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(54) ENDOSCOPIC GUIDE WIRE TRACK

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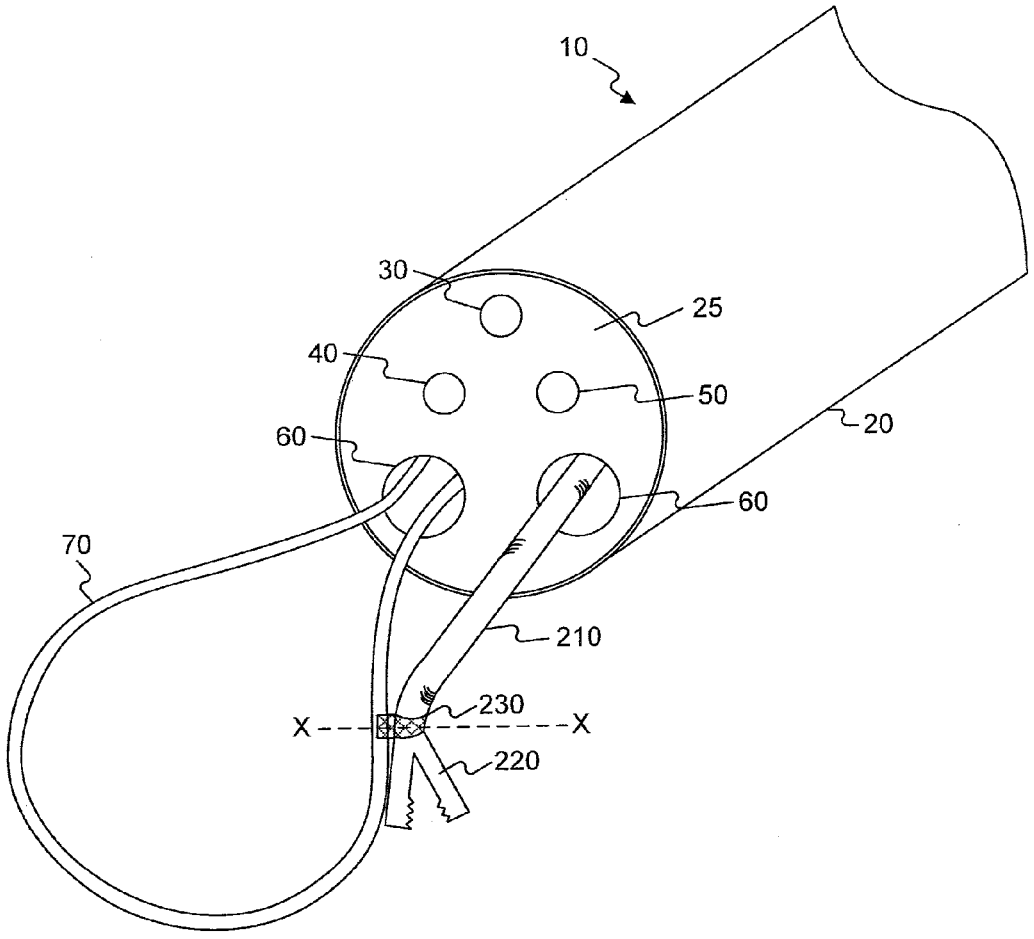
(57) **ABSTRACT**

A medical device may include an end effector configured to perform a therapeutic procedure. The medical device may further include a guide having a modifiable shape. The guide may be adapted for insertion through a lumen of an access tube. Also, the end effector may be selectively attachable to the guide and configured to move along the guide.



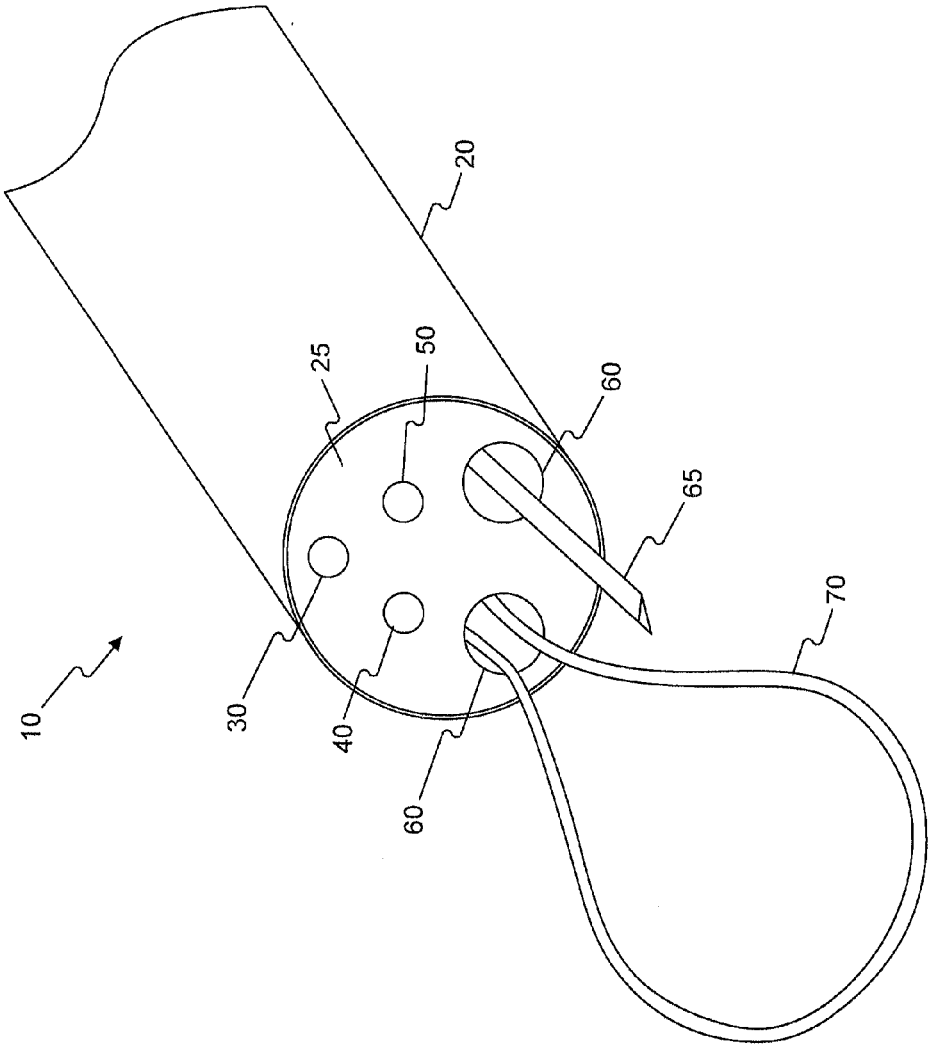


Fig. 1

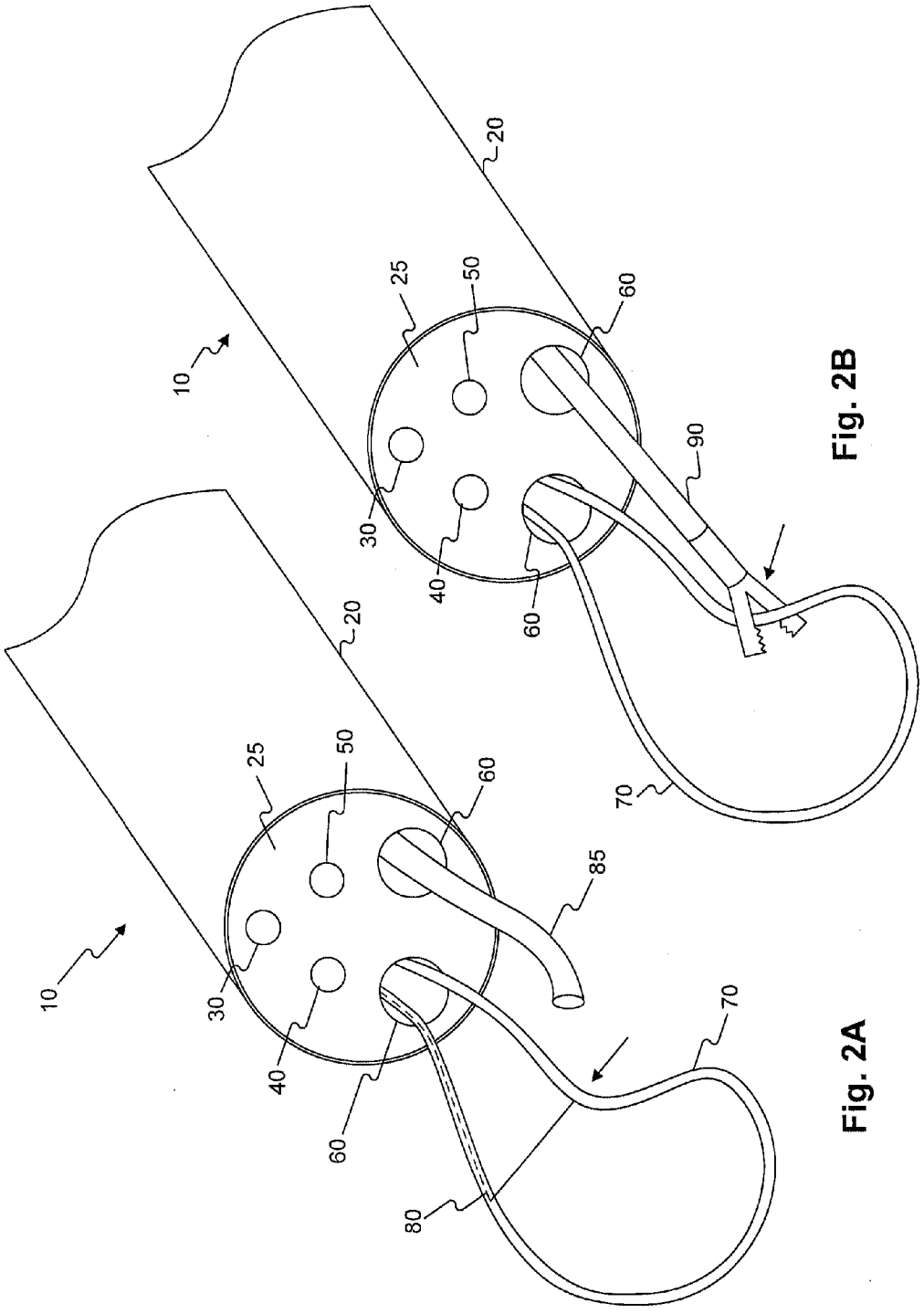


Fig. 2B

Fig. 2A

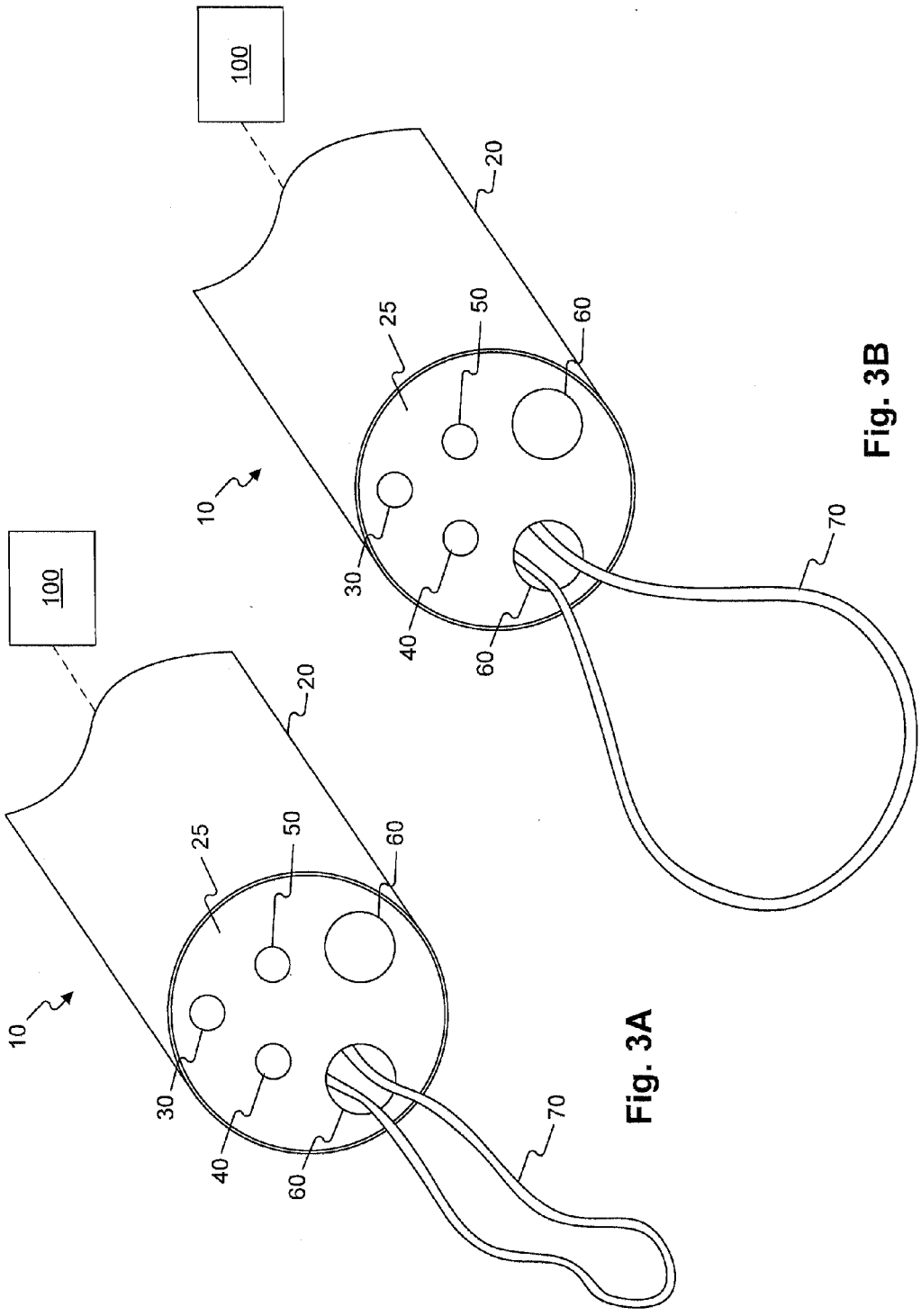


Fig. 3A

Fig. 3B

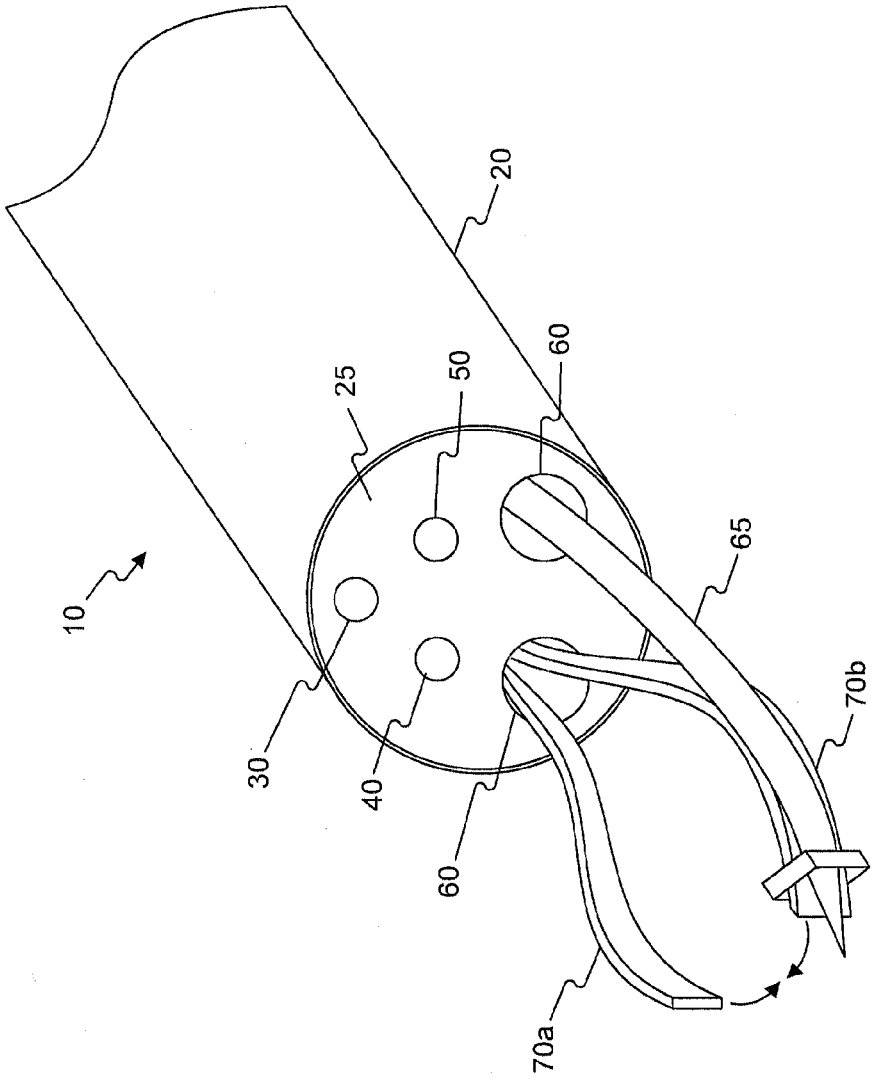


Fig. 4

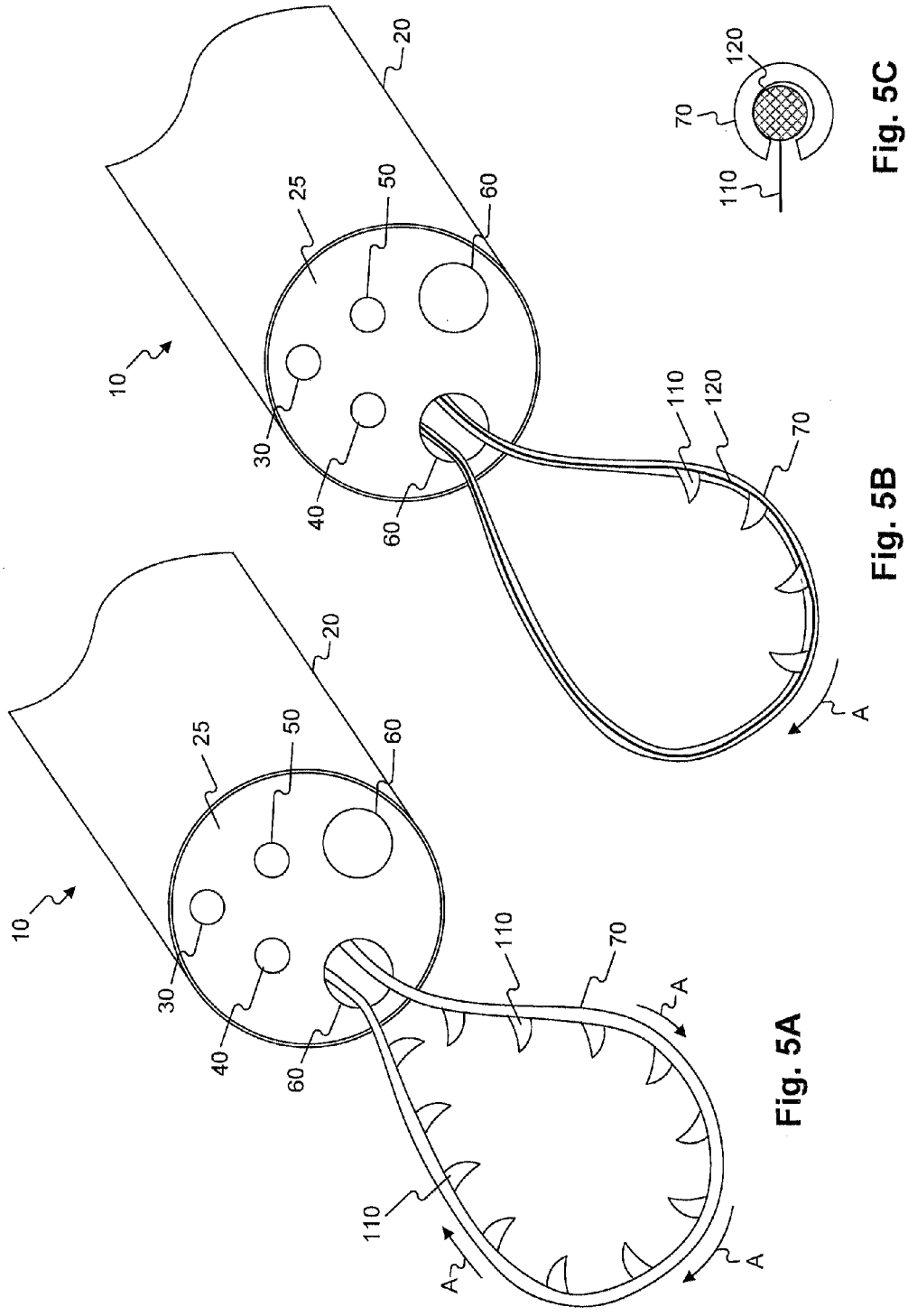


Fig. 5A

Fig. 5B

Fig. 5C

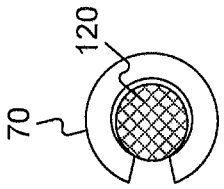


Fig. 6B

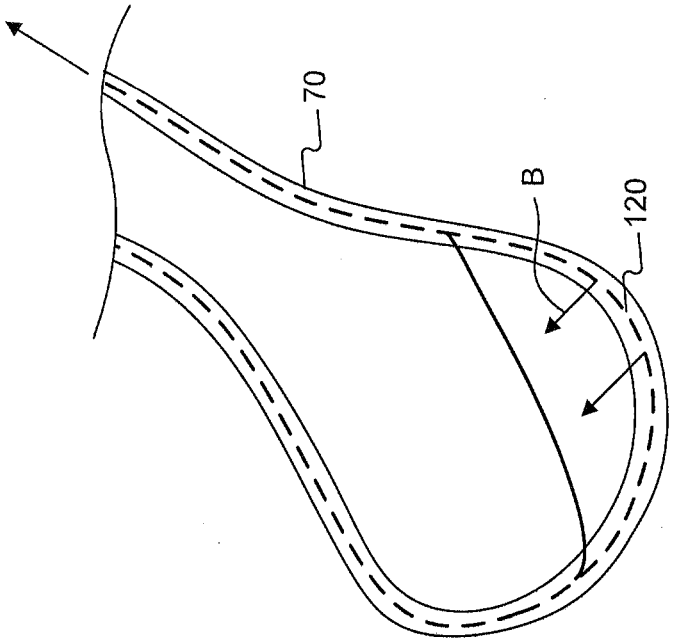


Fig. 6A

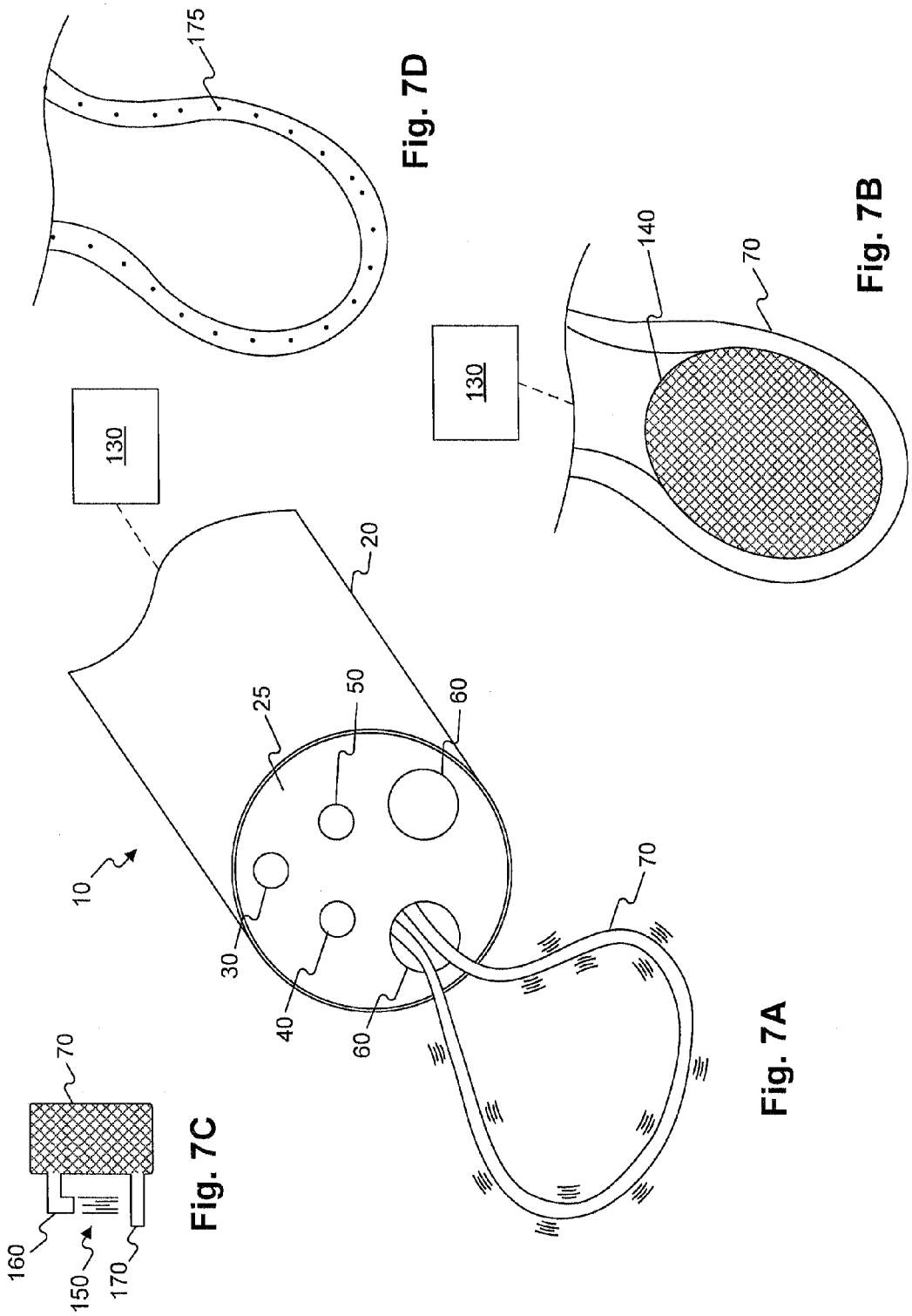


Fig. 7C

Fig. 7D

Fig. 7A

Fig. 7B

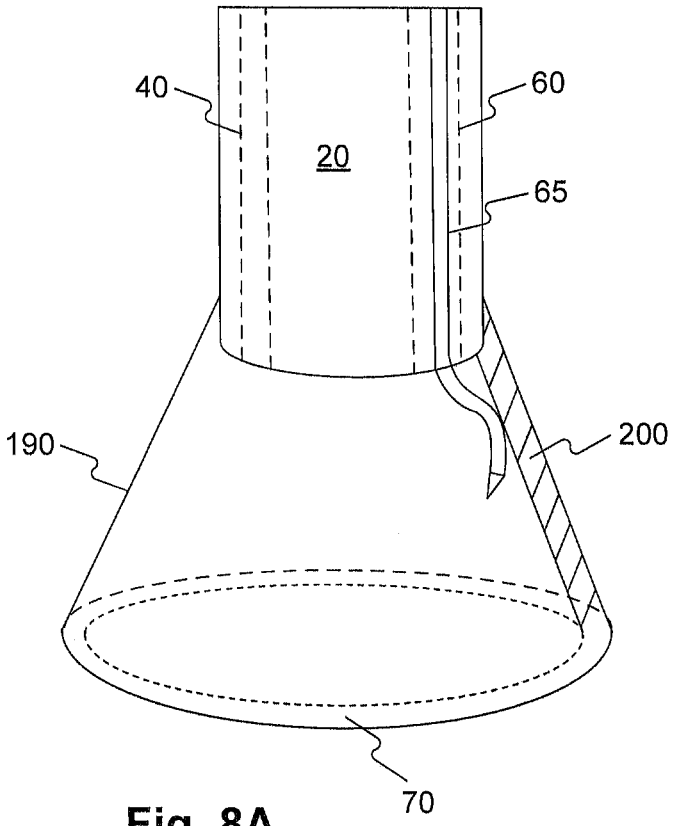


Fig. 8A

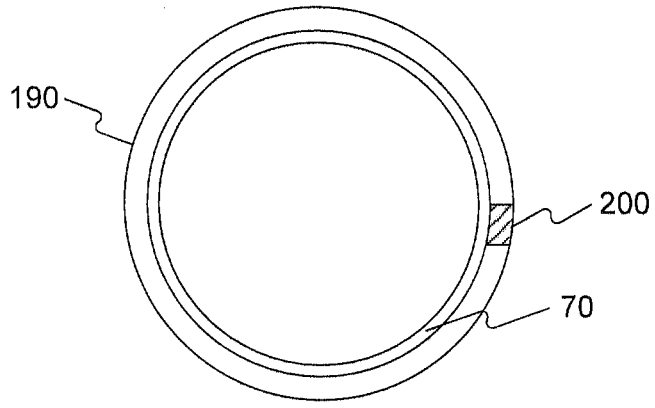


Fig. 8B

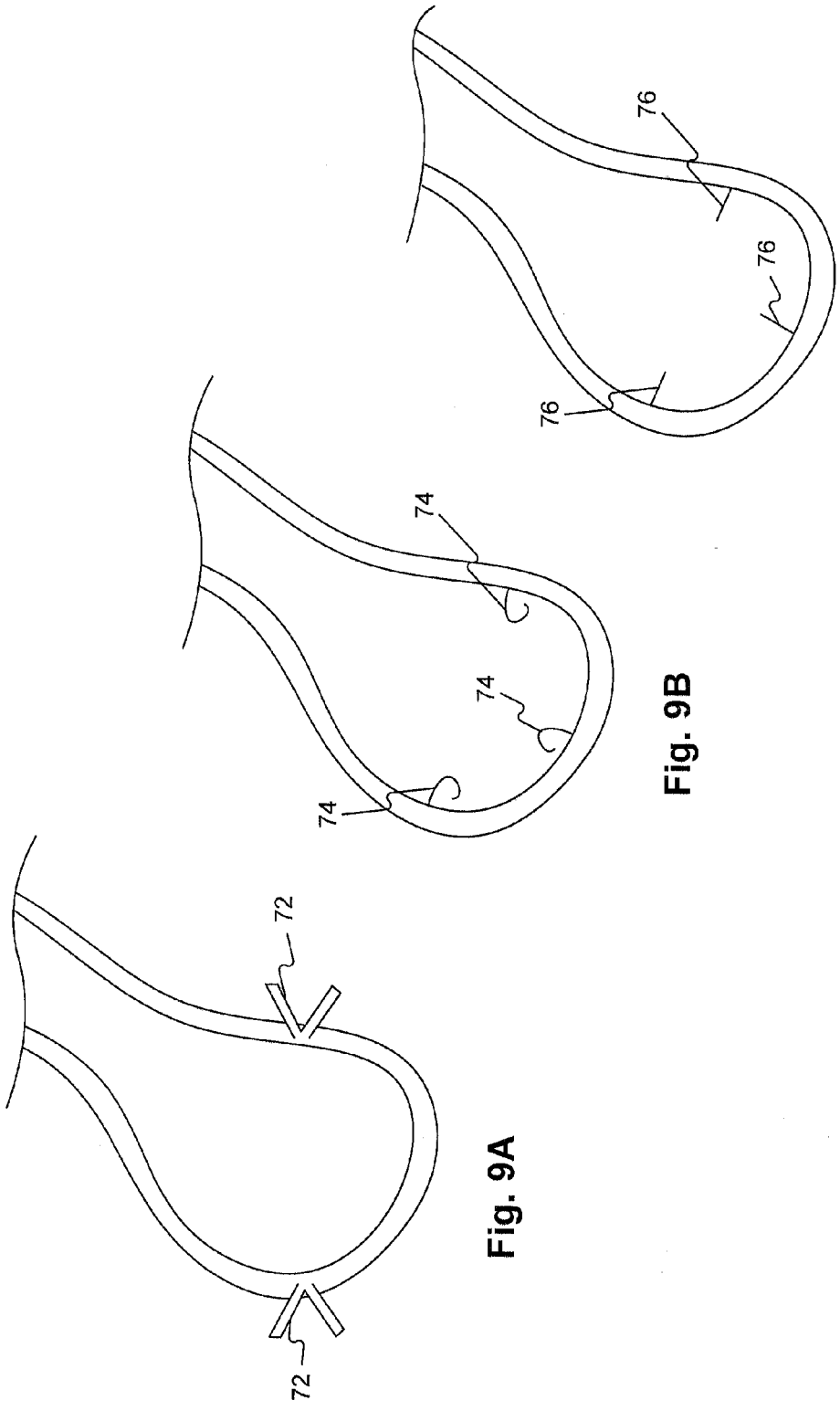


Fig. 9A

Fig. 9B

Fig. 9C

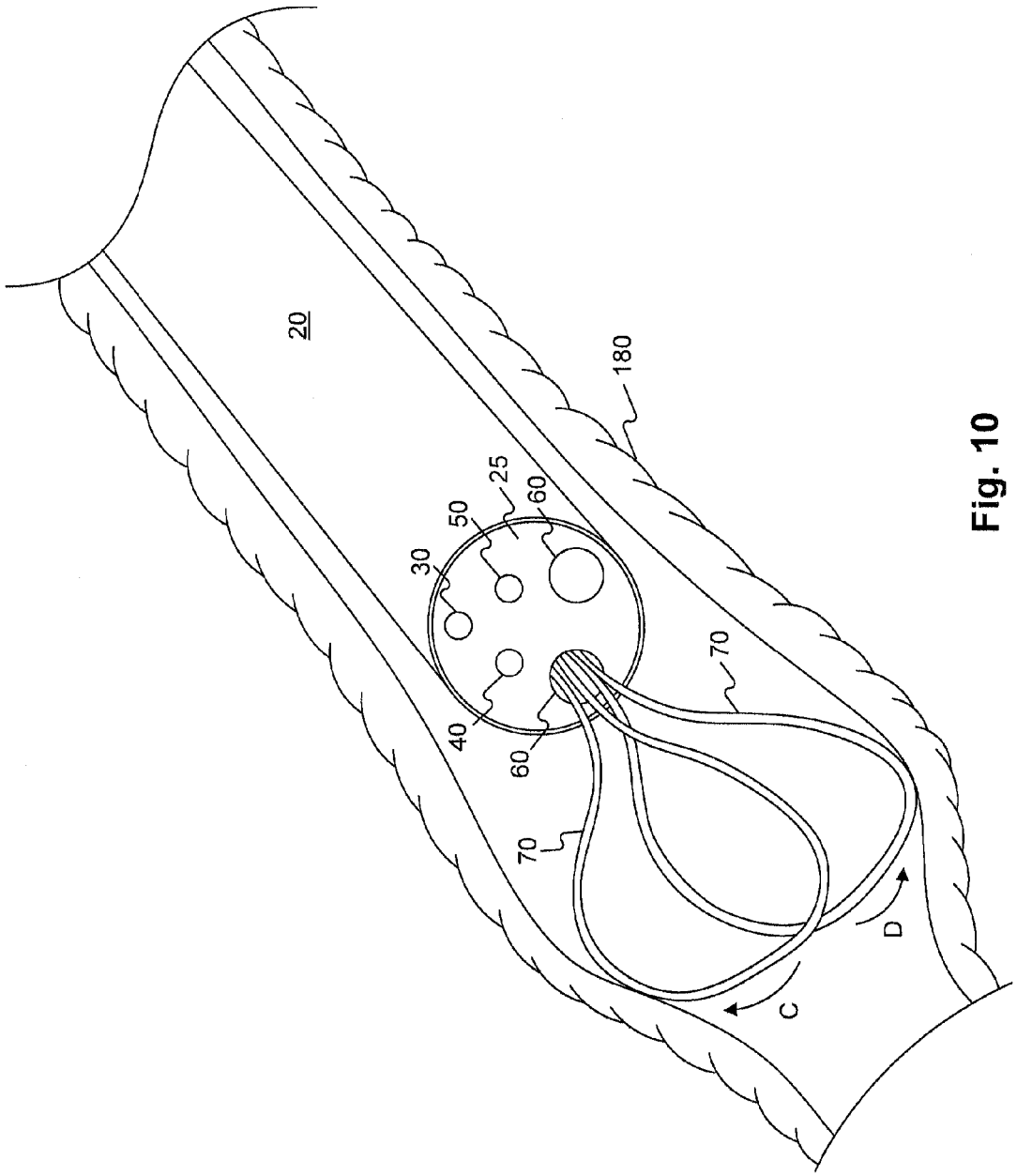


Fig. 10

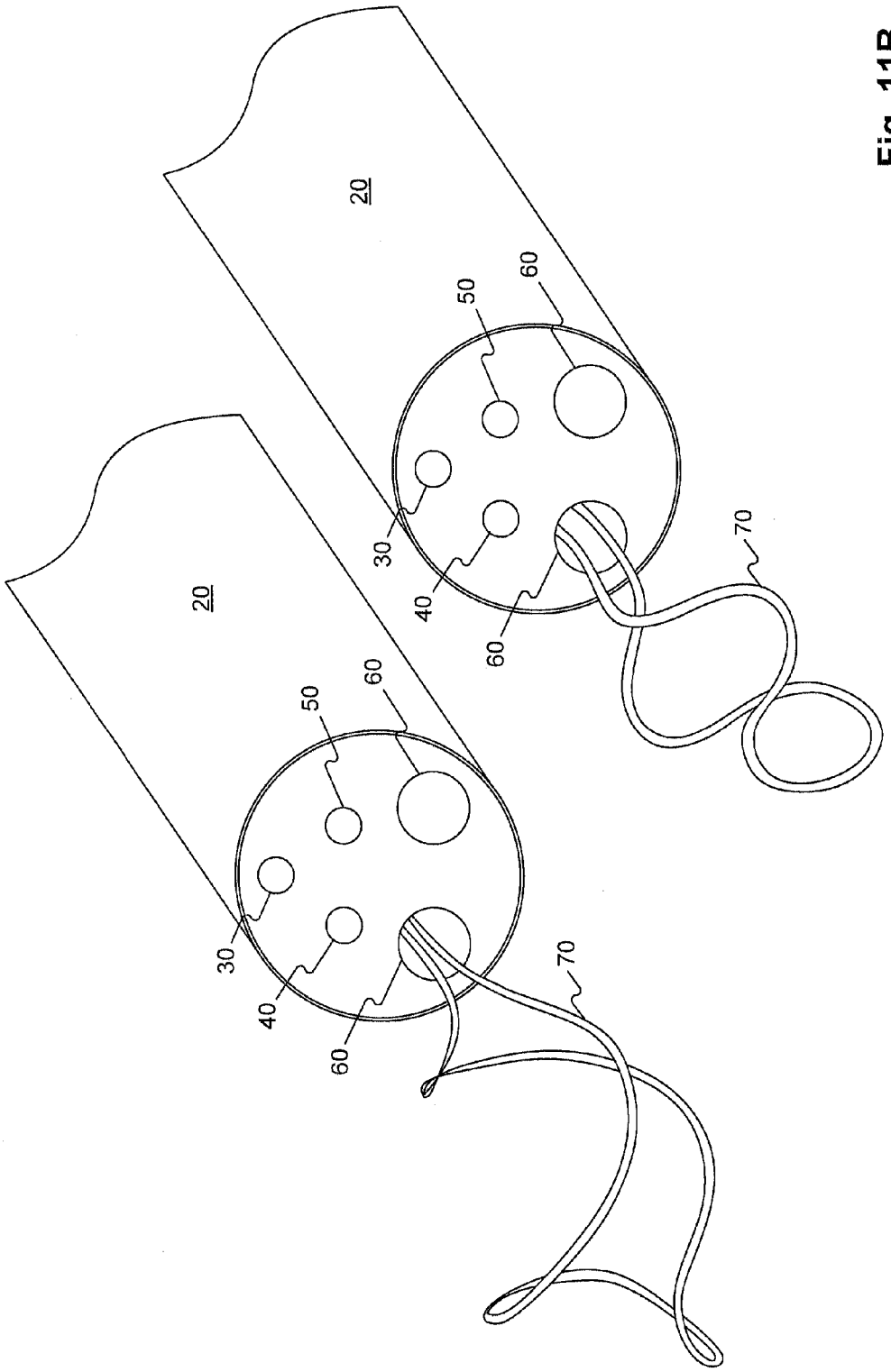


Fig. 11B

Fig. 11A

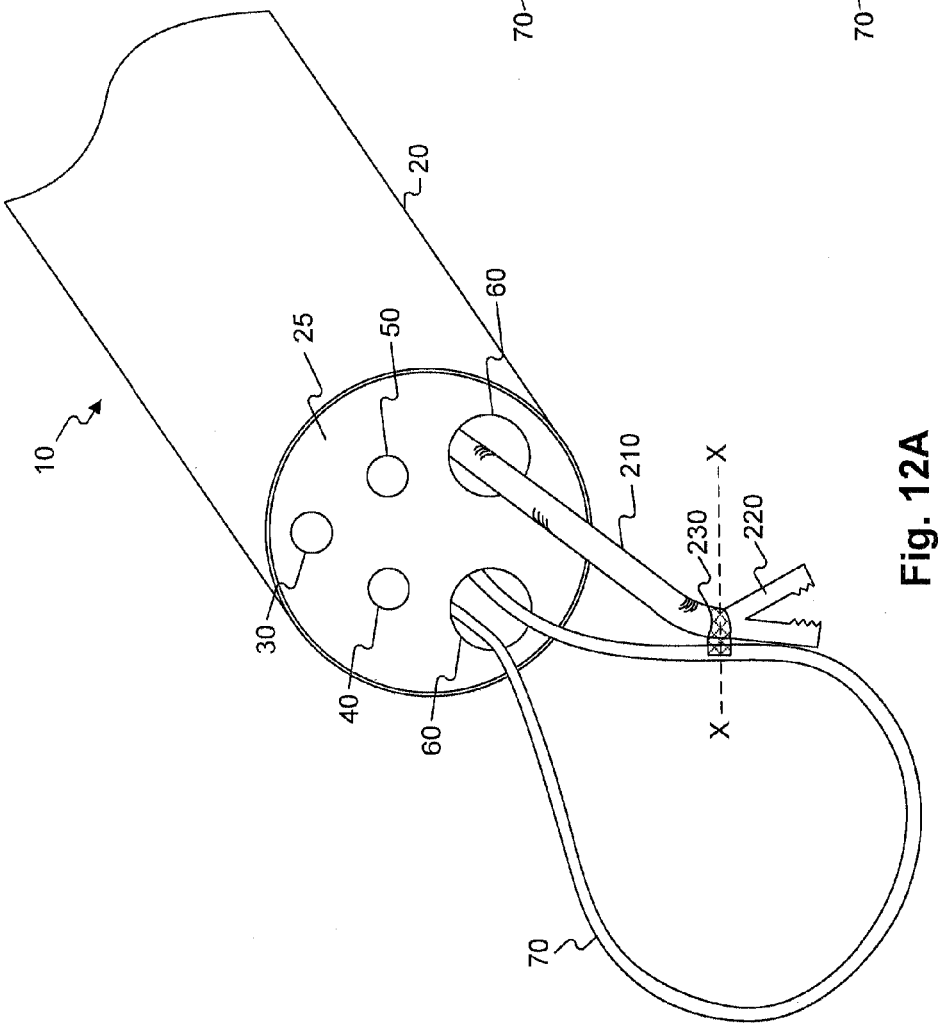


Fig. 12A

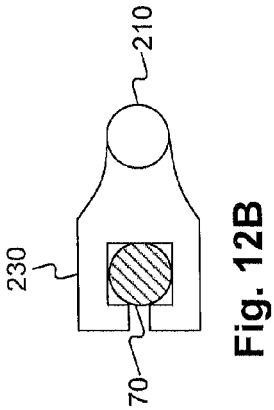


Fig. 12B

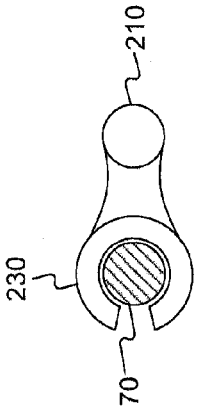


Fig. 12C

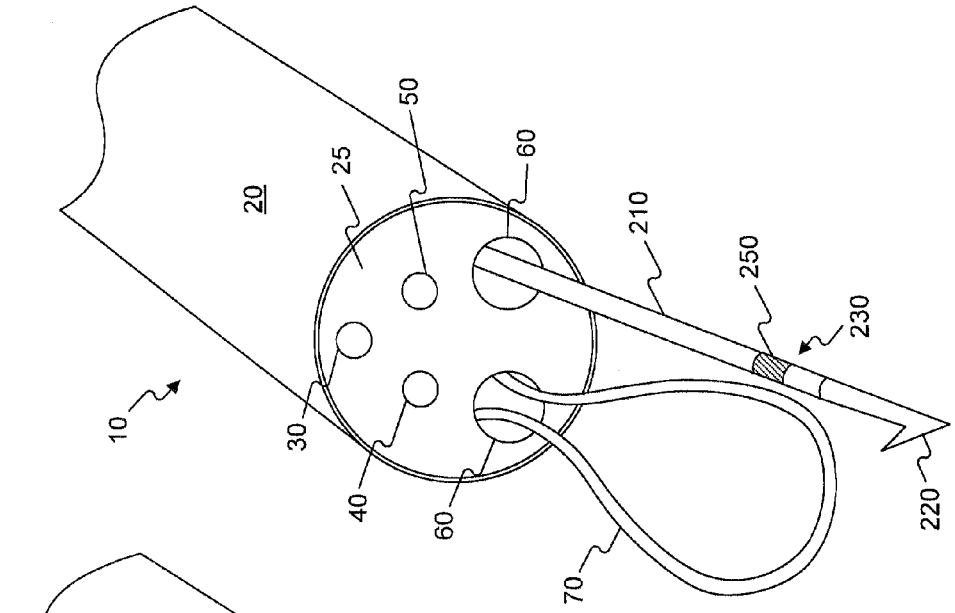


Fig. 13B

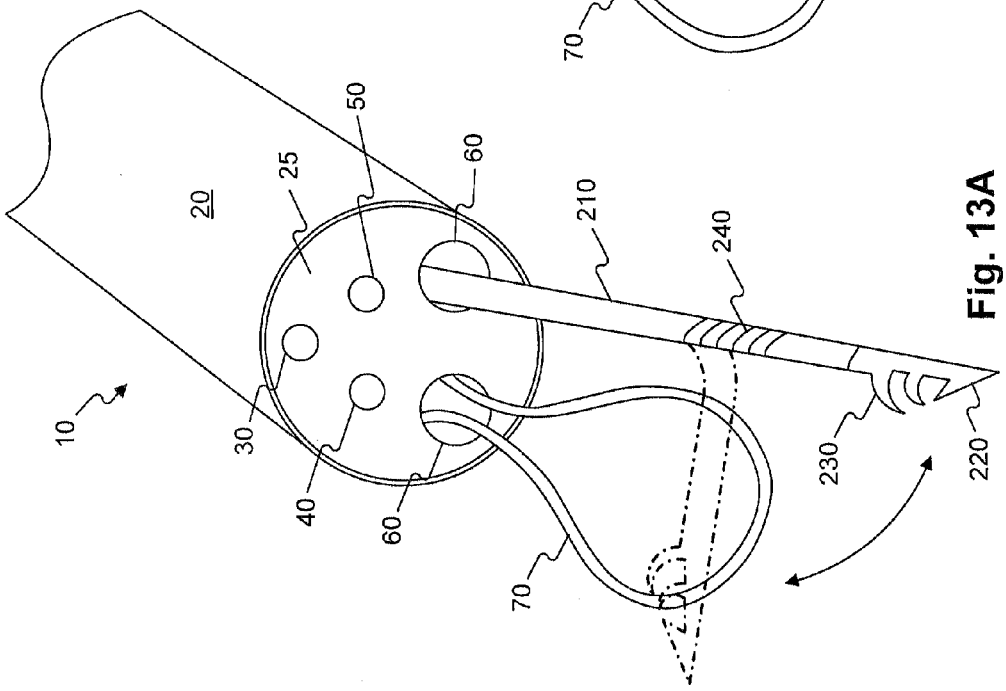


Fig. 13A

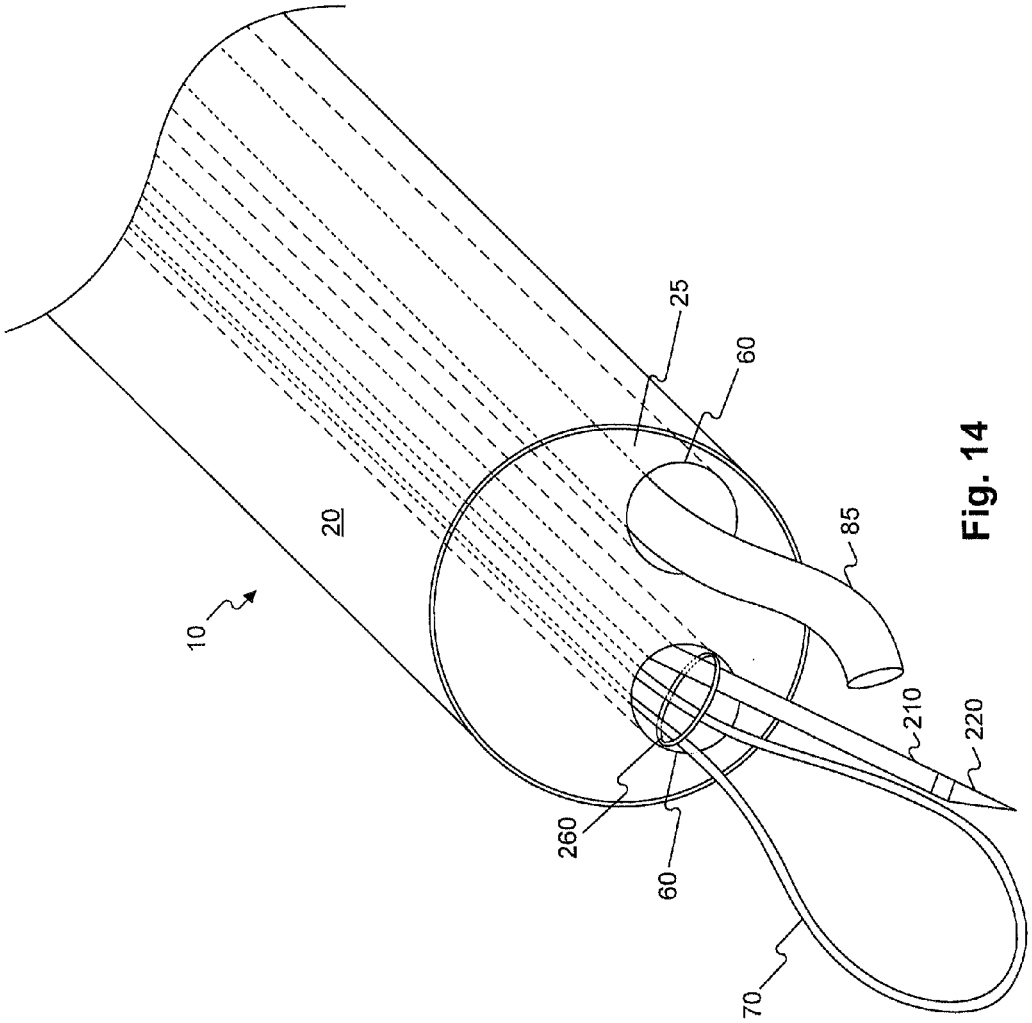


Fig. 14

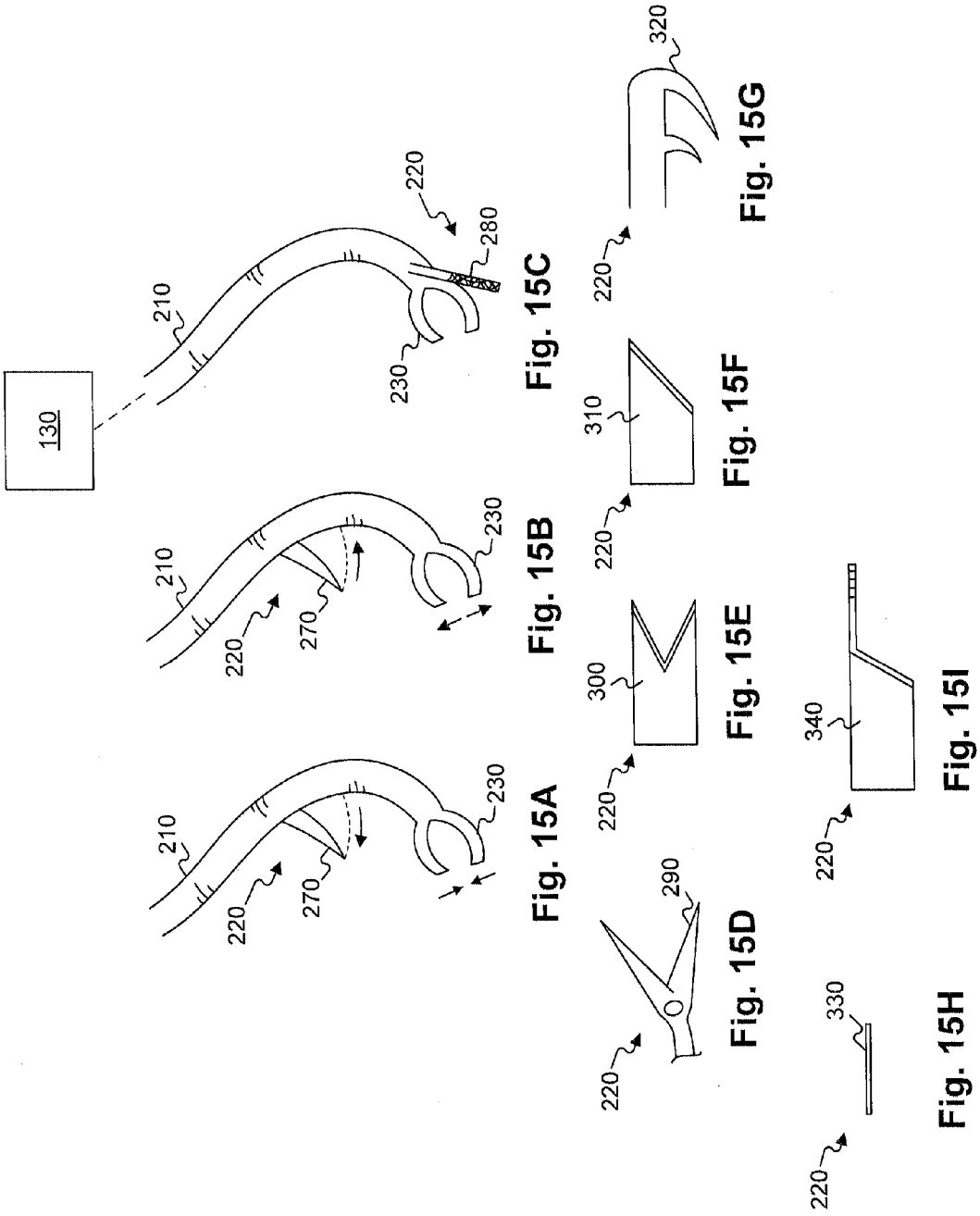


Fig. 15A

Fig. 15B

Fig. 15C

Fig. 15D

Fig. 15E

Fig. 15F

Fig. 15G

Fig. 15H

Fig. 15I

ENDOSCOPIC GUIDE WIRE TRACK

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of priority from U.S. Provisional Application No. 61/580,921, filed Dec. 28, 2011, which is herein incorporated in its entirety.

FIELD OF THE INVENTION

[0002] The present embodiments generally relate to medical devices, and, in particular, to medical devices providing a path for performance of medical procedures.

BACKGROUND OF THE INVENTION

[0003] A transluminal device is a flexible instrument introduced into a patient's body for diagnostic or therapeutic purposes. Such a device is inserted into the body through a natural or an artificially created opening, and is delivered to a work site inside the body through a body channel, such as, for example, the esophagus, a blood vessel, etc. Examples of transluminal devices include endoscopes, guide tubes, catheters, etc. Although particular embodiments of the invention may be broadly applied to any transluminal device, for the sake of brevity and as an exemplary embodiment, the invention will be described as being applied to an endoscope in this disclosure.

[0004] Endoscopes are widely used for diagnostic and therapeutic purposes inside a body. There are many different uses for endoscopes, and typically, endoscope designs may be varied to optimize their performance for an intended application. For example, there are upper endoscopes for examination of the esophagus, stomach and duodenum, urethroscopes for examining the urethra and bladder, colonoscopes for examining the colon, angioscopes for examining the blood vessels and heart, bronchoscopes for examining the bronchi, laparoscopes for examining the peritoneal cavity, arthroscopes for examining joint spaces, etc. Each of these devices may include features to optimize their performance for the intended application.

[0005] In typical applications, a distal end of an endoscope is inserted into the body through a natural anatomic opening, such as, for example, the mouth, anus, vagina, etc. Endoscopes may also be inserted into the body through a surgically created incision. The distal end of the endoscope then proceeds from the point of insertion to a region of interest (work site) within the body by traversing a body channel. The endoscope may also include one or more channels configured to house various diagnostic or treatment devices. These diagnostic or treatment devices may include, among others, a light source, a viewing/imaging device, an irrigation channel, an aspiration channel, or the like. Therapeutic tools configured for specific therapeutic tasks (such as, for example, incision, grasping, stitching, etc.) may also be delivered to the work site through the channels of the endoscope. These and other devices that may be used with an endoscope are broadly referred to as therapeutic or diagnostic tools in this application.

[0006] In order to position a therapeutic tool for application of specific therapeutic tasks, an operator must typically manipulate controls at a proximal end of the medical device to bend, e.g., articulate, the distal end of the medical device to a particular orientation. Additionally, upon positioning of the endoscope to the appropriate orientation, an operator may also need to manipulate controls at the proximal end of the medical device to drive and/or actuate the therapeutic tool along a path within the body to perform a medical procedure. For example, an operator may need to direct a therapeutic tool around a tissue growth, such as a polyp, in order to treat and/or remove the polyp. Such manipulation requires the operator to possess an increased skill level. Further, the more a therapeutic tool must be directed, the more likely an error may occur and the longer a procedure may last. As such, there remains a need to provide a device for medical procedures which reduces the necessary skill level of the operator, and increase efficiency and patient safety.

SUMMARY OF THE INVENTION

[0007] One embodiment of the invention is directed to a medical device. The medical device may include an end effector configured to perform a procedure. The medical device may further include a guide having a modifiable shape. The guide may also be adapted for insertion through a lumen of an access tube. Also, the end effector may be selectively attachable to the guide and configured to move along the guide.

[0008] In various embodiments, the medical device may include one or more of the following additional features: an access tube configured to receive the guide therein; wherein the guide includes a channel and the medical device further includes a tool disposed within the channel, wherein the tool is slidable within the channel and includes the end effector thereon; wherein the guide is configured to receive electric energy; a suction tube, wherein the guide is positioned along a distal end of the suction tube; wherein the guide further includes at least one securing mechanism configured to retain the shape of the guide; wherein the guide includes a first guide portion and a second guide portion, the first guide portion and second guide portion having a first unconnected configuration and a second connected configuration; wherein the end effector may include at least one of a retractable blade, scissors, a v-blade, a straight blade, a hooked blade, an injection needle, a grasping mechanism, and an energy probe; a tool having the end effector thereon, wherein the tool is configured to attach the end effector to the guide; wherein the tool includes a connector configured to attach the tool to the guide, the connector may include at least one of a channel, a hook, a clamp, and a magnet; wherein the connector includes a pair of flexible arms defining the channel, and wherein the channel is shaped to receive the guide therein; and wherein the channel may include one of a u-shaped channel and a c-shaped channel.

[0009] Another embodiment of the invention may be directed to a medical device. The medical device may include a tool having a distal end effector which may be configured to perform a procedure. The medical device may further include a guide which may be configured to transform from a collapsed configuration to an expanded configuration, wherein the expanded configuration defines a path. Also, the tool may be configured to be coupled with the guide and move relative to at least a portion of the path.

[0010] In various embodiments, the medical device may include one or more of the following additional features: wherein the tool includes a connector configured to couple the tool to the guide, the connector including at least one of a channel, a hook, a clamp, and a magnet; wherein the connector includes a pair of flexible arms defining the channel, wherein the channel is shaped to receive the guide therein; wherein the channel is at least one of a u-shaped channel and

a c-shaped channel; wherein the tool includes at least one of a retractable blade, scissors, a v-blade, a straight blade, a hooked blade, an injection needle, a grasping mechanism, and an energy probe; an access tube configured to receive the guide therein; wherein the guide is configured to receive electric energy; and a suction tube, wherein the guide is positioned along a distal end of the suction tube.

[0011] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate exemplary embodiments of the present disclosure and together with the description, serve to explain the principles of the invention.

[0013] FIG. **1** is a perspective view of a medical device having a track according to an embodiment of the present disclosure.

[0014] FIGS. **2**A and **2**B are perspective views of the medical device of FIG. **1**, including embodiments of mechanisms for shaping the track.

[0015] FIGS. **3**A and **3**B are perspective views of the medical device of FIG. **1** having a track in a first configuration and a second configuration, respectively, including an alternative mechanism for shaping the track.

[0016] FIG. **4** is a perspective view of a medical device having a track according to another embodiment of the present disclosure.

[0017] FIG. **5**A is a perspective view of a medical device having a track according to another embodiment of the present disclosure.

[0018] FIG. **5**B is a perspective view of a medical device having a track according to another embodiment of the present disclosure.

[0019] FIG. **5**C is a cross-sectional view of a portion of the track shown in FIG. **5**B.

[0020] FIG. **6**A is a perspective view of a track according to another embodiment of the present disclosure.

[0021] FIG. **6**B is a cross-sectional view of FIG. **6**A.

[0022] FIG. **7**A is a perspective view of a medical device having a track according to another embodiment of the present disclosure.

[0023] FIG. **7**B is a perspective view of a track according to another embodiment of the present disclosure.

[0024] FIG. **7**C is a cross-sectional view of a track according to another embodiment of the present disclosure.

[0025] FIG. **7**D is a perspective view of a track according to another embodiment of the present disclosure.

[0026] FIG. **8**A is a side-view of a medical device having a track and including a suction cone according to another embodiment of the present disclosure.

[0027] FIG. **8**B is a bottom-view of the cone of FIG. **8**A.

[0028] FIGS. **9**A-**9**C are perspective views of tracks including securing mechanisms.

[0029] FIG. **10** is a perspective view of a medical device have multiple tracks according to another embodiment of the present disclosure.

[0030] FIG. **11**A is a perspective view of a medical device having a track according to another embodiment of the present disclosure.

[0031] FIG. **11**B is a perspective view of a medical device having a track according to another embodiment of the present disclosure.

[0032] FIG. **12**A is a perspective view of a medical device including an end effector tool and track guide according to another embodiment of the present disclosure.

[0033] FIGS. **12**B and **12**C are cross-sectional views of embodiments of the track guide according to FIG. **12**A.

[0034] FIGS. **13**A and **13**B are perspective views of medical devices including exemplary connection mechanisms of embodiments of the present disclosure.

[0035] FIG. **14** is a perspective view of a medical device including an end effector tool according to another embodiment of the present disclosure.

[0036] FIGS. **15**A-**15**I are perspective views of end effectors according to embodiments of the present disclosure.

DESCRIPTION OF THE EMBODIMENTS

[0037] Reference will now be made in detail to embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

[0038] The terms "proximal" and "distal" are used herein to refer to the relative positions of the components of the exemplary medical device **10**. When used herein, "proximal" refers to a position relatively closer to the exterior of the body of a patient or closer to the operator using medical device **10**. In contrast, "distal" refers to a position relatively further away from the operator using medical device **10** or closer to the interior of the body of the patient.

[0039] FIG. **1** depicts an exemplary medical device **10** that may be used for any therapeutic or diagnostic procedure, and the components thereof. The phrase "therapeutic or diagnostic procedure" is broadly used to indicate any medical procedure that may be performed by inserting a transluminal device, such as an endoscope, guide tube, catheter, or any other medical device, into the body through any anatomic opening. Medical device **10** may be used for performing surgery at a relative distance via medical instruments within device **10**. The medical device **10** may be adapted for, but not limited to, trans-oral, trans-anal, trans-vaginal, trans-urethral, trans-nasal, trans-cranial, transluminal, laparoscopic, thoracoscopic, orthopedic, through the ear, and/or percutaneous access. The components of medical device **10** described below may be made of any suitable material capable of being inserted into the body, e.g., a suitable biocompatible material.

[0040] As shown in FIG. **1**, medical device **10**, may include a shaft **20** extending longitudinally from a proximal end to a distal end and terminating in a distal end face **25**. Shaft **20** may include one or more channels **30**, **40**, **50**, **60** each of which extends substantially longitudinally within shaft **20**, and terminates in a port in distal end face **25**. Channels **30**, **40**, **50**, **60** may provide access to devices and facilities that may aid in performing a diagnostic or therapeutic task inside the body. In general, channels **30**, **40**, **50**, **60** may be of any shape or geometry. In some embodiments, some or all of channels **30**, **40**, **50**, **60** may be lined with a polymeric layer or another layer or coating to facilitate use. Channels **30**, **40**, **50**, **60** may include one or more of, among others, an illumination/viewing/imaging channel **30**, an aspiration channel **40**, an irrigation channel **50**, and one or more working channels **60**.

[0041] Illumination/viewing/imaging channel **30** may include devices at the distal end configured to illuminate the

work site. These devices may include, among others, bulbs, LED's, fiber optic cables and light guides. Illumination/viewing/imaging channel **30** may further include devices (such as a camera) at the distal end, configured to deliver an image of the work site external to the body of the patient. In some embodiments the camera may be a digital camera, such as a CCD or a CMOS camera. Illumination/viewing/imaging channel **30** may also include electric signal cables or wires that may run from the distal end of medical device **10** to the proximal end of medical device **10**. Although depicted as a single channel in FIG. **1**, the illumination/viewing/imaging channel **30** may, in an alternative embodiment, be divided amongst two (or more) channels including a first channel for illumination capabilities and a second channel for viewing/imaging capabilities. Additionally, any component of medical device **10** may further include a light transmitting material to deliver light.

[0042] Aspiration channel **40** may be configured to facilitate suction and/or fluid flow therethrough. As such, aspiration channel **40** may be in communication with a source of suction (i.e., vacuum) and/or fluid flow such as a pump at a proximal end of medical device **10**. Irrigation channel **50** may be configured to facilitate fluid flow (including a vacuum) from the proximal end of medical device **10** to the distal end of medical device **10**. In some embodiments, a proximal end of irrigation channel **50** may be attached to a source of fluid, and a distal end of irrigation channel **50** may include a nozzle to alter fluid flow. In some embodiments, fluid may flow from the proximal end of medical device **10** to the work site through irrigation channel **50**. The fluid may then be removed from the work site, via suction, through aspiration channel **40**. In some embodiments, aspiration channel **40** may also be configured to remove biological material along with fluid from the work site. For instance, a tissue sample along with fluid (delivered to the work site via irrigation channel **50**) may be extracted out of the body of the patient through aspiration channel **40**. In any event, both aspiration **40** and irrigation channel **50** may be used for infusion or aspiration of fluids and/or tissue.

[0043] Each of the working channels **60** may include a hollow cavity configured to deliver a tool **65**, **210** to the work site. In general, working channel **60** may have any suitable shape, size, and configuration. In some embodiments, working channel **60** may have a substantially circular cross-section, while in other embodiments, the shape of the working lumen may correspond to the shape of tool **65** to be passed therethrough.

[0044] Additionally, working channel **60** may be configured to deliver a guide or track **70** to the work site. Track **70** may include an elongate piece of material extending from a proximal end of the medical device **10** towards the distal end of medical device **10** and bending back and extending toward the proximal end of medical device **10**. Alternatively, track **70** may be configured as an elongate piece of material having a distal configuration, such as a loop. Track **70** may be delivered and/or moved to follow a single or compound path in any of three Cartesian directions, up/down, left/right, forward/backward. Track **70** may define a pre-determined, precise path for tool **65** to follow. As such, the path of tool **65** may be made increasingly accurate and safe. Further, use of track **70** may reduce the time necessary for a therapeutic procedure as the operator may simply guide tool **65** along path **70** rather than independently control tool **65** to move around or within the work site. Alternatively, as described below, track **70** may be provided with therapeutic procedure capabilities such that no additional tool **65** is required.

[0045] Track **70** may have a variety of configurations. For example, track **70** may have a modifiable shape and/or size in order to meet the needs of a particular procedure and/or patient. As such, track **70** may be formed of a semi-rigid or flexible material that may be shaped in a free-form manner or on a pre-determined template (not shown). The template may have any desired configuration. For example, the template may be configured to shape track **70** to dimensions corresponding to common polyps and/or tissue lesions such that the track may guide tool **65** around or near the polyp and/or lesion in order to treat a patient. Once positioned in the desired shape, the track may be treated, i.e. heated or chemically treated, such that track **70** may be made more rigid or has a shape memory effect. In one embodiment, track **70** may be manipulated by one or more moveable cores (not shown) configured to move inside of track **70**. Alternatively, one or more moveable coaxial sheaths or tubes (not shown) may be moved along track **70**. Either a cone or a sheath may be configured to follow the shape of the track **70** or may be configured to create a compound shape of track **70**.

[0046] Alternatively, as shown in FIGS. **2**A and **2**B, track **70**, being made of a modifiable material, may be manipulated via a pull-wire **80** and/or a manipulation tool **90** under direct visualization from a visualization scope **85**. Visualization scope may be employed with any exemplary embodiments disclosed herein and may include a visualization mechanism, for example a camera, to transmit images to an operator of the track **70** while being shaped. Alternatively, a camera within illumination/viewing/imaging channel **30** can provide sufficient visualization.

[0047] As shown in FIG. **2**A, pull-wire **80** may extend from a proximal end of medical device **10** through at least a first portion of track **70**. Further, pull-wire **80** may exit a side wall of the first portion of track **70** and attach to a second portion of track **70**, preferably opposite the first portion. In such a configuration, an operator may pull on a proximal end of pull-wire **80** such that the second portion of track **70** moves towards, i.e. is pulled, in the direction shown in FIG. **2**A. Although not shown, medical device **10** may further include an oppositely arranged additional pull-wire **80** extending from a proximal end of medical device **10** through at least the second portion of track **70**, exiting a side wall of the second portion of track **70**, and attaching to the first portion of track **70**. As such, the first portion of track **70** may move, i.e. is pulled, towards the second portion of track **70** in the direction opposite from that shown in FIG. **2**A. As shown in FIG. **2**B, the shape of track **70** may be modified via one or more manipulation tools **90**. For example, manipulation tool **90** may be extended through a working lumen **60** and be configured to grasp and push track **70** in the direction shown in FIG. **2**B or pull track **70** in a direction opposite to the direction shown in FIG. **2**B.

[0048] The shape of track **70** may also be modified through application of an excitation signal. In such an embodiment, track **70** may be made of a shape memory alloy (SMA) material. Non-limiting examples of SMA's that may be used to form track **70** include alloys of titanium-palladium-nickel, nickel-titanium-copper, gold-cadmium, iron-zinc-copper-aluminum, titanium-niobium-aluminum, iron-manganese-silicon, nickel-titanium, nickel-iron-zinc-aluminum, copper-aluminum-iron, titanium-niobium, etc. In some embodiments, track **70** may be made of nitinol. In such

embodiments, track **70** may be subjected to an excitation signal originating from a signal generator **100**. Signal generator **100** may be located at a proximal end of medical device **10** and electrically and/or thermally coupled to track **70**. Signal generator **100** may be configured to deliver the excitation signal to track **70** thereby enabling track **70** to transform from a first configuration to second configuration by the application of heat or other stimuli. The first configuration may, for example, correspond to a contracted configuration (FIG. **3**A), and the second configuration may, for example, correspond to an expanded configuration (FIG. **3**B). In operation, track **70** may be delivered to the work site through working channel **60** in the first configuration as shown in FIG. **3**A. After extension of track **70** through working channel **60**, signal generator **100** may deliver the excitation signal to track **70** whereby track **70** may transform to the second configuration as shown in FIG. **3**B.

[0049] In an alternative embodiment, as shown in FIG. **4**, track **70** may comprise two or more track portions **70***a* and **70***b*. Track portions **70***a* and **70***b* may extend alongside one another within working channel **60** and may be of any cross-sectional shape. For example, as shown in FIG. **4**, track portions **70***a* and **70***b* may be configured as elongate members of generally rectangular cross-section. Division of track **70** into track portions **70***a* and **70***b* may prevent bunching or tangling of track **70**. Additionally, such a configuration may allow tool **65** to attach more readily to track portions **70***a* and **70***b*. For example, after deployment of track portions **70***a* and **70***b* extending substantially longitudinally, tool **65** may slide onto a distal end of track portion **70***b*, via a clip or other suitable device. First and second track portions **70***a* and **70***b* may biased such that upon connection of tool **65**, the first and second portions **70***a* and **70***b* close, i.e. move towards one another such that a single continuous track is formed.

[0050] In an alternative embodiment, track **70** may include one or more end effectors **110**. As shown in FIG. **5**A, for example, each end effector **110** may include a blade, or any other structure capable of performing a therapeutic procedure. For example, end effectors **110** may include any of a variety of end effectors **220** discussed below. Further, track **70** may be configured to rotate either clockwise or counterclockwise. For example, track **70** may rotate in the direction A as shown in FIG. **5**A. Alternatively, track **70** may rotate in a direction opposite of direction A, or capable of rotating in both directions. As track **70** rotates, one or more therapeutic procedures, such as cutting, may be performed.

[0051] In another exemplary embodiment, as shown in FIGS. **5**B and **5**C, track **70** may be non-rotary. In such a configuration, track **70** may be hollow and configured to receive an inner track **120** therein. Inner track **120** may be made rotatable/slidable within track **70**. For example, track **70** may have a generally u-shaped or c-shaped cross-section and be configured to receive inner track **120**. Track **70** may also include an opening or slot through which end one or more end effectors **110** extends. Inner track may further include one or more end effectors **110** thereon. Upon deployment of track **70** through working channel **60**, inner track **120** with end effectors **110** may be rotated either clockwise or counterclockwise. As such, inner track **120** may rotate in the direction A as shown in FIG. **5**B. Alternatively, inner track **120** may rotate in a direction opposite to the direction A. As inner track **120** rotates, one or more therapeutic procedures, such as cutting, may be performed.

[0052] In an alternative exemplary embodiment, as shown in FIGS. **6**A and **6**B, track **70** may be hollow and configured to receive inner track **120** therein. Inner track **120** may be made moveable into and out of track **70** such that inner track **120** may contact tissue to perform a therapeutic procedure, such as cutting. For example, at least a portion of track **70** may have a generally u-shaped or c-shaped cross-section configured to receive inner track **120**. The remaining portion of track **70** may fully encircle or enclose inner track **120**. For example, a distal portion of track **70** may include the generally u-shaped or c-shaped cross-sectioned portion while the remainder of track **70** may have a circular cross-section. In such an embodiment, the portion of inner track **120** within the distal portion of track **70** may be made moveable into and out of track **70** such that inner track **120** may contact tissue. The remainder of the track **70**, having a circular cross-section, may prevent the portion of the inner track **120** received therein from moving into and out of track **70**. Inner track **120** may be configured to exit track **70** in a direction B upon being tensioned at a proximal end. As such, inner track **120** may perform a therapeutic procedure only a preset distance from track **70**. This may allow for increased control and versatility in performing a therapeutic procedure. For example, an operator may perform a therapeutic procedure on one side of the work site at a time.

[0053] In another embodiment, as shown in FIG. **7**A, track **70** may be electrically coupled to a source **130**. Source **130** may be configured to deliver an electric current signal to track **70**. For example track **70** may coagulate, cauterize, dissect, burn, and/or cut tissue at the work site upon being energized by the electric current signal from source **130**. Alternatively, as shown in FIG. **7**B, track **70** may be configured to deploy an radio-frequency (RF) conducting mesh **140**. Mesh **140** may be configured to receive an RF signal from source **130** and ablate tissue at the work site. Mesh **140** may be in the shape of an oval as shown in FIG. **7**B. Alternatively, mesh **140** may be in any appropriate shape to ablate tissue at the work site, such as, for example, a square, a rectangle, or any irregular shape.

[0054] As shown in FIG. **7**C, track **70** may include a fluid or laser jet device **150**. Jet device **150** may extend from a side portion of track **70** and may include a port **160** configured to direct fluid (e.g., saline or water) or laser energy towards platen **170**. Although shown as extending to the left of a center of track **70**, platen **170** and port **160** are not so limited. Rather, platen **170** and port **160** may extend in any direction from track **70** (e.g., towards and inside or outside of track **70**, or above or below track **70**) so as to achieve a desired therapeutic procedure. In operation, tissue received between port **160** and platen **170** may be treated. For example, jet device **150** can cause laser energy or high pressure fluid from port **160** towards platen **170** to cut tissue received therebetween. In such embodiments, port **160** may be in communication with a source of laser energy or fluid at the proximal end of medical device **10**.

[0055] As shown in FIG. **7**D, track **70** may include one or more needle projections and/or ports **175**. The needle projections and/or ports **175** may disposed along track **70** and may be configured to simultaneously, or individually, inject fluid, such as saline, solution and/or water to the work site. In some embodiments, the fluid injected through projections and/or ports **175** may be pressurized such that track **70** is provided with fluid jet capability. Although projections and/or ports **175** are shown as disposed as facing above track **70**, other orientations are possible. For example, projections and/or

ports **175** may face upwards, downwards, radially inwards, radially outwards, or some combination thereof without departing from the scope of the disclosure. As such, orientation of the projections and/or ports may be selected to perform a desired therapeutic procedure. Additionally, projections and/or ports **175** may be configured to deliver suction, i.e. vacuum, as needed. The application of suction through projections and/or ports **175** may aid to retain track **70** in place while a procedure is performed.

[0056] In another exemplary embodiment, as shown in FIGS. **8**A and **8**B, the distal end of shaft **20** may be associated with a suction cone **190**. Suction cone **190** may extend distally of shaft **20** and have any shape required to achieve a desired therapeutic procedure. For example, as shown in FIGS. **8**A and **8**B, suction cone **190** may have a circular cross-section. Alternatively, the cross-sectional shape of suction cone **190** may be selected to correspond with the dimensions of common polyps and/or tissue lesions. Suction cone **190** may surround the polyp and/or lesion in order to treat a patient. Suction cone **190** may be used to apply suction to the work site. For example, suction cone **190**, in conjunction with aspiration channel **40**, may apply suction via a source of suction such as a pump at a proximal end of medical device **10**.

[0057] As shown in FIG. **8**A, a side wall of suction cone **190** may include a channel **200** and a distal rim of suction cone **190** may include track **70**. That is, track **70** may be positioned along the inner wall and/or a distal end of suction cone **190**. Alternatively, track **70** may be positioned along a portion or a perimeter of any portion of suction cone **190**. As such, track **70** may extend along and between any plane passing through suction cone **190**. Additionally, track **70** may be configured in any shape, including a spiral shape, along an inside wall of suction cone **190**. In such a configuration, tool **65** may be guided through working channel **60** of medical device **10**, along channel **200** in suction cone **190**, to track **70**. Although shown as inside cone **190**, channel **200** may alternatively be provided along an outside wall of suction cone **190**. Use of suction through suction cone **190** may aid in retaining track **70** in place. For example, upon insertion into the body of a patient, suction cone **190** may be placed over the work site. After placement, suction may be applied through aspiration channel **40**. As such, suction cone **190** may be temporarily fixed in place on tissue at the work site. Such an engagement prevents accidental displacement of track during use, thereby improving accuracy of an operator and reducing potential damage to healthy tissue adjacent to the work site.

[0058] As shown in FIGS. **9**A-**9**C, track **70** may include one or more anchoring mechanisms configured to engage tissue and retain track **70** in a particular shape and/or location within the body of the patient. For example, anchoring mechanisms, may include clips **72** (FIG. **8**A), hooks **74** (FIG. **8**B), and/or barbs **76** (FIG. **8**C). Moreover, the anchoring mechanisms may be made retractable. As such, track **70** may be extended through working channel **60** while clips **72**, hooks **74**, and/or barbs **76** are in a retracted positioned. Upon attainment of the desired track **70** shape, clips **72**, hooks **74**, and/or barbs **76** may be actuated, manually or automatically, such that clips **72**, hooks **74**, and/or barbs **76** engage tissue and secure track **70** in place. Additionally, an operator may employ clips **72**, hooks **74**, and/or barbs **76** to mark and/or score the work site. Further, one track **70** has been anchored in a desired position, track **70** may be expanded and/or manipulated to stretch and or make tissue taut such that tissue may be dissected with greater ease and accuracy. Further, the track **70**, including one or more anchoring mechanisms, may be used to retract tissue. That is, track **70** may be positioned such that upon expansion of track **70**, track **70** and the one or more anchoring mechanisms may manipulate tissue so as to retract tissue away from the work site.

[0059] As shown in FIG. **10**, multiple tracks **70** may be deployed through shaft **20**. For example, two tracks **70** may be extended through the same working channel **60**. Alternatively, each track **70** may be extended through separate working channels **60** (not shown). Tracks **70** may be manipulated within a body lumen **180** of a patient so as to create an enlarged space therein. That is, upon deployment of the medical device **10** into body lumen **180**, tracks **70** may be extended through working channel(s) **60** of medical device **10**. After deployment, tracks **70** may be separated, i.e. moved away from one another so as to increase a volume of body lumen **180**. For example, movement of a first track **70** in the direction C and movement of a second track **70** in the direction D may place tension on body lumen **180**. Under such tensions, an inner circumferential wall of body lumen **180** may spread so as to increase in diameter. The tracks may be separated by moving in opposite directions from one another, such as up/down or left/right. Alternatively, tracks **70** may be rotated or tilted away from one another.

[0060] Although generally depicted as arcuate in shape, track **70** may employ any configuration useful for a therapeutic procedure. For example, as shown in FIGS. **11**A and **11**B, track **70** may include any spiraling shape such that a tool **65** may travel around a 360° path.

[0061] As shown in FIG. **12**A, a tool **210** which may be sized and configured for insertion through working channel **60** of shaft **20**. Tool **210** may be used to carry a manipulator for shaping track **70** as shown in FIG. **2**B and described above. Alternatively, tool **210** may include an end effector **220** for performing a therapeutic procedure. Tool **210** may include a connector **230** configured to connect tool **210** to track **70**. Connector **230** may be configured as a cuff having a u-shaped (FIG. **12**B) or c-shaped (FIG. **12**C) cross-section. Connector **230** may extends from tool **210** and surrounds track **70**. Although depicted as being open on the left side of connector **230**, other configurations may be employed. For example, connector **230** may be open to the top, the bottom, or the right side such that tool **210** and end effector **220** may be guided on bottom, top, or inside of track **70**, respectively. Connector **230** may include a sufficiently flexible material and/or a living hinge configured to deflect outwardly upon engagement with track **70**, where the material is also sufficiently rigid so as to retain track **70** therein. That is, as connector **230** is directed into engagement with track **70**, connector **230** may expand so as to receive track **70** therein. Further, upon insertion of track **70** into connector **230**, track **70** may be held within connector **230**. Upon connection of connector **230** to track **70**, an operator may guide, i.e. push or pull, tool **210** along track **70** such that end effector **220** performs a therapeutic procedure at the work site. The angle at which end effector **220** is positioned with respect to track **70** may be a function of how tool **210** is guided. That is, in an embodiment where tool **210** is pushed along track **70**, the angle end effector **220** is disposed with respect to track **70** may be larger. On the other hand, in an embodiment where tool **210** pulled along track **70**, the angle end effector **220** is disposed with respect to track **70** may be smaller.

[0062] Alternative connections between tool **210** and track **70** are possible. For example, tool **210** may be keyed to track **70** or track **70** may be keyed to tool **210**. As shown in FIG. **13**A, a hook-shaped connector **230** may be employed. Alternatively, connector **230** may include a magnet **250** as shown in FIG. **13**B. In such an embodiment, track **70** may be made of a magnetic material such that upon deployment of tool **210** through working channel **60**, magnetic interaction between track **70** and magnet **250** acts to connect tool **210** to track **70**. Further, track **70** may be increased in size so as to create a large surface area for magnetic interaction with magnet **250**.

[0063] Regardless of the configuration of connector **230**, tool **210** may include an articulation joint **240** to facilitate connection. For example, as shown in FIG. **13**A, articulation joint **240** may include a series of rings that aid in bending a distal end of tool **210** in a desired direction, upon actuation by a controller at the proximal end of medical device **10**. Alternatively, articulation joint **240** may include a portion having different material properties, such as increased flexibility.

[0064] Although shown as extending through a separate working channel **60** than track **70** in FIGS. **12**A, **13**A, and **13**B, in an alternate embodiment tool **210** and track **70** may extend through a common working channel **60**. For example, as shown in FIG. **14**, tool **210** and track **70** are deployed through a common working channel **60**. Such an embodiment may ease connection of tool **210** to track **70**. For example, where tool **210** and track **70** are deployed through a common lumen, tool **210** may be connected to track **70** at a proximal end of medical device prior to insertion of either track **70** or tool **210** in common working channel **60**. Alternatively, after insertion of track **70** into common working channel **60**, tool **210** may be connected to a proximal end of track **70** and then subsequently deployed through common working channel **60**. In such a configuration, medical device **10** may further include a ring **260**. Ring **260** may be independent and movable with respect to each of track **70** and tool **210**. Alternatively, ring **260** may be formed integral with either one of track **70** and tool **210**. Ring **260** may be employed to maintain tool **210** in close proximity with track **70**. Further, ring **260** may prevent tangling of track **70** and tool **210** within common working channel **60**. As described above, working channel **60** may include any conceivable geometry. For example, working channel **60** in FIG. **14** may be elliptical or oblong in shape to accommodate track **70** and tool **210**.

[0065] In another embodiment, as shown in FIGS. **15**A and **15**B, tool **210** may include a retractable end effector, such as retractable blade **270**. Retractable blade **270** may move between a first unextended position and a second deployed position. For example, while in the first unextended position, retractable blade **270** may lie substantially flat along and/or within tool **210**. Upon actuation, retractable blade **270** may move towards the second deployed position in which retractable blade **270** moves outward from tool **210**. While in the second deployed position, retractable blade **270** may perform a therapeutic procedure. Retractable blade **270** may be actuated manually through controls and/or a pull wire (not shown) extending through tool **210** and connected to a controller at the proximal end of the medical device **10**.

[0066] In an embodiment including retractable end effector such as retractable blade **270**, connector **230** may be adjustable. That is, connector **230** may be actuated to open and close depending on the position of retractable blade **270**. Connector **230** may be actuated manually through controls and/or a pull wire (not shown) extending through tool **210** and connected at the proximal end of medical device **10**. Alternatively, connector **230** may be actuated automatically upon actuation of retractable blade **270**. For example, connector **230** may be configured to close when retractable blade moves towards or is in the deployed position (FIG. **15**A). As such, connector **230** may clamp around track **70** to secure tool **210** and retractable blade **270** to track **70**. As retractable blade **270** moves toward or is in the unextended position, connector **230** may open such that tool **210** and retractable blade **270** may be disconnected from track **70** (FIG. **15**B).

[0067] In another embodiment, as shown in FIG. **15**C, a proximal end of tool **210** may be connected to source **130**. Source **130**, as described above, may be configured to deliver an electric current signal to tool **210** and/or end effector **220**. End effector **220** may include a probe **280** configured to receive the electric current signal supplied by source **130**. For example, probe **280** may coagulate, cauterize, dissect, burn, and/or cut tissue at the work site upon being energized by the electric current signal from source **130**.

[0068] End effector **220** may include any type of end effector **220** capable of performing a desired therapeutic procedure. For example, end effector **220** may include scissors **290** (FIG. **15**D). Scissors **290** may be of any shape and/or size configured to achieve a desired therapeutic effect. Further, scissors **290** may be bipolar or monopolar. Alternatively, end effector **220** may include any of a variety of blades such as a v-blade **300** (FIG. **15**E), a straight blade **310** (FIG. **15**F), and/or a hooked blade **320** (FIG. **15**G). Blades **300**, **310**, and **320**, similarly to scissors **290**, may be of any shape and/or size configured to achieve a desired therapeutic effect, and may be configured to receive energy for electrocautery or coagulation. Additionally, end effector **220** may include an injection needle **330** (FIG. **15**H). Needle **330** may be in communication with a fluid source to provide, for example, saline, solution, water, and or medicines, located at a proximal end of medical device **10**, and may be configured to inject such fluid as needed to perform a therapeutic procedure.

[0069] Further, end effector **220** may include multiple devices for performing a therapeutic procedure. For example, as shown in FIG. **15**I, end effector **220** may include a combination blade and probe **340**. In such an embodiment, combination blade and probe **340** may be employed such that the probe may separate tissue at the work site and the blade may follow to perform a therapeutic procedure, such as cutting tissue.

[0070] In further embodiments, track **70** may provide power to tool **210**, tool **210** may provide power to the track **70**, and/or the connector **230** may complete a monopolar circuit. Track **70** and tool **210** may comprise opposite charges thus creating a bipolar circuit. Connector **230** may be configured to insulate track **70** and tool **210** from each other.

[0071] Medical device **10** may employ any variety of combinations of embodiments disclosed herein in order to achieve a therapeutic effect. Indeed, any of the embodiments disclosed herein may be used in conjunction with any other. For example, medical device **10** may include a tool **210** connected via connector **230** to a track **70** wherein each of the tool **210** and track **70** may be provided with therapeutic capabilities. By way of example only, track **70** may include tissue effector mechanism(s) **110** (FIGS. **5**A-C), inner track **120** (FIGS. **6**A-B), an electrically energized track (FIGS. **7**A and **7**B), a water and/or laser jet **150** (FIG. **7**D), a plurality of injection ports **175** (FIG. **7**D), and/or combinations thereof. Further, tool **210** may also include a retractable end effector such as

retractable blade **270** (FIGS. **15**A and **15**B), probe **280** (FIG. **15**C), scissors **290** (FIG. **15**D), v-blade **300** (FIG. **15**E), straight blade **310** (FIG. **15**F), hook blade **320** (FIG. **15**G), needle **330** (FIG. **15**H), and/or combinations thereof. As such, any combination of embodiments disclosed herein may be selected to achieve a desired therapeutic effect.

[0072] As will be appreciated by one of ordinary skill in the art, the presently disclosed injection embodiments may have numerous advantages. For example, the disclosed track **70** may define a pre-determined, precise path for a tool **65**, **210** to follow. As such, the path of the tool **65**, **210** may be made increasingly accurate and safe. Further, use of track **70** may reduce the time and skill necessary for a therapeutic procedure as the operator may simply guide the tool **65**, **210** along path **70** rather than independently control tool **65**, **210** to move around or within the work site. Alternatively, track **70** itself may be provided with therapeutic procedure capabilities such that no additional tool **65**, **210** is required. Also, track **70** may have a modifiable shape and/or size in order to meet the needs of a particular patient. As such, track **70** may employ an unlimited number of track designs and shapes and may be adapted to treat any required work site.

[0073] As noted above, any aspect set forth in any embodiment may be used with any other embodiment set forth herein. For example, in any embodiment, multiple tools may follow one track **70**. The tools may interact to perform a procedure. In some embodiments, one tool may grasp and interact and/or apply tension to tissue while another tool may cut or dissect tissue. In embodiments employing multiple tools, some tool may be configured to interact with track **70** while tools may not. Every device and apparatus set forth herein may be used in any suitable medical procedure, may be advanced through any suitable body lumen and body cavity, and may be used for treatment of any suitable body portion. For example, the apparatuses and methods described herein may be used in any natural body lumen or tract, including those accessed orally, vaginally, or rectally.

[0074] The many features and advantages of the present disclosure are apparent from the detailed specification, and thus, it is intended by the appended claims to cover all such features and advantages of the present disclosure which fall within the true spirit and scope of the present disclosure. Further, since numerous modifications and variations will readily occur to those skilled in the art, it is not desired to limit the present disclosure to the exact construction and operation illustrated and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the present disclosure. For example, in any embodiment, track **70** may include a removable sheath (not shown) surrounding track **70**. The sheath may be removed to reveal track **70** and or one or more anchors. Additionally, in embodiments including a plurality of tracks **70**, each track **70** may be configured to cooperate with a separate tool **210**, or may be designed to allow at least one tool **210** to be moved from any one track **70** to another.

What is claimed is:

1. A medical device, comprising:

an end effector configured to perform a procedure; and

a guide having a modifiable shape and adapted for insertion through a lumen of an access tube;

wherein the end effector is selectively attachable to the guide and configured to move along the guide.

2. The medical device of claim **1**, further comprising:

an access tube configured to receive the guide therein.

3. The medical device of claim **1**, wherein the guide includes a channel, the medical device further comprising:

a tool disposed within the channel, wherein the tool is moveable relative to and within the channel and includes the end effector thereon.

4. The medical device of claim **1**, wherein the guide is configured to receive electric energy.

5. The medical device of claim **1**, further comprising:

a plurality of tools, each of the plurality of tools configured to move relative to the guide.

6. The medical device of claim **1**, wherein the guide further includes at least one securing mechanism configured to retain the shape of the guide.

7. The medical device of claim **1**, wherein the guide includes a first guide portion and a second guide portion, the first guide portion and second guide portion having a first unconnected configuration and a second connected configuration.

8. The medical device of claim **1**, wherein the end effector includes at least one of a retractable blade, scissors, a v-blade, a straight blade, a hooked blade, an injection needle, a grasping mechanism, and an energy probe.

9. The medical device of claim **1**, further comprising:

a tool having the end effector thereon, wherein the tool is configured to attach the end effector to the guide.

10. The medical device of claim **9**, wherein the tool includes a connector configured to attach the tool to the guide, the connector including at least one of a channel, a hook, a clamp, and a magnet.

11. The medical device of claim **10**, wherein the connector includes a pair of flexible arms defining the channel, wherein the channel is shaped to receive the guide therein.

12. The medical device of claim **11**, wherein the channel is at least one of a u-shaped channel and a c-shaped channel.

13. A medical device, comprising:

a tool having a distal end effector configured to perform a procedure;

a guide configured to transform from a collapsed configuration to an expanded configuration, wherein the expanded configuration defines a path; and

wherein the tool is configured to be coupled with the guide and move along and relative to at least a portion of the path.

14. The medical device of claim **13**, wherein the tool includes a connector configured to couple the tool to the guide, the connector including at least one of a channel, a hook, a clamp, and a magnet.

15. The medical device of claim **14**, wherein the connector includes a pair of flexible arms defining the channel, wherein the channel is shaped to receive the guide therein.

16. The medical device of claim **15**, wherein the channel is at least one of a u-shaped channel and a c-shaped channel.

17. The medical device of claim **13**, wherein the tool includes at least one of a retractable blade, scissors, a v-blade, a straight blade, a hooked blade, an injection needle, a grasping mechanism, and an energy probe.

18. The medical device of claim **13**, further comprising:

an access tube configured to receive the guide therein.

19. The medical device of claim **13**, wherein the guide is configured to receive electric energy.

20. The medical device of claim **13**, further comprising:

at least one second tool having a distal end effector configured to perform a procedure.

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