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**Kiani et al.**

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- (54) **PULSE OXIMETER PROBE-OFF DETECTION SYSTEM**
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- (\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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**Related U.S. Application Data**

- (62) Division of application No. 09/595,081, filed on Jun. 16, 2000, now Pat. No. 6,526,300.
- (60) Provisional application No. 60/140,000, filed on Jun. 18, 1999.
- (51) **Int. Cl.**<sup>7</sup> ..... **A61B 5/00**
- (52) **U.S. Cl.** ..... **600/323; 600/344**
- (58) **Field of Search** ..... 600/309–310, 600/322–324, 316, 344, 473, 476

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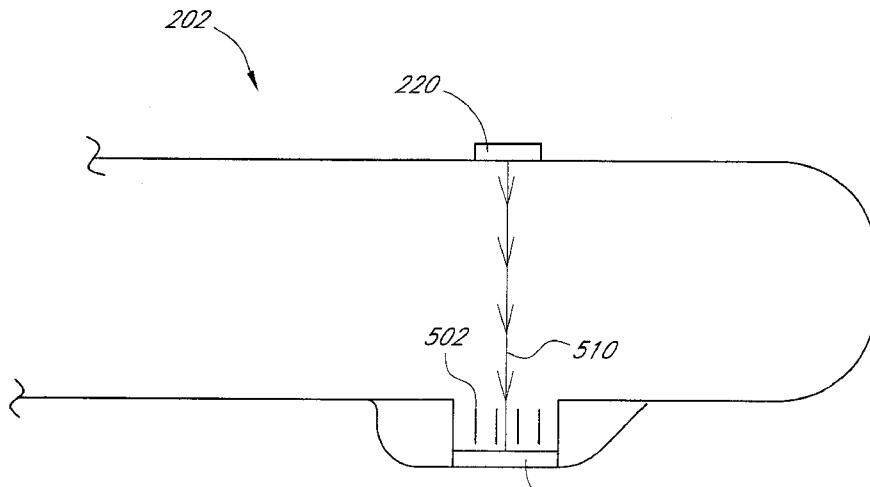
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(57) **ABSTRACT**

The present invention provides a number of improvements that can be incorporated into a pulse oximeter probe to detect when a probe has become dislodged from a patient and/or to prevent a probe-off condition. A probe-off condition occurs when the optical probe becomes partially or completely dislodged from the patient, but continues to detect an AC signal within the operating region of the pulse oximeter. In one aspect, the present invention provides electrical contacts that contact the skin of a patient when the probe is properly attached. In another aspect, the present invention provides a number of louvers placed in front of the sensor's photodetector to filter out oblique light rays that do not originate from a point in front of the detector. Accordingly, if the emitter and photodetector are not properly aligned, the photodetector will not produce a signal within the valid operating range of the pulse oximeter. In accordance with a method of the present invention the pulse oximeter can sound an alarm or display a warning if it determines that the probe is not properly attached to the patient.

**18 Claims, 15 Drawing Sheets**



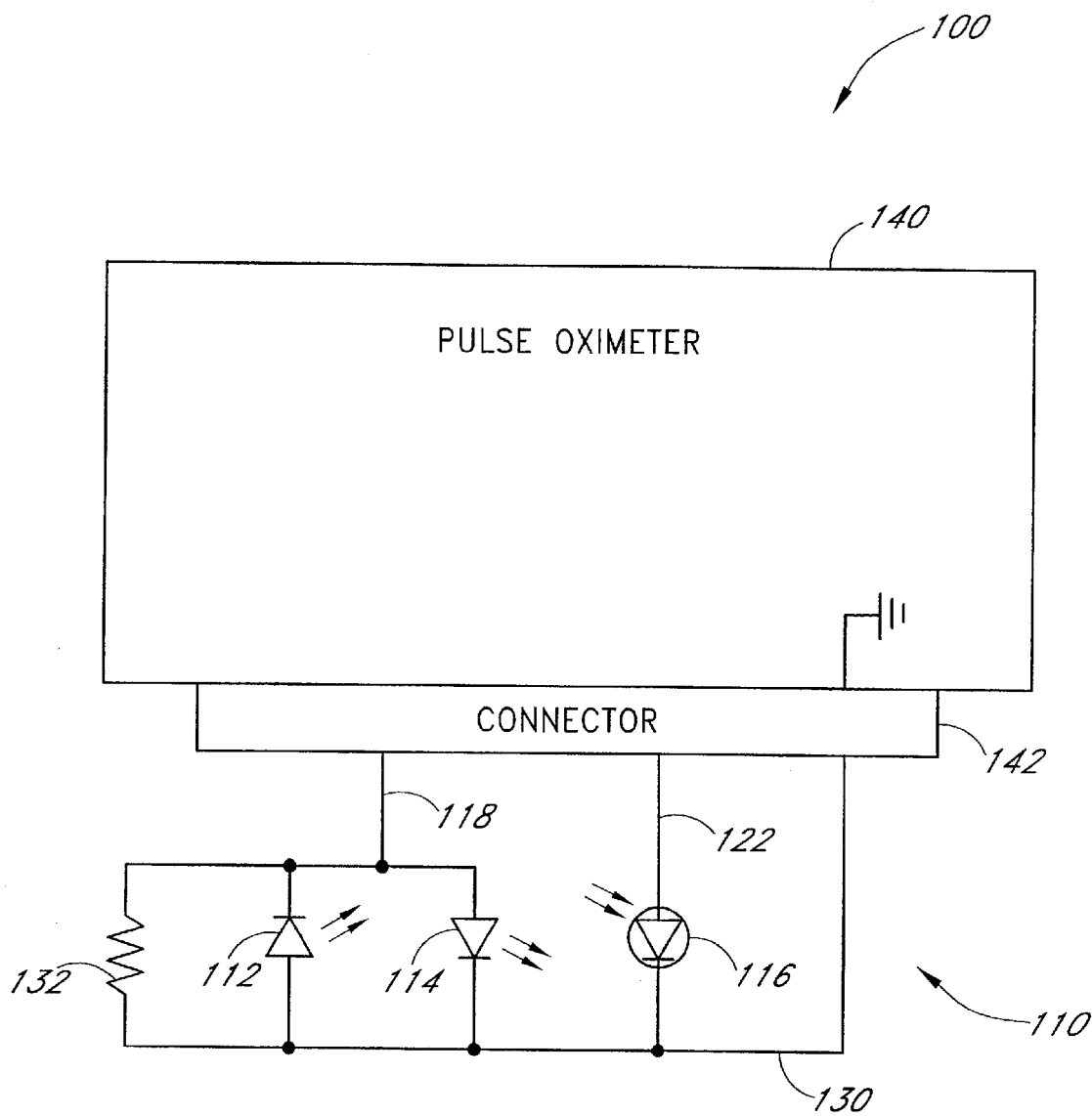
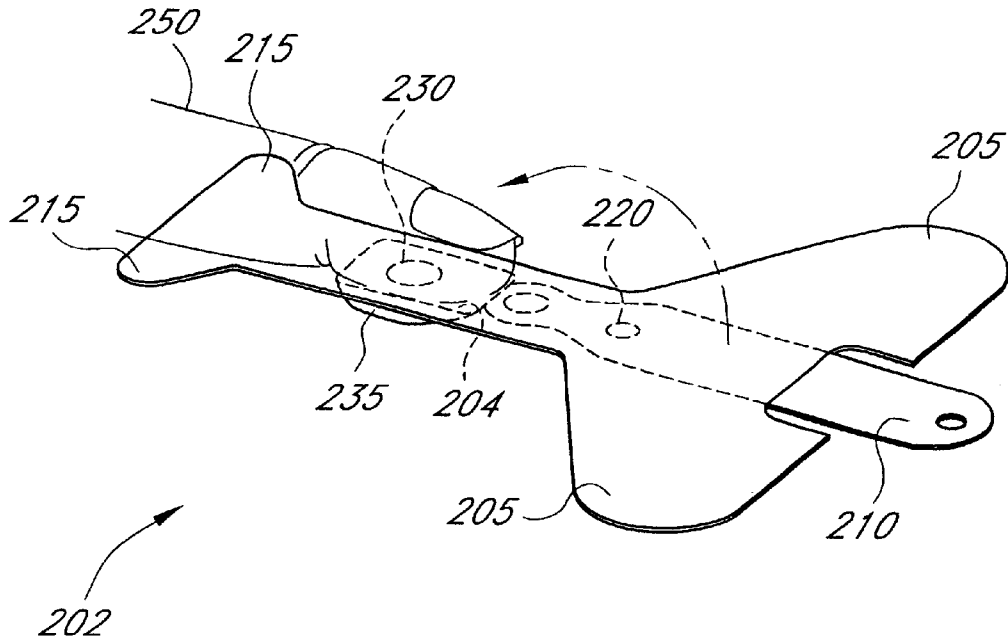
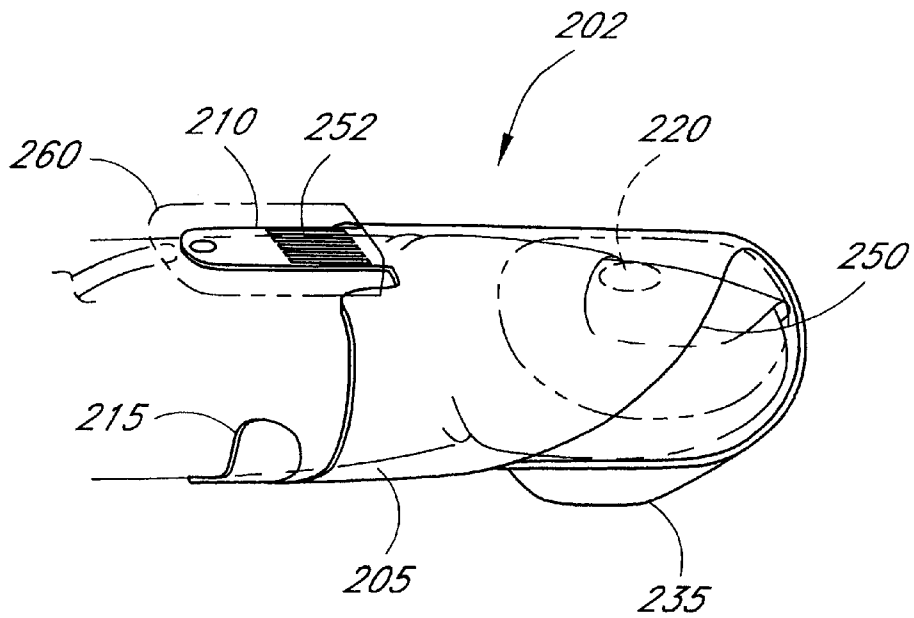


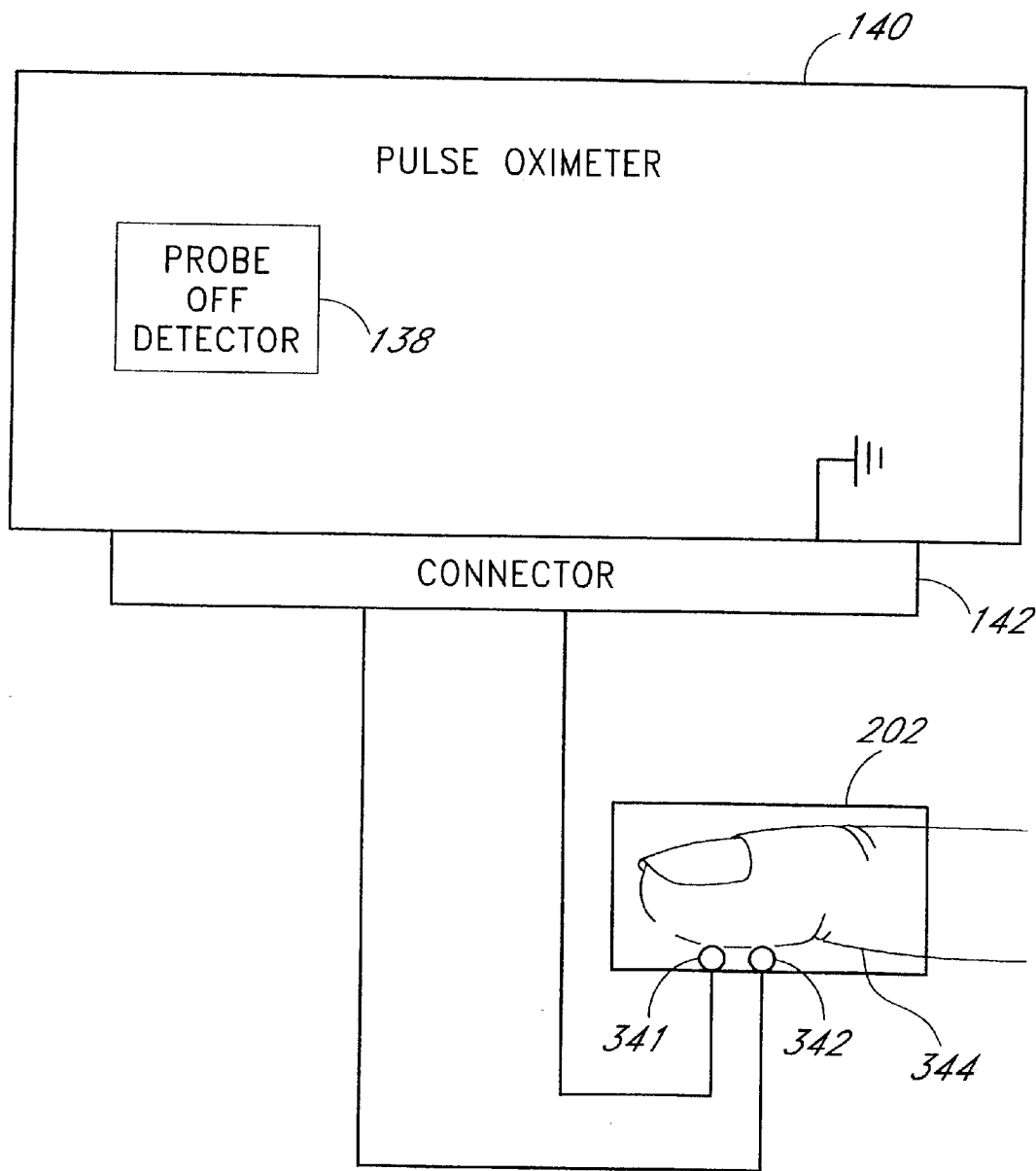
FIG. 1



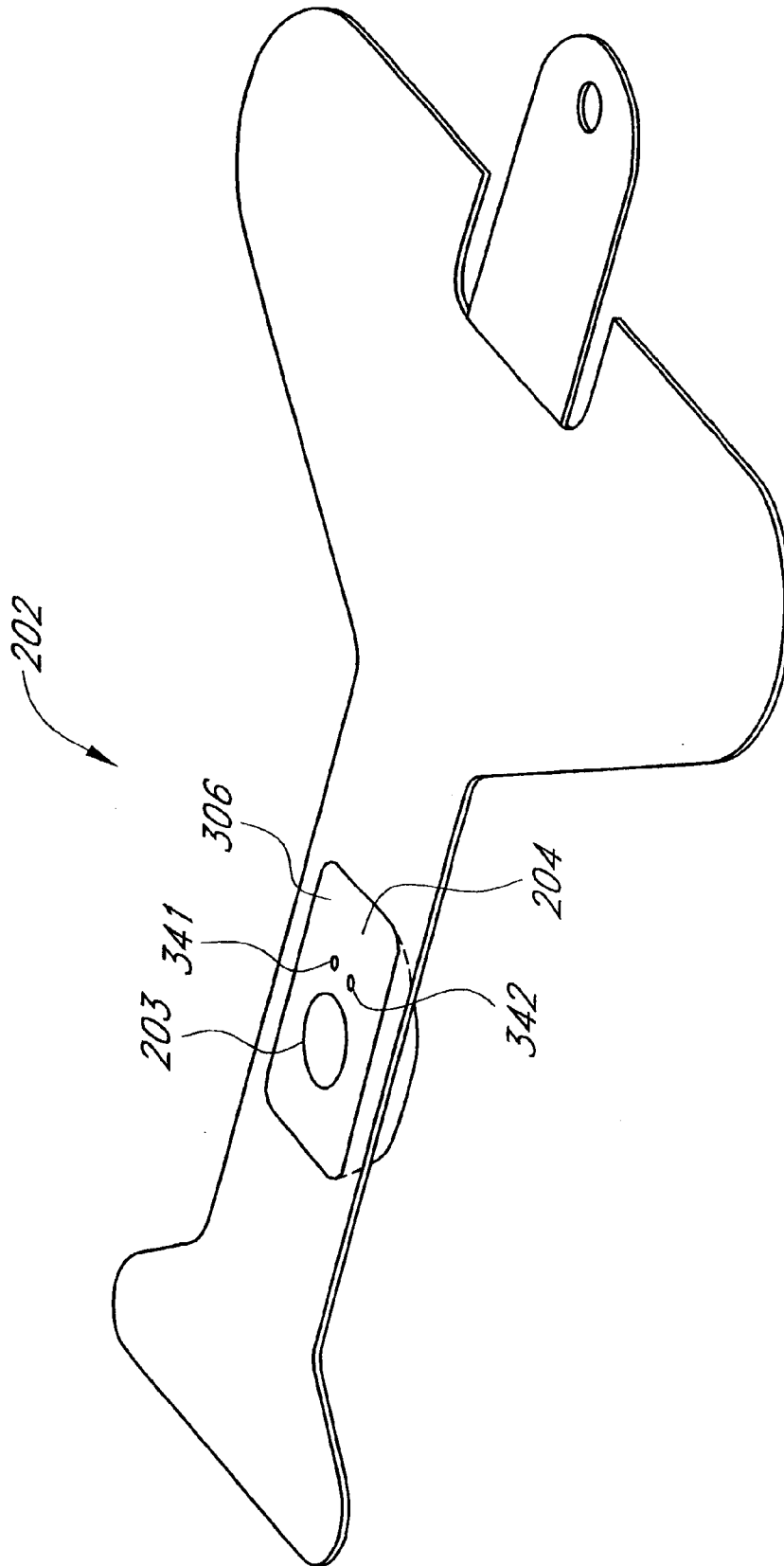
**FIG. 2A**



**FIG. 2B**



**FIG. 3A**



**FIG. 3B**

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