 is pivoted away from the firing trigger 20 of the handle assembly 12, the firing trigger 20 may be actuated. Actuation of the firing trigger 20 causes the firing trigger 20 to pivot about the pivot member 42 to move the firing link 44 proximally until the pivot member 48 engages the first abutment surface 58a (FIG. 13) of the screw stop 58. Continued pivoting movement of the firing trigger 20 causes the firing link 44 to push against the first abutment surface 58a of the screw stop 58 and to drive or advance the distal portion 20b of the firing trigger 20 distally. As the distal portion 20b of the firing trigger 20 advances distally, the pusher link 40 is advanced distally against the bias of (e.g., tension in) the spring 52. Distal movement or advancement of the pusher link 40 drives the pusher 50 of the shell assembly 16a distally within the staple guide 66 of the shell assembly 16a so that the fingers 68 of the pusher

50 eject the staples 72 from the slots 70 of the staple guide 66.

#### Audible Indicator Mechanism

**[0050]** With reference to FIGS. 3-6, the audible indicator mechanism 100 of the handle assembly 12 includes a mounting assembly 102, a spring assembly 104 supported by the mounting assembly 104, a support bracket 106 mounted to the mounting assembly 102, and a cam member 108 coupled to the spring assembly 104 and movably supported between the support bracket 106 and the mounting assembly 102.

**[0051]** The mounting assembly 102 of the audible indicator mechanism 100 includes a mounting body 110 formed in the handle assembly 12 having a plurality of mounting stems 110a. The mounting body 110 defines a cam channel 112 in a proximal portion of the mounting body 110 and an elongated channel 114 in a distal portion of the mounting body 110. The cam channel 112 includes a first leg 112a, a second leg 112b, and a third leg 112c. The first leg 112a is coupled to the second leg 112b by a first cam surface 112d. The second leg 112b is coupled to the third leg 112c by a second cam surface 112e. The third leg 112c is coupled to the first leg 112a by a third cam surface 112f.

**[0052]** The spring assembly 104 of the audible indicator mechanism 100 includes a spring 116 having a proximal end portion 116a and a distal end portion 116b. The proximal end portion 116a of the spring 116a is coupled to a support pin 118 that is secured to the support bracket 106 and extends laterally from the spring 116. The distal end portion 116b of the spring 116 is in the form of a hook or loop.

**[0053]** The support bracket 106 of the audible indicator mechanism 100 defines a plurality of openings 120 positioned to receive the mounting stems 110a of the mounting assembly 102 (FIG. 6). Each opening 120 of the plurality of openings 120 receives a fastener (not shown) that secures the support bracket

106 to the mounting stems 110a of the mounting assembly 102. The support bracket 106 further defines an aperture 122 that receives the support pin 118 to secure the spring assembly 104 to the support bracket 106.

**[0054]** The cam member 108 of the audible indicator mechanism 100 defines a central channel 124 having a proximal portion 124a and a distal portion 124b. The cam member 108 includes a cam fin 126 that extends proximally from the cam member 108. The cam member 108 further includes a cam pin 128 that extends laterally from a proximal portion of the cam member 108 and is slidably positioned in the cam channel 112 of the mounting body 110 between extended and retracted positions. The cam member 108 also includes an elbow 130 (FIG. 3) that extends laterally from a distal portion of the cam member 108 and couples to the distal end portion 116b of the spring 116.

**[0055]** As seen in FIGS. 10-12, actuation of the firing trigger 20 of the handle assembly 12 pivots the firing link 44 in the direction indicated by arrow "A" in FIG. 11 toward the cam member 108 of the audible indicator mechanism 100 so that the wing member 44c of the firing link 44 moves toward the cam fin 126 of the cam member 108. Continued pivotal movement of the firing link 44 causes the wing member 44c to engage the cam fin 126 and drive the cam fin 126 upwardly, as indicated by arrow "A" (FIG. 11). As the cam fin 126 is driven upwardly, the cam pin 128 is driven upwardly from the second leg 112b of the cam channel 112 and distally along the first cam surface 112d of the cam channel 112. The distal movement of the cam pin 128 drives the cam member 108 distally such that the elbow 130 extends the spring 116 distally relative to the support pin 118 to tension the spring 116.

**[0056]** With reference to FIGS. 11 and 12, when the cam pin 128 passes over the first cam surface 112d of the cam channel 112 upon further actuation of the firing trigger 20, the spring 116 biases the cam member 108 proximally to



create increased tension in the spring 116 such that the cam pin 128 snaps into the first leg 112a of the cam channel 112 and approaches a first proximal inner wall 112g of the cam member 108. As the cam pin 128 snaps into the first leg 112a of the cam channel 112, the cam fin 126 contacts a contact arm 129 of handle assembly 12 at an upper segment 129U of the contact arm 129 to provide an audible sound (e.g., a click). The audible sound indicates that firing of the surgical stapling device 10 is complete. The contact arm 129 and/or the cam fin 126, or portions thereof, can include any suitable ceramic, metallic, and/or polymeric material to enhance the sound produced by the resulting contact between the cam fin 126 and the contact arm 129 such that the sound is audibly perceptible by humans (e.g., within the frequency range of about 20Hz to about 20kHz).

[0057] With reference to FIGS. 13-16, once firing of the surgical stapling device 10 is complete, the knob 22 of the approximation mechanism can be rotated to unapproximate the anvil and shell assemblies 30, 31 such that the screw stop 58 is advanced distally. Distal movement of the screw stop 58 causes the wing 60a of the body 60 of the screw stop 58 to engage the cam member 108 such that the second abutment surface 58b of the wing 60a is in contact with a proximal surface 108a of the cam member 108. Continued distal advancement of the screw stop 58, as indicated by arrow "B" (FIG. 14) drives the cam member 108 distally so that the elbow 130 extends the spring 116 distally relative to the support pin 118 to increase tension in the spring 116. As the cam member 108 moves distally, the cam pin 128 moves distally out of the first leg 112a of the cam channel 112, as indicated by arrow "C" (FIG. 14), moves distally and downwardly along the third cam surface 112f, as indicated by arrow "D" (FIG. 15), into the third leg 112 of the cam channel 112 so that the wing 60a of the body 60 of the screw stop 58 disengages from the cam member 108.

With the cam member 108 disengaged from the screw stop 58, the cam member 108 is biased proximally by the spring 116 so that the cam pin 128 moves proximally and downwardly along the second cam surface 112e, as indicated by arrow “E” (FIG. 16) and snaps back into the first leg 112a of the cam channel 112. As the cam pin 128 snaps back into the first leg 112a of the cam channel 112, the cam fin 126 contacts the contact arm 129 of the handle assembly 12 at a lower segment 129L of the contact arm 129 as the cam pin 128 approaches a second proximal inner wall 112h of the cam channel 112 to provide another audible sound (e.g., a click) that indicates anvil tilt and that the audible indicator mechanism 100 was reset. The audible sounds may be different (e.g., volume, type of sound, duration, etc., or combinations thereof, for example, due to differences in materials, dimensions of materials, and/or positional acoustics of portions of the contact arm 129 as it relates to its relative positioning within the handle assembly 12), and in some embodiments, may be the same.

[0058] Persons skilled in the art will understand that the structures and methods specifically described herein and shown in the accompanying figures are non-limiting exemplary embodiments, and that the description, disclosure, and figures should be construed merely as exemplary of particular embodiments. It is to be understood, therefore, that the present disclosure is not limited to the precise embodiments described, and that various other changes and modifications may be effected by one skilled in the art without departing from the scope or spirit of the disclosure. Additionally, the elements and features shown or described in connection with certain embodiments may be combined with the elements and features of certain other embodiments without departing from the scope of the present disclosure, and that such modifications and variations are also included within the scope of the present disclosure. Accordingly, the subject matter of the present disclosure is not limited by what

has been particularly shown and described.

## CLAIM

1. A surgical stapling device, comprising:
  - a proximal handle assembly including a contact arm;
  - an elongated central body portion that extends distally from the proximal handle assembly to a distal end portion;
  - a tool assembly supported on the distal end portion of the elongated central body portion; and
  - an audible indicator mechanism supported by the proximal handle assembly and including a cam member, the cam member configured to contact the contact arm of the proximal handle assembly as the cam member moves between distal and proximal positions to generate an audible sound that indicates that the tool assembly was fired.
  
2. The surgical stapling device of claim 1, wherein the cam member includes a cam fin that is positioned to contact the contact arm of the proximal handle assembly to generate the audible sound.
  
3. The surgical stapling device of claim 2, wherein the contact arm includes an upper segment and a lower segment, the cam fin configured to contact one of the upper and lower segments to indicate that the tool assembly was fired.
  
4. The surgical stapling device of claim 1, wherein the audible indicator mechanism includes a mounting body defining a cam channel, and the cam member includes a cam pin that is slidably positioned within the cam channel to enable the cam member to move between the proximal and distal positions.

5. The surgical stapling device of claim 4, wherein the cam channel includes a plurality of legs, the cam pin receivable within each leg of the plurality of legs as the cam member moves between the proximal and distal positions.

6. The surgical stapling device of claim 4, wherein the mounting body defines an elongated channel that supports a spring, the spring coupled to a support bracket by a support pin.

7. The surgical stapling device of claim 6, wherein the spring is a compression spring that urges the cam member into contact with the contact arm in response to tension in the compression spring.

8. The surgical stapling device of claim 6, wherein the spring is coupled to the cam member by an elbow that extends from the cam member.

9. The surgical stapling device of claim 6, wherein the cam member defines a central channel through which the support pin extends to enable the cam member to move vertically and axially relative to the support pin as the cam member moves between the proximal and distal positions.

10. The surgical stapling device of claim 1, wherein the tool assembly includes a circular anvil and a circular shell assembly that are positioned to move between unapproximated and approximated positions.

11. The surgical stapling device of claim 1, wherein the cam member is

positioned to move from the distal position to the proximal position to generate the audible sound.

12. An audible indicator mechanism for a surgical stapling device, the audible indicator mechanism comprising:

a mounting assembly;

a spring assembly supported by the mounting assembly;

a support bracket mounted to the mounting assembly; and

a cam member coupled to the spring assembly and supported between the support bracket and the mounting assembly, the cam member supported for movement between distal and proximal positions relative to the support bracket to generate an audible sound that indicates that the surgical stapling device was fired.

13. The audible indicator mechanism of claim 12, wherein the cam member includes a cam fin that is positioned to generate the audible sound as the cam member moves from the distal position to the proximal position.

14. The audible indicator mechanism of claim 12, wherein the mounting assembly includes a mounting body that defines a cam channel and the cam member includes a cam pin that is slidably positioned within the cam channel to enable the cam member to move between the proximal and distal positions.

15. The audible indicator mechanism of claim 14, wherein the cam channel includes a plurality of legs, the cam pin receivable within each leg of the plurality of legs as the cam member moves between the proximal and distal positions.

16. The audible indicator mechanism of claim 14, wherein the spring assembly includes a spring and the mounting body defines an elongated channel that supports the spring, the spring coupled to the support bracket by a support pin.

17. The audible indicator mechanism of claim 16, wherein the spring is a compression spring that urges the cam member toward the proximal position in response to tension in the compression spring.

18. The audible indicator mechanism of claim 16, wherein the spring is coupled to the cam member by an elbow that extends from the cam member.

19. The audible indicator mechanism of claim 16, wherein the cam member defines a central channel through which the support pin extends to enable the cam member to move vertically and axially relative to the support pin as the cam member moves between the proximal and distal positions.

20. The audible indicator mechanism of claim 12, wherein the cam member is positioned to move from the distal position to the proximal position to generate the audible sound.

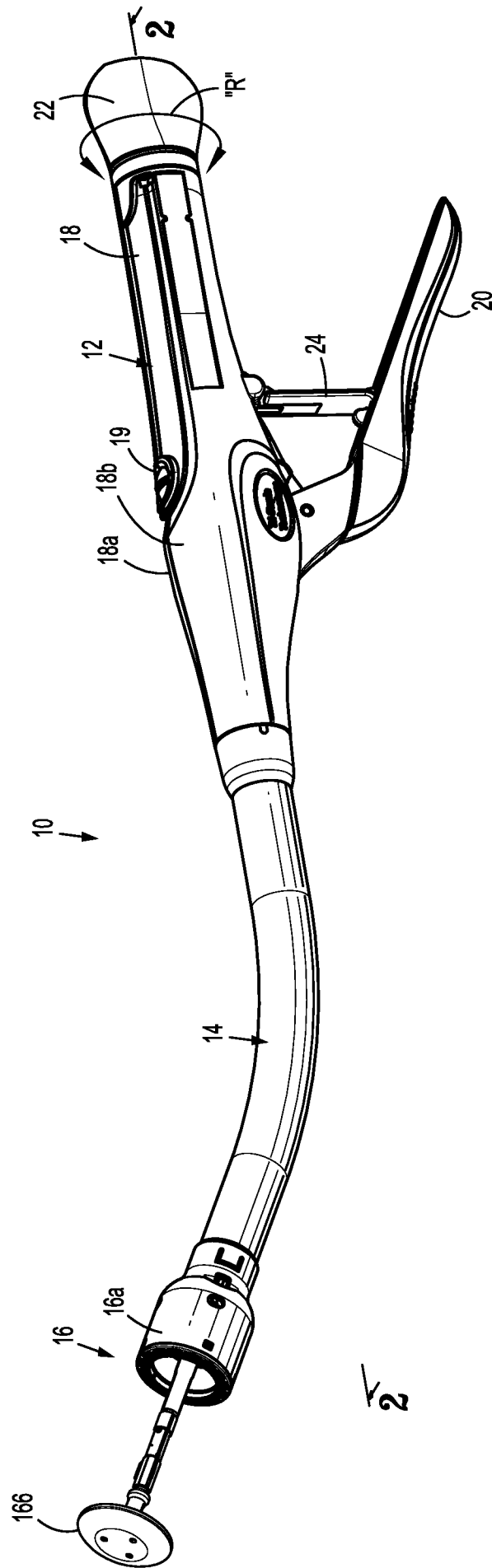
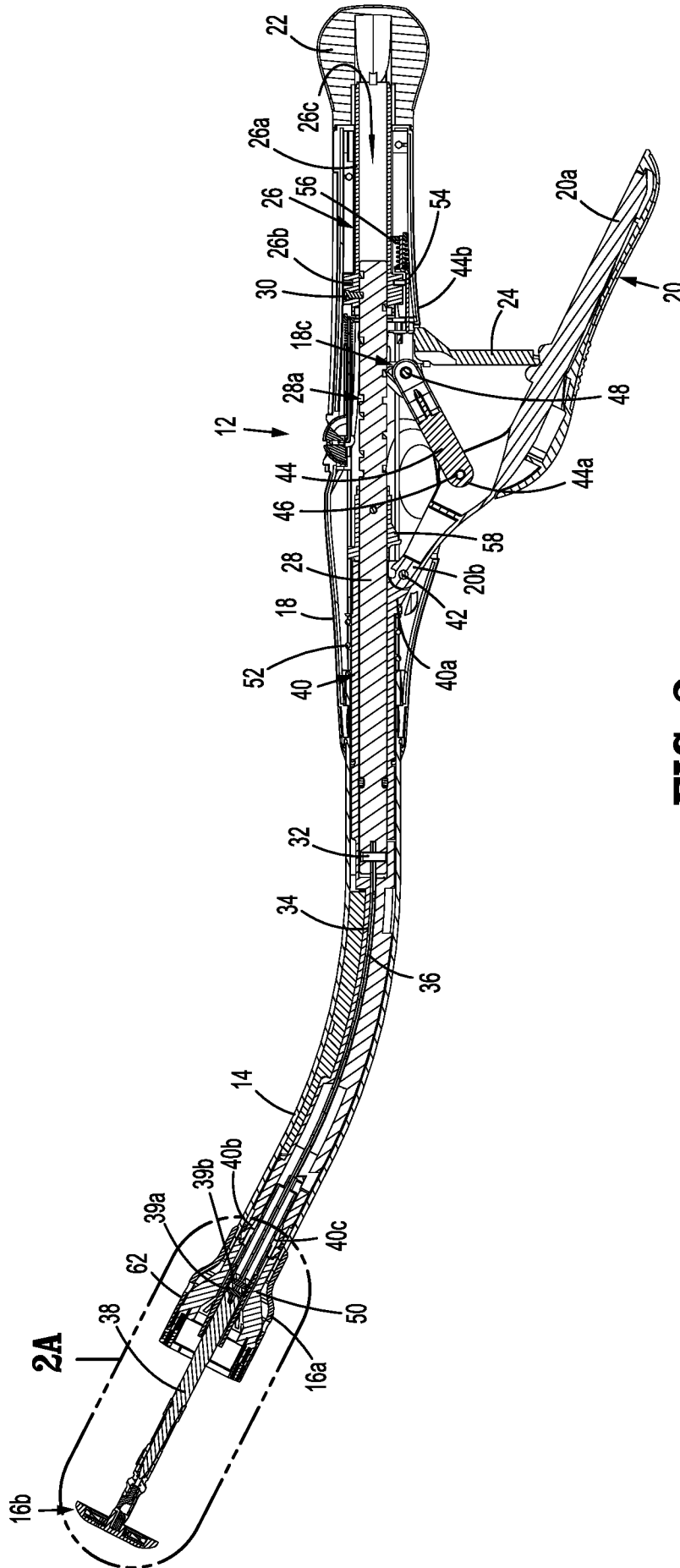
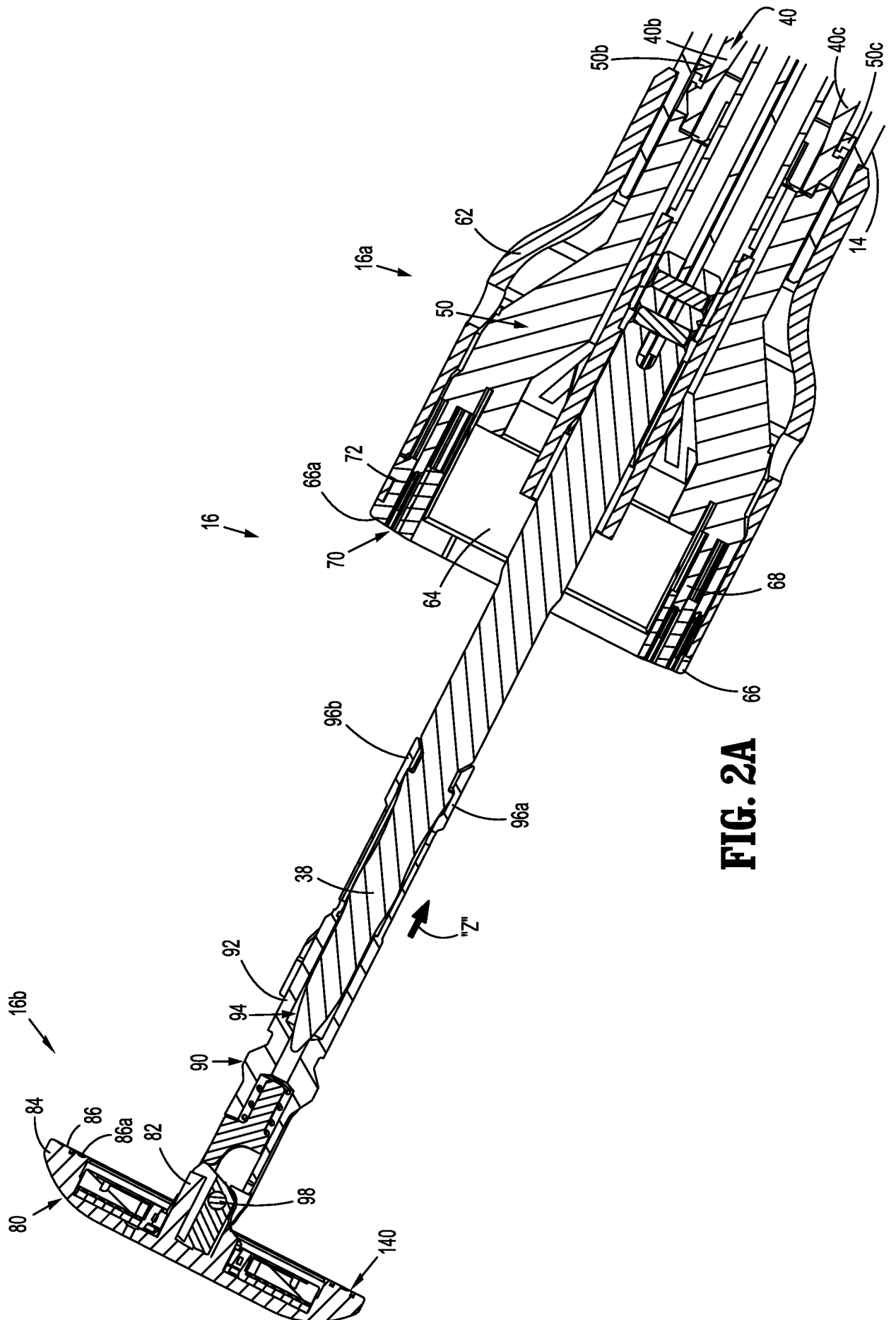


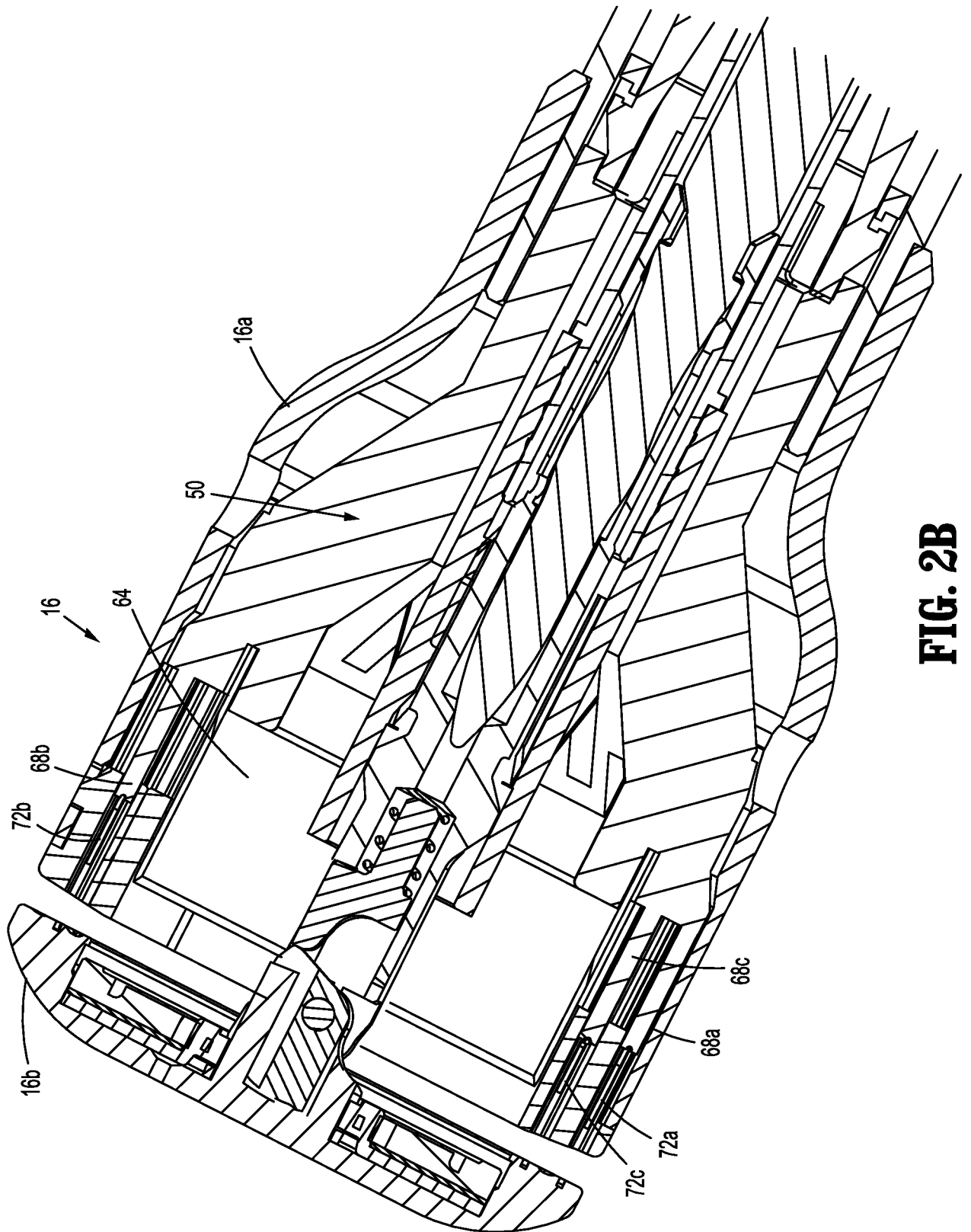
FIG. 1



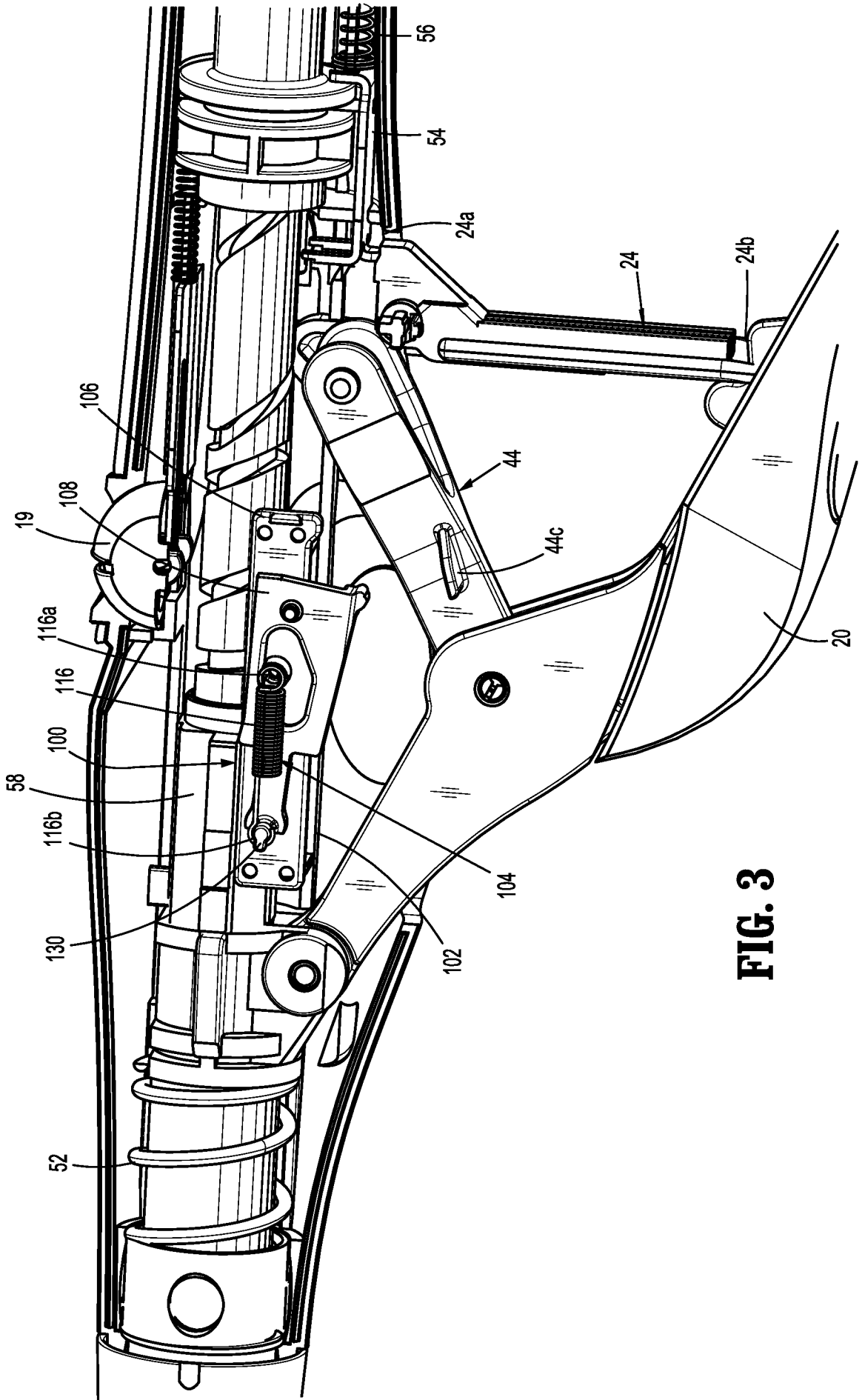


**FIG. 2**

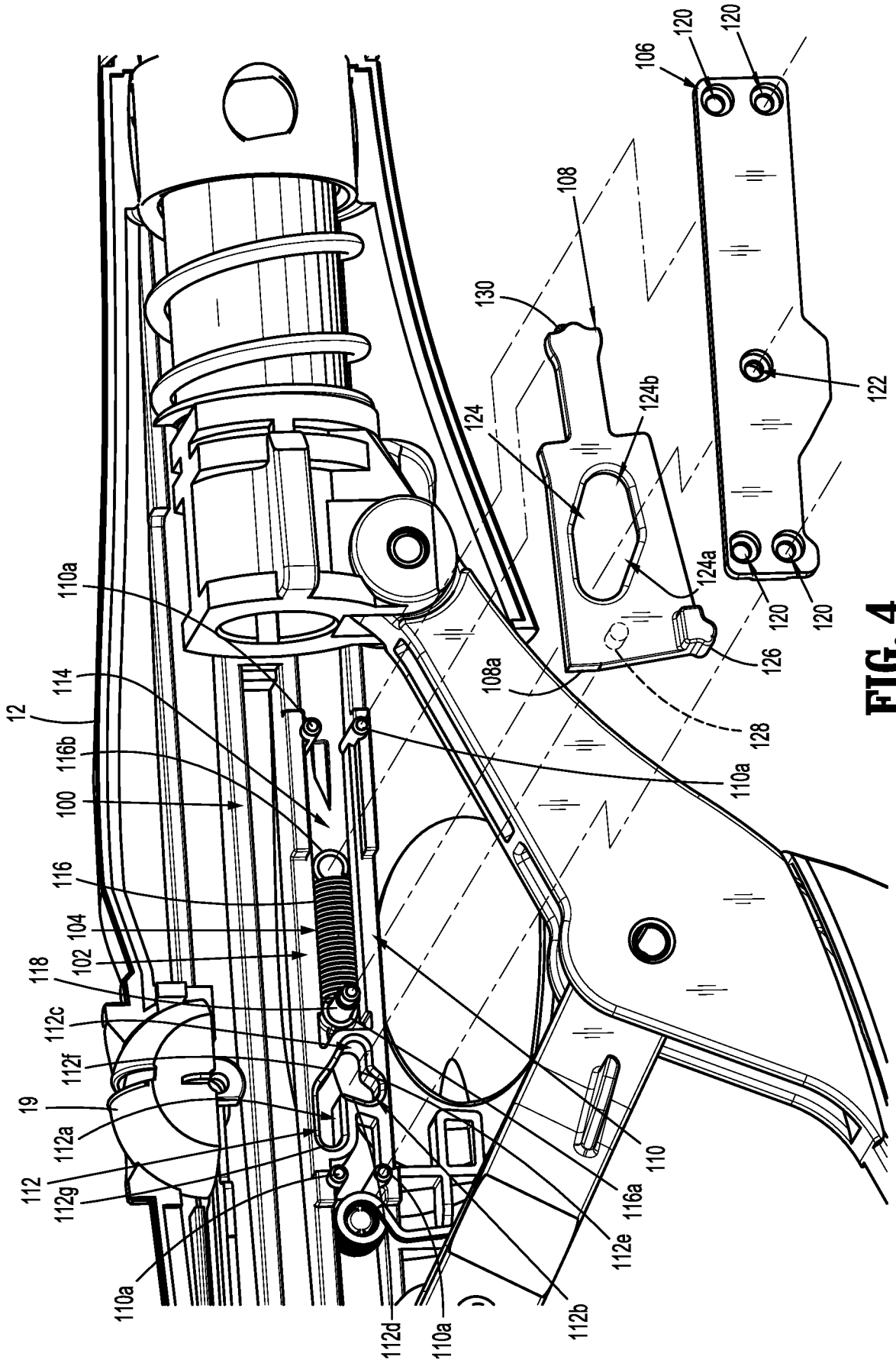




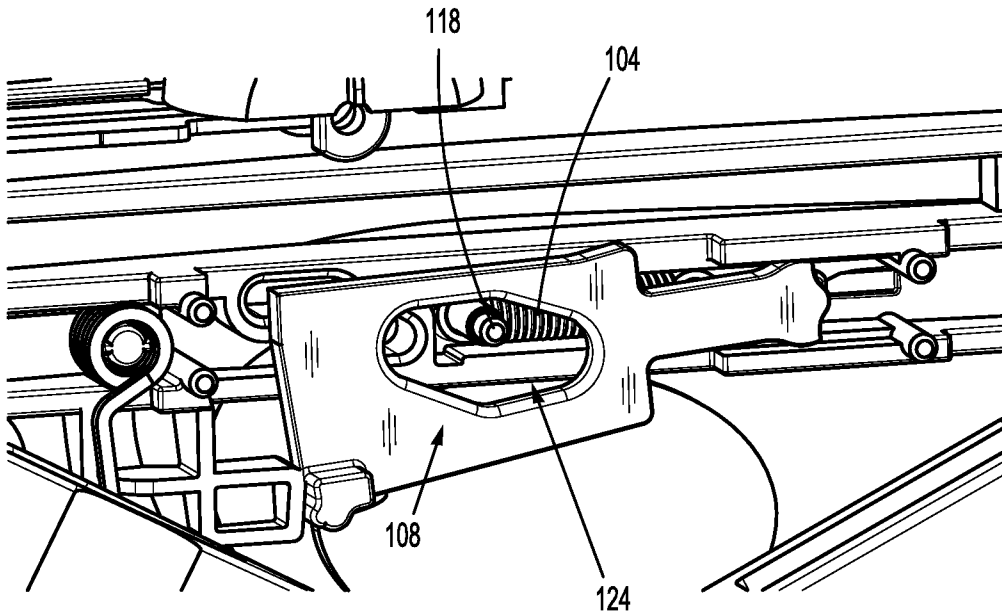
**FIG. 2B**



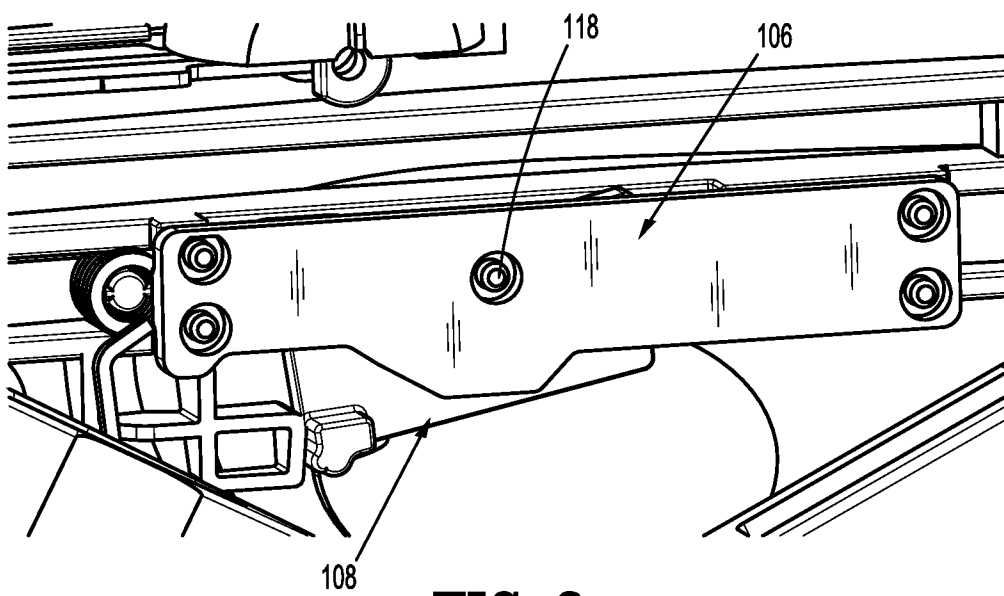
**FIG. 3**



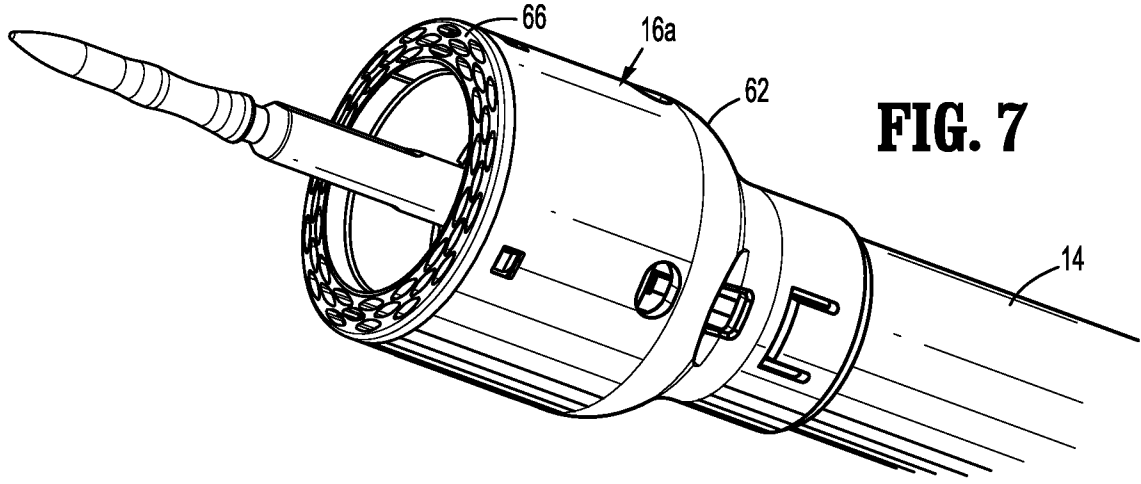
**FIG. 4**



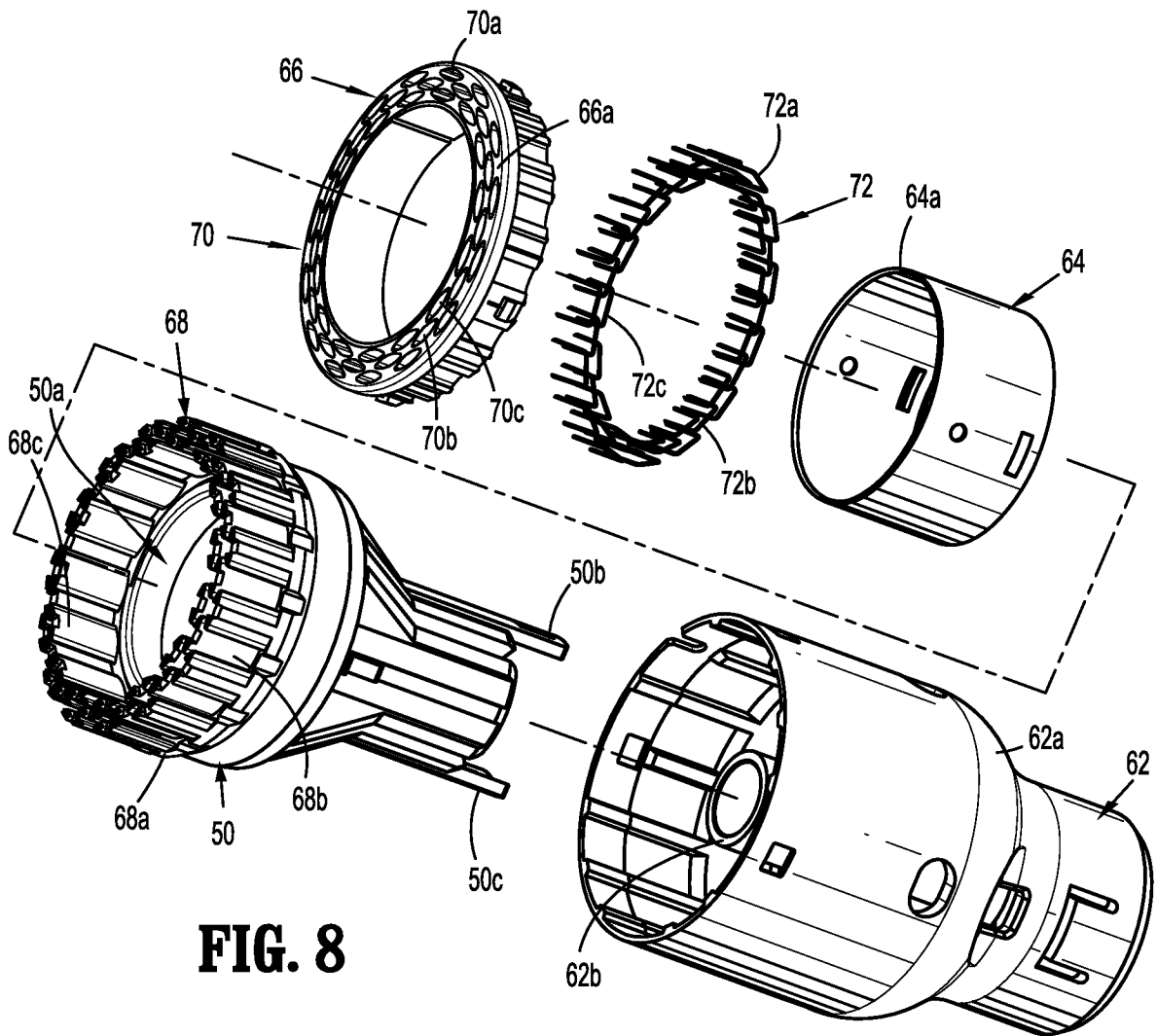
**FIG. 5**



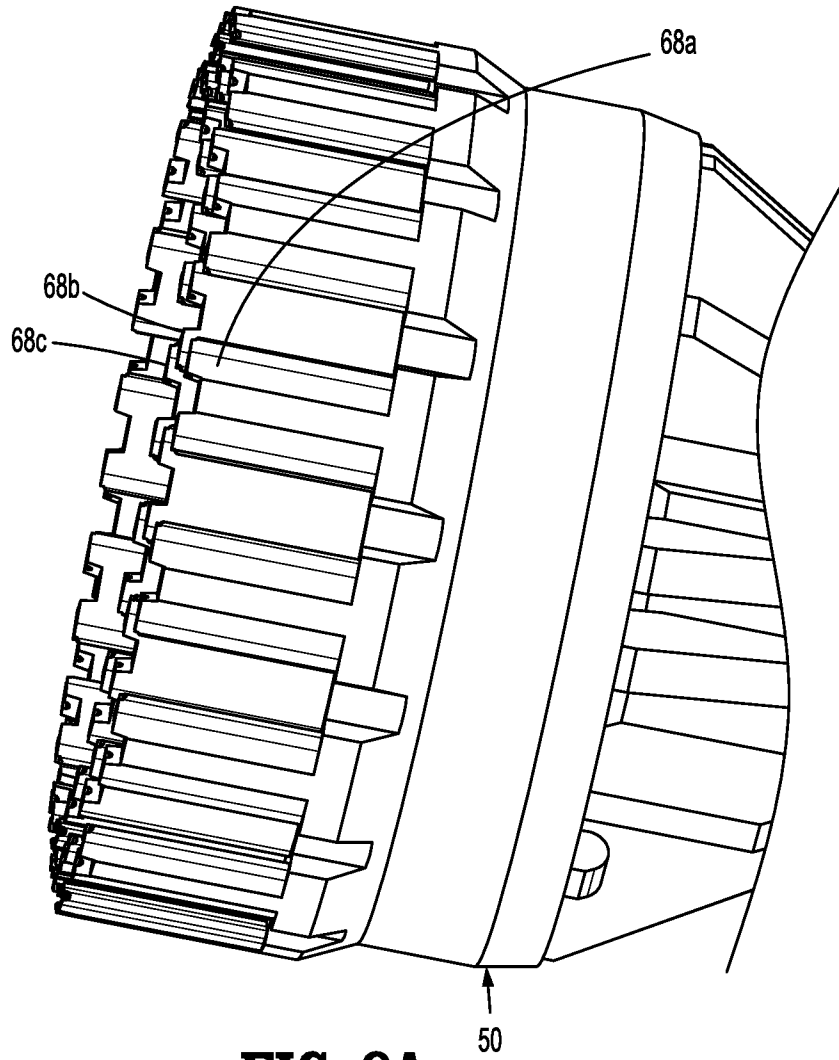
**FIG. 6**



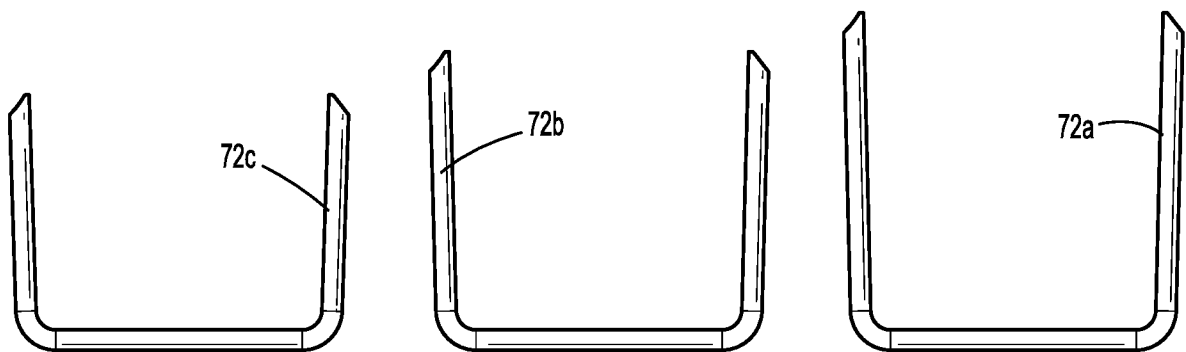
**FIG. 7**



**FIG. 8**

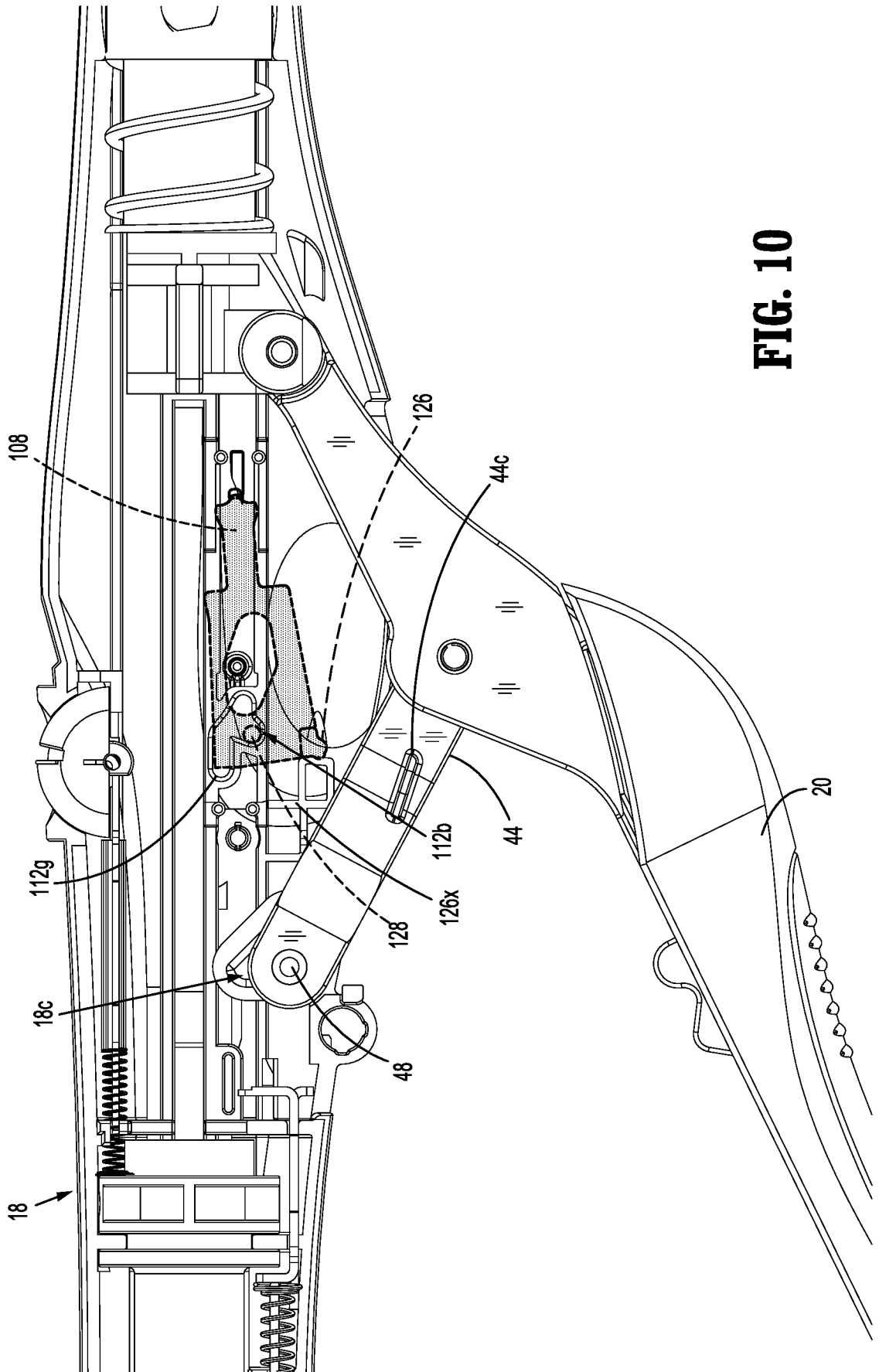


**FIG. 8A**



**FIG. 9**





**FIG. 10**

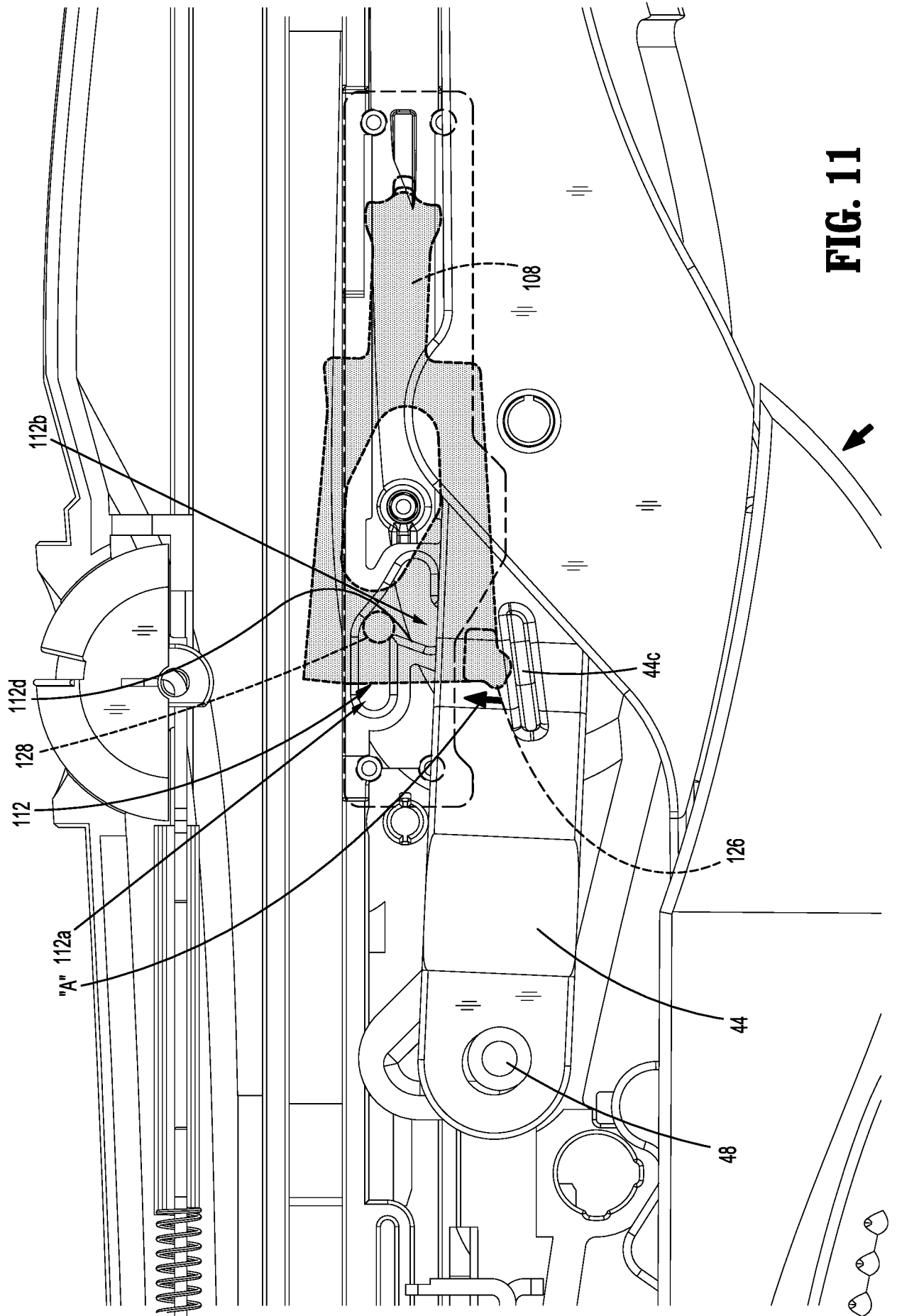
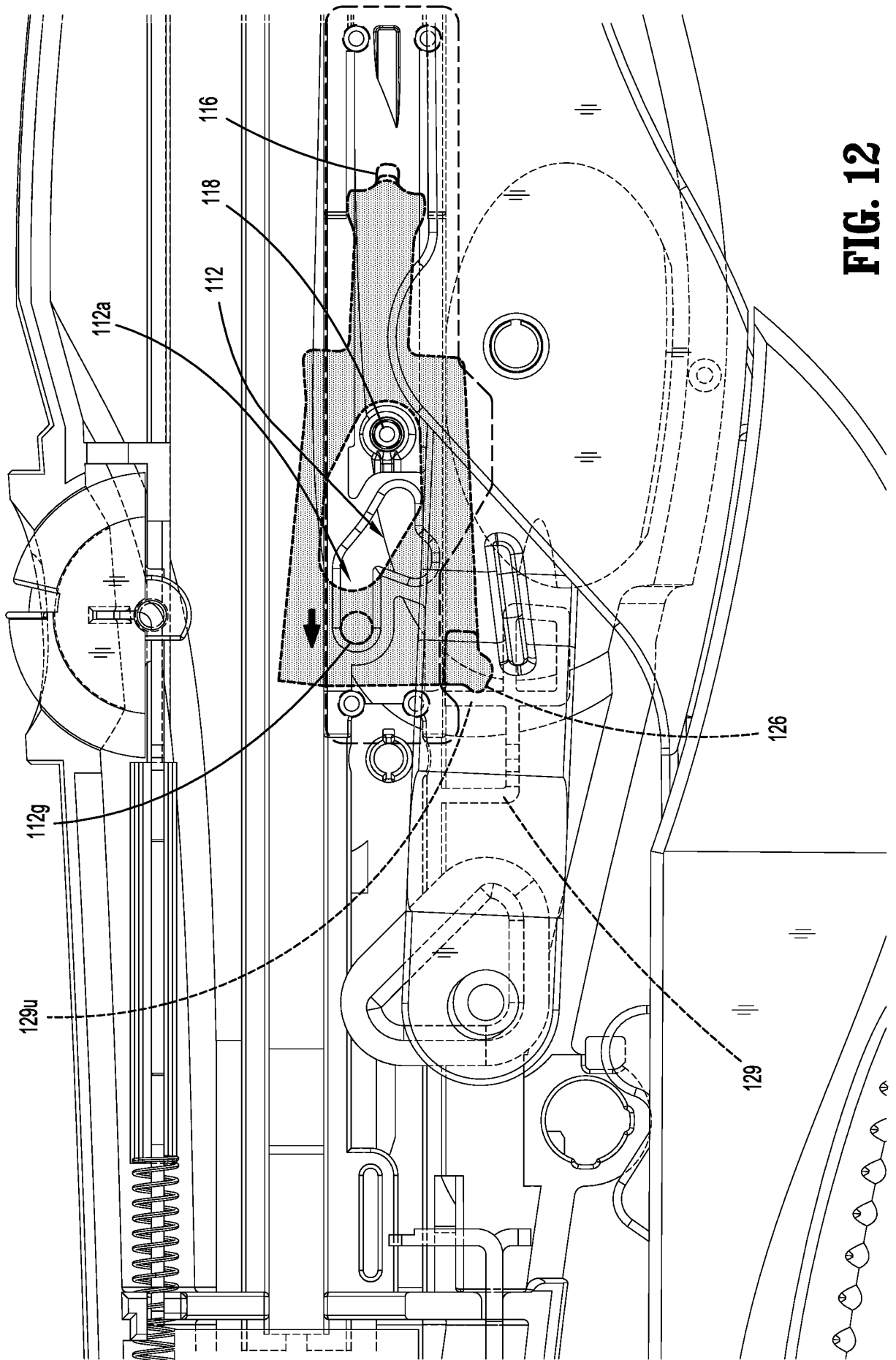


FIG. 11



**FIG. 12**

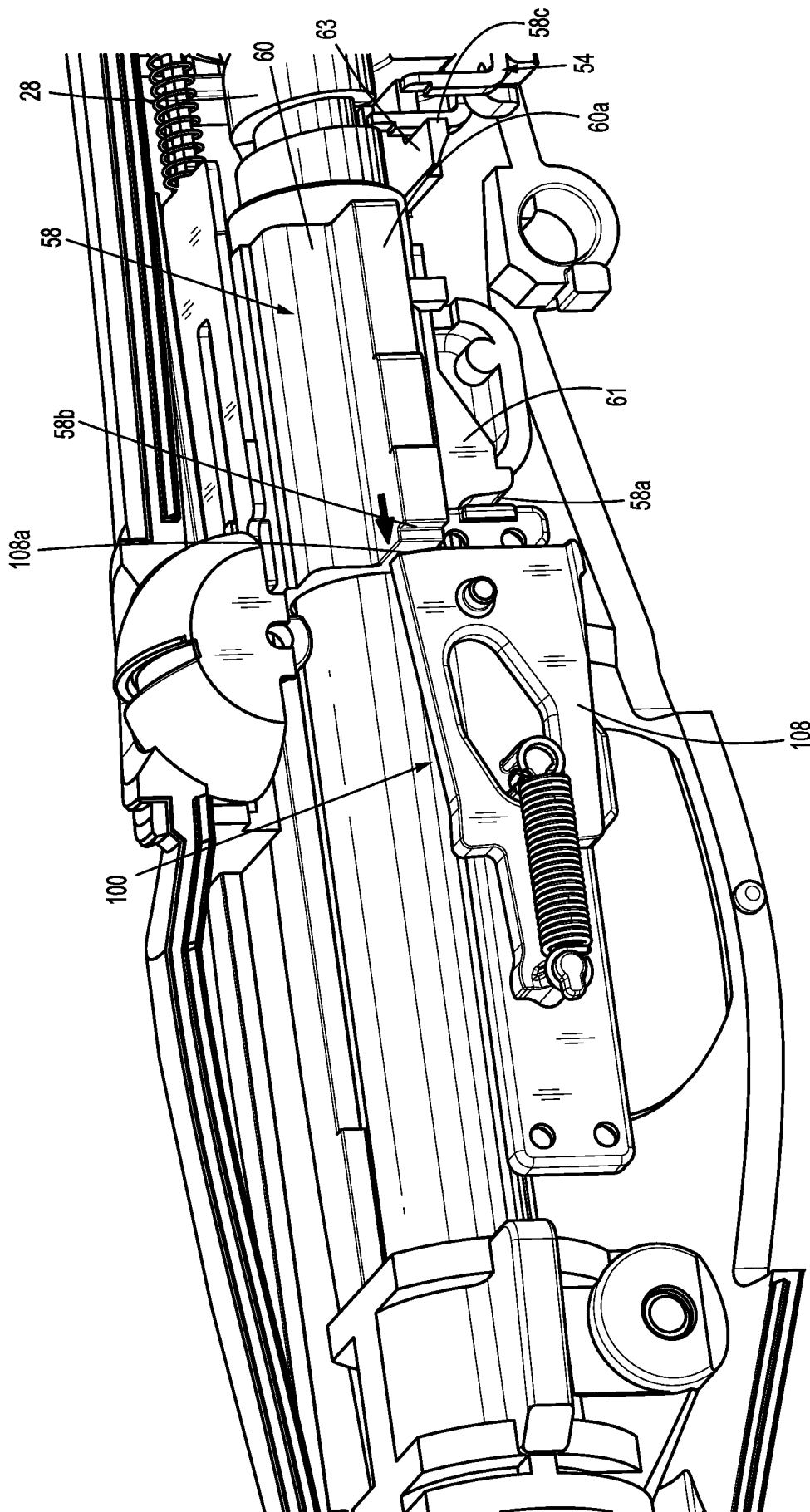
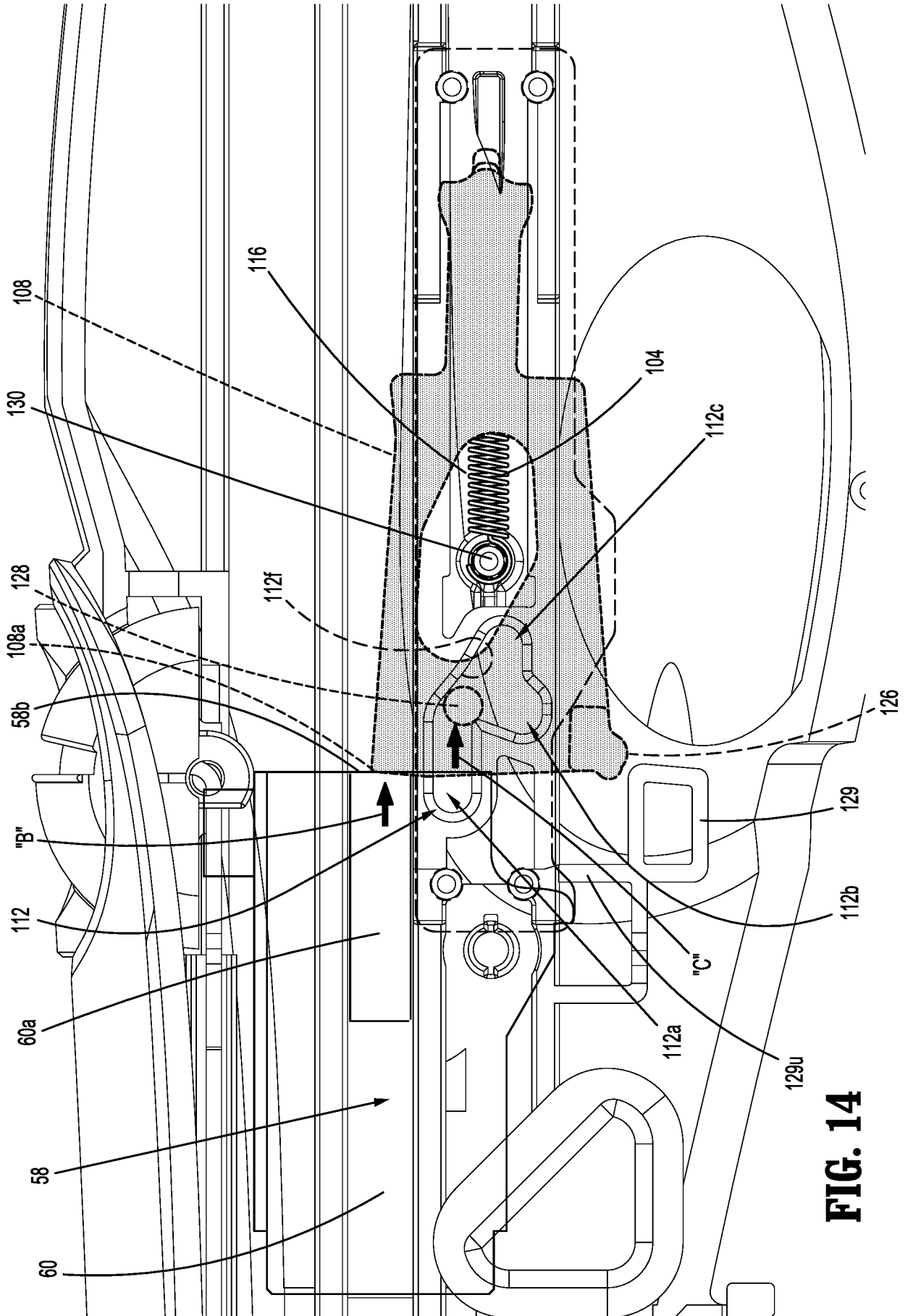
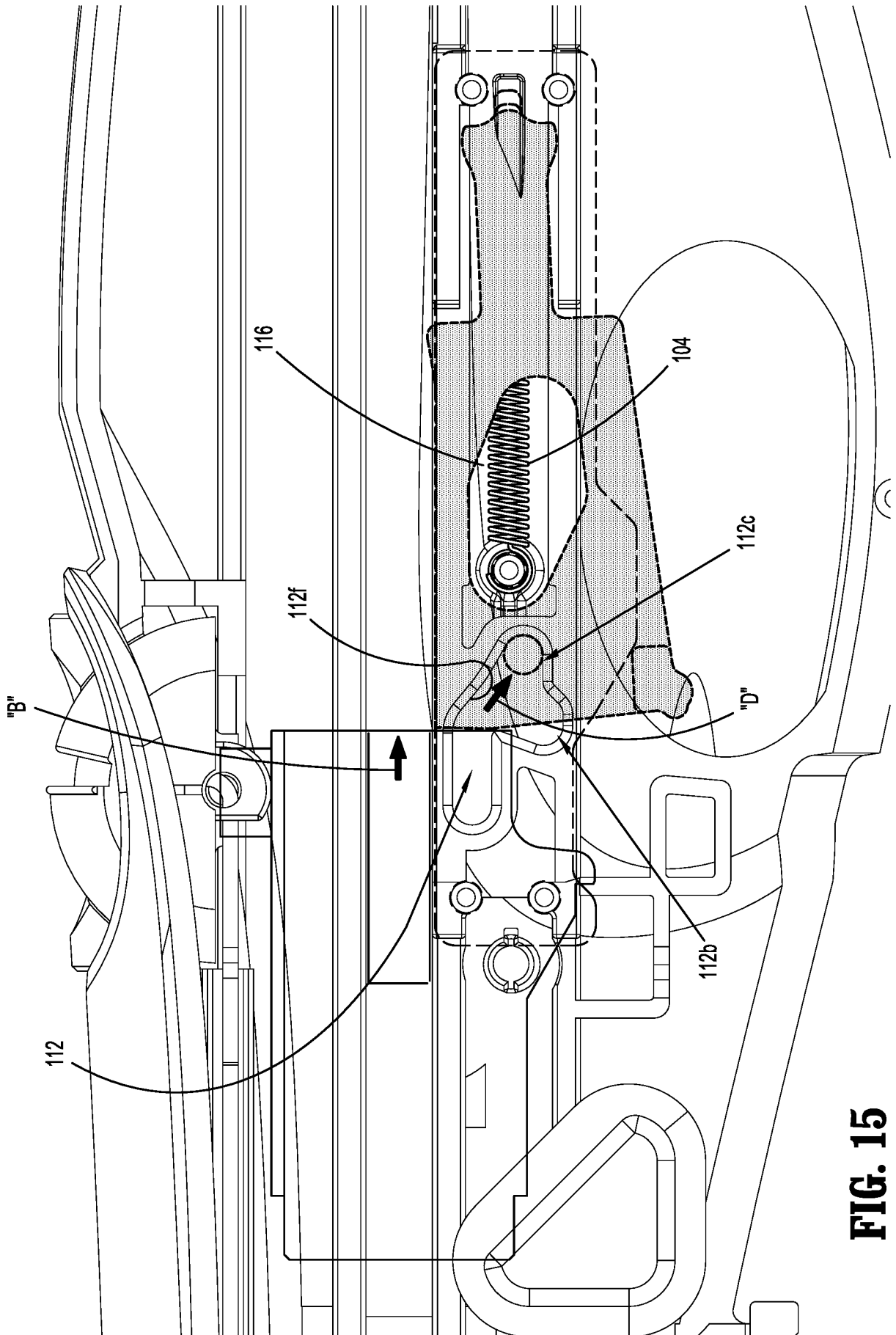


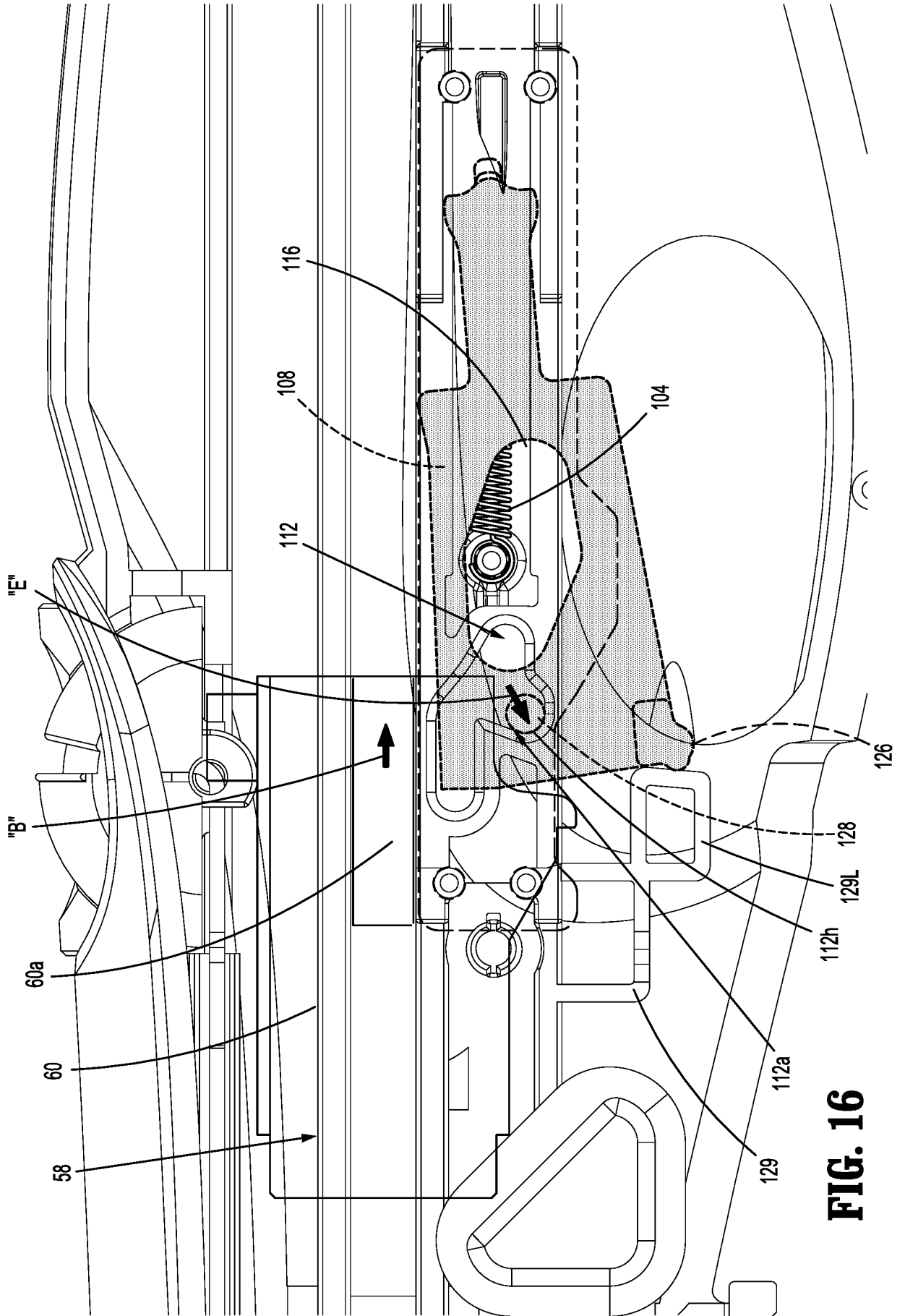
FIG. 13



**FIG. 14**



**FIG. 15**



**FIG. 16**

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2017/076161

**A. CLASSIFICATION OF SUBJECT MATTER**

A61B 17/115(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)

A61B17/-

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

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

CNPAT, CNKI, WPI, EPODOC: Staple?, Stapling, Audible, Sound, Indicat+, Cam, Spring, Fir+

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007095877 A1 (RACENET, DAVID C. ET AL.) 03 May 2007 (2007-05-03) Description, paragraphs [0076]-[0077], [0098], [0107]-[0108] and figures 2, 4, 10-10A, 12, 18A, 19-19C	1-3, 10-13, 20
X	CN 104039242 A (ETHICON ENDO-SURGERY, INC.) 10 September 2014 (2014-09-10) Description, paragraphs [0069]-[0074] and figures 1-2A, 7	1-3, 10-11
X	CN 203506807 U (WUXI SHENKANG MEDICAL INSTR. EQUIP. CO., LTD.) 02 April 2014 (2014-04-02) Description, paragraph [0021] and figures 1-2	1-3, 10
A	US 5697543 A (ETHICON ENDO-SURGERY, INC.) 16 December 1997 (1997-12-16) the whole document	1-20
A	CN 2461494 Y (ZHANG, ZUREN) 28 November 2001 (2001-11-28) the whole document	1-20
A	CN 205041474 U (TIANJIN TIANYAO METAL PROD. CO., LTD.) 24 February 2016 (2016-02-24) the whole document	1-20

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Date of the actual completion of the international search

16 November 2017

Date of mailing of the international search report

01 December 2017

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**INTERNATIONAL SEARCH REPORT**  
**Information on patent family members**

International application No.

**PCT/CN2017/076161**

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**Information on patent family members**

International application No.

**PCT/CN2017/076161**

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CN 2461494	Y 28 November 2001	None	
CN 205041474	U 24 February 2016	None	