

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

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

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(57) **ABSTRACT**

§ 102(e) Date: **Apr. 30, 1999**

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.

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

(30) **Foreign Application Priority Data**

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

(51) **Int. Cl.⁷** **A61B 5/00**

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

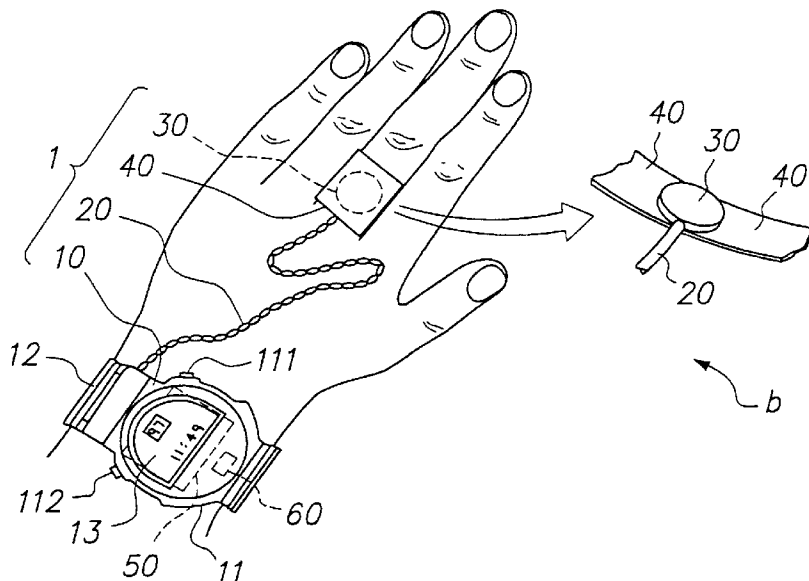
(58) **Field of Search** 600/322, 323, 600/336, 310, 316, 330, 340, 344

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19 Claims, 27 Drawing Sheets



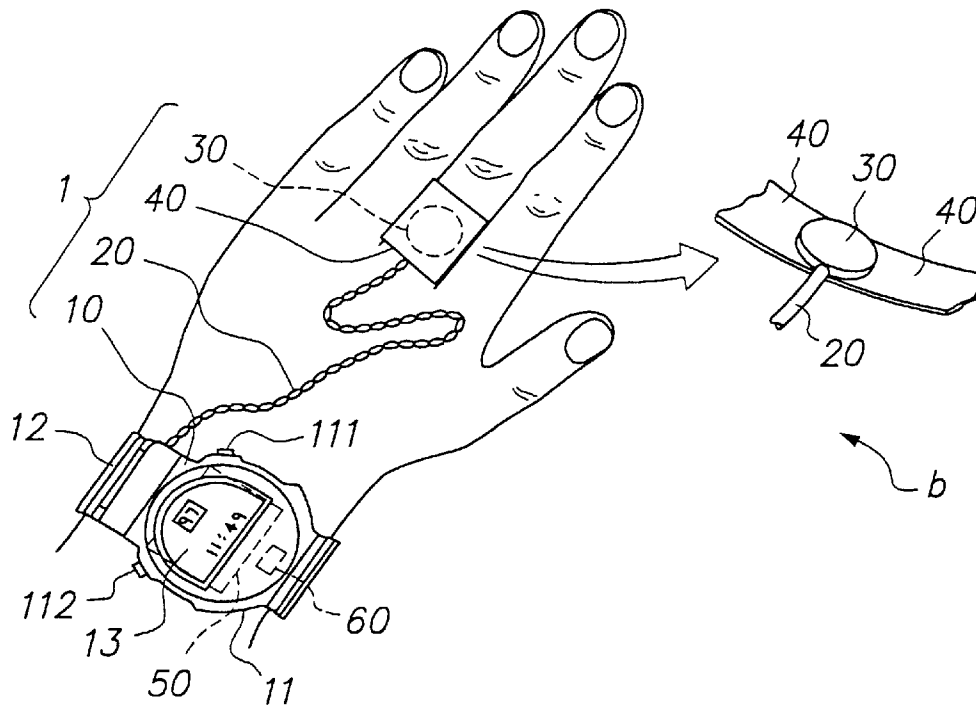


FIG. 1

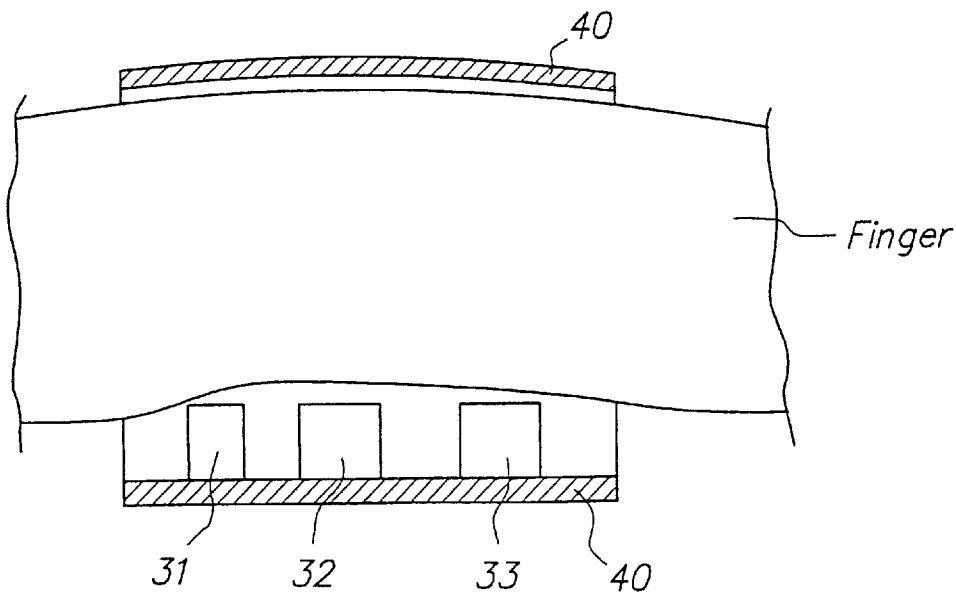


FIG. 2

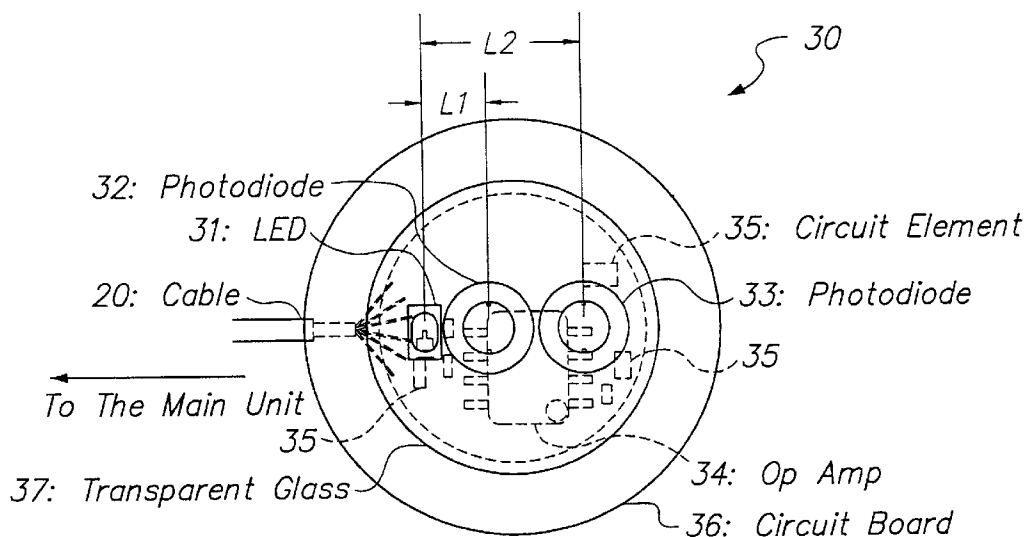


FIG. 3

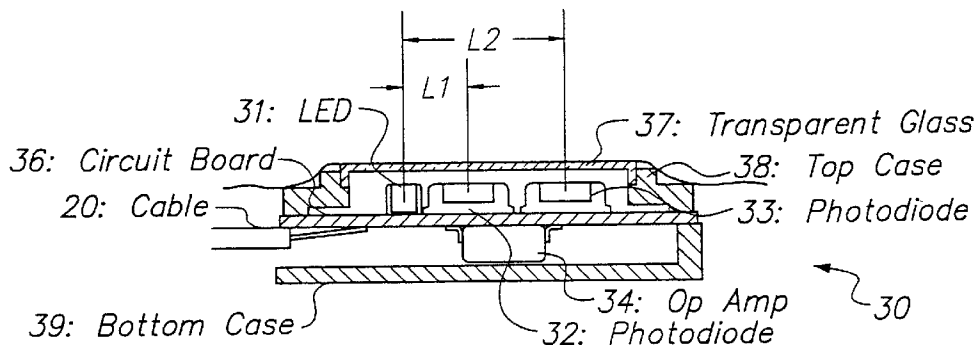


FIG. 4

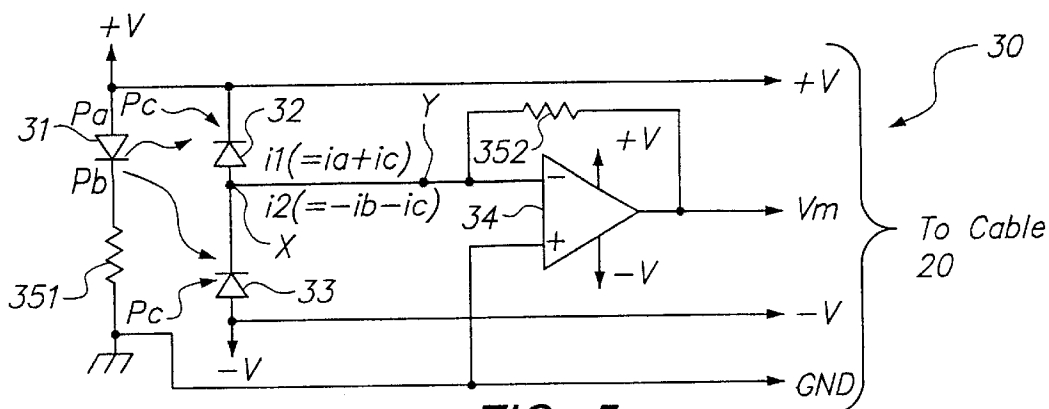


FIG. 5

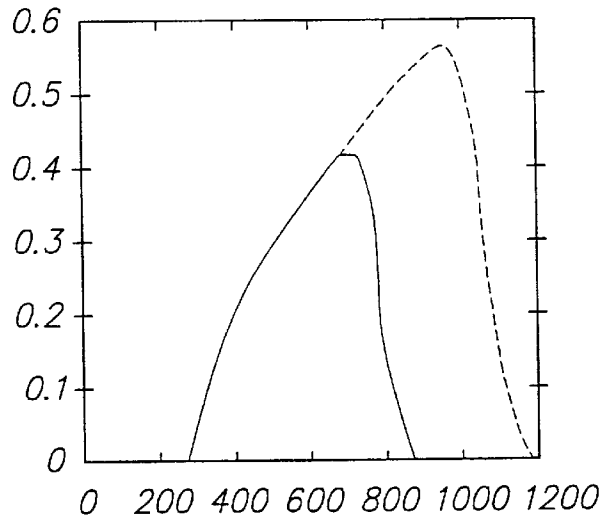


FIG. 6

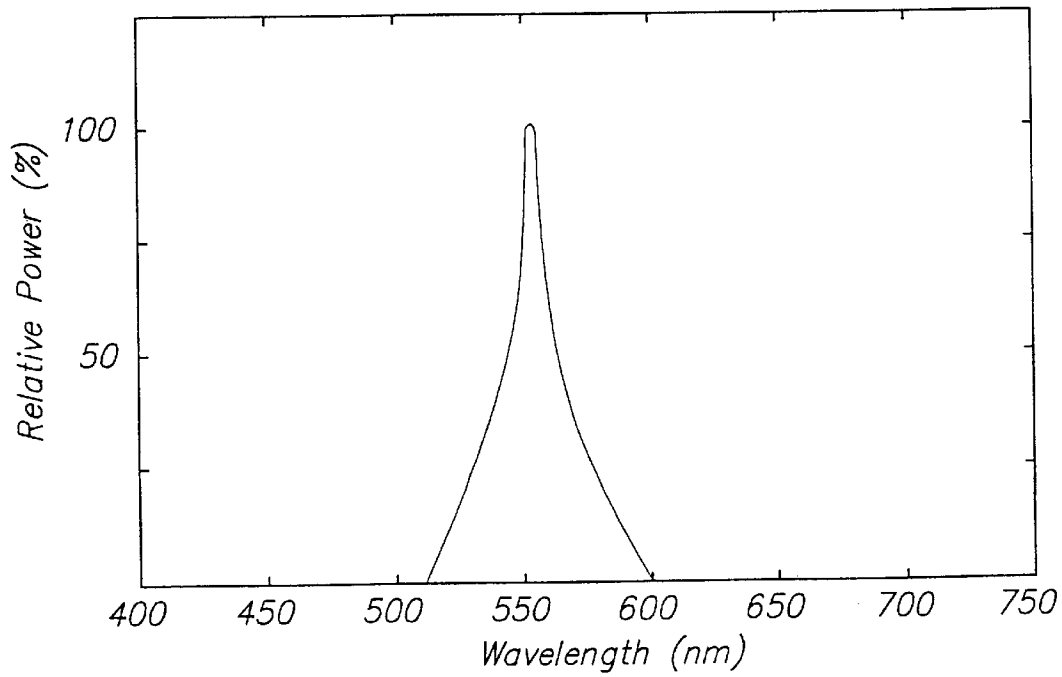


FIG. 7

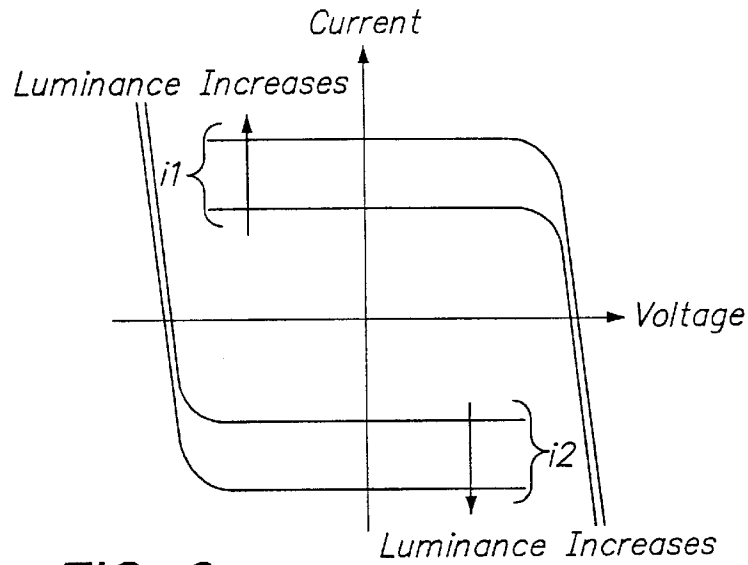


FIG. 8

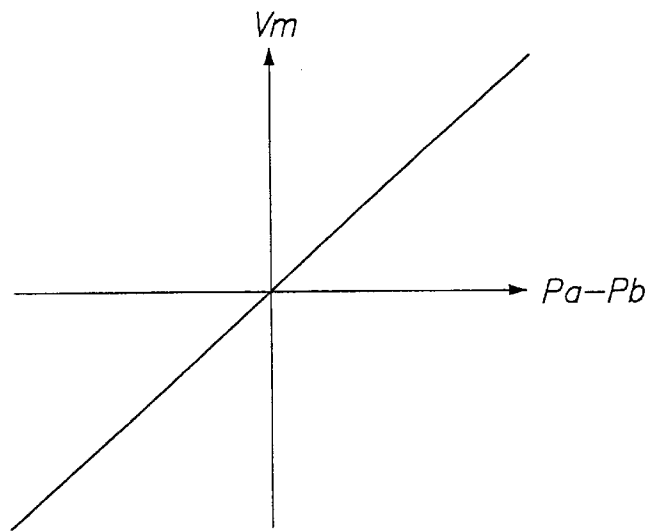


FIG. 9

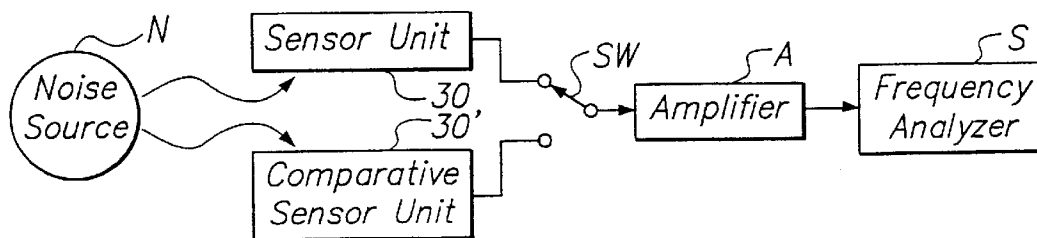


FIG. 12

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