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(54) **Surgical instrument with enhanced battery performance**

Chirurgisches Instrument mit verbesserter Batterieleistung

Instrument chirurgical avec une performance de batterie améliorée

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(73) Proprietor: **Ethicon LLC**
00969 Guaynabo (PR)

(72) Inventors:
- **Shelton, Frederick E.**
  New Vienna, OH 45159 (US)
- **Giordano, James R.**
  Milford, OH 45150 (US)
- **Swayze, Jeffrey S.**
  Hamilton, OH 45011 (US)
- **Siebenaler, Douglas Jon**
  Maineville, OH 45039 (US)

(74) Representative: **Tunstall, Christopher Stephen et al**
Carpmaels & Ransford LLP
One Southampton Row
London WC1B 5HA (GB)

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Description

BACKGROUND

[0001] Endoscopic surgical instruments are often preferred over traditional open surgical devices since a smaller incision tends to reduce the post-operative recovery time and complications. Consequently, significant development has gone into a range of endoscopic surgical instruments that are suitable for precise placement of a distal end effector at a desired surgical site through a cannula of a trocar. These distal end effectors engage the tissue in a number of ways to achieve a diagnostic or therapeutic effect (*e.g.*, endocutter, grasper, cutter, staplers, clip applier, access device, drug/gene therapy delivery device, and energy device using ultrasound, RF, laser, *etc*.).

[0002] US 5 693 042 discloses a device for identifying certain characteristics of an end piece or end effector of a surgical instrument. A preferred embodiment provides a surgical stapling instrument having an electrical circuit contained on the stapling cartridge which is capable of indicating cartridge type and/or status (i.e., with or without staples) when a voltage or current is applied to the circuit. The two-part form of independent claim 1 is based on this document. WO 03/090630 discloses surgical instruments that are couplable to or have an end effector or a disposable loading unit with an end effector, and at least one micro-electromechanical system (MEMS) device operatively connected to the surgical instrument for at least one of sensing a condition, measuring a parameter and controlling the condition and/or parameter.

[0003] US 6 181 105 discloses a power source maintenance and charge system comprising a charge maintenance circuitry for maintaining a desired charge on or for charging, a special power source of a packaged device; control circuitry for actuating and de-actuating the charge maintenance circuitry; and coupling circuitry for coupling the charge maintenance circuitry to the power source including a polymer insulated flat ribbon cable that passes through one of a sterile or non-sterile sealed plastic package containing the device to connect an auxiliary power source of the charge maintenance circuitry to the special power source of the device.

[0004] US 6 666 875 discloses a surgical instrument that can be disinfected or sterilized, and has a rechargeable secondary battery incorporated therein. A distal treatment section of the surgical instrument is ultrasonically oscillated or otherwise activated using the secondary battery as a driving power source to perform surgery on a living tissue. Electromagnetic energy generated by an energy generation unit located outside the surgical instrument is received by a reception coil incorporated in the surgical instrument with the surgical instrument by induction from the energy generation unit. The electromagnetic energy is then converted into charging power with which the secondary battery is recharged. Thus, the surgical instrument can be readily recharged without compromising sterility.

[0005] Known surgical staplers include an end effector that simultaneously makes a longitudinal incision in tissue and applies lines of staples on opposing sides of the incision. The end effector includes a pair of cooperating jaw members that, if the instrument is intended for endoscopic or laparoscopic applications, are capable of passing through a cannula passageway. One of the jaw members receives a staple cartridge having at least two laterally spaced rows of staples. The other jaw member defines an anvil having staple-forming pockets aligned with the rows of staples in the cartridge. The instrument includes a plurality of reciprocating wedges which, when driven distally, pass through openings in the staple cartridge and engage drivers supporting the staples to effect the firing of the staples toward the anvil.

[0006] An example of a surgical stapler suitable for endoscopic applications is described in U.S. Pat. No. 5,465,895, which discloses an endocutter with distinct closing and firing actions. A clinician using this device is able to close the jaw members upon tissue to position the tissue prior to firing. Once the clinician has determined that the jaw members are properly gripping tissue, the clinician can then fire the surgical stapler with a single firing stroke, thereby severing and stapling the tissue. The simultaneous severing and stapling avoids complications that may arise when performing such actions sequentially with different surgical tools that respectively only sever and staple.

[0007] One specific advantage of being able to close upon tissue before firing is that the clinician is able to verify via an endoscope that the desired location for the cut has been achieved, including that a sufficient amount of tissue has been captured between opposing jaws. Otherwise, opposing jaws may be drawn too close together, especially pinching at their distal ends, and thus not effectively forming closed staples in the severed tissue. At the other extreme, an excessive amount of clamped tissue may cause binding and an incomplete firing.

[0008] Endoscopic staplers/cutters continue to increase in complexity and function with each generation. One reason for this is the quest to lower force-to-fire (FTF) to a level that all or a great majority of surgeons can handle. One known solution to lower FTF uses CO_2 or electrical motors. These devices have not faired much better than traditional hand-powered devices, but for a different reason. Surgeons typically prefer to experience proportionate force distribution to that being experienced by the end effector in the forming of the staple to assure them that the cutting/stapling cycle is complete, with the upper limit within the capabilities of most surgeons (usually around 67 - 133 N (15-30 lbs)). They also typically want to maintain control of deploying the staples and being able to stop at anytime if the forces felt in the handle of the device feel too great or for some other clinical reason.

[0009] To address this need, so-called "power-assist" endoscopic surgical instruments have been developed

in which a supplemental power source aids in the firing of the instrument. For example, in some power-assist devices, a motor provides supplemental electrical power to the power input by the user from squeezing the firing trigger. Such devices are capable of providing loading force feedback and control to the operator to reduce the firing force required to be exerted by the operator in order to complete the cutting operation. One such power-assist device is described in United States Patent Application Publication No. 2007-0175952, filed January 31, 2006 by Shelton et al., entitled "Motor-driven surgical cutting and fastening instrument with loading force feedback".

[0010] Another reason for the increase in complexity and function of endoscopic surgical instruments is the quest to monitor and provide increased control over instrument components. For example, sensors and control systems arc now being used to implement new functionality in surgical instruments including, for example, electronic lock-outs. For example, One such lockout device is described in United States Patent Application publication No. 2007-0175956, filed January 31, 2006 by Swayze et al., entitled, "Electronic Lockouts And Surgical Instrument including Same,".

[0011] One challenge in using electronics in any kind of surgical instrument is providing a suitable power source. Most surgical instruments are stocked in sealed, sterilized packages. Because of this, it is usually not practical to access an instrument after it is packaged to verify the status of its power source or recharge if necessary. Accordingly, the shelf-life of the instrument is limited by the time that the power source is able to reliably hold a charge. For many kinds of instruments, though, it is desirable to choose a power source with a high peak power output. A high peak power output makes a power source more suitable for driving the motors, sensors and control systems used in surgical instruments. Sources with a high peak power output, however, such as lithium ion batteries, typically do not hold a full charge for a suitably long time. Accordingly, the choice of a power source must compromise the need for high peak power with a corresponding need for a long shelf-life.

SUMMARY

[0012] The present invention is directed to an end effector cartridge for use with a surgical instrument. The end effector cartridge comprises an electrical component; a power source; and a circuit element. The circuit element is configured to electrically connect the power source and the electrical component when the end effector cartridge is installed in a surgical instrument.

[0013] The present invention is also directed to an assembly comprising a package and an end effector cartridge within the package. The end effector cartridge comprises an electrical component; a power source and a circuit element. The circuit element is configured to electrically connect the power source and the electrical component when the end effector cartridge is installed in a surgical instrument. Methods of reconditioning surgical instruments and components thereof are also disclosed.

FIGURES

[0014] Various embodiments of the present invention are described herein by way of example in conjunction with the following figures wherein:

Figures 1 and 2 are perspective views of a surgical instrument according to various embodiments of the present invention;

Figures 3-5 are exploded views of an end effector and shaft of the instrument according to various embodiments of the present invention;

Figure 6 is a side view of the end effector according to various embodiments of the present invention;

Figure 7 is an exploded view of the handle of the instrument according to various embodiments of the present invention;

Figures 8 and 9 are partial perspective views of the handle according to various embodiments of the present invention;

Figure 10 is a side view of the handle according to various embodiments of the present invention;

Figure 11 is a perspective view of a surgical instrument according to various embodiments of the present invention;

Figure 12 is a schematic diagram of a circuit used in the instrument according to various embodiments of the present invention;

Figures 13 is a side view of an end effector used in the instrument according to various embodiments of the present invention;

Figures 14-16 show the instrument in a sterile package according to various examples;

Figures 17-19 show schematic diagrams of circuits used in the instrument according to various embodiments of the present invention;

Figure 20 shows a component of the instrument in a sterile package according to various embodiments of the present invention; and

Figure 21 shows a component of the instrument according to various embodiments of the present invention.

DESCRIPTION

[0015] The present invention is directed to having an end effector cartridge having a power source whose charges can be applied or maintained while the cartridge sealed in a sterile package. The present invention may be used with any type of surgical instrument comprising at least one power source, such as endoscopic or laparoscopic surgical instruments. Before describing aspects of the system, one type of surgical instrument in which embodiments of the present invention may be used - an

endoscopic stapling and cutting instrument (*i.e.,* an endocutter) - is first described by way of illustration.

[0016] Figures 1 and 2 depict an endoscopic surgical instrument 10 that comprises a handle 6, a shaft 8, and an articulating end effector 12 pivotally connected to the shaft 8 at an articulation pivot 14. Correct placement and orientation of the end effector 12 may be facilitated by controls on the hand 6, including (1) a rotation knob 28 for rotating the closure tube (described in more detail below in connection with Figures 4-5) at a free rotating joint 29 of the shaft 8 to thereby rotate the end effector 12 and (2) an articulation control 16 to effect rotational articulation of the end effector 12 about the articulation pivot 14. In the illustrated embodiment, the end effector 12 is configured to act as an endocutter for clamping, severing and stapling tissue, although in other embodiments, different types of end effectors may be used, such as end effectors for other types of surgical instruments, such as graspers, cutters, staplers, clip appliers, access devices, drug/gene therapy devices, ultrasound, RF or laser devices, *etc.*

[0017] The handle 6 of the instrument 10 may include a closure trigger 18 and a firing trigger 20 for actuating the end effector 12. It will be appreciated that instruments having end effectors directed to different surgical tasks may have different numbers or types of triggers or other suitable controls for operating the end effector 12. The end effector 12 is shown separated from the handle 6 by the preferably elongate shaft 8. In one embodiment, a clinician or operator of the instrument 10 may articulate the end effector 12 relative to the shaft 8 by utilizing the articulation control 16, as described in more detail in pending U.S. patent application publication No. US 2007-0158385, filed January 10, 2006, entitled "Surgical Instrument Having An Articulating End Effector," by Geoffrey C. Hueil *et al.,*

[0018] In this example, the end effector 12 includes, among other things, a staple channel 22 and a pivotally translatable clamping member, such as an anvil 24, which are maintained at a spacing that assures effective stapling and severing of tissue clamped in the end effector 12. The handle 6 includes a pistol grip 26 towards which a closure trigger 18 is pivotally drawn by the clinician to cause clamping or closing of the anvil 24 toward the staple channel 22 of the end effector 12 to thereby clamp tissue positioned between the anvil 24 and channel 22. The firing trigger 20 is farther outboard of the closure trigger 18. Once the closure trigger 18 is locked in the closure position, the firing trigger 20 may rotate slightly toward the pistol grip 26 so that it can be reached by the operator using one hand. Then the operator may pivotally draw the firing trigger 20 toward the pistol grip 12 to cause the stapling and severing of clamped tissue in the end effector 12. U.S. Application Publication No. 2007-0175952 describes various configurations for locking and unlocking the closure trigger 18. Different types of clamping members besides the anvil 24 could be used, such as, for example, an opposing jaw, *etc.*

[0019] It will be appreciated that the terms "proximal" and "distal" are used herein with reference to a clinician gripping the handle 6 of an instrument 10. Thus, the end effector 12 is distal with respect to the more proximal handle 6. It will be further appreciated that, for convenience and clarity, spatial terms such as "vertical" and "horizontal" are used herein with respect to the drawings. However, surgical instruments are used in many orientations and positions, and these terms are not intended to be limiting and absolute.

[0020] The closure trigger 18 may be actuated first. Once the clinician is satisfied with the positioning of the end effector 12, the clinician may draw back the closure trigger 18 to its fully closed, locked position proximate to the pistol grip 26. The firing trigger 20 may then be actuated. The firing trigger 20 returns to the open position (shown in Figures 1 and 2) when the clinician removes pressure. A release button 30 on the handle 6, and in this example, on the pistol grip 26 of the handle, when depressed may release the locked closure trigger 18.

[0021] Figure 3 is an exploded view of the end effector 12 according to various embodiments. As shown in the illustrated embodiment, the end effector 12 may include, in addition to the previously-mentioned channel 22 and anvil 24, a cutting instrument 32, a sled 33, a staple cartridge 34 that is removably seated in the channel 22, and a helical screw shaft 36. The cutting instrument 32 may be, for example, a knife. The anvil 24 may be pivotably opened and closed at a pivot point 25 connected to the proximate end of the channel 22. The anvil 24 may also include a tab 27 at its proximate end that is inserted into a component of the mechanical closure system (described further below) to open and close the anvil 24. When the closure trigger 18 is actuated, that is, drawn in by a user of the instrument 10, the anvil 24 may pivot about the pivot point 25 into the clamped or closed position. If clamping of the end effector 12 is satisfactory, the operator may actuate the firing trigger 20, which, as explained in more detail below, causes the knife 32 and sled 33 to travel longitudinally along the channel 22, thereby cutting tissue clamped within the end effector 12. The movement of the sled 33 along the channel 22 causes the staples of the staple cartridge 34 to be driven through the severed tissue and against the closed anvil 24, which turns the staples to fasten the severed tissue. U.S. Pat. 6,978,921, entitled "Surgical stapling instrument incorporating an E-beam firing mechanism", provides more details about such two-stroke cutting and fastening instruments. The sled 33 may be part of the cartridge 34, such that when the knife 32 retracts following the cutting operation, the sled 33 does not retract. The channel 22 and the anvil 24 may be made of an electrically conductive material (such as metal) and in various instruments may serve as part of an antenna for communication with sensor(s) in the end effector. The cartridge 34 could be made of a nonconductive material (such as plastic) and the sensor may be connected to or disposed in the cartridge 34, as described further below.

[0022] It should be noted that, although the instrument 10 described herein employs an end effector 12 that staples the severed tissue, other different techniques for fastening or sealing the severed tissue may be used. For example, end effectors that use RF energy or adhesives to fasten the severed tissue may also be used. U.S. Patent No. 5,709,680, entitled "Electrosurgical Hemostatic Device" to Yates *et al.,* and U.S. Patent No. 5,688,270, entitled "Electrosurgical Hemostatic Device With Recessed And/Or Offset Electrodes" to Yates *et al.,* disclose cutting instruments that use RF energy to fasten the severed tissue. U.S. Patent Application Publication No. US2007-0102453 to Morgan et al. and U.S. Patent Application Publication No. US 2007-0104582 to Shelton et al., disclose cutting instruments that use adhesives to fasten the severed tissue. Accordingly, although the description herein refers to cutting/stapling operations and the like, it should be recognized that this is an exemplary instrument and is not meant to be limiting. Other tissue-fastening techniques may also be used.

[0023] Figures 4 and 5 are exploded views and Figure 6 is a side view of the end effector 12 and shaft 8. The shaft 8 may include a proximate closure tube 40 and a distal closure tube 42 pivotably linked by a pivot links 44. The distal closure tube 42 includes an opening 45 into which the tab 27 on the anvil 24 is inserted in order to open and close the anvil 24. Disposed inside the closure tubes 40, 42 may be a proximate spine tube 46. Disposed inside the proximate spine tube 46 may be a main rotational (or proximate) drive shaft 48 that communicates with a secondary (or distal) drive shaft 50 via a bevel gear assembly 52. The secondary drive shaft 50 is connected to a drive gear 54 that engages a proximate drive gear 56 of the helical screw shaft 36. The vertical bevel gear 52b may sit and pivot in an opening 57 in the distal end of the proximate spine tube 46. A distal spine tube 58 may be used to enclose the secondary drive shaft 50 and the drive gears 54, 56. Collectively, the main drive shaft 48, the secondary drive shaft 50, and the articulation assembly (*e.g.*, the bevel gear assembly 52a-c), are sometimes referred to herein as the "main drive shaft assembly."

[0024] A bearing 38, positioned at a distal end of the staple channel 22, receives the helical drive screw 36, allowing the helical drive screw 36 to freely rotate with respect to the channel 22. The helical screw shaft 36 may interface a threaded opening (not shown) of the knife 32 such that rotation of the shaft 36 causes the knife 32 to translate distally or proximately (depending on the direction of the rotation) through the staple channel 22. Accordingly, when the main drive shaft 48 is caused to rotate by actuation of the firing trigger 20 (as explained in more detail below), the bevel gear assembly 52a-c causes the secondary drive shaft 50 to rotate, which in turn, because of the engagement of the drive gears 54, 56, causes the helical screw shaft 36 to rotate, which causes the knife 32 to travel longitudinally along the channel 22 to cut any tissue clamped within the end effector. The sled 33 may be made of, for example, plastic, and may have a sloped distal surface. As the sled 33 traverses the channel 22, the sloped forward surface may push up or drive the staples in the staple cartridge 34 through the clamped tissue and against the anvil 24. The anvil 24 turns the staples, thereby stapling the severed tissue. When the knife 32 is retracted, the knife 32 and sled 33 may become disengaged, thereby leaving the sled 33 at the distal end of the channel 22.

[0025] As shown Figures 7-10, the surgical instrument may include a battery 64 in the handle 6. The illustrated instrument provides user-feedback regarding the deployment and loading force of the cutting instrument in the end effector 12. In addition, the instrument may use power provided by the user in retracting the firing trigger 18 to power the instrument 10 (a so-called "power assist" mode). As shown in the illustrated instrument, the handle 6 includes exterior lower side pieces 59, 60 and exterior upper side pieces 61, 62 that fit together to form, in general, the exterior of the handle 6. The handle pieces 59-62 may be made of an electrically nonconductive material, such as plastic. A battery 64, such as a lithium ion battery, may be provided in the pistol grip portion 26 of the handle 6. The battery 64 powers a motor 65 disposed in an upper portion of the pistol grip portion 26 of the handle 6. The battery 64 may be consctructed according to any suitable construction or chemistry including, for example, a Li-ion chemistry such as $LiCoO_2$ or $LiNiO_2$, a Nickel Metal Hydride chemistry, *etc.* The motor 65 may be a DC brushed driving motor having a maximum rotation of, approximately, 5000 RPM to 100,000 RPM. The motor 64 may drive a 90° bevel gear assembly 66 comprising a first bevel gear 68 and a second bevel gear 70. The bevel gear assembly 66 may drive a planetary gear assembly 72. The planetary gear assembly 72 may include a pinion gear 74 connected to a drive shaft 76. The pinion gear 74 may drive a mating ring gear 78 that drives a helical gear drum 80 via a drive shaft 82. A ring 84 may be threaded on the helical gear drum 80. Thus, when the motor 65 rotates, the ring 84 is caused to travel along the helical gear drum 80 by means of the interposed bevel gear assembly 66, planetary gear assembly 72 and ring gear 78.

[0026] The handle 6 may also include a run motor sensor 110 in communication with the firing trigger 20 to detect when the firing trigger 20 has been drawn in (or "closed") toward the pistol grip portion 26 of the handle 6 by the operator to thereby actuate the cutting/stapling operation by the end effector 12. The sensor 110 may be a proportional sensor such as, for example, a rheostat or variable resistor. When the firing trigger 20 is drawn in, the sensor 110 detects the movement, and sends an electrical signal indicative of the voltage (or power) to be supplied to the motor 65. When the sensor 110 is a variable resistor or the like, the rotation of the motor 65 may be generally proportional to the amount of movement of the firing trigger 20. That is, if the operator only draws or closes the firing trigger 20 in a little bit, the rotation of the

motor 65 is relatively low. When the firing trigger 20 is fully drawn in (or in the fully closed position), the rotation of the motor 65 is at its maximum. In other words, the harder the user pulls on the firing trigger 20, the more voltage is applied to the motor 65, causing greater rates of rotation. In another instrument, for example, the control unit (described further below) may output a PWM control signal to the motor 65 based on the input from the sensor 110 in order to control the motor 65.

[0027] The handle 6 may include a middle handle piece 104 adjacent to the upper portion of the firing trigger 20. The handle 6 also may comprise a bias spring 112 connected between posts on the middle handle piece 104 and the firing trigger 20. The bias spring 112 may bias the firing trigger 20 to its fully open position. In that way, when the operator releases the firing trigger 20, the bias spring 112 will pull the firing trigger 20 to its open position, thereby removing actuation of the sensor 110, thereby stopping rotation of the motor 65. Moreover, by virtue of the bias spring 112, any time a user closes the firing trigger 20, the user will experience resistance to the closing operation, thereby providing the user with feedback as to the amount of rotation exerted by the motor 65. Further, the operator could stop retracting the firing trigger 20 to thereby remove force from the sensor 100, to thereby stop the motor 65. As such, the user may stop the deployment of the end effector 12, thereby providing a measure of control of the cutting/fastening operation to the operator.

[0028] The distal end of the helical gear drum 80 includes a distal drive shaft 120 that drives a ring gear 122, which mates with a pinion gear 124. The pinion gear 124 is connected to the main drive shaft 48 of the main drive shaft assembly. In that way, rotation of the motor 65 causes the main drive shaft assembly to rotate, which causes actuation of the end effector 12, as described above.

[0029] The ring 84 threaded on the helical gear drum 80 may include a post 86 that is disposed within a slot 88 of a slotted arm 90. The slotted arm 90 has an opening 92 at its opposite end 94 that receives a pivot pin 96 that is connected between the handle exterior side pieces 59, 60. The pivot pin 96 is also disposed through an opening 100 in the firing trigger 20 and an opening 102 in the middle handle piece 104.

[0030] In addition, the handle 6 may include a reverse motor (or end-of-stroke sensor) 130 and a stop motor (or beginning-of-stroke) sensor 142. The reverse motor sensor 130 may be a limit switch located at the distal end of the helical gear drum 80 such that the ring 84 threaded on the helical gear drum 80 contacts and trips the reverse motor sensor 130 when the ring 84 reaches the distal end of the helical gear drum 80. The reverse motor sensor 130, when activated, sends a signal to the control unit which sends a signal to the motor 65 to reverse its rotation direction, thereby withdrawing the knife 32 of the end effector 12 following the cutting operation.

[0031] The stop motor sensor 142 may be, for example, a normally-closed limit switch. In various instruments, it may be located at the proximate end of the helical gear drum 80 so that the ring 84 trips the switch 142 when the ring 84 reaches the proximate end of the helical gear drum 80.

[0032] In operation, when an operator of the instrument 10 pulls back the firing trigger 20, the sensor 110 detects the deployment of the firing trigger 20 and sends a signal to the control unit which sends a signal to the motor 65 to cause forward rotation of the motor 65 at, for example, a rate proportional to how hard the operator pulls back the firing trigger 20. The forward rotation of the motor 65 in turn causes the ring gear 78 at the distal end of the planetary gear assembly 72 to rotate, thereby causing the helical gear drum 80 to rotate, causing the ring 84 threaded on the helical gear drum 80 to travel distally along the helical gear drum 80. The rotation of the helical gear drum 80 also drives the main drive shaft assembly as described above, which in turn causes deployment of the knife 32 in the end effector 12. That is, the knife 32 and sled 33 are caused to traverse the channel 22 longitudinally, thereby cutting tissue clamped in the end effector 12. Also, the stapling operation of the end effector 12 is caused to happen in embodiments where a stapling-type end effector is used.

[0033] By the time the cutting/stapling operation of the end effector 12 is complete, the ring 84 on the helical gear drum 80 will have reached the distal end of the helical gear drum 80, thereby causing the reverse motor sensor 130 to be tripped, which sends a signal to the control unit which sends a signal to the motor 65 to cause the motor 65 to reverse its rotation. This in turn causes the knife 32 to retract, and also causes the ring 84 on the helical gear drum 80 to move back to the proximate end of the helical gear drum 80.

[0034] The middle handle piece 104 includes a backside shoulder 106 that engages the slotted arm 90 as best shown in Figures 8 and 9. The middle handle piece 104 also has a forward motion stop 107 that engages the firing trigger 20. The movement of the slotted arm 90 is controlled, as explained above, by rotation of the motor 65. When the slotted arm 90 rotates CCW as the ring 84 travels from the proximate end of the helical gear drum 80 to the distal end, the middle handle piece 104 will be free to rotate CCW. Thus, as the user draws in the firing trigger 20, the firing trigger 20 will engage the forward motion stop 107 of the middle handle piece 104, causing the middle handle piece 104 to rotate CCW. Due to the backside shoulder 106 engaging the slotted arm 90, however, the middle handle piece 104 will only be able to rotate CCW as far as the slotted arm 90 permits. In that way, if the motor 65 should stop rotating for some reason, the slotted arm 90 will stop rotating, and the user will not be able to further draw in the firing trigger 20 because the middle handle piece 104 will not be free to rotate CCW due to the slotted arm 90.

[0035] Components of an exemplary closure system for closing (or clamping) the anvil 24 of the end effector 12 by retracting the closure trigger 18 are also shown in

Figures 7-10. In the illustrated instrument, the closure system includes a yoke 250 connected to the closure trigger 18 by a pin 251 that is inserted through aligned openings in both the closure trigger 18 and the yoke 250. A pivot pin 252, about which the closure trigger 18 pivots, is inserted through another opening in the closure trigger 18 which is offset from where the pin 251 is inserted through the closure trigger 18. Thus, retraction of the closure trigger 18 causes the upper part of the closure trigger 18, to which the yoke 250 is attached via the pin 251, to rotate CCW. The distal end of the yoke 250 is connected, via a pin 254, to a first closure bracket 256. The first closure bracket 256 connects to a second closure bracket 258. Collectively, the closure brackets 256, 258 define an opening in which the proximate end of the proximate closure tube 40 (see Figure 4) is seated and held such that longitudinal movement of the closure brackets 256, 258 causes longitudinal motion by the proximate closure tube 40. The instrument 10 also includes a closure rod 260 disposed inside the proximate closure tube 40. The closure rod 260 may include a window 261 into which a post 263 on one of the handle exterior pieces, such as exterior lower side piece 59 in the illustrated instrument, is disposed to fixedly connect the closure rod 260 to the handle 6. In that way, the proximate closure tube 40 is capable of moving longitudinally relative to the closure rod 260. The closure rod 260 may also include a distal collar 267 that fits into a cavity 269 in proximate spine tube 46 and is retained therein by a cap 271 (see Figure 4).

[0036] In operation, when the yoke 250 rotates due to retraction of the closure trigger 18, the closure brackets 256, 258 cause the proximate closure tube 40 to move distally (*i.e.,* away from the handle end of the instrument 10), which causes the distal closure tube 42 to move distally, which causes the anvil 24 to rotate about the pivot point 25 into the clamped or closed position. When the closure trigger 18 is unlocked from the locked position, the proximate closure tube 40 is caused to slide proximately, which causes the distal closure tube 42 to slide proximately, which, by virtue of the tab 27 being inserted in the window 45 of the distal closure tube 42, causes the anvil 24 to pivot about the pivot point 25 into the open or unclamped position. In that way, by retracting and locking the closure trigger 18, an operator may clamp tissue between the anvil 24 and channel 22, and may unclamp the tissue following the cutting/stapling operation by unlocking the closure trigger 18 from the locked position.

[0037] The control unit (described further below) may receive the outputs from end-of-stroke and beginning-of-stroke sensors 130, 142 and the run-motor sensor 110, and may control the motor 65 based on the inputs. For example, when an operator initially pulls the firing trigger 20 after locking the closure trigger 18, the run-motor sensor 110 is actuated. If the staple cartridge 34 is present in the end effector 12, a cartridge lockout sensor (not shown) may be closed, in which case the control unit may output a control signal to the motor 65 to cause the motor 65 to rotate in the forward direction. When the end effector 12 reaches the end of its stroke, the reverse motor sensor 130 will be activated. The control unit may receive this output from the reverse motor sensor 130 and cause the motor 65 to reverse its rotational direction. When the knife 32 is fully retracted, the stop motor sensor switch 142 is activated, causing the control unit to stop the motor 65.

[0038] In other instruments, rather than a proportional-type sensor 110, an on-off type sensor could be used. In such instruments. the rate of rotation of the motor 65 would not be proportional to the force applied by the operator. Rather, the motor 65 would generally rotate at a constant rate. But the operator would still experience force feedback because the firing trigger 20 is geared into the gear drive train.

[0039] The instrument 10 may include a number of sensors in the end effector 12 for sensing various conditions related to the end effector 12, such as sensors for determining the status of the staple cartridge 34 (or other type of cartridge depending on the type of surgical instrument), user input loads, the progress of the stapler during closure and firing, a compatible surgical instrument or instruments for the cartridge 34, *etc.* The sensors may be passively powered by inductive signals, or may be powered by a remote power source, such as a battery in the end effector 12, for example. The sensor(s) could include magnetoresistive, optical, electromechanical, radio frequency identification (RFID), micro-electrical-mechanical systems (MEMS), motion or pressure sensors, for example. These sensors may be in communication with a control unit 300, which may be located in the handle 6 of the instrument 10, for example, as shown in Figure 11. The sensors may be in contact with the control unit 300 according to any suitable wired or wireless method.

[0040] As shown in Figure 12, the control unit 300 may comprise a processor 306 and one or more memory units 308. By executing instruction codes stored in the memory 308, the processor 306 may control various components of the instrument 10, such as the motor 65 or a user display (not shown), based on inputs received from the various end effector sensors and other sensor(s) (such as the run-motor sensor 110, the end-of-stroke sensor 130, and the beginning-of-stroke sensor 142, for example). The control unit 300 may be powered by the battery 64 during surgical use of instrument 10. In instruments where the control unit 300 does not have a direct, wired connection to each of the sensors and/or motors, it may comprise an inductive element 302 *(e.g.,* a coil or antenna) for transmitting and receiving wireless signals from the various sensors/motors, *etc.* Input signals received by the inductive element 302 acting as a receiving antenna may be demodulated by a demodulator 310 and decoded by a decoder 312. Output signals may be transmitted via the encoder 316, modulator 318 and inductive element 302. Various instruments may include separate inductive elements (not shown) for receiving and trans-

mitting.

[0041] The control unit 300 may be embodied as a single component, such as a microcontroller, a system-on-chip (SoC) or a system-in-package (SIP). Alternatively, the control unit 300 may be embodied as two or more discrete components. As shown in Figure 11, the control unit 300 may be housed in the handle 6 of the instrument 10 and one or more of the sensors 368 for the instrument 10 may be located in the end effector 12. In instruments where the control unit 300 and sensors 368 communicate wirelessly, the inductive element 302 of the control unit 300 may be inductively to the transponders via one or more wires (*e.g.,* 322) and/or secondary inductive elements (*e.g.,* coils 320 and 324). The secondary inductive elements 320, 324 may be placed to avoid running wires through articulating joints such as rotatary joint 29, pivot 14, *etc.*

[0042] Figure 13 is a diagram of an end effector 12 including a sensor 368 held or embedded in the cartridge 34 at the distal end of the channel 22. The sensor 368 may be connected to the cartridge 34 by a suitable bonding material, such as epoxy. In this embodiment, the sensor 368 includes a magnetoresistive sensor. The anvil 24 also includes a permanent magnet 369 at its distal end and generally facing the transponder 368. The cartridge 34 also includes a permanent magnet 370 connected to the sled 33 in this example embodiment. This allows the sensor 368 to detect both opening/closing of the end effector 12 (due to the permanent magnet 369 moving further or closer to the transponder as the anvil 24 opens and closes) and completion of the stapling/cutting operation (due to the permanent magnet 370 moving toward the transponder 368 as the sled 33 traverses the channel 22 as part of the cutting operation). It will be appreciated that various other sensors and/or sensor types may be included in the end effector 12 and/or cartridge 34 including, for example, the radio frequency identification (RFID) sensor 371 shown.

[0043] Figure 13 also shows the staples 380 and the staple drivers 382 of the staple cartridge 34. As explained previously, when the sled 33 traverses the channel 22, the sled 33 drives the staple drivers 382 which drive the staples 380 into the severed tissue held in the end effector 12, the staples 380 being formed against the anvil 24. As noted above, such a surgical cutting and fastening instrument is but one type of surgical instrument in which the present invention may be advantageously employed. Various embodiments of the present invention may be used in any type of surgical instrument having one or more sensors.

[0044] In the instruments described above, the battery 64 or other suitable power source powers (at least partially) the firing operation of the instrument 10. As such, the instrument may be a so-called "power-assist" device. More details and additional embodiments of power-assist devices are described in U.S. Application Publication No. 2007-0175952. It should be recognized, however, that the instrument 10 need not be a power-assist device and that this is merely an example of a type of device that may utilize aspects of the present invention. For example, the instrument 10 may include a user display (such as a LCD or LED display) that is powered by the battery 64 and controlled by the control unit 300. Data from the sensor transponders 368 in the end effector 12 may be displayed on such a display.

[0045] Typically, surgical instruments, such as the instrument 10, are cleaned and sterilized prior to use. In one sterilization technique, the instrument 10 is placed in a closed and sealed package 280, such as a plastic and/or TYVEK container or bag, as shown in Figs. 14 and 15. The package 280 and the instrument arc then placed in a field of radiation that can penetrate the package, such as gamma radiation, x-rays, or high-energy electrons. The radiation kills bacteria on the instrument 10 and in the package 280. The sterilized instrument 10 can then be stored in the sterile package 280. The sealed, sterile package 280 keeps the instrument 10 sterile until it is opened in a medical facility or some other use environment. Instead of radiation, other means of sterilizing the instrument 10 may be used, such as ethylene oxide or steam. The instrument 10 may be provided to a customer in a sterilized or un-sterilized state. When the instrument 10 is provided in an un-sterilized state, the customer may sterilize the instrument 10 in-house, or send it out to an outside contractor.

[0046] Figure 16 shows a view, according to various examples, of the instrument 10 and package 280 that also includes an auxiliary power source 402. The auxiliary power source 402 may be in electrical communication with the instrument 10 (*e.g.,* the battery 64) via a connection 404 and a circuit element (not shown). The auxiliary power source 402 may provide power for charging and/or recharging an instrument power source. The auxiliary power source 402 may be any kind of battery or other suitable power source. For example, the auxiliary power source may include a rechargeable battery, such as a lithium-ion or nickel metal hydride battery, a non-rechargeable battery, such as a Zinc/Carbon, Zn/alkaline/MnO_2, Li/MnO_2, Zn/Ag2O, Li/FeS_2, *etc.*

[0047] The circuit element may regulate power transferred from the auxiliary power source 402 to the instrument 10 to ensure that the battery 64 or other power source of the instrument 10 has an appropriate charge when the instrument 10 is ready for use. Physically, the circuit element may be positioned in any suitable location including, for example, as a stand alone item within the package 280, within the auxiliary power source 402, within the instrument, *etc.* The connection 404 may be any suitable kind of connection including, for example, a direct wired connection, an inductive connection, *etc.* In an inductive connection, the connection 404 may include inductive elements in close proximity to one another. A current in a first inductive element may induce a corresponding current in a second inductive element, thus transferring electric power across the connection 404.

[0048] Figure 17 shows an exemplary schematic dia-

gram of the auxiliary power source 402 connected to an instrument power source 406 (*e.g.,* battery 64) via a circuit element 410. The auxiliary power source 402 may charge the instrument power source 406 according to any suitable method or charging profile. For example, the circuit element 410 may comprise a direct connection (*e.g.*, inductive or wired) between the power sources 402, 406. The auxiliary source 402 may provide a charging current to charge the instrument source 406 as its charge is dissipated, for example, as the instrument 10 sits on the shelf. Also, for example, the auxiliary power source 402 may provide a charging current based on a current state of the source instrument. As shown in Figure 18, the circuit element 410 may comprise one or more switches 412 or resistors (not shown) to monitor the charge on the instrument power source 406 and provide current from the auxiliary source 402 when the charge on the source 406 reaches a predetermined threshold. Current provided by the auxiliary power source 402 may also be regulated by various other means including, for example, by microprocessor 414 and switch network 416 as shown in Figure 19. The functions of the processor 414 may be performed by the processor 306 described above, or by any other control system of the instrument 10.

[0049] According to various embodiments, the auxiliary power source 402 may charge the instrument source 406 relatively quickly when the instrument 10 is ready for use. For example, referring to Figure 18, the switch 412 may be left in an open position while the instrument 10 and package 280 are stocked. Accordingly, the charge on the instrument power source 406 may be allowed to degrade. When the instrument 10 is ready for use, the switch 412 closed, allowing the auxiliary power source 402 to provide a charging current to the power source 406, charging the source 406 prior to use. For example, the switch 412 may be configured to close automatically when the package 280 is opened. In various embodiments, the switch may include a tab 405, as shown in Figure 16. The tab 405 may be connected to a portion of the package 280 and configured to close the switch 412 as the package 280 is opened. Also, for example, a clinician may pull the tab 405 at or near the time when the instrument 10 will be used, closing the switch 412 and causing the source 406 to charge.

[0050] As described above, some end effector cartridges 34 may have sensors or other electrical components that require a power source. For example, Figure 3 shows the cartridge 34 with a power source 456. The power source 456 may be any power source suitable for operating electronics present in the cartridge and/or the end effector 12. For example, the power source 456 may include a capacitor, a battery, *etc.* The power source 456 may be positioned within the cartridge 34 in any suitable location including, for example, at a distal tip, as shown in Figure 20, and as a part of the sled 33, as shown in Figure 21.

[0051] End effector cartridges 34 may be stored and sterilized according to the methods described above. For example, Figure 20 shows a view of a cartridge 34 enclosed in a package 450 for sterilization. As shown, the package 450 also includes an auxiliary power source 452. The auxiliary power source may provide power to the cartridge power source 456. Like the power source 402, the power source 452 may tend to charge or recharge a power source 456 of the cartridge 34, thus increasing the shelf-life of the cartridge 34. The auxiliary power source 452 may be linked to the cartridge 34 via a connection 454 and a circuit element (not shown) similar to the circuit element described above. The auxiliary power source 452, circuit element and cartridge power source may be linked and may charge the power source 456 according to any suitable method wired or wireless (*e.g.*, inductive) method including, for example, those discussed above with respect to Figures 17, 18 and 19.

[0052] According to various embodiments, a cartridge power source 456 may have a small charge capacity. Accordingly, it may be desirable to prevent unnecessary use of this charge. For example, the cartridge power source 456 may be electrically isolated from its load until the cartridge 34 is ready for use. The cartridge 34 may include a cut-off switch or other circuit element that is closed when the cartridge 34 is installed in an end effector 12. When the cut-off switch is closed, the power source 456 may be connected to its load (*e.g.,* any sensors or other powered electronics present in the cartridge 34).

[0053] The cut-off switch may be implemented in any suitable way. For example, as shown in Figure 3, the cartridge 34 may include indentations 401 that are received by corresponding protrusions (not shown) in the channel 22 when the cartridge 34 is secured into the channel 22. Switch elements may be placed within these indentations 401. When the cartridge 34 is installed into the channel 22, the protrusions may be received into the indentations 401, closing the cut-off switch and connecting the power source 456 to its load. Figure 21 shows an additional embodiment of the cut-off switch. As shown, the cut-off switch may include a pair of electrical contacts 462 positioned on a sidewall of the cartridge 34. When the cartridge 34 is secured within the channel 22 (*see* Figure 3), the contacts 462 are shorted by the conductive sidewall of the channel 22, closing the switch and connecting the power source 456 to its load.

[0054] The various embodiments of the present invention have been described above in connection with cutting-type surgical instruments. It should be noted, however, that in other embodiments, the inventive surgical instrument disclosed herein need not be a cutting-type surgical instrument, but rather could be used in any type of surgical instrument including remote sensor transponders. For example, it could be a non-cutting endoscopic instrument, a grasper, a stapler, a clip applier, an access device, a drug/gene therapy delivery device, an energy device using ultrasound, RF, laser, *etc.* In addition, the present invention may be in laparoscopic instruments, for example.

[0055] The devices disclosed herein can be designed

to be disposed of after a single use, or they can be designed to be used multiple times. In either case, however, the device can be reconditioned for reuse after at least one use. Reconditioning can include any combination of the steps of disassembly of the device, followed by cleaning or replacement of particular pieces, and subsequent reassembly. In particular, the device can be disassembled, and any number of the particular pieces or parts of the device can be selectively replaced or removed in any combination. Upon cleaning and/or replacement of particular parts, the device can be reassembled for subsequent use either at a reconditioning facility, or by a surgical team immediately prior to a surgical procedure. Those skilled in the art will appreciate that reconditioning of a device can utilize a variety of techniques for disassembly, cleaning/replacement, and reassembly. Use of such techniques, and the resulting reconditioned device, are all within the scope of the present application.

[0056] Although the present invention has been described herein in connection with certain disclosed embodiments, many modifications and variations to those embodiments may be implemented. For example, different types of end effectors may be employed. Also, where materials are disclosed for certain components, other materials may be used. The foregoing description and following claims arc intended to cover all such modification and variations.

Claims

1. An end effector cartridge (34) for use with a surgical instrument (10), the end effector cartridge comprising:

a circuit element,
characterised in that the end effector cartridge further comprises:

a power source (456); and
an electrical component,

wherein the circuit element is configured to electrically connect the power source and the electrical component when the end effector cartridge is installed in a surgical instrument (10).

2. The end effector cartridge of claim 1, wherein the electrical component comprises at least one of the group consisting of a passive sensor and an active sensor.

3. The end effector cartridge of claim 1, wherein the electrical component comprises a Radio Frequency Identification (RFID) component.

4. The end effector cartridge of claim 1, wherein the electrical component is configured to indicate at least one of the group consisting of a status of the end effector cartridge (34), a type of the end effector cartridge and a compatible surgical instrument (10) for the end effector cartridge.

5. The end effector cartridge of claim 1, wherein the circuit element comprises a switch configured to close an electrical connection between the electrical component and the power source (456) when the end effector cartridge (34) is installed in the surgical instrument (10).

6. The end effector cartridge of claim 1, wherein the circuit element comprises at least two electrodes (462), and wherein an electrical connection is made between the electrodes when the cartridge is installed into a surgical instrument.

7. The end effector cartridge of claim 1, wherein the circuit element comprises a contact switch configured to be actuated when the end effector cartridge is installed in the surgical instrument.

8. A method for processing an end effector cartridge of any one of claims 1-7, the method comprising:

obtaining the end effector cartridge (34);
sterilizing the end effector cartridge; and
storing the end effector cartridge in a sterile package (450).

9. An assembly comprising:

a package (450);
the end effector cartridge (34) of any one of claims 1-7 within the package;
an auxiliary power source (452) within the package; and
a circuit element in electrical communication with the power source and the auxiliary power source.

10. The assembly of claim 9, wherein the package (450) is sterile.

11. The assembly of claim 9, wherein the power source (456) is a battery or a capacitor.

12. The assembly of claim 9, wherein the circuit element comprises a direct electrical connection (454) between the power source (456) and the auxiliary power source (452).

13. The assembly of claim 12, wherein the direct electrical connection comprises an inductive connection.

14. The assembly of claim 9, wherein the power source (456) is not in electrical communication with the in-

strument component.

15. The assembly of claim 9, wherein the auxiliary power source (452) comprises at least one cell selected from the group consisting of a Zinc/Carbon cell, a Zn/alkaline/MnO2 cell, a Li/MnO2 cell, a Zn/Ag2O, and a Li/FeS2 cell.

Patentansprüche

1. Zur Verwendung mit einem chirurgischen Instrument (10) vorgesehene Endeffektorpatrone (34), umfassend:

- ein Schaltkreiselement,
dadurch gekennzeichnet, dass die Endeffektorpatrone außerdem
- eine Stromquelle (456) und
- ein elektrisches Bauteil umfasst,
wobei das Schaltkreiselement dazu ausgebildet ist, die Stromquelle elektrisch mit dem elektrischen Bauteil zu verbinden, wenn die Endeffektorpatrone in ein chirurgisches Instrument (10) eingesetzt wird.

2. Endeffektorpatrone nach Anspruch 1, wobei das elektrische Bauteil einen passiven und/oder einen aktiven Sensor enthält.

3. Endeffektorpatrone nach Anspruch 1, wobei das elektrische Bauteil ein RFID-Bauteil (radio frequency identification = Identifikation mittels Radiowellen) umfasst.

4. Endeffektorpatrone nach Anspruch 1, wobei das elektrische Bauteil dazu ausgebildet ist, den Zustand der Endeffektorpatrone (34) und/oder den Typ der Endeffektorpatrone und/oder ein mit der Endeffektorpatrone kompatibles chirurgisches Instrument (10) anzuzeigen.

5. Endeffektorpatrone nach Anspruch 1, wobei das Schaltkreiselement einen Schalter umfasst, welcher dazu ausgebildet ist, eine elektrische Verbindung zwischen dem elektrischen Bauteil und der Stromquelle (456) herzustellen, wenn die Endeffektorpatrone (34) in das chirurgische Instrument (10) eingesetzt wird.

6. Endeffektorpatrone nach Anspruch 1, wobei das Schaltkreiselement mindestens zwei Elektroden (462) umfasst und wobei eine elektrische Verbindung zwischen den Elektroden hergestellt wird, wenn die Patrone in ein chirurgisches Instrument eingesetzt wird.

7. Endeffektorpatrone nach Anspruch 1, wobei das Schaltkreiselement einen Kontaktschalter umfasst, welcher dazu ausgebildet ist, betätigt zu werden, wenn die Endeffektorpatrone in das chirurgische Instrument eingesetzt wird.

8. Verfahren zur Behandlung einer Endeffek-torpatrone nach einem der Ansprüche 1 bis 7, wobei das Verfahren folgende Schritte umfasst:

- Erhalten der Endeffektorpatrone (34);
- Sterilisation der Endeffektorpatrone und
- Aufbewahrung der Endeffektorpatrone in einer sterilen Packung (450).

9. Baugruppe, umfassend:

- eine Packung (450);
- die Endeffektorpatrone (34) nach einem der Ansprüche 1 bis 7 in der Packung;
- eine Hilfsstromquelle (452) in der Packung und
- ein Schaltkreiselement in elektrischer Verbindung mit der Stromquelle und der Hilfsstromquelle.

10. Baugruppe nach Anspruch 9, wobei die Packung (450) steril ist.

11. Baugruppe nach Anspruch 9, wobei die Stromquelle (456) eine Batterie oder ein Kondensator ist.

12. Baugruppe nach Anspruch 9, wobei das Schaltkreiselement eine direkte elektrische Verbindung (454) zwischen der Stromquelle (456) und der Hilfsstromquelle (452) umfasst.

13. Baugruppe nach Anspruch 12, wobei die direkte elektrische Verbindung eine induktive Verbindung umfasst.

14. Baugruppe nach Anspruch 9, wobei die Stromquelle (456) nicht mit dem Instrumententeil elektrisch verbunden ist.

15. Baugruppe nach Anspruch 9, wobei die Hilfsstromquelle (452) eine Zink/Carbon-Zelle und/oder eine Zn/Alkali/MnO_2-Zelle und/oder eine Li/MnO_2-Zelle und/oder eine Zn/Ag_2O-Zelle und/oder eine Li/FeS2-Zelle umfasst.

Revendications

1. Cartouche d'effecteur terminal (34) pour son utilisation avec un instrument chirurgical (10), la cartouche d'effecteur terminal comprenant :

un élément de circuit,
caractérisée en ce que la cartouche d'effecteur

terminal comprend en outre :

une source d'alimentation (456) ; et
un composant électrique,

dans laquelle l'élément de circuit est configuré pour connecter électriquement la source d'alimentation et le composant électrique lorsque la cartouche d'effecteur terminal est installée dans un instrument chirurgical (10).

2. Cartouche d'effecteur terminal selon la revendication 1, dans laquelle le composant électrique comprend au moins l'un du groupe consistant en un capteur passif et un capteur actif.

3. Cartouche d'effecteur terminal selon la revendication 1, dans laquelle le composant électrique comprend un composant d'identification par radiofréquence (RFID).

4. Cartouche d'effecteur terminal selon la revendication 1, dans laquelle le composant électrique est configuré pour indiquer au moins l'un du groupe consistant en un statut de la cartouche d'effecteur terminal (34), un type de la cartouche d'effecteur terminal et un instrument chirurgical compatible (10) pour la cartouche d'effecteur terminal.

5. Cartouche d'effecteur terminal selon la revendication 1, dans laquelle l'élément de circuit comprend un interrupteur configuré pour fermer une connexion électrique entre le composant électrique et la source d'alimentation (456) lorsque la cartouche d'effecteur terminal (34) est installée dans l'instrument chirurgical (10).

6. Cartouche d'effecteur terminal selon la revendication 1, dans laquelle l'élément de circuit comprend au moins deux électrodes (462), et dans laquelle une connexion électrique est établie entre les électrodes lorsque la cartouche est installée dans un instrument chirurgical.

7. Cartouche d'effecteur terminal selon la revendication 1, dans laquelle l'élément de circuit comprend un interrupteur de contact configuré pour être actionné lorsque la cartouche d'effecteur terminal est installée dans l'instrument chirurgical.

8. Procédé de traitement d'une cartouche d'effecteur terminal de l'une quelconque des revendications 1 à 7, le procédé comprenant :

l'obtention de la cartouche d'effecteur terminal (34) ;
la stérilisation de la cartouche d'effecteur terminal ; et
le stockage de la cartouche d'effecteur terminal dans un emballage stérile (450).

9. Ensemble comprenant :

un emballage (450) ;
la cartouche d'effecteur terminal (34) de l'une quelconque des revendications 1 à 7 au sein de l'emballage ;
une source d'alimentation auxiliaire (452) au sein de l'emballage ; et
un élément de circuit en communication électrique avec la source d'alimentation et la source d'alimentation auxiliaire.

10. Ensemble selon la revendication 9, dans lequel l'emballage (450) est stérile.

11. Ensemble selon la revendication 9, dans lequel la source d'alimentation (456) est une batterie ou un condensateur.

12. Ensemble selon la revendication 9, dans lequel l'élément de circuit comprend une connexion électrique directe (454) entre la source d'alimentation (456) et la source d'alimentation auxiliaire (452).

13. Ensemble selon la revendication 12, dans lequel la connexion électrique directe comprend une connexion inductive.

14. Ensemble selon la revendication 9, dans lequel la source d'alimentation (456) n'est pas en communication électrique avec le composant d'instrument.

15. Ensemble selon la revendication 9, dans lequel la source d'alimentation auxiliaire (452) comprend au moins une pile choisie dans le groupe consistant en une pile Zinc/Carbone, une pile Zn/alcaline/MnO2, une pile Li/MnO2, une pile Zn/Ag2O, et une pile Li/FeS2.

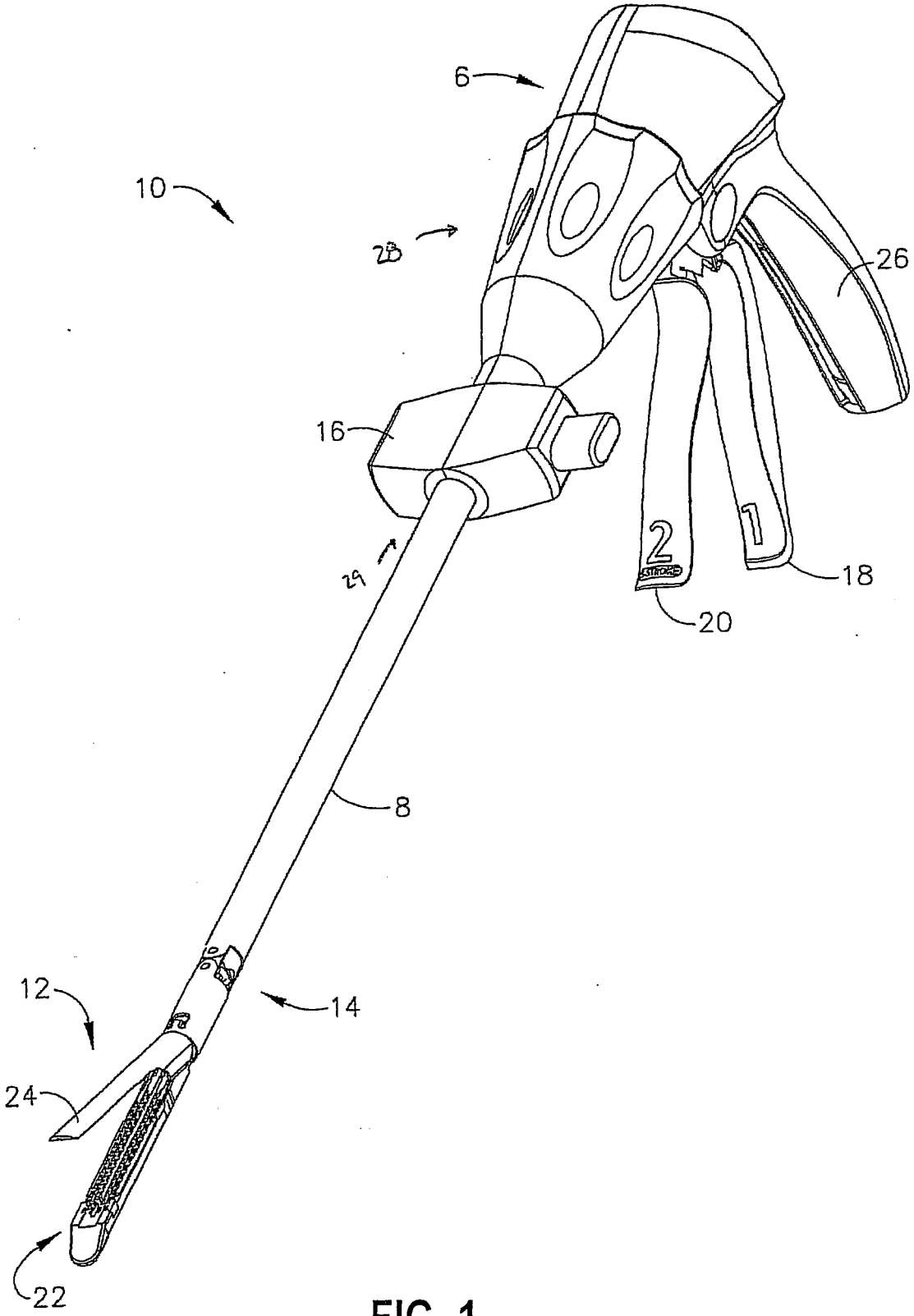


FIG. 1

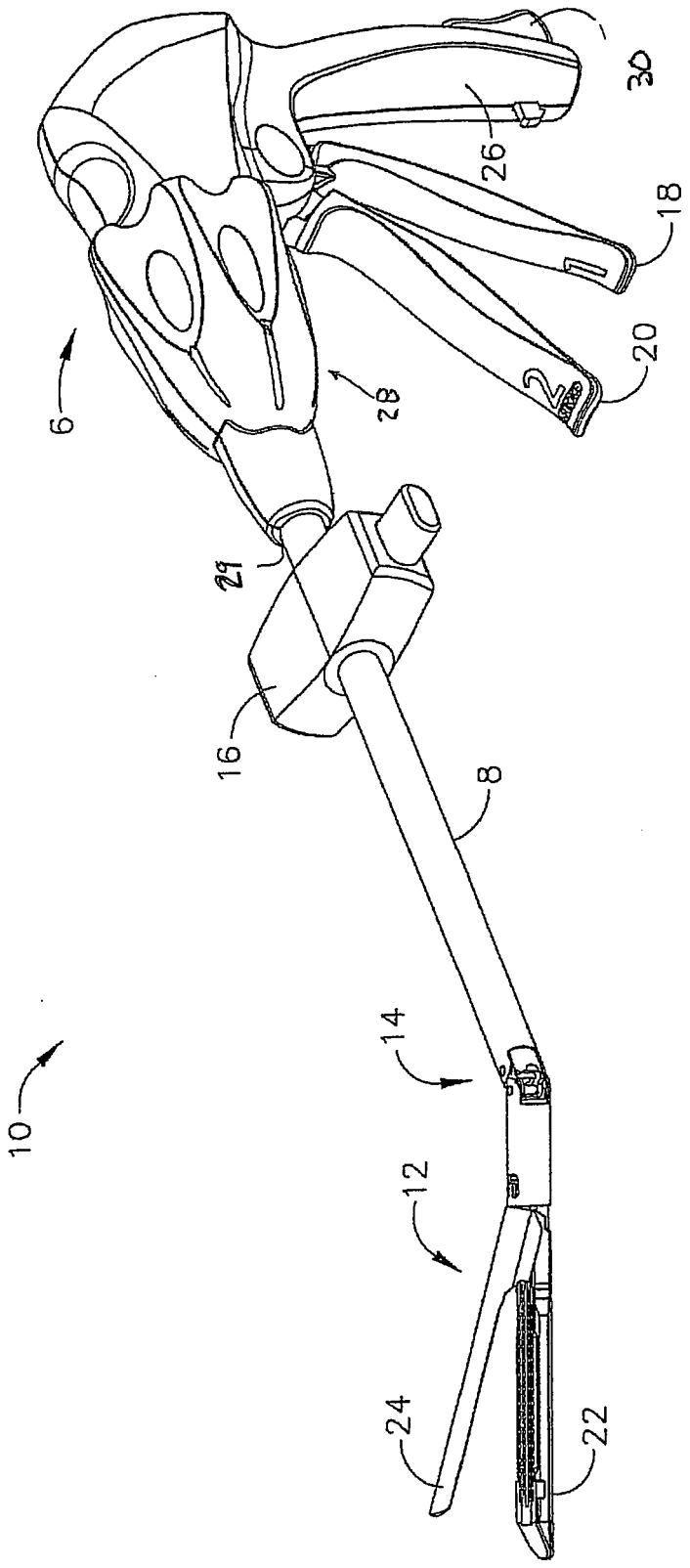


FIG. 2

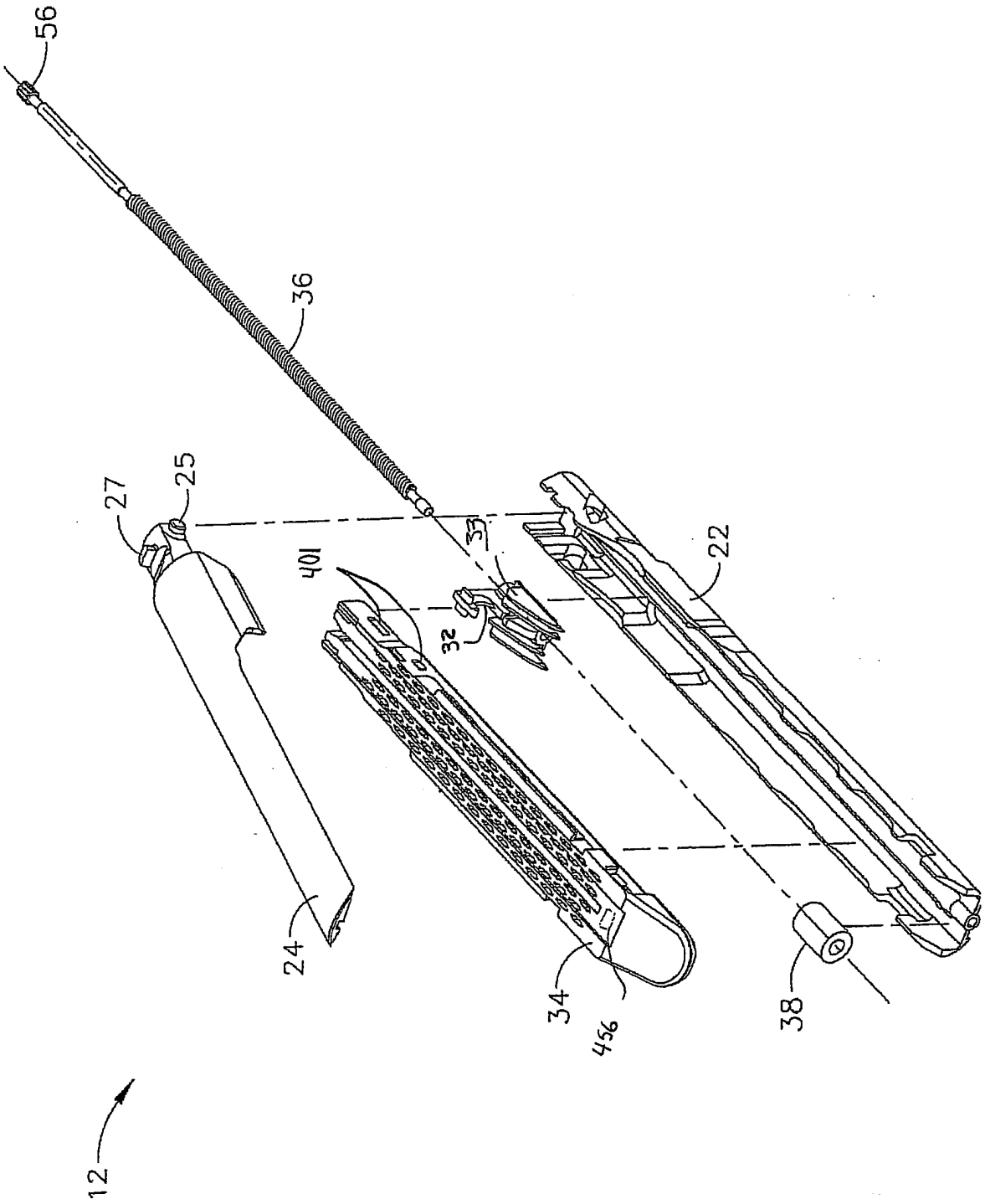


FIG. 3

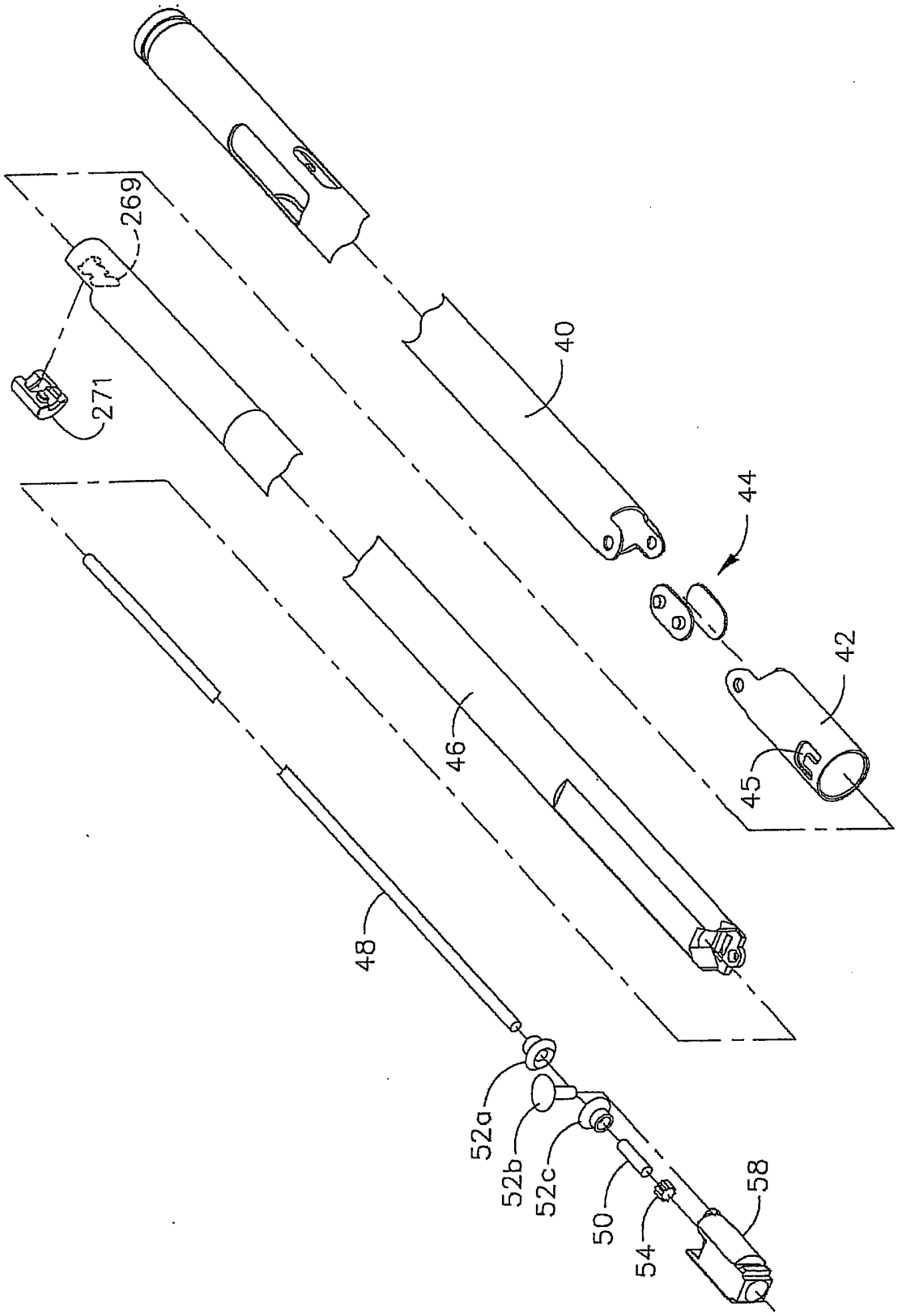


FIG. 4

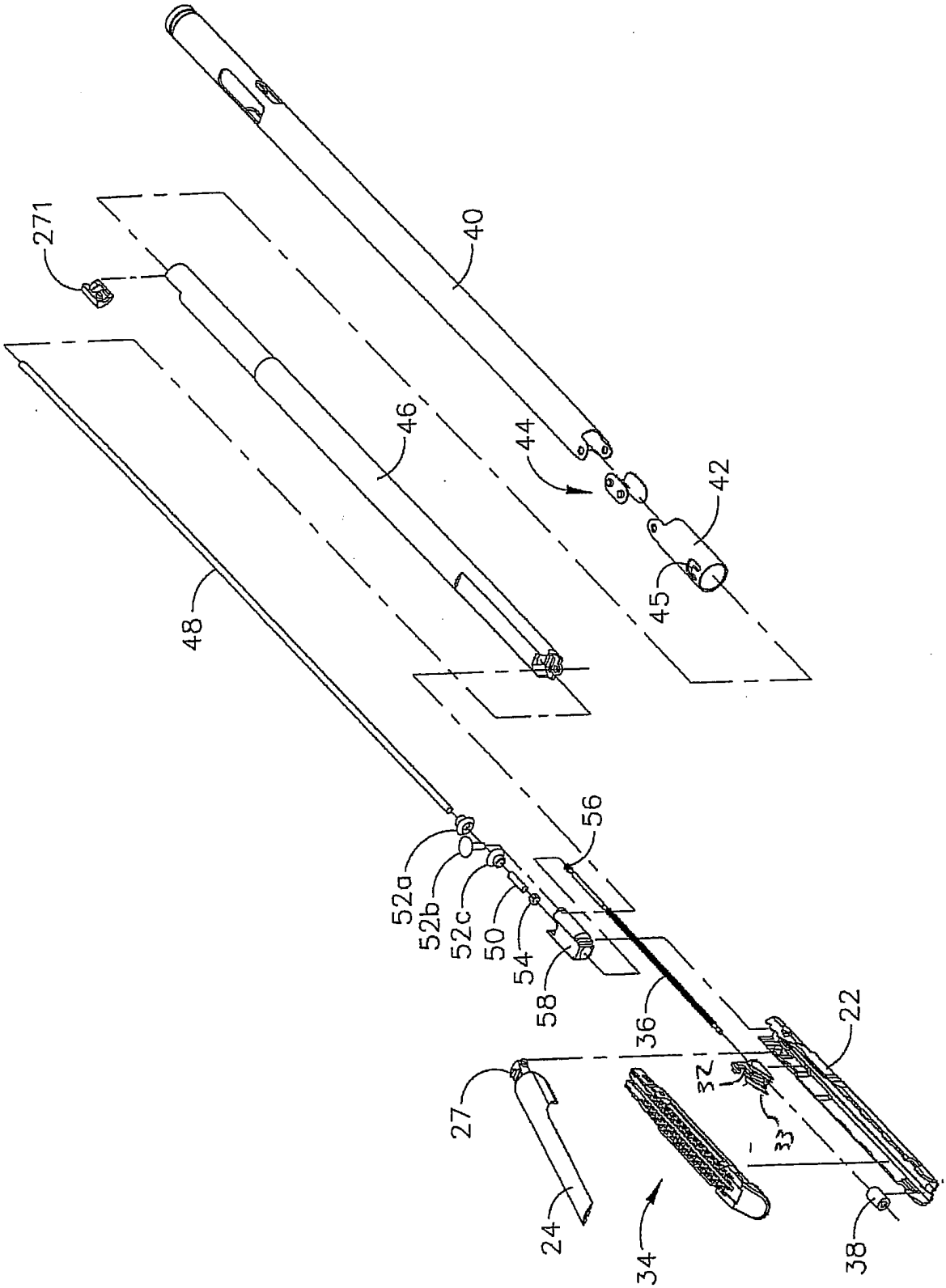


FIG. 5

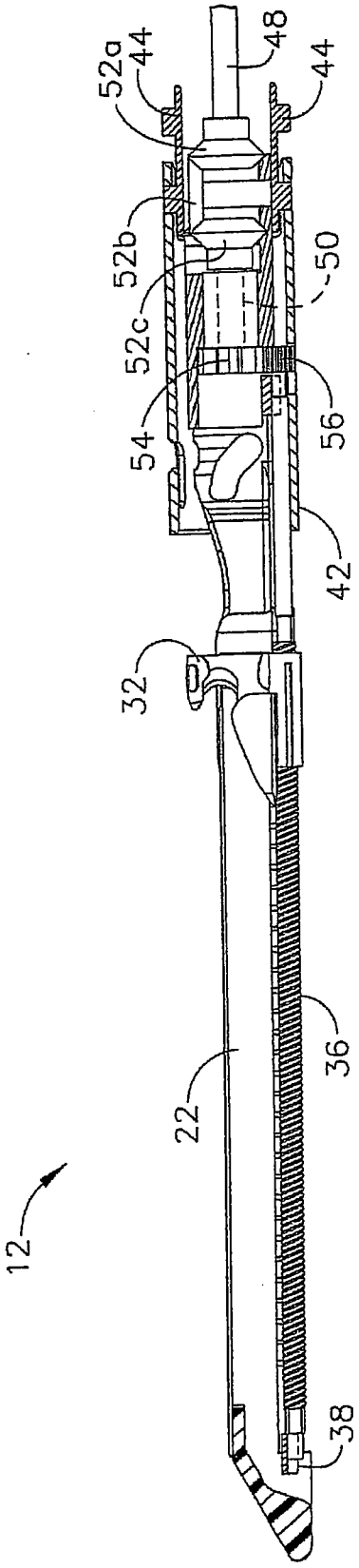
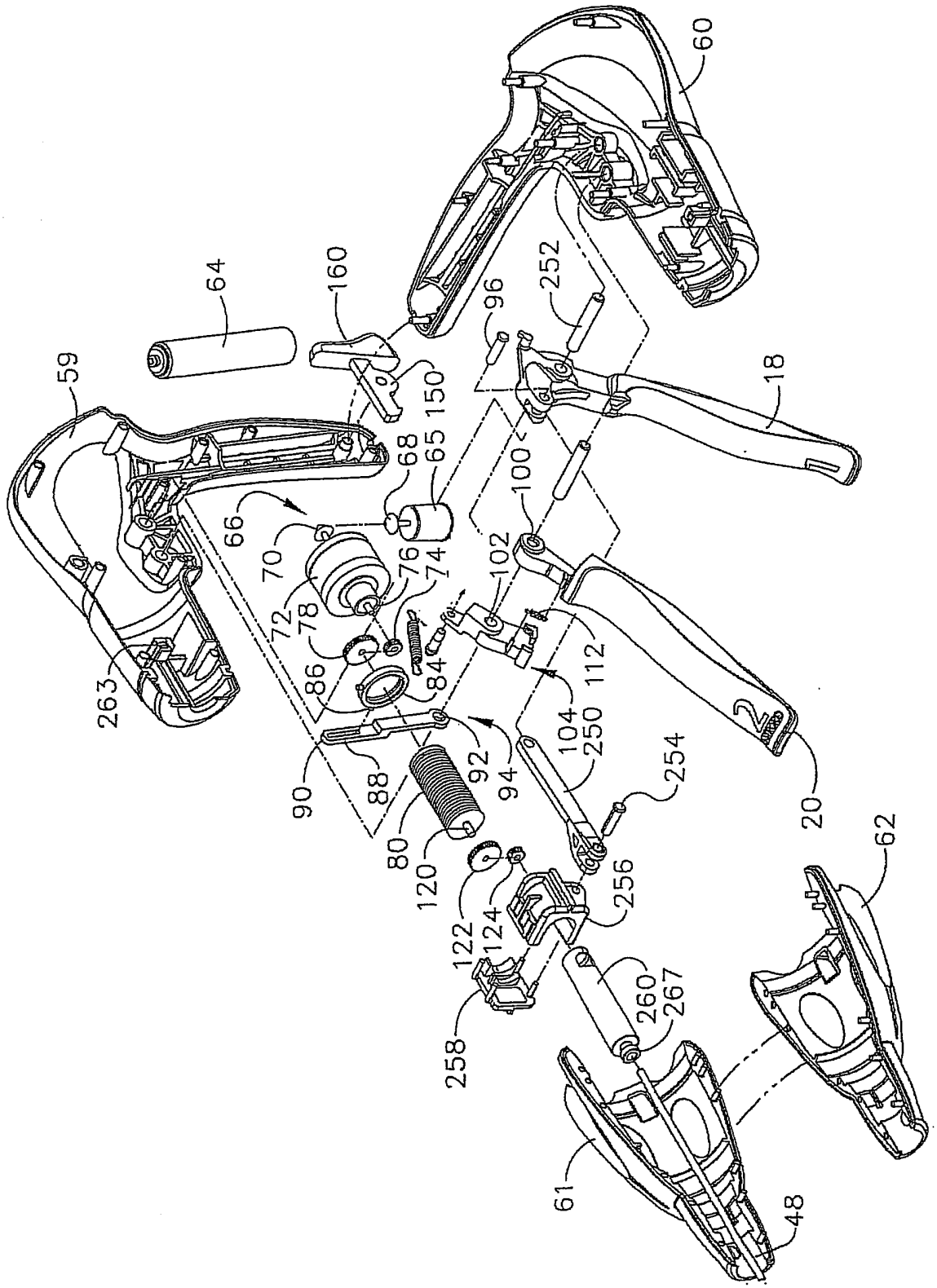


FIG. 6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263
104
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124
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258
61
48

FIG. 7

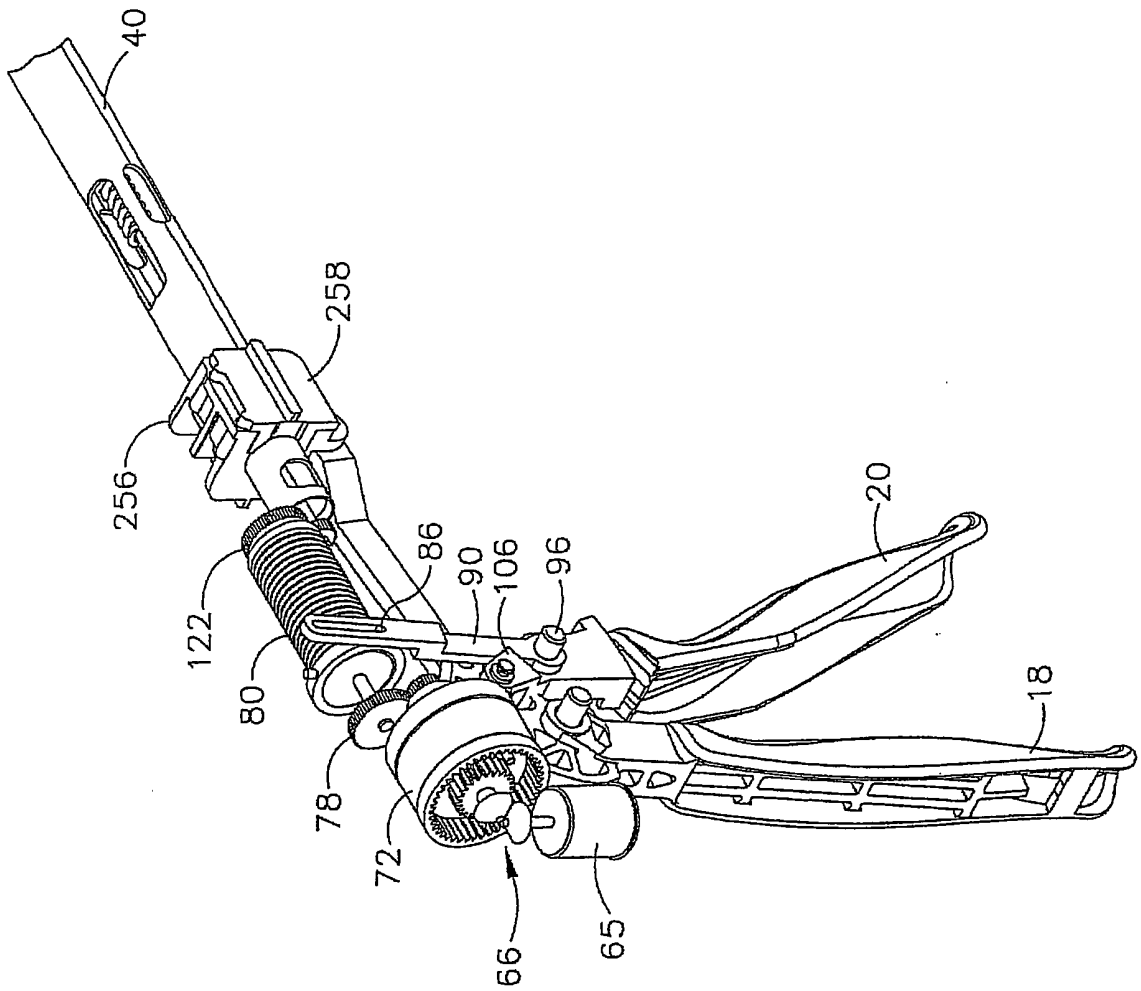

FIG. 8

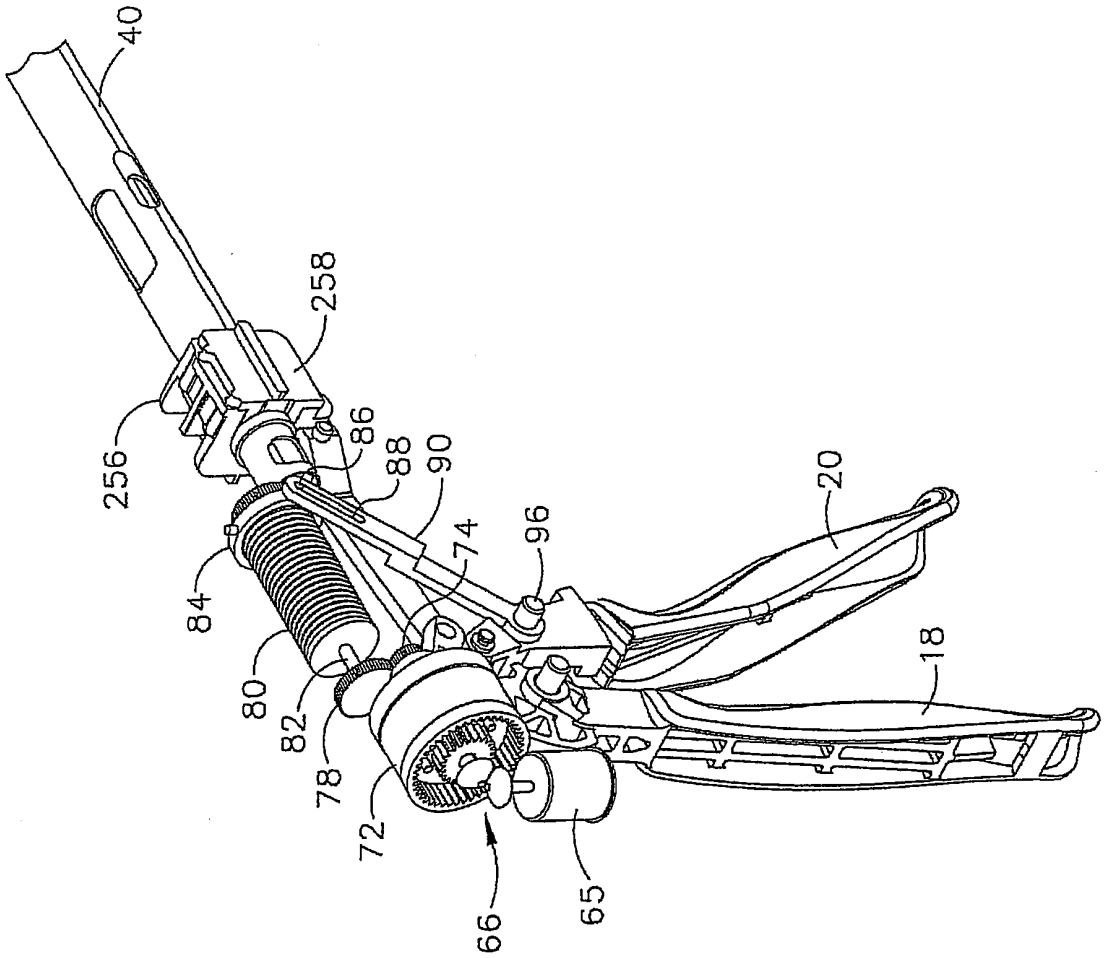

FIG. 9

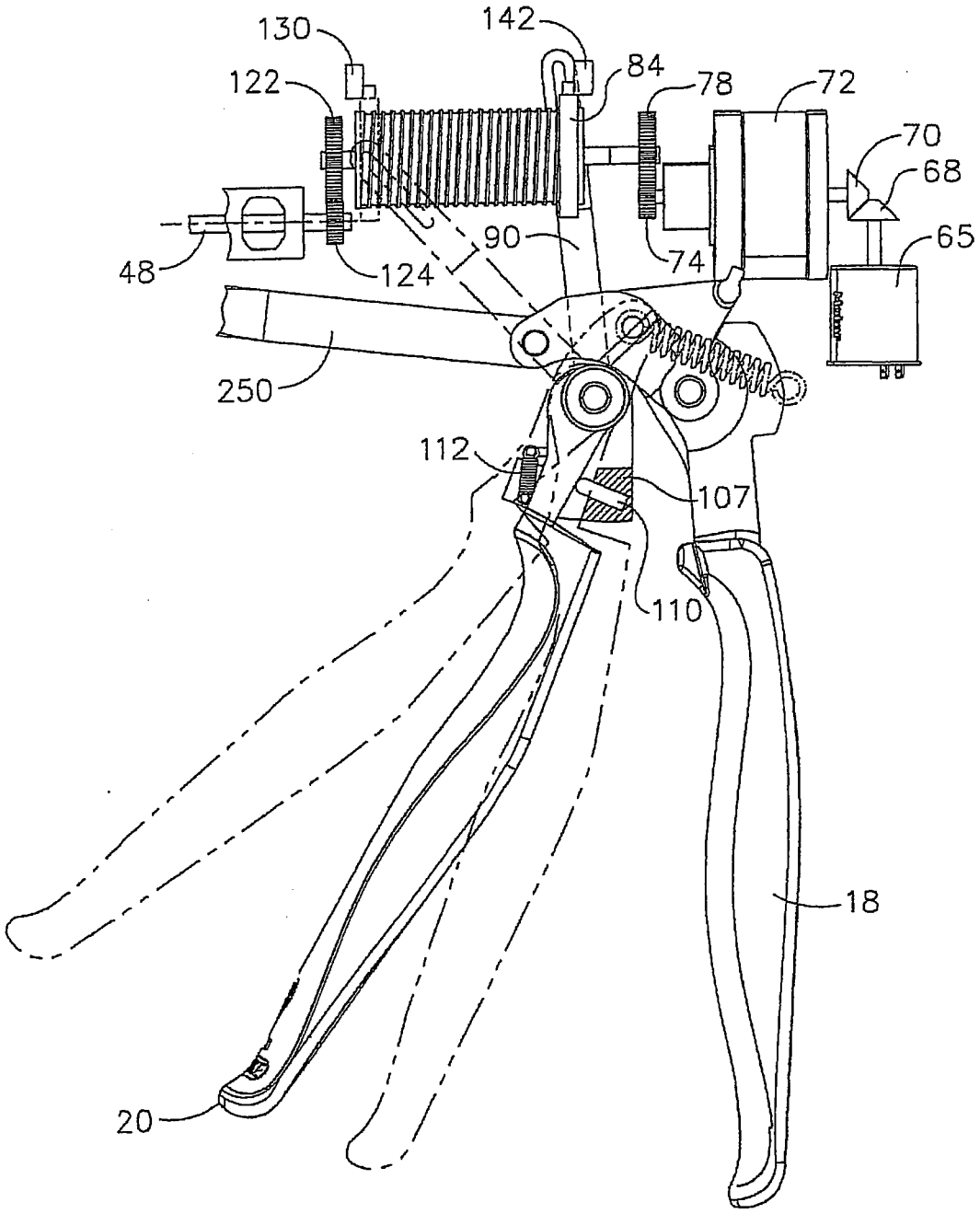

FIG. 10

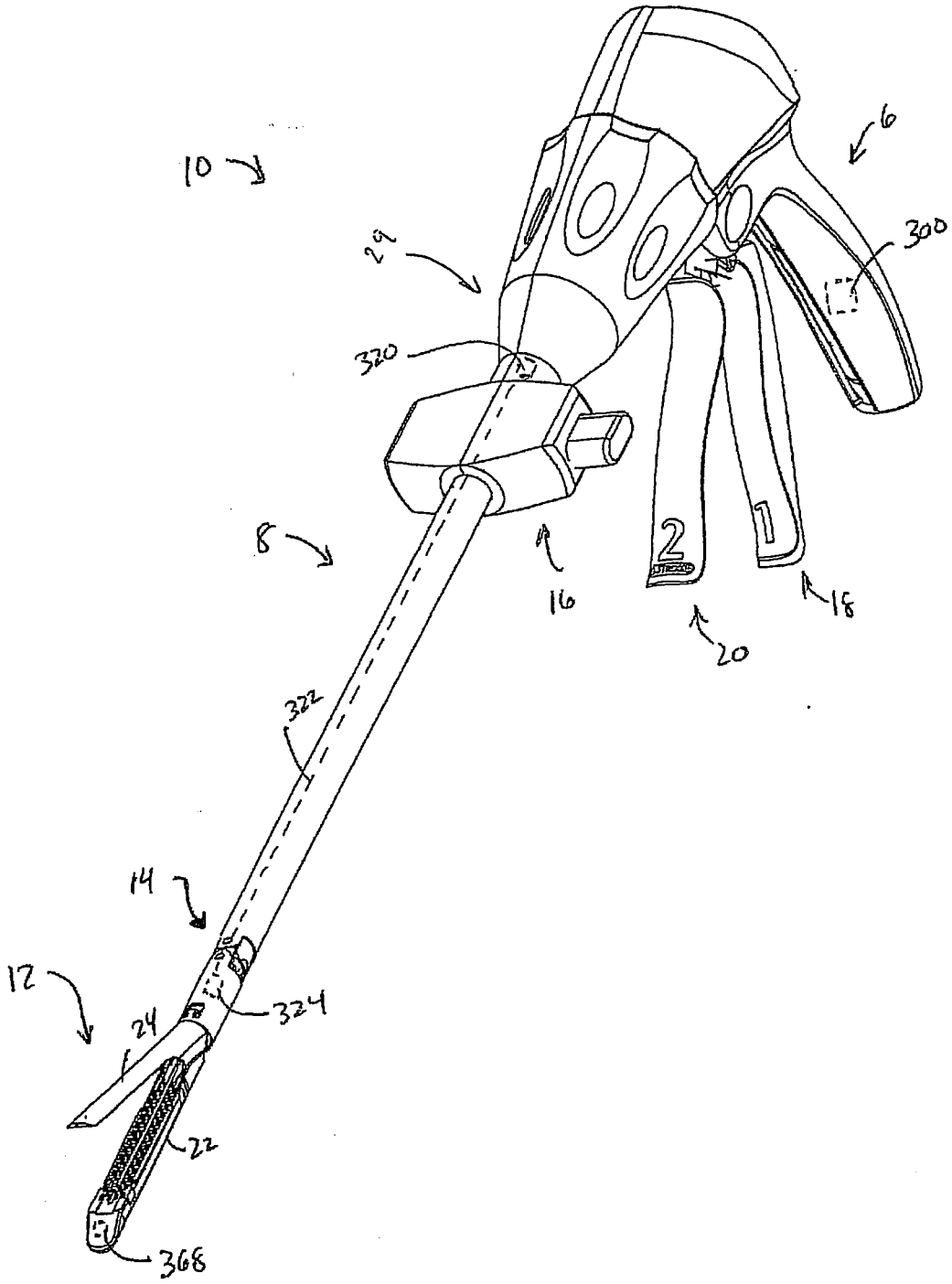

FIG. 11

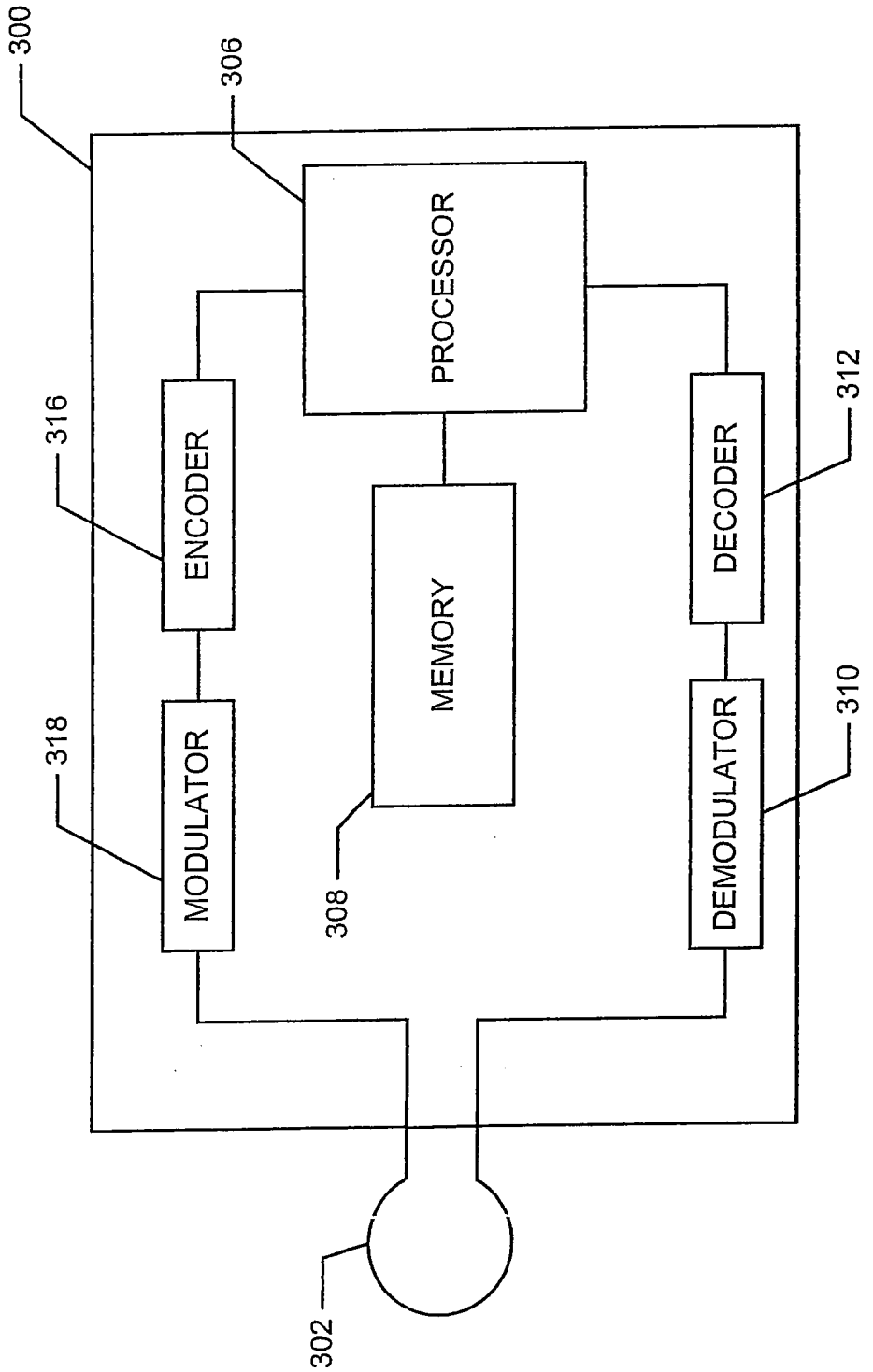
300
306
PROCESSOR
316
ENCODER
MEMORY
DECODER
312
318
MODULATOR
308
DEMODULATOR
310
302

FIG. 12

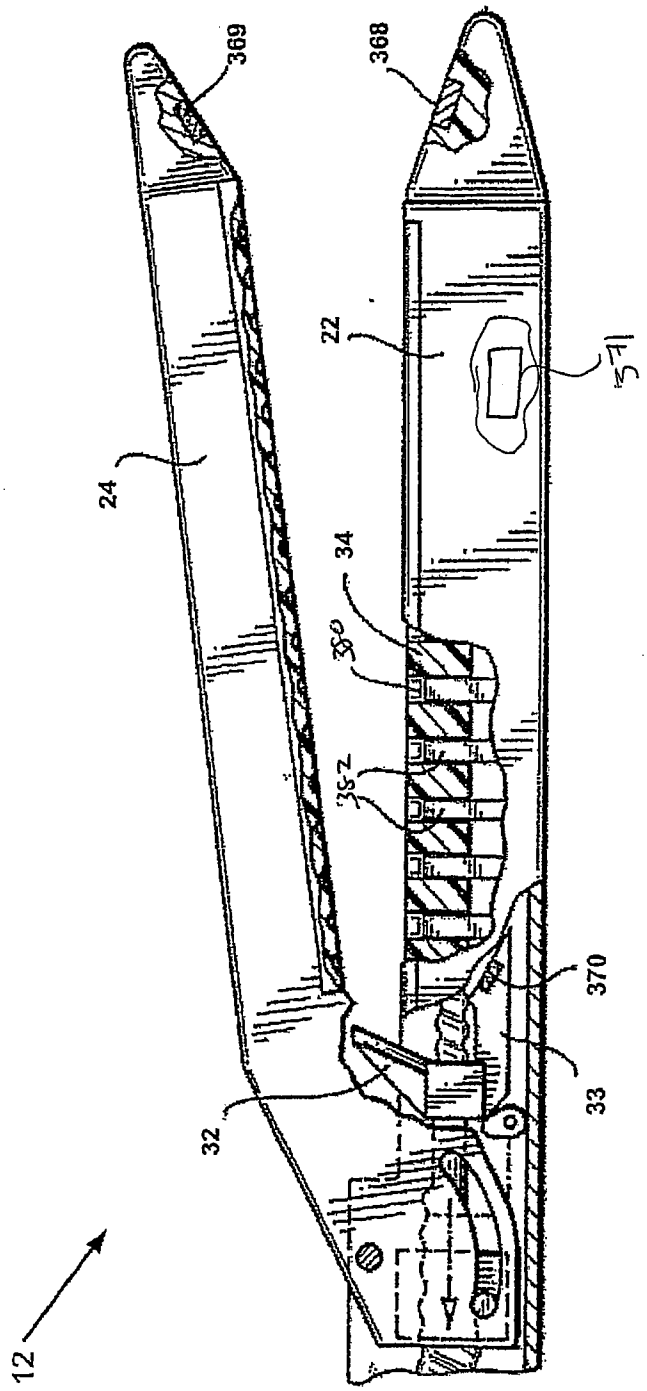

FIG. 13

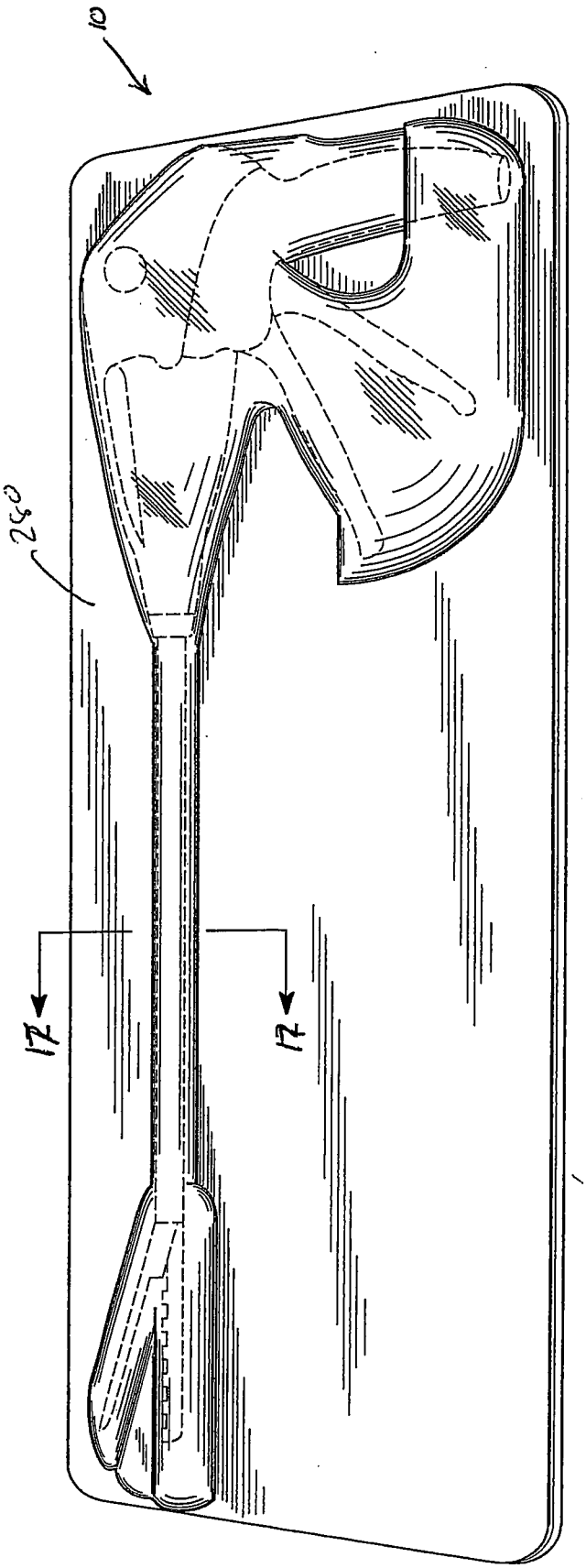

FIG. 14

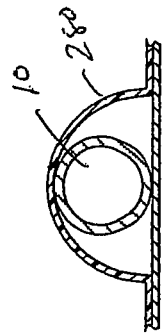

FIG. 15

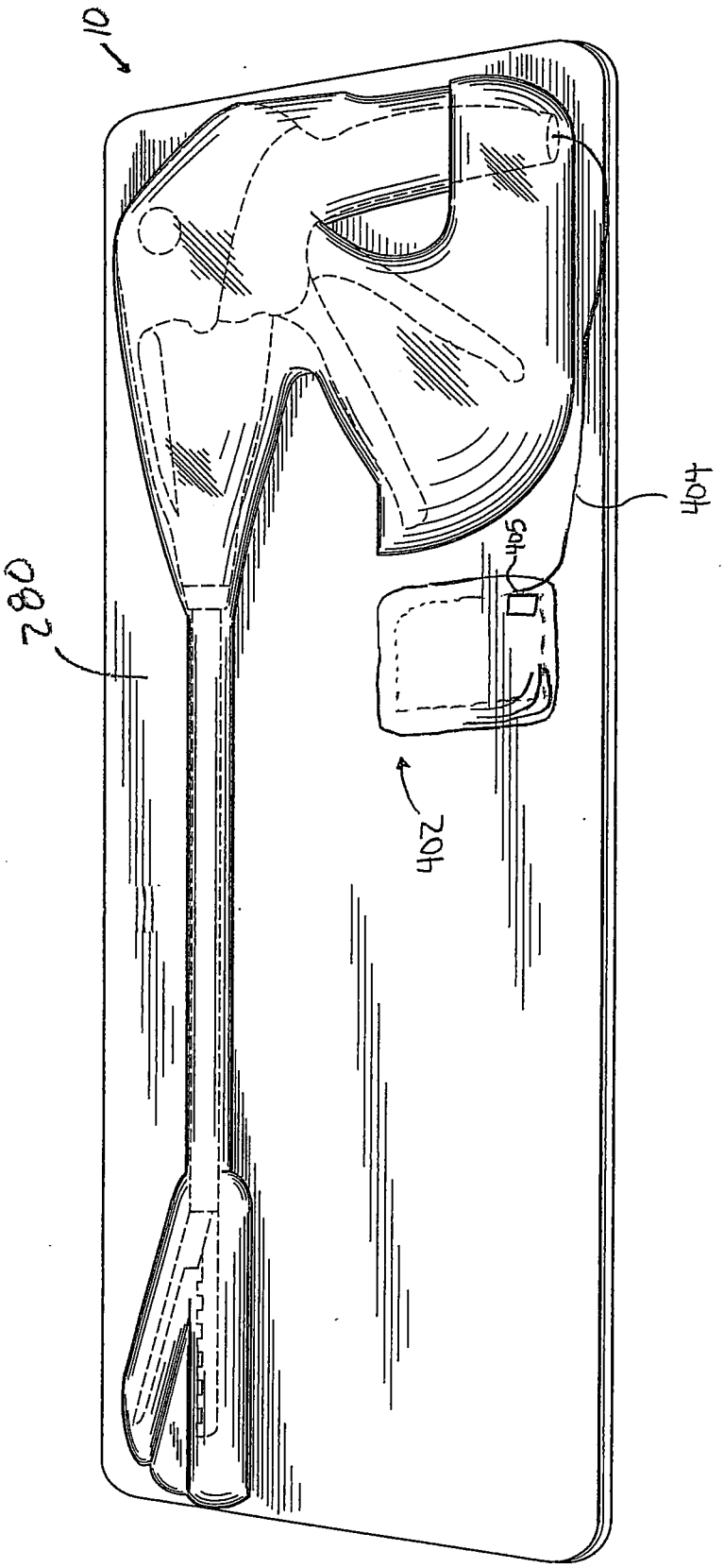

FIG. 16

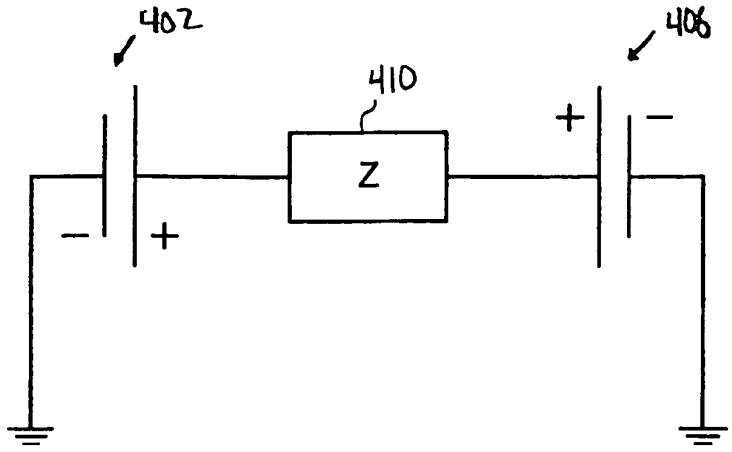

FIG. 17

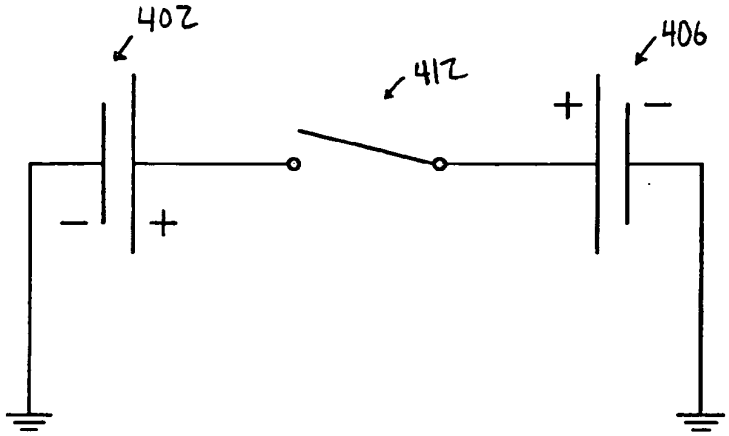

FIG. 18

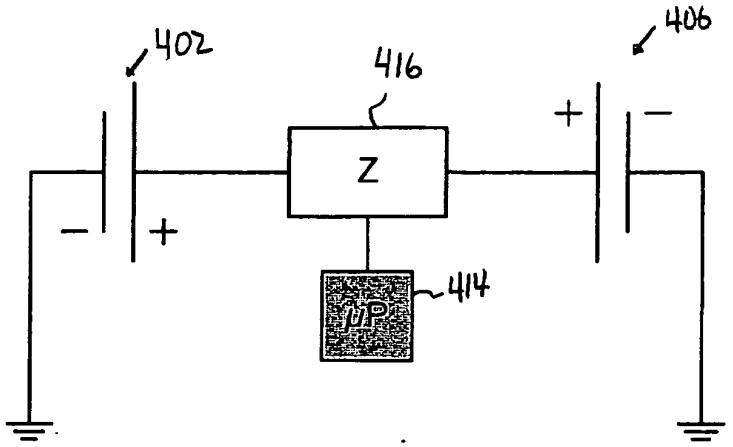

FIG. 19

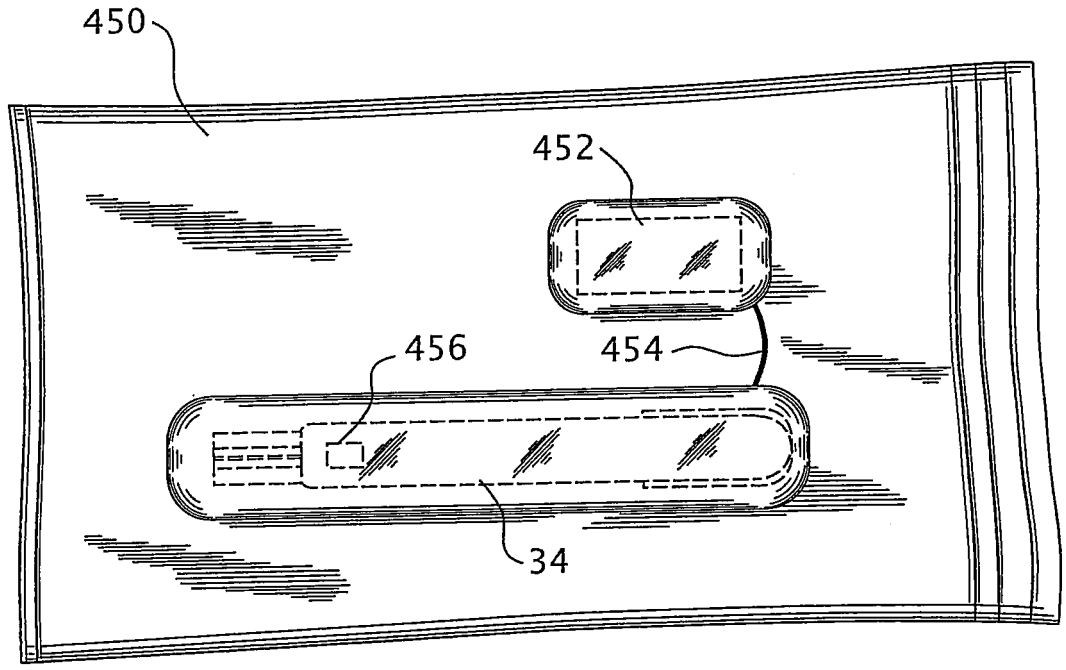

FIG. 20

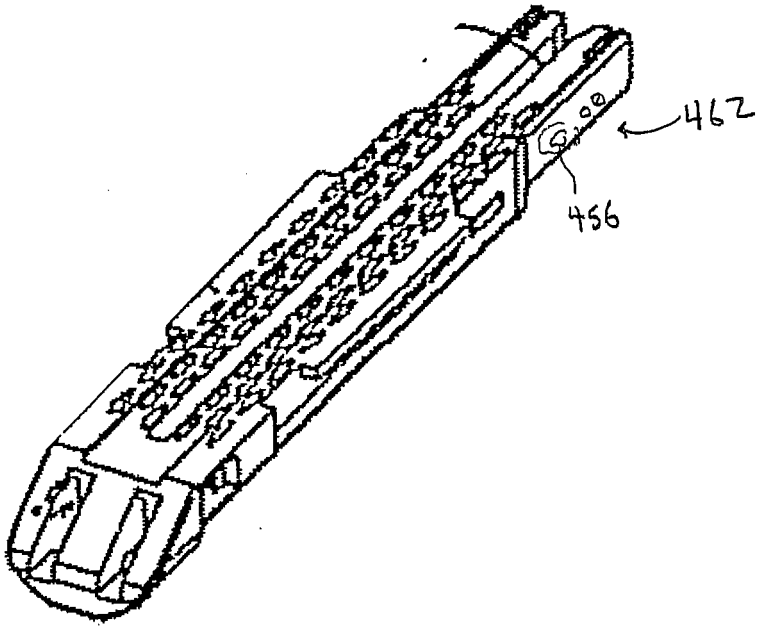

FIG. 21

REFERENCES CITED IN THE DESCRIPTION

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专利名称(译)	手术器械具有增强的电池性能		
公开(公告)号	EP2353538B1	公开(公告)日	2018-01-03
申请号	EP2011160040	申请日	2008-01-09
[标]申请(专利权)人(译)	伊西康内外科公司		
申请(专利权)人(译)	爱惜康内镜手术，INC.		
当前申请(专利权)人(译)	ETHICON LLC		
[标]发明人	SHELTON FREDERICK E GIORDANO JAMES R SWAYZE JEFFREY S SIEBENALER DOUGLAS JON		
发明人	SHELTON, FREDERICK E. GIORDANO, JAMES R. SWAYZE, JEFFREY S. SIEBENALER, DOUGLAS JON		
IPC分类号	A61B50/30		
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优先权	11/651785 2007-01-10 US		
其他公开文献	EP2353538A2 EP2353538A3		
外部链接	Espacenet		

摘要(译)

一种组件，包括手术器械的部件，例如内窥镜或腹腔镜器械。该组件可包括包装;包装内的手术器械部件;和包装内的电源。电源可以配置成与手术器械部件电连通。组件还可以包括封装内的辅助电源和电路元件，其中电路元件与电源和辅助电源电连通。

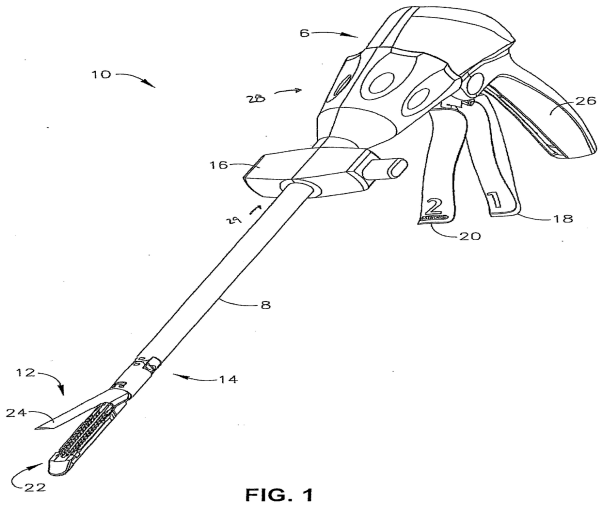

FIG. 1