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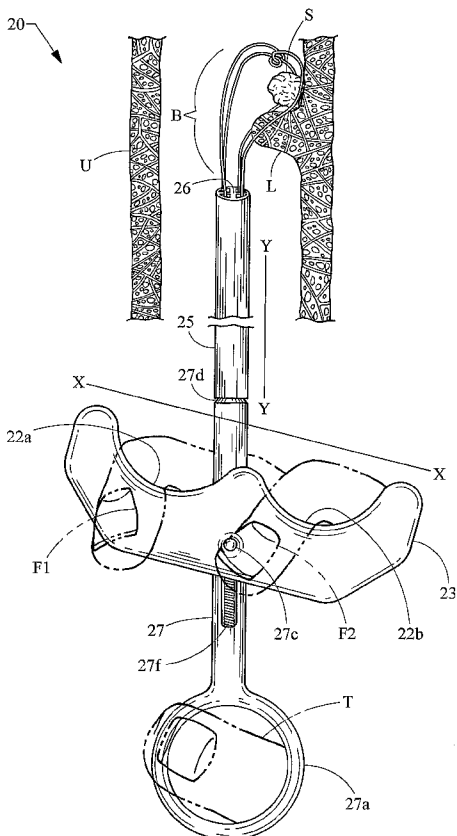
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(54) Title: ARTICULATING BASKET WITH SIMULTANEOUS BASKET EXTENSION OR BASKET RETRACTION



(57) Abstract: A retrieval device is provided for retrieving stones, calculi and other objects from a body. The device may comprise a body (17), a slide assembly (161) slidably attached to the body, an articulator (13) rotatably attached to the body and in communication with the slide assembly, and wires (11a, 11b) attached to the articulator and distally to a basket (B), such that moving the slide assembly can retract and extend the basket longitudinally while operating the articulator moves it transversely.

WO 2007/056003 A1



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ARTICULATING BASKET WITH SIMULTANEOUS BASKET EXTENSION  
OR BASKET RETRACTION

RELATED APPLICATIONS

**[0001]** The present patent document claims the benefit of priority and the filing date under 35 U.S.C. § 119(e) of Provisional U.S. Patent Application Serial No. 60/732,929, filed November 3, 2005, which is hereby incorporated by reference in its entirety.

FIELD OF THE INVENTION

**[0002]** This invention relates to medical retrieval devices used in minimally invasive surgery, particularly those used to retrieve stones and calculi from a patient.

BACKGROUND OF THE INVENTION

**[0003]** Stone retrieval devices are often employed in order to remove a stone from a ureter or kidney. Removal of a stone from a ureter or kidney is a difficult process because the area within which the medical professional works is small and narrow. Often a stone is not located directly in front of the retrieval basket. The location of the stone makes it difficult to retrieve. In an attempt to retrieve the object, the medical professional will attempt to bend the basket, causing the basket to bend-over partially onto itself. This movement will allow one side of the basket to expand and be more open than the opposite side. When the basket is at least partially bent-over on itself, the medical professional will attempt to maneuver the basket so that it encapsulates the object. However, the basket cannot be extended or retracted while bent. Thus, stones that are not directly in front of the device cannot be easily captured.

**[0004]** The medical professional has little control of the basket because the basket cannot be bent while being extended or retracted. Thus, during the interim period between when the basket surrounds the stone and when the basket is retracted, the stone can shift, move, or dislodge, making the capture attempt a failure, causing the medical professional to start the procedure over.

## BRIEF SUMMARY OF THE INVENTION

[0005] A medical device is provided. The device includes a body, an articulator movably connected to the body, and at least a first and a second wire having distal ends. The first and second wire is in communication with the articulator. The device further includes a tool disposed at the distal end of the first and second wire, wherein the articulator is capable of moving the tool outside the longitudinal plane, and wherein the tool is capable of being extended and retracted in a longitudinal plane simultaneously with movement outside the longitudinal plane.

[0006] Further, a medical device is provided. The device includes a body, a slide assembly slideably attached to the body, and an articulator rotateably attached to the body. The articulator is in communication with the slide assembly. The device further includes a first wire and a second wire having distal ends, wherein the first wire and the second wire are attached to the articulator. The device further includes a tool disposed at the distal ends of the first and second wires, wherein the articulator is configured to move the tool outside a longitudinal plane, and wherein the slide assembly is configured to extend and retract the first and second wires.

[0007] Further, a medical device is provided. The device includes a tool formed by at least one wire. The device further includes means for extending or retracting the tool and simultaneously articulating the tool in a plane outside a longitudinal plane.

[0008] Further, a method for retrieving an object is provided. The method includes inserting a device for removing an object into a patient, extending a tool of the device out to the object, and articulating the tool to encapsulate the object. The method further includes retracting the tool to retrieve the object, wherein the extending and the articulating are capable of being performed simultaneously or the articulating and the retracting are capable of being performed simultaneously.

## BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0009] The embodiments will be further described in connection with the attached drawing figures. It is intended that the drawings included as a part of this specification be illustrative of the embodiments and should in no way be considered as a limitation on the scope of the invention.

[0010] **Figs. 1A, 1B-1C** show partial cross-sectional views of an embodiment of the device;

[0011] **Fig. 1D** shows a partial plan view of an embodiment of the device;

[0012] **Fig. 1E** shows a partial cross-sectional view of an embodiment of the device;

[0013] **Fig. 2** is an isometric view of the an embodiment of the device;

[0014] **Fig. 3** is an isometric view of an embodiment of the device;

[0015] **Figs. 4, and 4A** show partial cross-sectional views of the proximal portion of embodiments of the device;

[0016] **Figs. 5 and 5A-5C** show partial cross-sectional views of the proximal portion of embodiments of the device;

[0017] **Figs. 6, and 6A** show partial cross-sectional views of the proximal portion of embodiments of the device;

[0018] **Figs. 7A-7E** are isometric views of pivot pins of embodiments of the device;

[0019] **Figs. 8A-8B** are isometric views of the proximal portion of embodiments of the device;

[0020] **Figs. 9A-9C** are isometric views of grasping wire restraint disks of embodiments of the device;

[0021] **Fig. 10** is an isometric view of a sheath of an embodiment of the device;

[0022] **Fig. 10A** is a cross-sectional view of **Fig. 10** at line **10A**;

[0023] **Figs. 10B-10C** are isometric views of a sheath of embodiments of the device;

- [0024] Fig. 11 is a close-up view of the distal portion of an embodiment of the device;
- [0025] Fig. 12 is a close-up view of the distal portion of an embodiment of the device;
- [0026] Fig. 13 is a close-up view of the distal portion of an embodiment of the device;
- [0027] Fig. 14A is a perspective view of the distal portion of an embodiment of the device;
- [0028] Figs. 14B-14D are frontal views of the distal portion of embodiments of the device; and
- [0029] Figs. 15-18 depict another embodiment of the device.

#### DETAILED DESCRIPTION OF PRESENTLY PREFERRED EMBODIMENTS

[0030] The device provides a way to simultaneously articulate and extend a retrieval basket and also to simultaneously articulate and retract the basket for retrieving stones, calculi, and other objects from a patient. The use of the device is not limited to use in human patients; the device has veterinary and non-medical uses including but not limited to retrieving objects from any hard-to-reach area. A more detailed description of the embodiments will now be given with reference to Figs. 1-18. The present invention is not limited to those embodiments illustrated; it specifically contemplates other embodiments not illustrated but intended to be included in the claims.

[0031] Figs. 1A, 1B, 1C, and 1D depict partial cross-sectional views of an embodiment of the device. Retrieval device 10 has a proximal portion 10a and a distal portion 10b. Figs. 1B and 1C are cross-sectionals of proximal portion 10a of retrieval device 10 shown in Fig. 1A. Fig. 1C is a perspective view of proximal portion 10a of retrieval device 10 shown in Fig. 1A. Located at distal portion are two grasping wires 11a and 11b that travel through a lumen 15a extending through the sheath 15. Although two grasping wires are depicted, it is contemplated that a greater or lesser amount of grasping wires can be used. Furthermore, it is contemplated that one continuous wire could also be used.

[0032] The use of the word “wire” is not intended to be limiting. Throughout the disclosure, grasping wires may be made from stainless steel but are preferably made from a shape memory alloy, including but not limited to Nitinol. Nitinol is available from Memry Corp of Bethel, Connecticut and from other suppliers. Grasping wires can also be made from other semi-flexible materials, including but not limited to nylon, plastic, as well as a shape memory polymer. Shape memory polymers are disclosed in U.S. Patent No. 6,720,402 which is hereby incorporated by reference in its entirety. Grasping wires may also include, but are not limited to, filaments or threads. Grasping wires preferably have a diameter of .005 - .009 inches; however, the diameter of grasping wires is not limited to those dimensions. Grasping wires may be larger or smaller depending on the need. Grasping wires are preferably round or flat, however other shapes can be used, such as the near-triangular pre-shaped Delta Wire available from Cook Urological, Spencer, Indiana.

[0033] At distal portion **10b** of retrieval device **10** is a grasping wire connection point **18**, which is preferably atraumatic and is used to connect grasping wires **11a**, **11b** so that they come together in the shape of a basket to keep grasping wires **11a**, **11b** constrained together. Grasping wires **11a**, **11b** may be looped together as shown here to form grasping wire connection point **18**, but the connection of grasping wires **11a**, **11b** is not limited to just a loop. Looping of wires is disclosed in U.S. Patent No. 5,989,266 which is hereby incorporated by reference in its entirety.

[0034] Grasping wire restraint disk **16** is located within sheath **15** and can be held in place by ways including but not limited to, gluing, soldering, or sewing into place. Grasping wire restraint disk **16** is used to keep grasping wires **11a**, **11b** separated once they enter sheath **15**. Grasping wire restraint disk **16** can be made from any medically-acceptable material, including but not limited to, polycarbonate, stainless steel, nylon, other metals, and plastics.

[0035] Sheath **15** protects grasping wires **11a**, **11b** from becoming tangled and controls their interaction with the patient. Sheath **15** is preferably made from PVC, but can also be made from materials including, but not limited to,

polytetrafluoroethylene (PTFE), polyimide, nylon, polyurethane, polyethylene, or any polymer or semi-flexible metal. Sheath **15** preferably has an outer diameter of 1.5 – 4.5 Fr., although other sizes can be used and the size should be suitable for insertion through an orifice. The outer diameter of sheath **15** is generally based on the size of the orifice through which it will be introduced.

[0036] The articulator **13** houses pivot pins **14a**, **14b**, and **14c** which can be made from many materials, including but not limited to, stainless steel, medically-acceptable polymers, and metals. Articulator **13** can be made from many materials, including but not limited to, rigid nylon, stainless steel, acrylonitrile-butadiene-styrene (ABS) and other medically acceptable polymers and metals. Sheath connection point **17d** of body **17** is threaded so that sheath **15** can connect to body **17**. Wires **11a**, **11b** travel through sheath connection point **17d**, into body **17**, through lumen **17b** of body **17**, and out through windows **17c** into articulator **13**. Pivot pin **14c** travels through articulator **13** and through body **17**. Pivot pin **14c** allows articulator **13** to have tilting see-saw movement on either side of transverse axis **X-X** articulating basket **B**. Although a basket is depicted, the use of other tools is contemplated including other grasping and sampling devices. Additionally, the wires need not be continuous with the tool, nor do the wires and the tool need to be made from the same material. Pivot pins **14a**, **14b**, and **14c** are configured in a triangle-shape.

[0037] First grasping wire **11a** is shown pulled through lumen **15a** of sheath **15**, into sheath connection point **17d**, into lumen **17b** of body **17**, out through windows **17c** and around pivot pin **14c** where it is attached to pivot pins **14a** and **14b**. Second grasping wire **11b** is attached directly to third pivot pin **14c**.

[0038] The configuration of pivot pins **14a**, **14b**, **14c** allows the user to articulate basket **B** from side-to-side, making basket **B** tilt on its side along transverse axis **X-X** enabling basket **B** to grasp an object that may not be directly in-line with basket **B**. Therefore, articulating basket **B** allows for basket **B** to move in a plane in addition outside the longitudinal access.

[0039] Furthermore, articulator **13** can move longitudinally along axis **Y-Y** of body **17** which in turn retracts or extends basket **B**. Thus, articulator **13** translates



relative to body 17; body 17 is stationary with respect to articulator 13 when a thumb (not shown) or other stationary object (not shown) is placed within thumb hole 17a. Two springs 17f sit within body 17 and are in communication with articulator 13 and body 17. Springs are made from stainless steel, although they can be made from any other material so long as they generate an acceptable force to push articulator 13 distally in order to extend basket B. Springs 17f provided resistance against pivot pin 14c which is attached to articulator 13. Thus, when fingers (not shown) apply pressure into either finger groove 12a, 12b and articulator 13 is pulled in the proximal direction, springs 17f are compressed and basket B is retracted. When compression is released from finger groove 12a, 12b, springs 17f are also released and will push articulator 13 in the distal direction, thus extending basket B.

[0040] To articulate basket B, the user tilts articulator 13 on either side of transverse axis X-X by pressing a finger (not shown) down into one of the finger grooves 12a, 12b. Tilting articulator 13 in the direction of finger groove 12a will articulate basket B in the direction of finger groove 12a. Similarly, tilting articulator 13 in the direction of finger groove 12b will articulate basket B in the direction of finger groove 12b.

[0041] While basket B is being articulated, the user can retract basket B by placing a thumb or finger (not shown) in the thumb-hole 17a and using fingers (not shown) placed in finger grooves 12a, 12b to pull articulator 13 proximally along longitudinal axis Y-Y compressing springs 17f. This moves the entire articulator 13 proximally, and thus, moves pivots pins 14a, 14b, and 14c proximally as well. The proximal movement pulls the respective grasping wires 11a, 11b proximally and retracts basket B. While retracting basket B, the user can articulate basket B by tilting articulator 13 on either side of transverse axis X-X by placing pressure into either finger groove 12a, 12b.

[0042] Furthermore, while basket B is being articulated, the user can also extend basket B by releasing the compression on finger grooves 12a, 12b, which releases springs 17f so that they push articulator 13 in the distal direction along longitudinal axis Y-Y. This moves the entire articulator 13 distally, and thus,

moves pivots pins **14a**, **14b**, and **14c** distally as well. The distal movement pushes the respective grasping wires **11a**, **11b** distally and extends basket **B**. While extending basket **B**, the user can articulate basket **B** by tilting articulator **13** on either side of transverse axis **X-X** by placing pressure into either finger groove **12a**, **12b**.

[0043] **Fig. 1E** shows a different embodiment from that shown in **Fig. 1A**. The embodiment shown in **Fig. 1E** needs no springs since finger holes **12c**, **12d** are provided. Thus, when a user places fingers (not shown) within finger holes **12c**, **12d**, the user is able to move articulator **13** in the distal direction along longitudinal axis **Y-Y** without the aid of a spring. Further embodiments are shown in **Figs. 2-14D**.

[0044] **Fig. 2** is an isometric view of an embodiment of the device. Sheath **25** is connected to body **27** at threaded sheath connection point **27d** of retrieval device **20**. Basket **B** enters sheath **25** through grasping wire restraint disk **26**. Articulator **23** is shown pushed in the distal direction along longitudinal axis **Y-Y** and tilted to the right-side of transverse axis **X-X**. Articulator **23** is moveable along axis **Y-Y** in the direction of the proximal portion **20a** or distal portion **20b** of retrieval device **20** when a user pulls or releases articulator **23**, which results in springs **27f** being compressed or released resulting in basket **B** being retracted or extended.

[0045] Retrieval device **20** is introduced into a ureter **U** through a functional lumen of an endoscope (not shown), or an access sheath, or other device. After introduction into the patient, retrieval device **20** is advanced to stone **S**. Here stone **S** is shown abutted to ledge **L** of ureter **U**, and thus, is not directly in front of basket **B**. When articulator **23** is pulled proximally, springs **27f** are compressed and basket **B** retracts. As articulator **23** is released, springs **27f** are released causing articulator **23** to move distally along axis **Y-Y**, as shown, basket **B** extends. A first finger **F1** is located in a first finger groove **22a**, a second finger **F2** is located in a second finger groove **22b**, and a thumb **T** is located in thumb hole **27a**. While extending basket **B**, second finger **F2** is pressing and tilting articulator **23** so that articulator **23** tilts along axis **X-X**, via pivot pin **27c**. This

causes basket **B** to articulate while simultaneously moving articulator **23** distally along longitudinal axis **Y-Y** to extend basket **B** out to stone **S** to surround stone **S**. Here, basket **B** is shown extended and articulated after having just captured stone **S**.

[0046] **Fig. 3** is an isometric view of another embodiment of the device. Here, the basket **B** of the retrieval device **30** is shown extended and articulated, having captured a stone **S** abutting a ledge **L** within a ureter **U**. The sheath **35** is connected to body **37** at sheath connection point **37d**. Basket **B** enters sheath **35** through grasping wire restraint disk **36**. Articulator **33** surrounds body **37**. Articulator **33** has longitudinal movement along longitudinal axis **Y-Y**. Furthermore, articulator **33** has tilting see-saw movement along either side of transverse axis **X-X** due to the pivot pin **34c** that extends from articulator **33** through body **37**. Articulator **33** moves in the direction of the proximal portion **30a** and distal portion **30b** of the retrieval device **30** when a user pulls and releases, respectively, articulator **33**. Thus, body **37** remains stationary with respect to articulator **33** when a thumb **T** is placed within the thumb-hole **37a**. When articulator **33** is released springs **37f** are released causing articulator **33** to move in the distal direction (not shown), which causes basket **B** to extend. As articulator **33** is pulled proximally along axis **Y-Y**, as shown, springs **37f** are compressed and basket **B** retracts. While retracting basket **B**, a first finger **F1** is located in a first finger groove **32a** and a second finger **F2** is located in a second finger groove **32b**. First finger **F1** is pressing and tilting articulator **33** so that articulator **33** tilts along transverse axis **X-X** causing basket **B** to articulate. Since basket **B** is articulated and retracted simultaneously, it can be manipulated in a sweeping motion to capture stone **S**.

[0047] **Figs. 4, 4A, 5, 5A, 5B, 5C, 6, and 6A** each show partial cross-sectional views of the proximal portion of embodiments of the device. The figures each show different configurations of the pivot pins housed within the articulator, **43, 53, 63**. In **Fig. 4** the retrieval device **40** has articulator **43** that houses pivot pins **44a, 44b, 44c**. Each grasping wire **41a, 41b** enter lumen **47b** of body **47** at the sheath connection point **47d**. From there, grasping wires **41a, 41b** travel through

lumen 47b of body 47 and out through windows 47c of body 47 into articulator 43. Each grasping wire 41a, 41b loops around pins 44a, 44b. Pivot pin 44c travels through articulator 43 and into body 47 to allow for tilting see-saw movement of articulator 43 which in turn articulates the basket (not shown). Furthermore, articulator 43 is movably connected to body 47 to allow for longitudinal movement which extends and retracts grasping wires 41a and 41b attached to pivot pins 44a, 44b. Springs 47f are compressed when articulator 43 is pulled in the proximal direction via finger grooves 42a, 42b and thumb hole 47a which retracts the basket (not shown). When springs 47f are released they push articulator 43 in the distal direction which extends the basket (not shown).

[0048] Fig. 4A is the same as Fig. 4, except that no springs are needed since articulator 43 has finger loops 42c, 42d that allow a user to push and pull articulator along longitudinal axis of body 47 in order to extend and retract the basket (not shown).

[0049] Fig. 5 shows another pivot pin – 54a, 54b, 54c – configuration housed within articulator 53 of retrieval device 50. Here, grasping wires 51a, 51b each travel through lumen 57b of body 57 at sheath connection point 57d, out through windows 57c, and into articulator 53. Each end of grasping wires 51a, 51b are each attached to a pivot pin 54a, 54b, located on either side of articulator 53. Pivot pin 54c travels through articulator 53 and into body 57 to allow for tilting see-saw movement which in turn articulates basket (not shown). Furthermore, articulator 53 is movably connected to body 57 to allow for longitudinal movement which extends and retracts grasping wires 51a and 51b attached to pivot pins 54a, 54b. The greater the distance, the less tilting see-saw movement of articulator 53 is required to articulate the basket (not shown). Springs 57f are compressed when articulator 53 is pulled in the proximal direction using finger grooves 52a, 52b, and thumb hole 57a which retracts the basket (not shown). When springs 57f are released they push articulator 53 in the distal direction which extends the basket (not shown).

[0050] Fig. 5A is the same as Fig. 5, except that no springs are needed since articulator 53 has finger loops 52c, 52d that allow a user to push and pull

articulator along the longitudinal axis of body 57 in order to extend and retract the basket (not shown).

[0051] Fig 5B is the same as Fig. 5 except grasping wires 51a and 51b are in a different configuration. Here, each grasping wire 51a, 51b first goes around pin 54c before connecting to pivot pins 54a, 54b.

[0052] Fig. 5C is the same as Fig. 5B, except that no springs are needed since articulator 53 has finger loops 52c, 52d that allow a user to push and pull articulator directly along a longitudinal axis of body 57 in order to extend and retract the basket (not shown).

[0053] Fig. 6 shows yet another pivot pin configuration – 64a, 64b, 64c, 64d, 64e – housed within articulator 63 of retrieval device 60. Grasping wires 61a, and 61b enter body 67 at sheath connection point 67d and travel through lumen 67b of body 67. Grasping wires 61a and 61b then both loop around fourth pivot pin 64d, exit through window 67c, and are attached to first pivot pin 64a. Grasping wires 61a and 61b also both loop around third pivot pin 64c, exit through window 67c, and then are attached to second pivot pin 64d. Pivot point 64e allows for the articulator 63 to have tilting see-saw movement to allow the basket (not shown) to be articulated. Articulator 63 to move longitudinally proximally and distally along longitudinal axis of body 67. This configuration allows for both pushing and pulling of the basket (not shown). Springs 67f are compressed when articulator 63 is pulled in the proximal direction using finger grooves 62a, 62b, and thumb hold 67a which retracts the basket (not shown). When springs 67f are released they push articulator 63 in the distal direction which extends the basket (not shown).

[0054] Fig. 6A is the same as Fig. 6, except that no springs are needed since articulator 63 has finger loops 62c, 62d that allow a user to push and pull articulator along longitudinal axis of body 67 in order to extend and retract the basket (not shown).

[0055] Figs. 7A-7E are isometric views of pivot pins of embodiments of the device. In Fig. 7A, pivot pin 74a is a nail-shaped pin having a head H that has a greater diameter than the body. This prevents grasping wire 71 from slipping off

of pivot pin 74a when the basket (not shown) is articulated, extended, and/or retracted.

[0056] Fig. 7B shows an alternate embodiment of pivot pin 74b having an eye E in which grasping wire 71 is threaded through to prevent it from becoming detached from pivot pin 74b when the basket (not shown) is articulated, extended, and/or retracted.

[0057] Fig. 7C shows a pivot pin 74c with an arch shape through which grasping wire 71 is threaded to prevent grasping wire 71 from becoming detached from pivot pin 74c when the basket (not shown) is articulated, extended, and/or retracted.

[0058] Fig. 7D shows a pivot pin 74d having a "j" shape, an angular bend AB, and a head H that has a larger diameter than the body. Pivot pin 74d keeps grasping wire 71 in place when the basket (not shown) is articulated, extended, and/or retracted.

[0059] Fig. 7E shows a pivot pin 74e with grasping wire 71 attached to pivot pin 74e by way of soldering.

[0060] Figs. 8A and 8B are isometric views of the proximal portion of embodiments of the device. In Fig. 8A the articulator 83 of retrieval device 80 has ergonomically-shaped finger grooves 82a, 82b and thumb-hole 87a. The shape provides a comfortable fit for fingers F1, F2 and thumb T. Grasping wires 81a, 81b enter body 87 at sheath connection point 87d, travel through lumen 87b, and connect to pivot pins (now shown). Pivot pin 87c allows articulator 83 to have tilting see-saw movement in order to allow for the basket (not shown) to articulate. Basket (not shown) retraction occurs by moving articulator 83 proximally along longitudinal axis of body 87 which compresses springs 87f. Basket (not shown) extension occurs by releasing articulator 83 which decompresses springs 87f causing articulator 83 to move along body 87.

[0061] Fig. 8B shows an alternate configuration of articulator 83 of retrieval device 80. Here, articulator 83 has ergonomically-shaped finger holes 82c, 82d for fingers F1, F2. No springs are needed in this embodiment since finger holes

**82c, 83d** allow the user to pull and push articulator **83** directly thus enabling basket (now shown) retraction and extension.

[0062] **Figs. 9A-9C** are isometric views of grasping wire restraint disks. In **Fig. 9A** the grasping wire restraint disk **96** is shown having four guide holes **96a** for wires in the shape of a cross. Each grasping wire (not shown) is threaded through a single lumen **96a** of grasping wire restraint disk **96**.

[0063] **Fig. 9B** shows a grasping wire restraint disk **96** wherein four lumens are created with circular-shaped openings **96b** cut into grasping wire restraint disk **96** creating four guide holes. Each of grasping wires (not shown) are threaded through a single lumen **96b** of grasping wire restraint disk **96**.

[0064] **Fig. 9c** shows a grasping wire restraint disk **96** wherein grasping wires (not shown) are treaded through a single lumen **96c**.

[0065] **Fig. 10** is an isometric view of an optional sheath for the retrieval device. Here, instead of maintaining grasping wire (not shown) separation by using a grasping wire restraint disk (not shown) the sheath **105** itself has four semi-circular lumens **105a**. A cross section of sheath **105** at line-**10A** is depicted in **Fig. 10A**. Each grasping wire (not shown) are threaded through a lumen **105a** of sheath **105** so that the grasping wires (not shown) do not become tangled and stay separated as they travel through sheath **105**. **Fig. 10B** depicts an alternate configuration of circular-grasping wire lumens **105b** built into sheath **105**. **Fig. 10C** depicts an alternate configuration of a single circular grasping wire lumen **105c** built into sheath **105**.

[0066] **Fig. 11** is a close-up view of the distal portion **110b** of an embodiment of retrieval device **110**. Here, grasping wires **111a, 111b** are connected at grasping wire connection point **118** via a soldered point in order to form the top of basket **B**.

[0067] **Fig. 12** is a view of the distal portion **120b** of retrieval device **120**. Here, grasping wires **121a, 121b**, are connected at grasping wire connection point **128** via a grasping wire connection disk **128a** in order to form the top of basket **B**. Grasping wire connection disk **128a** can be made from many materials including polycarbonates, stainless steel, nylon, and polymers. Grasping wire connection

disk **128a** contains four holes **128b** through which grasping wires **121a**, **121b** are threaded.

[0068] **Fig. 13** is a view of the distal portion **130b** of retrieval device **130**. Here, grasping wires **131a**, **131b** are connected at grasping wire connection point **138** via a loop-in-loop configuration in order to form the top of basket **B**.

[0069] **Fig. 14A** is a perspective view of the distal portion of retrieval device **140**. Each grasping wire **141a**, **141b** is connected at a soldered grasping wire connection point **148** and then threaded into sheath **145**. The net configuration of grasping wires **141a**, **141b** may enable better retrieval of smaller stones or calculi that could slip between the wires if there were no net.

[0070] **Figs. 14B-14D** are frontal views of retrieval device embodiments **140**, **180**, **190**. Each show grasping wire **141a**, **141b** connected at a soldered grasping wire connection point **148**. Each figure depicts a different net-configuration of wire fibers **141c**, **141d**, **141e**. Wire fiber **141c**, **141d**, **141e** configurations are not limited to those depicted. Depending on the shape of the object to be retrieved, different wire fiber **141c**, **141d**, **141e** configurations may result in a better retrieval success rate of smaller stones (not shown), calculi (not shown), or other objects (not shown).

[0071] **Figs. 15-17** depict different views of another embodiment of the device. **Fig. 15** is a side-view of a retrieval device **150** having a proximal portion **150a** and a distal portion **150b**. **Fig. 16** is a partial cross-sectional view of retrieval device **150**. **Fig. 17** is an exploded view of articulator **162**.

[0072] Body **157**, and the components housed therein including an articulator **162** and a slide assembly **161** depicted in **Figs. 16-17**, can be made from many materials, including but not limited to, rigid nylon, stainless steel, acrylonitrile-butadiene-styrene (ABS) and other medically acceptable polymers and metals. Body **157** is preferably a snap-fit housing consisting of two pieces that house that components depicted in **Figs. 16-17**.

[0073] Distal portion of grasping wires come together to form a basket (not shown). Each of grasping wires **151a** and **151b** is disposed through optional sheath **105** and is connected to a wire pivot **153a**, **153b** respectively. Wire pivots



**153a, 153b** each have a male thread **155a, 155b**, respectively, that engages with female thread **156a, 156b**, respectively, located on articulator drum **160**. Articulator drum **160** has a post **159** disposed therethrough. Articulator drum **160** is rotateably attached to slide assembly **161** which is slideably attached to body **157** and is held in place by each of anchors **158a, 158b** that are fixedly attached to post **159** and rotateably attached to body **157**. Tilting lever **154** from side to side causes post **159** and articulator drum **160** to rotate in the direction that lever **154** is pushed. Rotation of the drum **160** is not limited to use of lever **154**; the device can also be driven by a gear set, a wheel, or any device capable of causing rotation. As articulator drum **160** is rotated, wire pivots **153a, 153b** move opposite each other in the proximal **150a** or distal **150b** direction causing each of wires **151a, 151b** to move in the direction that wire pivots **153a, 153b** move; accordingly, this movement causes the basket to articulate from side to side. Pulling slide **152** in the proximal direction **150a** causes the basket to retract because articulator drum **160** and its component wire pivots **153a, 153b** and grasping wires **151a, 151b** are moved in the proximal direction. Pushing slide **152** in the distal direction **150b** causes the basket to extend because articulator drum **160** and its component wire pivots **153a, 153b** and grasping wires **151a, 151b** are moved in the distal direction. In addition, the basket can be articulated by tilting lever **154** with finger **F1** and simultaneously retracted or extended by moving slide **152** in the proximal **150a** or distal **150b** direction with thumb **T**. The embodiments described are not limited to the specific component parts herein named. For example the articulating components could be made from a series of gears and/or wheels that are configured to articulate a basket. Additionally, not all component parts are necessary, nor is it required that the component parts be assembled in an identical fashion. For example, the locations of lever **154** and slide **152** are not limited to that which is shown; both may be placed in alternate locations including the side of the retrieval device as depicted in **Fig. 18**, retrieval device **170**. Additionally, wire pivots **153a, 153b** may be configured so as to move along the same female thread **156a**, as depicted in **Fig. 18**.

[0074] To use a retrieval device having an articulating basket for removing an object from a patient that is configured for simultaneous basket extension or basket retraction, the basket is inserted into the patient and is moved near an item to be removed from a patient, i.e. a calculus, stone, etc. The basket is extended out to the object to be removed. The object to be removed is captured by simultaneously articulating the basket while extending or retracting the basket until the object is captured. The basket is then retracted and the device and object are removed from the patient.

[0075] As is evident, the embodiments provide a very effective solution for removal of stones, calculi, or other objects from a patient by a device that allows for simultaneous basket articulation and extension, and also provides for simultaneous basket articulation and retraction.

[0076] The foregoing description and drawings are provided for illustrative purposes only and are not intended to limit the scope of the invention described herein or with regard to the details of its construction and manner of operation. It will be evident to one skilled in the art that modifications and variations may be made without departing from the spirit and scope of the invention. Changes in form and in the proportion of parts, as well as the substitution of equivalence, are contemplated as circumstances may suggest and render expedience; although specific terms have been employed, they are intended in a generic and descriptive sense only and not for the purpose of limiting the scope of the invention set forth in the following claims.

## CLAIMS

What is claimed is:

1. A medical device, the device comprising:
  - a body;
  - an articulator movably connected to the body;
  - at least a first and a second wire having distal ends;
  - the first and second wire in communication with the articulator;
  - a tool disposed at the distal end of the first and second wire, wherein the articulator is capable of moving the tool outside the longitudinal plane; and
  - wherein the tool is capable of being extended and retracted in a longitudinal plane simultaneously with movement outside the longitudinal plane.
2. The device according to Claim 1 wherein the tool is a basket, a grasping device, or a sampling device.
3. The device according to Claim 1 wherein the articulator further comprises two finger grooves or two finger-holes.
4. The device according to Claim 1 wherein the articulator is movably connected to the body via a pivot pin.
5. The device according to Claim 1 wherein the articulator further comprises at least a first and a second pivot pin, wherein at least one wire is in communication with the first pivot pin or the second pivot pin.
6. The device according to Claim 1 wherein the articulator further comprises at least a first and a second pivot pin, wherein the first wire and the second wire are in communication with the first pivot pin and the second pivot pin.

7. The device according to Claim 1 wherein the articulator further comprises a first pivot pin, a second pivot pin, and a third pivot pin; wherein the first wire is connected to the first pivot pin and the second pivot pin, and the second wire is connected to the third pivot pin.

8. The device according to Claim 1 further comprising a wire connection point; wherein the distal ends of the first wire and the second wire are connected via a soldered point, a loop, or a connection disk.

9. The device according to Claim 1 wherein the body further comprises an axis where along the articulator can move in a proximal and a distal direction.

10. The device according to Claim 1 wherein the first and second wires further comprise wire fibers and the wire fibers are in a net-configuration.

11. A medical device, the device comprising:  
a body;  
a slide assembly slideably attached to the body;  
an articulator rotateably attached to the body, wherein the articulator is in communication with the slide assembly;  
a first wire and a second wire having distal ends, wherein the first wire and the second wire are attached to the articulator;  
a tool disposed at the distal ends of the first and second wires, wherein the articulator is configured to move the tool outside a longitudinal plane; and  
wherein the slide assembly is configured to extend and retract the first and second wires.

12. The device according to Claim 11, wherein the articulator further comprises:  
an articulator drum that is rotateably connected to the slide assembly; and

a first wire pivot and a second wire pivot, wherein the first wire pivot and the second wire pivot are threadily attached to the articulator drum and the first wire pivot is fixedly attached to the first wire, and the second wire pivot is fixedly attached to the second wire.

13. The device according to Claim 12, wherein the articulator further comprises a lever, wheel, or gear set that is configured to rotate the articulator drum.

14. The device according to Claim 11, wherein the slide assembly further comprises a slide that is configured to extend and retract the first wire and the second wire.

15. The device according to Claim 11, wherein the slide assembly and the articulator can be engaged simultaneously.

16. The device according to Claim 11, wherein the tool is a basket, a grasping device, or a sampling device.

17. A retrieval device, the device comprising:  
a tool formed by at least one wire; and  
means for extending or retracting the tool and simultaneously articulating the tool in a plane outside a longitudinal plane.

18. The device according to Claim 17, wherein the means for extending the tool comprises a slide assembly.

19. The device according to Claim 17, wherein the tool is a basket, a grasping device, or a sampling device.

20. The device according to Claim 17, wherein the means for articulating the tool comprises an articulator having at least two pivot pins wherein the at least one wire of the tool is attached to at least one of the two pivot pins.

21. The device according to Claim 17, wherein the at least one wire further comprises a first and a second wire;

wherein the tool is a basket, a grasping device, or a sampling device;

wherein the tool is formed by the first and second wire; and

wherein the means for articulating the tool comprises a first wire pivot and a second wire pivot, wherein the first wire pivot and the second wire pivot are threadily attached to an articulator drum, the first wire pivot is fixedly attached to the first wire, and the second wire pivot is fixedly attached to the second wire.

22. A method for retrieving an object, the method comprising:

inserting a device for removing an object into a patient;

extending a tool of the device out to the object;

articulating the tool to encapsulate the object; and

retracting the tool to retrieve the object, wherein the extending and the articulating are capable of being performed simultaneously or the articulating and the retracting are capable of being performed simultaneously.

23. The method of according to Claim 22, wherein the tool is a basket, a grasping device, or a sampling device.







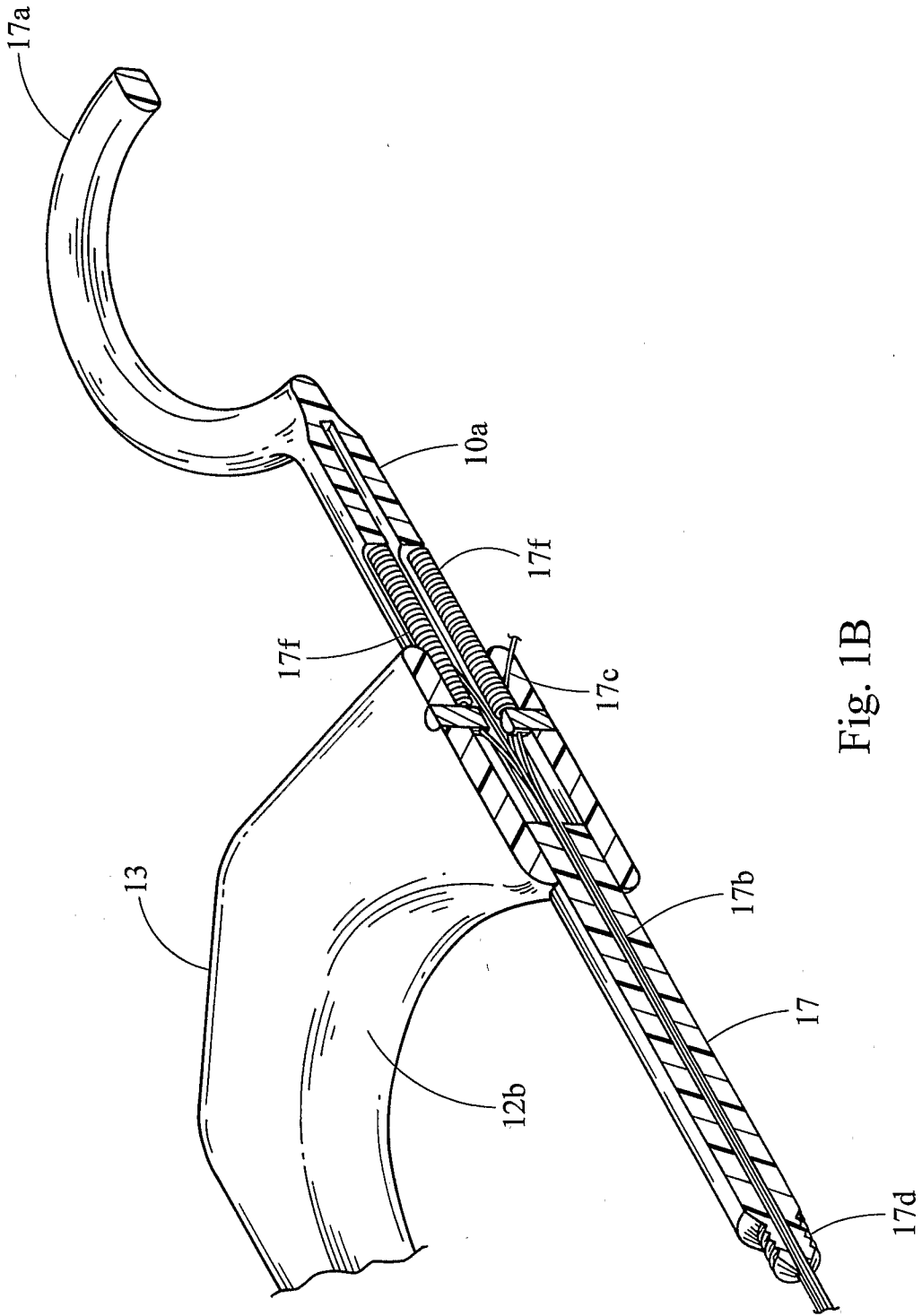


Fig. 1B

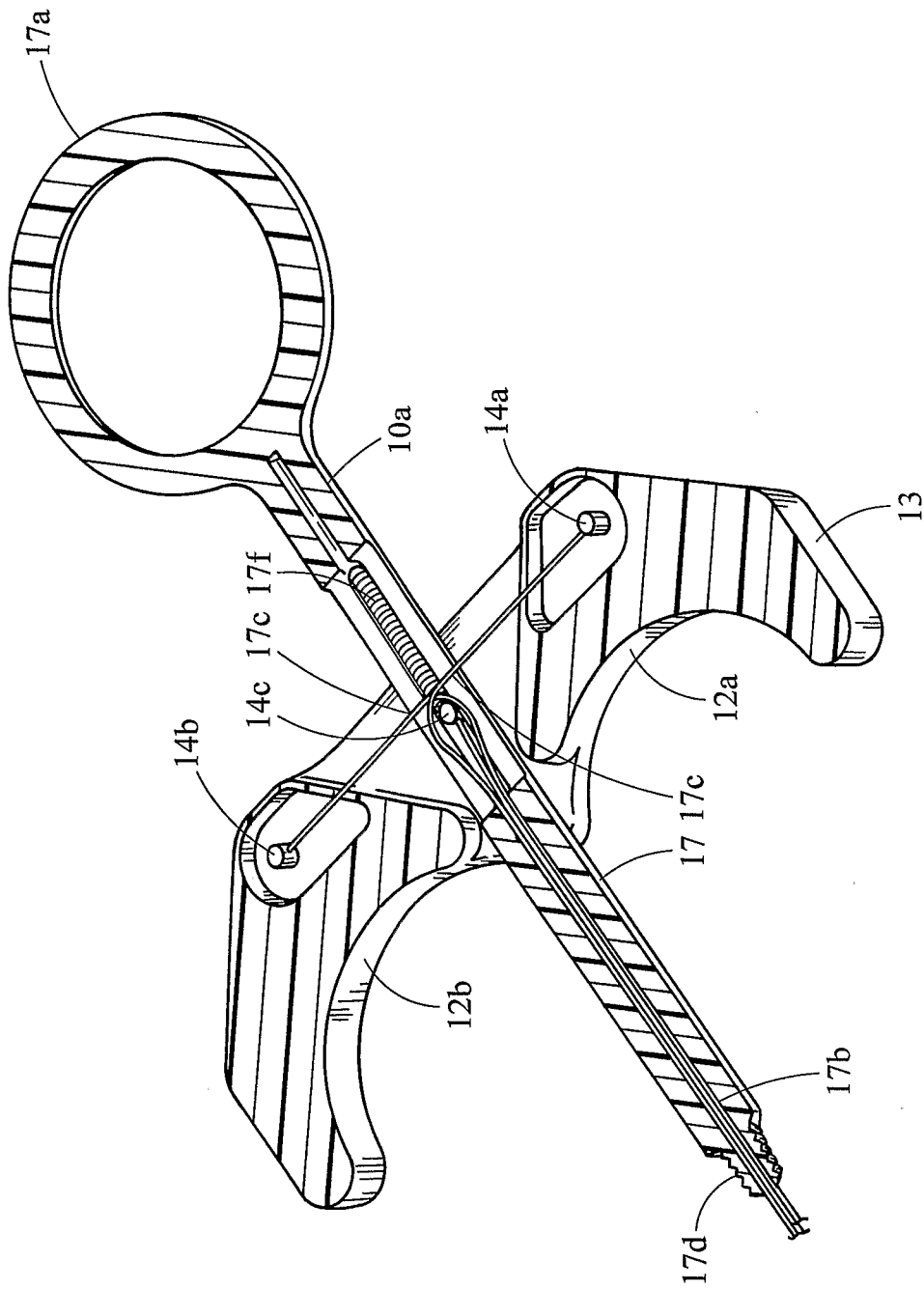


Fig. 1C

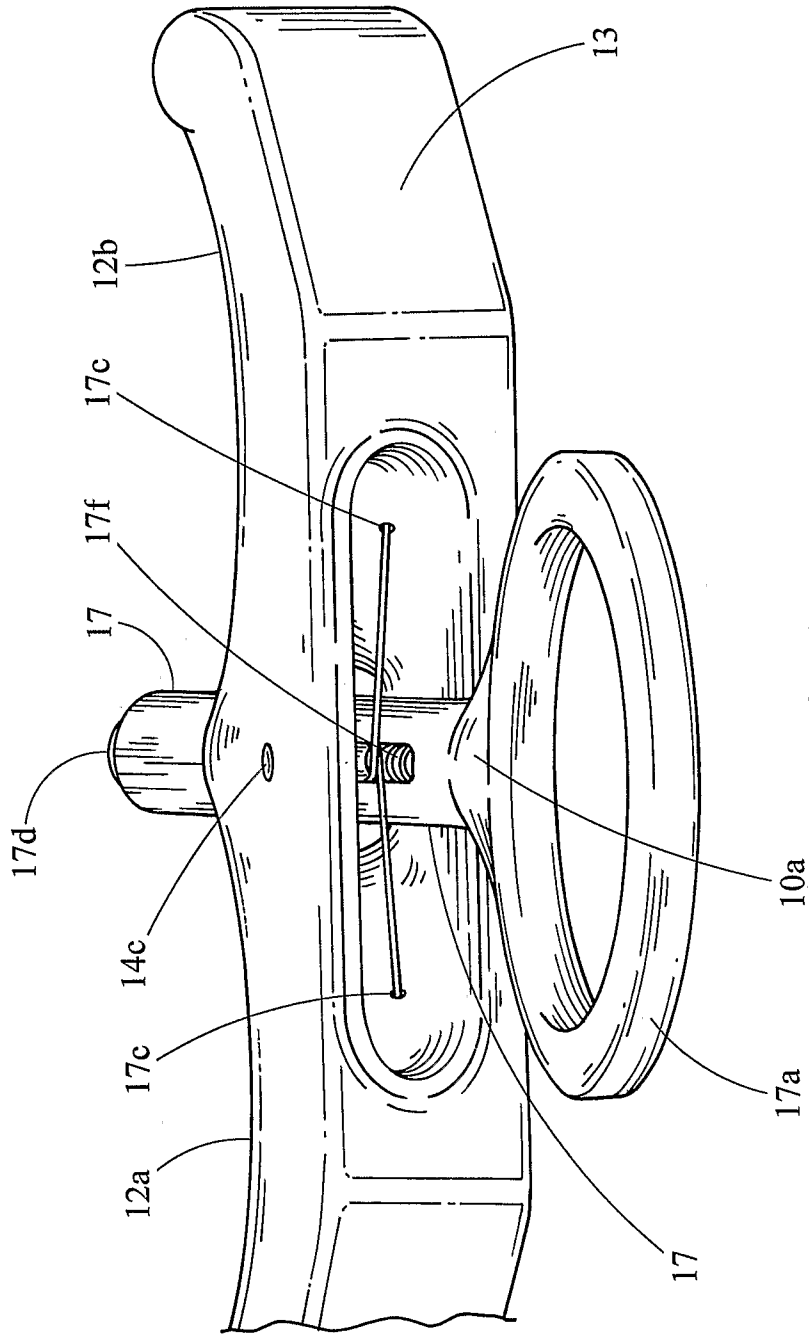


Fig. 1D

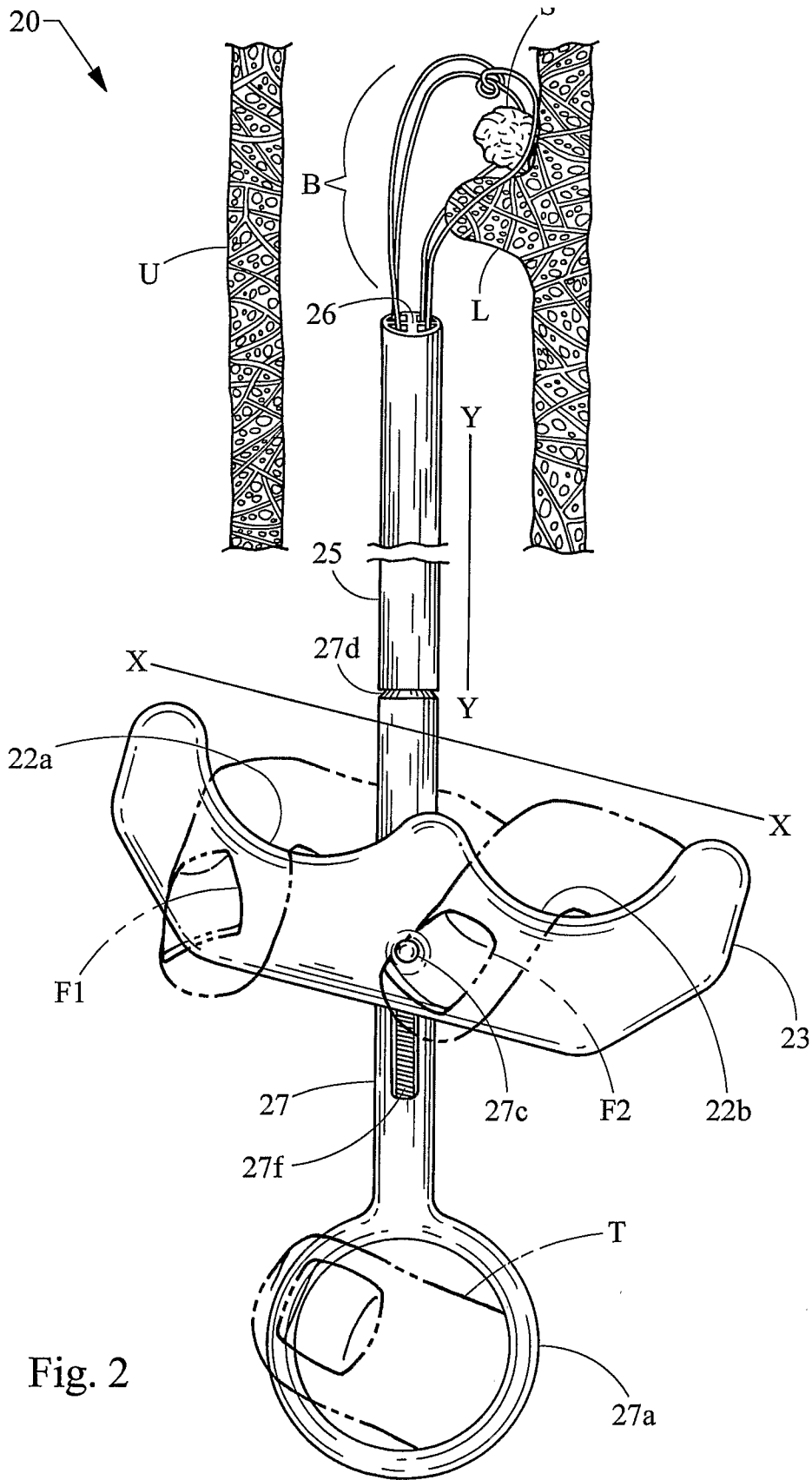


Fig. 2



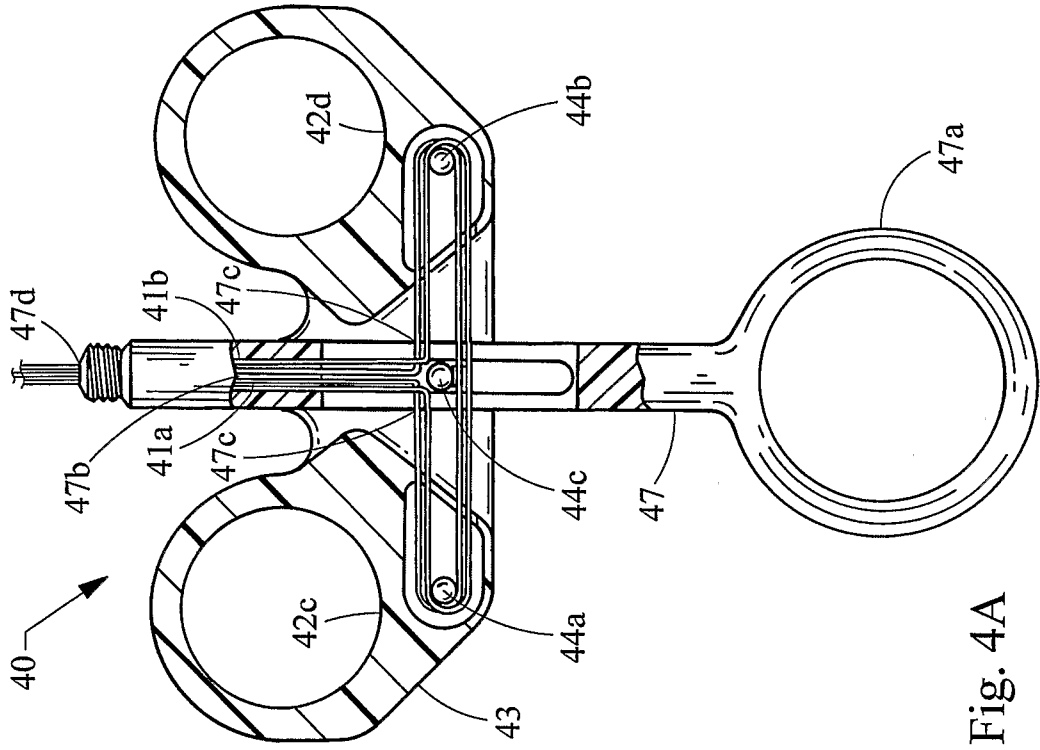


Fig. 4A

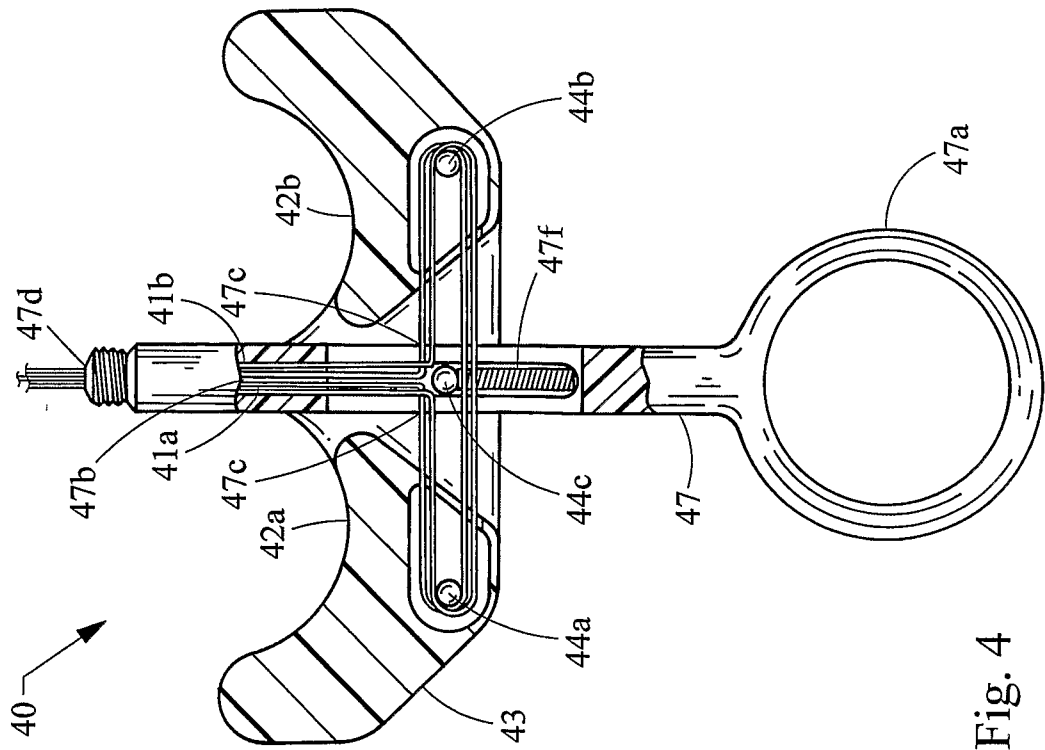


Fig. 4

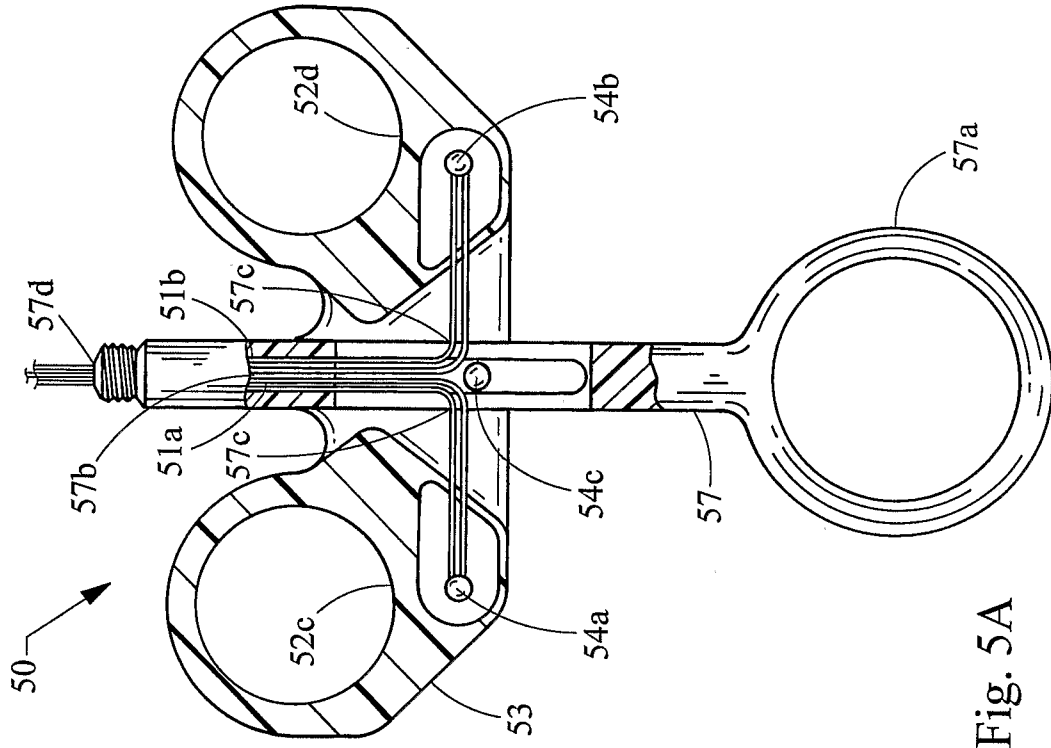


Fig. 5A

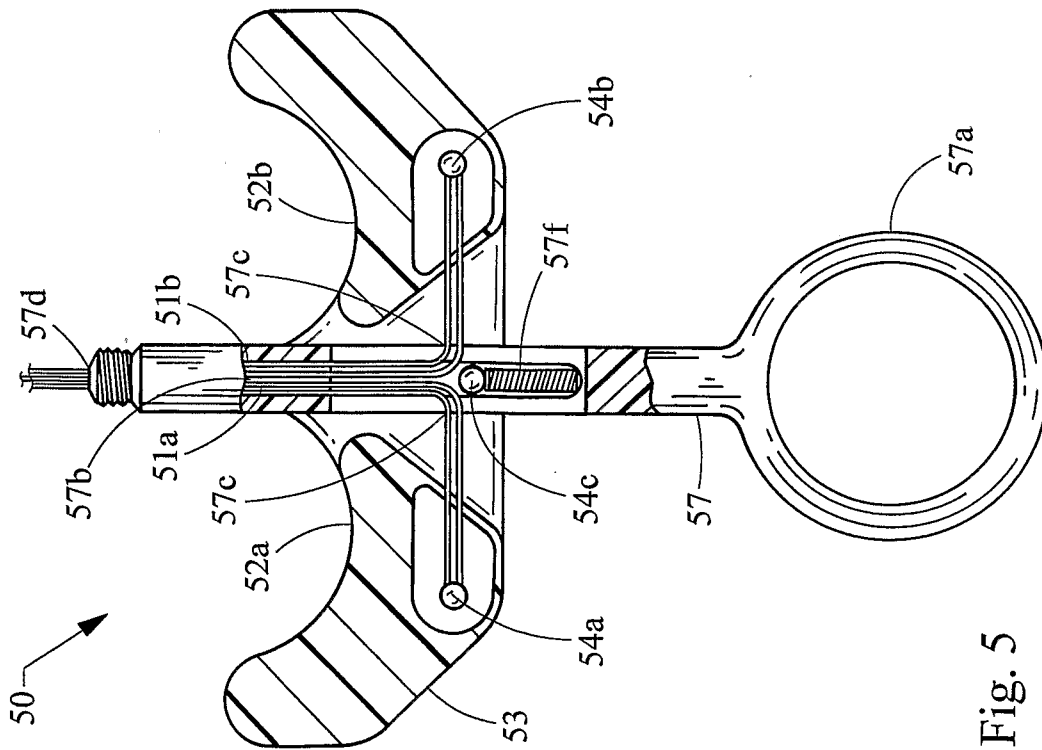


Fig. 5

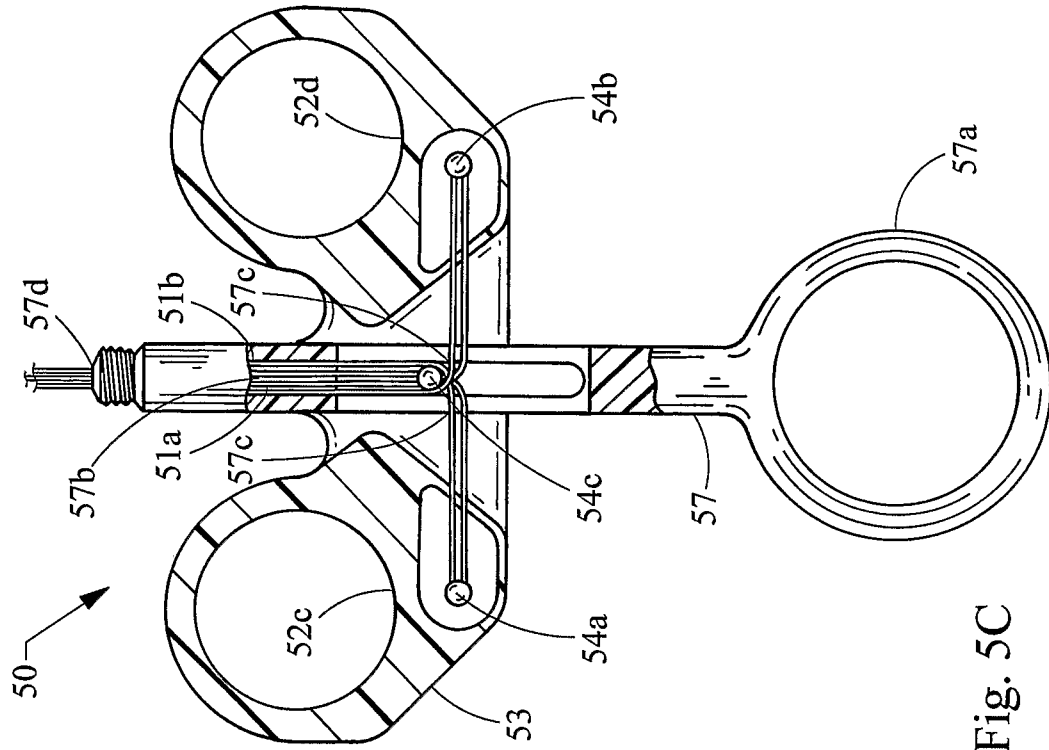


Fig. 5C

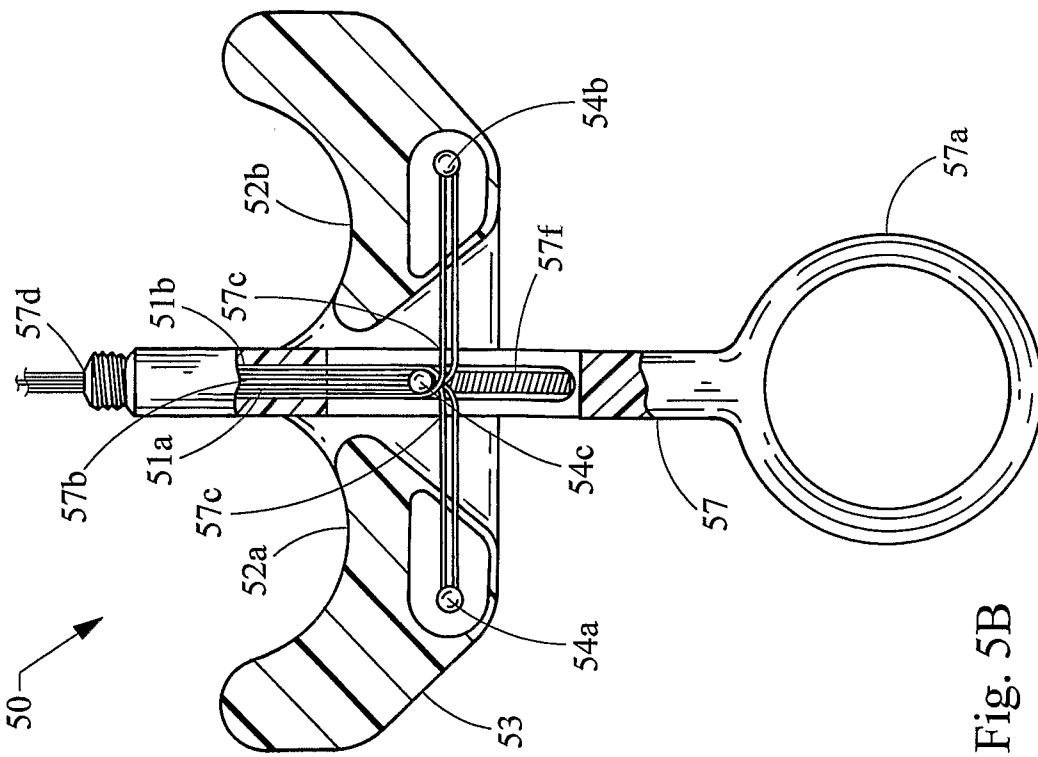


Fig. 5B



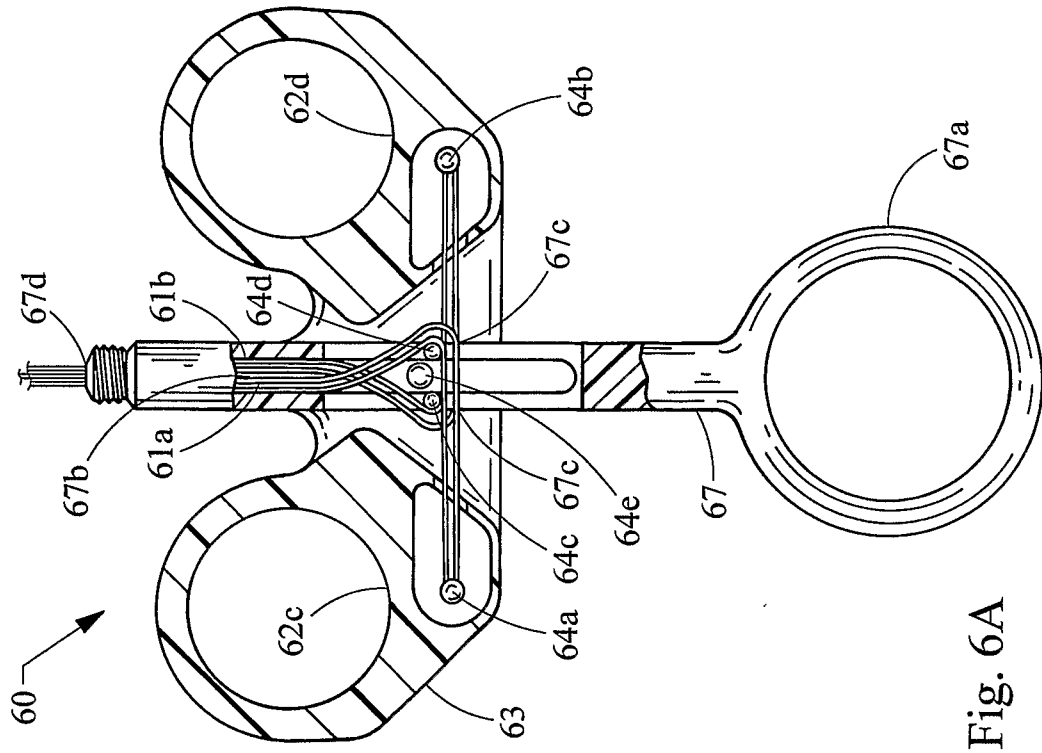


Fig. 6A

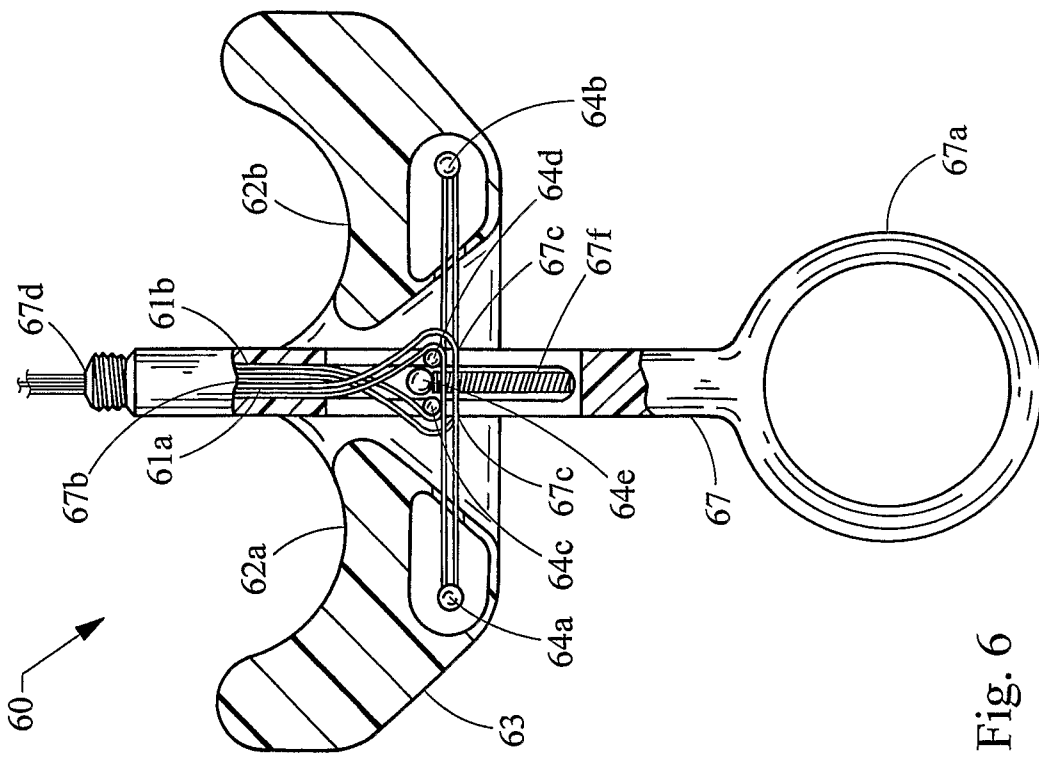


Fig. 6

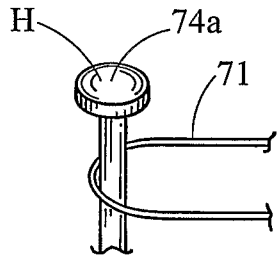


Fig. 7A

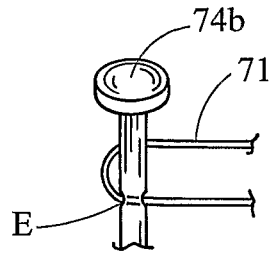


Fig. 7B

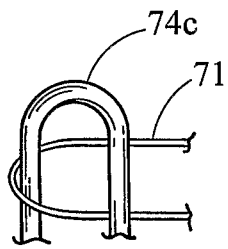


Fig. 7C

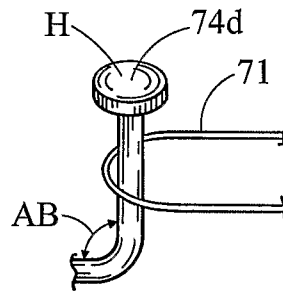


Fig. 7D

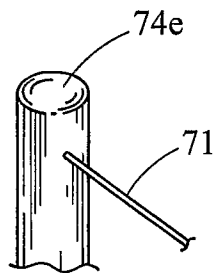
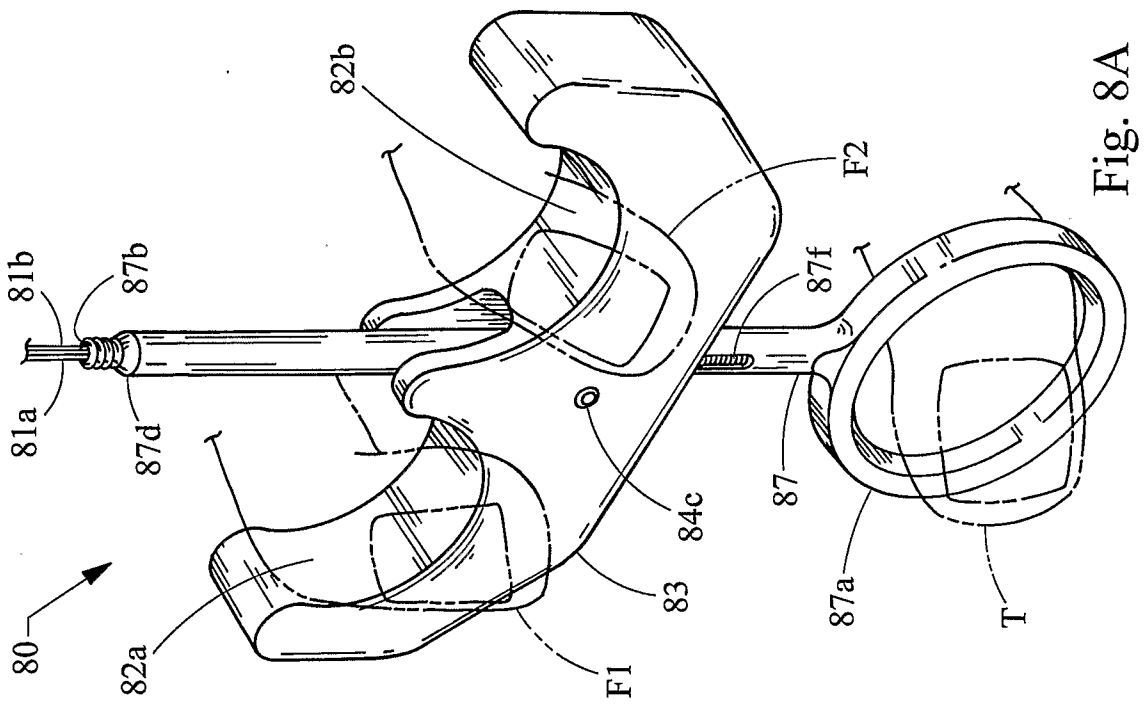
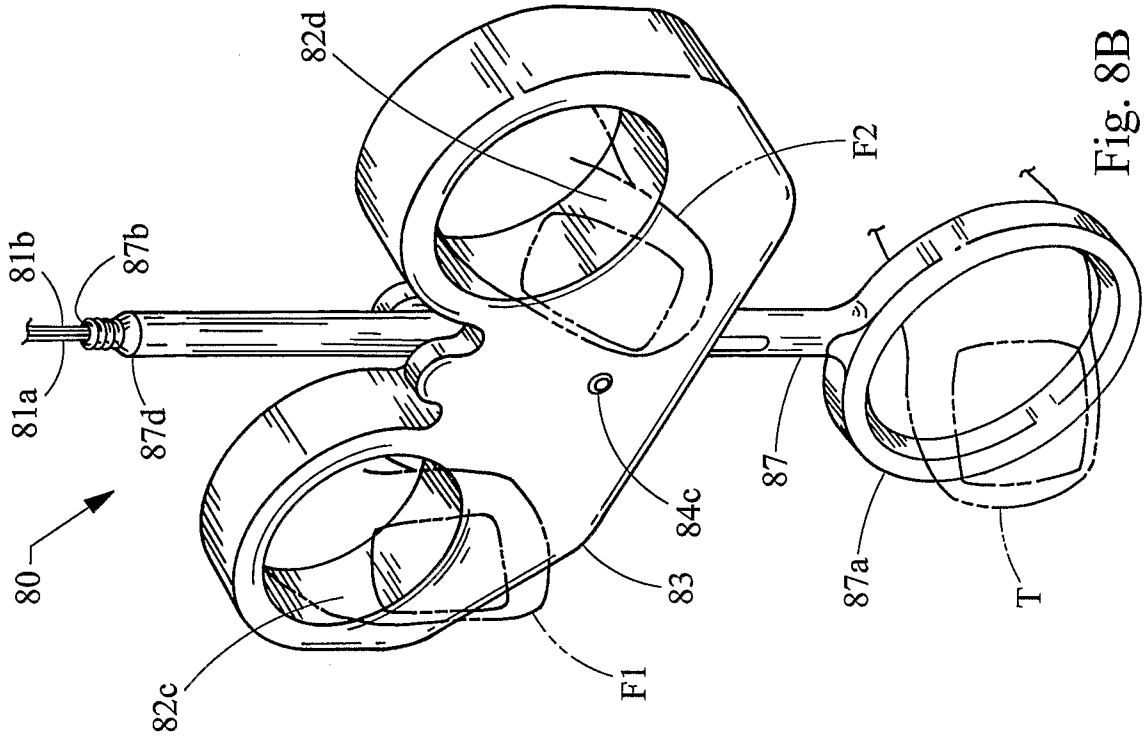


Fig. 7E



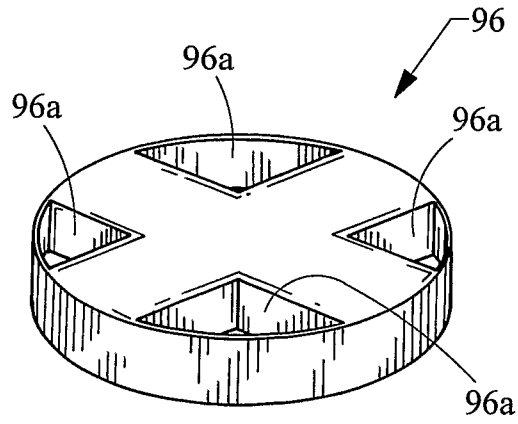


Fig. 9A

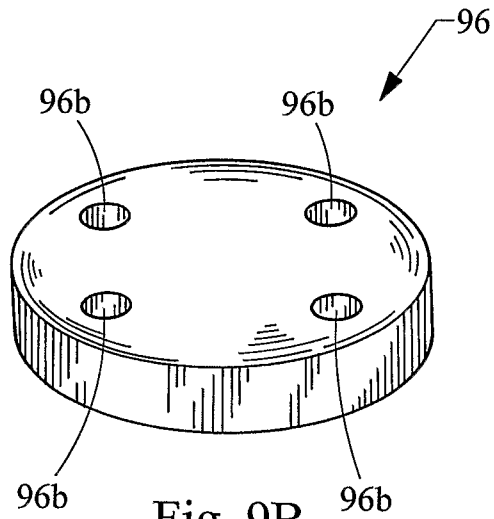


Fig. 9B

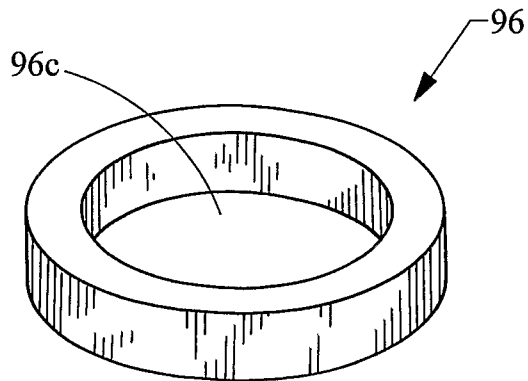


Fig. 9C

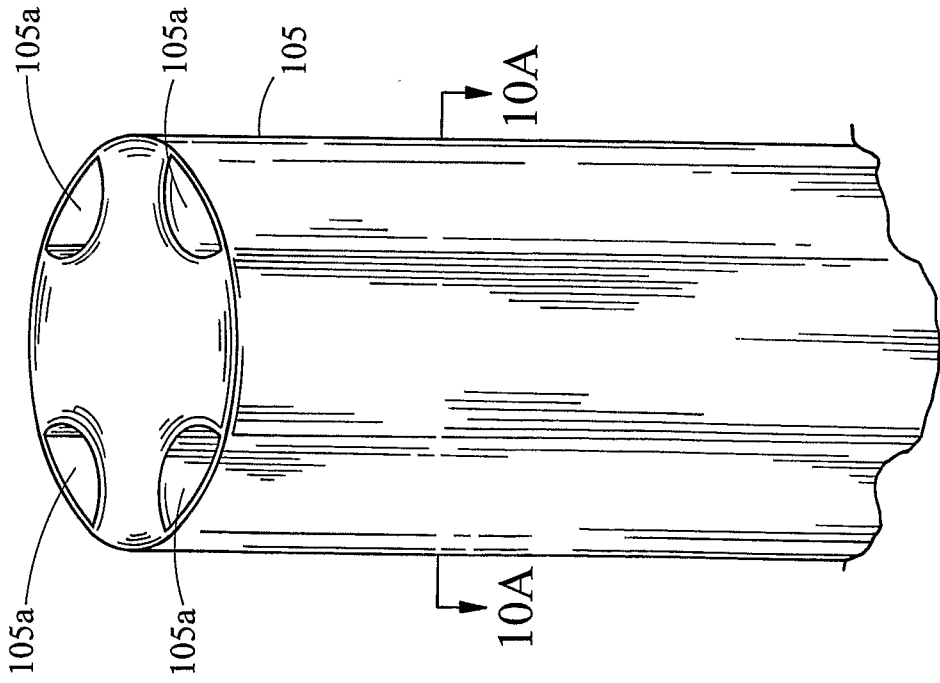


Fig. 10

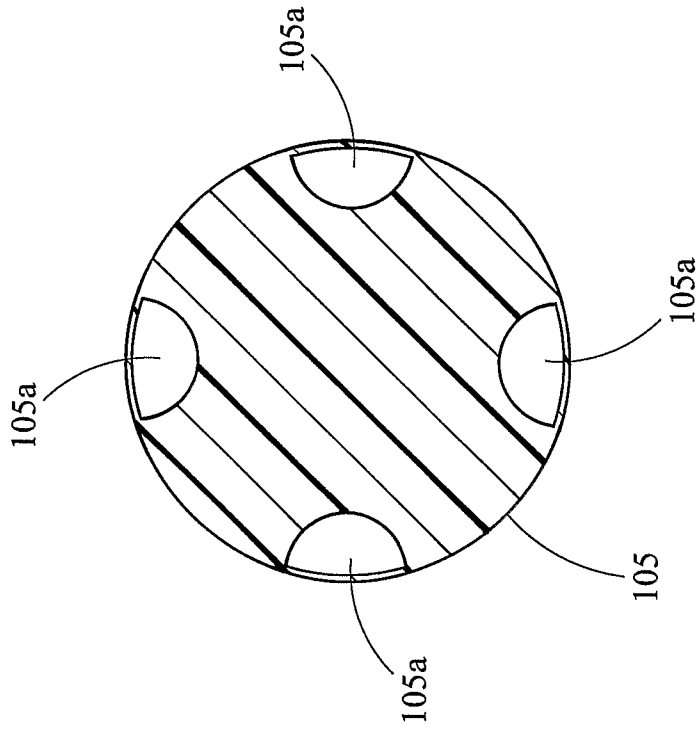


Fig. 10A

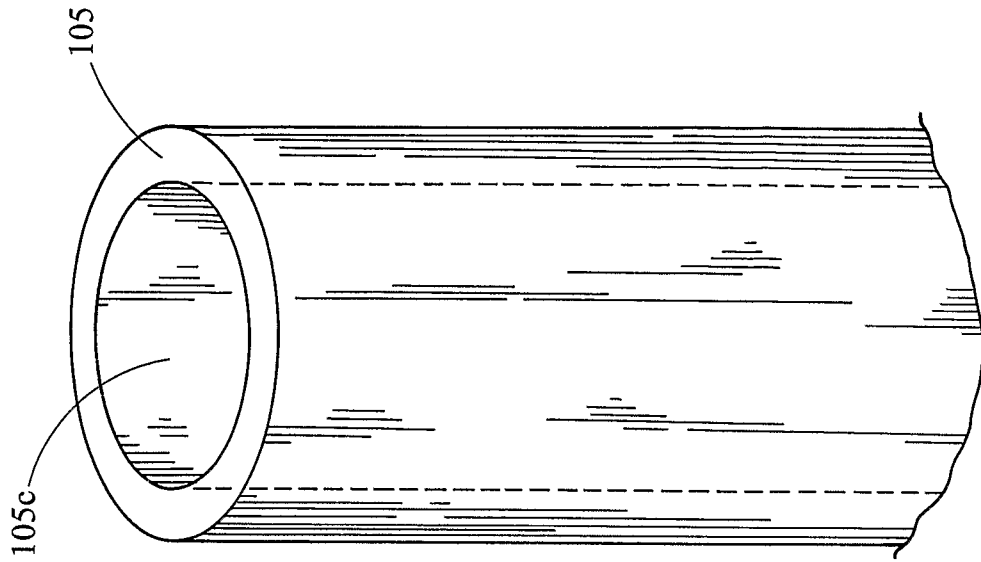


Fig. 10C

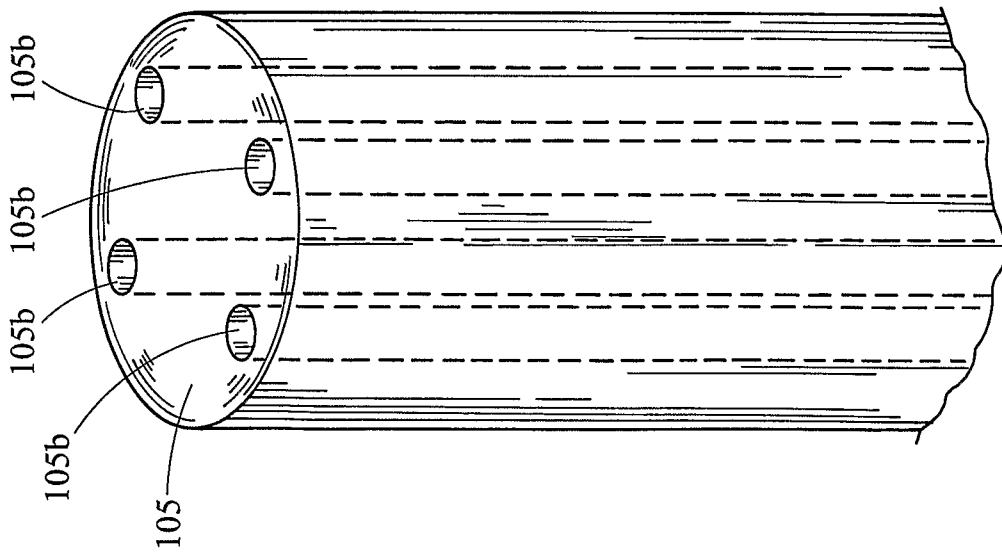


Fig. 10B

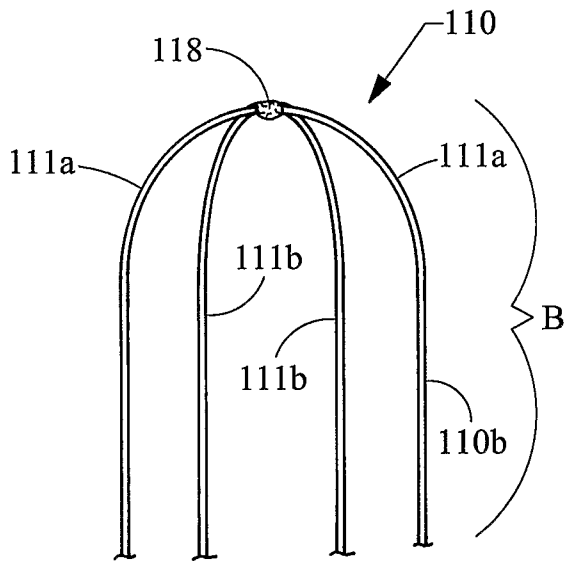


Fig. 11

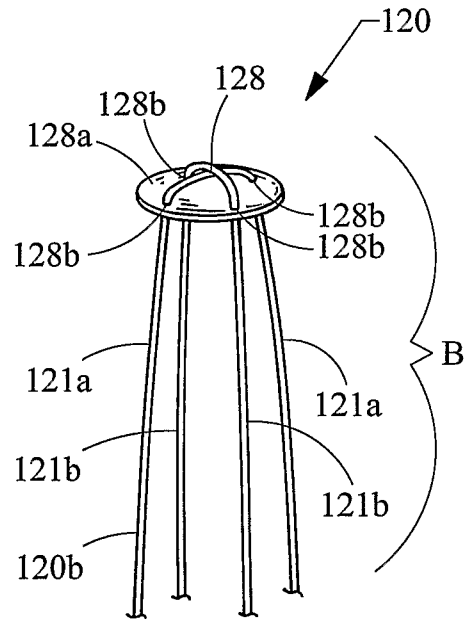


Fig. 12

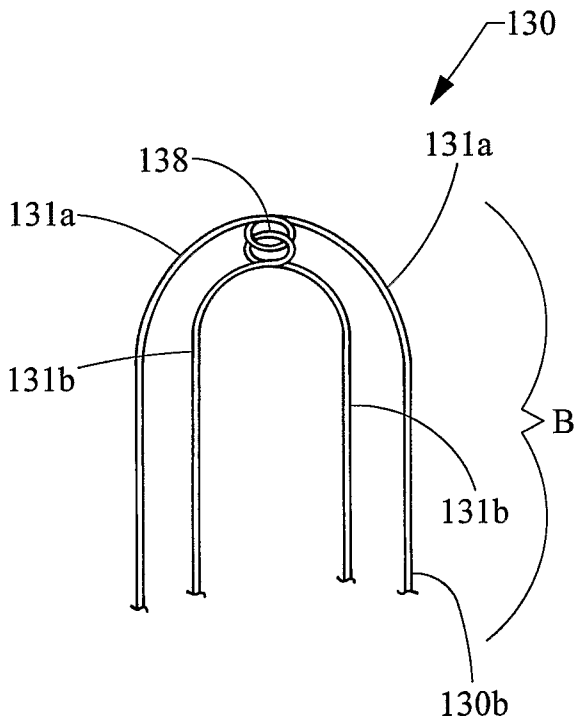


Fig. 13

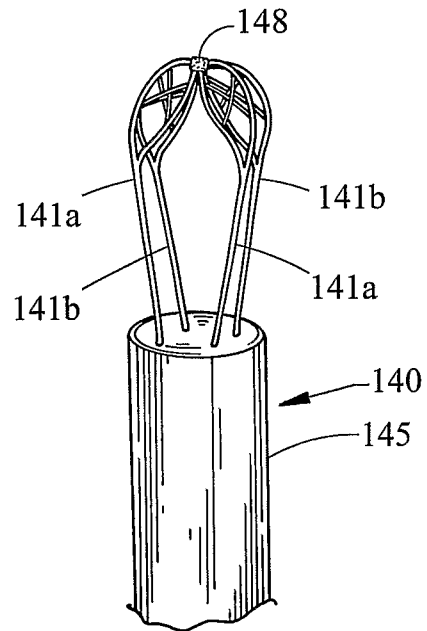


Fig. 14A

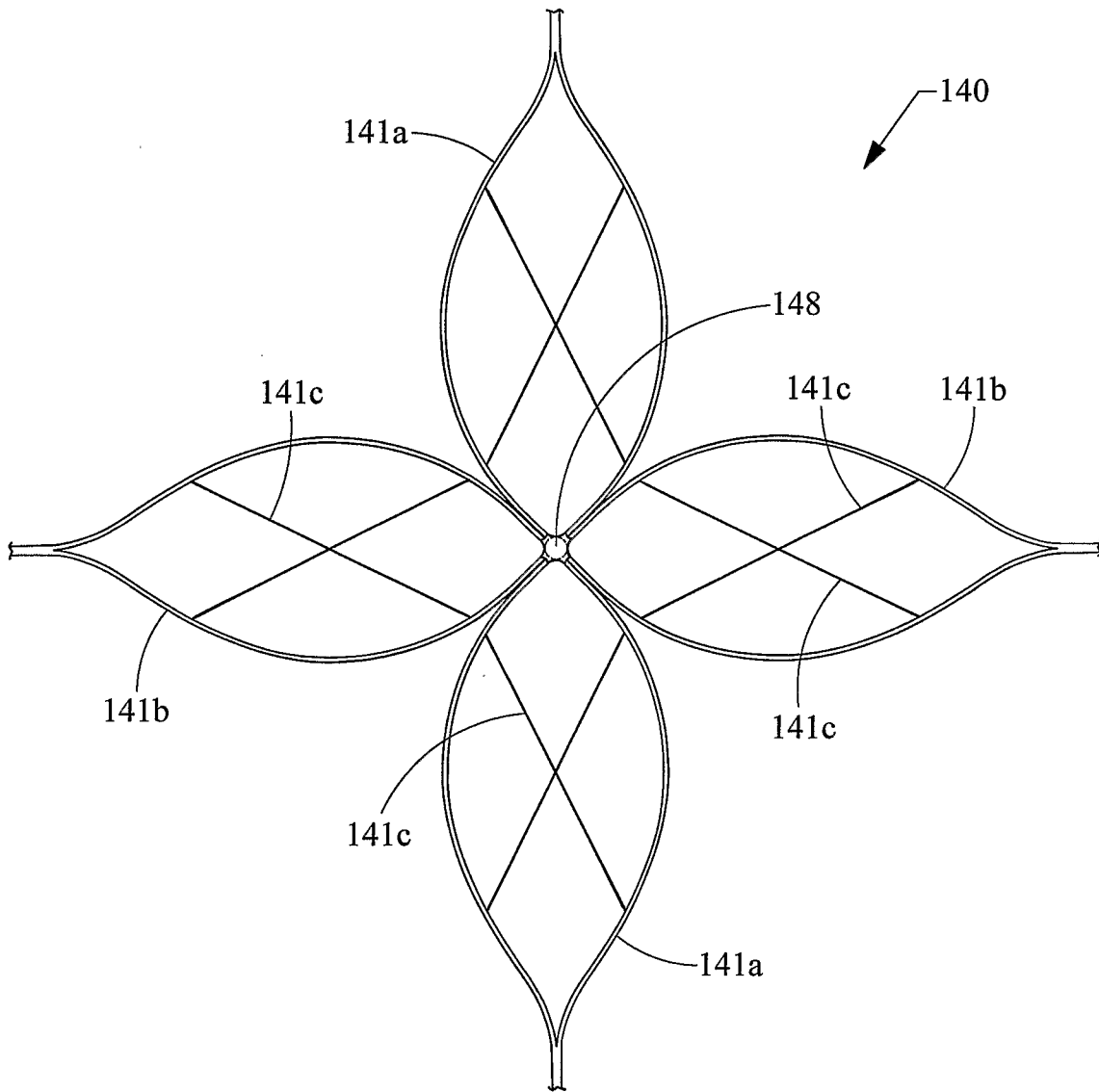


Fig. 14B



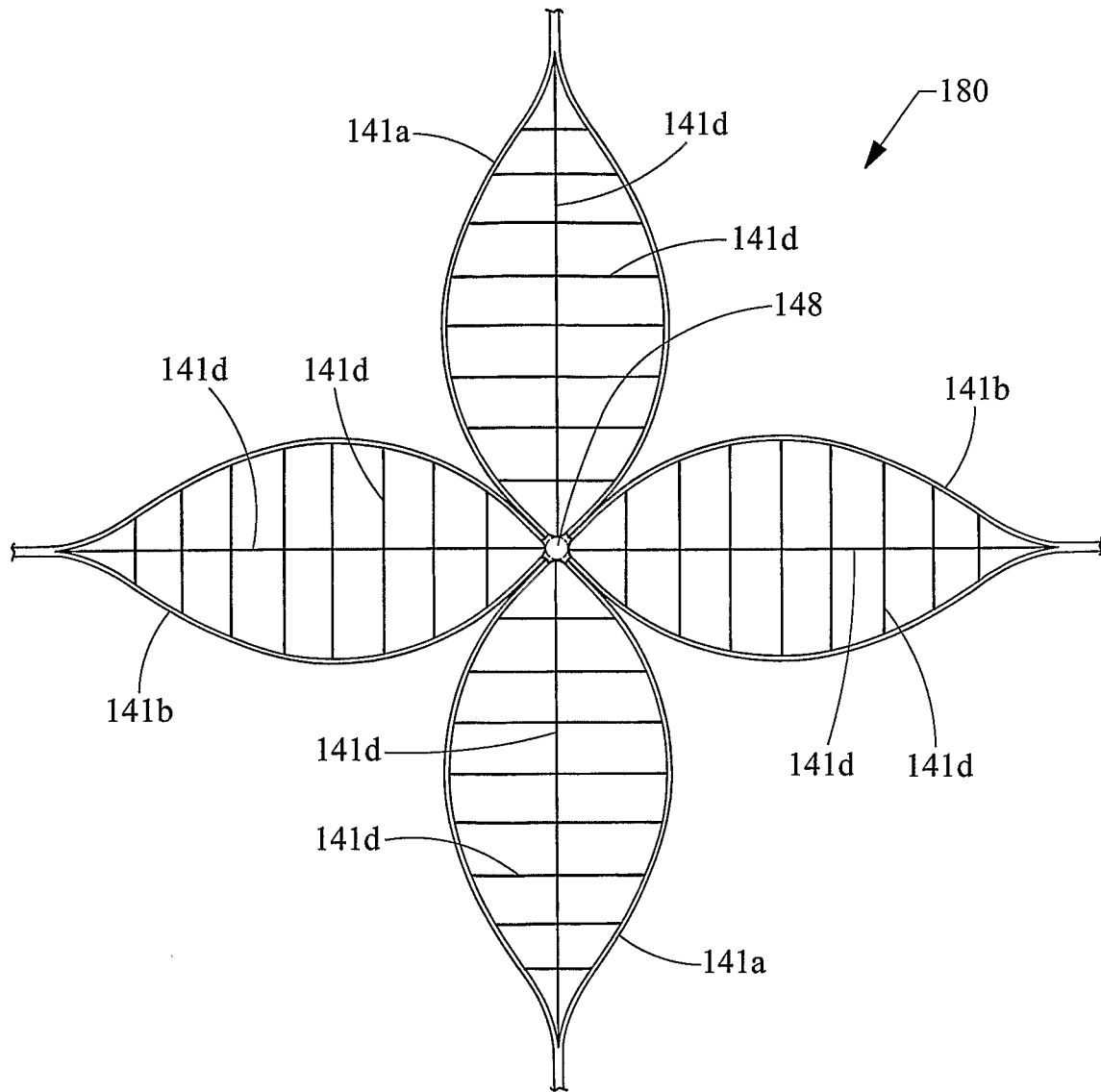


Fig. 14C

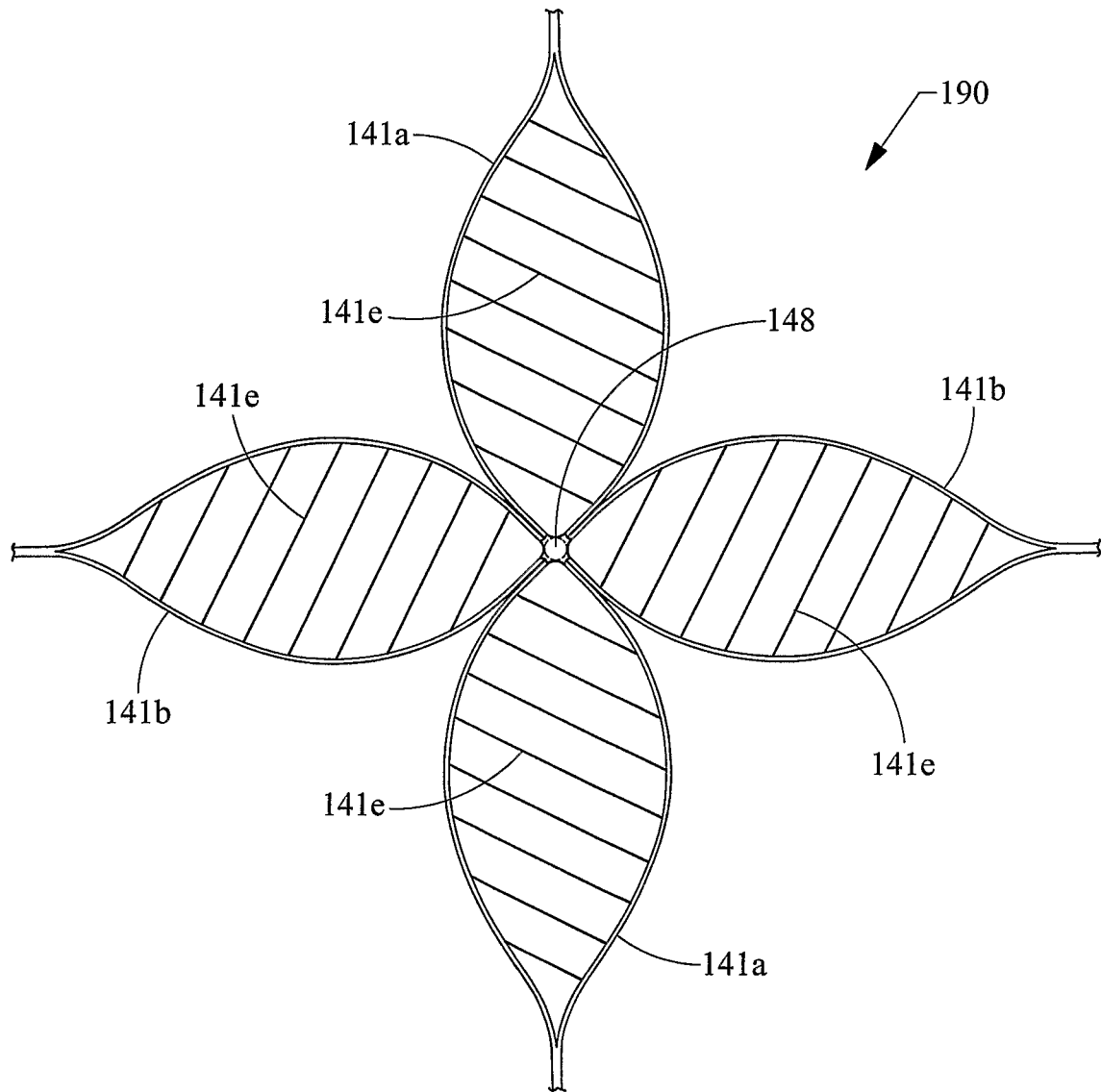


Fig. 14D

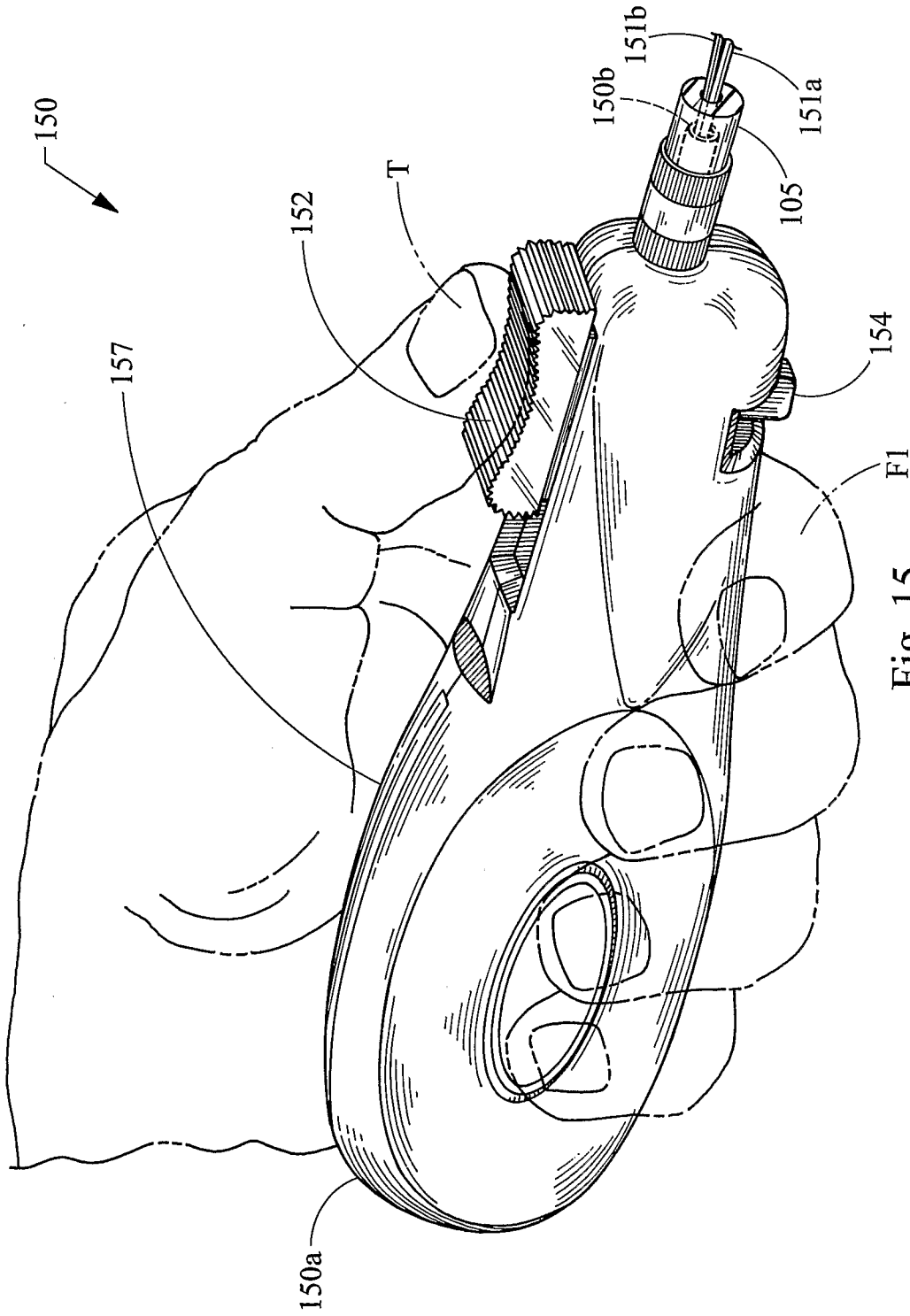


Fig. 15

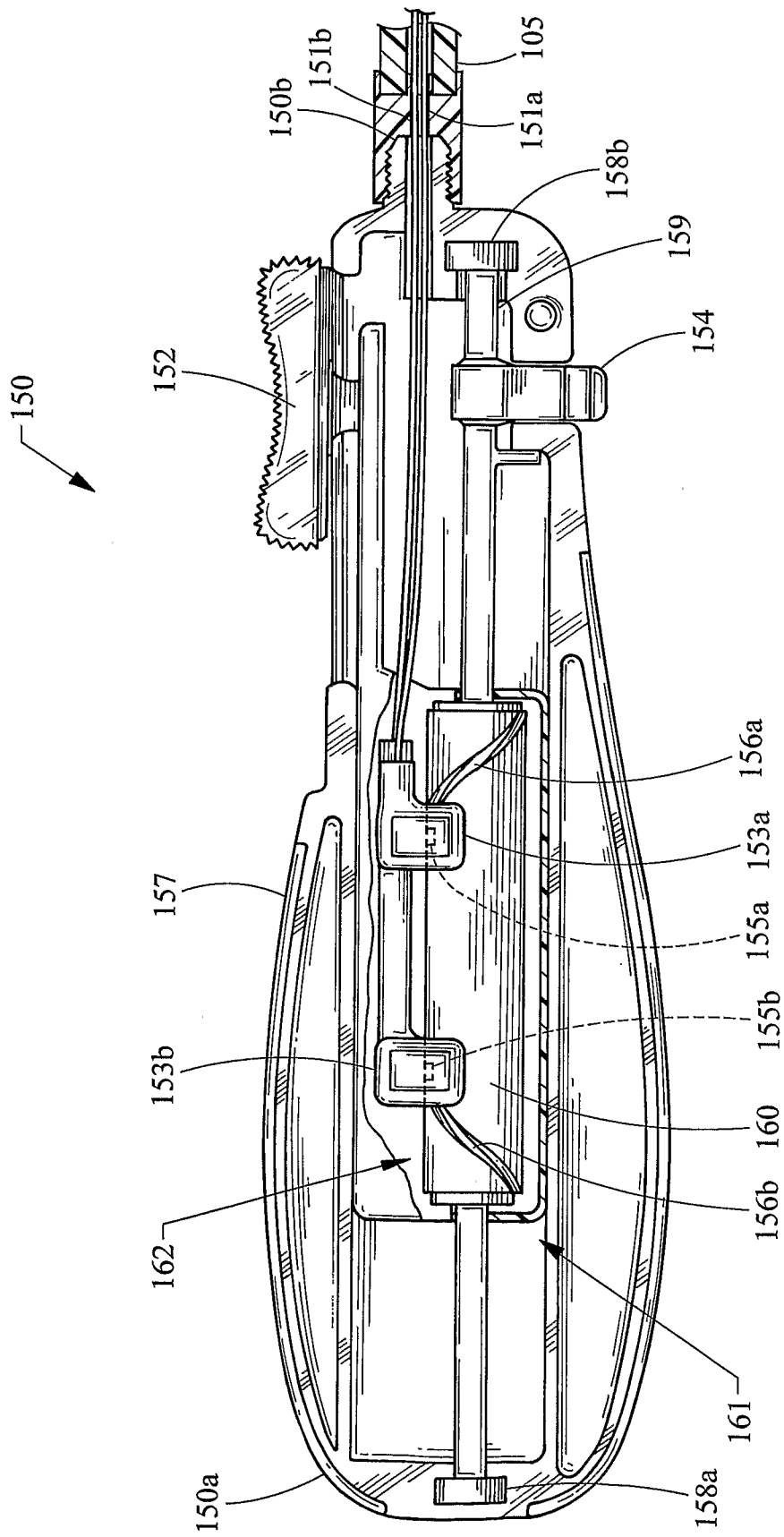


Fig. 16

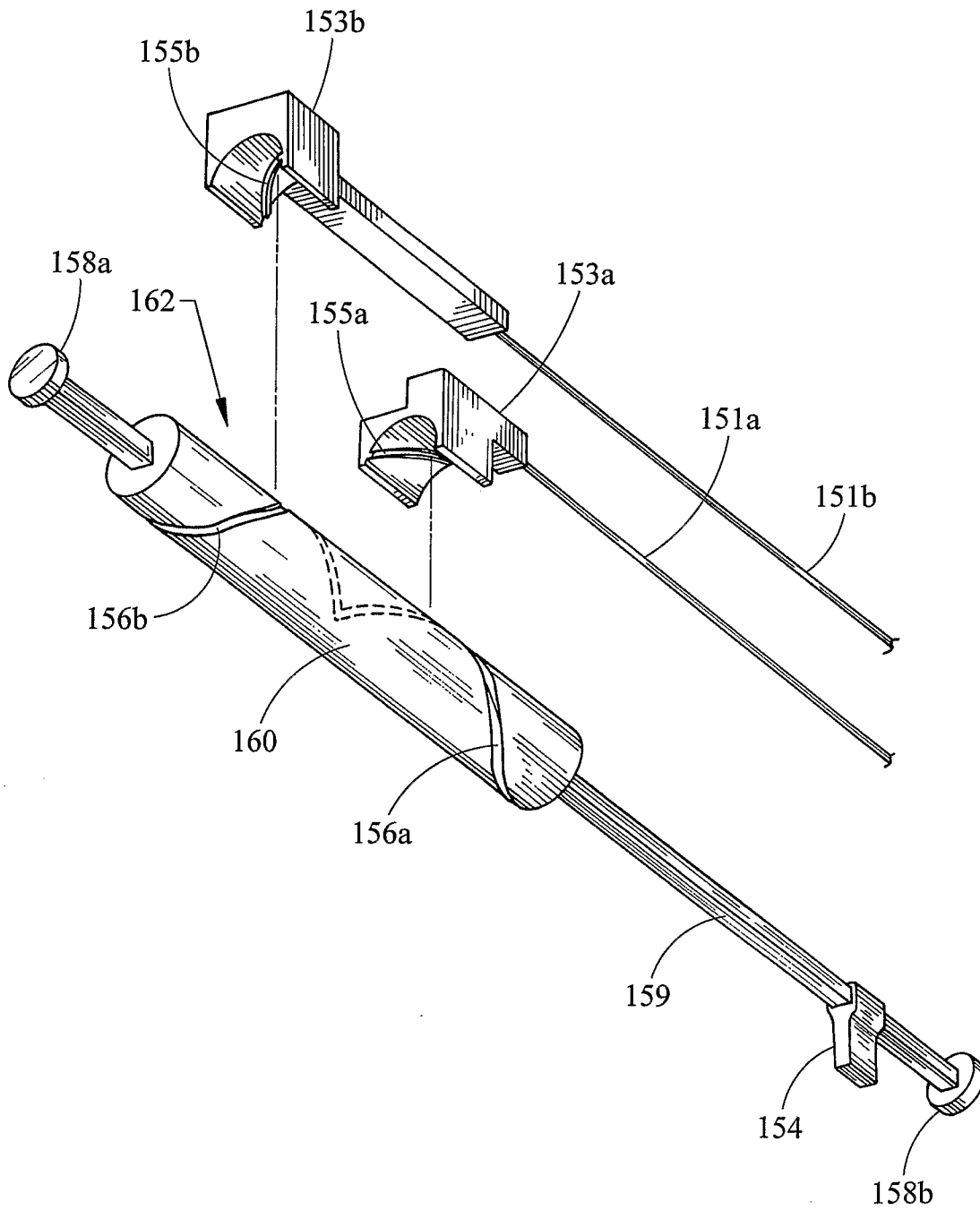


Fig. 17

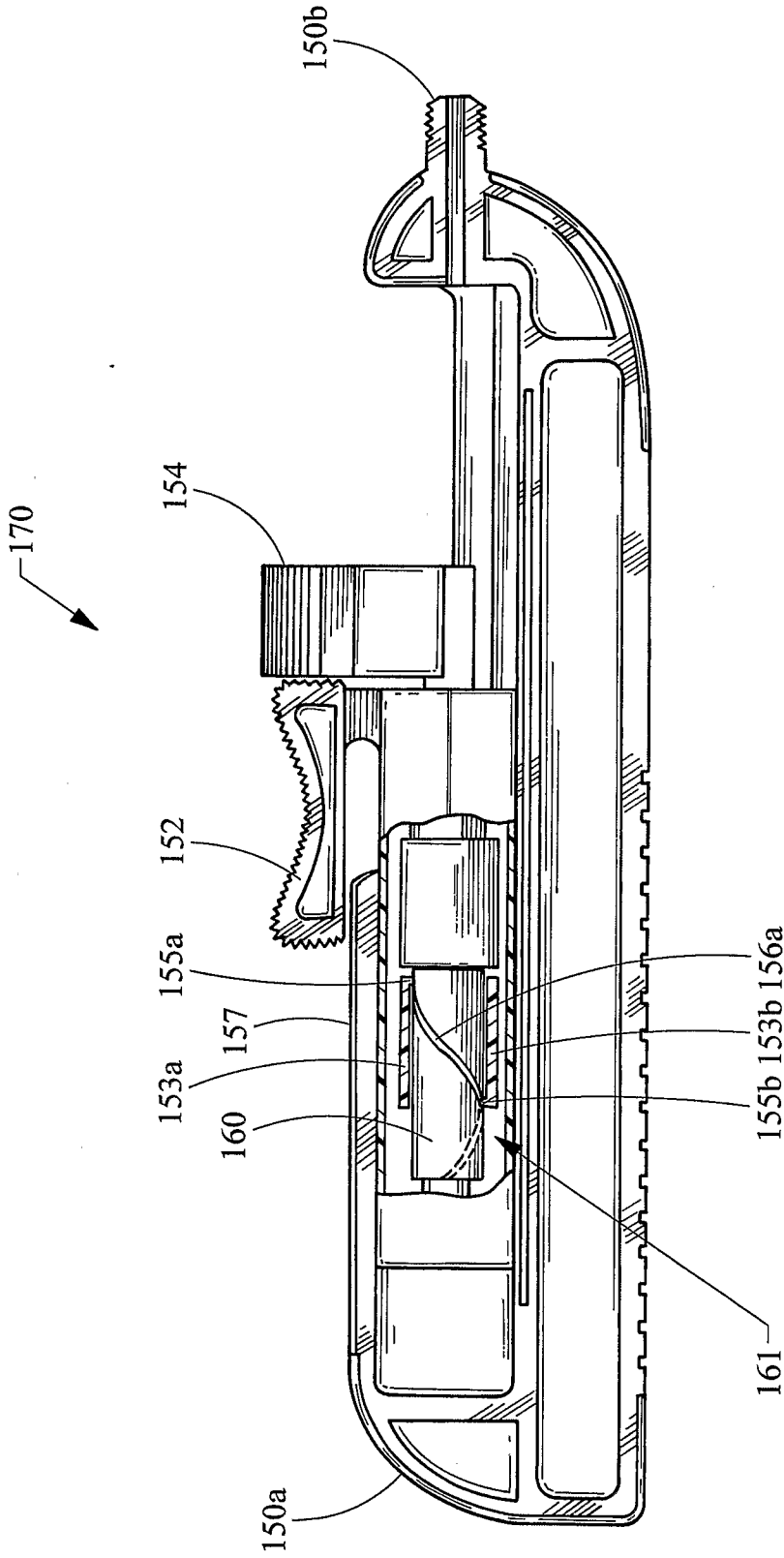


Fig. 18

**INTERNATIONAL SEARCH REPORT**

International application No  
PCT/US2006/042637

**A. CLASSIFICATION OF SUBJECT MATTER**  
INV. A61B17/221

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)  
A61B

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 practical, search terms used)  
EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 071 281 A (BURNSIDE R. ET AL.) 6 June 2000 (2000-06-06)	1, 8, 9, 11, 14, 15, 17, 18
Y	column 17, line 31 - line 51  column 17, line 60 - column 18, line 11 column 19, line 8 - line 53 figures 13-16, 20-27	3-7, 10, 20
X	US 2003/109874 A1 (DENNIS W.G.) 12 June 2003 (2003-06-12)	17-19
Y	abstract; figures 3-10, 17, 18  paragraphs [0001] - [0003], [0028], [0035], [0041], [0046], [0047], [0052] - [0055], [0057]	1, 2, 10, 11, 16
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Further documents are listed in the continuation of Box C.       See patent family annex.

\* 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 document 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.

\*Z\* document member of the same patent family

Date of the actual completion of the international search  28 February 2007	Date of mailing of the international search report  06/03/2007
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer  Nice, Philip
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## INTERNATIONAL SEARCH REPORT

International application No

PCT/US2006/042637

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	US 5 254 088 A (LUNDQUIST I. & THOMPSON R.B.) 19 October 1993 (1993-10-19) figures 16-19,23,24 -----	1-7,10, 11,16,20 17
Y A	US 5 989 266 A (FOSTER T.L.) 23 November 1999 (1999-11-23) cited in the application abstract; figure 1 -----	10  1,11,17
A	US 6 258 101 B1 (BLAKE J.W.) 10 July 2001 (2001-07-10) column 2, line 61 - column 3, line 56; figures 1a,2 -----	1,11,17



# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2006/042637

## Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.: 22-23  
because they relate to subject matter not required to be searched by this Authority, namely:  
Rule 39.1(iv) PCT - Method for treatment of the human or animal body by surgery
2.  Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1.  As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2.  As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3.  As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4.  No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2006/042637

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6071281	A	06-06-2000	NONE
US 2003109874	A1	12-06-2003	US 2005043743 A1 24-02-2005
US 5254088	A	19-10-1993	US 5395327 A 07-03-1995 US 5336182 A 09-08-1994
US 5989266	A	23-11-1999	NONE
US 6258101	B1	10-07-2001	WO 02098305 A1 12-12-2002