



US006343223B1

(12) **United States Patent**
Chin et al.

(10) **Patent No.:** **US 6,343,223 B1**
(45) **Date of Patent:** **Jan. 29, 2002**

- (54) **OXIMETER SENSOR WITH OFFSET EMITTERS AND DETECTOR AND HEATING DEVICE**
- (75) Inventors: **Rodney Chin**, Oakland; **Steven Hobbs**, Pasadena, both of CA (US)
- (73) Assignee: **Mallinckrodt Inc.**, Hazelwood, MO (US)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

- (21) Appl. No.: **09/483,098**
- (22) Filed: **Jan. 14, 2000**

Related U.S. Application Data

- (63) Continuation-in-part of application No. 09/447,449, filed on Nov. 22, 1999, and a continuation-in-part of application No. 08/903,120, filed on Jul. 30, 1997.
- (51) **Int. Cl.**⁷ **A61B 5/00**
- (52) **U.S. Cl.** **600/323; 600/334**
- (58) **Field of Search** 600/310, 322-324, 600/334-344

(56) **References Cited**

U.S. PATENT DOCUMENTS

- 4,805,623 A * 2/1989 Jobsis
- 4,807,631 A * 2/1989 Hersh et al.
- 4,819,752 A * 4/1989 Zeliin
- 4,822,568 A * 4/1989 Tomita
- 4,824,242 A * 4/1989 Frick et al.
- 4,869,253 A * 9/1989 Craig, Jr. et al.
- 4,869,254 A * 9/1989 Stone et al.
- 4,926,867 A * 5/1990 Kanda et al.
- 4,928,692 A * 5/1990 Goodman et al.
- 5,007,423 A * 4/1991 Branstetter et al.
- 5,028,787 A * 7/1991 Rosenthal et al.
- 5,048,524 A * 9/1991 Bailey
- 5,119,815 A * 6/1992 Chance

- 5,213,099 A * 5/1993 Tripp, Jr.
- 5,219,400 A * 6/1993 Jacot et al.
- 5,246,002 A * 9/1993 Prosser
- 5,259,381 A * 11/1993 Cheung et al.
- 5,300,769 A * 4/1994 Dahlin et al.
- 5,313,940 A * 5/1994 Fuse et al.
- 5,348,004 A * 9/1994 Hollub
- 5,351,685 A * 10/1994 Potratz
- 5,355,882 A * 10/1994 Ukawa et al.
- 5,368,224 A * 11/1994 Richardson et al.
- 5,372,134 A * 12/1994 Richardson
- 5,373,850 A * 12/1994 Kohno et al.
- 5,379,238 A * 1/1995 Stark
- 5,408,998 A * 4/1995 Mersch
- 5,413,101 A * 5/1995 Sugiura
- 5,490,523 A * 2/1996 Isaacson et al.
- 5,503,148 A * 4/1996 Pologe et al.
- 5,551,422 A * 9/1996 Simonsen et al.
- 5,551,423 A * 9/1996 Sugiura
- 5,596,986 A * 1/1997 Goldfarb
- 5,770,454 A * 6/1998 Essenpreis et al.
- 5,800,349 A * 9/1998 Isaacson et al.
- 5,817,008 A * 10/1998 Rafert et al.

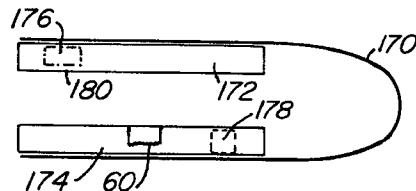
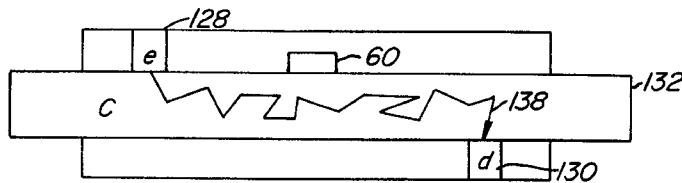
* cited by examiner

Primary Examiner—Linda C. M. Dvorak
Assistant Examiner—David M. Ruddy
(74) *Attorney, Agent, or Firm*—Townsend & Townsend & Crew LLP

(57) **ABSTRACT**

A method and apparatus for improving blood perfusion by both heating a patient's skin and providing emitters and a detector which are offset from each other. Since the emitters and detector are not directly opposite each other, the light is forced to pass through more blood perfused tissue (with blood perfusion enhanced by heating) to pass from the emitters to the detector. This causes the light emitted by the emitters to pass through more blood-perfused tissue to reach the detector than it would on the direct path through the appendage if the emitters and detector were opposite each other.

26 Claims, 5 Drawing Sheets



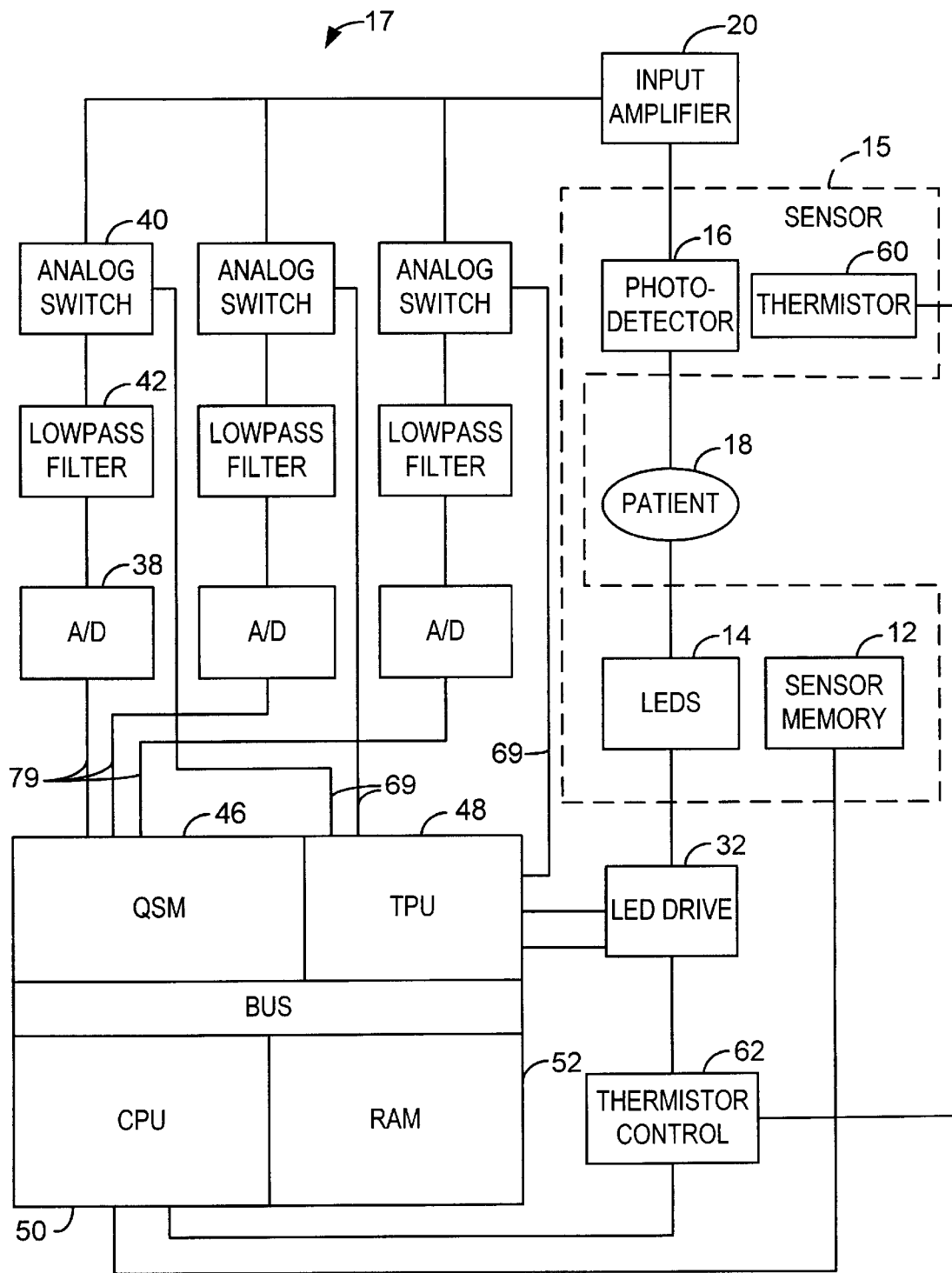


FIG. 1.

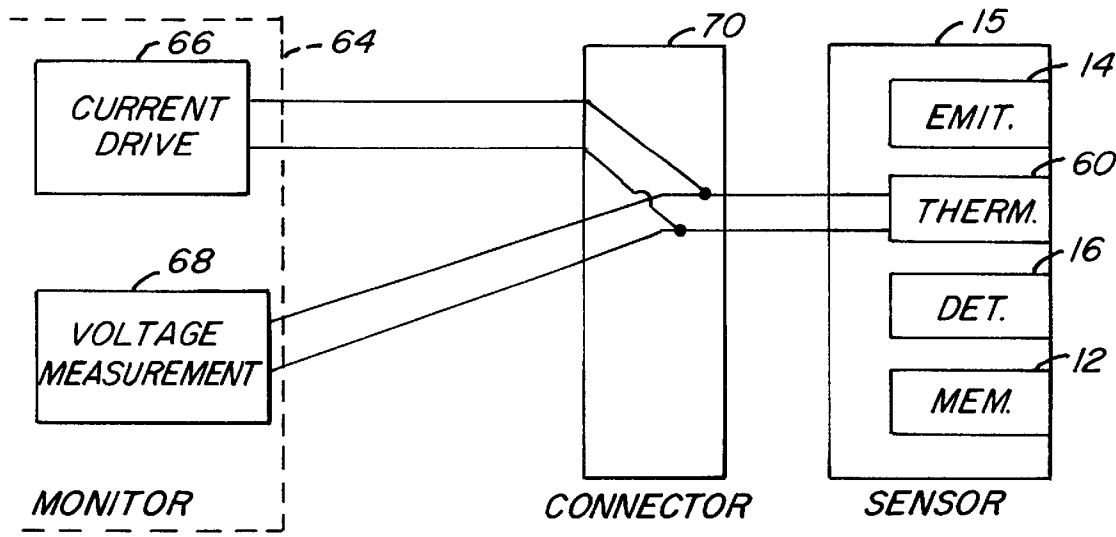


FIG. 2.

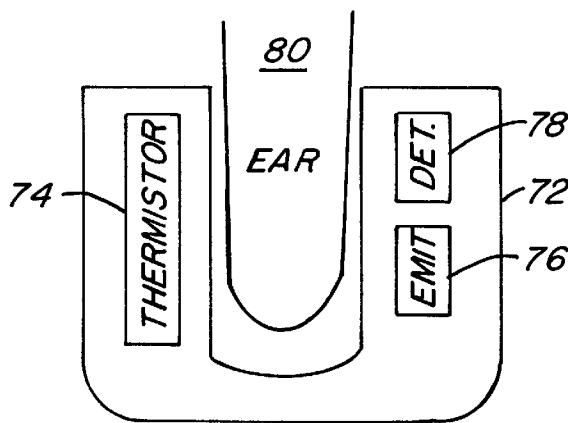


FIG. 3.

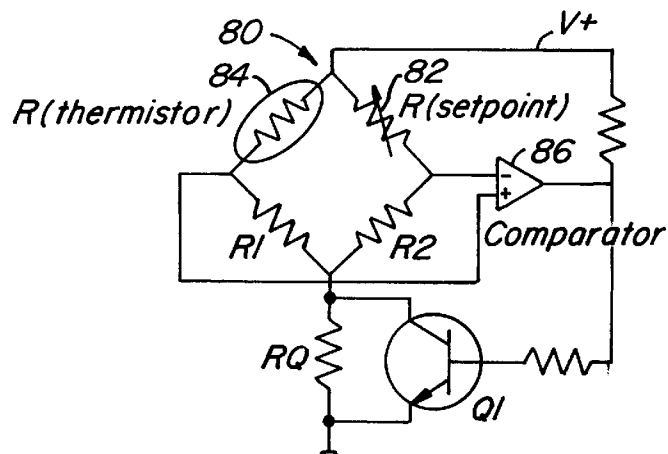
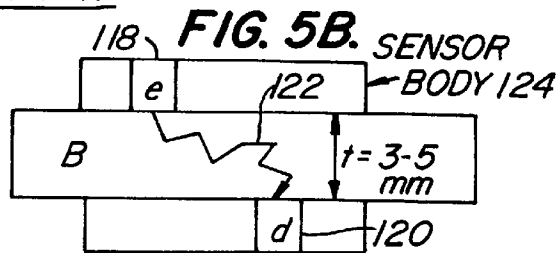
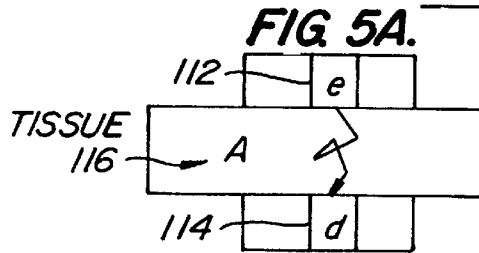
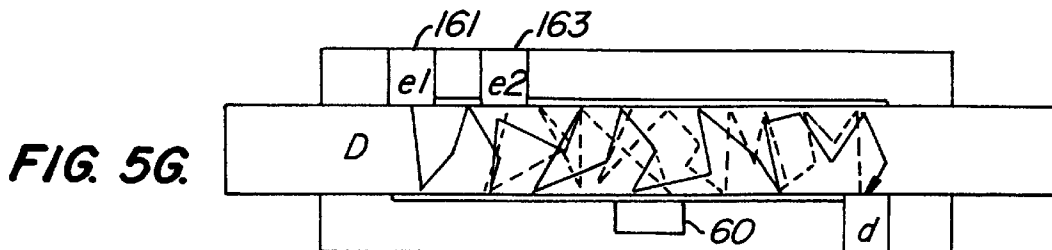
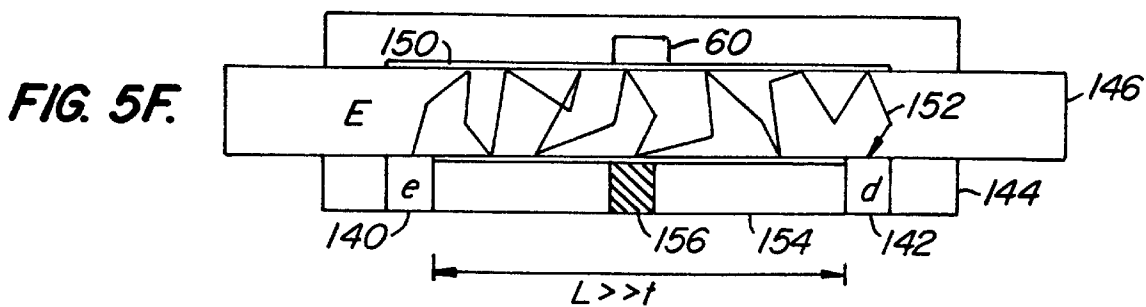
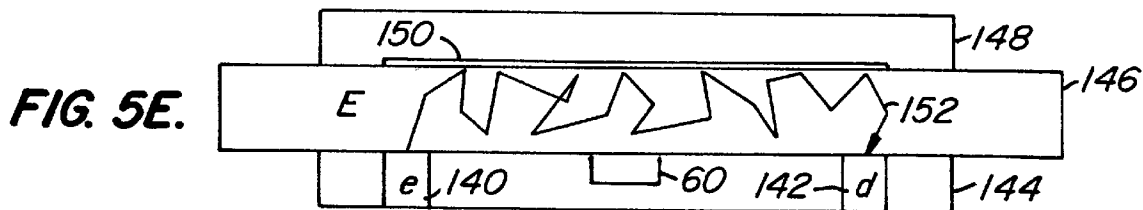
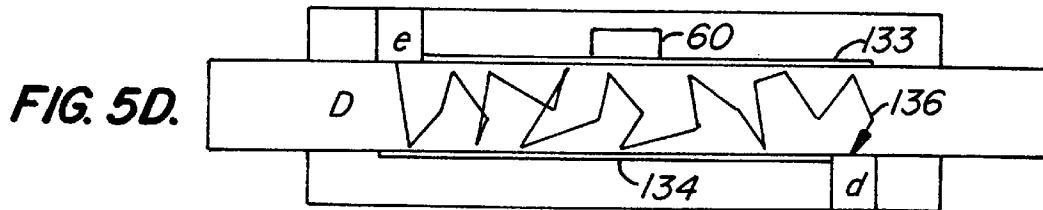
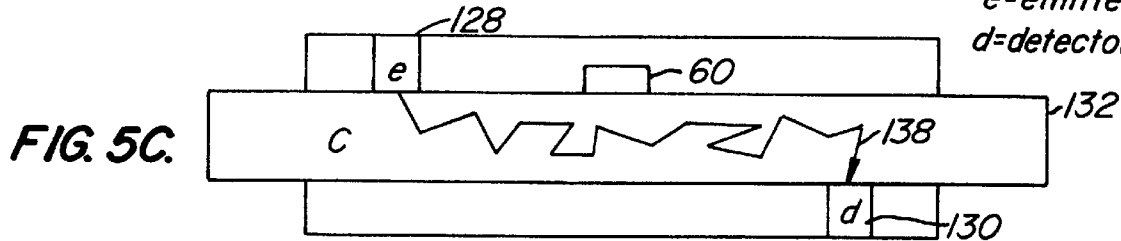


FIG. 4

PRIOR ART



e=emitters
d=detector



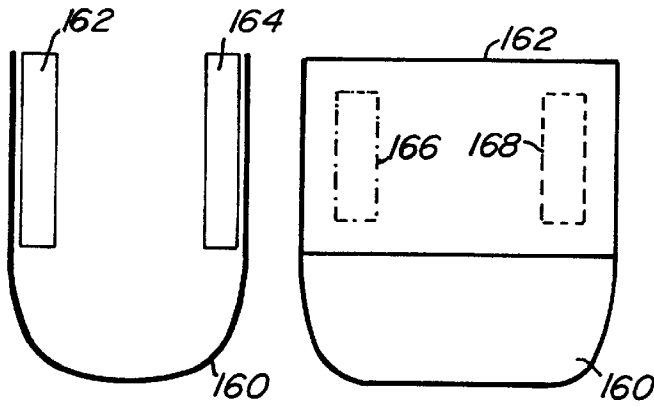


FIG. 6A.

FIG. 6B.

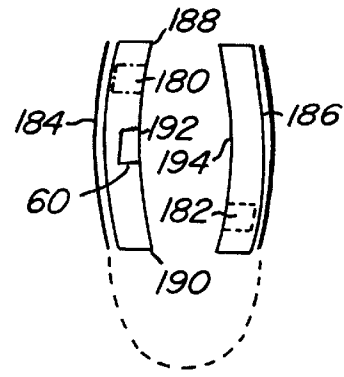


FIG. 8.

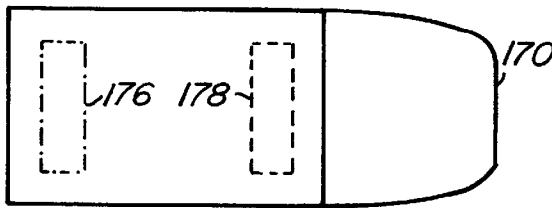


FIG. 7A.

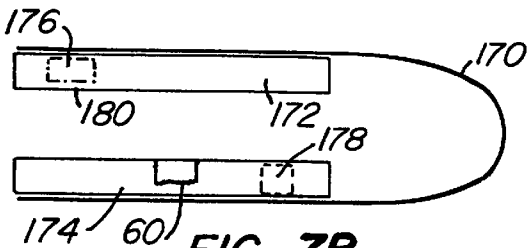


FIG. 7B.

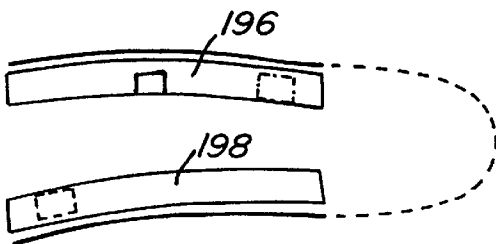


FIG. 9.

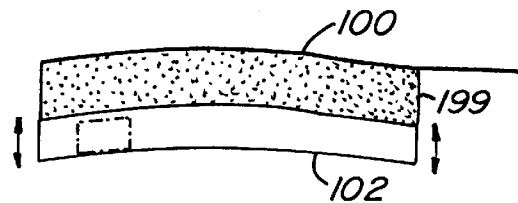


FIG. 10.

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.