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**Carpenter et al.**

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(54) **SURGICAL DEVICE**

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(51) **Int. Cl.**  
**A61B 17/00** (2006.01)

(52) **U.S. Cl.** ..... **606/205**

(58) **Field of Classification Search** ..... 606/205,  
606/206, 207, 208

See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

3,608,544 A	9/1971	Schnepper	128/2 R
4,440,170 A	4/1984	Golden et al.	128/325
4,483,562 A	11/1984	Schoolman	294/19
4,590,936 A	5/1986	Straub et al.	128/305
4,813,407 A	3/1989	Vogen	
5,112,299 A	5/1992	Pascaloff	
5,147,357 A *	9/1992	Rose et al.	606/49
5,174,300 A	12/1992	Bales et al.	128/751
5,176,702 A *	1/1993	Bales et al.	606/208
5,234,460 A	8/1993	Stouder, Jr.	606/205
5,251,638 A	10/1993	Cottoner, Jr. et al.	128/751

D349,341 S	8/1994	Lichtman et al.	D24/143
5,342,391 A *	8/1994	Foshee et al.	606/205
5,370,659 A	12/1994	Sakashita	606/205
5,409,478 A	4/1995	Gerry et al.	606/1
5,470,328 A	11/1995	Furnish et al.	606/1
5,476,479 A	12/1995	Green et al.	606/205
5,478,351 A	12/1995	Meade et al.	606/205
5,480,409 A	1/1996	Riza	606/205
5,483,952 A	1/1996	Aranyi	600/131
5,498,256 A	3/1996	Furnish	606/1
5,562,655 A	10/1996	Mittelstadt et al.	606/1

(Continued)

**FOREIGN PATENT DOCUMENTS**

DE 103 53 552 A1 10/1998

(Continued)

**OTHER PUBLICATIONS**

Information Sheet—"The MicroLine Handpiece", for handpieces  
and related tips, undated, 1 page.

(Continued)

*Primary Examiner*—Todd E Manahan

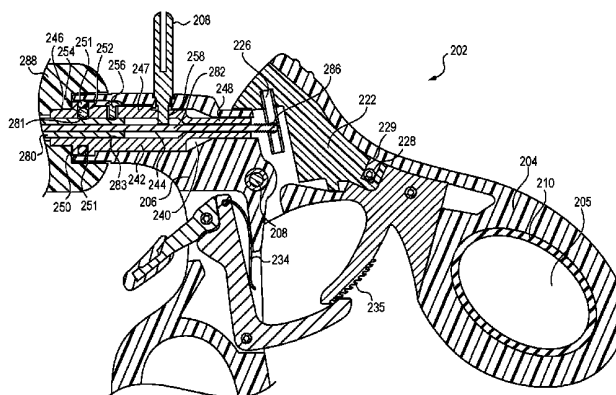
*Assistant Examiner*—Naquan Ishman

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(57) **ABSTRACT**

A laparoscopic surgical device is provided, including a  
ratchet mechanism. The ratchet mechanism includes a single  
button or lever that may be used to release or defeat a ratchet  
engagement.

**24 Claims, 24 Drawing Sheets**



## U.S. PATENT DOCUMENTS

5,562,682 A	10/1996	Oberlin et al. ....	606/139	6,440,144 B1	8/2002	Bacher	
5,569,269 A *	10/1996	Hart et al. ....	606/144	6,506,208 B2	1/2003	Hunt et al.	
5,582,615 A	12/1996	Foshee et al. ....	606/139	6,524,238 B2	2/2003	Velikaris et al.	
5,603,723 A *	2/1997	Aranyi et al. ....	606/205	6,584,693 B2	7/2003	DeBolt	
5,609,601 A	3/1997	Kolesa et al. ....	606/170	6,605,036 B1	8/2003	Wild	
5,626,608 A	5/1997	Cuny et al. ....	606/205	6,620,184 B2	9/2003	deLaforcade et al.	
5,665,105 A	9/1997	Furnish et al. ....	606/205	6,626,929 B1	9/2003	Bannerman	
5,725,536 A	3/1998	Oberlin et al. ....	606/139	6,635,071 B2	10/2003	Boche et al.	
5,728,121 A *	3/1998	Bimbo et al. ....	606/207	6,641,595 B1	11/2003	Moran et al.	
5,735,874 A	4/1998	Measamer et al.		6,663,641 B1	12/2003	Kovac et al.	
5,743,456 A	4/1998	Jones et al.		6,676,120 B1	1/2004	Hallbeck et al.	
5,782,749 A	7/1998	Riza		2004/0167569 A1	8/2004	Dicesare et al. ....	606/208
5,797,956 A	8/1998	Furnish et al.		2004/0225323 A1	11/2004	Nagase et al. ....	606/205
5,827,263 A	10/1998	Furnish et al.		2004/0254605 A1	12/2004	DiFrancesco et al. ....	606/205
5,827,323 A	10/1998	Klieman et al.		2004/0260314 A1	12/2004	Lizardi et al. ....	606/14
5,830,231 A	11/1998	Geiges, Jr.					
5,836,960 A	11/1998	Kolesa et al.					
5,843,122 A	12/1998	Riza					
5,868,784 A	2/1999	Riza					
5,868,785 A	2/1999	Tal et al.					
5,871,488 A	2/1999	Tovey et al.					
5,911,736 A	6/1999	Dingler et al.					
5,922,007 A	7/1999	Hooageboom et al.					
5,925,064 A	7/1999	Meyers et al.					
5,928,256 A	7/1999	Riza					
5,928,263 A	7/1999	Hooageboom					
5,935,126 A	8/1999	Riza					
5,938,667 A	8/1999	Peyser et al.					
5,938,685 A	8/1999	Giurtino					
5,980,511 A	11/1999	Bilitz et al.					
6,000,138 A *	12/1999	Bornancini .....	30/232				
6,039,752 A	3/2000	Kimiura et al.					
6,102,925 A	8/2000	Oren et al.					
6,117,158 A	9/2000	Measamer et al.					
6,139,563 A	10/2000	Cosgrove, III et al.					
6,146,391 A	11/2000	Cigaina					
6,146,392 A	11/2000	Smith					
6,168,605 B1	1/2001	Measamer et al.					
6,171,316 B1	1/2001	Kovac et al.					
6,187,026 B1	2/2001	Devlin et al.					
6,280,458 B1	8/2001	Boche et al.					
6,299,625 B1	10/2001	Bacher					
6,358,267 B1 *	3/2002	Murakami et al. ....	606/205				
6,358,268 B1	3/2002	Hunt et al.					

## FOREIGN PATENT DOCUMENTS

EP	0 555 105 A	8/1993
EP	0 702 937 A	3/1996
EP	0 813 843 A	12/1997
EP	1 498 075 A	1/2005
WO	WO 01/89396	11/2001

## OTHER PUBLICATIONS

Informational Literature—"Logic Laparoscopic Instrument System", by Surgical Innovations Limited, Leeds, England, undated, 4 pages.

Catalog Pages—AdTec Monopolar endoscopic surgical instruments, Aesculap, undated, 3 pages.

Information Sheet—"DetachaTip® System Multi-Use Endoscopic System", Conmed Corporation, undated.

Informational Literature—Aesculap, Various surgical instruments for use during general gynecological and laparoscopic procedures, undated, 5 pages.

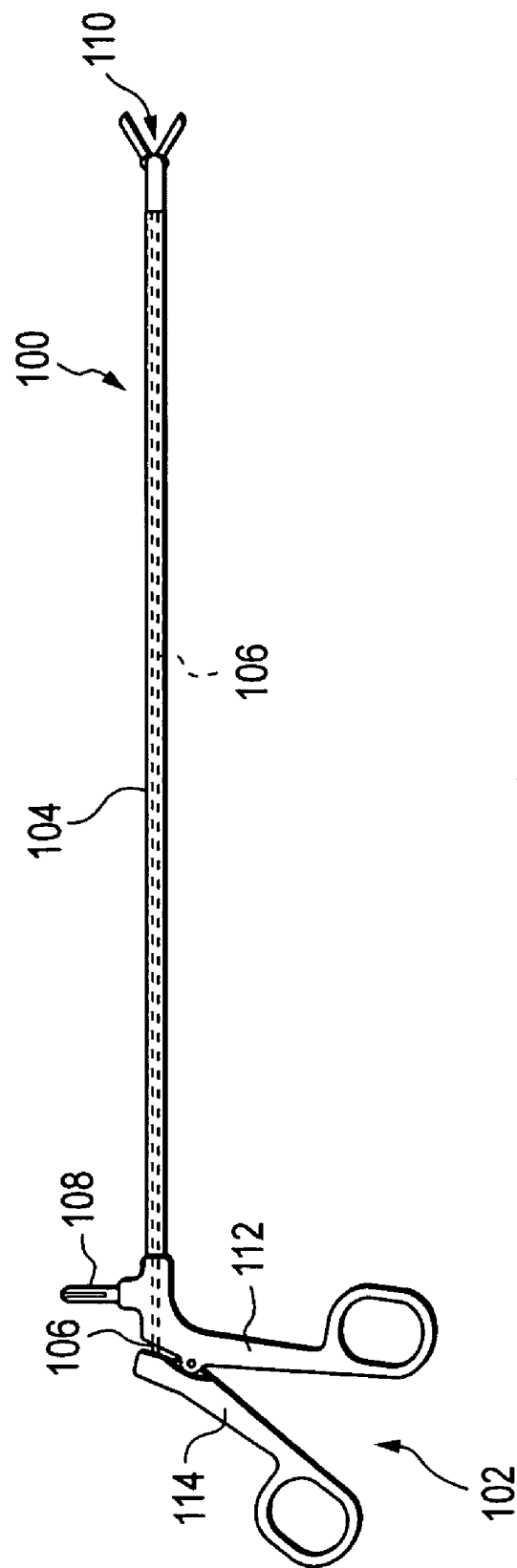
Instructions for various endoscopic surgical instruments, Olympus, "HiQ+ The Intelligent Line", undated, 5 pages.

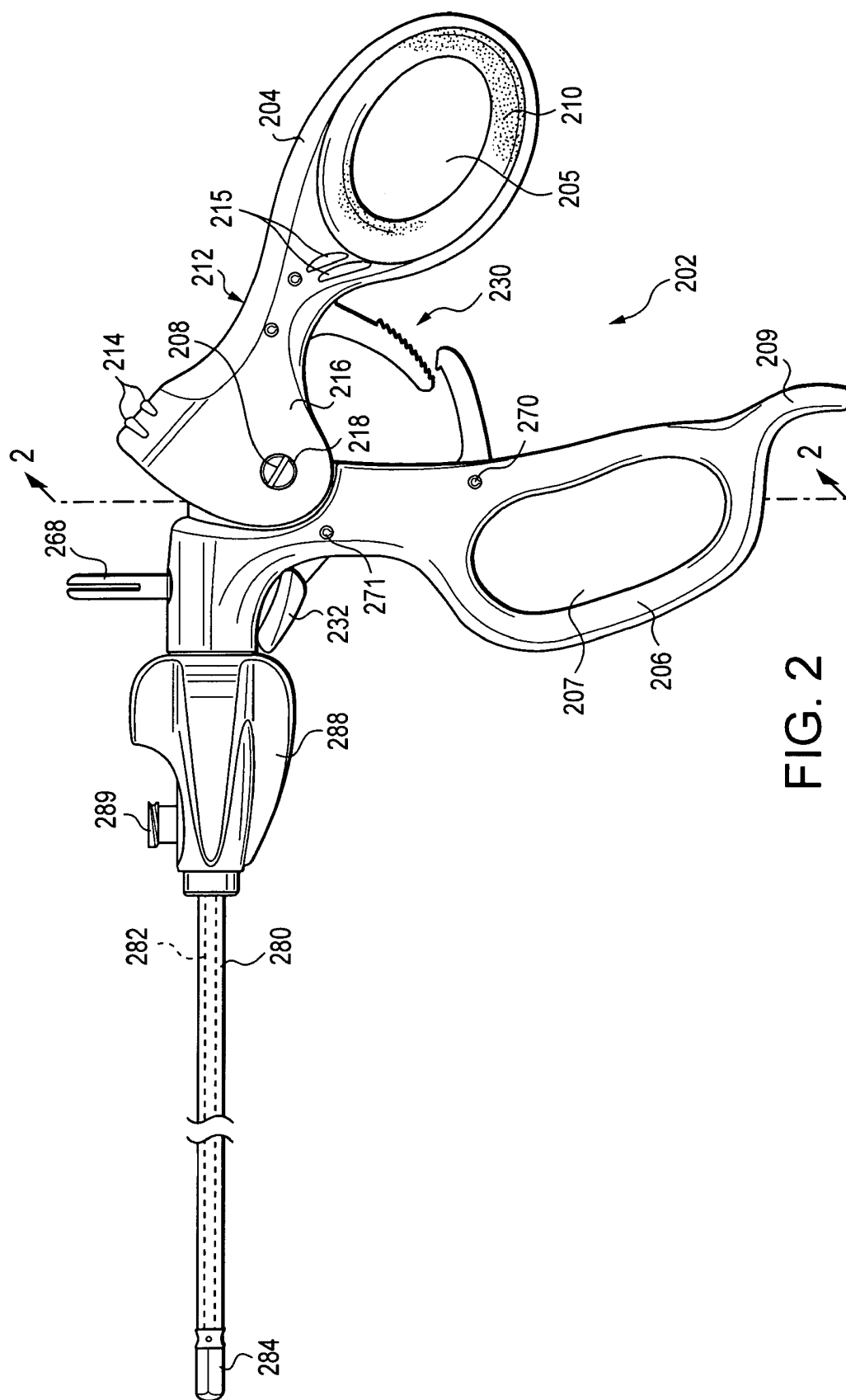
Instruction booklet for Assembly, use and sterilization of "DetachaTip® System Multi-Use Endoscopic System", Conmed Corporation, undated, various languages, 8 pages.

Instruction Sheet for MicroLine "Re-New IV Laparoscopic hand Pieces" and Electrocautery surgical instruments, P/N 09-39-36 Rev. Original issue, Oct. 2002, ECO#583, 2 pages.

Informational Literature, "Storz Karl Storz—Endoskope", Various handles for endoscopic surgical instruments, undated, 4 pages.

\* cited by examiner





**FIG. 2**

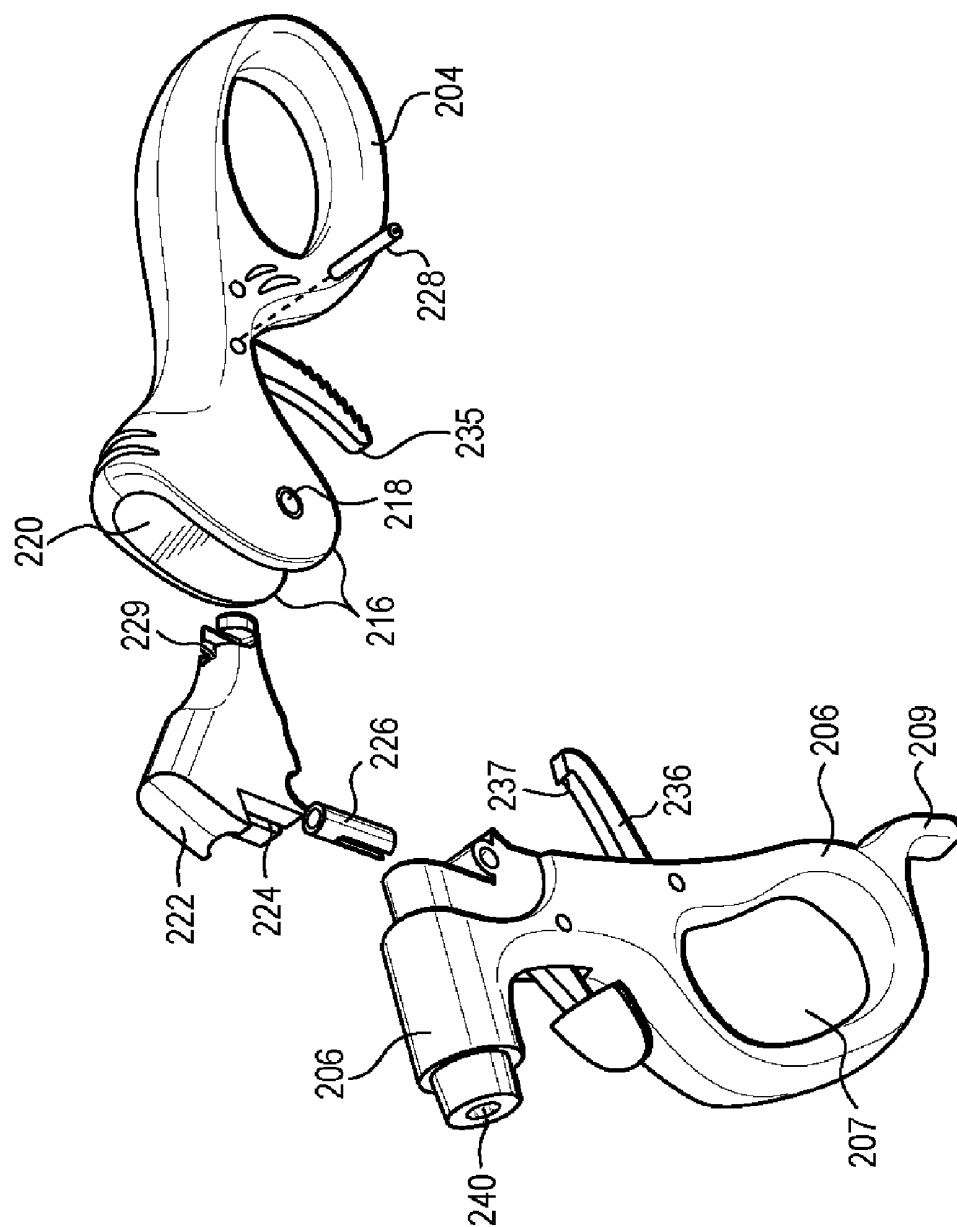


FIG. 2A

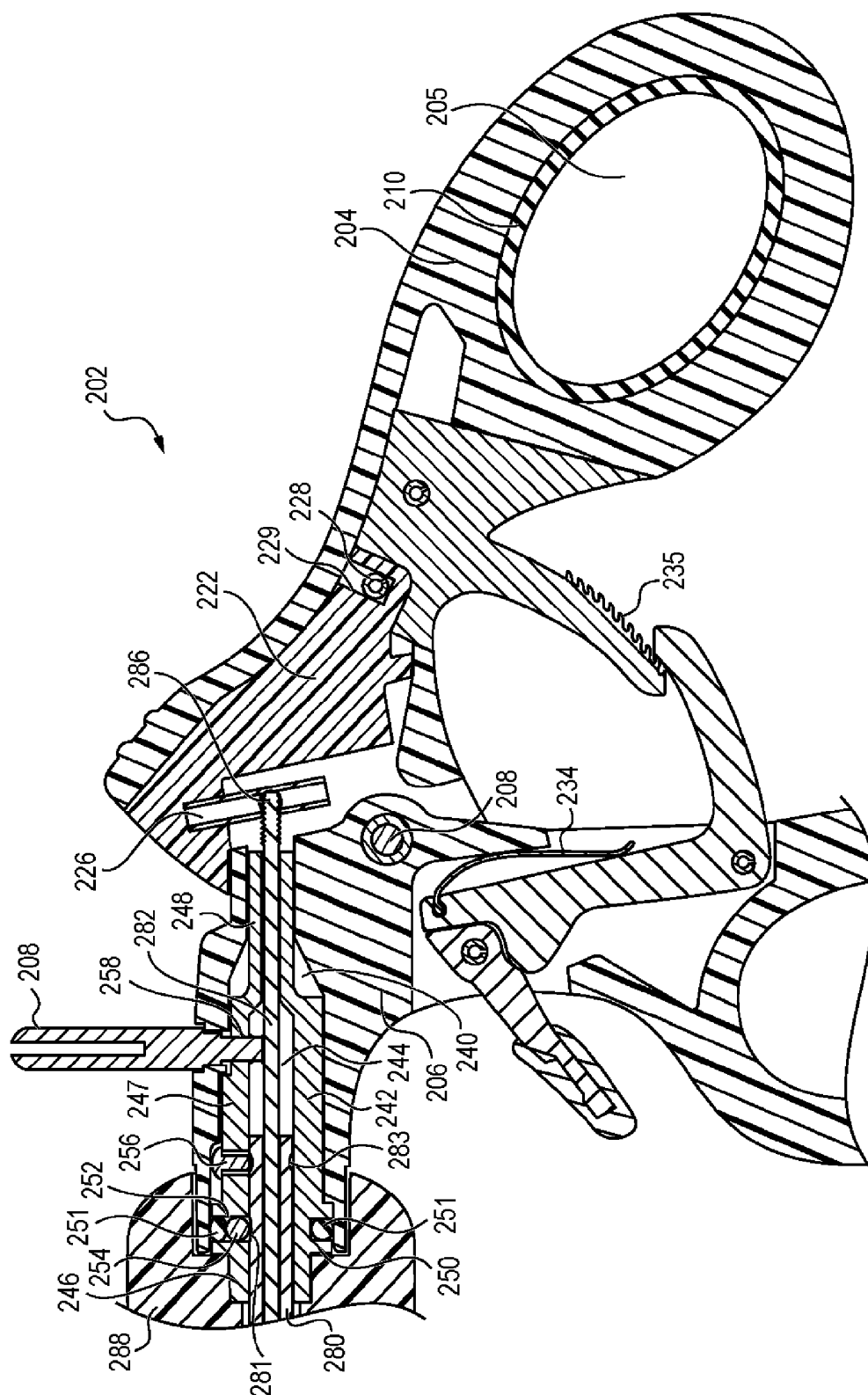


FIG. 2B

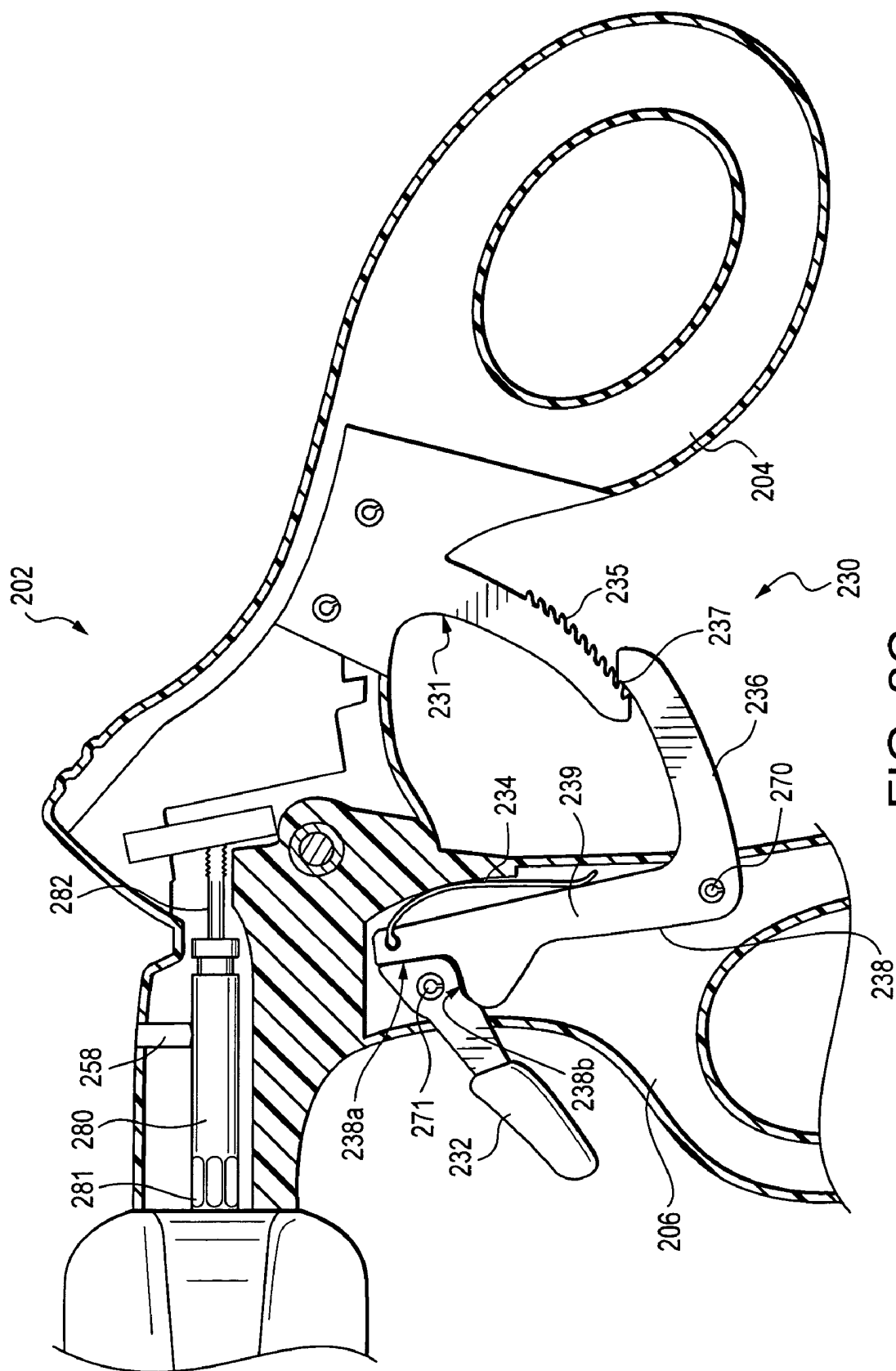


FIG. 2C

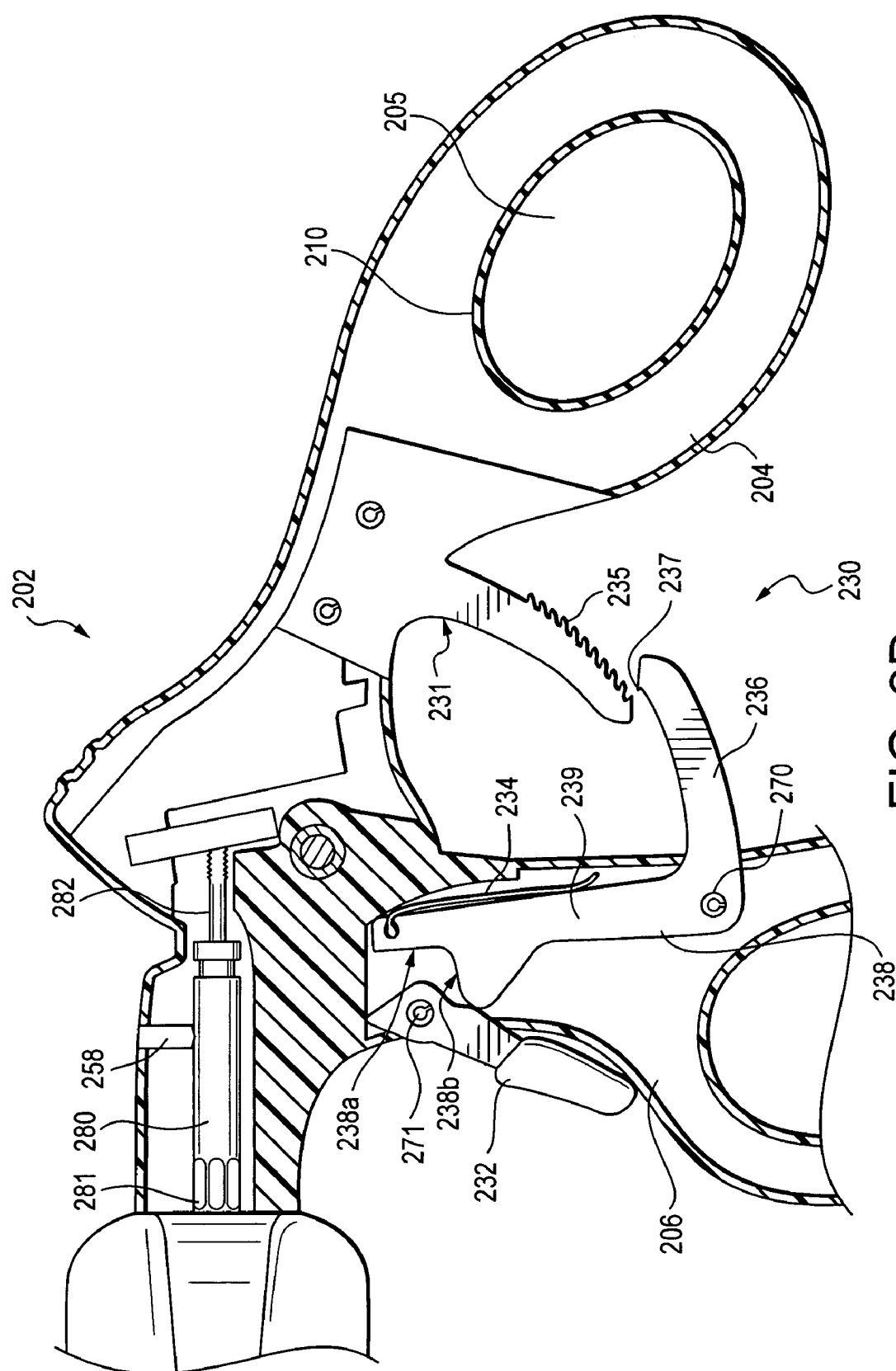


FIG. 2D



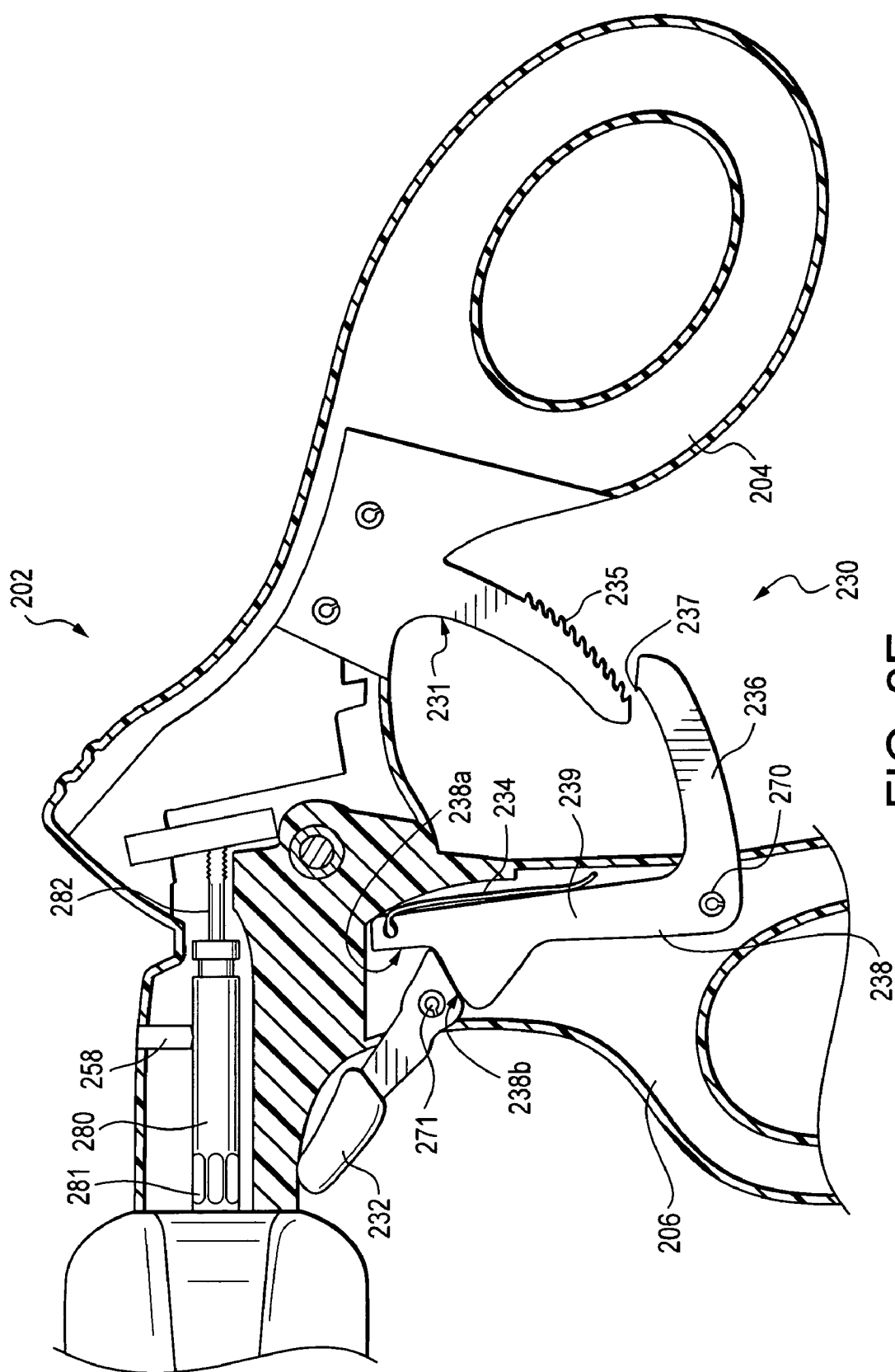


FIG. 2E

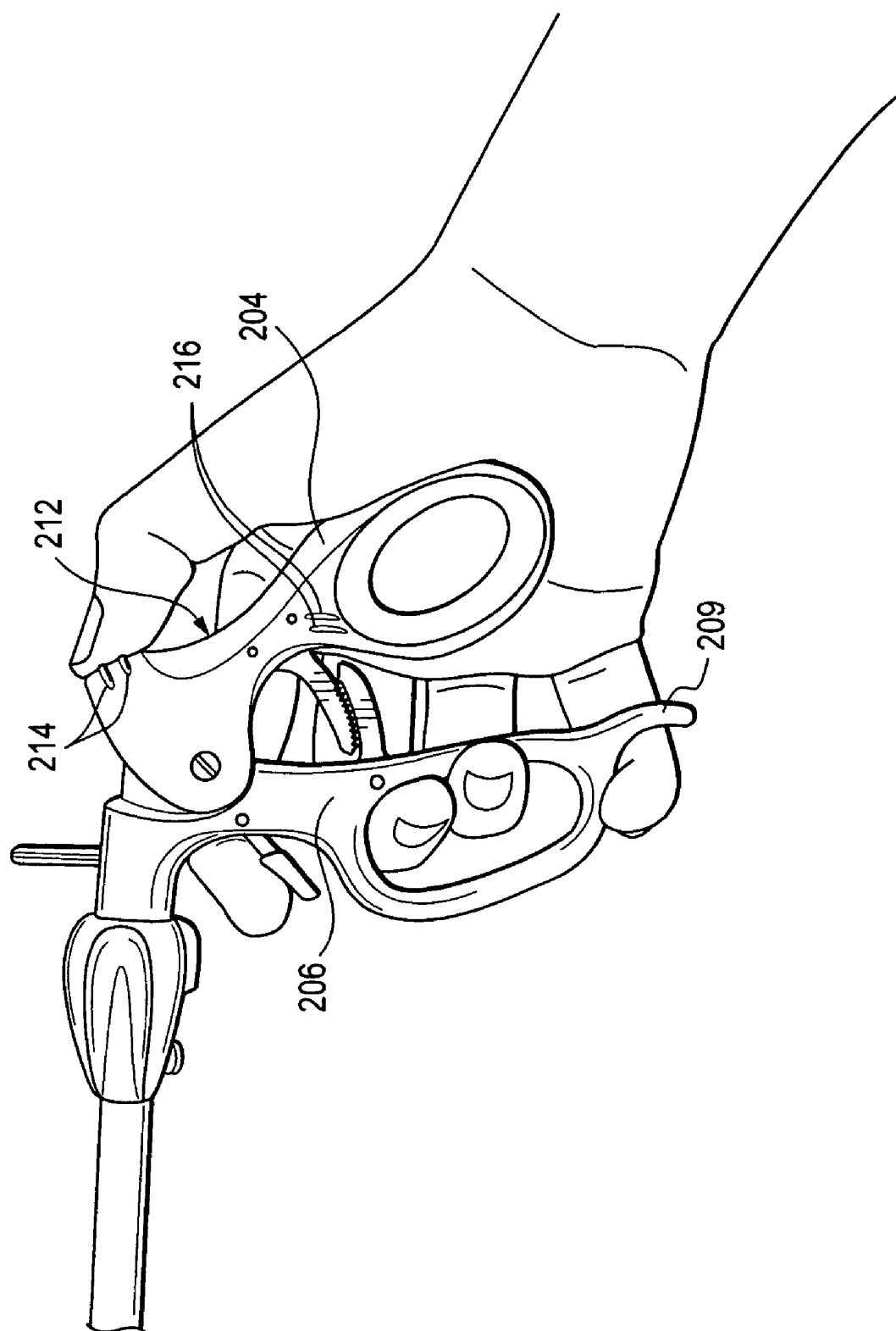


FIG. 2F

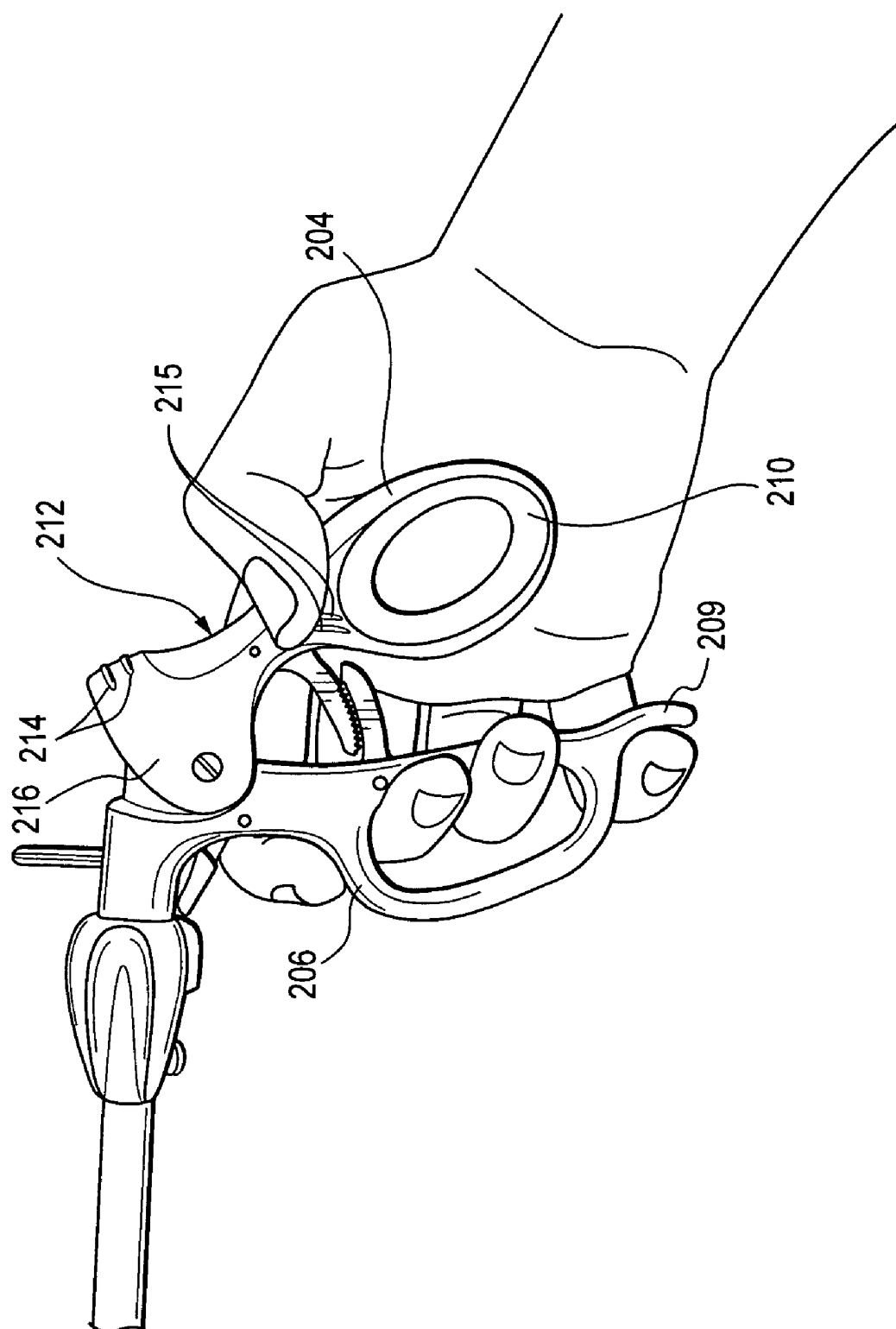


FIG. 2G

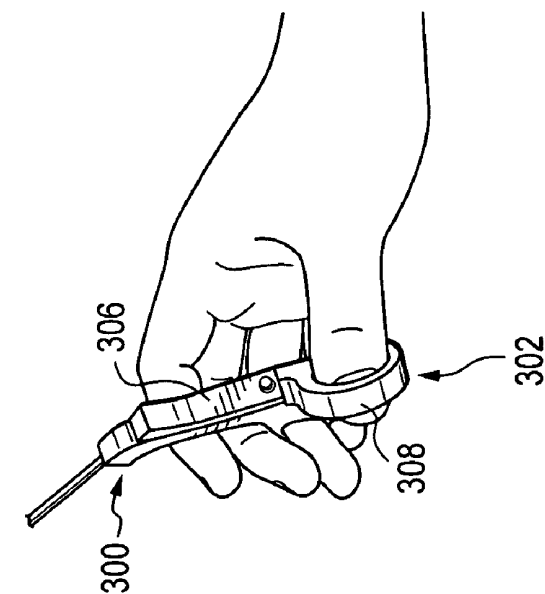


FIG. 3A

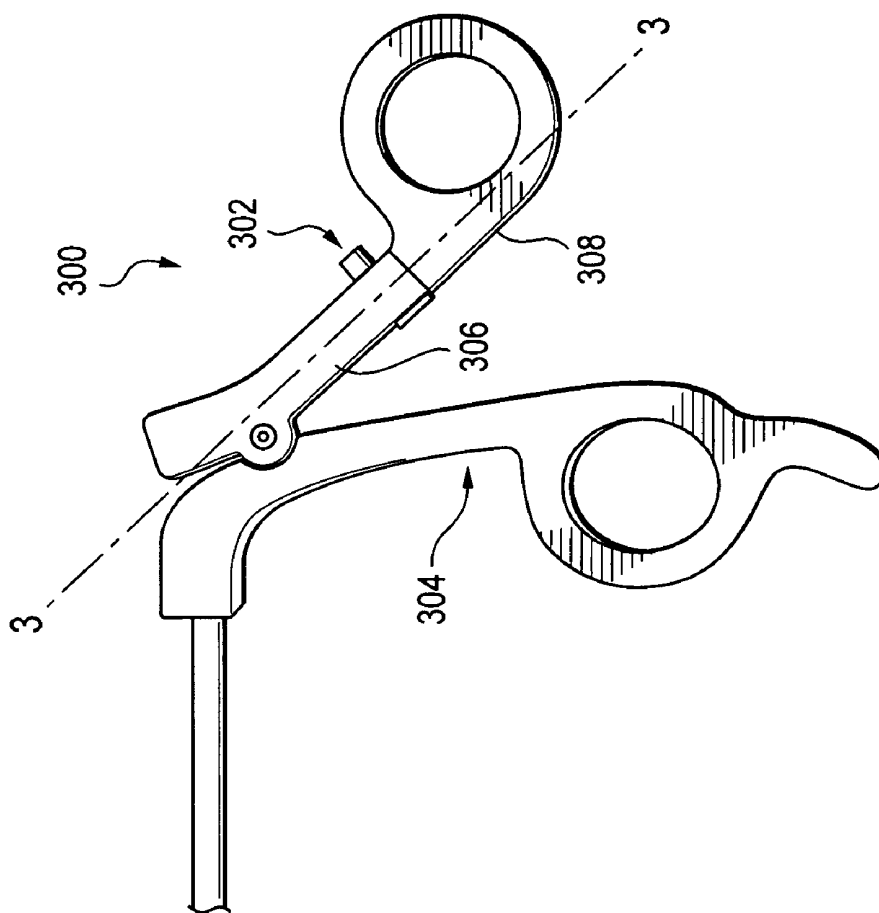


FIG. 3

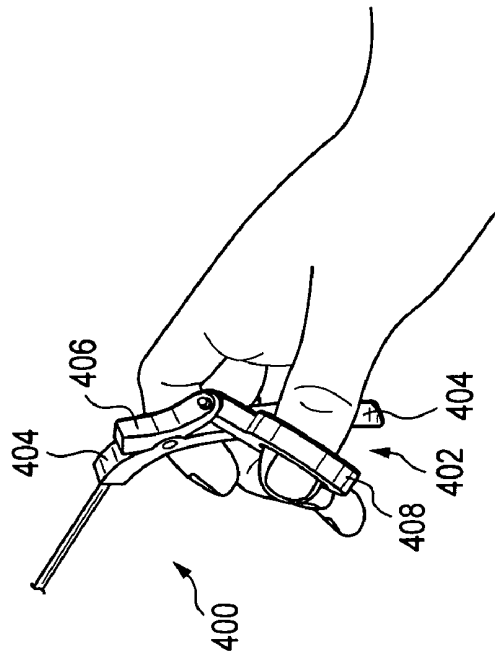


FIG. 4A

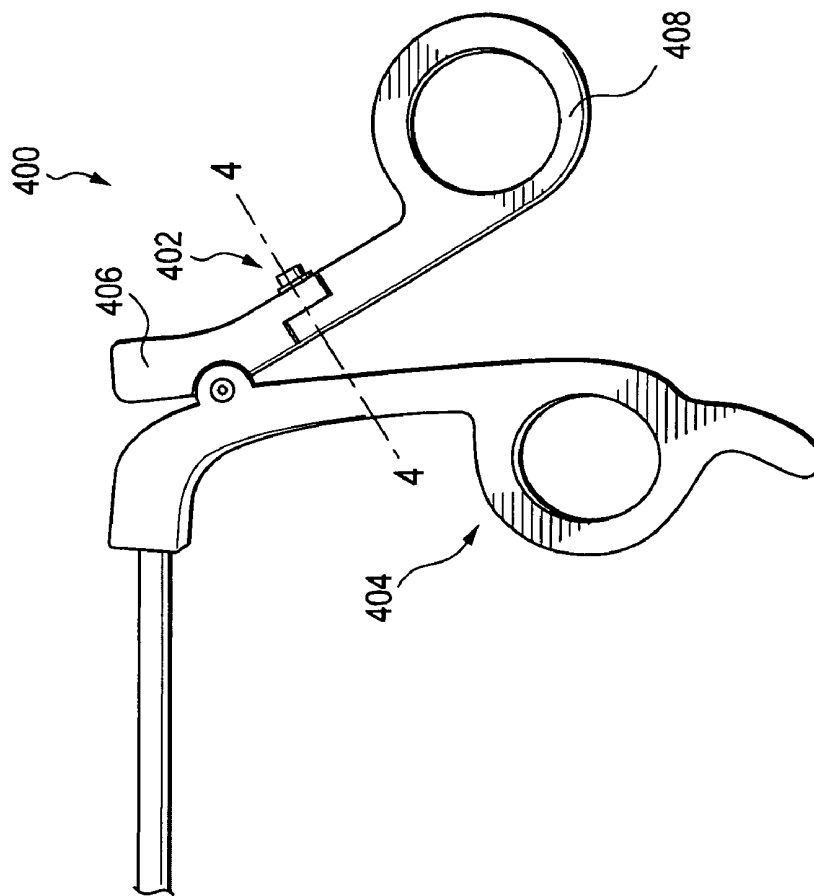


FIG. 4

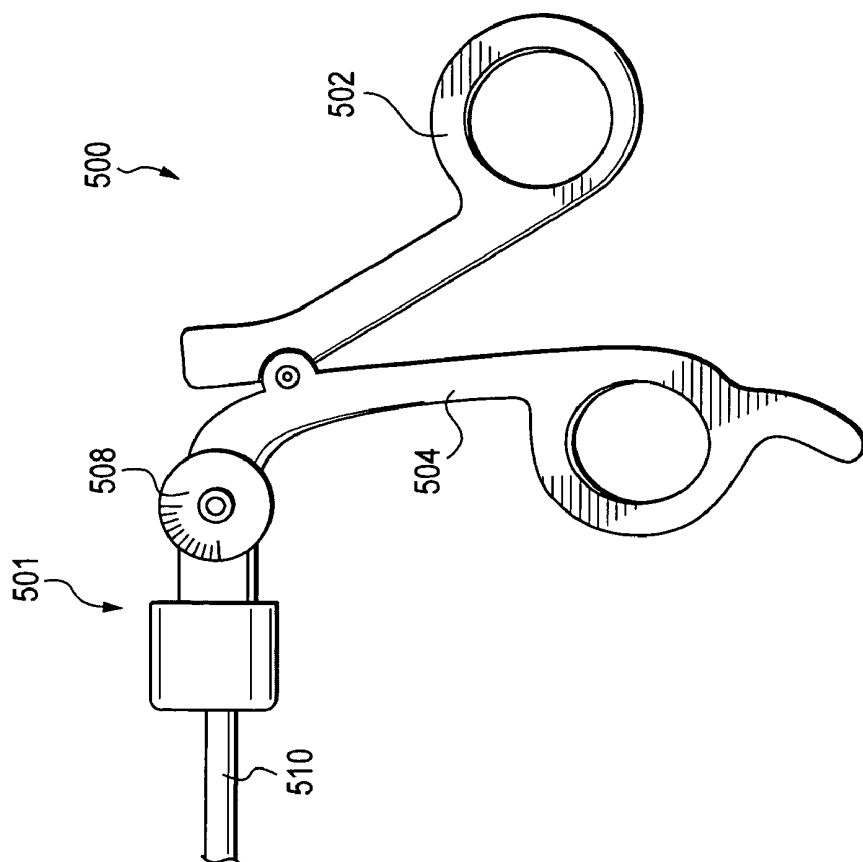


FIG. 5

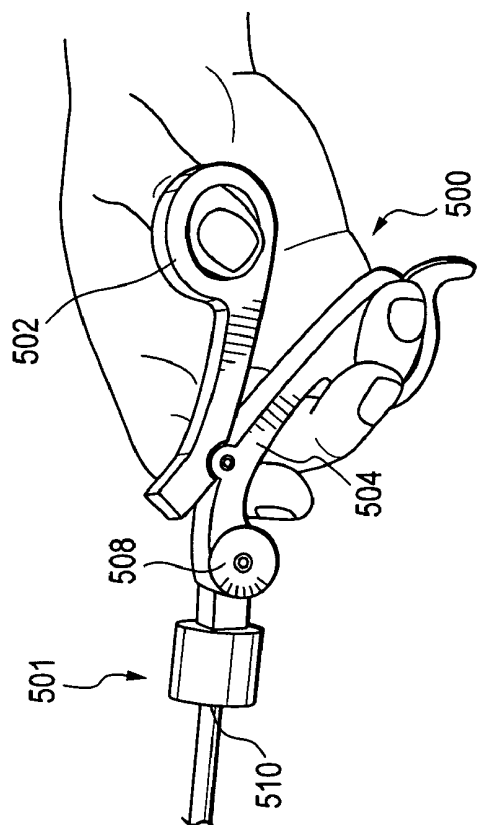


FIG. 5A

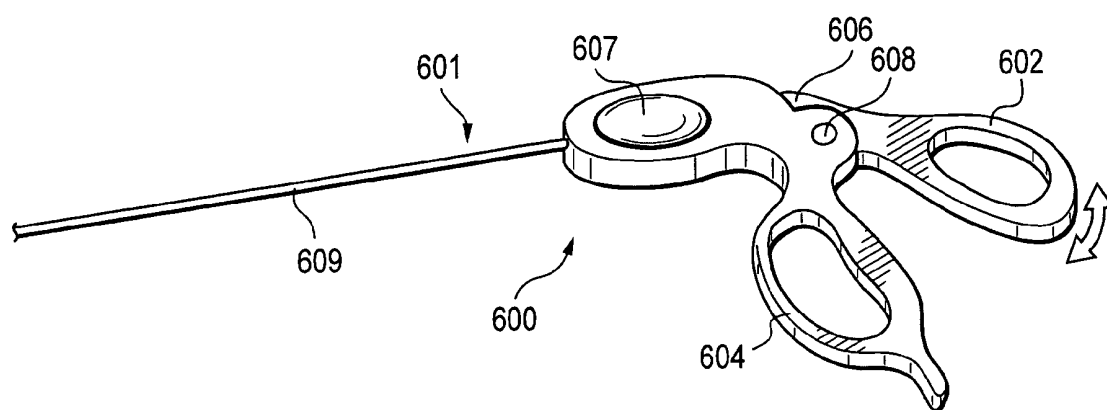


FIG. 6A

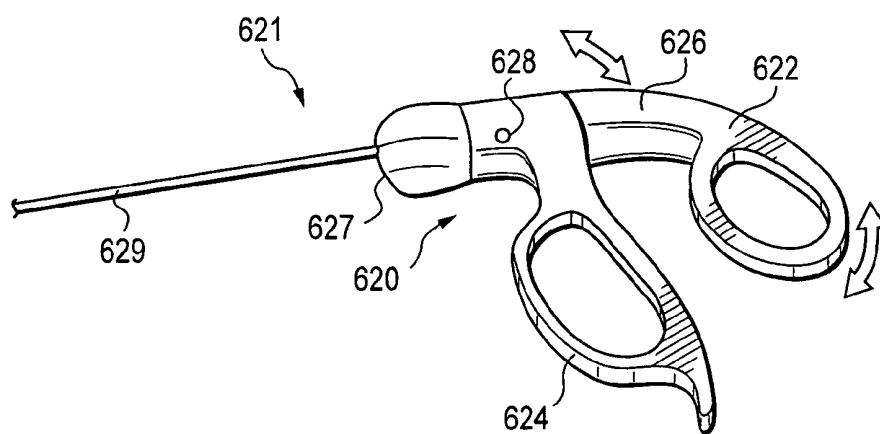


FIG. 6B

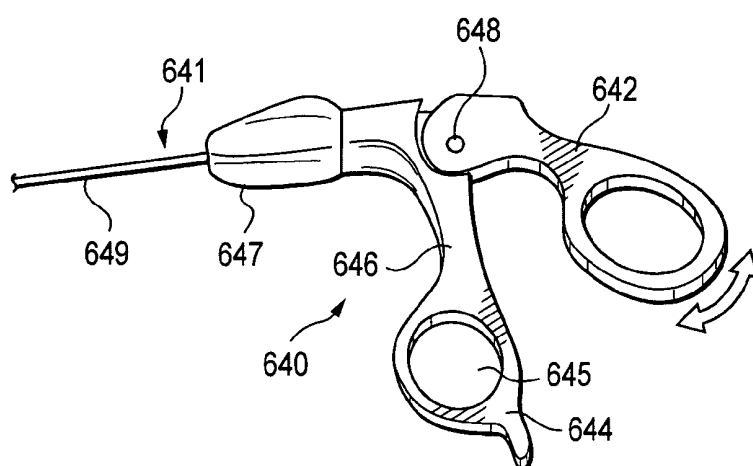


FIG. 6C

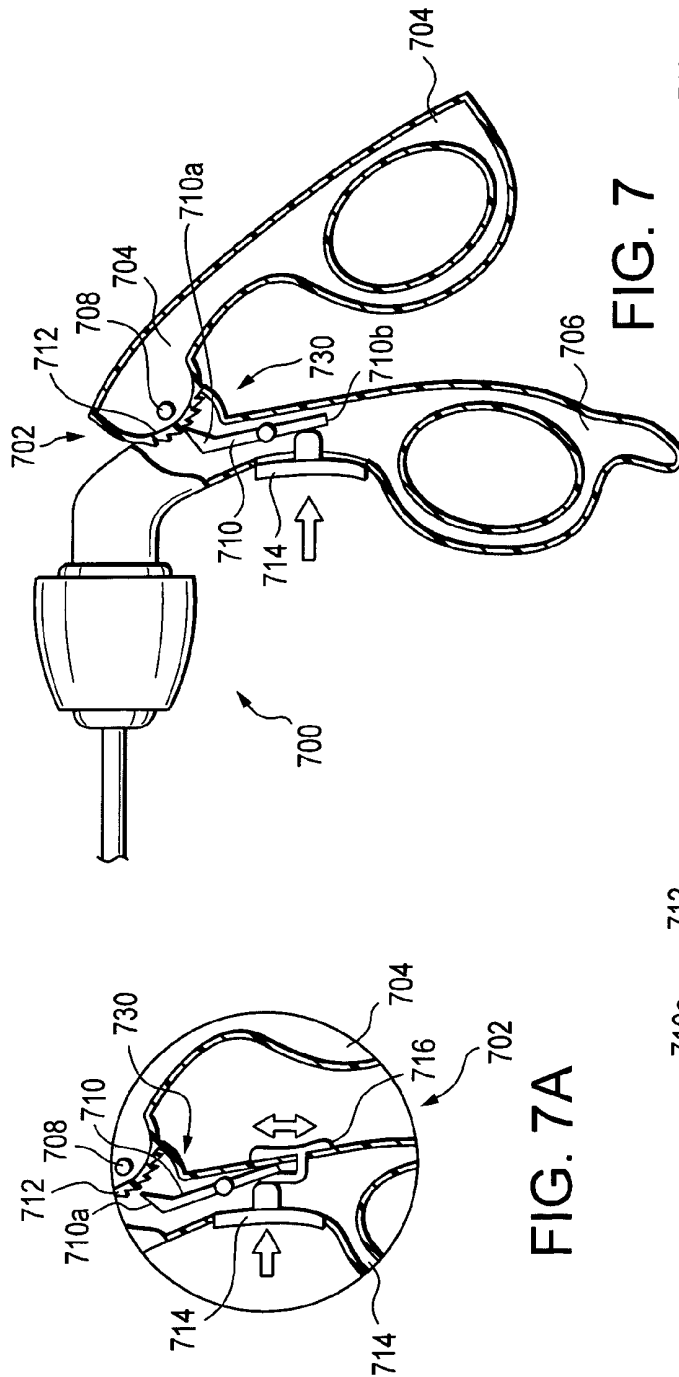


FIG. 7A

FIG. 7

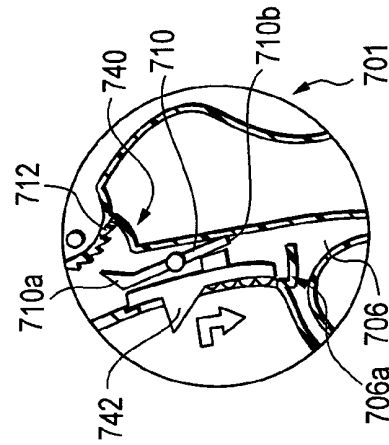


FIG. 7B

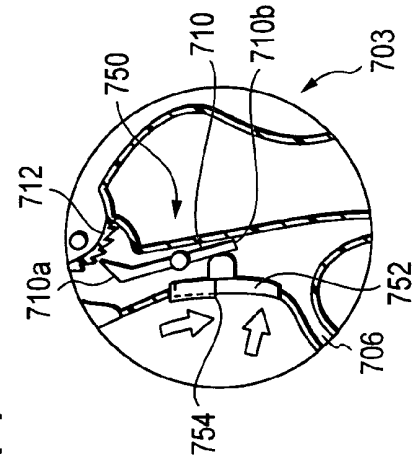


FIG. 7C



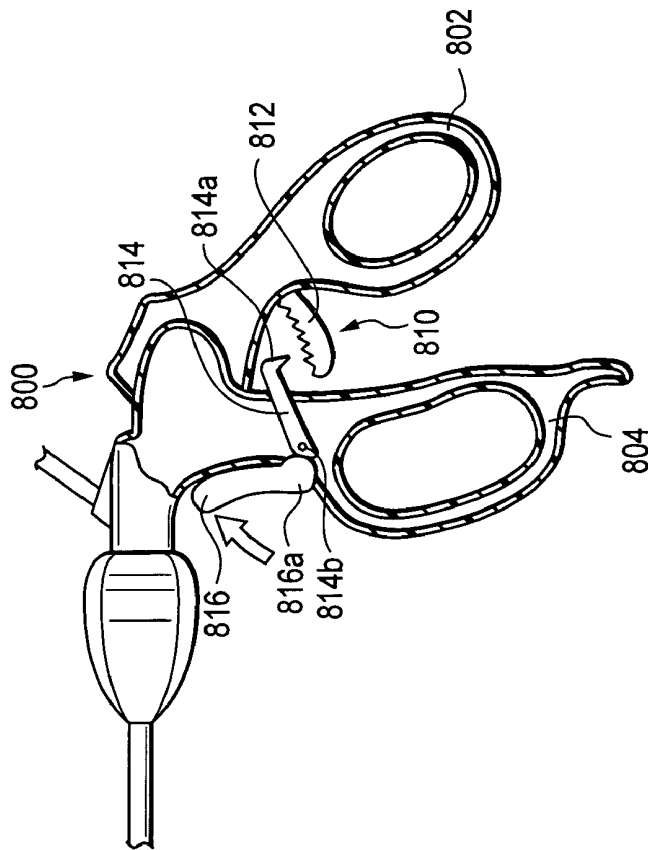


FIG. 8B

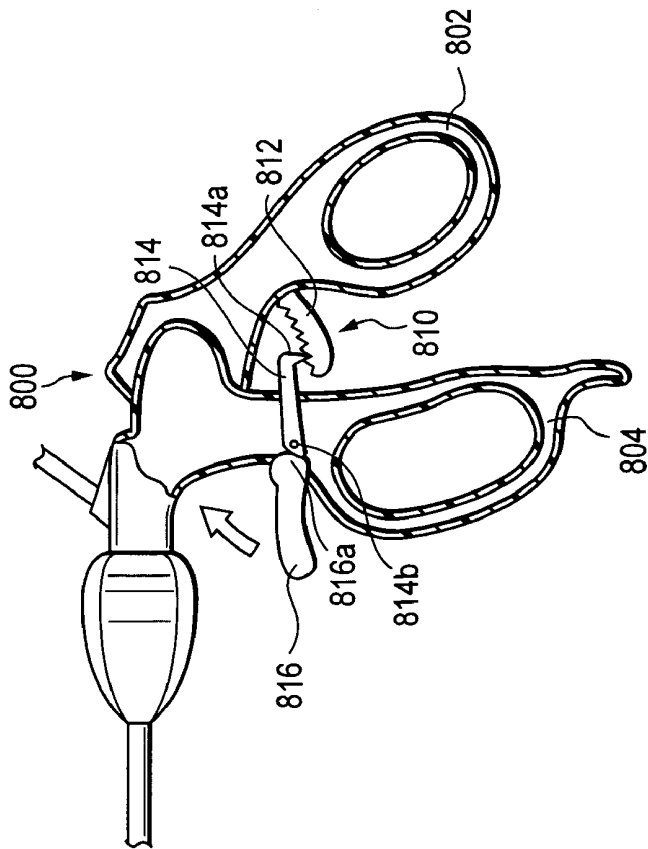


FIG. 8A

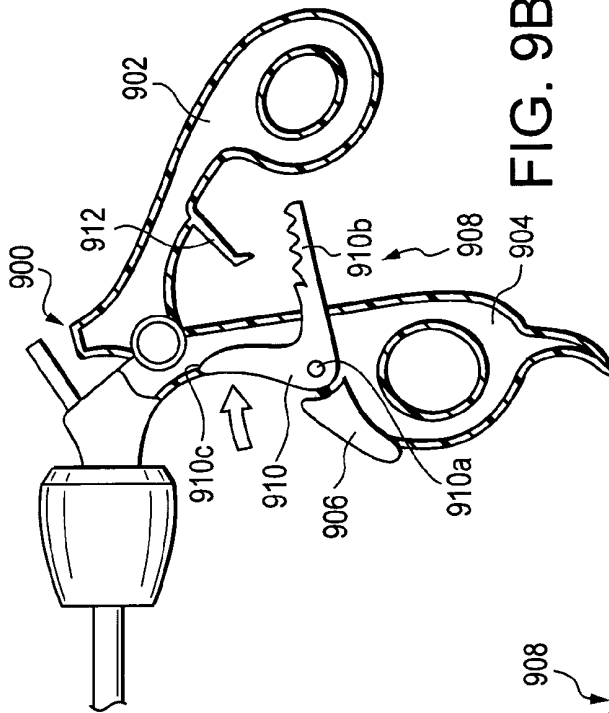


FIG. 9A

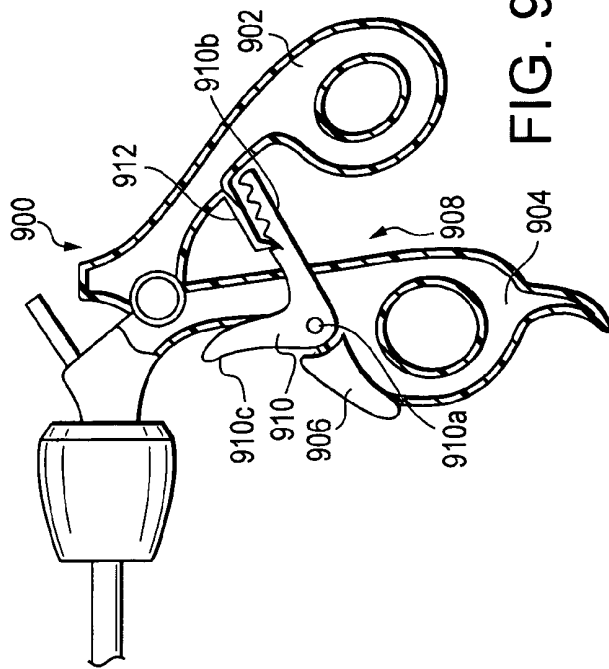


FIG. 9B

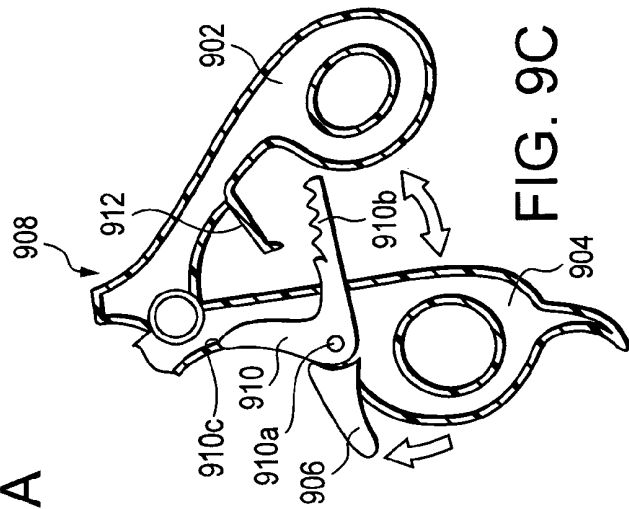
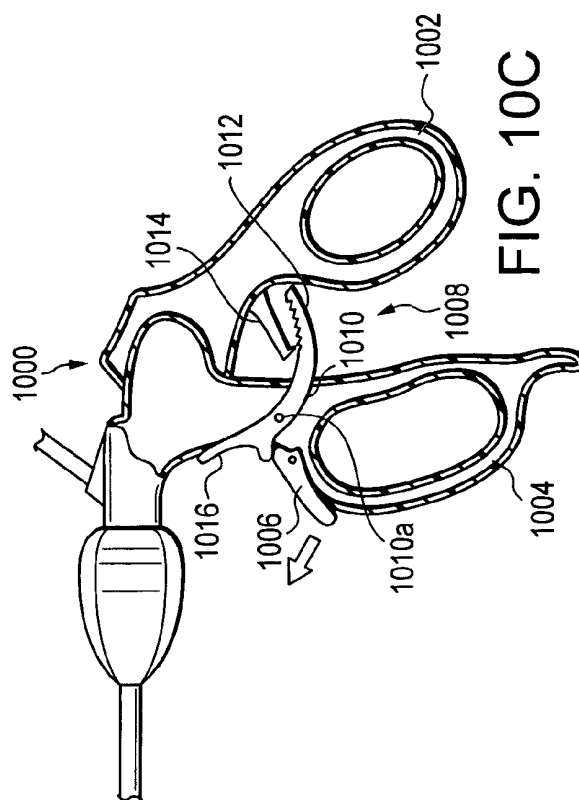
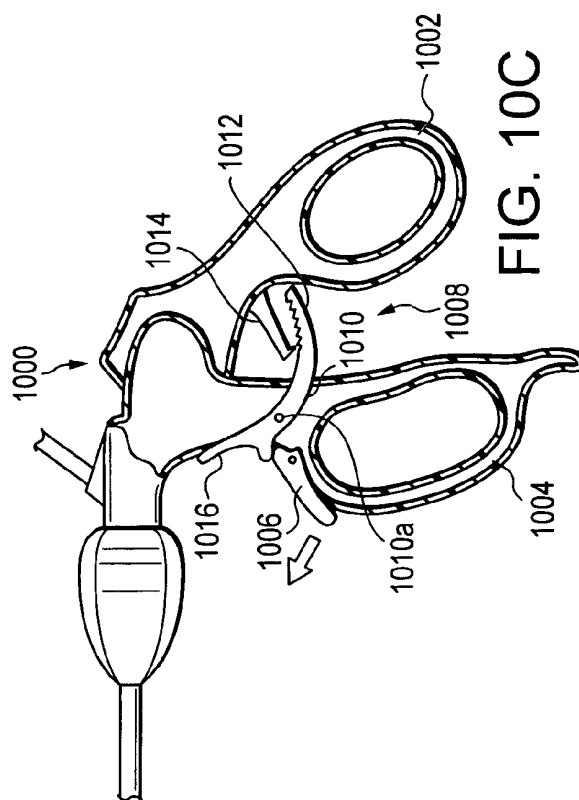
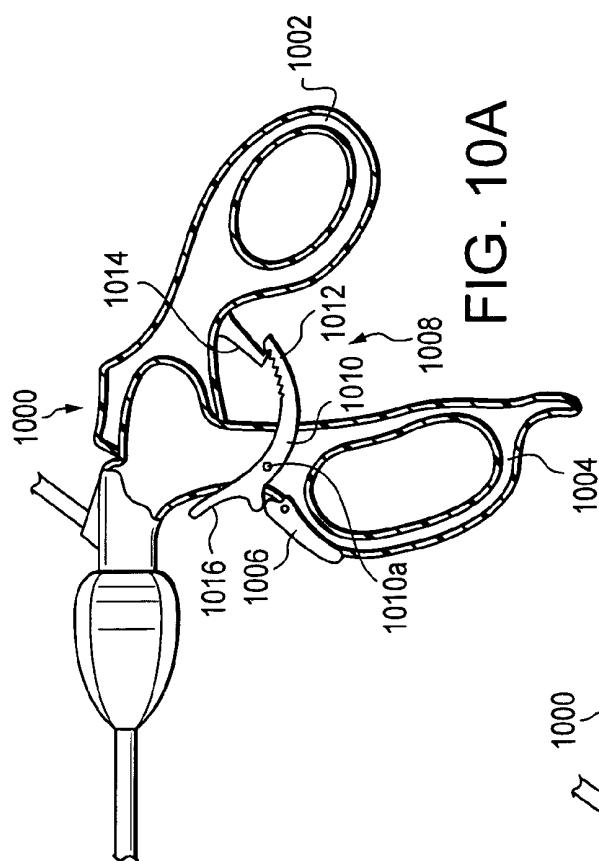


FIG. 9C



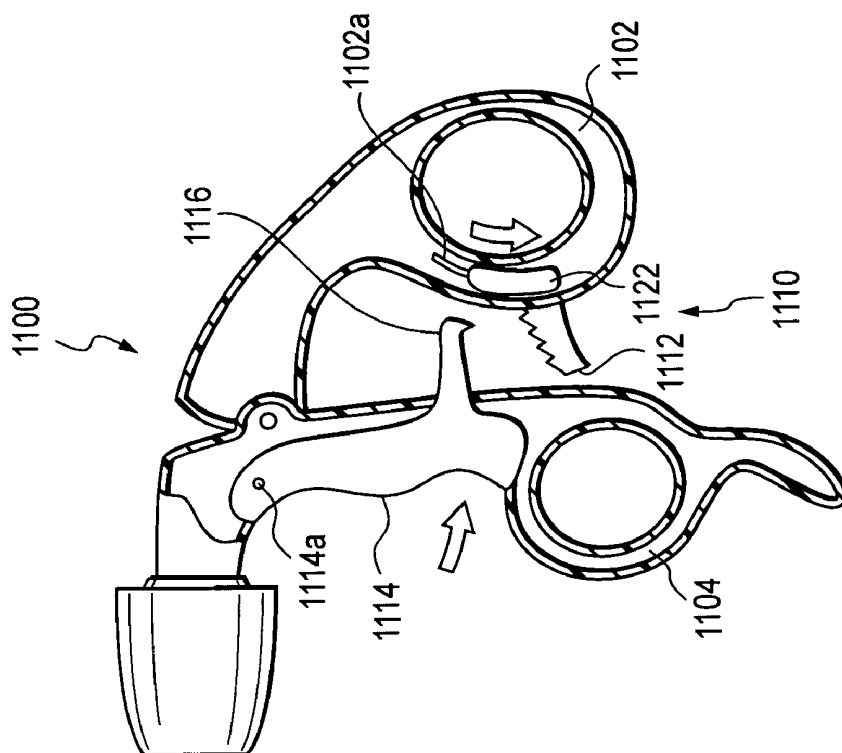


FIG. 11B

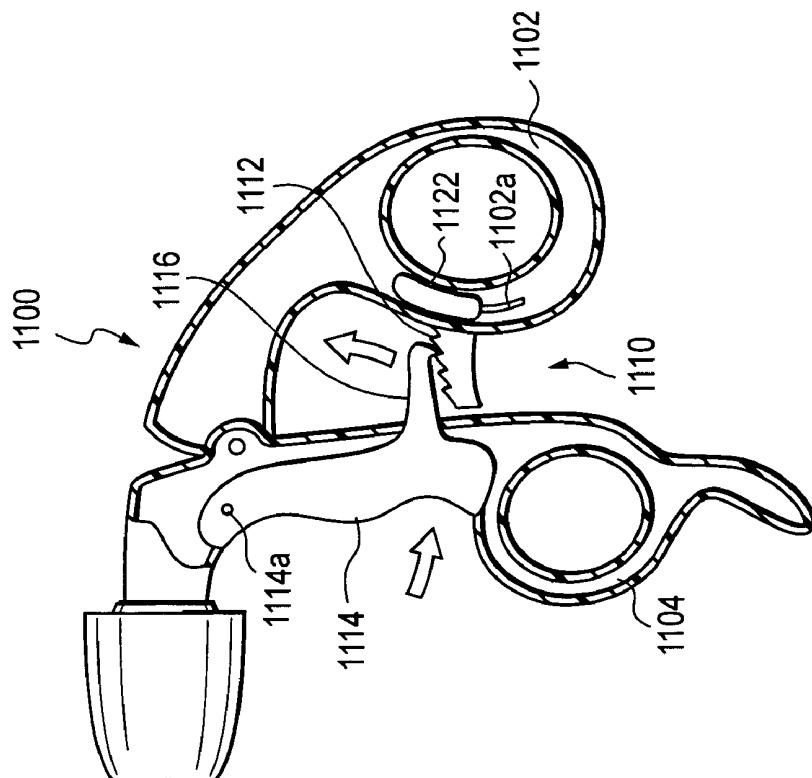


FIG. 11A

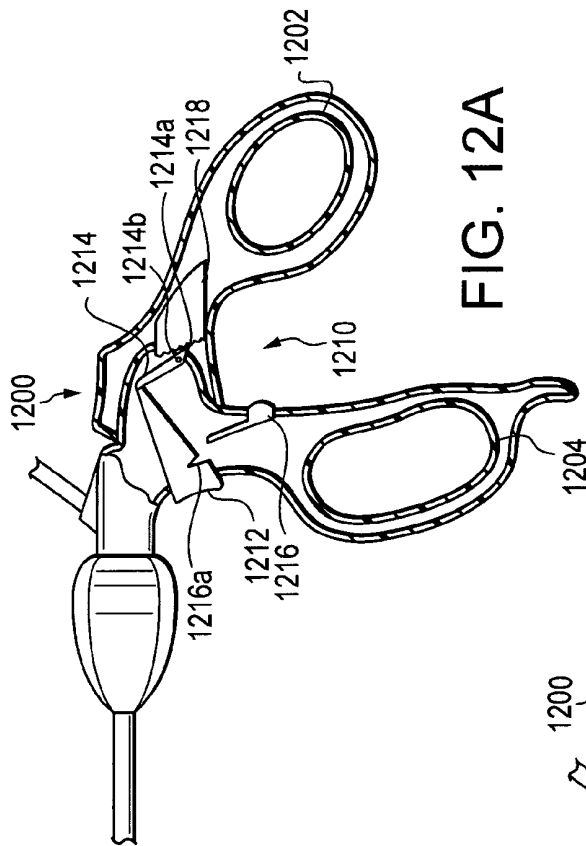


FIG. 12A

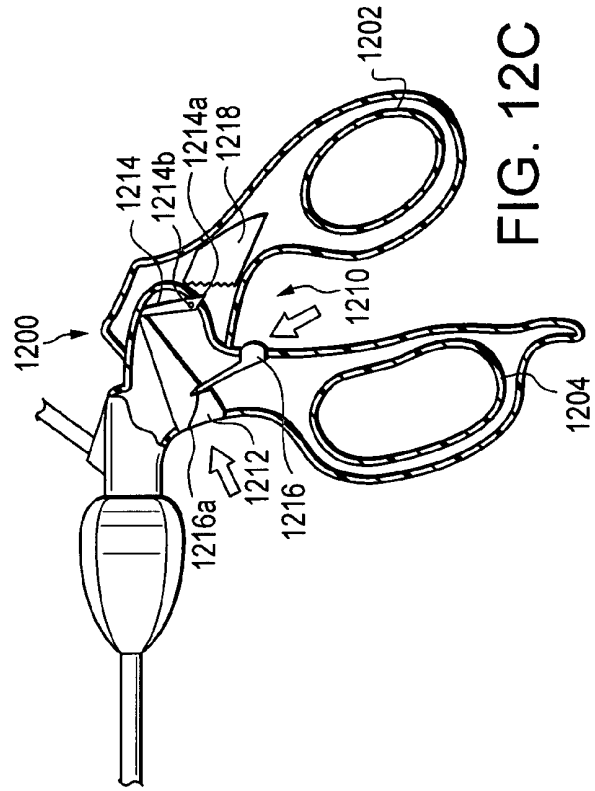


FIG. 12B

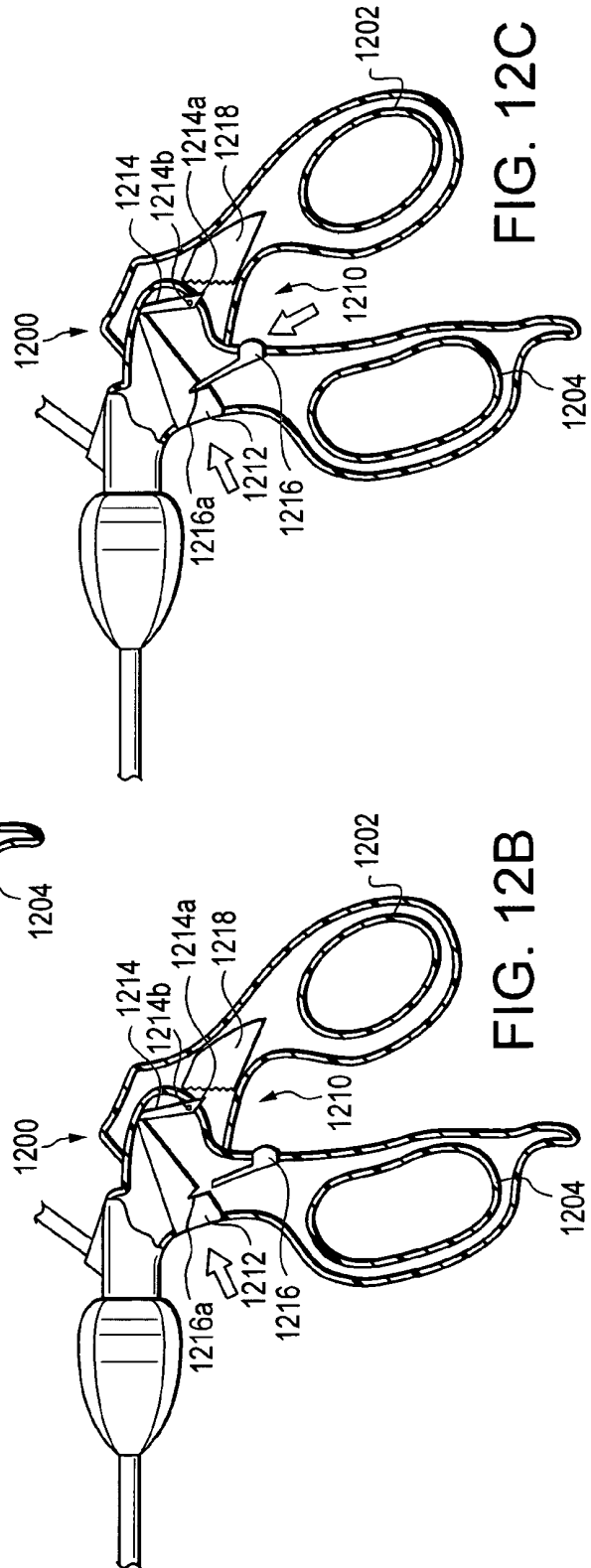


FIG. 12C

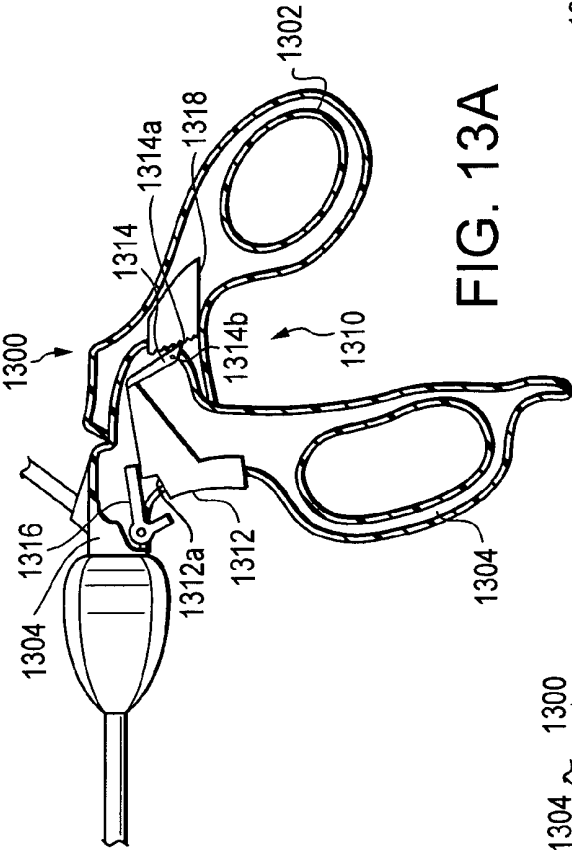


FIG. 13A

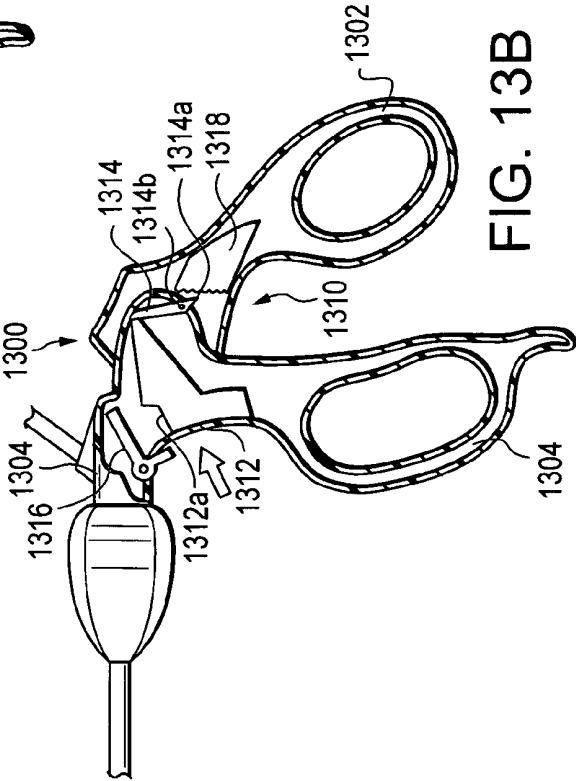


FIG. 13B

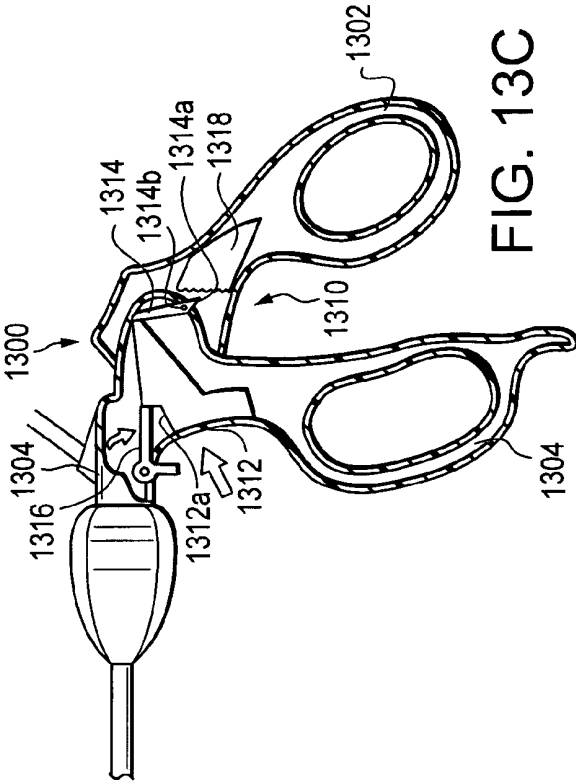


FIG. 13C

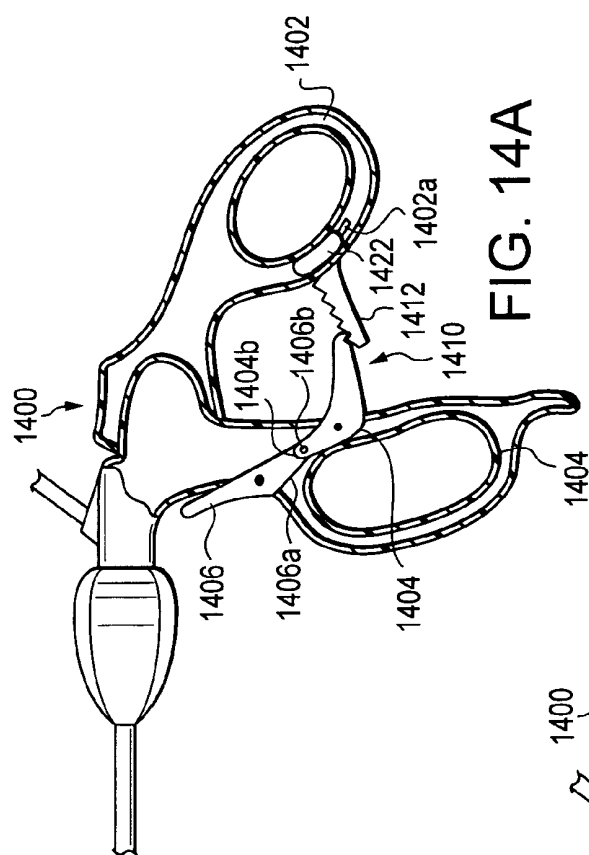


FIG. 14A

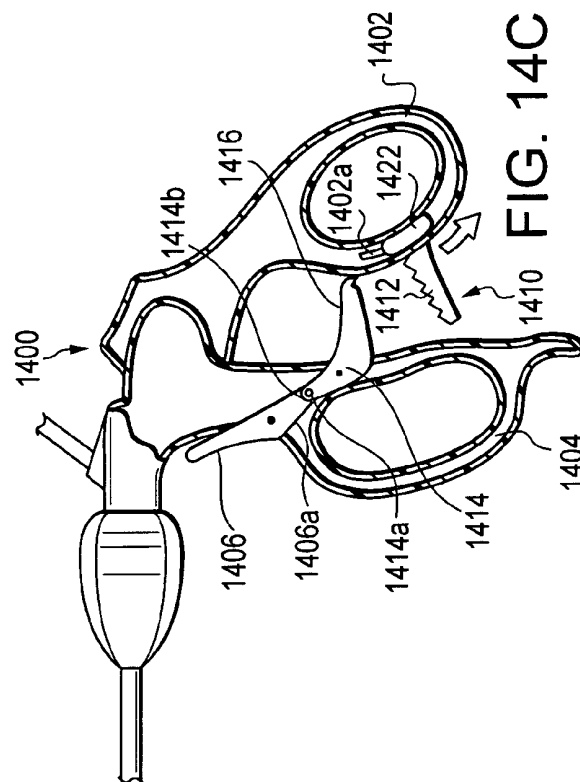
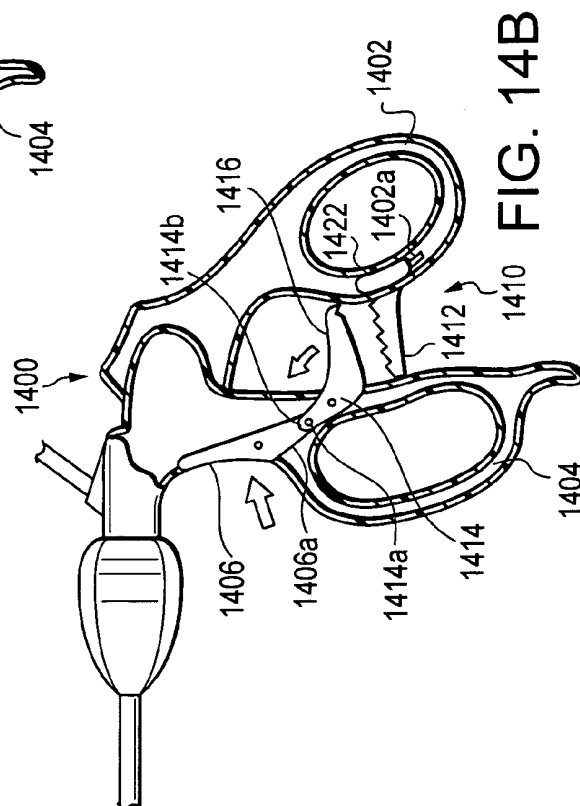
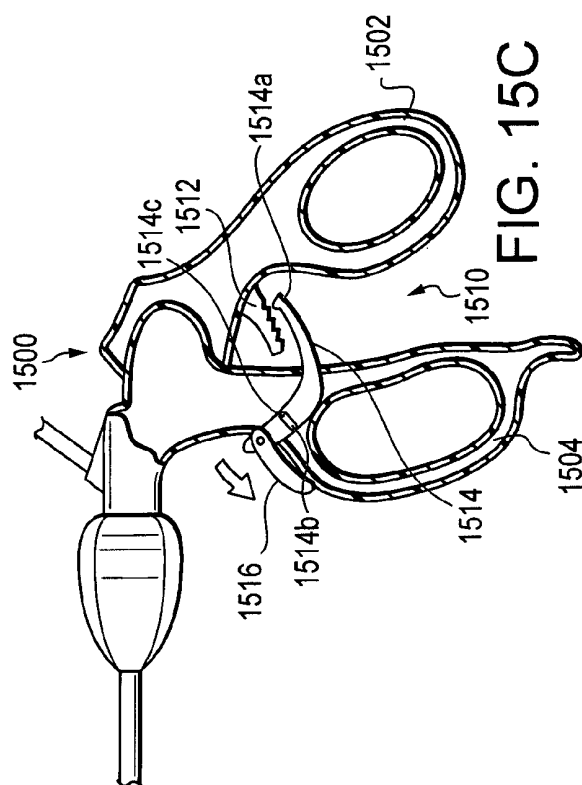
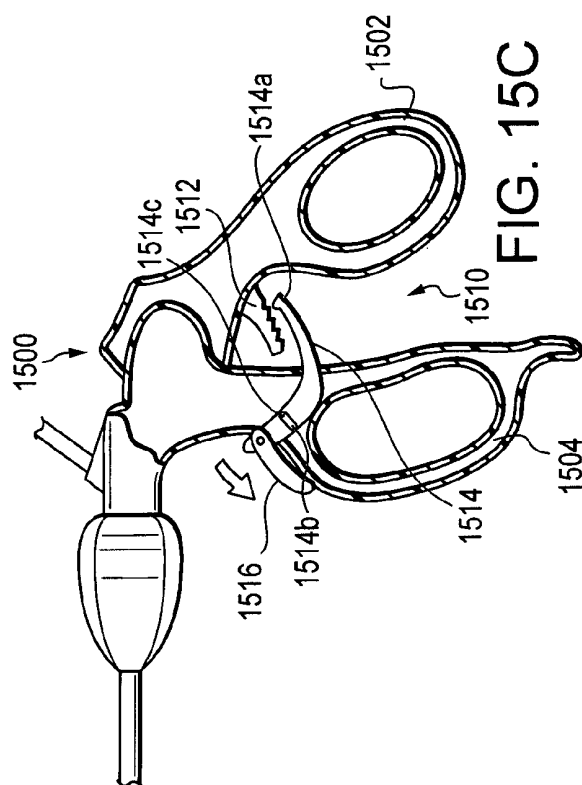
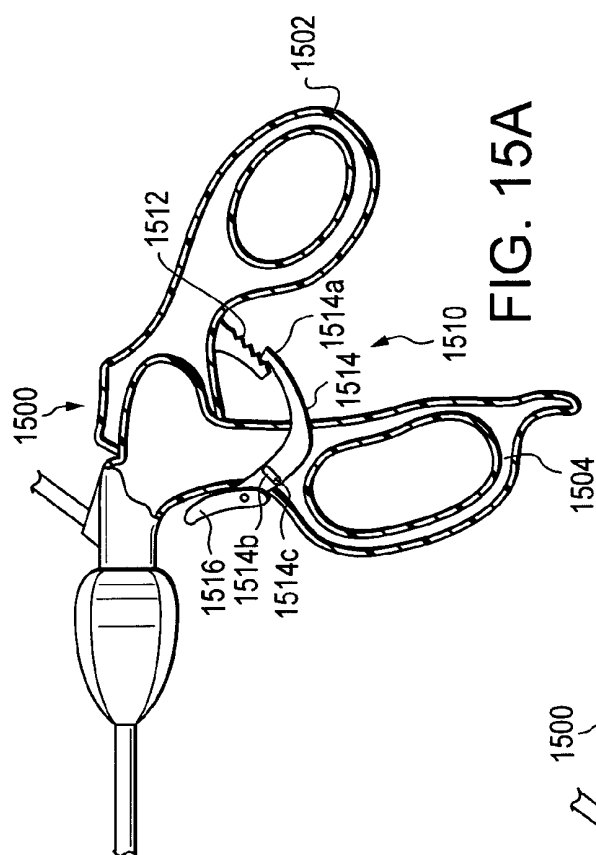


FIG. 14C



**FIG. 14B**





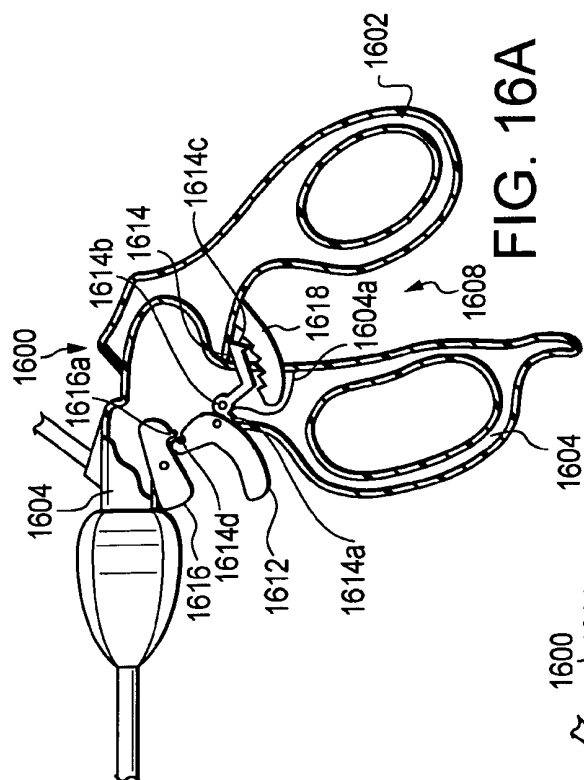


FIG. 16A

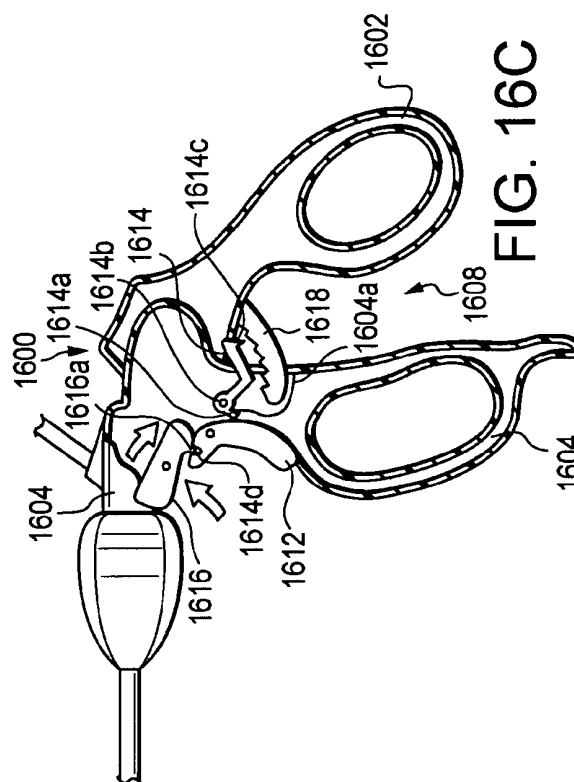


FIG. 16B

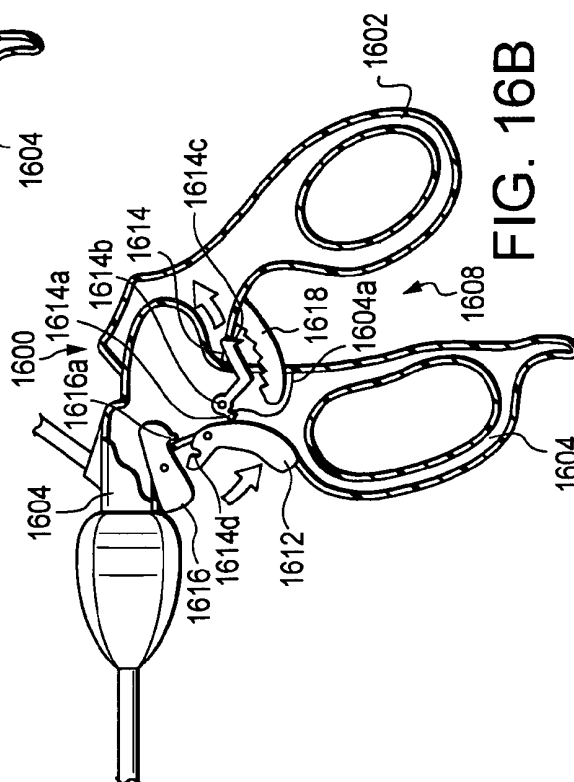


FIG. 16C

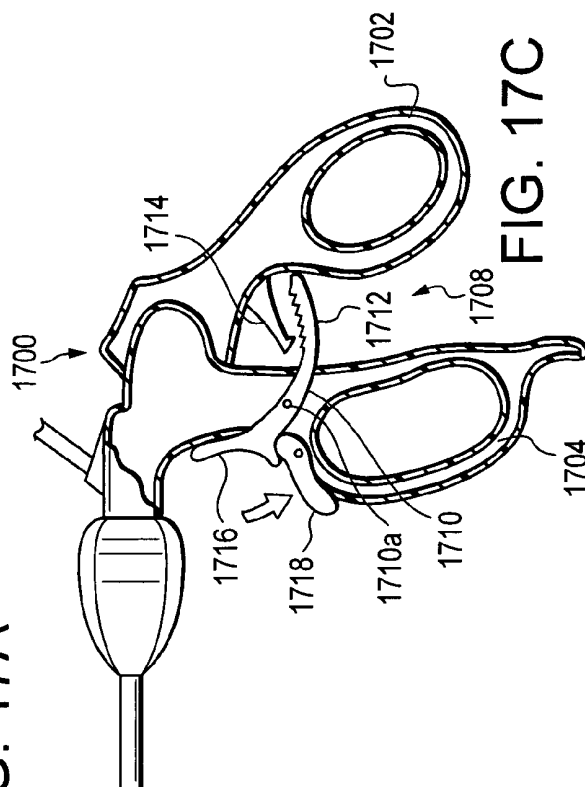
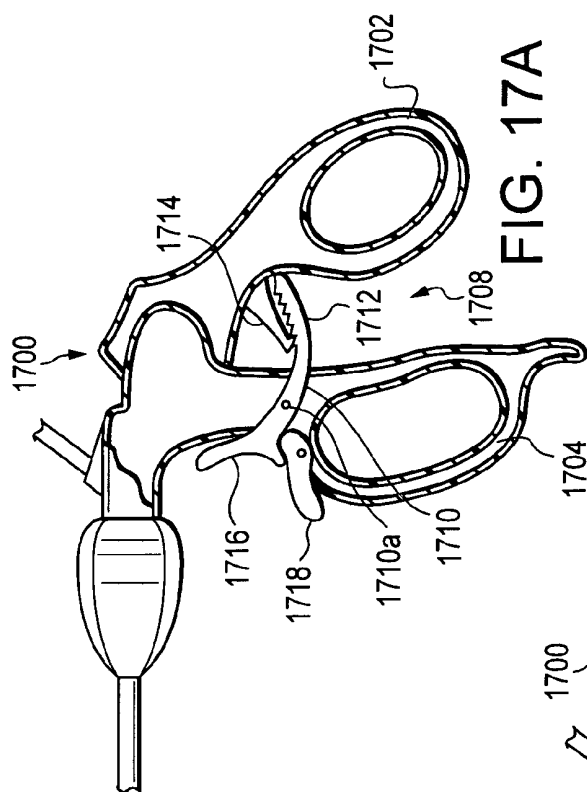
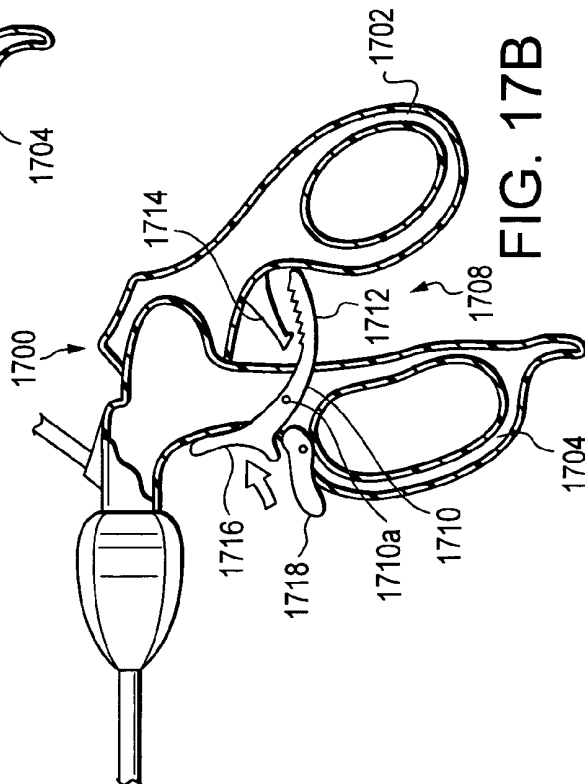


FIG. 17A

FIG. 17C



# 1

## SURGICAL DEVICE

### FIELD OF THE INVENTION

The present invention relates generally to medical devices, and more particularly to a handle configured to manipulate a distal tool end of a laparoscopic device.

### BACKGROUND

As depicted in FIG. 1, a typical monopolar electrosurgical laparoscopic tool device **100** generally has five main components: a handle **102**, an outer shaft **104** extending longitudinally from the handle, an actuation rod **106** extending through the outer shaft, an electrode **108** in electroconductive contact with the actuation rod, and an actuatable end effector **110**, disposed at the distal end of the device. The handle **102** illustrated is a “ring handle”, which has a stationary finger portion **112** attached to the outer shaft **104** and an actuatable thumb portion **114** attached to the actuation rod **106**. Actuation of the thumb portion **114** by pivoting relative to the finger portion **112** moves the actuation rod **106** axially within the outer shaft **104** to operate the end effector **110**. Although many different variations of each of the above components have been introduced into the art, there exists a need for designs that provide efficiency in manufacturing, and that provide surgeons and other users with ergonomic features to enhance safety and ease of use. In particular, there is a need for a handle design that includes an easy-to-use locking feature with a minimal number of components to provide for ease of assembly and durability.

### BRIEF SUMMARY

Embodiments of the present invention are configured to address the needs in the art for ergonomic designs that present advantages in manufacture and use. Preferred embodiments of the present invention are configured such that they may be sterilized and reused. The most preferred embodiments of the present invention include a ratchet mechanism that is biased so as to engage the handle members with each other, and that can be released or defeated using a single button or lever. This provides an advantage over many of the prior art ratchet mechanisms that require actuation of two or more separate components to engage, release, and defeat a ratchet. While embodiments of the present invention are directed to aspects of the handle for a laparoscopic surgical device, those of skill in the art will appreciate that handle embodiments of the present invention may be used with different shaft configurations and end effectors (e.g., needle holders, clamps, scissors, dissectors, graspers), and that such uses are within the scope of the present invention.

In one aspect, the present invention includes a surgical instrument having a handle operatively connected to an elongate shaft. The handle includes a thumb ring member pivotably connected to a finger ring member, a first engagement member fixed in and projecting generally distally from the thumb ring member, a second engagement member pivotably mounted to and projecting generally proximally from the finger ring member (with a first end portion of the second engagement member being biased into engagement with the first engagement member), and an elongate cam member pivotably connected to the finger ring member. The handle includes an operative contact of the elongate cam member with a second end portion of the second engagement member such that when the elongate cam member is at a first angle relative to the second engagement member, the operative

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contact is sufficient to pivot the second engagement member so as to overcome the biased engagement of the second engagement member with the first engagement member. And, when the elongate cam member is at a second angle relative to the second engagement member, the operative contact is sufficient to pivot the second engagement member so as to overcome the biased engagement of the second engagement member with the first engagement member and is sufficient to bias the second engagement member out of engagement with the first engagement member.

In another aspect, the present invention includes a surgical instrument having a handle operatively connected to an elongate shaft wherein the handle includes a first handle member pivotably connected to a second handle member and a ratchet mechanism removably engaging the first and second handle members. The ratchet mechanism includes a ratchet-toothed engagement member fixed to and projecting generally distally from the first handle member, an L-shaped pawl member having a camming leg portion and a pawl leg portion generally perpendicular to the camming leg portion. The L-shaped pawl member is pivotably mounted in the second handle member such that the pawl leg portion projects generally proximally from the second handle member, and an upper region of the camming leg portion includes both a generally vertical camming surface and a distally projecting camming surface. A biasing spring is mounted in the second handle member and forms an operative contact with the L-shaped pawl member such that a proximal end region of the pawl leg portion is biased into engagement with the ratchet-toothed engagement member. The ratchet mechanism also includes a cam lever that is pivotably connected to the second handle member. The cam lever has a first operative contact state with the L-shaped pawl member such that when the cam member is disposed at a first angle relative to the L-shaped pawl member, a first operative contact between the cam lever and the distally projecting camming surface is sufficient to pivot the L-shaped pawl member so as to overcome the biased engagement of the pawl leg portion with the ratchet-toothed engagement member. And, when the cam lever is disposed at a second angle relative to the L-shaped pawl member, a second operative contact between the cam lever and the generally vertical camming surface is sufficient to pivot the L-shaped pawl member so as to overcome the biased engagement of the pawl leg portion with the ratchet-toothed engagement member, and the second operative contact is also sufficient to bias the L-shaped pawl member at an angle wherein the pawl leg portion is not engaged with the ratchet-toothed engagement member.

In yet another aspect, the present invention includes a single-button release/defeat ratchet mechanism for a surgical device handle. The single-button release/defeat ratchet mechanism includes a cam button member, a pawl member in operative contact with the cam button member, a biasing member, and a ratchet member. It is configured such that when the mechanism is in a ratchet-engaged state, the cam button member is in a neutral first position, the operative contact is minimal and the biasing member biases the pawl member into engagement with the ratchet member. When the mechanism is in a ratchet-released state, the cam button member is in a second position such that the operative contact resists the bias of the biasing member and releases the pawl member from engagement with the ratchet member. And, when the mechanism is in a ratchet-defeated state, the cam button member is in a third position such that the operative contact biases the pawl member out of engagement with the ratchet member.

In still another aspect, the present invention includes a surgical instrument having a handle operatively connected to an elongate shaft, wherein the handle includes a first handle member pivotably connected to a second handle member; and a ratchet mechanism removably engaging the first and second handle members. The first handle member includes a plurality of raised thumb-grip ridges disposed on an upper proximal surface of the first handle member, and the ridges are configured to provide a frictional gripping surface. In still yet another aspect, the present invention includes a surgical instrument having a handle operatively connected to an elongate shaft, wherein the handle includes a first handle member pivotably connected to a second handle member; and a ratchet mechanism removably engaging the first and second handle members. The first handle member includes a plurality of raised thumb-grip ridges disposed on an intermediate side surface of the first handle member, and the ridges are configured to provide a frictional gripping surface.

In yet another aspect, the present invention includes a method of using a surgical instrument. The method includes the steps of: (a) providing a surgical instrument having a handle, wherein the surgical instrument handle includes a thumb ring member pivotably connected to a finger ring member, a ratchet-toothed arm fixed in and projecting generally distally from the thumb ring member, an L-shaped pawl member pivotably mounted to the finger ring member and having a first end portion projecting generally proximally from the finger ring member, and a cam lever that is pivotably connected to the finger ring member and that includes an operative contact with a second end portion of the pawl member wherein the first end portion of the pawl member is spring-biased by a spring into engagement with the ratchet-toothed arm when the cam lever is at a default first angle relative to the finger ring member; (b) pivoting the cam lever to a second angle relative to the finger ring member, such that the operative contact is sufficient to pivot the pawl member so as to overcome the spring bias and to release the engagement of the first end portion of the pawl member with the ratchet-toothed arm.

In still another aspect, the present invention includes a surgical instrument having a handle ratchet mechanism with a single-button release/defeat feature, wherein the handle ratchet mechanism includes a first engagement member, a second engagement member pivotably mounted to a handle portion and projecting toward the first engagement member (with a first end portion of the second engagement member being biased into engagement with the first engagement member), and a cam button pivotably connected to the handle portion and comprising an operative contact with a second end portion of the second engagement member. The mechanism is configured such that when the cam button is at a first angle relative to the second engagement member, the operative contact is sufficient to pivot the second engagement member so as to overcome the biased engagement of the second engagement member with the first engagement member, and, when the cam button is at a second angle relative to the second engagement member, the operative contact is sufficient to pivot the second engagement member so as to overcome the biased engagement of the second engagement member with the first engagement member and is sufficient to bias the second engagement member out of engagement with the first engagement member.

In another aspect, the present invention includes a surgical instrument having a handle operatively connected to an elongate shaft. The handle includes a thumb ring member pivotably connected to a finger ring member, a toothed first engagement member comprised by the thumb ring member, a

second engagement member pivotably mounted in the finger ring member, a first end portion of the second engagement member being biased into engagement with the toothed first engagement member, and an elongate cam member movably connected to the finger ring member. The cam member includes an operative contact with a second end portion of the second engagement member. The handle is configured such that when the elongate cam member is in a first position relative to the second engagement member, the operative contact is sufficient to move the second engagement member such that the operative contact provides a force sufficient to overcome the biased engagement of the second engagement member with the toothed first engagement member, and, when the elongate cam member is in a second position relative to the second engagement member, the operative contact is sufficient to move the second engagement member so as to overcome the biased engagement of the second engagement member with the first engagement member and is sufficient to bias the second engagement member out of engagement with the first engagement member.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a prior art laparoscopic tool device;

FIG. 2 illustrates a laparoscopic device incorporating a first handle embodiment of the present invention;

FIG. 2A is a partially exploded view of the first handle embodiment;

FIG. 2B is a longitudinal sectional view of the first handle embodiment along line 2-2 of FIG. 2, illustrating a bearing assembly;

FIGS. 2C-2E depict, respectively, engaged, released, and defeated ratchet states for the first handle embodiment in longitudinal section along line 2-2 of FIG. 2;

FIGS. 2F-2G show alternative user grip positions useful with handle embodiments of the present invention;

FIGS. 3-3A illustrate a first thumb-twist embodiment of a handle;

FIGS. 4-4A illustrate a second thumb-twist embodiment of a handle;

FIGS. 5-5A illustrate an in-line/traditional convertible embodiment of a handle;

FIGS. 6A-6C depict different external configuration embodiments of a handle;

FIGS. 7-7A show a first ratchet embodiment of a handle;

FIG. 7B illustrates a second ratchet embodiment of a handle;

FIG. 7C illustrates a third ratchet embodiment of a handle;

FIGS. 8A-8B depict a handle housing a fourth ratchet mechanism embodiment;

FIGS. 9A-9C show a handle housing a fifth ratchet mechanism embodiment;

FIGS. 10A-10C illustrate a handle housing a sixth ratchet mechanism embodiment;

FIGS. 11A-11B depict a handle housing a seventh ratchet mechanism embodiment;

FIGS. 12A-12C illustrate a handle housing a eighth ratchet mechanism embodiment;

FIGS. 13A-13C depict a handle housing a ninth ratchet mechanism embodiment;

FIGS. 14A-14C show a handle housing a tenth ratchet mechanism embodiment;

FIGS. 15A-15C depict a handle housing a eleventh ratchet mechanism embodiment;

FIGS. 16A-16C show a handle housing a twelfth ratchet mechanism embodiment; and

FIGS. 17A-17C illustrate a handle housing a thirteenth ratchet mechanism embodiment;

#### DETAILED DESCRIPTION

A first embodiment of a handle **202** for a laparoscopy device **200** is illustrated with reference to FIGS. 2-2E. The handle **202** includes a thumb ring member **204** pivotably attached at a pivot pin **208** to a finger ring member **206**. The thumb and finger ring members **204**, **206** preferably are constructed of a resin material but may alternatively be constructed of plastic, or other materials known in the art to be suitable for multiple sterilizations in an autoclave. A single-use embodiment may be constructed of materials known in the art, but not necessarily configured for multiple sterilizations. An elongate tubular shaft **280** extends distally from the finger ring member **206**. An actuation rod **282** extends distally from the thumb ring member **204** through the shaft **280**. At the distal end of the device **200**, an end effector **284** is operably connected both to the shaft **280** and the actuation rod **282**.

In the preferred embodiment illustrated, a ratchet mechanism **230**, embodied as a single-button release/defeat ratchet mechanism, is mounted in the handle **202** and configured to selectably secure the thumb ring member **204** at a user-selected angle to the finger ring member **206**. Alternative embodiments may not include a ratchet mechanism; but, in a preferred aspect of those alternative embodiments, the space occupied by the ratchet mechanism within the handle **202** preferably is filled by a metal insert or other appropriate material to maintain the balance and tactile properties associated with embodiments including a ratchet mechanism.

In the illustrated embodiment of FIGS. 2-2E, a thumb aperture **205** of the thumb ring member **204** includes an optional soft ring insert **210**. A similar insert optionally may be provided in the finger ring member **206**, either with or without the thumb ring insert. The soft ring insert **210** preferably is formed from a pliable, non-latex material and can provide different advantages including, for example: enhanced frictional surface for improved grip; softer contact surface to provide ergonomic comfort, particularly in extended use conditions; and, improved purchase/security for a user with smaller hands.

As is illustrated in FIGS. 2F and 2G, the proximal surface **212** of the thumb ring member **204** preferably bows inward/distally above the thumb aperture **205** in a manner that allows a user comfortably to operate the thumb ring member **204** in a “palm grip” rather than the traditional or “precision grip” (not shown) where the thumb is extended at least partially through the thumb aperture **205**. In a preferred embodiment, a textured surface (e.g., grooves or ridges) on an upper proximal surface and/or on an intermediate side surface of the thumb ring member provides both enhanced frictional contact and a tactile cue for use in the “thumb-up palmed position” (see, e.g., proximal surface ridges **214** in FIG. 2F) and in the “thumb-down palmed position” (see, e.g., intermediate side ridges **215** in FIG. 2G). Preferred embodiments of the handle **202** also may include other ergonomic design features. For example, the finger ring aperture **207** may be sized to accommodate the middle two fingers of a user’s hand while the user’s index finger can be used for actuation of the ratchet mechanism above the finger ring **206**, and the user’s little finger can be contact the pinky rest **209**. In preferred embodiments, the surfaces of the finger ring aperture **207** and the thumb ring aperture **205** are contoured to provide comfort during use with either of a user’s hand, and also to facilitate a user removing her hands from gripping the handle **202**. As another example, the handle **202** preferably is oriented at an

angle relative to the shaft **280** that provides for ease of use with either of a user’s hands as well as in an “upside-down” grip.

FIG. 2A shows a partially exploded view of the handle **202**, and FIG. 2B shows a cross-sectional view of the handle **202**. The forward upper region of the thumb ring member **204** is constructed to engage the finger ring member **206**. Specifically, the forward upper region includes two distally extending arms **216** with a pivot aperture **218** through each arm for engaging the pivot pin **208** on either side of an upper rear region of the finger handle member **206**. The rear upper region of the thumb ring member **204** includes a receiving chamber **220** configured to receive an actuation rod retainer **222**. When assembled to the thumb ring member **204**, the actuation rod retainer **222** preferably is held in place by a ratchet-retainer pin **228** engaging a mounting groove **229** (see FIG. 2A). The actuation rod retainer **222** preferably is a molded piece having a keyhole groove **224** dimensioned to receive and retain a ball **286** (or other shaped rod-retaining structure) on the proximal end of the actuation rod **282**. Most preferably, the groove **224** includes a semi-cylindrical metal insert **226** that maintains contact with the ball **286**. The open side of the groove **224** and the open side of the metal insert **226** are aligned to form a retaining channel. The metal insert **226** provides a durable interface between the ball **286** of the actuation rod **282** and the thumb ring member **204** used to actuate the rod in axial motion. The construction described for the retainer **222** provides for insulation of a user from electric current flowing through the actuation rod **282**. In addition, the described construction provides for ease of manufacture as the components of the thumb ring member **204** may be assembled together before being connected to the finger ring member **206**. In an alternative embodiment, the actuation rod retainer may be formed as a single metallic component with a key-lock groove to capture the proximal ball of the actuation rod. In preferred embodiments and as illustrated, all handle components are constructed and dimensioned such that, once the electrode is connected to an electrosurgical power unit, all electroconductive components are insulated from being touched by a user.

In the illustrated embodiment of FIGS. 2-2E, the finger ring member **206** includes an elongate finger aperture **207** (e.g., such as appropriate for inserting more than one finger) with a pinky rest **209** extending downward therefrom. The finger aperture **207** and pinky rest **209** preferably are oriented at an angle that provides comfort and ergonomic advantage for a user whether the thumb ring member **204** is being used in a “palm grip” or in a “precision/thumb-grip” application (see FIGS. 2F-2G). The upper region of the finger ring member **206** includes a channel **240** extending along its proximal-distal axis. A bearing **242** is disposed in the channel **240**.

The bearing **242** is generally cylindrical, and has a lumen **244** extending through its central longitudinal axis, through which a proximal portion of the actuation rod **282** extends. The bearing **242** has a slightly smaller outer diameter distal portion **246**, an intermediate body portion **247**, and a significantly smaller outer diameter proximal portion **248**. A longitudinally grooved proximal region **281** of the device shaft **280** extends rotatably into the distal part of the lumen **244**. Near the distal end of the intermediate body portion **247**, a groove **250** encircles the diameter of the bearing **242**. A detent ball-holding aperture **252** extends between the groove **250** and the bearing lumen **244**. An o-ring **251** in the groove **250** retains a ball detent **254** in the aperture **252** and biases it against the longitudinal grooves (not shown) in the proximal region **281** of the shaft **280**. This detent provides for indexed rotatability of the shaft **280**. Specifically, the shaft **280** may be rotated

about its longitudinal axis in discrete increments wherein each increment of rotation provides for engagement of the ball detent **254** with a longitudinal groove. Near the middle of the bearing's intermediate body portion **247**, a set screw **256** is mounted through the wall of the bearing **242**. The set screw **256** engages a circumferential retention groove **283** adjacent the proximal end of the shaft **280** in a manner that allows the shaft to rotate about its longitudinal axis relative to the bearing **242**, but axially retains the shaft within the bearing and thereby in the handle **202**. Near the proximal end of the intermediate body portion **247**, the upper surface of the bearing **242** is slightly flattened and an electrode aperture **258** is open to the lumen **244**. An electrode **268** configured for connection to an electrosurgical power unit extends through the aperture **258** and contacts the actuation rod **282** in a manner providing for current flow to the rod, but still allowing it to rotate.

The proximal body portion **248** of the bearing **242** extends nearly to a proximal end surface of the finger ring member **206** and helps to secure the bearing **242** in the channel **240**. In addition to providing the structural components described above, the bearing **242** provides for efficient assembly of the device **200** by allowing ease of assembly of components into the finger ring member **206**. The bearing **242** preferably is formed from a metal or plastic material and, in a preferred embodiment, provides electrical insulation around the shaft **280**.

An indexed rotation knob **288** rotatably overlaps the distal exterior of the upper region of the finger ring member **206** and is attached to the exterior of the shaft **280**. The rotation knob **288** preferably includes a flush port **289** open to the interior of the shaft **280**. (See, e.g., U.S. Pat. No. 5,489,290, which is incorporated herein by reference, for illustration of a representative flush port/rotation knob mechanism). The rotation knob **288** provides means for rotating the shaft **280** about its longitudinal axis, relative to the handle **202**. The knob **288** preferably is disposed in an ergonomically-oriented, position such that a user may rotate it with an index finger without removing or altering her grip on the handle **202**, and its outer surface preferably includes a plurality of broad grooves to provide purchase for the user's index finger. As described above, the rotation of the shaft by rotating the knob **288** is indexed (by the interaction of the ball detent **254** with longitudinal grooves on the shaft **280**) to allow precise, controlled rotation of the shaft **280**.

The handle **202** includes a ratchet mechanism **230**, described with reference to FIGS. 2C-2E, the design of which provides advantages for assembly of the device **200** and ease of use. The ratchet mechanism **230** preferably includes a four-piece design. A ratchet-toothed member **231** is fixed in the thumb ring member **204**. A release/defeat button, shown here as a cam member **232**, an L-shaped pawl member **238**, and a leaf spring **234** are disposed in the finger ring member **206**. The ratchet-toothed member **231** includes a curved, toothed projection **235** that extends generally distally out of the thumb ring member **204** toward the finger ring member **206**. The pawl member **238** includes a curved pawl projection **236** that extends proximally out of the finger ring member **206** toward the thumb ring member **204** and that has a pawl tooth **237** on its upper surface. The pawl member **238** also includes a first cam-engaging surface **238a** on the distal side near the upper end of its vertical pawl leg **239** and a second cam-engaging surface **238b** projecting distally below the first cam-engaging surface **238a**. The upper end of the leaf spring **234** is secured near the upper end of the pawl member **238** and its bowed-out surface contacts an interior surface of the finger ring member **206**, thereby biasing the vertical pawl leg **239** in

a distal direction. The pawl member **238** is pivotably attached within the finger ring member **206** by a pawl pivot pin **270**, which is located proximate the juncture of the curved pawl projection **236** with the vertical member **239**. The cam member **232** is pivotably attached to the finger ring member **206** by a cam pivot pin **271**. In an alternative embodiment, the distal projection of the thumb ring member may include one or more pawl teeth, and the proximal projection of the finger ring member may include a ratcheted surface. This reversibility of the complementary/engaging surfaces is also applicable to other embodiments of the present invention.

The ratchet mechanism **230** can be actuated to one of three user-selected states (engaged, released, and defeated), which are described, respectively, with reference to FIGS. 2C, 2D, and 2E.

As shown in FIG. 2C, when the ratchet mechanism **230** is in an engaged state, the pawl tooth **237** of the pawl member **238** engages the teeth of the curved, toothed projection **235**. This engagement prevents the thumb ring **204** from being moved proximally relative to (i.e., away from) the finger ring **206**, but allows it to be moved distally relative to (i.e., closer to) the finger ring. In the engaged state, the position of the pawl member **238** is maintained by the bias of the leaf spring **234** against an inner surface of the finger ring member **206**. This bias exerts a distal/downward force against the vertical pawl leg **239**, thereby pivoting the pawl member **238** about the pawl pivot pin **270** such that the pawl toothed projection **236** is directed distally/upward into engagement with the curved, toothed projection **235** of the thumb ring member. In the engaged position, the cam member **232** is at rest and does not have significant force-exerting contact with the pawl member **238**.

As shown in FIG. 2D, when the ratchet mechanism **230** is in a released state, the pawl tooth **237** of the pawl member **238** is disengaged from the teeth of the curved, toothed projection **235**. This disengagement allows the thumb ring **204** to be moved toward or away from the finger ring **206**. The disengagement of the released state is effected by holding the cam member **232** in a downward position. In the released state, a proximal portion of the cam member **232** is dynamically held against the second cam-engaging surface **238b** of the pawl member **238**. This contact forces the vertical pawl leg **239** proximally, against the bias of the leaf spring **234**. This proximal force pivots the pawl member **238** about the pawl pivot pin **270** such that the pawl toothed projection **236** is levered distally/downward and out of engagement with the curved, toothed projection **235** of the thumb ring member. To resist the bias of the leaf spring **234**, the cam member **232** must be held in position to maintain the released state.

As shown in FIG. 2E, when the ratchet mechanism **230** is in a defeated state, the pawl tooth **237** of the pawl member **238** is disengaged from the teeth of the curved, toothed projection **235**. This disengagement allows the thumb ring **204** freely to be moved toward or away from the finger ring **206**. The disengagement of the released state is effected by moving the cam member **232** into an upward position. In the defeated state, a proximal portion of the cam member **232** is locked against the first cam-engaging surface **238a** of the pawl member **238**. This contact forces the vertical pawl leg **239** proximally, against the bias of the leaf spring **234**. The proximal force pivots the pawl member **238** about the pawl pivot pin **270** such that the pawl toothed projection **236** is directed distally/downward and out of engagement with the curved, toothed projection **235** of the thumb ring member. The cam member **232** is rotated past a point of inflection such that the cam member **232** angle of contact with the first cam-engaging surface **238a** locks the cam member **232** in the upward posi-

tion to maintain the defeated state. In an alternative embodiment (not shown), a leaf spring may be provided between the thumb ring member 204 and finger ring member 206 to bias them apart (in an "open" position).

A first thumb-twist handle embodiment 300 is shown in FIGS. 3A-3B. The handle 300 includes a thumb ring member 302 and a finger ring member 304. The thumb ring member 302 includes a pivot arm component 306 that is pivotably connected to the finger ring member 304 in a manner allowing the thumb ring member to pivot within the same plane as the finger ring member 304 in the same fashion as a typical handle design. The thumb ring member 302 includes a thumb aperture component 308 that is pivotably connected to the pivot arm component 306 in a manner that allows the thumb aperture component 308 to pivot relative to the pivot arm component 306 about the longitudinal axis (line 3-3) of the pivot arm component 306 (i.e., the proximal portion of the thumb aperture component 308 can rotate out of a major plane defined by the default orientation of the thumb ring member 302 and finger ring member 304 in FIG. 3A). This design feature allows a user to maintain a natural thumb-wrist orientation while allowing a greater range of handle movement without disengaging the user's thumb from the handle 300.

A second thumb-twist handle embodiment 400 is shown in FIGS. 4A-4B. The handle 400 includes a thumb ring member 402 and a finger ring member 404. The thumb ring member 402 includes a pivot arm component 406 that is pivotably connected to the finger ring member 404 in a manner allowing the thumb ring member to pivot within the same plane as the finger ring member 404 in the same fashion as a typical handle design. The thumb ring member 402 includes a thumb aperture component 408 that is pivotably connected to the pivot arm component 406 in a manner that allows the thumb aperture component 408 to pivot out of the longitudinal axis of the pivot arm component 406 (i.e., the entire thumb aperture component 408 can rotate along a transverse axis 4-4 and out of a major plane defined by the default orientation of the thumb ring member 402 and finger ring member 404 in FIG. 4A). This design feature allows a user to maintain a natural thumb-wrist orientation while allowing a greater range of handle movement without disengaging the user's thumb from the handle 400.

A first in-line/traditional convertible embodiment of a handle 500 for a laparoscopic device 501 is depicted in FIGS. 5-5A. The handle 500 includes a thumb ring member 502 and a finger ring member 504. The thumb ring member 502 is pivotably connected to the finger ring member 504 in a manner allowing the thumb ring member to pivot within the same plane as the finger ring member 504 in the same fashion as a typical handle design. A pivoting mechanism 508 is disposed at the juncture of the handle 500 with a shaft 510 and other, more distal components of the device 501. This pivoting mechanism 508 provides for a user-selected ability to configure the handle 502 in a "traditional" (or "pistol-grip") orientation, wherein the longitudinal axis of the finger ring member 504 is nearly perpendicular relative to the shaft 510 (see FIG. 5). Or, the user may pivot the handle 500 upward into an "in-line" orientation, wherein the longitudinal axis of the finger ring member 504 is nearly coaxial with the longitudinal axis of the shaft 510 (see FIG. 5A). Those of skill in the art will appreciate that user may select to orient the handle 500 at a greater or lesser angle than is illustrated.

FIGS. 6A-6C illustrate alternative handle embodiments wherein the shape and relative position of the ring members and rotation knob are varied.

A first alternative geometry embodiment of a handle 600 for a laparoscopic device 601 is depicted in FIG. 6A. The

handle 600 includes a thumb ring member 602 and a finger ring member 604. The thumb ring member 602 includes a pivot arm component 606 that is pivotably connected to the finger ring member 604 by a pivot pin 608 in a manner allowing the thumb ring member to pivot within the same plane as the finger ring member 604. The pivot pin 608 is disposed low and proximally on the upper region of the finger ring member 604. The portion of the thumb ring pivot arm component 606 that is above the pivot pin 608 goes into an open region in the finger ring member 604 when the handle portions are opened/separated. A rotation knob 607 for rotating a shaft 609 of the device 601 about its longitudinal axis is disposed in a forward upper region of the finger ring member 604.

A second alternative geometry embodiment of a handle 620 for a laparoscopic device 621 is depicted in FIG. 6B. The handle 620 includes a thumb ring member 622 and a finger ring member 624. The thumb ring member 622 includes a pivot arm element 626 that is pivotably connected to the finger ring member 624 by a pivot pin 628 in a manner allowing the thumb ring member to pivot within the same plane as the finger ring member 624. The pivot pin 628 is disposed distally on the upper region of the finger ring member 624. The portion of the thumb ring pivot arm component 626 that is above the pivot pin 628 rotates above the longitudinal axis of a shaft 629 of the device when the handle members 622, 624 are opened/separated. A rotation knob 627 for rotating the shaft 629 of the device 621 about its longitudinal axis is disposed distal to a forward upper region of the finger ring member 624.

A third alternative geometry embodiment of a handle 640 for a laparoscopic device 641 is depicted in FIG. 6A. The handle 640 includes a thumb ring member 642 and a finger ring member 644. The thumb ring member 642 is pivotably connected to the finger ring member 644 by a pivot pin 648 in a manner allowing the thumb ring member to pivot within the same plane as the finger ring member 644. The pivot pin 648 is disposed in substantially the same manner as the device embodiment of FIG. 2. A rotation knob 647 for rotating a shaft 649 of the device 641 about its longitudinal axis is disposed in a forward upper region of the finger ring member 644. The finger ring member 644 includes a finger aperture 645 configured for a single finger and a finger rest stem 646 configured to support one or more fingers.

A first alternatively ratcheted embodiment of a handle 702 for a laparoscopy device 700 is illustrated with reference to FIGS. 7-7C. The handle 702 includes a thumb ring member 704 pivotably attached at a pivot pin 708 to a finger ring member 706. An elongate tubular shaft 780 extends distally from the finger ring member 706.

In the embodiment illustrated in FIGS. 7-7C, ratchet mechanism embodiments are illustrated as comprised by a handle 702 and configured to selectively secure a thumb ring member 704 at a user-selected angle to a finger ring member 706. An upper region of the thumb ring member 704 includes a curved ratcheted surface 712 adjacent and below the pivot pin 708.

FIG. 7 depicts a first ratchet mechanism embodiment 730. In addition to the curved ratcheted surface 712, the ratchet mechanism 730 includes a cam switch 714 and a pawl lever 710. The pawl lever 710 includes an upper pawl arm 710a and a lower pawl arm 710b. The upper pawl arm 710a includes a pawl tooth 710c configured to engage the ratcheted surface 712 and the mechanism 730 includes a spring (e.g. torsion or leaf spring, not shown) that biases the pawl lever 710 into engagement with the ratcheted surface 712 when—as shown—the cam switch 714 is in a neutral position (handle-

engaged state), allowing the ratchet mechanism **730** to be engaged to prevent the handle **702** from being opened. The cam switch **714** can be moved upward, exerting force against the lower pawl arm **710b** to lever the pawl **710** out of engagement with the ratcheted surface **712** (handle-released state). Alternatively, the cam switch **712** may be configured to be pulled proximally into the finger ring member **706**.

FIG. 7A illustrates a detail view of the first ratchet mechanism of FIG. 7, with the addition of a defeat switch **716**. In the illustrated embodiment, the defeat switch **716** can be moved upwards to engage the lower pawl arm **710b** when it (**716**) is disengaged from the ratcheted surface **712**. When the defeat switch **716** is thus engaged, the handle **702** may freely be opened and closed.

FIG. 7B illustrates a detail of a second ratchet mechanism embodiment **740** in a handle **701** that is nearly identical to the handle **702** in FIG. 7, but for a different camming member arrangement. The second ratchet mechanism embodiment **740** includes a cam slide **742**. In a ratchet-engaged (neutral) state, the cam slide **742** has little or no contact with the lower portion **710b** of the pawl lever **710**. To release the pawl lever **710** from engagement with the ratcheted surface **712**, a user depresses the cam slide **742**, thereby levering the upper pawl arm **710a** away from the ratcheted surface **712**. To defeat the engagement, a user depresses the cam slide **742** proximally to release the engagement, then locks the cam slide **742** in place by moving it downward into engagement with a notch **706a** provided on the finger ring member **706**.

FIG. 7C depicts a detail view of a third ratchet mechanism embodiment **750** in a handle **703** that is nearly identical to the handle **702** in FIG. 7, but for a different camming member arrangement. The third ratchet mechanism embodiment **740** includes a cam button **752** and a cam button locking slide **754**. In a ratchet-engaged (neutral) state, the cam button **752** has only minimal contact with the lower portion of the pawl lever **710**. To release the pawl lever **710** from engagement with the ratcheted surface **712**, a user depresses the cam button **752** distally, thereby levering the upper pawl arm **710a** away from the ratcheted surface **712** (released state). To defeat the ratchet engagement, a user depresses the cam button **752** to release the engagement, and then locks the cam button **752** in place by moving downward the cam button locking slide **754** over the cam button **752** to hold it (**752**) in place. The embodiments in FIGS. 7-7C, as well as FIGS. 12A-13C illustrate an alternative location for a thumb ring member-mounted ratchet-toothed surface. In these embodiments, the ratchet mechanism components are generally enclosed in the handle body or at least preferably do not extend significantly externally between the handle members. Those of skill in the art will appreciate that these embodiments may provide a user with more freedom to manipulate his hand around the finger ring member and thumb ring member in different orientations and/or grips than embodiments with projections from/between the handle members.

FIGS. 8A-8B illustrate a handle **800** housing a fourth embodiment of a ratchet mechanism **810**. The handle includes a thumb ring member **802** pivotably attached to a finger ring member **804**. The ratchet mechanism **810** includes a curved ratchet-toothed arm **812** projecting distally from the thumb ring member **802**, a pawl arm **814** pivotably attached to the finger ring member **804**, and a cam lever **816** pivotably connected to the finger ring member **804**. A pawl-tooth **814a** adjacent the proximal end of the pawl arm **814** preferably is biased into engagement with the ratchet-toothed arm **812** (e.g., by a torsion or leaf spring, not shown). A curved lower cam end **816a** of the cam lever **816** contacts an angled distal end **814b** of the pawl arm **814**. In the neutral/engaged state

illustrated in FIG. 8A, the pawl-tooth **814a** is engaged with the ratchet-toothed arm **812**, and the pawl arm **814** is oriented generally perpendicular to the finger ring member **804**. In the ratchet-defeated state depicted in FIG. 8B, the pawl arm **814** is oriented generally parallel to the finger ring member **804**, and the contact of the curved lower cam end **816a** of the cam lever **816** with the angled distal end **814b** of the pawl arm **814** levers the proximal pawl-tooth end **814a** out of engagement from the ratchet-toothed arm **812**. In the defeated state, it is preferable that the surface contact between the cam lever **816** and the pawl arm **814** be configured to form a frictional lock sufficient to resist the bias of the pawl arm toward engagement with the ratchet-toothed arm **812**.

FIGS. 9A-9C illustrate a handle **900** housing a fifth embodiment of a ratchet mechanism **908**. The handle includes a thumb ring member **902** pivotably attached to a finger ring member **904**. The ratchet mechanism **908** includes an L-shaped member **910** having a curved ratchet-toothed arm **910b** projecting generally proximally from the finger ring member **904**, a lever arm **910c** projecting generally distally at an acute angle from the finger ring member **904**, and an over-center cam switch **906** pivotably attached to the finger ring member **904**. The L-shaped member **910** includes a pivoting connection **910a** to the finger ring member **904**, the connection **910a** being disposed at the junction of the curved ratchet-toothed arm **910b** with the lever arm **910c**. The ratchet mechanism **908** also includes a pawl arm **912** projecting generally distally from the thumb ring member **902**. The L-shaped member **910** preferably is biased (e.g., by a torsion or leaf spring, not shown) such that the curved ratchet-toothed arm **910b** engages the pawl arm **912** when the handle **900** is in a neutral state as shown in FIG. 9A. In the ratchet-released state shown in FIG. 9B, a user depresses proximally the lever arm **910c** of the L-shaped member **910**, thereby levering the curved ratchet-toothed arm **910b** out of engagement with the pawl arm **912**. In the ratchet-defeated state depicted in FIG. 9C, the L-shaped member **910** is moved to the released state shown in FIG. 9B, then the user moves upward the over-center cam switch **906** to contact the L-shaped member **910** above the pivoting connection **910a** and hold it (**910**) in place. The over-center cam switch **906** preferably includes a mechanical locking means to maintain the released state position (e.g., an internal locking spring, a pin-groove lock, or other locking means known to those of skill in the art). In the released state, it is preferable that the surface contact between the cam lever **910c** and the pawl arm **912** be sufficient to resist the bias of the pawl arm toward engagement with the ratchet-toothed arm **910b**.

FIGS. 10A-10C illustrate a handle **1000** housing a sixth embodiment of a ratchet mechanism **1008**. The handle includes a thumb ring member **1002** pivotably attached to a finger ring member **1004**. The ratchet mechanism **1008** includes a generally arcuate member **1010** having a curved ratchet-toothed arm **1012** projecting generally proximally from the finger ring member **1004**, a trigger arm **1016** projecting generally distally at an acute angle from the finger ring member **1004**, and an under-center cam switch **1006** pivotably attached to the finger ring member **1004**. The generally arcuate member **1010** includes a pivoting connection **1010a** to the finger ring member **1004**, the connection **1010a** being disposed at the junction of the curved ratchet-toothed arm **1012** with the trigger arm **1016**. The ratchet mechanism **1008** also includes a pawl arm **1014** projecting generally distally from the thumb ring member **1002**. The generally arcuate member **1010** preferably is biased (e.g., by a torsion or leaf spring, not shown) such that the curved ratchet-toothed arm **1012** engages the pawl arm **1014** when the handle **1000** is in



a neutral state as shown in FIG. 10A. In the ratchet-released state shown in FIG. 10B, a user depresses proximally the trigger arm 1016 of the generally arcuate member 1010, thereby levering the curved ratchet-toothed arm 1012 out of engagement with the pawl arm 1014. In the ratchet-defeated state depicted in FIG. 10C, the generally arcuate member 1010 is moved to the released state shown in FIG. 10B, then the user moves upward the under-center cam switch 1006 to contact the underside of the generally arcuate member 1010 below the pivoting connection 1010a to hold it (1010) in place. The under-center cam switch 1006 preferably is maintained frictionally in the released position or alternatively includes a mechanical locking means to maintain the released state position (e.g., an internal locking spring, a pin-groove lock, or other locking means known to those of skill in the art). In the released state, it is preferable that the contact between the trigger arm 1016 and the pawl arm 1014 be sufficient to resist the bias of the pawl arm toward engagement with the ratchet-toothed arm 1012.

FIGS. 11A-11B illustrate a handle 1100 housing a seventh embodiment of a ratchet mechanism 1110. The handle includes a thumb ring member 1102 pivotably attached to a finger ring member 1104. The ratchet mechanism 1110 includes a curved ratchet-toothed arm 1112 projecting distally from the thumb ring member 1102 and slidably mounted therein, and a pawl grip 1114 pivotably attached at a pivot pin 1114a to the finger ring member 1104 (biased in a distal/downward position), the pawl grip 1114 including a proximally projecting pawl arm 1116. The thumb ring member 1102 includes a defeat slider button 1122 that is attached (through a groove 1102a) to the curved ratchet-toothed arm 1112, and which is configured to move the curved ratchet-toothed arm 1112 generally vertically relative to the thumb ring member 1102. In the neutral/engaged state illustrated in FIG. 11A, the pawl arm 1116 is engaged with the ratchet-toothed arm 1112, which is in an upper position relative to the groove 1102a. The ratchet mechanism 1110 may be released by a user depressing the pawl grip 1114 such that it pivots generally proximally/upward (against its bias) relative to the finger ring member 1104, which disengages the pawl arm 1116 from the ratchet-toothed arm 1112. In the ratchet-defeated state depicted in FIG. 11B, the defeat slider button 1122 is moved downward in the groove 1102a, defeating the engagement of the ratchet-toothed arm 1112 with the pawl arm 1116.

FIGS. 12A-12C illustrate a handle 1200 housing an eighth embodiment of a ratchet mechanism 1210, which is a substantially internal mechanism. The handle 1200 includes a thumb ring member 1202 pivotably attached to a finger ring member 1204. The ratchet mechanism 1208 includes a slidably disposed cam button 1212, a pivotably disposed pawl lever 1214 (pivoting about a transverse pivot pin 1214b), and a slidably disposed, nearly vertical defeat switch member 1216 in an upper region of the finger ring member 1204. A ratchet-toothed member 1218 is disposed in the thumb ring member 1202, proximally adjacent the pawl lever 1214. In the neutral/engaged position shown in FIG. 12A, a lower end 1214a of the pawl lever 1214 is engaged with the teeth of the ratchet-toothed member 1218. As depicted in FIG. 12B, in order to release the pawl lever 1214 from engagement with the ratchet-toothed member 1218, a user may depress the cam button 1212 in a proximal direction against the pawl lever 1214, which levers it (1214) away from the ratchet-toothed member 1218. FIG. 12C illustrates that the ratchet engagement may be defeated by depressing the cam button 1212 into

the released state, and then sliding the defeat switch member 1216 up into engagement with a defeat-lock notch 1216a on the cam button 1212.

FIGS. 13A-13C illustrate a handle 1300 housing a ninth embodiment of a ratchet mechanism 1310, which is also a substantially internal mechanism. The handle 1300 includes a thumb ring member 1302 pivotably attached to a finger ring member 1304. The ratchet mechanism 1310 includes a slidably disposed cam button 1312, a pivotably disposed, nearly vertical pawl lever 1314 (pivoting about a transverse pivot pin 1314b), and a pivotably disposed defeat switch member 1316 in an upper region of the finger ring member 1304. A ratchet-toothed member 1318 is disposed in the thumb ring member 1302, proximally adjacent the pawl lever 1314. In the neutral/engaged position shown in FIG. 13A, a lower end 1314a of the pawl lever 1314 is engaged with the teeth of the ratchet-toothed member 1318. As depicted in FIG. 13B, in order to release the pawl lever 1314 from engagement with the ratchet-toothed member 1318, a user may depress the cam button 1312 in a proximal direction against the pawl lever 1314, which levers it (1314) about the transverse pivot pin 1314b such that the lower pawl lever 1314a is disengaged from the ratchet-toothed member 1318. FIG. 13C illustrates that the ratchet engagement may be defeated by depressing the cam button 1312 into the released state, and then pivoting the defeat switch member 1316 such that its distal end 1316a engages with a defeat-lock notch 1312a on the cam button 1312.

FIGS. 14A-14C illustrate a handle 1400 housing a tenth embodiment of a ratchet mechanism 1410. The handle includes a thumb ring member 1402 pivotably attached to a finger ring member 1404. The ratchet mechanism 1410 includes a curved ratchet-toothed arm 1412 projecting distally from the thumb ring member 1402 and slidably mounted therein. It (1410) also includes a release lever 1406 pivotably mounted to the finger ring member 1404 and a pawl member 1414 pivotably attached to the finger ring member 1404, the pawl member 1414 including a proximally projecting pawl arm 1416. The lower lever end 1406a of the release lever 1406 is engaged for slidable/pivotable operation with the upper end 1414a of the pawl member 1414 as a pin 1406b on the lower lever end 1406a engages a closed slot 1414b on the upper pawl member end 1414a. The thumb ring member 1402 includes a defeat slider button 1422 that is attached (through a groove 1402a) to the curved ratchet-toothed arm 1412, and which is configured to move the curved ratchet-toothed arm 1412 generally vertically relative to the thumb ring member 1402. In the neutral/engaged state illustrated in FIG. 14A, the pawl arm 1416 is biased into engagement (e.g., by a torsion spring) with the ratchet-toothed arm 1412, which is in an upper position within the groove 1402a. As illustrated in FIG. 14B the ratchet mechanism 1410 may be released by a user depressing the release lever 1406 such that its upper end 1414a moves generally proximally relative to the finger ring member 1404, which moves the lever pin 1406b in the pawl slot 1414b such that the pawl member 1414 pivots up and disengages the pawl arm 1416 from the ratchet-toothed arm 1412. In the ratchet-defeated state depicted in FIG. 14C, the defeat slider button 1422 is moved downward in the groove 1402a, defeating the engagement of the ratchet-toothed arm 1412 with the pawl arm 1416. As also shown in FIG. 14C, in this embodiment, it is not necessary to release the ratchet engagement (e.g., by depressing the release lever 1406) before defeating the ratchet mechanism 1410.

FIGS. 15A-15B illustrate a handle 1500 housing an eleventh embodiment of a ratchet mechanism 1510. The handle includes a thumb ring member 1502 pivotably attached to a

finger ring member 1504. The ratchet mechanism 1510 includes a curved ratchet-toothed arm 1512 projecting distally from the thumb ring member 1502, a pawl arm 1514 pivotably attached to the finger ring member 1504, and a cam lever 1516 pivotably connected to the pawl arm 1514. A proximal end 1514a of the pawl arm 1514 preferably is biased into engagement with the ratchet-toothed arm 1512 (e.g., by a torsion or leaf spring, not shown). A distal end region of the pawl arm 1514 includes an elongate aperture 1514b that engages a transverse pin 1514c attached to the finger ring member 1504. In the neutral/engaged state illustrated in FIG. 15A, the proximal pawl arm end 1514a is engaged with the ratchet-toothed arm 1512, and the transverse pin 1514c is in the bottom end of the elongate aperture 1514b. To reach the ratchet-released state depicted in FIG. 15B, a user actuates the pawl arm 1514 proximally and slightly downward until the transverse pin 1514c is in the top end of the elongate aperture 1514b, which levers the proximal pawl arm end 1514 out of engagement from the ratchet-toothed arm 1512. To reach the ratchet-defeated state depicted in FIG. 15C, a user actuates the pawl arm 1514 into the released state, and then pivots the cam lever 1516 distally and downward. In the defeated state, it is preferable that the contact between the cam lever 1516, the pawl arm 1514, and the finger ring member 1504 be configured to form a frictional lock sufficient to resist the bias of the pawl arm 1514 toward engagement with the ratchet-toothed arm 1512.

FIGS. 16A-16C illustrate a handle 1600 housing a twelfth embodiment of a ratchet mechanism 1608. The handle 1600 includes a thumb ring member 1602 pivotably attached to a finger ring member 1604. The ratchet mechanism 1608 includes a pivotably disposed cam trigger 1612, a pivotably disposed pawl member 1614 (pivoting about a transverse pivot pin 1614b), and a pivotably disposed defeat switch member 1616 in an upper, longitudinal region of the finger ring member 1604. A ratchet-toothed member 1618 is disposed in the thumb ring member 1602, proximally adjacent the pawl member 1614. The finger ring member 1604 includes a proximal cavity 1604a configured to receive a distal end portion of the ratchet-toothed member 1618 when the handle members 1602, 1604 are drawn together. The pawl member 1614 is generally L-shaped, with a small camming protrusion 1614a projecting distally from its upper end and is mounted on the pivot pin 1614b. In the neutral/engaged position shown in FIG. 16A, the pawl member 1614 preferably is biased (e.g., by a spring or other biasing means, not shown) such that a lower end 1614c is engaged with the teeth of the ratchet-toothed member 1618. As depicted in FIG. 16B, in order to release the pawl lever 1614 from engagement with the ratchet-toothed member 1618, a user may depress the cam trigger 1612 in a proximal direction against the camming protrusion 1614a of the pawl member 1614. The proximal surface of the cam trigger 1612 preferably is angled so that its contact with the camming protrusion 1614a levers the lower pawl member end 1614c away from the ratchet-toothed member 1618. FIG. 16C illustrates that the ratchet engagement may be defeated by depressing the cam trigger 1612 into the released state, and then pivoting the defeat switch member 1616 such that its proximal end 1616a engages with a defeat-lock notch 1614d on the cam trigger 1612.

FIGS. 17A-17C illustrate a handle 1700 housing a thirteenth embodiment of a ratchet mechanism 1708. The handle includes a thumb ring member 1702 pivotably attached to a finger ring member 1704. The ratchet mechanism 1708 includes a generally arcuate ratchet lever member 1710 that has a curved ratchet-toothed arm 1712 projecting generally proximally from the finger ring member 1704 and a trigger

arm 1716 projecting generally distally from the finger ring member 1704. A defeat switch 1718 is disposed below and slightly distally from the trigger arm 1716. The ratchet lever member 1710 includes a pivoting connection 1710a to the finger ring member 1704, the connection 1710a being disposed near the longitudinal midpoint of both the ratchet lever member 1710 and the finger ring member 1704. The ratchet mechanism 1708 also includes a fixed pawl arm 1714 projecting generally distally from the thumb ring member 1702. The ratchet lever member 1710 preferably is biased (e.g., by a torsion or leaf spring, or other biasing means, not shown) such that the curved ratchet-toothed arm 1712 engages the pawl arm 1714 when the handle 1700 is in a neutral state as shown in FIG. 17A. In the ratchet-released state shown in FIG. 17B, a user depresses proximally the trigger arm 1716 of the ratchet lever member 1710, thereby levering the curved ratchet-toothed arm 1712 out of engagement with the pawl arm 1714. In the ratchet-defeated state depicted in FIG. 17C, the ratchet lever member 1710 is moved to the released state shown in FIG. 17B, then the user may pivot the defeat switch 1718 to contact the underside of the ratchet lever member 1710 to hold it (1710) in place. The defeat switch 1718 preferably includes a frictional or other locking means to maintain it in the released/defeated position (e.g., an internal locking spring, a pin-groove lock, or other locking means known to those of skill in the art).

Those of skill in the art will appreciate that there are known means for controlling the relative position/bias of the ratchet members disclosed above that are appropriate for use within the scope of the present invention, and that different materials may be useful in embodiments of the present invention. Those of skill in the art will also appreciate that, for handle embodiments of the present invention, the thumb ring member and/or the finger ring member may not actually require a closed ring structure, but may include an open ring or other-shaped support structure for a user's thumb and fingers, respectively. It is intended that the foregoing detailed description be regarded as illustrative rather than limiting. It should be understood that the following claims, including all equivalents, are intended to define the spirit and scope of this invention.

We claim:

1. A surgical instrument having a handle operatively connected to an elongate shaft, the handle comprising:
  - a thumb ring member pivotably connected to a finger ring member;
  - a first engagement member fixed in and projecting generally distally from the thumb ring member;
  - a second engagement member pivotably mounted to and projecting generally proximally from the finger ring member, a first end portion of the second engagement member being biased into engagement with the first engagement member and defining an engaged state; and
  - an elongate cam member pivotably connected to the finger ring member and comprising an operative contact with a second end portion of the second engagement member; wherein, the elongate cam member is at a first angle relative to the second engagement member, the operative contact is sufficient to pivot the second engagement member so as to overcome the biased engagement of the second engagement member with the first engagement member defining a released state; wherein, when the elongate cam member is at a second angle relative to the second engagement member, the operative contact is sufficient to pivot the second engagement member so as to overcome the biased engagement of the second engagement member with the first engagement member and is sufficient to bias

the second engagement member out of engagement with the first engagement member defining a defeated state; and

wherein the elongate cam member, first engagement member, and second engagement member are configured such that, when the handle occupies the engaged state, the elongate cam member is disposed intermediate the first angle and the second angle.

2. The surgical instrument of claim 1, wherein the operative contact of the handle to the elongate shaft comprises:

an externally indexed rotation knob attached to an exterior surface of the elongate shaft, the knob configured to rotate the elongate shaft around its longitudinal axis; and a rotation-permitting retaining connection of the second handle member to the elongate shaft.

3. The surgical instrument of claim 2, further comprising: an indexed detent connection of the second handle member to the elongate shaft, the indexed detent connection comprising:

a ball detent disposed in a cavity adjacent a distal end of the second handle member;

a longitudinally grooved exterior surface portion near the proximal end of the elongate shaft; and

an o-ring, said o-ring retaining the ball detent in the cavity and biasing the ball detent into indexing contact with the longitudinally grooved exterior surface portion of the elongate shaft.

4. The surgical instrument of claim 1, wherein the elongate shaft comprises an actuation rod extending longitudinally therethrough and the actuation rod includes a proximal-end rod-retention structure that is of greater diameter than a majority length of the actuation rod; and

the thumb ring member comprising an actuation rod retainer, the actuation rod retainer including a distal keyhole groove configured to retain the proximal-end retention structure.

5. The surgical instrument of claim 4, further comprising a generally tubular bearing member disposed at least partially around a proximal portion of the actuation rod.

6. The surgical instrument of claim 5, wherein the generally tubular bearing member provides electrical insulation around at least a proximal portion of the actuation rod.

7. The surgical instrument of claim 5, wherein the generally tubular bearing member comprises a connector for retaining the actuation rod.

8. The surgical instrument of claim 4, further comprising an electrode in conductive contact with the actuation rod.

9. The surgical instrument of claim 4, wherein the proximal-end rod-retention structure is generally spherical.

10. The surgical instrument of claim 4, wherein a metal insert is disposed in the distal keyhole groove.

11. The surgical instrument of claim 1, wherein the elongate shaft comprises an actuation rod extending longitudinally therethrough and a longitudinally grooved exterior surface portion near the proximal end of the elongate shaft.

12. The surgical instrument of claim 11, wherein the finger ring member comprises a generally cylindrical bearing component disposed in an upper region thereof, the bearing component comprising:

a central longitudinal lumen through which a proximal portion of the actuation rod fully extends, a distal portion of said lumen disposed around a longitudinally grooved exterior proximal portion of the elongate shaft;

a ball detent disposed in a cavity in the distal portion of the bearing; and

a groove immediately adjacent the cavity, said groove seating an o-ring, and said o-ring being configured to retain the ball detent in the cavity and to bias the ball detent into indexing contact with the longitudinally grooved exterior proximal portion of the elongate shaft.

13. The surgical instrument of claim 12, wherein the elongate shaft is retained in the distal portion of said lumen by a threaded connector.

14. The surgical instrument of claim 1, further comprising a cushioning insert disposed on a region selected from the finger ring member, the thumb ring member, or both.

15. The surgical instrument of claim 1, further comprising a finger rest projecting generally downward from the finger ring member.

16. The surgical instrument of claim 1, further comprising a textured surface on an upper proximal surface of the thumb ring member.

17. The surgical instrument of claim 1, further comprising a textured surface on an intermediate side surface of the thumb ring member.

18. The surgical instrument of claim 1, wherein an upper portion of the thumb ring member and an upper portion of the finger ring member are configured and coupled such that an actuation rod disposed slidably through the finger ring member and connected to the thumb ring portion is shielded from contact by a hand of a user.

19. A surgical instrument having a handle operatively connected to an elongate shaft according to claim 1, wherein:

the thumb ring member comprising a plurality of raised thumb-grip ridges disposed on an upper proximal surface of the thumb ring member, said ridges configured to provide a frictional gripping surface.

20. A surgical instrument having a handle operatively connected to an elongate shaft according to claim 1, wherein:

the thumb ring member comprising a plurality of raised thumb-grip ridges disposed on an intermediate side surface of the thumb ring member, said ridges configured to provide a frictional gripping surface.

21. A surgical instrument having a handle operatively connected to an elongate shaft, the handle comprising:

a first handle member pivotably connected to a second handle member; and a ratchet mechanism removably engaging the first and second handle members, the ratchet mechanism comprising:

a ratchet-toothed engagement member fixed to and projecting generally distally from the first handle member;

an L-shaped pawl member having a camming leg portion and a pawl leg portion generally perpendicular to the camming leg portion,

the L-shaped pawl member pivotably mounted in the second handle member such that the pawl leg portion projects generally proximally from the second handle member,

an upper region of the camming leg portion comprising a generally vertical camming surface and a distally projecting camming surface;

a cam lever;

a biasing spring mounted in the second handle member and operatively contacting the L-shaped pawl member such that a proximal end region of the pawl leg portion is biased into engagement with the ratchet-toothed engagement member when the cam lever is disposed at a neutral angle; and

the cam lever pivotably connected to the second handle member, the cam lever comprising a first operative

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contact with the L-shaped pawl member such that when the cam member is disposed at a first angle relative to the L-shaped pawl member, the first operative contact is between the cam lever and the distally projecting camming surface, said first operative contact being sufficient to pivot the L-shaped pawl member so as to overcome and release the biased engagement of the pawl leg portion with the ratchet-toothed engagement member; and

wherein, when the cam lever is disposed at a second angle relative to the L-shaped pawl member, a second operative contact between the cam lever and the generally vertical camming surface is sufficient to pivot the L-shaped pawl member so as to overcome and defeat the biased engagement of the pawl leg portion with the ratchet-toothed engagement member and is also sufficient to bias the L-shaped pawl member at an angle wherein the pawl leg portion is not engaged with the ratchet-toothed engagement member; and wherein the neutral angle of the cam lever is between the first angle and the second angle relative to the L-shaped pawl member.

**22.** A method of use of a surgical instrument, the method comprising the steps of:

providing a surgical instrument having a handle, the surgical instrument handle comprising  
a thumb ring member pivotably connected to a finger ring member;  
a ratchet-toothed arm fixed in and projecting generally distally from the thumb ring member;  
an L-shaped pawl member pivotably mounted to and comprising a first end portion projecting generally proximally from the finger ring member; and  
a cam lever pivotably connected to the finger ring member and comprising an operative contact with a second end portion of the pawl member, the first end portion of the pawl member being spring-biased by a spring into engagement with the ratchet-toothed arm when the cam lever is at a default first angle relative to the finger ring member;  
pivoting the cam lever to a second angle relative to the finger ring member, wherein the operative contact is sufficient to pivot the pawl member so as to overcome the spring bias and release the engagement of the first end portion of the pawl member with the ratchet-toothed arm; and  
pivoting the cam lever to a third angle relative to the finger ring member so that the spring biases the second end portion of the pawl member against the cam lever such that the engagement of the first end portion of the pawl member with the ratchet-toothed arm is defeated, wherein the position of the cam lever at the default first angle is between position of the cam lever at the second angle and at the third angle.

**23.** A surgical instrument having a handle ratchet mechanism with a single-button release/defeat feature, the handle ratchet mechanism comprising:

a first engagement member;  
a second engagement member pivotably mounted to a handle portion and projecting toward the first engagement member;

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a spring member biasing a first end portion of the second engagement member into engagement with the first engagement member; and

a cam button pivotably connected to the handle portion and comprising an operative contact with a second end portion of the second engagement member;

wherein, when the cam button is at a first angle relative to the second engagement member, the operative contact is sufficient to pivot the second engagement member so as to overcome the biased engagement of the second engagement member with the first engagement member;

wherein, when the cam button is at a second angle relative to the second engagement member, the operative contact is sufficient to pivot the second engagement member so as to overcome the biased engagement of the second engagement member with the first engagement member and is sufficient to bias the second engagement member out of engagement with the first engagement member; and

wherein when the cam button is at a third angle, between the first and second angles, the operative contact permits the biased engagement of the second engagement member with the first engagement member.

**24.** A surgical instrument having a handle operatively connected to an elongate shaft, the handle comprising:

a thumb ring member pivotably connected to a finger ring member;

a toothed first engagement member comprised by the thumb ring member;

a second engagement member pivotably mounted in the finger ring member; and

an elongate cam member movably connected to the finger ring member and comprising an operative contact with a second end portion of the second engagement member;

wherein a first end portion of the second engagement member is biased into engagement with the toothed first engagement member by a spring member when the elongate cam member is disposed in a neutral position;

wherein, when the elongate cam member is in a first position relative to the second engagement member, the operative contact is sufficient to move the second engagement member such that the operative contact provides a force sufficient to overcome the biased engagement of the second engagement member with the toothed first engagement member;

wherein, when the elongate cam member is in a second position relative to the second engagement member, the operative contact is sufficient to move the second engagement member so as to overcome the biased engagement of the second engagement member with the first engagement member and is sufficient to bias the second engagement member out of engagement with the first engagement member; and

wherein the neutral position of the elongate cam member is between the first position and the second position.

\* \* \* \* \*

专利名称(译)	手术设备		
公开(公告)号	<a href="#">US7846177</a>	公开(公告)日	2010-12-07
申请号	US11/474792	申请日	2006-06-26
[标]申请(专利权)人(译)	DAVID木匠 勒米厄ERIN ANNE 斯科拉布洛克 BOOTH大卫· LEONARD ROBERT LOOPER ANTHONY TOMMASINI JOSEPH		
申请(专利权)人(译)	DAVID木匠 勒米厄ERIN-ANNE 斯科拉布洛克 BOOTH大卫· LEONARD ROBERT LOOPER ANTHONY TOMMASINI JOSEPH		
当前申请(专利权)人(译)	CAREFUSION 2200 , INC.		
[标]发明人	CARPENTER DAVID LEMIEUX ERIN ANNE SKORA BROOKE BOOTH DAVID J LEONARD ROBERT F LOOPER ANTHONY TOMMASINI JOSEPH		
发明人	CARPENTER, DAVID LEMIEUX, ERIN-ANNE SKORA, BROOKE BOOTH, DAVID J. LEONARD, ROBERT F. LOOPER, ANTHONY TOMMASINI, JOSEPH		
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代理机构(译)	BRINKS霍费尔GILSON & LIONE		
其他公开文献	US20070299469A1		
外部链接	<a href="#">Espacenet</a> <a href="#">USPTO</a>		

#### 摘要(译)

提供了一种腹腔镜手术装置，包括棘轮机构。棘轮机构包括单个按钮或杠杆，其可用于释放或阻止棘轮接合。

