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TISSUE RESECTING INSTRUMENT INCLUDING A ROTATION LOCK FEATURE

Abstract

A tissue resecting instrument includes an end effector assembly having a proximal hub housing, a retainer cap extending proximally therefrom, an elongated outer shaft extending distally from the proximal hub housing, an inner cutting shaft rotatably disposed within the elongated outer shaft, and an inner core drive assembly that includes a proximal driver and a distal driver. The distal driver is coupled to the inner cutting shaft such that rotation of the distal driver rotates the inner cutting shaft relative to the elongated outer shaft. The proximal driver is slidable relative to the distal drive between a more-proximal position wherein the proximal driver is engaged with the retainer cap to rotationally fix the proximal driver, thereby rotationally locking the inner cutting shaft, and a more-distal position wherein the proximal driver is disengaged from the retainer cap permitting rotation thereof thereby permitting rotation of the inner cutting shaft.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] This application is a continuation of U.S. patent application Ser. No. 16/359,484, filed on Mar. 20, 2019, now U.S. Pat. No. 10,945,752, the entire contents of which are hereby incorporated herein by reference.

BACKGROUND
1. Technical Field
[0002] The present disclosure relates generally to the field of tissue resection. In particular, the present disclosure relates to a tissue resecting instrument including a rotation lock feature.
2. Background of Related Art
[0003] Tissue resection may be performed endoscopically within an organ, such as a uterus, by inserting an endoscope (or hysteroscope) into the uterus and passing a tissue resection instrument through the endoscope (or hysteroscope) and into the uterus. With respect to such endoscopic tissue resection procedures, it often is desirable to distend the uterus with a fluid, for example, saline, sorbitol, or glycine. The inflow and outflow of the fluid during the procedure maintains the uterus in a distended state and flushes tissue and other debris from within the uterus to maintain a visible working space.
SUMMARY
[0004] As used herein, the term “distal” refers to the portion that is described which is further from a user, while the term “proximal” refers to the portion that is described which is closer to a user. Further, to the extent consistent, any or all of the aspects described herein may be used in conjunction with any or all of the other aspects described herein.
[0005] Provided in accordance with aspects of the present disclosure is an end effector assembly of a tissue resecting instrument. The end effector assembly includes a proximal hub housing, a retainer cap fixed relative to and extending proximally from the proximal hub housing, an elongated outer shaft fixed relative to and extending distally from the proximal hub housing, an inner cutting shaft extending within and rotatable relative to the elongated outer shaft, and an inner core drive assembly extending at least partially through the retainer cap and the proximal hub housing. The inner core drive assembly includes a proximal driver configured to receive a rotational input and a distal driver rotationally fixed and slidable relative to the proximal driver. The distal driver is coupled to the inner cutting shaft such that rotation of the distal driver rotates the inner cutting shaft relative to the elongated outer shaft. The proximal driver is slidable relative to the distal drive between a more-proximal position wherein the proximal driver is engaged with the retainer cap to rotationally fix the proximal driver relative to the retainer cap, thereby rotationally locking the inner cutting shaft relative to the elongated outer shaft, and a more-distal position wherein the proximal driver is disengaged from the retainer cap to permit rotation of the proximal driver relative to the retainer cap, thereby permitting rotation of the inner cutting shaft relative to the elongated outer shaft.
[0006] In an aspect of the present disclosure, the inner core drive assembly further includes a

biasing member configured to bias the proximal driver towards the more-proximal position.

[0007] In another aspect of the present disclosure, the proximal driver includes a proximally-facing cavity configured to receive and rotationally engage a driver rotor configured to provide the rotational input.

[0008] In still another aspect of the present disclosure, the proximal driver and the distal driver cooperate to define an outflow path disposed in fluid communication with an interior of the inner cutting shaft. Further, the proximal hub housing may define an outflow opening in fluid communication with the outflow path.

[0009] In yet another aspect of the present disclosure, in the more-proximal position, a tab of the proximal driver is engaged within a notch of the retainer cap to rotationally fix the proximal driver relative to the retainer cap.

[0010] In still yet another aspect of the present disclosure, the elongated outer shaft defines a window at a distal end portion thereof. In such aspects, in the more-proximal position of the proximal driver, the inner cutting shaft may be locked in a closed position relative to the elongated outer shaft wherein the inner cutting shaft blocks the window of the elongated outer shaft.

[0011] Also provided in accordance with aspects of the present disclosure is a tissue resecting instrument including a handpiece assembly and an end effector assembly. The handpiece assembly includes a handle housing, a motor disposed within the handle housing, and a drive rotor operably coupled to and extending from the motor. The end effector assembly is configured to releasably engage the handpiece assembly and includes a proximal hub housing, a retainer cap fixed relative to and extending proximally from the proximal hub housing, an elongated outer shaft fixed relative to and extending distally from the proximal hub housing, an inner cutting shaft extending within and rotatable relative to the elongated outer shaft, and an inner core drive assembly extending at least partially through the retainer cap and the proximal hub housing. The inner core drive assembly includes a proximal driver and a distal driver rotationally fixed and slidable relative to the proximal driver, the distal driver coupled to the inner cutting shaft such that rotation of the distal driver rotates the inner cutting shaft relative to the elongated outer shaft. The proximal driver is initially disposed in a more-proximal position relative to the distal driver wherein the proximal driver is engaged with the retainer cap to rotationally fix the proximal driver relative to the retainer cap, thereby rotationally locking the inner cutting shaft relative to the elongated outer shaft. During engagement of the end effector assembly with the handpiece assembly, the drive rotor is operably engaged with the proximal driver and urges the proximal driver to a more-distal position relative to the distal driver wherein the proximal driver is disengaged from the retainer cap to permit rotation of the proximal driver relative to the retainer cap, thereby permitting rotation of the inner cutting shaft relative to the elongated outer shaft.

[0012] In an aspect of the present disclosure, the inner core drive assembly further includes a biasing member configured to bias the proximal driver towards the more-proximal position. During engagement of the end effector assembly with the handpiece assembly, the drive rotor urges the proximal driver to the more-distal position against the bias of the biasing member.

[0013] In another aspect of the present disclosure, the end effector assembly includes an engagement lever extending from the proximal hub housing. The engagement lever is configured to mechanically engage the handle housing of the handpiece assembly to engage the end effector assembly with the handpiece assembly.

[0014] In another aspect of the present disclosure, the proximal driver includes a proximally-facing cavity configured to receive and rotationally engage the driver rotor therein. In such aspects, the drive rotor may be configured to bottom-out with the proximally-facing cavity and thereafter urge the proximal driver to the more-distal position during engagement of the end effector assembly with the handpiece assembly.

[0015] In still another aspect of the present disclosure, the proximal driver and the distal driver cooperate to define an outflow path disposed in fluid communication with an interior of the inner

cutting shaft. In such aspects, the proximal hub housing may define an outflow opening and the handle housing may define an outflow port wherein the outflow opening and the outflow port are disposed in fluid communication with the outflow path.
[0016] In yet another aspect of the present disclosure, a tab of the proximal driver is engaged within a notch of the retainer cap to rotationally fix the proximal driver relative to the retainer cap.
[0017] In still yet another aspect of the present disclosure, the elongated outer shaft defines a window at a distal end portion thereof. In such aspects, in the more-proximal position of the proximal driver, the inner cutting shaft is locked in a closed position relative to the elongated outer shaft wherein the inner cutting shaft blocks the window of the elongated outer shaft.
[0018] In another aspect of the present disclosure, with the end effector assembly engaged with the handpiece assembly and the motor activated, the motor is configured to drive rotation of the drive rotor to thereby drive rotation of the proximal and distal drivers and, thus, the inner cutting shaft. In such aspects, upon subsequent deactivation, the motor is configured to further drive rotation of the drive rotor to thereby drive rotation of the proximal and distal drivers and the inner cutting shaft back to initial positions thereof.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0019] Various aspects and features of the present disclosure are described hereinbelow with reference to the drawings wherein like numerals designate identical or corresponding elements in each of the several views.
[0020] FIG. **1**A is a side view of a tissue resecting instrument provided in accordance with aspects of the present disclosure including a handpiece assembly and an end effector assembly, wherein a distal end portion of the end effector assembly is enlarged to better illustrate features thereof and an inner cutting shaft of the end effector assembly is disposed in a first position;
[0021] FIG. **1**B is an enlarged, side view of the distal end portion of the end effector assembly of FIG. **1**A wherein the inner cutting shaft is disposed in a second position;
[0022] FIG. **2**A is a side view of a proximal portion of the end effector assembly of FIG. **1**A;
[0023] FIG. **2**B is a longitudinal, cross-sectional of the proximal portion of the end effector assembly of FIG. **2**A;
[0024] FIG. **3** is a perspective view of a retainer cap of the end effector assembly of FIG. **1**A;
[0025] FIG. **4** is a side view of the retainer cap of FIG. **3**;
[0026] FIG. **5** is a longitudinal, cross-sectional view taken across section line “**5-5**” of FIG. **4**;
[0027] FIG. **6** is perspective view of a proximal driver of the end effector assembly of FIG. **1**A;
[0028] FIG. **7** is a longitudinal, cross-sectional view taken across section line “**7-7**” of FIG. **6**;
[0029] FIG. **8** is a longitudinal, cross-sectional view of a portion of the tissue resecting instrument of FIG. **1** prior to engagement of the end effector assembly with the handpiece assembly; and
[0030] FIG. **9** is a longitudinal, cross-sectional view of the portion of the tissue resecting instrument of FIG. **8**, with the end effector assembly engaged with the handpiece assembly.
DETAILED DESCRIPTION
[0031] Referring generally to FIG. **1**A, a tissue resecting instrument **10** provided in accordance with the present disclosure and configured to resect tissue includes an end effector assembly **100** and a handpiece assembly **200**. Tissue resecting instrument **10** is adapted to connect to a control unit (not shown) via a cable **300** to provide power and control functionality to tissue resecting instrument **10**, although tissue resecting instrument **10** may alternatively or additionally include controls associated with handpiece assembly **200** and/or a power source, e.g., battery, disposed within handpiece assembly **200**. Tissue resecting instrument **10** is further adapted to connect to a fluid management system (not shown) via outflow tubing **400** for applying suction to remove fluid,

tissue, and debris from a surgical site via tissue resecting instrument **10**, as detailed below. The control unit and fluid management system may be integral with one another, coupled to one another, or separate from one another.

[0032] Tissue resecting instrument **10** may be configured as a single-use device that is discarded after use or sent to a manufacturer for reprocessing, a reusable device capable of being cleaned and/or sterilized for repeated use by the end-user, or a partially-single-use, partially-reusable device. With respect to partially-single-use, partially-reusable configurations, handpiece assembly **200** may be configured as a cleanable/sterilizable, reusable component, while end effector assembly **100** is configured as a single-use, disposable/reprocessable component. In any of the above configurations, end effector assembly **100** is configured to releasably engage handpiece assembly **200** to facilitate disposal/reprocessing of any single-use components and cleaning and/or sterilization of any reusable components. Further, enabling releasable engagement of end effector assembly **100** with handpiece assembly **200** allows for interchangeable use of different end effector assemblies, e.g., different length, configuration, etc., end effector assemblies, with handpiece assembly **200**.

[0033] Continuing with reference to FIG. **1**A, handpiece assembly **200** generally includes a handle housing **210**, an outflow port **220** (see FIGS. **8** and **9**) defined through handle housing **210**, a motor **250** disposed within handle housing **210**, and a drive rotor **260** disposed within handle housing **210** and operably coupled to motor **250**. Handpiece assembly **200** may further include one or more controls (not shown) disposed on or operably associated with handle housing **210** to facilitate activation of tissue resecting instrument **10**. Further, outflow tubing **400** is configured to connect to outflow port **220** to thereby connect outflow port **220** to the fluid management system (not shown). The fluid management system includes a vacuum source to establish suction through tissue resecting instrument **10** and outflow tubing **400** to facilitate removal of fluid, tissue, and debris from the surgical site and may also include a collection reservoir, e.g., a collection canister, for collecting the removed fluid, tissue, and debris. As an alternative or in addition to a vacuum source establishing suction through tissue resecting instrument **10** and outflow tubing **400**, vacuum may be created therethrough via a pressure differential between the surgical site and the outflow path.

[0034] Handle housing **210** defines a pencil-grip configuration, although other configurations are also contemplated, e.g., pistol-grip configurations, and includes an open distal end portion **212** communicating with an internal bore **214** (FIGS. **8** and **9**), and a distal hub **216** disposed about open distal end portion **212** thereof. Distal hub **216** defines an annular recess **218** configured to facilitate releasably engagement of end effector assembly **100** with handpiece assembly **200**, as detailed below. Open distal end portion **212** of handle housing **210** provides access to drive rotor **260** and internal bore **214** (FIGS. **8** and **9**) within handle housing **210** such that, upon engagement of end effector assembly **100** with handpiece assembly **200**, as also detailed below, a portion of end effector assembly **100** extends through open distal end portion **212** and into internal bore **214** (FIGS. **8** and **9**) to operably couple with drive rotor **260** and fluidly couple end effector assembly **100** with internal bore **214** (FIGS. **8** and **9**) and, thus, outflow port **220**.

[0035] Cable **300** extends proximally from handle housing **210** and is configured to connect to the control unit (not shown) to provide power and control functionality to tissue resecting instrument **10**. Cable **300**, more specifically, houses one or more wires **310** that extend into handle housing **210** and connect to the controls thereof and/or motor **250** to power motor **250** and control operation of tissue resecting instrument **10** in accordance with controls associated with handpiece assembly **200**, the control unit, and/or other remote control devices, e.g., a footswitch (not shown).

[0036] Drive rotor **260** is operably coupled with and extends distally from motor **250** such that, upon activation of motor **250**, motor **250** drives rotation of drive rotor **260**. Drive rotor **260** defines a base **262** and rotor body **264** extending distally from base **262**. At least a portion of rotor body **264** defines a non-circular cross-sectional configuration, e.g., a square or other polygonal configuration, and is configured for at least partial receipt within proximal driver **152** of end effector assembly **100** (see FIG. **9**) in fixed rotational orientation relative thereto upon engagement of end effector assembly **100** with handpiece assembly **200**. As such, activation of motor **250** drives rotation of drive rotor **260** to, in turn, drive proximal driver **152** of end effector assembly **100** (see FIG. **9**).

[0037] Referring to FIGS. **1**A-**2**B, end effector assembly **100** includes a proximal hub housing **110**, an elongated outer shaft **120** monolithically formed, fixedly engaged, or otherwise connected with and extending distally from proximal hub housing **110**, an inner cutting shaft **130** disposed within elongated outer shaft **120**, a retainer cap **140** engaged about a proximal end portion of proximal hub housing **110**, and an inner core drive assembly **150**.

[0038] Proximal hub housing **110** of end effector assembly **100** includes a distal body portion **112** and a proximal extension portion **114** that may be monolithically formed, engaged, or otherwise connected to one another. With end effector assembly **100** engaged with handpiece assembly **200**, proximal extension portion **114** of proximal hub housing **110** extends into internal bore **214** (FIGS. **8** and **9**) of handle housing **210** of handpiece assembly **200** while distal body portion **112** substantially abuts and extends distally from handle housing **210** of handpiece assembly **200**. Proximal extension portion **114** of proximal hub housing **110** defines an outflow opening **115** through a sidewall thereof that is configured to fluidly communicate with internal bore **214** of handle housing **210** of handpiece assembly **200** when end effector assembly **100** is engaged therewith.

[0039] An engagement lever **116** extends from proximal hub housing **110**. Engagement lever **116** includes a finger tab **117***a* and an engagement tooth **117***b* disposed on opposite sides of a living hinge pivot **117***c* such that urging finger tab **117***a* towards proximal hub housing **110** urges engagement tooth **117***b* away from proximal hub housing **110**, and vice versa.

[0040] Upon insertion of proximal extension portion **114** of proximal hub housing **110** of end effector assembly **100** into internal bore **214** (FIGS. **8** and **9**) of handle housing **210** of handpiece assembly **200**, engagement tooth **117***b* is configured to cam over distal hub **216** of handpiece assembly **200** and into engagement within annular recess **218** of distal hub **216** to engage end effector assembly **100** and handpiece assembly **200** with one another. Disengagement of end effector assembly **100** from handpiece assembly **200** is effected by depressing finger tab **117***a* towards proximal hub housing **110** to thereby withdraw engagement tooth **117***b* from annular recess **218**. With engagement tooth **117***b* disengaged from annular recess **218**, end effector assembly **100** may be moved distally relative to handpiece assembly **200** to withdraw proximal extension portion **114** from internal bore **214** (FIGS. **8** and **9**) of handle housing **210**, thereby disengaging end effector assembly **100** from handpiece assembly **200**.

[0041] Referring to FIGS. **1**A and **1**B, elongated outer shaft **120** of end effector assembly **100** includes a proximal end portion **122** fixedly engaged with distal body portion **112** of proximal hub housing **110** (see also FIG. **2**B). Elongated outer shaft **120** further includes a distal end portion **124** defining a closed distal end **126** and a window **128** proximally-spaced from closed distal end **126**. Window **128** provides access to the interior of elongated outer shaft **120** and may be surrounded by a cutting edge **129** about the outer perimeter of window **128** so as to facilitate cutting of tissue passing through window **128** and into elongated outer shaft **120**.

[0042] Inner cutting shaft **130** of end effector assembly **100** extends through elongated outer shaft **120**. Inner cutting shaft **130** defines a proximal end portion **132** (see FIG. **2**B) and a distal end portion **134**. Proximal end portion **132** of inner cutting shaft **130** is operably coupled with inner core drive assembly **150**, as detailed below (see FIG. **2**B). Distal end portion **134** of inner cutting shaft **130** defines a closed distal end **136** and a window **138** proximally-spaced from closed distal end **136**. Window **138** provides access to the interior of inner cutting shaft **130** and may be surrounded by a cutting edge **139** about the outer perimeter of window **138** so as to facilitate cutting of tissue passing through window **138** and into inner cutting shaft **130**.

[0043] Inner cutting shaft **130** is rotatable within and relative to elongated outer shaft **120** to thereby rotate window **138** relative to window **128**. More specifically, inner cutting shaft **130** is configured to rotate such that cutting edge **139** and window **138** are exposed within window **128** of elongated outer shaft **120** during at least a portion of the rotational motion of inner cutting shaft **130** to enable cutting of tissue therewith. As detailed below, suction is provided to facilitate drawing tissue into window **128** of elongated outer shaft **120** and window **138** of inner cutting shaft **130** and, thus, to facilitate the cutting of tissue extending into inner cutting shaft **130** as inner cutting shaft **130** is rotate relative to elongated outer shaft **120**. The applied suction also facilitates removal of tissue, fluids, and debris through inner cutting shaft **130**, as detailed below. Other suitable configurations of elongated outer shaft **120** and/or inner cutting shaft **130** that cooperate to facilitate tissue cutting are also contemplated such as for example, both reciprocation and rotation of inner cutting shaft **130** relative to elongated outer shaft **120**.

[0044] With additional reference to FIGS. **2**A-**5**, retainer cap **140** is connected to proximal extension portion **114** of proximal hub housing **110** and extends proximally therefrom. Retainer cap **140** may be engaged with proximal extension portion **114**, e.g., via snap-fit engagement of tabs **141** (FIGS. **3**-**5**) of retainer cap **140** within corresponding slots (not shown) defined within proximal extension portion **114**, may be monolithically formed with proximal extension portion **114** of proximal hub housing **110**, or may be connected thereto in any other suitable manner. Retainer cap **140** includes an interior surface **142** defining a longitudinal lumen **144** extending through retainer cap **140**. An internal collar **146** protrudes radially inwardly from interior surface **142** into longitudinal lumen **144**. Internal collar **146** includes a distally-oriented notch **148** defined therein.

[0045] Turning back to FIGS. **2**A and **2**B, inner core drive assembly **150** is operably disposed within at least a portion of proximal hub housing **110** and retainer cap **140** and is configured to operably couple drive rotor **260** of handpiece assembly **200** (see FIGS. **1** and **9**) with inner cutting shaft **130** such that rotation of drive rotor **260** (FIGS. **1** and **9**) drives rotation of inner cutting shaft **130** within and relative to elongated outer shaft **120**. Inner core drive assembly **150**, more specifically, includes a proximal driver **152**, a distal driver **154**, and a biasing member **156**, e.g., a coil compression spring. In some embodiments, inner core drive assembly **150** further includes a threaded coupler and cam follower (not shown) operable to convert rotation of drive rotor **260** (FIGS. **1** and **9**) into reciprocation of inner cutting shaft **130** such that inner cutting shaft **130** is both rotated and reciprocated in response to rotation of drive rotor **260** (see FIGS. **1** and **9**). Additionally or alternatively, inner core drive assembly **150** may include gearing (not shown) configured to amplify or attenuate the output rotation of inner cutting shaft **130** relative to the input rotation from drive rotor **260** (FIGS. **1** and **9**).

[0046] Referring also to FIGS. **6** and **7**, proximal driver **152** of inner core drive assembly **150** includes a proximal body portion **162** and a distal body portion **164** that may be monolithically formed with one another, engaged with one another, or otherwise connected to one another. Proximal body portion **162** includes an external collar **166** disposed annularly about proximal body portion **162**. External collar **166** includes a proximally-oriented tab **168** that extends therefrom along the exterior surface of proximal body portion **162**. Proximal body portion **162** further includes a proximally-facing cavity **170** at least a portion of which has a non-circular cross-sectional configuration, e.g., an 8-point star or other polygonal configuration, that is configured to at least partially receive drive rotor **260** of handpiece assembly **200** in fixed rotational orientation (see FIG. **9**). Distal body portion **164** includes a distally-facing cavity **172** at least a portion of which has a non-circular cross-sectional configuration, e.g., a rectangular or other polygonal configuration. A longitudinally-extending slot **173** defined through a side wall of distal body portion **164** communicates with distally-facing cavity **172**.

[0047] With reference to FIG. **2**B, distal driver **154** of inner core drive assembly **150** includes a proximal body portion **174**, a distal body portion **176**, and a lumen **178** extending longitudinally through proximal and distal body portions **174**, **176**, respectively. Proximal and distal body portions **174**, **176**, respectively may be monolithically formed, engaged, or otherwise connected to one another. Distal driver **154** further includes a collar **180** disposed thereabout between proximal and distal body portions **174**, **176**, respectively. Distal driver **154** may be longitudinally fixed within and rotatable relative to proximal hub housing **110**. In other embodiments, e.g., where distal driver **154** imparts both reciprocation and rotation to inner cutting shaft **130**, distal driver **154** may be both rotatable and reciprocatable relative to proximal hub housing **110**.

[0048] Proximal body portion **174** of distal driver **154** of inner core drive assembly **150** includes a proximal foot **182** extending proximally therefrom. Proximal foot **182** defines a channel **183** that communicates with lumen **178** and is open along the length of proximal foot **182**. At least a portion of proximal foot **182** defines a non-circular cross-sectional configuration, e.g., a rectangular or other polygonal configuration, and is slidably received, in fixed rotational orientation, within distally-facing cavity **172** of distal body portion **164** of proximal driver **152** such that proximal and distal drivers **152**, **154**, respectively, are rotatably coupled to one another but slidably relative to one another. Distal body portion **164** of proximal driver **152**, more specifically, is slidably disposed about proximal foot **182** and at least a portion of proximal body portion **174** of distal driver **154**.

[0049] Distal body portion **176** of distal driver **154** of inner core drive assembly **150** is configured to receive and fixedly engage proximal end portion **132** of inner cutting shaft **130** therein such that the open proximal end of inner cutting shaft **130** is disposed in fluid communication with lumen **178** of distal driver **154** and such that rotation of distal driver **154** effects similar rotation of inner cutting shaft **130**.

[0050] Biasing member **156** of inner core drive assembly **150** is disposed about proximal body portion **174** of distal driver **154**. Biasing member **156**, more specifically, is disposed about proximal body portion **174** of distal driver **154** between collar **180** and a distal end of distal body portion **164** of proximal driver **152**. In this manner, biasing member **156** biases proximal driver **152** proximally such that proximally-oriented tab **168** of external collar **166** of proximal body portion **162** of proximal driver **152** is biased into engagement within distally-oriented notch **148** of internal collar **146** of retainer cap **140** to thereby rotationally fix proximal and distal drivers **152**, **154** relative to retainer cap **140** and proximal hub housing **110** and, as a result, rotationally fix inner cutting blade **130** relative to elongated outer shaft **130**.

[0051] Turning to FIGS. **8** and **9**, engagement of end effector assembly **100** with handpiece assembly **200** in preparation for use of tissue resecting instrument **10** is detailed. Initially, as noted above, prior to engagement of end effector assembly **100** with handpiece assembly **200**, proximally-oriented tab **168** is engaged within distally-oriented notch **148** under the bias of biasing member **156** to rotationally fixed proximal and distal drivers **152**, **154** and, thus, inner cutting shaft **130**, relative to retainer cap **140** and proximal hub housing **110** and, thus, elongated outer shaft **120**. Referring momentarily to FIG. 1B, end effector assembly **100** may be configured such that, in this biased, rotationally locked position, windows **128**, **138** of elongated outer shaft **120** and inner cutting shaft **130**, respectively, are disposed in non-overlapping orientation relative to one another, corresponding to a closed position of inner cutting shaft **130**.

[0052] In order to engage end effector assembly **100** with handpiece assembly **200**, end effector assembly **100**, lead by retainer cap **140**, is inserted proximally through open distal end portion **212** of handle housing **210** of handpiece assembly **200** and into internal bore **214** thereof, as shown in FIG. **8**. Referring to FIG. **9**, as end effector assembly **100** is inserted further proximally into internal bore **214**, rotor body **264** is received within proximally-facing cavity **170** of proximal body portion **162** of proximal driver **152** of inner core drive assembly **150** to rotationally fix rotor body **264** within proximal driver **152** and, thus, relative to distal driver **154** and inner cutting shaft **130**.

[0053] Upon further insertion of end effector assembly **100** into internal bore **214**, rotor body **264** is further inserted into proximally-facing cavity **170** until rotor body **264** bottoms out within proximally-facing cavity **170**. However, rotor body **264** bottoms out within proximally-facing cavity **170** prior to engagement of engagement tooth **117***b* of engagement lever **116** of end effector assembly **100** within annular recess **218** of distal hub **216** of handpiece assembly **200** and, thus, prior to engagement of end effector assembly **100** with handpiece assembly **200**. Accordingly, end effector assembly **100** is required to be moved further proximally into internal bore **214** to engage end effector assembly **100** with handpiece assembly **200**. As a result, with rotor body **264** bottomed-out within proximally-facing cavity **170**, further proximal movement of end effector assembly **100** urges proximal driver **152** distally through and relative to retainer cap **140** and proximal hub housing **110** of end effector assembly **100**.

[0054] The distal movement of proximal driver **152** under the urging from rotor body **264** is accomplished against the bias of biasing member **156**. More specifically, proximal driver **152** is moved distally such that distal body portion **164** of proximal driver **152** is slid about and relative to proximal foot **182** and proximal body portion **174** of distal driver **154** to compress biasing member **156** between the distal end of distal body portion **164** of proximal driver **152** and collar **180**.

[0055] In addition to compressing biasing member **156**, the distal movement of proximal driver **152** relative to retainer cap **140** disengages proximally-oriented tab **168** of external collar **166** of proximal body portion **162** of proximal driver **152** from within distally-oriented notch **148** of internal collar **146** of retainer cap **140** to thereby rotationally unlock proximal and distal drivers **152**, **154** relative to retainer cap **140** and proximal hub housing **110**, thereby unlocking inner cutting shaft **130** from rotationally-fixed orientation, e.g., the closed position, relative to elongated outer shaft **120**.

[0056] Further, at or near the insertion depth of end effector assembly **100** into handpiece assembly **200** required to rotationally unlock inner cutting shaft **130**, engagement tooth **117***b* of engagement lever **116** is cammed over distal hub **216** of handpiece assembly **200** and into engagement within annular recess **218** of distal hub **216** of handpiece assembly **200** to engage end effector assembly **100** and handpiece assembly **200** with one another. Accordingly, upon engagement of end effector assembly **100** and handpiece assembly **200** with one another, inner cutting shaft **130** is rotationally unlocked.

[0057] Continuing with reference to FIG. **9**, with end effector assembly **100** and handpiece assembly **200** engaged with one another, fluid communication is established between the interior of inner cutting shaft **130**, lumen **178** of distal driver **154**, channel **183** of proximal foot **182** of distal driver **154**, distally-facing cavity **172** of proximal driver **152**, longitudinally-extending slot **173** of distal body portion **164**, the interior of proximal extension portion **114** of proximal hub housing **110**, outflow opening **115** of proximal hub housing **110**, internal bore **214** of handle housing **210**, outflow port **220**, and outflow tubing **400**. In this manner, suction may be applied by a vacuum source of the fluid management system to which outflow tubing **400** is connected to thereby establish suction through inner cutting shaft **130** of end effector assembly **100** to suction tissue, fluids, and debris therethrough.

[0058] Referring generally to FIGS. **1**A, **1**B, and **9**, with end effector assembly **100** engaged with handpiece assembly **200** as detailed above, tissue resecting instrument **10** is ready for use. In use, motor **250** of handpiece assembly **200** is activated to drive rotation of drive rotor **260**. Upon activation of motor **250**, with a head-start or delay relative to activation of motor **250**, or independently thereof, suction is established through outflow tubing **400** and, thus, through tissue resecting instrument **10**, e.g., via activating the vacuum source of the fluid management system.

[0059] Activation of motor **250** drives rotation of drive rotor **260** which, in turn, drives rotation of proximal driver **152** to, in turn, drive rotation of distal driver **154** and thereby rotate inner cutting shaft **130** relative to elongated outer shaft **120**. The rotation of inner cutting shaft **130** relative to elongated outer shaft **120**, together with the suction applied through inner cutting shaft **130**, enables tissue to be drawn through cutting windows **128** and **138** and into inner cutting shaft **130**, cut, and suctioned, along with fluids and debris, proximally through tissue resecting instrument **10** and outflow tubing **400** to the collection reservoir of the fluid management system.

[0060] Upon engagement of end effector assembly **100** with handpiece assembly **200**, the rotational position of inner cutting shaft **130** relative to elongated outer shaft **120** is known, e.g., the closed position of inner cutting shaft **130**. This is because of the rotational lock provided prior to engagement of end effector assembly **100** with handpiece assembly **200**. Accordingly, upon engagement, a control program (not shown) associated with motor **250** may record the rotational position of drive rotor **260** as a home position and, after activation, ensure that drive rotor **260** stops at a rotational position corresponding to the closed position of inner cutting shaft **130** relative to elongated outer shaft **120**.

[0061] The control program may utilize correlation information correlating, for example, rotation of drive rotor **260** with rotation of inner cutting shaft **130** to ensure that inner cutting shaft **130** is returned to the closed position relative to elongated outer shaft **120** after each activation. As the correlation information may vary depending upon the particular end effector assembly **100** utilized, the control program may communicate with or read information from end effector assembly **100** in order to correlate rotation of drive rotor **260** with rotation of inner cutting shaft **130** and, thus, set the home position.

[0062] Returning to the home position, corresponding to the closed position of inner cutting shaft **130**, also returns proximal driver **152** to its initial rotational position whereby proximally-oriented tab **168** of external collar **166** of proximal body portion **162** of proximal driver **152** is rotationally aligned with distally-oriented notch **148** of internal collar **146** of retainer cap **140**. As such, upon disengagement and withdrawal of end effector assembly **100** from handpiece assembly **200**, biasing member **156** returns proximal driver **152** distally to thereby bias proximally-oriented tab **168** into engagement within distally-oriented notch **148**. With tab **168** engaged within notch **148**, the rotational lock is re-engaged, rotationally fixing proximal and distal drivers **152**, **154**, respectively, relative to retainer cap **140** and proximal hub housing **110** and, thus, rotationally locking inner cutting shaft **130** in the closed position relative to elongated outer shaft **120**.

[0063] Referring generally to FIG. **1**A, as an alternative to handpiece assembly **200** configured for manual grasping and manipulation during use, tissue resecting instrument **10** may alternatively be configured for use with a robotic surgical system wherein handle housing **210** is configured to engage a robotic arm of the robotic surgical system. The robotic surgical system may employ various robotic elements to assist the surgeon and allow remote operation (or partial remote operation). More specifically, various robotic arms, gears, cams, pulleys, electric and mechanical motors, etc. may be employed for this purpose and may be designed with the robotic surgical system to assist the surgeon during the course of an operation or treatment. The robotic surgical system may include remotely steerable systems, automatically flexible surgical systems, remotely flexible surgical systems, remotely articulating surgical systems, wireless surgical systems, modular or selectively configurable remotely operated surgical systems, etc.

[0064] The robotic surgical system may be employed with one or more consoles that are next to the operating theater or located in a remote location. In this instance, one team of surgeons or nurses may prep the patient for surgery and configure the robotic surgical system with the surgical device disclosed herein while another surgeon (or group of surgeons) remotely controls the surgical device via the robotic surgical system. As can be appreciated, a highly skilled surgeon may perform multiple operations in multiple locations without leaving his/her remote console which can be both economically advantageous and a benefit to the patient or a series of patients.

[0065] The robotic arms of the robotic surgical system are typically coupled to a pair of master handles by a controller. The handles can be moved by the surgeon to produce a corresponding movement of the working ends of any type of surgical instrument (e.g., end effectors, graspers, knifes, scissors, cameras, fluid delivery devices, etc.) which may complement the use of the tissue resecting devices described herein. The movement of the master handles may be scaled so that the working ends have a corresponding movement that is different, smaller or larger, than the movement performed by the operating hands of the surgeon. The scale factor or gearing ratio may be adjustable so that the operator can control the resolution of the working ends of the surgical instrument(s).

[0066] While several embodiments of the disclosure have been shown in the drawings, it is not intended that the disclosure be limited thereto, as it is intended that the disclosure be as broad in scope as the art will allow and that the specification be read likewise. Therefore, the above description should not be construed as limiting, but merely as examples of particular embodiments. Those skilled in the art will envision other modifications within the scope and spirit of the claims appended hereto.
[0067] Although the foregoing disclosure has been described in some detail by way of illustration and example, for purposes of clarity or understanding, it will be obvious that certain changes and modifications may be practiced within the scope of the appended claims.

Claims

1-20. (canceled)
21. An end effector assembly of a tissue resecting instrument, the end effector assembly comprising: a distal driver rotationally fixed and slidable relative to a proximal driver configured to receive a rotational input, the distal driver operably coupled to an inner cutter rotatably disposed within an elongated outer shaft such that rotation of the distal driver rotates the inner cutter relative to the elongated outer shaft; and a biasing member configured to bias the proximal driver relative to the distal driver in a locked position, wherein the proximal driver is selectively movable to rotationally lock the inner cutter relative to the elongated outer shaft.
22. The end effector assembly according to claim 21, wherein the biasing member is disposed about an outer periphery of the distal driver and biases the proximal driver proximally.
23. The end effector assembly according to claim 22, wherein the biasing member is a coil spring disposed about a proximal portion of the distal driver.
24. The end effector assembly according to claim 21, wherein at least one of the proximal driver or the distal driver is longitudinally slidable relative to the other between a more-overlapping position and a less-overlapping position.
25. The end effector assembly according to claim 24, wherein the biasing member is configured to bias the at least one of the proximal driver or the distal driver towards the less-overlapping position.
26. The end effector assembly according to claim 21, wherein the proximal driver is longitudinally slidable against the bias of the biasing member to an unlocked position permitting rotation of the proximal driver relative to a proximal hub housing of the end effector assembly.
27. The end effector assembly according to claim 26, wherein, in the locked position, the proximal driver is engaged with the proximal hub housing via a tab and a notch engagement, and wherein, in the unlocked position, the tab is displaced from the notch to disengage the proximal driver from the proximal hub housing.
28. The end effector assembly according to claim 21, wherein the proximal driver and the distal driver cooperate to define an outflow path disposed in fluid communication with an interior of the inner cutter.
29. The end effector assembly according to claim 28, wherein a proximal hub housing of the end effector assembly defines an outflow opening in fluid communication with the outflow path.
30. A tissue resecting instrument, comprising: a handpiece assembly including a motor disposed therein and a drive rotor operably coupled to and extending from the motor; and an end effector assembly configured to releasably engage the handpiece assembly, the end effector assembly including: a distal driver rotationally fixed and slidable relative to a proximal driver configured to receive a rotational input, the distal driver operably coupled to an inner cutter rotatably disposed within an elongated outer shaft such that rotation of the distal driver rotates the inner cutter relative to the elongated outer shaft; and a biasing member configured to bias the proximal driver relative to the distal driver in a locked position, wherein the proximal driver is selectively movable to

rotationally lock the inner cutter relative to the elongated outer shaft.
31. The tissue resecting instrument according to claim 30, wherein the biasing member longitudinally biases the proximal driver relative to the distal driver.
32. The tissue resecting instrument according to claim 30, wherein the biasing member is disposed about an outer periphery of the distal driver and biases the proximal driver proximally.
33. The tissue resecting instrument according to claim 32, wherein the biasing member longitudinally biases the proximal driver proximally relative to the distal driver and wherein the drive rotor is configured to urge the proximal driver distally against the bias of the biasing member upon engagement of the end effector assembly with the handpiece assembly.
34. The tissue resecting instrument according to claim 31, wherein at least one of the proximal driver or the distal driver is longitudinally slidable relative to the other between a more-overlapping position and a less-overlapping position.
35. The tissue resecting instrument according to claim 34, wherein the biasing member is configured to bias the at least one of the proximal driver or the distal driver towards the less-overlapping position.
36. The tissue resecting instrument according to claim 31, wherein the proximal driver is longitudinally slidable, under urging of the drive rotor upon engagement of the end effector assembly with the handpiece assembly, against the bias of the biasing member to an unlocked position permitting rotation of the proximal driver relative to a proximal hub housing of the end effector assembly.
37. The tissue resecting instrument according to claim 36, wherein, in the locked position, the proximal driver is engaged with the proximal hub housing of the end effector assembly via a tab and a notch engagement, and wherein, in the unlocked position, the tab is displaced from the notch to disengage the proximal driver from the proximal hub housing.
38. The tissue resecting instrument according to claim 37, wherein the proximal driver and the distal driver cooperate to define an outflow path disposed in fluid communication with an interior of the inner cutter.
39. The tissue resecting instrument according to claim 38, wherein the proximal hub housing defines an outflow opening in fluid communication with the outflow path.