



US006853909B2

(12) **United States Patent**
Scherzinger

(10) **Patent No.:** **US 6,853,909 B2**
(45) **Date of Patent:** **Feb. 8, 2005**

(54) **WALKING STICK NAVIGATOR FOR POSITION DETERMINATION**

(75) Inventor: **Bruno Scherzinger**, Richmond Hills (CA)

(73) Assignee: **Applanix Corporation, INC**, Richmond Hill, Ontario (CA)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/307,129**

(22) Filed: **Nov. 29, 2002**

(65) **Prior Publication Data**

US 2003/0114984 A1 Jun. 19, 2003

Related U.S. Application Data

(60) Provisional application No. 60/337,256, filed on Dec. 3, 2001.

(51) **Int. Cl.**⁷ **G01C 21/00**

(52) **U.S. Cl.** **701/207; 701/213; 701/216; 342/357.14**

(58) **Field of Search** **701/207, 213, 701/216, 220; 342/357.06, 357.14; 702/5, 160**

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,512,905	A	*	4/1996	Nichols et al.	342/357.06
5,583,776	A		12/1996	Levi		
5,734,348	A	*	3/1998	Aoki et al.	342/357.17
5,956,660	A		9/1999	Neumann		
5,973,618	A	*	10/1999	Ellis	340/990
6,132,391	A		10/2000	Onari		
6,366,855	B1		4/2002	Reilly		
6,401,036	B1		6/2002	Geier et al.		
2002/0038178	A1		3/2002	Talkenberg		
2002/0091482	A1		7/2002	Eakle, Jr.		
2002/0111717	A1		8/2002	Scherzinger		

OTHER PUBLICATIONS

Scherzinger, B. M. ; "Inertial Navigator Error Models For Large Heading Uncertainty"; IEEE Position Location and Navigation Symposium, 2001; pp. 2254-2263; abs.

HeunSoo, L.; Mase, K; Adachi, T.; Oosawa, T.; Nakano, K.; Sengoku, M; Hidaka, H.; Shinagawa, N.; Kobayashi, T; "Pedestrian Tracking Using GPS, Pedometer And Magnetic Compass"; Inst Electron Inf & Commun Eng.; vol. 84 B No. 12; Dec. 2001;pp. 2254-2263; abs.

Brbaker, K. M.; "Soldier Systems Fusion", Proceedings of the SPIE the International Society of Optical Engineering; vol. 3394; 1998; pp. 73-78; abstract.

The Estimation and Control of Terrestrial Inertial Navigation System Errors Due to Vertical Deflections; Nash, IEEE Transactions on Automatic Control, vol. AC-13, No. 4, B/1968.

Quentin Ladetto; On Foot Continuous Step Calibration Using Both Complimentary Recursive Prediction and Adaptive Kalman Filtering; Ion GPS 2000 Sep. 19-22, 2000 Salt Lake City, UT; pp. 1735-1740.

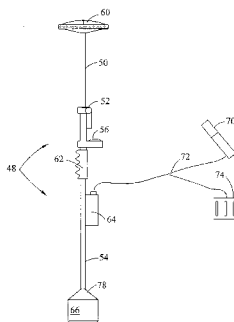
* cited by examiner

Primary Examiner—Michael J. Zanelli
(74) *Attorney, Agent, or Firm*—James F. Kirk

(57) **ABSTRACT**

A walking stick navigator (WSN) apparatus and method comprises an aided INS (AINS) on a staff assembly with the "look and feel" of a GPS survey instrument. When GPS is available, the AINS is aided by GPS data, and the survey or manipulates the staff assembly like a standard GPS survey instrument. When GPS is not available due to signal obstruction, the surveyor manipulates the staff assembly as a walking stick. A switch means coupled to the lower end of the staff assembly provides a stationary interval signal when the surveyor plants and holds the WSN on the ground while walking. A digital computer is coupled to be responsive to AINS output signals and to the stationary interval signals and to run a program that solves a position aiding algorithm and a velocity aiding algorithm that provide at least one aiding input to the AINS for each successive stationary interval.

24 Claims, 13 Drawing Sheets



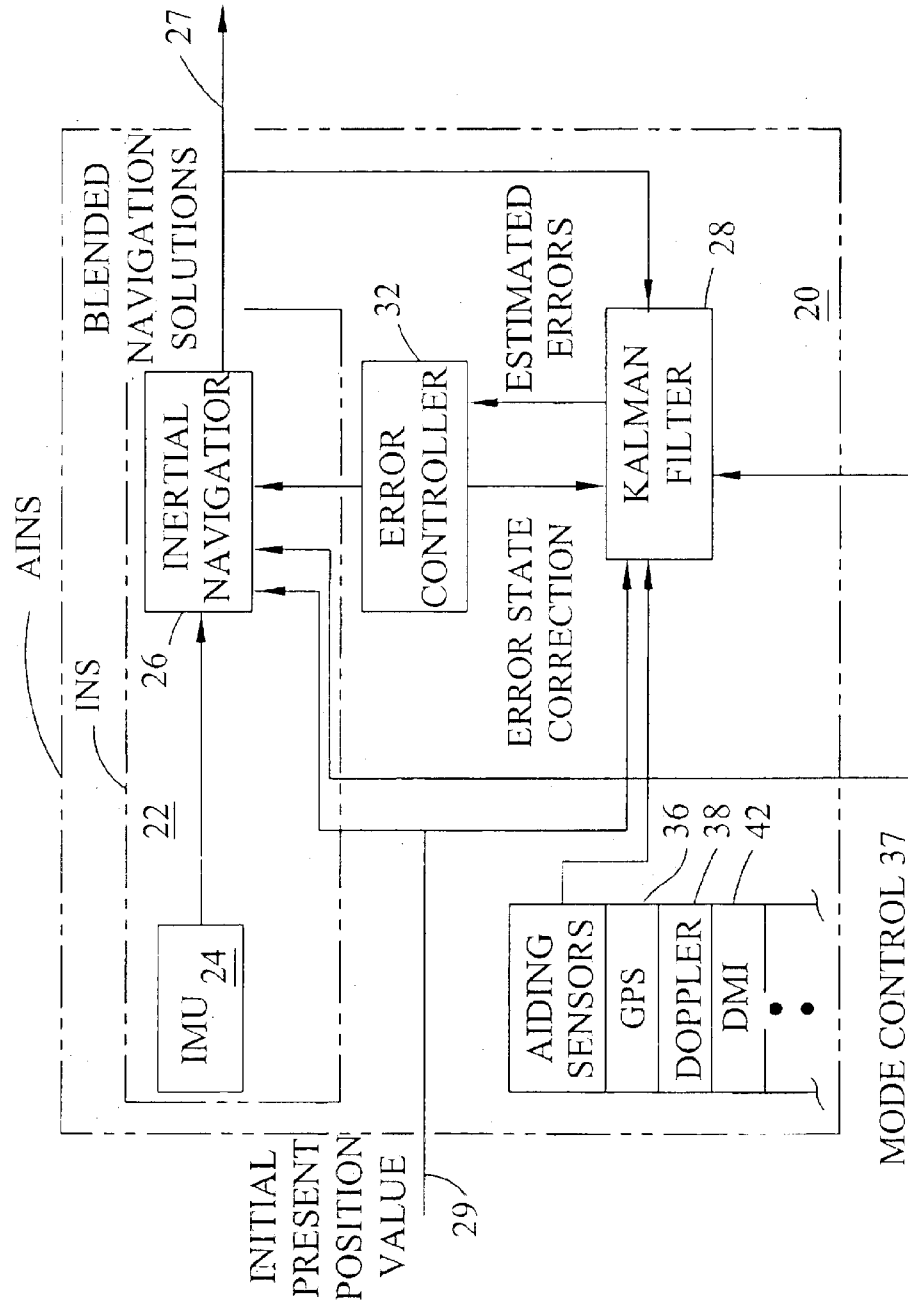


FIG. 1

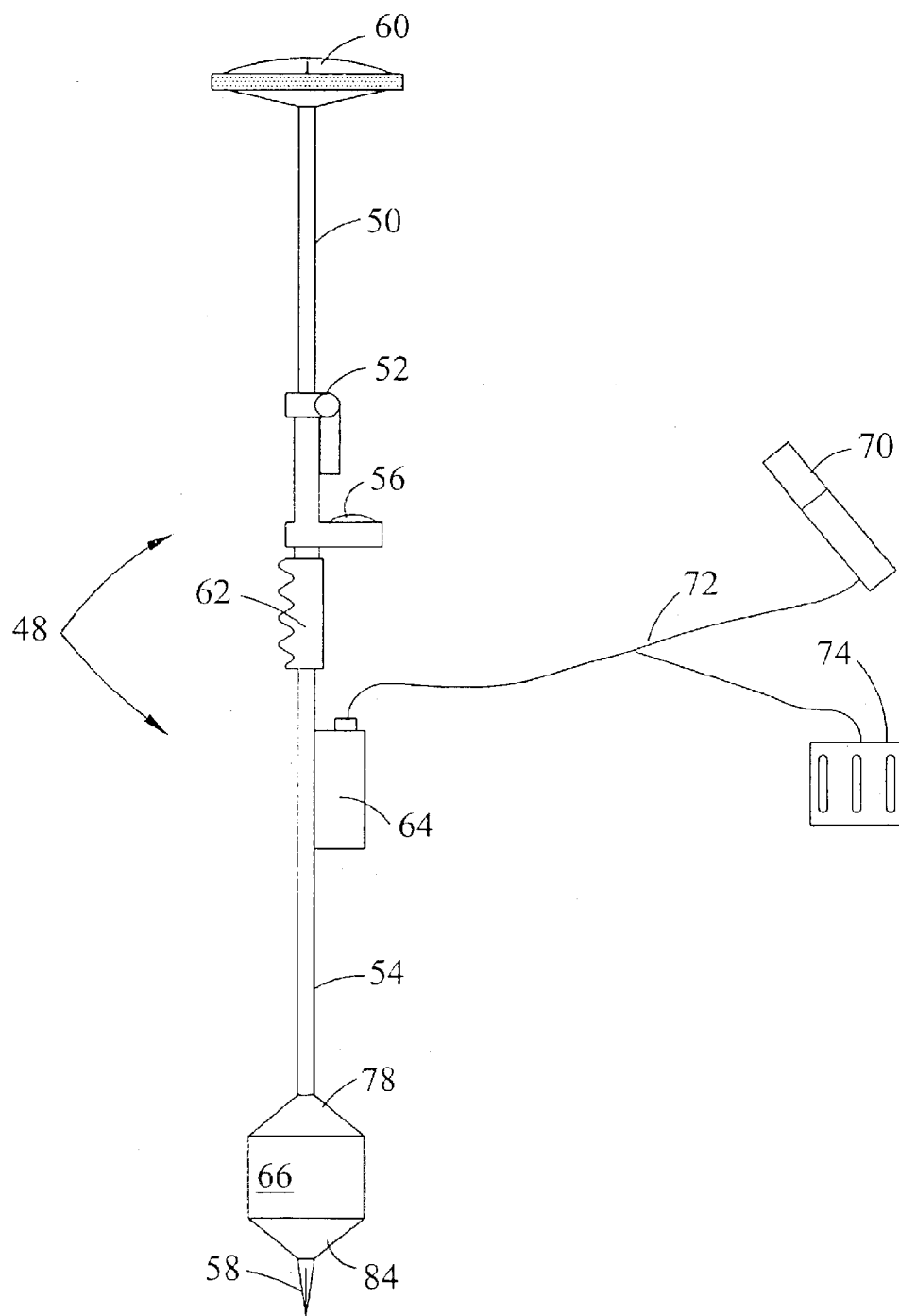


FIG. 2

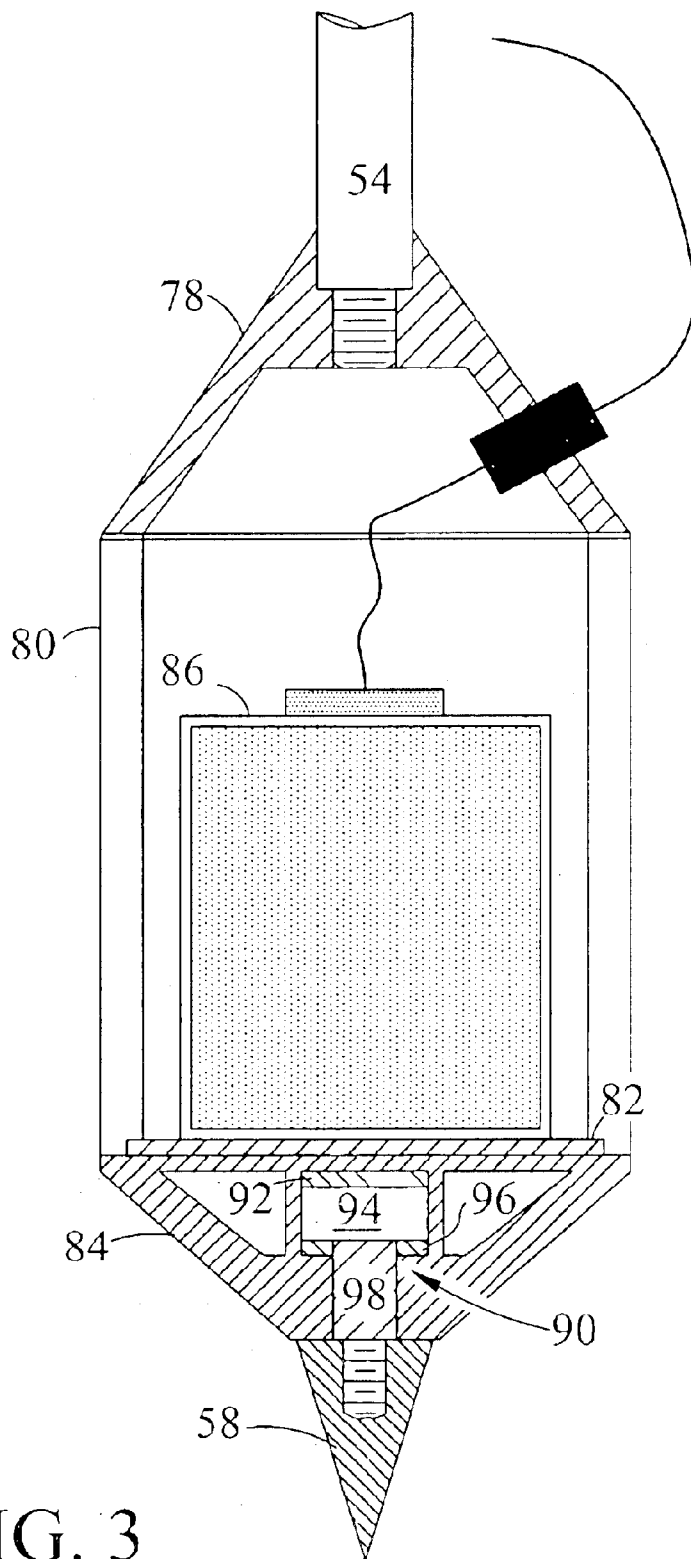


FIG. 3

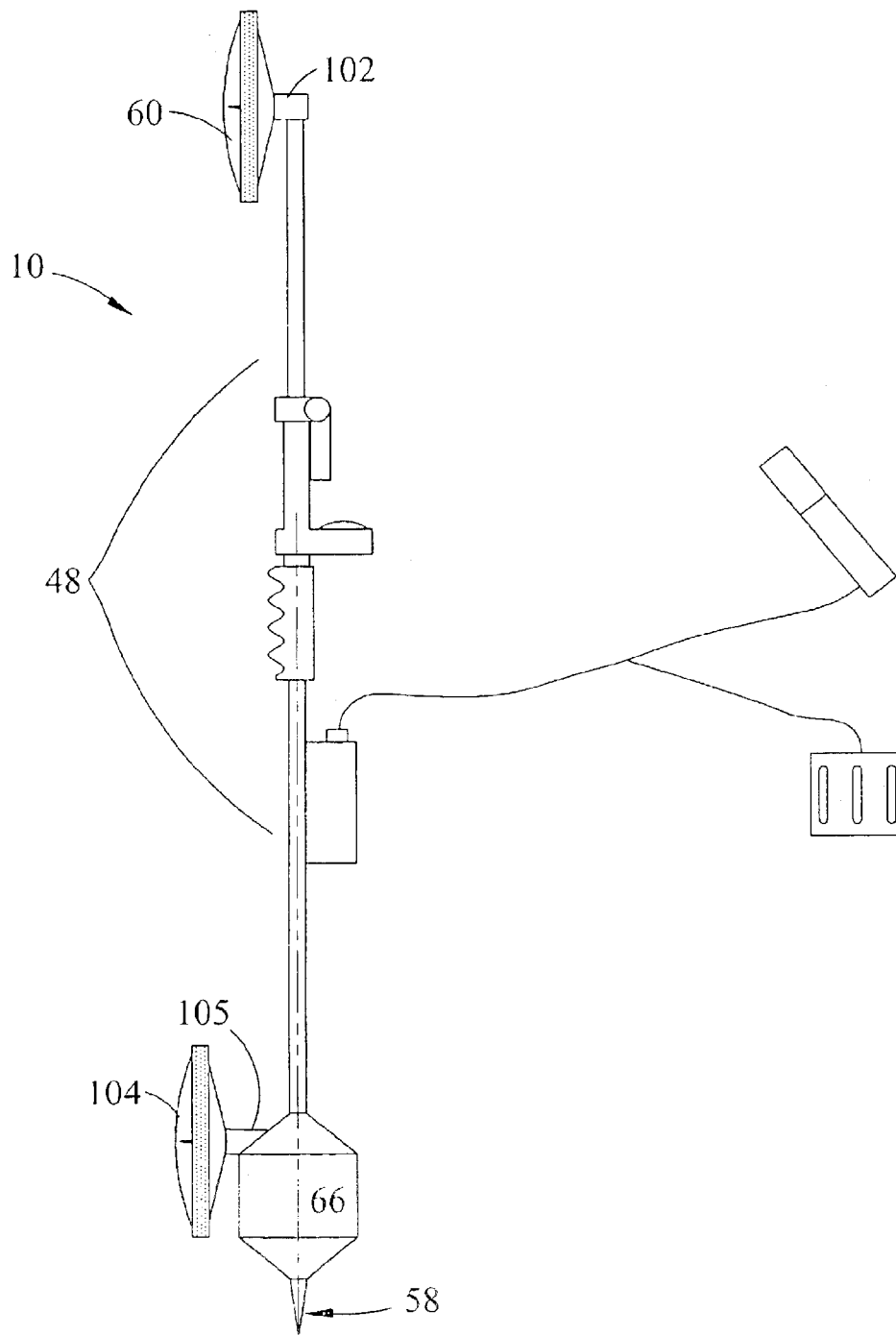


FIG. 4

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.