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Soehren et al.

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(54) **NAVIGATION SYSTEM, METHOD AND SOFTWARE FOR FOOT TRAVEL**

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(52) **U.S. Cl.** **340/988**; 600/595; 702/160
(58) **Field of Search** ..... 340/988; 73/178 R; 377/24.2, 39; 482/3, 8, 74; 600/595; 702/97, 160

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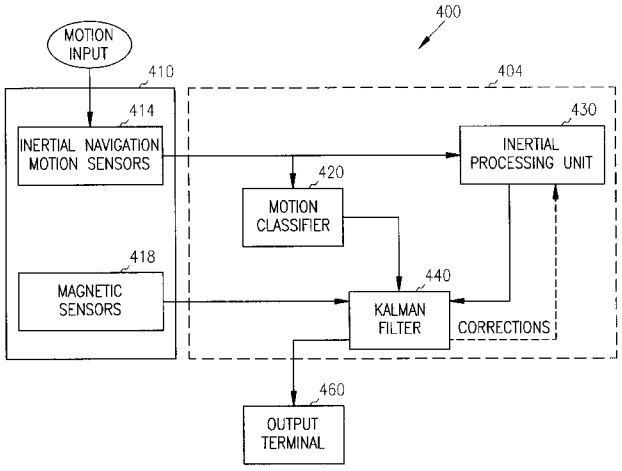
(57) **ABSTRACT**

A navigation system for mounting on a human. The navigation system includes one or more motion sensors for sensing motion of the human and outputting one or more corresponding motion signals. An inertial processing unit coupled to one or more of motion sensors determines a first position estimate based on one or more of the corresponding signals from the motion sensors. A distance traveled is determined by a motion classifier coupled to one or more of the motion sensors, where the distance estimate is based on one or more of the corresponding motion signals processed in one or more motion models. A Kalman filter is also integrated into the system, where the Kalman filter receives the first position estimate and the distance estimate and provides corrective feedback signals to the inertial processor for the first position estimate. In an additional embodiment, input from a position indicator, such as a GPS, provides a third position estimate, and where the Kalman filter provides corrections to the first position estimate, the distance estimate and parameters of the motion model being used.

29 Claims, 9 Drawing Sheets



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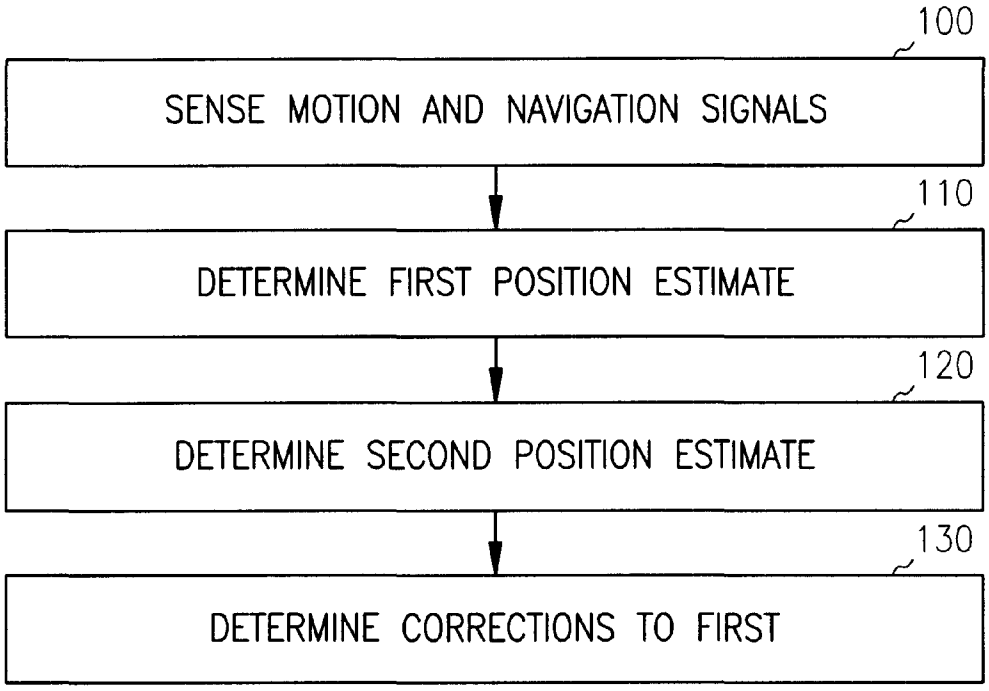

FIG. 1

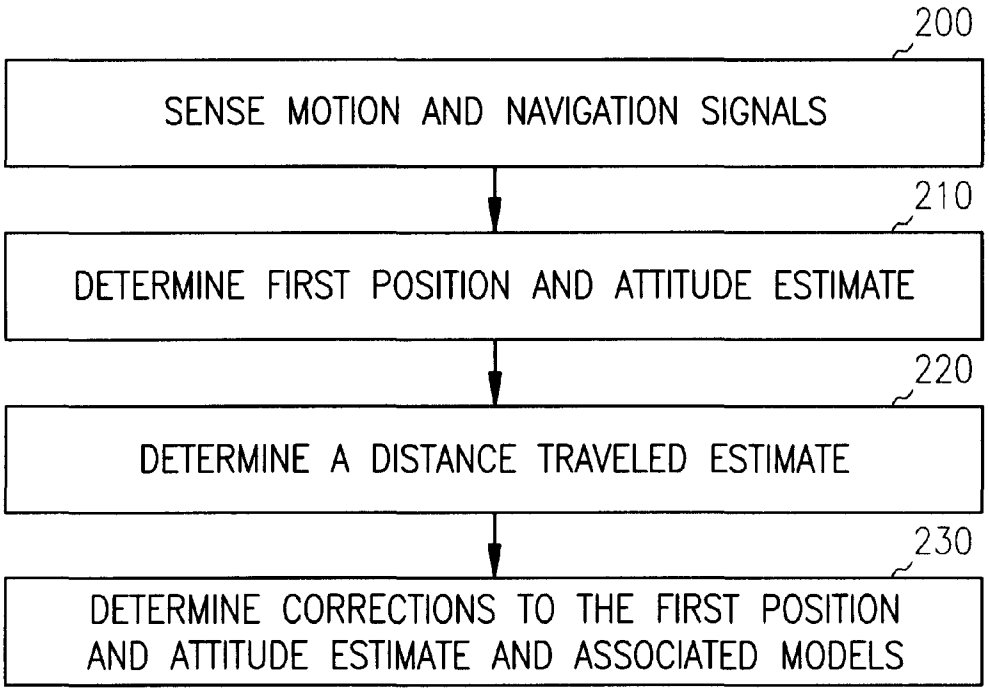

FIG. 2

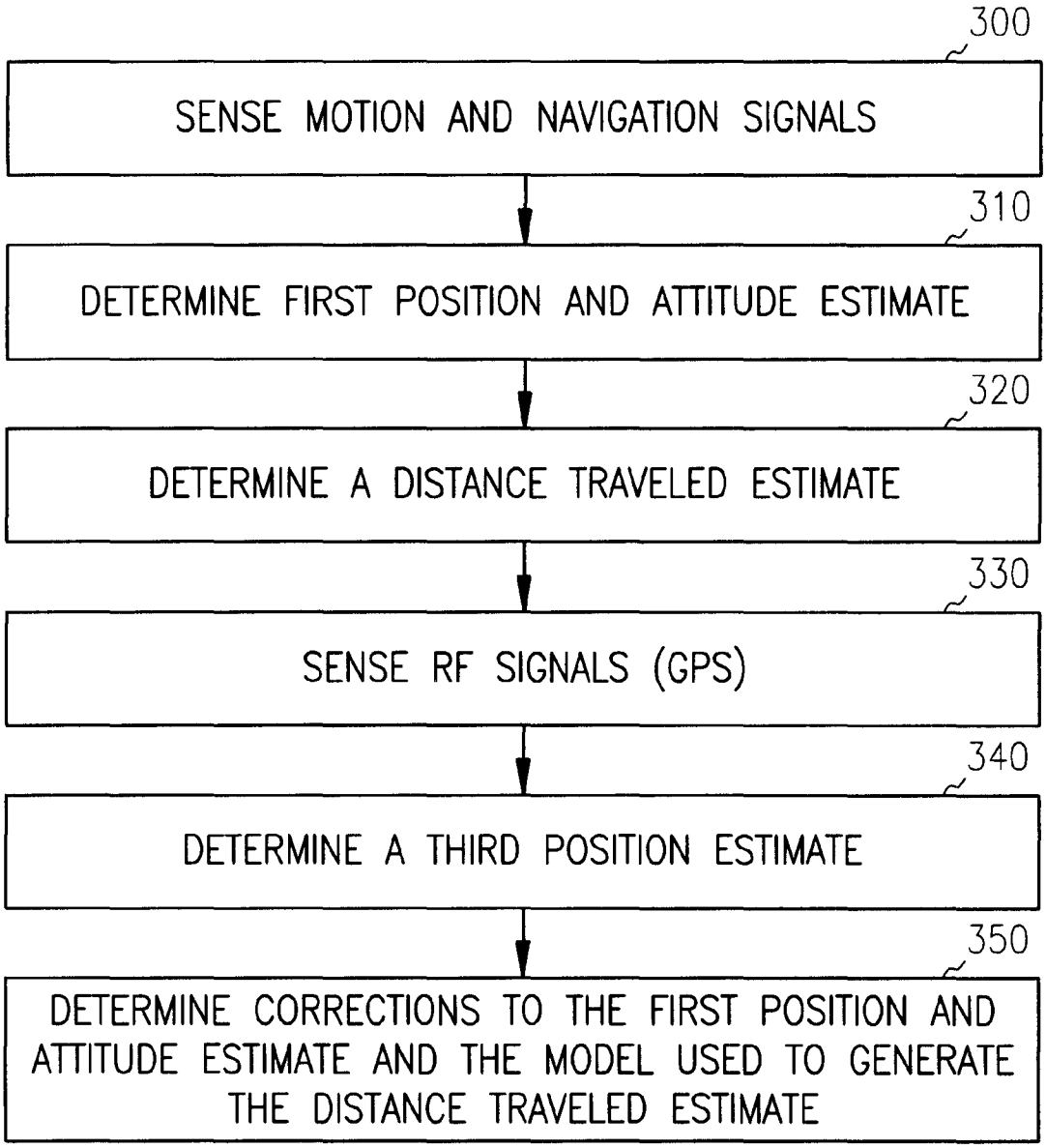

FIG. 3

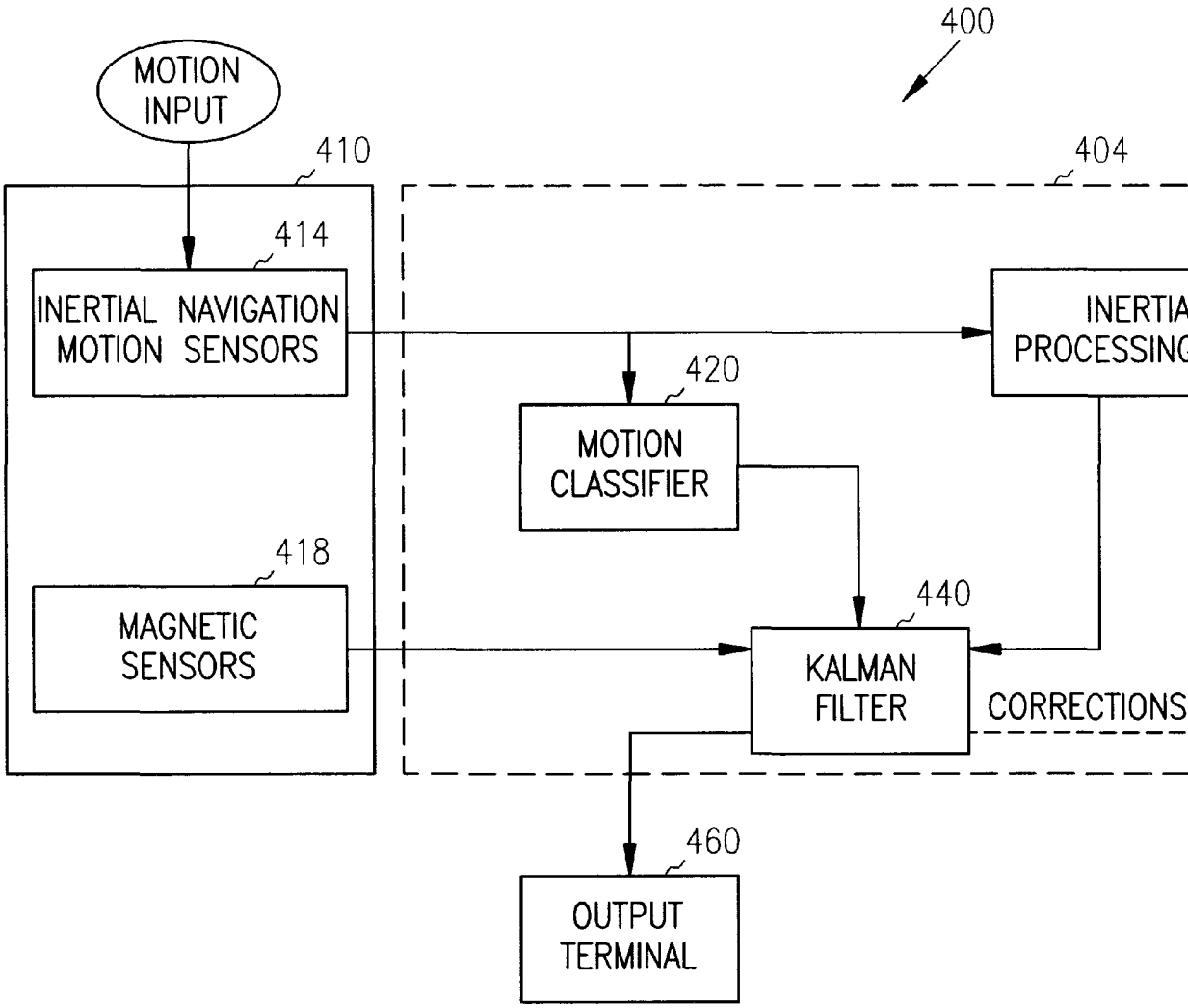

FIG. 4

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