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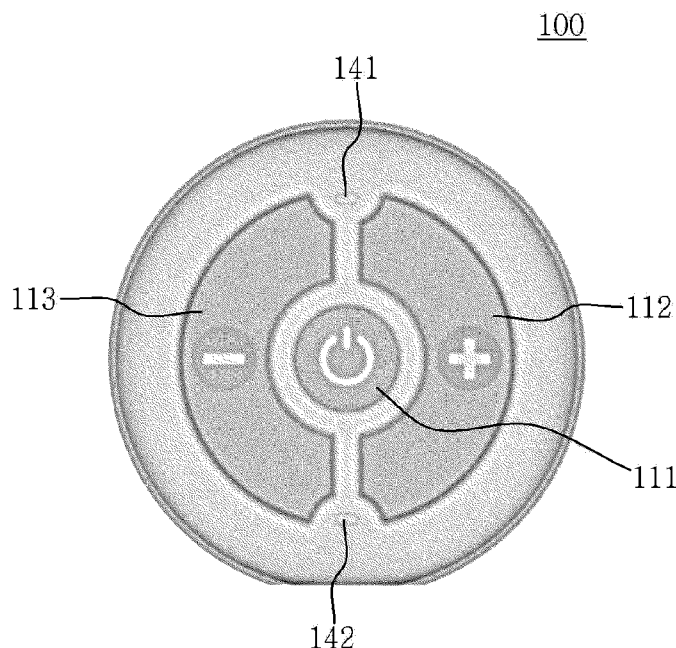
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[Continued on next page]

(54) Title: STIMULATION APPARATUS, METHOD FOR CONTROLLING THE SAME, AND ELECTRICAL STIMULATION DEVICE



(57) Abstract: Provided is a method for controlling a stimulation apparatus, which includes detecting a control input of a user, determining an operation mode and an operation strength based on the control input, generating an electrical stimulation signal corresponding to the operation mode and the operation strength, determining a state of the stimulation apparatus, providing an electrical stimulation corresponding to the electrical stimulation signal to the user through the electrode, when the stimulation apparatus is in the first state, and discharging residual charges of the stimulation apparatus according to a preset period, when the stimulation apparatus is in the second state. Here, the state of the stimulation apparatus may include a first state in which an electrode is electrically connected to the stimulation apparatus and a second state in which an electrode is not electrically connected to the stimulation apparatus.



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## Description

### Title of Invention: STIMULATION APPARATUS, METHOD FOR CONTROLLING THE SAME, AND ELECTRICAL STIMULATION DEVICE

#### Technical Field

- [1] The present disclosure relates to a stimulation apparatus and an electrical stimulation device, and more particularly, to a stimulation apparatus and an electrical stimulation device to/from which an electrode may be attached or detached.

#### Background Art

- [2] Recently, various electrical stimulation devices such as a transcutaneous electrical nerve stimulation (TENS) apparatuses for relieving pain by persistently applying electrical stimulations to nervus antennalis to restrain the sense of pain have been proposed.
- [3] However, in an existing electrical stimulation device, a stimulation apparatus and an electrode are integrally combined, or a stimulator is connected to an electrode using a cable. If the existing electrical stimulation device is attached to a portion of a human body which is not reached by the hand of the user, it is difficult to control the electrical stimulation device, and the cable causes inconvenience in use.

[4]

- [5] RELATED LITERATURES

- [6] Patent Literature

- [7] KR 10-1364598

#### Disclosure of Invention

##### Technical Problem

- [8] The present disclosure is directed to providing a stimulation apparatus and an electrical stimulation device to/from which an electrode may be attached or detached for the convenience of a user.

##### Solution to Problem

- [9] In one general aspect, the present disclosure provides a stimulation apparatus, which includes: an input unit configured to detect a control input of a user; a signal generation unit configured to generate an electrical stimulation signal; an output unit configured to output the electrical stimulation signal; and a control unit configured to control the input unit, the signal generation unit and the output unit, wherein the control unit performs: determining an operation mode and an operation strength based on the control input; generating an electrical stimulation signal corresponding to the

operation mode and the operation strength; determining a state of the stimulation apparatus, the state of the stimulation apparatus including a first state in which an electrode is electrically connected to the stimulation apparatus and a second state in which an electrode is not electrically connected to the stimulation apparatus; providing an electrical stimulation corresponding to the electrical stimulation signal to the user through the electrode, when the stimulation apparatus is in the first state; and discharging residual charges of the stimulation apparatus according to a preset period, when the stimulation apparatus is in the second state.

[10] In another general aspect, the present disclosure provides a method for controlling a stimulation apparatus, which includes: detecting a control input of a user; determining an operation mode and an operation strength based on the control input; generating an electrical stimulation signal corresponding to the operation mode and the operation strength; determining a state of the stimulation apparatus, the state of the stimulation apparatus including a first state in which an electrode is electrically connected to the stimulation apparatus and a second state in which an electrode is not electrically connected to the stimulation apparatus; providing an electrical stimulation corresponding to the electrical stimulation signal to the user through the electrode, when the stimulation apparatus is in the first state; and discharging residual charges of the stimulation apparatus according to a preset period, when the stimulation apparatus is in the second state.

[11] In another general aspect, the present disclosure provides an electrical stimulation device, which includes: a stimulation apparatus configured to generate an electrical stimulation signal according to a control input of a user; an electrode configured to provide an electrical stimulation corresponding to the electrical stimulation signal to the user; and a connection unit configured to connect the stimulation apparatus to the electrode, wherein the stimulation apparatus performs: determining a state of the stimulation apparatus, the state of the stimulation apparatus including a first state in which the electrode is electrically connected to the stimulation apparatus and a second state in which the electrode is not electrically connected to the stimulation apparatus; providing an electrical stimulation corresponding to the electrical stimulation signal to the user through the electrode, when the stimulation apparatus is in the first state; and discharging residual charges of the stimulation apparatus according to a preset period, when the stimulation apparatus is in the second state.

### **Advantageous Effects of Invention**

[12] According to the present disclosure, since the stimulation apparatus may be connected to an electrode without using a separate connection cable, the stimulation apparatus may be easily attached or detached, and the detached stimulation apparatus

may be easily attached again after an operation mode or the like is adjusted.

[13] In addition, according to the present disclosure, since the stimulation apparatus may be electrically connected to an electrode through an annular contact point, it may be electrically connected to the electrode regardless of a rotating direction of the stimulation apparatus.

[14] In addition, according to the present disclosure, when an electrical stimulation is provided to a user, the stimulation apparatus may prevent a large amount of charges from being transferred unexpectedly, by means of a safety function, and it is possible to provide safe electrical stimulation to the user.

### **Brief Description of Drawings**

[15] Fig. 1 shows an electrical stimulation device according to an embodiment of the present disclosure.

[16] Fig. 2 is a diagram showing an appearance of a stimulation apparatus according to an embodiment of the present disclosure.

[17] Fig. 3 shows a configuration of the stimulation apparatus according to an embodiment of the present disclosure.

[18] Fig. 4 shows a stimulation waveform of each operation mode according to an embodiment of the present disclosure.

[19] Fig. 5 is a diagram showing an operation state of the stimulation apparatus according to an embodiment of the present disclosure.

[20] Fig. 6 is a flowchart for illustrating a method for controlling a stimulation apparatus according to an embodiment of the present disclosure.

### **Best Mode for Carrying out the Invention**

[21] Exemplary embodiments now will be described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments are shown. The present disclosure may, however, be embodied in many different forms and should not be construed as limited to the exemplary embodiments set forth therein.

[22] The terms used in the present disclosure are selected as most common terms generally used in the art, which however may differ as intended by those skilled in the art or according to custom or new technologies. In addition, in special cases, a term arbitrarily chosen by the applicant can be used, and in this case, its meaning will be explained in a suitable portion of this specification. Therefore, the terms used in the present disclosure should be interpreted based on substantial meanings of the terms and overall contents of the present disclosure, without being limited to the expressions of the terms.

[23]

[24] In the present disclosure, an electrical stimulation device means an apparatus for

providing an electrical stimulation corresponding to an electrical stimulation signal generated by a stimulator to a user through an electrode. For example, the electrical stimulation device may be a transcutaneous electrical nerve stimulation (TENS) apparatus, a low-frequency medical apparatus, an electrical stimulation apparatus or a portable electrical stimulation apparatus, which provides an electrical stimulation to a human body for medical treatment, pain relief or the like.

[25]

[26] Fig. 1 shows an electrical stimulation device according to an embodiment of the present disclosure. In more detail, Fig. 1a shows an electrical stimulation device 1 in which a stimulation apparatus 100 is connected to an electrode 200, and Fig. 1b shows an electrical stimulation device 1 in which the stimulation apparatus 100 is separated from the electrode 200. Referring to Figs. 1a and 1b, the electrical stimulation device 1 may include a stimulation apparatus 100 and an electrode 200. Here, the stimulation apparatus 100 means a portion of the electrical stimulation device 1 which generates an electrical stimulation signal, and may also be called an electric signal generator. In an embodiment, the stimulation apparatus 100 may be a reusable part. In addition, the stimulation apparatus 100 may include a pair of output units (for example, a pair of output terminals) for outputting an electrical stimulation signal. The stimulation apparatus 100 will be described in detail later with reference to Figs. 2 and 3.

[27] Here, the electrode 200 means a portion which provides an electrical stimulation corresponding to an electrical stimulation signal generated by the stimulation apparatus 100 to a user. In an embodiment, the electrode 200 may have various sizes and shapes.

[28] In an embodiment, the electrode 200 may include a body, a circuit board, a conductive connection unit and a pair of electrode pads (for example, hydrogel pads). Here, the body may be made of silicon rubber, polyurethane or the like. In this case, the electrode 200 may be bent into various shapes, and thus the user may attach the electrode 200 to portions with various curves. Here, the circuit board may include a pair of annular contact points, which are electrically connected to a pair of output terminals of the stimulation apparatus, respectively. In an embodiment, the pair of annular contact points may have different radii. If the stimulation apparatus 100 is electrically connected to the electrode 200 by using such annular contact points, the stimulation apparatus 100 and the electrode 200 may be electrically connected to each other regardless of a rotating direction of the stimulation apparatus 100. By doing so, the user may easily detach the stimulation apparatus 100, and after adjusting an operation mode or the like of the stimulation apparatus 100 in a detached state, the user may easily attach the stimulation apparatus 100 again to the electrode 200. In an embodiment, the annular contact point may be located at the center of the body, without being limited thereto. Here, the conductive connection unit may be connected to the

pair of annular contact points to transmit each electrical stimulation signal to the pair of hydrogel pads. In an embodiment, the conductive connection unit may be conductive sheet, conductive textile, conductive ink printing or the like. Here, the conductive hydrogel pad may be attached to the skin of a user to provide an electrical stimulation corresponding to the electrical stimulation signal to the user. In other words, each electrical stimulation signal received through the pair of annular contact points may be transmitted to the pair of hydrogel pads through the conductive connection unit. By doing so, an electrical stimulation corresponding to the electrical stimulation signal generated by the stimulation apparatus may be transmitted to the skin of the user.

[29] In addition, the electrode 200 may include an anti-separation frame 330 in order to prevent the stimulation apparatus 100 connected to the electrode 200 from being easily separated therefrom. In an embodiment, the anti-separation frame may have a cradle shape. In an embodiment, the anti-separation frame may surround the annular contact point. For example, the anti-separation frame configured as above may be made of fiber-reinforced plastic, ceramic, silicon, sapphire glass, soda glass or the like.

[30] The stimulation apparatus 100 and the electrode 200 may be connected to each other through a connection unit. Here, the connection unit may be made of material capable of repeatedly attaching or detaching the electrode 200 to/from the stimulation apparatus 100. In an embodiment, the connection unit may be made of magnetic material. For example, a first magnet in the stimulation apparatus 100 and a second magnet in the electrode 200, which have opposite polarities, may be used as the connection unit. In this case, the stimulation apparatus 100 and the electrode 200 may be connected to each other by means of a magnetic force (for example, an attractive force). By doing so, the stimulation apparatus 100 may be connected to the electrode 200 without any separate connection cable, and thus the user may easily attach or detach the stimulation apparatus 100, and after adjusting an operation mode or the like of the stimulation apparatus 100 in a detached state, the user may easily attach the stimulation apparatus 100 again to the electrode 200.

[31]

[32] Fig. 2 is a diagram showing an appearance of a stimulation apparatus according to an embodiment of the present disclosure. In more detail, Fig. 2a is a front view showing the stimulation apparatus 100, and Fig. 2b is a rear view showing the stimulation apparatus 100. In addition, Fig. 3 is a diagram showing the stimulation apparatus according to an embodiment of the present disclosure.

[33] Referring to Figs. 2 and 3, the stimulation apparatus 100 may include an input unit 110, a display unit 140 and an output unit 130 out of the housing 110 and also include a signal generation unit 120 and a control unit 150 inside the housing. Here, the input

unit 110 and the display unit 140 may give an interaction between the stimulation apparatus 100 and the user and thus may be called a user interface.

- [34] The input unit 110 may detect a control input of the user. As shown in Fig. 2a, the input unit 110 may include at least one control button. Here, the control button means a button for controlling an operation of the stimulation apparatus 100.
- [35] The control button may include a power/mode button 111 for turning on/off the stimulation apparatus 100 and/or controlling an operation mode of the stimulation apparatus 100. Here, the operation mode may include at least one mode. For example, the operation mode may include at least one of a tapping mode, a massaging mode, a strong massaging mode and a combination mode. In addition, one of the operation modes may be set as a basic mode. For example, the tapping mode may be set as a basic mode. The operation mode will be described later in detail with reference to Fig. 4.
- [36] In an embodiment, if the power/mode button 111 is pressed over a preset time (for example, 3 seconds), the stimulation apparatus 100 may turn on or off. If turning on, the stimulation apparatus 100 may operate in the basic mode. For example, if turning on, the stimulation apparatus 100 may operate in the tapping mode which is the basic mode. In an embodiment, in a turning-on state, if the power/mode button 111 is pressed shortly (for example, less than 1 second), the operation mode of the stimulation apparatus 100 may vary in order, without being limited thereto. For example, if the power/mode button 111 is pressed shortly in the tapping mode, the operation mode of the stimulation apparatus 100 may be changed from the tapping mode to the massaging mode. In another example, if the power/mode button 111 is pressed shortly in the massaging mode, the operation mode of the stimulation apparatus 100 may be changed from the massaging mode to the strong massaging mode. In another example, if the power/mode button 111 is pressed shortly in the strong massaging mode, the operation mode of the stimulation apparatus 100 may be changed from the strong massaging mode to the combination mode. In another embodiment, if the power/mode button 111 is pressed shortly in the combination mode, the operation mode of the stimulation apparatus 100 may be changed from the combination mode to the massaging mode.
- [37] In addition, the control button may further include an increase button 112 for increasing stimulation strength and a decrease button 113 for decreasing stimulation strength.
- [38] The signal generation unit 120 may generate an electrical stimulation signal. The signal generation unit 120 may generate an electrical stimulation signal corresponding to the operation mode and the operation strength. In more detail, the signal generation unit 120 may generate an electrical stimulation signal with stimulation waveform cor-



responding to the operation mode and stimulation strength corresponding to the operation strength. The stimulation waveform corresponding to each operation mode will be described later in detail with reference to 4.

- [39] The output unit 130 may output an electrical stimulation signal. In an embodiment, the stimulation apparatus 100 may have a pair of output terminals for outputting an electrical stimulation signal. For example, the output unit 130 may include a pair of positive (+) and negative (-) terminals for outputting an electrical stimulation signal. In this case, the pair of output terminals in the stimulation apparatus may be electrically connected to the pair of annular contact points in the electrode, respectively. By doing so, the stimulation apparatus 100 may be electrically connected to the electrode. For electric connection between the pair of output terminals and the pair of annular contact points, a distance from a center of each output terminal may be identical to a radius of each annular contact point.
- [40] The display unit 140 may display a state of the stimulation apparatus 100. The display unit 140 may be an optional component of the stimulation apparatus 100. In an embodiment, the display unit 140 may include at least one indicator light for displaying a state of the stimulation apparatus 100. For example, the display unit 140 may include a first indicator light 141 and a second indicator light 142. Here, each indicator light may include at least one LED. For example, each indicator light may include at least one of yellow, green, sky-blue and violet LEDs. In this case, the stimulation apparatus 100 may provide state information about the stimulation apparatus 100 to the user by using at least one indicator light. Here, the state information may include information about at least one of an operation state, an operation mode and an operation strength. Here, the operation state may include at least one of a normal operation state, a sleep state and a charging state. For example, the stimulation apparatus may provide information about the operation mode to the user by using the first indicator light 141 and provide information about the operation state to the user by using the second indicator light 142. The operation state will be described later in more detail with reference to Fig. 5.
- [41] The control unit 150 may control at least one component provided at the stimulation apparatus 100. In more detail, the control unit 150 may control each unit described above and also control data transmission and/or reception between units. In the present disclosure, the control unit 150, the stimulation apparatus 100 and the electrical stimulation device 1 may be described as being identical to each other.
- [42] In the present disclosure, the control unit 150 may detect a control input of the user through the input unit 110. In addition, the control unit 150 may determine the operation mode and the operation strength based on the detected control input. In addition, the control unit 150 may issue an electrical stimulation signal corresponding

to the determined operation mode and operation strength.

- [43] In addition, the control unit 150 may determine a state (or, the operation state) of the stimulation apparatus 100. Here, the state of the stimulation apparatus 100 may include a first state in which the electrode 200 is electrically connected to the stimulation apparatus 100 and a second state in which the electrode 200 is not electrically connected to the stimulation apparatus 100. If the stimulation apparatus 100 is in the first state, the control unit 150 may provide an electrical stimulation corresponding to the electrical stimulation signal to the user through the electrode. By doing so, stimulation treatment or the like may be provided to the user. In addition, if the stimulation apparatus 100 is in the second state, the control unit 150 may discharge residual charges of the stimulation apparatus 100 according to a preset period. By doing so, it is possible to prevent a large amount of charges from being transferred unexpectedly, when an electrical stimulation is provided to the user, and thus it is possible to provide safe electrical stimulation to the user.
- [44] In addition, the control unit 150 may detect the change of state of the stimulation apparatus 100. When the state of the stimulation apparatus 100 changes from the second state to the first state, the stimulation strength of the electrical stimulation signal may be changed into a preset basic strength. In an embodiment, the basic strength may be a stimulation strength lower than the operation strength. In addition, the control unit 150 may enhance stimulation strength step by step from the basic strength to the operation strength. In the present disclosure, this may be called a soft restart function, which is one of safety functions. This will be described later in more detail with reference to Fig. 5.
- [45] In addition, if a preset sleep condition is satisfied, the control unit 150 may discharge residual charges of the stimulation apparatus 100 and keep the stimulation apparatus 100 in the sleep state. Here, the case of satisfying the sleep condition may include at least one of a case where a residual power of the stimulation apparatus 100 is lower than a preset level, a case when an electrical stimulation signal is not output during a preset first time and a case when an electrical stimulation signal is output during a preset second time. In addition, the control unit 150 may notify the state of the stimulation apparatus 100 to the user through the display unit. This will be described later in more detail with reference to Fig. 5.
- [46] In addition, though not shown in the figures, the stimulation apparatus 100 may further include an external input terminal, a power unit, a communication unit and a storage unit. Here, the communication unit and storage unit may be an optional component.
- [47] The external input terminal means a terminal for receiving an input from an external object. In an embodiment, the external input terminal may receive power from an

external power source to charge the stimulation apparatus 100 with power. In another embodiment, the external input terminal may receive setting information about the operation mode of the stimulation apparatus 100 from the external device.

[48] In addition, the power unit may supply power to each component of the stimulation apparatus 100. In an embodiment, the power unit may include at least one rechargeable or replaceable battery. If the power unit includes a rechargeable battery, the stimulation apparatus 100 may charge the battery of the power unit with the power supplied from the external power source to the external input terminal.

[49] In addition, the communication unit may communicate with an external device. In an embodiment, the communication unit may communicate with an external device by using at least one wire/wireless communication method. For example, the communication unit may communicate with an external device by means of bluetooth communication, without being limited thereto. In an embodiment, the external device may be a remote controller or a mobile phone (for example, a smart phone) having an application for controlling the stimulation apparatus 100. In this case, an external device may be paired with the electrical stimulation device 1 through the communication unit, and the external device paired with the electrical stimulation device 1 may control the stimulation apparatus 100 through a communication signal (or, a control signal). Here, the communication signal may be a bluetooth signal, a RF signal, or any other kinds of signals.

[50] The storage unit may store data. In an embodiment, the storage unit may store preset data about the operation mode of the stimulation apparatus 100. In another embodiment, the storage unit may store data about the operation mode of the stimulation apparatus 100, input through the external input terminal. In this case, the user may newly update information about the operation mode of the stimulation apparatus 100.

[51] Fig. 3 is a block diagram according to an embodiment of the present disclosure, in which blocks separately depicted represent logically-distinguished elements of a device. Therefore, the elements of the device may be mounted as a single chip or multiple chips depending on the device design.

[52] Hereinafter, if each step or operation performed by the stimulation apparatus 100 or the electrical stimulation device 1 is initiated or progressed by a received user input (for example, a touch input), it should be understood that a process of generating and receiving a signal according to the received user input is included in the above procedure, even though it is not described in detail here. Hereinafter, it may be expressed that the control unit 150 controls at least one unit included in the stimulation apparatus 100 or the electrical stimulation device 1 according to an input, and the control unit 150 may also be described as being identical to the stimulation apparatus 100 and the electrical stimulation device 1.

[53]

[54] Fig. 4 shows a stimulation waveform of each operation mode according to an embodiment of the present disclosure. As described above, the stimulation apparatus may include a tapping mode, a massaging mode, a strong massaging mode and a combination mode as the operation modes, without being limited thereto. In an embodiment, the stimulation apparatus may set one of the operation modes as the basic mode. For example, the stimulation apparatus may set the tapping mode as the basic mode.

[55] Fig. 4a shows a stimulation waveform of the tapping mode. The tapping mode represents a mode in which an electrical stimulation for tapping a stimulation spot is given to the user. As shown in the upper portion of Fig. 4a, the tapping mode may have a stimulation waveform in which an ascending pulse and a descending pulse with preset frequencies and intensities are alternately provided repeatedly. In this case, a pulse interval between the ascending pulse and the descending pulse may be 1s, without being limited thereto. In addition, as shown in the lower portion of Fig. 4a, a pulse width of the ascending pulse and the descending pulse may be 110  $\mu$ s, without being limited thereto.

[56] Fig. 4b shows a stimulation waveform of the massaging mode. The massaging mode represents a mode in which an electrical stimulation for massaging a stimulation spot is given to the user. As shown in the upper portion of Fig. 4b, the massaging mode may have a stimulation waveform in which a process of continuously providing an ascending pulse during a preset first duration time, giving a first interval, and then continuously providing a descending pulse during a preset first duration time is repeated. In this case, the first duration time may be 6.5s, and the first interval may be 1.5s, without being limited thereto. In addition, as shown in the lower portion of Fig. 4b, the ascending pulse and the descending pulse may have a pulse width of 70  $\mu$ s, and a gap between the pulses may be 60 ms, without being limited thereto.

[57] Fig. 4c shows a stimulation waveform of the strong massaging mode. The strong massaging mode represents a mode in which an electrical stimulation for massaging a stimulation spot more strongly in comparison to the massaging mode is given to the user. As shown in the upper portion of Fig. 4c, the strong massaging mode may have a stimulation waveform in which a process of continuously providing an ascending pulse for a preset second duration time, giving a second interval, and continuously providing a descending pulse for a preset second duration time is repeated. In this case, the second duration time may be 4s, and the second interval may be 2s, without being limited thereto. In addition, as shown in the lower portion of Fig. 4c, the ascending pulse and the descending pulse may have a pulse width of 60  $\mu$ s, and a gap between the pulses may be 30 ms, without being limited thereto.

- [58] Fig. 4d shows a stimulation waveform of the combination mode. The combination mode represents a mode in which electrical stimulations corresponding to the tapping mode, the massaging mode and the strong massaging mode are sequentially provided to the user repeatedly. Each mode has been described above with reference to Figs. 4a to 4c and is not described in detail here.
- [59]
- [60] Fig. 5 is a diagram showing an operation state of the stimulation apparatus according to an embodiment of the present disclosure. Referring to Fig. 5, the stimulation apparatus may have a normal operation state 10, a sleep state 20 and a charging state 30.
- [61] The normal operation state 10 means that the stimulation apparatus normally operates. If a preset sleep releasing condition is satisfied during the sleep state 20, the stimulation apparatus may come into the normal operation state 10. In an embodiment, the stimulation apparatus in the sleep state 20 may determine whether the stimulation apparatus is in the normal operation state 10 by detecting whether the preset sleep releasing condition is satisfied. Here, the case where the sleep releasing condition is satisfied may include a case in which a power button is pressed over a preset time (for example, 3 seconds) in the sleep state 20. In this case, the stimulation apparatus may operate in the basic mode among the operation modes. For example, the stimulation apparatus may operate in the massaging mode which is set to be the basic mode.
- [62] The normal operation state 10 may include a first state in which the electrode is electrically connected to the stimulation apparatus 100 and a second state in which the electrode is not electrically connected to the stimulation apparatus 100. In this case, the stimulation apparatus may notify through the display unit to the user that the stimulation apparatus is in the first state 11 or the second state 12, among the normal operation states 10. For example, the stimulation apparatus may notify that the stimulation apparatus is in the first state 11 by blinking a green LED of the second indicator light and notify that the stimulation apparatus is in the second state 12 by blinking a yellow LED of the second indicator light.
- [63] In the normal operation state 10, the stimulation apparatus may determine whether the stimulation apparatus is in the first state 11 or the second state 12 by detecting whether the electrode is electrically connected to the stimulation apparatus. In the first state 11 and the second state 12, the stimulation apparatus may operate in each operation mode described above with reference to Fig. 4. In this case, the stimulation apparatus may notify through the display unit to the user a mode in which the stimulation apparatus is among the operation modes. For example, the stimulation apparatus may notify to the user that the stimulation apparatus is in the tapping mode by blinking a yellow LED of the first indicator light, that the stimulation apparatus is in

the massaging mode by blinking a green LED of the first indicator light, that the stimulation apparatus is in the strong massaging mode by blinking a sky-blue LED of the first indicator light, and that the stimulation apparatus is in the combination mode by blinking a violet LED of the first indicator light.

- [64] If the stimulation apparatus is in the first state 11, the stimulation apparatus may provide an electrical stimulation corresponding to the electrical stimulation signal to the user through the electrode. By doing so, stimulation treatment or the like may be provided to the user. In addition, if the operation mode changes in the first state 11, the stimulation apparatus may discharge residual charges of the stimulation apparatus. In addition, if the stimulation apparatus is in the second state 12, the stimulation apparatus may discharge residual charges of the stimulation apparatus according to a preset period. By doing so, it is possible to prevent a large amount of charges from being transferred unexpectedly, when an electrical stimulation is provided to the user, and thus it is possible to provide safe electrical stimulation to the user.
- [65] If the state of the stimulation apparatus changes from the second state 12 to the first state 11, the stimulation apparatus may change a stimulation strength of the electrical stimulation signal to a preset basic strength. In an embodiment, the basic strength may be a stimulation strength lower than the operation strength. If the stimulation strength is changed to the basic strength, the stimulation strength may be enhanced step by step from the basic strength to the operation strength. In addition, when a control input is detected while the stimulation strength is being increased step by step, the stimulation apparatus may maintain a stimulation strength of the electrical stimulation signal at a stimulation strength lower than a current stimulation strength by one step. In this case, if the user feels that the stimulation strength is too strong while the stimulation strength is increasing, the user may press one of control buttons of the input unit so that the stimulation strength is maintained at a strength lower than a current strength as much as one step. By doing so, it is possible to provide safe electrical stimulation to the user.
- [66] If the state of the stimulation apparatus changes from the first state 11 to the second state 12, the stimulation apparatus may discharge residual charges. If the stimulation strength is in a level 1 or above while the state of the stimulation apparatus is changing from the first state 11 to the second state 12, the stimulation apparatus may give a feedback (for example, an audible feedback using a buzzer or the like) to the user to notify the situation. By doing so, it is possible to provide safe electrical stimulation to the user.
- [67] The sleep state 20 means that the stimulation apparatus 100 is in a sleep or standby state. If a sleep condition is satisfied in the normal operation state 10 or if a power cable is disconnected in the charging state 30, the stimulation apparatus may come into the sleep state 20. In an embodiment, the stimulation apparatus in the normal operation

state 10 may determine whether the stimulation apparatus is in the sleep state 20 by detecting whether a preset sleep condition is satisfied. If the preset sleep condition is satisfied, the stimulation apparatus may discharge residual charges and maintain the stimulation apparatus in the sleep state 20. Here, the case of satisfying the sleep condition may include at least one of a case where a power button is pressed over a preset time (for example, 3 seconds) in the normal operation state 10, a case where a residual power of the stimulation apparatus is lower than a preset level, a case when an electrical stimulation signal is not output during a preset first time (for example, 2 minutes), and a case where an electrical stimulation signal is output during a preset second time (for example, 20 minutes). In an embodiment, the first time may shorter than the second time.

[68] The charging state 30 means that the stimulation apparatus is being charged with power. If a power cable is connected in the normal operation state 10 or the sleep state 20, the stimulation apparatus may come into the charging state 30. As described above, the power unit of the stimulation apparatus may include at least one rechargeable or replaceable battery. If the power unit includes a rechargeable battery, the stimulation apparatus may charge the battery of the power unit with the power supplied from the external power source to the external input terminal. In an embodiment, the stimulation apparatus in the charging state 30 may stop supply of power to the control unit. By doing so, it is possible to prevent excessive charges generated during the charging process from being transferred to the user.

[69]

[70] Fig. 6 is a flowchart for illustrating a method for controlling a stimulation apparatus according to an embodiment of the present disclosure. Any feature identical to that of Figs. 1 to 5 will not be described in detail here.

[71] Referring to Fig. 6, the stimulation apparatus may detect a control input of the user (S10). In an embodiment, the stimulation apparatus may detect a control input of the user by using the input unit. Here, the input unit may include at least one control button as described above with reference to Figs. 2 and 3.

[72] Next, the stimulation apparatus may determine an operation mode and an operation strength based on the control input (S20). Here, the operation mode may include at least one of a tapping mode, a massaging mode, a strong massaging mode and a combination mode. In addition, one of the operation modes may be set as a basic mode. This has been described above with reference to Fig. 4 and thus is not described in detail here.

[73] Next, the stimulation apparatus may generate an electrical stimulation signal corresponding to the operation mode and the operation strength (S30). In an embodiment, the stimulation apparatus may generate an electrical stimulation signal corresponding

to the operation mode and the operation strength by using the signal generation unit. For example, the stimulation apparatus may generate an electrical stimulation signal having a stimulation waveform corresponding to the operation mode and a stimulation strength corresponding to the operation strength by using the signal generation unit, as described above with reference to Fig. 4.

[74] Next, the stimulation apparatus may determine a state of the stimulation apparatus (S40). Here, the state of the stimulation apparatus may include a first state in which the electrode is electrically connected to the stimulation apparatus and a second state in which the electrode is not electrically connected to the stimulation apparatus. In this case, the stimulation apparatus may determine whether the stimulation apparatus is in the first state or the second state by detecting whether the electrode is electrically connected to the stimulation apparatus (S50). This has been described above with reference to Fig. 5 and is not described in detail here.

[75] Next, if the stimulation apparatus is in the first state, the stimulation apparatus may provide an electrical stimulation corresponding to the electrical stimulation signal to the user through the electrode (S60). By doing so, it is possible to provide stimulation treatment or the like to the user. In addition, if the operation mode changes in the first state, the stimulation apparatus may discharge residual charges of the stimulation apparatus. Next, if the stimulation apparatus is in the second state, the stimulation apparatus may discharge residual charges of the stimulation apparatus according to a preset period (S70). By doing so, it is possible to prevent a large amount of charges from being transferred unexpectedly, when an electrical stimulation is provided to the user, and thus it is possible to provide safe electrical stimulation to the user, as described above with reference to Fig. 5.

[76] In addition, the stimulation apparatus may detect the change of state of the stimulation apparatus. When the state of the stimulation apparatus changes from the second state to the first state, the stimulation apparatus may change the stimulation strength of the electrical stimulation signal into a preset basic strength. In an embodiment, the basic strength may be a stimulation strength lower than the operation strength. If the stimulation strength changes into the basic strength, the stimulation apparatus may enhance the stimulation strength step by step from basic strength to the operation strength. In addition, if the state of the stimulation apparatus changes from the first state to the second state, the stimulation apparatus may discharge residual charges. If the stimulation strength is in a level 1 or above while the state of the stimulation apparatus is changing from the first state to the second state, the stimulation apparatus may give a feedback (for example, an audible feedback using a buzzer or the like) to the user to notify the situation. This has been described above with reference to Fig. 5 and is not described in detail here.



- [77] Next, the stimulation apparatus may determine whether a preset termination condition is satisfied (S80). Here, the termination condition represents various conditions at which the stimulation apparatus stops its operation. For example, the termination condition may be identical to the preset sleep condition. If the termination condition is satisfied, the stimulation apparatus may stop the operation of the stimulation apparatus. For example, if the termination condition is identical to the sleep condition, when the termination condition is satisfied, the stimulation apparatus may stop the operation of the stimulation apparatus and change the state of the stimulation apparatus from the operation state to the sleep state. If the termination condition is not satisfied, the stimulation apparatus may determine a state of the stimulation apparatus without stopping the operation of the stimulation apparatus. By doing so, the stimulation apparatus may repeatedly perform S40 to S80.
- [78]
- [79] The method for operating the stimulation apparatus or the electrical stimulation device may be implemented as an application or program commands executable by various kinds of computer means and recorded on a computer-readable recording medium. The computer-readable recording medium may include program commands, data files, data structures or the like solely or in combination. The program commands recorded on the medium may be specially designed or configured for the present disclosure or known to and available by computer software engineers.
- [80] The computer-readable recording medium includes, for example, magnetic media such as a hard disk, a floppy disk and a magnetic tape, optical media such as CD-ROM and DVD, magneto-optical media such as a floptical disk, hardware devices such as ROM, RAM and a flash memory, specially configured to store and perform program commands, or the like. The program commands include not only machine codes made by a compiler but also high-level language codes executable by a computer by using an interpreter. The hardware device may be configured to operate as at least one software module to perform the operations of the present disclosure, or vice versa.
- [81] While the exemplary embodiments have been shown and described, it will be understood by those skilled in the art that various changes in form and details may be made thereto without departing from the spirit and scope of this disclosure as defined by the appended claims. In addition, many modifications can be made to adapt a particular situation or material to the teachings of this disclosure without departing from the essential scope thereof.
- [82] In addition, in the present disclosure, both an article invention and a process invention are described together, and both of them may be complementarily applied if necessary.

**Mode for the Invention**

[83] Various embodiments have been described in the best mode for carrying out the invention.

[84] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

**Industrial Applicability**

[85] As described above, the present invention is totally or partially applicable to electronic devices.

## Claims

- [Claim 1] A stimulation apparatus, comprising:  
an input unit configured to detect a control input of a user;  
a signal generation unit configured to generate an electrical stimulation signal;  
an output unit configured to output the electrical stimulation signal; and  
a control unit configured to control the input unit, the signal generation unit and the output unit,  
wherein the control unit is further configured to:  
determine an operation mode and an operation strength based on the control input;  
generate an electrical stimulation signal corresponding to the operation mode and the operation strength;  
determine a state of the stimulation apparatus, the state of the stimulation apparatus including a first state in which an electrode is electrically connected to the stimulation apparatus and a second state in which an electrode is not electrically connected to the stimulation apparatus;  
when the stimulation apparatus is in the first state, provide an electrical stimulation corresponding to the electrical stimulation signal to the user through the electrode; and  
when the stimulation apparatus is in the second state, discharge residual charges of the stimulation apparatus according to a preset period.
- [Claim 2] The stimulation apparatus according to claim 1,  
wherein the control unit is further configured to discharge residual charges of the stimulation apparatus, when the operation mode changes in the first state.
- [Claim 3] The stimulation apparatus according to claim 1,  
wherein the control unit is further configured to change a stimulation strength of the electrical stimulation signal into a preset basic strength, when the state of the stimulation apparatus changes from the second state to the first state.
- [Claim 4] The stimulation apparatus according to claim 3,  
wherein the basic strength is a stimulation strength lower than the operation strength.
- [Claim 5] The stimulation apparatus according to claim 4,  
wherein the control unit is further configured to increase the

stimulation strength step by step from the basic strength to the operation strength.

[Claim 6] The stimulation apparatus according to claim 5, wherein when the control input is detected while the control unit is increasing the stimulation strength step by step, the control unit is further configured to maintain a stimulation strength of the electrical stimulation signal at a stimulation strength lower than a current stimulation strength by one step.

[Claim 7] The stimulation apparatus according to claim 1, wherein when a preset sleep condition is satisfied, the control unit is further configured to discharge residual charges of the stimulation apparatus and maintain the stimulation apparatus in a sleep state.

[Claim 8] The stimulation apparatus according to claim 7, wherein the case of satisfying the sleep condition includes at least one of a case where a residual power of the stimulation apparatus is lower than a preset level, a case when an electrical stimulation signal is not output during a preset first time and a case when an electrical stimulation signal is output during a preset second time.

[Claim 9] The stimulation apparatus according to claim 8, wherein the first time is shorter than the second time.

[Claim 10] The stimulation apparatus according to claim 1, wherein the operation mode includes at least one of a tapping mode, a massaging mode, a strong massaging mode and a combination mode.

[Claim 11] A method for controlling a stimulation apparatus, comprising:  
detecting a control input of a user;  
determining an operation mode and an operation strength based on the control input;  
generating an electrical stimulation signal corresponding to the operation mode and the operation strength;  
determining a state of the stimulation apparatus, the state of the stimulation apparatus including a first state in which an electrode is electrically connected to the stimulation apparatus and a second state in which an electrode is not electrically connected to the stimulation apparatus;  
when the stimulation apparatus is in the first state, providing an electrical stimulation corresponding to the electrical stimulation signal to the user through the electrode,; and  
when the stimulation apparatus is in the second state, discharging

- residual charges of the stimulation apparatus according to a preset period.
- [Claim 12] The method for controlling a stimulation apparatus according to claim 11, further comprising:  
discharging residual charges of the stimulation apparatus, when the operation mode changes in the first state.
- [Claim 13] The method for controlling a stimulation apparatus according to claim 11, further comprising:  
changing a stimulation strength of the electrical stimulation signal into a preset basic strength, when the state of the stimulation apparatus changes from the second state to the first state.
- [Claim 14] The method for controlling a stimulation apparatus according to claim 13,  
wherein the basic strength is a stimulation strength lower than the operation strength.
- [Claim 15] The method for controlling a stimulation apparatus according to claim 14,  
wherein said changing of the stimulation strength into a preset basic strength further includes increasing the stimulation strength step by step from the basic strength to the operation strength.
- [Claim 16] The method for controlling a stimulation apparatus according to claim 15,  
wherein in said changing of the stimulation strength into a preset basic strength, when the control input is detected while the stimulation strength is being increased step by step, a stimulation strength of the electrical stimulation signal is maintained at a stimulation strength lower than a current stimulation strength by one step.
- [Claim 17] An electrical stimulation device, comprising:  
a stimulation apparatus configured to generate an electrical stimulation signal according to a control input of a user;  
an electrode configured to provide an electrical stimulation corresponding to the electrical stimulation signal to the user; and  
a connection unit configured to connect the stimulation apparatus to the electrode,  
wherein the stimulation apparatus is further configured to:  
determine a state of the stimulation apparatus, the state of the stimulation apparatus including a first state in which the electrode is electrically connected to the stimulation apparatus and a second state in

which the electrode is not electrically connected to the stimulation apparatus;

when the stimulation apparatus is in the first state, provide an electrical stimulation corresponding to the electrical stimulation signal to the user through the electrode;; and

when the stimulation apparatus is in the second state, discharge residual charges of the stimulation apparatus according to a preset period.

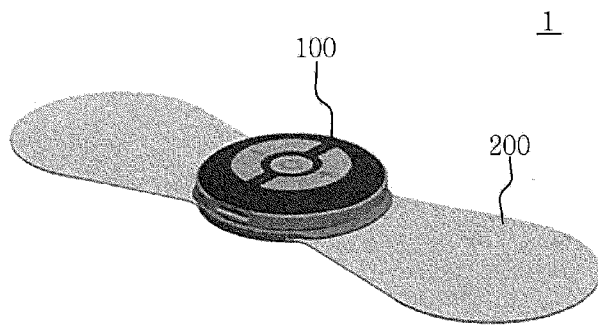
[Claim 18]

The electrical stimulation device according to claim 17, wherein the connection unit includes magnetic material.

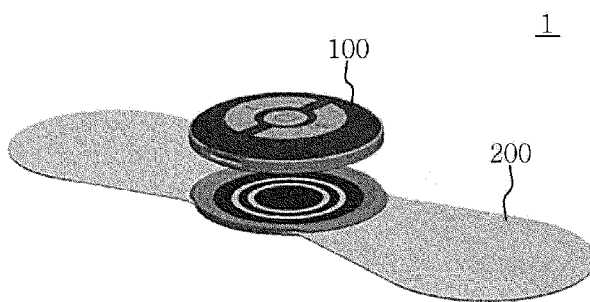
[Claim 19]

The electrical stimulation device according to claim 17, wherein the stimulation apparatus includes a pair of output terminals configured to output the electrical stimulation signal, and wherein the electrode includes a pair of annular contact points electrically connected to the pair of output terminals, respectively.

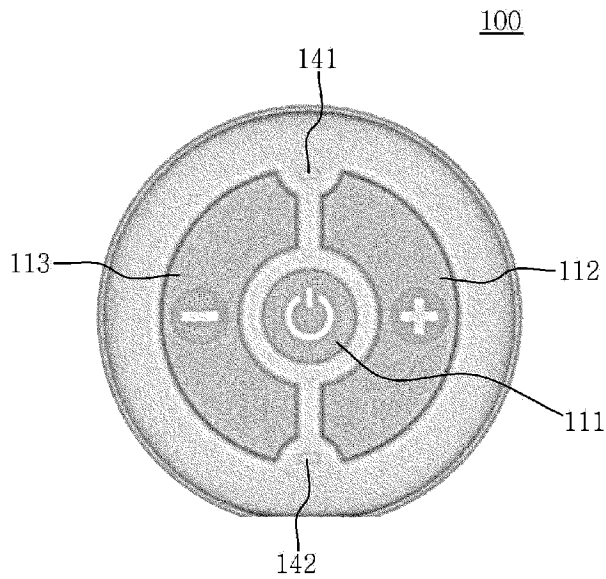
[Fig. 1a]



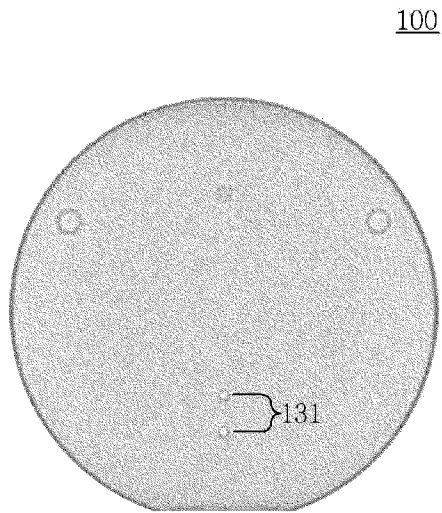
[Fig. 1b]



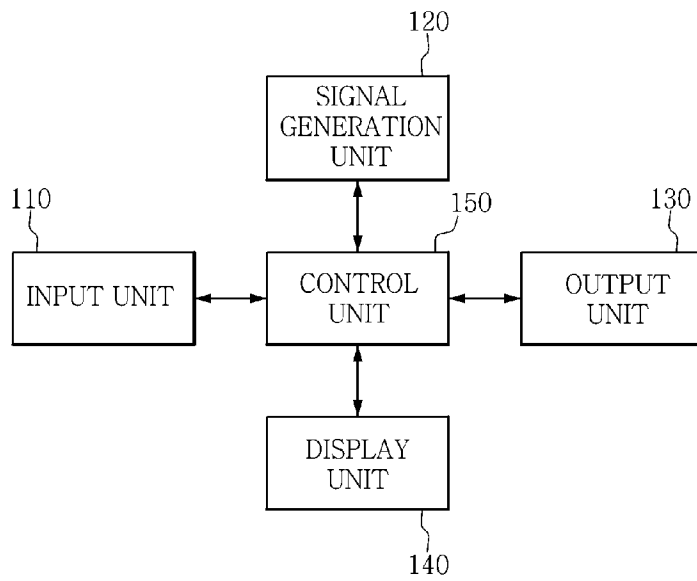
[Fig. 2a]



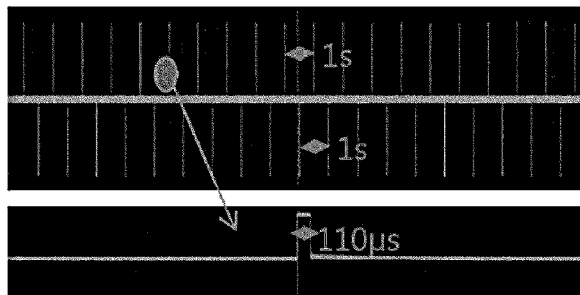
[Fig. 2b]



[Fig. 3]



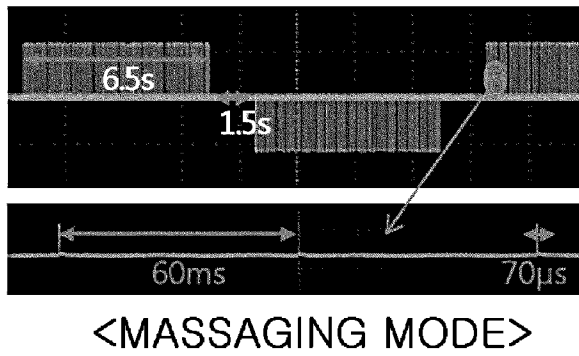
[Fig. 4a]



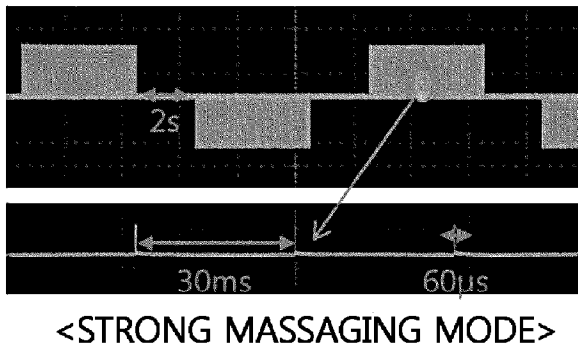
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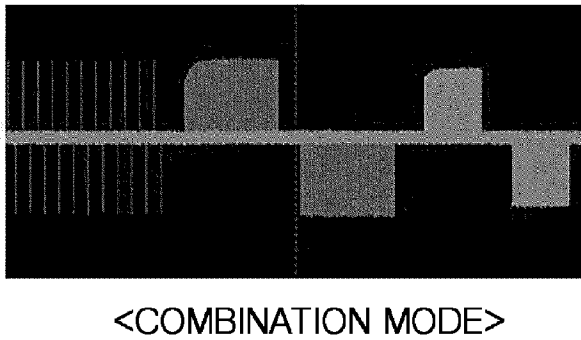
[Fig. 4b]



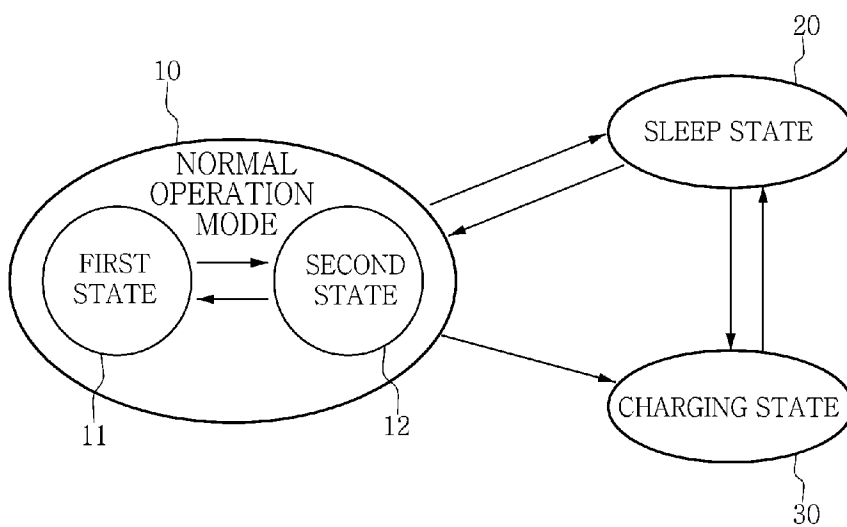
[Fig. 4c]



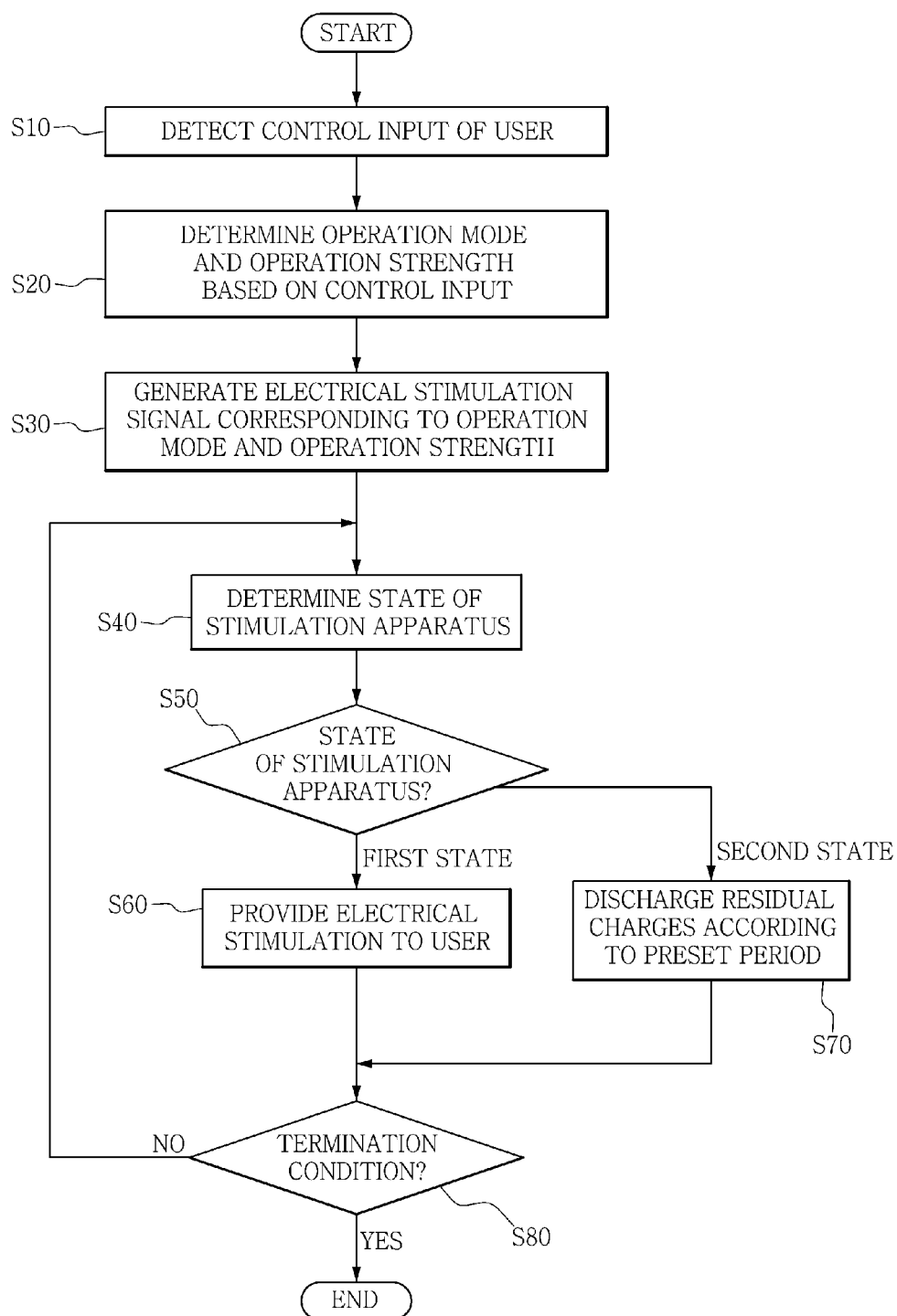
[Fig. 4d]



[Fig. 5]



[Fig. 6]



**A. CLASSIFICATION OF SUBJECT MATTER****A61N 1/36(2006.01)i, A61N 1/08(2006.01)i, A61H 23/00(2006.01)i, A61H 7/00(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

A61N 1/36; A61N 1/378; A61N 1/08; A61N 1/04; A61H 23/00; A61H 7/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) &amp; keywords: electrical stimulation, control, electrode, discharge, state, preset

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2013-0090712 A1 (POPOVIC, M. R. et al.) 11 April 2013 See abstract; claims 33, 62; figure 2.	1-2, 10
Y		17-19
A		3-9
Y	US 6445955 B1 (MICHELSON, S. A. et al.) 3 September 2002 See abstract; claim 1; column 9, line 66-column 10, line 5; figures 1-23.	17-19
A	WO 2013-142785 A1 (UNDERWOOD, W. M.) 26 September 2013 See entire document.	1-10, 17-19
A	US 2008-0147143 A1 (POPOVIC, D. et al.) 19 June 2008 See entire document.	1-10, 17-19
A	US 2014-0100638 A1 (HOU, Z. et al.) 10 April 2014 See entire document.	1-10, 17-19



Further documents are listed in the continuation of Box C.



See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

15 July 2015 (15.07.2015)

Date of mailing of the international search report

**16 July 2015 (16.07.2015)**

Name and mailing address of the ISA/KR

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**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 11-16  
because they relate to subject matter not required to be searched by this Authority, namely:  
Claims 11-16 pertain to methods for treatment of the human body and thus relate to a subject-matter which this International Searching Authority is not required to search under PCT Article 17(2)(a)(i) and PCT Rule 39.1(iv).
2. ☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of any additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/KR2015/003997**

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