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Hotelling et al.

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(54) **METHODS AND SYSTEMS FOR MODULATION AND DEMODULATION OF OPTICAL SIGNALS**

(58) **Field of Classification Search**
CPC G01J 1/0228; G01J 2001/0257; G01J 2001/4242; G01J 2001/444; A61B 5/7225; A61B 5/02427
See application file for complete search history.

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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 428 days.

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(63) Continuation of application No. 14/618,664, filed on Feb. 10, 2015, now Pat. No. 9,952,095.
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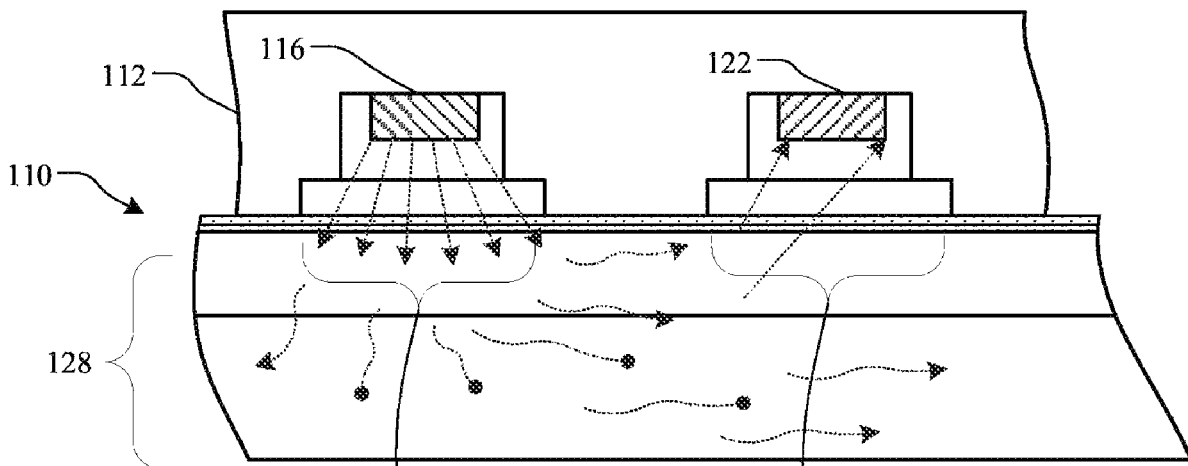
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G01J 1/44 (2006.01)
A61B 5/024 (2006.01)
G01J 1/18 (2006.01)
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(57) **ABSTRACT**
An electronic device includes one or more light sources for emitting light toward a body part of a user and one or more optical sensors for capturing light samples while each light source is turned on and for capturing dark samples while the light source(s) are turned off. A signal produced by the one or more optical sensors is filtered and demodulated produce multiple demodulated signals each associated with a light source. Each signal associated with the light source(s) is analyzed to estimate or determine a physiological parameter of the user.

19 Claims, 7 Drawing Sheets



- (51) **Int. Cl.**
G01J 1/02 (2006.01)
G01J 1/42 (2006.01)

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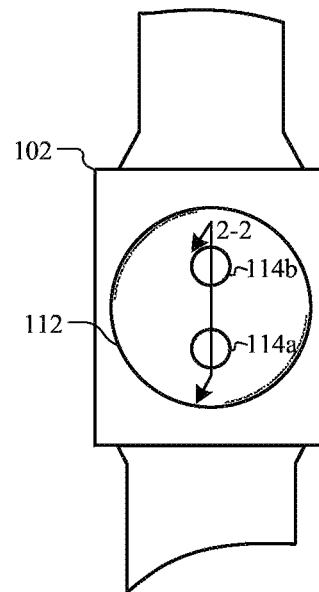
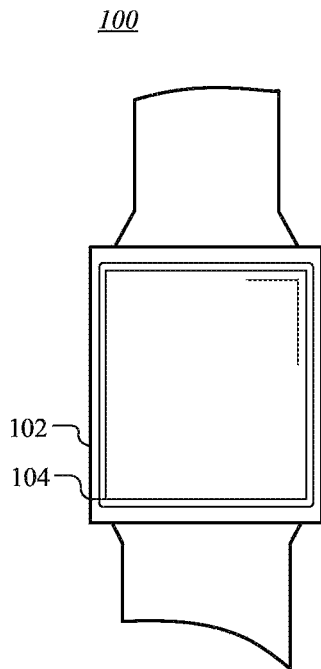
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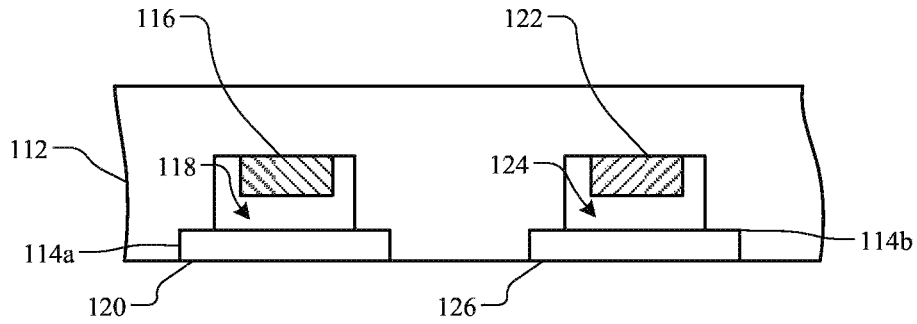


FIG. 2A

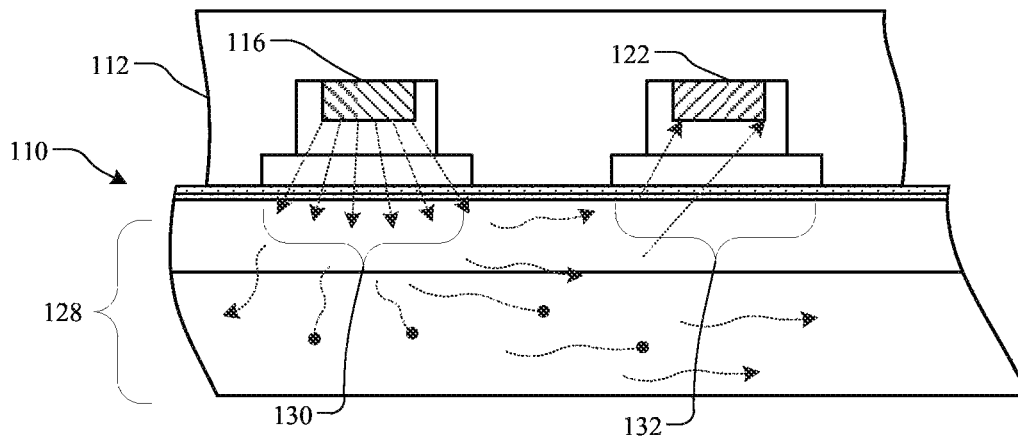


FIG. 2B

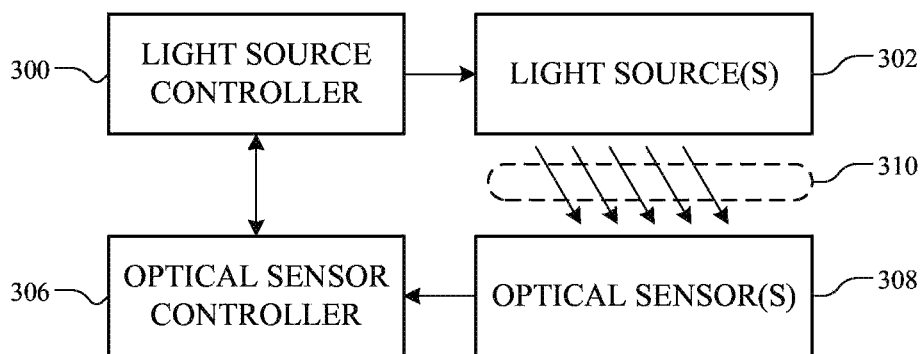


FIG. 3

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