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(54) **Motion detector for controlling electrosurgical output**

Bewegungsnachweisgerät zur Kontrolle des elektrochirurgischen Ausgangs

Détecteur de mouvement pour contrôler un résultat électrochirurgical

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(73) Proprietor: **Covidien AG**
8212 Neuhausen am Rheinfall (CH)

(72) Inventors:
- **Sartor, Joe Don**
Longmont
CO 80504-7326 (US)
- **Schmaltz, Dale Francis**
Fort Collins
CO 80524 (US)

(74) Representative: **HOFFMANN EITLE**
Patent- und Rechtsanwälte
Arabellastrasse 4
81925 München (DE)

(56) References cited:
WO-A-96/39086
WO-A-2004/010883
US-A- 4 625 723
US-A- 5 178 012
US-B1- 6 249 706
US-B1- 6 286 512
US-B1- 6 386 032
US-B1- 6 494 882

Description

BACKGROUND

Technical Field

[0001] The present disclosure relates generally to an electrosurgical instrument and, more particularly, to an electrosurgical pencil having a motion detector for controlling the electrosurgical output thereof.

Background of Related Art

[0002] Electrosurgical instruments have become widely used by surgeons in recent years. Accordingly, a need has developed for equipment that is easy to handle, is easy to operate, and is reliable and safe. By and large, most surgical instruments typically include a variety of hand-held pencils, e.g., electrosurgical pencils, forceps, scissors and the like, and electrosurgical pencils, which transfer energy to a tissue site. The electrosurgical energy is initially transmitted from an electrosurgical generator to an active electrode which, in turn, transmits the electrosurgical energy to the tissue. In a monopolar system, a return electrode pad is positioned under the patient to complete the electrical path to the electrosurgical generator. A smaller return electrode is positioned in bodily contact with or immediately adjacent to the surgical site in a bipolar system configuration.

[0003] For the purposes herein, the term electrosurgical fulguration includes the application of an electric spark to biological tissue, for example, human flesh or the tissue of internal organs, without significant cutting. The spark is produced by bursts of radio-frequency electrical energy generated from an appropriate electrosurgical generator. Generally, electrosurgical fulguration is used to dehydrate, shrink, necrose or char tissue. As a result, electrosurgical fulguration instruments are primarily used to stop bleeding and oozing of various surgical fluids. These operations are generally embraced by the term "coagulation." Meanwhile, electrosurgical "cutting" includes the use of the applied electric spark to tissue which produces a cutting effect. By contrast, electrosurgical "sealing" includes utilizing a unique combination of electrosurgical energy, pressure and gap distance between electrodes to melt the tissue collagen into a fused mass.

[0004] It is known that certain electrosurgical waveforms are preferred for different surgical effects. For example, a continuous (i.e., steady) sinusoidal waveform is preferred to enhance the cutting effect of the electrosurgical blade in an electrosurgical pencil or enhance the cooperative effect of the two opposing jaw members. A series of discontinuous, high energy electrosurgical pulses are preferred to enhance the coagulation of biological tissue. Other types of electrosurgical waveforms are preferred for electrosurgical "blending", "shorting" or fusing tissue. As can be appreciated, these waveforms are typically regulated by the generator and are generally dependent upon the desired mode of operation manually selected by the surgeon at the onset (or during) the operation.

[0005] As used herein, the term "electrosurgical pencil" is intended to include instruments which have a handpiece which is attached to an active electrode and are used to coagulate, cut, and seal tissue. The pencil may be operated by a hand-switch (in the form of a depressible button provided on the handpiece itself) or a foot-switch (in the form of a depressible pedal operatively connected to the handpiece). The active electrode is an electrically conducting element which is usually elongated and may be in the form of a thin flat blade with a pointed or rounded distal end. Typically, electrodes of this sort are known in the art as "blade" type. Alternatively, the active electrode may include an elongated narrow cylindrical needle which is solid or hollow with a flat, rounded, pointed or slanted distal end. Typically, electrodes of this sort are known in the art as "loop" or "snare", "needle" or "ball" type.

[0006] As mentioned above, the handpiece of the pencil is connected to a suitable electrosurgical source (e.g., generator) which supplies the electrosurgical energy necessary to the conductive element of the electrosurgical pencil. In general, when an operation is performed on a patient with an electrosurgical pencil, energy from the electrosurgical generator is conducted through the active electrode to the tissue at the site of the operation and then through the patient to a return electrode. The return electrode is typically placed at a convenient place on the patient's body and is attached to the generator by a return cable.

[0007] During the operation, the surgeon depresses the hand-switch or foot-switch to activate the electrosurgical pencil. Then, depending on the level of radio-frequency electrosurgical energy desired for the particular surgical effect, the surgeon manually adjusts the power level on the electrosurgical generator by, for example, rotating a dial on the electrosurgical instrument. Recently, electrosurgical pencils have been developed which vary the level of electrosurgical energy delivered depending on the amount of drag sensed by the active electrode or by the degree the hand-switch has been depressed by the surgeon. Examples of some of these instruments are described in commonly assigned U.S. Provisional Application Nos. 60/398,620 filed July 25, 2002 corresponding to U.S. Publication No. US 2006/0058783, published March 16, 2006; and 60/424,352 filed November 5, 2002corresponding to U.S. Publication No. US 2004/0092927, published May 13, 2004.

[0008] Accordingly, a need exists for an electrosurgical pencil which is activated without the use of hand-switches or foot-switches and which can automatically control the electrosurgical output from the electrosurgical generator without manual intervention by the surgeon.

SUMMARY

[0009] According to the present invention there is provided an electrosurgical instrument according to claim 1. An electrosurgical instrument having a movement sensing device for controlling the electrosurgical output thereof, is disclosed. In one aspect of the present disclosure, the electrosurgical instrument includes an elongated housing, an electrically conductive element supported within the housing and extending distally from the housing, the electrically conductive element being connectable to a source of electrosurgical energy, and a sensor disposed within the housing and in electrical connection with the electrosurgical generator. The sensor detects movement of the electrically conductive element and communicates a signal to the electrosurgical generator relating to the movement of the electrically conductive element. The source of electrosurgical energy supplies electrosurgical energy in response to the signal communicated from the sensor.

[0010] It is envisioned that the sensor for detecting movement of the electrically conductive element is at least one of force-sensing transducers, accelerometers, optical positioning systems, radiofrequency positioning systems, ultrasonic positioning systems and magnetic field positioning systems.

[0011] Preferably, the electrically conductive element includes a longitudinal axis defined therethrough and the sensor detects at least one of a axial movement of the electrically conductive element along the longitudinal axis, a transverse movement across the longitudinal axis of the electrically conductive element, and a rotational movement about the longitudinal axis of the electrically conductive element. In one embodiment it is envisioned that the source of electrosurgical energy transmits a dissecting RF energy output in response to the detection of axial movement of the electrically conductive element along the longitudinal axis. In another embodiment it is envisioned that the source of electrosurgical energy transmits a hemostatic RF energy output in response to the detection of transverse movement of the electrically conductive element across the longitudinal axis.

[0012] It is envisioned that the sensor is at least one of a differential parallel plate accelerometer, a balanced interdigitated comb-finger accelerometer, an offset interdigitated comb-finger accelerometer and a film-type accelerometer. Preferably, the sensor includes a first accelerometer for detecting a movement of the electrically conductive element in an axial direction along the longitudinal axis and a second accelerometer for detecting movement of the electrically conductive element in a transverse direction across the longitudinal axis. It is also envisioned that the sensor may include at least one piezoelectric film.

[0013] In one embodiment it is contemplated that the first accelerometer is configured and adapted to transmit an output signal to the electrosurgical energy source corresponding to the axial movement of the electrically conductive element, and the second accelerometer is configured and adapted to transmit an output signal to the electrosurgical energy source corresponding to the transverse movement of the electrically conductive element. Preferably, each of the first and second accelerometers is at least one of a differential parallel plate accelerometer, a balanced interdigitated comb-finger accelerometer, an offset interdigitated comb-finger accelerometer and a film-type accelerometer.

[0014] In certain embodiments it is envisioned that the source of electrosurgical energy ceases supplying electrosurgical energy when the sensor does not detect a movement of the electrosurgical pencil for a predetermined period of time and/or does not detect a movement of the electrosurgical pencil above a predetermined threshold level of movement.

[0015] It is further envisioned that in certain embodiments the source of electrosurgical energy resumes supplying electrosurgical energy when the sensor detects a movement of the electrosurgical pencil following the predetermined period of time and/or detects a movement of the electrosurgical pencil above the predetermined threshold level of movement.

[0016] These and other objects will be more clearly illustrated below by the description of the drawings and the detailed description of the preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The accompanying drawings, which are incorporated and constitute a part of this specification, illustrate embodiments of the disclosure and, together with a general description of the disclosure given above, and the detailed description of the embodiments given below, serve to explain the principles of the disclosure.

[0018] FIG. 1 is a partially broken away side, elevational view of an embodiment of the electrosurgical pencil in accordance with the present disclosure;

[0019] FIGS. 2A-2C illustrate three embodiments of accelerometers suitable for in-plane sensing or forcing;

[0020] FIG. 3 is a partially broken away perspective view of an electrosurgical pencil in accordance with another embodiment of the present disclosure; and

[0021] FIG. 4 is an enlarged perspective view of the indicated area of FIG. 3.

DETAILED DESCRIPTION

[0022] Embodiments of the presently disclosed electrosurgical pencil will now be described in detail with reference to the drawing figures wherein like reference numerals identify similar or identical elements. In the drawings, and in the description which follows, as is traditional, the term "proximal" will refer to the end of the electrosurgical pencil which is closest to the operator, while the term "distal" will refer to the end of the electrosurgical pencil which is furthest from the operator.

[0023] Acceleration is a physical quality which often must be sensed or measured. Acceleration is defined as the rate of change of velocity with respect to time. For example, acceleration is often sensed to measure force or mass, or to operate some kind of control system. At the center of any acceleration measurement is an acceleration-sensing element, or force-sensing transducer. The transducer is often mechanical or electromechanical element (e.g., a piezoelectric transducer, a piezo-resistive transducer or a strain gauge) which is typically interfaced with an electrical signal or electrical circuits for providing a useful output signal to a generator, computer or other surgical console. Exemplary transducers are described in U.S. Pat. Nos. 5,367,217, 5,339,698, and 5,331,242. An accelerometer is defined as an instrument which measures acceleration or gravitational force capable of imparting acceleration. Another type of force-sensing transducer is an accelerometer. Exemplary accelerometers are described in U.S. Pat. Nos. 5,594,170, 5,501,103, 5,379,639, 5,377,545, 5,456,111, 5,456,110, and 5,005,413 .

[0024] Several types of accelerometers are known. A first type of accelerometer incorporates a bulk-micromachined silicon mass suspended by silicon beams, wherein ion-implanted piezo-resistors on the suspension beams sense the motion of the mass. A second type of accelerometer utilizes a change in capacitance to detect movement of the mass. A third type of accelerometer detects acceleration by measuring a change in a structure's resonant frequency as a result of a shift in the physical load of the structure. It is envisioned that the accelerometers can include a piezoelectric film sandwiched into a weighted printed flex circuit. It is also envisioned that at least one resistive flex circuit could be used to detect the position and/or orientation of the surgical instrument rather than acceleration.

[0025] Turning now to FIG. 1, there is set forth a partially broken away side, elevational view of an electrosurgical pencil constructed in accordance with an embodiment of the present disclosure and generally referenced by numeral 100. While the following description will be directed towards electrosurgical pencils, it is envisioned that the features and concepts of the present disclosure can be applied to other electrosurgical instruments, e.g., dissectors, ablation instruments, probes, etc. Electrosurgical pencil 100 includes an elongated housing 102 configured and adapted to support a blade receptacle 104 at a distal end 103 thereof which, in turn, receives an electrocautery blade 106 therein. A distal end 108 of blade 106 extends distally from receptacle 104 while a proximal end 110 of blade 106 is retained within the distal end 103 of housing 102. Preferably, electrocautery blade 106 is fabricated from a conductive material, e.g., stainless steel or aluminum or is coated with an electrically conductive material.

[0026] As shown, electrosurgical pencil 100 is coupled to a conventional electrosurgical generator "G" via a cable 112. Cable 112 includes a transmission wire 114 which electrically interconnects electrosurgical generator "G" with proximal end 110 of electrocautery blade 106. Cable 112 further includes a control loop 116 which electrically interconnects a movement sensing device 124 (e.g., an accelerometer), supported within housing 102, with electrosurgical generator "G".

[0027] By way of example only, electrosurgical generator "G" may be any one of the following, or equivalents thereof: the "FORCE FX", "FORCE 2" or "FORCE 4" generators manufactured by Valleylab, Inc., a division of Tyco Healthcare, LP, Boulder, Colorado. Preferably, the energy output of electrosurgical generator "G" can be variable in order to provide appropriate electrosurgical signals for tissue cutting (e.g., 1 to 300 watts) and appropriate electrosurgical signals for tissue coagulation (e.g., 1 to 120 watts). One example of a suitable electrosurgical generator "G" is disclosed in commonly-assigned U.S. Patent No. 6,068,627 to Orszulak, et al.. The electrosurgical generator disclosed in the '627 patent includes, *inter alia,* an identifying circuit and a switch therein. In general, the identification circuit is responsive to the information received from a generator and transmits a verification signal back to the generator. Meanwhile, the switch is connected to the identifying circuit and is responsive to signaling received from the identifying circuit.

[0028] Electrosurgical pencil 100 further includes an activation button 126 supported on an outer surface of housing 102. Activation button 126 is operable to control a depressible switch 128 which is used to control the delivery of electrical energy transmitted to electrocautery blade 106.

[0029] Turning back to FIG. 1, as mentioned above, electrosurgical pencil 100 includes an accelerometer 124 which is supported within housing 102. Accelerometer 124 is operatively connected to generator "G" which, in turn, controls and transmits an appropriate amount of electrosurgical energy to electrocautery blade 106 and/or controls the waveform output from electrosurgical generator "G".

[0030] in use, the surgeon activates electrosurgical pencil 100 by depressing activation button 126 thereby allowing electrical energy to be transmitted to electrocautery blade 106. With activation button 126 depressed, as the surgeon moves electrosurgical pencil 100 repeatedly along the X axis (i.e., in a stab-like motion), as indicated by double-headed arrow "X" in FIG. 1, accelerometer 124 transmits a corresponding signal, through control loop 116, to generator "G". Generator "G" then interprets the signal received from accelerometer 124 and, in turn, transmits a corresponding dissecting electrosurgical energy output (i.e., specific power and waveform associated with dissecting), via transmission wire 114, to electrocautery blade 106.

[0031] On the other hand, if the surgeon moves electrosurgical pencil 100 in a direction orthogonal to the X axis, for example, as indicated by double-headed arrow "Z" in FIG. 1, accelerometer 124 transmits a corresponding signal, through control loop 116, to generator "G".

Generator "G" then interprets the orthogonal signal received from accelerometer 124 and, in turn, transmits a hemostatic electrosurgical energy output (i.e., specific power and waveform associated with hemostasis), via transmission wire 114, to electrocautery blade 106.

[0032] Accordingly, the electrosurgical pencil of the present disclosure will enable a surgeon to control the type of output and/or the amount of energy delivered to electrocautery blade 106 by simply moving electrosurgical pencil in a particular pattern or direction. In this manner, the surgeon does not have to depress any buttons or switches which are disposed on the electrosurgical pencil 100 in order to produce either a dissecting or hemostasis energy output in electrocautery blade 106. As can be appreciated, the surgeon does not have to adjust dials or switches on generator "G" in order to produce either the dissecting or hemostasis energy output in electrocautery blade 106.

[0033] Accelerometers suitable for position sensing or electrostatic forcing may be formed with fixed and movable electrodes in many configurations. Several embodiments of accelerometers having in-plane motion sensitivity are shown in FIG. 2, along with an orthogonal coordinate system. In particular, as seen in FIGS. 2A-2C, a differential parallel plate accelerometer is shown generally as 150. Differential parallel plate accelerometer 150 includes an electrode 152, attached to a proof mass 154, which is movable along the Y-axis thereby changing the gap between movable electrode 152 and fixed electrodes 156 and 158. Motion of movable electrode 152, along the Y-axis, causes opposite changes in capacitance formed by electrode pair 152, 156 and 152, 158. In FIG. 2B, a balanced, interdigitated comb-finger accelerometer is shown generally as 160.

[0034] Balanced, interdigitated comb-finger accelerometer 160 includes an electrode 162, attached to a proof mass 164, which is movable along the Y-axis thereby changing the overlap area between movable electrode 162 and a fixed wrap-around electrode 166. In FIG. 2C, an offset, interdigitated comb-finger accelerometer is shown generally as 170. Offset, interdigitated comb-finger accelerometer 170 includes an electrode 172, attached to a proof mass 174, which is movable along the Y-axis thereby changing gaps between movable electrode 172 and a fixed wrap-around electrode 176.

[0035] While a single accelerometer 124 which can measure changes in the acceleration of electrosurgical pencil 100 in the axial (i.e., X-direction), lateral (i.e., Y-direction) and vertical (i.e., Z-direction) directions is preferred, it is envisioned that a pair of identical accelerometers or different accelerometers (i.e., accelerometers 150, 160 and 170), as shown in FIGS. 2A-2C, can be used. For example, a first accelerometer, such as, offset interdigitated comb-finger accelerometer 170, can be mounted within electrosurgical pencil 100 such that a displacement of movable electrode 172 in the Y-direction results in the transmission of dissecting electrosurgical energy by generator "G" to electrocautery blade 106 while a second accelerator, such as, another offset interdigitated comb-finger accelerometer 170, can be mounted within electrosurgical pencil 100, orthogonal to the first accelerometer, such that a displacement of movable electrode 172 in the X-direction results in transmission of hemostatic electrosurgical energy by generator "G" to electrocautery blade 106.

[0036] It is envisioned that any combination of accelerometers can be provided in electrosurgical pencil 100 in any number of orientations to measure changes in acceleration in any number of directions including rotational acceleration (Y-direction and Z-direction). It is also envisioned that any combination of accelerations in the X-direction, Y-direction and Z-direction can also be detected, measured and calculated to effect the electrosurgical output from Generator "G".

[0037] In addition to accelerometers, it is envisioned that many other types of sensors for detecting movement of electrocautery blade 106 can be provided. Other types of force-sensing transducers may be used. Other types, including and not limited to, optical positioning systems, radiofrequency positioning systems, ultrasonic positioning systems and magnetic field positioning systems may be used.

[0038] While an active electrode in the form of a blade has been shown and described, it is envisioned that any type of tip can be used as the active electrode of electrosurgical pencil 100. For example, the active electrode can be an elongated narrow cylindrical needle which is solid or hollow with a flat, rounded, pointed or slanted distal end.

[0039] It is further envisioned that the amount of time required for the transmission of electrosurgical energy from the generator "G" to the electrocautery blade 106, in response to an output signal received from the accelerometer 124 can be adjusted based on the degree of responsiveness desired by the surgeon. For example, a relatively shorter response time would be considered more responsive than a relatively longer response time.

[0040] In addition, it is envisioned that the accelerometer 124 be provided with motion detection algorithms which transmit energy cut-off signals to generator "G" if electrosurgical pencil 100 is held motionless or laid down for an extended period of time. It is contemplated that the sensitivity to activation of electrosurgical pencil 100, in response to an axial, vertical or transverse movement, may be decreased as time lapses from the last time that electrosurgical pencil 100 was used. As such, electrosurgical pencil 100 would be less likely to be inadvertently activated as more time elapses. In addition, the ability to disable the electrosurgical pencil 100 when not in use improves the clinical safety of the device. The motion detection algorithm effectively creates a "virtual holster' which keeps electrosurgical pencil 100 from being inadvertently activated.

[0041] Turning now to FIGS. 3 and 4, there is set forth a partially broken away perspective view of an electrosurgical pencil constructed in accordance with another embodiment of the present disclosure and generally referenced by numeral 200. Electrosurgical pencil 200 is similar to electrosurgical pencil 100 and will only be discussed in detail to the extent necessary to identify differences in construction and operation.

[0042] As seen in FIGS. 3 and 4, electrosurgical pencil 200 includes a film-type accelerometer or sensor 224 supported in housing 102. Sensor 224 is preferably includes substrate 226 fabricated from an elastomeric material. Sensor 224 further includes an array of electrodes 228 (in the interest of clarity only four electrodes 228a-228d have been shown) positioned around the periphery of substrate 226. Sensor 224 further includes a proof mass 230 electrically connected to each electrode 228 via electrical leads 232. Proof mass 230 is movable in any direction along axes X, Y and Z thereby changing the gap distance between itself and electrodes 228 and the resistance through leads 232.

[0043] Accordingly, motion of proof mass 230, along the X, Y and/or Z axis results in transmission of a particular signal, through control loop 116, to generator "G" (see FIG. 1). Generator "G" then interprets the particular signal received from sensor 224 and, in turn, transmits a corresponding distinct electrosurgical energy output (i.e., specific power and/or waveform), via transmission wire 114, to electrocautery blade 106.

[0044] For example, with activation button 126 depressed, movement by the surgeon of electrosurgical pencil 200 is directions along the X axis (i.e., in a stab-like motion), causes sensor 224 to transmit a first characteristic signal to generator "G". Generator "G" interprets the first characteristic signal and, in turn, transmits a corresponding dissecting electrosurgical energy output (i.e., a specific power and a specific waveform associated with dissecting), to electrocautery blade 106.

[0045] In a further example, with activation button 126 depressed, movement by the surgeon of electrosurgical pencil 200 in directions transverse to the X axis, such as, for example, along the Y and/or Z axes, causes sensor 224 to transmit a second characteristic signal to generator "G". Generator "G" interprets the second characteristic signal and, in turn, transmits a corresponding hemostatic electrosurgical energy output (i.e., a specific power and a specific waveform associated with hemostasis), to electrocautery blade 106.

[0046] It is envisioned that substrate 226 has a concave-like configuration. In this manner, when the surgeon holds electrosurgical pencil 200 still, proof mass 230 will have a tendency to return to the bottom of substrate 226 and effectively reset itself automatically. In other words, a concave-like substrate 226 can be self-centering and thus provide electrosurgical pencil 200 with a self-resetting capability. It is also envisioned that other shapes may be used.

[0047] Accordingly, the electrosurgical energy output of electrosurgical pencils 100, 200 will be controlled by the natural movements of the surgeon's hand and no specific thought is required to change the corresponding energy output from a "dissecting" setting to a "hemostatic" setting and vice-a-versa.

[0048] It is envisioned that when electrosurgical pencil 100, 200 is held motionless for a predetermined amount of time and/or below a predetermined threshold level of movement (i.e., accelerometer 124 and/or sensor 224 do not sense movement of electrosurgical pencil 100 or 200 for a predetermined period of time and/or sense movement which is below a predetermined threshold level), electrosurgical generator "G" does not transmit electrosurgical energy to the electrocautery blade. It is further envisioned that the sensitivity of electrosurgical pencil 100 or 200 can be increased and/or decreased by adjusting the threshold levels of time and movement accordingly.

[0049] It is further envisioned that electrosurgical generator "G" begins and/or resumes supplying electrosurgical energy to the electrocautery blade when accelerometer 124 and/or sensor 224 detects a movement of electrosurgical pencil 100 or 200 after the predetermined period of time has elapsed and/or after the predetermined threshold level has been surpassed.

[0050] From the foregoing and with reference to the various figure drawings, those skilled in the art will appreciate that certain modifications can also be made to the present disclosure without departing from the scope of the present disclosure. For example, embodiments of the present disclosure include an electrosurgical pencil having a button for controlling the electrosurgical energy output, in addition to the sensor or sensors discussed above. While embodiments of electrosurgical instruments according to the present disclosure have been described herein, it is not intended that the disclosure be limited there and that the above description should be construed as merely exemplifications of preferred embodiments.

Claims

1. An electrosurgical pencil (100), comprising:

a housing (102);
an electrically conductive element (106) supported within the housing (102) and extending distally therefrom, the electrically conductive element (106) connectable to a source of electrosurgical energy (G); and
a sensor (124) is disposed within the housing (102) and in electrical connection with the source of electrosurgical energy (G), the sensor (124) detecting movement of the electrosurgical pencil (100) in a plurality of directions; **characterised in that**
the sensor (124) includes a plurality of motion detection algorithms which transmit energy cut-off signals if the electrosurgical instrument (100) is held motionless or laid down for an extended

period of time, which disables the electrosurgical pencil (100) when not in use, and wherein the sensitivity to activation of the electrosurgical pencil (100) in response to an axial, vertical or transverse movement, is decreased as time lapses from the last time that the electrosurgical pencil (100) was used.

2. The electrosurgical pencil according to claim 1, wherein the motion sensor (124) is at least one of an accelerometer, an optical positioning system, a radiofrequency positioning system, an ultrasonic positioning system, a differential parallel plate accelerometer, a balanced interdigitated comb-finger accelerometer, an offset interdigitated comb-finger accelerometer, and a film-type accelerometer.

3. The electrosurgical pencil according to claim 1, wherein the electrically conductive element (106) includes a longitudinal axis defined therethrough and the sensor is operable to detect at least one of an axial movement of the electrically conductive element axially along the longitudinal axis, a transverse movement of the electrically conductive element (106) transversely across the longitudinal axis, and a rotational movement of the electrically conductive element (106) about the longitudinal axis.

4. The electrosurgical pencil according to claim 3, wherein the sensor (124) includes:

a first accelerometer (124) operable to detect the axial movement; and
a second accelerometer (124) operable to detect the transverse movement.

5. The electrosurgical pencil according to claim 4, wherein the first accelerometer (124) is configured and adapted to transmit a first signal to the source of electrosurgical energy (G) corresponding to the axial movement, and the second accelerometer (124) is configured and adapted to transmit a second signal to the source of electrosurgical energy (G) corresponding to the transverse movement.

6. The electrosurgical pencil according to claim 4, wherein each of the first and second accelerometers (124) is at least one of a differential parallel plate accelerometer, a balanced interdigitated comb-finger accelerometer, an offset interdigitated comb-finger accelerometer, a film-type accelerometer, and at least one piezoelectric film motion detector.

7. The electrosurgical pencil according to claim 1, wherein,
the sensor (124) detects a movement of the electrosurgical pencil (100) as the electrosurgical pencil (100) is moved, the sensor (124) communicates a signal to the source of electrosurgical energy (G) to control the type of output and/or the amount of energy delivered to the electrically conductive element by moving the electrosurgical pencil (100) in a particular manner or direction.

8. The electrosurgical pencil according to claim 7, wherein the sensor (124) is at least one of an accelerometer, an optical positioning system, a radiofrequency positioning system, an ultrasonic positioning system, a differential parallel plate accelerometer, a balanced interdigitated comb-finger accelerometer, an offset interdigitated comb-finger accelerometer, and a film-type accelerometer.

9. The electrosurgical pencil according to claim 7, wherein the electrically conductive element (106) includes a longitudinal axis defined therethrough and the sensor (124) is operable to detect at least one of an axial movement of the electrically conductive element (106) axially along the longitudinal axis, a transverse movement of the electrically conductive element transversely across the longitudinal axis, and a rotational movement of the electrically conductive element (106) about the longitudinal axis.

10. The electrosurgical pencil according to claim 9, wherein the signal is operable to cause the source of electrosurgical energy (G) to transmit a dissecting RF energy output in response to the detection of the axial movement.

11. The electrosurgical pencil according to claim 9, wherein the signal is operable to cause the source of electrosurgical energy (G) to transmit a hemostatic RF energy output in response to the detection of the transverse movement.

12. The electrosurgical pencil according to claim 9, wherein the sensor includes:

a first accelerometer (124) operable to detect the axial movement; and
a second accelerometer (124) operable to detect the transverse movement.

13. The electrosurgical pencil according to claim 12, wherein the first accelerometer (124) is configured and adapted to transmit a first signal to the source of electrosurgical energy (G) corresponding to the axial movement, and the second accelerometer (124) is configured and adapted to transmit a second signal to the source of electrosurgical energy (G) corresponding to the transverse movement.

14. The electrosurgical pencil according to claim 7, wherein the source of electrical surgical energy (G) ceases supplying electrosurgical energy when the sensor (124) does not detect a movement of the electrosurgical instrument (100) for a predetermined period of time.

15. The electrosurgical pencil according to claim 11, wherein the source of electrosurgical energy (G) resumes supplying electrosurgical energy when the sensor (124) detects a movement of the electrosurgical instrument (100) following the predetermined period of time and/or detects a movement of the electrosurgical instrument (100) above the predetermined threshold level of movement.

16. An electrosurgical system, comprising:

a source of electrosurgical energy (G);
an electrosurgical pencil according to claim 1, coupled to the source of electrosurgical energy (G), the electrosurgical pencil (100) including:

an elongated housing (102);
wherein the sensor (124) communicates a signal to the source of electrosurgical energy (G), and wherein the plurality of motion detection algorithms which transmit energy cut-off signals to the source of electrosurgical energy such that the source of electrical energy (G) ceases supplying electrosurgical energy when the sensor (124) does not detect a movement of the electrosurgical pencil (100) for a predetermined period of time.

17. The electrosurgical pencil according to claim 16, wherein the source of electrosurgical energy (G) is operable to transmit a dissecting RF energy output in response to the detection of an axial movement of the electrosurgical instrument (100) along a longitudinal axis.

18. The electrosurgical pencil according to claim 16, wherein the source of electrosurgical energy (G) is operable to transmit a hemostatic RF energy output in response to the detection of a transverse movement of the electrosurgical instrument across a longitudinal axis.

Patentansprüche

1. Elektrochirurgischer Stift (100), mit:

einem Gehäuse (102);
einem elektrisch leitenden Element (106), das in dem Gehäuse (102) gelagert ist und sich distal von ihm erstreckt, wobei das elektrisch leitende Element (106) mit einer Quelle elektrochirurgischer Energie (G) verbindbar ist; und
einem Sensor (124), der in dem Gehäuse (102) angeordnet und in elektrischer Verbindung mit der Quelle elektrochirurgischer Energie (G) ist, wobei der Sensor (124) eine Bewegung des elektrochirurgischen Stifts (100) in einer Vielzahl von Richtungen erfasst; **dadurch gekennzeichnet, dass**
der Sensor (124) eine Vielzahl von Bewegungserfassungsalgorithmen aufweist, die Energietrennsignale übertragen, wenn das elektrochirurgische Instrument (100) bewegungslos gehalten wird oder für eine längere Zeitperiode abgelegt wird, was den elektrochirurgischen Stift (100) deaktiviert, wenn er nicht in Verwendung ist, und wobei die Empfindlichkeit auf eine Aktivierung des elektrochirurgischen Stifts (100) als Antwort auf eine axiale, vertikale oder Bewegung in Querrichtung vermindert wird, während die Zeit von der letzten Zeit vergeht, währende der der elektrochirurgische Stift (100) verwendet worden ist.

2. Elektrochirurgischer Stift nach Anspruch 1, bei dem der Bewegungssensor (124) ein Beschleunigungsmesser, ein optisches Positioniersystem, ein Hochfrequenzpositioniersystem, ein Ultraschallpositioniersystem, ein Parallelplatten-Differenzialbeschleunigungsmesser, ein Gleichgewichtsbeschleunigungsmesser mit ineinandergreifenden Kammfingern, ein Offsetbeschleunigungsmesser mit ineinandergreifenden Kammfingern und/oder ein folienartiger Beschleunigungsmesser ist.

3. Elektrochirurgischer Stift nach Anspruch 1, bei dem das elektrisch leitfähige Element (106) eine durch sich hindurch definierte Längsachse aufweist und der Sensor im Betrieb imstande ist, eine axiale Bewegung des elektrisch leitfähigen Elements axial entlang der Längsachse, eine Querbewegung des elektrisch leitfähigen Elements (106) quer zur Längsachse und/oder eine Drehbewegung des elektrisch leitfähigen Elements (106) um die Längsachse zu erfassen.

4. Elektrochirurgischer Stift nach Anspruch 3, bei dem der Sensor (124) aufweist:

einen ersten Beschleunigungsmesser (124), der im Betrieb imstande ist, die axiale Bewegung zu erfassen; und
einen zweiten Beschleunigungsmesser (124), der im Betrieb imstande ist, eine Querbewegung zu erfassen.

5. Elektrochirurgischer Stift nach Anspruch 4, bei dem der erste Beschleunigungsmesser (124) eingerichtet und angepasst ist, um ein erstes Signal an die Quelle elektrochirurgischer Energie (G), das der axialen Bewegung entspricht, zu übertragen und der zweite Beschleunigungsmesser (124) eingerichtet und angepasst ist, um ein zweites Signal an die Quelle elektrochirurgischer Energie (G) zu übertragen, das der Querbewegung entspricht.

6. Elektrochirurgischer Stift nach Anspruch 4, bei dem jeder der ersten und zweiten Beschleunigungsmesser (124) ein Parallelplatten-Differenzialbeschleunigungsmesser, ein Gleichgewichtsbeschleunigungsmesser mit ineinandergreifenden Kammfingern, ein Offsetbeschleunigungsmesser mit ineinandergreifenden Kammfingern, ein folienartiger Beschleunigungsmesser und/oder mindestens ein piezoelektrischer Folienbewegungsdetektor ist.

7. Elektrochirurgischer Stift nach Anspruch 1, bei dem der Sensor (124) eine Bewegung des elektrochirurgischen Stifts (100) erfasst, während der elektrochirurgische Stift (100) bewegt wird, der Sensor (124) ein Signal zu der Quelle elektrochirurgischer Energie (G) übermittelt, um die Art der Ausgabe und/oder die Energiemenge, die dem elektrisch leitfähigen Element zugeführt wird, durch Bewegen des elektrochirurgischen Stifts (100) auf eine bestimmte Weise oder in einer bestimmten Richtung zu steuern.

8. Elektrochirurgischer Stift nach Anspruch 7, bei dem der Sensor (124) ein Beschleunigungsmesser, ein optisches Positioniersystem, ein Hochfrequenzpositioniersystem, ein Ultraschallpositioniersystem, ein Parallelplatten-Differenzialbeschleunigungsmesser, ein Gleichgewichtsbeschleunigungsmesser mit ineinandergreifenden Kammfingern, ein Offsetbeschleunigungsmesser mit ineinandergreifenden Kammfingern und/oder ein folienartiger Beschleunigungsmesser ist.

9. Elektrochirurgischer Stift nach Anspruch 7, bei dem das elektrisch leitfähige Element (106) eine durch sich hindurch definierte Längsachse aufweist und der Sensor (124) im Betrieb imstande ist, eine axiale Bewegung des elektrisch leitfähigen Elements (106) axial entlang der Längsachse, eine Querbewegung des elektrisch leitfähigen Elements quer zur Längsachse und/oder eine Drehbewegung des elektrisch leitfähigen Elements (106) um die Längsachse zu erfassen.

10. Elektrochirurgischer Stift nach Anspruch 9, bei dem das Signal im Betrieb imstande ist, zu verursachen, dass die Quelle elektrochirurgischer Energie (G) eine sezierende Hochfrequenzenergieausgabe als Antwort auf die Erfassung der axialen Bewegung überträgt.

11. Elektrochirurgischer Stift nach Anspruch 9, bei dem das Signal im Betrieb imstande ist, zu verursachen, dass die Quelle elektrochirurgischer Energie (G) eine hämostatische Hochfrequenzenergieausgabe als Antwort auf die Erfassung der Querbewegung überträgt.

12. Elektrochirurgischer Stift nach Anspruch 9, bei dem der Sensor aufweist:

einen ersten Beschleunigungsmesser (124), der im Betrieb imstande ist, die axiale Bewegung zu erfassen; und
einen zweiten Beschleunigungsmesser (124), der im Betrieb imstande ist, eine Querbewegung zu erfassen..

13. Elektrochirurgischer Stift nach Anspruch 12, bei dem der erste Beschleunigungsmesser (124) eingerichtet und angepasst ist, ein erstes Signal an die Quelle elektrochirurgischer Energie (G), das der axialen Bewegung entspricht, zu übertragen und der zweite Beschleunigungsmesser (124) eingerichtet und angepasst ist, ein zweites Signal an die Quelle elektrochirurgischer Energie (G) zu übertragen, das der Querbewegung entspricht..

14. Elektrochirurgischer Stift nach Anspruch 7, bei dem die Quelle elektrischer, chirurgischer Energie (G) aufhört, elektrochirurgische Energie zuzuführen, wenn der Sensor (124) über eine festgelegte Zeitdauer keine Bewegung des elektrochirurgischen Instruments (100) erfasst.

15. Elektrochirurgischer Stift nach Anspruch 11, bei dem die Quelle elektrochirurgischer Energie (G) das Zuführen elektrochirurgischer Energie wiederaufnimmt, wenn der Sensor (124) eine Bewegung des elektrochirurgischen Instruments (100) nach der festgelegten Zeitdauer erfasst und/oder eine Bewegung des elektrochirurgischen Instruments (100) über der festgelegten Bewegungsgrenzwerthöhe erfasst.

16. Elektrochirurgisches System, mit:

einer Quelle elektrochirurgischer Energie (G);
einem elektrochirurgischen Stift nach Anspruch 1, der mit der Quelle elektrochirurgischer Energie (G) verbunden ist, wobei der elektrochirurgische Stift (100) aufweist:

einem länglichen Gehäuse (102);
wobei der Sensor (124) ein Signal zu der Quelle elektrochirurgischer Energie (G) übermittelt und die Vielzahl an Bewegungserfassungsalgorithmen, die Energietrennsignale an die Quelle elektrochirurgischer Energie übertragen, sodass die Quelle elektrochirurgischer Energie (G) aufhört,

elektrochirurgische Energie zuzuführen, wenn der Sensor (124) keine Bewegung des elektrochirurgischen Stifts (100) über eine festgelegte Zeitdauer erfasst.

17. Elektrochirurgischer Stift nach Anspruch 16, bei dem die Quelle elektrochirurgischer Energie (G) im Betrieb imstande ist, eine sezierende Hochfrequenzenergieausgabe als Antwort auf die Erfassung einer axialen Bewegung des elektrochirurgischen Instruments (100) entlang einer Längsachse zu übertragen.

18. Elektrochirurgischer Stift nach Anspruch 16, bei dem die Quelle elektrochirurgischer Energie (G) im Betrieb imstande ist, eine hämostatische Hochfrequenzenergieausgabe als Antwort auf die Erfassung einer Querbewegung des elektrochirurgischen Instruments quer zu einer Längsachse zu übertragen.

Revendications

1. Stylet électrochirurgical (100), comprenant :

un boîtier (102) ;
un élément électriquement conducteur (106) supporté dans le boîtier (102) et s'étendant en direction distale à partir de celui-ci, l'élément électriquement conducteur (106) pouvant être relié à une source d'énergie électrochirurgicale (G) ; et
un détecteur (124) est disposé dans le boîtier (102) et en connexion électrique avec la source d'énergie électrochirurgicale (G), le détecteur (124) détectant un mouvement du stylet électrochirurgical (100) dans une pluralité de directions ;
caractérisé en ce que
le détecteur (124) comprend une pluralité d'algorithmes de détection de mouvement qui transmettent des signaux seuils d'énergie si l'instrument électrochirurgical (100) est maintenu immobile ou est posé pendant une période de temps prolongée, ce qui désactive le stylet électrochirurgical (100) lorsqu'il n'est pas utilisé, et où la sensibilité à l'activation du stylet électrochirurgical (100) en réponse à un mouvement axial, vertical ou transversal, est réduite au fur et à mesure que le temps s'écoule depuis le dernier moment où le stylet électrochirurgical (100) a été utilisé.

2. Stylet électrochirurgical selon la revendication 1, où le détecteur de mouvement (124) est au moins l'un d'un accéléromètre, d'un système de positionnement optique, d'un système de positionnement radiofréquence et d'un système de positionnement ultrasonique, d'un accéléromètre différentiel à plaques parallèles, d'un accéléromètre équilibré à doigts en peigne à interdigitation, d'un accéléromètre de décalage à doigts en peigne à interdigitation et d'un accéléromètre d'un type de film.

3. Stylet électrochirurgical selon la revendication 1, dans lequel l'élément électriquement conducteur (106) comprend un axe longitudinal défini à travers celui-ci et le détecteur est fonctionnel pour détecter au moins l'un d'un mouvement axial de l'élément électriquement conducteur dans une direction axiale le long de l'axe longitudinal, un mouvement transversal de l'élément électriquement conducteur (106) dans une direction transversale sur l'axe longitudinal, et un mouvement de rotation de l'élément électriquement conducteur (106) autour de l'axe longitudinal.

4. Stylet électrochirurgical selon la revendication 3, dans lequel le détecteur (124) comprend :

un premier accéléromètre (124) fonctionnel pour détecter le mouvement axial ; et
un deuxième accéléromètre (124) fonctionnel pour détecter le mouvement transversal.

5. Stylet électrochirurgical selon la revendication 4, dans lequel le premier accéléromètre (124) est configuré et adapté pour transmettre un premier signal à la source d'énergie électrochirurgicale (G) correspondant au mouvement axial, et le deuxième accéléromètre (124) est configuré et adapté pour transmettre un deuxième signal à la source d'énergie électrochirurgicale (G) correspondant au mouvement transversal.

6. Stylet électrochirurgical selon la revendication 4, dans lequel chacun des premier et deuxième accéléromètres (124) est au moins l'un d'un accéléromètre différentiel à plaques parallèles, d'un accéléromètre équilibré à doigts en peigne à interdigitation, d'un accéléromètre de décalage à doigts en peigne à interdigitation et d'un accéléromètre d'un type de film, et au moins un détecteur de mouvement de film piézoélectrique.

7. Stylet électrochirurgical selon la revendication 1, dans lequel,
le détecteur (124) détecte un mouvement du stylet électrochirurgical (100) lorsque le stylet électrochirurgical (100) est déplacé, le détecteur (124) communique un signal à la source d'énergie électrochirurgicale (G) pour contrôler le type d'émission et/ou la quantité d'énergie délivrée à l'élément électriquement conducteur en déplaçant le stylet électrochirurgical (100) d'une manière ou dans une direction particulière.

8. Stylet électrochirurgical selon la revendication 7, dans lequel le détecteur (124) est au moins l'un d'un accéléromètre, d'un système de positionnement optique, d'un système de positionnement radiofréquence, d'un système de positionnement ultrasonique, d'un accéléromètre différentiel à plaques parallèles, d'un accéléromètre équilibré à doigts en peigne à interdigitation, d'un accéléromètre de décalage à doigts en peigne à interdigitation, et d'un accéléromètre d'un type de film.

9. Stylet électrochirurgical selon la revendication 7, dans lequel l'élément électriquement conducteur (106) comprend un axe longitudinal défini à travers celui-ci et le détecteur (124) est fonctionnel pour détecter au moins l'un d'un mouvement axial de l'élément électriquement conducteur (106) en direction axiale le long de l'axe longitudinal, un mouvement transversal de l'élément électriquement conducteur dans une direction transversale sur l'axe longitudinal, et un mouvement de rotation de de l'élément électriquement conducteur (106) autour de l'axe longitudinal.

10. Stylet électrochirurgical selon la revendication 9, dans lequel le signal est fonctionnel pour que la source d'énergie électrochirurgicale (G) transmette une émission d'énergie RF de dissection en réponse à la détection du mouvement axial.

11. Stylet électrochirurgical selon la revendication 9, dans lequel le signal est fonctionnel pour que la source d'énergie électrochirurgicale (G) transmette une émission d'énergie RF hémostatique en réponse à la détection du mouvement transversal.

12. Stylet électrochirurgical selon la revendication 9, dans lequel le détecteur comprend :

un premier accéléromètre (124) fonctionnel pour détecter le mouvement axial ; et
un deuxième accéléromètre (124) fonctionnel pour détecter le mouvement transversal.

13. Stylet électrochirurgical selon la revendication 12, dans lequel le premier accéléromètre (124) est configuré et adapté pour transmettre un premier signal à la source d'énergie électrochirurgicale (G) correspondant au mouvement axial, et le deuxième accéléromètre (124) est configuré et adapté pour transmettre un deuxième signal à la source d'énergie électrochirurgicale (G) correspondant au mouvement transversal.

14. Stylet électrochirurgical selon la revendication 7, dans lequel la source d'énergie électrochirurgicale (G) cesse d'émettre de l'énergie électrochirurgicale lorsque le détecteur (124) ne détecte aucun mouvement de l'instrument électrochirurgical (100) pendant une période de temps prédéterminée.

15. Stylet électrochirurgical selon la revendication 11, dans lequel la source d'énergie électrochirurgicale (G) recommence à émettre de l'énergie électrochirurgicale lorsque le détecteur (124) détecte un mouvement de l'instrument électrochirurgical (100) suite à la période de temps prédéterminée et/ou détecte un mouvement de l'instrument électrochirurgical (100) au-dessus du niveau seuil de mouvement prédéterminé.

16. Système électrochirurgical, comprenant :

une source d'énergie électrochirurgicale (G) ;
un stylet électrochirurgical selon la revendication 1, couplé à la source d'énergie électrochirurgicale (G), le stylet électrochirurgical (100) comprenant :

un boîtier oblong (102) ;
où le détecteur (124) communique un signal à la source d'énergie électrochirurgicale (G), et où la pluralité d'algorithmes de détection de mouvement transmet des signaux seuls d'énergie à la source d'énergie électrochirurgicale de sorte que la source d'énergie électrique (G) cesse d'émettre de l'énergie électrochirurgicale lorsque le détecteur (124) ne détecte aucun mouvement du stylet électrochirurgical (100) pendant une période de temps prédéterminée.

17. Stylet électrochirurgical selon la revendication 16, dans lequel la source d'énergie électrochirurgicale (G) est fonctionnelle pour transmettre une émission d'énergie RF de dissection en réponse à la détection d'un mouvement axial de l'instrument électrochirurgical (100) le long d'un axe longitudinal.

18. Stylet électrochirurgical selon la revendication 16, dans lequel la source d'énergie électrochirurgicale (G) est fonctionnelle pour transmettre une émission d'énergie RF hémostatique en réponse à la détection d'un mouvement transversal de l'instrument électrochirurgical sur un axe longitudinal.

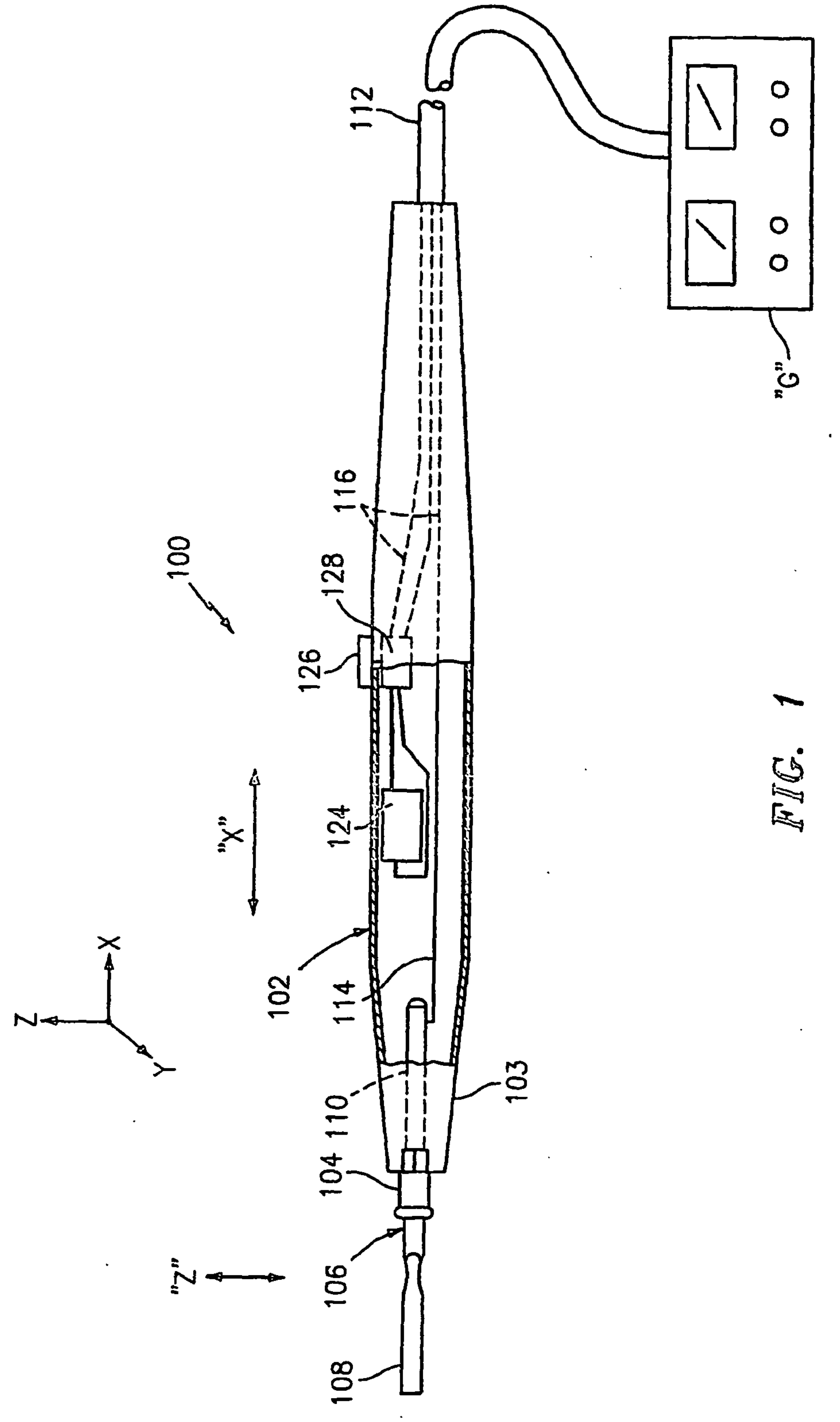

FIG. 1

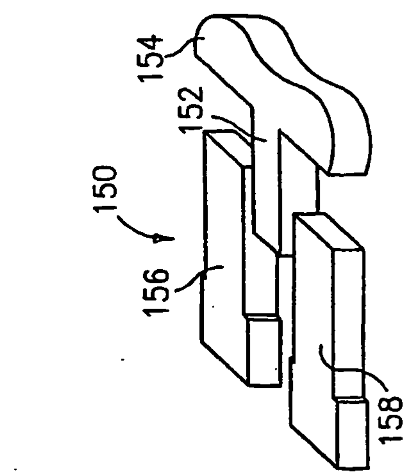

FIG. 2A

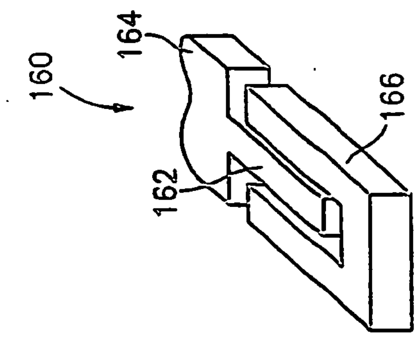

FIG. 2B

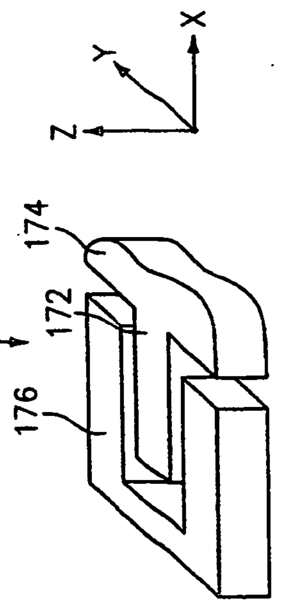

FIG. 2C

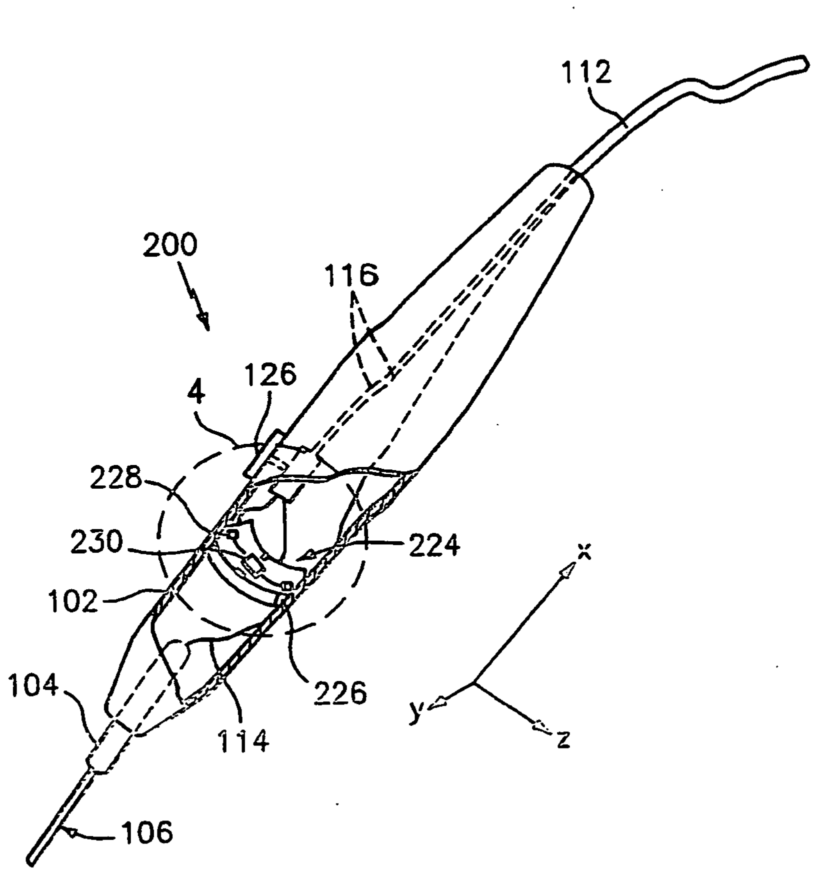

FIG. 3

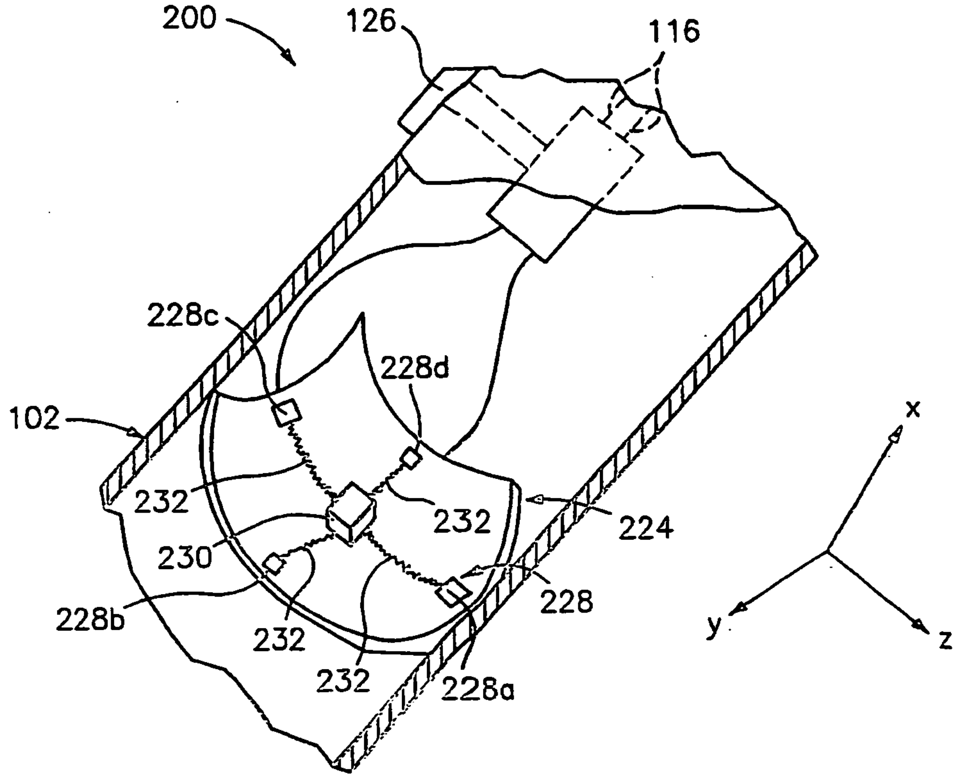
200
126
116
228c
228d
102
232
232
224
230
228
228b
232
232
228a
x
y
z

FIG. 4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 39862002 P **[0007]**
- US 20060058783 A **[0007]**
- US 60424352 B **[0007]**
- US 20040092927 A **[0007]**
- US 5367217 A **[0023]**
- US 5339698 A **[0023]**
- US 5331242 A **[0023]**
- US 5594170 A **[0023]**
- US 5501103 A **[0023]**
- US 5379639 A **[0023]**
- US 5377545 A **[0023]**
- US 5456111 A **[0023]**
- US 5456110 A **[0023]**
- US 5005413 A **[0023]**
- US 6068627 A, Orszulak **[0027]**

专利名称(译)	用于控制电外科输出的运动检测器		
公开(公告)号	EP1949867B1	公开(公告)日	2013-07-31
申请号	EP2008002357	申请日	2004-02-17
[标]申请(专利权)人(译)	Covidien公司.		
申请(专利权)人(译)	COVIDIEN AG		
当前申请(专利权)人(译)	COVIDIEN AG		
[标]发明人	SARTOR JOE DON SCHMALTZ DALE FRANCIS		
发明人	SARTOR, JOE DON SCHMALTZ, DALE FRANCIS		
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其他公开文献	EP1949867A1		
外部链接	Espacenet		

摘要(译)

公开了一种具有用于控制其电外科输出的运动传感装置的电外科器械。在本公开的一个方面，电外科器械包括细长壳体，支撑在壳体内并从壳体向远侧延伸的导电元件，导电元件可连接到电外科能量源，以及设置在壳体内的传感器并与电外科发生器电连接。传感器检测导电元件的运动并将信号传递给电外科发生器，该信号与导电元件的运动有关。电外科能量源响应来自传感器的信号提供电外科能量。