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(54) **OPEN LOOP POLYPECTOMY SYSTEM**

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(60) Provisional application No. 62/377,743, filed on Aug. 22, 2016, provisional application No. 61/648,312, filed on May 17, 2012, provisional application No. 61/583,785, filed on Jan. 6, 2012.

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(52) **U.S. Cl.**

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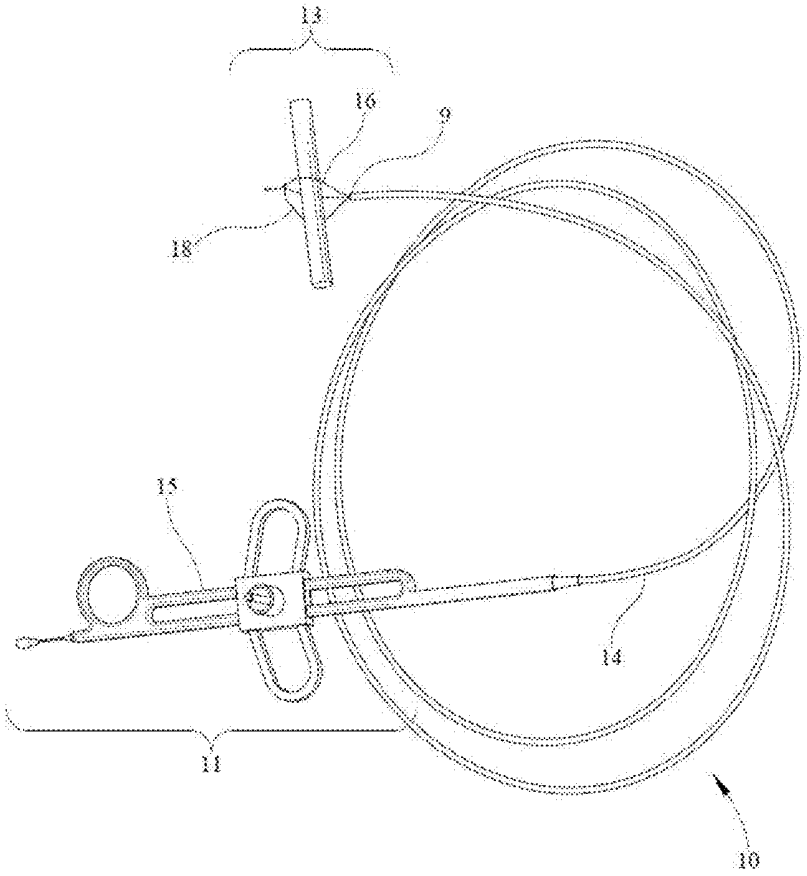
(57) **ABSTRACT**

Embodiments of this invention relate to endoscopic and laparoscopic surgical instruments. More specifically, embodiments of this invention relate to an open loop polypectomy system including a means for securely closing the loop. In some embodiments, the open loop polypectomy system comprises a snare wire and a capture mechanism wherein, when the snare wire is advanced, the snare wire extends from a distal portion of the open loop polypectomy system along a path passing through the capture mechanism. After the snare wire has advanced through the plane of the capture mechanism, retraction of the capture mechanism secures the snare wire, creating a formed loop around a target tissue. Retraction of at least one of the snare wire and capture mechanism contracts the formed loop, resecting the target tissue.



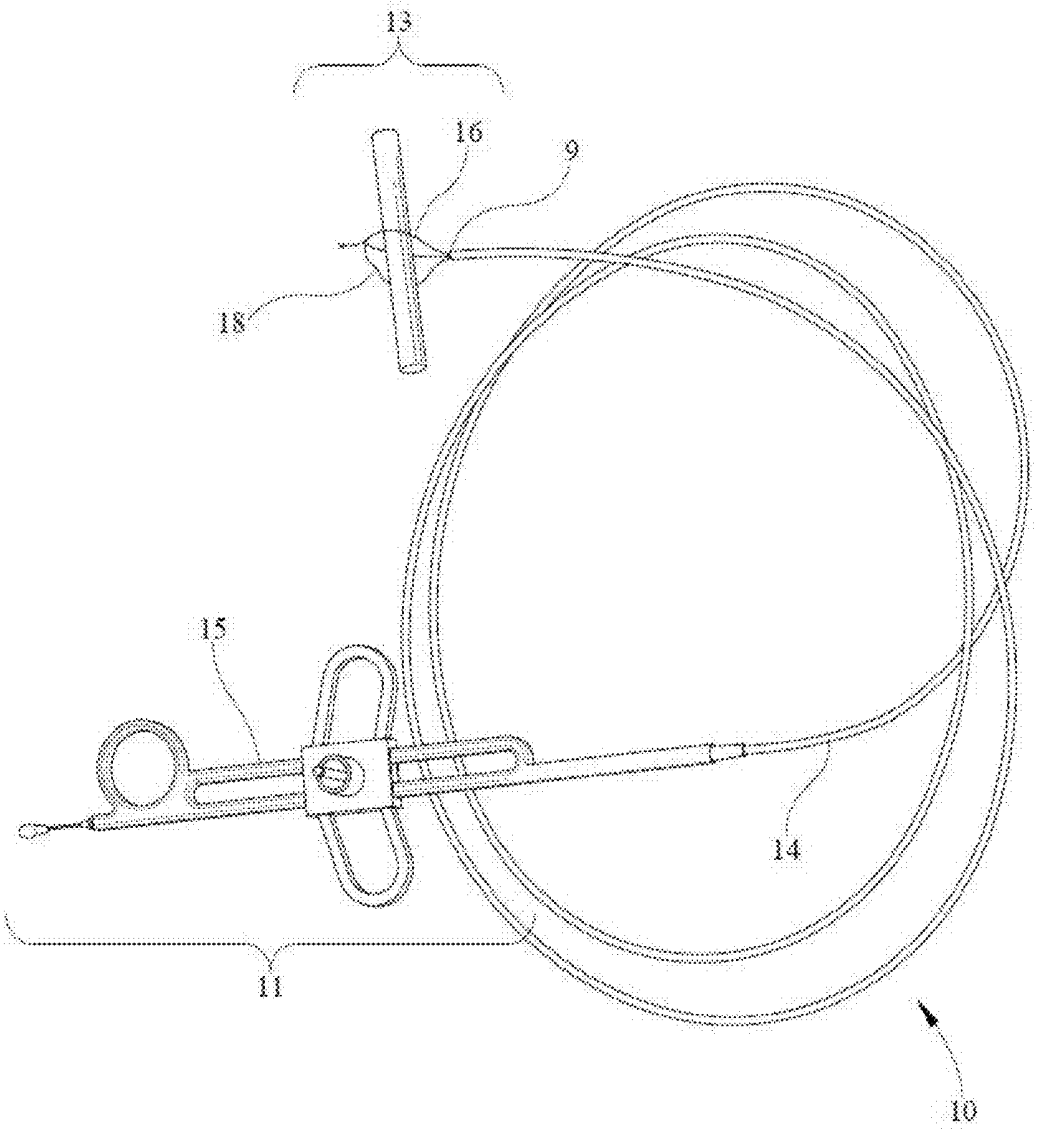


FIG. 1

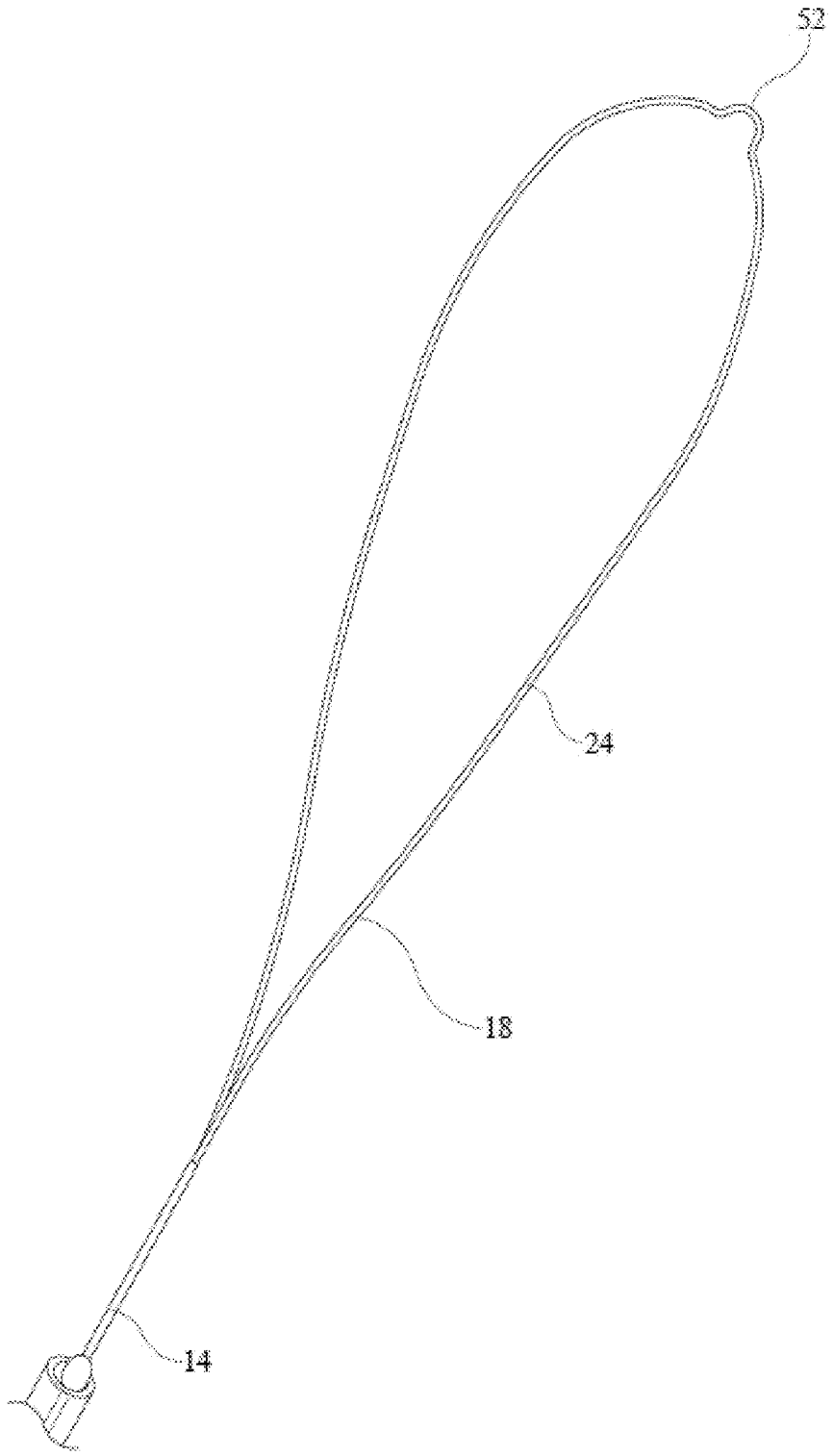


FIG. 2

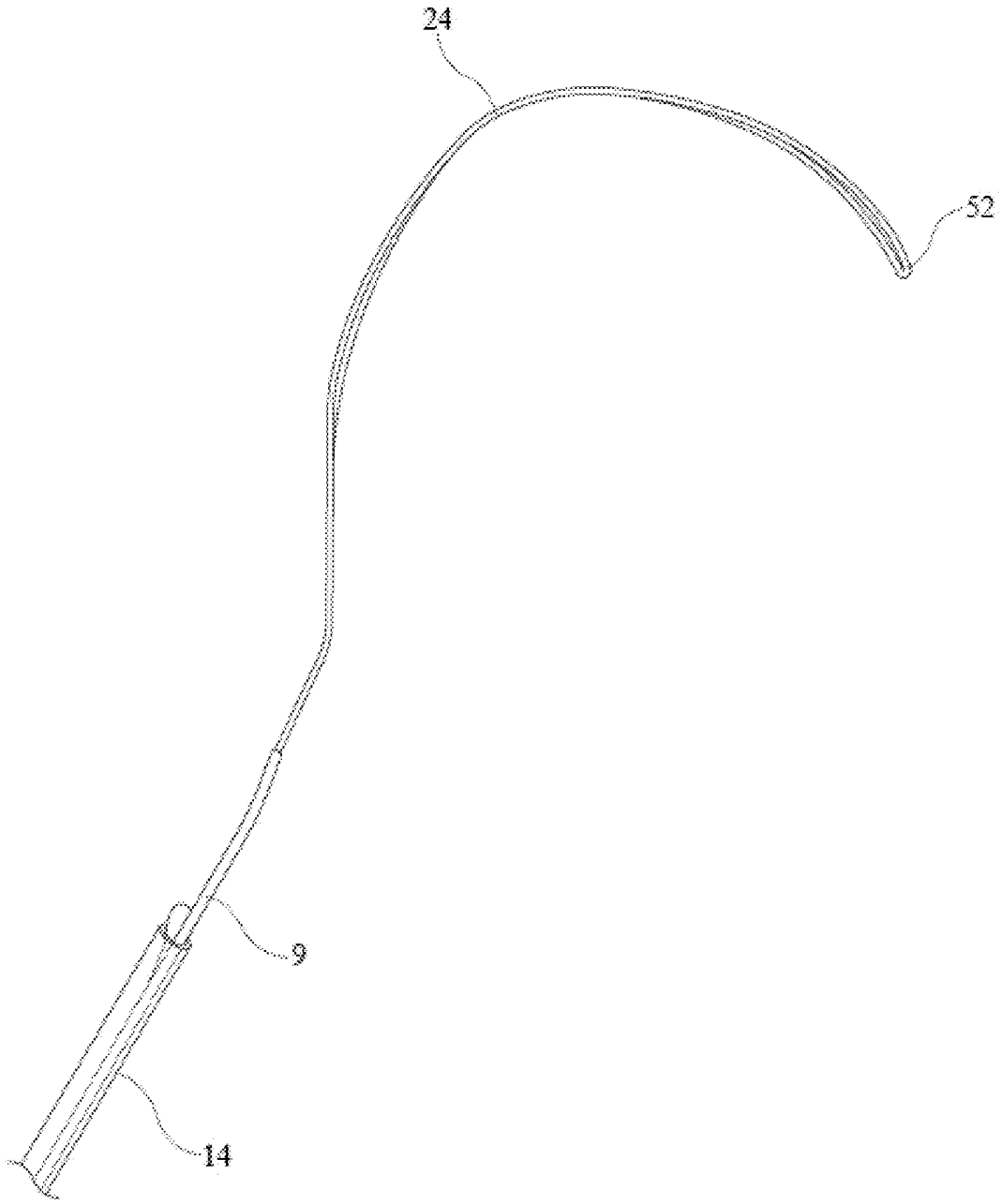


FIG. 3

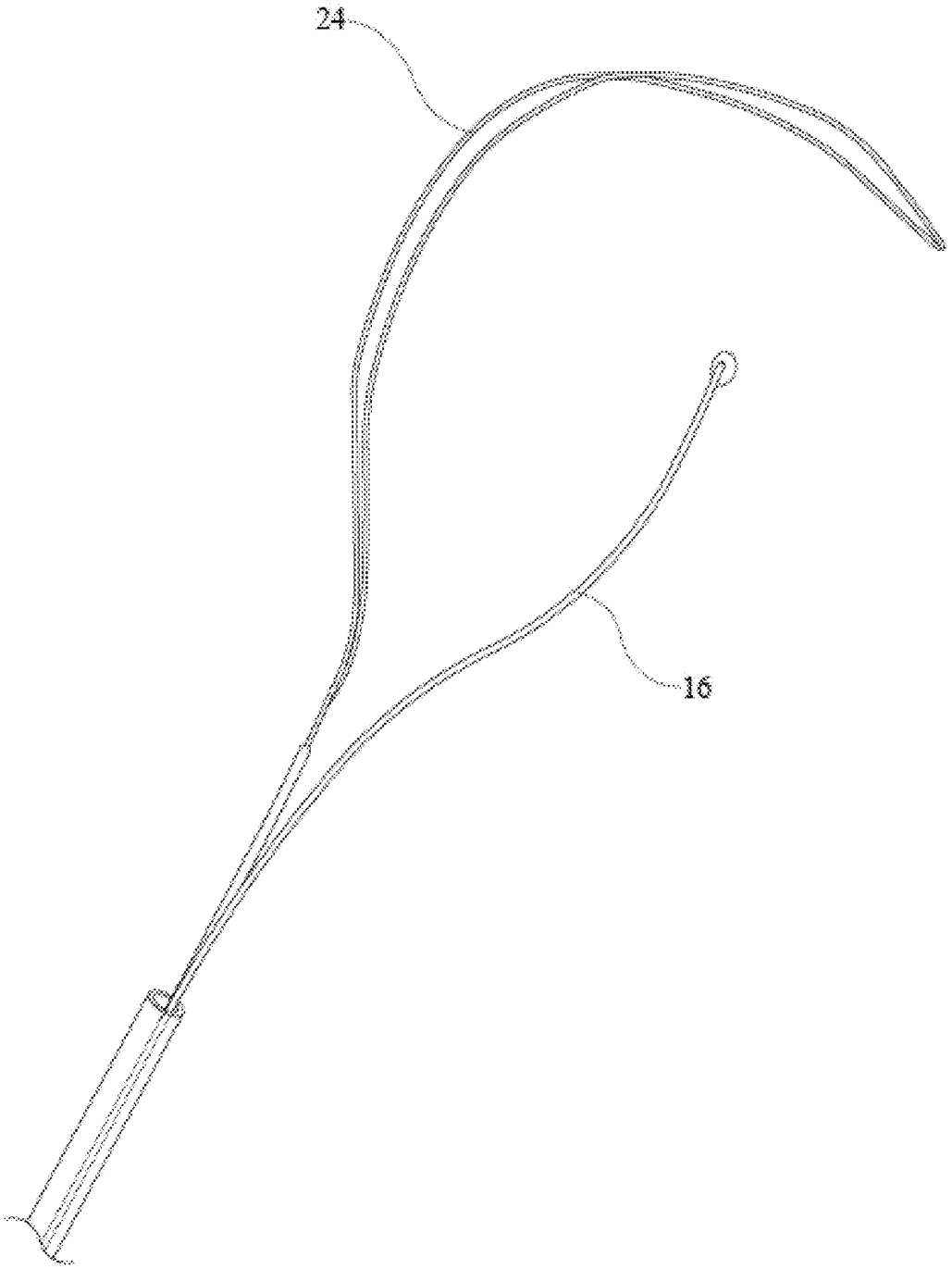


FIG. 4

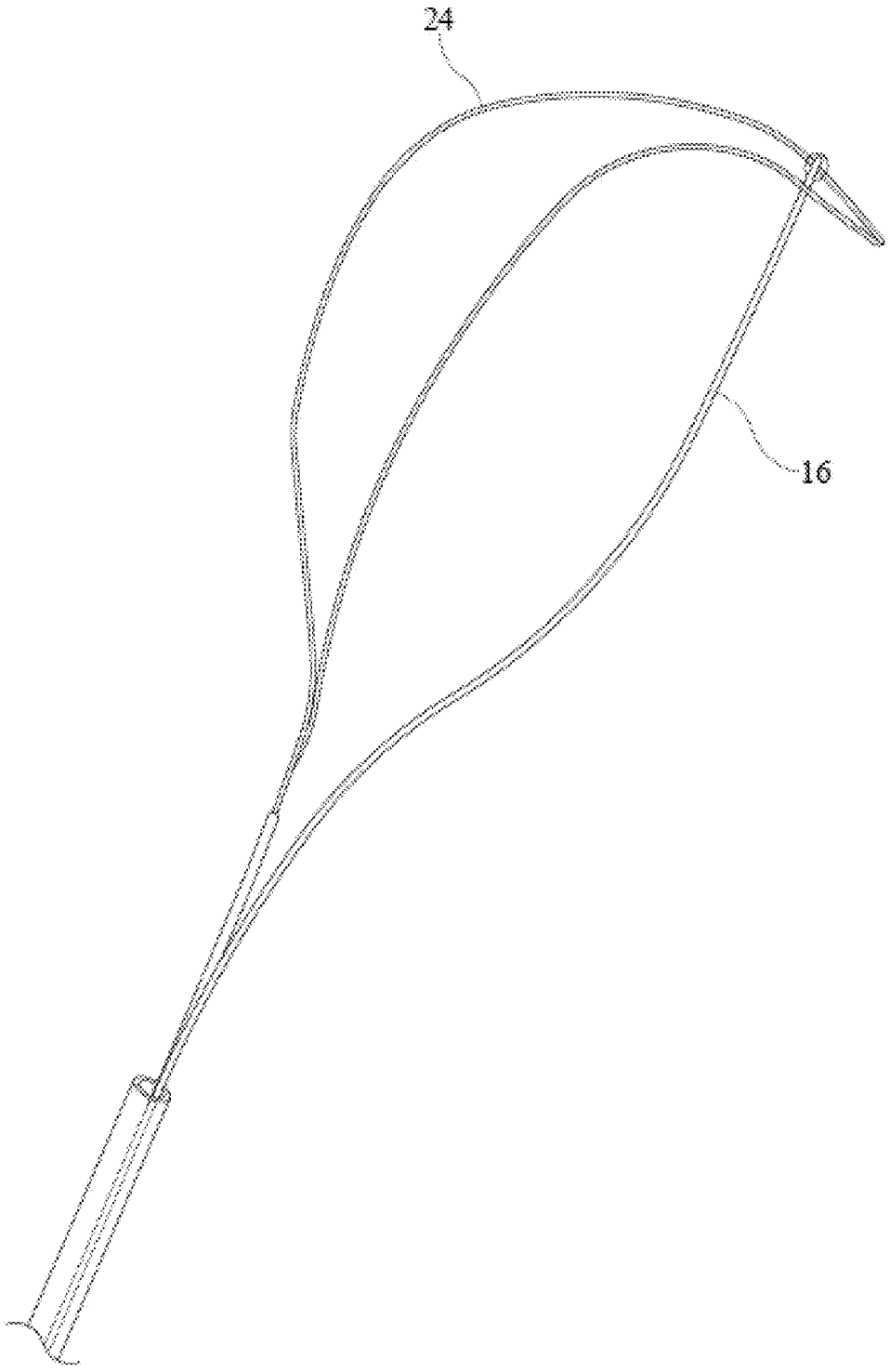


FIG. 5

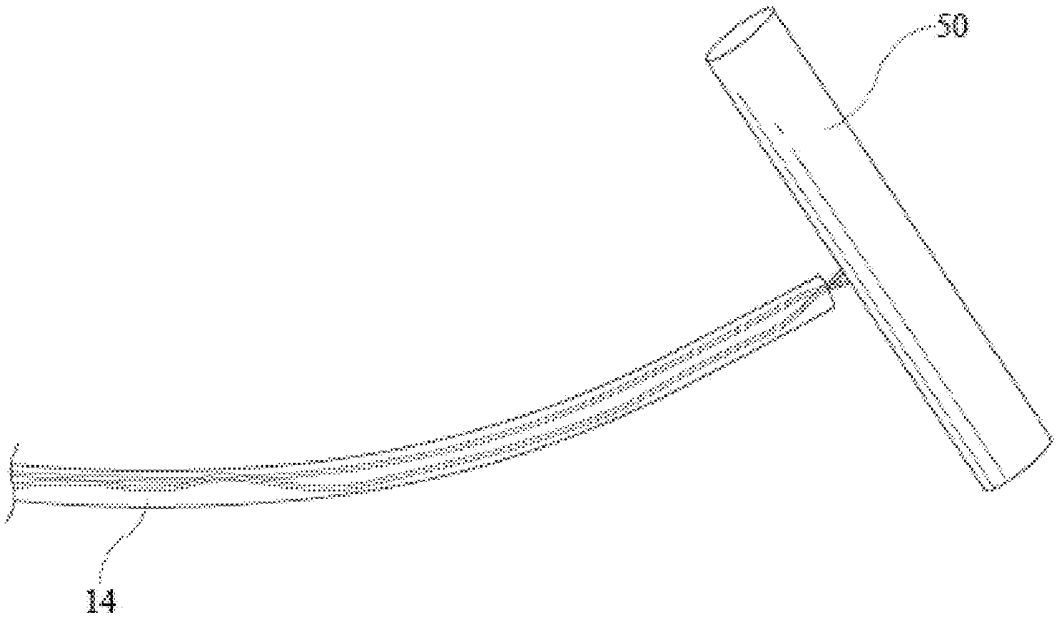


FIG. 6

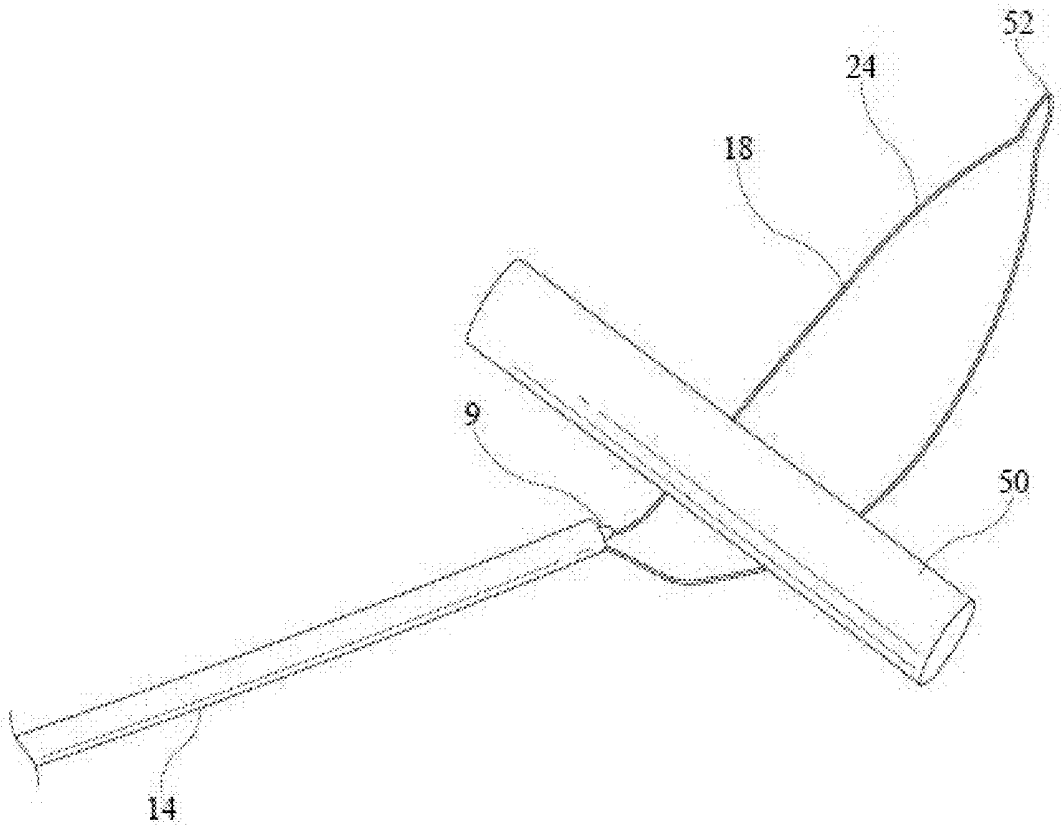


FIG. 7

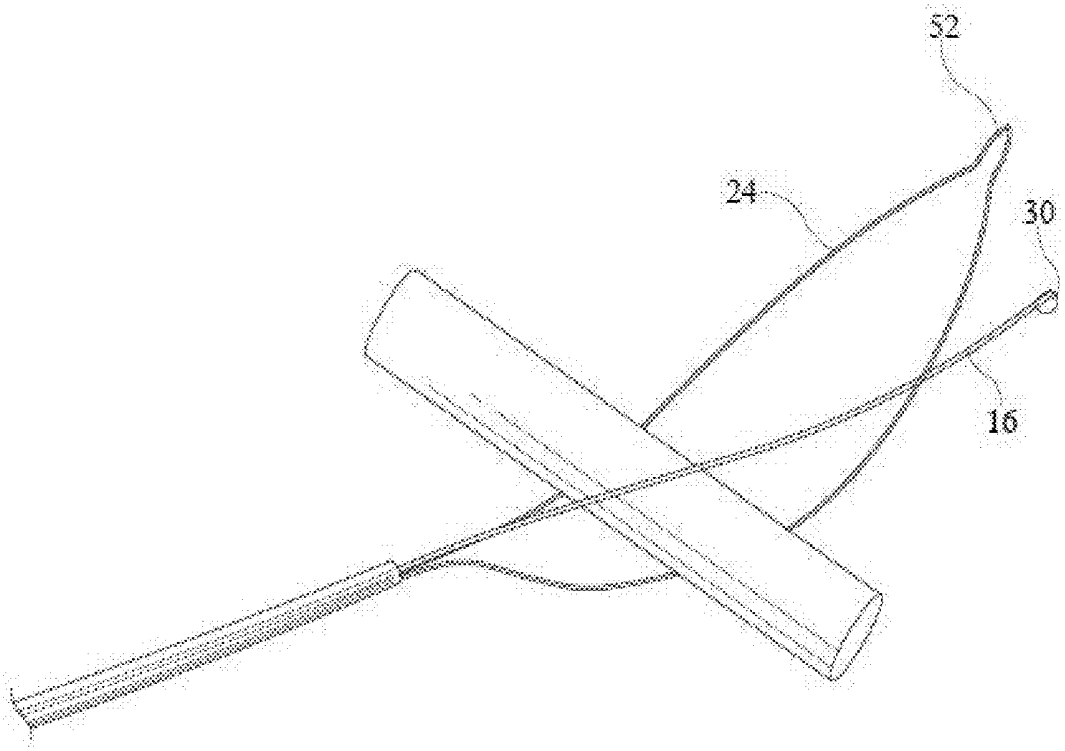


FIG. 8

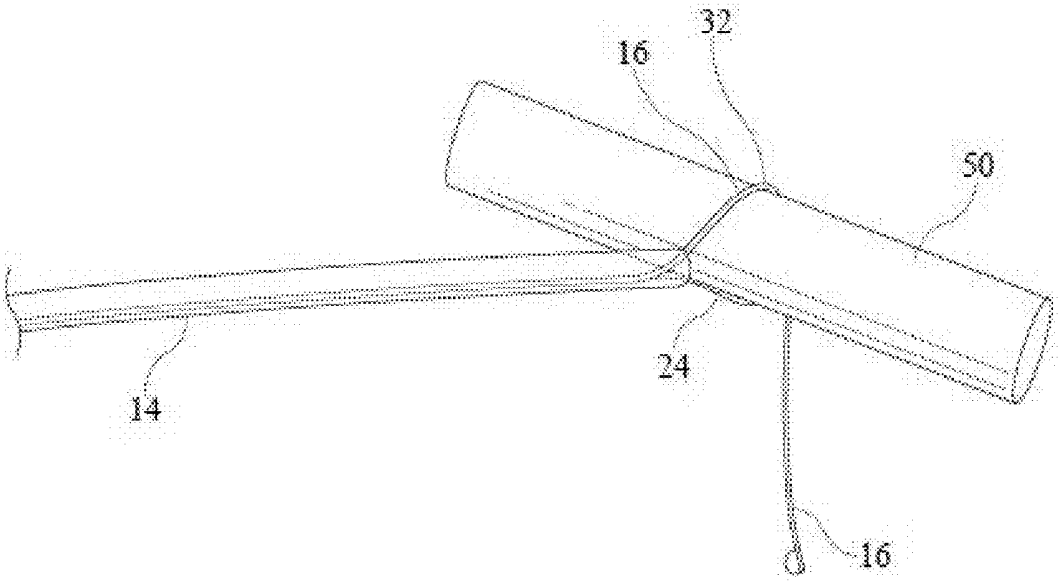


FIG. 9

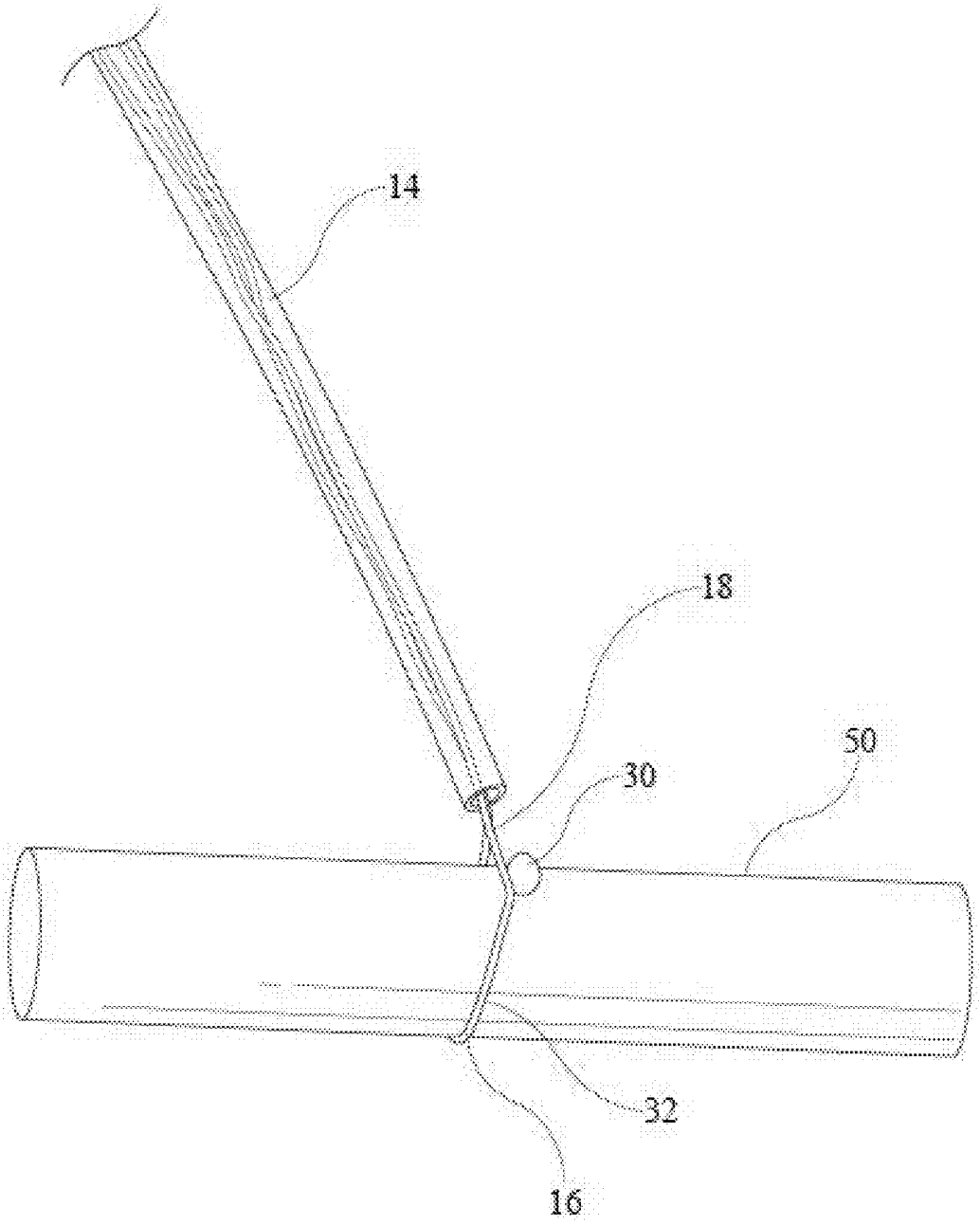


FIG. 10

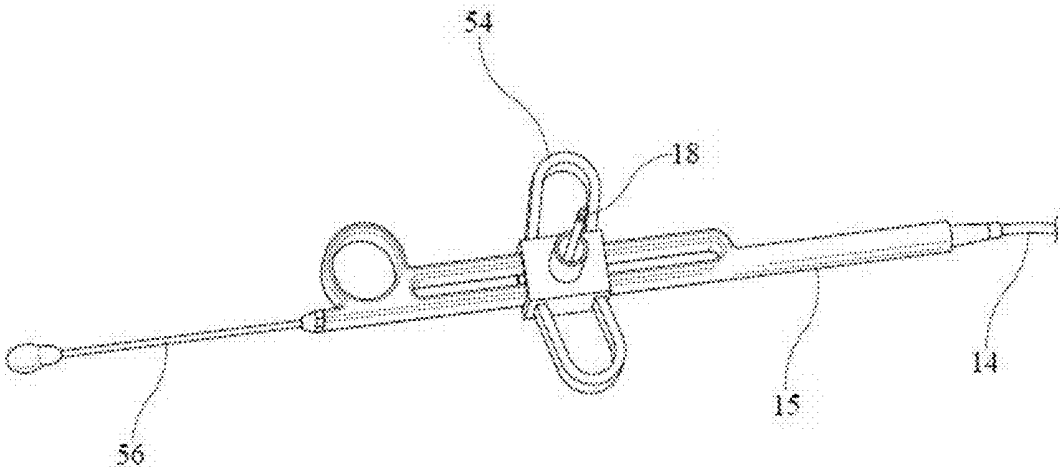


FIG. 11

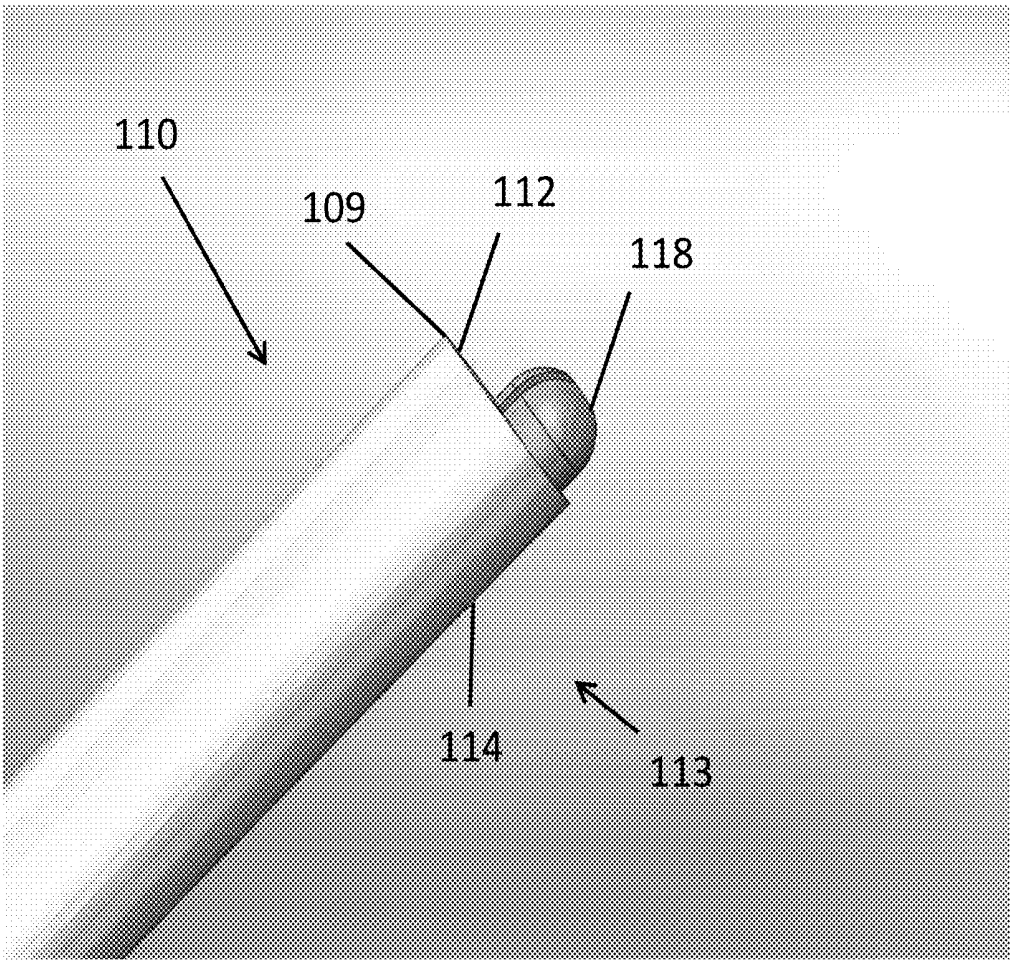


FIG. 12

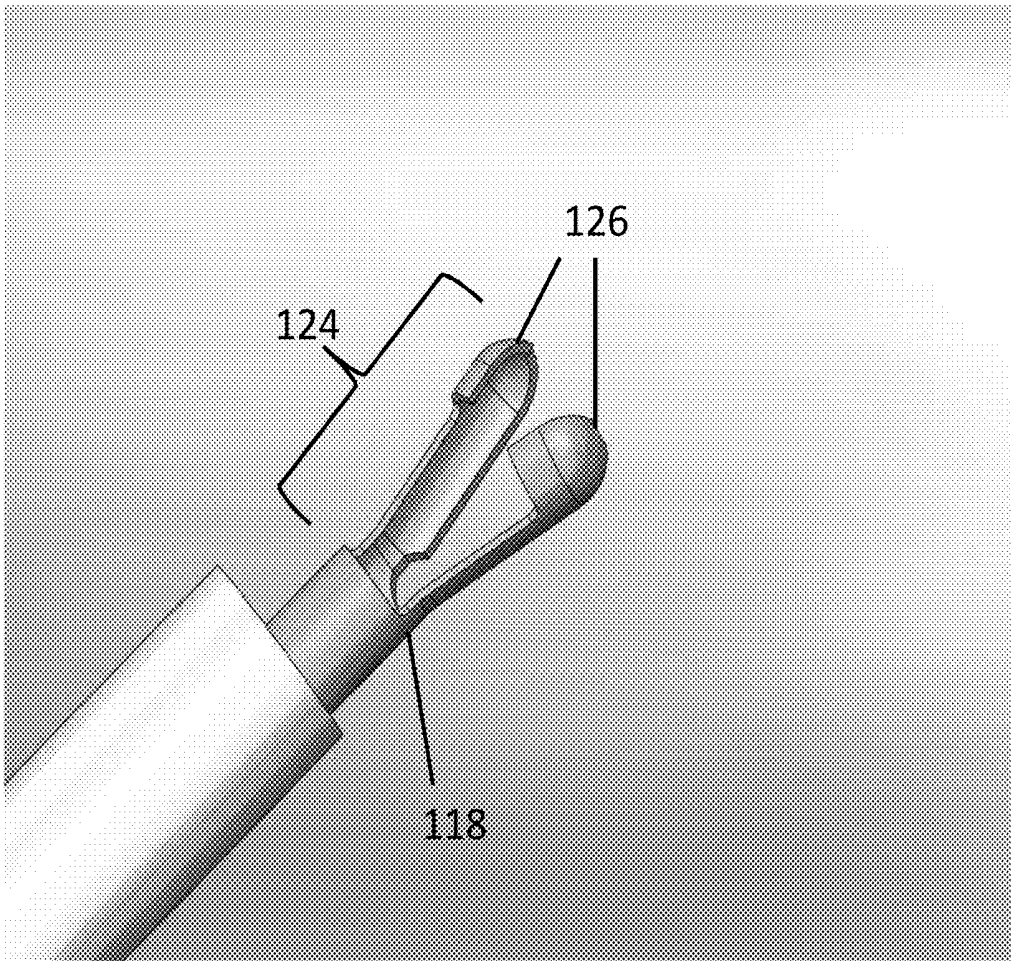
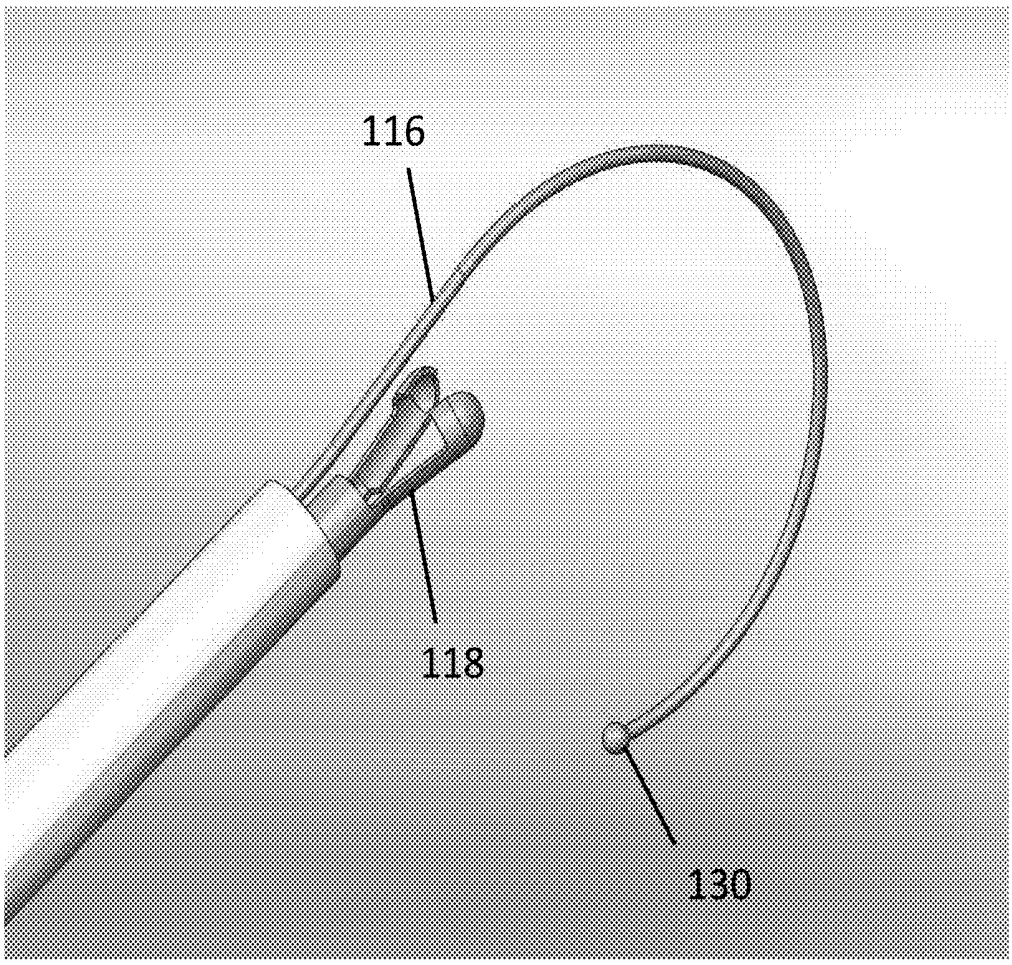


FIG. 13



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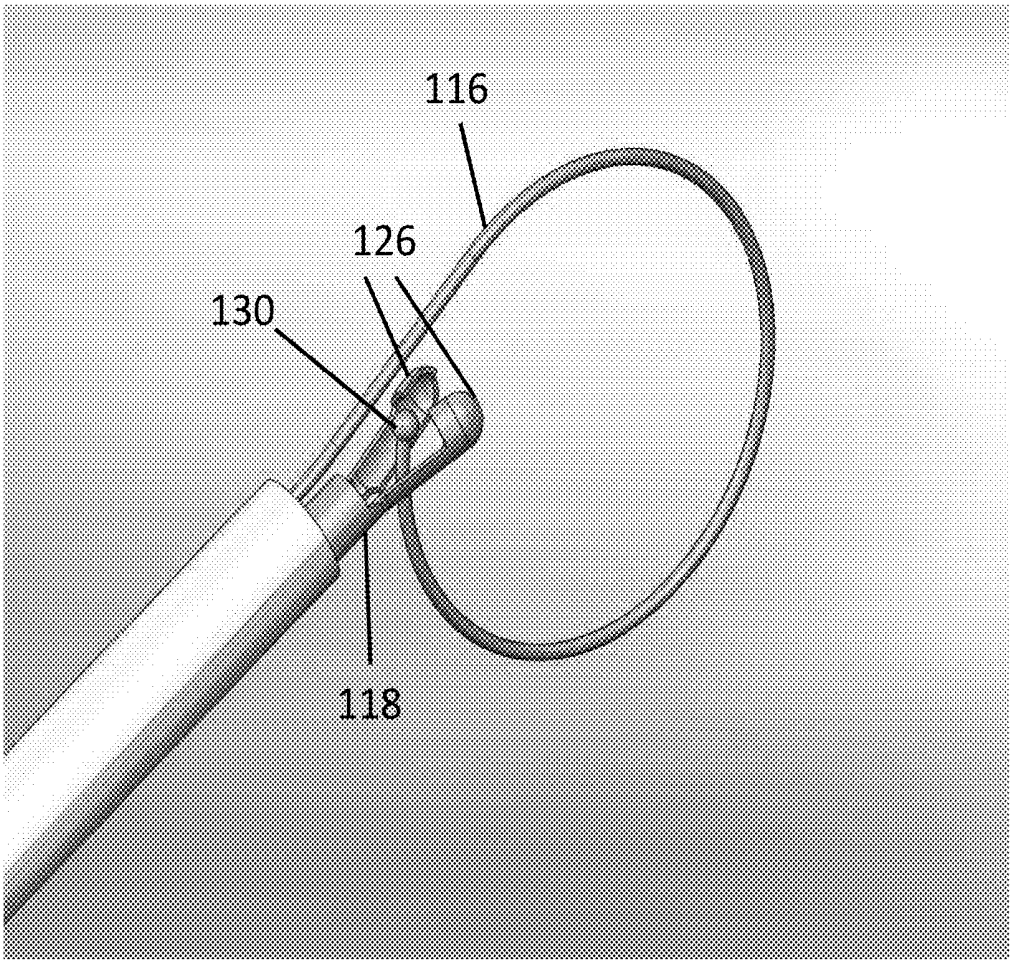


FIG. 15

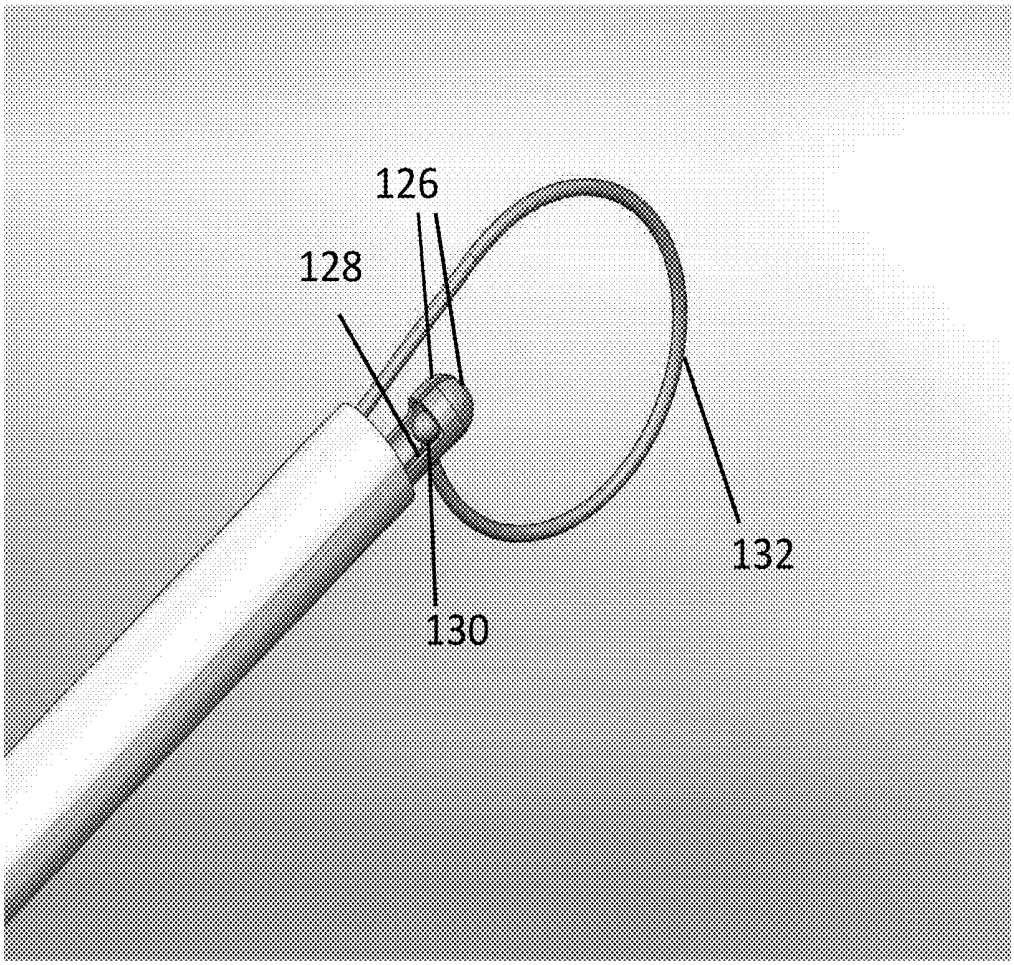


FIG. 16

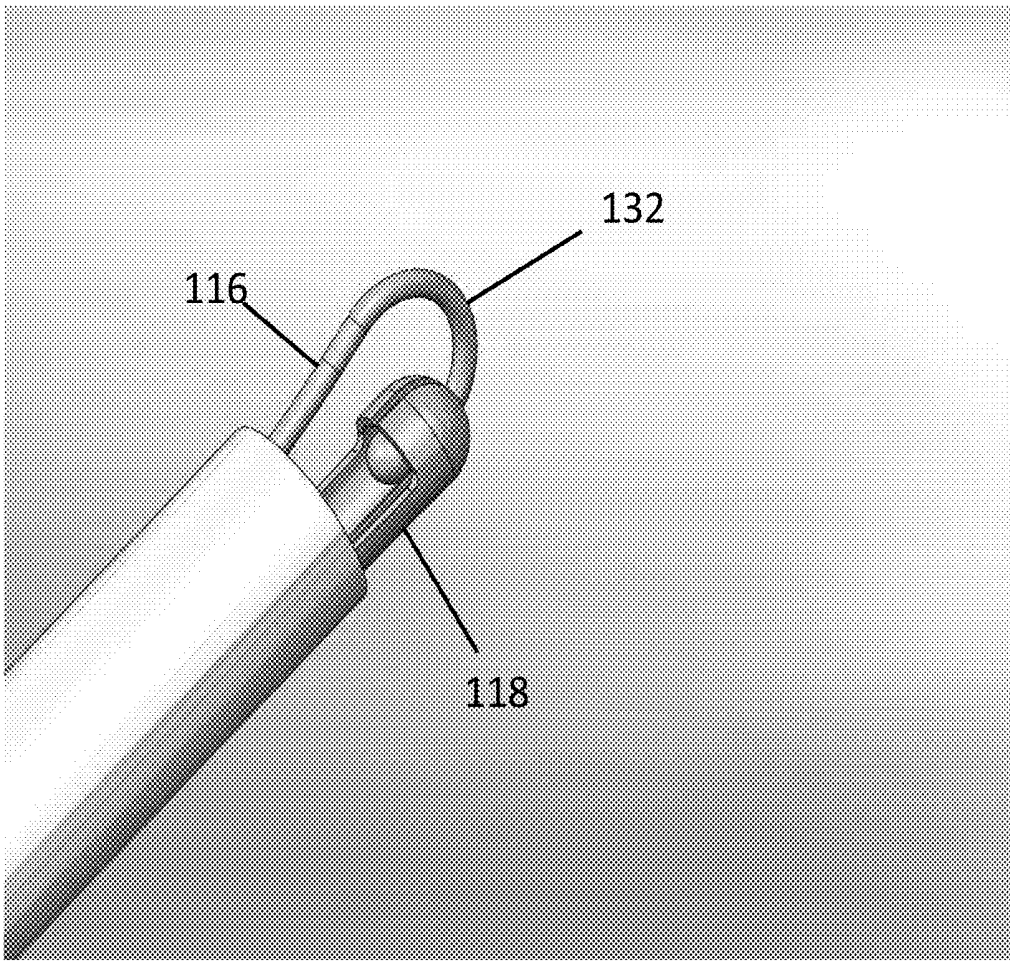
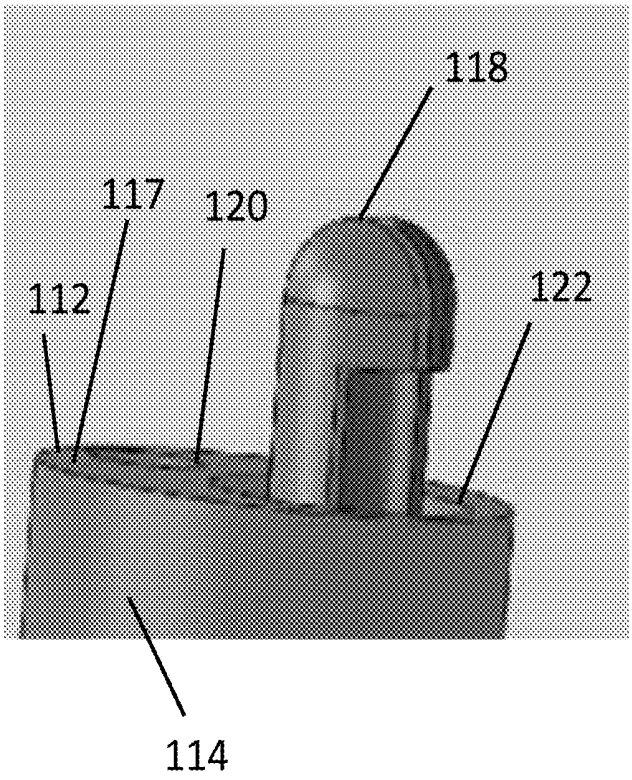


FIG. 17



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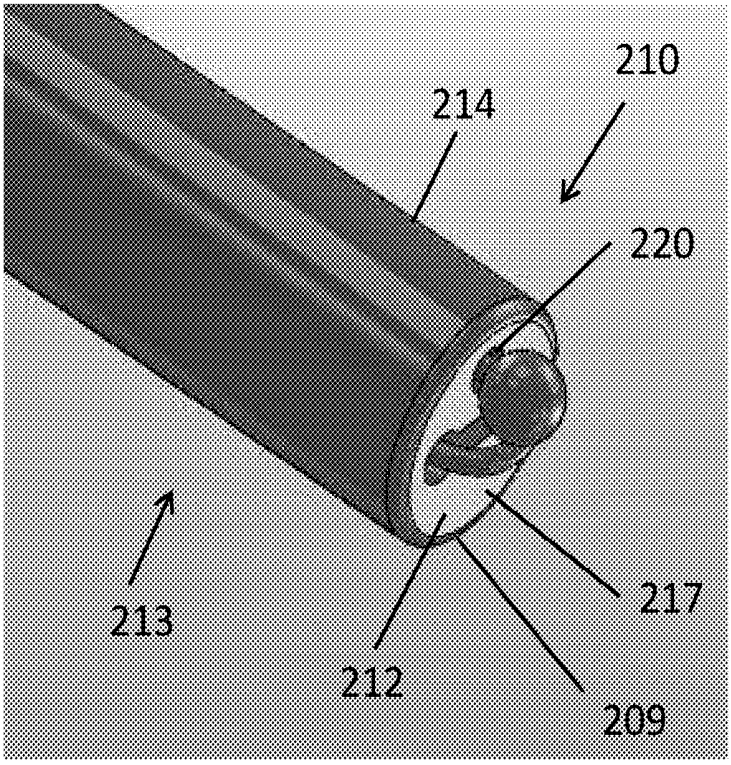


FIG. 19

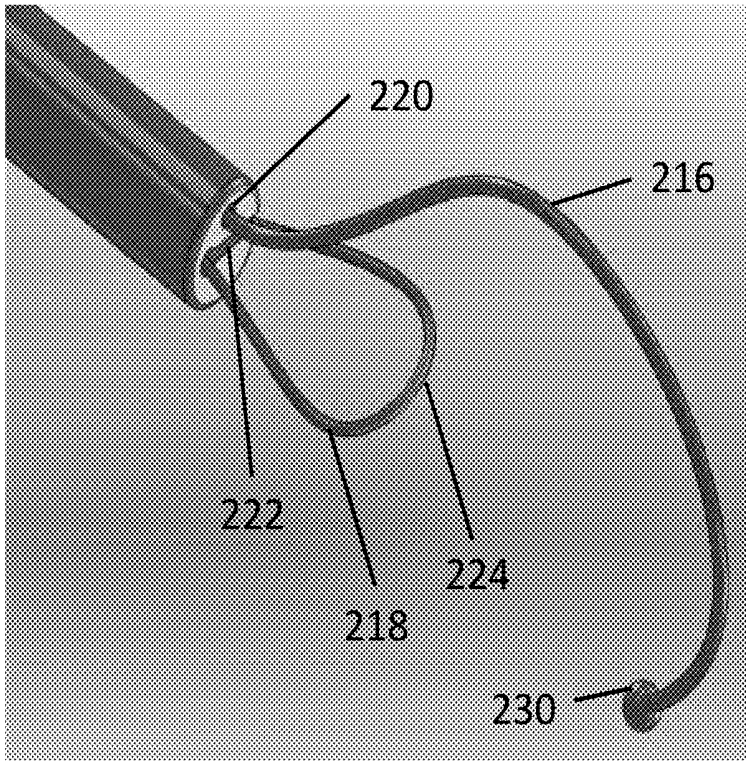
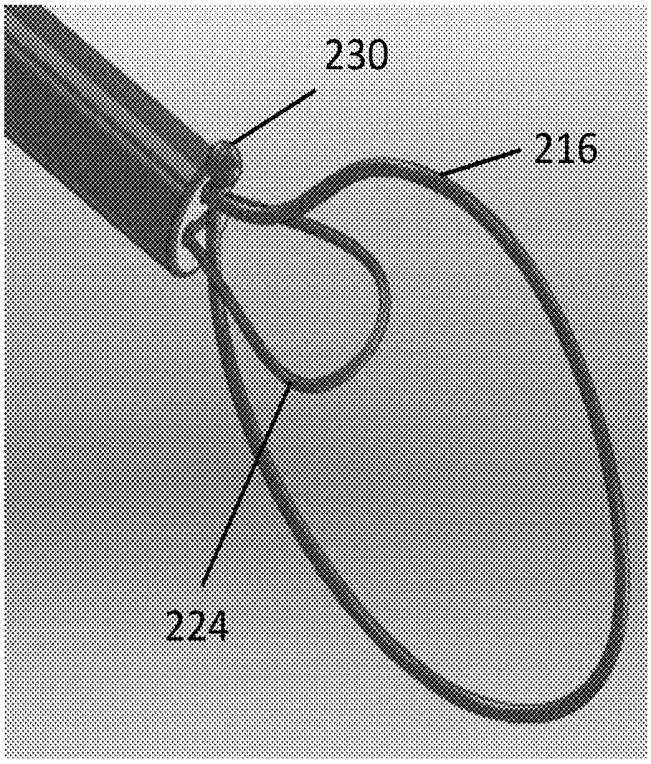


FIG. 20



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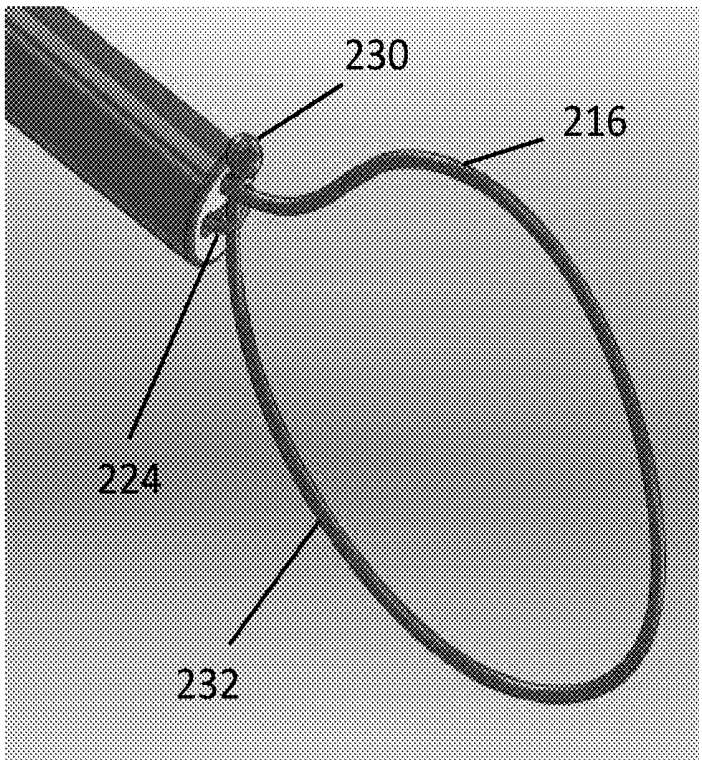

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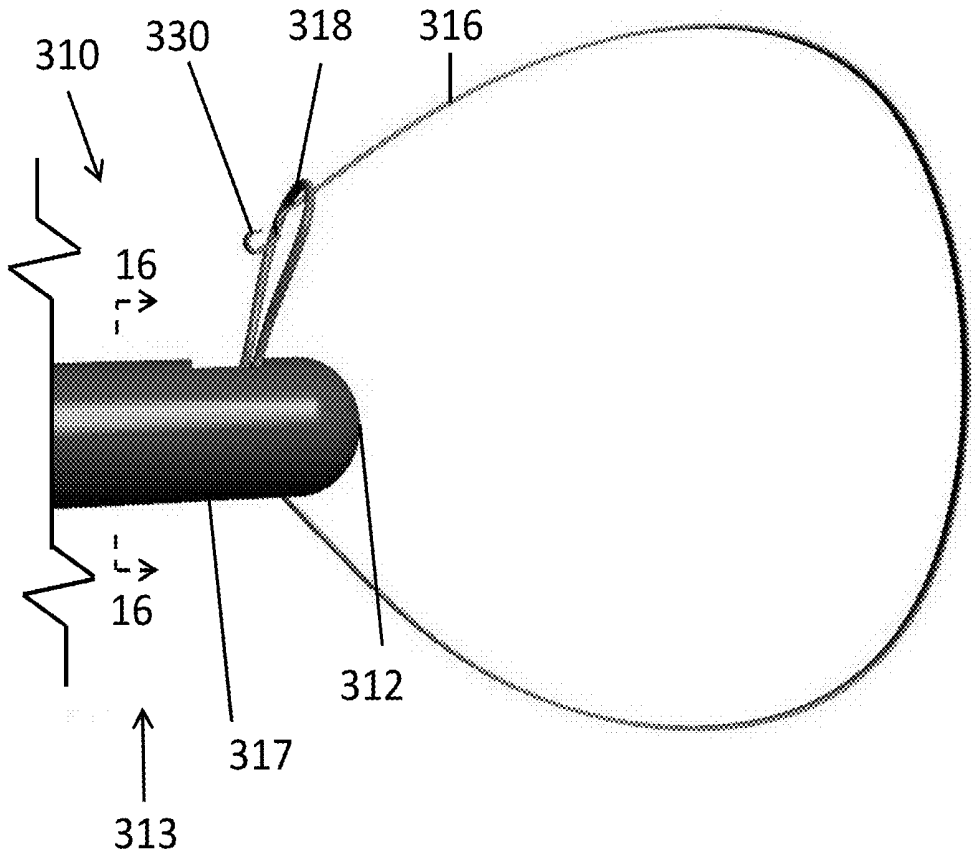

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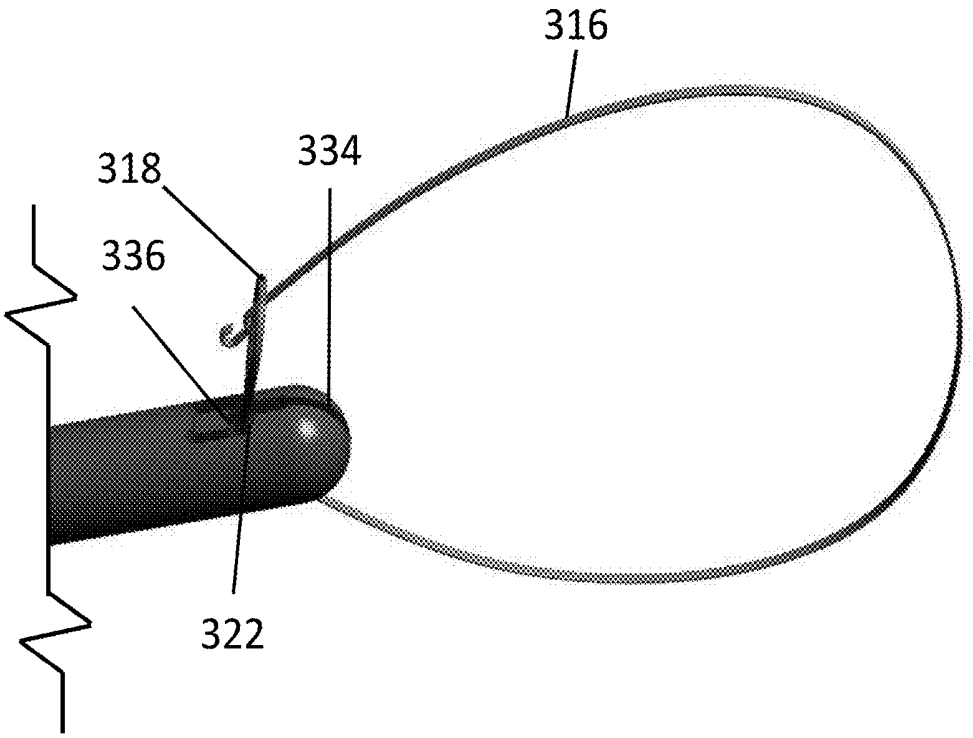

FIG. 24

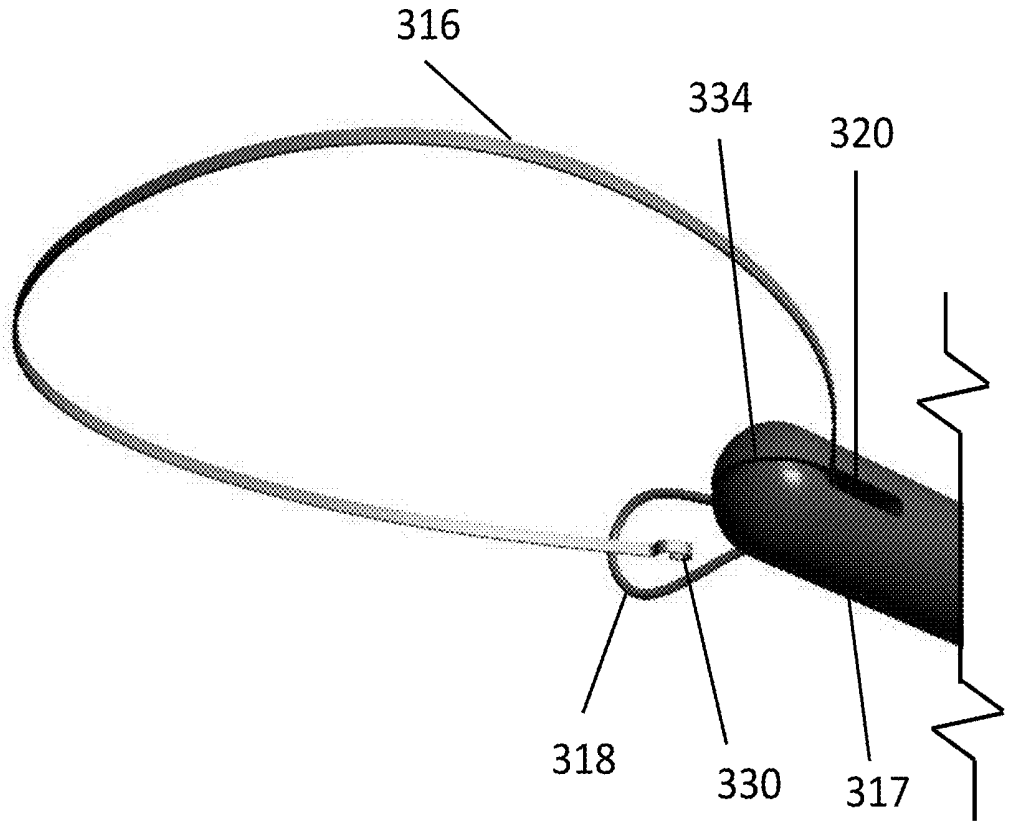

FIG. 25

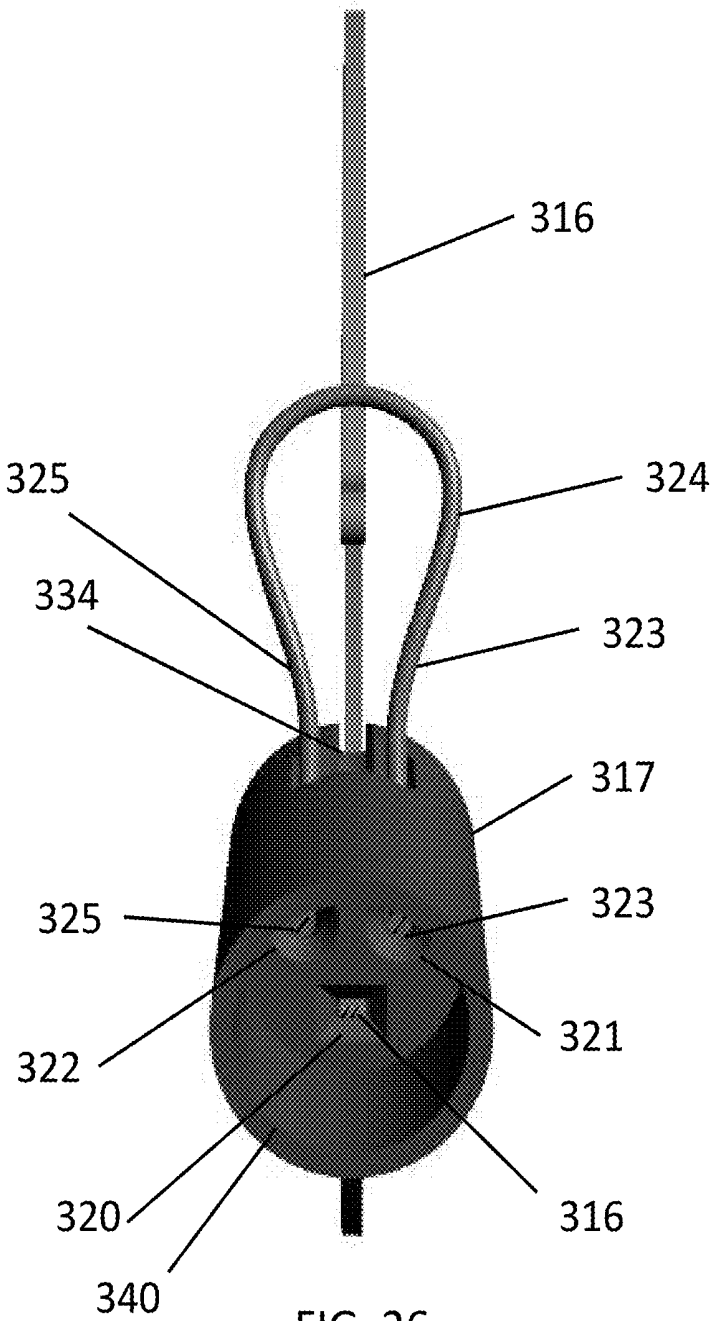

FIG. 26

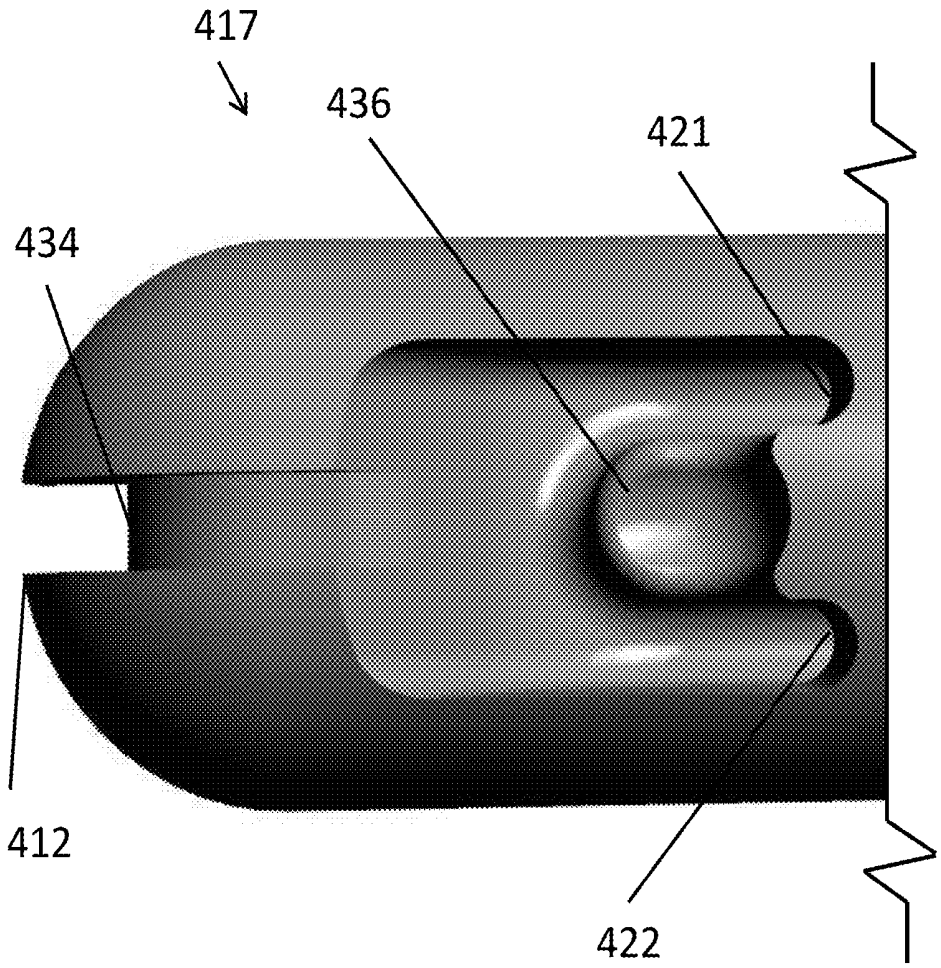

FIG. 27

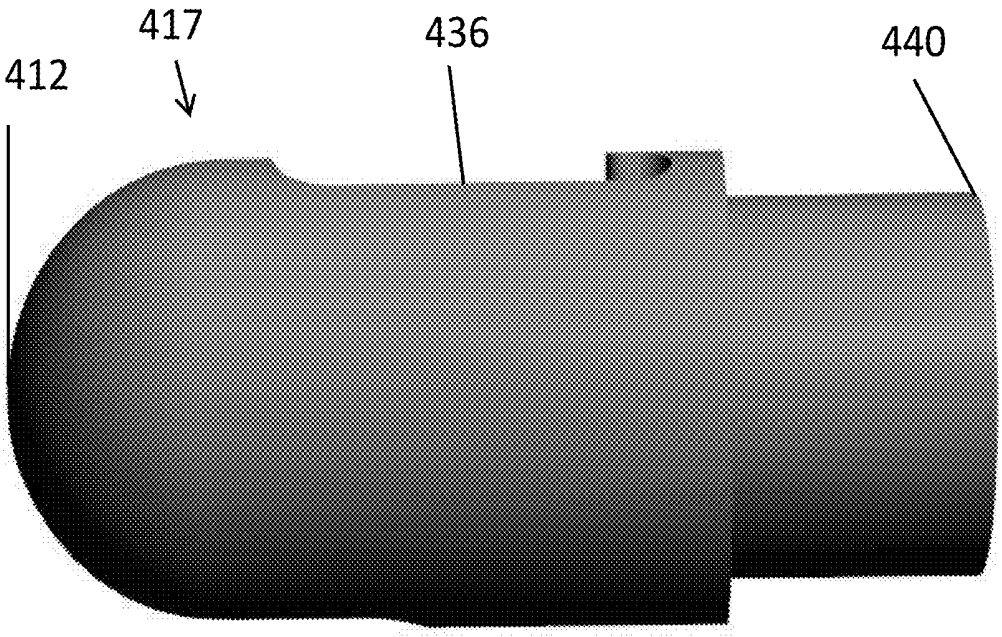

FIG. 28

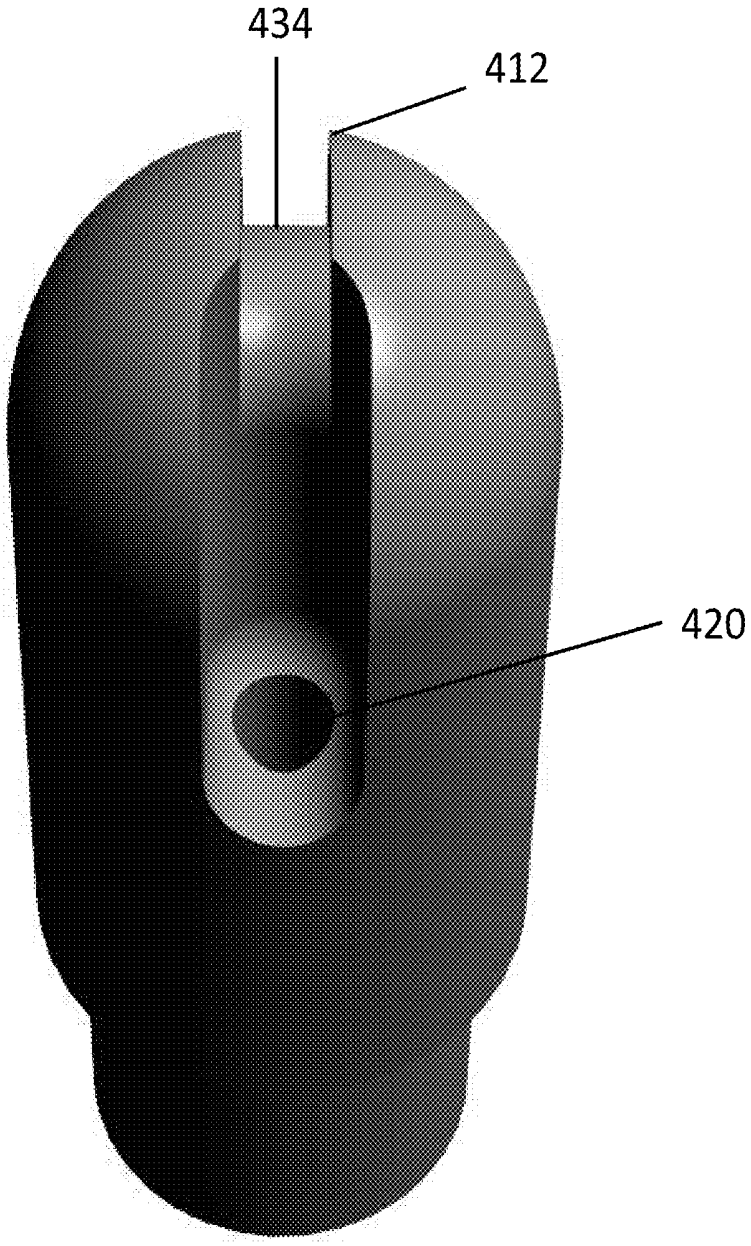

FIG. 29

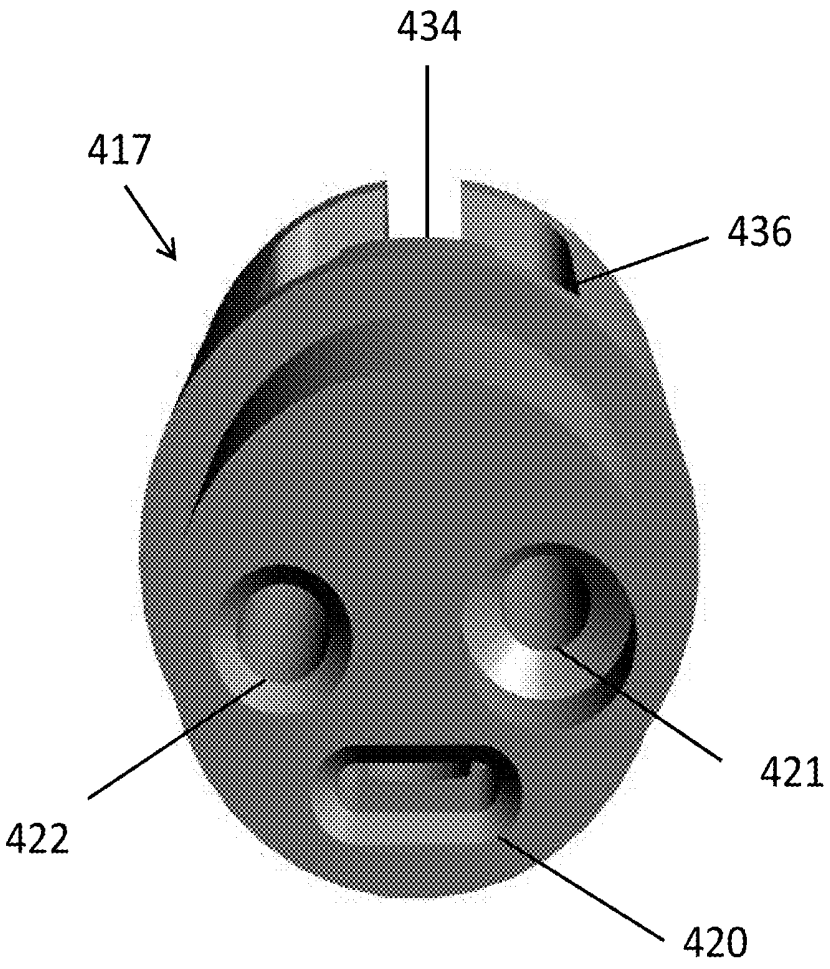

FIG. 30

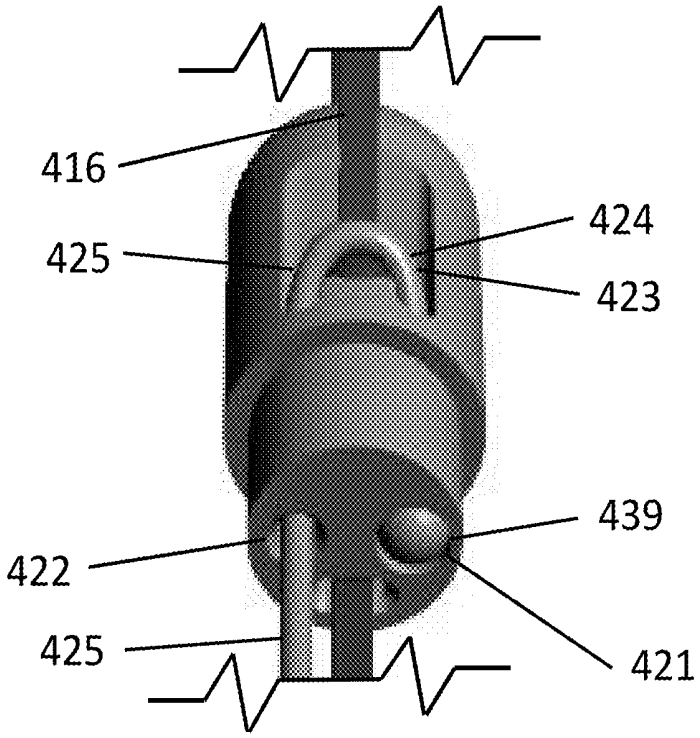

FIG. 31

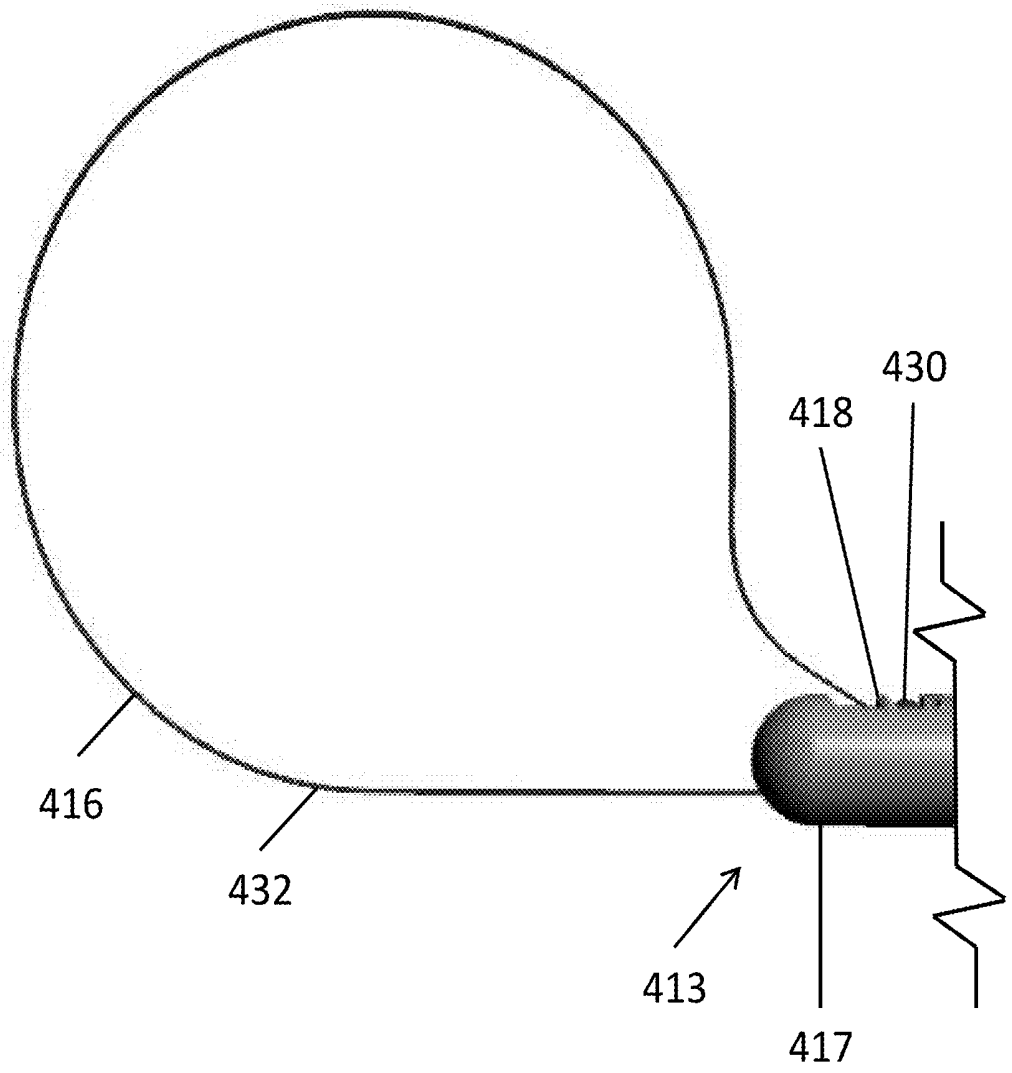

FIG. 32

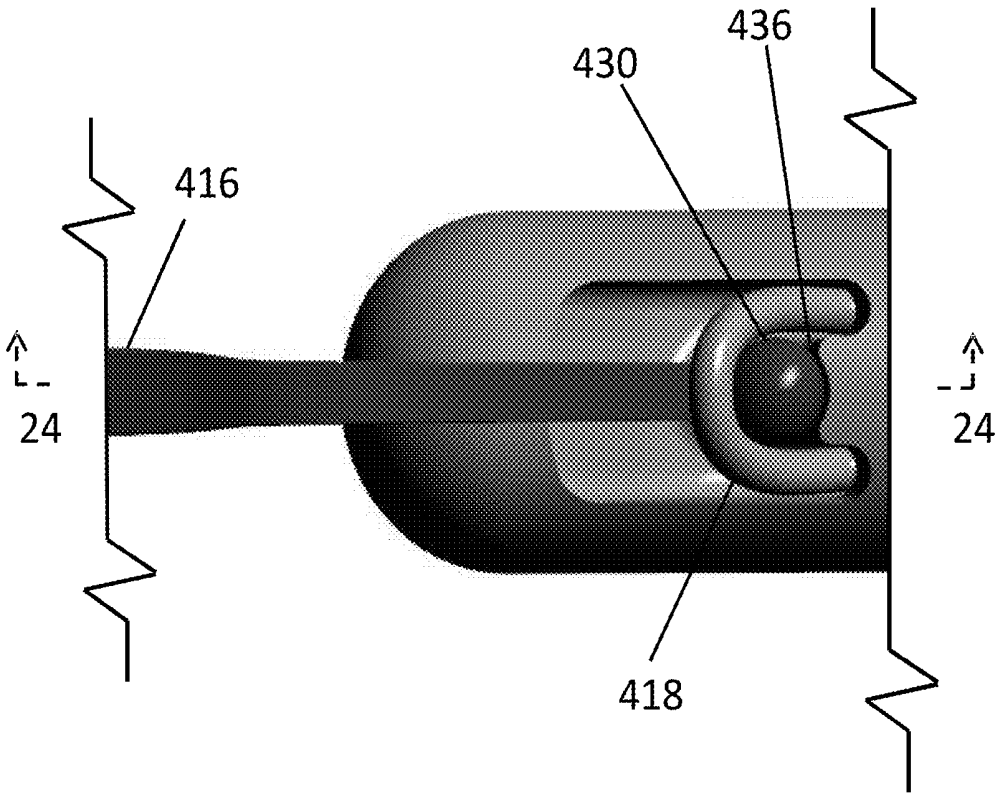

FIG. 33

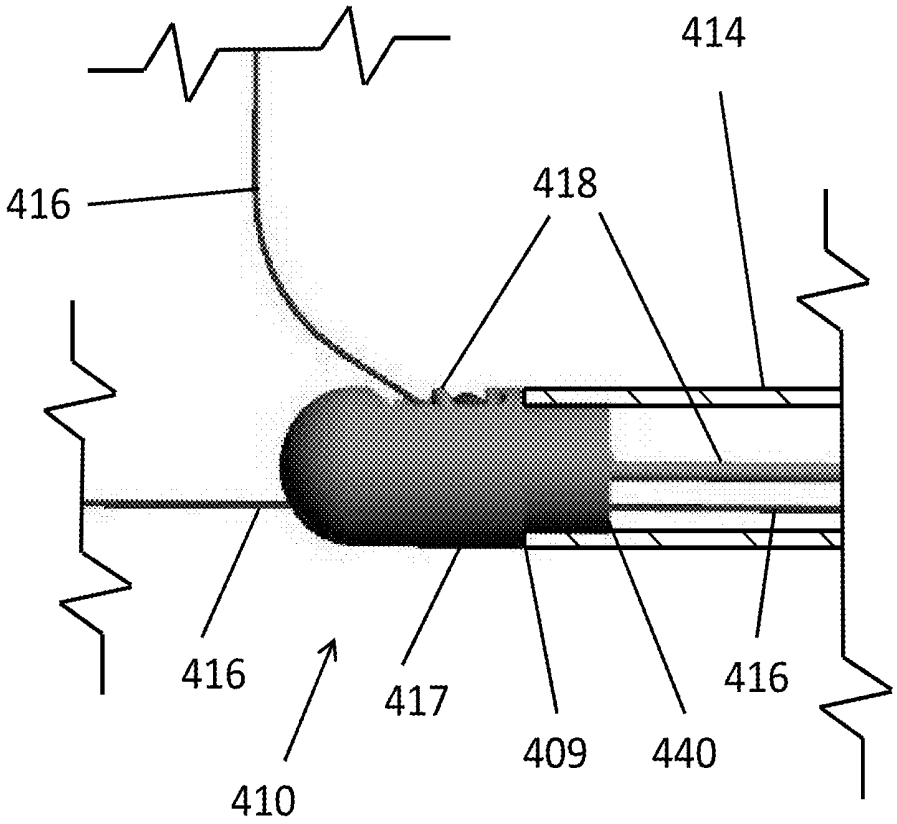

FIG. 34

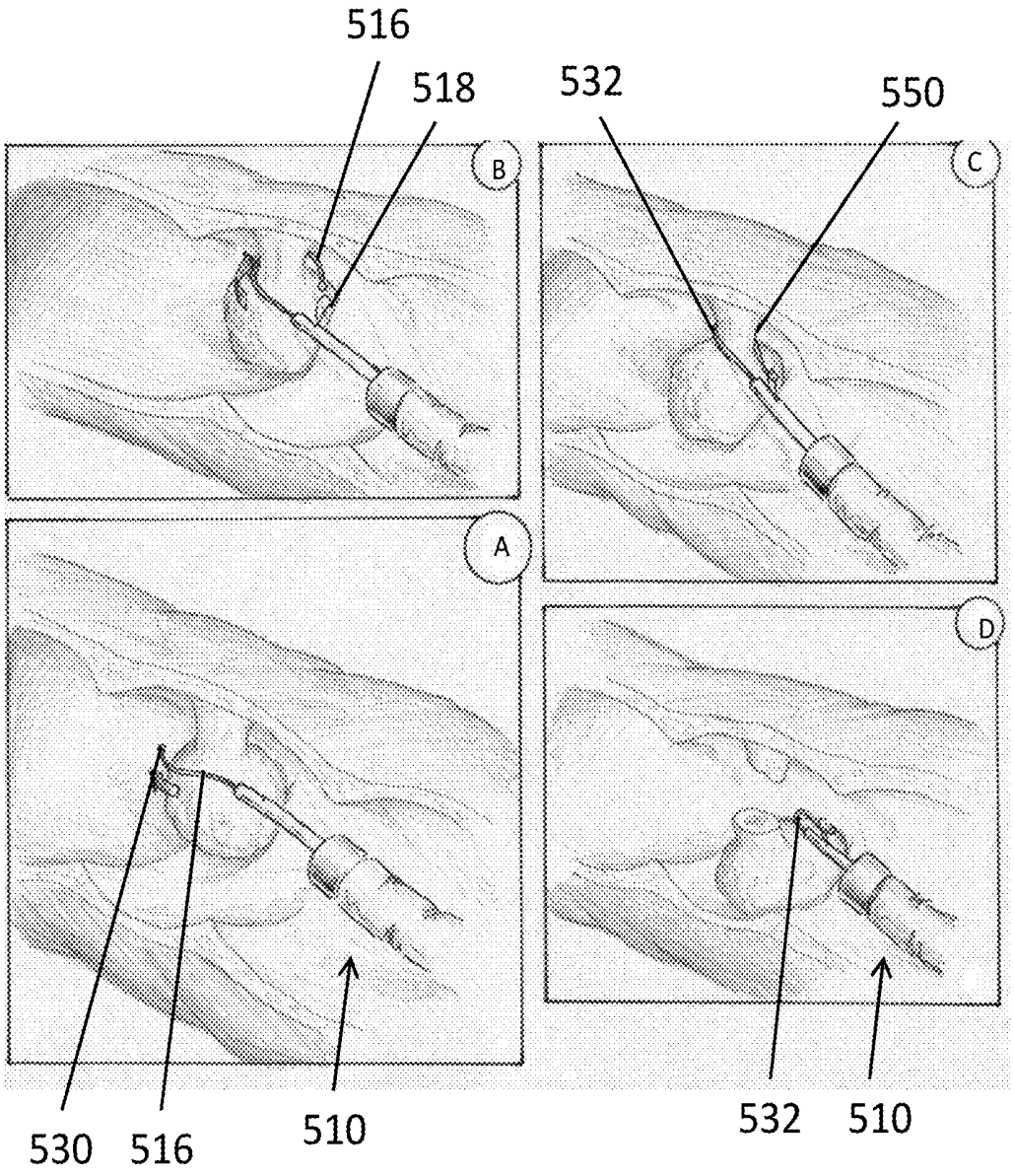

FIG. 35

OPEN LOOP POLYPECTOMY SYSTEM

[0001] This application claims the benefit as a continuation-in-part of U.S. patent application Ser. No. 14/370,617, filed Jul. 3, 2014, for ENDOSCOPIC SNARE DEVICE, which is a 371 of international application serial no. PCTUS1320457, filed Jan. 7, 2013, for ENDOSCOPIC SNARE DEVICE, which in turn claims the benefit of U.S. provisional patent application Ser. No. 61/648,312, filed May 17, 2012, for ENDOSCOPIC SNARE DEVICE, and U.S. provisional patent application Ser. No. 61/583,785, filed Jan. 6, 2012, for POLYPECTOMY SNARE DEVICE, all of which are incorporated herein by reference. This application also claims the benefit of U.S. provisional patent application Ser. No. 62/377,743, filed Aug. 22, 2016, for OPEN LOOP POLYPECTOMY SYSTEM, incorporated herein by reference.

FIELD OF THE INVENTION

[0002] Embodiments of this invention relate to endoscopic and laparoscopic surgical instruments. More specifically, embodiments of this invention relate to an open loop polypectomy system including a means for securely closing the loop. In some embodiments, the open loop polypectomy system comprises a snare wire and a capture mechanism wherein, when the snare wire is advanced, the snare wire extends from a distal portion of the open loop polypectomy system along a path passing through the capture mechanism. After the snare wire has advanced through the plane of the capture mechanism, retraction of the capture mechanism secures the snare wire, creating a formed loop around a target tissue. Retraction of at least one of the snare wire and capture mechanism contracts the formed loop, resecting the target tissue.

BACKGROUND OF THE INVENTION

[0003] Polyps are routinely found in the mucosal lining of colons and rectums of adults over the age of 50 years. In addition to the colon and rectum, polyps can develop in the mucosal lining of other hollow organs and cavities in the body, including the small intestine, ear, nose, sinuses, bronchi, stomach, and uterus. Removal of colon polyps has been strongly associated with a reduction in the incidence of colorectal cancer.

[0004] Polyps can be removed by surgical and endoscopic methods. Many polyps are routinely removed by biopsy forceps or closed loop endoscopic snares followed by cauterization or the application of a ligature. Snare polypectomy with cutting electrosurgical currents is a well-regarded currently available method for complete polyp removal. Polypectomy snares are monofilament, braided or coiled wire snares shaped into a closed loop at the end of an endoscopic tool. Snares are typically categorized as mini (<11 mm diameter) or standard (15 mm-45 mm diameter). Snare geometries also vary widely and closed loop snares include oval, hexagonal, crescent, and circular-shaped loops.

[0005] Certain types of polyps can be difficult to remove. Difficult polyps include large pedunculated polyps with thick pedicles and/or large heads as well as sessile polyps (i.e. large, flat polyps) that have little to no stalk. Polyps may also be difficult to remove due to their location or multiple polyps clustering together. These difficult polyps present challenges to the clinician using existing snare technology.

[0006] The endoscopic treatment of difficult polyps presents unique challenges to the safety and efficacy of polypectomies. Encircling the stalk, or elongated pedicle, of a large polyp is often difficult with existing closed loop snares as the size of the polyp head inhibits the seating of the snare's loop around the stalk of the polyp which in turn prevents the typically necessary step of cauterization used to facilitate removal of the polyp. Sessile polyps often require the creation of a saline pillow beneath the polyp by using a submucosal saline injection technique to separate the tissue layers of the colon wall to reduce the chance of removal causing thermal injury or perforation of the colon wall.

[0007] Snare polypectomy is made more difficult when polyps are located in the right colon and cecum, behind folds, flexures and turns, or when polyps present themselves in an arrangement which creates access complications relative to the path of the endoscopic snare. Proper alignment can be particularly difficult to obtain when resecting a polyp from the medial wall of the cecum, just proximal to the ileocecal valve or at a flexure, or bend, of the colon. Polyp resection in the cecum and ascending colon are especially problematic due to the thinness of the colon wall which increases the risk of perforation or transmural burn.

[0008] Clinicians have dealt with complicated polypectomies in a number of ways. Difficult polyps are often removed piecemeal, sometimes over several procedures. The removal of colorectal polyps in this manner increases the risk to the patient, adds to the backlog of procedures scheduled for surgical suites, and unnecessarily consumes the valuable time of the clinician and support staff. Large pedunculated polyps located in sharp sigmoid bends can also be difficult and require individualized approaches, especially when utilizing conventional closed loop polypectomy snares.

SUMMARY

[0009] The disclosed open loop polypectomy system is an open loop snare device with a capture mechanism to secure an extended snare wire, thereby forming a loop. The diameter of the formed loop may then be decreased, resecting tissue surrounded by the formed loop. The loop used to resect tissue is controllably formed by the user at a desired location in contrast to existing closed loop snares, wherein closed loops must be maneuvered over and around obstacles to reach the desired location.

[0010] In some embodiments, the invention comprises an open loop polypectomy system including a snare wire and a capture mechanism, wherein, when the snare wire is advanced, the snare wire extends from a distal portion of the system along a path passing through the capture mechanism, wherein, after the snare wire is advanced at least to the capture mechanism, activation of the capture mechanism captures the snare wire, creating a formed loop, and wherein retraction of at least one of the snare wire and capture mechanism contracts the formed loop.

[0011] In further embodiments, the invention comprises an open loop polypectomy system including a handle, an elongated flexible sheath including a distal end and a proximal end, the proximal end being attached to the handle, a snare wire extending from the distal end of the sheath, and a closed loop extending from the distal end of the sheath, wherein when the snare wire is advanced, the snare wire extends from the distal end through the closed loop, wherein, after the snare wire is advanced through the closed loop, retrac-

tion of the closed loop captures the snare wire, creating a formed loop, and wherein retraction of at least one of the snare wire and the capture mechanism contracts the formed loop.

[0012] This summary is provided to introduce a selection of the concepts that are described in further detail in the detailed description and drawings contained herein. This summary is not intended to identify any primary or essential features of the claimed subject matter. Some or all of the described features may be present in the corresponding independent or dependent claims, but should not be construed to be a limitation unless expressly recited in a particular claim. Each embodiment described herein is not necessarily intended to address every object described herein, and each embodiment does not necessarily include each feature described. Other forms, embodiments, objects, advantages, benefits, features, and aspects of the present invention will become apparent to one of skill in the art from the detailed description and drawings contained herein. Moreover, the various apparatuses and methods described in this summary section, as well as elsewhere in this application, can be expressed as a large number of different combinations and subcombinations. All such useful, novel, and inventive combinations and subcombinations are contemplated herein, it being recognized that the explicit expression of each of these combinations is unnecessary.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] A better understanding of the present invention will be had upon reference to the following description in conjunction with the accompanying drawings. The drawings are described in greater detail as follows:

[0014] FIG. **1** depicts an embodiment of a first embodiment of an open loop polypectomy system.

[0015] FIG. **2** depicts a front view of a distal end of the first embodiment with an extended capture mechanism.

[0016] FIG. **3** depicts a side view of the distal end of the first embodiment shown in FIG. **2**.

[0017] FIG. **4** depicts the side view of the distal portion of the first embodiment shown in FIG. **3** with a snare wire partially extended.

[0018] FIG. **5** depicts the side view of the distal portion of the first embodiment shown in FIG. **4** with the snare wire extended through the capture mechanism.

[0019] FIG. **6** depicts a flexible sheath of the first embodiment adjacent to a target object (a cylinder, serving as a proxy for a polyp stalk).

[0020] FIG. **7** depicts the first embodiment shown in FIG. **6** with a capture mechanism extended from the sheath to partially encircle the target object.

[0021] FIG. **8** depicts the first embodiment shown in FIG. **7** with a snare wire extended from the sheath to pass through the capture mechanism.

[0022] FIG. **9** depicts the first embodiment shown in FIG. **8** with the capture mechanism partially retracted into the sheath, the capture mechanism and snare wire cooperatively forming a loop encircling the target object.

[0023] FIG. **10** depicts the first embodiment shown in FIG. **9** with the snare wire partially retracted into the sheath, thereby tightening the formed loop around the target object.

[0024] FIG. **11** depicts the handle of the first embodiment.

[0025] FIG. **12** depicts a side view of the distal portion of a second embodiment of an open loop polypectomy system with a capture mechanism partially exposed.

[0026] FIG. **13** depicts a side view of the distal portion of the second embodiment with the capture mechanism further exposed and having two jaws in an open configuration.

[0027] FIG. **14** depicts a side view of the distal portion of the second embodiment with a snare wire deployed along an arcuate path and curling back toward the capture mechanism.

[0028] FIG. **15** depicts a side view of the distal portion of the second embodiment with the snare wire deployed along an arcuate path and curling back toward and through the open jaws of the capture mechanism.

[0029] FIG. **16** depicts a side view of the distal portion of the second embodiment with the snare wire deployed along an arcuate path captured by the closed jaws of the capture mechanism, with the capture mechanism being partially retracted.

[0030] FIG. **17** depicts a side view of the distal portion of the second embodiment with the snare wire being retracted.

[0031] FIG. **18** depicts a perspective view of the distal portion of the second embodiment with the snare wire capture mechanism partially exposed.

[0032] FIG. **19** depicts a perspective view of the distal portion of a third embodiment of an open loop polypectomy system.

[0033] FIG. **20** depicts a perspective view of the distal portion of the third embodiment with a capture mechanism extended, and with a snare wire deployed along an arcuate path and curling back toward the snare wire capture mechanism.

[0034] FIG. **21** depicts a perspective view of the distal portion of the third embodiment with the snare wire deployed along an arcuate path and curling back toward and through the closed loop of the capture mechanism.

[0035] FIG. **22** depicts a perspective view of the distal portion of the third embodiment with the snare wire deployed along an arcuate path and captured by the retraction of the capture mechanism.

[0036] FIG. **23** depicts a side view of the distal portion of a fourth embodiment of an open loop polypectomy system, with a snare wire deployed along an arcuate path and curling back toward and through the closed loop of a snare wire capture mechanism.

[0037] FIG. **24** depicts a top perspective view of the distal portion of the fourth embodiment.

[0038] FIG. **25** depicts a bottom perspective view of the distal portion of the fourth embodiment.

[0039] FIG. **26** depicts a rear perspective view of the head of the fourth embodiment of the snare device, with the snare wire and legs of the closed loop shown in cross section along lines **16-16** of FIG. **23**.

[0040] FIG. **27** depicts a top view of the head of a fifth embodiment of an open loop polypectomy system.

[0041] FIG. **28** depicts a side view of the head of the fifth embodiment.

[0042] FIG. **29** depicts a bottom perspective view of the head of the fifth embodiment.

[0043] FIG. **30** depicts a rear view of the head of the fifth embodiment, with the sheath omitted for clarity.

[0044] FIG. **31** depicts a rear perspective view of the head of the fifth embodiment of the snare device, with the sheath omitted for clarity.

[0045] FIG. **32** depicts a side view of the distal portion of the fifth embodiment, with a snare wire deployed along an arcuate path and captured by a retracted closed loop capture mechanism.

[0046] FIG. **33** depicts a top view of the distal portion of the fifth embodiment.

[0047] FIG. **34** depicts a side view of the distal portion of the fifth embodiment, with the sheath shown in cross section along lines **24-24** of FIG. **33**.

[0048] FIG. **35**(A-D) is a series perspective views sequentially showing steps of a method of using an open loop snare device.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0049] For the purposes of promoting an understanding of the principles of the invention, reference will now be made to selected embodiments illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended; any alterations and further modifications of the described or illustrated embodiments, and any further applications of the principles of the invention as illustrated herein are contemplated as would normally occur to one skilled in the art to which the invention relates. At least one embodiment of the invention is shown in great detail, although it will be apparent to those skilled in the relevant art that some features or some combinations of features may not be shown for the sake of clarity.

[0050] Any reference to "invention" within this document is a reference to an embodiment of a family of inventions, with no single embodiment including features that are necessarily included in all embodiments, unless otherwise stated. Furthermore, although there may be references to "advantages" provided by some embodiments of the present invention, other embodiments may not include those same advantages, or may include different advantages. Any advantages described herein are not to be construed as limiting to any of the claims.

[0051] Specific quantities (spatial dimensions, dimensionless parameters, etc.) may be used explicitly or implicitly herein, such specific quantities are presented as examples only and are approximate values unless otherwise indicated. Discussions pertaining to specific compositions of matter, if present, are presented as examples only and do not limit the applicability of other compositions of matter, especially other compositions of matter with similar properties, unless otherwise indicated.

[0052] FIGS. **1-11** depict a first embodiment of an open loop polypectomy system **10**. FIGS. **3-5** depict the stepwise progression of advancement of the snare wire in the first embodiment. FIGS. **6-10** depict the stepwise progression of advancement, capture of a target object (a cylinder, serving as a proxy for a polyp stalk), and retraction.

[0053] The first embodiment of an open loop polypectomy system **10** includes a proximal portion **11** and a distal portion **13**. The open loop polypectomy system **10** is designed to ensnare polyps or other tissues in proximity to the distal portion **13** of the open loop polypectomy system **10** and to be controlled by a user manipulating the proximal portion **11**. The proximal portion **11** is designed to remain outside a patient and includes a means for controlling the distal portion **13**, such as, for example, a handle **15**. Attached to the handle **15** is an elongated flexible sheath **14**. The distal portion **13** of the open loop polypectomy system **10** includes the distal end **9** of the sheath **14**, and a snare wire **16** and a capture mechanism **18** extending from the distal end **9**. The distal portion **13** is designed to be inserted into a patient. FIG. **1** displays the snare wire **16** and capture mechanism **18** cooperatively surrounding a cylindrical tube **4**, the tube **4** serving as a proxy for a polyp stalk.

[0054] The open loop polypectomy system **10** is adapted to be channeled to a desired position within a patient by passing the elongated flexible sheath **14** though a channel in an elongated flexible tube adapted for introduction into a patient, such as an endoscopic or laparoscopic tube containing an instrument insertion channel. The sheath **14** preferably has a smaller diameter than that of the instrument insertion channel through which the distal portion **13** is to be channeled such that the distal portion **13** may pass with relative ease through the length of an endoscopic tube, and exit through the distal end of the endoscopic or laparoscopic tube when inserted within a body cavity. In some embodiments, the sheath **14** may be channeled to a desired position within a patient without use of a separate endoscopic or laparoscopic tube. In the depicted first embodiment, the sheath **14** is an elongated, transparent plastic tube. In other embodiments, the sheath may be translucent or opaque, or may be formed of a different biocompatible substance.

[0055] The distal portion **13** of an embodiment of an open loop polypectomy system **10** is shown in FIGS. **2-10**. In this embodiment, the sheath **14** terminates at a sheath distal end **9**. At least a portion of the snare wire **16** and at least a portion of the capture mechanism **18** reside within the sheath **14**.

[0056] The distal portion **13** can be rotated within the endoscope's instrument insertion channel by manipulating the proximal portion **12** to modify the position and orientation of the snare wire **16** and capture mechanism **18** relative to the target polyp or tissue. Furthermore, as described in further detail below, in some embodiments at least one of the snare wire **16** and capture mechanism **18** is independently rotatable with respect to the sheath **14** to facilitate orienting the snare wire **16** and capture mechanism to encircle a target polyp or tissue.

[0057] In the depicted first embodiment, the capture mechanism **18** is a curved closed loop **24** that can be controllably extended and retracted from the distal end **9** of the sheath **14**, enlarging and shrinking the diameter of the closed loop **24**. As most easily seen in FIGS. **2** and **3**, the curved closed loop **24** is generally oval shaped when viewed from the front and shaped similar to a letter "C" when viewed from the side. In some embodiments, the closed loop **24** is made from a memory shape material such as a memory shape alloy, for example, nickel titanium, also known as nitinol, or a memory shape polymer configured to adopt the depicted curved closed loop shape. As the closed loop **24** is retracted into the sheath **14**, it collapses to fit within the relatively narrow opening of the sheath distal end **9**. As the closed loop **24** is advanced to extend outwards from the distal end **9**, the closed loop **24** returns to the depicted curved closed loop shape. As most easily seen in FIG. **2**, in some embodiments, the closed loop **24** includes a notch **52** sized to receive the snare wire **16**.

[0058] Referring now to FIGS. **3-5**, the snare wire **16** is advanced from the sheath **14** to pass through the closed loop **24**. At least one of the snare wire **16** and the closed loop **24** can be rotated to facilitate the snare wire **16** passing through the closed loop **24**.

[0059] FIGS. **6-10** depict the stepwise progression of advancement, capture of a target object **50** (a simple cylinder, serving as a proxy for a polyp stalk or other tissue), and retraction of the same embodiment of the open loop polypectomy system. As shown in FIG. **6**, the sheath **14** is positioned in proximity to or adjacent to a target object **50**. As shown in FIG. **7**, the curved closed loop **24** is advanced from the sheath **14** and oriented to partially encircle the target object **50**. As shown in FIG. **8**, the snare wire **16** is advanced to extend past the target object **50** and pass through the closed loop **24**. As shown in FIG. **9**, the capture mechanism **18** can be activated by retracting at least a portion of the closed loop **24** into the sheath **14**, capturing the snare wire **16** against the target object and creating a formed loop **32**. As shown in FIG. **10**, at least a portion of the snare wire **16** is retracted into the sheath **14**, further tightening the formed loop **32** encircling the target object **50**. The snare wire **16** is received in and extends through the notch **52**. In the depicted embodiment, the snare wire **16** includes a distal bulb **30** to prevent the snare wire **16** from reversing back through the capture mechanism **18**, once captured. Preferably, the notch **52** is sized to pass the snare wire **16** and sized to prevent passage of the distal bulb **30** through the notch **52**. If advisable, the capture mechanism **18** may be re-extended to release the snare wire **16** and disassemble the formed loop **32**, thereby removing the risk of the formed loop **32** being "hung" on a polyp or other tissue.

[0060] In the event that the target object is a polyp, target object can be incised by further decreasing the diameter of the formed loop **32**, or by retraction of the open loop polypectomy system **10** along the path of the endoscope as the endoscope is withdrawn from the colon, or as the open loop polypectomy system **10** is retracted into the instrument insertion channel of the endoscope.

[0061] In certain embodiments, the capture mechanism **18** and snare wire **16** are controlled by control wires (not visible within the sheath) affixed to the capture mechanism **18** and snare wire **16**, passing through the sheath **14**, and extending to the proximal portion **11** of the open loop polypectomy system **10**, where the control wires may be manipulated by the user. For example, advancing the control wire attached to the snare wire **16** would extend the snare wire **16**, and withdrawing the same control wire would retract the snare wire **16** into the sheath **14**. Referring now to FIG. **11**, in some embodiments, the handle **15** includes independent first and second control mechanisms **54**, **56**. The first control mechanism **54** is mechanically connected to the snare wire **16** via a control wire extending through the sheath **14** and the second control mechanism **56** is mechanically connected to the capture mechanism **18** via a separate control wire extending through the sheath **14**. Manipulation of the first and second control mechanisms **54**, **56** by the user allows the user to control the snare wire **16** and control mechanism **18**. In the depicted embodiment, sliding the first control mechanism **54** in the direction of the sheath **14** advances the snare wire **16** to extend from the sheath distal end **9**. Sliding the first control mechanism **54** in the opposite direction retracts the snare wire **16** into the sheath distal end **9**. In the depicted embodiment, advancing the second control mechanism **56** into the handle **15** advances the capture mechanism **18** to extend from the sheath distal end **9**. Retracting the second control mechanism **56** from the handle **15** retracts the capture mechanism **18** into the sheath distal end **9**. Rotating the second control mechanism **56** rotates the capture mechanism **18**. While the snare wire **16** is not rotatable in the depicted embodiment, additional embodiments are envisioned in which a first control mechanism is configured to retract, extend, and rotate the snare wire. In some embodiments, the control wires are omitted and the snare wire extends through the sheath to connect to the first control mechanism and the capture mechanism extends through the sheath to connect to the second control mechanism.

[0062] In some embodiments, the handle **15** includes an electrical input **58** for receiving electrical current, whereby the current is delivered to the formed loop **32** as described in further detail below. The snare wire **16**, capture mechanism **18**, and control wires are preferably formed of materials with low resistance to minimize heating of the snare wire, capture mechanism, and control wires when current is passed therethrough. In some embodiments, the snare wire, capture mechanism, and control wires are formed of stainless steel. In further embodiments, one or more of the snare wire, capture mechanism, and control wires are formed of stainless steel, a shape memory polymer, or a shape memory alloy, such as nickel titanium alloy, commonly referred to as nitinol.

[0063] FIGS. **12-17** depict the stepwise progression of advancement, capture, and retraction of a second embodiment of an open loop polypectomy system **210**. FIG. **18** depicts an intermediate step between FIGS. **13** and **14** at a different view to display additional components of the polypectomy system **210**.

[0064] The distal portion **113** of the second embodiment of an open loop polypectomy system **110** is shown in FIGS. **12-18**. In this embodiment, the sheath **114** terminates at a sheath distal end **109**. A substantially cylindrical head **117** is inserted within the sheath **114** and terminates at a flat distal end **112** flush with the sheath distal end **109**. The head **117** includes at least one channel in which at least a portion of a snare wire **116** and at least a portion of a capture mechanism **118** reside. In some embodiments, the head **117** may include at least two channels, at least one retaining the capture mechanism **118** and at least one retaining the snare wire **116**. In embodiments incorporating a plurality of snare wires **116**, the polypectomy system **110** may include three or more channels, at least one for the capture mechanism **118** and at least one for each of the plurality of snare wires **116**. As shown in FIG. **18**, the distal end **112** of the first embodiment of the polypectomy system **110** includes two channels: a snare wire channel **120** and a capture mechanism channel **122**.

[0065] The capture mechanism **118** is configured to capture the snare wire **116**. In the second embodiment depicted in FIGS. **12-18**, the capture mechanism **118** is a pair of opposing jaws **124** that can be controllably opened and closed from the proximal end (not shown for this embodiment) of the open loop polypectomy system **110**. Activation of the capture mechanism **118**, that is, transitioning the jaws **124** from an open position to a closed position, captures the snare wire **116** when the snare wire **116** extends between the jaws **124**.

[0066] The distal portion **113** can be rotated within the endoscope's instrument insertion channel by manipulating the proximal portion (not shown in this embodiment) of the endoscope to modify the position and orientation of the snare wire **116** and capture mechanism **118** relative to the target polyp or tissue. In certain embodiments, the snare wire

channel **120** is preferably slotted or otherwise non-circular, so that the snare wire **116** is maintained at a specific orientation and reliably extends from the snare wire channel **120** on a predetermined plane. In this first embodiment, as shown in FIG. **18**, the snare wire channel **120** is substantially circular.

[0067] The snare wire **116** is made from a memory shape material such as a memory shape alloy, for example, nickel titanium, also known as nitinol, or a memory shape polymer. As it exits the snare wire channel **120**, as shown by FIGS. **14-15**, the snare wire **116** is fashioned so as to preferably curl toward the capture mechanism **118** along a predetermined arcuate path to produce a snare of sufficient diameter to ensnare a target polyp or other tissue. The snare wire **116**, being made from a memory shape material and being configured to curl back upon a predetermined arcuate path of sufficient diameter, will curl around the stalk of the target polyp and will pass through the open jaws **124** of the capture mechanism **118**, as shown in FIG. **15**, at which point the jaws **124** will transition from an open position to a closed position, as shown in FIG. **16**. When in a closed position, jaw distal portions **126** fit flush or interlock, the jaws **124** thereby forming a snare wire capture orifice **128** surrounding the snare wire **116**. The diameter of the snare wire capture orifice **128** is larger than the diameter of the snare wire **116**. In this first embodiment, the snare wire includes a distal bulb **130** with a diameter larger than that of the snare wire capture orifice **128**, such that the distal bulb **130** cannot pass back through the snare wire capture orifice **128** once captured. The snare wire **116** and the capture mechanism **118**, when the jaws **124** are in the closed position capturing the distal bulb **130**, cooperatively create a formed loop **132**. The formed loop **132** is a closed loop formed when the capture mechanism **118** captures the snare wire **116**.

[0068] In some embodiments, the capture mechanism **118** is maintained at a predetermined orientation to aid capture of the snare wire **116**. In other embodiments, the capture mechanism **118** may be capable of rotating freely in the capture mechanism channel **122**. For example, in FIG. **18**, the capture mechanism **118** is shown rotated approximately **180** degrees compared to its orientation in FIGS. **12-17**.

[0069] In some embodiments, as shown in FIGS. **13-15**, the jaws **124** of capture mechanism **118** are biased in an open position, and may be forced into a closed position by partially retracting them into the capture mechanism channel **122**, as shown in FIGS. **16-17**, or by advancing an endoscopic tube over the jaws **124**. In other embodiments, not shown, the jaws **124** are hingedly attached at their proximal end.

[0070] In various embodiments, the diameter of the formed loop **132** may be decreased by at least one of: retracting at least a portion of the capture mechanism **118** into the capture mechanism channel **122** and retracting at least a portion of the snare wire **116** into the snare wire channel **120**. In some embodiments, as shown in FIG. **17**, both the capture mechanism **118** and snare wire **116** may be retracted into their respective channels **120**, **122** to decrease the diameter of the formed loop **132**.

[0071] FIGS. **19-22** depict the stepwise progression of advancement, capture, and retraction of a third embodiment of the open loop polypectomy system. The distal portion **213** of the third embodiment of an open loop polypectomy system **210** is shown in FIGS. **19-22**. In this embodiment, the sheath **214** terminates at a sheath distal end **209**. The substantially cylindrical head **217** is inserted within the sheath **214** and terminates at a flat distal end **212** flush with the sheath distal end **209**. The head **217** includes at least one channel in which at least a portion of a snare wire **216** and a capture mechanism **218** reside. In this third embodiment, the head **217** includes at least two channels: a snare wire channel **220** and a capture mechanism channel **222**.

[0072] The capture mechanism **218** of the third embodiment is a closed loop **224** that can be controllably extended and retracted from the distal end **212** of the head **217**, enlarging and shrinking the diameter of the closed loop **224**. The capture mechanism **218** is extended through the polypectomy system **210** via a capture mechanism channel **222**. In this third embodiment, as shown in FIGS. **19-22**, the capture mechanism channel **222** is generally rectangular or otherwise non-circular in shape, so that the capture mechanism **218** is maintained at a specific orientation and reliably extends from the capture mechanism channel **222** on a predetermined plane. In further embodiments, the capture mechanism channel **222** may be two separate channels, each containing a leg of the capture mechanism **218**.

[0073] The snare wire **216** is advanced through the head **217** via a snare wire channel **220**. The open loop polypectomy system **210** can be rotated within an endoscope's instrument insertion channel from the proximal end of the endoscope to modify the orientation of the snare wire **216** and capture mechanism **218** relative to a target polyp or tissue. In certain embodiments, the snare wire channel **220** is preferably slotted or otherwise non-circular, so that the snare wire **216** is maintained at a specific, predetermined orientation and reliably extends from the snare wire channel **220** on a predetermined plane.

[0074] The snare wire **216** is made from a memory shape material such as a memory shape alloy, for example, nickel titanium, or a memory shape polymer. As it exits the snare wire channel **220**, as shown by FIGS. **19-22**, the snare wire **216** is fashioned so as to curl toward the capture mechanism **218** along a predetermined arcuate path to produce a snare of sufficient diameter to ensnare a target polyp or tissue. The snare wire **216**, being made from a memory shape material and being configured to curl back upon a predetermined arcuate path designed to curl around a target tissue and will pass through the extended closed loop **224**, as shown in FIG. **21**. As shown in FIG. **22**, the capture mechanism **218** can be activated by retracting at least a portion of the closed loop **224** into the capture mechanism channel **222**, capturing the snare wire **216** against the head **217** and creating a formed loop **232**. The snare wire **216** includes a distal bulb **230** to prevent the wire **216** from reversing back through the capture mechanism **218**, once captured. In some embodiments, the distal end **212** includes a recessed portion shaped to receive the distal bulb **130**.

[0075] The distal portion **313** of a fourth embodiment of an open loop polypectomy system **310** is shown in FIGS. **23-26**. In this embodiment, the head **317** is generally cylindrical in shape, terminating in a rounded distal end **312**. In this third embodiment, the polypectomy system **310** possesses a snare channel **320** located at the bottom of the head **317** and a pair of capture mechanism channels **321**, **322** located at the top of the head **317**. The polypectomy system **310** may be freely rotated, so the description of channels or other features at the "top" or "bottom" of the head **317** only describes their positions relative to each other in the refer-

enced drawings, and does not limit the orientation of the polypectomy system **310** as a whole.

[0076] The capture mechanism **318** of the fourth embodiment is a closed loop **324** that can be controllably extended and retracted from the distal portion **312** of the polypectomy system **310**, enlarging and shrinking the closed loop **324**. At least a portion of each leg **323**, **325** of the closed loop **324** extends through the head **317** via a separate capture mechanism channel **321**, **322**. By using two separate capture mechanism channels **321**, **322**, the closed loop **324** is maintained at a specific orientation and reliably extends from the channels **321**, **322** on a predetermined plane. The closed loop **324** may be extended or retracted by extending or retracting either leg **323**, **325** of the closed loop **324** individually or both legs **323**, **325** of the loop in combination. In some embodiments, one of the legs **323**, **325** of the closed loop **324** may be fixed to the head **317** such that only the other, non-fixed leg may be extended or retracted. In this third embodiment, neither leg **323**, **325** is fixed to the head **317**.

[0077] The snare wire **316** is advanced through the polypectomy system **310** via a snare wire channel **320**. In this embodiment, as best shown in FIG. **26**, the snare wire **316** is a flattened, substantially rectangular shape, at least a portion of which resides in a substantially rectangular snare wire channel **320**. The snare wire **316** is unable to rotate within the snare wire channel **320**, thus maintaining the snare wire **316** at a predetermined orientation.

[0078] In this fourth embodiment, the distal portion **313** includes a slot **334** extending from the snare wire channel **320**, over the distal end **312**, in the direction of the capture mechanism **318**. The slot **334** is sized to accept the snare wire **316** such that the snare wire **316**, when retracted after being captured by the capture mechanism **318**, enters into the slot **334** and is thereby maintained at a specific orientation.

[0079] The snare wire **316** is made from a memory shape material such as a memory shape alloy, for example, nickel titanium, or a memory shape polymer. As it exits the snare wire channel **320**, as shown by FIGS. **23-26**, the snare wire **316** is fashioned so as to curl toward the capture mechanism **318** along a predetermined arcuate path to produce a snare of sufficient diameter to ensnare a target polyp or tissue. The snare wire **316**, being made from a memory shape material and being configured to curl back upon a predetermined arcuate path of sufficient diameter, will curl around the stalk of the target polyp and will pass through the extended capture mechanism **318**. The capture mechanism **318** can then be activated by retracting at least a portion of the closed loop **324** into at least one of the capture mechanism channels **321**, **322**, decreasing the diameter of the closed loop **324** and capturing the snare wire **316** against the head **317**, thereby creating a formed loop (not shown for this embodiment). The snare wire **316** includes a distal hook **330** to catch the closed loop **324** and prevent the wire **316** from reversing back through the capture mechanism **318**, once captured. In this embodiment, the head **317** includes a recessed portion **336** shaped to receive the distal hook **330**, once captured.

[0080] The head **317** is adapted to contact the distal end of the sheath (not shown). Unlike the head **117**, **217** in the second and third embodiments, the head **317** in the fourth embodiment is shaped to fit over the distal end of the sheath. As shown in FIG. **26**, the head **317** includes a cavity **340** sized to accept the distal end of the sheath. In various embodiments, the head may be adapted for at least a portion of the head to be inserted into the distal end of the sheath, for the distal end of the sheath to be inserted into the head, to abut the distal end of the sheath, or otherwise contact and be secured to the distal end of the sheath.

[0081] The distal portion **413** of a fifth embodiment of an open loop polypectomy system **410** is shown in FIGS. **27-34**, with FIGS. **27-31** focusing on the head **417**. In this embodiment, the head **417** is generally cylindrical in shape, terminating in a rounded distal end **412** and having a decreased diameter at its proximal end **440** to aid insertion of the proximal end **440** of the head **417** into the sheath **414**, as shown in FIG. **34**, contacting the sheath distal end **409**. In this fifth embodiment, the polypectomy system **410** possesses a snare wire channel **420** located at the bottom of the head **417** and a pair of capture mechanism channels **421**, **422** located at the top of the distal portion **413**, within a recessed portion **436**. The polypectomy system **410** may be freely rotated, so the description of channels or other features at the "top" or "bottom" of the head **417** only describes their positions relative to each other in the referenced drawings, and does not limit the orientation of the polypectomy system **410** as a whole.

[0082] As shown in FIGS. **29** and **30**, the snare wire channel **420** has a round exit but the interior of the channel **420** is substantially rectangular in shape. In this fifth embodiment, the substantially rectangular interior of the snare wire channel **420** maintains the snare wire **416** at a specific orientation, as the wire **416** cannot rotate within the channel **420**.

[0083] The capture mechanism **418** of the fifth embodiment is a closed loop **424** that can be controllably extended and retracted from the distal portion **412** of the polypectomy system **410**, enlarging and shrinking the closed loop **424**. Each leg **423**, **425** of the closed loop **424** is extended through the polypectomy system **410** via a separate capture mechanism channel **421**, **422**. By using two separate capture mechanism channels **421**, **422**, the closed loop **424** is maintained at a specific orientation and reliably extends from the channels **421**, **422** on a predetermined plane. As shown in FIG. **31**, in this fifth embodiment, leg **423** of the closed loop **424** is fixed to the head **417** such that only the other, non-fixed leg **425** may be extended or retracted. In this fourth embodiment, the fixed leg **423** terminates in a bulb **439** with a diameter greater than the diameter of the capture mechanism channel **421**. The capture mechanism **418** is thereby formed by single wire extending from the bulb **439**, through the capture mechanism channel **421**, out of the head **417** to form the closed loop **424**, returning through the capture mechanism channel **422**, and extending proximally down the sheath **414**. In other embodiments, other means for fixing a leg to the head may be used.

[0084] The snare wire **416** is advanced through the polypectomy system **410** via a snare wire channel **420**. In this embodiment, the distal portion **413** includes a slot **434** extending from the snare wire channel **420**, over the distal end **412**, in the direction of the capture mechanism **418**. The slot **434** is sized to accept the snare wire **416** such that the snare wire **416**, when retracted after being captured by the capture mechanism **418**, enters into the slot **434** and is thereby maintained at a specific orientation.

[0085] The snare wire **416** is made from a memory shape material such as a memory shape alloy, for example, nickel titanium, or a memory shape polymer. As in other embodi-

ments, the snare wire **416** is fashioned so as to curl toward the capture mechanism **418** along a predetermined arcuate path to produce a snare of sufficient diameter to ensnare a target polyp or tissue and pass through the extended capture mechanism **418**. The capture mechanism **418** can then be retracted into the capture mechanism channels **421**, **422**, capturing the snare wire **416** and creating a formed loop **432**. The snare wire **416** includes a distal bulb **430** to prevent the wire **416** from reversing back through the capture mechanism **418**, once captured. In this embodiment, the distal portion **412** includes a recessed portion **436** shaped to receive the distal bulb **430**. As shown in FIGS. **32** and **33**, once the snare wire **416** is captured, retracting the capture mechanism **418** secures the distal bulb **430** in the recessed portion **436**.

[0086] Referring now FIG. **35**(A-D), when the disclosed open loop polypectomy system **510** is used in a polypectomy procedure, the snare wire **516** may be extended to surround a polyp stalk **550** (panels A-B), then the distal bulb **530** be captured by the capture mechanism **518**, forming the formed loop **532** around the polyp stalk **550** (panel C). The polyp stalk **550** can be incised across the width of the stalk by decreasing the diameter of the formed loop **532**, or by retraction of the polypectomy system **510** of the along the path of the endoscope as the endoscope is withdrawn from the colon, or as the polypectomy system **510** is retracted into the instrument insertion channel of the endoscope (panel D).

[0087] Optionally, the formed loop **32**, **132**, **232**, **332**, **432**, **532** created by the snare wire **16**, **116**, **216**, **316**, **416** and the capture mechanism **18**, **118**, **218**, **318**, **418**, **518** completes a circuit across which current may be applied. This circuit will allow for the delivery of a bipolar current, which provides an integrated path for current return from the body to the current generator. This configuration may avoid the need for a grounding pad for bleeding current from the body, as is used with snares with a monopolar current configuration. The current may range from a level of amperes known by those skilled in the art to facilitate cutting up to a level of amperes known to those skilled in the art to facilitate coagulation and sealing of the wound created by the polyp removal. The known resistance of the snare wire facilitates the accurate calculation of the heat generated by electrically charging the snare wire. In one embodiment, the formed loop **32**, **132**, **232**, **332**, **432**, **532** is a means for biopolar current delivery in which electrical current travels from the snare wire **16**, **116**, **216**, **316**, **416**, **516** to the capture mechanism **18**, **118**, **218**, **318**, **418**, **518**.

[0088] After incision of a polyp stalk, the bleeding polyp stalk remnant is preferably sealed to prevent bleeding. In one embodiment, the stalk remnant can be cauterized by the application of sufficient electric current through the snare wire **16**, **116**, **216**, **316**, **416**, **516** or the capture mechanism **18**, **118**, **218**, **318**, **418**, **518**. In a further embodiment, the stalk remnant is sealed by application of a ligature. In a still further embodiment the stalk remnant is sealed both by application of a ligature and by cauterization by the charged snare wire **16**, **116**, **216**, **316**, **416**, **516** or the capture mechanism **18**, **118**, **218**, **318**, **418**, **518**.

[0089] Further embodiments (not shown) incorporate a first magnet on the distal end of the snare wire and a second a magnet or an electromagnet on the capture mechanism or the head to facilitate the capture of the snare wire, or alternatively, to guide the snare wire to the capture mechanism. In these embodiments, the first magnet may act as a complement to or a replacement for the distal bulb or distal hook. In these embodiments, the second magnet may be positioned to attract and secure the first magnet, when the snare wire has been captured.

[0090] The open loop polypectomy system disclosed herein is adapted to be channeled to a desired position within a patient by passing the snare device though a channel in an elongated flexible tube adapted for introduction into a patient, such as an endoscopic tube containing an instrument insertion channel. In some embodiments, the polypectomy system may be used in conjunction with at least one additional endoscopic device. For example, an endoscopic tube may include two instrument insertion channels, one for the polypectomy system disclosed herein and the other for an endoscopic camera. In some embodiments, the camera may be used to detect cancerous masses or other target tissue and the polypectomy system used to remove the identified masses during a single colonoscopy procedure. By viewing the environment local to the distal end of the polypectomy system using the camera, the user may watch the progress of the snare wire and manipulate the polypectomy system so as to capture the snare wire using the capture mechanism when the snare wire is in the desired position.

[0091] The disclosed first, third, fourth and fifth embodiments are capable of functioning as both open loop polypectomy systems, as described above, and as closed loop polypectomy systems. When using the open loop polypectomy systems as closed loop polypectomy systems, the snare wire **16**, **216**, **316**, **416** is not used and the curved closed loop **24**, **224**, **324**, **424** may be used to capture polyps or other tissues using techniques known in the art.

[0092] Various aspects of different embodiments of the present disclosure are expressed in paragraphs X1, X2, X3 and X4 as follows:

[0093] X1. One embodiment of the present disclosure includes an open loop polypectomy system comprising: a snare wire; and a capture mechanism; wherein, when the snare wire is advanced, the snare wire extends from a distal portion of the system along a path passing through the capture mechanism; wherein, after the snare wire is advanced at least to the capture mechanism, activation of the capture mechanism captures the snare wire, creating a formed loop; and wherein retraction of at least one of the snare wire and capture mechanism contracts the formed loop.

[0094] X2. Another embodiment of the present disclosure includes an open loop polypectomy system comprising: a handle; an elongated flexible sheath including a distal end and a proximal end, the proximal end being attached to the handle; a snare wire extending from the distal end of the sheath; and a closed loop extending from the distal end of the sheath; wherein when the snare wire is advanced, the snare wire extends from the distal end through the closed loop; wherein, after the snare wire is advanced through the closed loop, retraction of the closed loop captures the snare wire, creating a formed loop; and wherein retraction of at least one of the snare wire and the capture mechanism contracts the formed loop.

[0095] X3. One embodiment of the present disclosure includes a snare device comprising: a snare wire; and a capture mechanism; wherein when the snare wire is advanced, the snare wire extends from a distal portion of the device along an arcuate path curving back toward the capture mechanism; wherein after the snare wire is advanced

at least to the capture mechanism, activation of the capture mechanism captures the snare wire, creating a formed loop; and wherein retraction of at least one of the snare wire and capture mechanism contracts the formed loop.

[0096] X4. Another embodiment of the present disclosure includes a snare device comprising: a head including at least one channel; a snare wire, at least a portion of the snare wire residing in the at least one channel; and a closed loop, at least a portion of the closed loop residing in the at least one channel; wherein when the snare wire is advanced, the snare wire extends from the at least one channel along an arcuate path curving back toward the closed loop; wherein, after the snare wire is advanced through the closed loop, retraction of the closed loop the captures the snare wire, creating a formed loop; and wherein retraction of at least one of the snare wire and the capture mechanism contracts the formed loop.

[0097] Yet other embodiments include the features described in any of the previous paragraphs X1, X2, X3 or X4, as combined with one of more of the following aspects:

[0098] Wherein at least one of the snare wire and the capture mechanism is rotatable.

[0099] Wherein the capture mechanism includes opposing jaws.

[0100] Wherein the capture mechanism includes a closed loop.

[0101] Wherein the capture mechanism is a curved closed loop.

[0102] Wherein the head includes a recessed portion.

[0103] Wherein the snare wire includes one of a distal bulb and a distal hook.

[0104] Wherein the snare wire includes a distal bulb.

[0105] Wherein the closed loop includes a notch sized to pass the snare wire and sized to prevent passage of the distal bulb.

[0106] Wherein, after the snare wire is advanced through the closed loop, retraction of the closed loop captures the snare wire in the notch.

[0107] Wherein a diameter of the distal bulb is greater than a diameter of the snare wire.

[0108] Wherein the head includes a recessed portion shaped to receive one of a distal bulb and a distal hook.

[0109] Wherein activation of the capture mechanism comprises transitioning opposing jaws from an open position to a closed position.

[0110] Wherein activation of the capture mechanism comprises retraction of the closed loop.

[0111] Wherein the snare device includes a head contacting a distal end of a sheath.

[0112] Wherein the open loop polypectomy system includes a head contacting a distal end of a sheath.

[0113] Wherein the snare device includes a head at least partially inserting within the distal end of a sheath.

[0114] Wherein the head includes at least one snare wire channel and at least one capture mechanism channel.

[0115] Wherein the head includes one snare wire channel and one capture mechanism channel.

[0116] Wherein the head includes one snare wire channel and two capture mechanism channels.

[0117] Wherein the head includes a notch sized to receive said snare wire.

[0118] Wherein the snare wire and the capture mechanism both extend from a distal end of an elongated flexible sheath.

[0119] Wherein creation of said formed loop completes a circuit for delivery of electrical current.

[0120] Wherein the handle includes a first control mechanism mechanically connected to the snare wire through the sheath.

[0121] Wherein manipulation of the first control mechanism extends, retracts, or rotates the snare wire.

[0122] Wherein the handle includes a second control mechanism mechanically connected to the closed loop through the sheath.

[0123] Wherein manipulation of the second control mechanism extends, retracts, or rotates the closed loop.

[0124] The foregoing detailed description is given primarily for clearness of understanding and no unnecessary limitations are to be understood therefrom, for modifications can be made by those skilled in the art upon reading this disclosure and may be made without departing from the spirit of the invention.

[0125] Reference systems, if used herein, refer generally to various directions (for example, top, bottom, upper, lower, forward, rearward, left, right, etc.), which are merely offered to assist the reader in understanding the various embodiments of the disclosure and are not to be interpreted as limiting. Other reference systems may be used to describe various embodiments.

[0126] While illustrated examples, representative embodiments and specific forms of the invention have been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive or limiting. The description of particular features in one embodiment does not imply that those particular features are necessarily limited to that one embodiment. Features of one embodiment may be used in combination with features of other embodiments as would be understood by one of ordinary skill in the art, whether or not explicitly described as such. Exemplary embodiments have been shown and described, and all changes and modifications that come within the spirit of the invention are desired to be protected.

What is claimed is:

1) A open loop polypectomy system comprising:

a snare wire; and

a capture mechanism;

wherein, when the snare wire is advanced, the snare wire extends from a distal portion of the system along a path passing through the capture mechanism;

wherein, after the snare wire is advanced at least to the capture mechanism, activation of the capture mechanism captures the snare wire, creating a formed loop; and

wherein retraction of at least one of the snare wire and capture mechanism contracts the formed loop.

2) The open loop polypectomy system of claim **1**, wherein the capture mechanism includes a closed loop.

3) The open loop polypectomy system of claim **2**, wherein said snare wire includes a distal bulb.

4) The open loop polypectomy system of claim **3**, wherein the closed loop includes a notch sized to pass the snare wire and sized to prevent passage of the distal bulb.

5) The open loop polypectomy system of claim **4**, wherein, after the snare wire is advanced through the closed loop, retraction of the closed loop captures the snare wire in the notch.

6) The open loop polypectomy system of claim **3**, wherein a diameter of the distal bulb is greater than a diameter of the snare wire.

7) The open loop polypectomy system of claim **1**, wherein at least one of the snare wire and the capture mechanism is rotatable.

8) The open loop polypectomy system of claim **1**, wherein the capture mechanism is a curved closed loop.

9) The open loop polypectomy system of claim **1**, wherein creation of said formed loop completes a circuit for delivery of electrical current.

10) The open loop polypectomy system of claim **1**, wherein the snare wire and the capture mechanism both extend from a distal end of an elongated flexible sheath.

11) An open loop polypectomy system comprising:

a handle;

an elongated flexible sheath including a distal end and a proximal end, the proximal end being attached to the handle;

a snare wire extending from the distal end of the sheath; and

a closed loop extending from the distal end of the sheath;

wherein when the snare wire is advanced, the snare wire extends from the distal end through the closed loop;

wherein, after the snare wire is advanced through the closed loop, retraction of the closed loop captures the snare wire, creating a formed loop; and

wherein retraction of at least one of the snare wire and the capture mechanism contracts the formed loop.

12) The open loop polypectomy system of claim **11**, wherein the handle includes a first control mechanism mechanically connected to the snare wire through the sheath.

13) The open loop polypectomy system of claim **12**, wherein manipulation of the first control mechanism extends, retracts, or rotates the snare wire.

14) The open loop polypectomy system of claim **11**, wherein the handle includes a second control mechanism mechanically connected to the closed loop through the sheath.

15) The open loop polypectomy system of claim **14**, wherein manipulation of the second control mechanism extends, retracts, or rotates the closed loop.

16) The open loop polypectomy system of claim **11**, wherein the handle includes an electrical input for receiving electrical current, whereby the current is delivered to the formed loop.

17) The open loop polypectomy system of claim **11**, wherein at least one of the snare wire and the closed loop is formed of one of a stainless steel, a shaped memory polymer or nitinol.

18) The open loop polypectomy system of claim **11**, wherein creation of the formed loop completes a circuit for delivery of electrical current.

19) The open loop polypectomy system of claim **11**, wherein said snare wire includes a distal bulb.

20) The open loop polypectomy system of claim **19**, wherein the closed loop includes a notch sized to pass the snare wire and sized to prevent passage of the distal bulb.

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摘要(译)

本发明的实施例涉及内窥镜和腹腔镜手术器械。更具体地，本发明的实施例涉及一种开环息肉切除术系统，其包括用于牢固地闭合环的装置。在一些实施例中，开环息肉切除术系统包括圈套器钢丝和捕获机构，其中当圈套器钢丝前进时，圈套器钢丝从开环息肉切除术系统的远端部分沿着穿过捕获机构的路径延伸。在圈套器钢丝已经前进通过捕获机构的平面之后，捕获机构的缩回固定圈套器钢丝，在目标组织周围形成形成的环。收集圈套器和捕获机构中的至少一个收缩所形成的环，切除目标组织。