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(54) **SENSOR HOLDER**

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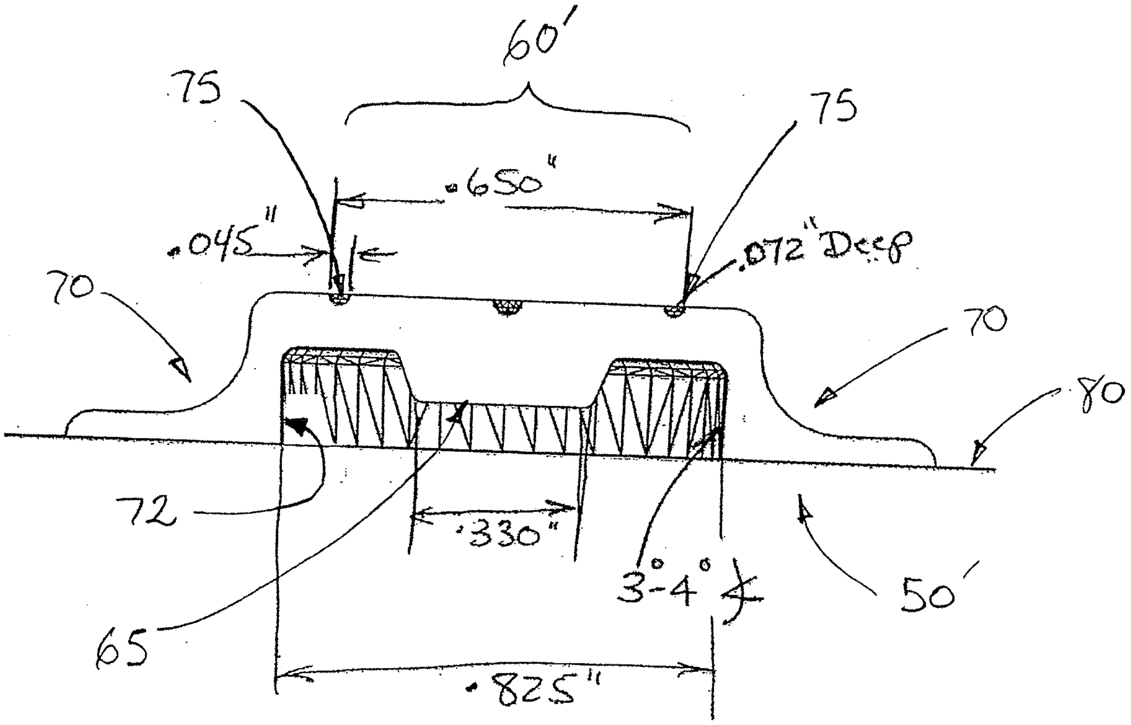
(57) **ABSTRACT**

The present invention is directed to holders for a sensor. The holders apply pressure to the sensor to prevent a venous blood signal without dampening the arterial blood signal and are optically opaque to shield ambient light from reaching the sensor.



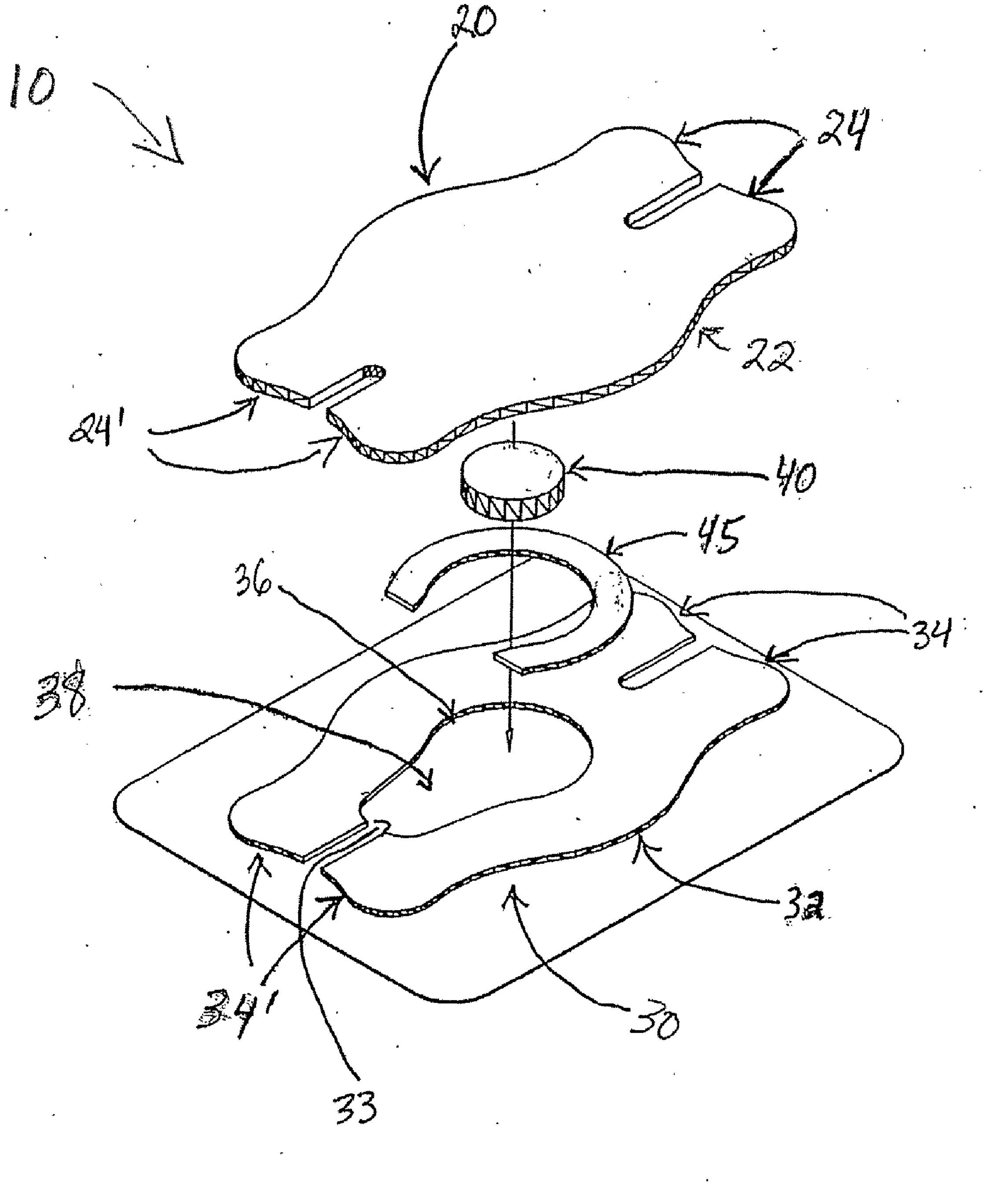


FIG. 1

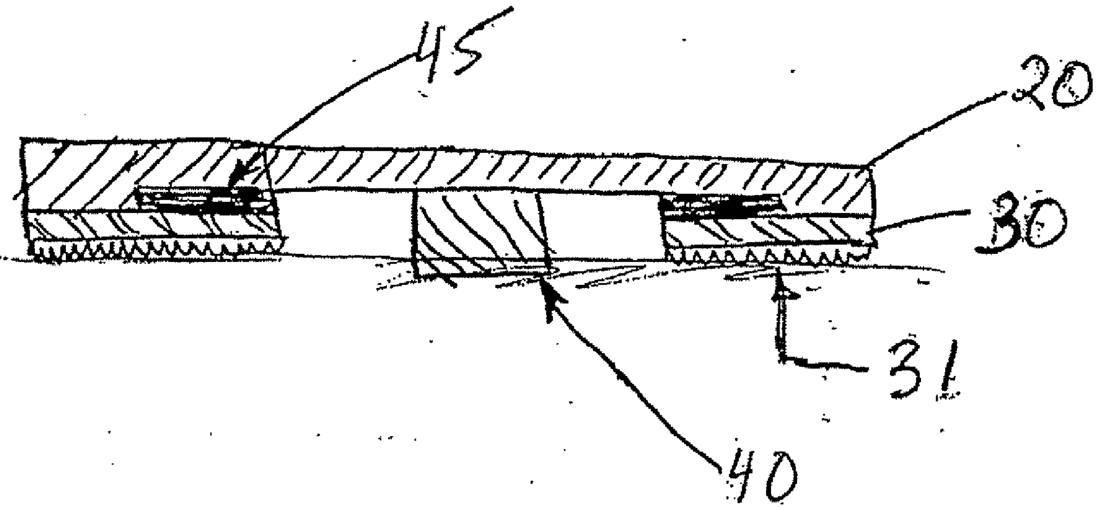


FIG. 2

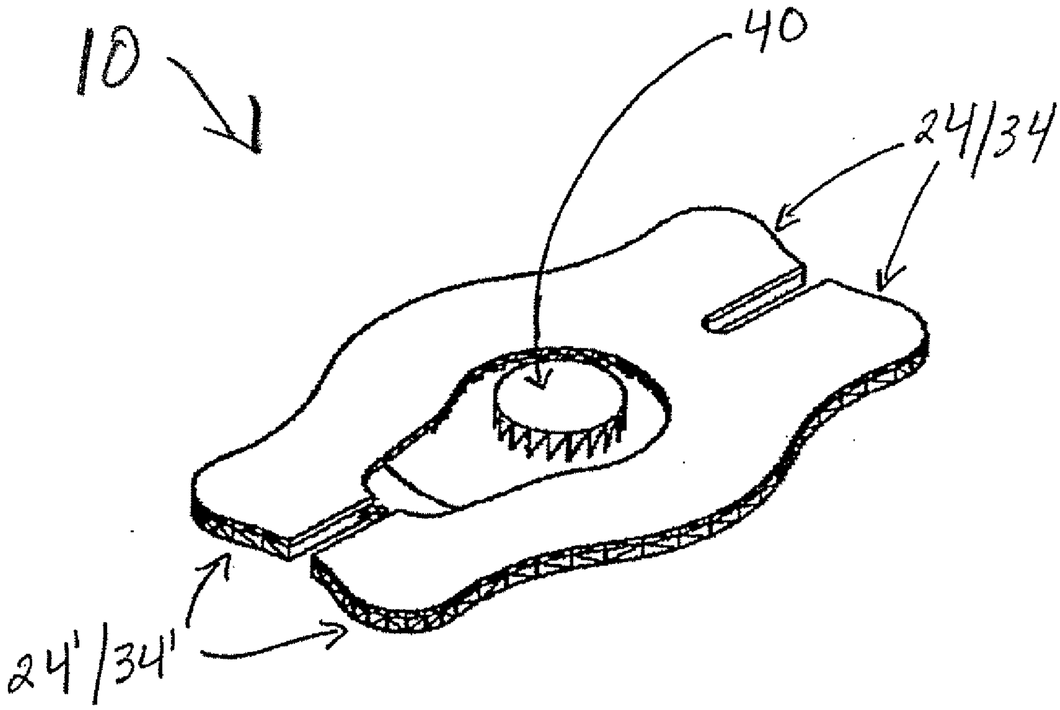


FIG. 3

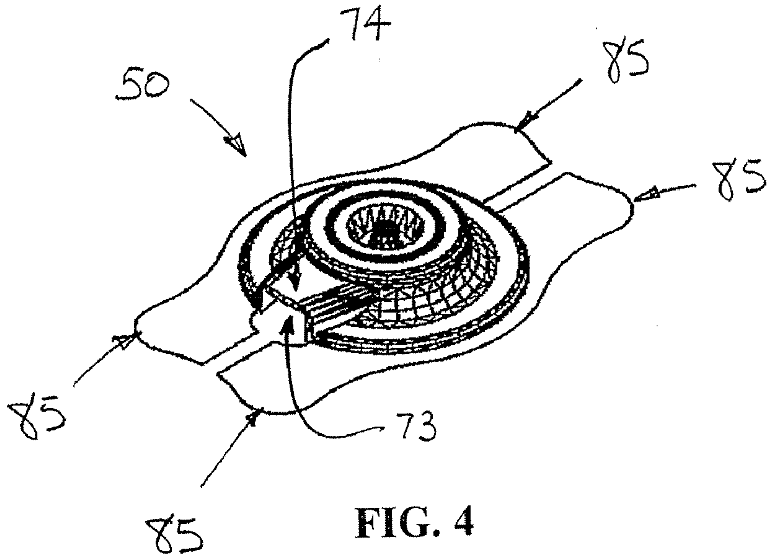


FIG. 4

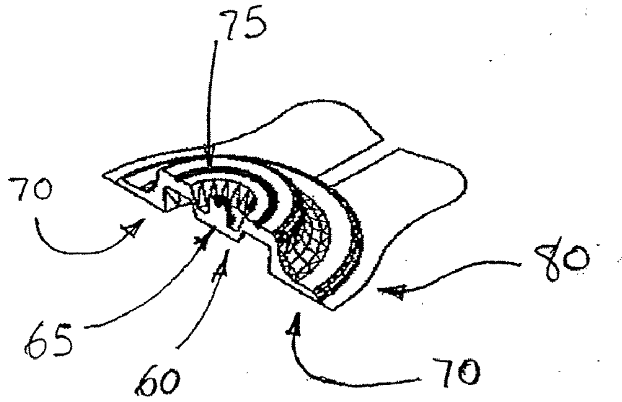


FIG. 5

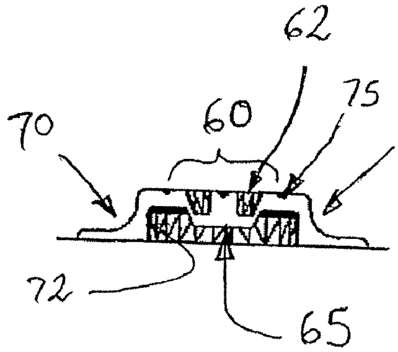


FIG. 6

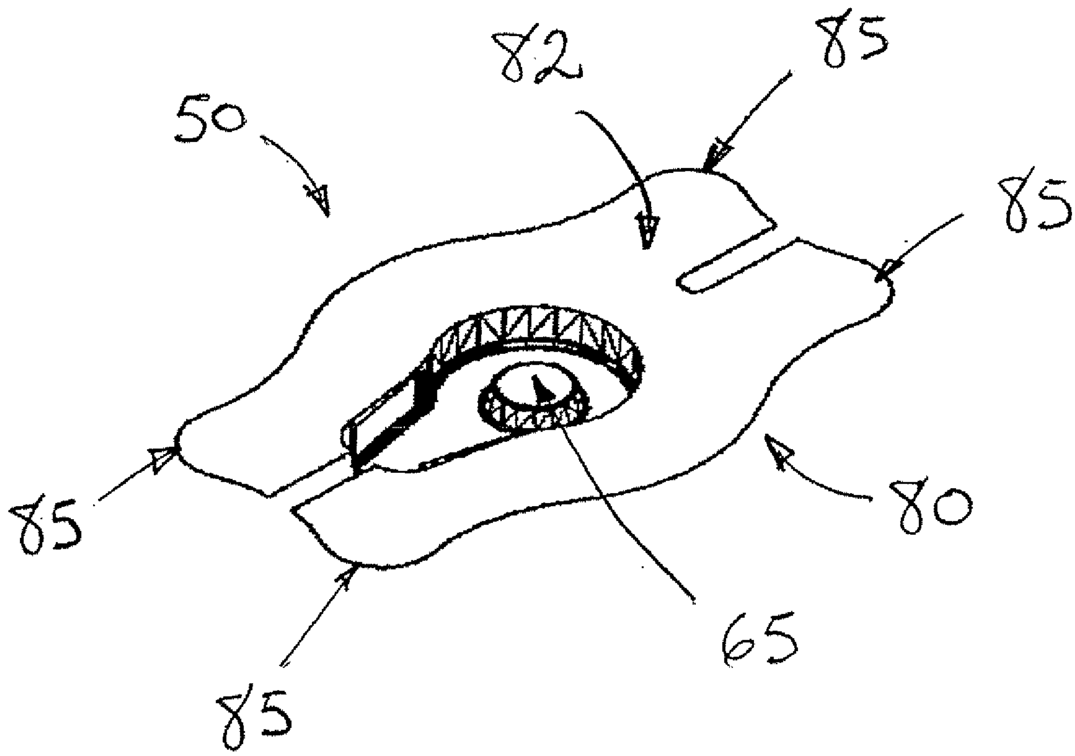


FIG. 7

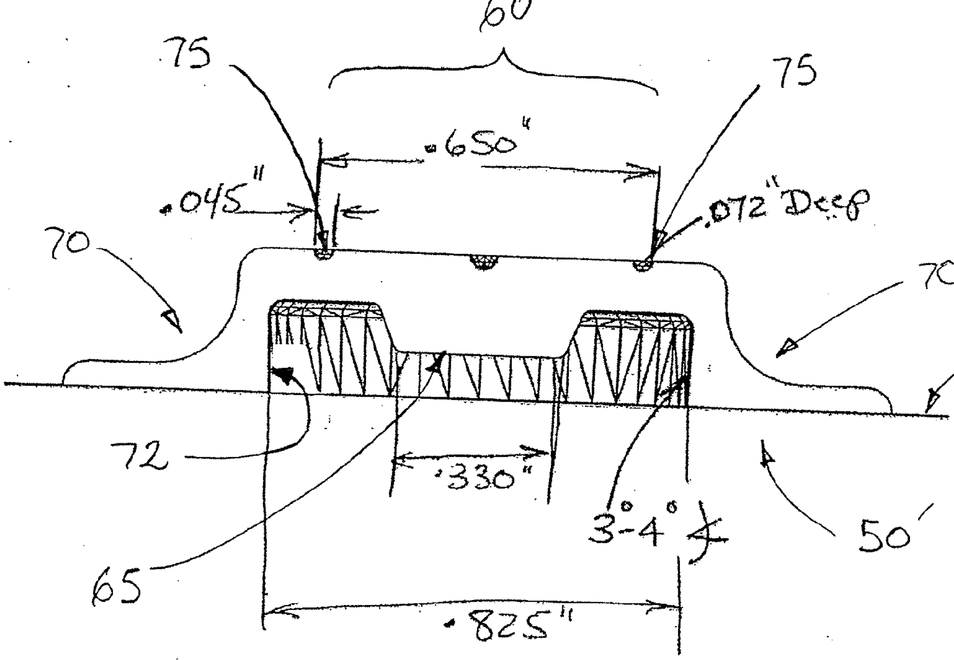


FIG. 8

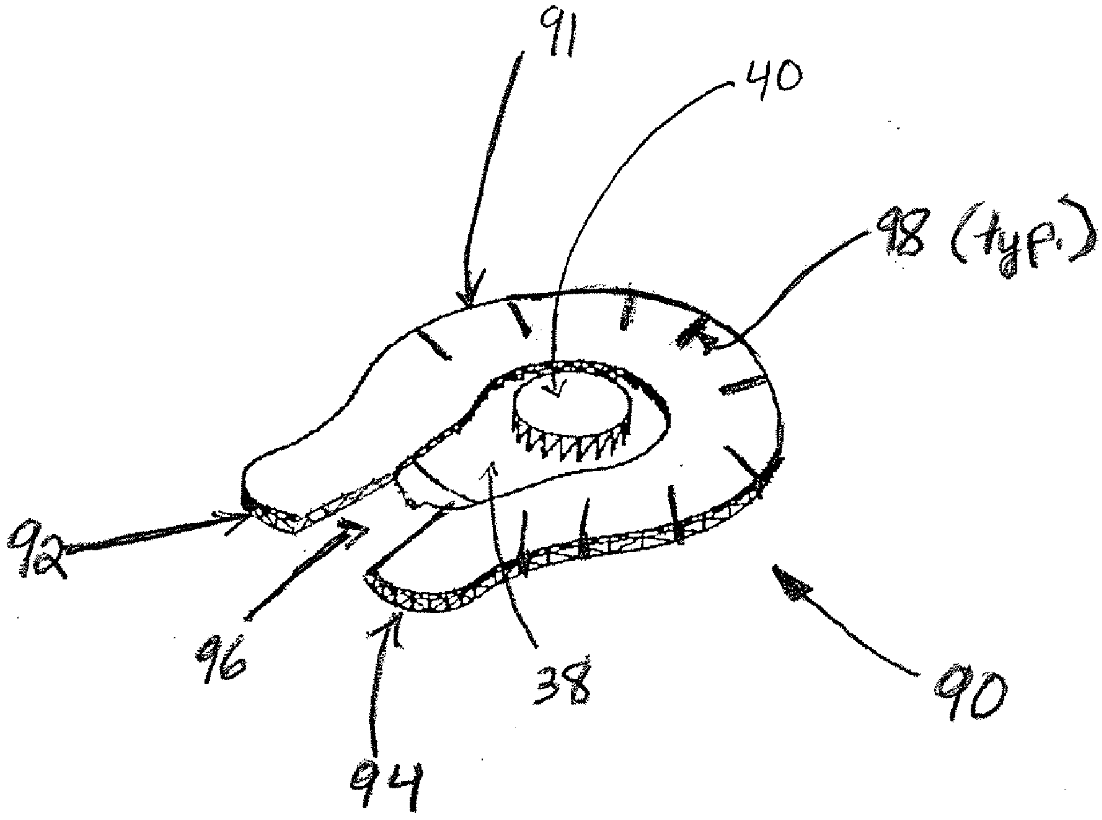


FIG. 9

SENSOR HOLDER

RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Application No. 60/721,823, filed Sep. 29, 2005, which is incorporated by reference herein.

BACKGROUND OF THE INVENTION

[0002] Noninvasive reflectance pulse oximetry has recently become an important new clinical technique with potential benefits in fetal and neonatal monitoring. The main reason for this application is the need to measure the relative concentration of oxygenated hemoglobin in arterial blood, SaO_2, from multiple convenient locations on the body (e.g. the head, torso, or upper limbs), where conventional transmission pulse oximetry cannot be used. Using reflectance oximetry to monitor SaO_2 in the fetus during labor, where the only accessible location is the fetal cheek or scalp, provides additional convenient locations for sensor attachment.

[0003] While transmission and reflection pulse oximetry are based on similar spectrophotometric principles, it is widely known that reflection pulse oximetry is more challenging to perform and has unique problems. Reflection pulse oximetry can be adversely affected by strong ambient light generated for instance by light sources in the operating room or other light sources used for patient examination or phototherapeutic interventions. Another practical problem in reflection pulse oximetry is the generally very weak pulsatile AC signals that are typically about 10 to 20 times smaller in amplitude compared to AC signals detected by transmission mode pulse oximeter sensors. Consequently, the normalized AC/DC ratios derived from the reflected R or IR photoplethysmograms that are used to compute arterial oxyhemoglobin saturation, SpO_2, are very small and range from about 0.001 to 0.005 depending on sensor configuration or placement. In addition, the small amplitudes add considerable noise often leading to unstable readings, false alarms and inaccurate measurements of SpO_2.

[0004] Improving the quality of the detected photoplethysmographic signals in reflectance pulse oximetry will be beneficial, since inaccuracies caused by noisy and weak pulsatile signals remain one of the major unsolved sources of errors in reflectance pulse oximetry.

SUMMARY OF THE INVENTION

[0005] The present invention is directed to holders for a sensor. The holders apply pressure to the sensor to prevent a venous blood signal without dampening the arterial blood signal and are optically opaque to shield ambient light from reaching the sensor.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. **1** is an exploded isometric view of a first embodiment of a sensor holder in accordance with the present invention;

[0007] FIG. **2** is a cross-sectional view of the holder of FIG. **1**;

[0008] FIG. **3** is a bottom isometric view of the holder of FIG. **1**;

[0009] FIG. **4** is a top isometric view of a second embodiment of a sensor holder in accordance with the present invention;

[0010] FIG. **5** is a top isometric cross-sectional view of the holder of FIG. **4**;

[0011] FIG. **6** is a cross-sectional view of the holder of FIG. **4**;

[0012] FIG. **7** is a bottom isometric view of the holder of FIG. **4**

[0013] FIG. **8** is a cross-sectional view of a third embodiment of a sensor holder in accordance with the present invention.

[0014] FIG. **9** is a bottom isometric view of a fourth embodiment of a sensor holder in accordance with the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0015] Reflectance pulse oximetry sensors can be used to obtain arterial pulse readings from a patient when they are in contact with a surface of the patient's body (e.g., skin on the patient's forehead or another suitable part of the body). Disposable holders are typically used to hold such sensors on the patient's body. When the holders are opaque, they advantageously provide optical shielding and reduce the negative effects of ambient light on the photoplethysmographic signal.

[0016] When the pulse oximetry sensor is placed in contact with the patient's skin and pressure is applied to the sensor, the arterial pulse readings are improved considerably. Pressure on a sensor diminishes venous blood in the tissue underneath and, consequently, the disturbing influence of pulsating and non-pulsating venous blood is reduced considerably. The arterial pulse readings are most improved when the amount of pressure is high enough to block venous blood interference, but not so high as to dampen the arterial signal. It is therefore desirable for the holder to press the sensor against the patient's skin with pressure in this range.

[0017] With reference to FIGS. **1-3**, a first embodiment of the present invention provides a holder **10** for an oximetry sensor (not shown) that simultaneously provides optical shielding, holds the sensor in place, and applies a desired amount of pressure. In the embodiments described herein, the sensor is a reflectance pulse oximetry sensor that is adapted to measure oxygen saturation in living tissue. In alternative embodiments, other types of sensors that benefit from optical shielding and/or a selective degree of pressure may be used instead of the oximetry sensors described herein.

[0018] As shown in FIG. **1**, the holder **10** of this embodiment is H-shaped and is about 2¾" long and about 1¾" wide. The holder **10** includes a roof portion **20** and a base portion **30**.

[0019] The roof portion **20** is sufficiently large to accommodate a sensor plus additional regions surrounding the sensor to permit good adhesion and to provide optical shielding. The roof portion **20** is preferably made of material that is optically opaque to provide shielding from ambient light. In addition, the roof portion **20** is preferably flexible so that the holder **10** can curve and conform to differently shaped body surfaces. One example of a suitable material for the roof portion **20** is black, closed cell polyethylene foam having a thickness of 1/16" and a 4 pound density. In the illustrated embodiment, flanges **24**, **24"** extend out on opposite sides of the central region of the roof portion **20**. These flanges are separated so that they can be positioned independent from each other. In the illustrated embodiment, they are spaced apart by about 1/8".

[0020] The base portion is shaped to match the roof portion, but with a cutout for aperture **33** for receiving the sensor (not shown). Preferably, this aperture **33** is dimensioned to conform to the shape of the sensor, but is slightly larger than the sensor. For example, if the sensor has a diameter of 0.8", a suitable diameter for the aperture would be about 0.825". The base portion **30** is preferably made of material that is optically opaque and flexible to provide shielding from ambient light and to allow the holder **10** to adhere to curved body surfaces. One example of a suitable material for the base portion **30** is black, closed cell polyethylene foam having a thickness of 1/32" and a 6 pound density. Flanges **34**, **34'** extend out on opposite sides of the central region and are configured to correspond and adhere to the flanges **24**, **24'** of the roof portion **20**.

[0021] To form a useable holder, the roof portion **20** and the base portion **30** are lined up and connected together using, for example, any suitable permanent adhesive such as a contact adhesive system. Once the roof portion **20** and base portion **30** are connected, the lower surface of the roof portion **20** and the inner sidewall **36** of the base portion **30** form an interior cavity **38**. The resulting interior cavity **38** will match the contour of the sensor that will be used with the holder **10**. This helps to limit motion artifacts that might otherwise interfere with the measurements being made (by providing a tight fit housing around the sensor). The roof portion **20** and the base portion **30** should be aligned during assembly so that the flanges **24**, **24'** of the roof portion **20** line up with the flanges **34**, **34'** of the base portion, resulting in a holder with flanges on opposite sides of the central region. These flanges **24/34**, **24'/34'** help hold the sensor holder **10** to the patient's skin. The holder **10** can be more readily and effectively placed on curved surfaces, such as the forehead of a patient, because each flange **24/34**, **24'/34'** can be positioned independently to yield greater adhesion, thereby preventing the holder **10** from peeling away from the patient's body during use.

[0022] As shown in FIG. 2, the holder **10** includes a layer of adhesive **31** located on the lower surface of the base portion **30** and the flanges **34**, **34'**. The sensor holder **10** is attached to the skin by this adhesive **31**. Preferably, the adhesive **31** is applied to the entire lower surface of the base portion **30** and all the flanges **34**, **34'**, but in alternative embodiments some sections may remain adhesive free. Suitable adhesives include biocompatible skin-friendly medical grade acrylic adhesives such as SPS896, which is an alcohol-soluble acrylic adhesive available from Electromed. Other suitable adhesives include the Adhesives Research 7717 system and the Avery Dennison 416A system. Preferably, the adhesive layer is between about 1¼ and 1¾mils thick.

[0023] A skin friendly, biocompatible Hydrogel adhesive may also be used, particularly on burn patients and babies. Hydrophilic hydrogels are preferred. Hydrogel adhesives allow the holder **10** to be repositioned and yet still provide strong adhesion to the patient's skin. One example of a suitable hydrogel adhesive is Conmed Hydrogel 2000, which is available through the patient care division of Conmed. Other suitable hydrogel adhesives are available from Axelguard and Ludlow, a division of Tyco International. Hydrogel adhesives may be supplied as sheeted gel die cut to meet the required shape.

[0024] In operation, a sensor is placed into the interior cavity **38** of the holder **10** and the lower surface of the base portion **30** is adhered to the patient's skin. The sensor is held in place on the patient's skin and the optically opaque material of the holder **10** provides optical shielding from ambient light. The flexibility and elasticity of the holder **10** material allows for easy placement of the holder **10** on curved body surfaces, and also operates to press down on the sensor.

[0025] Preferably the holder **10** also includes a pressure application portion **40** that is affixed to the lower surface of the roof portion **20**. The pressure application portion **40** may be any type of projection, button, cushion or the like. One example of a suitable material for the pressure application portion **40** is black, closed cell polyethylene foam having a thickness of about 1/8", a diameter of ½" and a 12 pound density. When a sensor is placed in the interior cavity **38** of the holder **10** and the holder **10** is affixed to the patient's body, the sensor presses up on the pressure application portion **40**. The roof portion **20** resists this upward force and presses back down on the pressure application portion **40** due to the elasticity of the roof portion **20** and base portion **30**. The materials and dimensions described above result in a holder **10** in which the downward force on the sensor will be sufficient to prevent venous blood interference, but not so strong as to interfere with the arterial blood flow or cause the holder to peel away from the skin. Preferably, the bottom of the pressure application portion **40** is not coated with adhesive. In an alternative embodiment (not shown), the pressure application portion **40** may be omitted, and the elasticity of the roof may be relied on to provide the downward force on the sensor.

[0026] In the illustrated embodiment, the holder **10** also includes a horseshoe shaped intervening member **45** that adheres to the upper surface of the base portion **30** in the vicinity of the sidewall **36**, but does not adhere to the lower surface of the roof portion **20**. This intervening member **45** is interposed between the lower surface of the roof portion **20** and the upper surface of the base portion **30** during the manufacture of the holder **10**. During manufacture, any suitable adhesive may be placed on the upper surface of the base portion **30** so that the intervening member **45** is adhered to the upper surface of the base portion **30**. One example of a suitable material for the intervening member **45** is black, closed cell polyethylene foam having a thickness of 1/32" and a 6 pound density. When a sensor is placed in the holder **10** and the holder **10** is adhered to the patient's skin, the sensor exerts an upward force on the pressure application portion **40**, which in turn exerts an upward force on the roof portion **20**. Ordinarily, this upward force would act to pull the holder **10** away from the patient's skin by peeling the inner edge upwards. However, since the intervening member **45** is adhered only to the upper surface of the base portion **30**, the upward force is directed radially outward, away from the inner sidewall **36** of the base portion **30**. As a result, the upward force is applied to the outer edge of the horseshoe-shaped intervening member **45**, instead of the inner edge of the inner sidewall **36**. This prevents the holder **10** from peeling off.

[0027] In an alternative embodiment, the holder **10** also includes a horseshoe shaped intervening member **45** that adheres to the lower surface of the roof portion **20** in the vicinity of the sidewall **36**, but does not adhere to the upper surface of the base portion **30**. This intervening member **45** is interposed between the lower surface of the roof portion **20** and the upper surface of the base portion **30**. During manufacture, any suitable adhesive may be placed on the lower surface of the roof portion **20** so that the intervening member **45** is adhered to the lower surface of the roof portion **20**. As stated above, when a sensor is placed in the holder **10** and the holder **10** is adhered to the patient's skin, the sensor exerts an upward force on the pressure application portion **40**. The upward force is directed radially outward, away from the inner sidewall **36** of the base portion **30** and applied to the outer edge of the horseshoe shaped intervening member **45** preventing the holder **10** from peeling off the patient's skin.

[0028] In another alternative embodiment, the intervening member **45** is omitted and the adhesive between the lower surface of the roof portion **20** and the upper surface of the base portion **30** is omitted in a region surrounding the inner sidewall **36** that roughly corresponds to the shape of the intervening member **45**. Again, when a sensor is placed in the holder **10** and the holder **10** is adhered to the patient's skin, the sensor exerts an upward force on the pressure application portion **40**. The upward force is directed radially outward, away from the inner sidewall **36** and applied to the outer edge of the horseshoe-shaped region to which no adhesive is applied to prevent peeling.

[0029] In a further alternative embodiment useful for neonate patients, the sensor holder **10** includes a roof portion **20** and a base portion **30**. However, this embodiment does not include a pressure application portion **40** on the lower surface of the roof portion **20**. In addition, this embodiment does not include any flanges **24**, **24'**, **34**, **34'**. When the roof portion **20** is adhered to the base portion **30**, the lower surface of the roof portion **20** and the inner sidewall **36** of the base portion **30** form an interior cavity **38**. The interior cavity **38** corresponds to the contours of the sensor.

[0030] FIGS. **4-7** show another embodiment of a holder **50** for an oximetry sensor (not shown) that simultaneously provides optical shielding, holds the sensor in place, and applies a desired amount of downward pressure to keep the sensor pressed against the patient's body. The main portion **60**, **70** of the holder **50** is preferable integrally molded from an optically opaque material. For example, it may be injection molded from an Evoprene rubber based material (G949) having a 54 Shore A durometer. The main portion in the illustrated embodiment includes a roof portion **60**, and a base/wall portion **70** (i.e., a lower portion) that supports the roof **60** above the surface to which the holder **50** is affixed.

[0031] The roof **60** and the base/walls **70** are configured so that an interior space is enclosed beneath the roof **60** and between the walls. The footprint of this interior space is preferably dimensioned to be slightly larger than the particular sensor that is being held in place by the holder **50**. In the illustrated example, the holder **50** is dimensioned to fit a sensor with a coin-shaped operating end having a diameter of about 0.8" and a thickness of about 0.125", with a flexible cable connected to the side of the coin shaped end. Both the coin-shaped operating end and the distal end of the cable are enclosed within a teardrop shaped housing. The interior space within the holder **50** is similarly teardrop shaped to match this sensor. A suitable diameter for the interior space of the holder for this sensor would be a diameter of 0.825".

[0032] The base/wall **70** contains an exit portal **73** through which the sensor's cable can pass. A shroud **74** surrounds and leads up to the portal **73** and is configured to prevent ambient light from entering the interior space beneath the holder **50** when the holder is installed over a sensor.

[0033] In the illustrated embodiment, the base/wall **70** is permanently attached to a foundation **80**. One suitable way to attach those two components is to insert the foundation **80** into the mold, and injection mold the rubber main portion **60/70** right onto the foundation **80**. Black polyethylene film is a suitable material for the foundation **80**. In this embodiment, the lower surface of the base/wall **70** is generally horizontal. The foundation **80** may be configured to extend beneath the entire lower horizontal portion of the base/wall **70**, but not beneath the interior space of the housing. In other words, the foundation **80** may extend radially inward up to the inner wall **72** of the base/wall **70**. In alternative embodiments, instead of extending radially inward all the way to the inner wall **72**, the foundation **80** may end before reaching that point. In the illustrated embodiment, the foundation **80** includes four tabs **85** that extend about ½" out past the base/wall **70** on opposite sides of the holder **50**. In still other alternative embodiments, the foundation may be omitted completely, and the base/wall **70** is applied directly to the patient.

[0034] An adhesive is applied to the bottom **82** of the foundation **80**, including the bottom of the tabs **85**. In addition, any portion of the base/wall **70** that will be in contact with the patient's body during use should preferably also be coated with the adhesive. (In embodiments that do not have a foundation **80**, the adhesive is applied to the bottom of the base/wall **70**.) Note that any of the adhesives described above in connection with the FIG. **1** embodiment may be used for this embodiment as well.

[0035] When used for the 0.8" diameter sensor described above, a suitable diameter for the interior space for the holder **50** is about 0.825", and a suitable exterior diameter of the base/wall **70** is about 1.6" in diameter. A suitable length for the foundation **80** (including the tabs **85**) is about 3".

[0036] As best seen in FIGS. **5-7**, the roof **60** includes a protrusion or button **65** that extends down into the interior space that is confined beneath the holder **50**. One suitable diameter for the button **65** is 0.33." In order to impart the desired downward force on the sensor, the button **65** must be dimensioned so that when a sensor is positioned beneath the holder **50**, and the holder **50** is stuck on the surface of the patient's body with an adhesive as described above, the lower surface of the button **65** presses down on the top surface of the sensor. In order for this to occur, the resting height of the lower surface of the button **65** with respect to the surface to which it is affixed must be less than the height of the sensor above that surface. For example, if the sensor is 0.125" high, the button **65** may be dimensioned so that the lower surface of the button **65** is ordinarily held by the roof **60** and base/wall **70** at a height of about 0.8" above the surface to which the holder **50** is affixed. When the holder **50** is so dimensioned, installation of the holder **50** on top of the sensor will cause the bottom of the button **65** to press down on the sensor.

[0037] The base/wall **70** and the roof **60** are configured so that the button **65** can float up and down like a spring. As a result, when the holder **50** is installed on top of a sensor and affixed to the surface of the patient's body, the sensor (which is taller than the resting height of the button **65**) will press up against the button **65**. In response, the spring effect will push the button **65** down against the sensor, thereby exerting a downward force on the sensor.

[0038] The amount of downward force that is applied to the sensor will depend on the structure on the base/wall **70** and the roof **60**, the dimension of those structures, and the materials used to form those structures. For example, increasing the diameter of the button **65** will increase the downward force that is applied to the sensor, and decreasing the diameter of the button will result in a corresponding decrease in that force. In addition, decreasing the resting height of the lower surface of the button **65** above the surface to which it is adhered will result in a higher downward force being applied to the sensor. Using a thicker material to form the roof **60** and the base/wall **70** will also increase the force that is applied to the sensor.

[0039] Preferably, an annular trough **75** is cut into the top roof **60**, positioned radially beyond the button **65**. The downward force exerted by button **65** on the sensor can also be adjusted by changing the dimensions of this trough **75**. (Making the trough **75** deeper will result in less downward force being applied to the sensor.) Optionally, a second annular trough **62** may be cut into the top surface of the roof portion **60** above the button **65**. Making this second trough **62** deeper and wider will also result in less downward force being applied to the sensor. This second trough **62** may also be omitted altogether (as it is in the FIG. **8** embodiment). In this case, the downward force applied to the sensor will be larger.

[0040] FIG. **8** depicts another embodiment of a holder **50'**. The holder **50'** of this embodiment is very similar to the holder **50** described above in connection with FIGS. **4-7**, and corresponding reference numbers refer to similar structure. In most cases, the above description of the FIG. **4** embodiment applies to the holder **50'**. However, the roof **60'** of the holder **50'** does not have the second (interior) annular trough above the button **65**. In addition, the interior walls **72** surrounding the interior space are not exactly vertically. Instead, those walls **72** are undercut, with the walls angled slightly outward (i.e., so that their inner diameter increases slightly with height). A preferred angle of inclination for the interior walls **72** is between about 3° and about 4°. Angling the wall **72** in this manner makes the base/wall **70** thinner near the top of the base/wall **70**, close to where the roof **60'** joins the base/wall **70**. This thinning of the side walls provides extra flexibility and increases the spring effect in the holder **50'**, making it easier for the button **65** to float up and down like a spring.

[0041] When the holder **50'** is placed on top of a sensor (not shown), the sensor pushes up against the button **65**, which pushes up against the entire roof portion **60'**. The upward force applied to the roof is transmitted through the base/wall **70** during use to the bottom of the holder **50'**, which is glued to the surface of the body as described above. This upward force acts in a direction that tends to pull the holder **50'** away from the surface to which it is adhered. If the walls were not undercut, this force would be directly normal to the surface to which the holder is adhered at the bottom corner of the interior wall **72**, and the adhesive might start peeling away from the body at the inside edge of the glued portion. However undercutting the interior sidewall at an angle of between about 3°-4° as shown causes the upward load to be distributed away from the edge of the adhesive contact region and more towards the center of the adhesive region. As a result, the holder is less likely to start peeling off from the surface to which it is adhered. This arrangement permits the desired downward force on the sensor to maintained over long periods of time by reducing the chance that the holder will peel away at the inside edge from the surface to which it is applied (which would result in a decreased downward force at the sensor).

[0042] Optionally, the undercutting described above in connection with the FIG. **8** embodiment may also be used in the FIG. **4** embodiment.

[0043] FIG. **9** shows another embodiment of a holder **90** for an oximetry sensor (not shown) that simultaneously provides optical shielding, holds the sensor in place, and applies a desired amount of downward pressure to keep the sensor pressed against the patient's body. The holder **90** of this embodiment is similar to the holder **10** described above in connection with FIGS. **1-3**, and corresponding reference numbers refer to similar structure. In most cases, the above description of the holder **10** in FIGS. **1-3** applies to the holder **90**. However, in the holder **90**, a first flange **92** and a second flange **94** extend out on the same side of the central region of the base portion **30**, and there are no flanges on the opposite side. Preferably, the flanges **92**, **94** extend out from the central body on the same side as the exit portal **96**, through which the sensor's cable can pass. The distance between the flanges **92**, **94** is preferably greater than the distance between the flanges in the FIG. **3** embodiment, to permit the tail end of the sensor to lift up away from the surface of the skin without lifting the sensor holder. For example, the flanges **92**, **94** may be spaced apart by about ¼". Optionally, a plurality of radial slits **98** may be cut into the holder **90**, preferably on the portions of the holder **90** that do not have the flanges **92**, **94**. The radial slits **98** are cut from the outer edge **91** of the holder **90** inward toward the center of the holder, but preferably do not extend so far inward so as to reach the interior cavity **38**. In the illustrated embodiment, the radial slits **98** are cut all the way through the sensor holder **90**. In alternative embodiments (not shown), the radial slits do not go all the way through the holder. For example, the slits may cut at least halfway into the holder from the top of the holder or from the bottom of the holder or about ¼ of the way in from each of the top and bottom of the holder at the same location. These slits serve to break up the mechanical strength of the foam material. A suitable spacing for the slits **98** is about 0.2" apart. The radial slits **98** provide additional flexibility to the holder **90**, allowing the holder **90** to stick better on curved surfaces.

[0044] Optionally, the radial slits described above in connection with the FIG. **9** embodiment may also be used in any of the other embodiments described above.

[0045] Additional advantages and modifications will readily occur to those skilled in the art. For example, the features of any of the embodiments may be used singularly or in combination with any other of the embodiments of the present invention. Accordingly, various modifications may be made without departing from the spirit or scope of the general inventive concept.

We claim:

1. A sensor holder for holding a reflectance type oximetry sensor against a patient's skin, the sensor holder comprising:

a lower portion having an adhesive bottom surface adapted to temporarily stick the lower portion onto the patient's skin, the lower portion having a central void therein that is bordered by at least one inner wall; and

a roof positioned above the central void and attached to the lower portion so as to form an interior cavity between the roof and the at least one inner wall, wherein the interior cavity is dimensioned to accept the oximetry sensor,

wherein the roof and the lower portion are configured so that when the sensor holder is positioned over the oximetry sensor and stuck on a patient's skin, the oximetry sensor exerts an upward force against the roof, and an interaction between the roof and the lower portion causes the roof to exert a downward force on the oximetry sensor, and

wherein the roof and the lower portion are configured so that the upward force against the roof is directed radially outward, with respect to the central void, from the at least one inner wall.

2. The sensor holder of claim 1, wherein the downward force exerted on the oximetry sensor is high enough to block venous blood flow in a region of skin beneath oximetry the sensor, but not high enough to block arterial blood flow in the region.

3. The sensor holder of claim 1, wherein the lower portion includes a sideways-facing entrance into the central void dimensioned to permit a lead of the oximetry sensor to pass therethrough.

4. The sensor holder of claim 3, wherein the roof is optically opaque, and wherein the apparatus further comprises a shroud for blocking light that is positioned about the entrance.

5. A sensor holder for a reflectance type oximetry sensor, the sensor holder comprising:

a base having a lower surface with an adhesive disposed thereon, the base having an aperture that is bordered by at least one inner sidewall; and

a roof disposed above the aperture so that a lower surface of the roof and the at least one inner sidewall of the base form an interior cavity dimensioned to hold the oximetry sensor,

wherein the roof and base are connected radially beyond a region that is adjacent to the at least one inner sidewall and extends radially outward from the at least one inner sidewall, and wherein the roof and base are not connected within the region.

6. The sensor holder of claim 5, wherein the roof is optically opaque, the region is horseshoe-shaped, and the base is configured to provide a sideways-facing entrance into the interior cavity at the open end of the horseshoe.

7. The sensor holder of claim 5, wherein the sensor holder has at least one radial slit running inwards from an outer edge of the sensor holder.

8. The sensor holder of claim 5, further comprising at least two flanges that extend radially outward from the base, the flanges having a lower surface with an adhesive disposed thereon.

9. The sensor holder of claim 5, wherein the base and the roof are made of substantially flat flexible material, the region is horseshoe shaped, and the base and the roof are connected using a permanent adhesive that is applied radially beyond the horseshoe shaped region, but is not applied within the horseshoe shaped region.

10. The sensor holder of claim 9, wherein the sensor holder has at least one radial slit running inwards from an outer edge of the sensor holder.

11. The sensor holder of claim 9, further comprising at least two flanges that extend radially outward from the base, the flanges having a lower surface with an adhesive disposed thereon, and wherein the roof is optically opaque.

12. The sensor holder of claim 5, wherein the base and the roof are made of substantially flat flexible material and the region is horseshoe shaped, and wherein the sensor holder further comprising a substantially flat horseshoe shaped intervening member that is affixed to either the lower surface of the roof or an upper surface of the base portion in the horseshoe shaped region.

13. The sensor holder of claim 12, wherein the sensor holder has at least one radial slit running inwards from an outer edge of the sensor holder.

14. The sensor holder of claim 12, further comprising at least two flanges that extend radially outward from the base, the flanges having a lower surface with an adhesive disposed thereon, and wherein the roof is optically opaque.

15. The sensor holder of claim 14, further comprising a protrusion configured to extend down from the roof into the interior cavity, and wherein the roof portion is black, closed cell polyethylene foam having a thickness of about $1/16^{th}$ of an inch, the base portion is black, closed cell polyethylene foam having a thickness of about $1/32^{nd}$ of an inch, and the protrusion has a thickness of about $1/8^{th}$ inch.

16. A sensor holder for a reflectance type oximetry sensor, the sensor holder comprising:

a lower portion having a lower surface with an adhesive disposed thereon, the lower portion having an aperture that is bordered by at least one inner sidewall, wherein the at least one inner sidewall is angled outward; and

a roof disposed above the aperture and connected to the lower portion so that a lower surface of the roof and the at least one inner sidewall form an interior cavity dimensioned to hold the oximetry sensor.

17. The sensor holder of claim 16, wherein the at least one inner sidewall is angled outward at an angle between about 30° and about 402°.

18. The sensor holder of claim 16, wherein the roof is optically opaque and the lower portion is configured to provide a sideways-facing entrance into the interior cavity to permit a lead of the oximetry sensor to pass therethrough.

19. The sensor holder of claim 18, further comprising a shroud that is positioned about the entrance for blocking light.

20. The sensor holder of claim 16, further comprising at least two flanges that extend radially outward from the lower portion, the flanges having a lower surface with an adhesive disposed thereon.

21. The sensor holder of claim 16, wherein the roof and lower portion are integrally molded.

22. The sensor holder of claim 16, wherein the roof and lower portion are integrally molded from an evoprene rubber based material.

23. The sensor holder of claim 16, further comprising a protrusion configured to extend down from the roof into the interior cavity.

24. The sensor holder of claim 23, further comprising an annular trough cut into an upper surface of the roof and positioned radially beyond the protrusion.

25. The sensor holder of claim 24, further comprising a second annular trough cut into the upper surface of the roof above the protrusion.

26. A sensor holder for holding a reflectance type oximetry sensor against a patient's skin, the sensor holder comprising:

a lower portion having an adhesive bottom surface adapted to temporarily stick the lower portion to the patient's skin at an adhesive contact region, the lower portion having a central void therein that is bordered by at least one inner wall, the adhesive contact region having an edge that is closest to the inner wall;

a roof positioned above the central void and attached to the lower portion so as to form an interior cavity between the roof and the at least one inner wall, wherein the interior cavity is dimensioned to accept the oximetry sensor, and wherein the roof and the lower portion are configured so that when the sensor holder is positioned over the oximetry sensor and stuck on a patient's skin, the oximetry sensor exerts an upward force against the roof, and an interaction between the roof and the lower portion causes the roof to exert a downward force on the oximetry sensor; and

means for directing the upward force exerted against the roof away from the edge of the adhesive contact region.

27. The sensor holder of claim 26, wherein the downward force exerted on the oximetry sensor is high enough to block venous blood flow in a region of skin beneath oximetry the sensor, but not high enough to block arterial blood flow in the region.

28. The sensor holder of claim 26, wherein the lower portion includes a sideways-facing entrance into the central void dimensioned to permit a lead of the oximetry sensor to pass therethrough.

29. The sensor holder of claim 28, wherein the roof is optically opaque, and wherein the apparatus further comprises a shroud for blocking light that is positioned about the entrance.

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专利名称(译)	传感器支架		
公开(公告)号	US20070142717A1	公开(公告)日	2007-06-21
申请号	US11/536244	申请日	2006-09-28
[标]申请(专利权)人(译)	LOWERY GUY - [R 席夫AL KOPOTIC罗伯特·J·		
申请(专利权)人(译)	LOWERY GUY - [R 席夫AL KOPOTIC罗伯特·J·		
当前申请(专利权)人(译)	CONMED CORPORATION		
[标]发明人	LOWERY GUY RUSSELL SCHIFF AL KOPOTIC ROBERT J		
发明人	LOWERY, GUY RUSSELL SCHIFF, AL KOPOTIC, ROBERT J.		
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其他公开文献	US8190229		
外部链接	Espacenet USPTO		

摘要(译)

本发明涉及传感器的支架。保持器向传感器施加压力以防止静脉血液信号而不抑制动脉血液信号并且是光学不透明的以屏蔽环境光到达传感器。