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# United States Patent [19]

[11] Patent Number: **5,259,381**

**Cheung et al.**

[45] Date of Patent: \* **Nov. 9, 1993**

[54] **APPARATUS FOR THE AUTOMATIC CALIBRATION OF SIGNALS EMPLOYED IN OXIMETRY**

### FOREIGN PATENT DOCUMENTS

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### [57] ABSTRACT

[\*] Notice: The portion of the term of this patent subsequent to Apr. 3, 2007 has been disclaimed.

Under the present invention, a method and apparatus are provided for compensating for the effect temperature variations have on the wavelength of light emitted by the oximeter sensor light source (40, 42). In pulse oximetry, LEDs (40, 42) are typically employed to expose tissue to light at two different wavelengths. The light illuminating the tissue is received by a detector (38) where signals proportional to the intensity of light are produced. These signals are then processed by the oximeter circuitry to produce an indication of oxygen saturation. Because current oximetry techniques are dependent upon the wavelengths of light emitted by the LEDs (40, 42), the wavelengths must be known. Even when predetermined combinations of LEDs (40, 42) having relatively precise wavelengths are employed, variations in the wavelength of light emitted may result. Because the sensor (12) may be exposed to a significant range of temperatures while in use, the effect of temperature on the wavelengths may be significant. To compensate for this effect, a temperature sensor (50) is included in the sensor (12) to produce a signal indicative of sensor temperature. This signal is interpreted by the oximeter circuitry including, for example, a microcomputer (16), where the effect of temperature on wavelength is compensated for. In a preferred arrangement, this compensation takes the form of a computation of an alternative calibration curve from which the oxygen saturation is indicated, given a particular processing of signals from the detector (38).

[21] Appl. No.: 377,722

[22] Filed: Jul. 10, 1989

### Related U.S. Application Data

[63] Continuation of Ser. No. 897,663, Aug. 18, 1986, Pat. No. 4,913,150.

[51] Int. Cl.<sup>5</sup> ..... **A61B 5/00**

[52] U.S. Cl. .... **128/633; 128/666; 356/41**

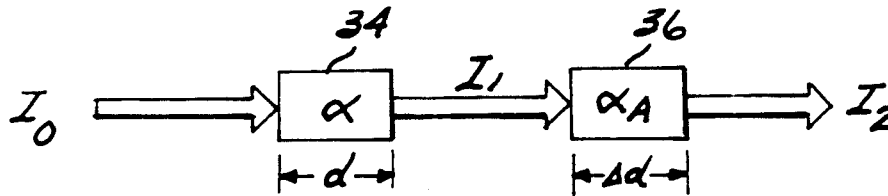
[58] Field of Search ..... 128/633, 634, 664-667; 330/59, 308; 250/214 A

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**3 Claims, 9 Drawing Sheets**



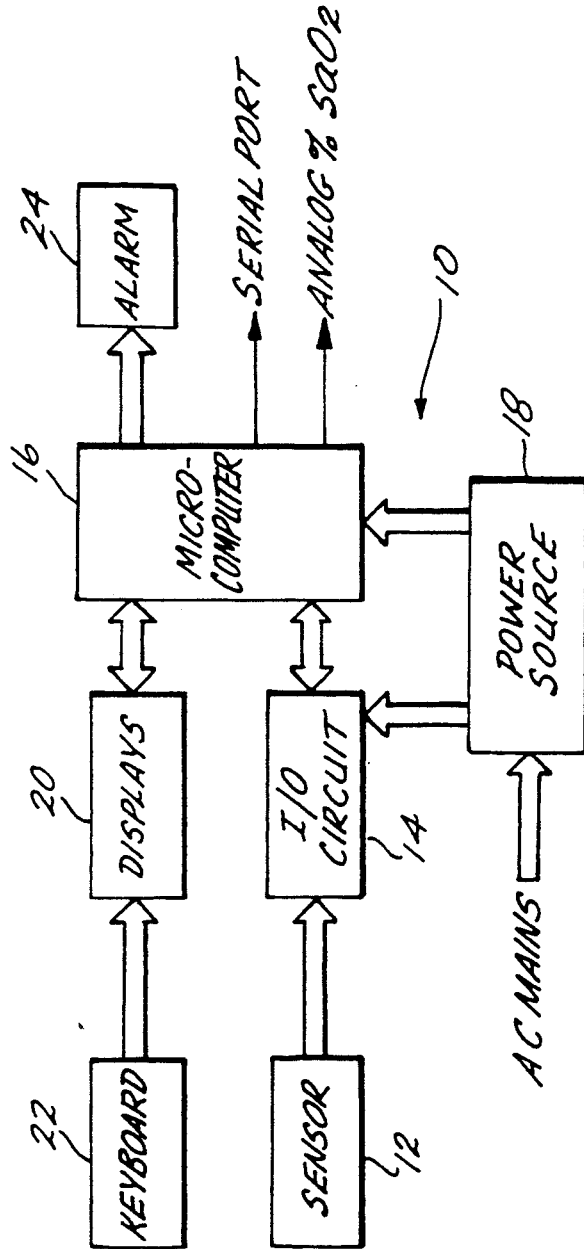
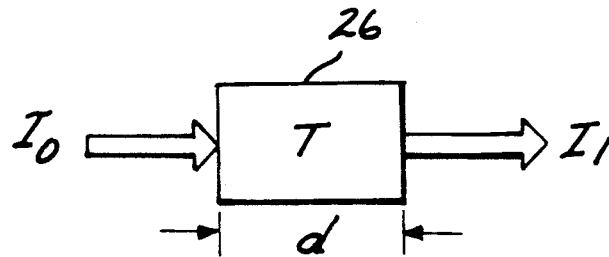
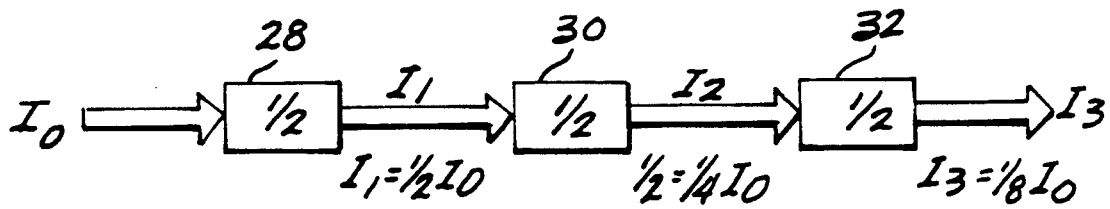


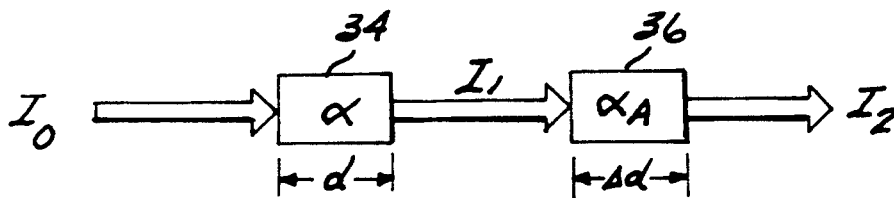
Fig. 1.



*Fig. 2.*



*Fig. 3.*



*Fig. 6.*

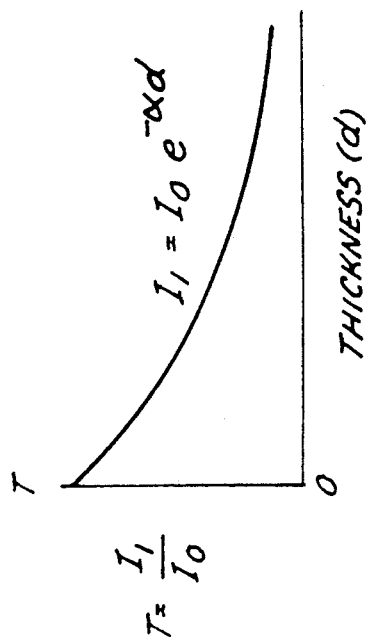


Fig. 4.

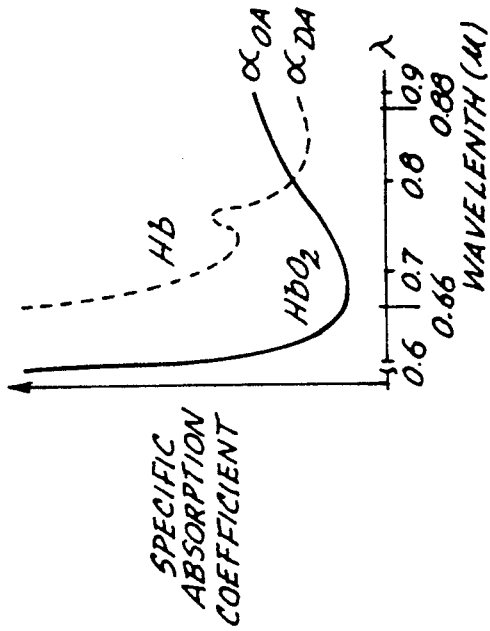


Fig. 5.

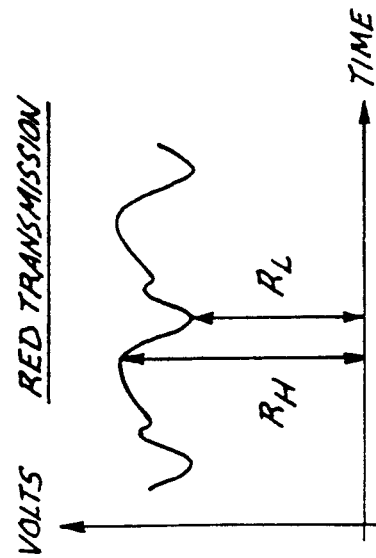


Fig. 9.

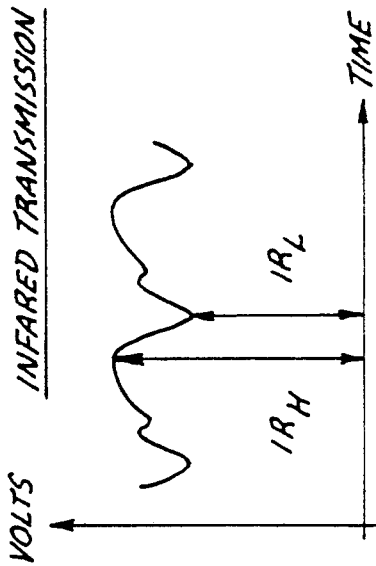


Fig. 10.

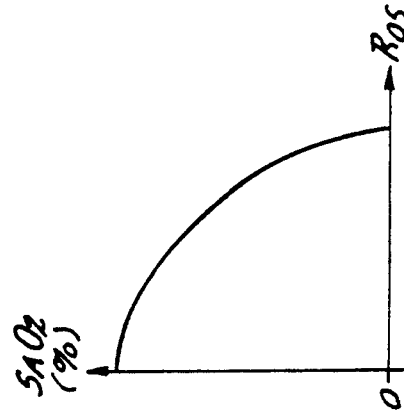
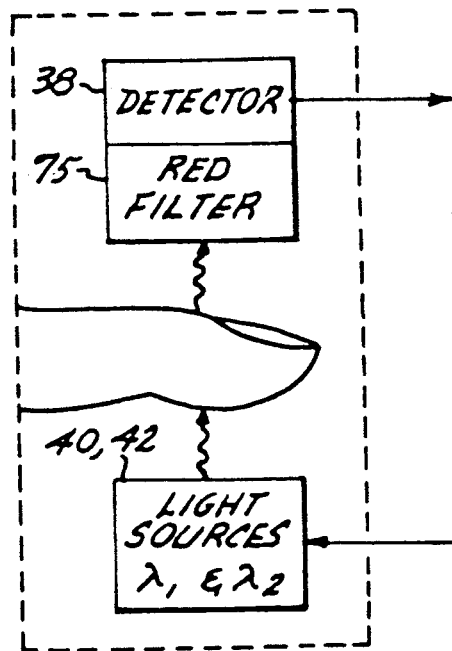


Fig. 7.



*Fig. 8.*

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