



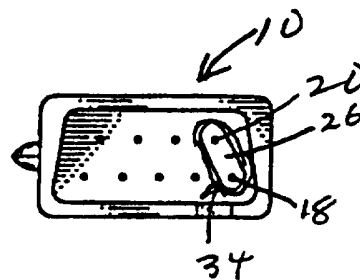
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/US96/17674 (22) International Filing Date: 13 November 1996 (13.11.96) (30) Priority Data: 08/555,719 14 November 1995 (14.11.95) US (71) Applicant: NELLCOR PURITAN BENNETT INCORPORATED [US/US]; 4280 Hacienda Drive, Pleasanton, CA 94588 (US). (72) Inventors: NIERLICH, Steve, L.; 264 Cherrywood Avenue, San Leandro, CA 94577 (US). PALMER, Phillip, S.; 14261 Ivy Court, San Leandro, CA 94578 (US). MERCHANT, Adnan, I.; 300 Clarke Avenue, Fremont, CA 94536 (US). (74) Agent: GLAUBENSKLEE, Marilyn; Nellcor Puritan Bennett Incorporated, Legal Dept., 4280 Hacienda Drive, Pleasanton, CA 94588 (US).</p>		<p>(81) Designated States: AU, CA, JP, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>

(54) Title: MEDICAL SENSOR CONNECTOR WITH REMOVABLE ENCODING DEVICE

(57) Abstract

A connector (10) for a medical sensor is provided. The connector (10) includes a number of contacts, and includes an electronic device (26) for encoding a characteristic of the medical sensor. The electronic device (26) is insertable into the connector (10). This simplifies the design of a sensor, which no longer needs to include a calibration element. In addition, the sensor can be made more cheaply, which is especially important for disposable sensors.



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MEDICAL SENSOR CONNECTOR WITH REMOVABLE ENCODING DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to medical sensors which include coded
5 calibration information relating to characteristics of the sensor, and in particular to a
connector for such a sensor.

An example of such an encoding mechanism is shown in U.S.
Patent No. 4,700,708. This relates to an optical oximeter probe which uses a pair of light
emitting diodes (LEDs) to direct light through blood-perfused tissue, with a detector picking
10 up light which has not been absorbed by oxygen in the blood. The operation depends upon
knowing the wavelength of the LEDs. Since the wavelength of LEDs actually manufactured
can vary, a resistor is placed in the sensor with the value of the resistor corresponding to the
actual wavelength of at least one of the LEDs. When the instrument is turned on, it first
applies a current to the coding resistor and measures the voltage to determine the value of the
15 resistor and thus the value of the wavelength of the LED in the probe.

Another method of storing coded information regarding the characteristics of
the LEDs is shown in U.S. Patent No. 4,942,877. This patent discloses using an EPROM
memory to store digital information, which can be provided in parallel or serially from the
sensor probe to the remote oximeter.

20 Other examples of coding sensor characteristics exist in other areas. In Patent
No. 4,446,715, assigned to Camino Laboratories, Inc., a number of resistors are used to
provide coded information regarding the characteristics of a pressure transducer. Patent
No. 3,790,910 discloses another pressure transducer with a ROM storing characteristics of the
individual transducer. Patent No. 4,303,984 shows another sensor with digital
25 characterization information stored in a PROM, which is read serially using a shift register.

Typically, the coding element is mounted in the sensor itself. For instance,
U.S. Patent No. 4,621,643 shows the coding resistor mounted in the sensor element itself. In
addition, U.S. Patent No. 5,246,003 shows the coding resistor being formed with a printed
conductive material on the sensor itself.

30 In some devices, an electrical connector coupled by a cable to a device
attached to a patient may include a coding element. For example, U.S. Patent No. 3,720,199
shows an intra-aortic balloon catheter with a connector between the catheter and the console.
The connector includes a resistor with a value chosen to reflect the volumetric displacement
of the particular balloon. U.S. Patent No. 4,684,245 discloses a fiberoptic catheter with a

module between the fiberoptic and electrical wires connected to a processor. The module converts the light signals into electrical signals, and includes a memory storing calibration signals so the module and catheter can be disconnected from the processor and used with a different processor without requiring a recalibration.

5

SUMMARY OF THE INVENTION

The present invention provides a connector for a medical sensor. The connector includes a number of contacts, and includes an electronic device for encoding a characteristic of the medical sensor. The electronic device is removably mounted in the connector. This simplifies the design of a sensor, which no longer needs to include a calibration element. In addition, the sensor can be made more cheaply, which is especially important for disposable sensors.

In one embodiment, the electronic device is a resistor enclosed in a clear plastic plug. The plug has two pins extending from it, and is inserted into a corresponding hole in the connector. When inserted, the pins are in alignment with the remaining pins of the connector to form the final connector configuration. The transparent plastic allows the resistor value to be observed and matched to a particular sensor during assembly. The plug is preferably inserted with a press-fit connection. The plug does not need to connect to anything else in a connector, since the signals for reading the resistor are provided from a remote oximeter monitor, and thus no signal needs to propagate beyond the connector to the sensor for performing this calibration.

In one embodiment, the connector includes a slot for engaging a corresponding tab on the oximeter monitor mating connector. This ensures that the proper type of sensor is only connected to the proper monitor. Additionally, or instead, a tab can be used to mate with a slot on the mating connector in the oximeter monitor.

For a further understanding of the nature and advantages of the invention, reference is made to the following description taken in conjunction with the accompanying drawings.

30

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a connector according to the present invention;

Fig. 2 is a diagram of a plug for insertion into the sensor of Fig. 1;

Fig. 3 is a diagram illustrating the plug of Fig. 2 inserted into the sensor connector of Fig. 1; and

Fig. 4 is a perspective view of a mating connector on an oximeter monitor.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 illustrates a connector 10 according to the present invention. A cable 12
5 connects to the remote sensor which is attached to the patient. The connector includes a casing 14 with an opening 16 in which a series of pins protrude. Included are pins 18 and 20 which connect to an electronic device encoding information regarding characteristics of the sensor attached to cable 12. The remaining pins provide connections to the sensor. For instance, in one embodiment, two pins or more will connect to two different LEDs in a pulse
10 oximeter sensor. Another two pins will connect to a light detector in the oximeter sensor. Another pin connects to a shield. Other connections, such as for electrodes for monitoring other conditions, may be connected to pins of connector 10.

Connector 10 also includes a slot 22 adjacent pin 18, and a tab 24 along one side for aligning the connector and ensuring that it only connects to a proper mating
15 connector, as described below with respect to Fig. 4.

Fig. 2 illustrates a plug 26, preferably made of a clear plastic. Seen through the plug is an internal encoding resistor 28 connected by wires 30 and 32 to pins 18 and 20, respectively.

As shown in Fig. 3, plug 26 of Fig. 2 is inserted into a correspondingly-shaped
20 hole 34 in connector 10. Preferably, the insertion is done with a press-fit.

During assembly, casing 14 is preferably formed around the pins (except 18 and 20) to form the connector body with hole 34. The connector is connected to cable 12, which is connected to a particular sensor. The wavelength of the red LED in the sensor attached to cable 12 is measured, and a resistor value indicating the wavelength spectrum of
25 this/these LED(s) is selected. Preferably, a plurality of plugs 26 are on hand with varying resistor values. The resistor value can be observed since the plug 26 is made of clear plastic by viewing the color code on the side of the resistor. An appropriate plug is then selected, and inserted into hole 34 in connector 10 to provide a coding resistor corresponding to the particular LED value in the sensor connected to cable 12. Thus, as can be seen, the sensor
30 need not include the coding resistor, and cable 12 need not include an additional two wires for connecting to a coding resistor in the sensor. This simplifies the sensor design, and allows it to be made more cheaply, an important factor for disposable sensors. In addition, the cable can be made smaller, and an additional source of potential electromagnetic

interference is eliminated in the cable by eliminating the two wires which connect to the coding resistor.

In alternate embodiments, an active electronic device could be used in place of resistor 28. A memory could be used in place of resistor 28, or a modulating device for producing a modulation code corresponding to the LED wavelength could be used. Alternately, the connector could be used for sensors other than pulse oximeter sensors, for indicating other characteristics of the medical sensor. Instead of a plug 26, a detachable module which snaps into place or is otherwise connected to the connector could be used.

Fig. 4 illustrates a mating connector 36 mounted in an oximeter monitor 38, which is shown broken away. Connector 36 includes a plurality of female connector holes 40 for mating with the corresponding pins on connector 10. Also shown, is a tab 42, designed to mate with slot 26 of connector 10. Tab 42 interrupts a gap 44 which receives the outer edges of casing 14 of connector 10.

The mating connector 36 includes a pair of sidewalls 46 and 48, between which connector 10 would be inserted. Sidewall 48 includes a slot 50 for receiving tab 24 of connector 10. The use of tab 42 and slot 50, in conjunction with tab 24 and slot 22 in connector 10, ensures that the wrong type of sensor will not be connected to the oximeter monitor, or vice versa.

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 spirit and essential characteristics thereof. For example, only one of the slot and tab may be used to ensure proper connector mating, rather than both. Alternately, the connector could have simply the slot, while the mating connector might have the tab in the slot, with the slot on the mating connector being superfluous. Additionally, a single pin might be connected to the resistor or other coding element of Fig. 2, with the plug having a connector for connecting to a separate pin internally to the connector, or simply connecting to a ground plane. Additionally, the notch and tab might be placed in different positions, with the different positions indicating the particular type of sensor to which the connector is attached. Alternately, instead of press-fitting, the plug could be attached by glue, weld, using a locking tab, etc. Accordingly, the above descriptions are intended to be illustrative, not limiting, of the scope of the invention, which is set forth in the appended claims.

IN THE CLAIMS:

1. A connector for a medical sensor, comprising:
a plurality of contacts; and
5 an electronic device for encoding a characteristic of said medical sensor,
removably mounted in said connector and connected to at least one of said contacts.
2. The connector of claim 1 wherein said contacts comprise pins, and further
comprising:
10 a plug, insertable into said connector, holding said electronic device and
having a pair of said pins extending therefrom; and
an opening in said connector for receiving said plug.
3. The connector of claim 1 wherein said plug is a plastic which press-fits into
15 said opening in said connector.
4. The connector of claim 3 wherein said plastic is transparent, allowing
identification of said electronic device after encapsulation in said plastic and before insertion
into said connector.
20
5. The connector of claim 1 further comprising a tab on said connector for
mating with a corresponding slot in a mating connector.
6. The connector of claim 5 wherein said connector has two rows of pins, said
25 tab being on a side of said connector adjacent to and between the levels of said two rows of
pins.
7. The connector of claim 1 further comprising a slot on said connector for
mating with a corresponding tab in a mating connector.
30
8. The connector of claim 7 wherein said connector contacts comprise two
rows of pins, with four pins in a first row and five pins in a second row, said slot being
adjacent an end pin in said second row.

9. The connector of claim 1 wherein said medical sensor is a pulse oximeter sensor.

5 10. The connector of claim 1 wherein said electronic device is a resistor.

11. The connector of claim 1 wherein said electronic device is an active device.

10 12. The connector of claim 1 further comprising a plurality of electrical wires connecting said connector to said medical sensor.

13. The connector of claim 1 wherein said plug is glued into said opening in said connector.

15

14. The connector of claim 1 wherein said plug is welded into said opening in said connector.

15. The connector of claim 1 wherein said plug is
20 held in said hole in said connector by a locking tab.

16. A connector for an oximeter sensor, comprising:
a plurality of contacts; and
an electronic device for encoding information corresponding to a wavelength
25 spectrum of a light emitting diode in said oximeter sensor;
a plug, separable from said connector, holding said electronic device and
having a pair of said pins extending therefrom; and
an opening in said connector for receiving said plug.

30 17. The connector of claim 16 wherein said electronic device is a resistor.

18. The connector of claim 16 wherein said electronic device is an active device.

19. The connector of claim 16 further comprising a tab on said connector for mating with a corresponding slot in a mating connector.

5 20. The connector of claim 19 wherein said connector has two rows of pins, said tab being on a side of said connector adjacent to and between the levels of said two rows of pins.

10 21. The connector of claim 16 further comprising a slot on said connector for mating with a corresponding tab in a mating connector.

15 22. The connector of claim 21 wherein said connector contacts comprise two rows of pins, with four pins in a first row and five pins in a second row, said slot being adjacent an end pin in said second row.

20 23. A method for constructing a connector for a medical sensor, comprising the steps of:

forming a connector body with a plurality of contacts;

connecting an electronic device to at least one contact, said electronic device

20 encoding a characteristic of said medical sensor;

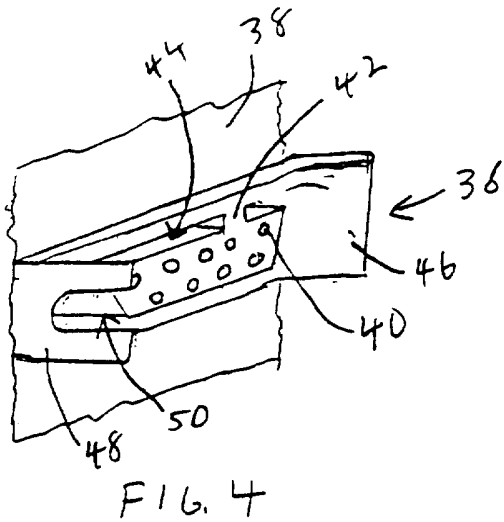
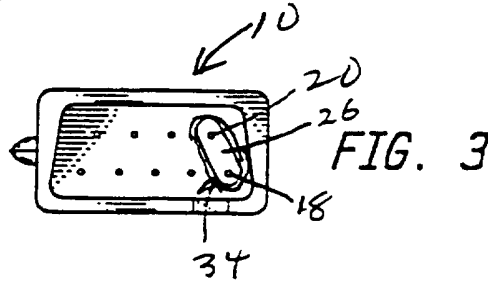
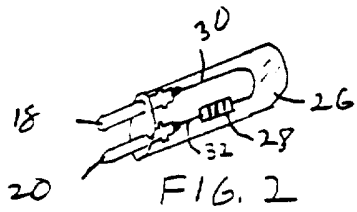
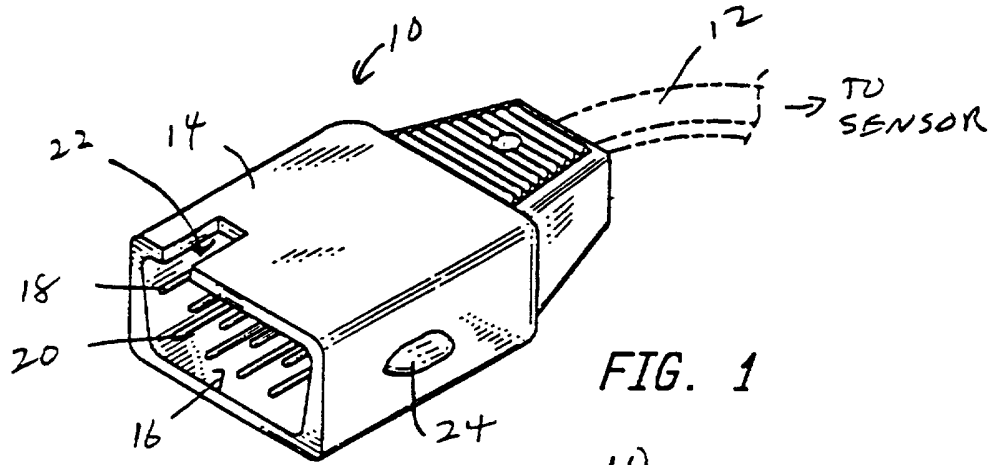
enclosing said electronic device in a plug;

inserting said plug into an opening in said connector.

25 24. The method of claim 23 wherein said contacts comprise pins, and further comprising the steps of:

press-fitting said plug into said opening.

30 25. The method of claim 23 further comprising the step of forming said plug with a plastic.



INTERNATIONAL SEARCH REPORT

Internat . Application No

PCT/US 96/17674

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 6 A61B5/00 H01R29/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 A61B H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	see the whole document	2,16-20, 23-25

X	US 5 387 131 A (FOREMAN & AL) 7 February 1995	1,10,11, 15,23-25
A	see column 2, line 57 - column 4, line 61	16-18

A	US 5 246 003 A (DELONZOR) 21 September 1993 cited in the application	1-3,7,9, 10,12, 15-17, 21,23-25
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Date of the actual completion of the international search

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