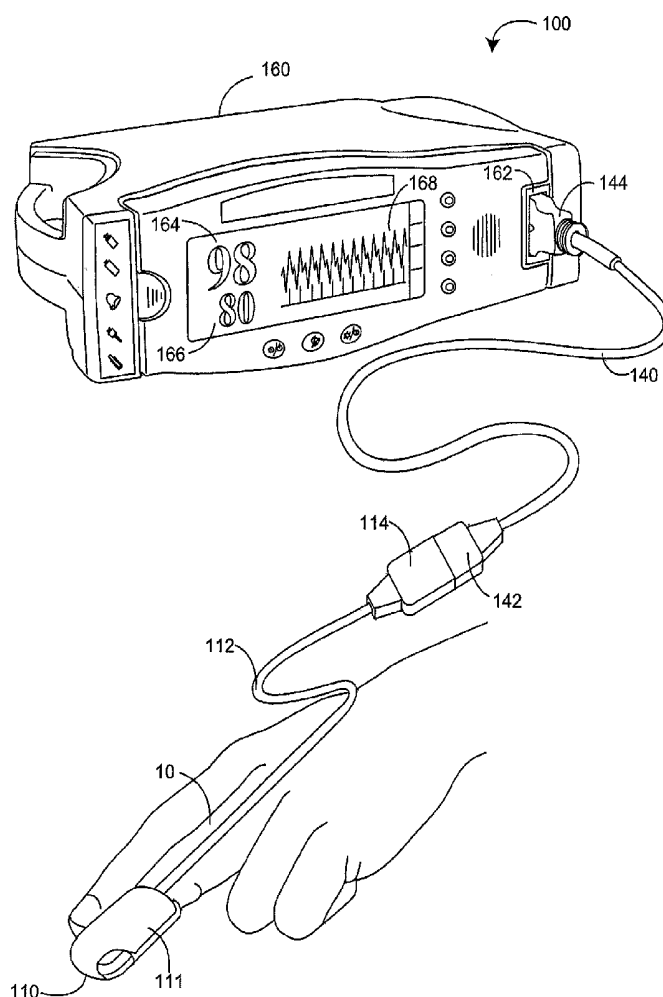




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**Al-Ali et al.**(10) **Pub. No.: US 2015/0374298 A1**(43) **Pub. Date: Dec. 31, 2015**(54) **PULSE OXIMETER ACCESS APPARATUS  
AND METHOD****Publication Classification**(71) Applicant: **MASIMO CORPORATION**, Irvine,  
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CA (US)(51) **Int. Cl.**  
**A61B 5/00** (2006.01)  
**A61B 5/1455** (2006.01)(52) **U.S. Cl.**  
CPC ..... **A61B 5/7221** (2013.01); **A61B 5/14551**  
(2013.01); **A61B 5/7271** (2013.01); **A61B**  
**2562/221** (2013.01); **A61B 2562/08** (2013.01);  
**A61B 2560/0475** (2013.01)(21) Appl. No.: **14/790,454**(22) Filed: **Jul. 2, 2015****Related U.S. Application Data**(63) Continuation of application No. 12/360,830, filed on  
Jan. 27, 2009, now Pat. No. 9,072,474, which is a  
continuation of application No. 10/981,186, filed on  
Nov. 4, 2004, now Pat. No. 7,483,729.(60) Provisional application No. 60/517,954, filed on Nov.  
5, 2003.(57) **ABSTRACT**

Access is provided to certain pulse oximetry systems utilizing 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, 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.



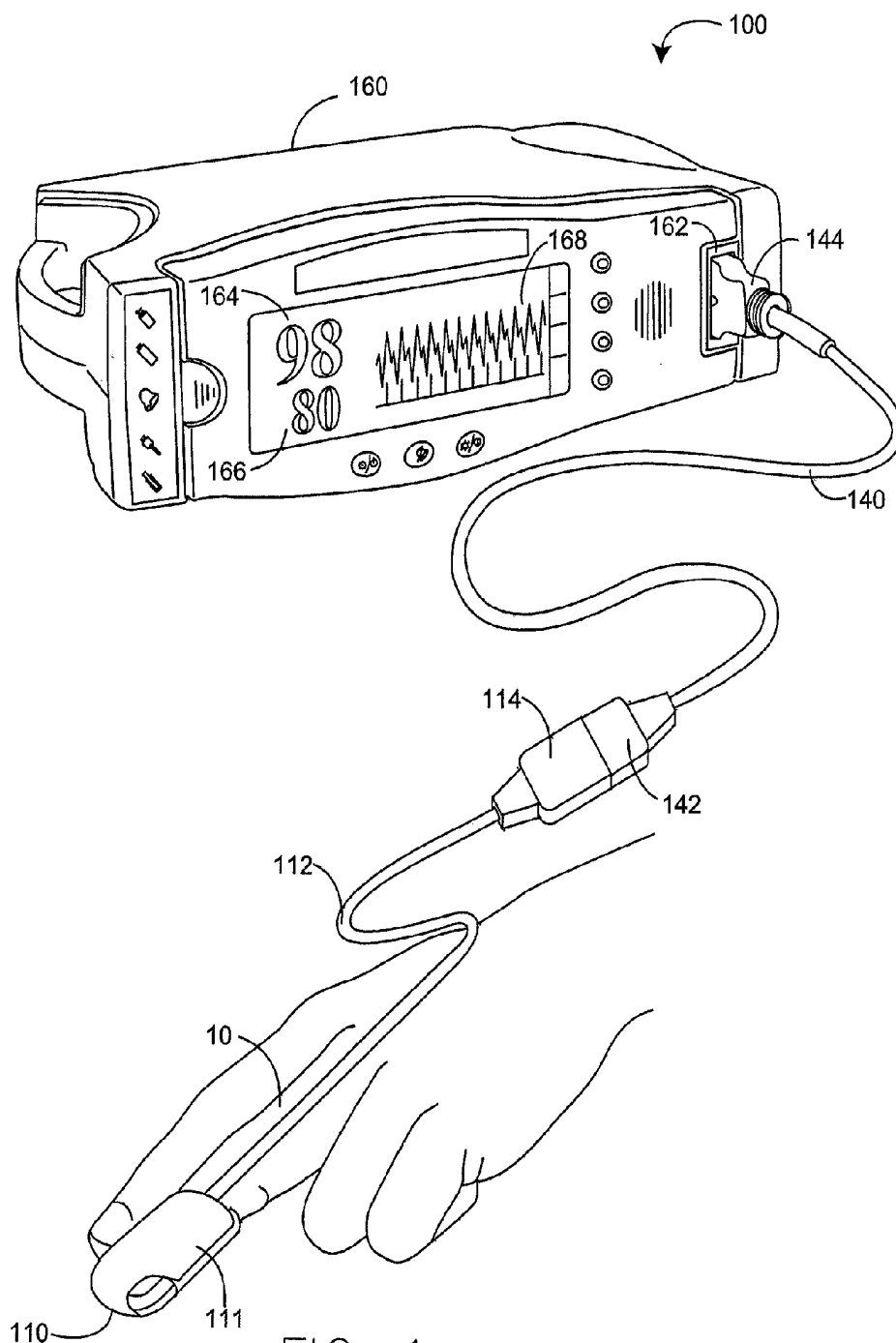


FIG. 1

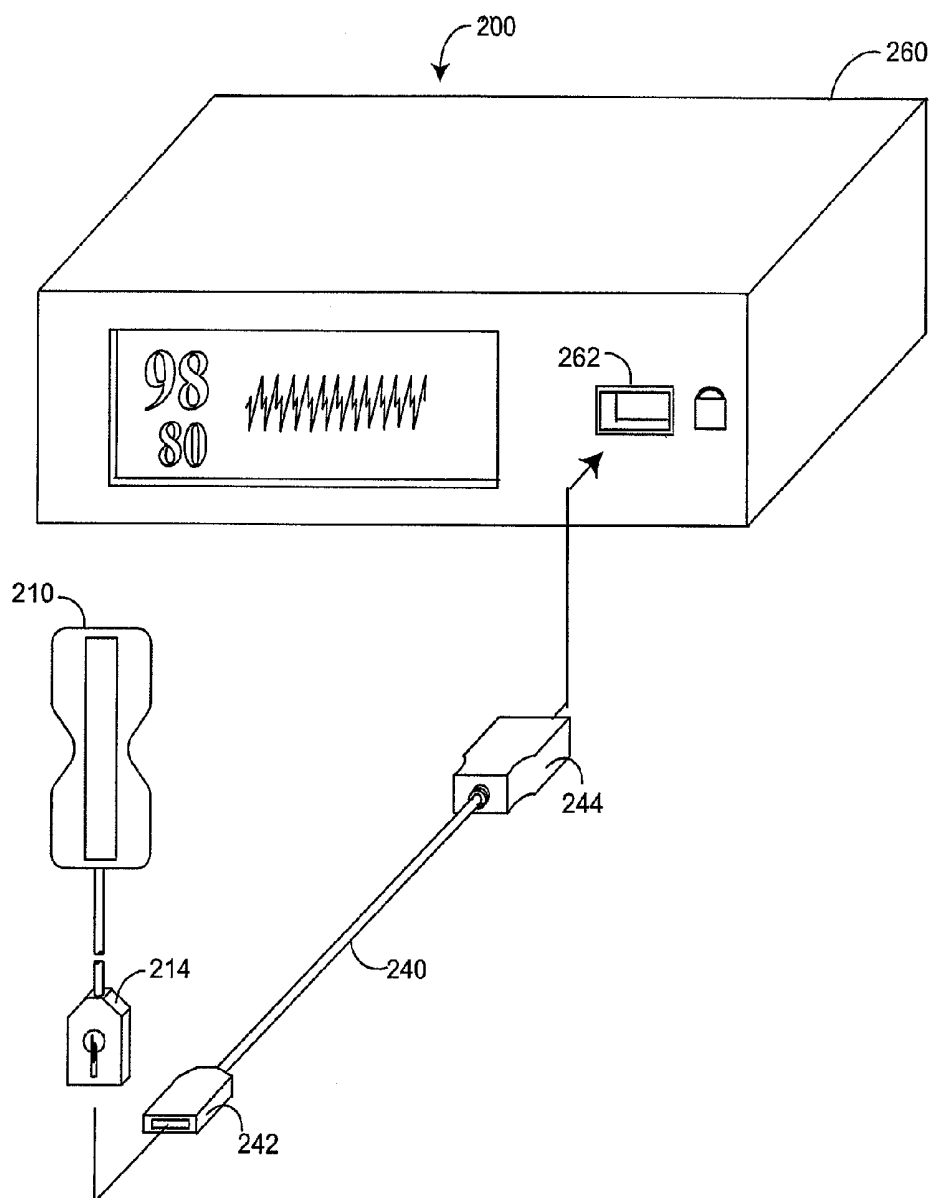
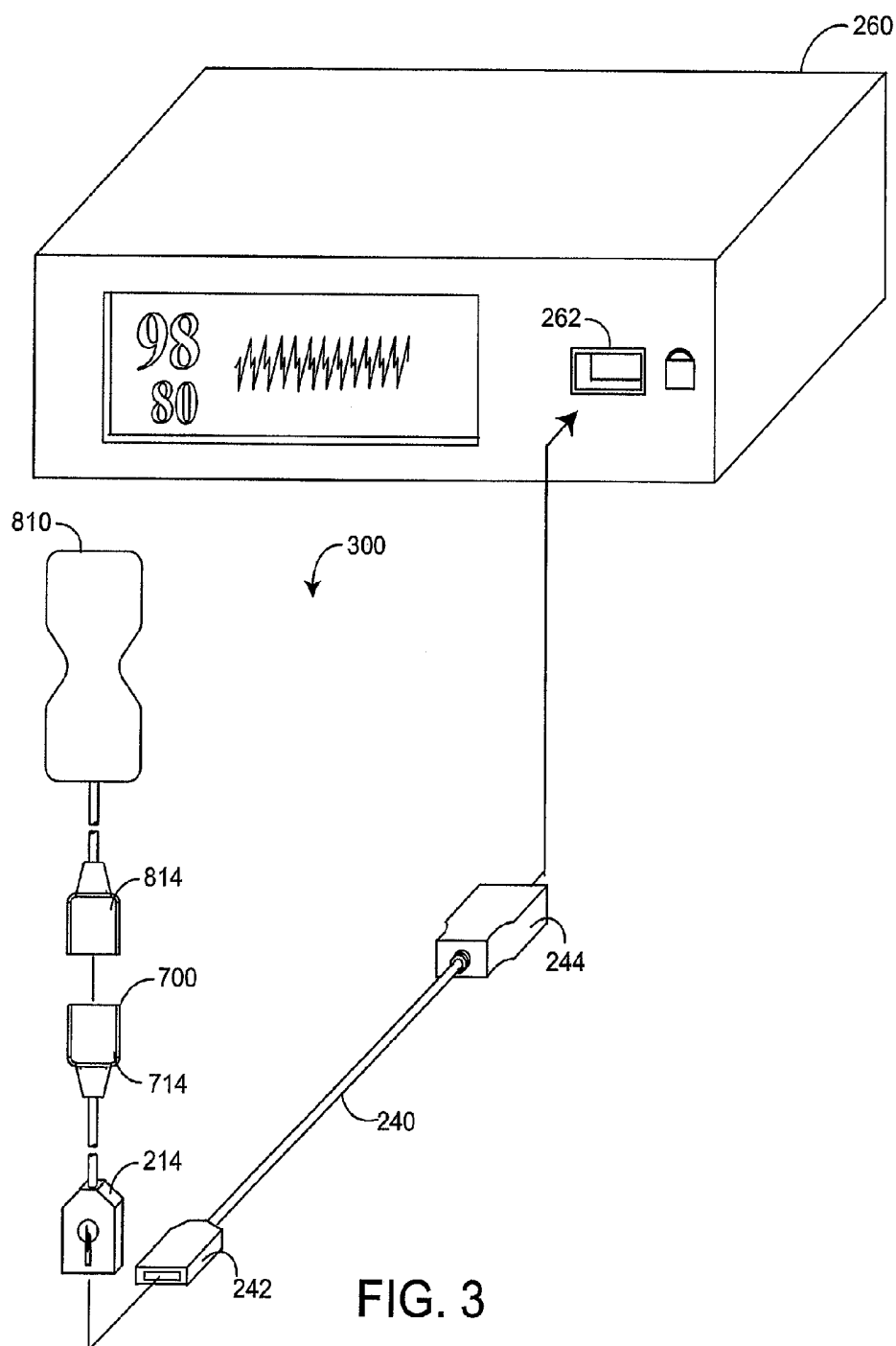


FIG. 2



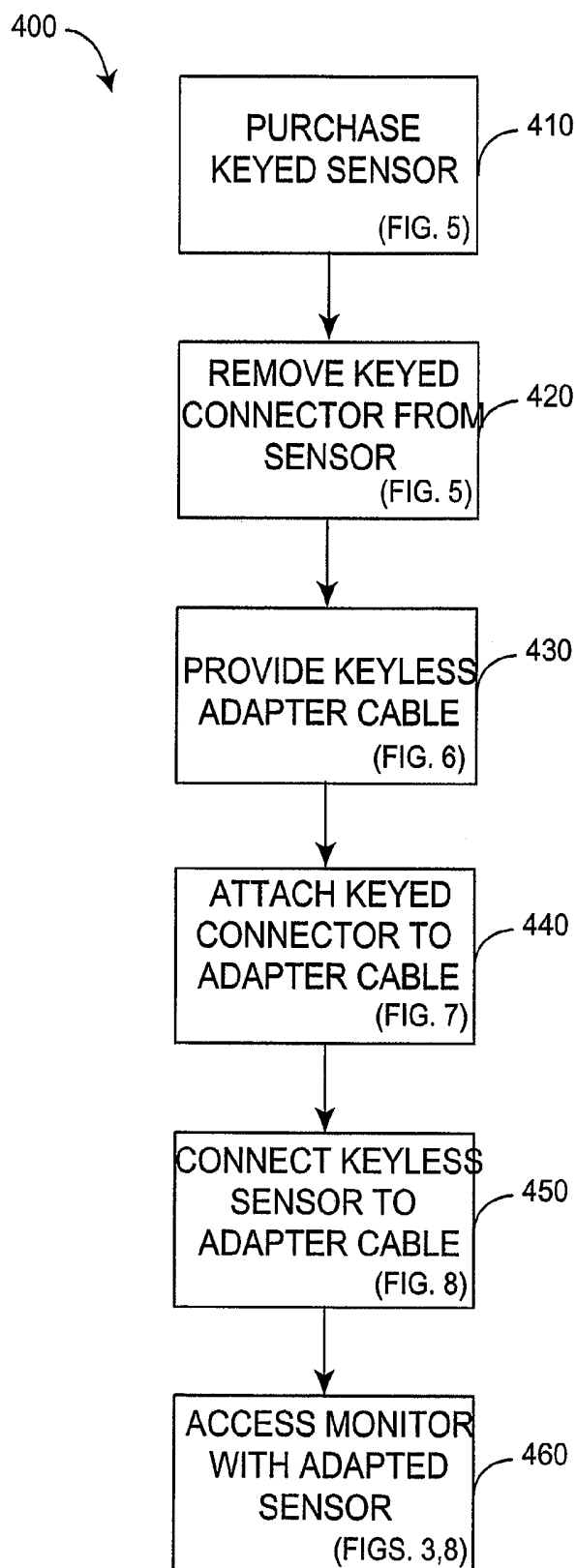


FIG. 4

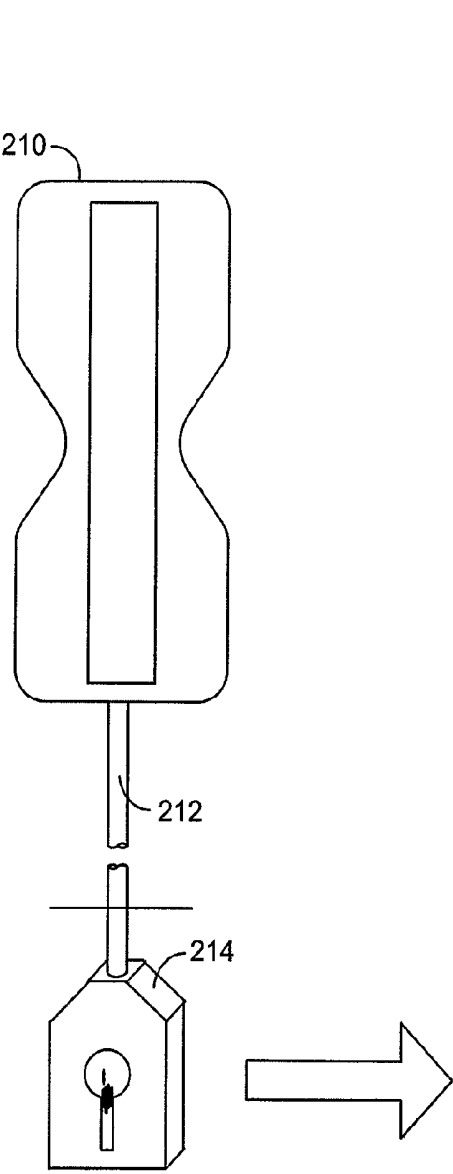


FIG. 5

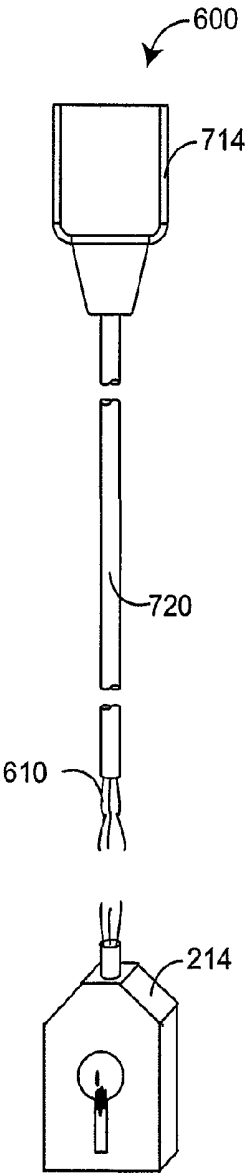


FIG. 6

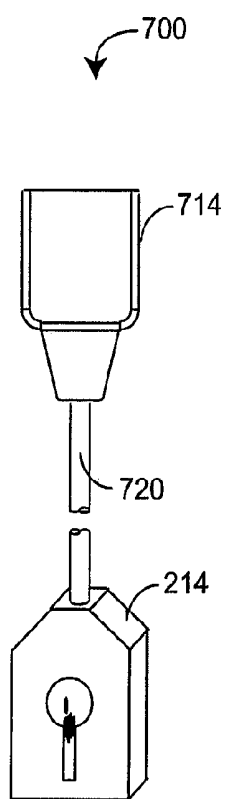


FIG. 7

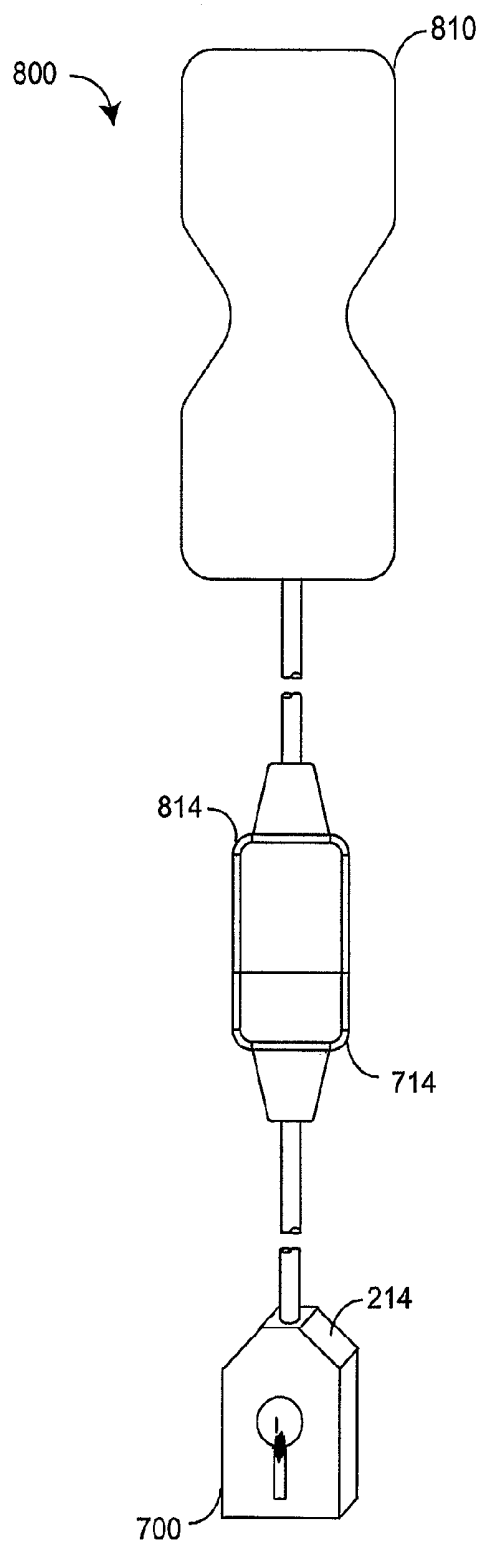


FIG. 8

## PULSE OXIMETER ACCESS APPARATUS AND METHOD

### REFERENCE TO RELATED APPLICATION

**[0001]** 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

**[0002]** 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.

**[0003]** 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

**[0004]** 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.

**[0005]** 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

**[0006]** 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.

**[0007]** 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.

[0008] 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.

[0009] 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

[0010] FIG. 1 is a perspective view of a prior art pulse oximetry system;

[0011] FIG. 2 is a perspective view of a prior art pulse oximetry system having a restricted access monitor with a locked sensor port;

[0012] FIG. 3 is a perspective view of a pulse oximeter access apparatus;

[0013] FIG. 4 is a flow diagram of a pulse oximeter access method;

[0014] FIGS. 5-6 are perspective views of a keyed sensor and a keyless adapter cable, respectively, illustrating lock removal and reattachment; and

[0015] FIGS. 7-8 are perspective views of a keyed adapter cable and an attached keyless sensor, respectively.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0016] 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.

[0017] 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.

[0018] 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.

[0019] 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).

[0020] 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.

**[0021]** 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.

**[0022]** 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.

**[0023]** 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.

**1-10.** (canceled)

**11.** A locked patient monitor system behaving like an unlocked patient monitor system, the locked patient monitor system normally comprising a patient monitor and an authorized noninvasive sensor, the locked patient monitor system considered locked because it is configured to process signals only from said authorized noninvasive sensor during normal operation for quality control purposes, the locked patient monitor system behaving like an unlocked patient monitor system because the patient monitor, opposite to its configuration, processes signals from unauthorized noninvasive sensors during normal operation, the locked 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 signals output from a light detector of said authorized noninvasive sensor, said input also configured to receive predetermined access information from a memory non-removably associated with said authorized noninvasive sensor, 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 said predetermined access information indicates the presence of said authorized noninvasive sensor; an accessory comprising one of a cable or a connector, said accessory including said memory harvested from said authorized noninvasive sensor, said accessory config-

ured to communicate said predetermined access information to said patient monitor through said input without said authorized noninvasive sensor; and

an unauthorized noninvasive optical sensor configured to communicate with said input once said accessory unlocks said patient monitor using said harvested memory, said signal processor configured to process signals from said unauthorized noninvasive sensor during normal operation because of the presence of said accessory.

**12.** The locked patient monitor system of claim 1, wherein said accessory comprises said cable.

**13.** The locked patient monitor system of claim 1, wherein said accessory comprises said connector.

**14.** A locked pulse oximetry patient monitor system behaving like an unlocked pulse oximetry patient monitor system, the locked patient monitor system normally comprising a patient monitor and an authorized noninvasive sensor, the locked patient monitor system considered locked because it is configured to process signals only from said authorized noninvasive sensor during normal operation for quality control purposes, the locked patient monitor system behaving like an unlocked patient monitor system because the patient monitor, opposite to its configuration, processes signals from one or more unauthorized noninvasive sensors during normal operation, the locked 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 signals output from a light detector of said authorized noninvasive sensor, said input also configured to receive predetermined access information from a memory non-removably associated with said authorized noninvasive sensor, 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 said predetermined access information indicates the presence of said authorized noninvasive sensor; an accessory comprising one of a cable or a connector, said accessory including said predetermined access information harvested from said memory non-removably associated with said authorized noninvasive sensor, said accessory configured to communicate said predetermined access information to said patient monitor through said input without said authorized noninvasive sensor; and

an unauthorized noninvasive optical sensor configured to communicate with said input once said accessory unlocks said patient monitor using said harvested predetermined access information, said signal processor configured to process signals from said unauthorized noninvasive sensor during normal operation because of the presence of said accessory.

**15.** The locked patient monitor system of claim 1, wherein said accessory comprises said cable.

**16.** The locked patient monitor system of claim 1, wherein said accessory comprises said connector.

**17.** The locked patient monitor system of claim 1, wherein said accessory further comprises a memory configured to store said predetermined access information harvested from said memory non-removably associated with said authorized noninvasive sensor.

**18.** A method of unlocking a locked patient monitor system so that the locked patient monitor system behaves like an

unlocked patient monitor system, the locked patient monitor system normally comprising a patient monitor and an authorized noninvasive sensor, the locked patient monitor system considered locked because it is configured to process signals only from said authorized noninvasive sensor during normal operation for quality control purposes, the locked patient monitor system behaving like an unlocked patient monitor system because the patient monitor, opposite to its configuration, processes signals from one or more unauthorized noninvasive sensors during normal operation, the method of unlocking a locked patient monitor system comprising:

harvesting predetermined access information from a locked patient monitor system, wherein the predetermined access information is stored on a memory non-removably associated with said authorized noninvasive sensor, the locked patient monitor system comprising a signal processor configured to receive said predetermined access information from said memory associated with said authorized noninvasive sensor to determine

whether said predetermined access information indicates the presence of said authorized noninvasive sensor; incorporating said harvested predetermined access information into a memory associated with an accessory, the accessory comprising one of a cable or a connector; and communicating said harvested predetermined access information from said memory associated with said accessory to said signal processor without said authorized noninvasive sensor, said communicating tricking said signal processor to indicate the presence of said authorized noninvasive sensor in the presence of an unauthorized noninvasive optical sensor.

**19.** The method of unlocking a locked patient monitor system of claim **8**, wherein said accessory comprises said cable.

**20.** The method of unlocking a locked patient monitor system of claim **8**, wherein said accessory comprises said connector.

\* \* \* \* \*

专利名称(译)	脉搏血氧计接入设备和方法		
公开(公告)号	<a href="#">US20150374298A1</a>	公开(公告)日	2015-12-31
申请号	US14/790454	申请日	2015-07-02
[标]申请(专利权)人(译)	梅西莫股份有限公司		
申请(专利权)人(译)	Masimo公司		
当前申请(专利权)人(译)	Masimo公司		
[标]发明人	AL ALI AMMAR COVERSTON RONALD KIANI MASSI E		
发明人	AL-ALI, AMMAR COVERSTON, RONALD KIANI, MASSI E.		
IPC分类号	A61B5/00 A61B5/1455		
CPC分类号	A61B5/14551 A61B2560/0266 A61B2562/08 A61B2562/221 A61B5/7221 A61B5/7271 A61B2560/0475 A61B2562/222		
优先权	60/517954 2003-11-05 US		
其他公开文献	US9743887		
外部链接	<a href="#">Espacenet</a> <a href="#">USPTO</a>		

#### 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。

