(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 231 857 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
19.01.2005 Bulletin 2005/03

(21) Application number: **00976831.8**

(22) Date of filing: **01.11.2000**

(51) Int Cl.[7]: **A61B 5/00**

(86) International application number:
PCT/US2000/030219

(87) International publication number:
WO 2001/037725 (31.05.2001 Gazette 2001/22)

(54) **PULSE OXIMETER SENSOR WITH WIDENED METAL STRIP**

PULSOXIMETERSENSOR MIT EINEM BREITEREN METALLBAND

CAPTEUR DE SPHYGMO-OXYMETRE COMPRENANT UNE BANDE METALLIQUE ELARGIE

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE

(30) Priority: **22.11.1999 US 447455**

(43) Date of publication of application:
21.08.2002 Bulletin 2002/34

(60) Divisional application:
04024752.0

(73) Proprietor: **MALLINCKRODT INC.**
Hazelwood, MO 63042 (US)

(72) Inventor: **CHIN, Rodney**
Oakland, CA 94611 (US)

(74) Representative: **Rees, Alexander Ellison et al**
Urquhart-Dykes & Lord LLP
30 Welbeck Street
London W1G 8ER (GB)

(56) References cited:
EP-A- 0 538 631
US-A- 5 054 488
US-A- 5 246 003

EP 1 231 857 B1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to pulse oximeter sensors, and in particular to techniques for shielding against ambient light and preventing delamination of flexible, disposable sensors.

[0002] A type of pulse oximeter sensor that is commonly used is a flexible, disposable sensor. It typically has multiple layers, with white layers on the outside visible to the user. The white gives the image of cleanliness and sterility, and also is opaque to certain wavelengths of light over the range of the photodetector's sensitivity. An example of a sensor referring to a white opaque layer is set forth in the US Patent No. 4,865,038.

[0003] A number of these sensors include metalized layers which can be either a conductive shield or a shield from ambient light. See, for example, US Patent Nos. 4,928,691; 5,246,003; 5,094,240; 5,054.488; and 4,964,408. US Patent No. 4.928.691 refers to the use of a red layer to avoid ambient light.

[0004] Document US-A-5 246 003 discloses a device having the features of the preamble of claim 1.

[0005] Ambient light can interfere with the operation of a pulse oximeter, especially under the bright lights of surgery or in outdoor, daylight conditions. While the use of a metal layer has been effective to shield from such ambient light, there is also a competing desire to have transparency in order to observe how a sensor is attached. In addition, the introduction of additional layers into the sensor is susceptible to sensor failure by delamination.

[0006] Accordingly, it would be desirable to have a sensor which would shield against ambient light, be resistant to delamination and have some transparency.

SUMMARY OF THE INVENTION

[0007] The present invention provides a pulse oximeter sensor according to claim 1, having an opaque, metalized layer to shield from ambient light. The metalized layer surrounds the area of the light detector. The sensor has a transparent portion, with the opaque, metalized layer covering only the portions around the light detector and other areas, such as a strip extending between the light detector and the emitter. The opaque, metalized layer is a strip which has a widened portion in the area around the light detector.

[0008] The widened portion of the metalized layer, in conjunction with widened portions that match on adjacent layers resists delamination stresses.

[0009] In a preferred embodiment, the wires connecting to the emitter take an angular path, preferably crossing over from one side of the detector, across a center line between the emitter and detector, to an opposite side of the emitter. This angular path. as opposed to a straight path, disperses stresses caused by the wires, further inhibiting delamination or separation of the layers of the sensor.

[0010] In another preferred embodiment, the widened area of the metalized and adjacent layers has a semicircular profile around the photodetector.

[0011] For a further understanding of the nature and advantages of the invention, reference should be made to the following description taken in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Fig. 1 is an exploded view of a sensor according to the present invention showing the different layers.

DESCRIPTION OF THE SPECIFIC EMBODIMENTS

[0013] Fig. 1 illustrates a sensor 10 according to the invention. The sensor includes a transparent layer 12 which is wider than a white layer 14 mounted on top of it. On top of white layer 14, is mounted a correspondingly-shaped metalized layer 16. On metalized layer 16 is mounted another white layer 18 having holes 20 and 22 allowing light to pass from/to the emitter and detector. The emitter and detector are mounted on metalized layer 16. Adhesives may be used between the layers for mounting.

[0014] As can be seen, metalized layer 16 includes a widened region defined by a curved perimeter 26. Similar widened regions 28 and 30 are found on white strips 18 and 14, respectively. This widened area surrounds the photodetector 32. Such a widened area prevents ambient light from reaching the photodetector and disturbing its readings. At the same time, by only widening a portion of the strip, other areas of transparent layer 12 allow viewing of the patient when the sensor is attached. This allows, for example, an examination of how tightly the sensor is secured to the patient by looking through transparent layer 12.

[0015] Widened area 26 and corresponding widened areas 28 and 30 also resist delamination. As opposed to a straight line strip, these areas are curved such that when the sensor is wrapped around a user's finger or other appendage, the stresses are dispersed rather than being focused on a line. Accordingly, it has been found that this design resists delamination and has fewer failures than a straight strip.

[0016] Another stress that can result in delamination is the stress induced by the wires 34 which connect to the emitter or light emitting diode (LED) 36. The present invention reduces the stresses by providing an angular path of wires 34 between cable 38 and photo emitter or LEDs 36. In prior devices, the wires were laid out in a straight line, which was found to contribute to delamination. The angular path where the wires start out beside photodetector 32 and cross the center line between the photodetector and emitter, then above emitter 36 reduces the stresses.

[0017] In addition, the wires circle around and attach to photo emitter 36 from the backside. as in previous devices. Also, as in previous devices, photodetector 32, which attached to a coaxial cable 40 inside cable 38. is mounted closer to cable 38 so that the coaxial cable extends onto less of the sensor.

[0018] Preferably, metalized layer 16 is a layer of aluminized mylar having a thickness of less than 1 mm. The curved area 26 preferably extends for at least three-quarters of an inch (1,9 cm), more preferably slightly more than one inch (2,5 cm) along the length of strip 16. It preferably extends outward from the straight edge of strip 16 by at least one-eighth of an inch (0,31 cm), more preferably approximately one-quarter inch (0,63 cm).

[0019] Fig. 1 also shows a Faraday shield 42 which wraps around photodetector 32. It is shown partially open in Fig. 1. The Faraday shield is preferably a piece of copper which is solid metal, except for a mesh portion directly above photodetector 32. In one embodiment, part of Faraday shield 42 attaches directly to metal layer 16.

[0020] As will be understood by those of skill in the art, the present invention may be embodied in other specific forms without departing from the essential characteristics thereof. For example, the widened area could be any shape, not just semi-circular. It could be more of an oval shape, square, trapezoidal, etc. Additionally, the metalized layer need not extend the entire length of the sensor, but could simply be in the area around the photodetector, or around the photodetector and photo emitter. Additionally, wires 34 could take any other angular path between the emitter and detector. Also, the strips themselves could be other shapes, with the transparent strip 12 in particular having other patterns for the portion which is viewable. Parts (layers) may have translucent layered components as well as transparent layered components. Layer 16 could be a metalized translucent layer. Layer 12 can be transparent. Layer 18 can be reflective white layer. Layer 24 is not used in a preferred embodiment. Layer 24 can be added if delamination is a problem. In one embodiment there are adhesive layers between each of layers 12, 14 16, and 18.

[0021] Accordingly, the foregoing description is intended to be illustrative, but not limiting, of the scope of the invention which is defined by the appended claims.

Claims

1. A pulse oximeter sensor, comprising a flexible, transparent substrate (12),

   an opaque, metalized layer (16) mounted on a first side of said transparent substrate, said metalized layer covering only a portion of said transparent substrate;

   a light emitter (36) mounted on a first side of said metalized layer to emit light away from said metalized layer,

   a light detector (32) mounted on said first side of said metalized layer;

   a non-tranparent layer (18) mounted over said light emitter and said detector, said non-transparent layer having holes over said light emitter and detector, and

   an adhesive layer (24) disposed on said non-transparent layer and a portion of said transparent layer not covered by said metalized layer and said non-transparent layer.

   wherein said metalized layer comprises a strip extending at least from said emitter to said detector, **characterised in that** said strip has a wider portion (26) adjacent said detector, said wider portion of said strip having a curved perimeter.

2. The sensor of claim 1 wherein said curved perimeter extends along at least three quarters of an inch (1.9 centimeters) on both sides of said strip adjacent said detector, and extends outward at least an eigth of an inch (0.31 centimeters) from said strip at a maximum point of extension.

3. The sensor of claim 1 wherein said non-transparent layer comprises a strip having a wider portion (28) matching said wider portion of said metalized layer.

4. The sensor of claim 1 further comprising a cable (38) extending into said sensor, said detector being mounted closer to said cable than said emitter, and further comprising wires (34) from said. cable connecting to said emitter, said wires crossing over a line between said emitter and said detector in a region between said emitter and said detector.

5. The sensor of claim 1 further comprising a Faraday shield (42) at least partially surrounding said detector, said Faraday shield being connected to said metalized layer.

Patentansprüche

1. Pulsoxymetersensor, umfassend ein flexibles durchsichtiges Substrat (12),

   eine undurchsichtige, metallisierte Schicht (16), die auf einer ersten Seite des durchsichtigen Substrats montiert ist, wobei die metallisierte Schicht nur einen Teil des durchsichtigen Substrats bedeckt;

   eine Lichtemissionsquelle (36), die auf einer ersten Seite der metallisierten Schicht montiert ist, um Licht von der metallisierten Schicht weg auszusenden;

   einen Lichtdetektor (32), der auf der ersten Seite der metallisierten Schicht montiert ist;

   eine nicht durchsichtige Schicht (18), die über der Lichtemissionsquelle und dem Detektor mon-

tiert ist, wobei die nicht durchsichtige Schicht über der Lichtemissionsquelle und dem Detektor Löcher aufweist; und

eine haftfähige Schicht (24), die auf der nicht durchsichtigen Schicht und einem Teil der durchsichtigen Schicht, die nicht von der metallisierten Schicht bedeckt ist, und der nicht durchsichtigen Schicht angebracht ist,

wobei die metallisierte Schicht einen Streifen umfasst, der sich mindestens von der Emissionsquelle zu dem Detektor erstreckt, **dadurch gekennzeichnet, dass** der Streifen einen breiteren Teil (26), der neben dem Detektor liegt, aufweist, wobei der breitere Teil des Streifens einen gekrümmten Umfang aufweist.

2. Sensor nach Anspruch 1, wobei der gekrümmte Umfang sich mindestens 1,9 Zentimeter (dreiviertel Zoll) auf beiden Seiten des neben dem Detektor liegenden Streifens entlang und mindestens 0,31 Zentimeter (einen achtel Zoll) von dem Streifen am maximalen Punkt der Ausdehnung nach außen erstreckt.

3. Sensor nach Anspruch 1, wobei die nicht durchsichtige Schicht einen Streifen umfasst, der einen breiteren Teil (28) aufweist, der zu dem breiteren Teil der metallisierten Schicht passt.

4. Sensor nach Anspruch 1, des Weiteren ein Kabel (38) umfassend, das sich in den Sensor erstreckt, wobei der Detektor näher zum Kabel montiert ist als die Emissionsquelle, und des Weiteren Drähte (34) von dem Kabel umfassend, die mit der Emissionsquelle verbunden sind, wobei die Drähte eine Leitung zwischen der Emissionsquelle und dem Detektor in einem Bereich zwischen der Emissionsquelle und dem Detektor überkreuzen.

5. Sensor nach Anspruch 1, des Weiteren eine Faradaysche Schutzscheibe (42) umfassend, die den Detektor mindestens teilweise umgibt, wobei die Faradaysche Schutzscheibe mit der metallisierten Schicht verbunden ist.

Revendications

1. Détecteur de type oxymètre à pulsation, comprenant un substrat transparent souple(12),

une couche métallisée opaque (16), montée sur une première face dudit substrat transparent, ladite couche métallisée ne recouvrant qu'une portion dudit substrat transparent;

un émetteur de lumière (36), monté sur une première face de ladite couche métallisée pour émettre de la lumière à l'écart de ladite couche métallisée;

un détecteur de lumière (32), monté sur ladite première face de ladite couche métallisée;

une couche non transparente (18), montée par dessus ledit émetteur de lumière et ledit détecteur, ladite couche non transparente ayant des trous sur ledit émetteur de lumière et ledit détecteur; et

une couche adhésive (24), disposée sur ladite couche non transparente et une portion de ladite couche transparente non recouverte par ladite couche métallisée et par ladite couche non transparente,

dans laquelle ladite couche métallisée comprend une bande se prolongeant au moins à partir dudit émetteur audit détecteur, **caractérisé en ce que** ladite bande a une portion plus large (26), adjacente audit détecteur, ladite portion plus large de ladite bande ayant un périmètre courbé.

2. Détecteur selon la revendication 1, dans lequel ledit périmètre courbé se prolonge le long d'au moins trois quarts d'un pouce (1,9 centimètres) sur les deux faces de ladite bande adjacente audit détecteur, et se prolonge vers l'extérieur d'au moins un huitième de pouce (0,31 centimètre) à partir de ladite bande à un point d'extension maximale.

3. Détecteur selon la revendication 1, dans lequel ladite couche non transparente comprend une bande ayant une portion plus large (28) s'assortissant à ladite portion plus large de ladite couche métallisée.

4. Détecteur selon la revendication 1, comprenant, en outre, un câble(38), se prolongeant vers ledit détecteur, ledit détecteur étant monté d'une manière plus rapprochée audit câble que ne l'est ledit émetteur, et comprenant, en outre, des fils (34) provenant dudit câble raccordé audit détecteur, lesdits fils croisant une ligne entre ledit émetteur et ledit détecteur dans une région entre ledit émetteur et ledit détecteur.

5. Détecteur selon la revendication 1, comprenant en outre un cage de Faraday (42), entourant au moins partiellement ledit détecteur, ladite cage de Faraday étant connectée à ladite couche métallisée.

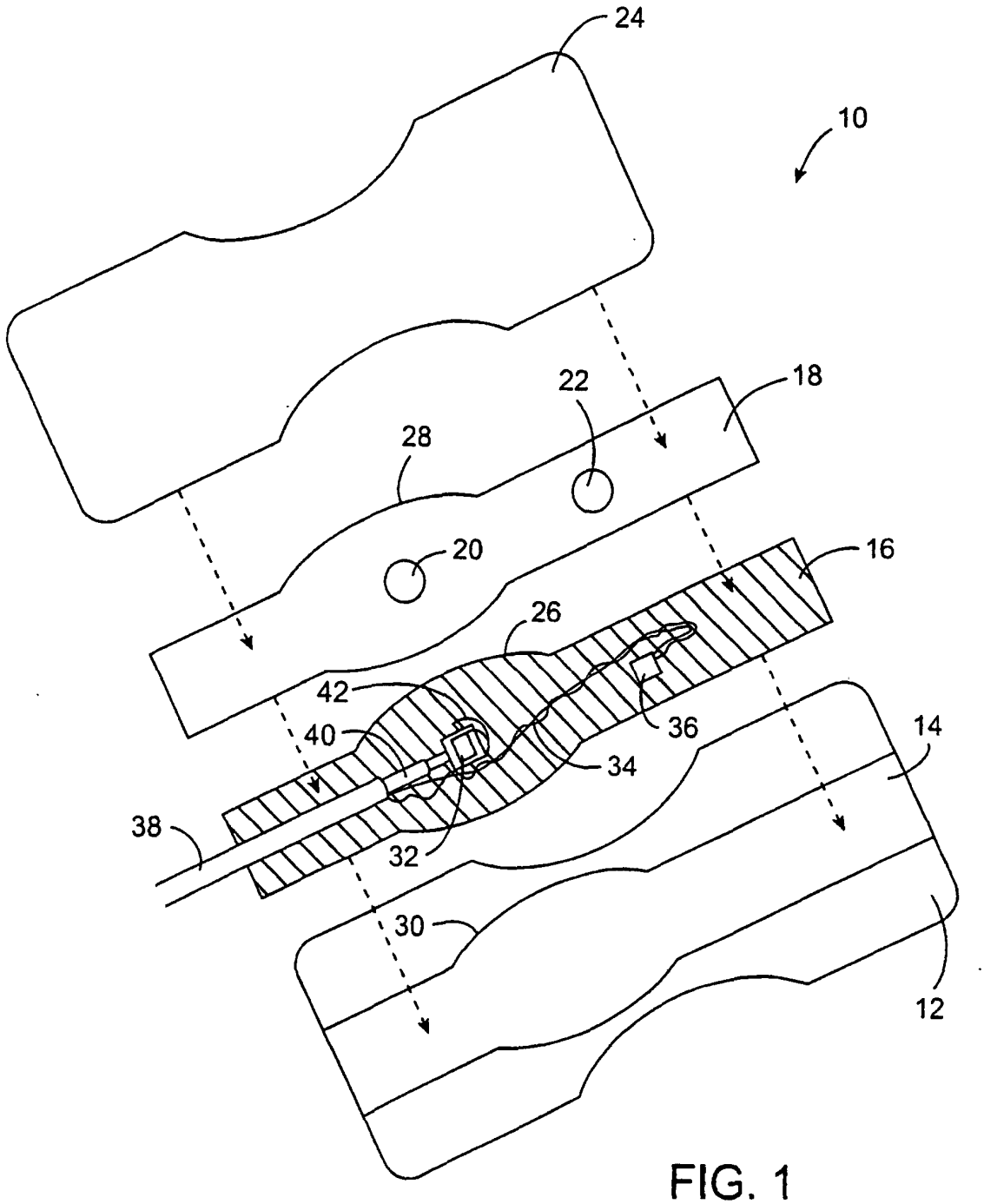

FIG. 1

专利名称(译)	带有加宽金属条的脉搏血氧仪传感器		
公开(公告)号	EP1231857B1	公开(公告)日	2005-01-19
申请号	EP2000976831	申请日	2000-11-01
[标]申请(专利权)人(译)	马林克罗特公司		
申请(专利权)人(译)	马林克罗特INC.		
当前申请(专利权)人(译)	马林克罗特INC.		
[标]发明人	CHIN RODNEY		
发明人	CHIN, RODNEY		
IPC分类号	A61B5/145 A61B5/00 A61B5/1455		
CPC分类号	A61B5/6826 A61B5/14552 A61B5/6838 A61B2562/182		
优先权	09/447455 1999-11-22 US		
其他公开文献	EP1231857A1		
外部链接	Espacenet		

摘要(译)

一种脉冲血氧计传感器，具有不透明的金属化层（16）以屏蔽环境光。金属化层（16）围绕光检测器（32）的区域。在一个实施例中，传感器具有透明部分（12），不透明的金属化层（16）仅覆盖光检测器（32）周围的部分和其他区域，例如在光检测器（32）之间延伸的条带。和发射器（36）。在优选实施例中，不透明的金属化层（16）是条带，其在光检测器（32）周围的区域中具有加宽部分。

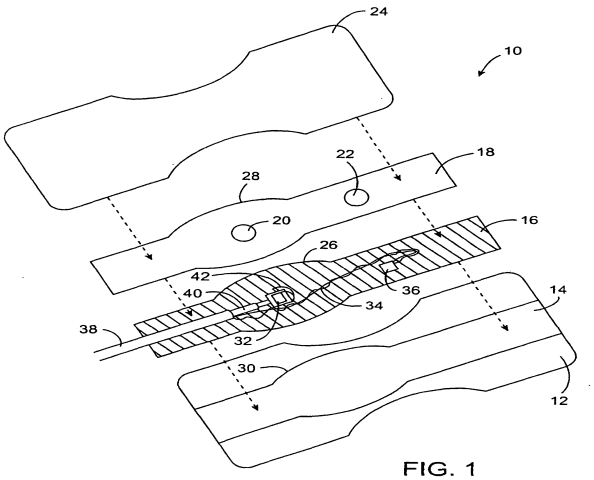

FIG. 1