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(54) **SHAFTS OF MEDICAL DEVICES AND RELATED DEVICES, SYSTEMS, AND METHODS**

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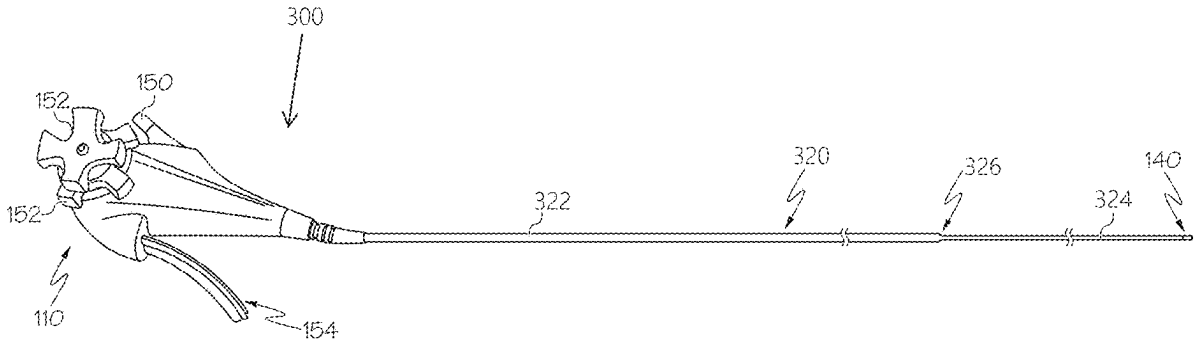
(57) **ABSTRACT**

A medical device may comprise a handle and a shaft extending distally from the handle. The shaft may include a proximal portion configured to remain external to a body lumen of a subject and a distal portion configured to be inserted into the body lumen of the subject. The proximal portion of the shaft may have a greater stiffness than the distal portion of the shaft.



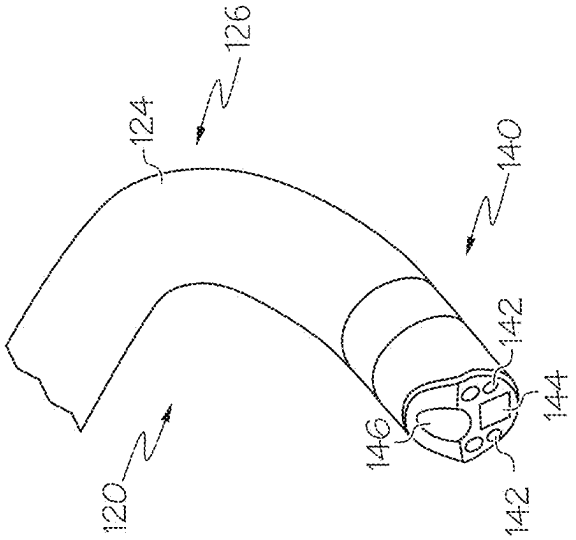


FIG. 1B

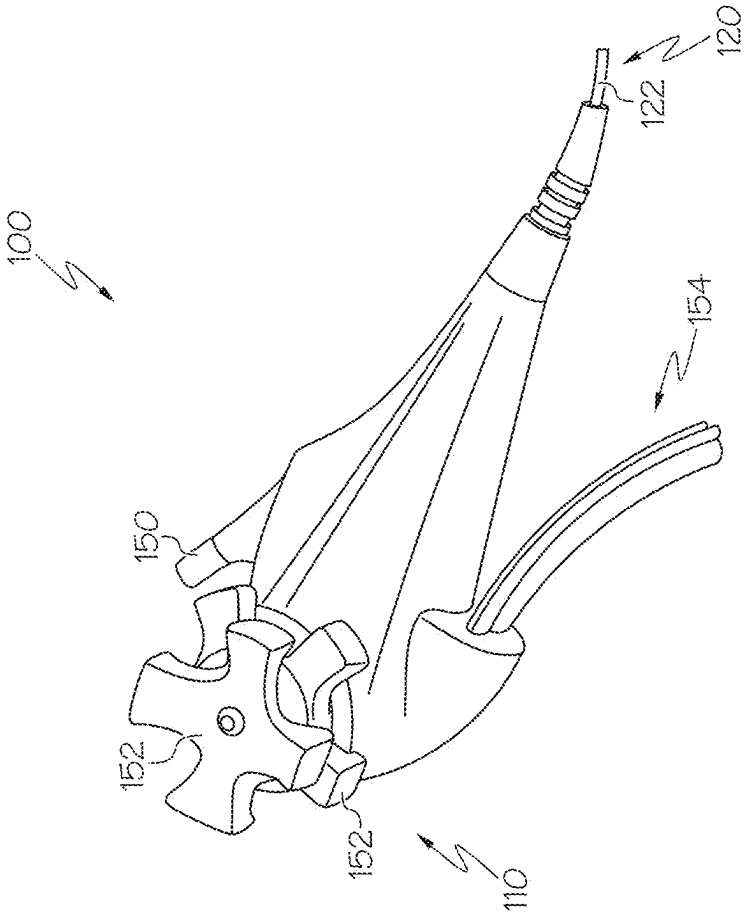


FIG. 1A

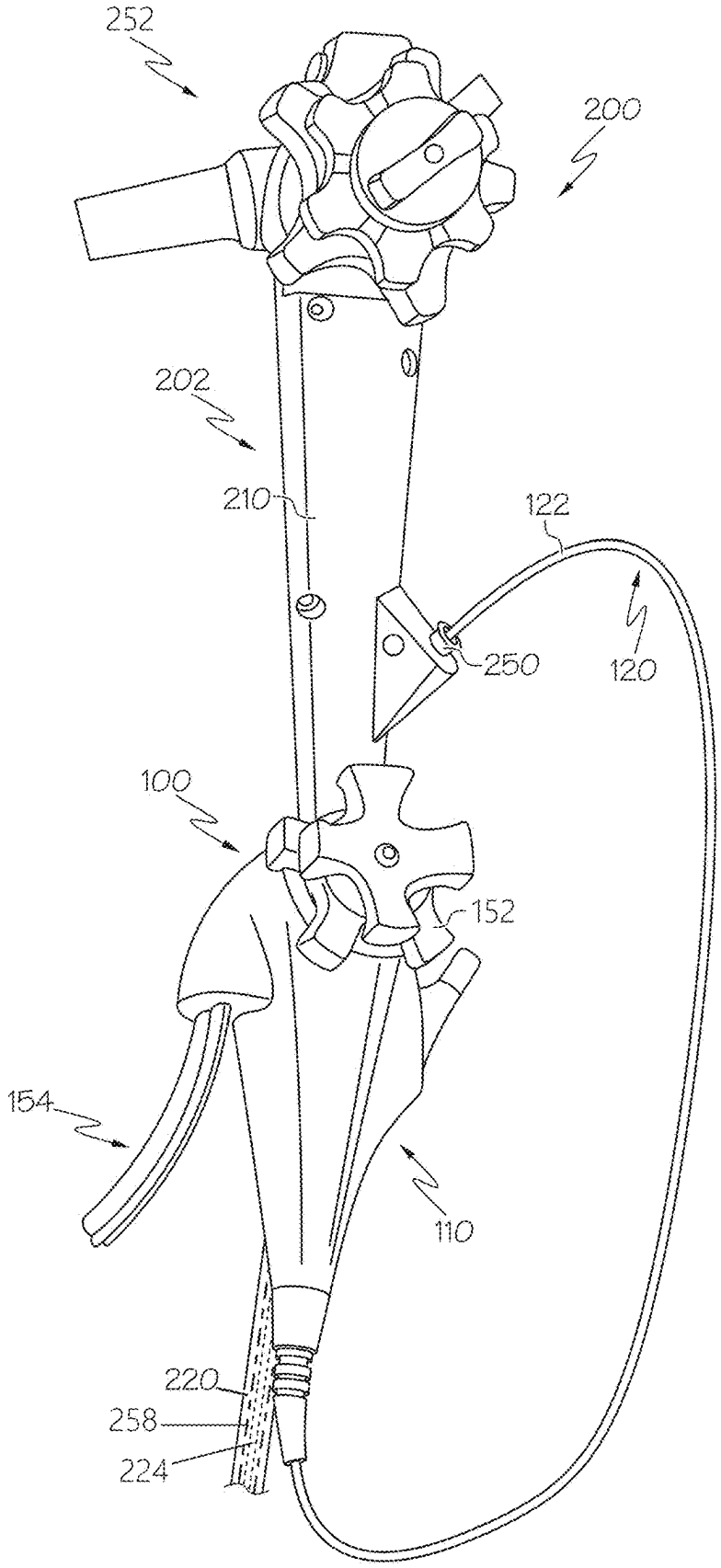


FIG. 2

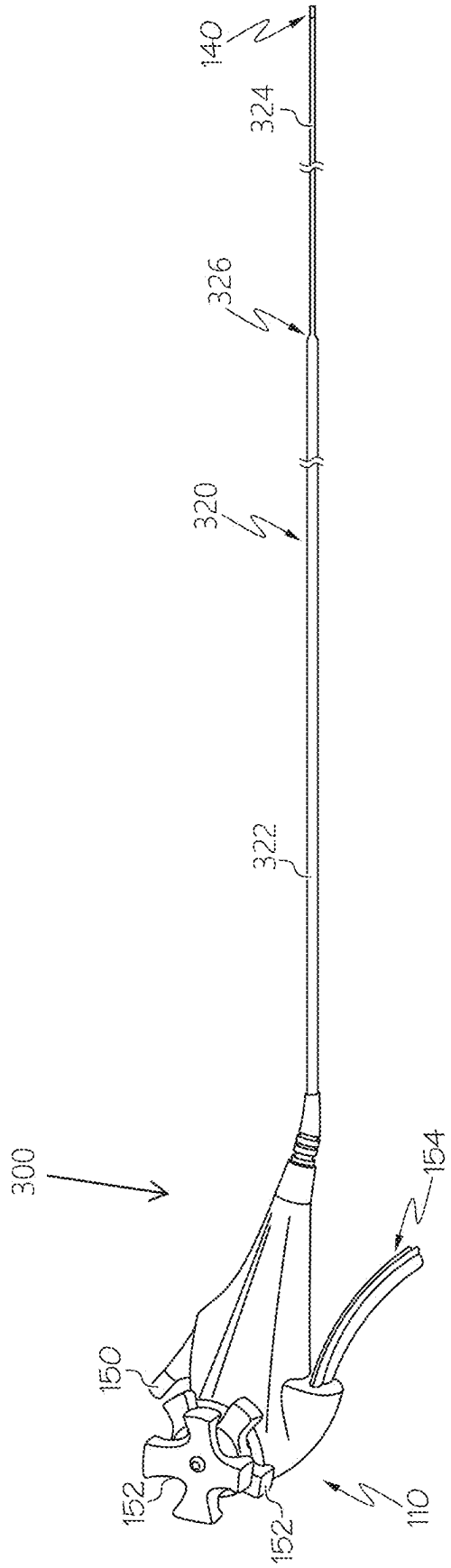


FIG. 3A

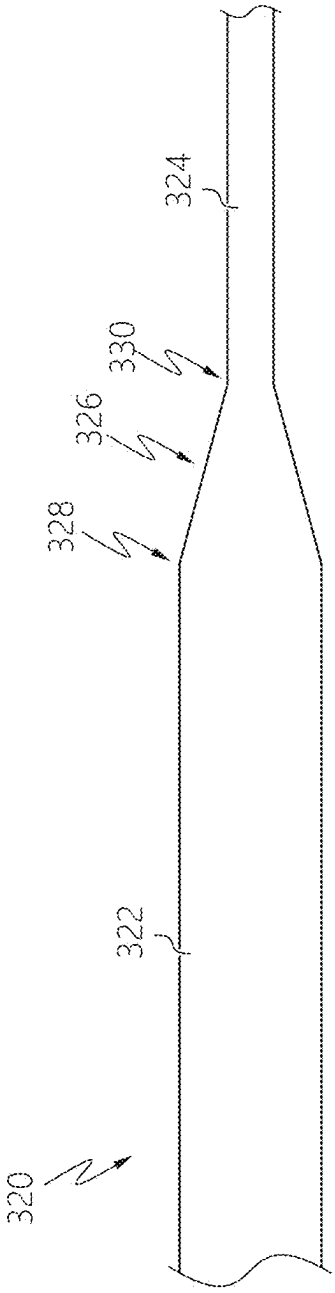


FIG. 3B

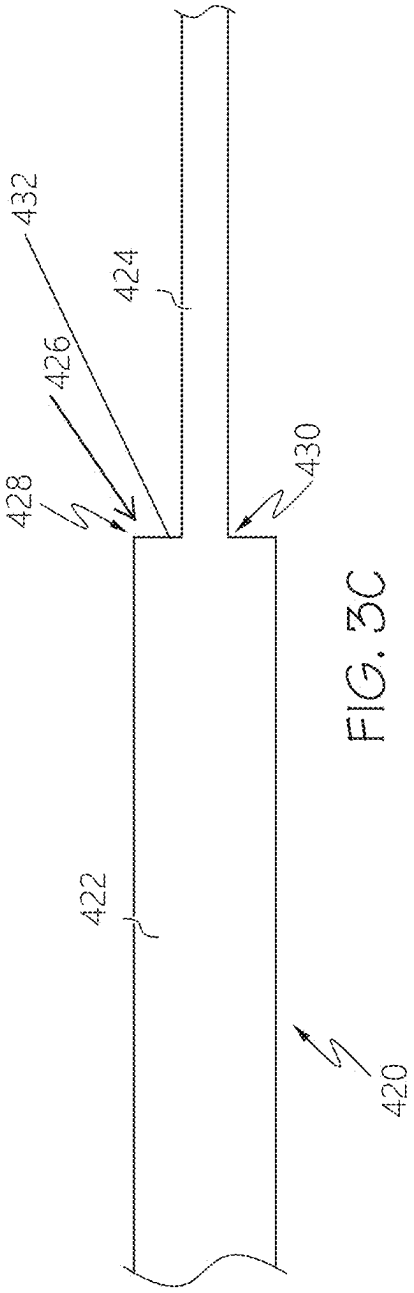


FIG. 3C

SHAFTS OF MEDICAL DEVICES AND RELATED DEVICES, SYSTEMS, AND METHODS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of priority to U.S. Provisional Application No. 63/555,612, filed on Feb. 20, 2024, which is incorporated by reference herein in its entirety.

TECHNICAL FIELD

[0002] Various aspects of this disclosure relate generally to shafts of medical devices, and related devices, systems, and methods. In particular, aspects of the disclosure relate to shafts of medical devices having variable properties along lengths of the shafts, among other aspects.

BACKGROUND

[0003] During an endoscopic procedure, an operator may insert a medical device into a working channel of a medical scope device, such as an endoscope or duodenoscope. The medical device inserted into the working channel may be a medical instrument or another medical scope device (e.g., a cholangioscope or another type of daughter scope). The medical device inserted into the working channel may have a shaft. A first portion of the shaft may extend through the working channel of the endoscopic scope. A second portion of the shaft may be proximal of a port of the working channel and outside of the working channel.

SUMMARY

[0004] Each of the aspects disclosed herein may include one or more of the features described in connection with any of the other disclosed aspects. Aspects of the disclosure may relate to shafts of medical devices.

[0005] In an example, a medical device may comprise a handle and a shaft extending distally from the handle. The shaft may include a proximal portion configured to remain external to a body lumen of a subject and a distal portion configured to be inserted into a body lumen of the subject. The proximal portion of the shaft may have a greater stiffness than the distal portion of the shaft.

[0006] Any of the aspects disclosed herein may have any of the following features, alone or in any combination. The proximal portion of the shaft may have a greater outer diameter than the distal portion of the shaft. The proximal portion of the shaft may have a length of approximately 25 cm to approximately 50. cm. The proximal portion of the shaft may include one or more of a reflowed or extruded outer jacket, a metal or plastic braid, a metal or plastic coil, or a laser cut plastic or metal tubing. The distal portion of the shaft may include one or more of etched polytetrafluoroethylene, a metal or plastic braid, a reflowed or extruded jacket, or a stiffener. The medical device may include a cholangioscope. The shaft may include a tapered transition between the proximal portion of the shaft and the distal portion of the shaft.

[0007] A medical system may include the medical device. The medical system may further comprise a medical scope having a working channel. The distal portion of the shaft may be configured to be inserted into the working channel. The proximal portion of the shaft may be configured to remain external to the working channel. Any of the medical systems or devices disclosed herein may have any of the features below, alone or in any combination or subcombination. The proximal portion of the shaft may have a greater diameter than the working channel of the medical scope. The proximal portion of the shaft may have a diameter greater than approximately 4.2 mm. In a configuration in which the distal portion of the shaft is inserted into the working channel, the proximal portion of the shaft may have a loop shape. In a configuration in which the proximal portion has a loop shape, the greater stiffness of the proximal portion of the shaft may inhibit buckling of the proximal portion upon actuation of an actuator of the handle of the medical device. The actuation of the actuator may cause a steerable portion of the distal portion of the shaft to articulate. The greater stiffness of the proximal portion of the shaft may increase an articulation performance of the steerable portion. In a configuration in which the distal portion of the shaft is inserted into the working channel, a transition between the proximal portion and the distal portion may be proximal of a port of the working channel.

[0008] In another example, a medical device may comprise a handle; and a shaft extending distally from the handle. The shaft may include a proximal portion configured to remain external to a body lumen of a subject; and a distal portion configured to be inserted into a body lumen of the subject. The proximal portion of the shaft may have a greater outer diameter than the distal portion.

[0009] A medical system may include the medical device. The medical system may further comprise a medical scope having a working channel. The distal portion of the shaft may be configured to be inserted into the working channel. The proximal portion of the shaft may be configured to remain external to the working channel. The proximal portion of the shaft may have a greater diameter than the working channel of the medical scope. Any of the medical systems or devices disclosed herein may include any of the following features, alone or in any combination or subcombination. In a configuration in which the distal portion of the shaft is inserted into the working channel, the proximal portion of the shaft may have a loop shape.

[0010] In a further aspect, a medical system may comprise a first medical device, which may include a first shaft having a proximal portion configured to remain external to a body lumen of a subject; and a distal portion configured to be inserted into a body lumen of the subject. The medical system may further comprise a second medical device including a second shaft having a working channel. The distal portion of the first shaft may be configured to be inserted into the working channel. The proximal portion of the first shaft may have a greater diameter than a diameter of the working channel.

[0011] Any of the medical systems or devices disclosed herein may have any of the following features, alone or in any combination or subcombination. The first medical device may be a cholangioscope.

BRIEF DESCRIPTION OF THE DRAWINGS

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

[0013] FIGS. **1**A and **1**B depict proximal and distal portions, respectively, of an exemplary first medical device.

[0014] FIG. **2** depicts a medical system including the first medical device of FIGS. **1**A and **1**B and a second medical device.

[0015] FIG. **3**A depicts another exemplary medical device.

[0016] FIGS. **3**B and **3**C depict aspects of a shaft of the medical device of FIG. **3**A.

DETAILED DESCRIPTION

[0017] It may 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. As used herein, the terms "comprises," "comprising," "has," "having," "includes," "including," or any other variation thereof, are intended to cover a non-exclusive inclusion, such that a process, method, article, or apparatus that comprises a list of elements does not include only those elements, but may include other elements not expressly listed or inherent to such process, method, article, or apparatus. The term "diameter" may refer to a width where an element is not circular. The term "distal" refers to a direction away from an operator, and the term "proximal" refers to a direction toward an operator. The term "exemplary" is used in the sense of "example," rather than "ideal." The term "approximately," or like terms (e.g., "substantially"), includes values+/−10% of a stated value. Unless otherwise stated, ranges disclosed herein include the end points of the ranges. The use of ordinals (e.g., first, second, third, fourth) herein is for convenient reference to different examples and does not imply any ordered or other type of relationship among identified elements. The ordinal applied to a given element is arbitrary, and any alternative ordinal may be used with the element. A period after a zero in a number indicates that the zero is significant for purposes of determining significant figures.

[0018] A first medical device, such as a cholangioscope (or other type of daughter scope) or an accessory instrument, may be inserted into a working channel of a second medical device, such as a duodenoscope or other type of scope. A distal portion of the shaft of the first medical device may extend through the working channel of the second medical device. A proximal portion of the shaft of the first medical device may be proximal (or otherwise outside) of a working channel port of the second medical device. Thus, the proximal portion of the shaft may be outside of the working channel. Thus, the proximal portion of the shaft may be external to a body lumen of a subject, whereas the distal portion of the shaft may be inserted into the body lumen of the subject. The proximal portion of the shaft may be looped to form a working loop.

[0019] In conventional devices, the proximal portion of the shaft may be so flexible as to be prone to buckling. This buckling may be detrimental to performance of the first medical device. For example, in aspects in which the first medical device is a cholangioscope or other type of daughter scope, buckling of the proximal portion of the shaft may be detrimental to articulation of the distal portion of the shaft of the first medical device. In other examples, buckling may be detrimental to actuation of other types of control wires (e.g., wires controlling end effectors). Actuation of the first medical device may compress the working loop, rather than deflecting a distal tip of the shaft of the first medical device or otherwise controlling a shaft or distal tip of the first medical device.

[0020] The disclosed aspects include a medical device with a shaft that has a reinforced proximal portion, which may improve performance (e.g., articulation performance or other actuation performance) of the medical device. The reinforced proximal portion may be stiffer than a distal portion of the shaft. In some examples, the proximal portion of the shaft (which may form a working loop) may have a diameter that is larger than a diameter of a distal portion of the shaft and/or a working channel into which the distal portion of the shaft is to be inserted.

[0021] FIGS. **1**A and **1**B depict proximal and distal portions, respectively, of a first medical device **100**. In some examples, first medical device **100** may be a cholangioscope. However, although cholangioscopes are referenced herein, it will be appreciated that first medical device **100** may be another type of daughter scope, an endoscope, a ureteroscope, a duodenoscope, a gastroscope, an endoscopic ultrasonography ("EUS") scope, a colonoscope, a bronchoscope, a laparoscope, an arthroscope, a cystoscope, an aspiration scope, a sheath, a catheter, a tome, or any type of accessory instrument having a shaft (e.g., a needle, a snare, a basket, a stent, a knife, a stapler, etc.).

[0022] First medical device **100** may include a handle **110** and a shaft **120**. Shaft **120** may have a distal tip **140** coupled to a distal end of shaft **120**. Shaft **120** may include a proximal portion **122** (FIG. **1**A) and a distal portion **124** (FIG. **1**B). Distal portion **124** of shaft **120** and distal tip **140** may be configured to be inserted into a body lumen of a subject. For example, distal portion **124** of shaft **120** and distal tip **140** may be inserted into a working channel of a second medical device (e.g., second medical device **202**, shown in FIG. **2** and described below). As described in further detail below, proximal portion **122** may remain outside of/external to the body lumen of the subject and the working channel of the second medical device. Distal portion **124** may include a steerable section **126**, which may include an articulation joint or other structure (e.g., a multilumen extruded shaft or other bendable shaft) that is configured to deflect or otherwise articulate in order to steer steerable section **126** and distal tip **140**.

[0023] Distal tip **140** may include one or more lighting elements **142**, one or more imaging devices **144**, and a distal opening **146** of a working channel of first medical device **100**. One or more lighting elements **142**, one or more imaging devices **144**, and distal opening **146** may have any suitable arrangement. Alternatively or additionally, distal tip **140** may include one or more end effectors (e.g., graspers, snares, staplers, clips, stents, forceps, suturing devices, baskets, etc.) for performing a medical procedure at a treatment site.

[0024] Handle **110** may include a port **150**, which may provide access to the working channel of first medical device **100**. An accessory instrument may be inserted into port **150**, advanced through the working channel, and out of distal opening **146** of distal tip **140**. Handle **110** may also include one or more actuators **152** for controlling aspects of shaft **120** and/or distal tip **140**. For example, one or more actuators **152** may include one or more steering knobs (or levers, sliders, etc.) for controlling articulation of steerable section **126**. For example, one or more cables and/or wires may extend from one or more actuators **152** to steerable section **126**. Tensioning or de-tensioning of the cables and/or wires may cause steerable section **126** to deflect in one or more of an up/down or left/right direction. In alternatives,

actuator(s) **152** may be used to control an end effector of distal tip **140** using one or more control wires or cables. Actuator(s) **152** may additionally or alternatively control electronic elements of distal tip **140** or deliver air, suction, and/or water.

[0025] An umbilicus **154** may extend from handle **110**. Umbilicus **154** may include one or more cables, tubes, or other conduits for conveying electrical signals, air, water, and/or suction to or from handle **110**, shaft **120**, and distal tip **140**. Umbilicus **154** may include one or more proximal connectors (not shown) for connecting to capital equipment, which may supply electrical controls, air, water, and/or suction.

[0026] FIG. **2** depicts a medical system **200**, including first medical device **100** and a second medical device **202**. Second medical device **202** may be, for example, a duodenoscope or other type of medical scope. Although a duodenoscope is referenced herein, it will be appreciated that second medical device **202** may be any medical device having a working channel extending from a proximal end to a distal end, such as a ureteroscope, an endoscope, a gastroscope, an endoscopic ultrasonography ("EUS") scope, a colonoscope, a bronchoscope, a laparoscope, an arthroscope, a cystoscope, an aspiration scope, a sheath, or a catheter.

[0027] Second medical device **202** may include a handle **210** and a shaft **220**. Although not shown in FIG. **2**, a distal tip having any of the features of distal tip **140** may be at a distal end of shaft **220**. Shaft **220** may be insertable into a body lumen of a subject in order to perform a procedure at a target site in the body lumen or other portion of the body.

[0028] Handle **210** may include a port **250**. Port **250** may provide access to a working channel **258** of second medical device **202**, including shaft **220**. A medical device (e.g., first medical device **100**) may be configured to be inserted into port **250**, advanced through working channel **258** of shaft **220**, and extended distally from the distal tip of second medical device **202**. Working channel **258** is shown in dotted-lines within shaft **220** to illustrate working channel **258** extending through an interior portion of shaft **220**. Handle **210** may also include one or more actuators **252** for controlling aspects of shaft **220** and/or a distal tip of second medical device **202**. For example, actuators **252** may include one or more knobs, levers, sliders, joysticks, buttons, or the like for articulating a distal portion of shaft **220**. One or more actuators **252** further include levers, knobs, buttons, sliders, buttons, or the like for locking the distal portion of shaft **220** from articulating. One or more actuators **252** may also include one or more actuators for capturing images from an imaging device of a distal tip of second medical device **202**, for delivering air, water, and/or suction to a distal tip of second medical device **202**.

[0029] As shown in FIG. **2**, handle **110** of first medical device **100** may be coupled to handle **210** of second medical device **202**. For example, a strap, clamp, or the like may couple handle **110** of first medical device **100** to handle **210** of second medical device **202**. Distal tip **140** may be inserted into port **250**, and distal portion **124** of shaft **120** may be advanced through shaft **220** until distal tip **140** extends from a distal tip of second medical device **202**. Because shaft **220** may be inserted into a body lumen of a subject, distal portion **124** of shaft **120** may also be inserted into the body lumen of the subject. In examples, a total length of shaft **120** may be approximately 200. cm long, and distal portion **124** may be approximately 150. cm to approximately 175 cm long.

[0030] As shown in FIG. **2**, in a configuration in which distal portion **124** has been inserted into working channel **258** of second medical device **202**, proximal portion **122** of shaft **120** of first medical device **100** may remain proximal of and outside of port **250** and outside of working channel **258** of second medical device **202**. Thus, proximal portion **122** may remain external to a body (and a body lumen) of a subject. Proximal portion **122** may form a loop shape (e.g., a working loop). Handle **110** may be coupled to handle **210** distally of port **250**, such that proximal portion **122** loops proximally before entering port **250**. For example, proximal portion **122** may extend distally from a distal end of handle **110** and may then be looped back in a proximal direction toward port **250**, before then extending distally into port **250**. In examples, a length of proximal portion **122** may be approximately 25 cm to approximately 50. cm.

[0031] Distal portion **124** may be supported by working channel **258**, which may constrain distal portion **124**. Such constraints of working channel **258** on distal portion **124** may improve a transmission of articulation controls from one or more actuators **152** to steerable section **126**. In other words, support of working channel **258** on distal portion **124** may help the steering wires and/or cables extending from one or more actuators **152** to steerable section **126** to appropriate shorten or lengthen (move proximally or distally relative to distal portion **124**) within distal portion **124**, so that steering control is transmitted to steerable section **126**.

[0032] In contrast, conventional proximal portions of shaft **120** are outside of and are not supported by working channel **258**. Upon actuation of one or more actuators **152**, the proximal, looped portion may buckle or bend due to action (e.g., movement or tensioning/detensioning) of the steering wires/cables. This buckling of conventional proximal portions may inhibit the steering wires or cables from transmitting tension to steerable section **126** in order to deflect steerable section **126**. In other words, actuation of one or more actuators **152** may cause compression of conventional proximal portions (working loops), rather than deflection of steerable section **126**.

[0033] To address these issues with conventional scopes, proximal portion **122** and distal portion **124** of shaft **120** may have different properties from one another. For example, proximal portion **122** may be stiffer than distal portion **124**. For example, proximal portion **122** may be reinforced with respect to distal portion **124**. An increased stiffness of proximal portion **122** as compared with distal portion **124** may help to transmit steering/articulation forces from handle **110** to distal tip **140**. For example, an increased stiffness of proximal portion **122** may help to inhibit it from buckling or compressing.

[0034] FIGS. **3**A-**3**B show an alternative exemplary first medical device **300** that may have reinforcement to prevent or inhibit buckling of a working loop of first medical device **300**. Unless otherwise specified herein, first medical device **300** may have any of the properties of first medical device **100**. First medical device **300** may have a shaft **320**, having any of the properties of shaft **120**, unless otherwise specified herein. Shaft **320** may have a proximal portion **322** (having any of the properties of proximal portion **122**) and a distal portion **324** (having any of the properties of distal portion **124**). Proximal portion **322** may be configured to remain external to working channel **258** of second medical device

202 and external to a body lumen of a subject. Distal portion 324 may be configured to be inserted into and extend through working channel 258 and, thus, be inserted into a body lumen of a subject.

[0035] Distal portion 324 may have an outer diameter such that distal portion 324 may be inserted into port 250 and extended through working channel 258 of shaft 220. In other words, an outer diameter of distal portion 324 may be smaller than an inner diameter of working channel 258. For example, working channel 258 may have an inner diameter of approximately 3.0 mm to approximately 5.0 mm, approximately 3.8 mm to approximately 4.4 mm, approximately 4.2 mm, or any other suitable diameter. Distal portion 324 may have an outer diameter of approximately 3.0 mm to approximately 4.2 mm, approximately 3.2 mm to approximately 4.0 mm, approximately 3.6 mm, or any other suitable diameter.

[0036] In contrast, proximal portion 322 may have an outer diameter that is larger than an outer diameter of distal portion 324 and/or larger than an inner diameter of working channel 258 because proximal portion 322 may not be insertable into working channel 258. For example, proximal portion 322 may have an outer diameter that is greater than approximately 3.6 mm (which may correspond to an outer diameter of distal portion 124) or greater than approximately 4.2 mm (which may correspond to an inner diameter of working channel 256). Proximal portion 322 may be reinforced to stiffen all or a portion of proximal portion 322 as compared to distal portion 324.

[0037] Distal portion 324 of shaft 320 may include, for example, layers of etched polytetrafluoroethylene (PTFE), braid (e.g., braided metal or plastic), and a jacket (e.g., a reflowed or extruded jacket). Additionally or alternatively, distal portion 324 may include layers of PTFE and a stiffener. By contrast, proximal portion 322 of shaft 320 may include a composite shaft with one or more of a reflowed or extruded outer jacket, a metal or plastic braid, a metal or plastic coil, and/or a laser cut plastic or metal tubing. For example, proximal portion 322 may include fluorinated ethylene propylene (FEP), such as an FEP heat-shrink. Proximal portion 322 may include additional or thicker layers of material, as compared with distal portion 324. As compared with distal portion 324, proximal portion 322 may be stiffer and may have a larger outer diameter.

[0038] In some examples, inner layers/materials of proximal portion 322 may be the same as the layers/materials of distal portion 324. Proximal portion 322 may have additional outer layers (such as the layers discussed above) added as outer layers of proximal portion 322. In other words, layers of distal portion 324 may extend proximally into proximal portion 322, and proximal portion 322 may further have additional outer layers added on an outer surface of proximal portion 322. Alternatively, some or all of the materials/layers of distal portion 324 may be omitted from proximal portion 322, and proximal portion 322 may have different materials and/or layers from distal portion 324.

[0039] Shaft 320, with distal portion 324 and proximal portion 322 having different properties, may offer advantages as compared to a shaft with uniform properties, such as a shaft that increases a stiffness of the entire shaft in order to create a stiffer working loop. For example, stiffening an entire length of a shaft may make it more difficult to advance a distal portion of the shaft along working channel 258 of second medical device 202 or to deflect the distal portion of the shaft with an elevator at the distal tip of second medical device 202.

[0040] As shown in FIGS. 3A and 3B, a transition 326 between proximal portion 322 and distal portion 324 may be tapered. Transition 326 may taper inward in a distal direction, from a widest portion 328 of transition 326 to a narrowest portion 330 of transition 326. Widest portion 328 of transition 326 may be proximal of narrowest portion 330 of transition 326. Widest portion 328 of transition 326 may have a same width/diameter as proximal portion 322 of shaft 320. Narrowest portion 330 of transition 326 may have a same width/diameter as distal portion 324 of shaft 320. In examples, an outer surface of shaft 320 may be molded, re-flowed, extruded, or otherwise formed to create transition 326. In addition or alternatively, additional layers may progressively be added to distal portion 324 moving in a proximal direction, to create a tapered shape of transition 326. Tapered transition 326 may have any suitable angle or shape. When device 300 is inserted into second medical device 202, transition 326 may be proximal of port 250.

[0041] FIG. 3C shows a portion of an alternative shaft 420 that may be used in place of shaft 320 with device 300. Shaft 420 may have any of the properties of shafts 120, 320, unless otherwise specified. Whereas transition 326 may be tapered, a transition 426 of shaft 420 may be a sharp or discrete transition. A widest portion 428 of transition 426 may have a same diameter/width as a proximal portion 422 of shaft 420. A narrowest portion 430 of transition 426 may have a same diameter/width as distal portion 424 of shaft 420. For example, a widest portion 428 of transition 426 may be axially aligned with a narrowest portion 430 of transition 426. Thus, transition 426 may extend perpendicularly to a central longitudinal axis of shaft 420. Transition 426 may form a shelf shape, and may include a distal facing surface 432 extending around a distalmost end of distal portion 424.

[0042] In one example, distal portion 424 and proximal portion 422 may have different compositions and may be coupled together at transition 426. Alternatively, a core of proximal portion 422 may have the same layers as distal portion 424, and additional layers may be added to proximal portion 422 in order to create a larger thickness and greater stiffness of proximal portion 422.

[0043] While principles of this disclosure are described herein with reference to illustrative examples for particular applications, it should be understood that the disclosure is not limited thereto. Those having ordinary skill in the art and access to the teachings provided herein will recognize additional modifications, applications, and substitution of equivalents all fall within the scope of the examples described herein. Additionally, a variety of elements from each of these embodiments can be combined to achieve a same or similar result as one or more of the disclosed embodiments. Accordingly, the invention is not to be considered as limited by the foregoing description.

We claim:

1. A medical device comprising:

a handle; and

a shaft extending distally from the handle, wherein the shaft includes:

a proximal portion configured to remain external to a body lumen of a subject; and

a distal portion configured to be inserted into the body lumen of the subject;

wherein the proximal portion of the shaft has a greater stiffness than the distal portion of the shaft.

2. The medical device of claim **1**, wherein the proximal portion of the shaft has a greater outer diameter than the distal portion of the shaft.

3. The medical device of claim **1**, wherein the proximal portion of the shaft has a length of approximately 25 cm to approximately 50. cm.

4. The medical device of claim **1**, wherein the proximal portion of the shaft includes one or more of a reflowed or extruded outer jacket, a metal or plastic braid, a metal or plastic coil, or a laser cut plastic or metal tubing.

5. The medical device of claim **4**, wherein the distal portion of the shaft includes one or more of etched polytetrafluoroethylene, a metal or plastic braid, a reflowed or extruded jacket, or a stiffener.

6. The medical device of claim **1**, wherein the medical device includes a cholangioscope.

7. The medical device of claim **1**, wherein the shaft includes a tapered transition between the proximal portion of the shaft and the distal portion of the shaft.

8. A medical system including the medical device of claim **1**, the medical system further comprising a medical scope having a working channel, wherein the distal portion of the shaft is configured to be inserted into the working channel, and wherein the proximal portion of the shaft is configured to remain external to the working channel.

9. The medical system of claim **8**, wherein the proximal portion of the shaft has a greater diameter than the working channel of the medical scope.

10. The medical system of claim **8**, wherein the proximal portion of the shaft has a diameter greater than approximately 4.2 mm.

11. The medical system of claim **8**, wherein, in a configuration in which the distal portion of the shaft is inserted into the working channel, the proximal portion of the shaft has a loop shape.

12. The medical system of claim **11**, wherein, in a configuration in which the proximal portion has a loop shape, the greater stiffness of the proximal portion of the shaft inhibits buckling of the proximal portion upon actuation of an actuator of the handle of the medical device.

13. The medical system of claim **12**, wherein the actuation of the actuator causes a steerable portion of the distal portion of the shaft to articulate.

14. The medical system of claim **13**, wherein the greater stiffness of the proximal portion of the shaft increases an articulation performance of the steerable portion.

15. The medical system of claim **8**, wherein, in a configuration in which the distal portion of the shaft is inserted into the working channel, a transition between the proximal portion and the distal portion is proximal of a port of the working channel.

16. A medical device comprising:

a handle; and

a shaft extending distally from the handle, wherein the shaft includes:

a proximal portion configured to remain external to a body lumen of a subject; and

a distal portion configured to be inserted into the body lumen of the subject;

wherein the proximal portion of the shaft has a greater outer diameter than the distal portion.

17. A medical system including the medical device of claim **16**, the medical system further comprising a medical scope having a working channel, wherein the distal portion of the shaft is configured to be inserted into the working channel, wherein the proximal portion of the shaft is configured to remain external to the working channel, and wherein the proximal portion of the shaft has a greater diameter than the working channel of the medical scope.

18. The medical system of claim **17**, wherein, in a configuration in which the distal portion of the shaft is inserted into the working channel, the proximal portion of the shaft has a loop shape.

19. A medical system comprising:

a first medical device including:

a first shaft including:

a proximal portion configured to remain external to a body lumen of a subject; and

a distal portion configured to be inserted into the body lumen of the subject; and

a second medical device including a second shaft having a working channel;

wherein the distal portion of the first shaft is configured to be inserted into the working channel, and wherein the proximal portion of the first shaft has a greater diameter than a diameter of the working channel.

20. The medical system of claim **19**, wherein the first medical device is a cholangioscope.

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