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(54) PULSE OXIMETERWITH VOICE BROADCAST FUNCTION

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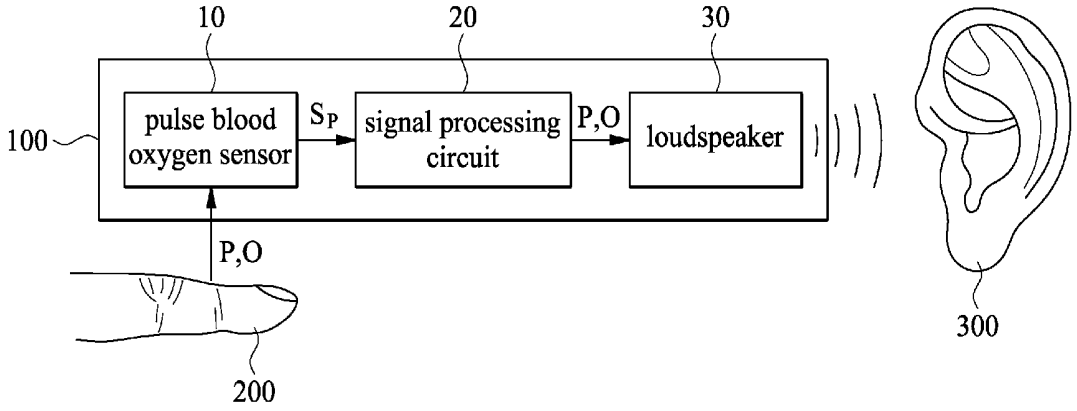
(57) **ABSTRACT**

A pulse oximeter with a voice broadcast function for voice-broadcasting pulse rate-related information and blood oxygen level-related information is introduced. The pulse oximeter includes a pulse blood oxygen sensor, a signal processing circuit, and a loudspeaker. The pulse blood oxygen sensor senses a user's pulse rate-related information and blood oxygen level-related information and sends a physiological signal carrying the pulse rate-related information and the blood oxygen level-related information. The signal processing circuit is electrically connected to the pulse blood oxygen sensor and adapted to receive and convert the physiological signal into the pulse rate-related information and the blood oxygen level-related information and send the pulse rate-related information and the blood oxygen level-related information. The loudspeaker is electrically connected to the signal processing circuit and adapted to receive and voice-broadcast the pulse rate-related information and the blood oxygen level-related information.



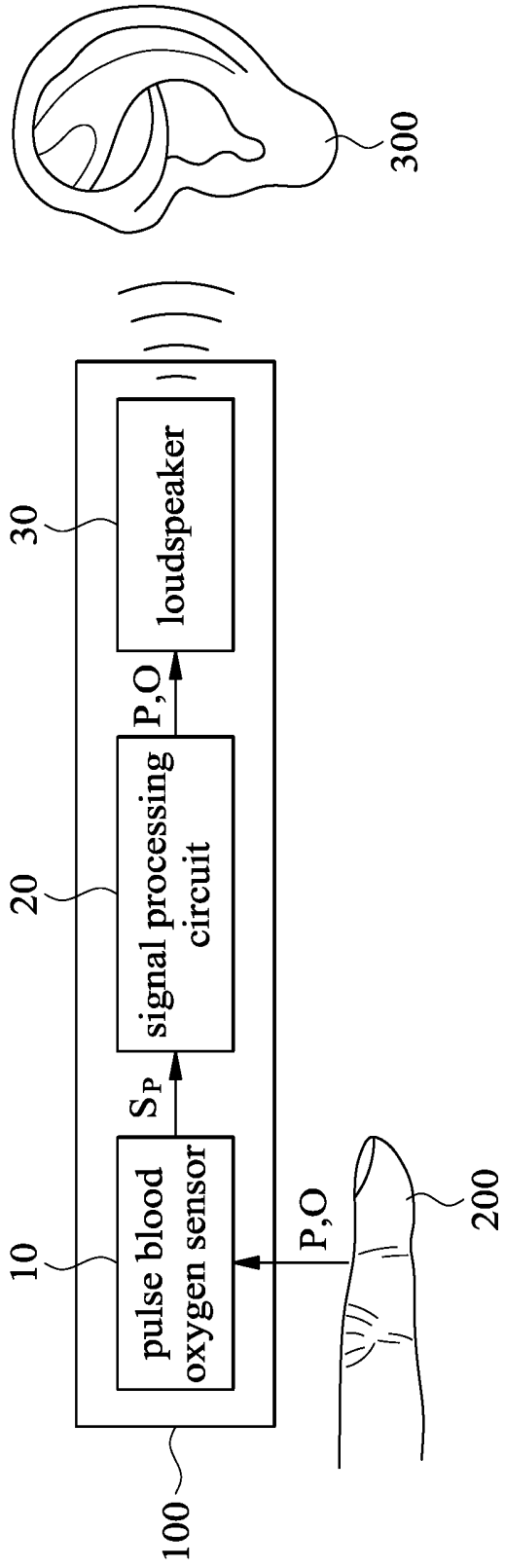

300
30
loudspeaker
P,O
20
signal processing circuit
S_P
10
pulse blood oxygen sensor
P,O
200
100

FIG. 1

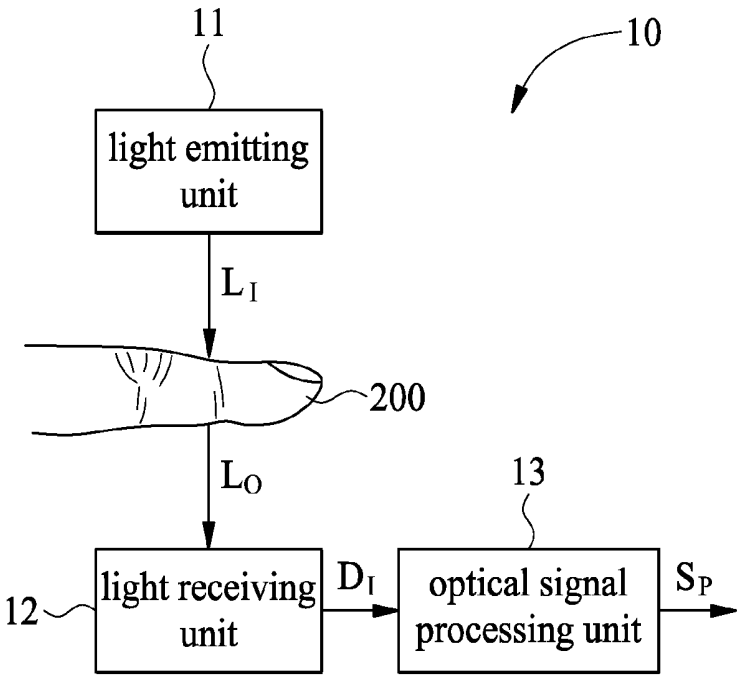

11
10
light emitting unit
L_I
200
L_O
13
12
light receiving unit
D_I
optical signal processing unit
S_P

FIG. 2A

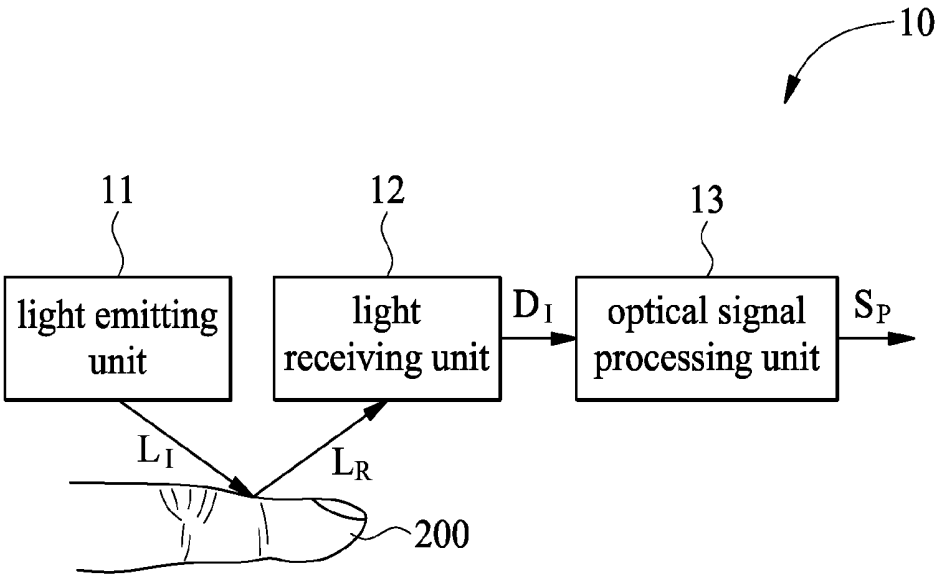

10
11
12
13
light emitting unit
light receiving unit
D_I
optical signal processing unit
S_P
L_I
L_R
200

FIG. 2B

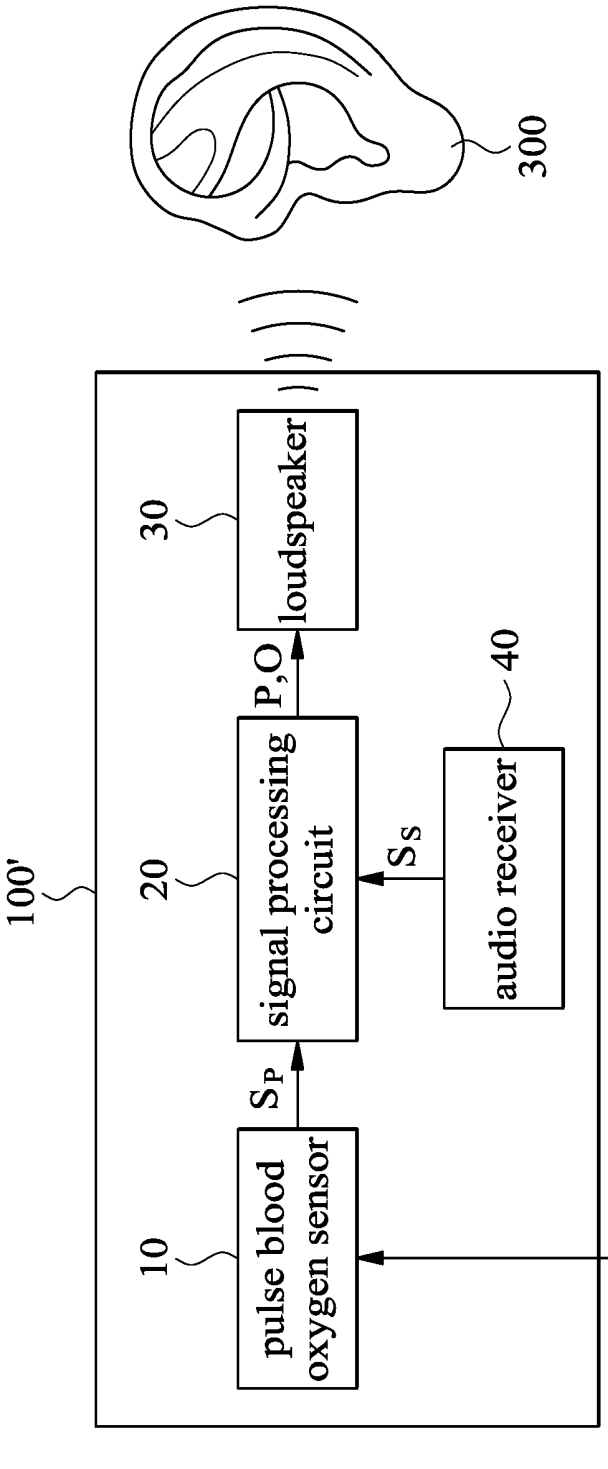

300
100'
10
pulse blood oxygen sensor
S_P
20
signal processing circuit
S_S
40
audio receiver
P,O
30
loudspeaker
P,O
200

FIG. 3

PULSE OXIMETERWITH VOICE BROADCAST FUNCTION

FIELD OF THE INVENTION

[0001] The present invention relates to pulse oximeters, and more particularly, to a pulse oximeter with a voice broadcast function.

BACKGROUND OF THE INVENTION

[0002] During surgery, anesthesiologists monitor patients' physiological functions to ensure that the surgery can be performed safely and smoothly on the patients. In this regards, the anesthesiologists use various medical devices to monitor the patients' vital signs, namely body temperature, blood pressure, pulse rate, respiration rate, and, if necessary, additional vital signs, including blood oxygen level. These measurements are displayed on the monitors of the medical devices.

[0003] A conventional medical device, such as a pulse oximeter, measures blood oxygen level and pulse rate, and the measurements are displayed on a monitor of the pulse oximeter. Normally, it is an anesthesiologist who reads the measurements displayed on the pulse oximeter and reports verbally and instantly to the surgeon whatever changes in the measurement. But, during an operation performed by a surgeon, the surgeon has to glimpse at the measurements displayed on the pulse oximeter at times in some situations, for example, a cost-cutting scenario, a makeshift scenario, and a poor communication scenario.

[0004] As the medical service market is increasingly competitive worldwide, hospitals around the world cut staffing costs by hiring less anesthesiologists than needed. As a result, due to a shortage of anesthesiologists, each working anesthesiologist has to take care of two or more operating rooms simultaneously. And, in case an operation is simple and short, no anesthesiologist will be assigned to the operating room at all.

[0005] When equipped with an operating room, makeshift hospitals in a battlefield, at the scene of a natural disaster, and on a ship at sea, for example, seldom have any anesthesiologist.

[0006] Verbal communication between a surgeon and an anesthesiologist in an operating room is never free of errors, which is especially evident to a surgery team of multiple nationalities. In this regard, foolproof automation of vital sign monitoring is a good alternative but is not always affordable.

[0007] Hence, it is advantageous for surgeons to dispense with the need to glimpse at the measurements displayed on the monitor at times, so as to focus on the ongoing surgery.

SUMMARY OF THE INVENTION

[0008] In view of the aforesaid drawbacks of the prior art, it is an objective of the present invention to enable surgeons to dispense with the need to glimpse at the measurements displayed on monitors at times, so as to focus on the ongoing surgery.

[0009] In order to achieve the above and other objectives, the present invention provides a pulse oximeter with a voice broadcast function. The pulse oximeter comprises a pulse blood oxygen sensor, a signal processing circuit, and a loudspeaker. The pulse blood oxygen sensor is adapted for sensing a pulse rate-related information and a blood oxygen level-related information and sending a physiological signal carrying the pulse rate-related information and the blood oxygen level-related information. The signal processing circuit is electrically connected to the pulse blood oxygen sensor and adapted to receive the physiological signal, convert the physiological signal into the pulse rate-related information and the blood oxygen level-related information, and send the pulse rate-related information and the blood oxygen level-related information. The loudspeaker is electrically connected to the signal processing circuit and adapted to receive the pulse rate-related information and the blood oxygen level-related information and voice-broadcast the pulse rate-related information and the blood oxygen level-related information.

[0010] In an embodiment of the present invention, the pulse blood oxygen sensor comprises a light emitting unit, a light receiving unit, and an optical signal processing unit, wherein the light emitting unit and the light receiving unit are disposed at two opposite sides of a portion of a user's body, wherein the light emitting unit emits an incident light beam to penetrate the user's body and exit the user's body in form of an outgoing light beam, wherein the light receiving unit receives the outgoing light beam and sends a data indicative of light intensity of the outgoing light beam, wherein the optical signal processing unit is electrically connected to the light receiving unit and adapted to receive and convert the data indicative of the light intensity of the outgoing light beam into the physiological signal. The light emitting unit comprises a red light source and an infrared light source, the red light source is a red light-emitting diode, the infrared light source is an infrared light-emitting diode.

[0011] In another embodiment of the present invention, the pulse blood oxygen sensor comprises a light emitting unit, a light receiving unit, and an optical signal processing unit, wherein the light emitting unit and the light receiving unit are disposed on the same side of a portion of a user's body, wherein the light emitting unit emits an incident light beam, wherein the incident light beam falls on the user's body and then reflects off the user's body in form of a reflecting light beam, wherein the light receiving unit receives the reflecting light beam and sends a data indicative of light intensity of the reflecting light beam, wherein the optical signal processing unit is electrically connected to the light receiving unit and adapted to receive and convert the data indicative of the light intensity of the reflecting light beam into a physiological signal. The light emitting unit comprises a red light source and an infrared light source, the red light source is a red light-emitting diode, the infrared light source is an infrared light-emitting diode.

[0012] In yet another embodiment of the present invention, the pulse oximeter further comprises an audio receiver electrically connected to the signal processing circuit and adapted to generate a voice control signal in accordance with an external audio message received, wherein the voice control signal enables the signal processing circuit to enter an operating mode for receiving the physiological signal and sending the pulse rate-related information and the blood oxygen level-related information and enables the signal processing circuit to enter a low power consumption mode.

[0013] Accordingly, the present invention provides a pulse oximeter which enables surgeons to dispense with the need to glimpse at the measurements displayed on a monitor, so as to focus on the ongoing surgery.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] Objectives, features, and advantages of the present invention are hereunder illustrated with specific embodiments in conjunction with the accompanying drawings, in which:

[0015] FIG. **1** is a schematic view of a pulse oximeter according to an embodiment of the present invention;

[0016] FIG. **2**A is a schematic view of a pulse blood oxygen sensor of the pulse oximeter in the first aspect according to the embodiment of the present invention;

[0017] FIG. **2**B is a schematic view of the pulse blood oxygen sensor of the pulse oximeter in the second aspect according to the embodiment of the present invention; and

[0018] FIG. **3** is a schematic view of another pulse oximeter according to another embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] Referring to FIG. **1**, there is shown a schematic view of a pulse oximeter **100** according to an embodiment of the present invention. As shown in the diagram, the pulse oximeter **100** comprises a pulse blood oxygen sensor **10**, a signal processing circuit **20**, and a loudspeaker **30**.

[0020] The pulse blood oxygen sensor **10** is designed to come into contact with a portion of a user's body, such as the user's fingertip **200**. The pulse blood oxygen sensor **10** senses a pulse rate-related information P and a blood oxygen level-related information O of the user and sends a physiological signal Sp carrying the pulse rate-related information P and the blood oxygen level-related information O. In this embodiment, the pulse blood oxygen sensor **10** senses the user's pulse rate-related information P and blood oxygen level-related information O by operating in a non-invasive manner, for an illustrative purpose. However, in a variant embodiment, the pulse blood oxygen sensor **10** senses the user's pulse rate-related information P and blood oxygen level-related information O by operating in an invasive manner so as to achieve enhanced accuracy as needed. The pulse blood oxygen sensor **10** is further described below to illustrate how it operates in two common non-invasive modes.

[0021] Referring to FIG. **2**A, there is shown a schematic view of the pulse blood oxygen sensor **10** of the pulse oximeter in the first aspect according to the embodiment of the present invention. The pulse blood oxygen sensor **10** comprises a light emitting unit **11**, a light receiving unit **12**, and an optical signal processing unit **13**. The light emitting unit **11** and the light receiving unit **12** are designed to come into contact with the opposite sides of a portion of the user's body, such as the fingertip **200**. The optical signal processing unit **13** is electrically connected to the light receiving unit **12**. The light emitting unit **11** emits an incident light beam LI which falls on the fingertip **200**. In practice, the incident light beam LI is an electromagnetic wave which can penetrate the fingertip **200**. After penetrating the fingertip **200**, the otherwise incident light beam LI turns into an outgoing light beam L_O. As its name suggests, the outgoing light beam L_O exits the fingertip **200**. Afterward, the light receiving unit **12** receives the outgoing light beam L_O, converts the outgoing light beam L_O into a data D_I indicative of the light intensity of the outgoing light beam L_O, and sends the data D_I to the optical signal processing unit **13**. After receiving the data D_I, the optical signal processing unit **13** converts the data D_I into the physiological signal Sp.

[0022] Referring to FIG. **2**B, there is shown a schematic view of the pulse blood oxygen sensor **10** of the pulse oximeter in the second aspect according to the embodiment of the present invention. The first and second aspects of the embodiment of the present invention share some common features, that is, the pulse blood oxygen sensor **10** comprises the light emitting unit **11**, the light receiving unit **12**, and the optical signal processing unit **13**, wherein the optical signal processing unit **13** is electrically connected to the light receiving unit **12**. But the first and second aspects of the embodiment of the present invention are distinguished from each other by the features described below. In the second aspect according to the embodiment of the present invention, both the light emitting unit **11** and the light receiving unit **12** are positioned on the same side of the fingertip **200**, such that the incident light beam LI emitted from the light emitting unit **11** falls on the fingertip **200** to turn into a reflecting light beam LR which reflects off the fingertip **200**. The light receiving unit **12** receives the reflecting light beam LR and converts the reflecting light beam LR into a data D_I indicative of the light intensity of the reflecting light beam LR. The processing unit **13** receives the data D_I and converts the data D_I into the physiological signal Sp.

[0023] The amounts of the light emitting unit **11**, the incident light beam LI, the outgoing light beam L_O, the reflecting light beam LR and the data D_I of the foregoing pulse blood oxygen sensor **10** are respectively one for an illustration. However, the light emitting unit **11** can comprise a red light source and an infrared light source. The red light source and the infrared light source emit a red light and an infrared light to the fingertip **200**, respectively. The optical signal processing unit **13** receives a red light data and an infrared data transmitted or reflected from the fingertip **200** and converts the red light data and the infrared data into the physiological signal Sp. The red light source of the light emitting unit **11** can be a red light-emitting diode, the infrared light source of the light emitting unit **11** can be an infrared light-emitting diode.

[0024] There are rhythmic changes in the inner diameter of arterioles in the fingertip **200**, because the amount of blood passing through the arterioles in the fingertip **200** changes rhythmically as the heart expands and contracts rhythmically. Both the data D_I indicative of the light intensity of the outgoing light beam L_O in the first aspect of the embodiment of the present invention and the data D_I indicative of the light intensity of the reflecting light beam LR in the second aspect of the embodiment of the present invention change with the volume of blood passing through the arterioles in the fingertip **200**, and the changes are detected by the light receiving unit **12** in real time so as to create the user's pulse rate-related information.

[0025] Similarly, both the data D_I indicative of the light intensity of the outgoing light beam L_O in the first aspect of the embodiment of the present invention and the data D_I indicative of the light intensity of the reflecting light beam LR in the second aspect of the embodiment of the present invention change with the blood oxygen level, and the changes are detected by the light receiving unit **12** in real time so as to create the user's blood oxygen level-related information.

[0026] In practice, changes attributed to the data D_I and detected by the light receiving unit **12** are measured in terms of light absorbance. It is because light intensity sensed by the light receiving unit **12** is inversely proportional to light absor-

bance of a matter, such as blood, and depends on the volume of blood passing through blood vessels and blood oxygen level.

[0027] Accordingly, in the first and second aspects according to the embodiment of the present invention, it is practicable to sense the user's pulse rate-related information P and blood oxygen level-related information O with the pulse blood oxygen sensor **10** and send the physiological signal Sp indicative of the pulse rate-related information P and the blood oxygen level-related information O.

[0028] Referring to FIG. **1**, the signal processing circuit **20** is electrically connected to the pulse blood oxygen sensor **10** and adapted to receive the physiological signal S_P, convert the physiological signal S_P into the pulse rate-related information P and the blood oxygen information O, and send the pulse rate-related information P and the blood oxygen level-related information O.

[0029] The loudspeaker **30** is electrically connected to the signal processing circuit **20** and adapted to receive the pulse rate-related information P and the blood oxygen level-related information O and then voice-broadcast the pulse rate-related information P and the blood oxygen level-related information O. In addition, the pulse oximeter **100** can also electrically connect with a physiological monitor and use a loudspeaker of the physiological monitor to voice-broadcast the pulse rate-related information P and the blood oxygen level-related information O.

[0030] In practice, immediately before surgery, the pulse oximeter **100** is mounted on the patient's body in a manner that the patient's fingertip is in contact with the pulse blood oxygen sensor **10**, such that the light emitting unit **11**, the light receiving unit **12**, and the optical signal processing unit **13** of the pulse blood oxygen sensor **10** operate in conjunction with each other to generate the physiological signal Sp indicative of the pulse rate-related information P and the blood oxygen level-related information O. Afterward, the signal processing circuit **20** receives the physiological signal Sp, converts the physiological signal Sp into the pulse rate-related information P and the blood oxygen level-related information O, and sends the pulse rate-related information P and the blood oxygen level-related information O. At last, after receiving the pulse rate-related information P and the blood oxygen level-related information O, the loudspeaker **30** voice-broadcasts the pulse rate-related information P and the blood oxygen level-related information O. Hence, during the surgery, the surgeon is informed of the patient's pulse rate-related information P and blood oxygen level-related information O by listening (with the surgeon's ear **300**) to the loudspeaker **30**, such that surgeon can focus on the surgeon.

[0031] Referring to FIG. **3**, there is shown a schematic view of a pulse oximeter **100'** according to another embodiment of the present invention. In addition to the pulse blood oxygen sensor **10**, the signal processing circuit **20**, and the loudspeaker **30**,

the pulse oximeter **100'** further comprises an audio receiver **40**. The audio receiver **40** functions like a microphone for perceiving ambient sound. The audio receiver **40** is electrically connected to the signal processing circuit **20** and adapted to be operated by a surgeon or a medical technician to adjust the pulse oximeter **100'** in a voice-controlled manner. The surgeon's or medical technician's voice is recorded on a storage component (not shown) of the signal processing circuit **20** in advance. Furthermore, the signal processing circuit **20** analyzes the ambient sound received by the audio receiver **40** and thus generates a control instruction accordingly. Also, the signal processing circuit **20** generates a voice control signal S_S in accordance with an external audio message given by the surgeon or medical technician. The voice control signal S_S enables the signal processing circuit **20** to enter an operating mode for receiving the physiological signal Sp and sending the pulse rate-related information P and the blood oxygen level-related information O. Also, the voice control signal S_S enables the signal processing circuit **20** to enter a low power consumption mode (also known as sleeping mode). Hence, the pulse oximeter **100'** wakens or enters a sleeping mode by a surgeon or medical technician and in a voice-controlled manner.

[0032] In conclusion, the pulse oximeter of the present invention is equipped with the pulse blood oxygen sensor, the signal processing circuit, and the loudspeaker whereby, during an operation being performed by a surgeon on a patient, the surgeon listens to the loudspeaker for pulse rate-related information and the blood oxygen level-related information pertaining to the patient, such that the surgeon can focus on the ongoing surgery.

[0033] The present invention is disclosed above by preferred embodiments. However, persons skilled in the art should understand that the preferred embodiments are illustrative of the present invention only, but should not be interpreted as restrictive of the scope of the present invention. Hence, all equivalent modifications and replacements made to the aforesaid embodiments should fall within the scope of the present invention. Accordingly, the legal protection for the present invention should be defined by the appended claims.

What is claimed is:

1. A pulse oximeter with a voice broadcast function, comprising:

a pulse blood oxygen sensor for sensing a pulse rate-related information and a blood oxygen level-related information and sending a physiological signal carrying the pulse rate-related information and the blood oxygen level-related information;

a signal processing circuit electrically connected to the pulse blood oxygen sensor and adapted to receive the physiological signal, convert the physiological signal into the pulse rate-related information and the blood oxygen level-related information, and send the pulse rate-related information and the blood oxygen level-related information; and

a loudspeaker electrically connected to the signal processing circuit and adapted to receive the pulse rate-related information and the blood oxygen level-related information and voice-broadcast the pulse rate-related information and the blood oxygen level-related information.

2. The pulse oximeter of claim **1**, wherein the pulse blood oxygen sensor comprises a light emitting unit, a light receiving unit, and an optical signal processing unit, wherein the light emitting unit and the light receiving unit are disposed at two opposite sides of a portion of a user's body, wherein the light emitting unit emits an incident light beam to penetrate the user's body and exit the user's body in form of an outgoing light beam, wherein the light receiving unit receives the outgoing light beam and sends a data indicative of light intensity of the outgoing light beam, wherein the optical signal processing unit is electrically connected to the light receiving unit and adapted to receive and convert the data indicative of the light intensity of the outgoing light beam into the physiological signal.

3. The pulse oximeter of claim 2, wherein the light emitting unit comprises a red light source and an infrared light source, the red light source is a red light-emitting diode, the infrared light source is an infrared light-emitting diode.

4. The pulse oximeter of claim 1, wherein the pulse blood oxygen sensor comprises a light emitting unit, a light receiving unit, and an optical signal processing unit, wherein the light emitting unit and the light receiving unit are disposed on a same side of a portion of a user's body, wherein the light emitting unit emits an incident light beam, wherein the incident light beam falls on the user's body and then reflects off the user's body in form of a reflecting light beam, wherein the light receiving unit receives the reflecting light beam and sends a data indicative of light intensity of the reflecting light beam, wherein the optical signal processing unit is electrically connected to the light receiving unit and adapted to receive and convert the data indicative of the light intensity of the reflecting light beam into a physiological signal.

5. The pulse oximeter of claim 4, wherein the light emitting unit comprises a red light source and an infrared light source, the red light source is a red light-emitting diode, the infrared light source is an infrared light-emitting diode.

6. The pulse oximeter of claim 1, further comprising an audio receiver electrically connected to the signal processing circuit and adapted to generate a voice control signal in accordance with an external audio message received, wherein the voice control signal enables the signal processing circuit to enter an operating mode for receiving the physiological signal and sending the pulse rate-related information and the blood oxygen level-related information and enables the signal processing circuit to enter a low power consumption mode.

7. The pulse oximeter of claim 2, further comprising an audio receiver electrically connected to the signal processing circuit and adapted to generate a voice control signal in accordance with an external audio message received, wherein the voice control signal enables the signal processing circuit to enter an operating mode for receiving the physiological signal and sending the pulse rate-related information and the blood oxygen level-related information and enables the signal processing circuit to enter a low power consumption mode.

8. The pulse oximeter of claim 3, further comprising an audio receiver electrically connected to the signal processing circuit and adapted to generate a voice control signal in accordance with an external audio message received, wherein the voice control signal enables the signal processing circuit to enter an operating mode for receiving the physiological signal and sending the pulse rate-related information and the blood oxygen level-related information and enables the signal processing circuit to enter a low power consumption mode.

9. The pulse oximeter of claim 4, further comprising an audio receiver electrically connected to the signal processing circuit and adapted to generate a voice control signal in accordance with an external audio message received, wherein the voice control signal enables the signal processing circuit to enter an operating mode for receiving the physiological signal and sending the pulse rate-related information and the blood oxygen level-related information and enables the signal processing circuit to enter a low power consumption mode.

10. The pulse oximeter of claim 5, further comprising an audio receiver electrically connected to the signal processing circuit and adapted to generate a voice control signal in accordance with an external audio message received, wherein the voice control signal enables the signal processing circuit to enter an operating mode for receiving the physiological signal and sending the pulse rate-related information and the blood oxygen level-related information and enables the signal processing circuit to enter a low power consumption mode.

* * * * *

专利名称(译)	脉搏血氧仪具有语音播报功能		
公开(公告)号	US20160120484A1	公开(公告)日	2016-05-05
申请号	US14/531072	申请日	2014-11-03
[标]申请(专利权)人(译)	LIEN AUGUSTINE Y		
申请(专利权)人(译)	LIEN，AUGUSTINE Y.		
当前申请(专利权)人(译)	LIEN，AUGUSTINE Y.		
[标]发明人	LIEN AUGUSTINE Y		
发明人	LIEN, AUGUSTINE Y.		
IPC分类号	A61B5/00 A61B5/1455		
CPC分类号	A61B5/741 A61B2562/0238 A61B5/7278 A61B5/14552 A61B5/02416 A61B5/749		
外部链接	Espacenet USPTO		

摘要(译)

介绍了一种具有语音广播功能的脉搏血氧仪，用于语音广播脉搏率相关信息和血氧水平相关信息。脉搏血氧计包括脉冲血氧传感器，信号处理电路和扬声器。脉搏血氧传感器感测用户的脉搏率相关信息和血氧水平相关信息，并发送携带脉率相关信息和血氧水平相关信息的生理信号。信号处理电路电连接到脉冲血氧传感器，并适于接收生理信号并将其转换成脉率相关信息和血氧水平相关信息，并发送脉率相关信息和血氧水平-相关信息。扬声器电连接到信号处理电路，并适于接收和语音广播脉搏率相关信息和血氧水平相关信息。