MULTIPLE SELECTABLE FIELD/CURRENT-VOLTAGE PADS HAVING INDIVIDUALLY POWERED AND CONTROLLED CELLS

Inventor: Kiril Pandelisev

Correspondence Address:
CERMAK & KENEALY, LLP
515 EAST BRADDOCK RD SUITE B
Alexandria, VA 22314 (US)

Publication Classification

Int. Cl. A61N 1/00 (2006.01)
U.S. Cl. 607/115

ABSTRACT

A method and apparatus for speeding the healing process of soft tissues, bone fractures, cancerous tissue, nerve pathways and other body tissues, wherein a portable base having a plurality of cells is applied with the cells facing or encircling the wound. The cells generate electro-magnetic radiations, radio frequencies, magnetic fields, current-voltage signals or combinations thereof via a field generator coil or electrodes. Each cell is powered and controlled individually via self-contained controls or remote controls. The type, frequency, pulse characteristics, repetition rate and signal density of the energy are varied according to the size and type of wound to be treated and according to the proximity of each cell to the wounded tissue.

Multiple selectable field generator pad having 40 (A-ij, i=1-5, j=1-8) individually powered and controlled cells

|------|------|------|------|------|------|------|------|

Individual cell Aij where i=5, j=7
Multiple selectable field generator pad having 40 \( (A_{ij}, i=1-5, j=1-8) \) individually powered and controlled cells

|-----|------|------|------|------|------|------|------|------|

Individual cell \( A_{ij} \) where \( i=5, j=7 \)
Multiple selectable field generator pad having 40\((A_{i,j}=1-5, i=1-8)\) individual, remotely powered and controlled cells.

Fig. 2

Control panel with portable rechargeable battery power supply.

Power and signal control conduit.
Multiple selectable field generator pad having 40 (A_{i,j}, i=1-5, j=1-8) individual, pad powered and controlled cells

Fig. 4

Signal generator and control 1

Signal generator and control 2


RB1 RB2
Fig. 5

Multiple selectable field generator pad having

40 (A<sub>ij</sub>; i=1-5, j=1-8) individually, remotely powered and controlled cells

Connector to portable power and signal generator and control

Power and signal control conduit

Individual cell Ai, where i=5, j=7
Fig. 6

Multiple selectable field generator pad having 40 \((A_{ji}, i=1, \ldots, 5, j=1, \ldots, 8)\) individually, remotely powered and controlled cells.
Fig. 9

Soft tissue being treated

Frequency

Position

Increased Localized Strength with or w/o Variable Frequency

Decreased Localized Strength with or w/o Variable Frequency

Variable Field Strength with or w/o Variable Frequency

17 16 15 14 13 12 11
MULTIPLE SELECTABLE FIELD/CURRENT-VOLTAGE PADS HAVING INDIVIDUALLY POWERED AND CONTROLLED CELLS


BACKGROUND OF THE INVENTION

Brief Description of the Related Art

[0002] Several modes of therapeutic treatments of wounds are in vogue. Electromagnetic radiation devices, electrical tissue stimulators, and massage apparatuses are currently in use for stimulating the body’s healing processes. Generally, those treatment methods involve placing electrodes on the body and providing an electrical field to stimulate the body part.

[0003] Needs exist for portable devices that can be used anywhere at any time to apply energy to wounded tissue and that are capable of being variably controlled within the body of the device. The present invention meets requirement lacking in prior art devices.

SUMMARY OF THE INVENTION

[0004] According to one of numerous aspects of the present invention, a healing cell apparatus comprises a plurality of cells each having a battery and self-contained controls, the self-contained controls comprising control circuits connected to the batteries, cables connected to the control circuits, a field generator coil configured and arranged to produce energy, the field generator coil connected to the cables, a shielding separating the control circuits from the coil for shielding the control and any adjacent cells from interference, and a coil enclosure and patient insulation interposed adjacent to the coil.

[0005] According to another aspect of the present invention, a healing cell apparatus for producing current-voltage signals comprises a base and a plurality of cells mounted on the base, wherein each cell comprises a battery and a self-contained control connected to the battery.

[0006] According to yet another aspect of the present invention, a method for healing wounds on or in a patient’s body comprises mounting a plurality of cells on a base, placing the base proximate a wound on the body, the wound selected from the group consisting of a soft tissue wound, a bone fracture, cancerous tissues, and damaged nerve pathways, applying energy from the cells to the wound and peripheral areas of the body by communicating power from a power source to the cells, and controlling application of power to the cells individually, for speeding healing of said wound.

[0007] According to another aspect of the present invention, an apparatus for speeding healing process of wounded soft tissues, bone tissues, cancerous tissues, nerve pathway tissues and other body tissues, comprises a portable base configured and arranged to be positioned on a body, a plurality of cells on the portable base configured and arranged to be applied to the body with the portable base or the cells near or on the wound, field generators connected to the cells configured and arranged to generate energy as electromagnetic radiations, radio frequencies, magnetic fields, current-voltage signals or combinations thereof with the field generators, and self-contained or remote controls connected severally to each cell configured and arranged to power and control each cell individually with the self-contained controls or the remote controls, and to vary the frequency type, pulse characteristics, repetition rate, or signal density of the generated energy according to the size and type of the wounded tissues being healed and according to the proximity of each cell to the wounded tissues.

[0008] These and further and other aspects and features of the invention are apparent in the disclosure, which includes the above and ongoing written specification, with the claims and the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The invention of the present application will now be described in more detail with reference to exemplary embodiments of the apparatus and method, given only by way of example, and with reference to the accompanying drawings, in which:

[0010] FIG. 1 is a diagram of a multiple selectable field generator having forty individually controlled cells.

[0011] FIG. 2 is a diagram of a multiple selectable field generator having forty individual, remotely powered and controlled cells and a control panel located at only one end of the pad.

[0012] FIG. 3 is a diagram of a multiple selectable field generator having forty individual, remotely powered and controlled cells and a control panel located at both ends of the pad.

[0013] FIG. 4 is a diagram of a multiple selectable field generator pad having forty individual, pad powered and controlled cells that is connected to a portable power signal generator and control.

[0014] FIG. 5 is a diagram of a multiple selectable field generator pad having forty individual, remotely powered and controlled cells.

[0015] FIG. 6 is a diagram of a multiple selectable field generator pad having forty individual, remotely powered and controlled cells.

[0016] FIG. 7 is a plot of position against field strength in relation to the wounded area being treated.

[0017] FIG. 8 is a plot of position against frequency in relation to the wounded area being treated.

[0018] FIG. 9 is a plot of position against field strength and frequency in relation to the wounded area being treated.

[0019] FIG. 10 is a block diagram of a self-contained EM/RF/magnet field unit cell.

[0020] FIG. 11 is a block diagram of a self-contained current-voltage unit cell.

[0021] FIG. 12 is a block diagram of a remote controlled EM/RF/magnet field unit cell.
FIG. 13 is a block diagram of a remote controlled current-voltage unit cell.

FIG. 14 is a diagram of a remote controlled/self-contained flexible, cylindrically shaped multiple unit cell for bone regrowth and other applications having any type activated region that has multiple RF/EM/B field/current-voltage control sensors.

FIG. 15 is a diagram of a remote controlled/self-contained flexible, cylindrically shaped unit cell for bone regrowth and other applications.

FIG. 16 is a diagram of a remote controlled, self-contained flexible, cylindrically shaped multiple unit cell for bone regrowth and other applications that has a cross type activated region.

FIG. 17 is a remote controlled/self-contained flexible, cylindrically shaped multiple unit cell for bone regrowth and other applications having an elongated type activated region.

FIG. 18 is a remote controlled/self-contained flexible, cylindrically shaped multiple unit cell for bone regrowth and other applications that has a radial/helical type activated region.

FIG. 19 is a remote controlled/self-contained flexible, cylindrically shaped multiple unit cell for bone regrowth and other applications having any type activated region having multiple RF/EM/B field/current-voltage control sensors.

In the case of current-voltage applications, the choice of applying various signals at selected areas at the periphery of the wound, or across the wound, or any combinations thereof, speeds up the healing process and also provides for applications that are not possible with present techniques.

The combination of a RF/EM/B field and a current-voltage application further the non-invasive techniques for healing of various parts of the body.

The unit includes a pad that fits on a body part, having multiple small radio frequency transmitters arranged in an array. The transmitter coils directly above a wound are energized to transmit pulsed radio frequency energy to the wound periphery or center or both. Transmitters in the array which are not near the wound are deactivated. As a result, energy is focused on the wound periphery and/or central area to promote rapid healing and tissue growth there. The results are physiological activity at the wound site. Low energy can make a device portable, self-contained and reusable on different wounds after sterilization. One size of the pad fits all. The use of the pad allows for the body's healing energy to be focused precisely where needed, speeding healing and tissue growth.

The unit is portable, allowing the user to obtain the benefits of the unit at any time or location. The unit is extremely flexible in the available methods of providing power to the individual cells. Each cell may be supplied power individually by already incorporated power and signal capabilities. Each cell may be supplied power remotely, by either enabling the desired cells via connections to a control package that is located at one or both ends of the pad, by a flexible module surrounding the pad, or by a separate control unit that is powered by standard batteries, rechargeable batteries, or simply by connecting the control unit to a power outlet. Each cell may be turned ON or OFF by a switch on the cell or by a control unit.

The pad is preferably thin, flexible, and portable. It may be used by applying the pad over the patient with the cell surface facing down, under the patient with the cell surface facing up, or in any other desired position. The flexible nature of the pad allows for shaping of the pad and applying it around a leg, arm or any other part of the body that needs treatment. The number of the activated cells as well as the shape of the area that is subjected to the RF/EM/B field or the current-voltage signals, or a combination thereof, and the signal strength, the frequency and other signal characteristics greatly depend on the shape and size of the wounded area to be treated.

Sensors may be incorporated into the pad allow for measuring the dose of the treatment, the temperature of the treated area, blood pressure, or any other relevant parameters.

The cost of maintenance of the pad and the effectiveness of the pad in treating patients is drastically lowered by simply repairing the defective cells.

In other general terms, exemplary apparatus embodying principles of the present invention include a healing cell apparatus including a base on which a plurality of cells is arranged orthogonally for application to wounds on a body. The cells apply energy to the wound and peripheral areas of the body, speeding the healing process.
soft tissues, bone fractures, cancerous tissues, nerve pathways, and other body tissues. The base may be thin, flexible and portable. A power supply individually communicates independently with each of the plurality of cells, and controls connected to the cells control application of power to each of the cells individually. The cells generate radio frequencies, electromagnetic radiations, magnetic fields, current-voltage signals, and combinations thereof. The type, strength, pattern, frequency, pulse characteristics, width, repetition rate and signal density of the energy is varied according to the type and size of the wound to be treated and proximity of the cells to the wound. The frequency and field strength of the energy generated by the cells is varied and increases with proximity to a wound. A number of activated cells may be varied. The base may be applied with the cells facing the wound, or encircling a limb. Sensors may be incorporated into the base to measure the dose of the treatment, the temperature of the treated area, blood pressure or other relevant parameters.

[0040] The power source may be batteries or a connection to a power outlet, a converter and oscillator, and a transformer. The power source may be mounted on the base, on one end of the base, or on opposite ends of the base. The power source may be connected to the base. Power and signal conduits may be mounted on the base. The power and signal conduits connect to a power and signal generator and control. The power and signal generator and control may be portable.

[0041] A control panel, a power supply, and a signal generator and control may each be mounted on either end of the base, or on opposite ends of the base.

[0042] Cells may have self-contained controls, which are connected to batteries. Additionally, the cells can include external connectors on each cell for connecting the cells to external signal and power controls. The self-contained controls for cells which generate electromagnetic radiations, radio frequencies, magnetic fields, and combinations thereof comprise power and signal control circuits connected to the batteries, power and signal cables connected to the signal and power control circuits, a field generator coil for generating energy connected to cables, a shielding separating the control circuits form the coil for shielding the control and any adjacent cells from interference, and a coil enclosure and patient insulation interposed between a patient and the coil. The batteries, controls, shielding, coil and cables are surrounded by a housing.

[0043] The self-contained controls for cells which generate current-voltage signals include power and signal control circuits, power and signal control cables connected to the power and signal control circuits and to the battery, electrodes connected to the power and signal cables, and patient insulation mounting the electrodes.

[0044] Cells may be remotely controlled. The cells which are remotely controlled and generate electromagnetic radiations, radio frequencies, magnetic fields, and combinations thereof. They include signal and power cables, a field generator coil for generating energy, a coil enclosure, an on/off switch, and shielding for preventing interference with any adjacent cells.

[0045] The cells which are remotely controlled and generate current-voltage signals include power and signal cables, electrodes, patient insulation, a cable enclosure, and an on/off switch.

[0046] Turning now to the several drawing figures, a first exemplary embodiment includes a flexible and fully portable unit 1 employing individually powered and controlled cells 3 that produce a radio frequency (RF), electromagnetic radiation (EM), a magnetic field (B), or a current-voltage signal for healing purposes, as shown in FIGS. 1 - 6. The cells 3 are contained in the unit 1 by a pad housing 5. The cells 3 may have self-contained controls, as shown in FIG. 1, or be remotely controlled, as shown in FIGS. 2, 3 and 5. The unit 1 may contain only one type of cell 3 or it may be made up of a combination of radiation and signal producing cells.

[0047] The type of radiation or current-voltage application used, the strength of the radiation or current-voltage, the pattern of activated cells, the frequency of the signal, the pulse characteristics and its width, the repetition rate, the strength of the signal, the use of a continuous or a pulsating mode, the signal density per unit area, as well as the composition of the cells 3 comprising the pad 1 are determined by the wound being treated, the size and shape of the wound, the depth of the wound, and the type of tissue being treated. The tissue may be soft tissue, a bone fracture, cancerous tissue, a nerve path, or any other body type tissue.

[0048] In the case of RF/EM/B applications, certain patterns of the applied field, the pattern of activated cells, the frequency of the signal, the pulse characteristics and the pulse width, the repetition rate, the strength of the signal, the use of a continuous or a pulsating mode, and the signal density per unit area bring very improved healing results over the current techniques.

[0049] In the case of current-voltage applications, the choice of applying various signals at selected areas at the periphery of the wound, or across the wound, or any combinations thereof, speeds up the healing process and also provides for applications that are not possible with present techniques.

[0050] The combination of a RF/EM/B field and a current-voltage application furthers the non-invasive techniques for healing of various parts of the body.

[0051] The unit 1 is portable, allowing a user to obtain the benefits of the unit at any time or location. The unit 1 is also extremely flexible in the available methods of providing power to the individual cells. Each cell 3 may be supplied power individually by already incorporated power and signal capabilities, as shown in FIG. 1. Each cell 3 may be supplied power remotely, by either enabling the desired cells via connections to a control package 7 that is located at one or both ends of the pad or on a side away from the side facing the user (FIGS. 2 and 3, respectively), by a flexible module surrounding the pad 9 (FIG. 4), or by a separate control unit (FIG. 5) that is connected to the unit by a connector 11 that is powered by standard batteries, rechargeable batteries 10 (FIG. 4), or simply by connecting the control unit to a power outlet. The batteries may be provided between the pad and the power outlet having connections, such as cable or the like, between the batteries, power outlet and the pad. Each cell 3 may be turned ON or OFF by a switch on the cell or by a separate control unit.

[0052] The pad 1 is thin, flexible and portable. It may be used by applying the pad over the patient with the cell surface facing down, under the patient with the cell surface
facing up, or in any other desired position. The pad may be positioned proximal the body and may be spaced from the body or in contact with the body or be selectively in contact with or spaced from the body depending on the position of individual cells on the pad. For example, the cells may have variable positions on the pad with some of the cells being in contact with the body and some spaced form the body when the pad is in use.

[0053] FIG. 6 shows an example of how the pad 1 is placed over a wound 13 that is to be treated. FIGS. 7, 8 and 9 show the varying intensity of the individual cells in relation to the cell’s proximity to the wound 13 that is to be treated.

[0054] FIGS. 10 and 11 show an individual cell 3 that contains controls within the cell itself. FIG. 10 shows a cell 3 that uses electromagnetic radiation, radio frequencies, or a magnetic field to treat the wound. A battery 15 and signal and power control circuits 17 are both contained within the individual cell 3. Signals received by the signal and power controls 19 activate the battery 15 and the signal and power control circuits 17 that cause the field generator coil 18 to create a field. Signal and power cables 25 connect the signal and power controls 19, the battery 15, the signal and power control circuits 17, and the field generator coil 18 together. Shielding 21 around the cell 3 limits exposure to the generated field to only the wound that is to be treated. Insulation 23 houses the coil 18 and prevents direct contact with the coil by the patient.

[0055] FIG. 11 shows a cell 3 that uses current-voltage signals to treat the wound. A battery 15 and signal and power control circuits 17 are both contained within the individual cell 3, for internal control. However, the circuits may be outside the cell for generating and controlling current-voltage signals externally from a signal and control instrument or from a combined signal and control module. Some cells may have internal and some external generation and control as desired. The current-voltage cells may have one or more contacts with the body.

[0056] Signals received by the signal and power controls 19 activate the battery 15 and the signal and power control circuits 17 that cause the electrodes 27 to create an electrical signal. The electrodes 27 may be placed directly on the patient. Signal and power cables 25 connect the signal and power controls 17, the battery 15, the signal and power circuits 17, and the electrodes 27 together.

[0057] FIGS. 12 and 13 show an individual cell 3 that is remote controlled. FIG. 12 shows a cell 3 that uses electromagnetic radiation, radio frequencies or a magnetic field to treat the wound. Signal and power cables 25 connect the power supply to the individual cells 3. An on/off switch 31 located at each cell 3 supplies power to the field generator coil 18 for creating a field to treat the wound. The on/off switch 31 is used to select which individual cells 3 of the pad are to be used for treating the wound. Shielding 21 around the cell 3 limits exposure to the generated field to only the wound that is to be treated. Insulation 23 houses the coil 18 and prevents direct contact with the coil by the patient.

[0058] FIG. 13 shows a cell 3 that uses current-voltage signals to treat the wound. Signal and power cables 25 connect the power supply to the individual cells 3. An on/off switch 31 located at each cell 3 supplies power to the electrodes 27 for creating electrical signals to treat the wound. The on/off switch 31 is used to select which individual cells 3 of the pad are to be used for treating the wound. The electrodes 27 are placed directly on the patient.

[0059] The flexible nature of the pad 1 allows for shaping of the pad and applying it around a leg, arm, or any other part of the body 42 that needs treatment, as shown in FIG. 14. The number of the activated cells as well as the shape of the area that is subjected to the RF/EM/B field or the current-voltage signals, or a combination thereof, and the signal strength, the frequency and other signal characteristics greatly depends on the shape and size of the wounded area to be treated. As shown in FIG. 15, the pad 1 may comprise one unitary cell 3, or the pad 1 may have multiple cells 3, as shown in FIG. 16. As shown in FIGS. 16, 17 and 18, the activated area may be cross shaped, vertically shaped or horizontally shaped. The cells may have varied shapes such as, but not limited to, quadrilateral, triangular, polygonal, orthogonal, circular or any other shape and combinations thereof. The size of individual cells are varied and are not limited to a particular size with combinations of sizes possible and within the scope of this invention.

[0060] Sensors 41 may be incorporated into the pad 1. The sensors may be used for measuring the dose of the treatment, the temperature of the treated area, blood pressure, or any other relevant parameters, as shown in FIG. 19.

[0061] The cost of maintenance of the pad and the effectiveness of the pad in treating patients is drastically lowered by simply repairing the defective pads.

[0062] While the invention has been described in detail with reference to exemplary embodiments thereof, it will be apparent to one skilled in the art that various changes can be made, and equivalents employed, without departing from the scope of the invention. The foregoing description of the exemplary embodiments of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed, and modifications and variations are possible in light of the above teachings or may be acquired from practice of the invention. The embodiments were chosen and described in order to explain the principles of the invention and its practical application to enable one skilled in the art to utilize the invention in various embodiments as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the claims appended hereto, and their equivalents.

What is claimed is:
1. A healing cell apparatus comprising:
   a plurality of cells each having a battery and self-contained controls, the self-contained controls comprising control circuits connected to the batteries, cables connected to the control circuits, a field generator coil configured and arranged to produce energy, the field generator coil connected to the cables, a shielding separating the control circuits from the coil for shielding the control and any adjacent cells from interference, and a coil enclosure and patient insulation interposed adjacent to the coil.
2. The apparatus of claim 1, wherein the control circuits comprise power control circuits.
3. The apparatus of claim 1, wherein the control circuits comprise signal control circuits.

4. The apparatus of claim 1, wherein the cables comprise power cables.

5. The apparatus of claim 1, wherein the cables comprise signal cables.

6. The apparatus of claim 1, wherein the field generator coil is configured and arranged to produce energy is selected from the group consisting of electromagnetic radiations, radio frequencies, magnetic fields, and combinations thereof.

7. The apparatus of claim 1, further comprising:

   a housing surrounding the battery, the control, the shielding, the coil, and the cables.

8. A healing cell apparatus for producing current-voltage signals comprising:

   a base;

   a plurality of cells mounted on the base, wherein each cell comprises a battery and a self-contained control connected to the battery.

9. The apparatus of claim 8, wherein the self-contained control comprises control circuits, and further comprising:

   cables each connected between the control circuits and to the batteries;

   electrodes connected to the cables; and

   patient insulation, the electrodes mounted on the patient insulation.

10. The apparatus of claim 9, wherein the control circuits comprise power control circuits.

11. The apparatus of claim 9, wherein the control circuits comprise signal control circuits.

12. The apparatus of claim 9, wherein the cables comprise power cables.

13. The apparatus of claim 9, wherein the cables comprise signal cables.

14. The apparatus of claim 9, wherein each cell further comprises a housing containing the battery, the control circuits, and the cables.

15. A method for healing wounds on or in a patient’s body, the method comprising:

   mounting a plurality of cells on a base;

   placing the base proximate a wound on the body, the wound selected from the group consisting of a soft tissue wound, a bone fracture, cancerous tissues, and damaged nerve pathways;

   applying energy from the cells to the wound and peripheral areas of the body by communicating power from a power source to the cells; and

   controlling application of power to the cells individually, for speeding healing of said wound.

16. The method of claim 15, wherein applying energy comprises applying energy selected from the group consisting of radio frequencies, electro-magnetic radiations, magnetic fields, current-voltage signals, and combinations thereof.

17. The method of claim 15, wherein mounting the cells comprises mounting the cells on a thin, flexible, and portable base.

18. The method of claim 15, further comprising:

   varying the type, strength, pattern, frequency, pulse characteristics, width, repetition rate, and signal density of the energy according to the type and size of the wound to be treated and proximity of the cells to the wound.

19. The method of claim 15, further comprising:

   variably activating and controlling activation of each cell.

20. The method of claim 15, wherein placing the base on the wound comprises placing cells facing a wound or encircling a limb.

21. The method of claim 15, wherein placing the base on a body comprises placing the base proximate the body.

22. The method of claim 21, wherein placing the base proximate the body comprises placing the base in contact with the body.

23. The method of claim 21, wherein placing the base proximate the body comprises placing the base spaced from the body.

24. The method of claim 21, wherein placing the base proximate the body comprises placing predetermined cells in contact with the body while placing other cells spaced from the body.

25. The apparatus of claim 9, wherein the control circuits comprise power and signal control circuits positioned within each cell configured and arranged to internally generate and control signals.

26. The apparatus of claim 9, wherein the control circuits comprise power and signal control circuits positioned outside the cells and a signal and control instrument connected to the circuits for externally generating and controlling signals.

27. The apparatus of claim 9, wherein the control circuits comprise power and control circuits selectively positioned inside or outside the cells, and a combined signal and control module connected to the circuits for selectively controlling the cells.

28. Apparatus for speeding healing process of wounded soft tissues, bone tissues, cancerous tissues, nerve pathway tissues and other body tissues, comprising:

   a portable base configured and arranged to be positioned on a body;

   a plurality of cells on the portable base configured and arranged to be applied to the body with the portable base or the cells near or on the wound;

   field generators connected to the cells configured and arranged to generate energy as electromagnetic radiations, radio frequencies, magnetic fields, current-voltage signals or combinations thereof with the field generators;

   self-contained or remote controls connected severally to each cell configured and arranged to power and control each cell individually with the self-contained controls or the remote controls, and to vary the frequency type, pulse characteristics, repetition rate, or signal density of the generated energy according to the size and type of the wounded tissues being healed and according to the proximity of each cell to the wounded tissues.

* * * * *