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(54) **ACCESS AND CLOSURE DEVICE AND METHOD**

Publication Classification

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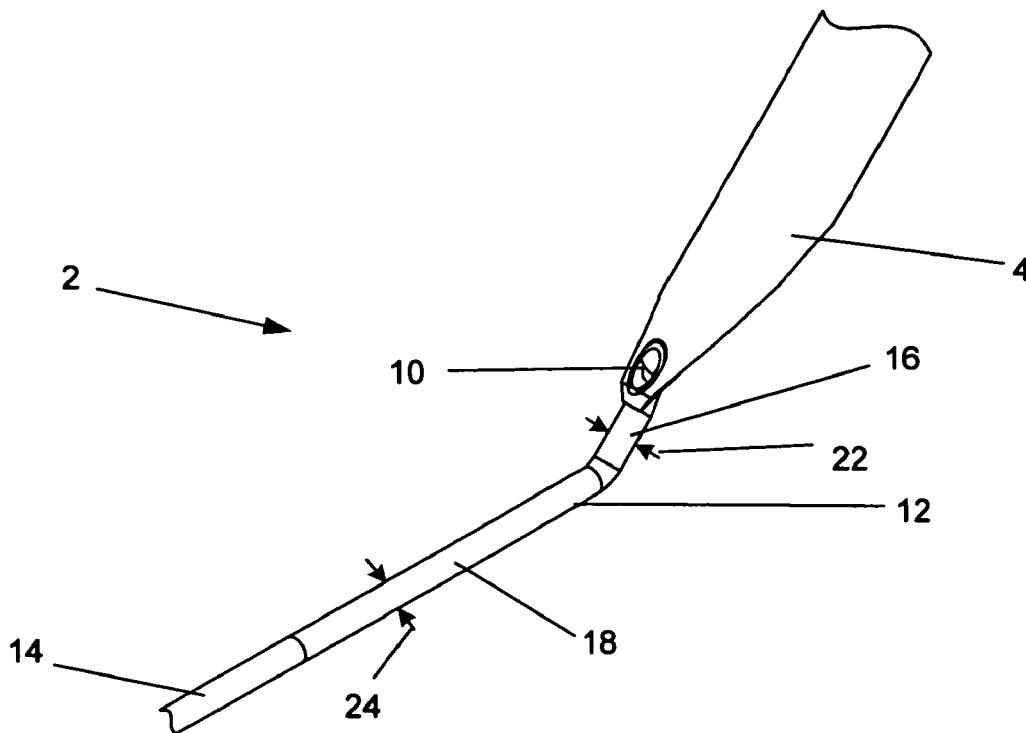
(57) **ABSTRACT**

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Related U.S. Application Data

(63) Continuation of application No. 10/844,247, filed on May 12, 2004.

Devices and methods for accessing and closing vascular sites are disclosed. Self-sealing closure devices and methods are disclosed. A device that can make a steep and controlled access path into a vascular lumen is disclosed. Methods for using the device are also disclosed.



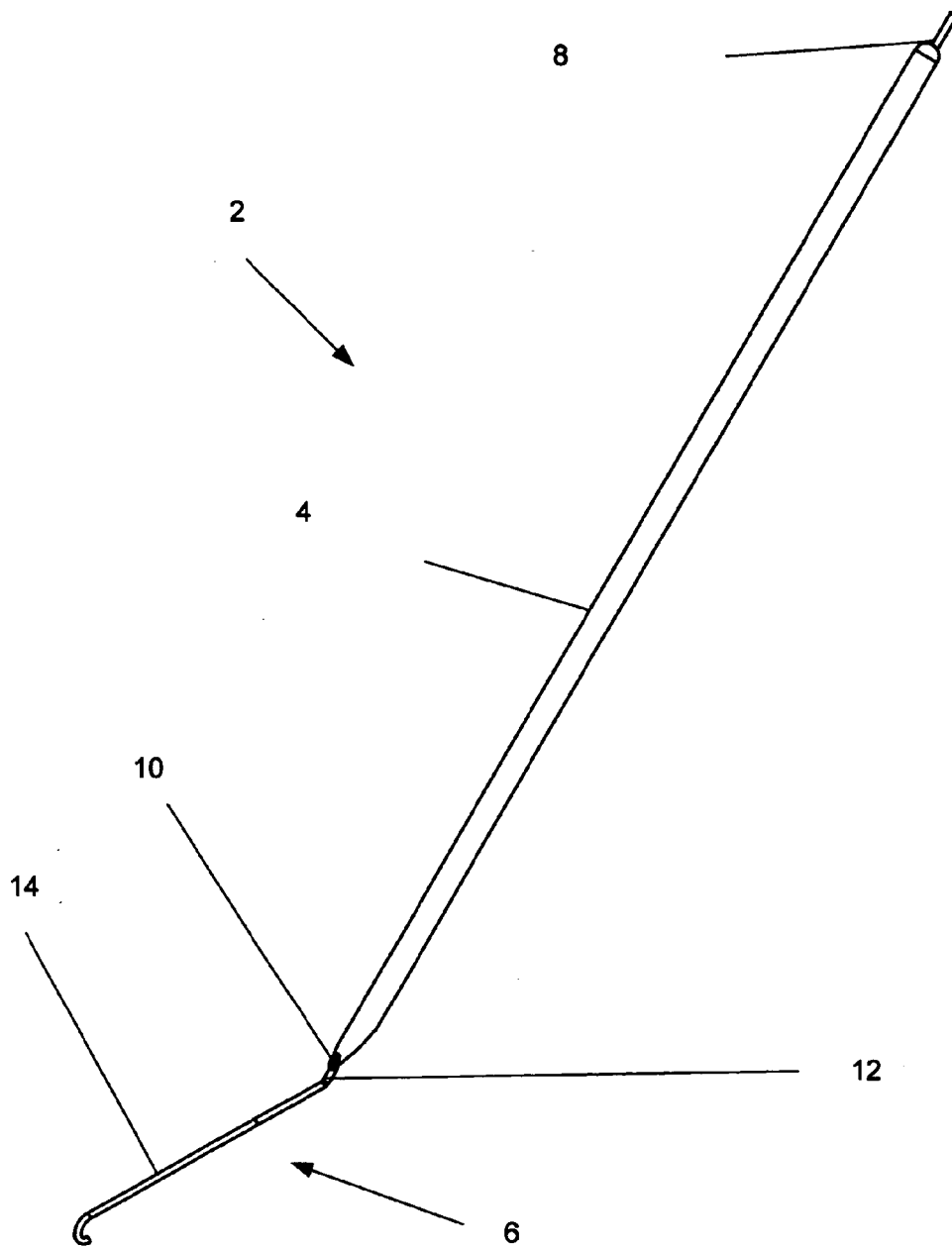


Fig. 1

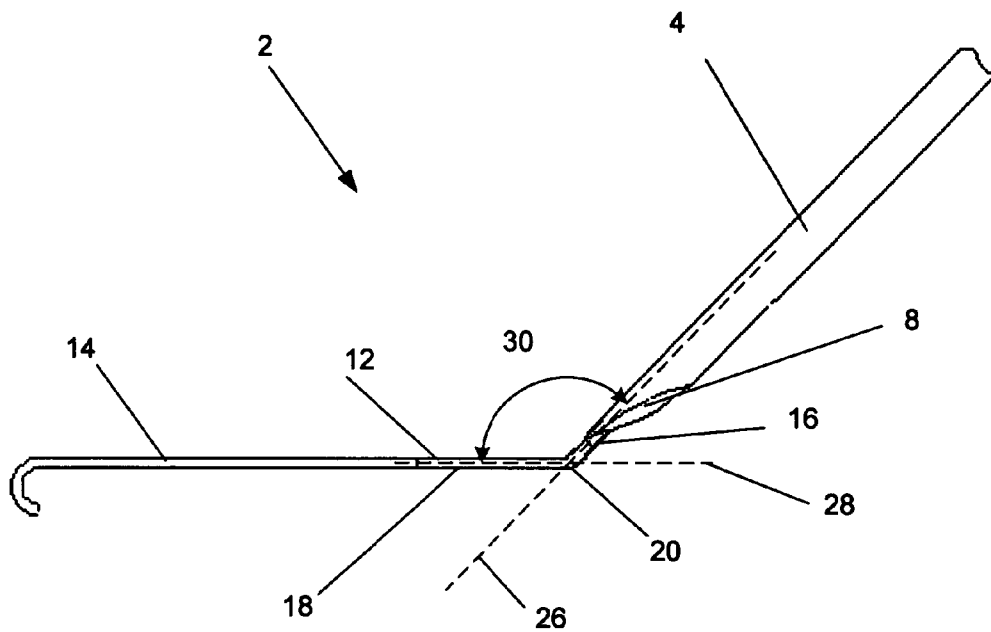


Fig. 2

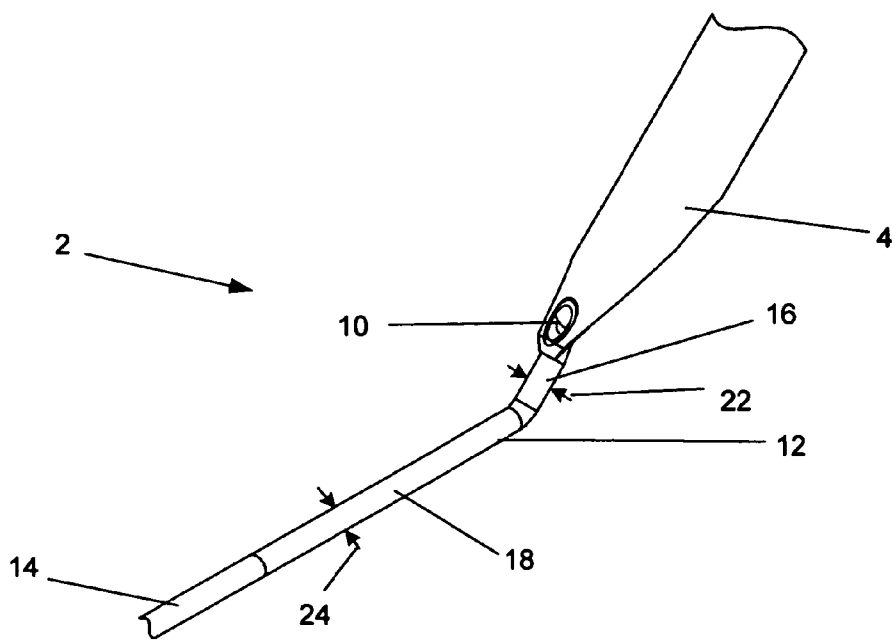


Fig. 3

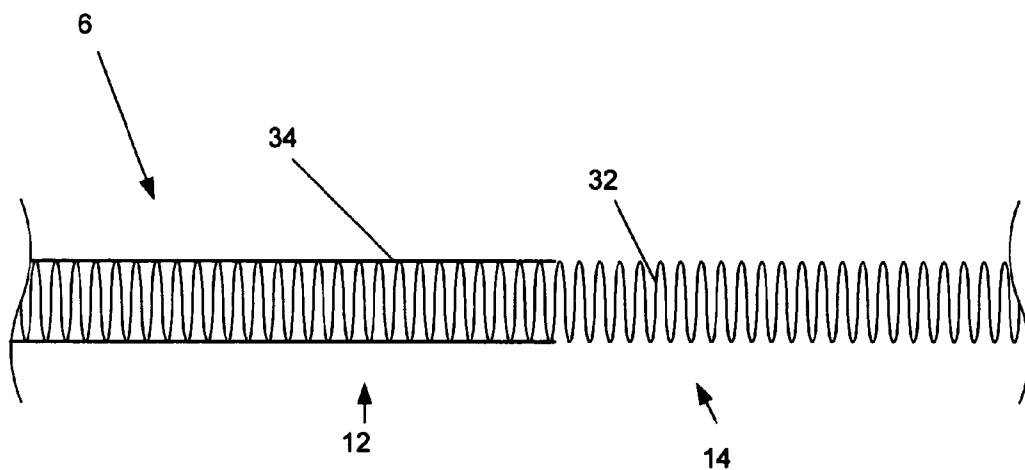


Fig. 4

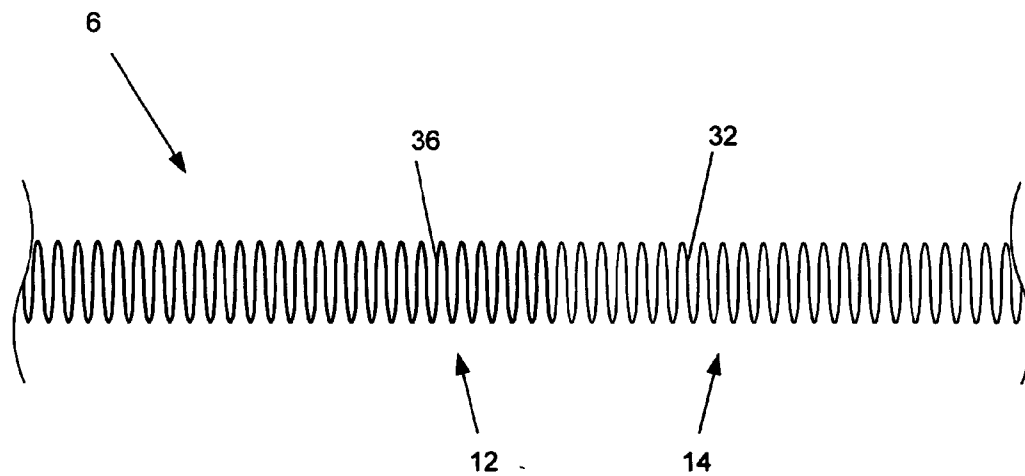


Fig. 5

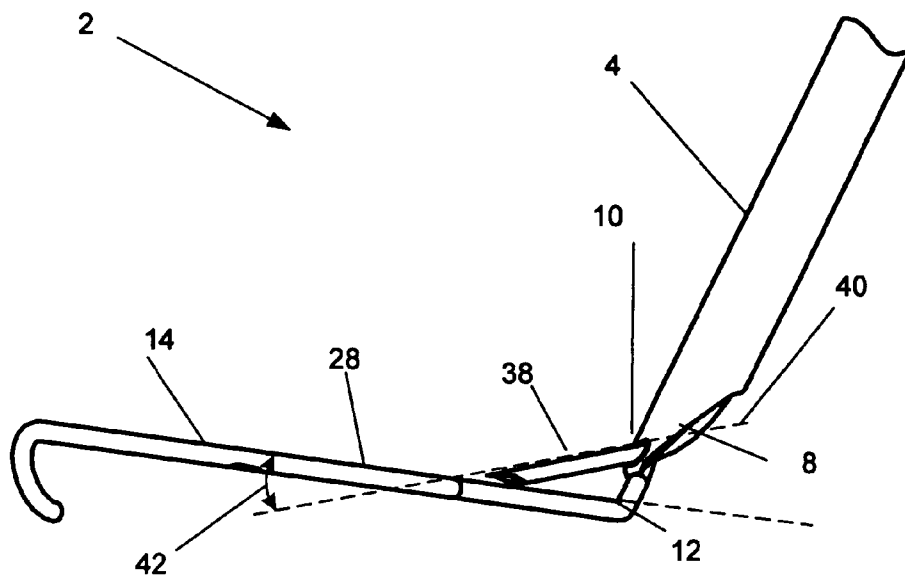


Fig. 6

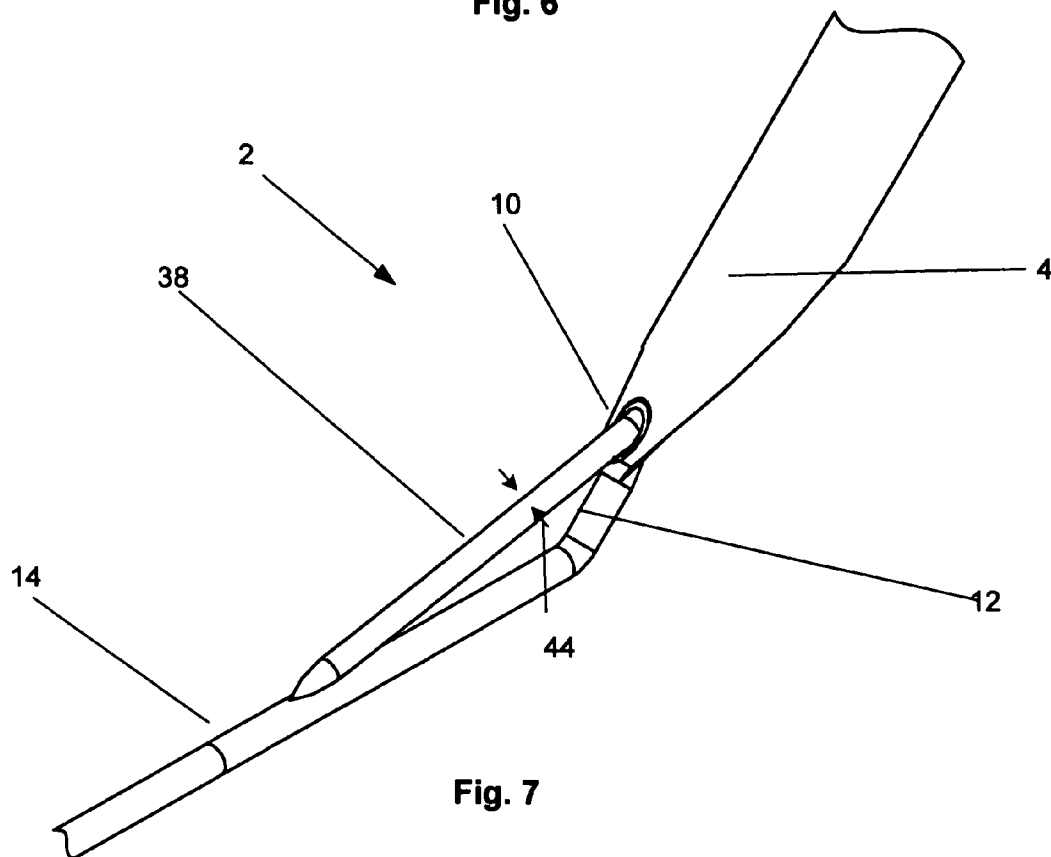


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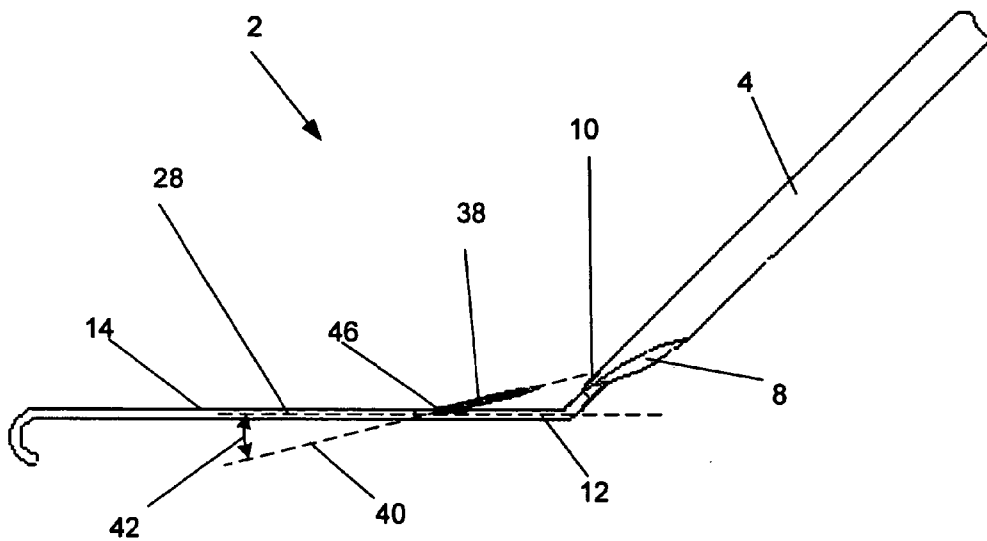


Fig. 8

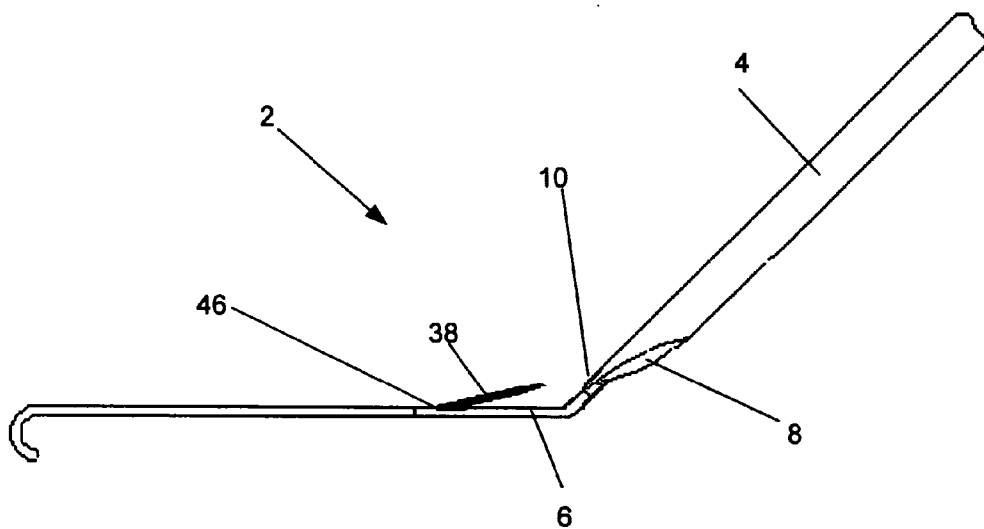


Fig. 9

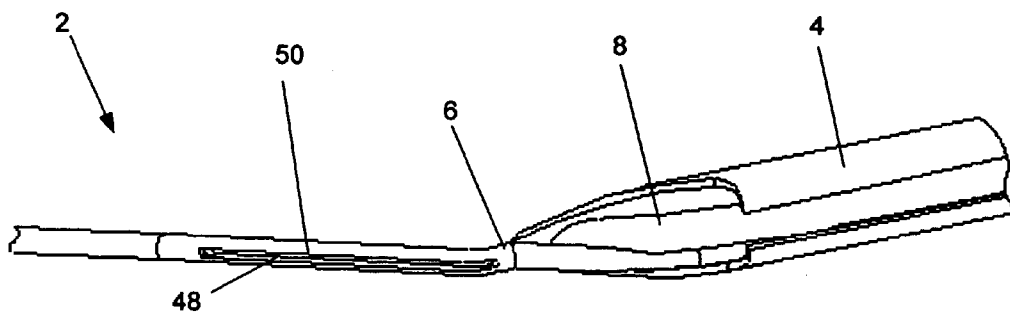


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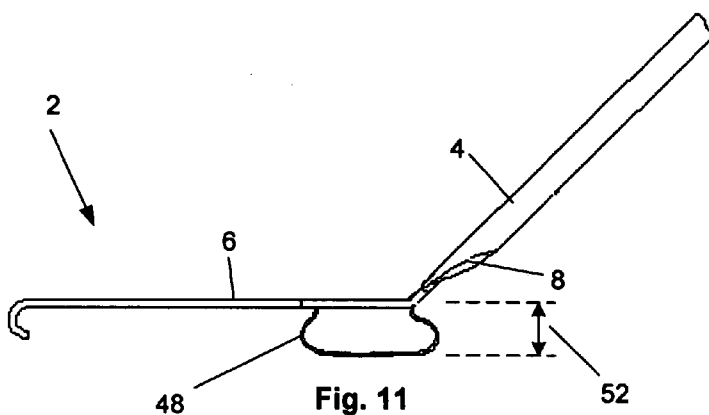


Fig. 11

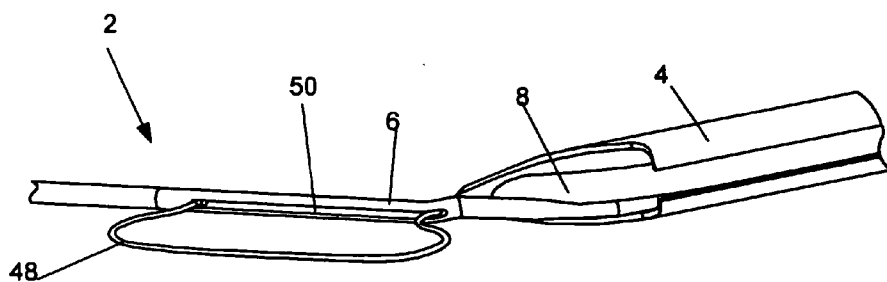


Fig. 12

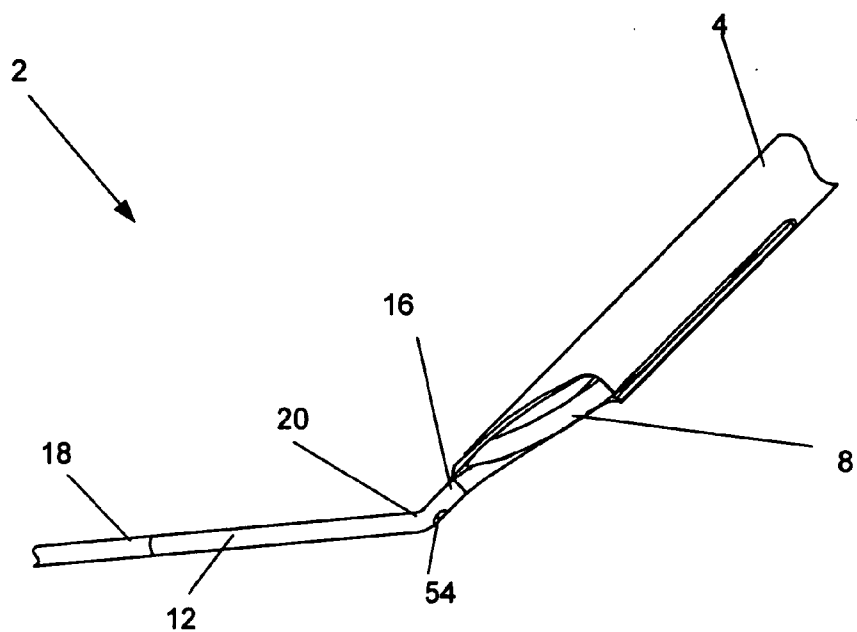


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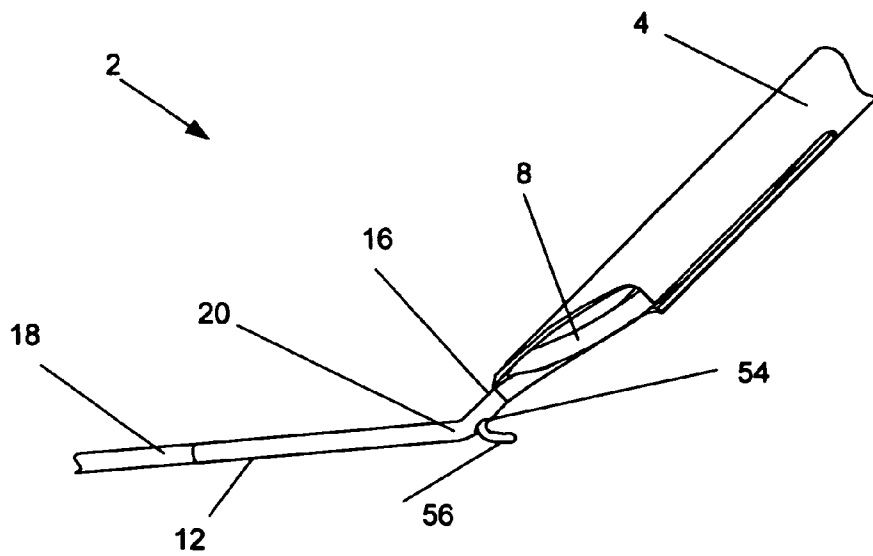


Fig. 14

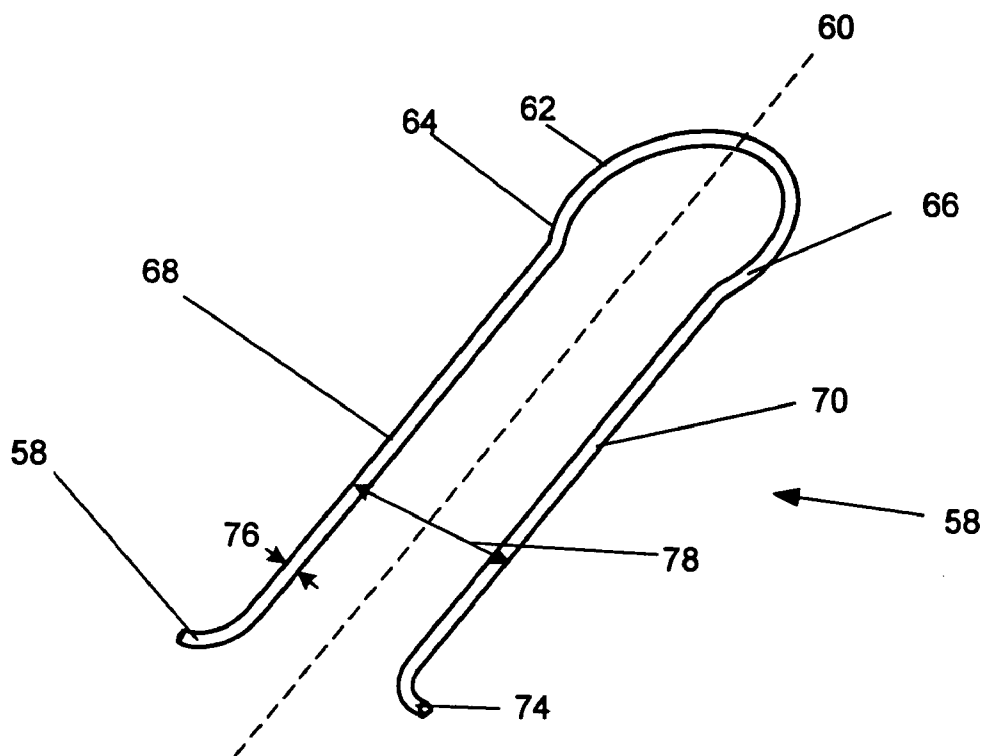


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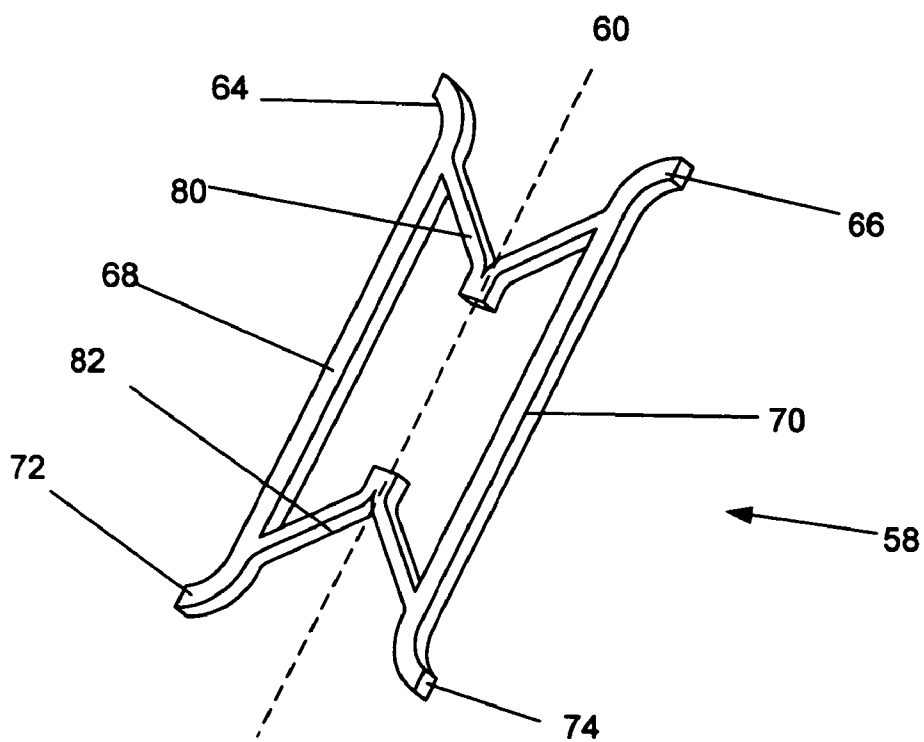


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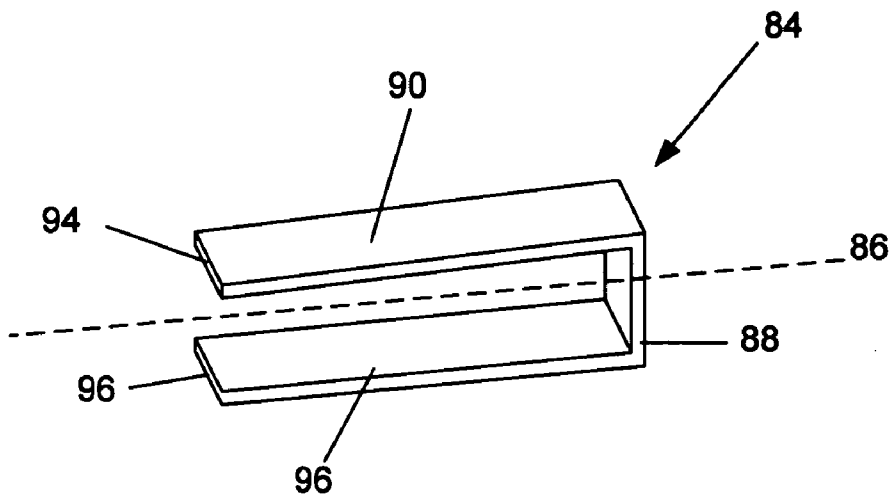


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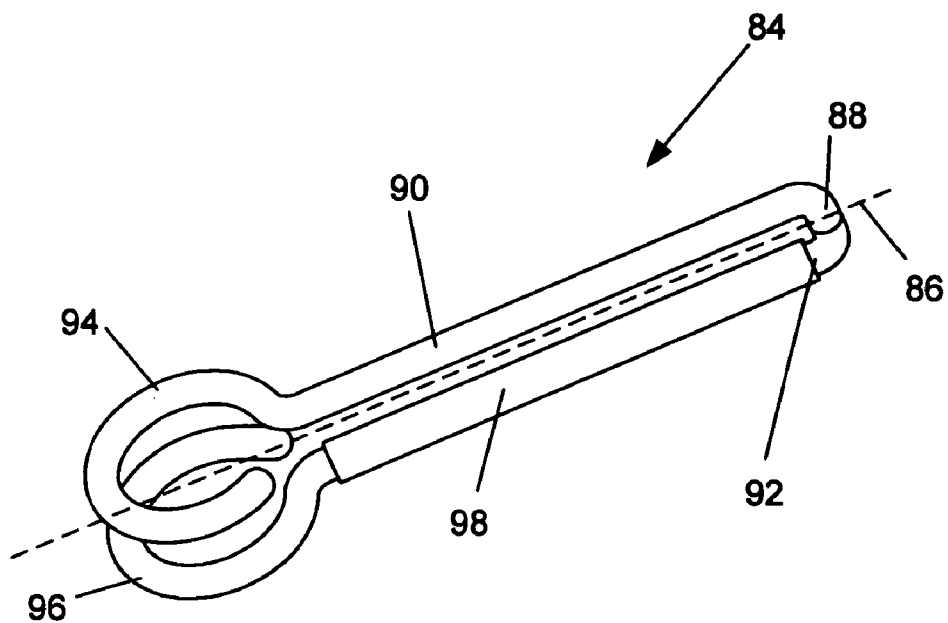


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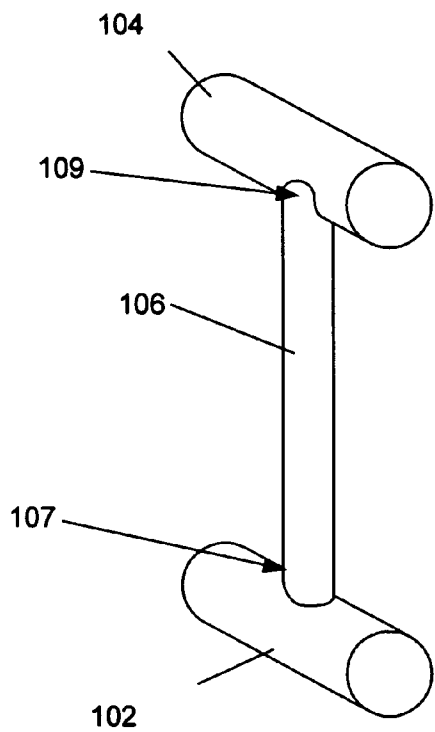


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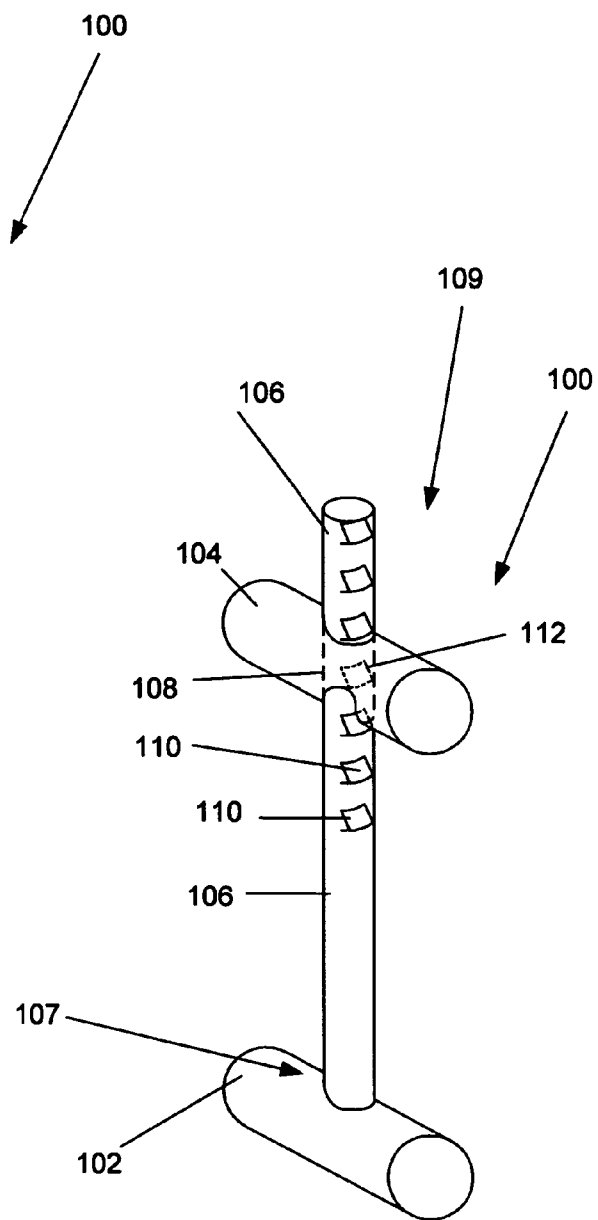


Fig. 20

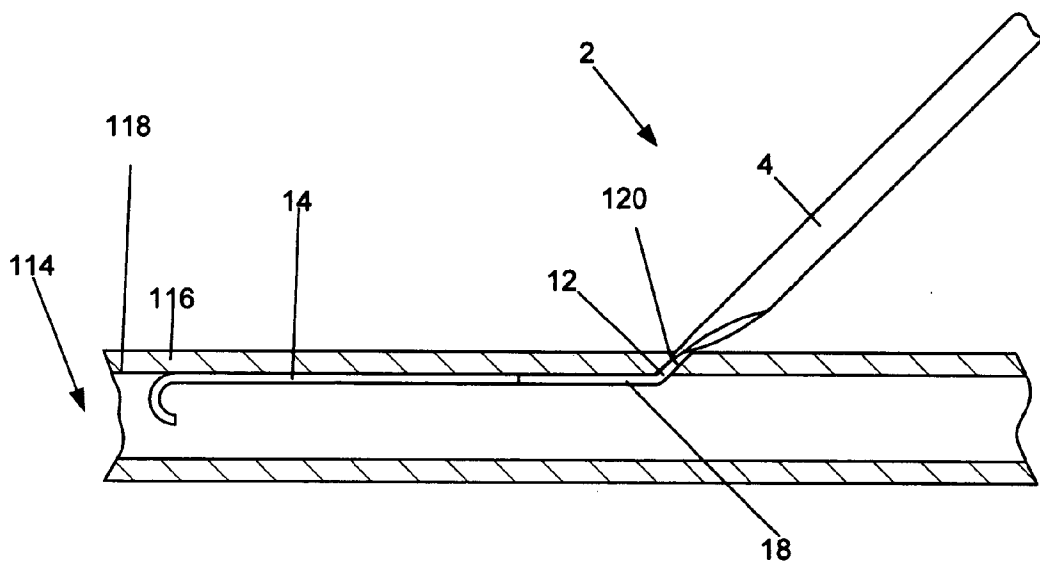


Fig. 21

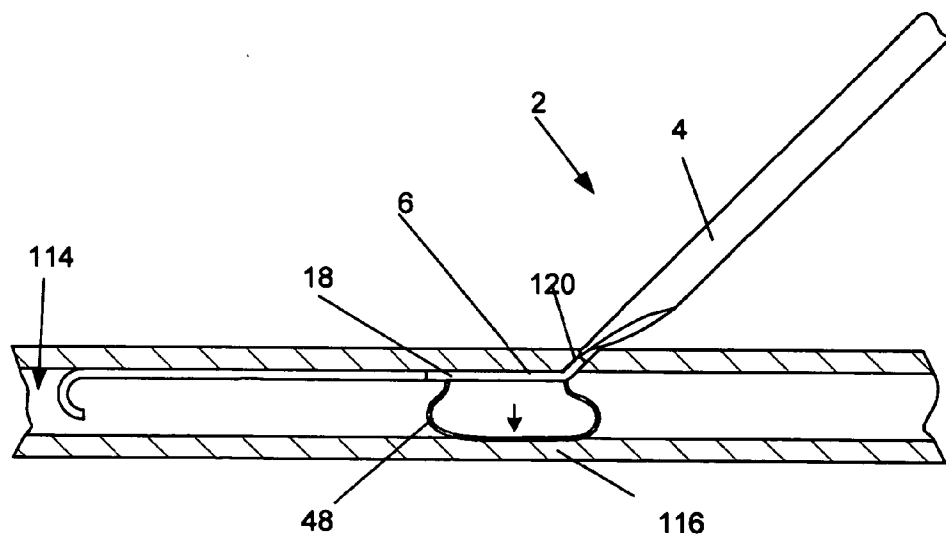


Fig. 22

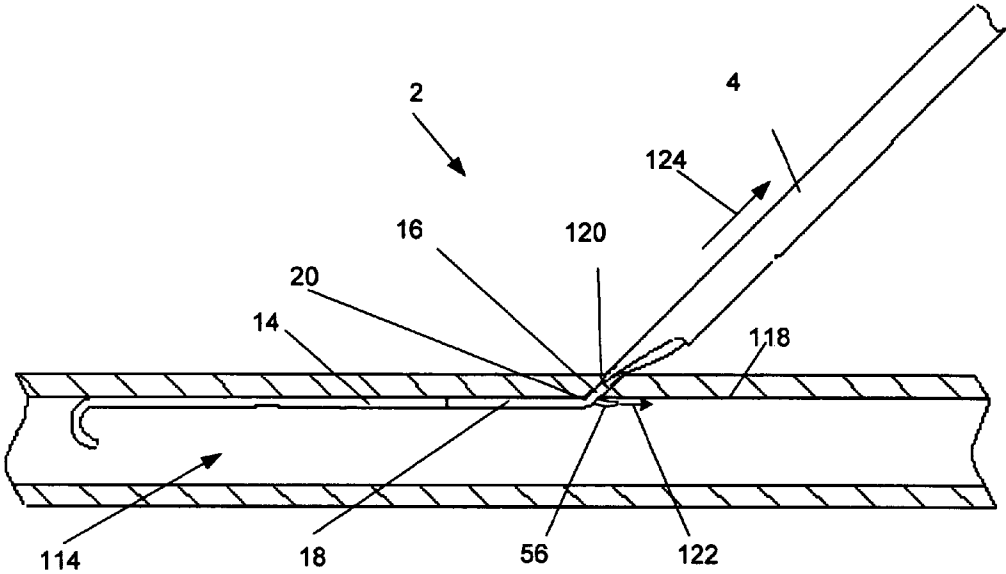


Fig. 23

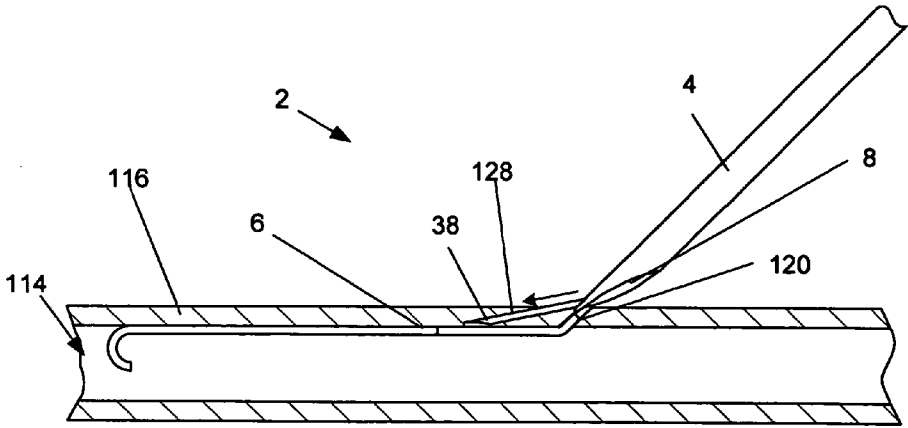
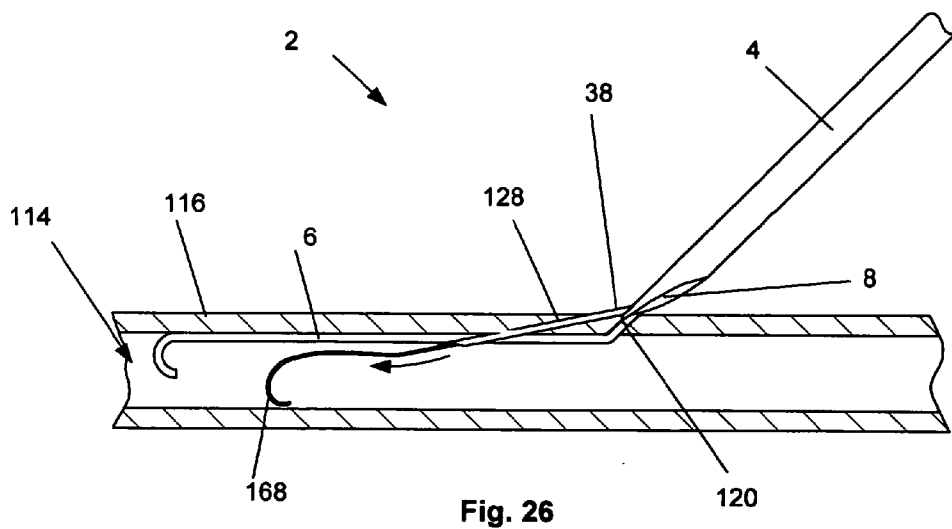
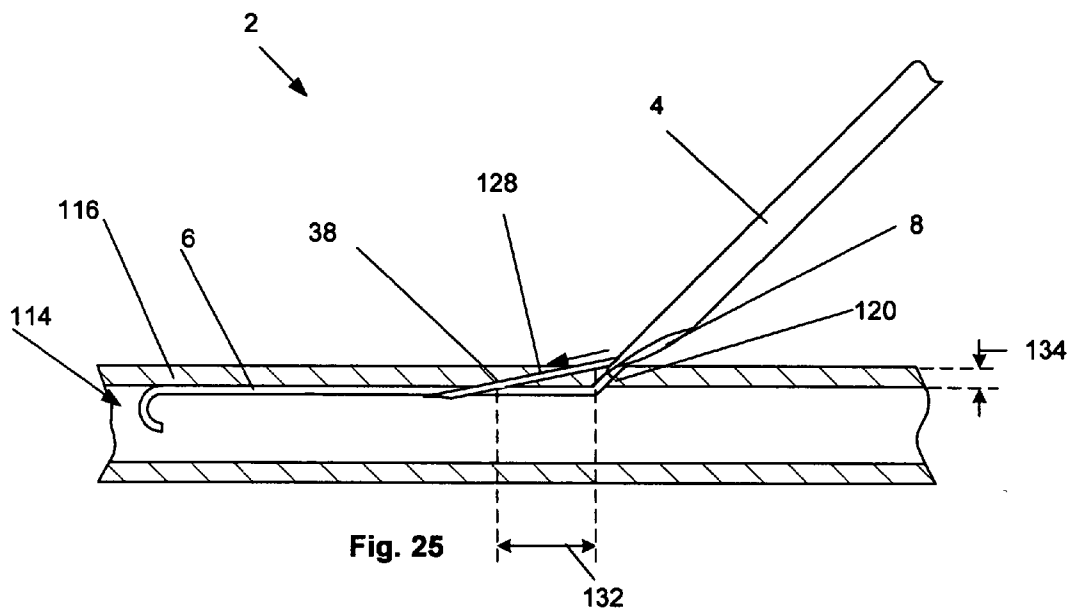


Fig. 24



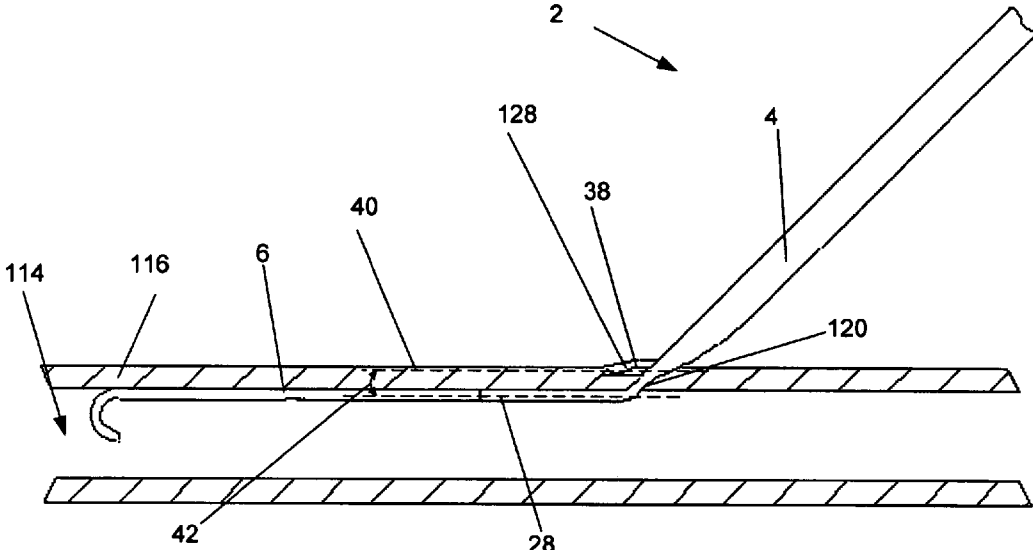


Fig. 27

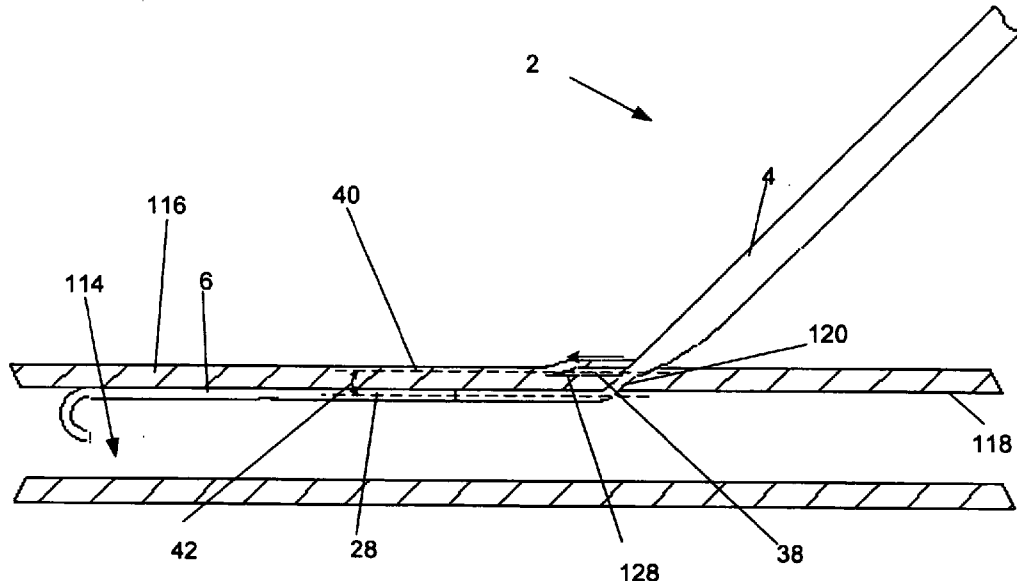
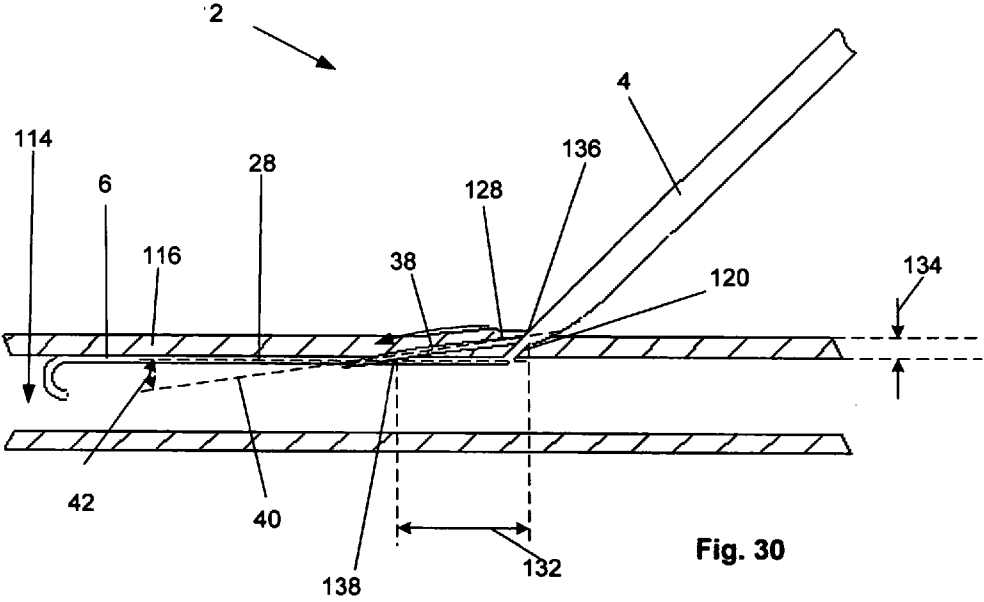
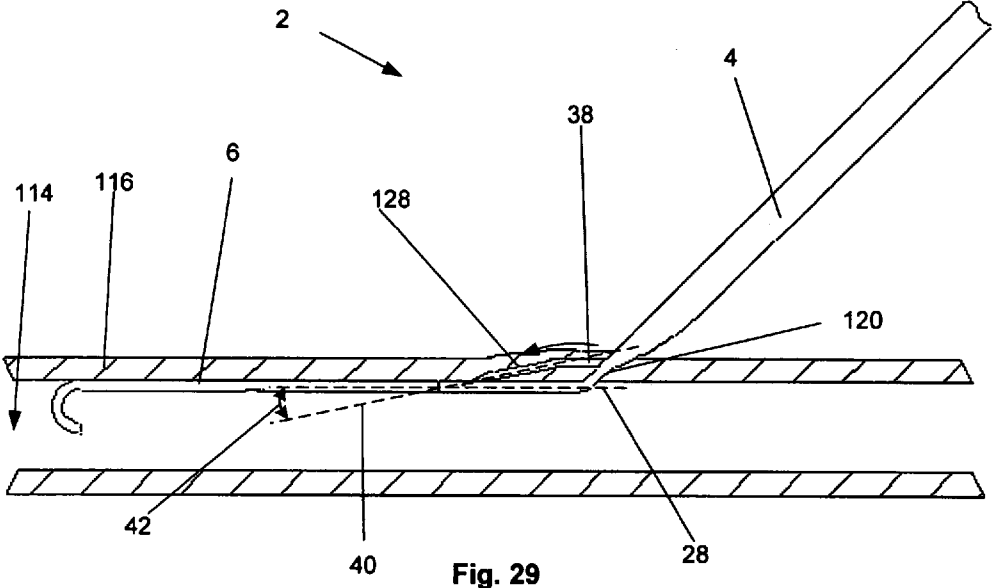


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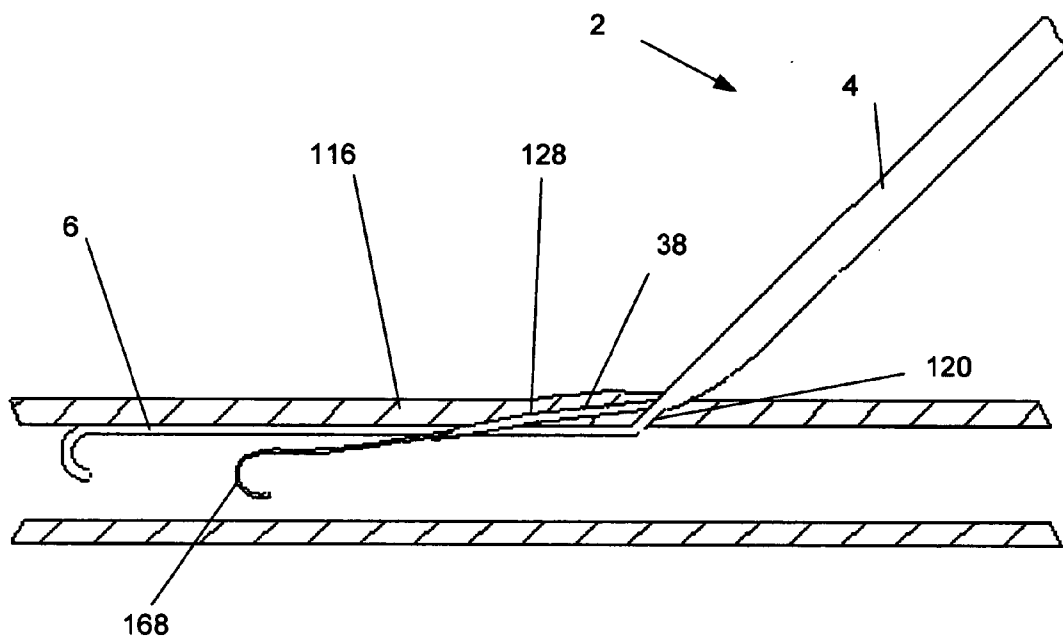


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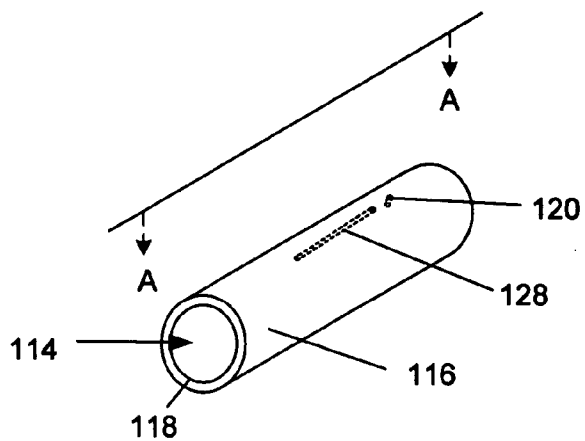


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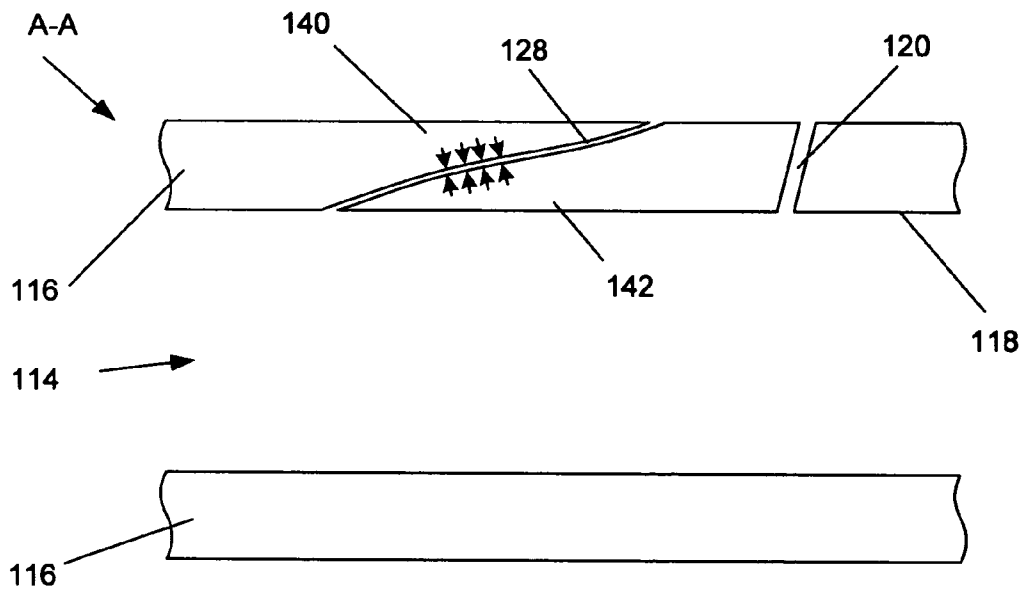


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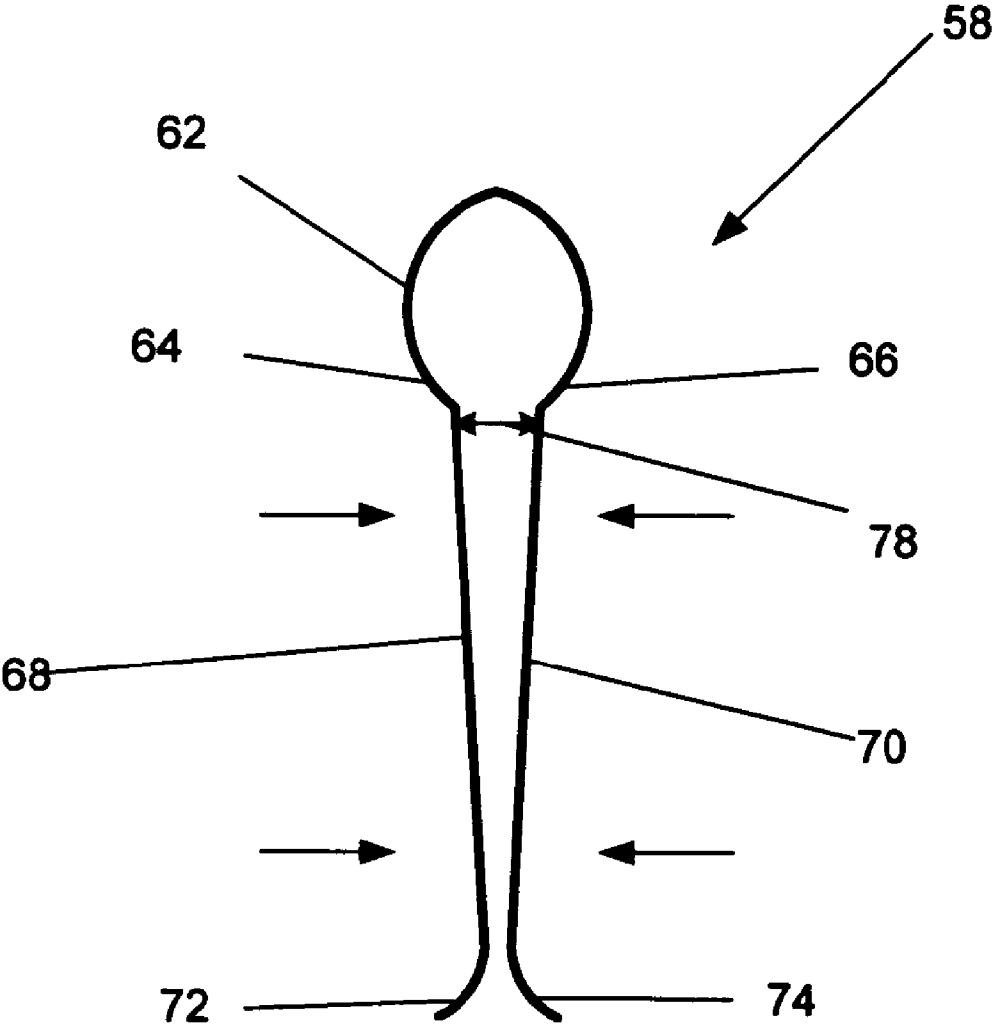
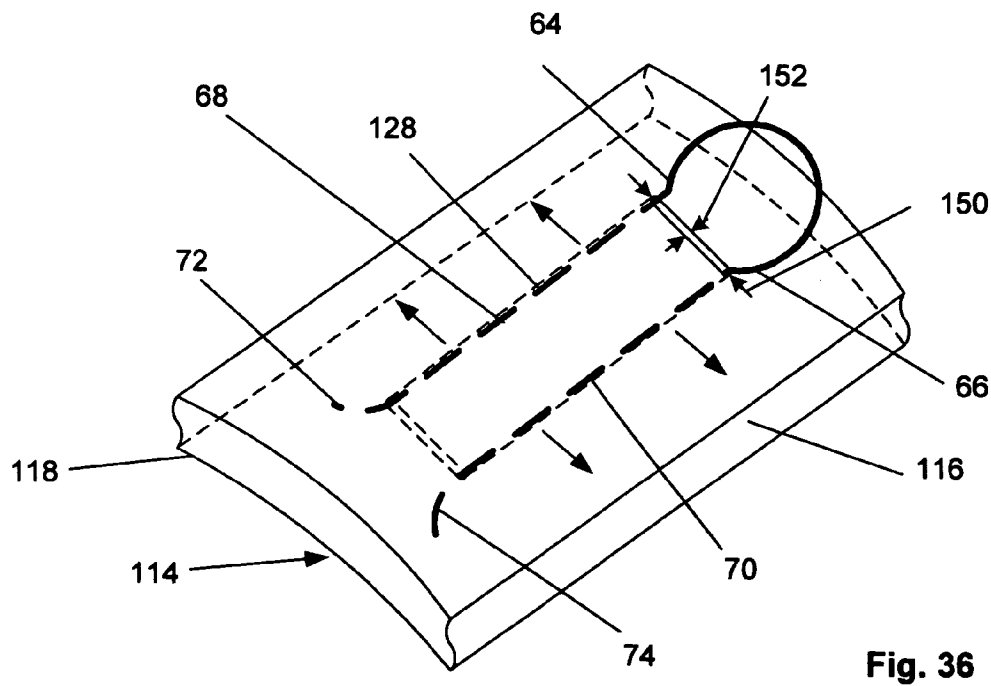
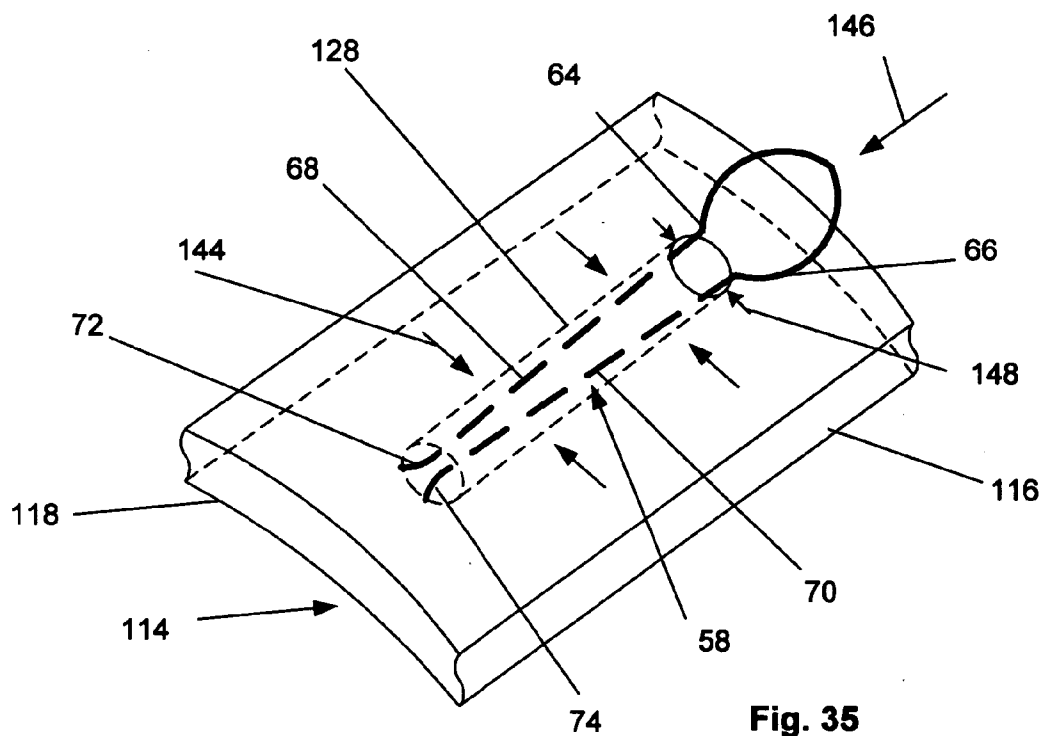
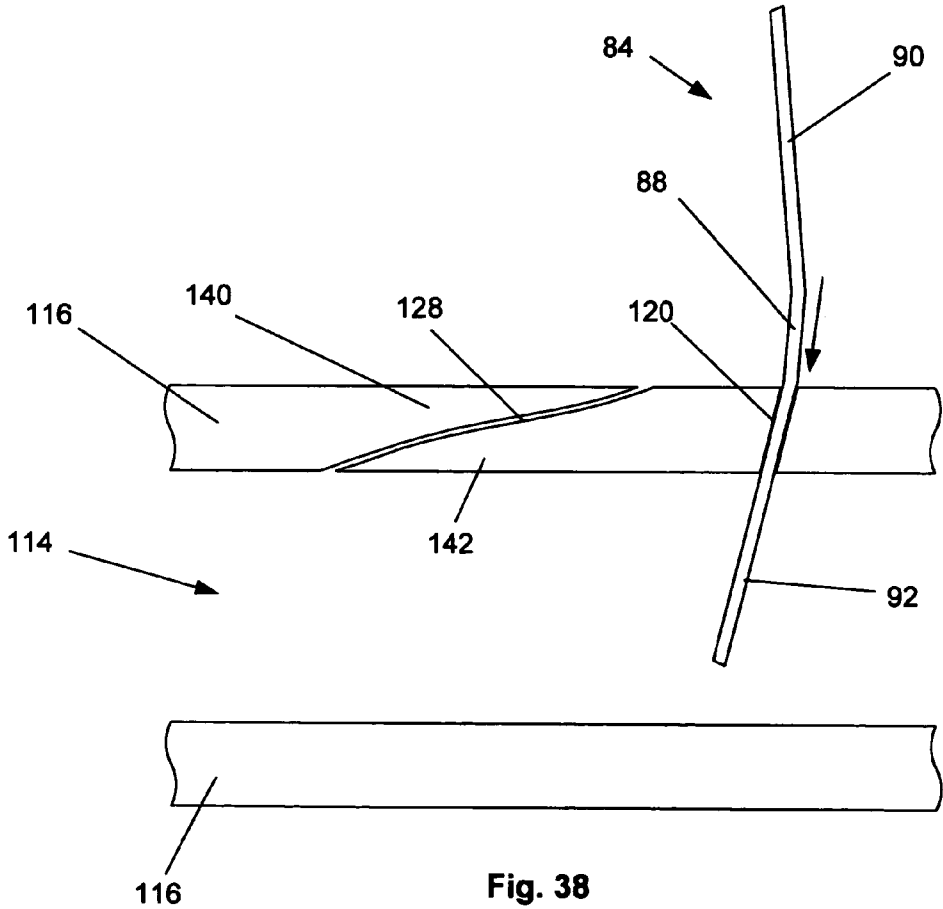
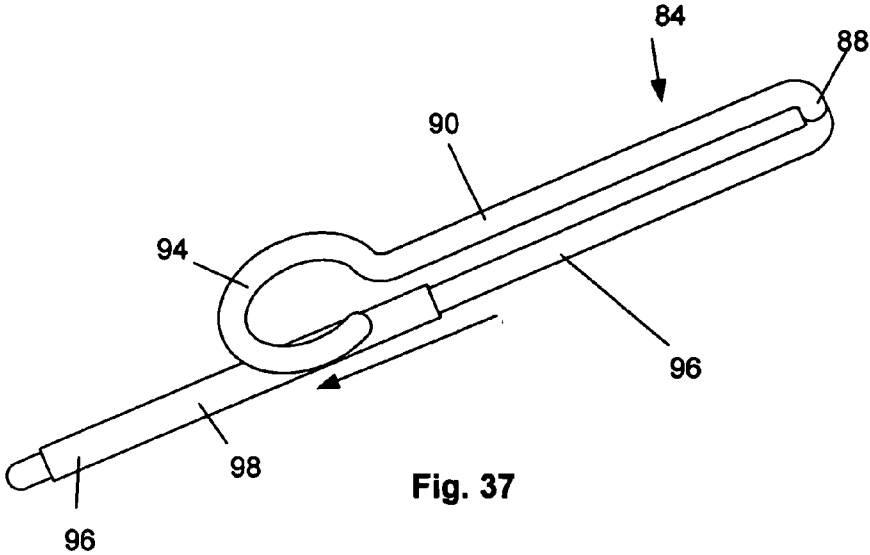
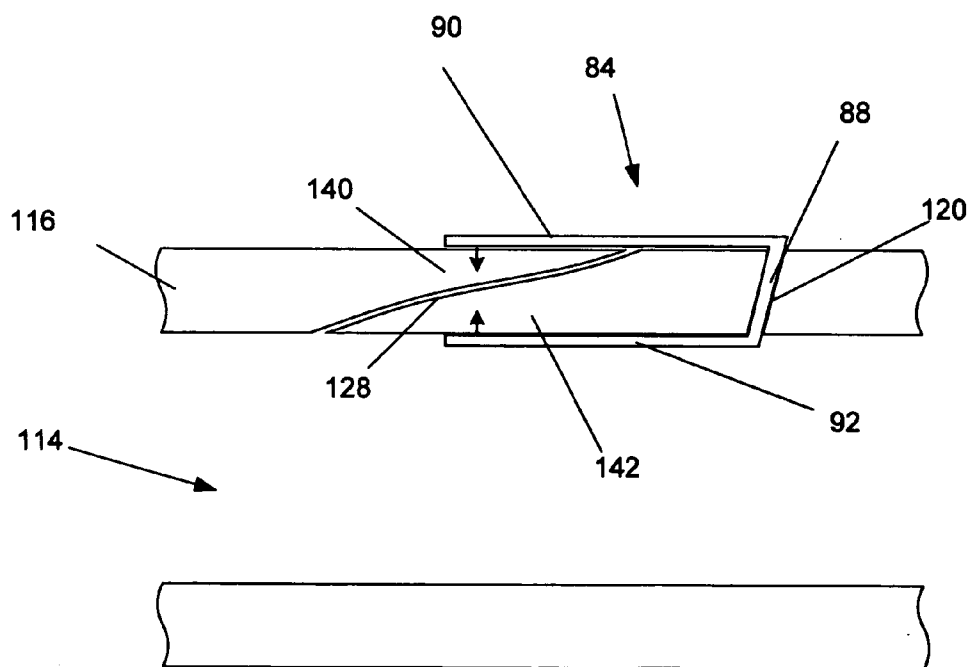
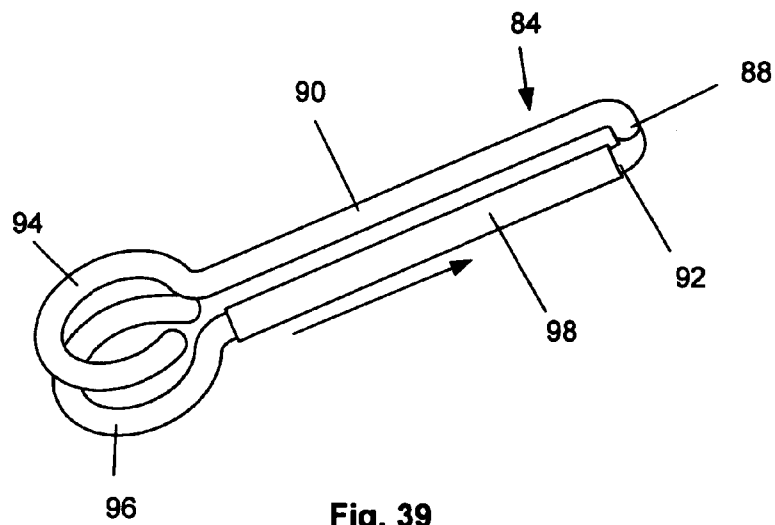


Fig. 34







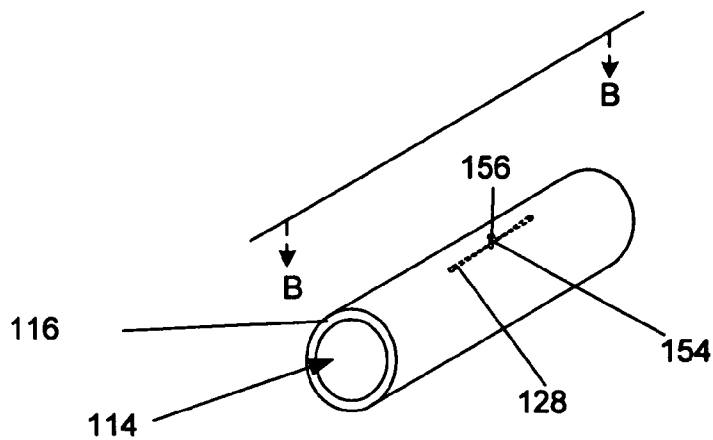


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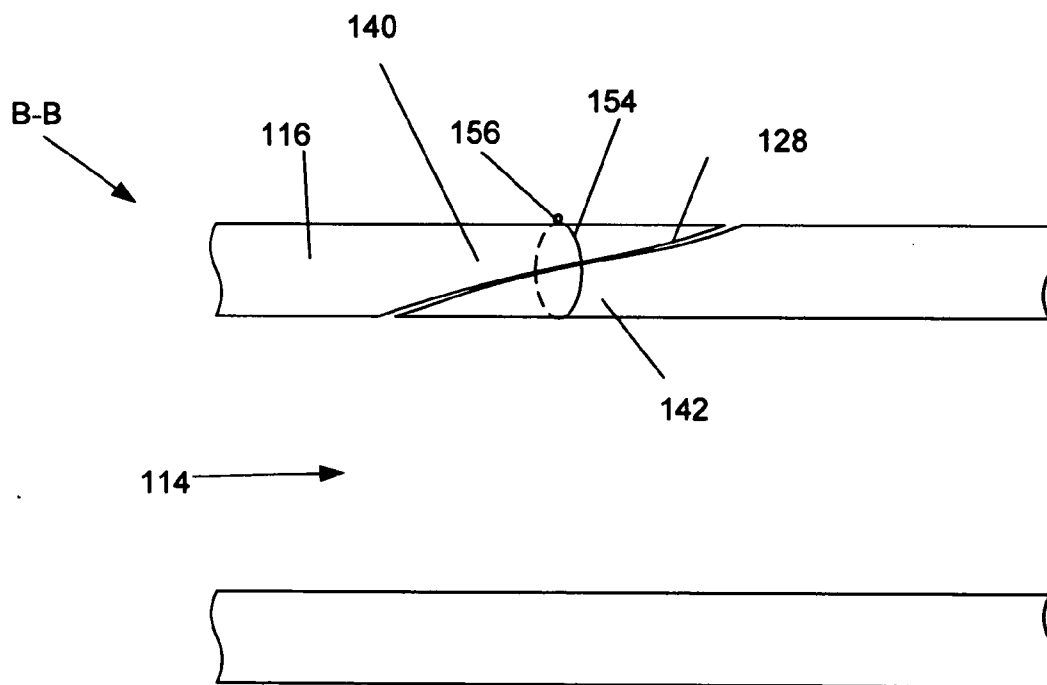


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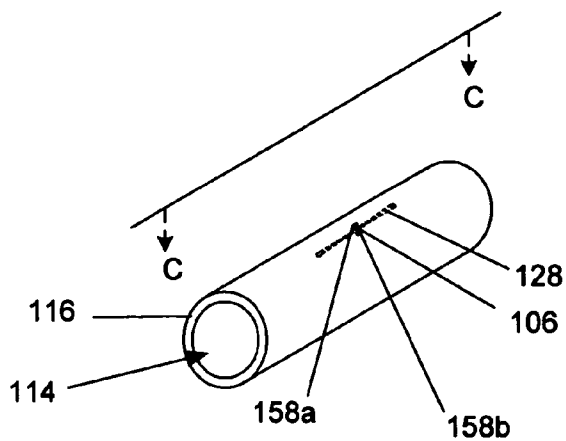


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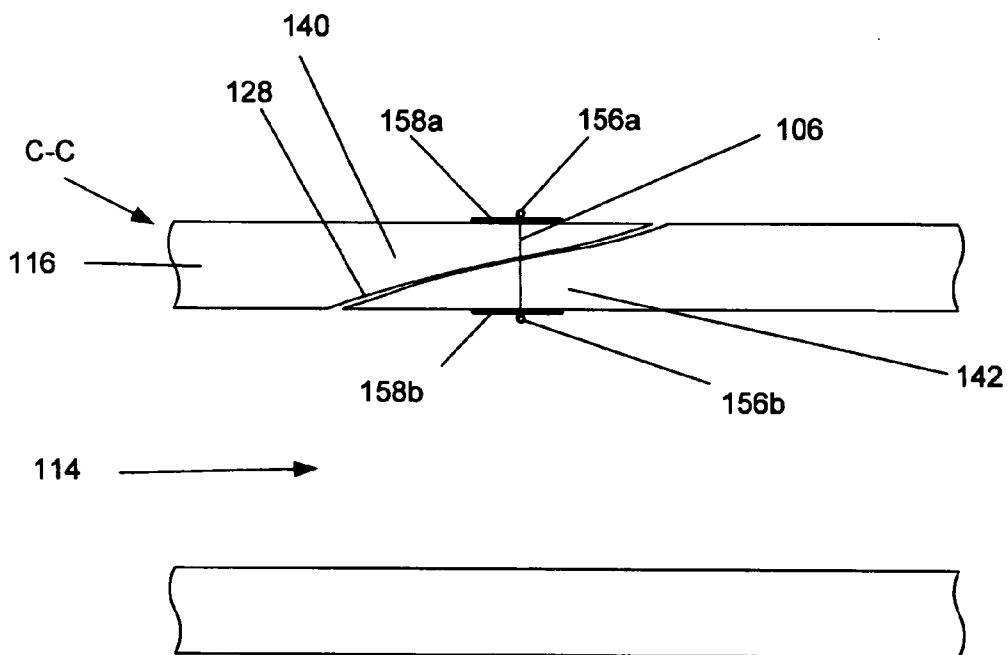


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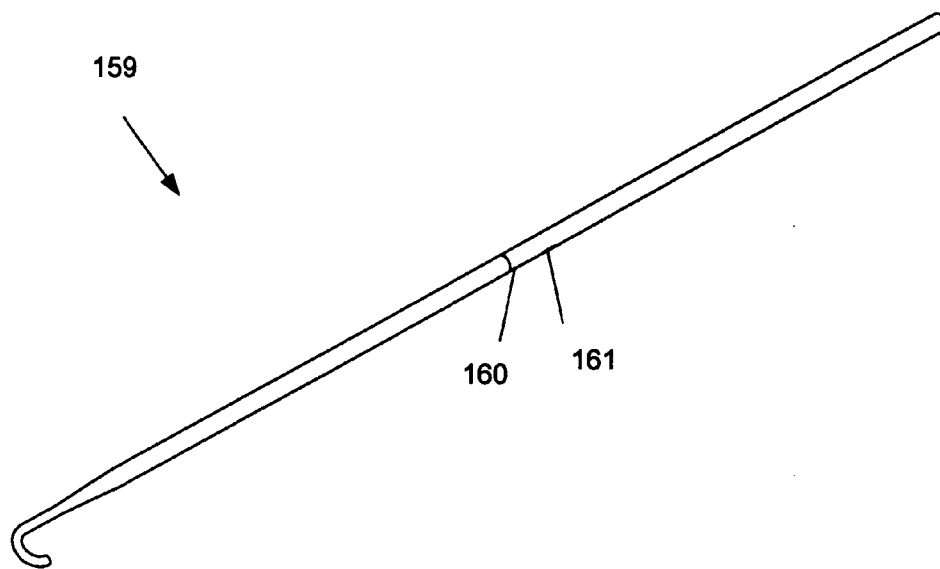


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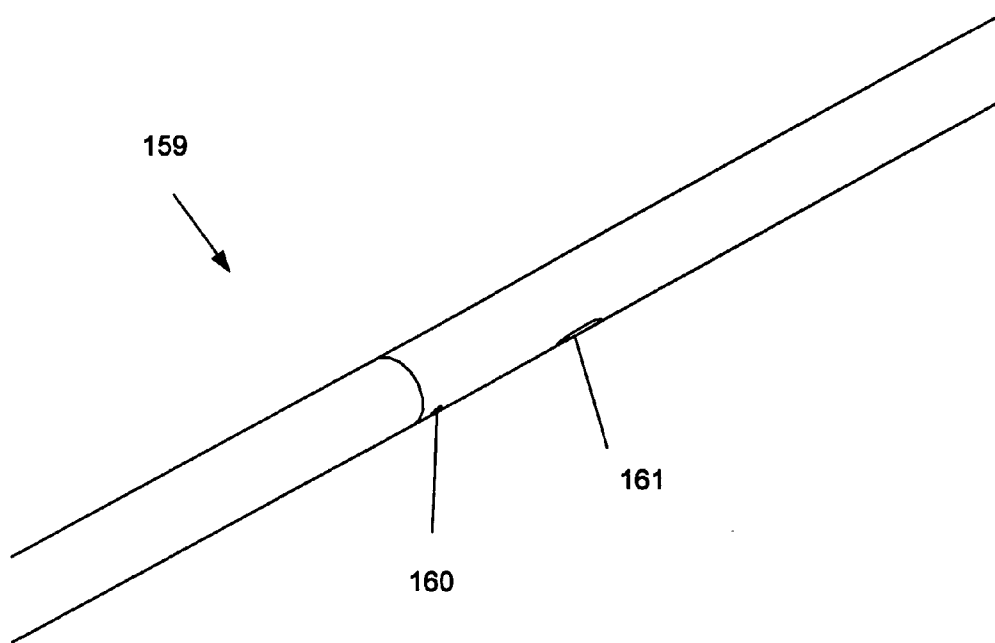


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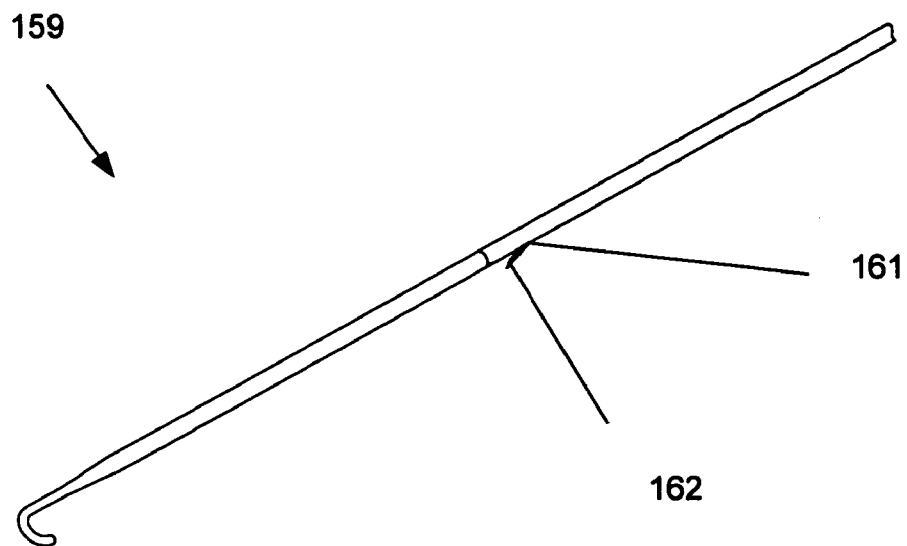


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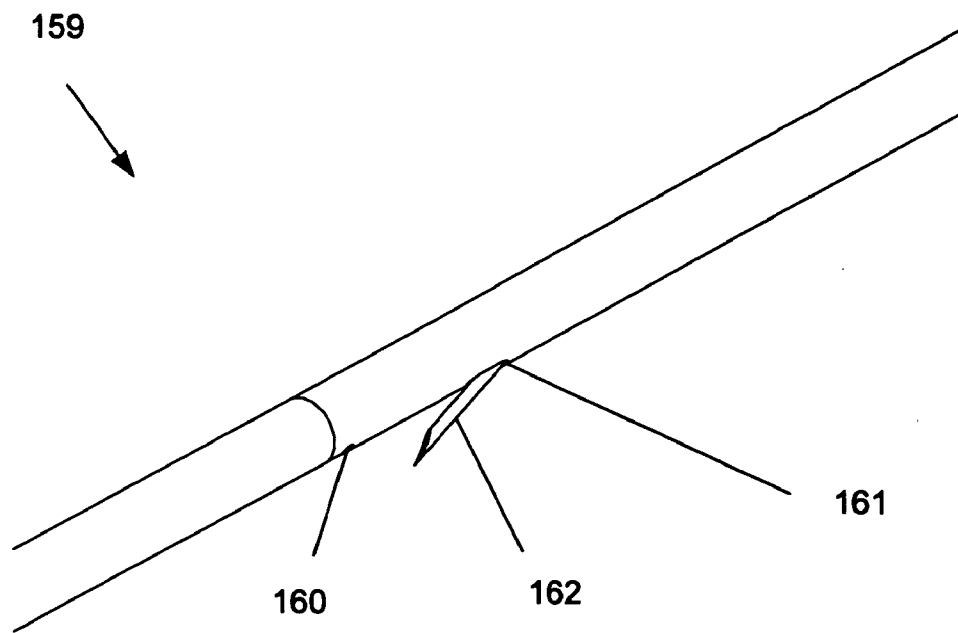


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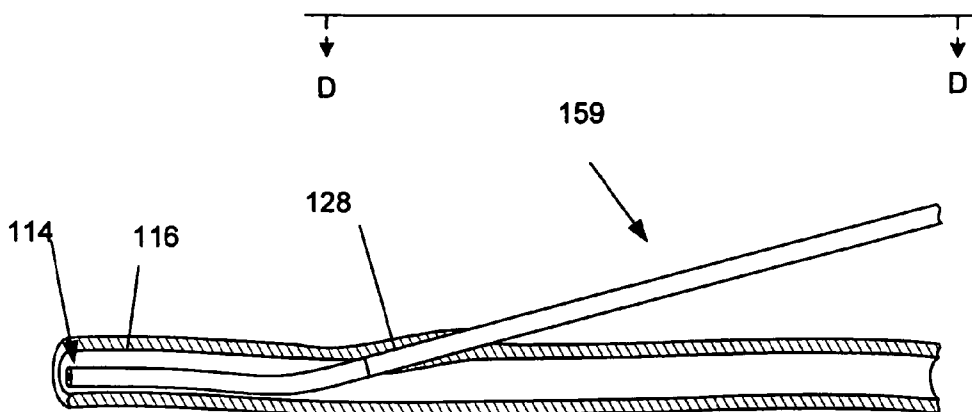


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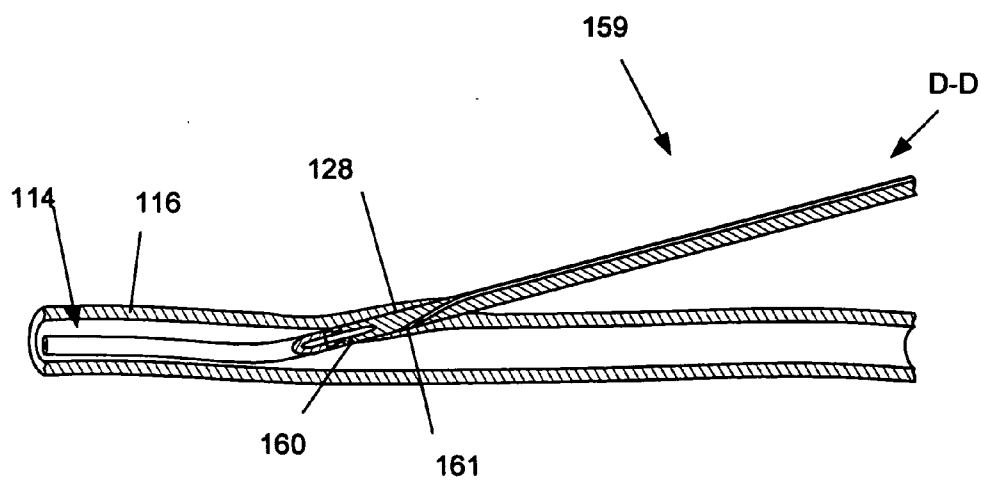


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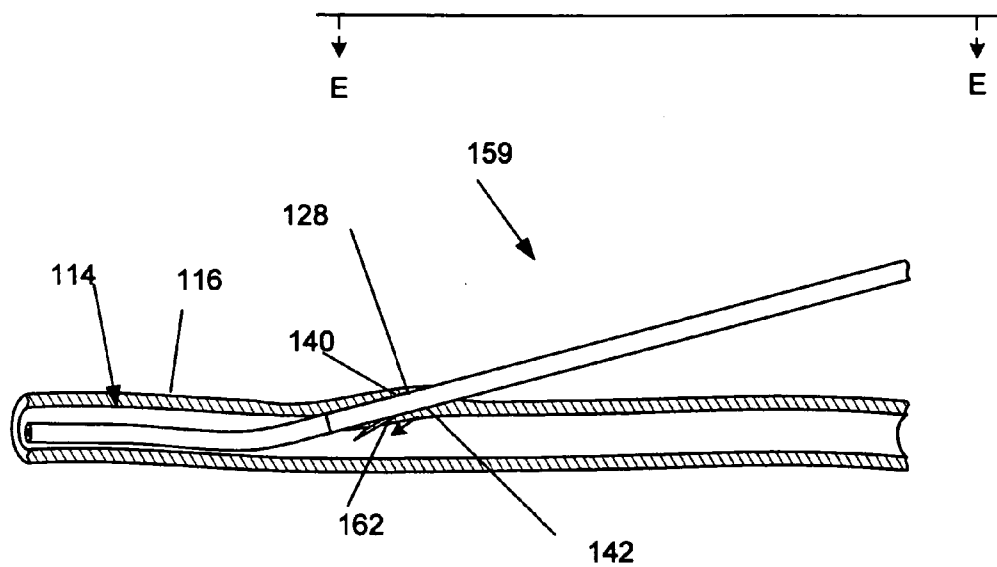


Fig. 51

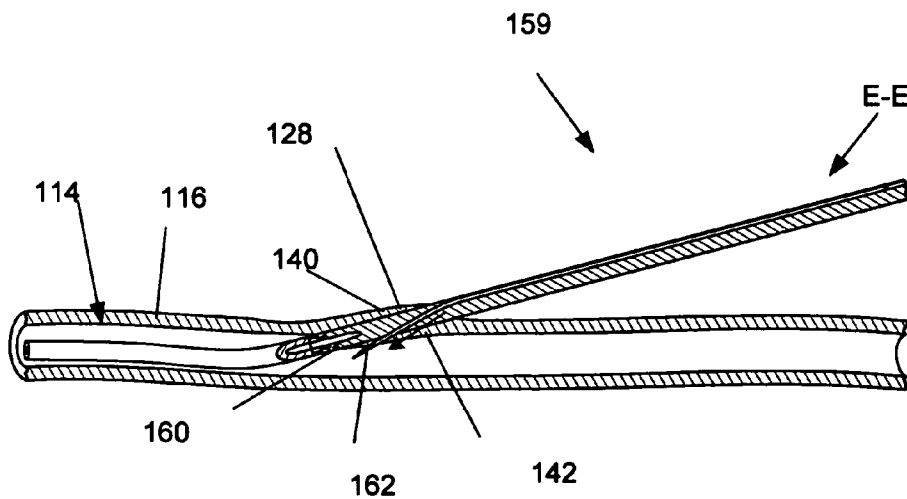


Fig. 52

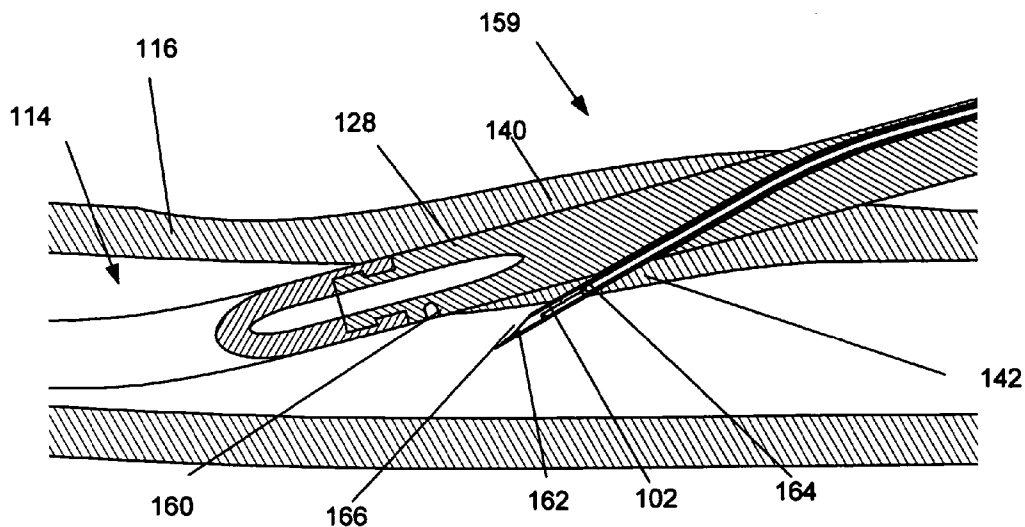


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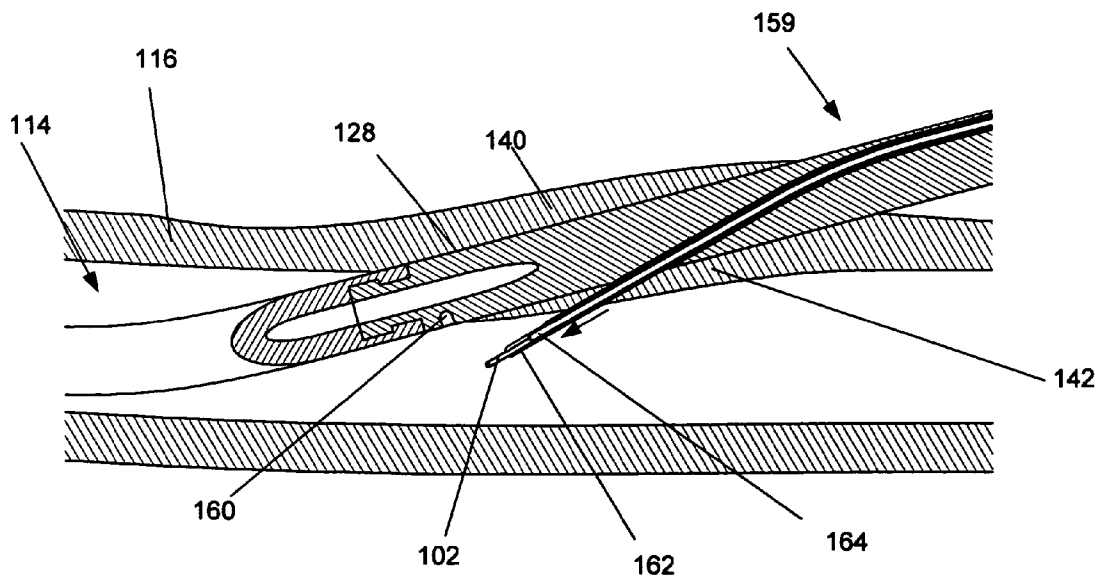


Fig. 54

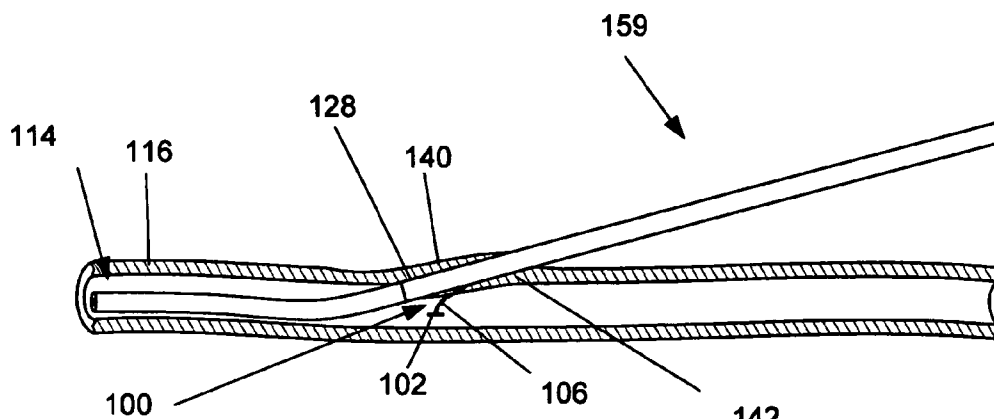


Fig. 55

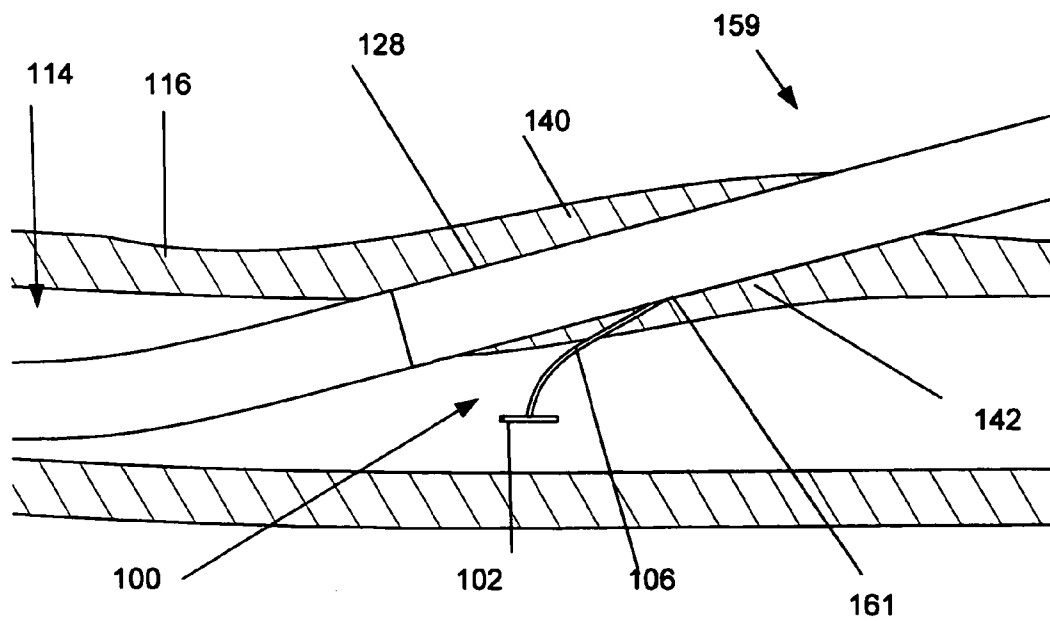


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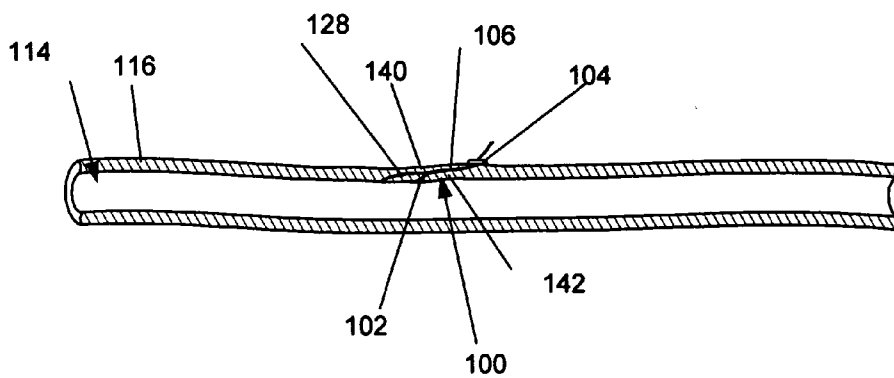


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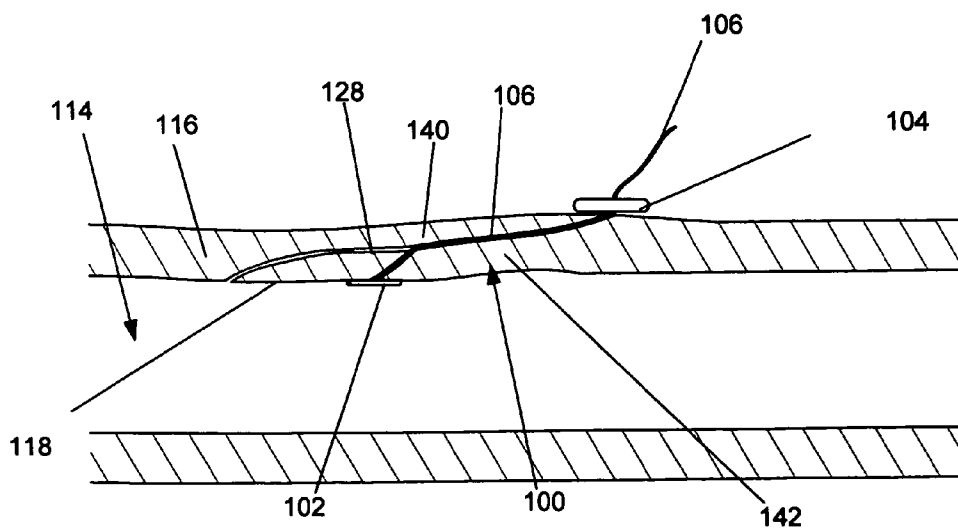
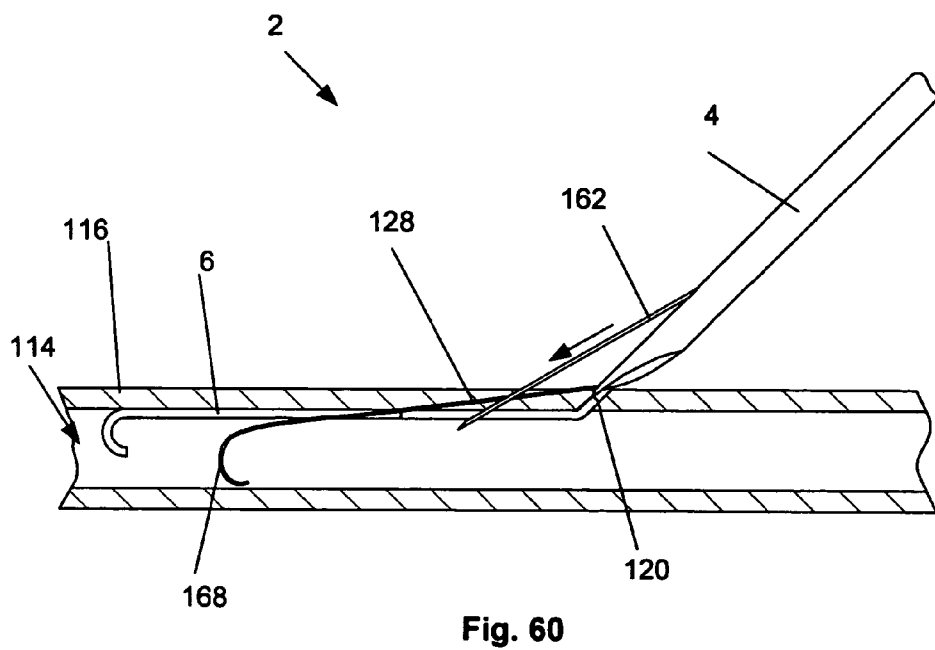
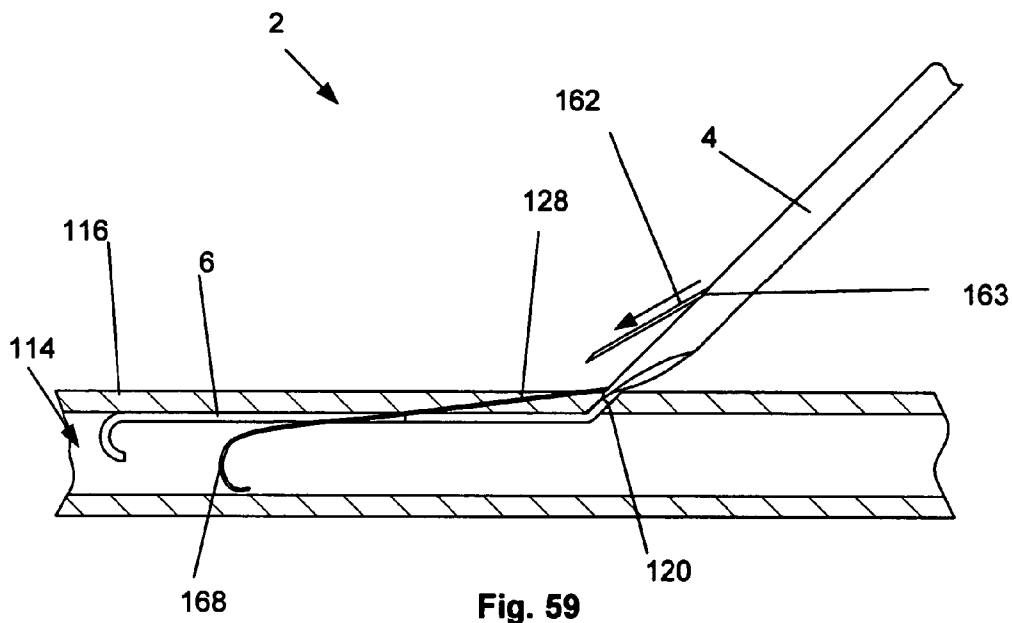


Fig. 58



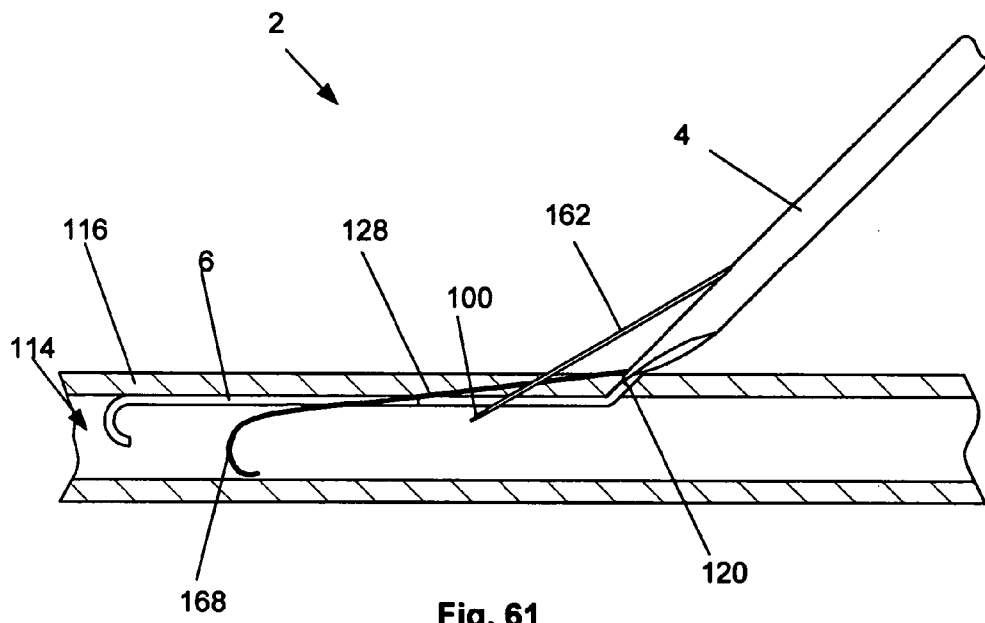


Fig. 61

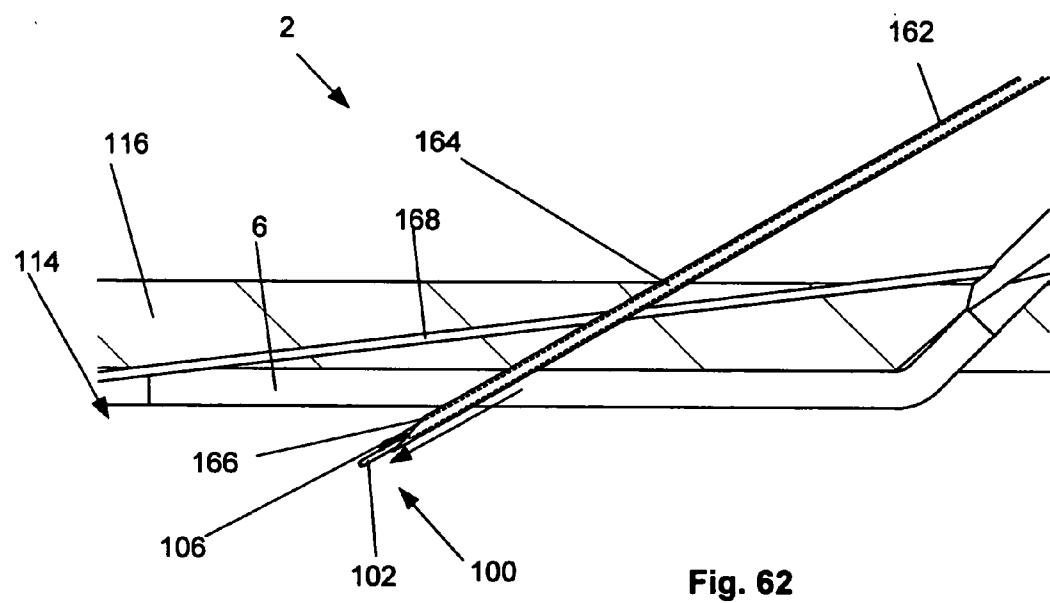


Fig. 62

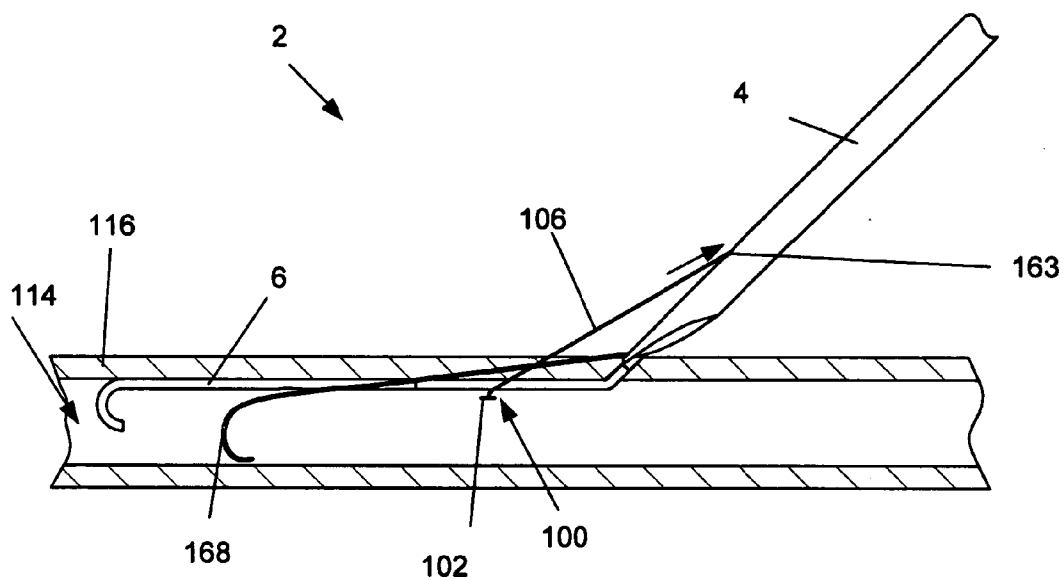


Fig. 63

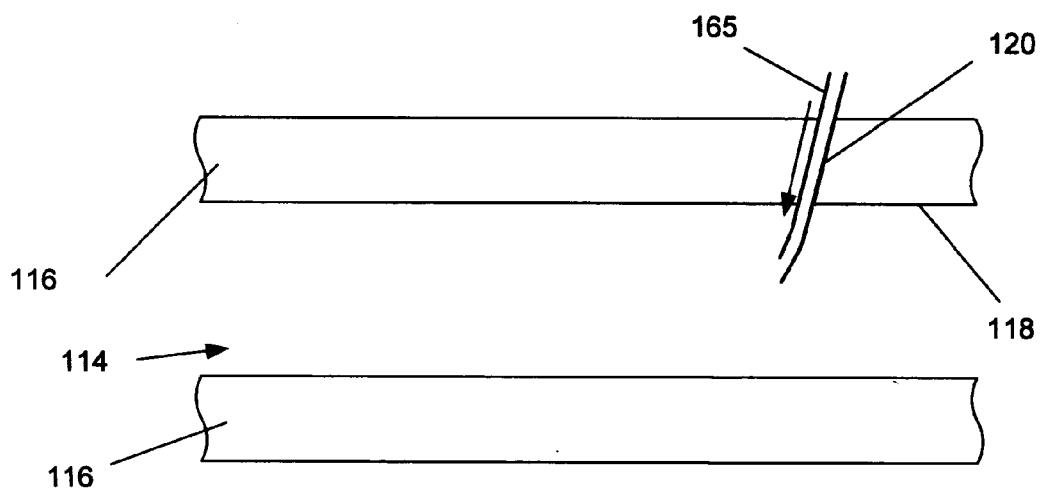


Fig. 64

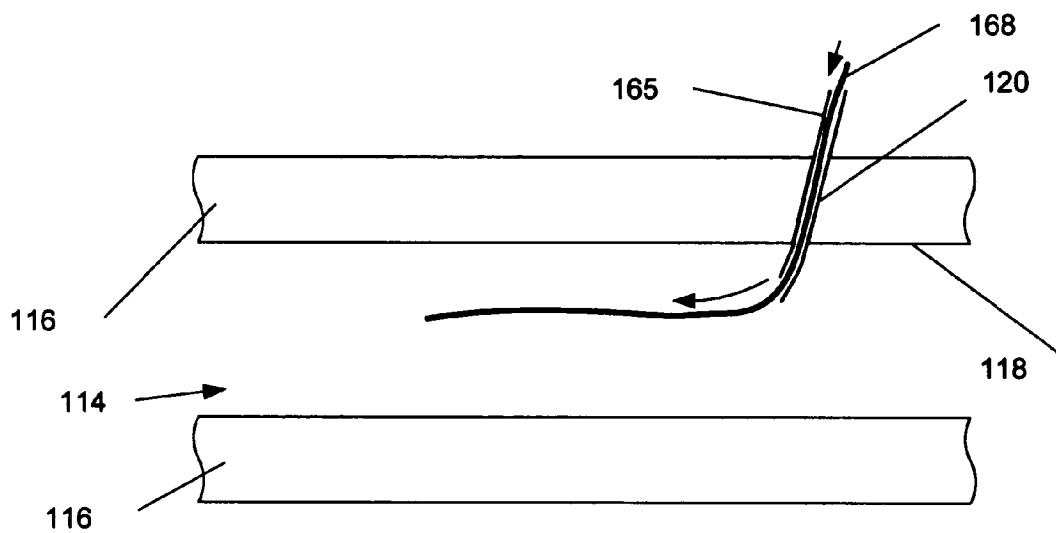


Fig. 65

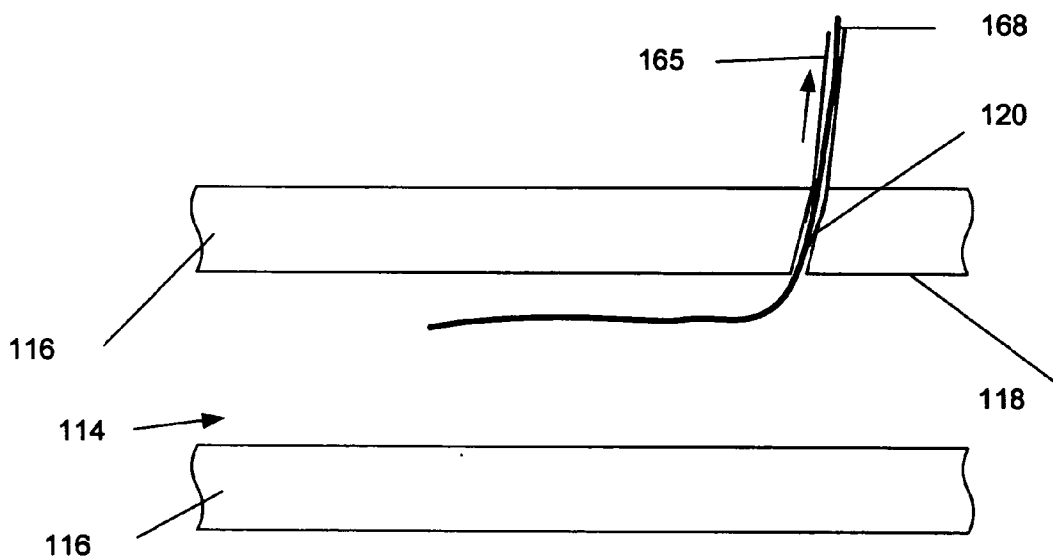


Fig. 66

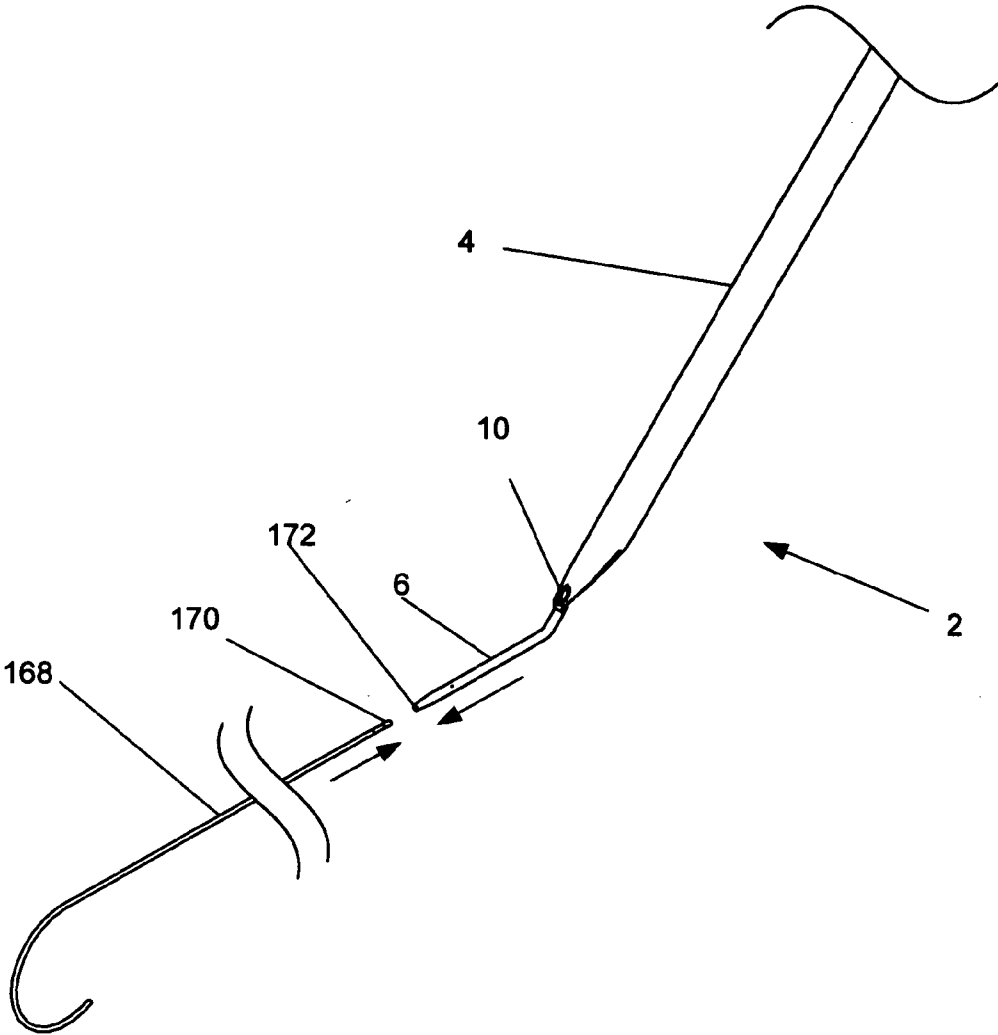


Fig. 67

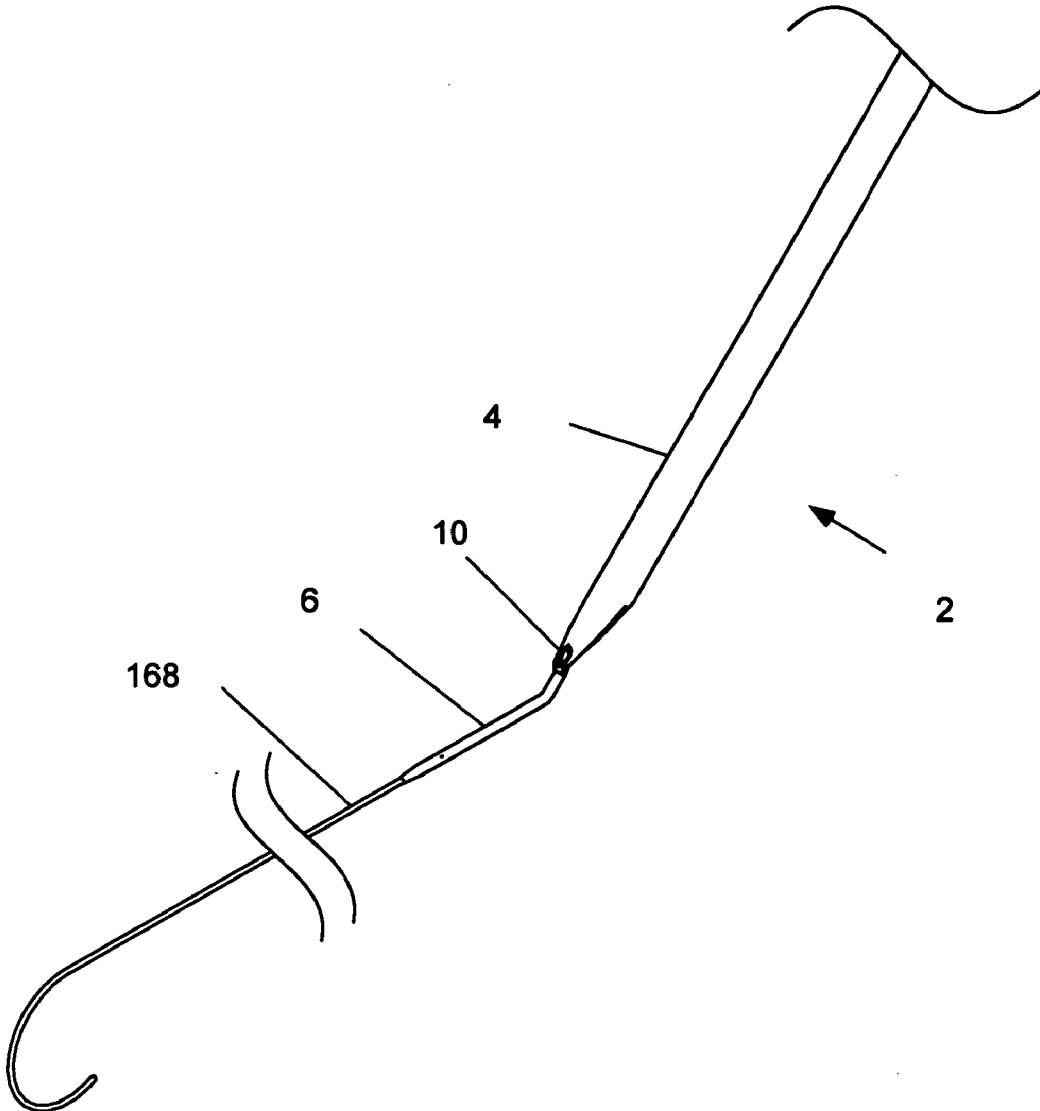


Fig. 68

ACCESS AND CLOSURE DEVICE AND METHOD

RELATED APPLICATION DATA

[0001] The present application is a continuation of copending U.S. patent application Ser. No. 10/844,247, filed May 12, 2004, the priority of which is claimed under 35 U.S.C. §120, and the contents of which is incorporated herein by reference in its entirety, as though set forth in full.

FIELD OF THE INVENTION

[0002] The present invention relates to the field of accessing a biological lumen and closing the access port thereby created.

DESCRIPTION OF THE RELATED ART

[0003] A number of diagnostic and interventional vascular procedures are now performed transluminally, where a catheter is introduced to the vascular system at a convenient access location—such as the femoral, brachial, or subclavian arteries—and guided through the vascular system to a target location to perform therapy or diagnosis. When vascular access is no longer required, the catheter and other vascular access devices must be removed from the vascular entrance and bleeding at the puncture site must be stopped.

[0004] One common approach for providing hemostasis is to apply external force near and upstream from the puncture site, typically by manual compression. This method is time-consuming, frequently requiring one-half hour or more of compression before hemostasis. This procedure is uncomfortable for the patient and frequently requires administering analgesics. Excessive pressure can also present the risk of total occlusion of the blood vessel, resulting in ischemia and/or thrombosis.

[0005] After hemostasis is achieved by manual compression, the patient is required to remain recumbent for six to eighteen hours under observation to assure continued hemostasis. During this time bleeding from the vascular access wound can restart, potentially resulting in major complications. These complications may require blood transfusion and/or surgical intervention.

[0006] Bioabsorbable fasteners have also been used to stop bleeding. Generally, these approaches rely on the placement of a thrombogenic and bioabsorbable material, such as collagen, at the superficial arterial wall over the puncture site. This method generally presents difficulty locating the interface of the overlying tissue and the adventitial surface of the blood vessel. Implanting the fastener too far from the desired location can result in failure to provide hemostasis. If, however, the fastener intrudes into the vascular lumen, thrombus can form on the fastener. Thrombus can embolize downstream and/or block normal blood flow at the thrombus site. Implanted fasteners can also cause infection and auto-immune reactions/rejections of the implant.

[0007] Suturing methods are also used to provide hemostasis after vascular access. The suture-applying device is introduced through the tissue tract with a distal end of the device located at the vascular puncture. Needles in the device draw suture through the blood vessel wall on opposite sides of the punctures, and the suture is secured directly over the adventitial surface of the blood vessel wall to close the vascular access wound.

[0008] To be successful, suturing methods need to be performed with a precise control. The needles need to be properly directed through the blood vessel wall so that the suture is well anchored in tissue to provide for tight closure. Suturing methods also require additional steps for the surgeon.

[0009] Due to the deficiencies of the above methods and devices, a need exists for a more reliable vascular closure method and device. There also exists a need for a vascular closure device and method that does not implant a foreign substance and is self-sealing. There also exists a need for a vascular closure device and method requiring no or few extra steps to close the vascular site.

BRIEF SUMMARY OF THE INVENTION

[0010] A device for accessing a biological lumen is disclosed. The biological lumen has a lumen wall having a longitudinal lumen wall axis. The device has an elongated member that has a longitudinal member axis. The member is configured to access the lumen at a first angle. The first angle is defined by the longitudinal lumen wall axis and the longitudinal member axis. The first angle is less than about 19 degrees.

[0011] The first angle can be less than about 15 degrees. The first angle can be less than about 10 degrees. The device can also have an anchor. The anchor can be configured to hold the elongated member at a fixed angle with respect to the longitudinal lumen wall axis.

[0012] The device can also have a retainer. The retainer can be configured to hold the elongated member at a fixed angle with respect to the longitudinal lumen axis.

[0013] Another device for accessing a biological lumen is disclosed. The biological lumen has a lumen wall and a longitudinal lumen wall axis. The device has a first elongated member and a second elongated member. The first elongated member has a first elongated member axis. The second elongated member has a second elongated member axis. The second elongated member is configured so that the second elongated member axis is parallel to the longitudinal lumen wall axis.

[0014] The second elongated member can have a retainer. The retainer can have an inflatable member. The retainer can have a resilient member. The second elongated member can extend substantially adjacent to the lumen wall.

[0015] Also disclosed is a device for closing an opening on a biological lumen wall. The device has a longitudinal axis, a first force-applying member, a second force-applying member, and a resilient member. The resilient member provides to the first and the second force-applying members a force that is radially outward with respect to the longitudinal axis.

[0016] A method of accessing a blood vessel through a blood vessel wall is also disclosed. The blood vessel wall has a longitudinal wall axis. The method includes entering the vessel at an angle of less than about 19 degrees with respect to the longitudinal wall axis. The method also includes inserting a luminal tool into the vessel.

[0017] Also disclosed is a method for accessing a biological lumen. The biological lumen has a lumen wall and a longitudinal lumen wall axis. The method includes inserting in the biological lumen a second elongated member. The second elongated member has a second elongated member axis. The method also includes aligning the second elongated member so that the second elongated member axis is substantially parallel to the longitudinal lumen wall axis. Further, the

method includes inserting in the biological lumen a first elongated member comprising a first elongated member axis.

[0018] Additionally disclosed is a method of closing a vascular opening. The vascular opening has an inside surface and a longitudinal axis. The method includes inserting a device in the opening and applying a force to the inside surface. The force is directed in at least one radially outward direction from the longitudinal axis.

[0019] The method can include maintaining the force. The applying a force can include the device applying at least a part of the force. The applying of a force can include the device applying all of the force.

[0020] Also disclosed is a method for accessing and closing a blood vessel having a vessel wall. The vessel wall can have an inside surface and an outside surface. The method includes forming an arteriotomy and deploying a closure augmentation device in the arteriotomy. The closure augmentation device produces pressure on the inside surface and the outside surface.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] FIG. 1 is a front perspective view of an embodiment of the arteriotomy device.

[0022] FIG. 2 is a side view of the arteriotomy device of FIG. 1.

[0023] FIG. 3 is a close-up view of the arteriotomy device of FIG. 1.

[0024] FIGS. 4 and 5 are close-up views of various embodiments of the anchor.

[0025] FIG. 6 is a side perspective view of an embodiment of the arteriotomy device with the introduction device deployed.

[0026] FIG. 7 is a close-up view of an embodiment of the arteriotomy device with the introduction device deployed.

[0027] FIGS. 8 and 9 are side views of various embodiments of the arteriotomy device with the introduction devices deployed.

[0028] FIG. 10 is a bottom perspective view of an embodiment of the arteriotomy device.

[0029] FIG. 11 is a side view of an embodiment of the arteriotomy device with the luminal retainer deployed.

[0030] FIG. 12 is a bottom perspective view of an embodiment of the arteriotomy device with the luminal retainer deployed.

[0031] FIG. 13 is a side perspective view of an embodiment of the arteriotomy device.

[0032] FIG. 14 is a side perspective view of an embodiment of the arteriotomy device with the entry wall retainer deployed.

[0033] FIGS. 15 and 16 illustrate various embodiments of the tensioner.

[0034] FIGS. 17 and 18 illustrate various embodiments of the pressure clip.

[0035] FIGS. 19 and 20 illustrate various embodiments of the toggle.

[0036] FIG. 21 illustrates a method for deploying the arteriotomy device in a cross-section of a lumen.

[0037] FIGS. 22 and 23 illustrate methods for deploying the retainers in a cross-section of a lumen.

[0038] FIGS. 24 and 25 illustrate a method for deploying the introduction device in a cross-section of a lumen.

[0039] FIG. 26 illustrates a method for deploying a guidewire in a cross-section of a lumen.

[0040] FIGS. 27-30 illustrate a method for deploying the introduction device in a cross-section of a lumen.

[0041] FIG. 31 illustrates a method for deploying a guidewire in a cross-section of a lumen.

[0042] FIG. 32 illustrates a portion of an arteriotomized lumen.

[0043] FIG. 33 illustrates section A-A of FIG. 28.

[0044] FIGS. 34-36 illustrate a method for deploying a tensioner in a see-through portion of lumen wall.

[0045] FIGS. 37-40 illustrate methods for deploying various embodiments of the pressure clip in a cross-section of a lumen.

[0046] FIG. 41 illustrates a method of using a suture on a portion of an arteriotomized lumen.

[0047] FIG. 42 illustrates section B-B of FIG. 41 with the out-of-section suture.

[0048] FIG. 43 illustrates a method of using pledgets on a portion of an arteriotomized lumen.

[0049] FIG. 44 illustrates section C-C of FIG. 43.

[0050] FIG. 45 illustrates an embodiment of the toggle deployment device in a first configuration.

[0051] FIG. 46 is a close-up view of FIG. 45.

[0052] FIG. 47 illustrates an embodiment of the toggle deployment device in a second configuration.

[0053] FIG. 48 is a close-up view of FIG. 47.

[0054] FIG. 49 illustrates a method of using the toggle deployment device in a cross-section of a lumen.

[0055] FIG. 50 illustrates FIG. 49 with a portion of the toggle deployment device shown in section D-D.

[0056] FIG. 51 illustrates a method of using the toggle deployment device in a cross-section of a lumen.

[0057] FIG. 52 illustrates FIG. 51 with a portion of the toggle deployment device shown in section E-E.

[0058] FIGS. 53-55 illustrate a method of using the toggle deployment device in a cross-section of a lumen.

[0059] FIG. 56 is a close-up view of FIG. 55.

[0060] FIG. 57 illustrates an embodiment of a deployed toggle in a cross-section of a lumen.

[0061] FIG. 58 is a close-up view of FIG. 59.

[0062] FIGS. 59-61 illustrate a method for deploying a toggle in a cross-section of a lumen.

[0063] FIG. 62 is a close-up view of FIG. 61.

[0064] FIG. 63 illustrates a method for deploying a toggle in a cross-section of a lumen.

[0065] FIGS. 64-66 shown, in cross-section, a method for deploying the guidewire through an arteriotomy.

[0066] FIGS. 67 and 68 illustrate a method for attaching guidewire to the anchor.

DETAILED DESCRIPTION

[0067] FIGS. 1 through 3 illustrate a device for accessing a biological lumen, such as an arteriotomy device 2. The arteriotomy device 2 can have a delivery guide 4. The delivery guide 4 can be slidably attached to an anchor 6. The anchor 6 can be rigid, flexible or combinations thereof. The anchor 6 can be resilient, deformable or combinations thereof. The anchor 6 can be retractable and extendable from the delivery guide 4. The delivery guide 4 can have an introducer lumen 8. The introducer lumen 8 can have an introducer lumen exit port 10. The introducer lumen exit port 10 can be on the surface of the delivery guide 4.

[0068] The anchor 6 can have an anchor angle section 12. The anchor 6 can have an anchor extension section 14, for example a guide eye sheath or an attachable guidewire. The

anchor extension section **14** can extend from the anchor angle section **12**. The anchor extension section **14** can be separate from and attached to, or integral with, the anchor angle section **12**.

[0069] The anchor angle section **12** can have an anchor angle first sub-section **16**, an anchor bend **20** and an anchor angle second sub-section **18**. The anchor angle first and/or second sub-sections **16** and/or **18** can be part of the anchor bend **20**. The anchor bend **20** can have a sharp or gradual curve. The radius of curvature for the anchor bend **20** can be from about 0.1 mm (0.004 in.) to about 2.0 mm (0.079 in.).

[0070] The anchor angle first sub-section **16** can have an anchor angle first sub-section diameter **22** from about 0.38 mm (0.015 in.) to about 1.0 mm (0.039 in.), for example about 0.71 mm (0.028 in.). The anchor angle second sub-section **18** can have an anchor angle second sub-section diameter **24** from about 0.38 mm (0.015 in.) to about 1.0 mm (0.039 in.), for example about 0.71 mm (0.028 in.).

[0071] The anchor angle first sub-section **16** can have a delivery longitudinal axis **26**. The anchor angle second sub-section **18** can have an anchor longitudinal axis **28**. The intersection of the delivery longitudinal axis **26** and the anchor longitudinal axis **28** can be an anchoring angle **30**. The anchoring angle **30** can be from about 20.degree. to about 90.degree., more narrowly from about 30.degree. to about 60.degree., for example about 45.degree.

[0072] Any or all elements of the arteriotomy device **2** or other devices or apparatuses described herein can be made from, for example, a single or multiple stainless steel alloys, nickel titanium alloys (e.g., Nitinol), cobalt-chrome alloys (e.g., ELGILOY® from Elgin Specialty Metals, Elgin, Ill.; CONICHROME® from Carpenter Metals Corp., Wyomissing, Pa.), molybdenum alloys (e.g., molybdenum TZM alloy, for example as disclosed in International Pub. No. WO 03/082363 A2, published 9 Oct. 2003, which is herein incorporated by reference in its entirety), tungsten-rhenium alloys, for example, as disclosed in International Pub. No. WO 03/082363, polymers such as polyester (e.g., DACRON® from E. I. Du Pont de Nemours and Company, Wilmington, Del.), polypropylene, polytetrafluoroethylene (PTFE), expanded PTFE (ePTFE), polyether ether ketone (PEEK), nylon, polyether-block co-polyamide polymers (e.g., PEBAX® from ATOFINA, Paris, France), aliphatic polyether polyurethanes (e.g., TECOFLEX® from Thermedics Polymer Products, Wilmington, Mass.), polyvinyl chloride (PVC), polyurethane, thermoplastic, fluorinated ethylene propylene (FEP), absorbable or resorbable polymers such as polyglycolic acid (PGA), polylactic acid (PLA), polydioxanone, and pseudo-polyamino tyrosine-based acids, extruded collagen, silicone, zinc, echogenic, radioactive, radiopaque materials or combinations thereof. Examples of radiopaque materials are barium sulfate, zinc oxide, titanium, stainless steel, nickel-titanium alloys, tantalum and gold.

[0073] Any or all elements of the arteriotomy device **2**, including supplemental closure devices, such as tensioners, clips, toggles, sutures, or other devices or apparatuses described herein can be or have a matrix for cell ingrowth or used with a fabric, for example a covering (not shown) that acts as a matrix for cell ingrowth. The matrix and/or fabric can be, for example, polyester (e.g., DACRON® from E. I. du Pont de Nemours and Company, Wilmington, Del.), polypropylene, PTFE, ePTFE, nylon, extruded collagen, silicone or combinations thereof.

[0074] The elements of the arteriotomy device **2** and/or the fabric can be filled and/or coated with an agent delivery matrix known to one having ordinary skill in the art and/or a therapeutic and/or diagnostic agent. The agents within these matrices can include radioactive materials; radiopaque materials; cytogenic agents; cytotoxic agents; cytostatic agents; thrombogenic agents, for example polyurethane, cellulose acetate polymer mixed with bismuth trioxide, and ethylene vinyl alcohol; lubricious, hydrophilic materials; phosphor cholene; anti-inflammatory agents, for example non-steroidal anti-inflammatories (NSAIDs) such as cyclooxygenase-1 (COX-1) inhibitors (e.g., acetylsalicylic acid, for example ASPIRIN® from Bayer AG, Leverkusen, Germany; ibuprofen, for example ADVIL® from Wyeth, Collegeville, Pa.; indomethacin; mefenamic acid), COX-2 inhibitors (e.g., VIOXX® from Merck & Co., Inc., Whitehouse Station, N.J.; CELEBREX® from Pharmacia Corp., Peapack, N.J.; COX-1 inhibitors); immunosuppressive agents, for example Sirolimus (RAPAMUNE®, from Wyeth, Collegeville, Pa.), or matrix metalloproteinase (MMP) inhibitors (e.g., tetracycline and tetracycline derivatives) that act early within the pathways of an inflammatory response. Examples of other agents are provided in Walton et al, Inhibition of Prostaglandin E.sub.2 Synthesis in Abdominal Aortic Aneurysms, Circulation, Jul. 6, 1999, 48-54; Tambiah et al, Provocation of Experimental Aortic Inflammation Mediators and Chlamydia Pneumoniae, Brit. J. Surgery 88 (7), 935-940; Franklin et al, Uptake of Tetracycline by Aortic Aneurysm Wall and Its Effect on Inflammation and Proteolysis, Brit. J. Surgery 86 (6), 771-775; Xu et al, Sp1 Increases Expression of Cyclooxygenase-2 in Hypoxic Vascular Endothelium, J. Biological Chemistry 275 (32) 24583-24589; and Pyo et al, Targeted Gene Disruption of Matrix Metalloproteinase-9 (Gelatinase B) Suppresses Development of Experimental Abdominal Aortic Aneurysms, J. Clinical Investigation 105 (11), 1641-1649 which are all incorporated by reference in their entireties.

[0075] FIG. 4 illustrates that the anchor angle section **12** and the anchor extension section **14** can have a flexible elongated element. The flexible elongated element can be resilient and/or deformable. The flexible elongated element can have an integral, or multiple separate and fixedly attached, wound wire **32**. The anchor angle section **12** can be in a sheath **34**. FIG. 5 illustrates that the anchor angle section **12** can have a wire coating **36**, for example a lubricious coating and/or a coating made from urethane.

[0076] FIGS. 6 and 7 illustrate that the arteriotomy device **2** can have an introduction device **38**. The introduction device **38** can be slidably attached to the introducer lumen **8**. The introduction device **38** can have a hollow needle (as shown in FIG. 6). The introduction device **38** can have a solid needle (as shown in FIG. 7). The introduction device **38** can have a guidewire.

[0077] The introduction device **38** can have an introduction longitudinal axis **40**. The intersection of the introduction longitudinal axis **40** and the anchor longitudinal axis **28** can be an introduction angle **42**. The introduction angle **42** can be less than or equal to about 19.degree., more narrowly less than or equal to about 15.degree., yet more narrowly from about 5.degree. to about 10.degree., for example about 10.degree.

[0078] The introduction device **38** can have an introduction device diameter **44**. The introduction device diameter **44** can be from about 0.25 mm (0.010 in.) to about 1.0 mm (0.039 in.), for example about 0.56 mm (0.022 in.).

[0079] FIGS. 8 and 9 illustrate that the arteriotomy device 2 can be configured so that the introduction device 38 can be deployed from the anchor 6. The anchor 6 can have an introduction device port 46. The introduction device 38 can be a hollow needle (as shown in FIG. 8). When fully deployed, the introduction device 38 can contact the introducer lumen exit port 10. The introduction device 38 can be a channel between the introducer lumen 8 and the anchor 6. The anchor 6 can have a port (not shown) configured to communicate with the biological lumen and the introduction device 38. The introduction device 38 can be a solid needle (as shown in FIG. 9).

[0080] FIG. 10 illustrates that a luminal retainer 48 can have a first retracted configuration. The luminal retainer 48 can be seated in a luminal retainer port 50. The luminal retainer port 50 can be in the anchor 6. The luminal retainer 48 can be a wire, scaffold or stent—for example made from a deformable or resilient material, such as a shape memory alloy—an inflatable balloon, or combinations thereof. Intraluminal inflatable balloons, such as those inflated with saline solution or carbon dioxide, are known to those having ordinary skill in the art. The luminal retainer 48 can extend into the delivery guide 4.

[0081] FIGS. 11 and 12 illustrate that the luminal retainer 48 can have a second deployed configuration. FIG. 11 shows that the luminal retainer 48 can be a wire or balloon. FIG. 12 shows that the luminal retainer 48 can be a wire. In the deployed configuration, the luminal retainer 48 can deploy away from the luminal retainer port. The luminal retainer 48 can have a luminal retainer deployed diameter 52. The luminal retainer deployed diameter 52 can be from about 2.54 mm (0.100 in.) to about 10.2 mm (0.400 in.), for example about 6.35 mm (0.250 in.).

[0082] FIG. 13 illustrates that the arteriotomy device 2 can have an entry wall retainer port 54. The entry wall retainer port 54 can be at or near the anchor bend 20. The entry wall retainer port 54 can be at or near the anchor angle first subsection 16. The entry wall retainer port 54 can be in fluid communication with a sensor or port (not shown) on or near the delivery guide 4 of the arteriotomy device 2.

[0083] FIG. 14 illustrates that an entry wall retainer 56 can be deployed through the entry wall retainer port 54. The entry wall retainer 56 can have a first retracted configuration (as shown in FIG. 13). The entry wall retainer 56 can have a second deployed configuration (as shown in FIG. 14).

[0084] FIGS. 15 through 20 illustrate various supplemental closure devices. The supplemental closure devices can be completely or partially bioabsorbable, bioresorbable, bioabsorbable or combinations thereof. The supplemental closure devices can be made from homografts, heterografts or combinations thereof. The supplemental closure devices can be made from autografts, allografts or combinations thereof.

[0085] FIG. 15 illustrates a tensioner 58. The tensioner 58 can be resilient, deformable, or combinations thereof. The tensioner 58 can have a tensioner longitudinal axis 60. The tensioner 58 can have a resilient element, such as a spring, for example a tensioner head 62. The tensioner head 62 can have a tensioner first shoulder 64. The tensioner head 62 can have a tensioner second shoulder 66. The tensioner first and second shoulders 64 and 66 can rotatably attached to a separate or integral tensioner first leg 68 and a separate or integral tensioner second leg 70, respectively. The tensioner first and second legs 68 and 70 can attach to tensioner first and second feet 72 and 74, respectively.

[0086] The tensioner legs 68 and 70 can have tensioner leg diameters 76. The tensioner leg diameters 76 can be from about 0.1 mm (0.005 in.) to about 0.76 mm (0.030 in.), for example about 0.38 mm (0.015 in.). The tensioner first and second legs 68 and 70 can have a tensioner inter-leg outer diameter 78. The tensioner inter-leg outer diameter 78 can be from about 1.3 mm (0.050 in.) to about 5.08 mm (0.200 in.), for example about 4.06 mm (0.160 in.). The tensioner shoulders 64 and/or 66 and/or the tensioner feet 72 and/or 74 can extend to a greater radius from the tensioner longitudinal axis 60 than their respective tensioner inter-leg radius.

[0087] FIG. 16 illustrates a tensioner first strut 80 that can attach to the tensioner first leg 68 and the tensioner second leg 70. The tensioner first leg 68 can be resilient, deformable or combinations thereof. A tensioner second strut 82 can attach to the tensioner first leg 68 and the tensioner second leg 70. The tensioner second leg 70 can be resilient and/or deformable. The tensioner 58 can have no tensioner head 62. The tensioner 58 can have more than two tensioner struts 80 and 82.

[0088] FIG. 17 illustrates a pressure clip 84. The pressure clip 84 can be resilient. The pressure clip 84 can be deformable. The pressure clip 84 can have a pressure clip longitudinal axis 86. The pressure clip 84 can have a pressure clip head 88. The pressure clip head 88 can be rotatably attached to a separate or integral pressure clip first leg 90. The pressure clip head 88 can be rotatably attached to a separate or integral pressure clip second leg 92. The pressure clip can have a pressure clip first end 94 and a pressure clip second end 96. The pressure clip first leg 90 can terminate in the pressure clip first end 94. The pressure clip second leg 92 can terminate in the pressure clip second end 96. The pressure clip first leg 90 and/or the pressure clip second leg 92 can be biased toward the pressure clip longitudinal axis 86.

[0089] FIG. 18 illustrates the pressure clip 84 that can have a pressure clip sheath 98 slidably attached to the pressure clip second leg 92. The pressure clip first and/or second ends 94 and/or 96 can be pressure dissipaters, such as flat and/or curved portions, for example circular loops. The pressure clip first and/or second ends 94 and/or 96 can be resilient and/or deformable. The pressure clip first leg 90 can be rotatably attached to the pressure clip second leg 92. The pressure clip first leg 90 can be attached to the pressure clip second leg 92 via a rotatable, and/or deformable, and/or flexural joint in the pressure clip head 88.

[0090] FIG. 19 illustrates a toggle 100. The toggle 100 can have a toggle first end 102. The toggle 100 can have a toggle second end 104. The toggle first and/or second ends 102 and/or 104 can be bars, dowels, rods, beams, or combinations thereof. The toggle 100 can have a filament 106. The filament 106 can be fixedly attached at a filament first end 107 to the toggle first end 102. The filament 106 can be fixedly attached at a filament second end 109 to the toggle second end 104. The filament 106 can be resilient or deformable. The filament 106 can be substantially flexible.

[0091] FIG. 20 illustrates the toggle 100 that can have the filament 106 that can be slidably attached to the toggle second end 104 at a hole 108. The filament 106 can frictionally fit the hole 108. The filament 106 can have no pawls 110 (not shown in FIG. 20). The filament 106 can interference fit the hole 108. The filament 106 can have one or more pawls 110. The hole 108 can have one or more notches 112. The notches 112 can be internal to the hole 108. The notches 112 and the pawls 110 can be configured to allow the toggle second end 104 to slide

toward the toggle first end **102**. The notches **112** and the pawls **110** can be configured to provide an interference fit when the toggle second end **104** is attempted to be moved away from the toggle first end **102**.

Method of Manufacture

[0092] The elements of the arteriotomy device **2**, including the supplemental closure devices, can be directly attached by, for example, melting, screwing, gluing, welding or use of an interference fit or pressure fit such as crimping, snapping, or combining methods thereof. The elements can be integrated, for example, molding, die cutting, laser cutting, electrical discharge machining (EDM) or stamping from a single piece or material. Any other methods can be used as known to those having ordinary skill in the art.

[0093] Integrated parts can be made from pre-formed resilient materials, for example resilient alloys (e.g., Nitinol, ELGILOY®) that are preformed and biased into the post-deployment shape and then compressed into the deployment shape as known to those having ordinary skill in the art.

[0094] Any elements of the arteriotomy device **2**, including the supplemental closure devices, or the arteriotomy device **2**, including the supplemental closure devices, as a whole after assembly, can be coated by dip-coating, brush-coating or spray-coating methods known to one having ordinary skill in the art. For example, these methods can be used to coat the wound wire **32** with the wire coating **36** can be spray coated, dip-coated or brushed onto the wire **32**.

[0095] One example of a method used to coat a medical device for vascular use is provided in U.S. Pat. No. 6,358,556 by Ding et al. and hereby incorporated by reference in its entirety. Time release coating methods known to one having ordinary skill in the art can also be used to delay the release of an agent in the coating, for example the coatings on the supplemental closure devices.

[0096] The supplemental closure devices can be covered with a fabric, for example polyester (e.g., DACRON® from E. I. du Pont de Nemours and Company, Wilmington, Del.), polypropylene, PTFE, ePTFE, nylon, extruded collagen, silicone or combinations thereof. Methods of covering an implantable device with fabric are known to those having ordinary skill in the art.

Method of Use

[0097] FIG. **21** illustrates a method of inserting the anchor **6** into a biological lumen **114**, for example a blood vessel, such as a femoral artery. The biological lumen **114** can have a lumen wall **116** and a lumen wall surface **118**. The anchor **6** can be inserted into the biological lumen **114** using a Seldinger technique, modified Seldinger technique, or other method known to one having ordinary skill in the art. The anchor **6** can create a first arteriotomy **120**. The anchor **6** can be inserted into the lumen **114** so that the anchor angle second sub-section **18** can be substantially parallel with the lumen wall surface **118**. The anchor **6** can be inserted into the lumen **114** so that the anchor angle second sub-section **18** can be substantially in contact with the lumen wall surface **118**.

[0098] FIG. **22** illustrates a method of deploying, as shown by arrow, the luminal retainer **48** from the first retracted configuration to the second deployed configuration. The luminal retainer **48** can be deployed by extending a wire, scaffold or stent, or by inflating a balloon. When the luminal retainer **48** is deployed, the anchor angle second sub-section

18 can be made substantially parallel with the lumen wall surface **118**. When the luminal retainer **48** is deployed, the anchor angle second sub-section **18** can be made to be substantially in contact with the lumen wall surface **118**.

[0099] FIG. **23** illustrates a method of deploying, as shown by arrow **122**, the entry wall retainer **56** from the first retracted configuration to the second deployed configuration. When the luminal retainer is in the second deployed configuration, the luminal retainer **48** can be substantially parallel with the lumen wall surface **118**. When the luminal retainer is in the second deployed configuration, the luminal retainer **48** can be substantially in contact with the lumen wall surface **118**.

[0100] A proximal force, as shown by arrow **124**, can be applied to the anchor **6**, for example by being applied to the delivery guide **4**. When the proximal force is applied, the anchor angle second sub-section **18** can be made substantially parallel with the lumen wall surface **118**. When the proximal force is applied, the anchor angle second sub-section **18** can be made to be substantially in contact with the lumen wall surface **118**.

[0101] FIGS. **24** and **25** illustrate a method for deploying the introduction device **38**. The introduction device **38** can egress from the introducer lumen **8** and the introducer lumen exit port **10**. As shown in FIG. **24**, the introduction device **38** can be pushed, as shown by arrow, into and through the lumen wall **116**. The introduction device **38** can form a second arteriotomy **128**. As shown in FIG. **25**, the introduction device **38** can be pushed, as shown by arrow, adjacent to or through the anchor **6**. The anchor **6** can be configured to have ports suitable to allow the introduction device **38** to pass through the anchor **6**. A tip of the introduction device **38** can enter the lumen **114**.

[0102] The introduction device **38** can pass through an introduction run **132** and an introduction rise **134**. The introduction run **132** can be the component of the length of the introduction device **38** in the lumen wall **116** that is parallel to the lumen wall **116**. The introduction run **132** can be the component of the length parallel to the lumen wall **116** between the opening of the second arteriotomy **128** on the outside of the lumen wall **116** and the opening of the second arteriotomy **128** on the inside lumen wall surface **118**. The introduction run **132** can be from about 0.10 cm (0.010 in.) to about 3.810 cm (1.500 in.), for example about 0.64 cm (0.25 in.).

[0103] The introduction rise **134** can be the component of the length of the introduction device **38** in the lumen wall **116** that is perpendicular to the lumen wall **116**. The introduction rise **134** can be the component of the length perpendicular to the lumen wall **116** between the opening of the second arteriotomy **128** on the outside of the lumen wall **116** and the opening of the second arteriotomy **128** on the inside lumen wall surface **118**. The introduction rise **134** can be from about 0.51 mm (0.020 in.) to about 5.08 mm (0.200 in.), for example about 1.0 mm (0.040 in.). An introduction slope can be the ratio of the introduction rise **134** to the introduction run **132**. The introduction slope can be from about $\frac{1}{2}$ to about {fraction ($\frac{1}{40}$)} or less, for example about $\frac{1}{6}$, also for example about $\frac{1}{3}$. The introduction slope can be, for examples, equal to or less than about $\frac{1}{2}$ or $\frac{1}{3}$, more narrowly equal to or less than about $\frac{1}{3}$ or $\frac{1}{4}$, yet more narrowly equal to or less than about $\frac{1}{5}$ or $\frac{1}{6}$, even still more narrowly than about equal to or less than about {fraction ($\frac{1}{10}$)}.

[0104] The introduction rise **134** and the introduction run **132** can be components of an introduction vector. The intro-

duction run **132** can be the component of the introduction vector parallel to the lumen wall **116**. The introduction rise **134** can be the component of the introduction vector perpendicular to the lumen wall **116**. The introduction vector can be a vector from an outer opening **136** to an inner opening **138**. The outer opening **136** can be a temporary or permanent opening on the outside of the lumen wall **116** formed by the introduction device **38**. The inner opening **138** can be a temporary or permanent opening on the inside of the vessel wall.

[0105] FIG. 26 illustrates that the introduction device **38**, for example a hollow needle, can act as a pathway for a luminal tool, for example tools such as a guidewire **168**, to be deployed, as shown by arrow, into the lumen **114**. The introduction device **38**, for example a solid needle, can be removed from the second arteriotomy **128** and the luminal tool can be deployed through, for example, the introducer lumen exit port **10**, and the second arteriotomy **128**. The introduction device **38** can be the luminal tool, for example a guidewire. The introduction device **38** can be further deployed and used as a luminal tool after passing through the lumen wall **116**.

[0106] FIGS. 27 through 30 illustrates a method of deploying the introduction device **38** that can have a pre-formed bend. As shown in FIG. 27, the arteriotomy device **2** can be configured to deploy the introduction device **38** at the introduction angle **42** from about 0.degree. to about 5.degree., for example about 0.degree.

[0107] As shown in FIG. 28, the introduction device **38** can be pushed, as shown by arrow, through the lumen wall **116**. The introduction device **38** can cleave a plane in the lumen wall **116**. The plane can be substantially parallel with the lumen wall surface **118**. The introduction device **38** can be adjacent to the adventitia in a blood vessel. The introduction device **38** can be advanced along the subintimal or submedial cleavage plane in a blood vessel. Once the lumen wall has been cleaved, a subintimal angioplasty can be performed as known to one having ordinary skill in the art. Once the lumen wall has been cleaved, a remote endarterectomy can be performed as known to one having ordinary skill in the art. Bent and straight introduction devices **38** can be swapped during use to selectively cleave the lumen wall **116**. Tools, such as guidewires, can be inserted through hollow introduction devices **38** to selectively cleave the lumen wall **116**.

[0108] As shown in FIG. 29, when the bend in the introduction device **38** moves into the lumen wall **116**, the introduction device **38** can rotate, as shown by arrow, toward the biological lumen **114**. As shown in FIG. 30, the bend in the introduction device **38** can continue to rotate the introduction device **38** toward the biological lumen **114**. As described infra, the introduction device **38** can enter the lumen **114**. FIG. 31 illustrates that the introduction device **38** that can have the bend can act as a pathway for a luminal tool, as described infra.

[0109] An introducer sheath can be inserted over the guidewire **168** and/or the introduction device **38**. The introducer sheath can be less than about 22 French (7.3 mm, 0.29 in. diameter) or less than the diameter of the lumen to which the introducer sheath is introduced. The introducer sheath can be, for examples, about 6 French (2.3 mm, 0.092 in. diameter), and about 8 French (2.67 mm, 0.105 in. diameter). The introducer sheath can be known to one having ordinary skill in the art, for example the introducer sheath described in U.S. Pat. No. 5,183,464 to Dubrul, et al.

[0110] The introducer sheath can be inserted into the second arteriotomy **128**. The introducer sheath can expand the

second arteriotomy **128** to a workable size. The introducer sheath can be inserted into the second arteriotomy **128** before and/or after and/or concurrently with the supplemental closure device is deployed and/or other closure method is used.

[0111] FIGS. 32 and 33 illustrate an exemplary biological lumen **114** after the arteriotomy device **2** has been deployed to, and removed from, the biological lumen **114**. The biological lumen **114** can have the first and second arteriotomies **120** and **128**. The biological lumen **114** can have a second arteriotomy **128**. The biological lumen **114** can have a first web **140** on one side of the arteriotomy (shown for the second arteriotomy **128**), and a second web **142** on the opposite side of the arteriotomy **120** or **128**. The natural pressure, shown by arrows, from the first and second webs **140** and **142** can self-seal the arteriotomy **120** or **128**.

[0112] One or more supplemental closure devices can be deployed to the first and/or second arteriotomies **120** and/or **128**. The supplemental closure devices can provide a force or restraint to aid hemostasis. The supplemental closure devices can be permanently or temporarily deployed. The supplemental closure devices can biodissolve after hemostasis is achieved and/or after the relevant arteriotomy **120** or **128** is substantially or completely healed. The force from the supplemental closure device can be maintained from about 15 minutes to about 24 hours or more, for example about 120 minutes.

[0113] FIG. 34 illustrates a tensioner **58** in a compressed configuration. Compressive forces, shown by arrows, can compress the tensioner first and second legs **68** and **70**. In a compressed configuration, the tensioner inter-leg outer diameter **78** can be from about 0.51 mm (0.020 in.) to about 2.54 mm (0.100 in.), for example about 1.5 mm (0.060 in.).

[0114] FIGS. 35 and 36 illustrate a method of deploying the tensioner **58**. As shown in FIG. 35, the tensioner **58** can be in a compressed configuration. The tensioner **58** can be exposed to the compressive forces, as shown by arrows **144**. The compressive forces can be applied by a retractable sheath, clamps, other methods known to one having ordinary skill in the art, or combinations thereof. A deployment force, shown by arrow **146**, can deploy the tensioner **58** into the arteriotomy **120** or **128**.

[0115] The arteriotomy **120** or **128** can have an arteriotomy diameter **148**. The arteriotomy diameter **148** can be from about 0.5 mm (0.020 in.) to about 400 mm (15 in.), yet a narrower range from about 1.0 mm (0.040 in.) to about 10.2 mm (0.400 in.), for example about 2.54 mm (0.100 in.). When in the compressed configuration, the tensioner inter-leg outer diameter **78** can be smaller than the arteriotomy diameter **148**. The tensioner first and second shoulders **64** and **66** can be wide enough to interference fit with the arteriotomy **120** or **128**. The tensioner first and second shoulders **64** and **66** can dissipate force on the lumen wall surface **118**.

[0116] As shown in FIG. 36, the compressive forces can be removed from the tensioner **58**. The tensioner first and second leg **68** and **70** can expand, as shown by arrows. The tensioner **58** can force the arteriotomy **120** or **128** into a substantially or completely flat and/or closed and/or stretched configuration. The walls of the arteriotomy **120** or **128** can come into close contact.

[0117] The arteriotomy **120** or **128** can have an arteriotomy width **150** and an arteriotomy height **152**. The arteriotomy width **150** can be about half the circumference of the arteriotomy **120** or **128**. The arteriotomy width **150** can be from

about 1.0 mm (0.040 in.) to about 10.2 mm (0.400 in.), for example about 4.06 mm (0.160 in.).

[0118] The arteriotomy height **152** can be about the tensioner leg diameter **76**. The arteriotomy height **152** can be less than about 0.51 mm (0.020 in.), more narrowly, less than about 0.38 mm (0.015 in.). The arteriotomy height **152** can be from about 0.25 mm (0.010 in.) to about 1.3 mm (0.050 in.), for example about 0.38 mm (0.015 in.). The arteriotomy height **152** can be small enough to enable cell growth, blood clotting, acoustic sealing, heat sealing, gluing, enhanced self-sealing and combinations thereof across the arteriotomy **120** or **128**.

[0119] The tensioner first and second shoulders **64** and **66** can be wide enough to interference fit with the arteriotomy **120** or **128**. The tensioner first and second feet **72** and **74** can be wide enough to interference fit with the arteriotomy **120** or **128**. The tensioner first and second feet **72** and **74** can dissipate force on the lumen wall surface **118**.

[0120] The arteriotomy **120** or **128** can be plugged, and/or packed, and/or tamponed before, and/or concurrent with, and/or after using any of any of the supplemental closure devices *infra* and/or *supra*, the self-sealing closure method, or combinations thereof. The plug, pack, tampon, or combinations thereof (not shown) can be made from gelfoam, collagen, other implantable and biocompatible tampon materials known to those having ordinary skill in the art, or combinations thereof.

[0121] FIGS. **37** through **40** illustrate deploying the pressure clip **84** to the arteriotomy **120** or **128**. FIG. **37** illustrates extending, and/or thinning, and/or straightening, and/or tensioning the pressure clip second end **96**. The pressure clip sheath **98** can be translated, as shown by arrow, along the pressure clip second leg **92** and onto the pressure clip second end **96**. The pressure clip **84** can be deployed to the arteriotomy after the pressure clip second end **96** is extended, and/or thinned, and/or straightened, and/or tensioned.

[0122] As shown in FIG. **38**, the pressure clip second leg **92** can be rotated with respect to the pressure clip head **88**, so that the pressure clip second leg **92** and the pressure clip head **88** are substantially aligned. The pressure clip second leg **92** can be deployed, as shown by the arrow, through the first arteriotomy **120**. The pressure clip second leg **92** can be deployed through the lumen wall **116** (e.g., if there is no existing first arteriotomy **120**, if the first arteriotomy **120** is not suitably located with respect to the second arteriotomy **128**).

[0123] FIG. **39** illustrates contracting, and/or widening, and/or releasing and/or relaxing the pressure clip second end **96**. The pressure clip sheath **98** can be translated, as shown by arrow, along the pressure clip second leg **92** and off of the pressure clip second end **96**. The pressure clip second end **96** can be contracted, and/or widened, and/or released and/or relaxed after the pressure clip **84** is deployed to the arteriotomy.

[0124] As shown in FIG. **40**, after the pressure clip second leg **92** is deployed through the first arteriotomy **120**, the pressure clip second leg **92** can be released or deformed so as to rotate with respect to the pressure clip head **88**. The pressure clip head **88** can seat in the first arteriotomy **120**. The pressure clip first and second legs **90** and **92** can apply force, as shown by arrows, to the first and second webs **140** and **142**, respectively.

[0125] FIGS. **41** and **42** illustrate a method of deploying a stitch **154** surrounding and/or through the arteriotomy **120** or **128**. The stitch **154** can be tightened to apply additional

pressure to the arteriotomy **120** or **128**. The stitch **154** can have a knot **156**, or other tying configuration or device, for example a pledget or clamp.

[0126] FIGS. **43** and **44** illustrate a method of deploying the filament **106** adjacent to and/or through the arteriotomy **120** or **128**. The filament **106** can be attached to a first pledget **158a** by a first knot **156a** or other tying configuration or device. The filament **106** can be attached to a second pledget **158b** by a second knot **156b** or other tying configuration or device. The first and second pledgets **158a** and **158b** can be other pressure diffusers known to one having ordinary skill in the art, such as the toggles **100** described *infra* and *supra*.

[0127] FIGS. **45** and **46** illustrate a toggle deployment device **159** that can be in a first retracted configuration. The toggle deployment device **159** can have a pressure check port **160**. The pressure check port **160** can be in fluid communication with a sensor or port on or near the handle (not shown) of the toggle deployment device **159**, such as an external lumen where blood flow can be observed, for example from flow from the end of an external tube or port and/or through a transparent or translucent window. The pressure check port **160** can facilitate deployment of the toggle deployment device **159** to a location where the pressure check port **160** is introduced to pressure, for example when the pressure check port **160** enters the biological lumen **114**. The sensor or port on or near the handle of the toggle deployment device **159** will signal that the pressure check port **160** has been placed into the biological lumen **114** (e.g., by displaying a small amount of blood flow). The pressure check port **160** can be deployed into the biological lumen **114** and then withdrawn from the biological lumen **114** to the point where the lumen wall **116** just stops the pressure in the pressure check port **160**. The entry wall retainer port **54** can additionally perform the function as described herein for the pressure check port **160**. The toggle deployment device **159** can have a delivery needle port **161**.

[0128] FIGS. **47** and **48** illustrate the toggle deployment device **159** that can be in a second delivery configuration. A delivery needle **162** can be slidably attached to the toggle deployment device **159**. The delivery needle **162** can egress from the delivery needle port **161** when the toggle deployment device **159** is in the second delivery configuration.

[0129] FIGS. **49** and **50** illustrate that the toggle deployment device **159** can be deployed into the arteriotomy **120** or **128** at a location where the pressure check port **160** can be located in the biological lumen **114**. The delivery needle port **161** can be in, or adjacent to, the lumen wall **116**.

[0130] FIGS. **51** and **52** illustrate that the toggle deployment device **159** can be placed in the second delivery configuration. If the delivery needle port is in, or adjacent to, the lumen wall **116** when the toggle deployment device **159** is placed in the second delivery configuration, the delivery needle **162** can enter the lumen wall **116**. For example, the delivery needle **162** can enter the second web **142**. The delivery needle **162** can exit the second web **142** and enter, as shown by arrows, the biological lumen **114**.

[0131] FIG. **53** illustrates that a pusher **164** can be slidably attached to the delivery needle **162**. The delivery needle **162** can have a needle tip port **166**. The toggle **100** can be in the delivery needle **162**. The toggle **100** can be configured in the delivery needle **162** such that the toggle first end **102** can be located on the needle tip port **166**-side of the pusher **164**.

[0132] FIG. **54** illustrates that the pusher **164** can be moved, as shown by arrow, toward the needle tip port **166**. The deliv-

ery needle 162 can be moved back relative to the pusher 164, the pusher 164 can be moved forward relative to the delivery needle 162, or combinations thereof. The pusher 164 can push the toggle first end 102 out of the delivery needle 162. The pusher 164 can push the toggle first end 102 into the biological lumen 114.

[0133] FIGS. 55 and 56 illustrate that the toggle deployment device 159 can be in a first retracted configuration after deploying the toggle first end 102 into the biological lumen 114. When the delivery needle 162 retracts into the toggle deployment device 159, the toggle second end 104 can be in the toggle deployment device 159. The filament 106 can extend through the delivery needle port 161.

[0134] FIGS. 57 and 58 illustrate that the toggle 100 can be deployed across the lumen wall. When the toggle deployment device 159 is removed from the arteriotomy, the toggle second end 104 can deploy on the outside of the lumen wall 116 from the delivery needle port 161. The toggle first end 102 can form an interference fit with the lumen wall surface 118. The toggle second end 104 can form an interference fit with the outside of the lumen wall 116 or the surrounding tissue, such as subcutaneous tissue. The toggle second end 104 can be slidably translated along the filament 106 toward the lumen wall 116, for example for the toggle 100 illustrated in FIG. 20. The length of the filament 106 on the opposite side of toggle second end 104 from the toggle first end 102 can be cut, snapped, torn or otherwise removed.

[0135] FIGS. 59 through 63 illustrate a method for deploying the toggle 100. The delivery needle 162 can egress, as shown by arrow, from a toggle deployment delivery port 163. The toggle deployment delivery port 163 can be in the delivery guide 4. The delivery needle 162 can be advanced toward the lumen 114.

[0136] FIG. 60 illustrates that the delivery needle 162 can be deployed through the lumen wall. When the delivery needle 162 is deployed through the lumen wall 116, the delivery needle can intersect, or pass adjacent to, the second arteriotomy.

[0137] FIGS. 61 and 62 illustrate that the pusher 164 can be advanced, as shown by arrow, through the delivery needle 162. The toggle first end 102 can egress from the needle tip port 166. The toggle first end 102 can deploy into the lumen 114.

[0138] FIG. 63 illustrates that the delivery needle 162 can be retracted into the delivery guide 4 and/or the filament 106 can be pulled taught, both shown by arrow. The toggle first end 102 can form an interference fit with the lumen wall surface 118. The toggle second end 104 (not shown in FIG. 63) can be slidably translated on the filament 106 down to, and form an interference fit with, the outside of the lumen wall

116. The length of the filament 106 on the opposite side of toggle second end 104 from the toggle first end 102 can be cut, snapped, torn or otherwise removed.

[0139] FIG. 64 illustrates an introducer needle 165 that can have an end inserted, as shown by arrow, through the lumen wall 116 and into the lumen 114, for example by using the Seldinger technique. The introducer needle 165 can be hollow and/or have a longitudinal channel. FIG. 65 illustrates that the guidewire 168 can be deployed, shown by arrows, through the hollow and/or longitudinal channel of the introducer needle 165.

[0140] FIG. 66 illustrates that the introducer needle 165 can be removed, as shown by arrow, from the lumen wall 116. The guidewire 168 can remain substantially in place. After the introducer needle 165 is removed, a portion of the guidewire 168 can be outside the lumen 114 and another portion of the guidewire 168 can be inside the lumen 114.

[0141] FIG. 67 illustrates a method of fixedly or slidably attaching the guidewire 168 to the anchor 6. A guidewire proximal end 170 can be placed in proximity to an anchor distal end 172. The guidewire proximal end 170 can then be attached, as shown by arrows, to the anchor distal end 172. The guidewire proximal end 170 can be attached to the anchor distal end 172 while some or all of the guidewire 168 is in the lumen 114. The guidewire proximal end 170 can be configured to snap-fit, interference fit, slidably attach or combinations thereof, to the anchor 6. When the guidewire 168 is attached to the anchor 6, the guidewire 168 can act as the anchor extension section 14 and/or the luminal tool. FIG. 68 illustrates the guidewire 168 attached to the anchor 6.

[0142] Where applicable, the methods described supra for deploying any supplemental closure device can be used for deploying any of the other supplementary deployment device. It is apparent to one skilled in the art that various changes and modifications can be made to this disclosure, and equivalents employed, without departing from the spirit and scope of the invention. Elements shown with any embodiment are exemplary for the specific embodiment and can be used on other embodiments within this disclosure.

What is claimed is:

1. A device for accessing a biological lumen having a lumen wall having a longitudinal lumen wall axis, the device comprising:

an elongated member comprising a longitudinal member axis, wherein the member is configured to access the lumen at a first angle, and wherein the first angle is defined by the longitudinal lumen wall axis and the longitudinal member axis, wherein the first angle is less than about 19 degrees.

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