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(54) **SOFT TISSUE RF TRANSECTION AND RESECTION DEVICE**

(75) Inventor: **Chris Rusin**, Golden, CO (US)

Correspondence Address:
COVIDIEN
60 MIDDLETOWN AVENUE
NORTH HAVEN, CT 06473 (US)

(73) Assignee: **SHERWOOD SERVICES AG**

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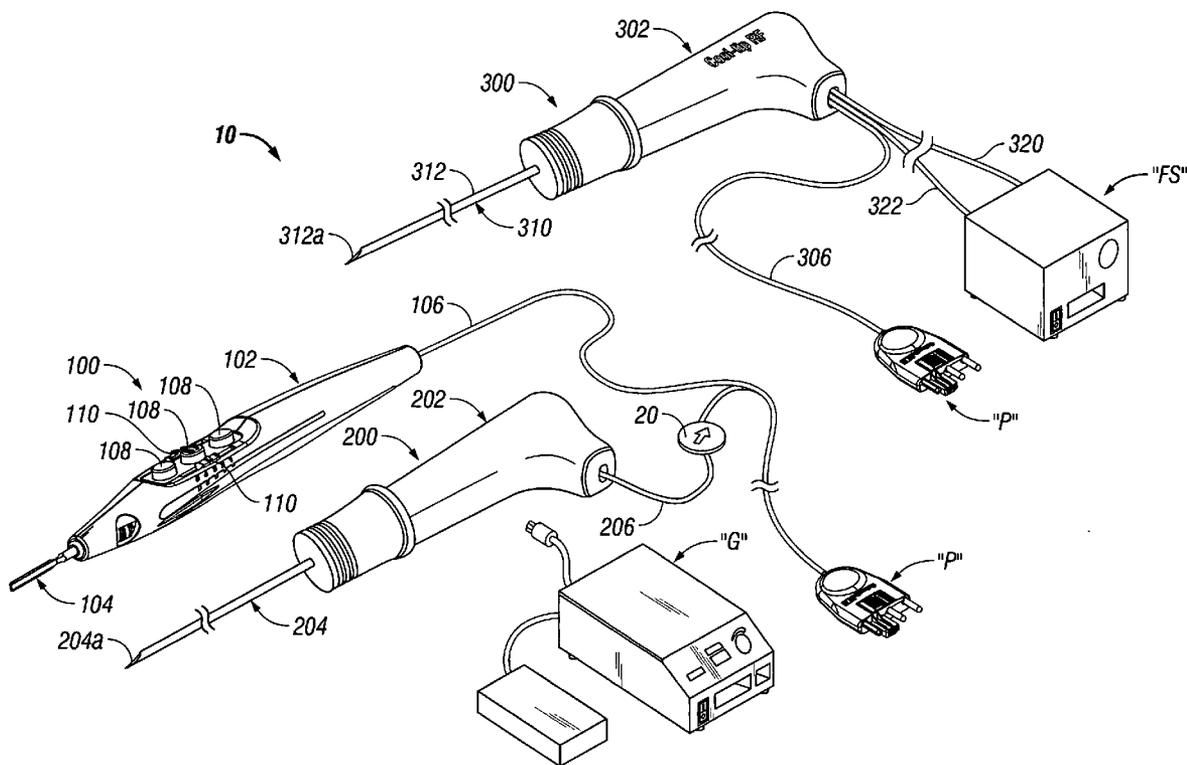
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(57) **ABSTRACT**

An electrosurgical system and method for transecting or resecting a target tissue is provided. The electrosurgical system includes an electrosurgical generator including an active terminal and a return terminal; a first electrically conductive element electrically connectable to the active terminal of the electrosurgical generator, the first electrically conductive element being selectively movable between a first location of a target tissue and a second location of the target tissue; a second electrically conductive element electrically connectable to the active terminal of the electrosurgical generator, the second electrically conductive element configured to couple to the first location of the target tissue; and a third electrically conductive element electrically connectable to the return terminal of the electrosurgical generator, the third electrically conductive element configured to couple to the second location of the target tissue.



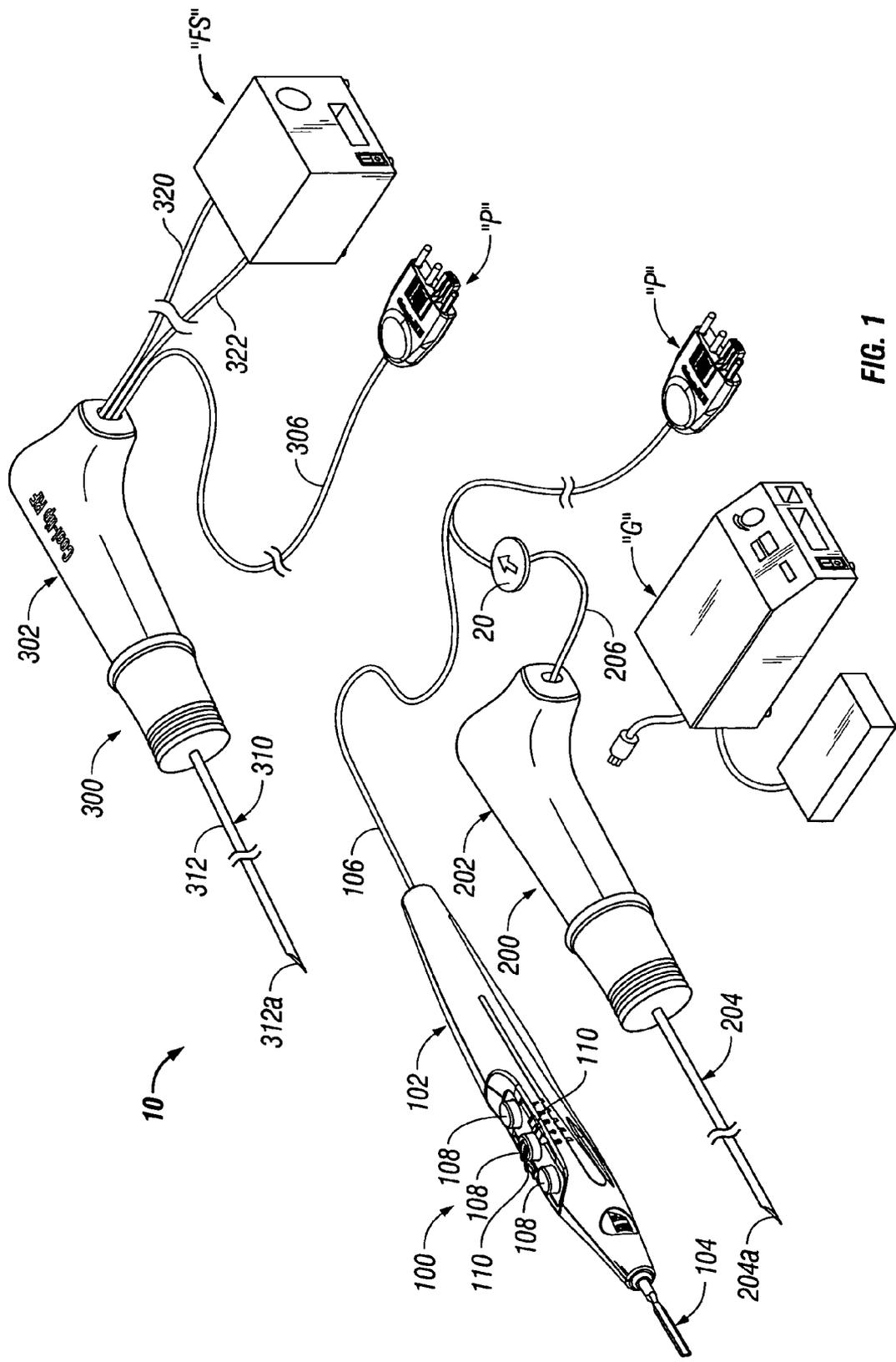


FIG. 1

SOFT TISSUE RF TRANSECTION AND RESECTION DEVICE

BACKGROUND

[0001] 1. Technical Field

[0002] The present disclosure is directed to electro-surgical systems and methods and, more particularly, to soft tissue RF transection and resection devices and methods of using the same.

[0003] 2. Background

[0004] Electro-surgical methods are widely used in the operative field since they generally reduce patient bleeding associated with tissue cutting, transecting and/or resecting procedures and improve the surgeons' ability to view the surgical site. Two widely accepted methods of electro-surgery are performed, namely, monopolar electro-surgery and bipolar electro-surgery.

[0005] Monopolar electro-surgery methods generally direct electric current along a defined path from an exposed or active electrode through the patient's body to a return pad or electrode, which is externally attached to a suitable location on the patient's skin.

[0006] Alternatively, bipolar electro-surgery methods generally direct electric current along a defined path from a first exposed or active electrode through the patient's body to a second exposed or return electrode. Both the first and the second electrodes are typically disposed within the body of the patient.

[0007] Transection and/or resection of soft tissues, such as the liver or spleen, pose particular difficulties during electro-surgical operation as compared to electro-surgical operation of other tissues and thus require unique electro-surgical instruments, systems, techniques and the like for operating thereon.

SUMMARY

[0008] The present disclosure is directed to electro-surgical systems and methods and, more particularly, to soft tissue RF transection and resection devices and methods of using the same.

[0009] According to an aspect of the present disclosure, an electro-surgical system for transecting or resecting a target tissue is provided. The electro-surgical system includes an electro-surgical generator including an active terminal and a return terminal; a first electrically conductive element electrically connectable to the active terminal of the electro-surgical generator, the first electrically conductive element being selectively movable between a first location of a target tissue and a second location of the target tissue; a second electrically conductive element electrically connectable to the active terminal of the electro-surgical generator, the second electrically conductive element configured to couple to the first location of the target tissue; and a third electrically conductive element electrically connectable to the return terminal of the electro-surgical generator, the third electrically conductive element configured to couple to the second location of the target tissue.

[0010] According to a further aspect of the present disclosure, a method of performing an electro-surgical procedure on a target tissue is provided. The method includes the steps of providing an electro-surgical system having an active terminal; a first electro-surgical device electrically connectable to the active terminal of the electro-surgical generator, the first electro-surgical device being selectively movable along target tissue; a second electro-surgical device electrically connectable to the active terminal of the electro-surgical generator, the second electro-surgical device being selectively connectable to a first location of the target tissue; and a third electro-surgical device electrically connectable to the return terminal of the electro-surgical generator, the third electro-surgical device being selectively connectable to a second location of the target tissue.

[0011] The method further includes the steps of coupling the second electro-surgical device to the first location of the target tissue; coupling the third electro-surgical device to the second location of the target tissue, wherein a resection line is defined between the first location and the second location; and moving the first electro-surgical device substantially along the resection line to desiccate or divide the target tissue.

[0012] According to yet another aspect of the present disclosure, a further method of performing an electro-surgical procedure on a target tissue is provided. The present method includes the steps of coupling a second electro-surgical device to a first location of a target tissue; coupling a third electro-surgical device to a second location of the target tissue; causing RF energy to flow between the first location and the second location; coupling a first electro-surgical device at or substantially near the first location; and moving the first electro-surgical device from the first location to the second location.

[0013] It is an advantage of the present disclosure to provide a system and method for performing a bipolar tissue transection and/or resection.

[0014] It is a further advantage of the present disclosure to provide a system and method to more efficiently desiccate and/or divide tissue using bipolar electro-surgical concepts.

[0015] For a better understanding of the present invention and to show how it may be carried into effect, reference will be made by way of example to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] In the drawings, which constitute a part of the specification, exemplary embodiments exhibiting various objectives and features hereof are set forth, specifically:

[0017] FIG. 1 is a perspective view of an electro-surgical system in accordance with one embodiment of the present disclosure; and

[0018] FIG. 2 is a schematic illustration of the electro-surgical system of FIG. 1 being used to perform an electro-surgical procedure on an exemplary body tissue.

DETAILED DESCRIPTION OF EMBODIMENTS

[0019] Embodiments of electro-surgical systems, in accordance with the present disclosure, are described in detail with reference to the drawings figures wherein like reference numerals identify similar or identical structural elements. As shown in the drawings and described throughout the fol-

lowing description, as is traditional when referring to relative positioning on a surgical instrument, device or apparatus, the term “proximal” refers to the end of the instrument, apparatus or device that is closer to the user and the term “distal” refers to the end of the apparatus that is further away from the user.

[0020] FIG. 1 sets forth a perspective view of an electro-surgical system 10 in accordance with an embodiment of the present disclosure. As seen in FIG. 1, electro-surgical system 10 includes a first electro-surgical device 100 and a second electro-surgical device 200 electrically connected in parallel to first electro-surgical device 100. The first electro-surgical device 100 and second electro-surgical device 200 may be connected to or connectable to an electro-surgical generator “G”, via a common plug or connector “P” or two individual plugs (not shown) connected in a parallel circuit. While a single common plug “P” is shown for first and second electro-surgical devices 100, 200, it is within the scope of the present disclosure for each of the first and second electro-surgical devices 100, 200 to have a respective plug or the like for electrical connection to the electro-surgical generator “G”.

[0021] In the illustrated embodiment, the first electro-surgical device 100 includes a housing or handle assembly 102, an electrode blade 104 supported within and extending from a distal end of housing 102, a cable 106 extending from a proximal end of housing 102, and optionally at least one activation switch 108 supported on housing 102. Blade 104 is electrically connected to cable 106. Blade 104 may be fabricated from a suitable electrically conductive material. Each activation switch 108 may function to control the transmission of RF electrical energy supplied from generator “G” to electro-surgical blade 104. While electrode blade 104 is shown and described as a blade, it is within the scope of the present disclosure for electrode blade 104 to be any suitable electrode having any suitable geometry or configuration, such as, for example, a loop, a ball, etc.

[0022] Reference may be made to U.S. application Ser. No. 11/337,990, filed on Jan. 24, 2006, the entire contents of which are incorporated herein by reference, for a more detailed discussion of the first electro-surgical device 100. Other suitable electro-surgical devices are contemplated by the present disclosure.

[0023] In the illustrated embodiment, the second electro-surgical device 200 includes a housing or handle assembly 202, a needle electrode 204 supported within and extending from a distal end of housing 202, and a cable 206 extending from a proximal end or side of housing 202. Electrode 204 is electrically connected to cable 206. Electrode 204 may terminate in a sharpened distal tip 204a, which is constructed so as to penetrate tissue with a minimum risk of hemorrhage from the puncture tract. Needle electrode 204 may be fabricated from a suitable electrically conductive material and may include an insulative layer covering at least a portion of the length thereof. In an embodiment, a distal end portion of needle electrode 204 may be exposed. Accordingly, since the distal end portion of needle electrode 204 is exposed or non-insulated, the distal end portion is capable of DC or AC delivery, preferably RF delivery.

[0024] While the second electro-surgical device 200 is shown as including a needle electrode 204, it is within the scope of the present disclosure for the second electro-surgical

device 200 to include any suitable electrically conductive element that is configured to couple to a target tissue. For example, the second electro-surgical device 200 may include a contact pad, an array of needle electrodes, a clamp or clip, or any other electrically conductive element that may contact, be inserted into, may grab onto, the target tissue.

[0025] As described above, cable 106 and cable 206 may join together and/or combine into a single cable that is connected to plug “P”. Accordingly, the first electro-surgical device 100 and the second electro-surgical device 200 are electrically joined in parallel to one another when connected to generator “G” and when in operative engagement with target tissue.

[0026] In one embodiment, a potentiometer 20 may be placed along a cable of any of or each electro-surgical device. Potentiometer 20 may be configured to vary the current and/or voltage being transmitted to needle electrode of the electro-surgical device or devices.

[0027] With continued reference to FIG. 1, electro-surgical system 10 further includes a third electro-surgical device 300. In the illustrated embodiment, the third electro-surgical device 300 includes a housing or handle assembly 302, at least one needle electrode assembly 310 supported within and extending from a distal end of handle 302, and a cable 306 extending from a proximal end or a side of housing 302. A plug “P” is provided at the end of cable 306 and functions to electrically connect the third electro-surgical device 300 to electro-surgical generator “G”.

[0028] Needle electrode assembly 310 may be fabricated from a suitable electrically conductive material and may include an insulative layer covering at least a portion of the length thereof.

[0029] In the illustrated embodiment, needle electrode assembly 310 includes an outer tube 312 having at least an exposed distal end portion terminating in a sharpened distal tip 312a, which is constructed so as to penetrate tissue with a minimum risk of hemorrhage from the puncture tract. Outer tube 312 includes a proximal end portion supported in housing 302. Outer tube 312 is hollow and defines a cavity therein that is in fluid communication with a distal end of an outflow conduit 320. Since the distal end portion of outer tube 312 is exposed or non-insulated, the distal end portion is capable of DC or AC delivery, preferably RF delivery.

[0030] Needle electrode assembly 312 further includes an inner tube (not explicitly shown) disposed substantially co-axially within the cavity of outer tube 312. The inner tube includes a distal end portion located near the distal end portion of outer tube 312 and a proximal end portion that extends from the proximal end portion of outer tube 312 and that is in fluid communication with a distal end of an inflow conduit 322.

[0031] As mentioned above, an inflow conduit 322 includes a distal end that is in fluid communication with the inner tube and a proximal end that extends from housing 302 and is fluidly connected to or connectable to a fluid source “FS”. An outflow conduit 320 includes a distal end that is in fluid communication with the cavity of outflow conduit 320 and a proximal end that extends from housing 302 and is fluidly connected to or connectable to fluid source “FS”.

[0032] In use, a cooling fluid is delivered to distal tip 312a of outer tube 312 from the inner tube and inflow conduit 322

and away from distal tip **312a** of outer tube **312** through the cavity of outflow conduit **320**. Circulation of the cooling fluid may be established with the use of a suitable pump (not explicitly shown).

[0033] While the third electrosurgical device **300** is shown as including a needle electrode assembly **312**, it is within the scope of the present disclosure for the third electrosurgical device **300** to include any suitable electrically conductive element that is configured to couple to a target tissue. For example, the third electrosurgical device **300** may include a contact pad, an array of needle electrodes, a clamp or clip, or any other electrically conductive element that may contact, be inserted into, may grab onto, the target tissue.

[0034] Reference may be made to U.S. Appl. Ser. No. _____, filed on _____, (H-US-00171 (203-4487)), the entire contents of which are incorporated herein by reference, for a more detailed discussion of the third electrosurgical device **300**.

[0035] In operation, the first and second electrosurgical devices **100** and **200** may be electrically connected to an active terminal of generator “G”, while the third electrosurgical device **300** may be electrically connected to the return electrode of generator “G”.

[0036] Turning now to FIG. 2, a method of using electrosurgical system **10** for transecting and/or resecting tissue is described according to one embodiment of the disclosure. With the patient opened, e.g., the skin of the patient has been cut open to expose the inner tissue “T” of an operating cavity, needle electrode **204** of the second electrosurgical device **200** and needle electrode assembly **310** of the third electrosurgical device **300** are percutaneously inserted into the tissue “T”. The line defined between needle electrode **204** of the second electrosurgical device **200** and needle electrode assembly **310** of the third electrosurgical device **300** is denoted as a resection line “R”. Accordingly, needle electrode **204** of the second electrosurgical device **200** and needle electrode assembly **310** of the third electrosurgical device **300** may be suitably positioned relative to one another so as to orient and define the direction and length of the resection line “R”.

[0037] In operation, when generator “G” is activated, RF energy flows between needle electrode **204** of the second electrosurgical device **200** and needle electrode assembly **310** of the third electrosurgical device **300**. With needle electrode **204** of the second electrosurgical device **200** and needle electrode assembly **310** of the third electrosurgical device **300** operatively positioned in tissue “T” and activated, blade electrode **104** of the first electrosurgical device **100** may be brought into contact with tissue “T” at or substantially near the resection line “R” in order to desiccate and/or divide ablate tissue “T”. As described above, the first electrosurgical device **100** and the second electrosurgical device **200** are connected in parallel with one another.

[0038] In order to aid the surgeon in making the cut along the resection line “R”, a visible line may be drawn or superimposed on a computer screen (not shown) between needle electrode **204** of the second electrosurgical device **200** and needle electrode assembly **310** of the third electrosurgical device **300** in order to approximate the resection line “R”.

[0039] In operation, contact of blade electrode **104** of first electrosurgical device **100** with tissue “T” creates a short circuit to needle electrode assembly **310** of the third electrosurgical device **300**. Accordingly, a majority of the RF

energy flows between blade electrode **104** of the first electrosurgical device **100** and needle electrode assembly **310** of the third electrosurgical device **300**, which results in relatively faster cutting and/or ablating of tissue “T”. According to one method of the present disclosure, blade electrode **104** of first electrosurgical device **100** is initially brought into contact with the resection line “R” in close proximity to needle electrode assembly **310** of the third electrosurgical device **300** and then moved along the resection line “R” toward needle electrode **204** of the second electrosurgical device **200**.

[0040] As blade electrode **104** of the first electrosurgical device **100** is moved along the resection line “R”, toward needle electrode **204** of the second electrosurgical device **200**, the RF energy ablates the tissue “T” disposed between the blade electrode **104** of the first electrosurgical device **100** and the needle electrode assembly **310** of the third electrosurgical device **300**.

[0041] As blade electrode **104** of the first electrosurgical device **100** is progressed or moved through tissue “T”, the tissue surrounding blade electrode **104** becomes cooked, thus increasing the impedance of the tissue. As a result, since blade electrode **204** of the second electrosurgical device **200** is connected in parallel with needle electrode **104** of the first electrosurgical device **100**, more RF energy is caused to flow between blade electrode **104** of the first electrosurgical device **100** and needle electrode assembly **310** of the third electrosurgical device **300**. In this manner, RF energy delivery to the tissue “T” is maximized with lower impedance loads on generator “G” and no relatively high impedance shut-offs are experienced.

[0042] When blade electrode **104** is removed or lifted from tissue “T”, RF energy once again flows between needle electrode **204** of the second electrosurgical device **200** and needle electrode assembly **310** of the third electrosurgical device **300**, thereby preventing impedance cut-out and/or deactivation of generator “G”.

[0043] In one embodiment, a cooling fluid may be circulated through needle electrode assembly **310** of third electrosurgical device **300**, in the manner described above. The cooling fluid prevents charring of tissue “T” around needle electrode assembly **310** and also function to maintain the impedance low.

[0044] Any suitable number of needle electrodes connected to the active terminal of electrosurgical generator “G” and inserted in the tissue “T” may be used in the electrosurgical procedure. In addition, any suitable number of needle electrode assemblies connected to the return terminal of electrosurgical generator “G” and inserted in the tissue “T” may be used in the electrosurgical procedure.

[0045] The foregoing description is merely a disclosure of particular embodiments and is no way intended to limit the scope of the invention. Other possible modifications are apparent to those skilled in the art and all modifications are to be defined by the following claims.

What is claimed is:

1. An electrosurgical system for transecting or resecting a target tissue, comprising:

an electrosurgical generator including an active terminal and a return terminal;

a first electrically conductive element electrically connectable to the active terminal of the electrosurgical

generator, the first electrically conductive element being selectively movable between a first location of a target tissue and a second location of the target tissue;

a second electrically conductive element electrically connectable to the active terminal of the electrosurgical generator, the second electrically conductive element configured to couple to the first location of the target tissue; and

a third electrically conductive element electrically connectable to the return terminal of the electrosurgical generator, the third electrically conductive element configured to couple to the second location of the target tissue.

2. The electrosurgical system according to claim 1, wherein the first and second electrically conductive elements are electrically connected in parallel to one another.

3. The electrosurgical system according to claim 1, wherein the first electrically conductive element is a blade electrode.

4. The electrosurgical system according to claim 3, wherein the first electrically conductive element is associated with an electrosurgical pencil including a handle for supporting the blade electrode.

5. The electrosurgical system according to claim 1, wherein the second electrically conductive element is a needle electrode having a sharpened distal tip configured for percutaneous tissue penetration.

6. The electrosurgical system according to claim 1, wherein the third electrically conductive element is a needle electrode assembly having a sharpened distal tip configured for percutaneous tissue penetration.

7. The electrosurgical system according to claim 6, wherein the third electrically conductive element is associated with a third electrosurgical device that is adapted to connect in fluid communication to a fluid source having a circulatable fluid disposed therein.

8. The electrosurgical system according to claim 1, wherein the first electrically conductive element and the electrically conductive element are electrically connected to a common plug.

9. A method of performing an electrosurgical procedure on a target tissue, the method comprising the steps of:

providing an electrosurgical system comprises:

an electrosurgical generator having an active and a return terminal;

a first electrosurgical device electrically connectable to the active terminal of the electrosurgical generator, the first electrosurgical device being selectively movable along target tissue;

a second electrosurgical device electrically connectable to the active terminal of the electrosurgical generator, the second electrosurgical device being selectively connectable to a first location of the target tissue; and

a third electrosurgical device electrically connectable to the return terminal of the electrosurgical generator, the third electrosurgical device being selectively connectable to a second location of the target tissue;

coupling the second electrosurgical device to the first location of the target tissue;

coupling the third electrosurgical device to the second location of the target tissue, wherein a resection line is defined between the first location and the second location; and

moving the first electrosurgical device substantially along the resection line to desiccate or divide the target tissue.

10. The method according to claim 9, further comprising the step of causing RF energy to flow between the second electrosurgical device and the third electrosurgical device by removing the first electrosurgical device from the target tissue.

11. The method according to claim 9, further comprising the step of connecting the first electrosurgical device and the second electrosurgical device in parallel.

12. The method according to claim 9, further comprising the step of circulating a fluid through the third electrosurgical device.

13. The method according to claim 9, wherein the electrically conductive element of the first electrosurgical device is a blade; wherein the electrically conductive element of the second electrosurgical device includes at least one needle electrode; and wherein the electrically conductive element of the third electrosurgical device includes at least one hollow needle electrode assembly.

14. The method according to claim 13, further comprising the step of circulating a fluid through the at least one needle electrode assembly of the third electrosurgical device.

15. The method according to claim 13, further comprising connecting a fluid source fluidly to the hollow needle electrode assembly.

16. The method according to claim 13, further comprising connecting a plurality of needle electrodes electrically to the active terminal of the electrosurgical generator, and connecting a plurality of hollow needle electrode assemblies electrically to the return terminal of the electrosurgical generator.

17. The method according to claim 16, further comprising the step of percutaneously introducing the needle electrode of the second electrosurgical device and the needle electrode assembly of the third electrosurgical device into the target tissue.

18. A method of performing an electrosurgical procedure on a target tissue, the method comprising the steps of:

coupling a second electrosurgical device to a first location of a target tissue;

coupling a third electrosurgical device to a second location of the target tissue;

causing RF energy to flow between the first location and the second location;

coupling a first electrosurgical device at or substantially near the first location; and

moving the first electrosurgical device from the first location to the second location.

19. The method according to claim 18, further comprising the step of percutaneously introducing the needle electrode of the second electrosurgical device and the needle electrode assembly of the third electrosurgical device into the target tissue.

20. The method according to claim 18, further comprising the step of connecting a potentiometer to at least one of the first, second and third electrosurgical devices.