United States Patent [19]

Goodman et al.

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[45] **Date of Patent: May 16, 1989**

[54] **SENSOR HAVING CUTANEOUS CONFORMANCE**

[75] Inventors: **David E. Goodman**, San Francisco; **James E. Corenman**, Menlo Park; **William New, Jr.**, Woodside; **Mark Yelderman**, Menlo Park, all of Calif.

[73] Assignee: **Nellcor Incorporated**, Hayward, Calif.

[21] Appl. No.: **70,619**

[22] Filed: **Jul. 7, 1987**

Related U.S. Application Data

[63] Continuation of Ser. No. 873,129, Jun. 11, 1986, abandoned, which is a continuation of Ser. No. 539,865, Oct. 7, 1983, abandoned, which is a continuation-in-part of Ser. No. 493,442, May 11, 1983, abandoned.

[51] **Int. Cl.**[4] **A61B 5/02**

[52] **U.S. Cl.** **128/665**; 128/666

[58] **Field of Search** 128/633, 637, 640, 644, 128/665, 667, 664, 689, 690, 691

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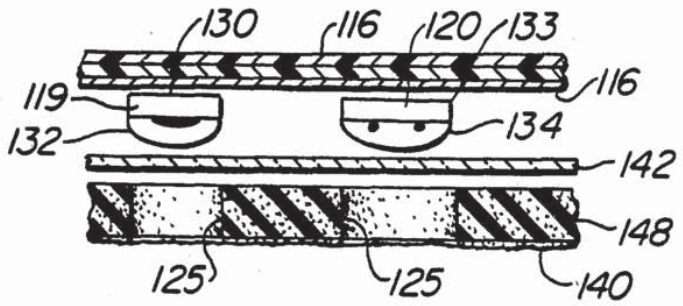
Primary Examiner—Edward M. Coven
Attorney, Agent, or Firm—Thomas L. Giannetti; Jeffrey H. Ingerman

[57] **ABSTRACT**

A sensor for trans-illumination of a blood perfused portion of flesh to measure light extinction during trans-illumination is disclosed. The sensor is preferably mounted on a fingertip but any digit or blood perfused portion of flesh will work. The sensor includes a first end for disposition on one side of the trans-illuminated flesh and a second end for disposition on the opposite and opposed side of the trans-illuminated flesh. A light source is mounted to the first side and a photo-sensor is mounted to the second side. If an elongated flexible strip is used, it is provided with adhesive and is suitably windowed that light is allowed to take an optical path through the finger. If no flexible strip is used, the two ends are aligned and secured to the flesh such that the light emitted takes an optical path through the finger. When the adhesive fastener is used, the effect of the light source and photo-detector substrates being integrated into the adhesive fastener is that they become, in effect, a part of the skin. The resulting device is resistant to accidental removal and avoids constriction of blood vessels. Most importantly, the low mass of the sensor itself and its conformance to, so as to effectively become a part of, the skin, prevents relative motion between the light source and sensor and the perfused flesh. This eliminates the common interference associated with the operation of conventional plethysmographs and oximeters.

2 Claims, 4 Drawing Sheets



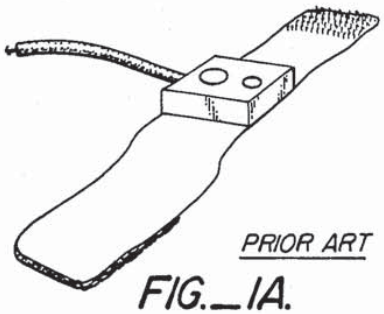


FIG._IA.

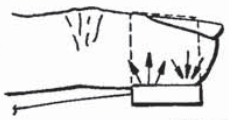


FIG._IB.

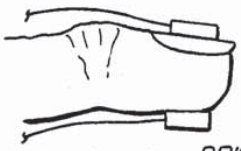


FIG._IC.

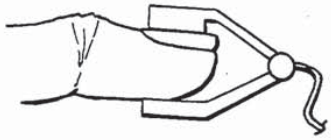


FIG._ID.

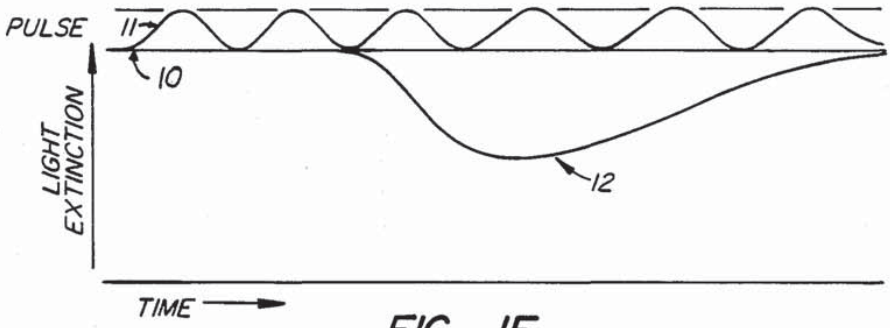


FIG._IE.

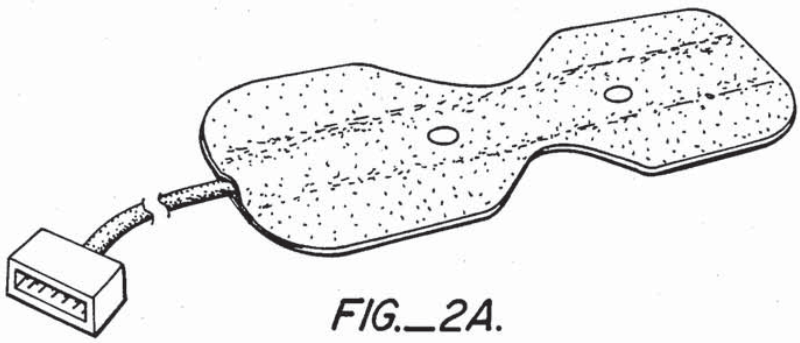


FIG._2A.

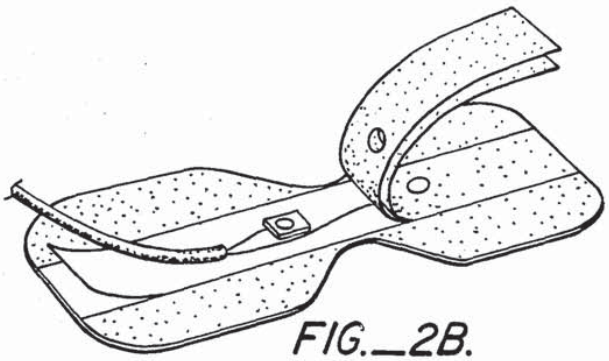


FIG._2B.

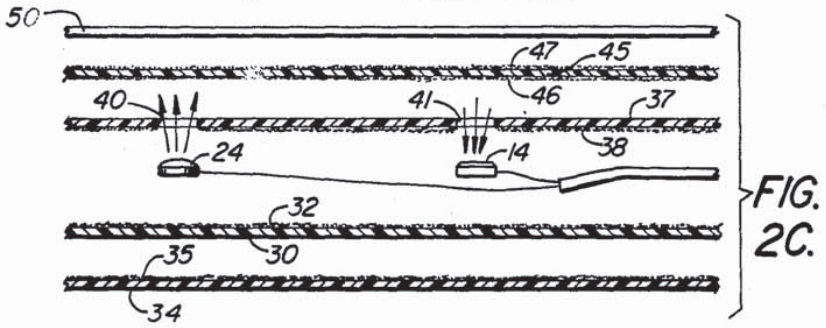


FIG. 2C.

FIG._3A.

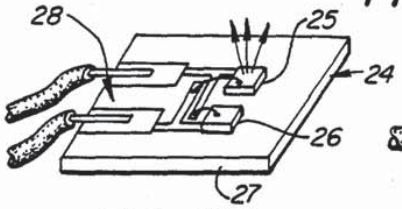


FIG._3B.

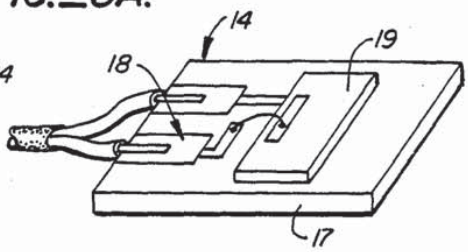


FIG._3C.

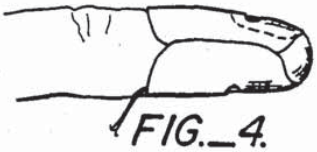


FIG._4.

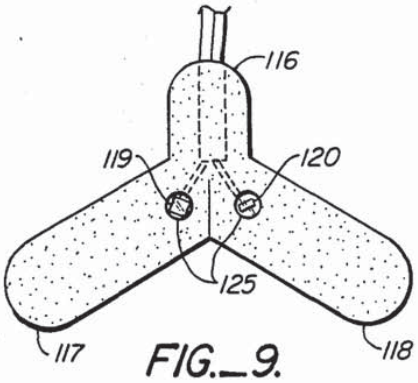


FIG._9.

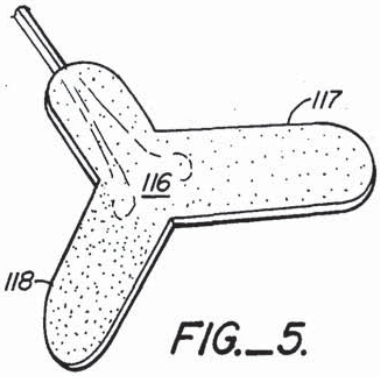


FIG._5.

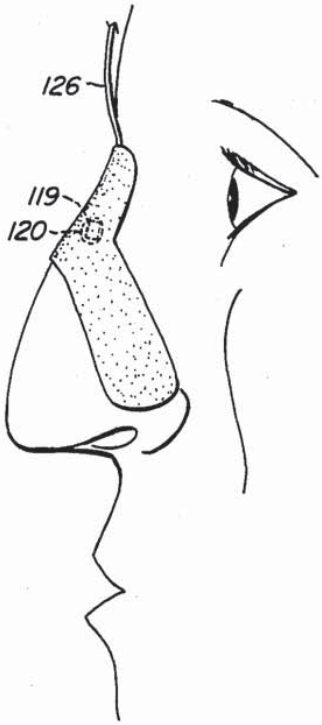


FIG._6A.

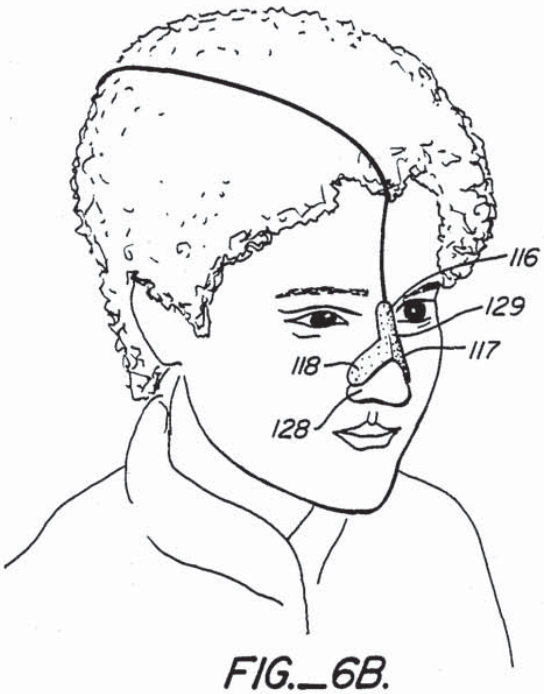


FIG._6B.

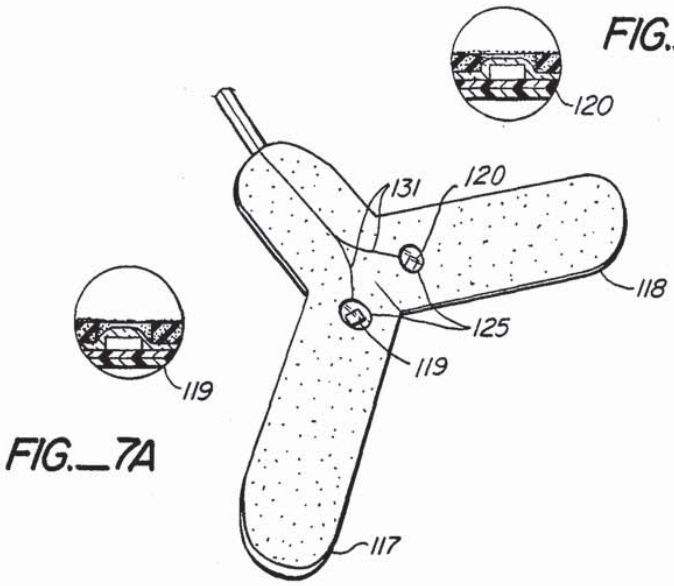


FIG._7B

FIG._7A

FIG._7.

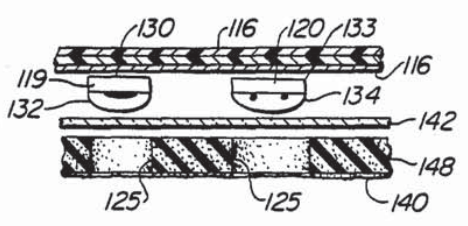


FIG._8.

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