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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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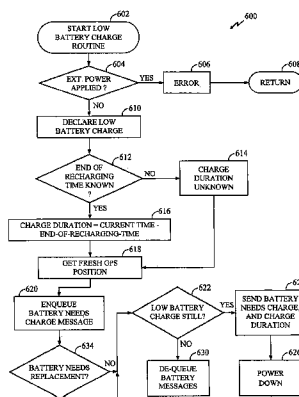
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(57)   **ABSTRACT**

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.
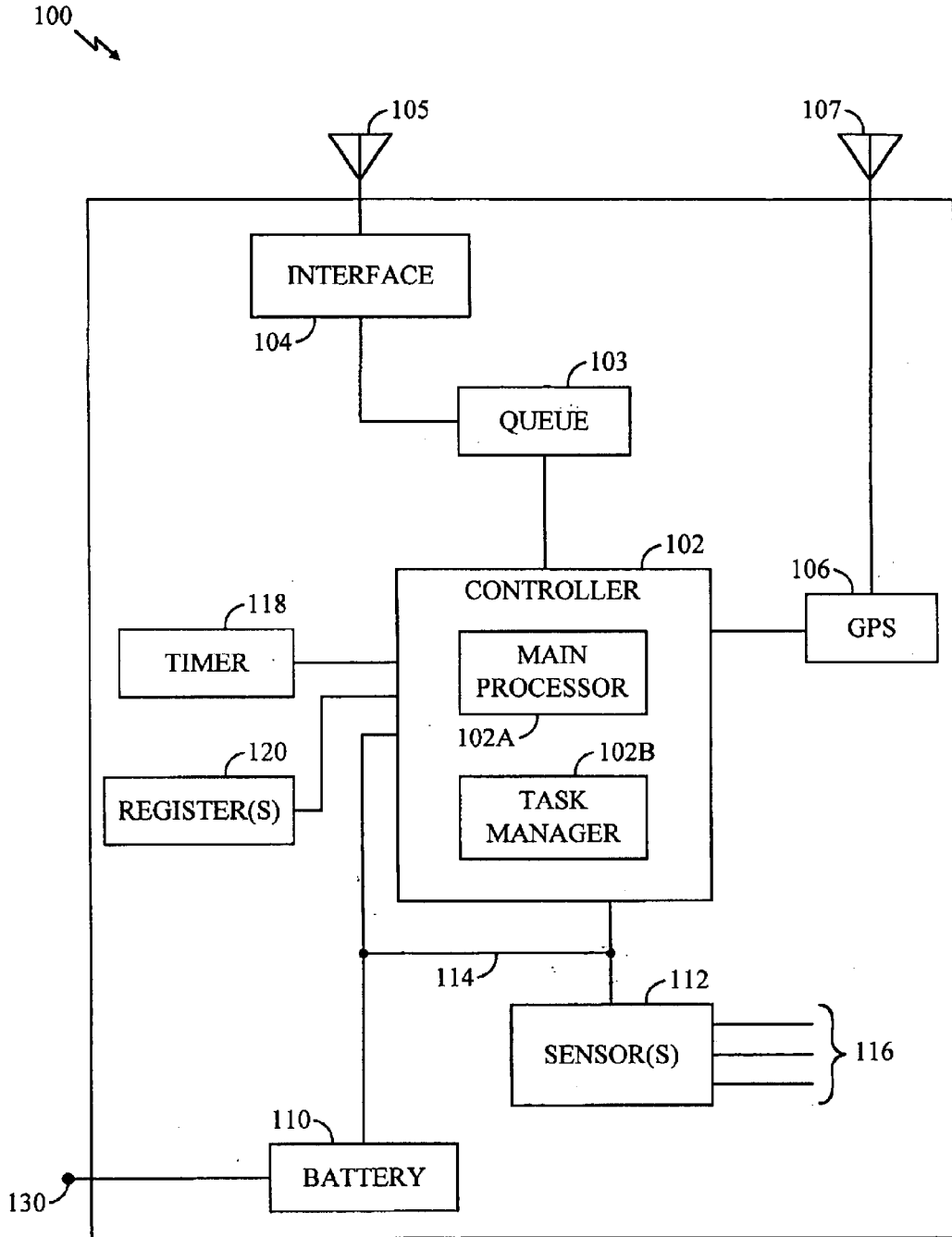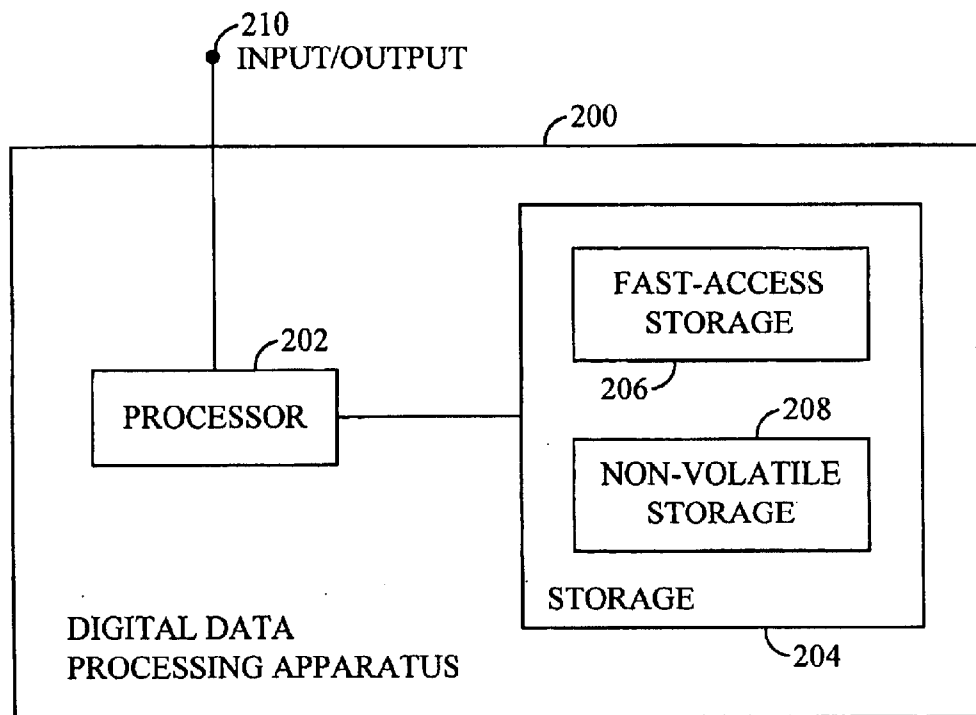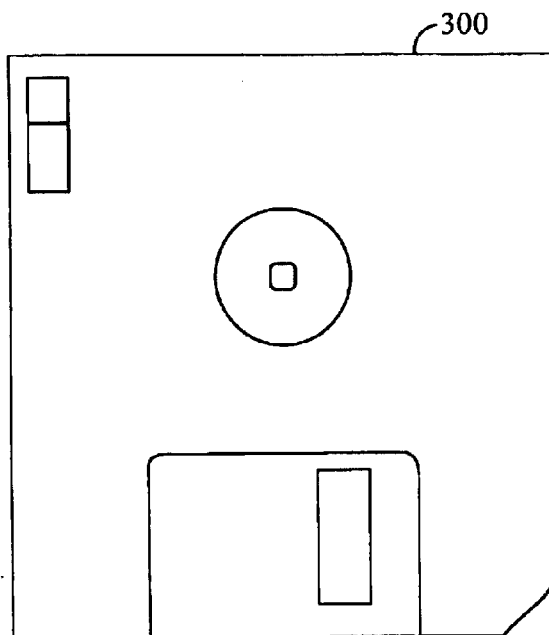
28 Claims, 9 Drawing Sheets

100

105

107

INTERFACE

104

103

QUEUE

102

106

CONTROLLER

118

TIMER

MAIN
PROCESSOR

GPS

102A

120

102B

REGISTER(S)

TASK
MANAGER

114

112

SENSOR(S)

116

110

130

BATTERY

FIG. 1

210
INPUT/OUTPUT

200

202

PROCESSOR

FAST-ACCESS
STORAGE

206

208

NON-VOLATILE
STORAGE

STORAGE

DIGITAL DATA
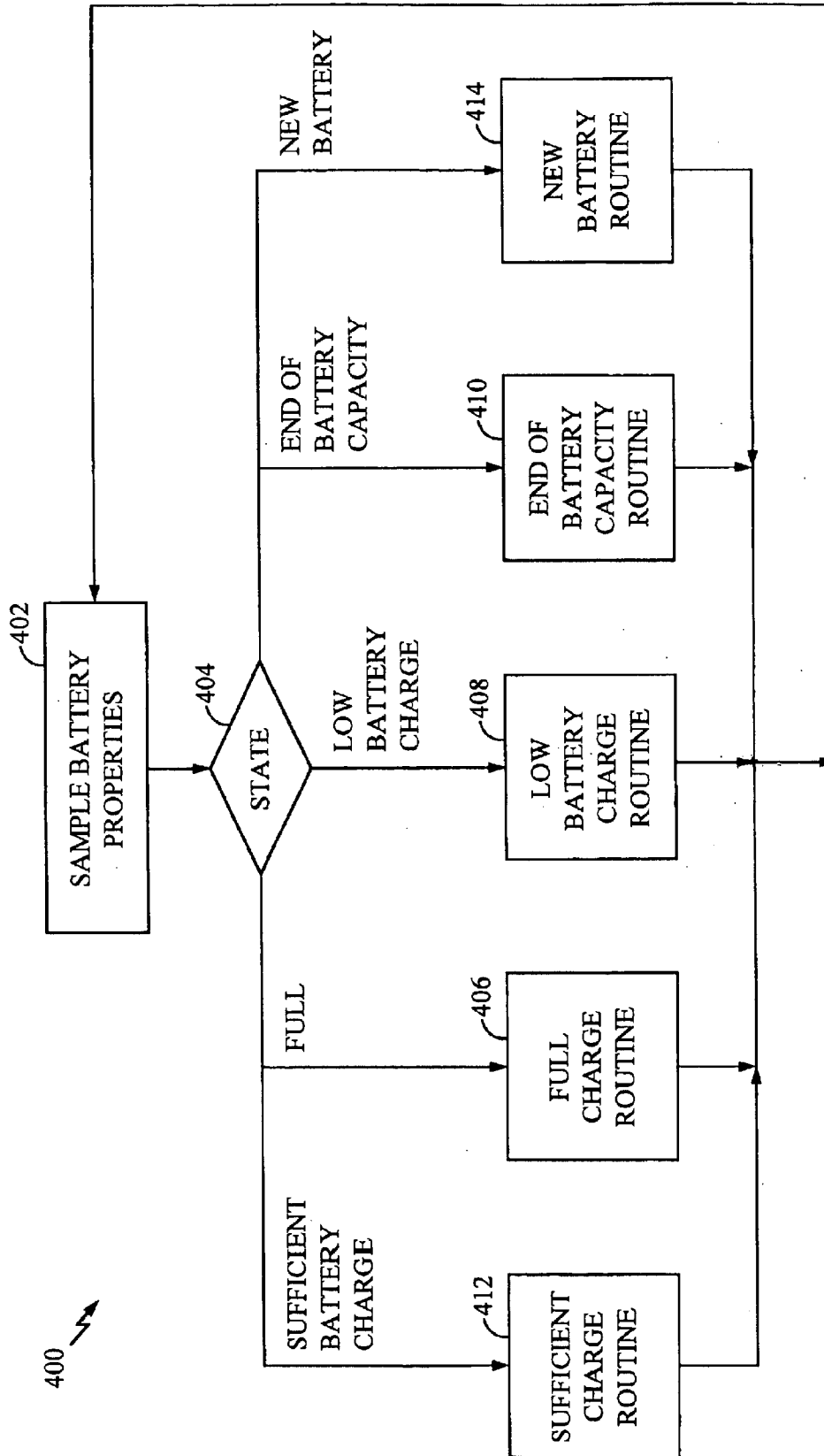PROCESSING APPARATUS
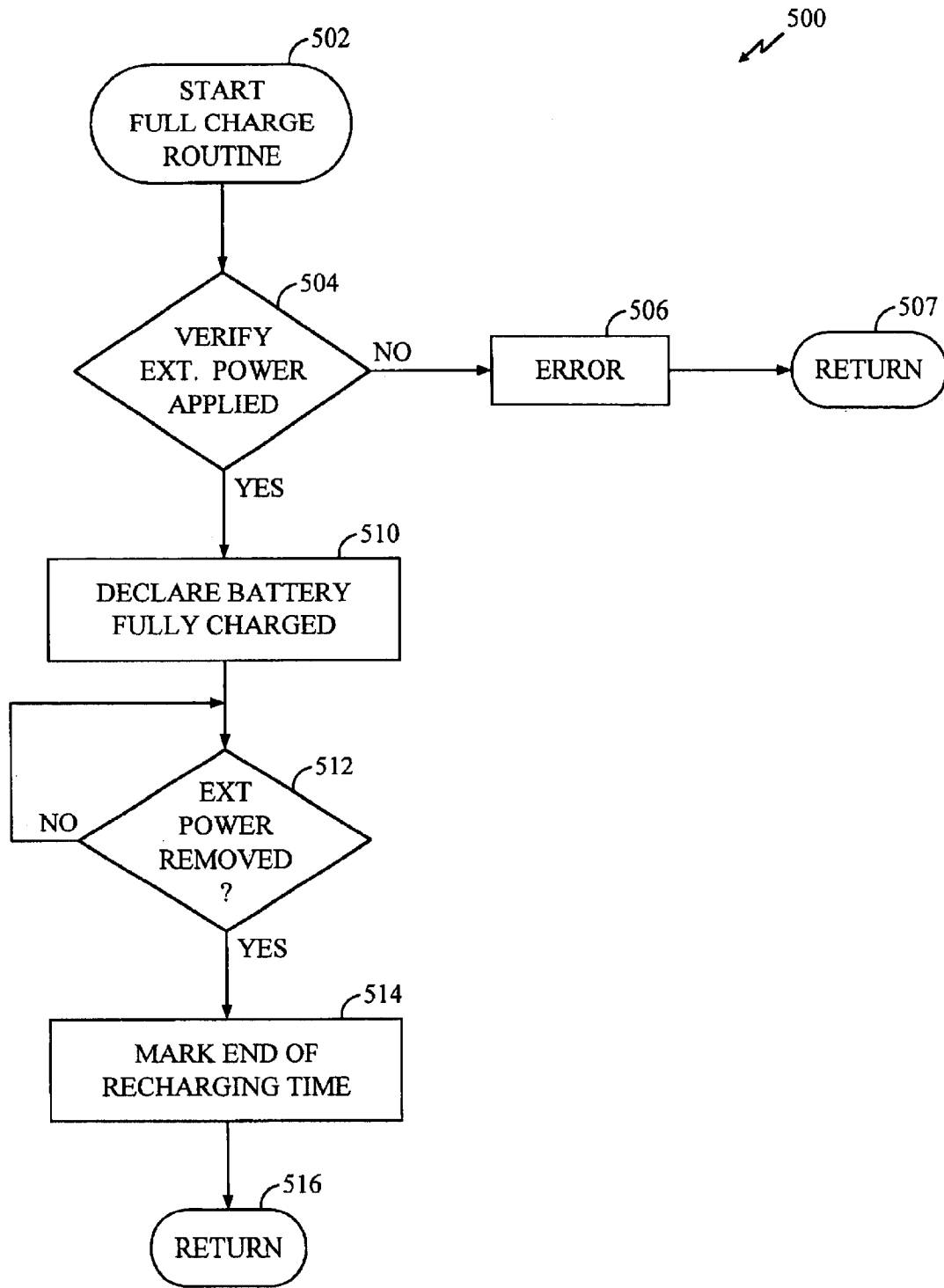
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FIG. 2

300

FIG. 3

FIG. 4

FIG. 5

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