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(54) **PULSE OXIMETER ACCESS APPARATUS
AND METHOD**

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2562/221 (2013.01); A61B 2562/222 (2013.01)

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(57) **ABSTRACT**

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Jan. 27, 2009, now Pat. No. 9,072,474, which is a
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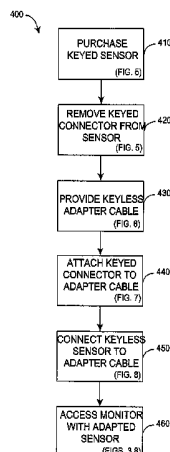
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(52) **U.S. Cl.**

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2560/0266 (2013.01); **A61B 2560/0475**

Access is provided to certain pulse oximetry systems uti-
lizing a keyed sensor and a corresponding locked sensor port
of a restricted access monitor. In such systems, the keyed
sensor has a key comprising a memory element, and the
monitor has a memory reader associated with the sensor
port. The monitor is configured to function only when the
key is in communications with the locked sensor port, and
the memory reader is able to retrieve predetermined data
from the memory element. The monitor is accessed by
providing the key separate from the keyed sensor, integrat-
ing the key into an adapter cable, and connecting the adapter
cable between the sensor port and an unkeyed sensor so that
the monitor functions with the unkeyed sensor.

6 Claims, 6 Drawing Sheets



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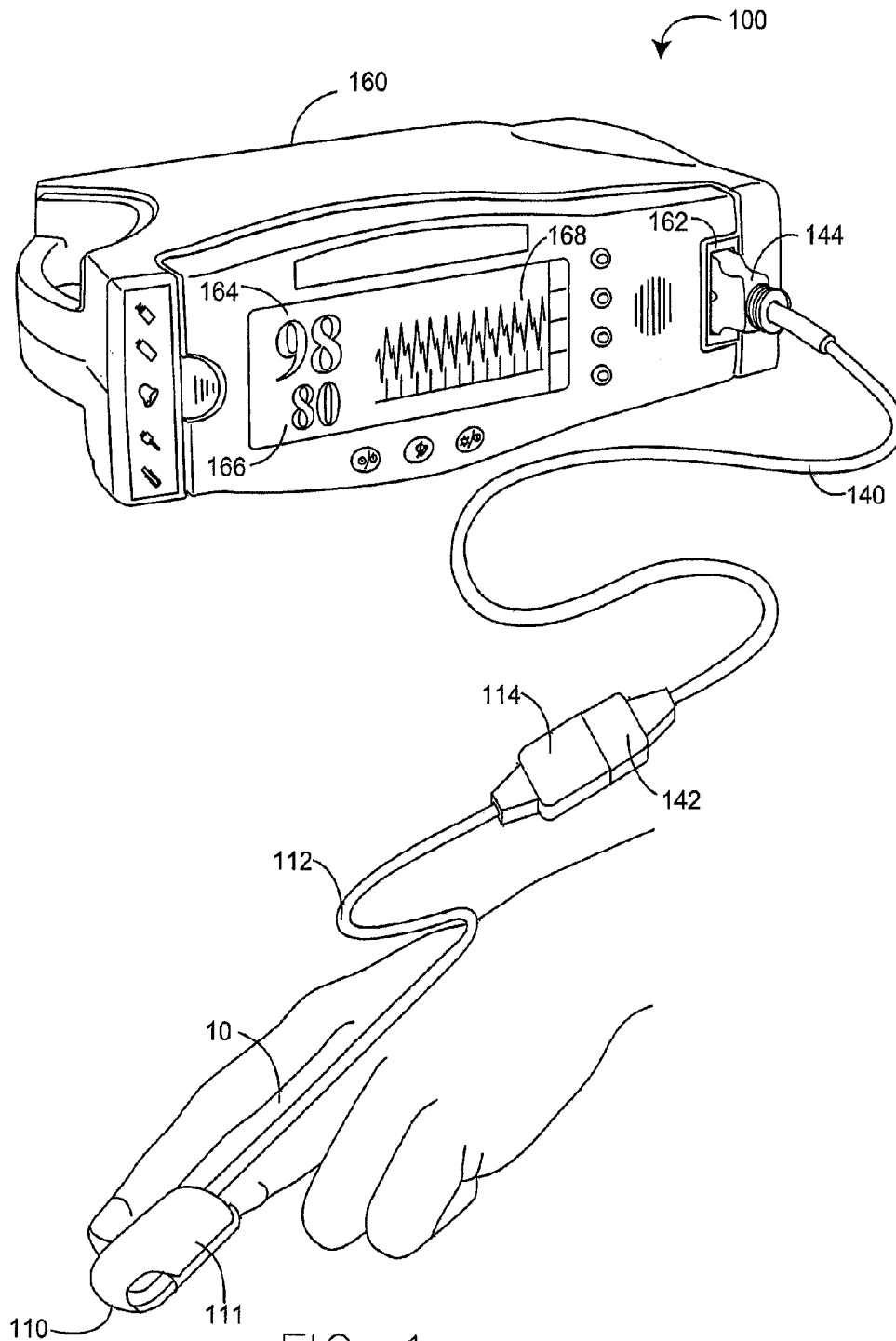


FIG. 1

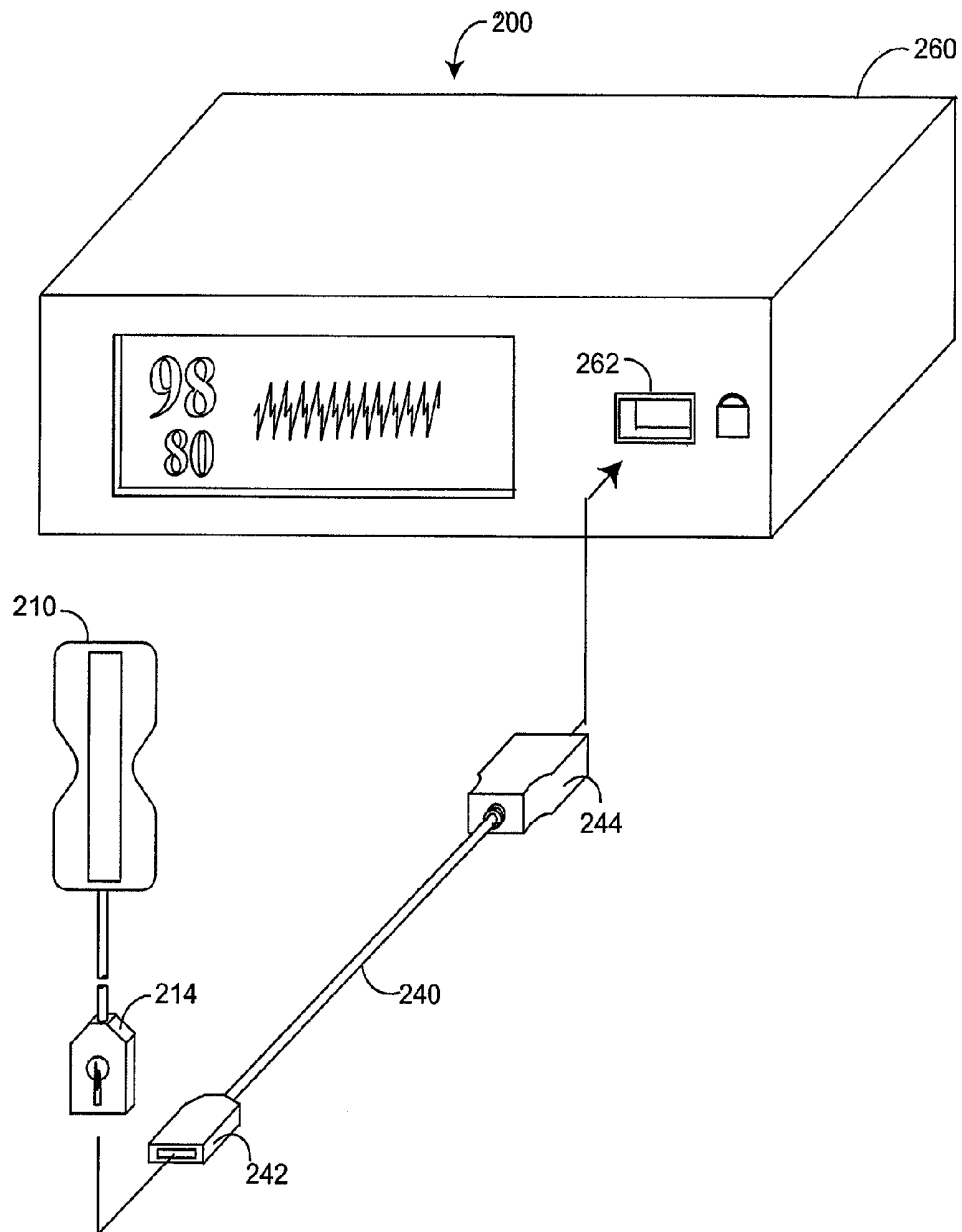
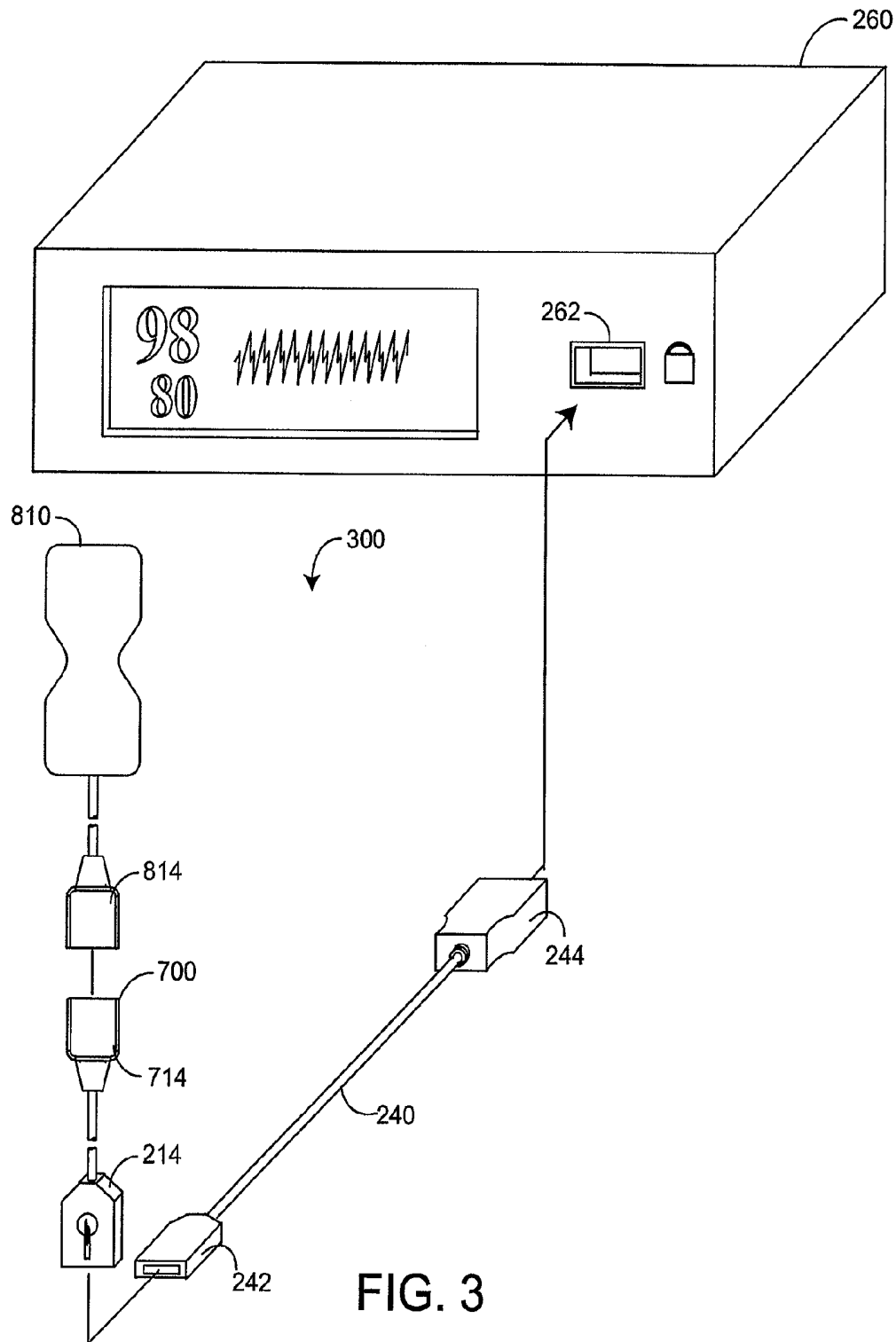
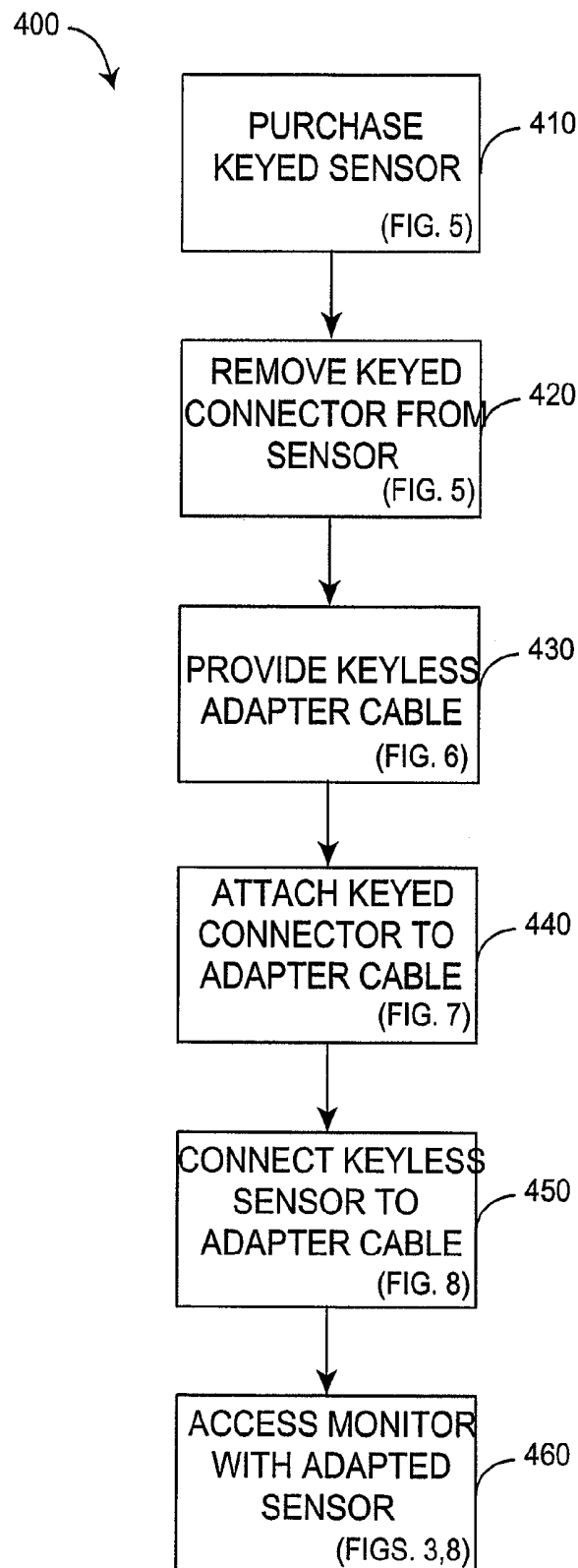


FIG. 2



**FIG. 4**

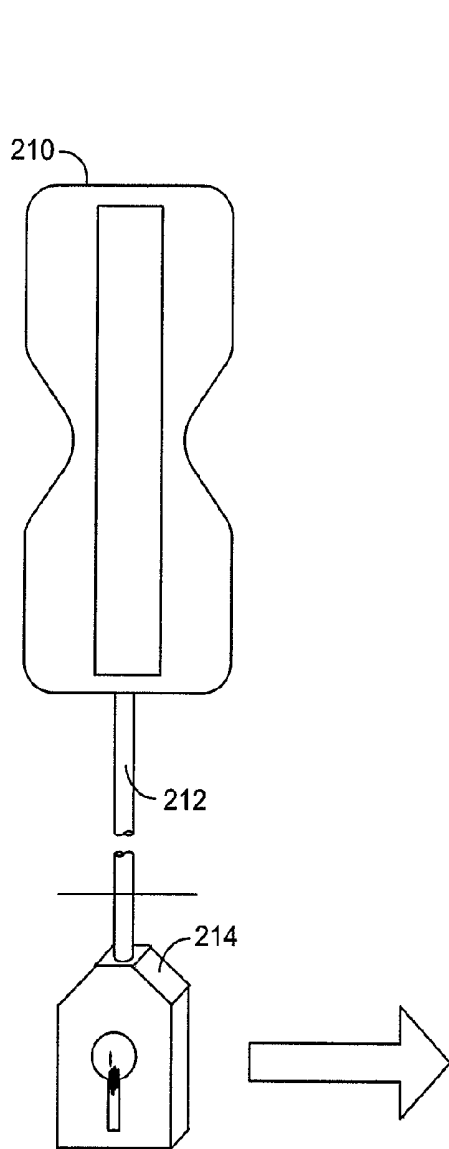


FIG. 5

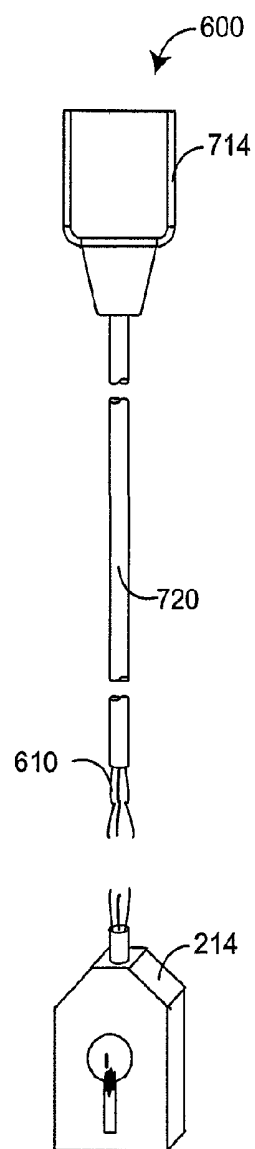


FIG. 6

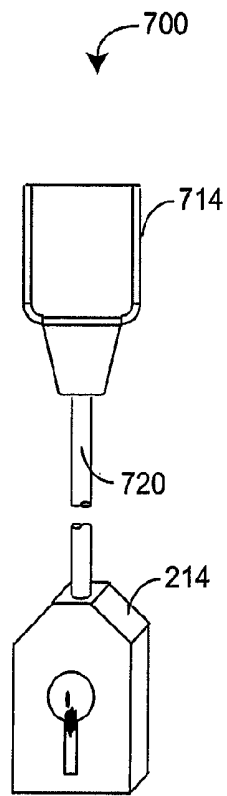


FIG. 7

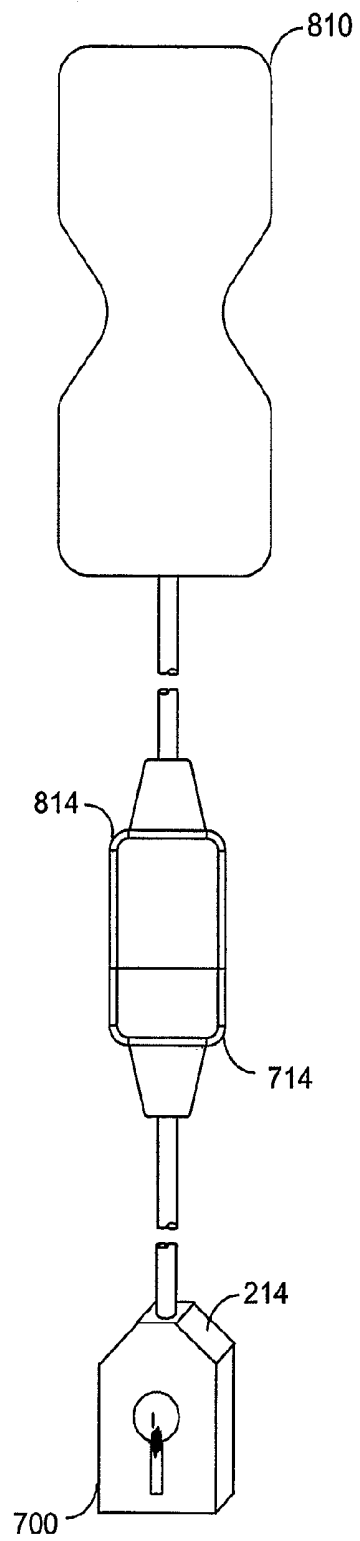


FIG. 8

PULSE OXIMETER ACCESS APPARATUS AND METHOD

REFERENCE TO RELATED APPLICATION

The present application claims priority benefit under 35 U.S.C. §120 to, and is a continuation of U.S. patent application Ser. No. 12/360,830, filed Jan. 27, 2009 entitled "Pulse Oximeter Access Apparatus and Method," which claims priority benefit under 35 U.S.C. §120 to, and is a continuation of U.S. patent application Ser. No. 10/981,186, filed Nov. 4, 2004 entitled "Pulse Oximeter Access Apparatus and Method," now U.S. Pat. No. 7,482,729, which claims priority benefit under 35 U.S.C. §119(e) from U.S. Provisional Application No. 60/517,954, filed Nov. 5, 2003, entitled "Pulse Oximeter Access Apparatus and Method." The present application also incorporates the foregoing disclosures herein by reference.

BACKGROUND OF THE INVENTION

Pulse oximeters have gained rapid acceptance in a wide variety of medical applications, including surgical wards, intensive care units, general wards and home care by providing early detection of decreases in the arterial oxygen supply, reducing the risk of accidental death and injury. FIG. 1 illustrates a pulse oximetry system 100 having a sensor 110 applied to a patient 10, a monitor 160, and a patient cable 140 connecting the sensor 110 and the monitor 160. The sensor 110 has a sensor body 111 that houses emitters and a detector and is attached to a patient at a selected fleshy medium site, such as a fingertip or ear lobe. The emitters are positioned to project light of at least two wavelengths through the blood vessels and capillaries of the fleshy medium. The detector is positioned so as to detect the emitted light after absorption by the fleshy medium, including hemoglobin and other constituents of pulsatile blood flowing within the fleshy medium, and generate at least first and second intensity signals in response. The sensor 110 has a patient cable connector 114 and may have an integrated sensor cable 112. The sensor 110 may be a disposable adhesive sensor for use on a single patient or a reusable clip-on sensor for use on multiple patients.

As shown in FIG. 1, the monitor 160, which may be a standalone device or may be incorporated as a module or built-in portion of a multiparameter patient monitoring system, computes at least one physiological parameter responsive to magnitudes of the intensity signals. A monitor 160 typically provides a numerical readout of the patient's oxygen saturation 164, a numerical readout of pulse rate 166, and a display the patient's plethysmograph 168, which provides a visual display of the patient's pulse contour and pulse rate. The monitor 160 has a sensor port 162 that transmits emitter drive signals to the sensor 110 and receives the detector intensity signals from the sensor 110. The patient cable 140 provides the electrical and mechanical connection and communications link between the sensor port 162 and the sensor 110. The patient cable 140 has a sensor connector 142 that connects to the patient cable connector 114 and a monitor connector 144 that connects to the sensor port 162.

SUMMARY OF THE INVENTION

Pulse oximeters have gained rapid acceptance in a wide variety of medical applications, including surgical wards, intensive care units, general wards and home care by pro-

viding early detection of decreases in the arterial oxygen supply, reducing the risk of accidental death and injury. FIG. 1 illustrates a pulse oximetry system 100 having a sensor 110 applied to a patient 10, a monitor 160, and a patient cable 140 connecting the sensor 110 and the monitor 160. The sensor 110 has a sensor body 111 that houses emitters and a detector and is attached to a patient at a selected fleshy medium site, such as a fingertip or ear lobe. The emitters are positioned to project light of at least two wavelengths through the blood vessels and capillaries of the fleshy medium. The detector is positioned so as to detect the emitted light after absorption by the fleshy medium, including hemoglobin and other constituents of pulsatile blood flowing within the fleshy medium, and generate at least first and second intensity signals in response. The sensor 110 has a patient cable connector 114 and may have an integrated sensor cable 112. The sensor 110 may be a disposable adhesive sensor for use on a single patient or a reusable clip-on sensor for use on multiple patients.

As shown in FIG. 1, the monitor 160, which may be a standalone device or may be incorporated as a module or built-in portion of a multiparameter patient monitoring system, computes at least one physiological parameter responsive to magnitudes of the intensity signals. A monitor 160 typically provides a numerical readout of the patient's oxygen saturation 164, a numerical readout of pulse rate 166, and a display the patient's plethysmograph 168, which provides a visual display of the patient's pulse contour and pulse rate. The monitor 160 has a sensor port 162 that transmits emitter drive signals to the sensor 110 and receives the detector intensity signals from the sensor 110. The patient cable 140 provides the electrical and mechanical connection and communications link between the sensor port 162 and the sensor 110. The patient cable 140 has a sensor connector 142 that connects to the patient cable connector 114 and a monitor connector 144 that connects to the sensor port 162.

SUMMARY OF THE INVENTION

FIG. 2 illustrates a restricted access pulse oximetry system 200 having a keyed sensor 210 and a restricted access monitor 260. The keyed sensor 210 and restricted access monitor 260 are designed so that the monitor 260 will only function with a specific sensor or family of sensors from a specific manufacturer or licensed vendors. Upon power up, the sensor port 262 is locked. That is, the monitor 260 will not function until it reads the correct information from the sensor port 262. In particular, a patient cable connector 214 has a memory device. The memory device and the data stored in the memory device act as a key. The sensor port 262 and a memory reader in the monitor associated with the sensor port 262 act as a lock. When the keyed patient cable connector 214 is in communications with the locked sensor port 262 via a patient cable 240, the memory reader can access the data stored in the memory device. If the stored data matches predetermined access data, the monitor unlocks the sensor port 262, i.e. properly functions with a sensor attached to the sensor port 262. A memory device commonly used for storing manufacturer and product information is the DS2502 from Dallas Semiconductor, which has a 1 kbit memory that is accessed through a single pin that provides data input, data output and power. Once the sensor port 262 is unlocked, the sensor 210, patient cable 240, sensor port 262 and monitor 260 function as described with respect to FIG. 1, above.

One aspect of a pulse oximeter access method is used in conjunction with a pulse oximetry system comprising a keyed sensor and a corresponding locked sensor port of a restricted access monitor. The keyed sensor has a key comprising a memory element. The monitor has a memory reader associated with the sensor port. The monitor is configured to function only when the key is in communications with the locked sensor port and the memory reader is able to retrieve predetermined data from the memory element. The access method comprises the steps of providing the key separate from the keyed sensor, integrating the key into an adapter cable, and connecting the adapter cable between the sensor port and an unkeyed sensor so that the monitor functions with the unkeyed sensor.

Another aspect of a pulse oximeter access apparatus comprises a sensor having emitters adapted to transmit light of at least first and second wavelengths into a fleshy medium and a light sensitive detector adapted to generate at least first and second intensity signals by detecting the light after absorption by constituents of pulsatile blood flowing within the fleshy medium. A monitor is configured to non-invasively measure one or more physiological parameters responsive to magnitudes of the intensity signals. A key contains access information. A sensor port is configured to communicate emitter drive signals from the monitor to the sensor, intensity signals from the sensor to the monitor, and the access information from the key to the monitor. A lock associated with the sensor port is adapted to read the access information from the key and to enable the monitor to provide measurements of the physiological parameters in response to the access information. An adapter cable containing the key is configured to provide a communications link between the sensor and the sensor port.

A further aspect of a pulse oximeter access apparatus comprises a sensor means for providing a physiological signal to a monitor and a key means for providing access to a locked sensor port portion of the monitor. An adapter cable means containing the key means provides communications between the sensor and the sensor port.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a prior art pulse oximetry system;

FIG. 2 is a perspective view of a prior art pulse oximetry system having a restricted access monitor with a locked sensor port;

FIG. 3 is a perspective view of a pulse oximeter access apparatus;

FIG. 4 is a flow diagram of a pulse oximeter access method;

FIGS. 5-6 are perspective views of a keyed sensor and a keyless adapter cable, respectively, illustrating lock removal and reattachment; and

FIGS. 7-8 are perspective views of a keyed adapter cable and an attached keyless sensor, respectively.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 3 illustrates a pulse oximeter access apparatus 300 having a keyless sensor 810, a keyed adapter cable 700 and a patient cable 240 that advantageously interconnect so as to allow the keyless sensor 810 to function with a restricted access monitor 260 having a locked sensor port 262. The keyed adapter cable 700 has a keyed connector 214 at one end, which mates with a sensor connector 242 of a patient

cable 240, and a sensor connector 714 at the opposite end, which mates with a patient cable connector 814 of the keyless sensor 810. The monitor connector 244 mates with the sensor port 262, providing communications between the keyless sensor 810 and the sensor port 262 and between a memory element in the keyed connector 214 and a memory reader within the monitor 260. The sensor connector 714 of the keyed adapter cable 700 can be any of a number of connectors that mate with any of a number of patient cable connectors 814. Further, a family of keyed adapter cables 700 can be configured, each with a different sensor connector 714 compatible with a different keyless sensor 810 or family of keyless sensors 810.

FIG. 4 illustrates a pulse oximeter access method 400 for creating and utilizing a keyed adapter cable 700 (FIGS. 3, 7). In an initial step, a sensor port key is provided by purchasing 410 a keyed sensor configured for a particular restricted access monitor 260 (FIG. 2) and removing 420 the associated keyed connector 214 (FIG. 2), as described in further detail with respect to FIG. 5, below. Further steps include providing 430 a keyless adapter cable 600 (FIG. 6), and attaching 440 the keyed connector 214 (FIG. 2) to one end to make the keyed adapter cable 700 (FIG. 7), as described in further detail with respect to FIGS. 6-7, below. Additional steps include connecting 450 a keyless sensor 810 (FIG. 8) to the keyed adapter cable, and accessing 460 the restricted access monitor with the resulting adapted sensor 800 (FIG. 8), as described in further detail with respect to FIG. 3, above, and FIG. 8, below.

FIGS. 5-6 illustrate obtaining a sensor key from a keyed sensor 210 (FIG. 5) and using the key in the construction of a keyed adapter cable 700 (FIG. 7). As shown in FIG. 5, the keyed connector 214 is removed from a keyed sensor 210, such as by cutting the sensor cable 212 so as to leave sufficient wire for reattachment. As shown in FIG. 6, a keyless adapter cable 600 is provided having a cable 720 with a sensor connector 714 attached to a first end and with unconnected wires 610 at a second end. The removed keyed connector 214 is spliced or otherwise attached to the second end by any of various well-known methods, such as soldering or crimping followed by heat-shrink insulation to name a few techniques.

Construction of a keyed adapter cable 700 (FIG. 7) is described above with respect to removal and reattachment of a keyed connector 214. In an alternative embodiment, the key or memory element itself is removed from the keyed connector 214 of a keyed sensor 210 (FIG. 5) and embedded into or otherwise integrated into or incorporated with either one or both connectors of an otherwise keyless adapter cable 600 to construct the keyed adapter cable 700 (FIG. 7). In yet another embodiment, an equivalent memory element is purchased, developed or otherwise obtained and programmed with access data compatible with the memory element of the keyed sensor 210 (FIG. 5) and embedded into or otherwise integrated into or incorporated with either one or both connectors of an otherwise keyless adapter cable 600 to construct the keyed adapter cable 700 (FIG. 7).

FIG. 7 illustrates a keyed adapter cable 700 having a sensor connector 714, a keyed connector 214 and a cable 720 interconnecting the sensor connector 714 and keyed connector 214. The sensor connector 714 is configured to connect to a sensor patient cable connector 814 (FIG. 8), and the keyed connector 214 is configured to connect to a patient cable sensor connector 242 (FIG. 3). The keyed connector 214 has a memory element that is readable by a restricted access monitor 260 (FIG. 3) so as to unlock a locked sensor port 262 (FIG. 3), as described above.

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FIG. 8 illustrates an adapted sensor **800** having a keyed adapter cable **700** attached to a keyless sensor **810**. The sensor connector **714** of the keyed adapter cable **700** is mated to the patient cable connector **814** of the keyless sensor **810**. The resulting adapted sensor **800** is configured to function with a restricted access monitor **260** (FIG. 3) in an equivalent manner as a keyed sensor **210** (FIG. 2). In particular, the keyed connector **214** mates with a patient cable **240** (FIG. 3), which mates with a locked sensor port **262** (FIG. 3) of a restricted access monitor **260** (FIG. 3) so that monitor **260** (FIG. 3) functions with the keyless sensor **810**, as described above with respect to FIG. 3.

A keyed adapter cable is described above with respect to an adapter between a keyless sensor **810** and a patient cable **240** (FIG. 3). Such an embodiment is particularly advantageous for utilization of a keyed connector **214** removed from a keyed sensor **210** (FIG. 5). In an alternative embodiment, the patient cable **240** (FIG. 3) itself is utilized as a keyed adapter cable between a keyless sensor **810** and a locked sensor port **262** (FIG. 3). In particular, a memory element containing access data is removed from a keyed sensor **210** (FIG. 5) or a memory element is purchased, developed or otherwise obtained and programmed with compatible access data. The memory element is embedded into or otherwise integrated into or incorporated with either one or both connectors of an otherwise keyless patient cable **240** (FIG. 3) to construct a keyed adapter cable.

A pulse oximeter access apparatus and method has been disclosed in detail in connection with various embodiments. These embodiments are disclosed by way of examples only and are not to limit the scope of the claims that follow. One of ordinary skill in art will appreciate many variations and modifications.

What is claimed is:

1. A patient monitor system that is locked behaving as if unlocked, the patient monitor system comprising a patient monitor and considered locked because the patient monitor is configured to process signals only from authorized non-invasive sensors during normal operation, the patient monitor system behaving as if unlocked because the patient monitor, opposite to its configuration, processes signals from unauthorized noninvasive sensors during normal operation, the patient monitor system comprising:

a patient monitor including an input configured to receive signals responsive to light attenuated by body tissue of a patient, said input also configured to receive predetermined access information, and a signal processor responsive to said signals and said predetermined access information from said input, said signal processor configured to process said predetermined access information to determine whether to process said signals;

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an accessory comprising a memory and one of a cable or a connector, said memory previously non-removably incorporated into a first noninvasive optical sensor so that removal significantly damages said first noninvasive optical sensor, said memory storing said predetermined access information and incorporated into said accessory subsequent to removal of said memory from said first noninvasive optical sensor by significantly damaging said first noninvasive optical sensor, said memory and said first noninvasive optical sensor having a one-to-one association with one another, said accessory configured to communicate said predetermined access information to said patient monitor through said input without said first noninvasive optical sensor, said accessory and said memory together having a one-to-many association with a plurality of non-invasive optical sensors; and

a second noninvasive optical sensor comprising a light detector configured to communicate an output signal to said input,

wherein in response to receiving said predetermined access information from said accessory through said input, said signal processor is configured to determine to process said output signal from said second noninvasive optical sensor during normal operation and subsequently process said output signal during normal operation.

2. The patient monitor system of claim 1, wherein said accessory comprises said cable.

3. The patient monitor system of claim 1, wherein said accessory comprises said connector.

4. The patient monitor system of claim 1, wherein prior to removal of said memory from said first noninvasive optical sensor, said memory communicated said predetermined access information to another patient monitor to unlock processing by said another patient monitor and enable patient monitoring with said another patient monitor using said first noninvasive optical sensor.

5. The patient monitor system of claim 1, wherein in response to not receiving said predetermined access information from said accessory through said input, said signal processor is configured to determine not to process said output signal from said second noninvasive optical sensor during normal operation and subsequently not process said output signal during normal operation.

6. The patient monitor system of claim 1, wherein said second noninvasive optical sensor is configured to communicate said output signal to said input through said accessory.

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专利名称(译)	脉搏血氧计接入设备和方法		
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摘要(译)

利用键控传感器和受限访问监视器的相应锁定传感器端口，为某些脉搏血氧测量系统提供访问。在这样的系统中，键控传感器具有包括存储元件的键，并且监视器具有与传感器端口相关联的存储器读取器。监视器被配置为仅在键与锁定的传感器端口通信时起作用，并且存储器读取器能够从存储器元件检索预定数据。通过提供与键控传感器分开的钥匙，将钥匙集成到适配器电缆中，并在传感器端口和未键控的传感器之间连接适配器电缆，使监视器与无键传感器一起工作，即可访问监视器。

