US 20160354101A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2016/0354101 A1**

Melsheimer (43) **Pub. Date: Dec. 8, 2016**

(54) **LAPAROSCOPIC MEDICAL DEVICE ASSEMBLY WITH DETACHABLE END EFFECTOR, AND METHOD OF USING SAME**

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(21) Appl. No.: **15/058,600**

(22) Filed: **Mar. 2, 2016**

Related U.S. Application Data

(60) Provisional application No. 62/169,636, filed on Jun. 2, 2015.

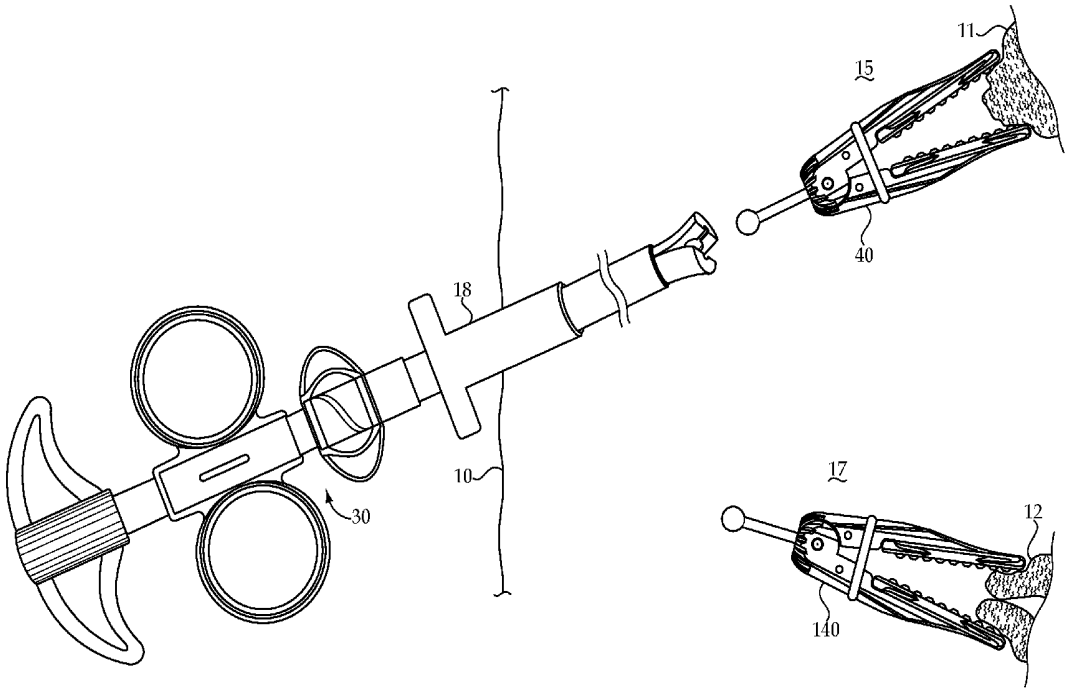
Publication Classification

(51) **Int. Cl.**
A61B 17/29 (2006.01)
A61B 17/28 (2006.01)

(52) **U.S. Cl.**
CPC ***A61B 17/2909*** (2013.01); ***A61B 17/282*** (2013.01); *A61B 2017/2808* (2013.01); *A61B 2017/292* (2013.01); *A61B 2017/2931* (2013.01)

(57) **ABSTRACT**

A laparoscopic medical device assembly includes a laparoscopic tool with a handle actuator coupled to slide a deployment/capture device within, and relative to, a sheath. An end effector has a knob attached to a proximal end of an actuator rod that extends through a base, and includes a pair of arms pivotally attached to the base. The laparoscopic tool and the end effector are movable among a capture/unactuated configuration, a capture/actuated configuration and a release configuration. The end effector may be left clamped to tissue while the laparoscopic tool is removed allowing an alternative use of the trocar access.



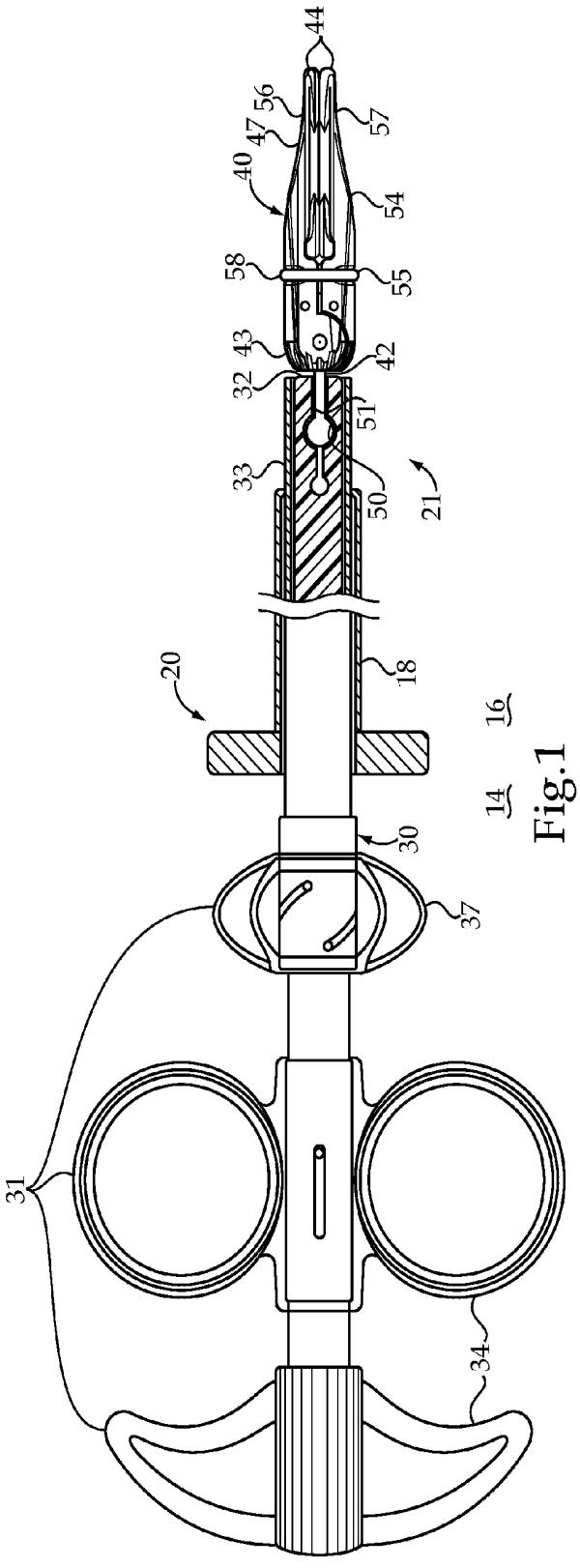


Fig.1

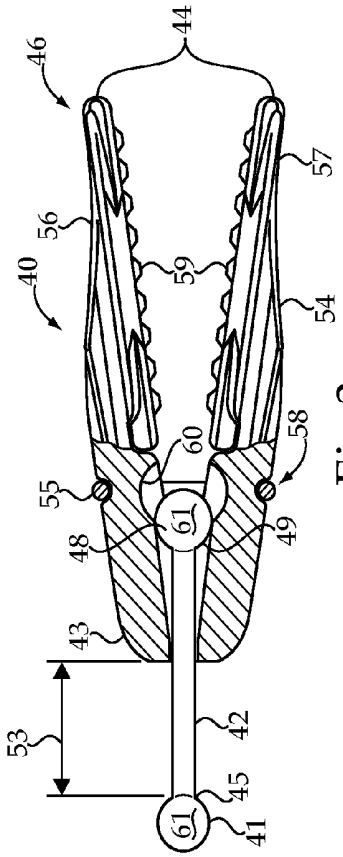


Fig.3

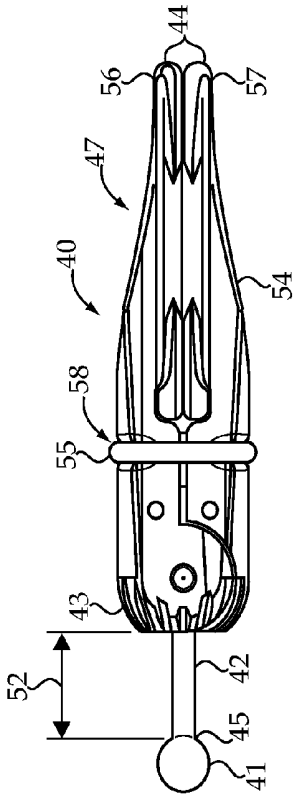


Fig.2

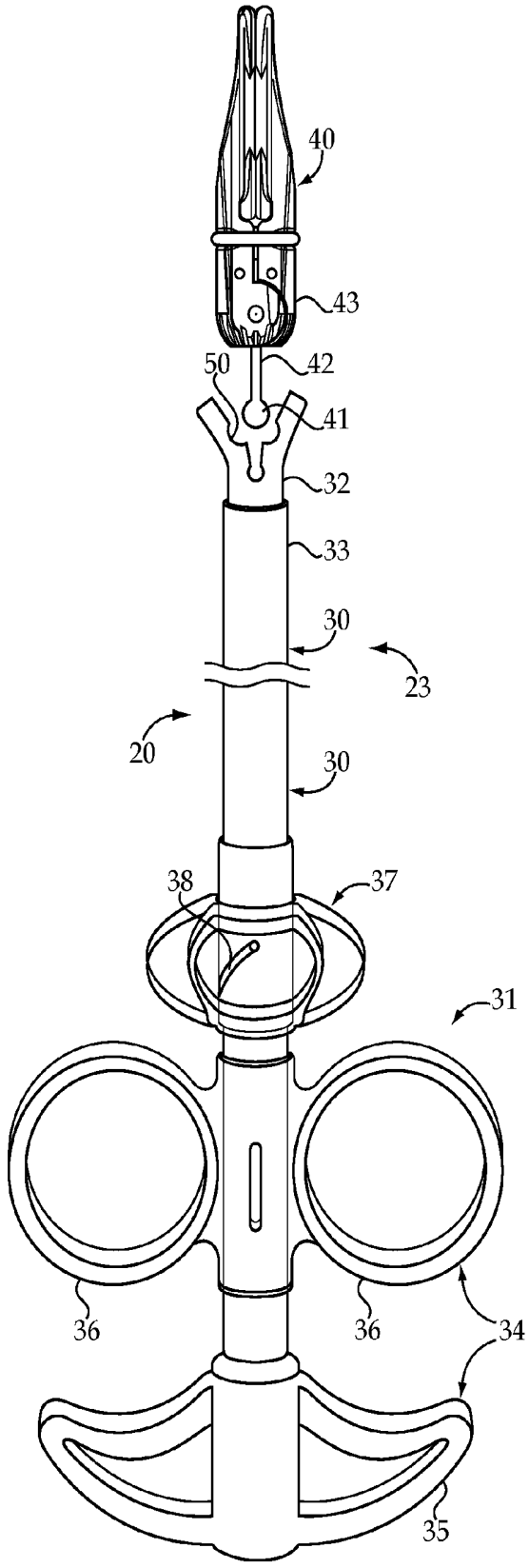


Fig.4

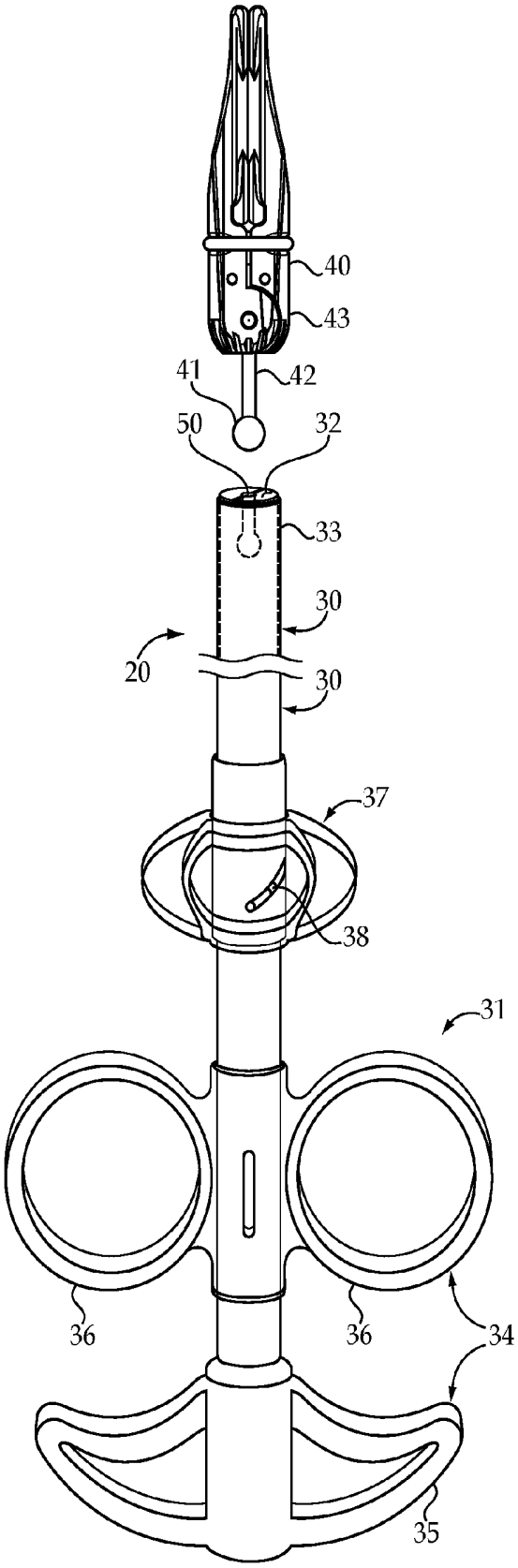


Fig.5

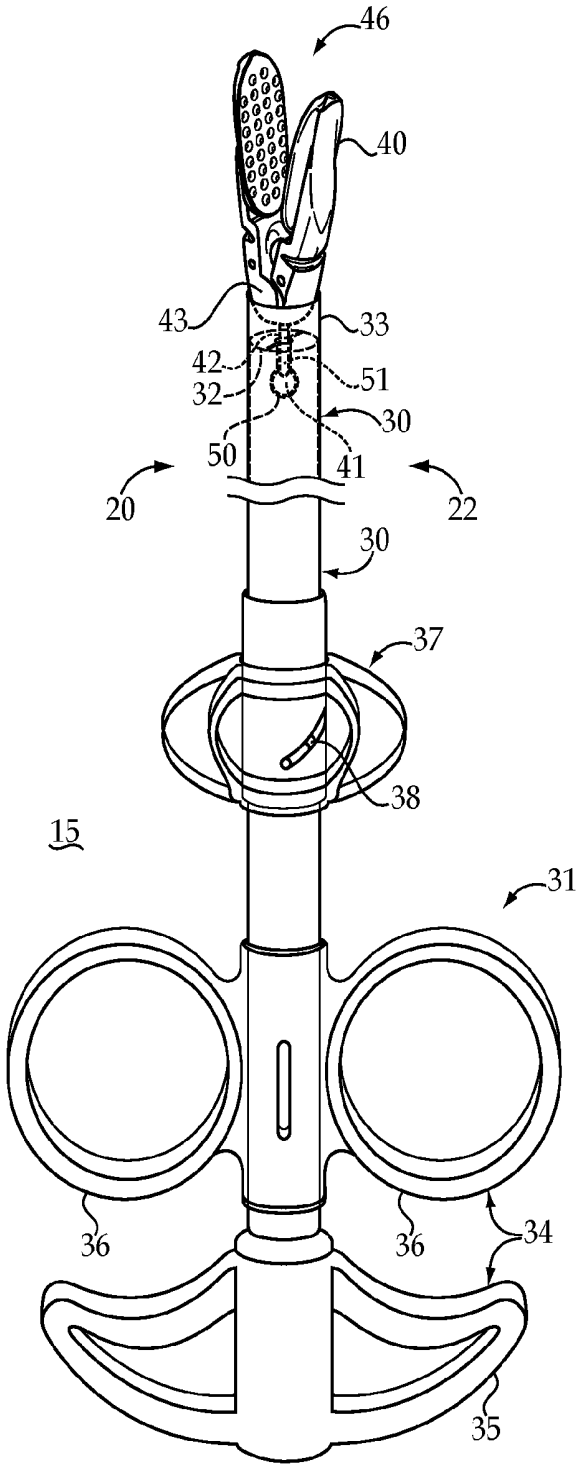


Fig.6

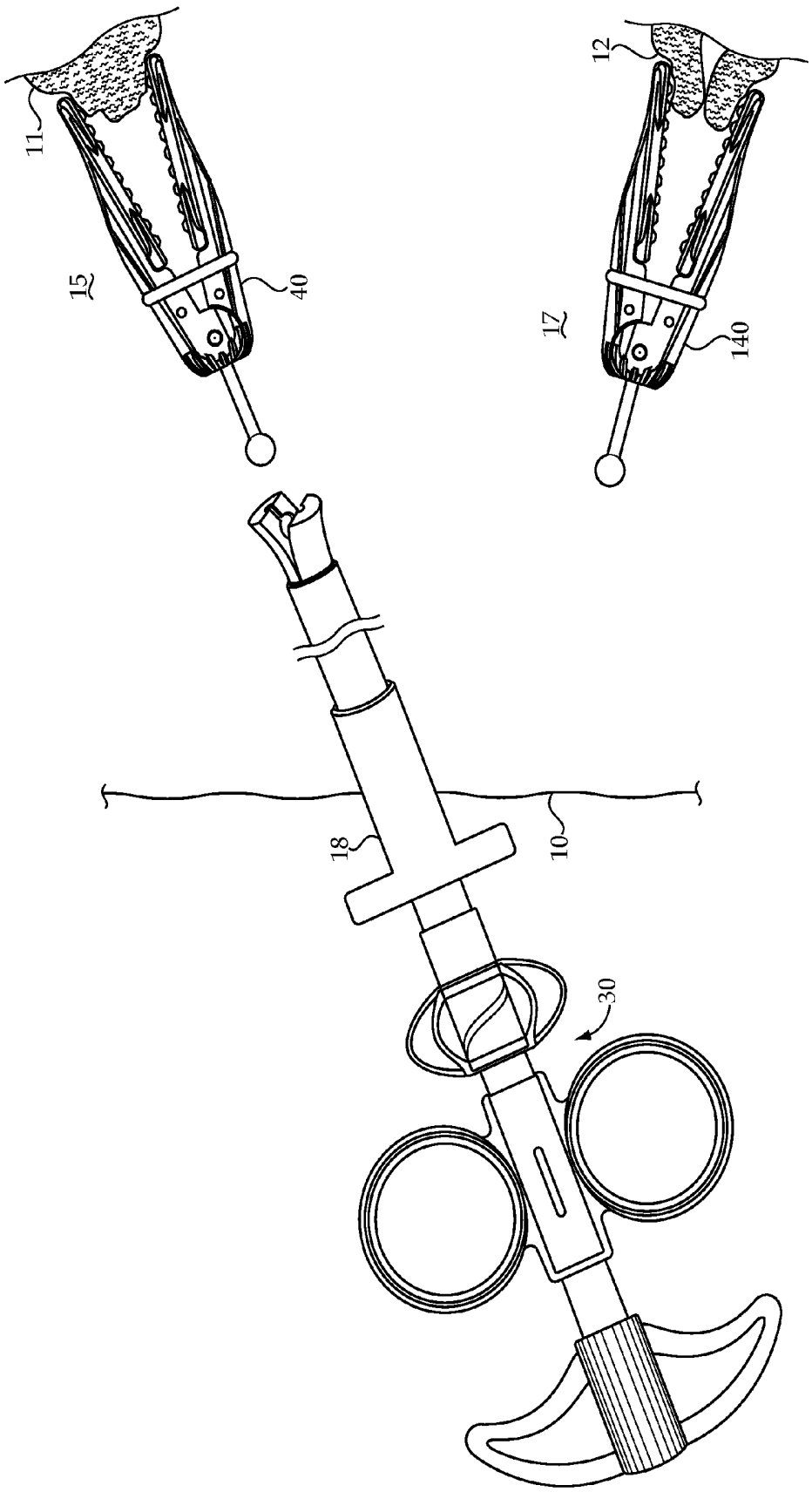


Fig.7

LAPAROSCOPIC MEDICAL DEVICE ASSEMBLY WITH DETACHABLE END EFFECTOR, AND METHOD OF USING SAME

TECHNICAL FIELD

[0001] The present disclosure relates generally to medical devices utilized in laparoscopic procedures, and more particularly to an end effector that may be detached from, and later retrieved by, a laparoscopic tool.

BACKGROUND

[0002] Often during laparoscopic surgery in the abdomen, there is need for multiple ports. For instance, a first port may be needed for visualization/insufflation/lighting, a second port may be utilized for the surgeons left hand tool, a third port for the surgeon's right hand tool, and possibly fourth and fifth ports for an assistant's left and right hand tools. All of these ports lead to many potential entry points for infection, many potential sources of pain, many potential scars, and can cause a potentially crowded work area.

[0003] The present disclosure is directed toward potentially relieving overcrowding and possibly enabling a greater number of tools relative to ports in a laparoscopic procedure.

SUMMARY

[0004] In one aspect, a laparoscopic medical device assembly includes a laparoscopic tool with a handle actuator coupled to slide a deployment/capture device within, and relative to, a sheath. An end effector has a knob attached to a proximal end of an actuator rod extending through a base, and includes a pair of arms pivotally attached to the base and movable between a first shape and a second shape. The laparoscopic tool and the end effector are movable among a capture/unactuated configuration, a capture/actuated configuration and a release configuration. The pair of arms are in the second shape in the capture/unactuated configuration, and in the first shape in the capture/actuated configuration. In the release configuration, the end effector is out of contact with the laparoscopic tool.

[0005] In another aspect, an end effector for use with a laparoscopic tool as part of a laparoscopic medical device assembly includes a base that is too large to be received in a sheath of the laparoscopic tool. A first arm and a second arm are pivotally attached to the base and are movable between a first shape and a second shape. A biasing element is operably positioned to bias the first arm and the second arm toward the second shape. An actuator rod is slidably received through the base with a distal end positioned between the first arm and the second arm, and has a knob attached to a proximal end of the actuator rod. The knob is at a first distance from the base when the first arm and the second arm are in the second shape, and the knob is at a greater distance than the first distance from the base when the first arm and the second arm are in the first shape.

[0006] In still another aspect, a method includes moving the laparoscopic medical device assembly in a capture/unactuated configuration at a first location to a second location with the laparoscopic medical device assembly in a capture/actuated configuration. The laparoscopic medical device assembly is then changed from the capture/actuated configuration to a release configuration at the second location. The laparoscopic tool is moved out of contact with the end effector. The knob of the end effector is captured with the deployment/capture device at least in part by moving the laparoscopic tool back into contact with the end effector and changing from the release configuration to the capture/unactuated configuration. The laparoscopic medical device assembly is then changed from the capture/unactuated configuration to the capture actuated configuration, and the medical device assembly is moved to a third location.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. **1** is a side view of a laparoscopic medical device assembly extending through a trocar while in a capture/unactuated configuration;

[0008] FIG. **2** is a side view of an end effector according to the present disclosure in a second shape;

[0009] FIG. **3** is a partially sectioned view of the end effector of FIG. **2** shown in its first shape;

[0010] FIG. **4** is a side view of the laparoscopic medical device assembly of the present disclosure in a release configuration;

[0011] FIG. **5** is a side view of the laparoscopic tool and the end effector separated from one another;

[0012] FIG. **6** is a side view of the laparoscopic medical device assembly in a capture/actuated configuration; and

[0013] FIG. **7** is a schematic view during a laparoscopic procedure in which two end effectors have been temporarily left in contact with different tissues within a patient.

DETAILED DESCRIPTION

[0014] Referring to FIGS. **1-6**, a laparoscopic medical device assembly **20** includes a laparoscopic tool **30** and a detachable end effector **40**. Laparoscopic medical device assembly **20** may permit a physician to position one or more end effectors **40** in a patient and leave the end effector(s) **40** in place detached from a laparoscopic tool **30** while performing other aspects of a medical procedure. In other words, by withdrawing the laparoscopic tool **30** while leaving behind one or more end effectors **40**, a trocar or other entry point can be utilized for another aspect of a procedure, or will allow for the use of fewer ports to perform a medical procedure. Thus, with the laparoscopic medical device assembly **20** of the present disclosure, an end effector **40** may retain its functionality, be introduced through a port and interact with a patient's tissue, such as clamp off a bleeding vessel. Then, the laparoscopic tool **30** can be detached from the end effector **40** allowing the end effector **40** to remain in place during a continuing portion of the procedure, then be reacquired and later withdrawn back out through the trocar when the medical procedure is finished.

[0015] Laparoscopic tool **30** includes a handle actuator **31**coupled to slide a deployment/capture device **32** within, and relative to, a sheath **33**. The handle actuator **31** may include a shaft actuator **34** and a sheath positioner **37**. The shaft actuator **34** may include a pair of finger rings **36** that are connected to move with the deployment/capture device **32**, and a palm contact **35** attached to move with the outer sheath **33**. Thus, movement of finger rings **36** toward palm contact **35** causes the deployment/capture device **32** to move proximally with respect to the distal end of the sheath **33**. Finger rings **36** may be biased away from palm contact **35**, such as by a spring positioned therebetween. Handle actuator **31** also includes a sheath positioner **37** that is operably coupled to sheath **33** via a pin and a spiral slot **38**. Sheath

positioner **37** may be rotated between a first position as shown in FIG. **4** in which the sheath **33** is retracted relative to finger rings **36**, and a second position as shown in FIGS. **1**, **5** and **6** in which sheath **33** is advanced distally with respect to finger rings **36**. Those skilled in the art will appreciate that other hand manipulatable features known in the art could be substituted in place of the various features of handle actuator **31** without departing from the present disclosure. For instance, an alternative pistol grip structure with matching functions could be substituted in place for the in-line handle actuator **31** shown in the Figs. without departing from the present disclosure.

[0016] Like many laparoscopic tools, the sheath **33** may have a circular cross section and have a size and length appropriate for sliding through a trocar **18** so that end effector **40** can be appropriately positioned in the patient while handle actuator **31** is located outside of the patient in a conventional manner. The laparoscopic tool **30** and the end effector **40** are movable among a capture/unactuated configuration **21** as shown in FIG. **1**, a capture/actuated configuration **22** shown in FIG. **6**, and a release configuration **23** as shown in FIG. **4**. FIG. **5** shows the laparoscopic tool **30** moving away from the end effector **40** after being released. Also as best shown in FIG. **4**, the end effector **40** is out of contact with the laparoscopic tool **30** when in the release configuration **23**. The knob **41** may be out of contact but still positioned between the open jaws of deployment/capture device **30** in the release configuration as shown in FIG. **4**.

[0017] Referring now specifically to FIGS. **2** and **3**, end effector **40** includes a knob **41** attached to a proximal end **45** of an actuator rod **42** that extends through, and is slidable with respect to, a base **43**. End effector **40** also includes a pair of arms **44** pivotally attached to base **43** and movable between a first shape **46** and a second shape **47**. In the illustrated embodiment, end effector **40** is illustrated as a grasper or a clamp **54**. Pair of arms **44** are in the second shape **47** when the laparoscopic tool **30** and the end effector **40** are in the capture/unactuated configuration **21** as shown in FIG. **1**. The pair of arms **44** are in the first shape **46** when the laparoscopic tool **30** and the end effector **40** are in the capture/actuated configuration as shown in FIG. **6**. Assuming that the end effector **40** is not interacting with tissue or something else, the pair of arms **44** will be in the second shape **47** in the release configuration **23** as shown in FIG. **4**.

[0018] The pair of arms **44** may be biased toward the second shape **47** using an appropriate biasing element **55** which takes the form of an elastic band **58** in the illustrated embodiment. Nevertheless, those skilled in the art will appreciate that other known structures could be utilized to bias pair of arms **44** between first shape **46** and the second shape **47** without departing from the present disclosure. For instance, if the end effector **40** took the form of a spreader, biasing element **55** could take an alternate form to bias the pair of arms **44** toward a spread configuration instead of as a clamp **54** as in the illustrated embodiment. Returning to the illustrated embodiment, actuator rod **42** may have a wedge **48** attached to a distal end **49** of the actuator rod **42**, and the wedge **48** is operably positioned between the pair of arms **44**. With this strategy, the laparoscopic tool **30** may tension actuator rod **42** to move knob **41** from a first distance **52** from base **43** to a second distance **53**, which forces first arm **56** and second arm **57** of the pair of arms **44** to spread apart as shown in FIGS. **3** and **6**. The second distance **53** is greater than the first distance **52**. The tensioning of actuator rod **42** may be accomplished by forming base **43** of end effector **40** to be too large to be received in sheath **43** when deployment/capture device **32** is pulling knob **41** into laparoscopic tool **30** responsive to movement of shaft actuator **34**.

[0019] The deployment/capture device **32** defines a receptacle **50** that is shaped to capture the knob **41** and an adjacent segment **51** of the actuator rod **42** in both the capture/unactuated configuration **21** shown in FIG. **1**, and the capture/actuated configuration **22** shown in FIG. **6**. The knob **41** may be considered to be trapped in the receptacle **50** in both the capture/unactuated configuration **21** and the actuated configuration **22**. Although knob **41** is shown as having a spherical or ball shape, those skilled in the art will appreciate that a knob with numerous other shapes could work equally well. For instance, knobs **41** with an ovoid or other rounded atraumatic shape might be desirable. Other shapes could include spherical or ball shaped, egg shaped, pear shaped, teardrop shaped or even a door knob type shape and many other shapes without sharp edges could be utilized without departing from the intended scope of the present disclosure. In the illustrated embodiment, actuator rod **42** is symmetrical with identically shaped knobs **61** on opposite ends, which may allow for the actuator rod to be molded from a suitable plastic material integrally with the identically ball shaped knobs **61**. Likewise, wedge **48** may take on a variety of shapes that interact appropriately with a wedge shaped cavity **60** in order to urge the pair of arms **44** apart when knob **41** is moved away from base **43** as shown in FIG. **3**. In the illustrated embodiment actuator rod **42** is symmetrical with identical ball shaped knobs **61** on opposite ends, which allows end effector **40** to be manufactured and assembled without regard to which end of actuator rod **42** acts as a wedge **48** in which acts as a knob **41**. Nevertheless, the wedge **48** and knob **41** could take on completely different shapes without departing from the present disclosure.

[0020] Although not necessary, the base **43** of end effector **40** may be out of contact with the sheath **33** of laparoscopic tool **30** in the capture/unactuated configuration **21** as shown in FIG. **1**, but the base **43** may be in contact with the sheath **33** in the capture/actuated configuration as shown in FIG. **6**. As stated earlier, the knob **41** is at a first distance **52** from the base **43** in both the capture/unactuated configuration **21** and the released configuration **23**. On the otherhand, the knob **41** may be at a second distance **53**, which is greater than the first distance **52**, from the base **43** in the capture/actuated configuration **22**. As stated earlier, end effector **40** is illustrated as a clamp **54** with the pair of arms **44** biased toward contact with each other by a biasing element **55** in the form of an elastic bend **58** that is in contact with each of the first arm **56** and the second arm **57**. In other words, when the first arm **56** and the second arm **57** are configured as a clamp **54**, opposing faces **59** may be in contact in the second shape **47** (FIG. **2**), but be out of contact in the first shape **46**, as best shown in FIG. **3**. Elastic band **58** may be positioned in a groove defined by the respective arms **56** and **57** as best shown in FIGS. **2** and **3**. Movement of wedge **48** toward base **43** against the action of biasing element **55** (elastic band **58**) causes the laparoscopic medical device assembly **20** to responsively move from the capture/unactuated configuration **21** toward the capture/actuated configuration **22**.

[0021] The deployment/capture device **32** may be made from a suitable semi-rigid material such as polyurethane that exhibits flexibility, some elasticity, and good tensile strength. It may be formed from a billet or rod of the

material, which has been split into halves. One end of the two halves may be held together (as if still whole) while the receptacle **50** is formed in the free end. The receptacle **50** may be formed in the two halves of the opposite end and then the free or distal end may be curled open and heat set in a manner well known in the art. Once properly formed and heat set, the deployment/capture device **32** should be biased toward an open shape as shown in FIG. **4** when unconstrained by sheath **33**. In other words, when deployment/capture device **32** is advanced beyond the distal end of sheath **33** by appropriately manipulating handle actuator **31**, the deployment/capture device **32** will spread open in order to facilitate both capture and release of the knob **41** and actuator rod **42** of end effector **40**. The actuator rod **42** and the associated knob **41** and wedge **48** may be molded or machined from a suitable polymer that is at least as strong as polyacetal, but maybe not any more lubricious that polyacetal. The actuator rod **42**, if not molded integrally with knob **41** and maybe wedge **48**, may be a flexible cable or strand as an alternative to the relatively rigid post of the illustrated embodiment. In any event, the actuator rod should be able to withstand a tensile load being imposed by the laparoscopic tool **30** when moving from the capture/unactuated configuration **21** to the capture/actuated configuration **22**. Thus, in the context of the present disclosure, "actuator rod" should be interpreted to include flexible cables and the like.

[0022] It should be noted that when sheath positioner **37** is in the second position shown in FIG. **6**, the laparoscopic medical device assembly **20** may only be capable of being moved between the capture/unactuated configuration **21** and the capture/actuated configuration **22**. When the sheath positioner **37** is rotated to the first position shown in FIG. **4**, the laparoscopic medical device assembly **20** may only be capable of moving between the capture/unactuated configuration **21** and the release configuration **23**.

INDUSTRIAL APPLICABILITY

[0023] The present disclosure finds generally applicability to medical procedures, and finds specific applicability for use in laparoscopic surgical procedures. Although the illustrated embodiment includes an end effector in the form of a clamp or a grasper, those skilled in the art will appreciate that other end effectors, such as a spreader would also fall within the intended scope of the present disclosure.

[0024] Although not necessary, the handle actuator **31** of the laparoscopic medical device assembly **20** is configured so that sheath positioner **37** is utilized to facilitate capture and release of knob **41** and hence end effector **40**, whereas the shaft actuator **34** is utilized to actuate and de-actuate the end effector **40** in a manner consistent with the expected action of other laparoscopic medical devices. Thus, with the illustrated embodiment, one cannot go directly from the release configuration **23** of FIG. **4** to the capture/actuated configuration of FIG. **6** by manipulating only one of the shaft actuator **34** and the sheath positioner **37**. In other words, in the illustrated embodiment, one must pass through the capture/unactuated configuration of FIG. **1** when moving between the release configuration **23** of FIG. **4** and the capture/actuated configuration **22** of FIG. **6**, and vice versa.

[0025] Referring now in addition to FIG. **7**, a method according to the present disclosure may begin by moving the laparoscopic medical device assembly **20** in a capture/unactuated configuration **21** at a first location **14** (FIG. **1**) to a second location **15** (FIGS. **6** and **7**) with the laparoscopic medical device assembly in a capture/actuated position **22**. For instance, the laparoscopic medical device assembly **20** shown in FIG. **1** may start outside of the patient's body **10**, then be advanced through a trocar **18** into a patient's body **10** until arriving at a clamping location **15**. During this portion of the procedure, the sheath positioner **37** may be "parked" at the second or advanced position so as to "lock" end effector **40** onto laparoscopic tool **30** so that it cannot become dislodged during introduction or withdrawal. In other words, the laparoscopic medical device assembly **20** may be incapable of achieving the release configuration **23** when the sheath positioner **37** is in the advanced or second position as shown in FIGS. **1**, **5** and **6**. As the laparoscopic medical device assembly **20** approaches location **15** where end effector **40** is to be deployed, shaft actuator **34** may be actuated by moving finger rings **36** toward palm contact **35**, as shown in FIG. **6**, so that base **43** contacts the distal end of sheath **33** while putting the actuator rod **42** in tension to spread arms **56** and **57** apart against the action of biasing element **55**. When in this configuration the physician may position tissue **11** between arms **57** and **56**. After this is done, the force on finger rings **36** and palm contact **35** can be relaxed to allow the internal bias to move them apart. This will also relieve tension on actuator rod **42** so that biasing element **55** can bias arms **56** and **57** toward each other to clamp the tissue **11** therebetween. Next, the sheath positioner **37** may be rotated from the second position to the first position to allow the deployment/capture device **32** to spread open to the release configuration **23**. When this is done, the laparoscopic tool **30** can be moved out of contact with, and away from, end effector **40**, which is left in place clamped to tissue **11** as shown in FIG. **7**. After laparoscopic tool **30** and end effector **40** are separated, sheath positioner **37** may be rotated back to the second position to re-close deployment/actuator device **32** so that laparoscopic tool **30** can be more easily withdrawn through trocar **18**. The laparoscopic tool **30** may then be completely withdrawn through trocar **18** so that the port may be used for another task during the remainder of the laparoscopic medical procedure, or the laparoscopic tool **30** may be loaded with a second end effector **140**. For instance, a second end effector **140** may be delivered with laparoscopic tool **30** to contact tissue **12** at a fourth location **17**. Later in the procedure, the laparoscopic tool **30** may be configured as shown in FIG. **4** and moved back toward contact to retrieve end effector **40**. When properly positioned, the knob **41** can be captured with the deployment/capture device **32** by rotating the sheath positioner **37** from the first position (FIG. **4**) to the second position (FIG. **1**). In other words, capture is accomplished by changing the laparoscopic medical device assembly **20** from the release configuration **23** to the capture/unactuated configuration **21**. Next, the laparoscopic medical device assembly **20** may be changed from the capture/unactuated configuration **21** to the capture/actuated configuration **22** in order to detach end effector **40** from tissue **11**. This is accomplished by manipulated shaft actuator **35** to move finger rings **36** toward palm contact **35**. The rejoined medical device assembly **20** may then be moved away from tissue **11**. Next the force on shaft actuator is relaxed, the internal bias moves finger ringer **36** away from palm contact **35**, the biasing element **58** moves end effector **40** to the second shape, and the complete assembly assumes the capture/unactuated configuration **21** as shown in FIG. **1**. The lapa-

roscopic medical device assembly **20** may then be moved to a third location **16**, such as back out of trocar **18** outside of the persons body **10**.

[0026] Thus, end effector **40** may be clamped to tissue **11**, left in place during a procedure, and then later retrieved and removed from the patient leaving the port associated with trocar **18** available for other purposes when end effector **40** is left clamped to tissue **11**. As discussed earlier, changing the laparoscopic medical device assembly **20** from the capture/unactuated configuration **21** to the capture/actuated configuration **22** includes pulling the knob **41** away from the base **43** of the end effector **40**. As an example, end effector **40** may be utilized to clamp off a bleeding vessel in the abdomen **10** of the patient while other aspects of a laparoscopic surgical procedure are being performed through the port used to deliver the end effector **40**, and maybe utilizing other ports in a manner known in the art.

[0027] The present description is for illustrative purposes only, and should not be construed to narrow the breadth of the present disclosure in any way. Thus, those skilled in the art will appreciate that various modification might be made to the presently disclosed embodiments without departing from the full and fair scope and spirit of the present disclosure. Other aspects, features and advantages will be apparent upon an examination of the attached drawings and appended claims.

what is claimed is:

1. A laparoscopic medical device assembly comprising:

a laparoscopic tool with a handle actuator coupled to slide a deployment/capture device within and relative to a sheath;

an end effector with a knob attached to a proximal end of an actuator rod extending through a base, and including a pair of arms pivotally attached to the base and being movable between a first shape and a second shape;

wherein the laparoscopic tool and the end effector are movable among a capture/unactuated configuration, a capture/actuated configuration and a release configuration; and

wherein the pair of arms are in the second shape in the capture/unactuated configuration, and in the first shape in the capture/actuated configuration, and the end effector is out of contact with the laparoscopic tool in the release configuration.

2. The laparoscopic medical device assembly of claim **1** wherein the pair of arms are biased toward the second shape; and

the laparoscopic tool tensions the actuator rod when moved from the capture/unactuated configuration to the capture/actuated configuration.

3. The laparoscopic medical device assembly of claim **2** wherein the actuator rod has a wedge attached to a distal end of the actuator rod, and the wedge is operably positioned between the pair of arms.

4. The laparoscopic medical device assembly of claim **1** wherein the deployment/capture device defines a receptacle shaped to capture the knob and an adjacent segment of the actuator rod in both the capture/unactuated configuration and the capture/actuated configuration; and

the knob is trapped in the receptacle in both the capture/unactuated configuration and the capture/actuated configuration.

5. The laparoscopic medical device assembly of claim **1** wherein the base of the end effector is too large to be received in the sheath;

the base is out of contact with the sheath in the capture/unactuated configuration, and in contact with the sheath in the capture/actuated configuration.

6. The laparoscopic medical device assembly of claim **1** wherein the knob is a first distance from the base in both the capture/unactuated configuration and the release configuration; and

the knob is a second distance, which is greater than the first distance, from the base in the capture/actuated configuration.

7. The laparoscopic medical device assembly of claim **1** wherein the end effector is a clamp with the pair of arms biased toward contact with each other by a biasing element;

the actuator rod has a wedge attached to a distal end, and the wedge is operably positioned between the pair of arms; and

the wedge is moved toward the base responsive to movement from the capture/unactuated configuration toward the capture/actuated configuration.

8. The laparoscopic medical device assembly of claim **7** wherein the deployment/capture device defines a receptacle shaped to capture the knob and an adjacent segment of the actuator rod in both the capture/unactuated configuration and the capture/actuated configuration, and the knob is trapped in the receptacle in both the capture/unactuated configuration and the capture/actuated configuration;

wherein the base of the end effector is too large to be received in the sheath, and the base is out of contact with the sheath in the capture/unactuated configuration, and in contact with the sheath in the capture/actuated configuration; and

wherein the knob is a first distance from the base in both the capture/unactuated configuration and the release configuration, and the knob is a second distance, which is greater than the first distance, from the base in the capture/actuated configuration.

9. An end effector for use with a laparoscopic tool as part of a laparoscopic medical device assembly, the end effector comprising:

a base that is too large to be received in a sheath of the laparoscopic tool;

a first arm and a second arm pivotally attached to the base and being movable between a first shape and a second shape;

a biasing element operably positioned to bias the first arm and the second arm toward the second shape;

a actuator rod slidably received through the base with a distal end positioned between the first arm and the second arm, and having a knob attached to a proximal end of the actuator rod;

the knob being a first distance from the base when the first arm and the second arm are in the second shape, and the knob being greater than the first distance from the base when the first arm and the second arm are in the first shape.

10. The end effector of claim **9** wherein the first arm and the second arm are configured as a clamp with opposing faces in contact in the second shape and out of contact in the first shape.

11. The end effector of claim **9** wherein the actuator rod is symmetrical with identically shaped knobs on opposite ends.

12. The end effector of claim **9** including a wedge attached to a distal end of the actuator rod and operably positioned between the first arm and the second arm.

13. The end effector of claim **9** wherein the biasing element includes an elastic band in contact with each of the first arm and the second arm.

14. The end effector of claim **9** wherein the actuator rod is symmetrical with identical ball shaped knobs on opposite ends;

the biasing element includes an elastic band in contact with each of the first arm and the second arm;

one of the ball shaped knobs is positioned in a wedge shaped cavity defined by the first arm and the send arm; and

the first arm and the second arm are configured as a clamp with opposing faces in contact in the second shape and out of contact in the first shape.

15. A method of using a laparoscopic medical device assembly that includes a laparoscopic tool with a handle actuator coupled to slide a deployment/capture device within and relative to a sheath; and an end effector with a knob attached to a proximal end of an actuator rod extending through a base, and including a pair of arms pivotally attached to the base and being movable between a first shape and a second shape, the method comprising the steps of:

moving the laparoscopic medical device assembly in a capture/unactuated configuration at a first location to a second location with the laparoscopic medical device assembly in a capture/actuated position;

changing the laparoscopic medical device assembly from the capture/actuated configuration to a release configuration at the second location;

moving the laparoscopic tool away from the end effector;

capturing the knob with the deployment/capture device at least in part by moving the laparoscopic tool back into contact with the end effector and changing from the release configuration to the capture/unactuated configuration; and

changing from the capture/unactuated configuration to the capture/actuated configuration, and then moving the laparoscopic medical device assembly to a third location.

16. The method of claim **15** wherein the step of moving the laparoscopic medical device assembly in a capture/unactuated configuration at a first location to a second location with the laparoscopic medical device assembly in a capture/actuated position includes:

moving the end effector through a trocar in the capture/unactuated configuration.

17. The method of claim **15** wherein the step of changing the laparoscopic medical device assembly from the capture/actuated configuration to a release configuration at the second location includes:

interacting with tissue with the end effector.

18. The method of claim **17** wherein the step of interacting with the tissue includes clamping the tissue with the end effector; and

the step of moving the laparoscopic tool away from the end effector includes leaving the end effector clamped to the tissue.

19. The method of claim **15** wherein the end effector is a first end effector; and

using the laparoscopic tool to deliver a second end effector to contact tissue at a fourth location.

20. The method of claim **15** wherein the changing the laparoscopic medical device assembly from the capture/unactuated configuration to the capture/actuated configuration includes pulling the knob away from the base.

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专利名称(译)	具有可拆卸末端执行器的腹腔镜医疗装置组件及其使用方法		
公开(公告)号	US20160354101A1	公开(公告)日	2016-12-08
申请号	US15/058600	申请日	2016-03-02
[标]申请(专利权)人(译)	库克医学技术有限责任公司		
申请(专利权)人(译)	库克医疗技术有限责任公司		
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发明人	MELSHEIMER, JEFFRY SCOTT		
IPC分类号	A61B17/29 A61B17/28		
CPC分类号	A61B17/2909 A61B17/282 A61B2017/2931 A61B2017/292 A61B2017/2808 A61B17/122 A61B17/1285 A61B17/29 A61B2017/00473 A61B2017/2933 A61B2017/2937 A61B2017/294		
优先权	62/169636 2015-06-02 US		
外部链接	Espacenet USPTO		

摘要(译)

腹腔镜医疗装置组件包括具有手柄致动器的腹腔镜工具，所述手柄致动器联接成在护套内并相对于护套滑动展开/捕获装置。端部执行器具有附接到延伸穿过基部的致动器杆的近端的旋钮，并且包括枢转地附接到基部的一对臂。腹腔镜工具和端部执行器可在捕获/未致动构造，捕获/致动构造和释放构造之间移动。端部执行器可以保持夹紧到组织，而腹腔镜工具被移除，允许套管针通路的替代使用。