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(54) INTERFACE MODULE FOR USE WITH NERVE MONITORING AND ELECTROSURGERY

SCHNITTSTELLENMODUL FÜR NERVENÜBERWACHUNG UND ELEKTROCHIRURGIE

MODULE D'INTERFACE DESTINÉ À ÊTRE UTILISÉ EN CONTRÔLE ET EN ÉLECTROCHIRURGIE DES NERFS

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Description

Background

[0001] Electrophysiological monitoring assists a surgeon in locating nerves within an obscured surgical field, as well as preserving and assessing nerve function in real-time during surgery. To this end, nerve integrity monitoring is commonly employed to monitor electromyographic (EMG) activity. During nerve integrity monitoring, sensing or recording electrodes are coupled to appropriate tissue (e.g., cranial muscles innervated or controlled by the nerve of interest, peripheral nerve, spinal cord, brainstem, etc.) to sense EMG activity. Stimulation, for example electrical stimulation or mechanical stimulation, can cause excitement of the tissue. During electrical stimulation, a stimulation probe applies a stimulation signal near the area where the subject nerve may be located. If the stimulation probe contacts or is reasonably near the nerve, the applied stimulation signal is transmitted through the nerve to excite the innervated tissue. In mechanical stimulation, direct physical contact of the appropriate tissue can cause excitement of the tissue. In any event, excitement of the related tissue generates an electrical impulse that is sensed by the recording electrodes (or other sensing device).

[0002] The recording electrode(s) signal the sensed electrical impulse information to the surgeon for interpretation in the context of determining EMG activity. For example, the EMG activity can be displayed on a monitor and/or presented audibly.

[0003] Nerve integrity monitoring is useful for a multitude of different surgical procedures or evaluations that involve or relate to nerve tissue, muscle tissue, or recording of neurogenic potential. For example, various head and neck surgical procedures (e.g. parotidectomy and thyroidectomy) require locating and identifying cranial and peripheral motor nerves. In some instances, an electrosurgical unit is used to perform these surgical procedures. Current electrosurgical units include a conductive tip or needle that serves as one electrode in an electrical circuit which is completed via a grounding electrode coupled to the patient. Incision of tissue is accomplished by applying a source of electrical energy (most commonly, a radio-frequency generator) to the tip. Upon application of the tip to the tissue, a voltage gradient is created, thereby inducing current flow and related heat generation at the point of contact. With sufficiently high levels of electrical energy, the heat generated is sufficient to cut the tissue and, advantageously, to simultaneously cauterize severed blood vessels.

[0004] Due to the levels of electrical energy generated by electrosurgical units, systems for nerve integrity monitoring experience a large amount of electrical interference when used during electrosurgical procedures. The electrical interference can create incorrect neurogenic (nerve tissue) or myogenic (muscle tissue) signals. For example, during EMG monitoring, electrosurgical activity can create artifacts (e.g., false positives) as well as introduce a significant amount of noise in the nerve integrity monitoring system. As a result, current techniques involve using a probe to mute all channels of the nerve integrity monitoring system during an electrosurgical procedure. Thus, monitoring of EMG activity is typically suspended during operation of the electrosurgical unit. In order for a surgeon to prevent cutting a nerve with the electrosurgical unit, the surgeon will cut for a brief period and then stop cutting such that nerve integrity monitoring can be restored. If no EMG activity is detected, the surgeon can then cut for another brief period, while pausing intermittently to restore nerve integrity monitoring so as to prevent from cutting a nerve. This process is repeated until the surgeon is completed with the electrosurgical procedure. Without being able to monitor EMG activity during an electrosurgical procedure, the electrosurgical procedure can be cumbersome and time consuming.

[0005] US6139545 discloses systems and method that ablate motor nerve tissue by inserting an operative element connectable to an ablation energy generator into a defined percutaneous tissue region. The systems and methods apply stimulant energy in the defined percutaneous tissue region to stimulate targeted motor nerve tissue prior to ablation by the operative element.

[0006] WO0112089 discloses an apparatus for nerve stimulation and tissue ablation in a patient. A low frequency generator and a high frequency generator are provided. A needle electrode is provided which is adapted to engage the body of the patient. Circuitry couples the needle electrode to the low and high frequency generators sequentially or simultaneously.

[0007] WO2009124726 discloses a surgical apparatus for testing nerves during surgery using an HF surgical generator and an electrosurgical instrument. The surgical apparatus comprises a converter unit for converting a high-frequency treatment current from the HF surgical generator into a nerve stimulating current. A controllable selector switch alternatively conducts the treatment current or the nerve stimulating current to the electrosurgical instrument.

Summary

[0008] Concepts presented herein relate to an interface module that can be electrically coupled to an electrical stimulation generator, a radio frequency generator and an instrument. A selection module is coupled to the interface module and operates in a first mode to deliver electrical stimulation signals from the electrical stimulation generator to the instrument and in a second mode to deliver and/or disable radio frequency signals from the radio frequency generator to the instrument.

Brief Description of the Drawings

[0009]

FIG. 1 is a schematic block diagram of an interface module selectively delivering electrical stimulation signals and radio frequency signals to an instrument.

FIG. 2 is a schematic block diagram of a surgical system including an interface module coupled to a nerve integrity monitoring system and an electrosurgical unit.

Detailed Description

[0010] FIG. 1 is a schematic block diagram of an instrument 10 for selectively applying signals received from an electrical stimulation generator 12 and a radio frequency (RF) generator 14 to tissue of interest in a surgical procedure. An interface module 16 is electrically coupled to the stimulation generator 12 and the RF generator 14 to selectively operate in a plurality of modes to deliver a desired output to the instrument 10. In particular, interface module 16 includes a first input 16a electrically coupled to the electrical stimulation generator 12, a second input 16b electrically coupled to RF generator 14 and an output 16c electrically coupled to instrument 10.

[0011] A selection module (e.g., a switch or network) 18 is coupled to interface module 16 and operates to selectively deliver one of electrical stimulation signals and RF signals provided by electrical stimulation generator 12 and RF generator 14, respectively, to instrument 10. In particular, selection module 18 is configured to complete either a first, electrical stimulation circuit 20 or a second, RF circuit 22. As such, when instrument 10 is brought into contact with tissue of a patient and electrical stimulation circuit 20 is complete, electrical stimulation signals from electrical stimulation generator 12 are delivered to the tissue. Alternatively, when RF circuit 22 is complete, radio frequency signals from RF generator 14 are delivered to the tissue. Interface module 16 can further be coupled to recording electrodes that can provide signals that are indicative of contact between instrument 10 and a nerve or muscle.

[0012] Instrument 10 can be any instrument that electrically interfaces with a patient to perform nerve monitoring and/or electrosurgery. In one embodiment, instrument 10 can be a bipolar forceps, a laproscopic bipolar instrument or a monopolar cautery pencil. In any event, instrument 10 can include an integrated nerve stimulating probe as well as a working tip appropriate for a desired application such as surgery.

[0013] In one embodiment, electrical stimulation generator 12 is part of a NIM-Response® 3.0 nerve monitoring system available from Medtronic Xomed, Inc. of Jacksonville, Florida, and configured to deliver electrical stimulation signals to instrument 10 so as to excite tissue in contact with instrument 10. In one embodiment, the electrical stimulation signals provided by electrical stimulation generator 12 are of sufficient strength so as to stimulate associated tissue yet inherently safe so as to prevent physical trauma to the associated tissue.

[0014] In one embodiment, RF generator 14 can be part of an electrosurgical unit (ESU) configured to manipulate tissue, for example through cutting, cauterizing and hemostasis. Example ESUs are available through Valleylab of Boulder, Colorado; ERBE of Marietta, Georgia; ConMed Corporation of Utica, New York; Gyrus ACMI of Southborough; Massachusetts and Megadyne of Draper, Utah. RF generator 14 can be configured to achieve various different tissue effects, as desired. In one embodiment, RF generator is configured to operate to delivery signals at a rate between 500-3,300 KHz at various voltage levels.

[0015] Interface module 16 integrates electrical stimulation generator 12 and RF generator 14. To this end, interface module 16 can be equipped to receive cabling from electrical stimulation generator 12, RF generator 14 and instrument 10. Interface module 16 can further be equipped to receive input from and/or provide output to other devices as desired.

[0016] Selection module 18 can take many forms including a manual switch, electrical switch or electrical network, to selectively direct and deliver signals from electrical stimulation generator 12 and RF generator 14. In one embodiment, selection module 18 can be a mechanical switch directly integrated into instrument 10 so that a user can easily select what signals are sent to instrument 10 while operating instrument 10. For example, instrument 10 may include a handle with selection module 18 maintained within the handle. In this embodiment, two way communication is provided between instrument 10 and interface module 16 so that selection module 18 notifies interface module 16 of a desired signal to be sent to instrument 10. In a further embodiment, selection module 18 can be directly coupled to interface module 16. Example mechanical switches include dome switches, rocker switches, toggle switches, etc. In a still further embodiment, selection module 18 can be an electrical switch. The electrical switch can be configured to interleave signals to instrument 10 so as to give the appearance to a user that both signals from electrical stimulation generator 12 and RF generator 14 are simultaneous, for example by periodically switching signals delivered to instrument 10 on a short time scale (e.g. milliseconds) into an alternating pattern. In another embodiment, the interface module 16 continuously combines and directs electrical stimulation signals and radio frequency signals in the output signals. In still a further embodiment, selection module 18 can be formed of a combination of mechanical and electrical switches. For example, an electrical switch can continuously interleave electrical stimulation signals into output signals that are sent to instrument 10 while a mechanical switch determines whether signals from RF generator 14 are sent to instrument 10. In yet a further embodiment, selection module 18 can be an electrical network configured to select a signal that is delivered to instrument 10, for example as a function of a frequency of the signal or alternatively combine electrical stimulation signals and RF signals into an output signal.

[0017] In a further embodiment, interface module 16 can be capable of two, three or more modes of operation. For example, RF generator 14 can provide multiple distinct operational signals when used as an electrosurgical unit. In one particular embodiment, these RF generator signals are configured for both cutting and coagulation. In this instance, interface module 16 can be configured to operate in three separate modes, namely an electrical stimulation mode, (thus delivering stimulation signals from electrical stimulation generator 12) an RF cutting mode (thus delivering cutting signals from RF generator 14) and an RF coagulation mode (thus delivering coagulation signals from RF generator 14).

[0018] In still further embodiments, interface module 16 can include a default mode of operation. For example, interface module 16 can be configured to deliver signals from electrical stimulation generator 12 when a user has not actively selected a desired mode of operation. As discussed above, signals from electrical stimulation generator 12 operates in an inherently safe mode that does not provide physical trauma to tissue in contact with instrument 10. By utilizing a default mode for delivering electrical stimulation, accidental delivery of RF signals to instrument 10 can be prevented. In an alternative default mode, interface module 16 prevents any signals from being transmitted to instrument 10. In yet a further embodiment, interface module 16 can prevent signals sent from electrical stimulation generation 12 upon an indication that instrument 10 is proximate and/or contacts a nerve.

[0019] In any event, selection module 18 operates to selectively complete electrical stimulation circuit 20 or RF circuit 22. To this end, circuits 20 and 22 can be configured for different modalities, such as monopolar, bipolar and/or combinations thereof. For example, in a monopolar modality, circuit 20 can include one or more recording electrodes coupled to tissue of a patient. When circuit 20 is complete, current passes from electrical stimulation generator 12, through interface module 16 and to instrument 10, in contact with tissue. Current then passes through tissue from the point of contact with instrument 10 to the point of coupling to the one or more recording electrodes.

[0020] Current then passes from the recording electrodes back to electrical stimulation generator 12. In an alternative embodiment, instrument 10 may be a bipolar instrument that includes two electrodes, one serving as an active electrode and one serving as a return electrode. In this case, current flows from electrical stimulation generator 12, through the interface module 16 and to the active electrode of instrument 10. Current then passes through the tissue from the point of contact with the active electrode to the point of contact with the return electrode and back through the return electrode, instrument 10, interface module 16 and to electrical stimulation generator 12. Similarly, RF circuit 22 can include a dispersive pad coupled to tissue in a monopolar configuration and/or instrument 10 can include multiple electrodes in a bipolar configuration so as to complete circuit 22 through tissue of the patient.

[0021] FIG. 2 is a schematic block diagram of a surgical environment utilizing specific implementations of components illustrated in FIG. 1 to selectively perform nerve monitoring and electrosurgery at an internal target tissue site "T". In one embodiment, the internal target tissue site "T" is accessed laparoscopically and surgery is performed using a surgical robot such as the DaVinci robot available from Intuitive Surgical of Sunnyvale, California. In this case, instrument 10 is a wristed instrument coupled to the surgical robot and capable of control by the robot. Electrical stimulation generator 12 is embodied within a nerve monitoring system 24 and RF generator 14 is embodied within an electrosurgical unit (ESU) 26. Interface module 16 is coupled to both nerve monitoring system 24 and electrosurgical unit 26 through inputs 16a and 16b as discussed above. Interface module 16 is also coupled to instrument 10 through output 16c. Selection module 18 is operatively coupled to interface module 18 to indicate desired signals to be delivered to instrument 10, so as to selectively complete circuits 20 and 22 (schematically shown).

[0022] In general terms, the nerve monitoring system 24 is configured to assist in and perform nerve integrity monitoring for virtually any nerve/muscle combination of the human anatomy, as well as recording nerve potential. The system 24 includes a control unit 30, which can assume a wide variety of forms and in one embodiment includes a console 40 and a patient interface module 50. The ESU 26 generates current that is sent to surgical instrument 10 for cutting or otherwise manipulating tissue of a patient.

[0023] System 24 includes one or more sensing probes 52, which can be any type of sensing device such as an electrode and can operate to complete circuit 20 in a monopolar configuration. In a laporoscopic surgical environment, sensing probes 52 can be coupled to tissue internal to a patient through a suitable introducer such as a cannula, trocar, etc. The control unit 30 facilitates stimulation of the instrument 10, as well as processes all information generated by instrument 10, sensing probes 52 and other components (not shown) during use. The instrument 10 and the control unit 30 are adapted to allow control and variation of a stimulus energy delivered to, and thus a stimulus level delivered by, the instrument 10. Further, the control unit 30 processes information (e.g., patient response) received from instrument 10 and/or sensing probes 52 resulting from delivered stimulation.

[0024] Using the sensing probes 52, the system 24 performs monitoring based upon recorded EMG activity in response to an electrical current energy delivered by the instrument 10 and/or physical manipulation of tissue. With the one embodiment of FIG. 2, the console 40 and the patient interface module 50 are provided as separate components, communicatively coupled by a cable 54. Alternatively, a wireless link can be employed. Further, the console 40 and the patient interface module 50 can be provided as a single device. In basic terms, however, the patient interface module 50 serves to promote easy connection of stimulus/sensory components (such as the instrument 10 and sensing probes 52), as well as to manage incoming and outgoing electrical signals. The console 40, in turn, interprets incoming signals (e.g., impulses sensed by sensing probes 52), displays information desired by a user, provides audible feedback of signals, presents a user interface (such as by including, for example, a touch screen), and delivers a stimulation energy to the instrument 10 pursuant to control signals from the instrument 10 (via connection to the patient interface module 50), as well as other tasks as desired.

[0025] As previously described, the patient interface module 50 communicates with the console 40 through the cable 54 information to and from the instrument 10, as well as information from the sensing probes 52. In effect, the patient interface module 50 serves to connect the patient (e.g., at tissue site "T") to the console 40. To this end, and in one embodiment, the patient interface module 50 includes one or more (preferably eight) sensory inputs 56, such as pairs of electrode inputs electrically coupled to receive signals from the sensing probes 52 (referenced generally in FIG. 2). In addition, the patient interface module 50 provides a stimulator input port 58 (referenced generally in FIG. 2) and a stimulator output port 60 (referenced generally in FIG. 2). The stimulator input port 58 receives control signals from the instrument 10 relating to desired stimulation levels and/or other activities, whereas the stimulator output port 60 facilitates delivery of stimulation energy from the electrical stimulation generator 12 to the instrument 10. The patient interface module 50 can further provide additional component port(s), such as a ground (or return electrode) jack, auxiliary ports for additional stimulator probe assemblies, etc.

[0026] The sensing probes 52 are coupled to the patient (e.g., selected tissue) to provide signals to the patient interface module 50. In one embodiment, the plurality of probes 52 includes eight probes that are electronically coupled to sensory inputs 56. In normal operation, the probes 52 sense electrical signals from the patient and send the signals to patient interface module 50. These signals include an electrical impulse from patient tissue, which is indicative of EMG activity (e.g., a bio-electric response) in the patient. Upon sensing that instrument 10 is proximate and/or contacting a nerve so as to create EMG activity (e.g., as a result of signals from ESG 12 and/or ESU 26), sensing probes 52 can provide an indication to interface module 16 that will disable any further signals from ESU 26 being transmitted to tissue site "T" through instrument 10. As a result, damage to nerves in tissue site "T" can be prevented by automatically disabling operation of ESU 26 (e.g., by suppressing its signals). In a further embodiment, interface module 16 can further provide an alert (e.g., an audible and/or visual signal) that sensing probes 52 are sensing EMG activity.

[0027] ESU 26 can be configured to perform various electrosurgical modalities such as monopolar, bipolar and/or combinations thereof. Moreover, ESU 26 can be configured to deliver different types of RF signals so as to achieve a desired tissue effect. To this end, various waveforms and/or power settings can be applied to instrument 10 through interface module 16 as desired. Additionally, instrument 10 can be equipped with a tip desired for a particular application of signals from ESU 26.

[0028] In a further embodiment, one or more cameras 60 are positioned so as to provide visual information of the surgical site to assist the surgeon in performing the desired surgical procedure. The one or more cameras 60 can also be introduced to site "T" laparoscopically. Video data from the one or more cameras 60 can be provided to a monitor 62, along with video data from console 40. To this end, the surgeon is provided with both visual information of the surgical site as well as visual information indicative of recorded responses from sensing probes 52 and/or instrument 10. By selectively providing stimulation signals and RF signals, the surgeon, through use of monitor 62, can visually check whether a targeted site is a nerve or whether RF signals can be sent so as to cut the targeted tissue. As such, a surgeon can quickly discern and cut targeted tissue.

[0029] Although the present disclosure has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes can be made in form and detail without departing from the scope of the present disclosure.

Claims

1. A surgical system for use on tissue at a target site, comprising:

   an instrument (10);
   an electrical stimulation generator (12) configured to generate electrical stimulation signals;
   an electrosurgical unit (14) configured to generate radio frequency signals;
   an interface module (16) electrically coupled to the instrument (10), the electrical stimulation generator (12) and the electrosurgical unit (14);
   a first circuit (20) including the instrument (10), the electrical stimulation generator (12) and the interface module (16);
   a second circuit (22) including the instrument (10), the electrosurgical unit (14) and the interface module (16);
   a selection module (18) electrically coupled to the interface module (16) and configured to selectively complete one of the first circuit (20) and the second circuit; and
   a control unit (30);

characterized by
one or more sensing probes (52) separate from the instrument (10) and electrically coupled to the interface module (16) via the control unit (30) to complete the first circuit (20) for monitoring EMG activity at the target site in response to an electric stimulus energy and configured to provide an indication, upon the sensed electromyographic activity, to the interface module (16) to disable any further signals from the electrosurgical unit of the second circuit (22) being transmitted to the instrument (10), wherein the control unit (30) is adapted to allow control and variation of the stimulus energy delivered to the instrument (10) and to process information received from the one or more sensing probes (52) resulting from the delivered stimulus energy.

2. The surgical system of claim 1 wherein the instrument is one of a bipolar forceps, a laproscopic bipolar instrument, a monopolar cautery pencil and a wristed instrument.

3. The surgical system of claim 1 wherein the selection module is coupled to the instrument.

4. The surgical system of claim 1 wherein the selection module is electrically coupled to the interface module and configured to disconnect the second circuit.

5. The surgical system of claim 1 wherein the selection module is electrically coupled to the interface module to provide a signal indicative of electrical activity at the target site.

6. The surgical system of claim 1, further comprising one or more recording from electrosurgical unit electrodes coupled to the tissue and configured to record a bio-electric response from the tissue, the response being used to disconnect the second circuit.

7. The system of claim 1, wherein the electrosurgical unit is configured to deliver both cutting signals and coagulation of signals to the instrument.

8. The surgical system of claim 1, wherein the selection module is an electrical switch that continuously interleaves electrical stimulation signals and radio frequency signals in output signals from the first and second circuits.

9. The surgical system of claim 1, wherein the selection module is an electrical switch that continuously combines and directs electrical stimulation signals and radio frequency signals in output signals from the first and second circuits.

10. The surgical system of claim 1, wherein the selection module is an electrical switch that continuously interleaves the electrical stimulation signal from the first circuit and the radio frequency signal from the second circuit.

Patentansprüche

1. Chirurgisches System zur Verwendung an Gewebe an einem Zielsitus, umfassend:

    ein Instrument (10);
    einen elektrischen Stimulationsgenerator (12), der zum Generieren von elektrischen Stimulationssignalen ausgelegt ist;
    eine elektrochirurgische Einheit (14), die zum Generieren von Hochfrequenzsignalen ausgelegt ist;
    ein Schnittstellenmodul (16), das elektrisch an das Instrument (10), den elektrischen Stimulationsgenerator (12) und die elektrochirurgische Einheit (14) gekoppelt ist;
    einen ersten Schaltkreis (20), der das Instrument (10), den elektrischen Stimulationsgenerator (12) und das Schnittstellenmodul (16) einschließt;
    einen zweiten Schaltkreis (22), der das Instrument (10), die elektrochirurgische Einheit (14) und das Schnittstellenmodul (16) einschließt;
    ein Auswahlmodul (18), das elektrisch an das Schnittstellenmodul (16) gekoppelt ist und ausgelegt ist, um einen von dem ersten Schaltkreis (20) und dem zweiten Schaltkreis selektiv zu komplettieren; und
    eine Steuereinheit (30),

gekennzeichnet durch
eine oder mehrere Abfühlsonden (52), die separat von dem Instrument (10) vorliegen und elektrisch über die Steuereinheit (30) an das Schnittstellenmodul (16) gekoppelt sind, um den ersten Schaltkreis (20) am Zielsitus zur Überwachung der EMG-Aktivität in Reaktion auf eine elektrische Stimulusenergie zu überwachen, und ausgelegt ist bzw. sind, um nach der abgefühlten elektromyographischen Aktivität eine Anzeige an das Schnittstellenmodul (16) bereitzustellen, um die Übertragung jeglicher weiteren Signale von der elektrochirurgischen Einheit des zweiten Schaltkreises (22) an das Instrument (10) zu deaktivieren, wobei die Steuereinheit (30) adaptiert ist, um Steuerung und Variation der an das Instrument (10) abgegebenen Stimulusenergie zu ermöglichen und um Informationen zu verarbeiten, die von der einen oder den mehreren Abfühlsonden (52) empfangen werden, die aus der abgegebenen Stimulusenergie resultieren.

2. Chirurgisches System nach Anspruch 1, wobei das Instrument eines von einer bipolaren Zange, einem

laparoskopischen bipolaren Instrument, einem monopolaren Kauterstift und einem Handgelenkinstrument ("wristed Instrument") ist.

3. Chirurgisches System nach Anspruch 1, wobei das Auswahlmodul an das Instrument gekoppelt ist.

4. Chirurgisches System nach Anspruch 1, wobei das Auswahlmodul elektrisch an das Schnittstellenmodul gekoppelt ist und ausgelegt ist, um die Verbindung zum zweiten Schaltkreis zu trennen.

5. Chirurgisches System nach Anspruch 1, wobei das Auswahlmodul elektrisch an das Schnittstellenmodul gekoppelt ist, um ein Signal bereitzustellen, das elektrische Aktivität am Zielsitus zeigt.

6. Chirurgisches System nach Anspruch 1, ferner umfassend eine oder mehrere Aufzeichnungen von Elektroden der elektrochirurgischen Einheit, die an das Gewebe gekoppelt sind und ausgelegt sind, um eine bioelektrische Reaktion von dem Gewebe aufzuzeichnen, wobei die Reaktion verwendet wird, um die Verbindung zum zweiten Schaltkreis zu trennen.

7. System nach Anspruch 1, wobei die elektrochirurgische Einheit ausgelegt ist, um sowohl Schneidsignale als auch Koagulierungssignale an das Instrument zu übertragen.

8. Chirurgisches System nach Anspruch 1, wobei das Auswahlmodul ein elektrischer Schalter ist, der kontinuierlich elektrische Stimulationssignale und Hochfrequenzsignale in Ausgabesignalen aus dem ersten und dem zweiten Schaltkreis verzahnt.

9. Chirurgisches System nach Anspruch 1, wobei das Auswahlmodul ein elektrischer Schalter ist, der kontinuierlich elektrische Stimulationssignale und Hochfrequenzsignale in Ausgabesignalen aus dem ersten und dem zweiten Schaltkreis kombiniert und lenkt.

10. Chirurgisches System nach Anspruch 1, wobei das Auswahlmodul ein elektrischer Schalter ist, der kontinuierlich das elektrische Stimulationssignal aus dem ersten Schaltkreis und das Hochfrequenzsignal aus dem zweiten Schaltkreis verzahnt.

Revendications

1. Système chirurgical pour l'utilisation sur des tissus à un emplacement cible, comprenant :

   un instrument (10),
   un générateur de stimulations électriques (12) configuré pour générer des signaux de stimulation électrique ;
   une unité d'électrochirurgie (14) configurée pour générer des signaux de fréquence radio ;
   un module d'interface (16) couplé électriquement à l'instrument (10), au générateur de stimulations électriques (12) et à l'unité d'électrochirurgie (14) ;
   un premier circuit (20) incluant l'instrument (10), le générateur de stimulations électriques (12) et le module d'interface (16) ;
   un deuxième circuit (22) incluant l'instrument (10), l'unité d'électrochirurgie (14) et le module d'interface (16) ;
   un module de sélection (18) couplé électriquement au module d'interface (16) et configuré pour sélectivement compléter l'un d'entre le premier circuit (20) et le deuxième circuit ; et
   une unité de commande (30) ;

   caractérisé par
   une ou plusieurs sondes de détection (52) séparées de l'instrument (10) et couplées électriquement au module d'interface (16) via l'unité de commande (30) pour compléter le premier circuit (20) pour surveiller une activité EMG à l'emplacement cible en réponse à une énergie de stimulation électrique
   et configurées pour fournir une indication sur l'activité électromyographique détectée au module d'interface (16) pour désactiver tout autre signal de l'unité d'électrochirurgie du deuxième circuit (22) transmis à l'instrument (10), dans lequel l'unité de commande (30) est adaptée pour permettre la commande et la variation de l'énergie de stimulation délivrée à l'instrument (10) et pour traiter de l'information reçue de l'une ou des plusieurs sondes de détection (52) résultant de l'énergie de stimulation délivrée.

2. Système chirurgical selon la revendication 1,

   dans lequel l'instrument est l'un/une d'entre une pince bipolaire, un instrument bipolaire laparoscopique, un stylo de cautérisation monopolaire et un instrument à poignée.

3. Système chirurgical selon la revendication 1,

   dans lequel le module de sélection est couplé à l'instrument.

4. Système chirurgical selon la revendication 1,

   dans lequel le module de sélection est couplé électriquement au module d'interface et configuré pour déconnecter le deuxième circuit.

5. Système chirurgical selon la revendication 1,

   dans lequel le module de sélection est couplé électriquement au module d'interface pour fournir un signal indicatif d'une activité électrique à l'emplacement cible.

6. Système chirurgical selon la revendication 1, comprenant en outre un ou plusieurs enregistrements de l'unité d'électrochirurgie,

des électrodes couplées au tissu et configurées pour enregistrer une réponse bioélectrique du tissu, la réponse étant utilisée pour déconnecter le deuxième circuit.

7. Système selon la revendication 1,

dans lequel l'unité d'électrochirurgie est configurée pour délivrer à la fois des signaux de coupe et des signaux de coagulation à l'instrument.

8. Système chirurgical selon la revendication 1,

dans lequel le module de sélection est un commutateur électrique qui entrelace en continu des signaux de stimulation électrique et des signaux de fréquence radio dans des signaux de sortie des premier et deuxième circuits.

9. Système chirurgical selon la revendication 1,

dans lequel le module de sélection est un commutateur électrique qui combine et règle en continu des signaux de stimulation électrique et des signaux de fréquence radio dans des signaux de sortie des premier et deuxième circuits.

10. Système chirurgical selon la revendication 1,

dans lequel le module de sélection est un commutateur électrique qui entrelace en continu le signal de stimulation électrique du premier circuit et le signal de fréquence radio du deuxième circuit.

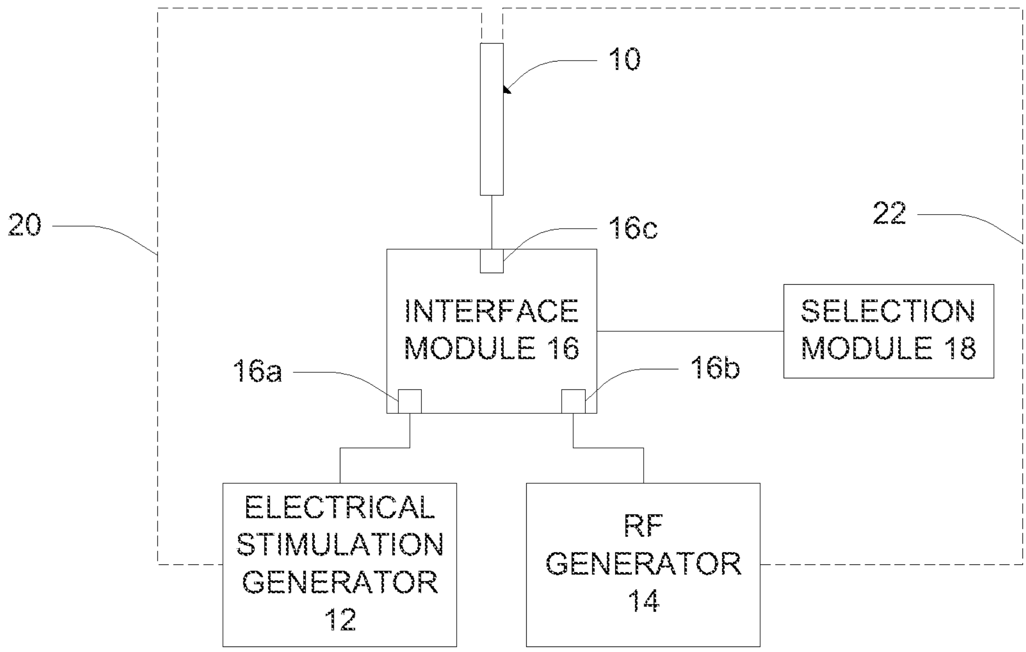
10
20
16c
22
INTERFACE MODULE 16
SELECTION MODULE 18
16a
16b
ELECTRICAL STIMULATION GENERATOR 12
RF GENERATOR 14

FIG. 1

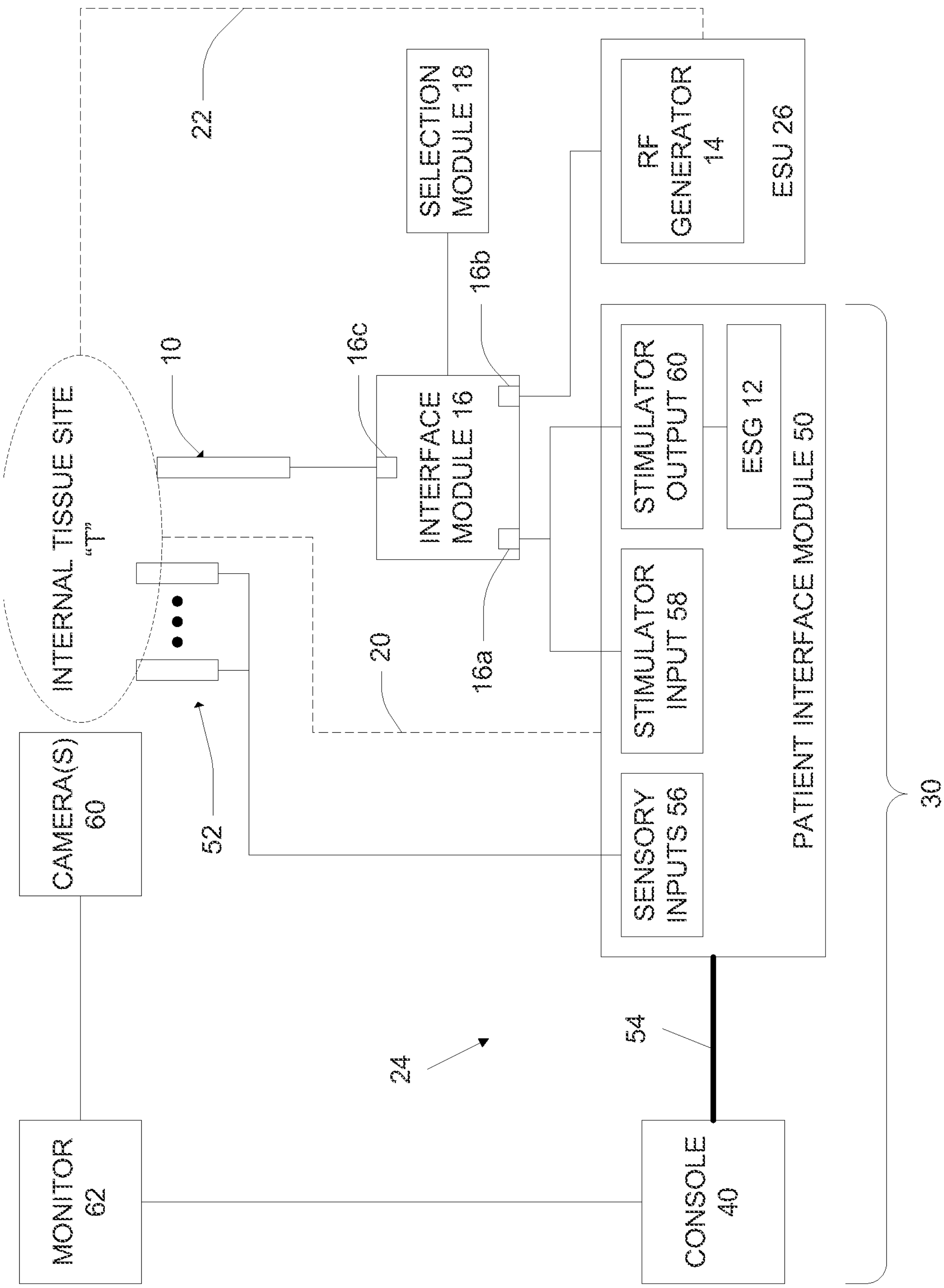
INTERNAL TISSUE SITE "T"
10
16c
16b
16a
INTERFACE MODULE 16
SELECTION MODULE 18
RF GENERATOR 14
ESU 26
22
20
52
CAMERA(S) 60
STIMULATOR OUTPUT 60
ESG 12
STIMULATOR INPUT 58
SENSORY INPUTS 56
PATIENT INTERFACE MODULE 50
30
54
24
MONITOR 62
CONSOLE 40

FIG. 2

REFERENCES CITED IN THE DESCRIPTION

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- WO 0112089 A **[0006]**
- WO 2009124726 A **[0007]**

patsnap

专利名称(译)	用于神经监测和电外科的接口模块		
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[标]申请(专利权)人(译)	美敦力公司		
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当前申请(专利权)人(译)	美敦力公司XOMED，INC.		
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发明人	MCFARLIN, KEVIN L. BRUCE, JOHN C. HACKER, DAVID C. TUCKER, ROBERT A.		
IPC分类号	A61B5/0488 A61B18/12 A61B5/00 A61N1/08		
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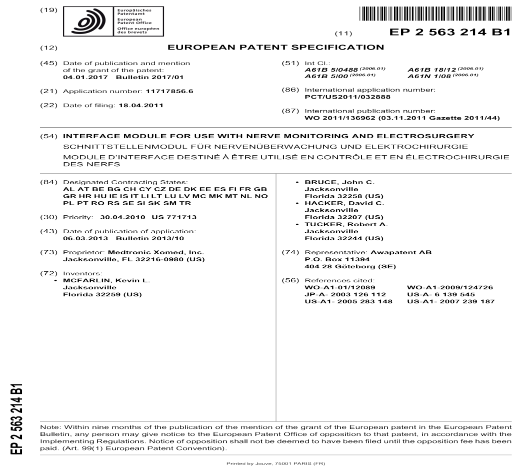
外部链接	[Espacenet]		

摘要(译)

本文提出的概念涉及可以电耦合到电刺激发生器，射频发生器和仪器的接口模块。选择模块耦合到接口模块并以第一模式操作以将电刺激信号从电刺激发生器传递到仪器，并且以第二模式将射频信号从射频发生器传递到仪器。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(54) INTERFACE MODULE FOR USE WITH NERVE MONITORING AND ELECTROSURGERY
SCHNITTSTELLENMODUL FÜR NERVENÜBERWACHUNG UND ELEKTROCHIRURGIE
MODULE D'INTERFACE DESTINÉ À ÊTRE UTILISÉ EN CONTRÔLE ET EN ÉLECTROCHIRURGIE DES NERFS

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