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

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(54) **MONITORING DEVICE WITH AN ACCELEROMETER, METHOD AND 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.  
This patent is subject to a terminal disclaimer.

(21) Appl. No.: **13/253,046**

(22) Filed: **Oct. 4, 2011**

**Related U.S. Application Data**

(63) Continuation-in-part of application No. 13/191,907, filed on Jul. 27, 2011, and a continuation-in-part of application No. 12/561,222, filed on Sep. 16, 2009, which is a continuation-in-part of application No. 11/856,056, filed on Sep. 16, 2007, now Pat. No. 7,625,344, which is a continuation of application No. 11/762,078, filed on Jun. 13, 2007, now Pat. No. 7,468,036, which is a continuation-in-part of application No. 11/388,707, filed on Mar. 24, 2006, which is a continuation-in-part of application No. 11/085,778, filed on Mar. 21, 2005, now abandoned.

(60) Provisional application No. 61/408,656, filed on Nov. 1, 2010, provisional application No. 61/394,744, filed on Oct. 19, 2010, provisional application No. 61/368,262, filed on Jul. 28, 2010, provisional application No. 61/097,844, filed on Sep. 17, 2008, provisional application No. 60/665,116, filed on Mar. 25, 2005, provisional application No. 60/613,785, filed on Sep. 28, 2004.

(51) **Int. Cl.**  
**A61B 5/02** (2006.01)

(52) **U.S. Cl.** ..... **600/503**; 600/500; 600/301; 600/481

(58) **Field of Classification Search** ..... 600/300-301, 600/310, 323, 481, 483, 500-504  
See application file for complete search history.

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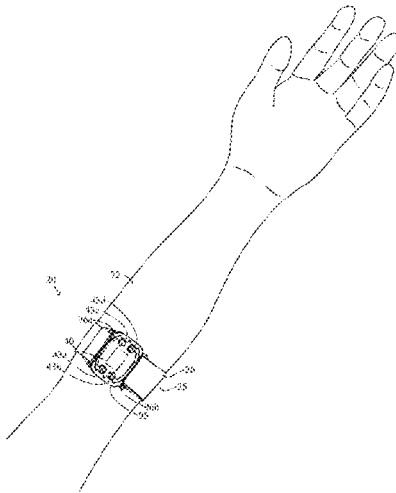
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(74) *Attorney, Agent, or Firm* — Clause Eight IPS; Michael Catania

(57) **ABSTRACT**

A monitoring device for monitoring the vital signs of a user is disclosed herein. The monitoring device is preferably comprises an article, an optical sensor, an accelerometer and processor. The optical sensor preferably comprises a photo-detector and a plurality of light emitting diodes. A sensor signal from the optical sensor is processed with a filtered accelerometer output signal from the accelerometer to create a filtered vital sign signal used to generate a real-time vital sign for a user.

**4 Claims, 18 Drawing Sheets**



# US 8,172,761 B1

Page 2

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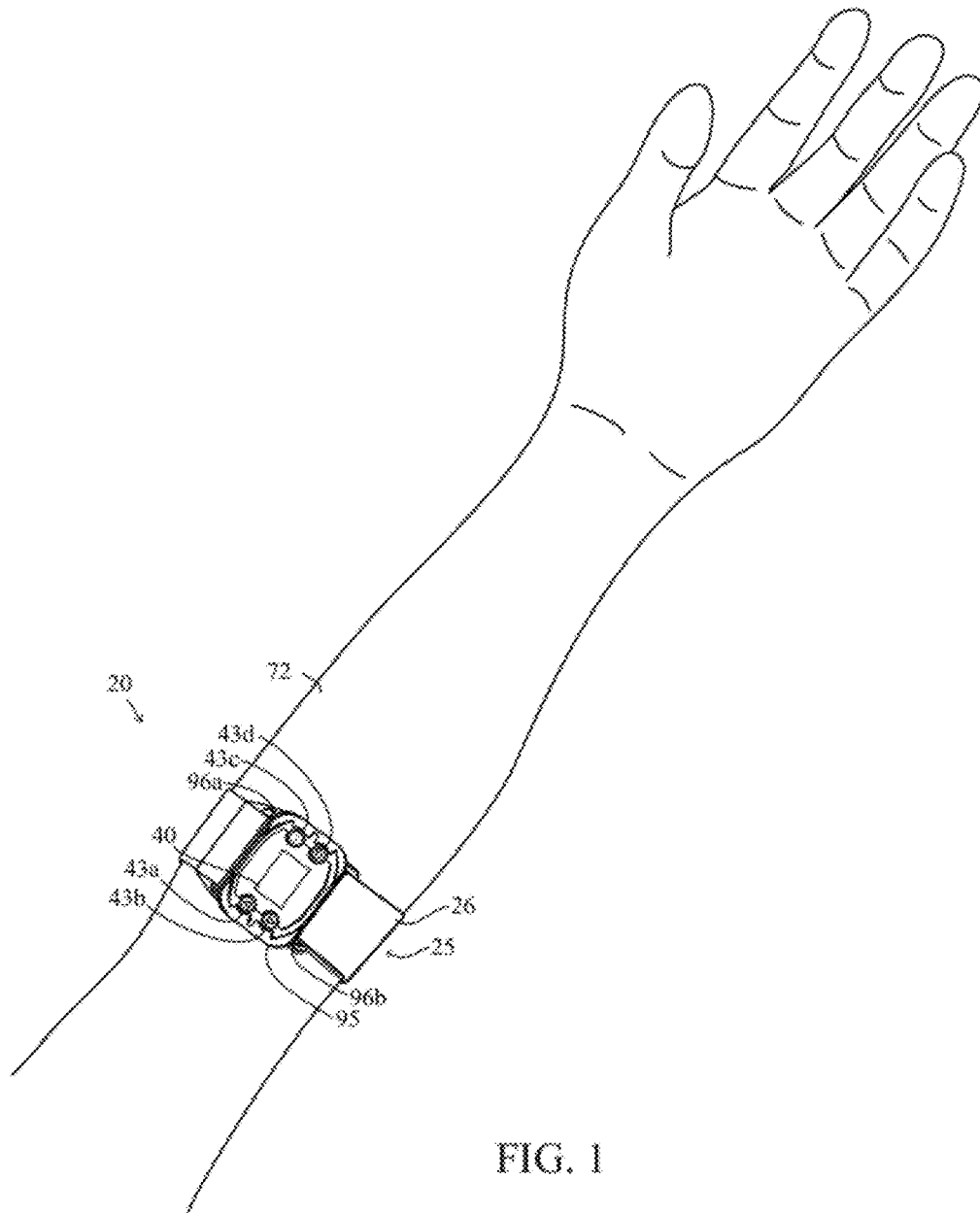
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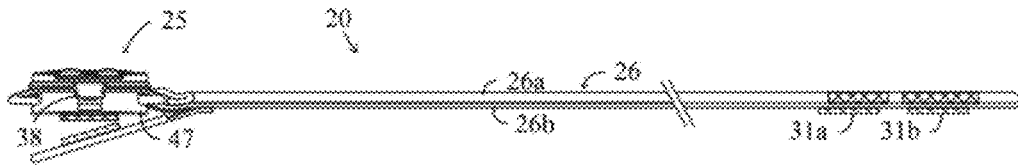


FIG. 2

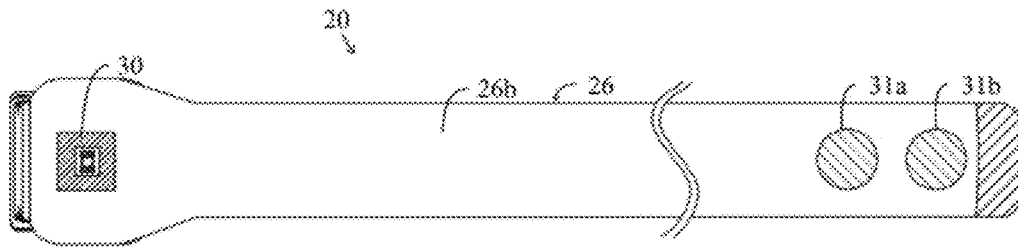


FIG. 3

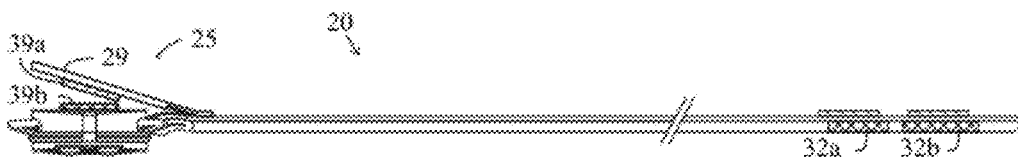


FIG. 4

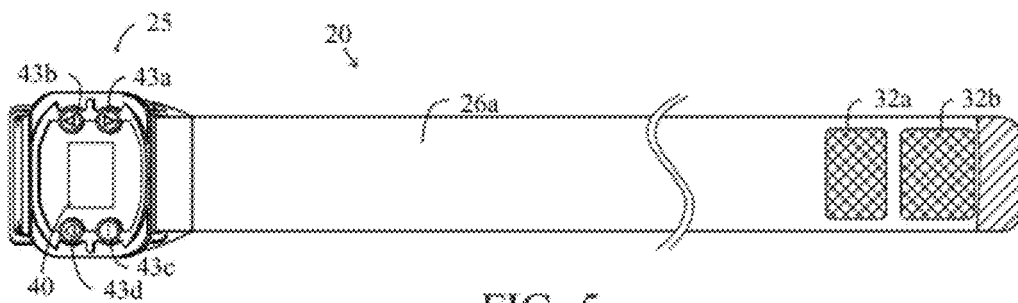


FIG. 5

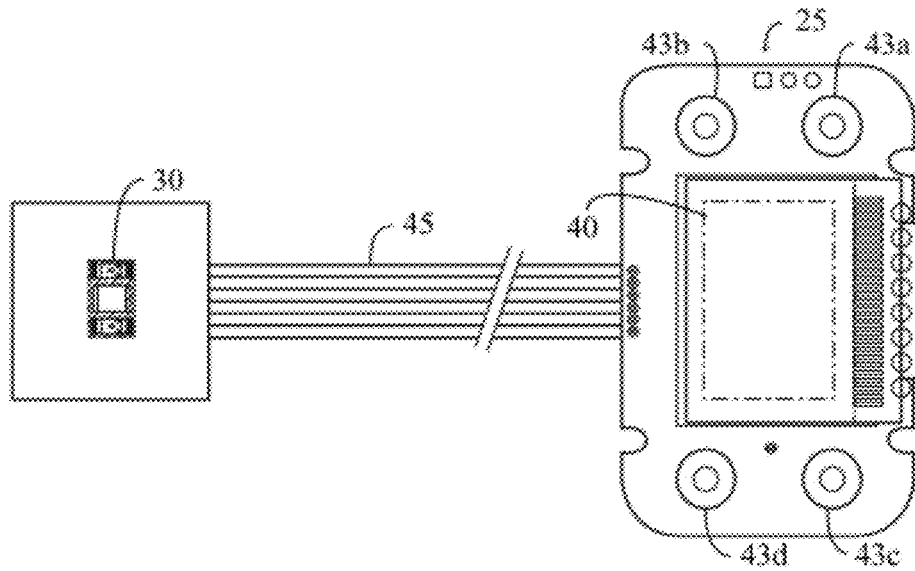


FIG. 6

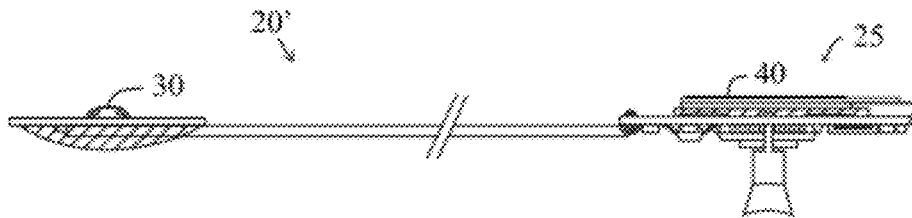


FIG. 7

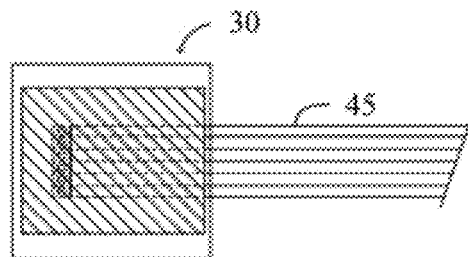


FIG. 8

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