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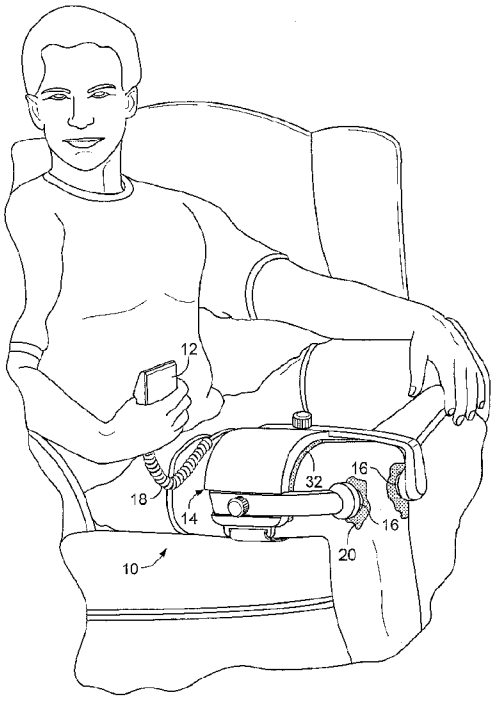

FIG. 1

(57) Abstract: A medical device includes a treatment module configured to apply a treatment to a patient. The medical device includes an interface configured to operatively connect to a removable storage device storing authorization data that identifies a level of treatment authorization. The medical device includes a processing device configured to perform operations in response to receiving user input indicating a treatment should be initiated. The operations include determining whether the removable storage device is valid for use with the medical device. If the removable storage device is determined to be valid, the authorization data is accessed. The processing device determines whether the treatment is authorized based on the accessed authorization data. If the treatment is determined to be authorized, the treatment module is controlled to apply the treatment. If the treatment is determined to not be authorized, the treatment module is controlled such that the treatment is not applied.

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CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to and the full benefit of United States Provisional Application Serial Number 61/392,154, filed October 12, 2010, and titled "Authorizing Use of Medical Devices," United States Provisional Application Serial Number 61/405,405, filed October 21, 2010, and titled "Medical Device," United States Provisional Application Serial Number 61/405,757, filed October 22, 2010, and titled "Medical Device," and United States Provisional Application Serial Number 61/483,445, filed May 6, 2011, and titled "Medical Device," the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

This description relates to a medical device.

BACKGROUND

Medical devices can provide treatment for a variety of health conditions. In some instances, a patient has a degree of control over treatment with a medical device. For example, a patient may be able to initiate treatment with a medical device. The capabilities of a medical device determine to a large degree the way that the patient and others interact with the medical device. In particular, it is important that a medical device be capable of providing effective treatment and a positive patient experience.

It is desired to address or ameliorate one or more disadvantages or limitations associated with the prior art, or to at least provide a useful alternative.

SUMMARY

In one embodiment, the present invention provides a medical device comprising:

at least one treatment source configured to couple to damaged tissue and apply therapy to the damaged tissue to stimulate healing;

a memory device configured to store authorization data, the authorization data being usable to determine that a patient is authorized to use the at least one treatment source in a first geographic area and unauthorized to use the at least one treatment source in a second geographic area;

a communication module configured to receive an update to the authorization data via a communication network, the update being usable to determine that the patient is authorized to use the at least one treatment source in the second geographic area; and

at least one processing device configured to:

prior to receiving the update with the communication module,

determine from the authorization data that the patient is authorized to use the at least one treatment source in the first geographic area and unauthorized to use the at least one treatment source in the second geographic area,

receive a first user input indicating to initiate therapy with the at least one treatment source,

determine a first location of the at least one treatment source in response to receiving the first user input,

permit application of therapy by the at least one treatment source in response to determining that the patient is authorized to use the at least one treatment source and that the first location is in the first geographic area,

receive a second user input indicating to initiate therapy with the at least one treatment source,

determine a second location of the at least one treatment source in response to receiving the second user input, and

prevent application of therapy by the at least one treatment source in response to determining that the second location is in the second geographic area,

receive the update with the communication module, and

subsequent to receiving the update with the communication module,

determine from the authorization data and the update that the patient is authorized to use the at least one treatment source in the second geographic area,

receive a third user input indicating to initiate therapy with the at least one treatment source,

determine a third location of the at least one treatment source in response to receiving the third user input, and

permit application of therapy by the at least one treatment source in response to determining that the patient is authorized to use the at least one treatment source and that the third location is in the second geographic area.

In a further embodiment, the present invention provides a computer-implemented method comprising:

determining from authorization data that a patient is authorized to use at least one treatment source of a medical device in a first geographic area, the authorization data being accessed from a memory device of the medical device and usable to determine that the patient is authorized to use the at least one treatment source in the first geographic area and unauthorized to use the at least one treatment source in a second geographic area, the at least one treatment source being configured to couple to damaged tissue of the patient;

receiving a first user input indicating to initiate therapy with the at least one treatment source;

determining a first location of the at least one treatment source in response to receiving the first user input;

performing therapy to the damaged issue to stimulate healing in response to determining that the patient is authorized to use the at least one treatment source and that the first location is in the first geographic area;

receiving an update to the authorization data via a communication network, the update being usable to determine that the patient is authorized to use the at least one treatment source in the second geographic area;

determining from the authorization data and the update that the patient is authorized to use the at least one treatment source in the second geographic area;

receiving a second user input indicating to initiate therapy with the at least one treatment source;

determining a second location of the at least one treatment source in response to receiving the second user input; and

performing therapy to the damaged issue to stimulate healing in response to determining that the patient is authorized to use the at least one treatment source and that the second location is in the second geographic area.

DESCRIPTION OF DRAWINGS

Preferred embodiments of the present invention are hereinafter described, by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view of a medical device.

Fig. 2 is a block diagram of the medical device.

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Fig. 3 is a diagram of the medical device configured to display information.

Fig. 4 is a chart illustrating examples of information that may be displayed.

Fig. 5 is a flow diagram illustrating a process for displaying information.

Figs. 6A to 6C are diagrams illustrating user interfaces for the medical device.

Fig. 7 is a diagram illustrating a medium for authorizing treatment using the medical device.

Fig. 8 is a diagram of a system for authorizing medical treatments.

Figs. 9A and 9B are flow diagrams of a process for authorizing medical treatments.

Fig. 10 is a diagram of a process for storing patient information.

Fig. 11 is a diagram of the medical device.

Fig. 12 is a diagram of a main operating unit of the medical device.

Fig. 13 shows authorized geographic areas.

Fig. 14 is a block diagram of geo-locking components of the medical device.

Fig. 15 is a block diagram of device authorization components of the medical device.

Fig. 16 is a flowchart depicted use of the medical device.

DETAILED DESCRIPTION

In one aspect, a medical device includes: a treatment module configured to apply a treatment to a patient; one or more processing devices configured to: disallow treatment using the treatment module until treatment authorization occurs; determine that treatment authorization occurs; and in response to determining that treatment authorization occurs, permit treatment to be applied using the treatment module.

Implementations may include one or more of the following features. For example, treatment authorization occurs via payment. Treatment authorization occurs via patient identification. Treatment authorization is linked to geographic location. Treatment authorization occurs via authorization data stored on a removable medium.

In another general aspect, a medical device includes: at least one treatment module configured to apply a treatment to a patient; an interface configured to operatively connect to a removable storage device storing authorization data that identifies a level of treatment authorization; and at least one processing device configured to perform the following in response to receiving user input indicating a treatment should be initiated: determine

whether the removable storage device is valid for use with the medical device; if the removable storage device is determined to be valid, access the authorization data; determine whether the treatment is authorized based on the accessed authorization data; if the treatment is determined to be authorized, control the treatment module to apply the treatment; and if the treatment is determined to not be authorized, control the treatment module such that the treatment is not applied.

Implementations of any of the aspects may include one or more of the following features. For example, to determine whether the removable storage device is valid for use with the medical device, the at least one processing device is configured to: access a serial number of the removable medium; and determine that the removable medium is valid if the serial number is within a predetermined range of values. The at least one processing device is configured to record compliance data for the treatment on the removable storage device if the treatment is applied. The compliance data indicates a time, date, and duration of the treatment. The treatment module includes at least one ultrasound transducer and at least one driver circuit coupled to the ultrasound transducer. To control the treatment module to apply the treatment, the processing device is configured to control the driver circuit such that the driver circuit causes the ultrasound transducer to produce ultrasound with therapeutic properties. To control the treatment module such that the treatment is not applied, the processing device is configured to control the driver circuit such that ultrasound with therapeutic properties is not produced. The driver circuit includes a signal generator and an ultrasound transducer driver.

The authorization data indicates a number of authorized treatments, and the at least one processing device is configured to decrease the number of authorized treatments indicated by the authorization data after a treatment is applied. The authorization data indicates an authorized amount of treatment time, and the at least one processing device is configured to decrease the amount of authorized treatment time indicated by the authorization data after a treatment is applied. The medical device includes a communication module. The at least one processing device is configured to: receive authorization data that indicates a level of treatment authorization through the communication module; store the received authorization data on the removable storage device or a second storage device of the medical device; and in response to receiving the user input indicating a treatment should be initiated, determine whether the treatment is

authorized based on the received authorization data. The communication module is a wireless communication module. The wireless communication module is a cellular communication module.

The authorization data is received from a server system configured to: determine that payment has been made for a number of treatments; determine that the payment is associated with the medical device; generate the authorization data; and transmit the authorization data to the medical device. The processing device is further configured to provide, if the treatment is determined to not be authorized, an indication to the patient that more treatments need to be purchased. The processing device is configured to receive new authorization data after providing the indication to the patient that more treatments need to be purchased, the new authorization data identifying a number of additional treatments for which payment has been received. The authorization data is encrypted, and the processing device is further configured to decrypt the authorization data. The medical device includes a second storage device. The second storage device stores a device identifier that uniquely identifies the medical device, the authorization data is encrypted, the at least one processing device is further configured to decrypt the authorization data; and the device identifier is used to decrypt the authorization data. The medical device includes a payment module configured to receive payment for a number of treatments. The payment module is configured to receive payment through a code, a credit card, or a SIM card. The at least one processing device is configured to: record on the removable storage device or an internal storage device information indicating occurrences of treatment applied by the medical device; and indicate, on a display of the medical device, days during which treatment was applied and days during which treatment was not applied. The medical device stores information about a treatment regimen for use of the medical device; and the at least one processing device is configured to indicate compliance with the treatment regimen by displaying a calendar that indicates the days during which treatment was applied and the days during which treatment was not applied.

In another general aspect, a medical device includes: a treatment module configured to apply a treatment to a patient, the treatment module including at least one ultrasound transducer and at least one driver circuit coupled to the ultrasound transducer, a display, one or more data storage devices, and one or more processing devices. The one or more processing devices are configured to: receive user input that a treatment should be

initiated using the treatment module; in response to receiving the user input, apply a treatment using the treatment module; record on the one or more data storage devices information indicating occurrences of treatment using the treatment module; and indicate on the display days during which treatment was applied and days during which treatment was not applied.

Implementations of any of the aspects may include one or more of the following features. For example, the days during which treatment was applied and days during which treatment was not applied are indicated on a calendar. Days of the calendar during which one or more treatments are applied are marked with a check mark and days of the calendar during which one or more treatments were not applied are unchecked. The one or more storage devices store information about a treatment regimen for use of the medical device, and the one or more processing devices are configured to indicate compliance with the treatment regimen on the calendar. The one or more processing devices being configured to indicate on the display days during which treatment was applied and days in which treatment was not applied includes the one or more processing devices being configured to automatically indicate on the display, in response to the medical device being powered on, days during which treatment was applied and days during which treatment was not applied.

The medical device includes means for determining the geographic location of the medical device, and treatment is not allowed to commence if the determined geographic location is outside an authorized geographic location. The medical device includes means for determining user identity, and treatment is not allowed to commence if the determined user identity does not match an authorized identity. The treatment module is configured to produce a pulsed ultrasound signal having a frequency in the range of 1 MHz to 2 MHz, consisting of pulses generated at a rate in the range of 100 Hz to 10 KHz with each pulse having a duration in the range of 10 microseconds to 2,000 microseconds. The pulsed ultrasound signal has a power intensity of 100 milliwatts per square centimeter or less. The medical device is a hand-held device configured to accelerate bone healing.

In another general aspect a computer-implemented method includes: receiving user input through a user interface of a medical device, the user input indicating a treatment should be administered by the medical device, and the medical device includes a treatment module configured to apply a treatment to a patient; determining whether a removable storage device coupled to the medical device is valid for use with the medical device; in

response to determining that the removable storage device is valid for use with the medical device, accessing authorization data stored on the removable storage device; determining that the treatment is authorized based on the accessed authorization data; and controlling the treatment module to apply the treatment in response to determining that the treatment is authorized based on the accessed authorization data.

Implementations of any of the aspects may include one or more of the following features. For example, determining whether the removable storage device coupled to the medical device is valid for use with the medical device includes accessing a serial number of the removable medium and determining that the removable medium is valid if the serial number is within a predetermined range of values. Recording compliance data for the treatment on the removable storage device if the treatment is applied. The treatment module includes at least one ultrasound transducer and at least one driver circuit. Controlling the treatment module to apply the treatment includes controlling the driver circuit such that the driver circuit causes an ultrasound transducer to produce ultrasound with therapeutic properties. Controlling the treatment module such that the treatment is not applied includes controlling the driver circuit such that ultrasound with therapeutic properties is not produced. Receiving the authorization data, and storing the received authorization data on the removable device.

Receiving the authorization data includes receiving the authorization data with a wireless communication module. The wireless communication module is a cellular communication module. The authorization data indicates a number of authorized treatments, and the computer-implemented method further includes decreasing the number of authorized treatments indicated by the authorization data after a treatment is applied. The authorization data indicates an authorized amount of treatment time, and the computer-implemented method further includes decreasing the amount of authorized treatment time indicated by the authorization data after a treatment is applied. Storing a device identifier that uniquely identifies a medical device. The authorization data is encrypted, accessing the authorization code includes decrypting the authorization data, and the device identifier is used to decrypt the authorization data. Recording on the removable storage device or an internal storage device information indicating occurrences of treatment applied by the medical device.

Indicating, on a display of the medical device, days during which treatment was applied and days during which treatment was not applied. Indicating compliance with a treatment regimen by displaying a calendar that indicates the days during which treatment was applied and the days during which treatment was not applied. Receiving payment for a number of treatments. Receiving payment for a number of treatments includes receiving payment at the medical device for a number of treatments, the payment being entered with a code, a credit card, or a SIM card.

In another general aspect, a computer-implemented method includes: receiving user input that a treatment should be initiated using a treatment module of a medical device; in response to receiving the user input, controlling the treatment module to apply a treatment; recording on one or more data storage devices information indicating occurrences of treatment using the treatment module; and indicating, on a display of the medical device, days during which treatment was applied and days during which treatment was not applied.

Implementations of any of the aspects may include one or more of the following features. For example, indicating days during which treatment was applied and days during which treatment was not applied includes indicating the days during which treatment was applied and the days during which treatment was not applied on a calendar. Indicating the days during which treatment was applied and the days during which treatment was not applied on a calendar includes marking days of the calendar during which treatment was applied with a check mark and displaying days of the calendar during which one or more treatments were not applied as unchecked. Storing information about a treatment regimen for use of the medical device, and indicating compliance with the treatment regimen on the calendar. Indicating the days during which treatment was applied and the days during which treatment was not applied occurs in response to the medical device being powered on.

Determining the geographic location of the medical device, and disallowing commencement of treatment using the treatment module if the determined geographic location is outside an authorized geographic location. Determining user identity, and disallowing commencement of treatment using the treatment module if the determined user identity does not match an authorized identity. Controlling the treatment module to apply a treatment includes controlling the treatment module to produce a pulsed ultrasound signal having a frequency in the range of 1 MHz to 2 MHz, consisting of pulses generated at a rate in the range of 100 Hz to 10 KHz with each pulse having a duration in the range of 10

microseconds to 2,000 microseconds. The pulsed ultrasound signal has a power intensity of 100 milliwatts per square centimeter or less.

According to another general aspect, a computer-readable storage medium storing instructions that, when executed by one or more processing devices, cause the one or more processing devices to perform the operations of the computer-implemented methods.

According to another general aspect, a medical device includes: at least one treatment module configured to apply a treatment to a patient, the treatment module including at least one ultrasound transducer and at least one driver circuit coupled to the ultrasound transducer; an interface configured to operatively connect to a removable storage device storing authorization data that identifies a level of treatment authorization; and at least one processing device. The at least one processing device is configured to perform the following in response to receiving user input indicating a treatment should be initiated: determine whether the removable storage device is valid for use with the medical device; if the removable storage device is determined to be valid, access the authorization data; determine whether the treatment is authorized based on the accessed authorization data; if the treatment is determined to be authorized, control the treatment module to apply the treatment by producing ultrasound with therapeutic properties; and if the treatment is determined to not be authorized, control the treatment module such that the treatment is not applied.

In some implementations, a medical device can control its operation to apply treatments that have been purchased and to not apply treatments that have not been purchased. For instance, the medical device can be authorized to provide a particular number of treatments purchased for a patient. When the purchased treatments are exhausted, the medical device can be authorized to perform additional treatments based on additional payment. For example, a user can purchase a card or other removable medium that authorizes a number of additional, prepaid treatments with the medical device. The medical device can access authorization data stored on the removable medium, determine that treatment is authorized, and perform the appropriate treatment.

In addition, or as an alternative, to the above-mentioned features, the medical device can also store information and provide information to a patient. For example, the medical device may provide instructions for using the medical device or information about a

particular health condition. The medical device can select the information to provide based a particular health condition of the patient or other information about the patient.

In addition, or as an alternative, to the above-mentioned features, the medical device can record compliance information that indicates occurrences of treatments using the medical device. Days and/or times that a patient has performed treatments using the medical device can be recorded. The compliance information can also indicate the degree to which a patient has complied with a particular treatment regimen.

In addition, or as an alternative, to the above-mentioned features, the medical device can display information to a patient that indicates the recorded compliance information. The medical device can display a calendar indicating days on which treatment was performed and days on which treatment was not performed. The calendar can also indicate whether or not the treatments that were performed occurred according to the scheduled treatments indicated by a particular treatment regimen for the patient.

In addition, or as an alternative, to the above-mentioned features, the medical device can limit restrict unauthorized use based on an identity of a user or the geographical location of the medical device. The medical device can determine the geographic location of the medical device and not allow treatment to commence if the determined geographic location is outside an authorized geographic region. The medical device can also determine the identify of a user and not allow treatment if the determined identity is not any authorized identity.

Some implementations of the medical device may provide the following advantages. For example, rather than incur a large initial expense by purchasing a medical device with unlimited treatments, in some instances, a patient or third-party payer may pay for only the treatments that are prescribed to the patient. By purchasing treatments as needed, patients and third-party payers may also spread expenses over time. Also, when treatments can be authorized after an initial set of treatments is exhausted, the additional use of the medical device can be easily added. Additional treatments can generally be authorized without service, repair, or reconditioning of the medical device. In some instances, the patient may enter payment directly at the medical device and receive treatment with minimal delay after payment is complete. In addition, by providing only treatments that have been purchased, excessive treatment and misuse of the medical device can be deterred.

Some implementations of the medical device may provide the following additional advantages. Information can be displayed to the patient during treatment, including, for example, information about a health condition of the patient, instructions for using the medical device, and information about the patient's compliance with a treatment regimen. Messages may, for example, encourage, motivate, inform, entertain, and instruct the patient.

Some implementations of the medical device may provide the following additional advantages. Information indicating a patient's usage of a medical device over time and compliance with a treatment regimen can be displayed. The patient's compliance with a treatment regimen can be easily discernable from a calendar display indicating days on which treatment occurred.

Some implementations of the medical device can limit use by unauthorized users. Some implementations of the medical device can also limit use outside an authorized geographical area.

Referring to Fig. 1, a patient is shown using a medical device 10 that includes a treatment module for applying a treatment to the patient. In the example illustrated, the medical device 10 is a portable ultrasonic treatment device. The treatment module may include, for example, one or more ultrasound transducers 16 and at least one driver circuit coupled to the ultrasound transducers 16.

The medical device 10 can include a control unit 12 that controls the operation of the transducers 16. The control unit 12 can include the transducer driver circuit. The medical device 10 can also include cables 18 that can carry power, data, and control signals between the control unit 12 and the transducers 16.

The medical device 10 can include a placement module 14 that couples the transducers at a location of the patient's body where treatment is needed, for example, over a fractured bone or next to damaged connective tissue. The placement module 14 can include a band, sleeve, applicator, or other connector to fasten the one or more transducers to a treatment site. An ultrasound conducting gel 20 can be applied to the skin of the patient to enable the ultrasound to propagate effectively to the patient's tissue.

The medical device 10 can use low intensity, high-frequency acoustic energy (ultrasound) to treat injuries, defects, or pathologies. For instance, the ultrasonic treatment device can be designed to treat injuries, defects, or pathologies of bones or connective tissue,

and, in some instances, can increase cellular level activity that leads to healing of ischaemic or grafted tissue. The medical device 10 may be used as an adjunct to surgical repair, in order to speed healing, or in some cases can be used alone to heal tissue injuries without surgery (e.g., for degenerative diseases such as osteoarthritis, tendonosis, and tendonitis). The medical device 10 can be suitable for use in treatment of bone fractures and/or connective tissues associated with joints, such as those in the hand, foot, wrist, ankle, knee, elbow, hip, shoulder, back, and neck.

For example, following surgery, the medical device 10 can be applied non-invasively to the outside of the body (e.g., coupled to the skin with coupling media, such as a gel) in the region of the repaired tissue. The medical device 10 can be operated to transmit ultrasound (for example, in the form of pulses) into the tissue in need of treatment, or at the interface with the uninjured tissues. Exposure to the ultrasound can stimulate a faster, better quality repair of the tissue. At a bone interface, the ultrasound can also stimulate bone repair and bone ingrowth into repair or graft tissue. This can give rise to a faster, stronger repair and improved integration of the interface between, for example, tendon, ligament, and bone. The ultrasonic treatment device may also be used to non-invasively treat pathologies of connective tissues, such as osteoarthritis, ligament and tendon conditions, without the need for a surgical procedure.

Referring to Fig. 2, the control unit 12 of the medical device 10 can include a processing device 50 that executes instructions stored on a storage device 52. The processing device 50 can include one or more processing devices. The storage device 52 can include one or more storage devices, one or more of which may be removable. The control unit 12 can also include a driver circuit 54, a user interface module 60, a payment module 62, a communication module 64, and a power supply 68.

By executing the instructions, the processing device 50 can, for example, determine whether a treatment is authorized. If treatment is authorized, the processing device 50 can control the treatment module (for example, driver circuit 54 and transducers 16) to apply the treatment. Applying the treatment can include controlling the driver circuit 54 to produce ultrasound with therapeutic properties. Controlling the driver circuit 54 to produce ultrasound can include activating the driver circuit 54, for example, supplying power to the driver circuit 54, sending control signals to the driver circuit 54, or causing the driver circuit

54 to produce a particular output. If the treatment is not authorized, the processing device 50 can control the treatment module such that the treatment is not applied. For example, the processing device 50 can control the driver circuit 54 such that ultrasound with therapeutic properties is not produced. Controlling the driver circuit to not apply treatment can include not activating the driver circuit 54, deactivating the driver circuit 54, setting the output of the driver circuit 54 (for example, setting the amplitude to zero), and/or otherwise limiting or preventing treatment. The processing device 50 can also be configured to control other components described below, for example through instructions stored on the storage device 52.

The processing device 50 can determine whether a treatment is authorized by, for example, accessing authorization data. If, for example, accessed authorization data is invalid, is for a different medical device 10, has expired or all treatments associated with the code have been expended, or if no authorization data can be accessed, the processing device 50 can determine that treatment is not authorized. On the other hand, if valid authorization data can be accessed, the processing device 50 determines whether at least one treatment using the medical device 10 is authorized. The authorization data may or may not include an authorization code that indicates that payment for treatments has occurred. The authorization data can be stored in the storage device 52, for example, or, as described further below, in a removable medium.

The storage device 52 can store a device identifier, such as a serial number, that identifies the particular medical device 10. The device identifier can uniquely identify the medical device 10 and distinguish it from all other ultrasonic treatment devices, even those of the same type or model. The storage device 52 can also store information about the treatments that are authorized for the medical device 10, for example, a number of treatments that are authorized or an authorization code that authorizes treatments.

The driver circuit 54 can be configured to send drive signals that cause the transducers 16 to generate ultrasound with therapeutic properties. The driver circuit 54 can include a signal generator 56 that generates a signal and a transducer driver 58 that drives the transducers 16 according to the generated signal. In an implementation, the ultrasound generated by the transducers 16 can include low intensity ultrasound (for example, 100mW/cm^2 or less) having a frequency ranging between about 1 and 2 MHz, more

particularly about 1.5 MHz. The ultrasound can be pulsed, with a pulse width ranging from about 10 to 2,000 microseconds, more particularly about 200 microseconds, with a repetition frequency ranging from about 100Hz to about 10KHz, more particularly about 1 KHz.

The user interface module 60 can provide information to the patient and enable treatment to be initiated. The user interface module 60 may include one or more input devices or controls, for example, buttons, a keypad, or a touch-sensitive screen. The user interface module 60 may be used by a patient or other person, for example, to enter user input that indicates that a treatment should be administered by the medical device. When the processing device 50 determines that treatment is not authorized, the processing device 50 can provide an indication to the patient on the user interface module 60 that more treatments need to be purchased.

The user interface module 60 may also include one or more output devices, for example a screen, a liquid crystal display, or lights. For example, the interface module 60 can include a screen 72, for example, a liquid crystal display (LCD), a thin-film transistor (TFT) display, a field sequential display, or an organic light-emitting diode (OLED) display. The interface module 60 can also include light-emitting diodes (LEDs) and other indicators. The interface module 60 may include a speaker or other device that can produce sound (not shown), or other output devices. The user interface module 60 may also include input capabilities or input devices (not shown), for example, buttons, one or more keypads, and other controls. The screen 72 may be touch-sensitive to receive input from a user. The user interface module 60 can also include an interface to access a removable storage medium, such as a subscriber identity module (SIM) card, a Secure Digital (SD) card, or other types of removable storage media.

The payment module 62 can enable a patient to enter payment at the control unit 12, or to receive information indicating prior payment. Payment can be enabled through one or more methods. The payment module 62 can include a credit card reader that reads a card and charges treatment to a credit card, debit card, or similar card that is swiped at the control unit 12. The payment module can include a SIM card reader, and a patient may purchase a SIM card that includes information that represents one or more payments made for treatment with the ultrasonic treatment device. The payment module can include a reader for reading other types of removable media, for example, a SD card or other flash memory device. The control

unit 12 can be configured to receive payment in the form of a code or other user input that may be entered on the interface module 60. Some implementations may exclude the payment module 62. For instance, in some implementations, provisions may be made to allow payment remotely from the device 10, for example, at a computer connected to a network.

The communication module 64 can be configured to send payment information to a remote system and/or receive authorization information that authorizes additional treatments using the medical device 10.

In some implementations, the processing device 50 is configured to receive an authorization code or other authorization data through the communication module 64 and to store the received authorization code in the storage device 52. The communication module 64 can enable communication with a server system, client system, or other computer system over a wired or wireless connection. The communication module 64 may enable a communication link that is wired or wireless. The communication module may enable communication over, for example, Ethernet, Universal Serial Bus, 502.11, Bluetooth, Zigbee, cellular networks, and other communication links. In one implementation, the communication module 64 can include a cellular transceiver 66 to receive and/or transmit information over a cellular network. The communication module 64 may also enable communication through multiple communication links.

The communication module 64 can be configured to send payment information to a remote system and/or receive authorization information that authorizes additional treatments using the medical device 10. The processing device 50 can be configured to receive an authorization code through the communication module 64 and to store the received authorization code in the storage device 52.

A power supply 68 can provide power to the components of the medical device 10, including the driver circuit 54, the processing device 50, the storage device 52, the payment module 62, the communication module 64, and the user interface module 60. The power supply 68 can include a battery that is integrated into the control unit 12 or is removable. The battery can be primary battery or a rechargeable battery, and the power supply 68 can include a detachable power adapter that can charge a rechargeable battery.

When a user performs treatment using the medical device 10, the medical device 10 can collect and store compliance information. Collecting compliance information can include recording information about use of the medical device 10, for example recording the number of treatments that are performed. Compliance information can include a number of treatments provided by the medical device 10, a date and time that a treatment was provided by the medical device 10, and/or a duration that a treatment was provided by the medical device 10. Information about multiple uses or treatments with the medical device 10 can be collected.

A treatment regimen that identifies a prescribed use of the medical device 10 can be identified. For example, the treatment regimen may be entered on the device after the health condition has been diagnosed or after the medical device 10 has been prescribed to the patient. Information about a treatment regimen may be entered on the medical device 10 or received from a network, which may include a cellular network. The information about the recorded use of the medical device 10 can be compared to the information about the prescribed use of the medical. Information indicating the degree that the recorded use matches the prescribed use can be generated.

Compliance information can be stored on the storage device 52, on a removable medium, or both the storage device 52 and a separate removable medium. The compliance information may, but is not required to, include one or more results of a comparison between the recorded use of the medical device 10 and the treatment regimen of the patient.

Referring to Fig. 3, the medical device 10 can display information to the patient. For example, the medical device 10 can display information that relates to the particular patient using the medical device 10, for example, information about a health condition of the patient, a treatment regimen of the patient, or a physician of the patient. The information displayed on the medical device 10 can thus be personalized to the particular patient that receives the medical device 10 and a particular health condition of the patient. In some instances, the information displayed may be selected to instruct, encourage, or entertain the patient. In addition, the information can provide advertisements and personalize treatment using the name or brand of, for example a particular physician, hospital, or insurance company.

The information displayed on the medical device 10 may be organized into a plurality of messages 304. Messages 304 can include a variety of media, including text, images,

video, and sound. Messages 304 can be stored on the storage device 52 of the control unit 12. Some messages 304 may be entered onto medical device 10 during manufacturing. For example, an initial set of predetermined messages 304 may be loaded onto a storage device 52 before it is shipped. Messages 304 may also be entered at other times to supplement the initially loaded messages 304, including before a medical device 10 is dispensed to a patient and after a patient begins use of the medical device 10. Messages 304 may be received with, for example, the communication module 64 and may be stored on the storage device 52.

Messages 304 can include information related to specific health conditions. For example, some messages 304 may relate to treatment of broken bones of the foot, and others may relate to treatment of broken bones of the arm. The medical device 10 can store messages 304 that relate to a wide variety of health conditions. To ensure that the messages 304 displayed to the patient are useful, the processing device 50 can access information that identifies a health condition of the patient, which can be stored on the storage device 52. Based on the identified health condition, the processing device 50 can select one or more messages out of the set of messages 304 that are stored on the storage device 52. For example, if the processing device 50 determines that the patient has a broken foot, the processing device 50 can select one or more messages 304 related to broken bones of the foot and treatment of a broken foot. The selected messages 304 can be displayed to the patient on the screen 72. In some implementations, the screen 72 may be part of the interface module 60, while in others the 72 screen may be integrated into the control unit 12.

Selected messages 304 can be displayed to the patient during treatment. For example, while a treatment is applied, the medical device 304 can display information to instruct the patient about proper use of the medical device 10. In many instances, a patient receives only minimal instruction about the proper use of the medical device 10 when the medical device 10 is dispensed to the patient. A patient may forget the proper use of medical device and the details of a treatment regimen, especially when the medical device 10 is new. By providing messages 304 that instruct the patient how to use the medical device 10, the patient may be more likely to perform treatment correctly. The instructive messages 304 can be selected based on the health condition of the patient and the associated treatment regimen for the health condition.

The medical device 10 can select and display a variety of other messages 304 during treatment. For example, messages 304 can also provide general health information, such as, "smoking inhibits bone healing" or "tell your doctor if you use blood thinners."

Messages 304 can also be selected based on a patient's compliance to a treatment regimen. The medical device 10 can store information that indicates when the patient should receive treatment. The medical device 10 can also record information indicating when treatment is actually performed. The medical device 10 can compare the planned or prescribed use of the medical device with the actual use of the device and determine how well the patient has complied with the prescribed treatment regimen. The medical device 10 can display messages 304 to the patient that directly or indirectly provide compliance information. For example, messages can provide direct feedback about a patient's compliance. Messages 304 can also be displayed that motivate, encourage, and remind the patient to follow a consistent treatment schedule. Messages 304 can also describe the benefits of continuing treatment or provide information about how the medical device 10 operates.

Messages 304 can also provide physicians and others an opportunity to provide a personalized message. For example, one or more messages 304 may include the name of a patient's physician, the name of the patient's insurance company, or the logo for a hospital. Customized messages 304 can enable physicians and organizations to reinforce their brands and enhance the patient's experience during treatment. Messages 304 can also include contact information, for example, the phone number for the patient's primary physician. Messages 304 can include advertisements and paid content.

Messages 304 can also be provided to entertain a patient during treatment and thus encourage the patient to complete the treatment. In some implementations, the medical device may enable the patient to acquire or input additional content to display on the medical device.

Referring to Fig. 4, a diagram illustrates the selection and display of messages 304 on a screen 72 of the medical device 10.

The processing device 50 of the medical device 10 can access information identifying a health condition of a patient. As illustrated, a health condition record 401 indicates that the health condition of the patient is a broken clavicle. Based on the identified health condition,

the processing device 50 can select one or more messages from a plurality of messages 304. The plurality of messages 304 may include a set 402 of predetermined messages 304. Each message 304 in the set 402 may be associated with an identifier, as represented by the numbers from one to ten. From the set 402, a subset 403 of messages 304 may be selected. The selected messages 304 can include messages 304 that relate to the particular health condition of the patient. The selected messages 304 can be ordered into a sequence 404 for display on the medical device 10.

The sequence 404 of messages 304 may be displayed on the screen 72 of the medical device 10. In one implementation, the sequence 404 of messages 304 may begin to be displayed when treatment begins, and the sequence 404 may end roughly when treatment ends. In addition to the messages 304, other information can be included, for example, information that describes the treatment being performed. For example, notifications 406 that indicate the time remaining until treatment is completed may be interspersed between other messages 304.

The messages 304 selected and the sequence 404 of the selected messages 304 can vary according to the needs of the patient and to limit unnecessary repetition. For example, instructions about how to use the medical device 10 may be selected and displayed for an initial set of treatments using the medical device 10, but instructions may be omitted after many treatments have successfully been performed.

Referring to Fig. 5, an example of a process 500 for providing information is illustrated. The processing device 50 of the medical device 10 can be configured to perform the process 500, for example, by executing instructions stored on the storage device 52.

A plurality of messages is stored on the medical device (502). For example, the storage device may store the plurality of messages. Messages may be entered on the storage device by a manufacturer of the medical device before the medical device is sold. Messages can also be entered on the storage device by sales representatives, physicians, and others at other times.

The medical device receives information about a health condition of a patient (504). For example, after a patient is diagnosed with a particular health condition, the health condition can be entered on the medical device. A physician, assistant, sales representative, or other person may enter information that indicates the health condition of the patient on the

medical device. In addition, or alternately, the medical device may receive information about a health condition of the patient through the communication module. For example, the medical device may receive information about a prescription or diagnosis automatically over a network, without requiring any manual input. The medical device can store the information about the patient's health condition for later access. The health condition can be, for example, a health condition that is treatable by the medical device.

The medical device selects messages for the patient (506). For example, the messages can be selected from the stored messages stored on the storage device. One or more messages can be selected based on the identified health condition of the patient. For example, if the patient has a broken ankle, messages can be selected that describe treatment of a broken ankle. The selected messages can include messages related to multiple health conditions. The selected messages can include instructions for using the medical device. The selected messages can include one or more messages that include information about a doctor that treated the patient or a medical office where the patient was treated. The selected messages can include one or more messages about the medical device or information about the provider of the medical device. The selected messages can include advertisements. The selected messages can include image data or video data.

In some implementations, the medical device can store records indicating use of the medical device. For example, the medical device can record the number of treatments that have been performed using the medical device, the date and time that each treatment is performed, and/or the duration of each treatment. The information in these records, referred to generally as compliance information, indicates the manner in which treatments were performed using the device, from which a patient's compliance with a particular treatment regimen can be determined.

Compliance information can be stored on the one or more storage devices 52. For example, the compliance information can be stored on internal memory of the medical device 10 and can also be stored on a removable medium, such as an SD memory card. Recording the compliance information on internal memory and the removable medium provides a backup in case one of the storage devices should fail. Additionally, the removable medium may be removed and used to transfer compliance information to other systems.

The medical device can also identify a treatment regimen that corresponds to the health condition. For example, the medical device may receive the information from a prescription, a treatment regimen that is entered directly on the medical device, or the medical device may store a number of treatment regimens on the storage device. The medical device can access the records indicating use of the device. The medical device can compare the records indicating use of the medical device to the treatment regimen identified for the health condition of the patient.

The medical device can provide an indication of compliance with the treatment regimen. For example, the medical device may provide an indication of compliance in one or more messages that are selected to be later displayed to the patient. The selected messages can also encourage compliance to a treatment regimen, for example, by praising the patient for past compliance or assuring the patient that continued treatment will bring good results. The selection of messages, including the selection of messages about compliance to the treatment regimen, can be based on the number of uses of the medical device indicated in the records that indicate use of the medical device.

The medical device can also identify the language of the patient and select one or more messages in the language of the patient. The plurality of messages stored on the medical device can include messages in at least two languages. For example, some or all of the stored messages can be included in multiple languages. The medical device can identify the language of the user, for example, based on user input, messages input on the medical device, information received by the communication module, or other information.

The medical device can begin treatment (508). For example, a patient may enter input indicating that treatment should begin, and the medical device may control a driver circuit to drive an ultrasound transducer so that the ultrasound transducer produces ultrasound with therapeutic properties. The medical device can store and update records indicating use of the medical device.

The medical device can display the selected messages (510). The selected messages can be displayed during treatment, for example, while the ultrasound with therapeutic properties is applied to the patient. The messages can be displayed on a liquid crystal display or other screen.

Referring to Fig. 6A, the medical device 10 can display information about a patient's compliance with a treatment regimen on a user interface 600a. The user interface 600a can be displayed on the screen 72 of the user interface module 60. The user interface 600a includes a calendar view 602 that indicates whether treatment was performed each day of, for example, the current month, or the current month and previous months. In the calendar space corresponding to each day that treatment was performed, a compliance indicator 604 can be displayed, for example, a colored square, a check mark, or other image or icon. In the space corresponding to each day in which treatment was not performed, a noncompliance indicator 606 can be displayed, for example, a different image or icon, such as a blank square or a red "X." Thus the user interface 600a can visually distinguish the days during which treatment was performed from days during which treatment was not performed, providing an easily-understandable indication of recent compliance with the treatment regimen.

In some implementations, information about the particular treatment regimen prescribed for the user of the medical device 10 is stored on the medical device 10, and the compliance indicator 604 is displayed to indicate that a treatment performed on a particular day complies with the particular treatment regimen prescribed. In other words, rather than assuming that the treatment regimen requires one treatment each day, the medical device 10 compares times that treatments were performed to times that treatments were scheduled to be performed, as dictated by a treatment regimen. If a treatment regimen involves treatment every other day, for example, a neutral indicator can be displayed to represent days in which treatment was not scheduled and was not performed. The neutral indicator may be, for example, the day of the month that the day occurs. The noncompliance indicator 606 may be displayed, for example, only when treatment was scheduled to be performed on a day and treatment did not occur on that day. If treatment was performed on a day that treatment was not scheduled, an improper treatment indicator different from the noncompliance indicator 606 may be displayed for that day, distinguishing noncompliance by omitted treatment from noncompliance by performance of an unscheduled treatment. As a result, compliance relative to a treatment regimen can be accurately indicated when scheduled treatments are not scheduled every day.

Similarly, compliance can be indicated for treatment regimens that dictate treatment multiple times in a day. For example, multiple compliance indicators 604 or multiple

noncompliance indicators 606 can be displayed to indicate each treatment that was completed or missed that day.

In other implementations, the medical device 10 displays the compliance indicator 604 for days that treatment was performed and displays the noncompliance indicator 606 for days that treatments were not performed, without regard to times that treatments were dictated by a prescribed treatment regimen. Thus even when the medical device 10 does not have access to information indicating a treatment regimen, the calendar view 602 indicates when treatments were performed, permitting the user or others to determine compliance with an appropriate treatment regimen.

The user interface 600a may display patient compliance for time period longer or shorter than a month, and for previous periods of time rather than, for example, the most recent weeks or months.

The medical device 10 can automatically display the calendar view 602 as the medical device 10 is powered on or at other times. For example, each time the medical device 10 is powered on, while the medical device 10 is initializing and for a period of time afterward, the calendar view 602 showing compliance can be displayed. The calendar view 602 can also be displayed to physicians, caretakers, and others. The calendar view 602 can be displayed automatically after particular functions of the medical device 10 are accessed, or in response to a request that the calendar view 602 be displayed.

The medical device 10 can automatically display a total compliance to-date indication. For example, if ten days have elapsed since the start of a daily treatment regimen and the patient only used the device for eight out of the ten days, then the total compliance indicator can display 8/10 or 80% to indicate the overall level of compliance.

The user interface 600a can also display notification icons 610. The notification icons 610 can vary in appearance according to the current status of the medical device 10. The notification icons 610 can indicate, for example, the status and availability of communication links such as wireless connections, whether service is needed, that error or notification messages are available, the types or quality of connections with various modules, the remaining battery charge of the medical device, and other notifications.

Referring to Fig. 6B, after the calendar view 602 is displayed, or after receiving user input, the medical device 10 can display a treatment timer 612 on a user interface 600b. The

treatment timer 612 can indicate the time remaining before a treatment is completed. For example, for a twenty-minute treatment, the treatment timer 612 can initially indicate the duration of treatment, twenty minutes. While a treatment is in progress, the treatment timer 612 can count down toward zero, reaching zero when the treatment ends. The notification icons 610 can also be displayed.

Referring to Fig. 6C, an alternative user interface 620 includes a calendar view 622 indicating daily compliance with the treatment regimen and a treatment timer 624. Days for which treatment was performed as indicated in the treatment regimen are indicated with a first marking 626, while days for which planned treatment failed to be performed are indicated with a different marking 628. Days in the future can be marked with their corresponding calendar numbers.

Referring to Fig. 7, a removable medium 710, for example, an SD card, USB device, or other removable memory device, can be used to authorize use of the medical device 10. The removable medium 710 can store authorization data 720 that indicates a level of treatment authorization, for example, a number of treatments authorized or an amount of treatment time authorized using the medical device 10.

The medical device 10 can include an interface 712 that operatively connects to the removable medium 710, permitting the processing device 50 to access the authorization data 720. The interface 712 can include a slot that receives the removable medium 710 within the medical device 10. The slot can be accessible to a user, permitting the user to replace the removable medium 710 with a different removable medium. The control unit 12 of the medical device 10 can define the slot and can include a cover that covers the slot.

To obtain treatment authorization, the patient can obtain the removable medium 710, which can be a prepaid medium that represents that payment has been made by or for the user. Removable media can store differing levels of treatment authorization. Different removable media may be sold with authorization data 720 that permits, for example, 50, 25, or 10 treatments. Treatment authorization may additionally or alternatively be indicated as an amount of time, for example, 1000, 500, or 100 minutes of treatment. In some implementations, the removable medium 710 can be purchased from a retail store or a physician's office. The fact that the patient obtained the removable medium 710 indicates

that payment was made, and no additional verification of payment may be necessary to use the medical device 10.

The removable medium 710 may be a secure mode of communicating that a particular number of treatments are authorized. The removable medium can include a copy-protection or anti-counterfeiting feature that can be used to determine whether the removable medium is genuine. For example, the removable medium can store an encoded value in a manner that the value is not easily duplicated or copied from one removable medium to another. The encoded value can be hardware-encoded or factory-set with a physical setting such that similar removable media cannot be altered to mimic the encoded value. In some implementations, the encoded value is a serial number that is embedded in non-writable storage of the removable medium. Each valid removable medium can have a unique serial number. Only removable media that have a serial number within a predetermined range of values can be considered genuine.

In use, a user interacts with the medical device 10 to indicate that treatment should be initiated, for example, by pressing a button or entering other input. In response, the processing device 50 determines whether a removable medium is present. If no removable medium is present, the processing device 50 disallows treatment.

If a removable medium such as the removable medium 710 is present, the processing device 50 determines whether the removable medium 710 is valid for use with the medical device 10. For example, the processing device 50 determines whether a serial number or other value encoded in the removable medium meets predetermined criteria. In some implementations, the processing device 50 determines whether the value is within a predetermined set or range of values. The serial number can be a value that is not modifiable by a user, for example, a value that is fixed in the hardware configuration of the removable medium and cannot be copied onto a similar removable medium. Thus the processing device 50 can verify that the physical medium is valid. If a removable medium is not genuine, or is not compatible with or intended for the medical device 10, the processing device 50 disallows treatment.

If the removable medium 710 is genuine, the processing device 50 accesses authentication data 720 stored on the removable medium 710. The authentication data 720 can indicate a number of treatments authorized or a number of treatment minutes that

treatment is authorized. For example, when each treatment has a duration of twenty minutes, the authorization data 720 may indicate that ten treatments are authorized, or may indicate that two hundred minutes of treatments are authorized. If the authorization data 720 indicates that at least one treatment is authorized, or that one or more treatment minutes are authorized, the processing device 50 controls the treatment module to provide ultrasound with therapeutic properties. If the authorization data 720 indicates that no treatments are authorized, the processing device 50 disallows treatment.

After the medical device 10 applies a treatment, the processing device 50 alters the authorization data 720 to indicate an updated level of authorization. For example, the medical device 10 can decrease the number of authorized treatments or decrease the number of authorized treatment minutes remaining. Modified authorization data that indicates an updated level of authorization can be stored on the removable medium 710, for example, by overwriting the authorization data 720 that was stored before treatment began.

The medical device 10 can also store compliance data 730 on the removable medium 710. When the medical device 10 applies a treatment, the processing device 50 can store information about the treatment performed. For example, the compliance data 730 can indicate the time, date, and duration of the treatment applied, along with other treatment information. The removable medium 710 can thus include a compliance log that indicates use of the medical device 10 over time. The compliance data 730 can also indicate, for example, the degree that the use of the medical device 10 corresponds to planned or prescribed use of the medical device 10. For example, the compliance data 730 can indicate days or times at which treatment was scheduled and whether treatment occurred at those days or times. Compliance data 730 can additionally or alternatively be stored on an internal storage device of the medical device, such as the storage device 52.

In some implementations, the authentication data 720 is encrypted, which can discourage tampering. In such implementations, the processing device 50 decrypts the authentication data 720 before determining whether treatment is authorized. Also, after modifying the authentication data to indicate a decreased level of authorization, the processing device 50 encrypts the modified data and stores the encrypted data on the removable medium 710.

When additional treatments are desired, for example, after the treatment authorization of the authorization data 720 is depleted, a user can obtain a different removable medium that includes authorization data for additional treatments.

In some implementations, the authorization data 720 directly authorizes the treatments, without the medical device 10 needing additional information or confirmation from another system. In some implementations, as described below, the medical device 10 verifies the authenticity of authorization data 720 by communicating with a server system or other device.

Referring to Fig. 8, a system 800 for authorizing medical treatments includes the medical device 10 connected to a server system 802 via a network 806. The system 800 can also include a third-party server system 804 and a cellular network 808. After payment is made by or for a patient, authorization data can be entered at or received by the medical device 10. The authorization data indicates a level of treatment authorization, and can include an authorization code.

A patient may desire to authorize medical treatments using the ultrasonic treatment device 10. For example, the patient may receive the ultrasonic treatment device 10 in a condition in which treatments have not yet been authorized. As another example, the patient may have used treatments authorized for the ultrasonic treatment device 10 so that an insufficient number of treatments are currently authorized to complete treatment.

To purchase additional treatments of the medical device 10, the patient may provide payment information 810 at the medical device 10. Payment information 810 includes payment entered or authorized at the medical device 10 and also information that indicates that payment has been made in another manner. For example, the patient may enter a credit card, a debit card, or another payment device into an appropriate reader of the medical device 10 and authorize a charge to an account owned by the patient. The patient may also enter an account number on the user interface module 60 of the medical device 10 to authorize payment. The patient may also purchase a prepaid medium, for example, a SIM card, a Secure Digital (SD) card, or a prepaid card with a magnetic strip, an optical code, or a printed code, from a store or physician's office. In one implementation, the prepaid medium may be a secure mode of communicating an amount of payment that has been paid. The patient may enter the prepaid medium at the ultrasonic treatment device 10 to indicate that payment has

been made. The patient may also purchase treatments in a store or through a web site, may receive a confirmation code for the transaction, and may enter the confirmation code at the ultrasonic treatment device 10. The system 800 can also be used to verify the validity of an authorization code received from a prepaid medium.

The medical device 10 can send the payment information 810 to a server system 802. The payment information 810 can be associated with a device identifier 812 that identifies the medical device 10, which can also be sent to the server system 802. In addition to, or instead of, sending a device identifier 812, the medical device 10 may send a patient identifier that identifies the patient, together with the payment information. As will be described in greater detail below, the server system 802 can send an authorization code to the medical device 10 after receiving the payment information 810 and the device identifier 812.

The medical device 10 may send the payment information 810 and the device identifier 812 to the server system 802 through the network 806. Alternatively, or additionally, the medical device 10 may initiate a communication using the cellular network 808 to send the payment information 810 and the device identifier 812 to the server system 802. Payment information 810 can also be received through a removable medium, token, code or other indication that treatment is authorized.

In one implementation, a prepaid medium can store an authorization code that can directly authorize treatments, so that the ultrasonic treatment device 10 is not required to transmit any information to the server system 802. A prepaid medium can include an authorization code that can enable treatments of the ultrasonic treatment device 10, independent of a server system 802. For example, a patient may purchase a SIM card or other device that stores an authorization code compatible with the ultrasonic treatment device 10. The SIM card containing the authorization code can be entered at the ultrasonic treatment device 10 and the treatments authorized by the authorization code can be enabled on the ultrasonic treatment device 10. Payment is received by the retail store or physician's office where the prepaid medium was obtained. The fact that the patient obtained the prepaid medium proves that payment was made, and no additional verification may be necessary. In some implementations, the ultrasonic treatment device 10 may verify that the authentication code included with the prepaid medium is authentic, and may ensure that the authentication code of the prepaid medium is not used multiple times (for example, by altering the data on

the prepaid medium). In another implementation, a mechanical device or key may also be used to indicate authorization of additional treatments of the ultrasonic treatment device 10.

Treatments can also be purchased for a patient by a third-party payer, for example, an insurance company. A third-party server system 804 can transfer payment information 816 to the server system 802 with a patient identifier 818 that identifies the patient. The payment information 816 can include the information that completes the act of payment or indicates that payment has been made. The patient identifier 818 can include a name, prescription number, insurance policy number, or other identifier.

The server system 802 can receive the payment information 810 and the device identifier 812 from the medical device 10, or can receive the payment information 816 and the patient identifier 818 from the third-party server system 804.

The server system 802 can determine that payment has been made for a number of treatments, for example, using the payment information 810, 816. The server system 802 can also determine that patient is associated with the medical device, for example, using the patient identifier 818 or device identifier 812 associated with the payment information 810, 816. The server system 802 can use the received information and stored records to associate the payment with the patient to be treated with the medical device 10. The server system 802 may store records that associate patient identifiers 818 and device identifiers 812 with particular patients and medical devices 10 so that payment can be applied for the correct patient and medical device 10.

The server system 802 can also generate an authorization code 814 that enables the medical device 10 to provide a number of treatments. The number of treatments authorized can be based on the amount of payment received. The server system 802 can send the authorization code 814 to the medical device 10 through the network 806 and/or through the cellular network 808.

The authorization code 814 can be encrypted or encoded so that the authorization code 814 enables treatments only for the particular medical device 10 associated with a particular payment received. In one implementation, the authorization code 814 can be encrypted so that the unique device identifier 812 or another unique decryption key is necessary to decrypt or decode the authorization code 814. For example, the authorization code 814 can be encrypted using a symmetric-key or asymmetric-key encryption scheme.

Using a symmetric-key or shared-key encryption system, a key may be used as both the encryption and decryption key. The key can be stored on both the server system 802 and the medical device 10, for example, by the manufacturer of the medical device 10. To prevent interception, the key may not be transmitted. The medical device 10 can send a patient identifier or a device identifier 812 unrelated to the key to identify the medical device 10. The server system 802 can send the encrypted data to the medical device 10, which can decrypt the data with the stored key.

Using an asymmetric-key cryptography system, for example, a public key private key pair encryption system, the server system 802 can store an encryption key and the medical device 10 can store a corresponding decryption key. The server system 802 may encrypt the authorization code 814 using the encryption key and send the encrypted data to the medical device 10. The medical device 10 can include a stored decryption key that can decrypt the encrypted data. The decryption key can include the device identifier 812 or another key. In an implementation, the encryption key that encrypts messages for a particular medical device 10 may be known only to the server system 802.

Because the server system 802 can store records associating patients, medical devices 10, and corresponding encryption keys, the system 800 may not require that the decryption key be sent to the server system 802. If the device identifier 812 is used to decrypt an authorization code 814, instead of sending the device identifier 812, the medical device 10 can send another identifier, such as a patient identifier or a device identifier unrelated to the encryption scheme. The device identifier 812 can be independent of the encryption scheme so that interception of the device identifier does not compromise the encryption scheme.

The medical device 10 can receive the encrypted authorization code 814 through the network 806 or the cellular network 808 and can decrypt the authorization code 814. The medical device 10 can use the authorization code 814 to authorize a number of treatments of the medical device 10. The authorization code 814 or information determined based on the authorization code 814 can be stored to indicate the number of treatments authorized. When the patient attempts to initiate treatment with the medical device 10, the processing device of the medical device 10 can determine that authorized treatments remain for the medical device 10 and initiate treatment.

The medical device 10 may also use the authorization code 814 to determine a change in treatment. For example, an authorization code 814 may indicate that treatment should be disallowed after a particular period of time has elapsed or if the patient does not apply a treatment for a period of time. The authorization code 814 may indicate that the number of treatments that are available each day should be changed, for example, from one treatment each day to two treatments each day. The authorization code 814 may indicate that the intensity of ultrasound produced by the medical device 10 should be changed, for example, that the intensity should be reduced if the patient is healing well.

Referring to Fig. 9A, a process 900 for authorizing medical treatments can include actions by a medical device, a server system, and/or a third-party system. The medical device can be an ultrasonic treatment device as described above.

As illustrated, the process 900 can include payment for treatment by a patient at the medical device, payment by a third-party at a remote system, or both sources of payment. The actions performed by the medical device can be performed by one or more processing devices of the medical device configured to perform those actions. The server system can include one or more processing devices and one or more storage devices that store instructions that, when executed by the one or more processing devices, cause the processing devices to perform the various functions of the server system described below.

A patient can attempt to initiate treatment with the medical device (902). For example, the medical device can receive user input indicating that a treatment should be administered by the medical device.

The medical device can determine whether treatment is authorized (903). For example, the medical device can determine whether at least one treatment is authorized based on stored information that indicates the number of treatments that are authorized. The medical device can access an authorization code that has been received, for example, and determine whether treatment is authorized based on the accessed authorization code. The determination whether the attempted treatment is authorized can be performed in response to the attempt to initiate treatment in (902).

If the determination indicates that treatment by the medical device is authorized, the medical device can control a treatment module to apply the treatment that the patient attempted. If the determination indicates that treatment is not authorized, the medical device

can control the treatment module so that the treatment attempted by the patient is not applied. No treatment may be authorized for a medical device if, for example, all of the previously authorized treatments have already been used or if the medical device has not received an initial authorization code to enable treatments.

When treatment is not authorized for the medical device, the medical device can notify the patient that payment is needed to purchase additional treatments (904). The example illustrated in Fig. 9A shows a scenario in which the medical device is not initially authorized to perform a treatment attempted by a patient, so additional payment and authorization of the medical device is needed.

Payment can be received at the medical device (906). The patient can then enter payment in one or more ways, including entering payment at the medical device using, for example, a credit card or a debit card to purchase additional treatments. The patient may also complete payment at a location other than the medical device, and enter proof of payment at the medical device. The patient may purchase treatments for example, at a store, at a medical office, or over the Internet. The patient may then enter proof of payment at the medical device in the form of, for example, a computer file, a code, or a SIM card.

The medical device can then send payment information for the payment received and an identifier to the server system (908). The identifier may be a device identifier that uniquely identifies the particular medical device used by the patient. In other words, the device identifier can identify not merely a model or type of medical device, but a single, particular medical device. The identifier may be a patient identifier that identifies a particular patient associated with the medical device.

Treatments can also be purchased for a patient by a third-party, for example, an insurance company. The third-party system can receive, for example, a prescription for treatment of the patient using the medical device (910). The third-party system can authorize one or more treatments using the medical device (912). For example, the third-party system can authorize the treatments identified in the received prescription.

The third party system can send payment information and an identifier to the server system (914). The payment information can include information that enables a transaction to occur, for example, an authorization to charge an account or otherwise cause funds to be transferred, and can include information that indicates that payment has been performed. The

identifier can identify the patient associated with the prescription that was received in action (910). For example, the identifier can include a name of the patient, an insurance policy number for the patient, a prescription identifier, or other information relating to the patient. The identifier may also identify the medical device for the patient.

The server system can receive payment information and an associated identifier from either the medical device or the third party system (916). The associated identifier can be a device identifier that uniquely identifies the medical device. The server system can match the payment described in the payment information with the patient and the medical device of the patient (918). The server system can store one or more associations between a patient and the medical device configured to apply a medical treatment to the patient. For example, the server system can store records that associate patients with particular medical devices, patient identifiers, and medical device identifiers.

The server system may use one or more received identifiers to determine which patient and device are associated with a payment. Specifically, the server system can determine that payment has been made for the patient for a particular number of treatments by the medical device. The determination can be made based on the received information that payment has been made for the patient. The server system can identify the medical device associated with the patient based on the stored association between the patient and the medical device and, for example, based on a received device identifier that uniquely identifies the medical device. The server system may also record the determination that payment has been made for the user and the identification of the medical device associated with the patient.

The server system can generate an authorization code that can authorize the medical device associated with the patient to perform the purchased treatments (920). The authorization code can enable the number of treatments purchased by the patient or third-party payer. The authorization code can be generated so that the code only enables treatments of the particular medical device associated with the patient for whom payment was received. For example, the authorization code may be encoded or encrypted so that only the particular medical device associated with the payment can decode or decrypt the authorization code. The authorization code may include or be transmitted with a unique device identifier, and a medical device can be configured to enter an authorization code only

when a device identifier of the medical device matches the device identifier received with an authorization code.

The server system can transmit the authorization code to the medical device (922). The authorization code may be transmitted, for example, over a cellular communication link to the medical device that the server system identified as being associated with the patient.

The medical device can receive the authorization code (924). The authorization code may be a new authorization code that is received after an initial or prior authorization code that authorized different treatments. The new authorization code can be received after the medical device has provided an indication to the patient that more treatments need to be purchased, and the new authorization code can identify a number of additional treatments for which payment has been received.

Referring to Fig. 9B, the medical device can decrypt or decode the authorization code (926). In one implementation, the medical device may decrypt the authorization code using a unique device identifier or decryption key stored on the medical device. The medical device may determine that an authorization code is authentic or intended for the particular medical device that received it. The medical device may determine, using decrypted or decoded data, what treatments are authorized. For example, the medical device may determine that a particular number of treatments are authorized. The medical device may also determine that treatment using the medical device should be modified in some way, for example, that two treatments are authorized each day instead of one treatment each day, or that the intensity of ultrasound produced should be changed.

The medical device can store authorization information (928). For example, the medical device can store the number of treatments that the authorization code indicates should be authorized. The medical device can also store the authorization code received, the authorization information extracted from the received data, and other authorization information. In some instances, treatments using the medical device can be authorized without any input or action by the patient. For example, when a third-party payer sends payment to the server system, the medical device can be authorized without involvement from the patient.

The medical device can determine whether treatment is authorized (929). For example, the medical device can determine whether treatment is authorized based on the

authorization code that was accessed by the medical device. The medical device can determine whether treatment authorized in response to receiving user input that treatment should be provided, in (902) or through later inputs. In the situation that the patient has attempted treatment with the medical device in (902), and subsequently entered payment needed to authorize treatment in (906), the medical device can proceed to apply the treatment after the determination is made that treatment is authorized. For example, the payment and authorization process may occur quickly so that the patient perceives very little delay between entering payment and the initiation of treatment. In one implementation, treatment may begin automatically when the patient has previously attempted to initiate treatment. Treatment may alternatively be delayed until the patient imitates treatment again or confirms that treatment should proceed.

If the determination indicates that treatment is authorized, the medical device can control a driver circuit to apply treatment (930). For example, the medical device may control an ultrasound transducer driver circuit in a manner that causes one or more ultrasound transducers to produce ultrasound with therapeutic properties. For example, the driver circuit can be activated to drive one or more ultrasound transducers. The driver circuit may continue to drive the ultrasound transducers until treatment is complete. Of course, if the determination indicates that treatment is not authorized based on the authorization code (for example, if the authorization code is for a different medical device, or if the treatments authorized by that code have already been expended), the medical device can control the driver circuit so that treatment is not applied, for example, by not activating the driver circuit so that treatment is prevented.

The driver circuit can be deactivated when treatment is finished (932). The medical device can store a record of the treatment applied (934). The medical device can also decrease the number of treatments authorized for the medical device (936). For example, if the medical device had received an authorization code that authorized twenty treatments of the medical device, after one treatment is completed, the medical device may update the number of authorized treatments to reflect that only nineteen treatments are currently authorized for the medical device.

Referring to Fig. 10, a process 1000 for storing patient information can begin with a physician writing a prescription for a patient for treatment using a medical device (1002). To

carry out the prescribed treatment, a medical device can be dispensed to the patient (1004). The medical device can be authorized at the time the medical device is dispensed or at a later time.

Records for the patient and the dispensed medical device can be entered into a database 1014 (1006). For example, the database 1014 may store a patient record 1010 that associates a particular medical device or treatment with a particular patient, in the example, a patient named "John Smith." The database 1014 may also store a prescription record 1012 that indicates the number of treatments that can be purchased for the patient. The number of treatments indicated in a prescription record 1012 may be authorized for application by the medical device after payment has been received for the prescribed treatments. For example, the treatments can be enabled after a third-party payer agrees to pay for the treatments or after the patient enters payment at the medical device. The database 1014 may also store other records including records that identify patient identifiers and medical device identifiers.

The information in the database can be accessed by one or more client devices 1018, 1020, a server system 1022, or other systems. For example, the server system 1022 may use the patient record 1010 to match payment to a particular medical device or patient. The records stored in the database 1014 may also be used to inform a third-party payer or patient the number of treatments that should be purchased to enable a treatment plan to be carried out.

Referring to Fig. 11, the authorized use of the medical device 10 can be limited to a particular patient and/or geographic area. In some instances, it is desirable by an automated method to limit the use of a medical device by an unauthorized person or in an unauthorized geographic area, such as in a country where the device has not received regulatory approval or in which an unauthorized sale of the device circumvents the chain of distribution of the device. Other examples where "geolocking" of a medical device may be desirable is where devices are sold at different price points in different regions and it is desirable to limit the ability of a lower priced device to be sold in a higher priced region, where device have region specific chargers, include specific languages, or are designed for single patient use or multiple patient use such as in some hospitals.

It is also desirable to limit a single patient use device from being shared with other than the intended patient by, for example, resale or shared use with friends or family

members, particularly where the device is a prescription device. The desire to limit such use is particularly applicable to medical devices such as the Exogen™ Ultrasound Bone Healing System sold by Smith & Nephew, Inc. that is easily transported.

To limit, and preferably prevent, the use of a medical device 10 (Fig. 11) in an unauthorized geographic area, the medical device 10 includes hardware and software that determine the geographical location of the medical device 10 upon start-up and compare the determined geographical location to an authorized geographical location. The authorized geographical location can be, for example, programmed in the medical device 10 during the manufacturing process. Referring to Fig. 12, the medical device 10 include a GPS receiver 1210 to determine geographical location, and memory 1214 to store authorized operating areas for the medical device 10. Alternatively, the medical device 10 can use cell phone networks or Wi-Fi to determine geographical location.

Referring to Fig. 13, the location of the medical device 10 is compared to an approved area 1318 in which treatment is authorized. If the geographical location 1320 of the device 10 is within the authorized area 1318, treatment begins. If the geographical location 1322 of the device 10 is in an unauthorized area 1324, no treatment is delivered. The device can include two-way communication, such as cellular, internet or wireless communication. To accommodate patient travel, the medical device 10 can be configured to accept over-the-air-updates to the authorized geographical location.

As illustrated in Fig. 14, for "geolocking" purposes, the medical device 10 includes the GPS receiver 1412, an antenna 1430 connected to the GPS receiver 1412 via an amplifier 1432 and a filter 1434, and a crystal 1436, an integrated circuit 1438, and a regulator 1440.

Advantageously, a medical device can be designed for use within only a specific geographical area, for example, a country or region as illustrated in Fig. 13, such that use of the device in unintended markets is limited or prevented.

To limit, and preferably prevent, the use of the medical device 10 by an unauthorized person, the medical device 10 requires proof of patient identity using, for example, a key card or token issued to the user, a password, or physical evidence. For example, referring to Fig. 2, the medical device 10 includes hardware and software and a user interface 70 implemented on the device to identify the patient using a fingerprint, retinal scan, or voice recognition.

The identity of the user is compared to the stored patient identity and treatment is only authorized when the user is confirmed to be the patient.

As illustrated in Fig. 15, for device authorization purposes, the medical device 10 includes, for example, a fingerprint sensor 1552, control electronics such as an integrated circuit 1554, and an EPROM 1556.

Advantageously, the use of a fingerprint, retinal scan, or voice recognition ensures that the patient is at least present during the treatment. In situations where the patient is, for example, young or elderly, the identity of a supervising individual can alternatively or additionally be required. The fingerprint, voice or retinal scan of the authorized user is saved into the memory of the device when the device is prescribed and fitted by a responsible party, for example, a doctor, pharmacist or sales representative.

Referring to Fig. 16, a method for limiting unauthorized use of the medical device 10 includes determining the geographic location of the medical device 10 and not allowing treatment to commence if the determined geographic location is outside an authorized geographic location, and/or includes determining user identity and not allowing treatment to commence if the determined user identity does not match an authorized identity. The medical device 10 includes means for determining the geographic location of the medical device 10 and means for determining user identity. Treatment is not allowed to commence if either the determined geographic location is outside an authorized geographic location or the determined user identity does not match an authorized identity.

In use, the patient turns the device 10 on at step 1660, the device performs a self-test of the clock and configuration at step 1662, the patient, for example, scans his or her index finger over the fingerprint sensor 1552, and the device confirms the patient identity at step 1664. If the patient is the authorized user, the geographical location of the device is checked at step 1666. If the patient is not the authorized user, an authorization alarm is delivered at step 1668 and treatment will not commence. If the patient is the authorized user and the device 10 is within its authorized geographical location treatment can be started at step 1670. If the device 10 is not within its authorized geographical location, an authorization alarm is delivered at step 1668 and treatment will not commence.

At steps 1672, 1674 and 1676, the device 10 monitors the time of use, allowing up to 20 minutes of treatment to be delivered before ending treatment.

The techniques described above are not limited to any particular hardware or software configuration. Rather, they may be implemented using hardware, software, or a combination of both. The methods and processes described may be implemented as computer programs that are executed on programmable computers comprising at least one processor and at least one data storage system. The programs may be implemented in a high-level programming language and may also be implemented in assembly or other lower level languages, if desired.

Any such program will typically be stored on a computer-usable storage medium or device (e.g., CD-ROM, RAM, or magnetic disk). When read into the processor of the computer and executed, the instructions of the program cause the programmable computer to carry out the various operations described above.

A number of implementations have been described. Nevertheless, it will be understood that various modifications may be made. For example, the described features of presentation of messages selected for a particular patient, the collection and display of compliance information, and treatment authorization, and medical device locking based on identity or geographical location may be implemented for a single medical device. In addition, any subset of the features described can be implemented. Each of the message presentation, compliance information collection and display, treatment authorization, and medical device locking features may be implemented individually, separate from the other features described, or together in any combination.

Accordingly, other implementations are within the scope of the following claims.

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.

2011316599 18 Apr 2018

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A medical device comprising:

at least one treatment source configured to couple to damaged tissue and apply therapy to the damaged tissue to stimulate healing;

a memory device configured to store authorization data, the authorization data being usable to determine that a patient is authorized to use the at least one treatment source in a first geographic area and unauthorized to use the at least one treatment source in a second geographic area;

a communication module configured to receive an update to the authorization data via a communication network, the update being usable to determine that the patient is authorized to use the at least one treatment source in the second geographic area; and

at least one processing device configured to:

prior to receiving the update with the communication module,

determine from the authorization data that the patient is authorized to use the at least one treatment source in the first geographic area and unauthorized to use the at least one treatment source in the second geographic area,

receive a first user input indicating to initiate therapy with the at least one treatment source,

determine a first location of the at least one treatment source in response to receiving the first user input,

permit application of therapy by the at least one treatment source in response to determining that the patient is authorized to use the at least one treatment source and that the first location is in the first geographic area,

receive a second user input indicating to initiate therapy with the at least one treatment source,

determine a second location of the at least one treatment source in response to receiving the second user input, and

prevent application of therapy by the at least one treatment source in response to determining that the second location is in the second geographic area,

receive the update with the communication module, and

subsequent to receiving the update with the communication module,

determine from the authorization data and the update that the patient is authorized to use the at least one treatment source in the second geographic area,

receive a third user input indicating to initiate therapy with the at least one treatment source,

determine a third location of the at least one treatment source in response to receiving the third user input, and

permit application of therapy by the at least one treatment source in response to determining that the patient is authorized to use the at least one treatment source and that the third location is in the second geographic area.

2. The medical device of claim 1, wherein the communication network is a wireless communication network.

3. The medical device of claim 2, wherein the wireless communication network is a cellular wireless communication network.

4. The medical device of claim 1, wherein:

the memory device stores a device identifier;

the authorization data is encrypted; and

the at least one processing device is further configured to decrypt the authorization data using the device identifier.

5. The medical device of claim 1, further comprising a sensor configured to receive a first authentication input from the patient, wherein:

the at least one processing device is configured to:

prior to receiving the update with the communication module,

determine from the first authentication input that the patient is using the at least one treatment source, and

permit application of therapy by the at least one treatment source in response to determining that (i) the patient is authorized to use the at least one treatment source, (ii) that the first location is in the first geographic area, and (iii) the patient is using the at least one treatment source, and

subsequent to receiving the update with the communication module,

determine from the first authentication input that the patient is using the at least one treatment source, and

permit application of therapy by the at least one treatment source in response to determining that (i) the patient is authorized to use the at least one treatment source, (ii) that the third location is in the second geographic area, and (iii) the patient is using the at least one treatment source.

6. The medical device of claim 5, wherein the first authentication input comprises a fingerprint image.

7. The medical device of claim 5, wherein the first authentication input comprises a retinal image.

8. The medical device of claim 5, wherein the first authentication input comprises a voice recording.

9. The medical device of claim 5, wherein:

the sensor is configured to receive a second authentication input from an individual other than the patient;

and the at least one processing device is configured to:

prior to receiving the update with the communication module,

determine from the second authentication input that the patient is attended to by the individual while using the at least one treatment source, and

permit application of therapy by the at least one treatment source in response to determining that (i) the patient is authorized to use the at least one treatment source, (ii) that the first location is in the first geographic area, (iii) the patient is using the at least one treatment source, and (iv) the patient is attended to by the individual while using the at least one treatment source, and

subsequent to receiving the update with the communication module,

determine from the second authentication input that the patient is attended to by the individual while using the at least one treatment source, and

permit application of therapy by the at least one treatment source in response to determining that (i) the patient is authorized to use the at least one treatment source, (ii) that the third location is in the second geographic area, (iii) the patient is using the at least one treatment source, and (iv) the patient is attended to by the individual while using the at least one treatment source.

10. The medical device of claim 1, further comprising an alarm indicator, wherein:

the at least one processing device is configured to:

prior to receiving the update with the communication module, activate the alarm indicator in response to determining that the second location is in the second geographic area.

11. The medical device of claim 1, wherein:

the at least one treatment source comprises a driver circuit configured to control application of therapy to the damaged issue; and

the at least one processing device is configured to permit application of therapy by activating the driver circuit.

12. The medical device of claim 1, wherein:

the at least one treatment source comprises a driver circuit configured to control application of therapy to the damaged issue; and

the at least one processing device is configured to permit application of therapy by not deactivating the driver circuit.

13. The medical device of claim 1, wherein:

the at least one treatment source comprises a driver circuit configured to control application of therapy to the damaged issue; and

the at least one processing device is configured to prevent application of therapy by not activating the driver circuit.

14. The medical device of claim 1, wherein:

the at least one treatment source comprises a driver circuit configured to control application of therapy to the damaged issue; and

the at least one processing device is configured to prevent application of therapy by deactivating the driver circuit.

15. The medical device of claim 1, wherein:

the at least one treatment source comprises a driver circuit configured to control application of therapy to the damaged issue; and

the at least one processing device is configured to prevent application of therapy by setting an output of the driver circuit.

16. The medical device of claim 1, wherein the communication module is configured to receive the update via the communication network from a server system.

17. The medical device of claim 1, further comprising a GPS receiver configured to determine a geographical location of the at least one treatment source, and the at least one processing device is configured to determine the first location from the GPS receiver.

18. The medical device of claim 1, further comprising a user interface configured to receive the first user input, the second user input, and the third user input as selections of at least one element of the user interface.

19. A computer-implemented method comprising:

determining from authorization data that a patient is authorized to use at least one treatment source of a medical device in a first geographic area, the authorization data being accessed from a memory device of the medical device and usable to determine that the patient is authorized to use the at least one treatment source in the first geographic area and unauthorized to use the at least one treatment source in a second geographic area, the at least one treatment source being configured to couple to damaged tissue of the patient;

receiving a first user input indicating to initiate therapy with the at least one treatment source;

determining a first location of the at least one treatment source in response to receiving the first user input;

performing therapy to the damaged issue to stimulate healing in response to determining that the patient is authorized to use the at least one treatment source and that the first location is in the first geographic area;

receiving an update to the authorization data via a communication network, the update being usable to determine that the patient is authorized to use the at least one treatment source in the second geographic area;

determining from the authorization data and the update that the patient is authorized to use the at least one treatment source in the second geographic area;

receiving a second user input indicating to initiate therapy with the at least one treatment source;

determining a second location of the at least one treatment source in response to receiving the second user input; and

performing therapy to the damaged issue to stimulate healing in response to determining that the patient is authorized to use the at least one treatment source and that the second location is in the second geographic area.

20. The computer-implemented method of claim 19, wherein the communication network is a wireless communication network.

21. The computer-implemented method of claim 20, wherein the wireless communication network is a cellular wireless communication network.

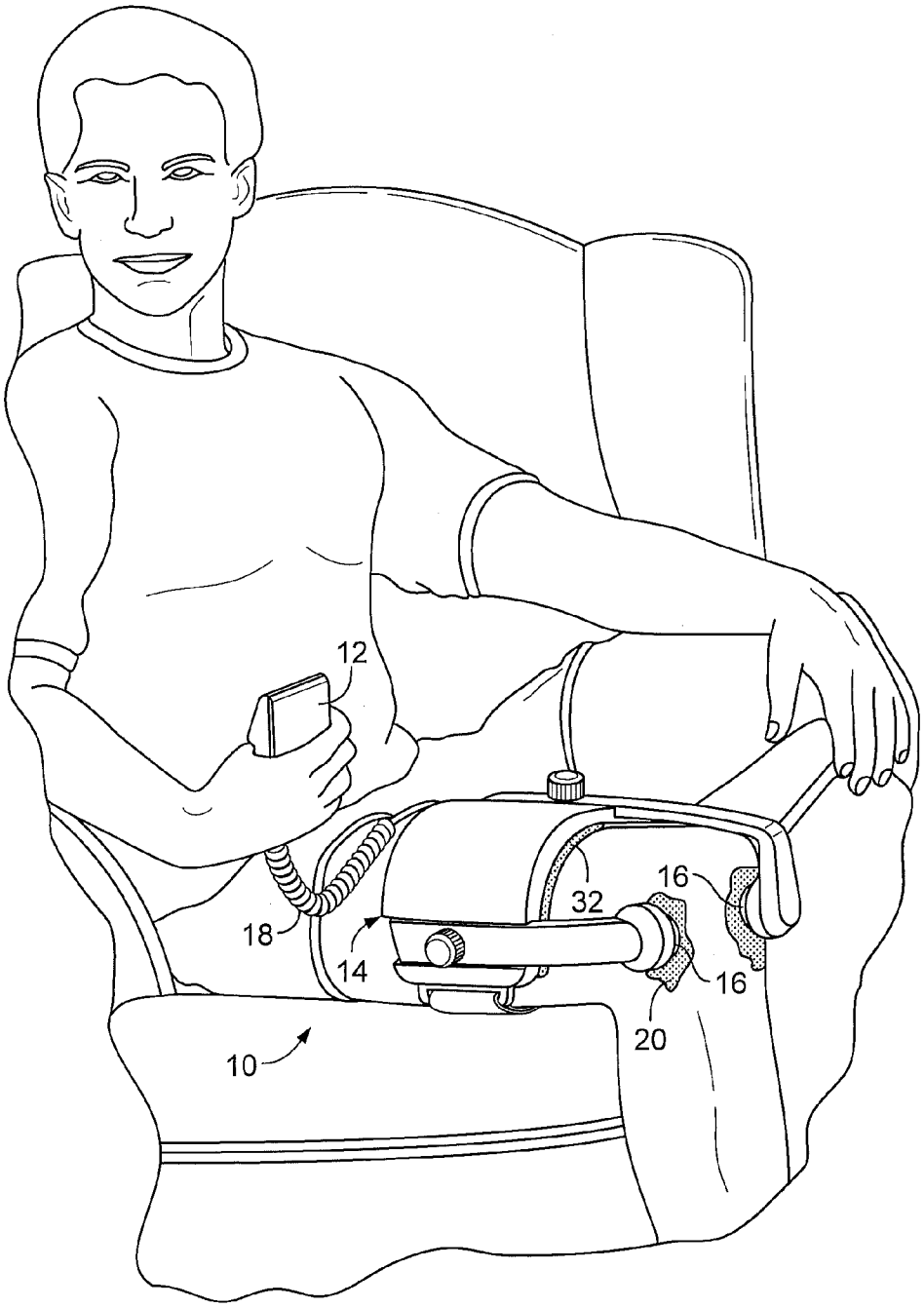

FIG. 1

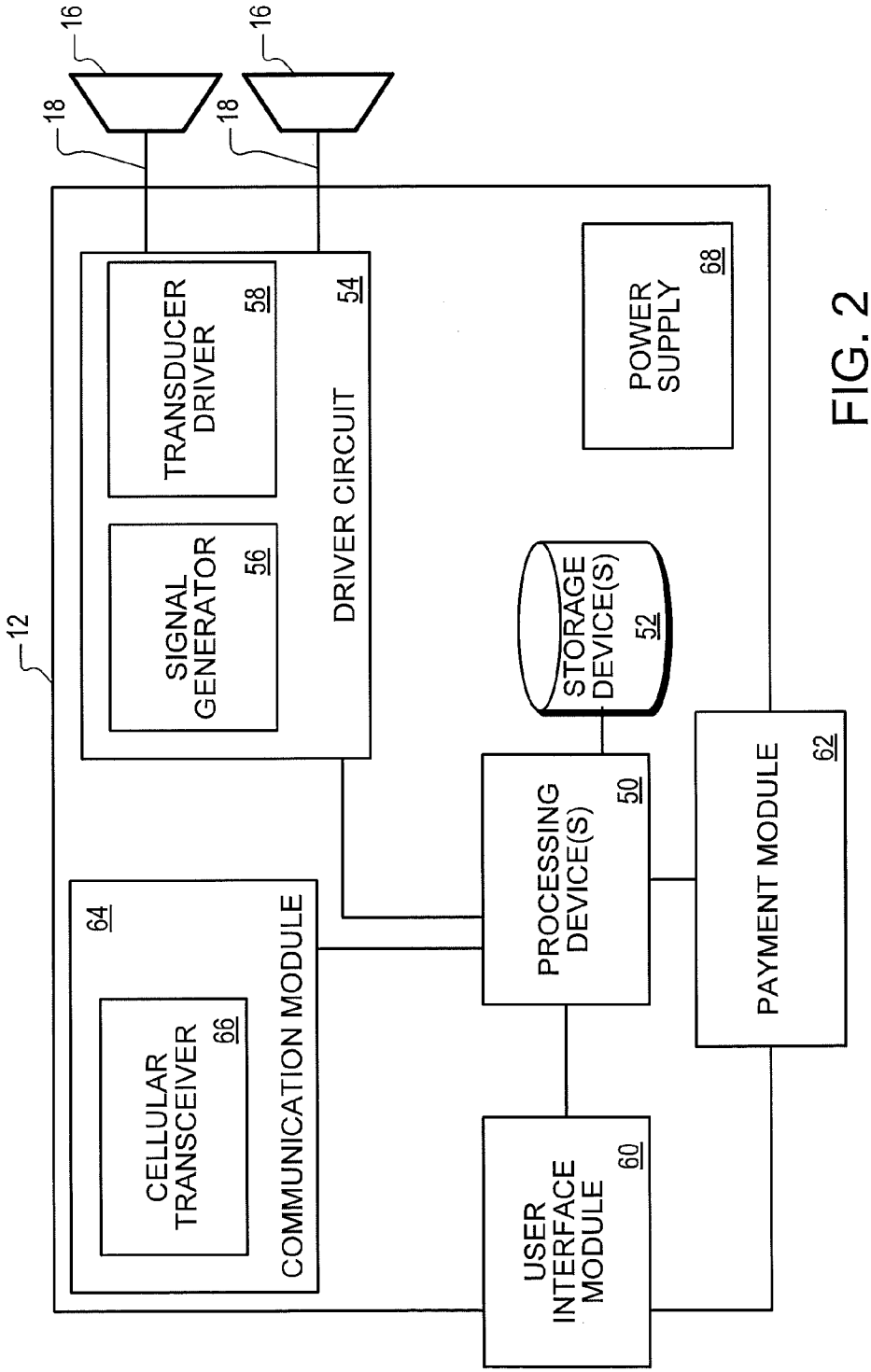
16
16
18
18
12
TRANSDUCER DRIVER
58
SIGNAL GENERATOR
56
DRIVER CIRCUIT
54
POWER SUPPLY
68
STORAGE DEVICE(S)
52
PROCESSING DEVICE(S)
50
PAYMENT MODULE
62
64
CELLULAR TRANSCEIVER
66
COMMUNICATION MODULE
USER INTERFACE MODULE
60

FIG. 2

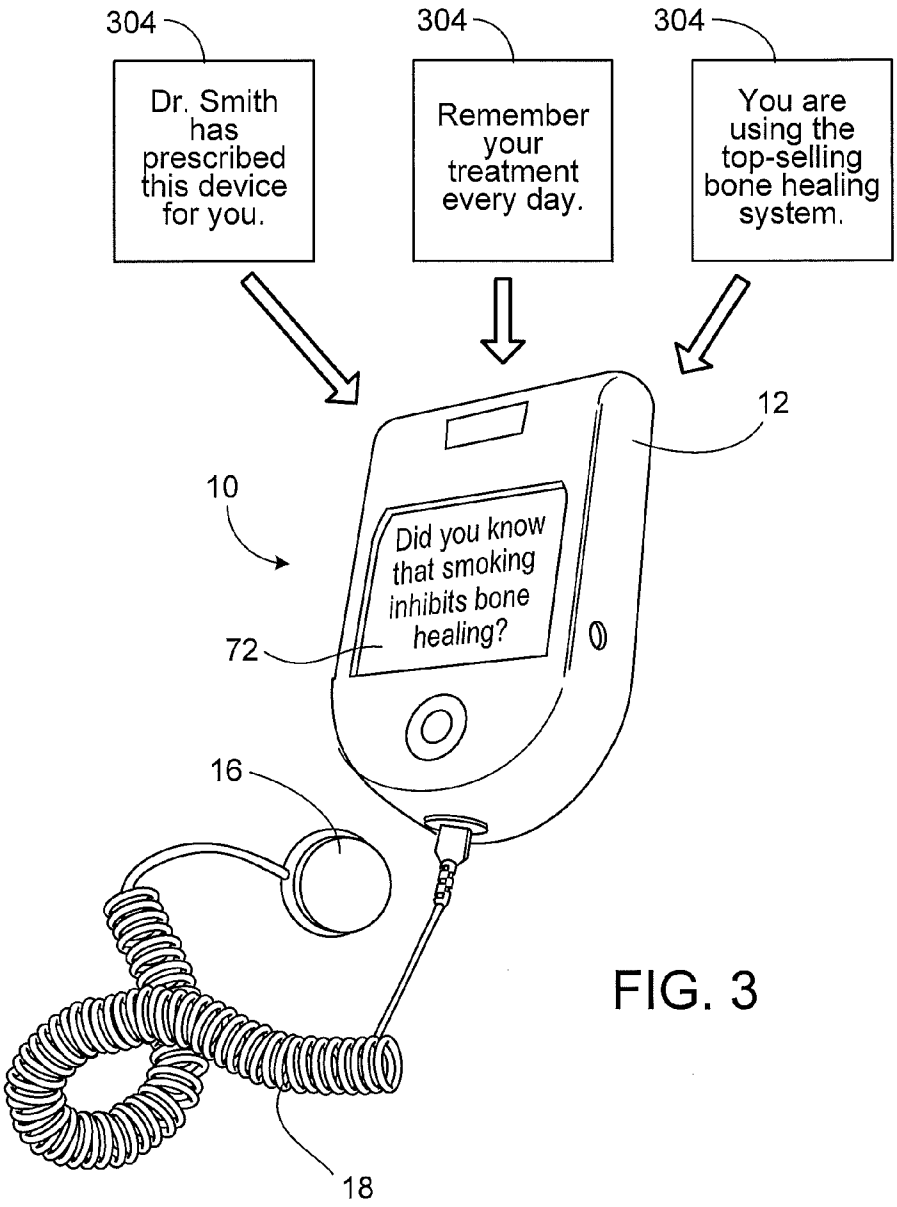
304
Dr. Smith has prescribed this device for you.
304
Remember your treatment every day.
304
You are using the top-selling bone healing system.
12
10
Did you know that smoking inhibits bone healing?
72
16
18

FIG. 3

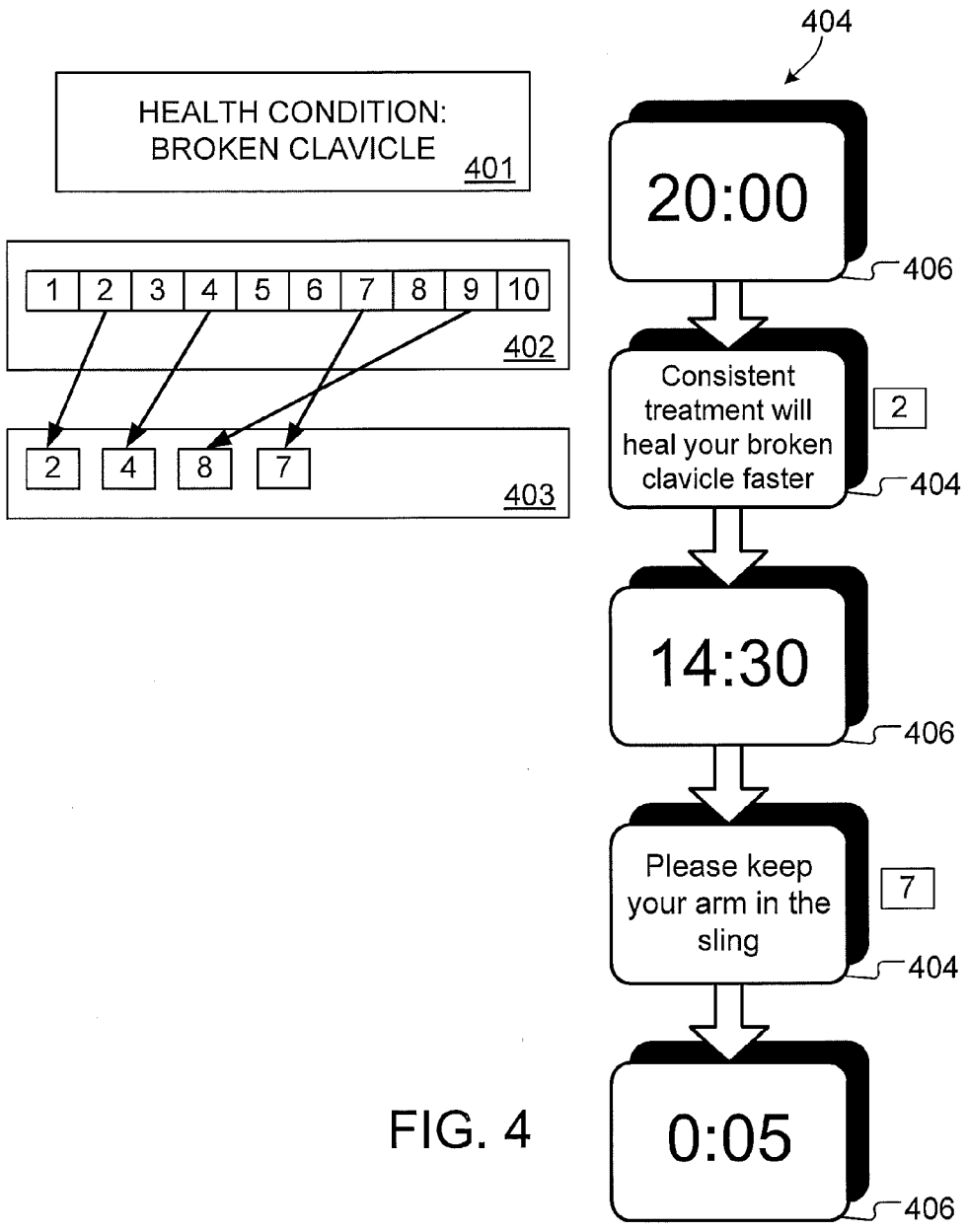
HEALTH CONDITION:
BROKEN CLAVICLE
401
1 2 3 4 5 6 7 8 9 10
402
2 4 8 7
403
404
20:00
406
Consistent treatment will heal your broken clavicle faster
2
404
14:30
406
Please keep your arm in the sling
7
404
0:05
406

FIG. 4

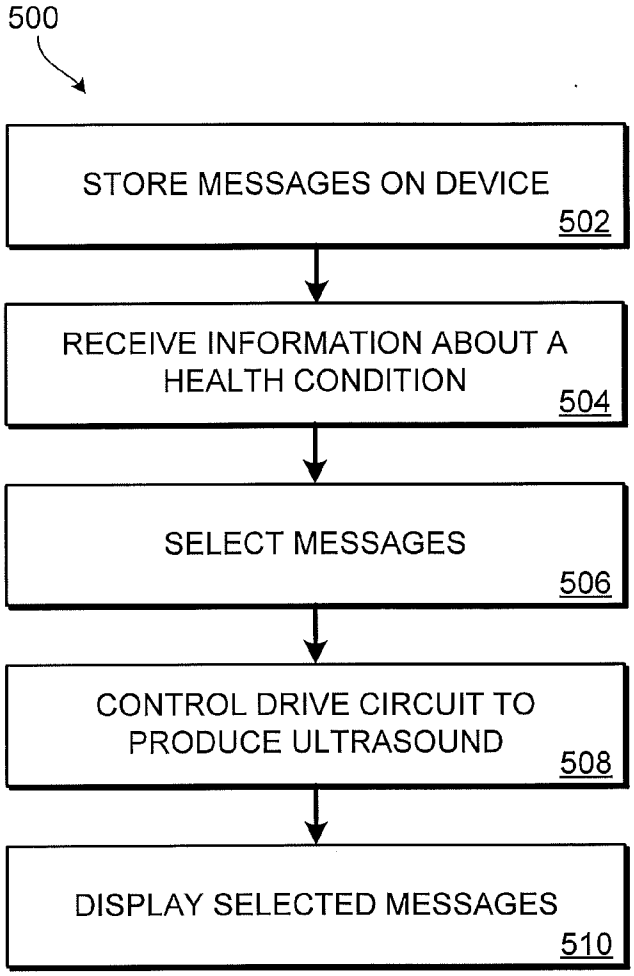
500
STORE MESSAGES ON DEVICE
502
RECEIVE INFORMATION ABOUT A HEALTH CONDITION
504
SELECT MESSAGES
506
CONTROL DRIVE CIRCUIT TO PRODUCE ULTRASOUND
508
DISPLAY SELECTED MESSAGES
510

FIG. 5

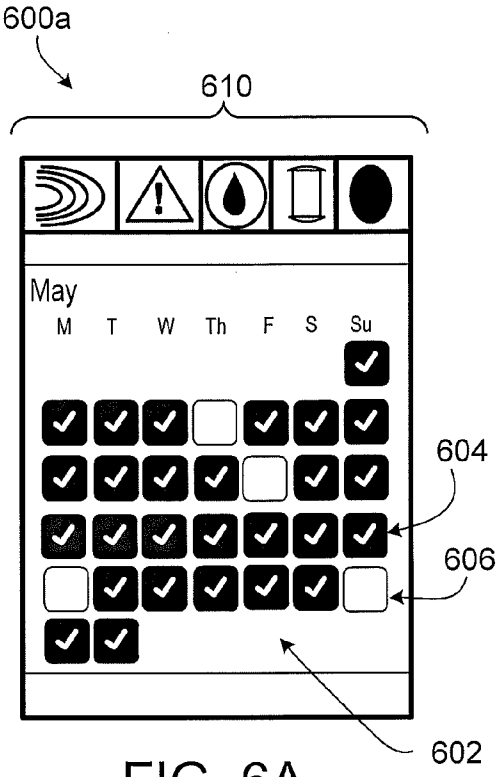

FIG. 6A

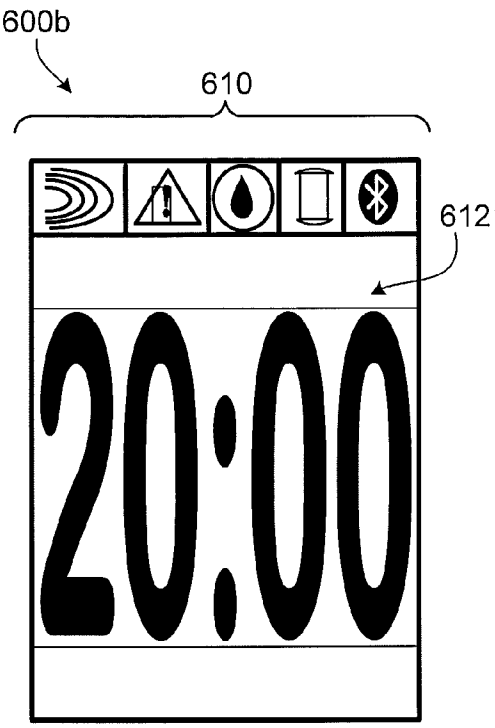

FIG. 6B

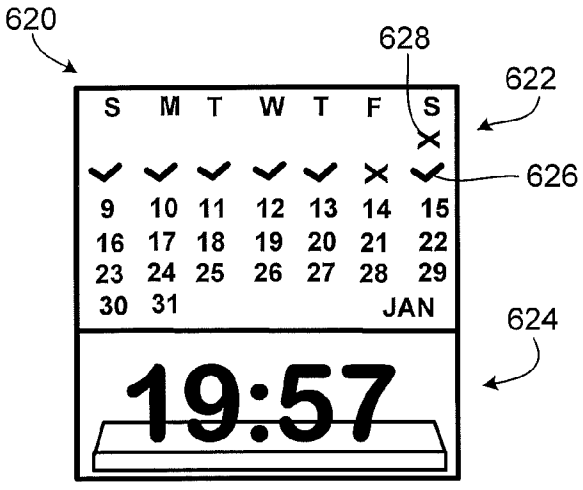

FIG. 6C

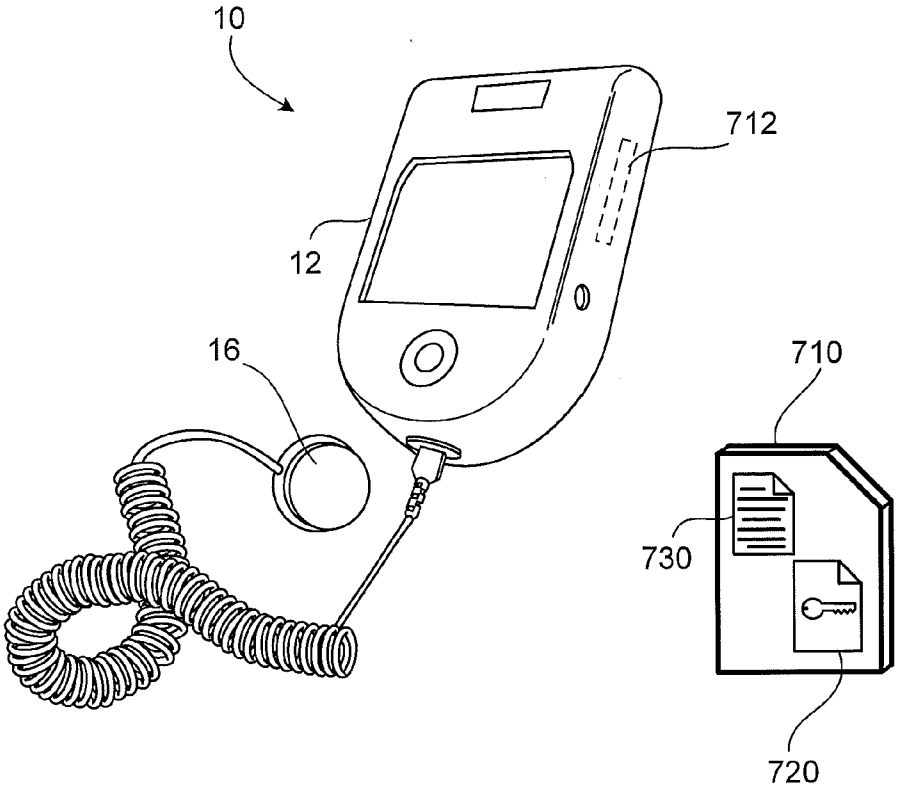

FIG. 7

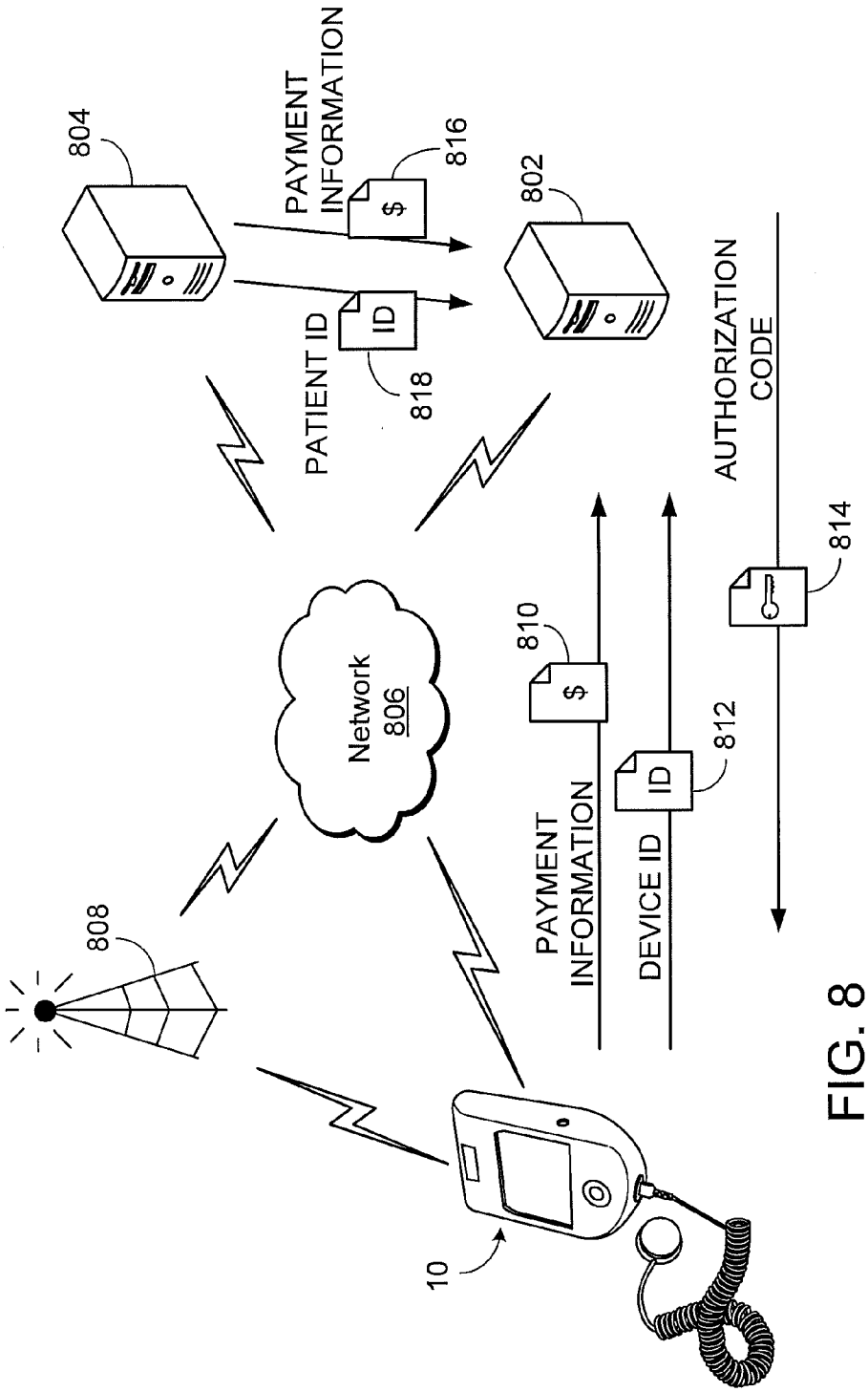
804
PAYMENT INFORMATION
816
802
PATIENT ID
ID
818
AUTHORIZATION CODE
814
Network 806
810
812
PAYMENT INFORMATION
DEVICE ID
808
10

FIG. 8

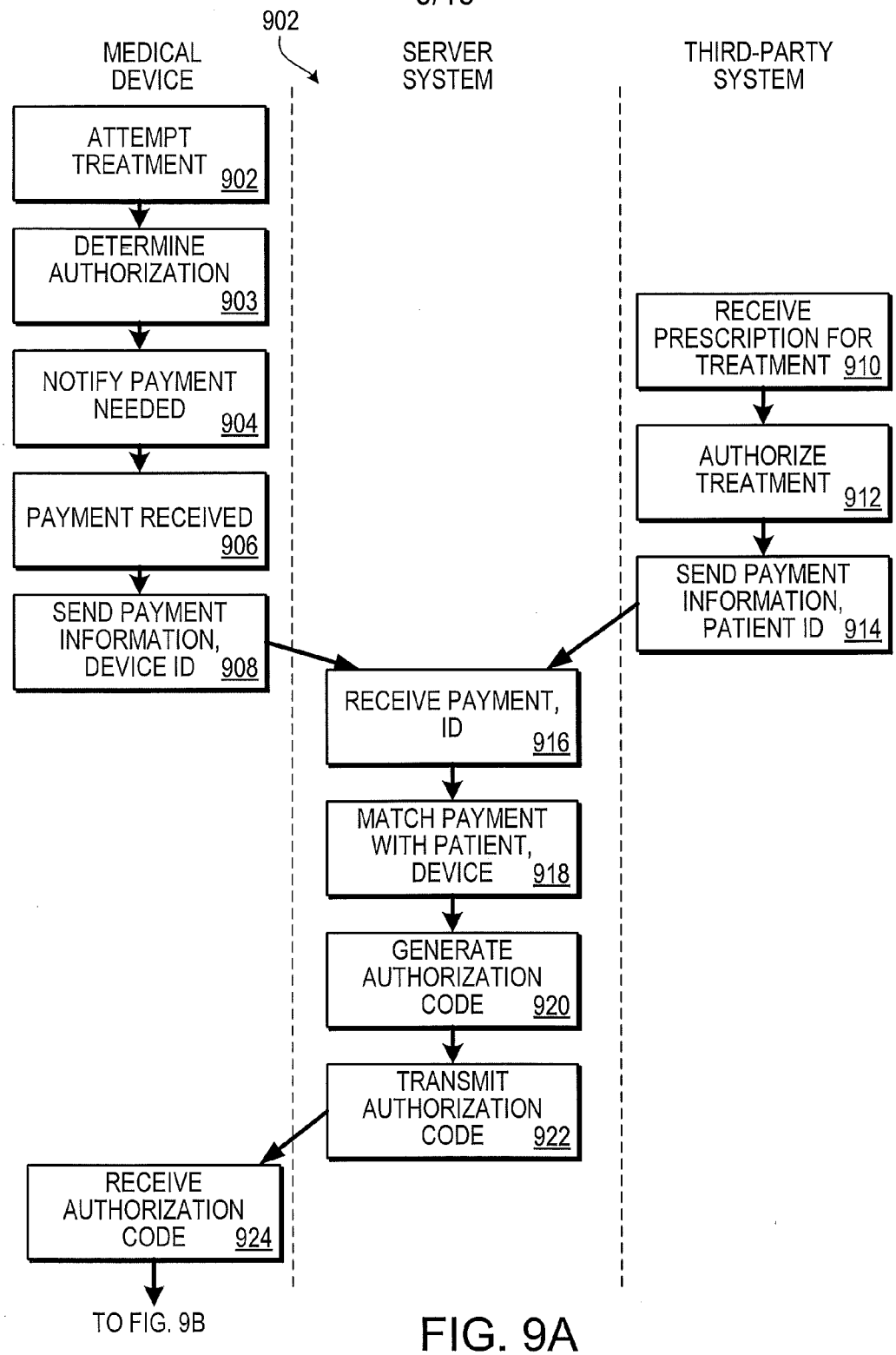
902
MEDICAL DEVICE
SERVER SYSTEM
THIRD-PARTY SYSTEM
ATTEMPT TREATMENT 902
DETERMINE AUTHORIZATION 903
NOTIFY PAYMENT NEEDED 904
PAYMENT RECEIVED 906
SEND PAYMENT INFORMATION, DEVICE ID 908
RECEIVE PRESCRIPTION FOR TREATMENT 910
AUTHORIZE TREATMENT 912
SEND PAYMENT INFORMATION, PATIENT ID 914
RECEIVE PAYMENT, ID 916
MATCH PAYMENT WITH PATIENT, DEVICE 918
GENERATE AUTHORIZATION CODE 920
TRANSMIT AUTHORIZATION CODE 922
RECEIVE AUTHORIZATION CODE 924
TO FIG. 9B

FIG. 9A

FROM FIG. 9A

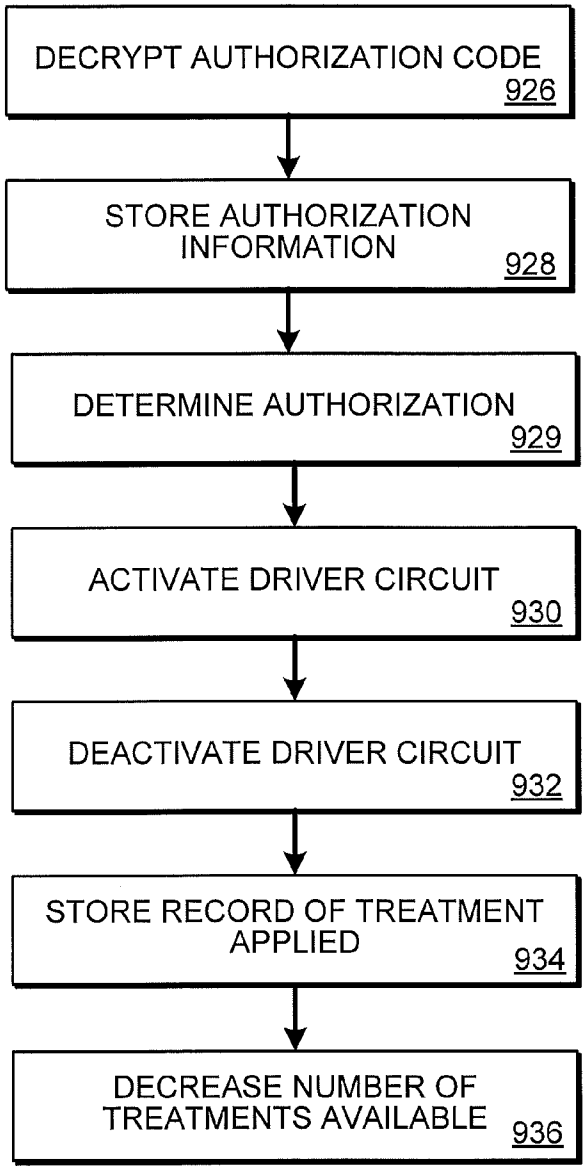

FIG. 9B

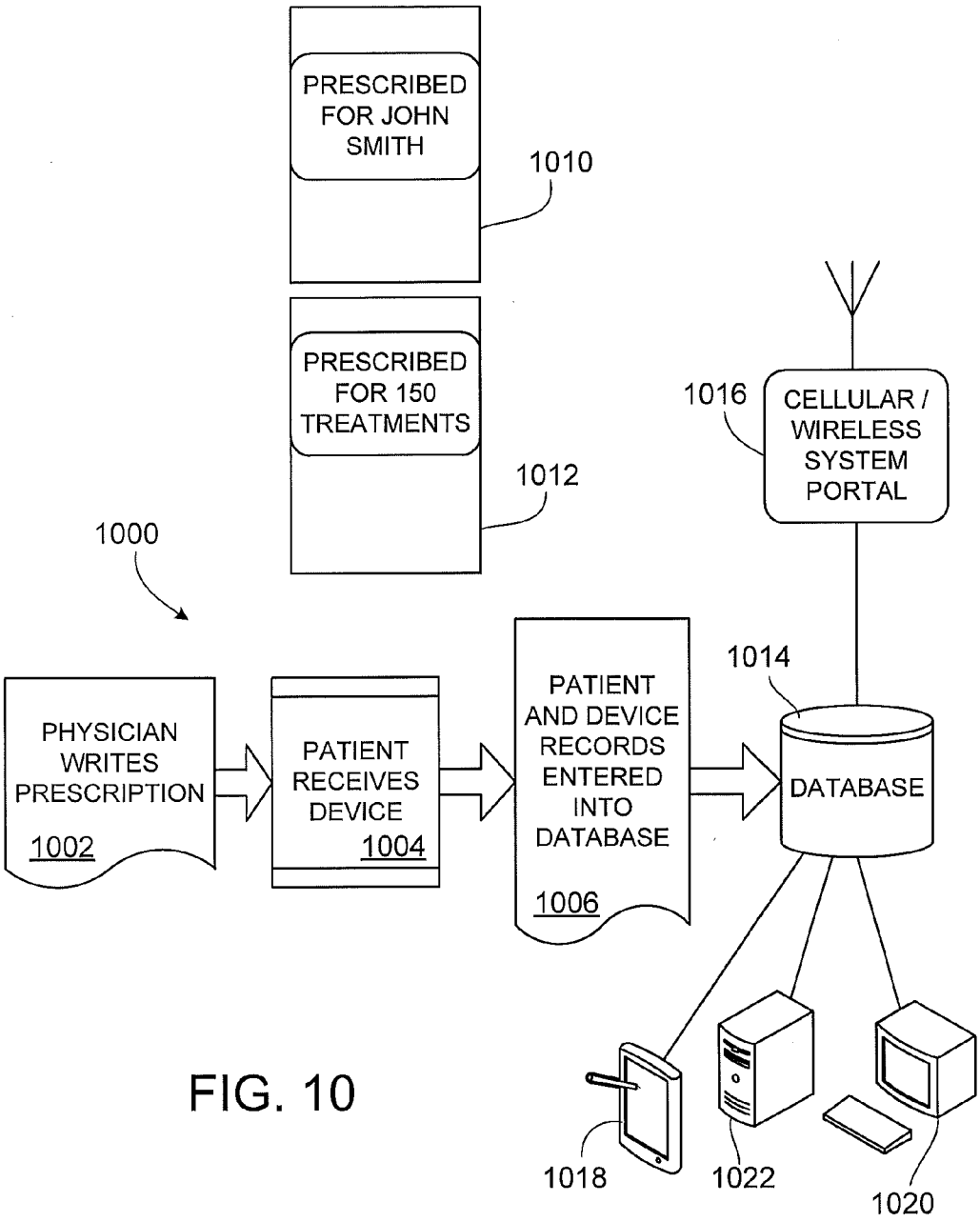
PRESCRIBED FOR JOHN SMITH
1010
PRESCRIBED FOR 150 TREATMENTS
1012
1000
1016
CELLULAR / WIRELESS SYSTEM PORTAL
1014
PHYSICIAN WRITES PRESCRIPTION
1002
PATIENT RECEIVES DEVICE
1004
PATIENT AND DEVICE RECORDS ENTERED INTO DATABASE
1006
DATABASE
1018
1022
1020

FIG. 10

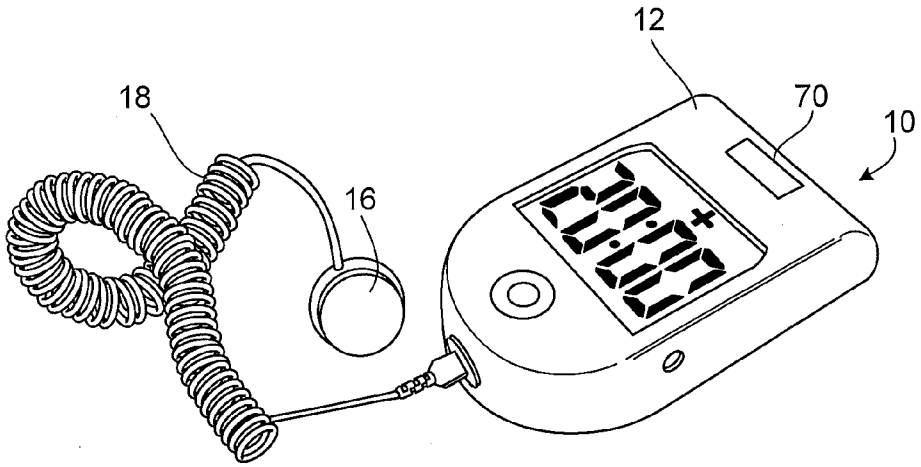

FIG. 11

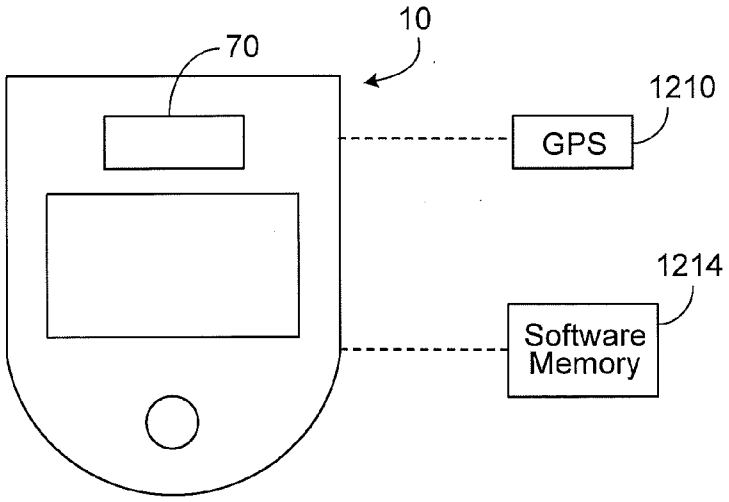

FIG. 12

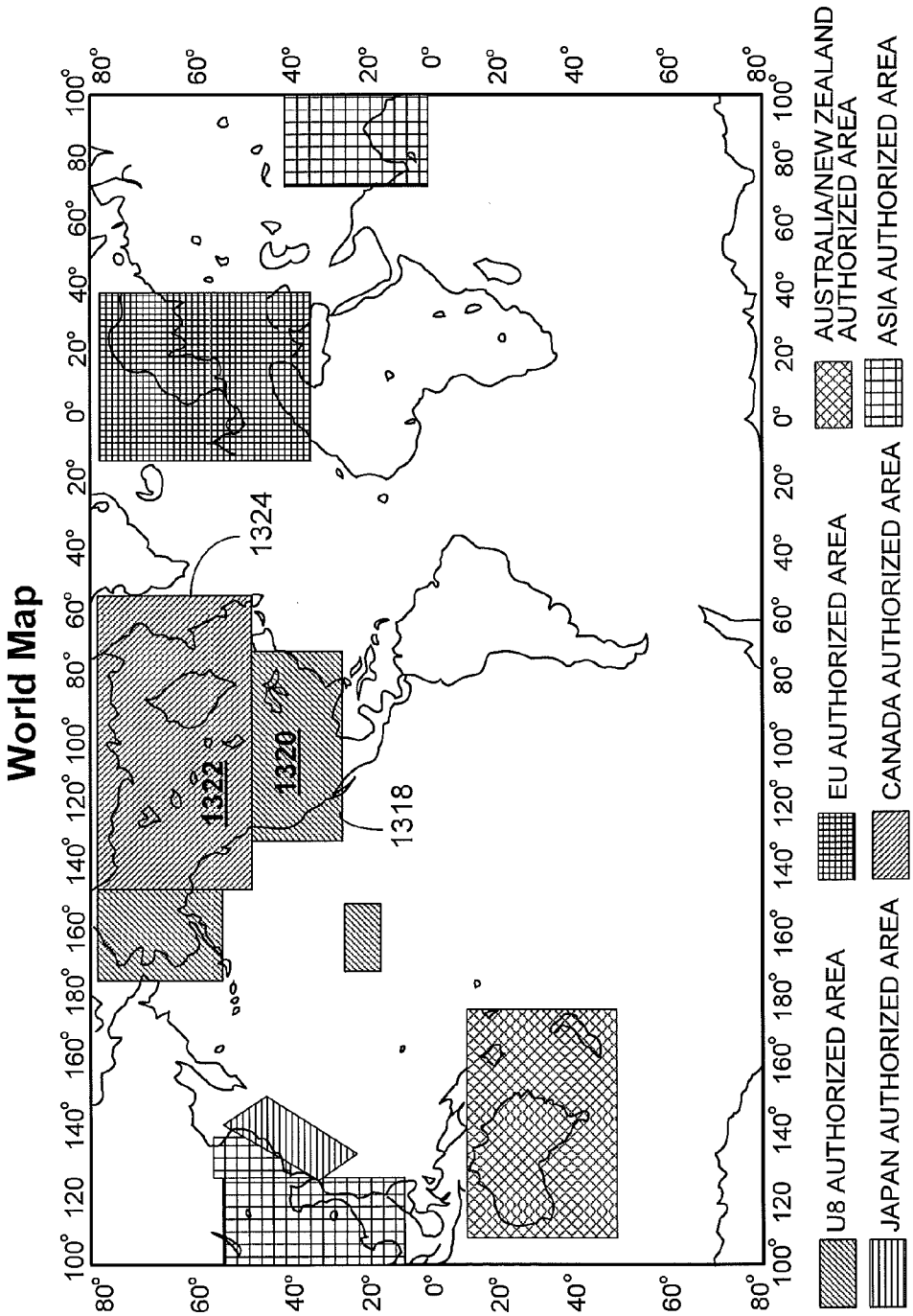
World Map
1324
1322
1320
1318
U8 AUTHORIZED AREA
EU AUTHORIZED AREA
CANADA AUTHORIZED AREA
JAPAN AUTHORIZED AREA
AUSTRALIA/NEW ZEALAND AUTHORIZED AREA
ASIA AUTHORIZED AREA

FIG. 13

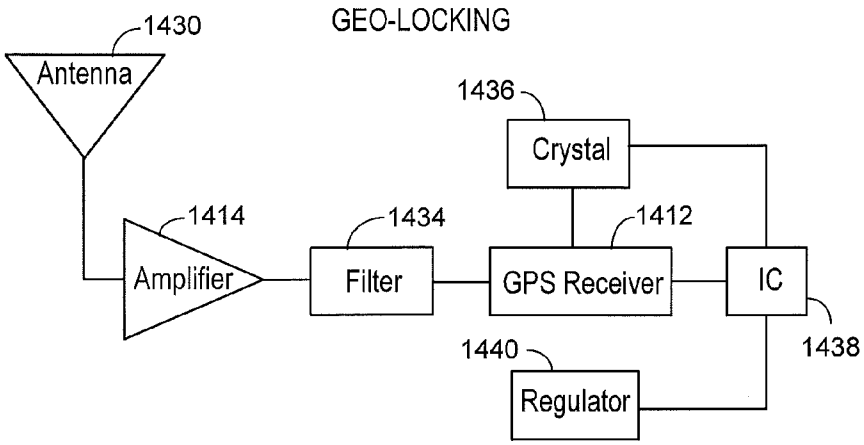
GEO-LOCKING
1430
Antenna
1436
Crystal
1414
Amplifier
1434
Filter
1412
GPS Receiver
IC
1438
1440
Regulator

FIG. 14

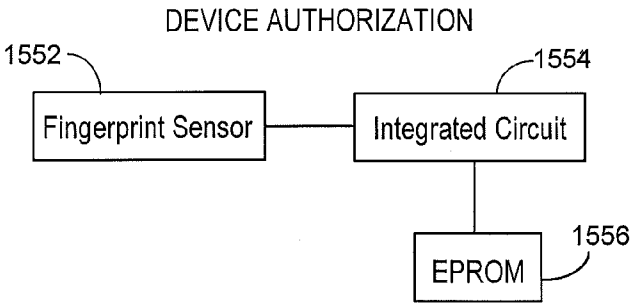
DEVICE AUTHORIZATION
1552
Fingerprint Sensor
1554
Integrated Circuit
1556
EPROM

FIG. 15

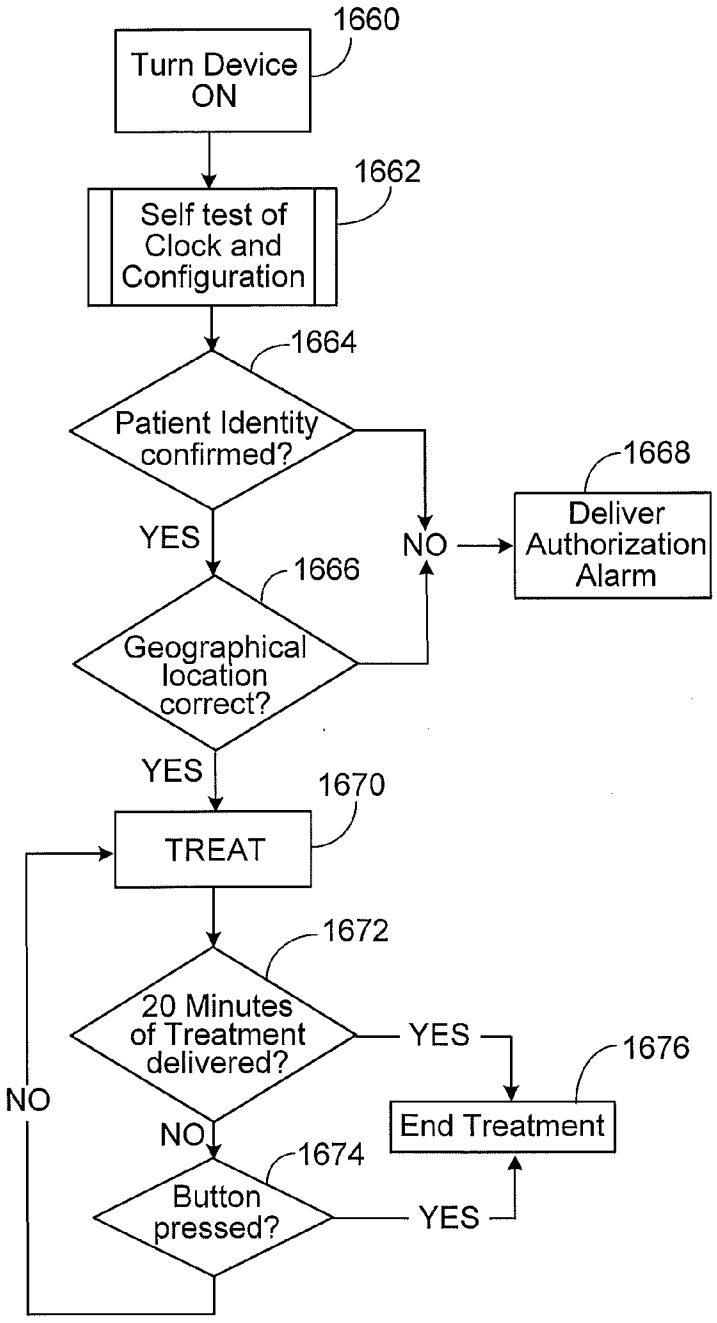
1660
Turn Device ON
1662
Self test of Clock and Configuration
1664
Patient Identity confirmed?
YES
NO
1668
Deliver Authorization Alarm
1666
Geographical location correct?
YES
1670
TREAT
1672
20 Minutes of Treatment delivered?
YES
1676
End Treatment
NO
NO
1674
Button pressed?
YES

FIG. 16