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**Deninger et al.**

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(54) **BATTERY MONITORING SYSTEM WITH LOW POWER AND END-OF-LIFE MESSAGING AND SHUTDOWN**

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**G01R 31/36** (2006.01)

(52) **U.S. Cl.** ..... **702/63; 320/113**

(58) **Field of Classification Search** ..... **702/57, 702/63, 64, 65, 117, 118, 122, 124, 126, 182, 702/183, 184, 134, 135, 170, 171; 320/113; 713/340; 600/300**

See application file for complete search history.

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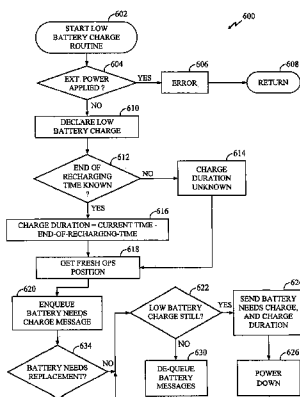
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(57) **ABSTRACT**

A battery monitoring apparatus that senses battery conditions such as low battery charge, end of battery capacity, and end of battery life, and responds by taking actions such as sending messages to a remote site and/or powering down. A rechargeable battery is coupled to one or more power-consuming electrical components, including battery monitoring equipment. The battery monitoring equipment senses battery charge. In response to a low-battery-charge condition, the battery monitoring equipment transmits a battery status message to a remote site and powers-down some of the electrical components. Whenever the battery nears the end of its capacity, the monitoring equipment powers down all electronic components and awaits the application of external power. The invention also tracks the time required for the battery charge to deplete. Charge duration decreases over time, and whenever it reaches a predetermined minimum, the battery monitoring equipment transmits a representative status message to the remote site.

**28 Claims, 9 Drawing Sheets**



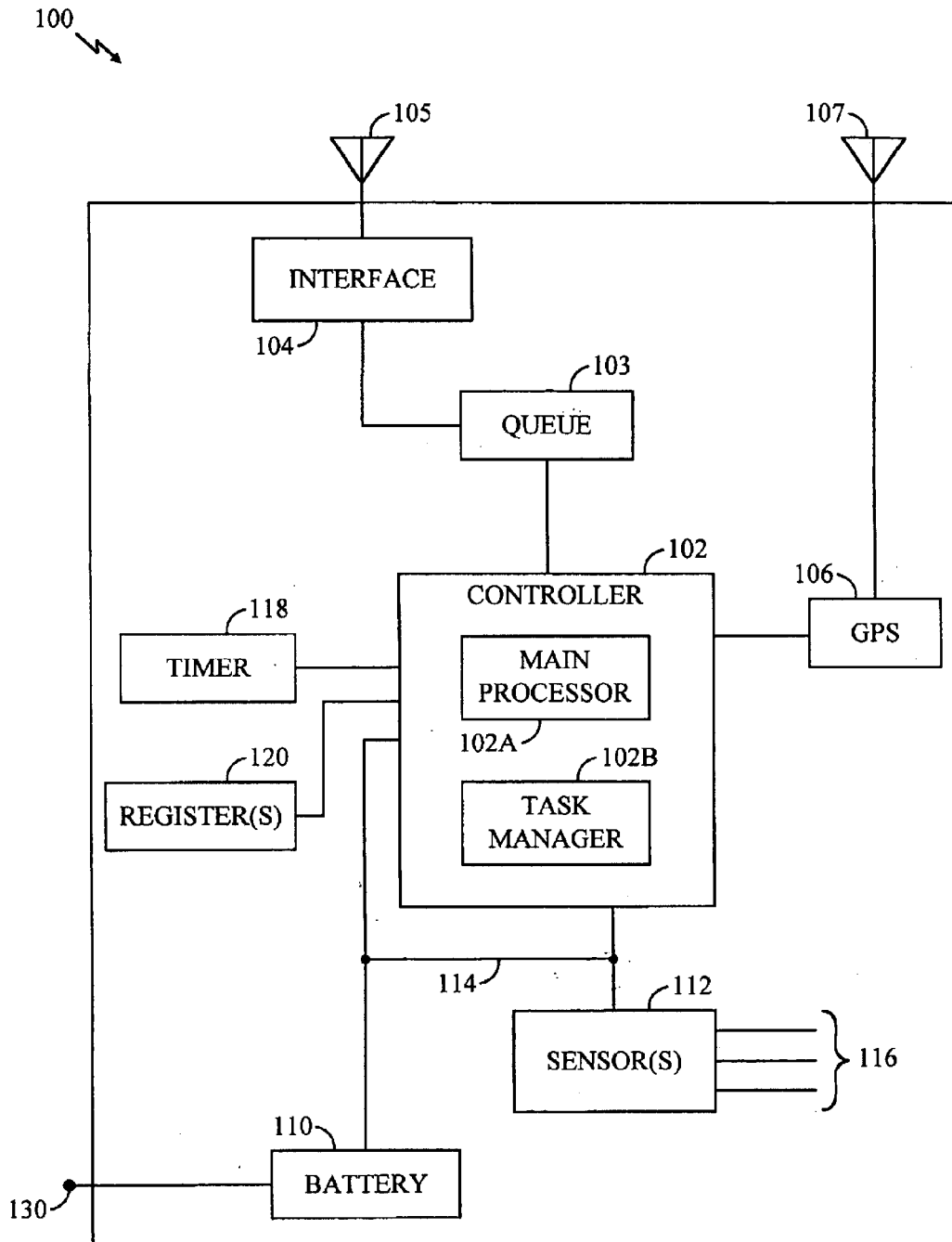


FIG. 1

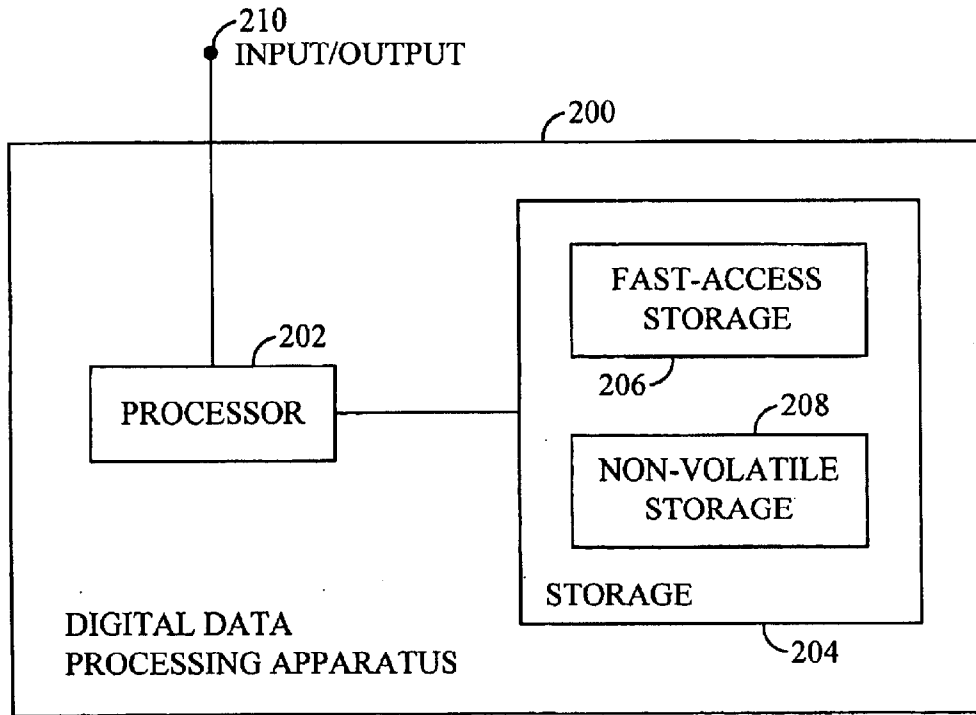


FIG. 2

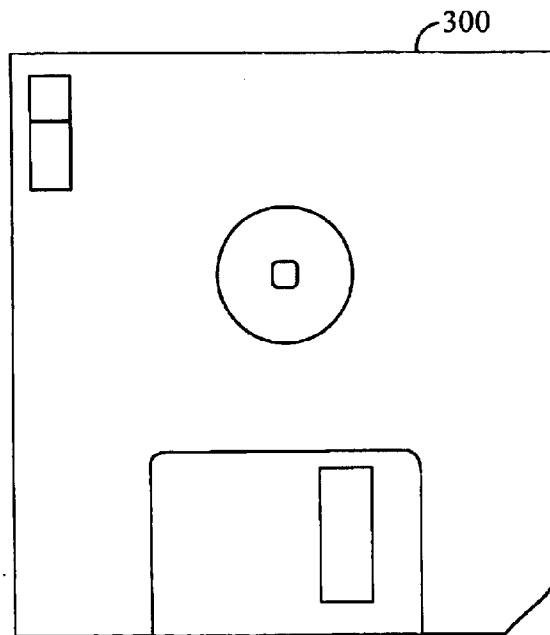


FIG. 3

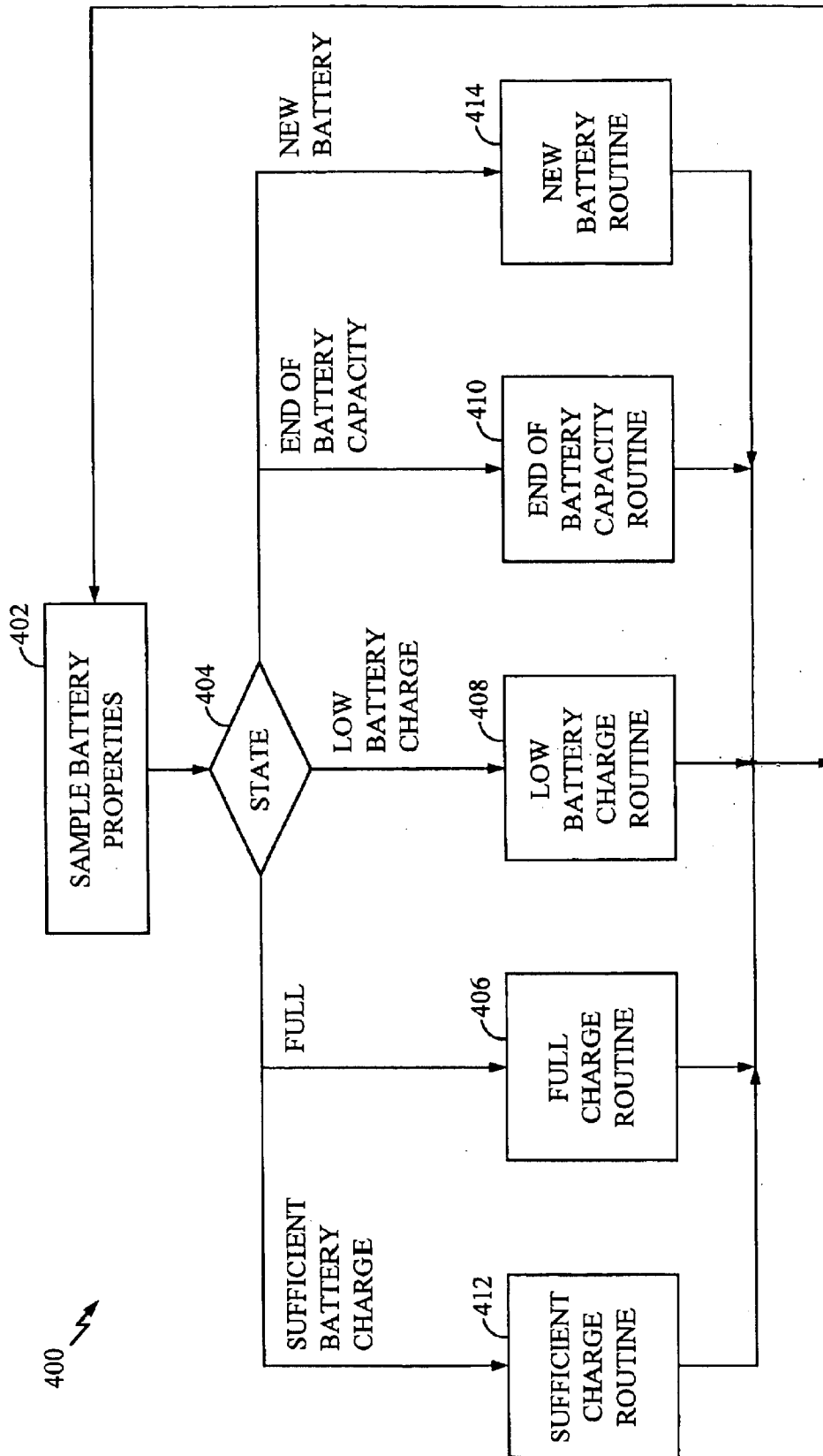


FIG. 4

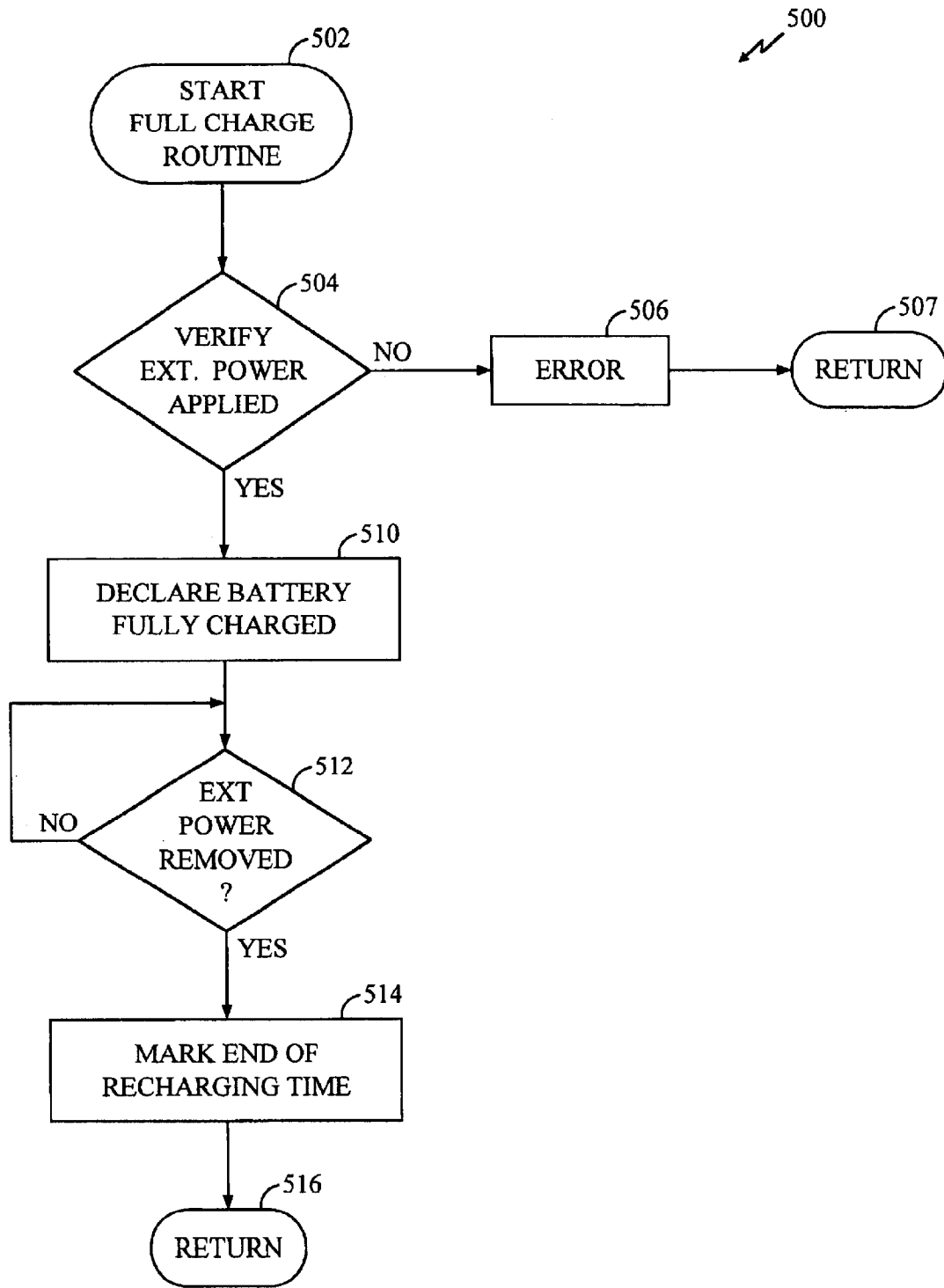


FIG. 5

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