



US006198951B1

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

(10) **Patent No.:** **US 6,198,951 B1**
(45) **Date of Patent:** **Mar. 6, 2001**

(54) **REFLECTION PHOTODETECTOR AND BIOLOGICAL INFORMATION MEASURING INSTRUMENT**

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(75) Inventors: **Tsukasa Kosuda; Yutaka Kondo**, both of Matsumoto; **Hajime Kurihara; Norimitsu Baba**, both of Shimosuwa-machi, all of (JP)

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(73) Assignee: **Seiko Epson Corporation**, Tokyo (JP)

(*) 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.: **09/297,438**

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(22) PCT Filed: **Sep. 4, 1998**

Primary Examiner—John P. Lacyk
(74) *Attorney, Agent, or Firm*—Michael T. Gabrik

(86) PCT No.: **PCT/JP98/03972**

§ 371 Date: **Apr. 30, 1999**

§ 102(e) Date: **Apr. 30, 1999**

(87) PCT Pub. No.: **WO99/12469**

PCT Pub. Date: **Mar. 18, 1999**

(30) **Foreign Application Priority Data**

(57) **ABSTRACT**

Sep. 5, 1997 (JP) 9-241426
Nov. 11, 1997 (JP) 9-308913

When emitted light from LED **31** is incident on photodiodes **32** and **33** with luminance Pa and Pb, currents ia and ib are generated according to luminance Pa and Pb. When outside light is incident through the finger tissues on photodiodes **32** and **33** with luminance Pc, current ic is produced. The current i1 (=ia+ic) generated by photodiode **32**, and the current i2 (=ib-ic) generated by photodiode **33**, are added at node X, and the current ic corresponding to outside light is thus cancelled. In addition, photodiodes **32** and **33** are disposed at different distances from LED **31**. As a result, the current flowing to opamp **34** is current ia corresponding to luminance Pa because luminance Pb is extremely low. The opamp **34** then applies a current voltage conversion to generate pulse wave signal Vm.

(51) **Int. Cl.⁷** **A61B 5/00**

(52) **U.S. Cl.** **600/323**

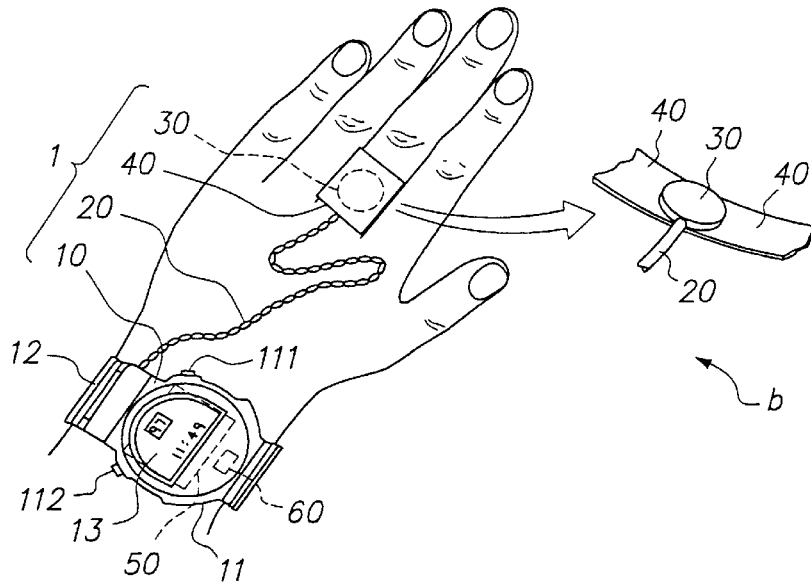
(58) **Field of Search** 600/322, 323, 600/336, 310, 316, 330, 340, 344

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19 Claims, 27 Drawing Sheets



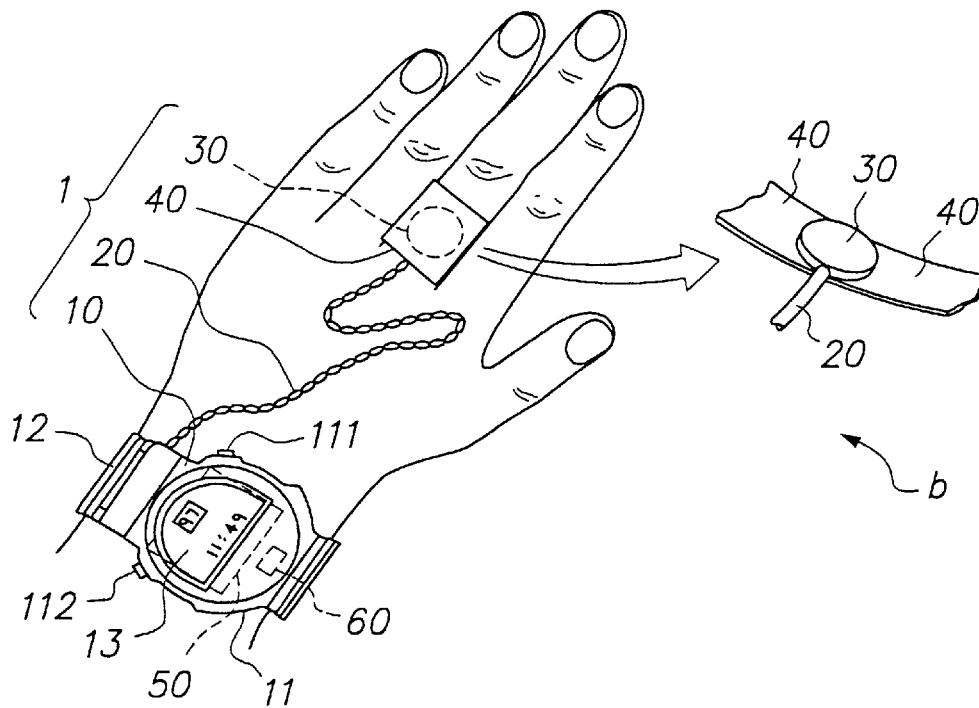


FIG. 1

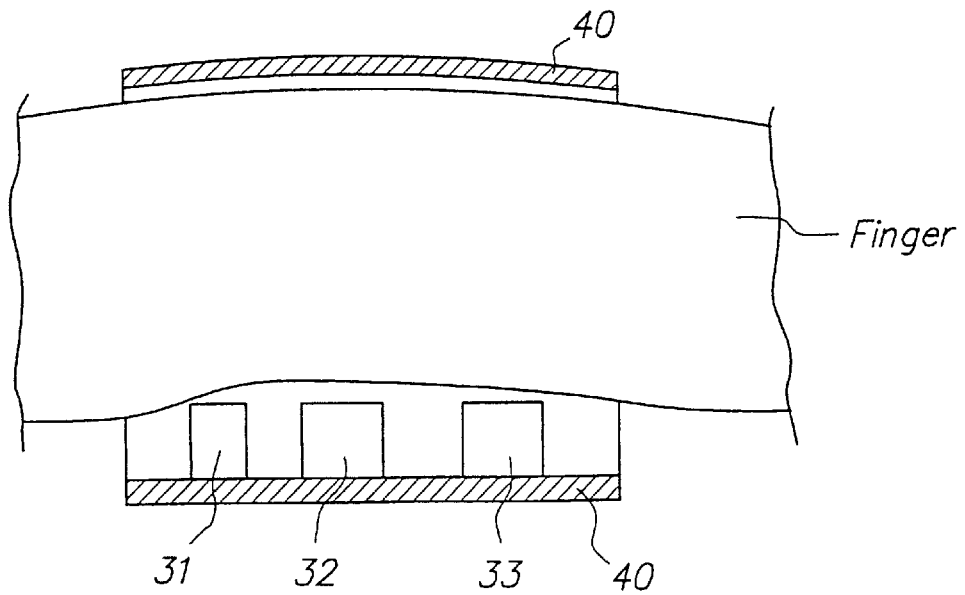


FIG. 2

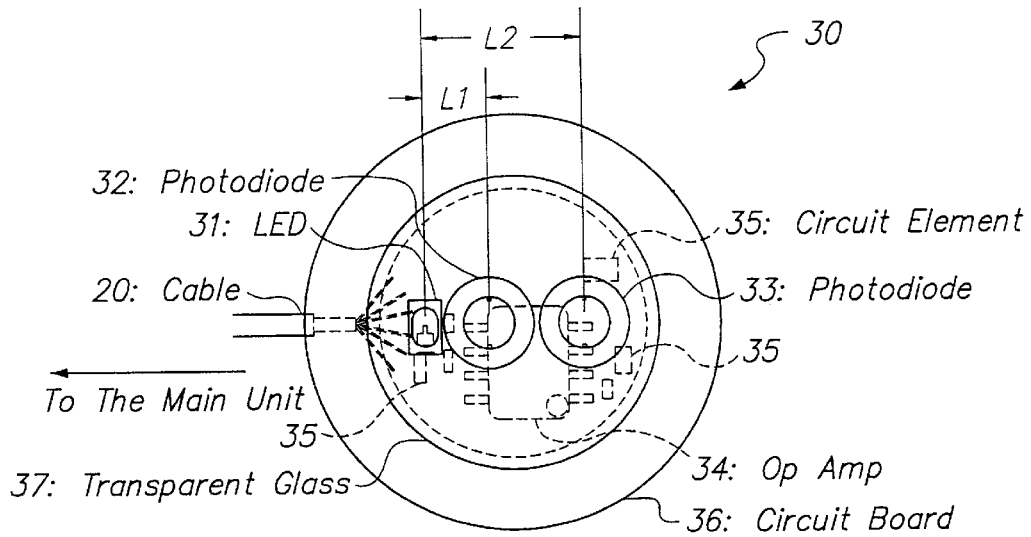


FIG. 3

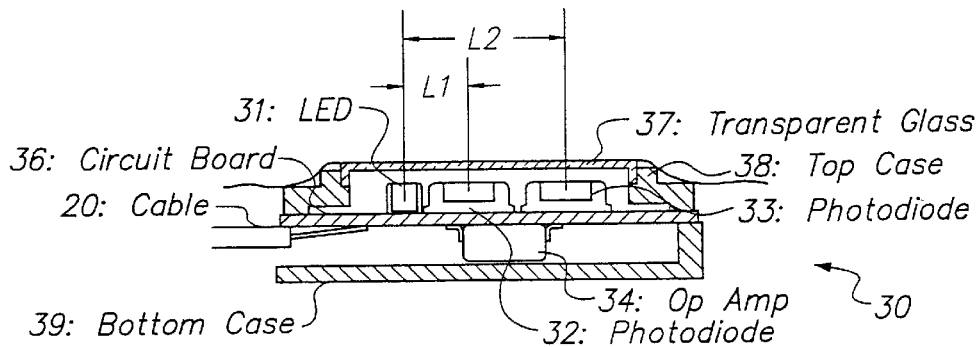


FIG. 4

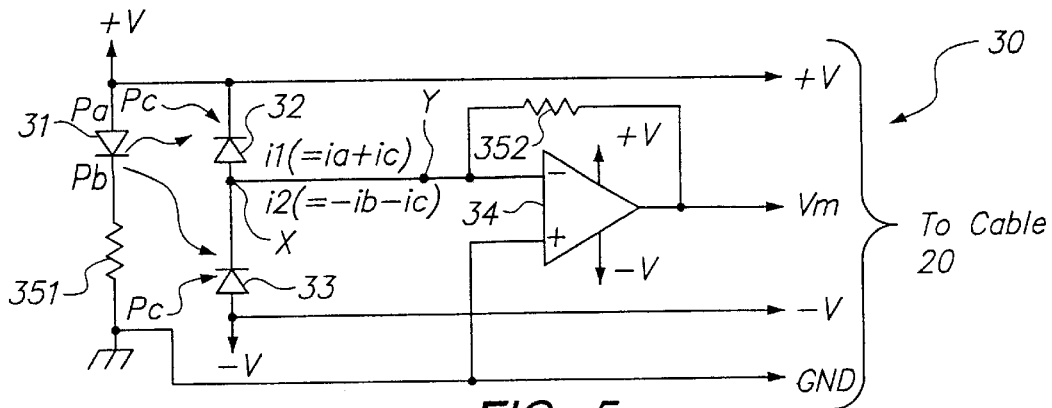


FIG. 5

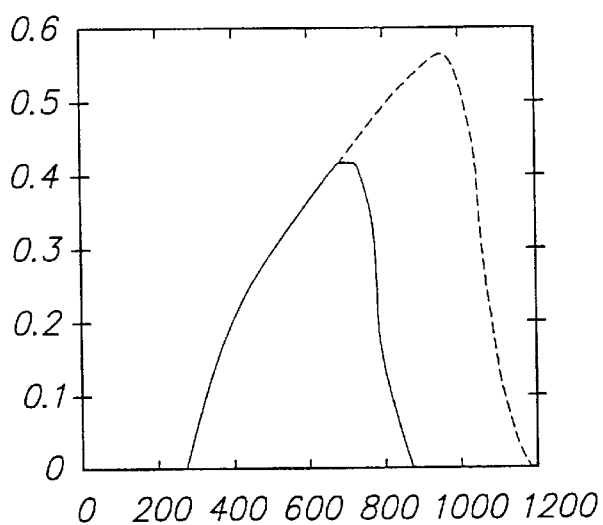


FIG. 6

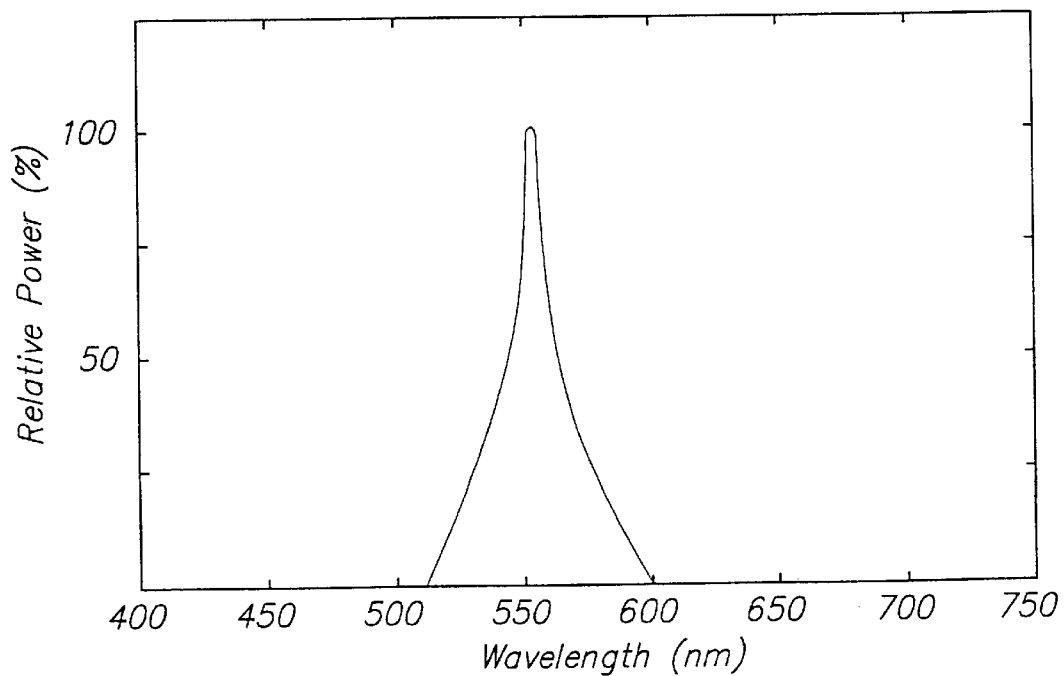


FIG. 7

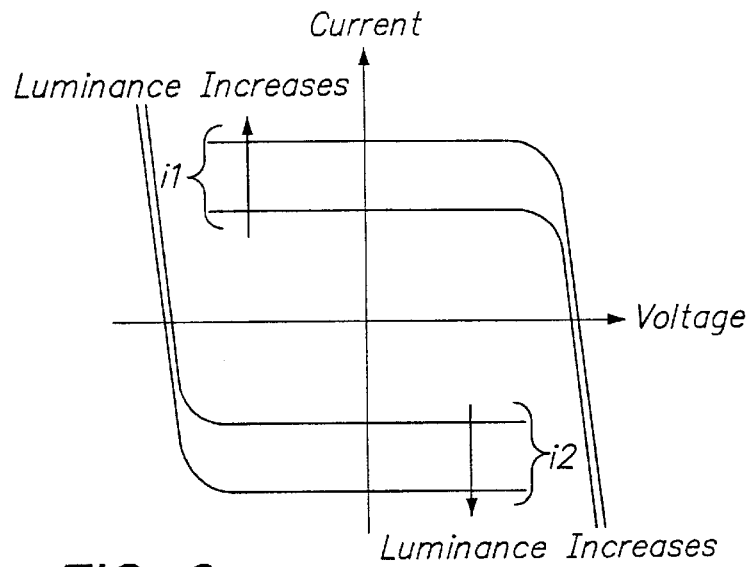


FIG. 8

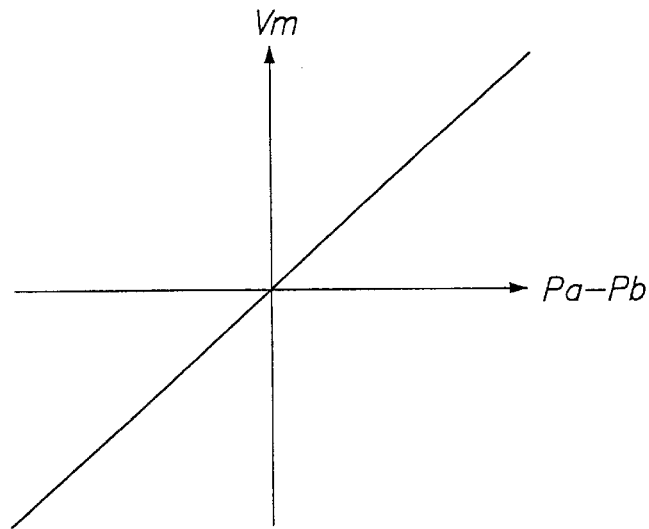


FIG. 9

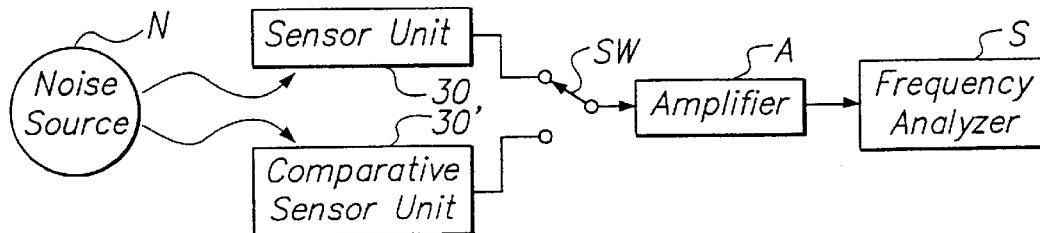


FIG. 12

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