(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
4 August 2011 (04.08.2011)

PCT

(10) International Publication Number
WO 2011/094261 A1

(51) International Patent Classification:
A61B 17/24 (2006.01)

(21) International Application Number:
PCT/US2011/022509

(22) International Filing Date:
26 January 2011 (26.01.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/336,832 27 January 2010 (27.01.2010) US

(71) Applicant *(for all designated States except US)*: **MERIT MEDICAL SYSTEMS, INC.** [US/US]; 1600 West Merit Parkway, South Jordan, Utah 84095 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **HEWITT, David R.** [US/US]; 8610 French Curve, Eden Prairie, Minnesota 55347 (US). **PRUKOP, Ted J.** [US/US]; 7 Wedgewood Lane, Ladera Ranch, California 92694 (US). **SEGERMARK, James D.** [US/US]; 3635 Big Fox Road, Gem Lake, Minnesota 55110 (US).

(74) Agent: **BETHARDS, Matthew S.**; STOEL RIVES LLP, 201 So. Main Street, Suite 1100, One Utah Center, Salt Lake City, Utah 84111 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(54) **Title**: SHAPEABLE RETRIEVAL DEVICE AND METHOD OF USING

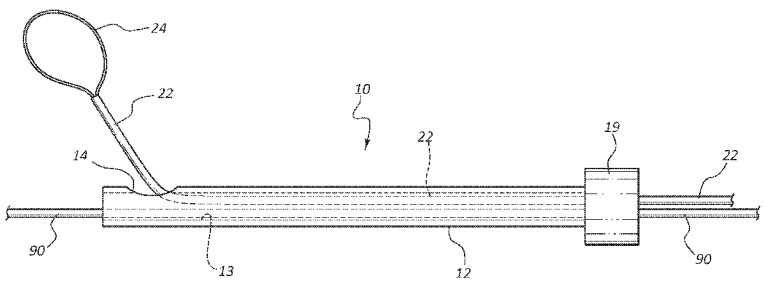

FIG. 7B

(57) **Abstract**: A retrieval device with a shapeable snare shaft for use in minimally invasive medical procedures. The retrieval device may further comprise a delivery conduit configured to receive both a snare shaft and a guidewire in one or more lumens. The retrieval device may also include a snare loop at both ends of the snare shaft.

WO 2011/094261 A1

SHAPEABLE RETRIEVAL DEVICE AND METHOD OF USING

TECHNICAL FIELD

[0001] The present disclosure relates generally to devices used to retrieve or manipulate items or structures located in anatomically remote locations, such as items located in body lumens. More specifically, the present disclosure relates to snare devices and methods for their use.

BRIEF DESCRIPTION OF THE DRAWINGS

[0002] The embodiments disclosed herein will become more fully apparent from the following description and appended claims, taken in conjunction with the accompanying drawings. These drawings depict only typical embodiments, which will be described with additional specificity and detail through use of the accompanying drawings in which:

[0003] Figure 1 is a side view of a delivery conduit having a single lumen.

[0004] Figure 1A is a cross sectional view taken through lines 1A-1A of the delivery conduit of Figure 1.

[0005] Figure 2 is a side view of a snare device with two loops.

[0006] Figure 2A is a side view of the snare device of Figure 2, with a bend placed in the shaft of the device.

[0007] Figure 3 is a side view of a snare device having with a loop at each end of the shaft portion and multiple bends in the shaft portion.

[0008] Figure 3A is a cross sectional view taken through lines 3A-3A of the snare loop shown in Figure 3.

[0009] Figure 4 is a side view of a snare device with two loops, each loop having a rectangular profile, and a shaft portion with a single angular bend.

[0010] Figure 4A is a cross sectional view taken through lines 4A-4A of the snare loop shown in Figure 4.

[0011] Figure 5 is a side view of a snare device with a trapezoidal loop at one end of the shaft, a circular loop at another end of the shaft, and a single angular bend in the shaft.

[0012] Figure 5A is a cross sectional view taken through lines 5A-5A of the snare loop shown in Figure 5.

[0013] Figure 6 is a side view of a snare device with an elliptical loop at one end of the shaft, a rectangular loop at another end of the shaft, and a shaft with multiple bends.

[0014] Figure 6A is a cross sectional view taken through lines 6A-6A of the snare loop shown in Figure 6.

[0015] Figure 7A is a side view of an embodiment of a snare device with a delivery conduit and a guidewire.

[0016] Figure 7B is a side view of the snare device of Figure 7A with the snare loop extended from the delivery conduit.

[0017] Figure 7C is a side view of the snare device of Figures 7A and 7B with the snare loop extended from the delivery conduit and surrounding a fragment.

[0018] Figure 7D is side view of the snare device of Figures 7A, 7B, and 7C with the snare loop drawn partially into the lumen such that the fragment is trapped between the loop and the delivery conduit.

[0019] Figure 8A is a side view of a snare device having a delivery conduit with two lumens.

[0020] Figure 8B is a cross sectional view of the delivery conduit taken through lines 8B-8B.

[0021] Figure 8C is a cross sectional view of another embodiment of a delivery conduit with two lumens.

[0022] Figure 8D is a cross sectional view of yet another embodiment of a delivery conduit with two lumens.

DETAILED DESCRIPTION

[0023] A snare device may be configured to allow a practitioner to change the shape of the snare device during a therapeutic procedure. Such a device may allow a practitioner to more precisely position the device with respect to the object to be retrieved and the surrounding body lumen. Precise positioning of a snare device may enable a practitioner to more quickly and efficiently perform the needed therapy. Further, precise positioning may lessen trauma at the therapy site, minimizing injury from unwanted contact between the snare and portions of the body lumen. For example, precise positioning of the snare loop may reduce the possibility that the snare loop will rotate (or “whip”) during therapy, which rotation can damage the inner lining of blood vessels.

[0024] It will be readily understood that the components of the embodiments as generally described and illustrated in the Figures herein could be arranged and designed in a wide variety of different configurations. Thus, the following more detailed description of various embodiments, as represented in the Figures, is not intended to limit the scope of the disclosure, but is merely representative of various embodiments. While the various aspects of the embodiments are presented in drawings, the drawings are not necessarily drawn to scale unless specifically indicated.

[0025] The phrases "connected to," "coupled to," and "in communication with" refer to any form of interaction between two or more entities, including mechanical, electrical, magnetic, electromagnetic, fluid, and thermal interaction. Two components may be coupled to each other even though they are not in direct contact with each other. For example, two components may be coupled to each other through an intermediate component.

[0026] The directional terms "distal" and "proximal" are given their ordinary meaning in the art. That is, the distal end of a medical device means the end of the device furthest from the practitioner during use. The proximal end refers to the opposite end, or the end nearest the practitioner during use.

[0027] "Delivery conduit," as used herein, refers to an artificial channel capable of establishing communication between a remote location and an external environment. For example, in certain embodiments described herein, the delivery conduit comprises the outer sheath of a snare device, which in some embodiments comprises a catheter.

[0028] A used herein "fragment" means either a foreign object disposed within a body lumen or an anatomical structure within the body which requires ligation or removal.

[0029] Further, as used herein, a "snare device" refers to a medical device with an elongate shape having at least one "snare loop." Thus, a snare device may or may not include a delivery conduit or outer sheath member. As used herein a "snare loop" refers to a closed shape configuration of an elongate member such as a wire. The term is not limited to "loops" with generally circular shapes, but includes any variety of shapes, including, for example, square loops, rectangular loops, ellipsoidal loops, trapezoidal loops, etc.

[0030] Finally, as used herein, the term "shapeable" refers to a component that retains approximately at least 25% of its shape when it is (1) plastically deformed or shaped, (2) coupled with a second component which tends to deform the first component from its shaped state (such as to its original shape), and (3) removed from the second component. For example, a shaft which is initially substantially straight, deformed with an angular bend, then placed in a sheath which tends to hold the shaft in a straight position is "shapeable" if the shaft retains approximately at least 25% of the angle of the deformation when it is removed from the sheath. Similarly, the term "shaped" refers to components that are pre-shaped, which tend to retain their shape and cannot be readily plastically deformed. For example, a snare loop formed from a memory alloy with a given shape which is placed in a sheath which constrains that shape may be said to be "shaped" if the snare loop returns to its original shape when removed from the sheath.

[0031] Referring now to Figure 1 which is a side view of a delivery conduit 12 having a single lumen 13. In the illustrated embodiment, the lumen 13 extends the length of the delivery conduit 12, from the proximal end 18 of the delivery conduit 12 to the distal end 16 of the delivery conduit 12. As also shown in Figure 1A, the delivery conduit 12 and the lumen 13 may define a side wall 15 of the delivery conduit. The side wall 15 may be defined as the portion of the delivery conduit 12 surrounding the lumen where the outer surface of the side wall runs generally parallel to the longitudinal axis of the delivery conduit 12. In some embodiments, the delivery conduit may have a side port 14, or an opening in the side wall 15 of the delivery conduit 12.

[0032] In certain embodiments the delivery conduit 12 may also be configured with a connector 19 to couple the delivery conduit 12 to another device. This connector 19 may be any type of connector known in the art, for example a Luer connector.

[0033] In the illustrated embodiment the side port 14 extends through the side wall 15 of the delivery conduit 12 allowing access from the lumen 13 to an area outside the delivery conduit 12. In one embodiment the side port 14 constitutes a removed area of from about 5% to about 48% of the circumference of the side wall 15 of the delivery conduit. In other embodiments the side port 14 may fall into a smaller range of values, for example from about 25% to about 48% of the circumference of the delivery conduit.

[0034] In some embodiments the distal end 16 of the delivery conduit 12 may be open, creating an end port, or distal opening in the distal tip of the delivery conduit 12. In such embodiments, the lumen 13 extends through the end of the delivery conduit 12 at the distal end 16. It other embodiments the lumen 13 may not extend through the distal end 16 of the delivery conduit 12. It will be appreciated that in some embodiments the delivery conduit 12 will have such an opening at the distal end 16 in addition to a side port 14, whereas in other embodiments the delivery conduit 12 will only have a side port 14 with no opening at the distal end 16. In still further embodiments the delivery conduit will only have an opening at the distal end 16 and have no side port 14.

[0035] In embodiments where the delivery conduit 12 has an opening at the distal end 16, the opening may be configured to allow a guidewire (not shown) or other elongate medical device to extend through the distal end of the delivery conduit 12. In one embodiment the delivery conduit 12 may be configured such that the lumen 13 is sized to accommodate both a guidewire and the shaft of a snare device. In one example of such an embodiment, the guidewire may be configured to extend through an opening in the distal end 16 of the delivery conduit 12 and the snare device configured to extend through a side port 14. In other embodiments, both a guidewire and a snare device may extend through the same opening.

[0036] In certain embodiments the delivery conduit 12 defines an outer sheath through which medical devices (for example guidewires or snare devices) may pass during therapy. It will be appreciated that medical devices disposed within the delivery conduit 12 may be configured to be longitudinally displaceable with respect to the delivery conduit 12 during use.

[0037] The delivery conduit 12 may be made from any extrudable, medical grade plastic such as those commonly used for making catheters. Examples include but are not limited to polyurethane, polyethylene (varying densities), PET (polyethylene terephthalate), PVC, polypropylene, nylon, peba byx, ABS, Hytrel ®, Santoprene ®, polycarbonate, Kraton ®, PES, PVDF, and FEP. The extruded plastic may be cut to length, followed by creation of the side opening 14 by conventional cutting or machining methods known in the art.

[0038] Figures 2-6 are side views of snare devices comprising shafts and snare loops. It will be appreciated that the illustrated embodiments have analogous features. The disclosure recited in connection with any embodiment may be

applicable to any analogous feature in another embodiment, whether or not the components are numbered in both embodiments. Further, it will be appreciated that any of the snare devices illustrated or described in connection with any of Figures 2-6 may be used in any combination with any of the embodiments of delivery conduits disclosed in connection with Figures 1 and 1A. Figures 2A, 3A, 4A, 5A, and 6A are cross sectional views of the corresponding snare devices, but it will be appreciated that any of the disclosure or features recited in connection with any of these embodiments may analogously apply to every other embodiment or combination.

[0039] Figure 2 is a side view of an embodiment of a snare device 20 comprising a first snare loop 24 attached to one end of a shaft 22 and a second snare loop 26 attached to an opposite end of the shaft 22. In this embodiment both the first snare loop 24 and the second snare loop 26 are configured to be in a generally circular configuration. In some embodiments the snare loops 24, 26 may be shaped. In other words, the circular configuration of the first snare loop 24 and the second snare loop 26 may be retained by constructing the first snare loop 24 and the second snare loop 26 of a superelastic material (such as a nickel titanium alloy, for example, nitinol). Superelastic materials may be able to be deformed to a much greater degree than ordinary materials without taking a permanent kink. It will be appreciated that in some embodiments only one of the two loops may be formed of a superelastic material, both loops may be so formed, or neither loop may be formed of a superelastic material.

[0040] In the embodiment illustrated in Figure 2, the first snare loop 24 and the second snare loop 26 are configured to be of differing sizes. When utilizing such embodiments, a physician may discover during the procedure one size of snare loop 24, 26 may be preferred or required. Accordingly, in certain embodiments the physician can insert the snare device into a body lumen in such a manner as to utilize the desired snare loop 24, 26.

[0041] Figure 2A is a side view of the snare device 20 shown in Figure 2, wherein the shaft 22 has been configured to have a bend 28 along its length. In certain embodiments, the shaft 22 may be shapeable, that is, made of a material such as stainless steel which allows a permanent deformation to be placed in it prior to or during the procedure as determined by the physician.

[0042] Figure 3 is a side view of another embodiment of a snare device 30 which has a shaft 34 configured with an angular bend 36 and an additional composite bend

38. In some embodiments bends 36, 38 will be formed during therapy and shaped according to an individual physician's preference. The shaft 34 may be made of a material such as stainless steel which allows a permanent deformation to be placed in it prior to or during the procedure as determined by the physician. As illustrated in Figure 3, a first snare loop 32 having an elliptical configuration may be attached to one end of the shaft 34 and a second snare loop 33 having a circular configuration may be attached to an opposite end of the shaft 34. The elliptical configuration of the first snare loop 32 and the second snare loop 33 may be retained by constructing the first snare loop 32 and the second snare loop 33 of a of a superelastic material (such as a nickel titanium alloy, for example, nitinol).

[0043] Figure 4 is a side view of an embodiment of a snare device 40 which has a shaft 44 configured with an angular bend 46. The shaft 44 may be made of a material such as stainless steel which allows a permanent deformation to be placed in it prior to or during the procedure as determined by the physician. In the illustrated embodiment, a first snare loop 42 having a rectangular configuration is attached to one end of the shaft 44 and a second snare loop 43 having a smaller rectangular configuration is attached to an opposite end of the shaft 44. The rectangular configuration of the first snare loop 42 and the second snare loop 43 may be retained by constructing the first snare loop 42 and the second snare loop 43 of a superelastic material.

[0044] Figure 5 is a side view of yet another embodiment of a snare device 50 having a first snare loop 52 shaped into a trapezoidal configuration and a shaft 54 shaped to have a single, angular, bend 56. A second snare loop 53 in a circular configuration is attached to an opposite end of the shaft 54. The trapezoidal configuration of the first snare loop 52 and the circular configuration of the second snare loop 53 may be retained by constructing the first snare loop 52 and the second snare loop 53 of a superelastic material. The shaft 54 may be made of a material such as stainless steel which allows a permanent deformation to be placed in it prior to or during the procedure as determined by the physician.

[0045] Figure 6 is a side view of an embodiment of a snare device 60 having a first snare loop 62 shaped into an elliptical configuration and a shaft 64 shaped to have a first angular bend 66, second angular bend 68 and a second snare loop 63 having a rectangular configuration. It is noted that, in this embodiment, the second snare loop 63 is smaller in dimension than the first snare loop 62. The elliptical

configuration of the first snare loop 62 and the rectangular configuration of the second snare loop 63 may be retained by constructing the first snare loop 62 and the second snare loop 63 of a superelastic material. The shaft 64 may be made of a material such as stainless steel which allows a permanent deformation to be placed in it prior to or during the procedure as determined by the physician.

[0046] It will be understood that the specific configurations shown in Figures 2-6 are illustrative only and that many possible shapes and configurations are possible. For example, any size or shape of snare loop described above may be used in any combination with any other size or shape of snare loop disclosed or any shape or configuration of shaft disclosed. Further, the particular shapes, sizes, and configurations are illustrative only; it is within the scope of the current disclosure to modify these shapes and sizes in a manner known in the art.

[0047] In some embodiments, the shafts 22, 34, 44, 54, 64 as seen in Figures 2-6 are shipped in an unshaped configuration and may also be used without a physician shaping the shaft during the procedure.

[0048] As depicted in Figures 3A, 4A, 5A, and 6A, the snare loops 24, 26, 32, 33, 42, 43, 52, 53, 62, 63 may be radiopaque in nature. Figures 3A, 4A, 5A, 6A are cross sectional views taken through the snare loops 32, 42, 52, 62 and show a radiopaque coating 95 which surrounds the core wire 97. Though not shown in the figures, it will be understood that the snare loops 24, 26, 32, 33, 42, 43, 52, 53, 62, 63 may also be radiopaque in some embodiments. Radiopacity may be imparted to the snare loops by processes known to those having skill in the art, including but not limited to dipping, coating, plating, vapor deposition, coils, coverings, and sleeves. Exemplary radiopaque materials include platinum, and gold plated tungsten. In one embodiment only the snare loops 24, 26, 32, 33, 42, 43, 52, 53, 62, 63 are radiopaque, while in other embodiments (not shown) the radiopaque coating 95 may extend proximally further down the shafts 22, 34, 44, 54, 64.

[0049] The snare devices 20, 30, 40, 50, 60 may be made by obtaining a shapeable wire of a thickness (in some embodiments between about 0.014 - 0.018 inches) suitable to maintain a bend, for the shaft portions 22, 34, 44, 54, 64, followed by cutting the wire to length. Suitable shaft materials include but are not limited to 304 stainless steel and 316 stainless steel, and could also include any non-superelastic material able to be quickly and easily shaped. In one embodiment, the snare loop 24, 26, 32, 33, 42, 43, 52, 53, 62, 63 is attached to a more proximal point

of the shaft wire and attached by conventional attachment methods known in the art, including but not limited to welding, adhesives, ball-and-socket techniques, cinching mechanisms, and mechanical fasteners. When completed, the joined area (not shown) may be substantially flush with the wire so as to minimize the occurrence of rough or inequitable areas that could cause tissue damage upon deployment.

[0050] Radiopacity may be imparted to the snare loops 24, 26, 32, 33, 42, 43, 52, 53, 62, 63 by applying a radiopaque coating 95 by conventional methods as discussed above. Following curing of the radiopaque coating 95 the snare wire 20, 30, 40, 50, 60 may be sterilized and loaded into a delivery conduit 12 with the proximal end being inserted through the proximal opening 18.

[0051] Figures 7A-8D illustrate embodiments of snare devices where shaft members such as those disclosed in connection with Figures 2-6 and 2A-6A are coupled to a delivery conduit such as that described in connection with Figures 1 and 1A.

[0052] Figures 7A-7D illustrate a snare device 10 comprising a single lumen 13 with a snare shaft 22 and a guidewire 90 disposed within the lumen 13. In the illustrated embodiment the delivery conduit 12 is configured with a side port 14 and an opening at the distal end of the delivery conduit. The guidewire is configured to extend through the opening in the distal end of the delivery conduit 12 and the snare loop and shaft configured to extend through the side port 14. Figures 7A-7D illustrate a single lumen delivery conduit 12 in multiple stages of deployment, including trapping a fragment F.

[0053] Figures 8A-8D illustrate embodiments of a snare device 10 with two lumens 13A, 13B. Figure 8A illustrates a snare device 10 comprising a delivery conduit 12 with two lumens 13A, 13B, a snare shaft 22 and loop 24, and a guidewire 90. In the illustrated embodiment, the snare shaft 22 is disposed within lumen 13A and the guidewire within lumen 13B. As illustrated, lumen 13A may have a side port 14 configured to allow communication between lumen 13A and an area outside the delivery conduit 12. In addition to side port 14, lumen 13A may also be configured with an opening at the distal end of the delivery conduit 12. Similarly, lumen 13A could include an opening at the distal end of the delivery conduit without a side port 14. In the illustrated embodiment, lumen 13B is configured with an opening at the distal end of the delivery conduit 12. Similar to lumen 13A, lumen 13B could also be configured only with a side port, only with an opening at the distal end of the delivery

conduit, or both. Furthermore, though the illustrated embodiment shows guidewire 90 disposed within lumen 13B and snare shaft 22 disposed within lumen 13A, in other embodiments, lumen 13A may be configured to receive a guidewire and lumen 13B configured to receive a snare shaft.

[0054] Figures 8B-8D illustrate cross sectional views of certain embodiments of a two lumen delivery conduit. The delivery conduit may have a substantially circular cross section with semicircular lumens at in Figure 8B, a "figure 8" cross section with circular lumens as in Figure 8C, a circular cross section with one semicircular lumen and one rounded (either circular or elliptical) lumen as in Figure 8D, or any combination of delivery conduit and lumen cross sectional shapes. For example, a delivery conduit may also have a circular cross section with two circular or elliptical lumens disposed within it. In Figure 8D a guidewire 90 is disposed within the elliptical lumen 13B and the snare shaft 22 within the semicircular lumen 13A. It will be appreciated that in other embodiments the lumen configured to receive the guidewire 90 may be semicircular in shape while the lumen configured to receive the snare shaft 22 may be ellipsoidal.

[0055] In certain embodiments the delivery conduit may further include three or more lumens. For example, in one embodiment the snare device may have a first lumen configured to receive a snare shaft, a second lumen configured to receive a guidewire, and a third lumen configured to receive a balloon device.

[0056] Figures 7A-7D generally may be understood as illustrating potential relative positions of the components of the snare device 10 during therapy. The therapeutic procedure may involve any therapy in which snares or snare devices may be utilized such as removing a fragment (either a foreign object or body matter) from a lumen of the central venous system, for example. To use the device, the physician may first remove the snare device from a sterile package (not shown). A snare shaft 22 may be disposed within the delivery conduit 12 in the packaged configuration. A physician may remove the snare shaft 22 from the delivery conduit 12 by displacing the snare shaft 22 with respect to the delivery conduit 12 in a proximal direction. In embodiments where the snare shaft has a snare loop coupled to each end, the physician will determine which snare loop is desirable to perform the therapy.

[0057] Once the snare shaft 22 is removed from the delivery conduit, the physician may deform the snare shaft into a desired configuration. The desired

configuration may include multiple bends (including compound bends), a single bend, or no bend at all. The physician may deform the shaft by use of human hands, by placement of the unshaped shaft over a mandrel, or any other means known in the art.

[0058] During therapy the delivery conduit 12 may be introduced into a body lumen of a patient. In some embodiments a guidewire 90 may be utilized to position the delivery conduit 12 and navigate the delivery conduit 12 through the body lumen. It will also be appreciated that the snare shaft 22 may be disposed within the delivery conduit 12 when the delivery conduit is initially introduced into the body lumen, or the snare shaft may be inserted into a lumen of the delivery conduit 12 after the delivery conduit is disposed within a body lumen of the patent. Further, the physician may: (A) remove the snare shaft 22 from the delivery conduit before the delivery conduit 12 is introduced into the body, shape the snare shaft 22, and reinsert the snare shaft 22 into the delivery conduit 12 before the delivery conduit is first introduced into the body; (B) the physician may first introduce the delivery conduit 12 (with the snare shaft 22 disposed inside) into the body, then remove the snare shaft 22 for shaping and reinsertion; (C) the physician may insert the delivery conduit 12 into the body lumen without the snare shaft 22 disposed inside, shape the snare shaft 22, then insert the snare shaft 22 into the delivery conduit 12; (D) or any other combination of these sequences. Furthermore, the physician may remove the snare shaft 22 from the delivery conduit 12 at any point during therapy for shaping or reshaping, regardless of whether the snare shaft 22 has already been shaped.

[0059] Once the delivery conduit 12 and snare shaft 22 are positioned and shaped for therapy, the physician may deploy the snare loop 24 by displacing the snare shaft 22 in a distal direction relative to the delivery conduit 12. As illustrated in Figure 7A-7D, the snare loop 24 may then be manipulated to surround the fragment F. Once the snare loop 24 is in place, the physician may then displace the snare shaft 22 in a proximal direction with respect to the delivery conduit 12 such that the fragment F is trapped between the snare loop 24 and the delivery conduit 12, as shown in Figure 7D. The snare device 10 may then be removed from the body lumen, thus removing the fragment F from the body.

[0060] In some embodiments it will be desirable to extend the guidewire 90 beyond the delivery conduit 12 (either through a distal opening or through a side port) prior to deploying the snare loop 24 beyond the delivery conduit 12. This

sequence may reduce the frequency of instances wherein the snare loop 22 inadvertently captures or becomes entangled with the guidewire 90.

[0061] Without further elaboration, it is believed that one skilled in the art can use the preceding description to utilize the present disclosure to its fullest extent. The examples and embodiments disclosed herein are to be construed as merely illustrative and exemplary and not a limitation of the scope of the present disclosure in any way. It will be apparent to those having skill in the art that changes may be made to the details of the above-described embodiments without departing from the underlying principles of the disclosure herein.

Claims

1. A snare device, comprising:

an elongate outer sheath having proximal and distal ends and having a first lumen disposed within the outer sheath between the proximal and distal ends of the outer sheath, the first lumen having a proximal opening near the proximal end of the outer sheath and a distal opening near the distal end of the outer sheath;

an elongate shaft having a first end and a second end, the shaft configured to be disposed within the first lumen of the outer sheath; and

a first snare loop coupled to the first end of the shaft and a second snare loop coupled to the second end of the shaft.

2. The snare device of claim 1, wherein the first snare loop circumscribes a larger area than the second snare loop.

3. The snare device of claim 1, wherein the distal opening of the first lumen is located in a side wall of the outer sheath.

4. The snare device of claim 1, wherein the outer sheath further comprises a second lumen having a proximal opening near the proximal end of the sheath and a distal opening near the distal end of the sheath, the second lumen configured to receive a guidewire.

5. The snare device of claim 4, wherein the distal opening of the second lumen is located at the distal end of the outer sheath, such that the distal opening of the second lumen is located distal of the distal opening of the first lumen.

6. The snare device of claim 1, wherein the shaft is shapeable.

7. The snare device of claim 1, wherein at least one of the first snare loop or the second snare loop is coated with a radiopaque material.

8. A snare device, comprising:

an elongate outer sheath having proximal and distal ends and having a first lumen disposed within the outer sheath between the proximal and distal ends of the outer sheath, the first lumen having a proximal opening near the proximal end of the outer sheath and a distal opening near the distal end of the outer sheath;

an elongate shapeable shaft having a first end and a second end, the shaft configured to be disposed within the first lumen of the outer sheath; and

a first snare loop coupled to the first end of the shaft.

9. The snare device of claim 8, wherein the distal opening of the first lumen is located in a side wall of the outer sheath.

10. The snare device of claim 8, wherein the outer sheath further comprises a second lumen having a proximal opening near the proximal end of the sheath and a distal opening near the distal end of the sheath, the second lumen configured to receive a guidewire.

11. The snare device of claim 10, wherein the distal opening of the second lumen is located at the distal end of the outer sheath, such that the distal opening of the second lumen is located distal of the distal opening of the first lumen.

12. The snare device of claim 8, wherein the first snare loop is coated with a radiopaque material.

13. The snare device of claim 8, wherein a second snare loop is coupled to the second end of the shaft.

14. The snare device of claim 13, wherein the first snare loop circumscribes a larger area than the second snare loop.

15. A snare assembly, comprising:

an elongate outer sheath having proximal and distal ends and having a first lumen disposed within the outer sheath between the proximal and distal ends of the outer sheath, the first lumen having a proximal opening near the proximal end of the outer sheath and a first distal opening near the distal end of the outer sheath;

an elongate shaft having a first end and a second end, the shaft configured to be disposed within the first lumen of the outer sheath;

a first snare loop coupled to the first end of the shaft; and

a guidewire configured to be disposed within a lumen of the outer sheath.

16. The snare assembly of claim 15, wherein: the first distal opening is in a side wall of the first lumen; the first lumen has a second distal opening located distal of the first distal opening; and wherein the first snare loop is configured to extend from the first distal opening and the guidewire is configured to extend from the second distal opening.

17. The snare assembly of claim 15, wherein the outer sheath further comprises a second lumen having a proximal opening near the proximal end of the outer sheath and a distal opening near the distal end of the outer sheath and wherein the guidewire is disposed within the second lumen, such that the distal opening of the second lumen is located distal of the distal opening of the first lumen.

18. The snare assembly of claim 17, wherein the first distal opening of the first lumen is located in a side wall of the outer sheath.

19. The snare assembly of claim 15, wherein a second snare loop is coupled to the second end of the shaft.

20. The snare assembly of claim 19 wherein the first snare loop circumscribes a larger area than the second snare loop.

21. A snare device, comprising:

an elongate body member, having a first end and a second end;

a first snare loop coupled to the first end of the body member; and

a second snare loop coupled to the second end of the body member;

wherein the body member is shapeable.

22. The snare device shaft of claim 21, wherein at least one of the first snare loop or the second snare loop is coated with a radiopaque material.

23. The snare device shaft of claim 21, wherein the first snare loop circumscribes a larger area than the second snare loop.

24. A method for retrieving a fragment in a body lumen of a patient, comprising:

obtaining a snare assembly, comprising:

an elongate outer sheath having proximal and distal ends and having at least one lumen disposed within the outer sheath between the proximal and distal ends of the outer sheath, at least one lumen having a proximal opening near the proximal end of the outer sheath, a distal opening near the distal end of the outer sheath, and a side wall opening near the distal end of the outer sheath wherein the side wall opening is located proximal of the distal opening;

an elongate shaft having a first end and a second end, the shaft configured to be disposed within at least one lumen of the outer sheath;

a first snare loop coupled to the first end of the shaft;

a guidewire configured to be disposed within at least one lumen of the outer sheath;

inserting the elongate outer sheath into the body lumen of a patient;

inserting the guidewire into at least one lumen of the outer sheath and extending the guidewire through a distal opening of the outer sheath;

inserting the snare shaft into at least one lumen of the outer sheath and extending the first snare loop through a side wall opening of the outer sheath;

trapping a fragment inside of the body lumen between the first snare loop and the outer sheath by first surrounding the fragment with the first snare

loop then displacing the snare shaft in a proximal direction relative to the outer sheath; and

retrieving the fragment by removing the snare assembly from the body lumen.

25. The method of claim 24, wherein the guidewire is inserted into at least one lumen of the outer sheath before the snare shaft is inserted into at least one lumen of the outer sheath.

26. The method of claim 24, wherein the elongate outer sheath comprises:

a first lumen disposed within the outer sheath between the proximal and distal ends of the outer sheath, the first lumen having a proximal opening near the proximal end of the outer sheath and a distal opening near the distal end of the outer sheath and

a second lumen disposed within the outer sheath between the proximal and distal ends of the outer sheath, the second lumen having a proximal opening near the proximal end of the outer sheath and a distal opening near the distal end of the outer sheath,

wherein the snare shaft is inserted into the first lumen and the guidewire is inserted into the second lumen.

27. The method of claim 26, wherein the distal opening of the first lumen is located in a side wall of the outer sheath and the distal opening of the second lumen is located proximal of the distal opening of the second lumen.

28. The method of claim 24, further comprising shaping the snare shaft to a desired configuration.

29. The method of claim 24, wherein inserting the snare shaft into at least one lumen of the outer sheath, comprises:

inserting the snare shaft into at least one lumen of the outer sheath a first time;

determining how the shaft may be shaped in order to facilitate trapping the fragment;

removing the snare shaft from at least one lumen;

shaping the snare shaft to a desired configuration by bending the shaft; and

reinserting the snare shaft into at least one lumen.

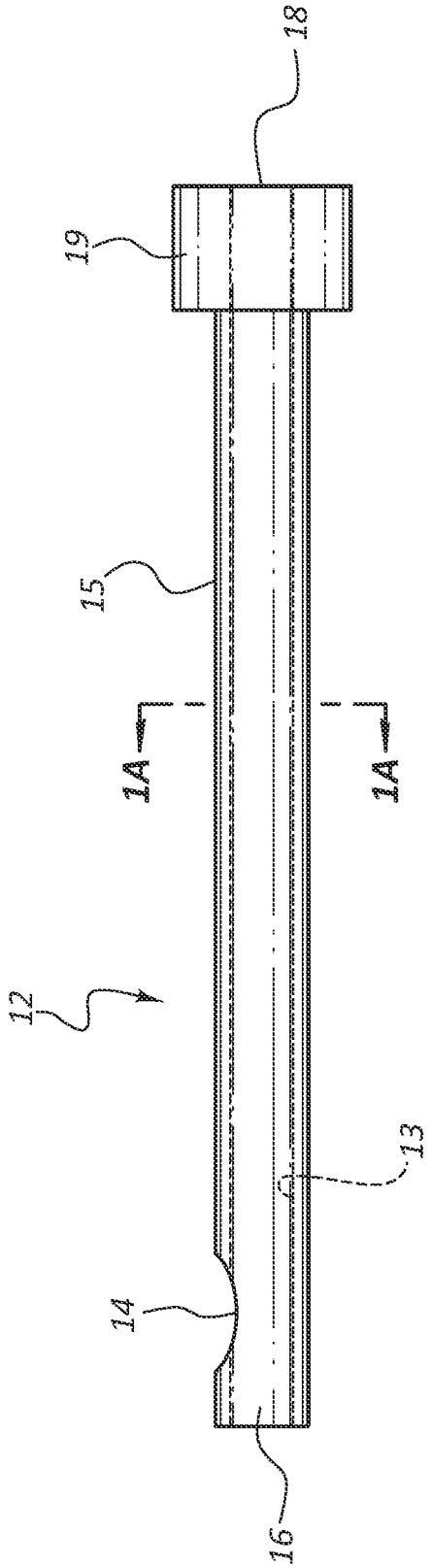

FIG. 1

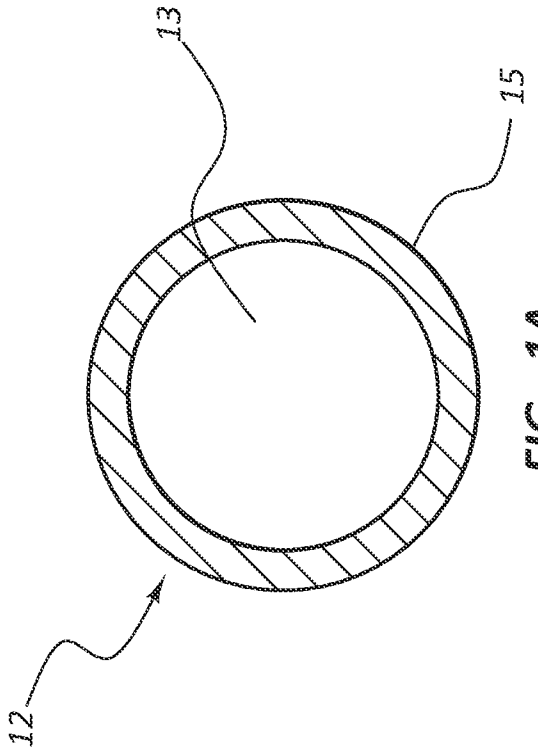

FIG. 1A

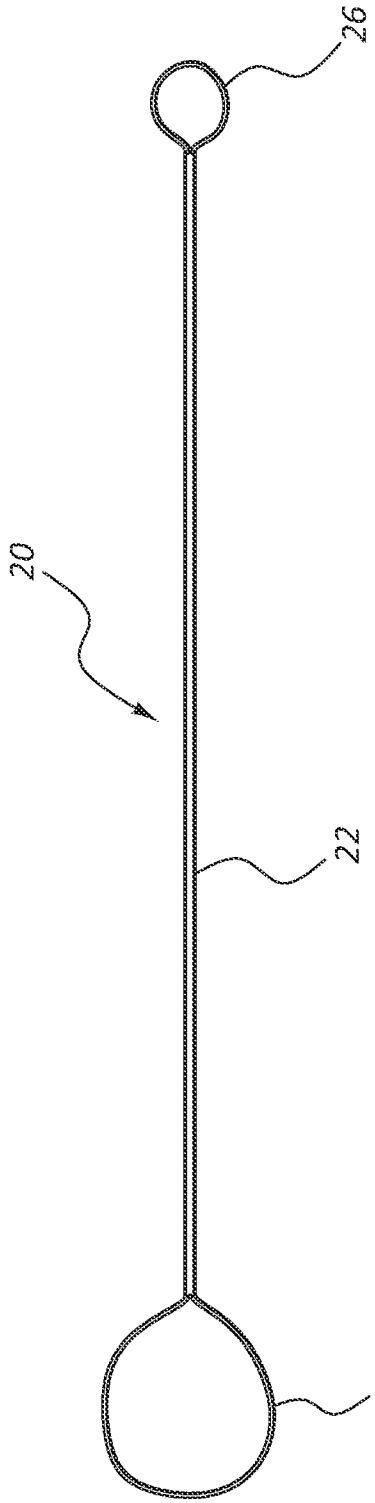

FIG. 2

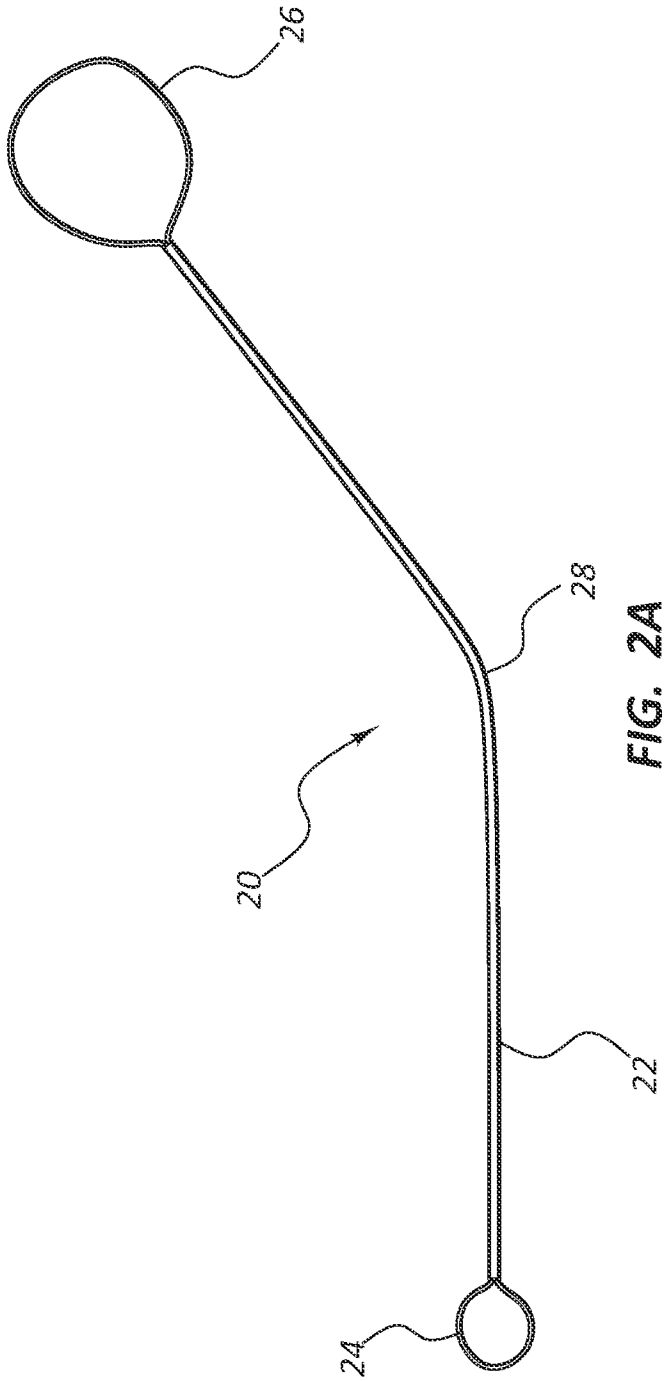

FIG. 2A

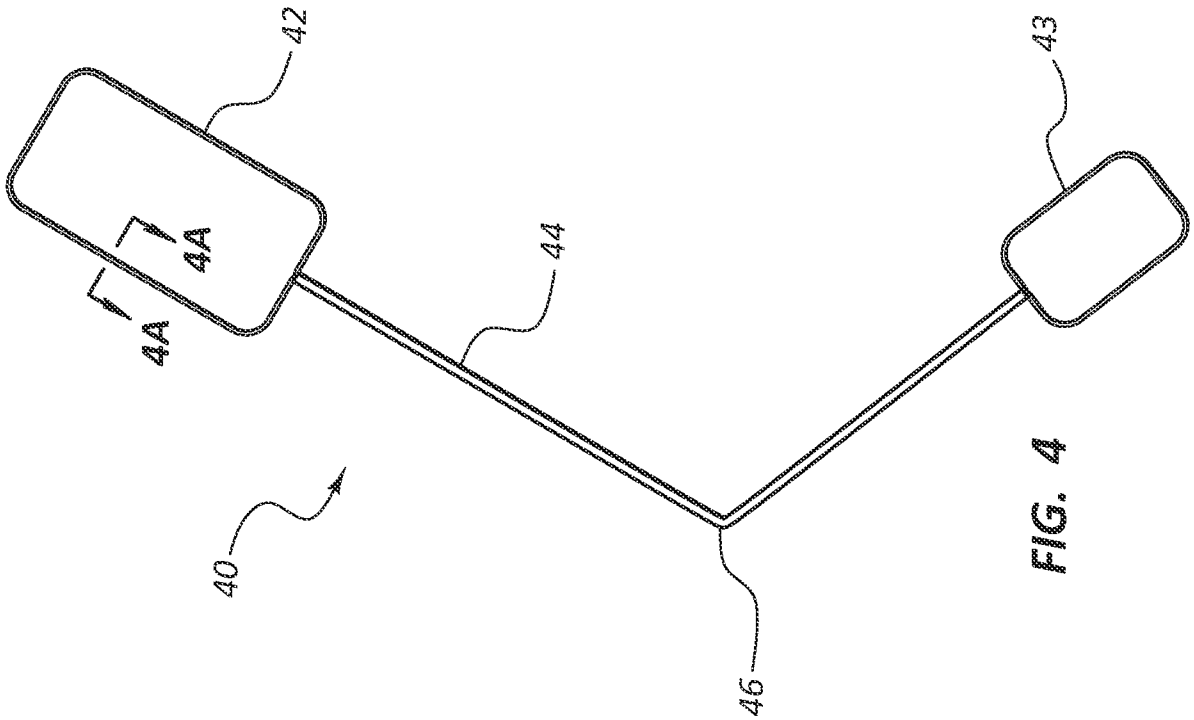

FIG. 4

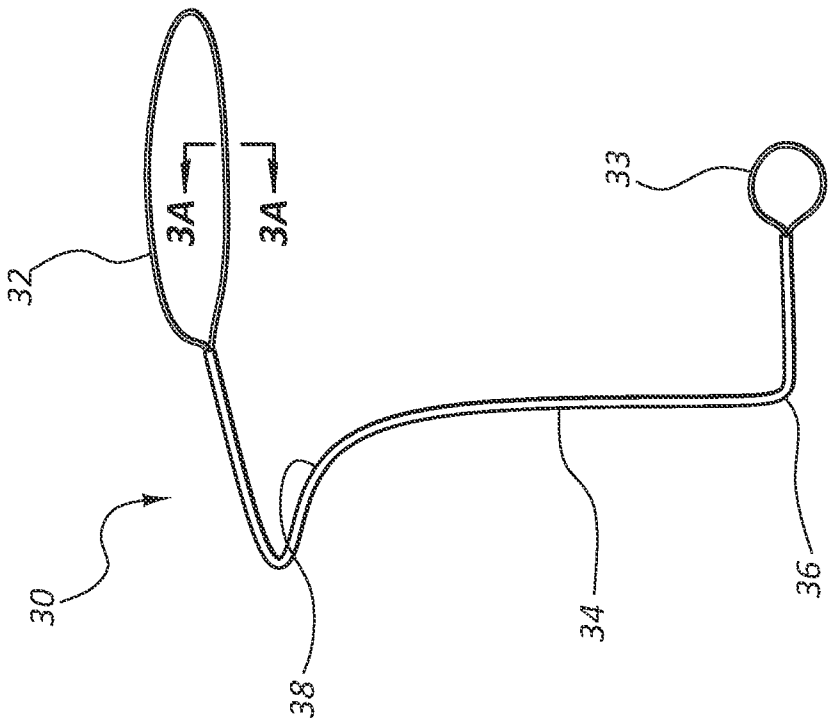

FIG. 3

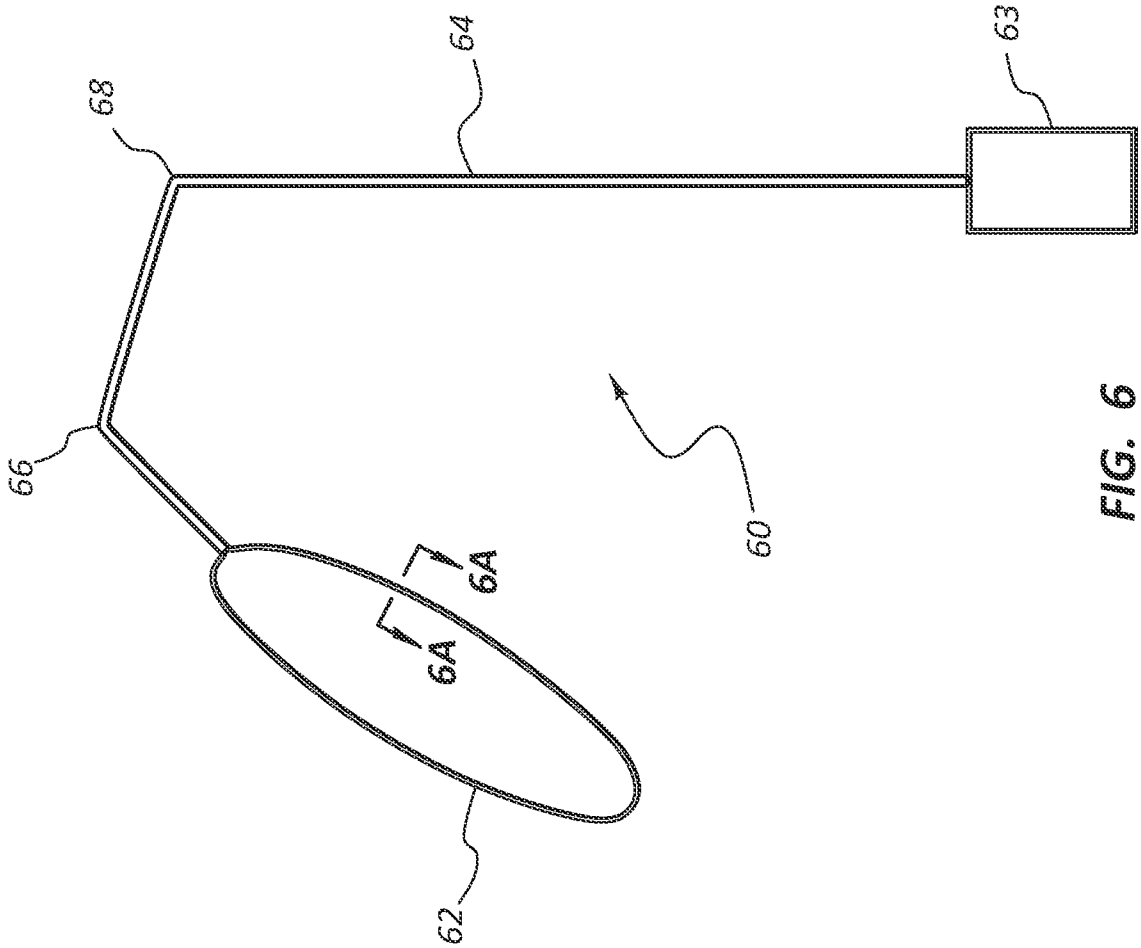

FIG. 6

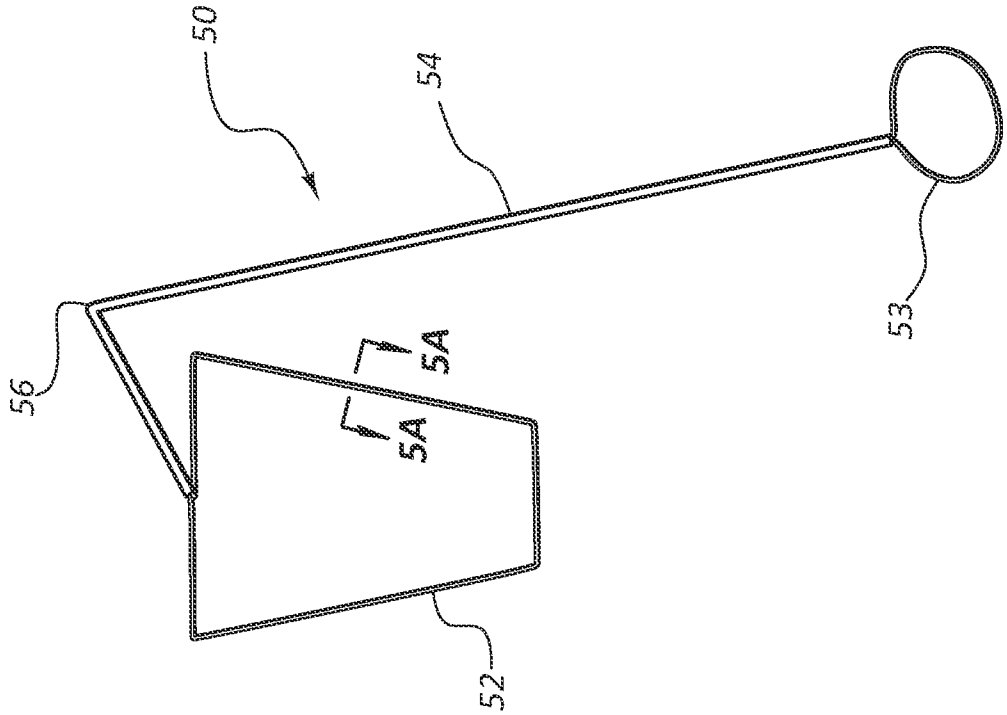

FIG. 5

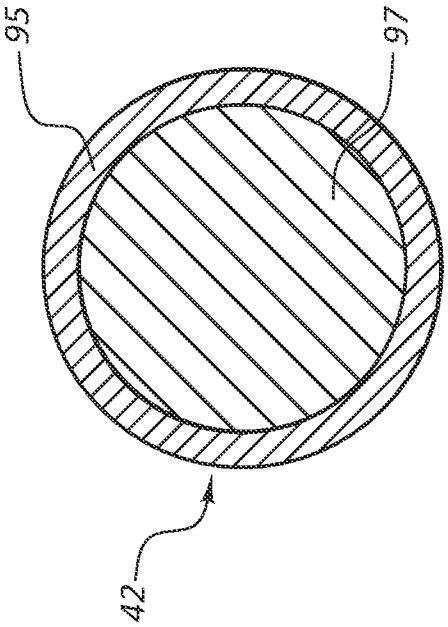

FIG. 4A

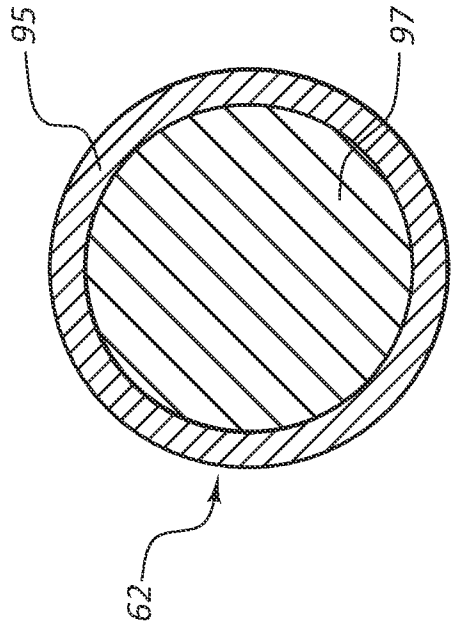

FIG. 6A

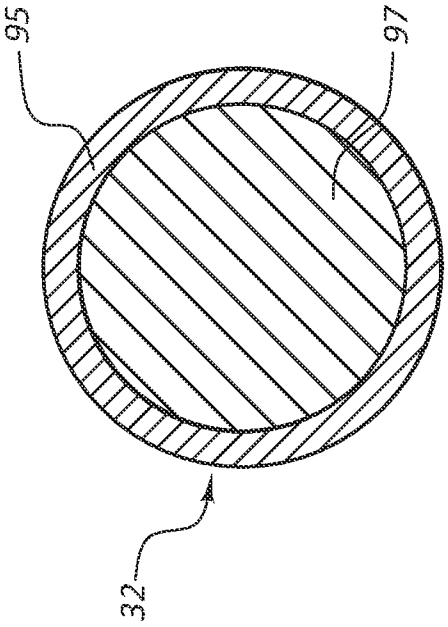

FIG. 3A

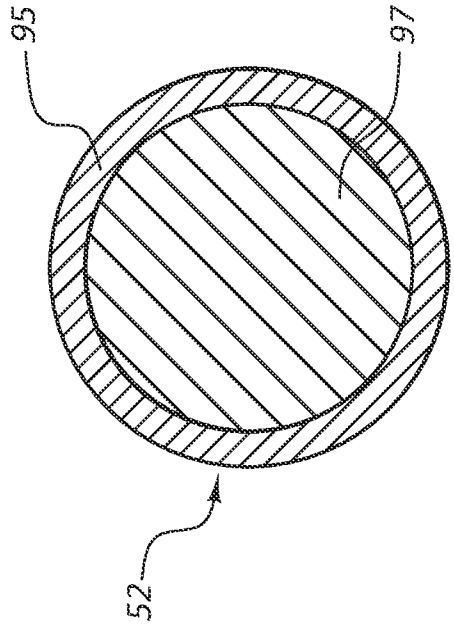

FIG. 5A

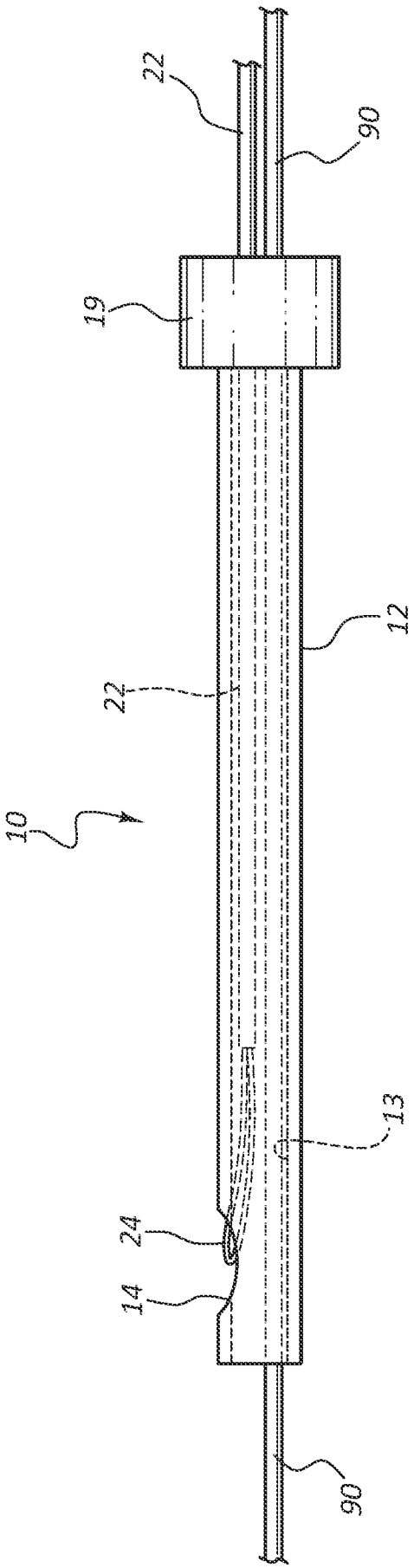

FIG. 7A

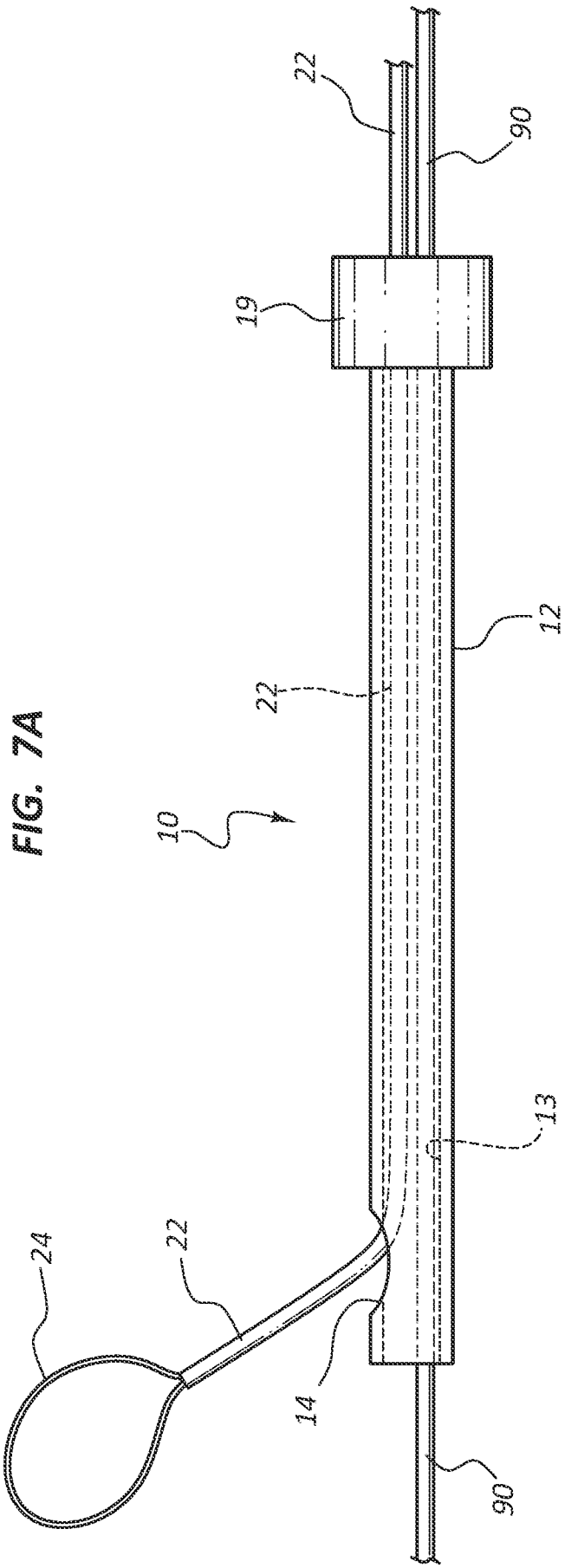

FIG. 7B

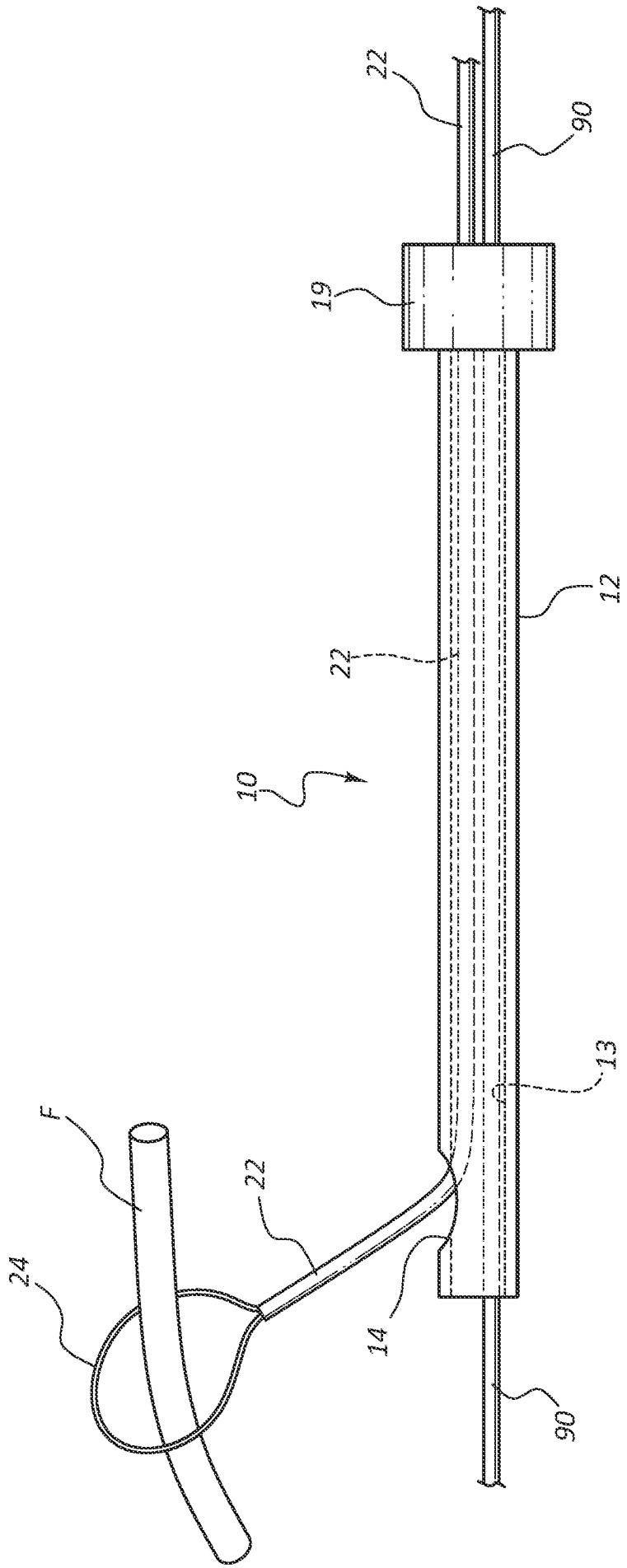

FIG. 7C

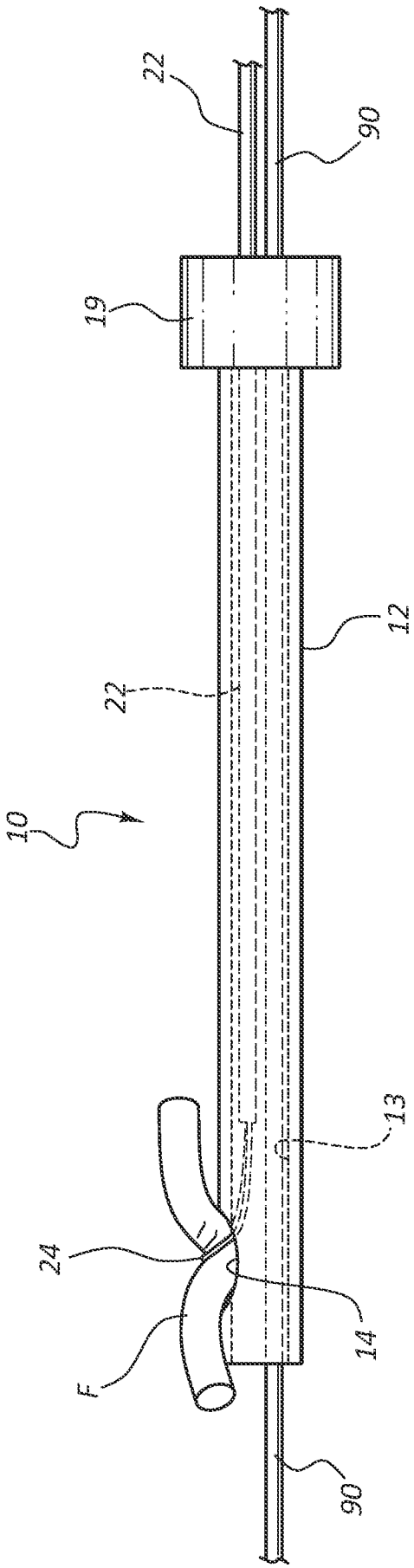

FIG. 7D

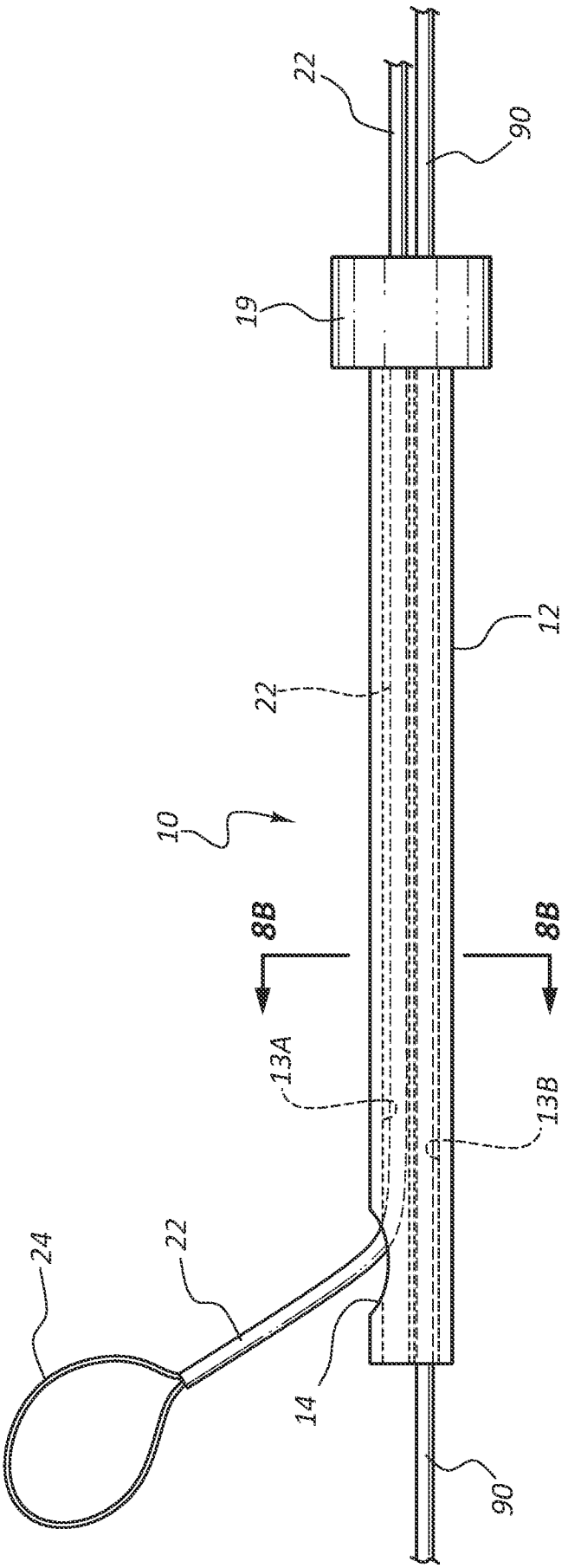

FIG. 8A

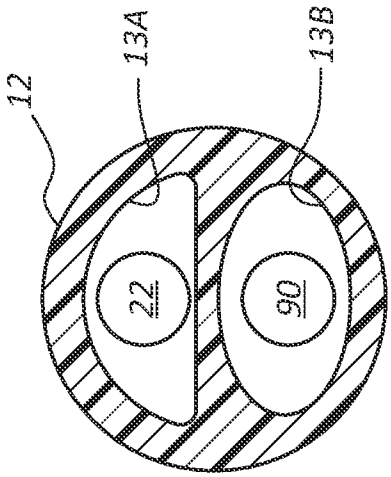

FIG. 8D

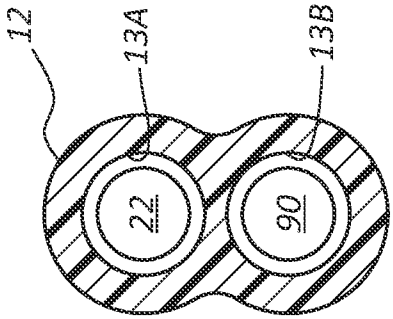

FIG. 8C

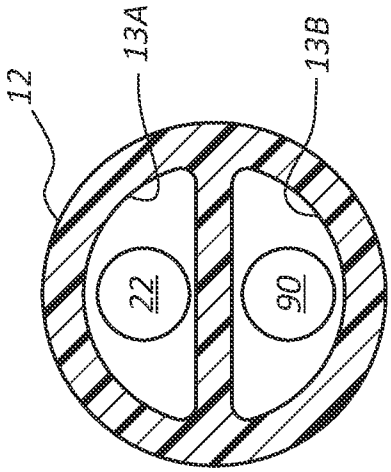

FIG. 8B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/022509

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A61B 17/24 (2011.01)
USPC - 606/113
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - A61B 17/00, 17/24 (2011.01)
USPC - 606/79, 108, 110, 113-114, 127, 128

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US 5,782,839 A (HART et al) 21 July 1998 (21.07.1998) see entire document	1-2 --- 3-29
Y	US 6,517,550 B1 (KONYA et al) 11 February 2003 (11.02.2003) see entire document	3-29

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04 March 2011	18 MAR 2011
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774