



US006493612B1

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

(10) **Patent No.:** **US 6,493,612 B1**
(45) **Date of Patent:** **Dec. 10, 2002**

- (54) **SENSORS ARRANGEMENT**
- (75) Inventors: **David Lindsey Bisset, Wiltshire (GB); Alan Gerard Clark, Wiltshire (GB)**
- (73) Assignee: **Dyson Limited, Malmesbury (GB)**
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

5,321,614 A	6/1994	Ashworth	180/167
5,341,540 A	8/1994	Souper et al.	15/319
5,377,106 A	* 12/1994	Drunk et al.	180/169
5,548,512 A	* 8/1996	Quraishi	180/167
5,682,313 A	* 10/1997	Edlund et al.	342/127
5,913,919 A	* 6/1999	Bauer et al.	180/169
5,995,884 A	* 11/1999	Allen et al.	180/167
6,055,042 A	* 4/2000	Sarangapani	180/167
6,076,025 A	* 6/2000	Ueno et al.	701/23
6,076,226 A	* 6/2000	Reed	15/319
6,119,057 A	* 9/2000	Kawagoe	15/319
6,338,013 B1	* 1/2002	Ruffner	180/167
2001/0004719 A1	* 6/2001	Sommer	701/23

- (21) Appl. No.: **09/868,492**
- (22) PCT Filed: **Dec. 6, 1999**
- (86) PCT No.: **PCT/GB99/04090**
§ 371 (c)(1),
(2), (4) Date: **Jun. 18, 2001**

FOREIGN PATENT DOCUMENTS

FR	2 695 342 A1	3/1994
WO	WO 93/03399	2/1993
WO	WO 97/41451	11/1997

* cited by examiner

Primary Examiner—William A. Cuchlinski, Jr.
Assistant Examiner—Ronnie Mancho

(74) *Attorney, Agent, or Firm*—Morrison & Foerster LLP

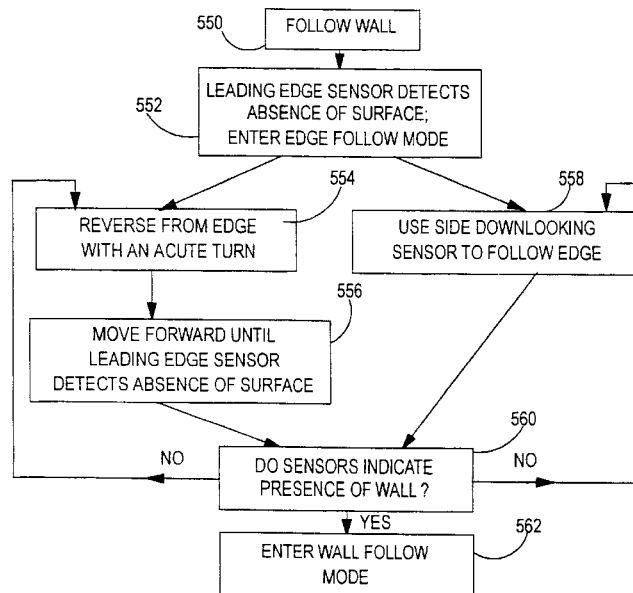
- (87) PCT Pub. No.: **WO00/38026**
PCT Pub. Date: **Jun. 29, 2000**
- (30) **Foreign Application Priority Data**
Dec. 18, 1998 (GB) 9827758
- (51) **Int. Cl.**⁷ **G01C 22/00; G05D 1/00; A47L 11/00; A47L 13/00**
- (52) **U.S. Cl.** **701/23; 701/22; 180/167; 180/168; 180/169; 180/180; 318/580; 318/587; 318/868.16; 340/943; 340/435; 15/319; 15/323; 15/339; 15/340.1; 706/905**
- (58) **Field of Search** **701/23.1, 22; 180/167, 180/168, 169, 280; 706/905; 318/580, 587, 568.16; 340/943, 435; 15/319, 323, 339, 340.1; 134/18, 21, 6**

(57) ABSTRACT

An autonomous vehicle, such as a robotic cleaning device, includes wheels which support the vehicle and allow the vehicle to traverse a surface. Downward looking wheel sensors sense the presence of a surface in front of the wheels. Another sensor is provided at or near a leading edge of the vehicle for sensing the presence beneath the leading edge of the vehicle. The vehicle is arranged so that movement of the vehicle is possible if the leading edge sensor senses that there is no surface beneath the leading edge of the vehicle, provided that the wheel sensors indicate that there is a surface adjacent to the wheel. When the leading edge sensor senses that there is no surface beneath the leading edge of the vehicle, the vehicle performs an edge following routine.

- (56) **References Cited**
U.S. PATENT DOCUMENTS
5,279,672 A * 1/1994 Betker et al. 134/18

13 Claims, 11 Drawing Sheets



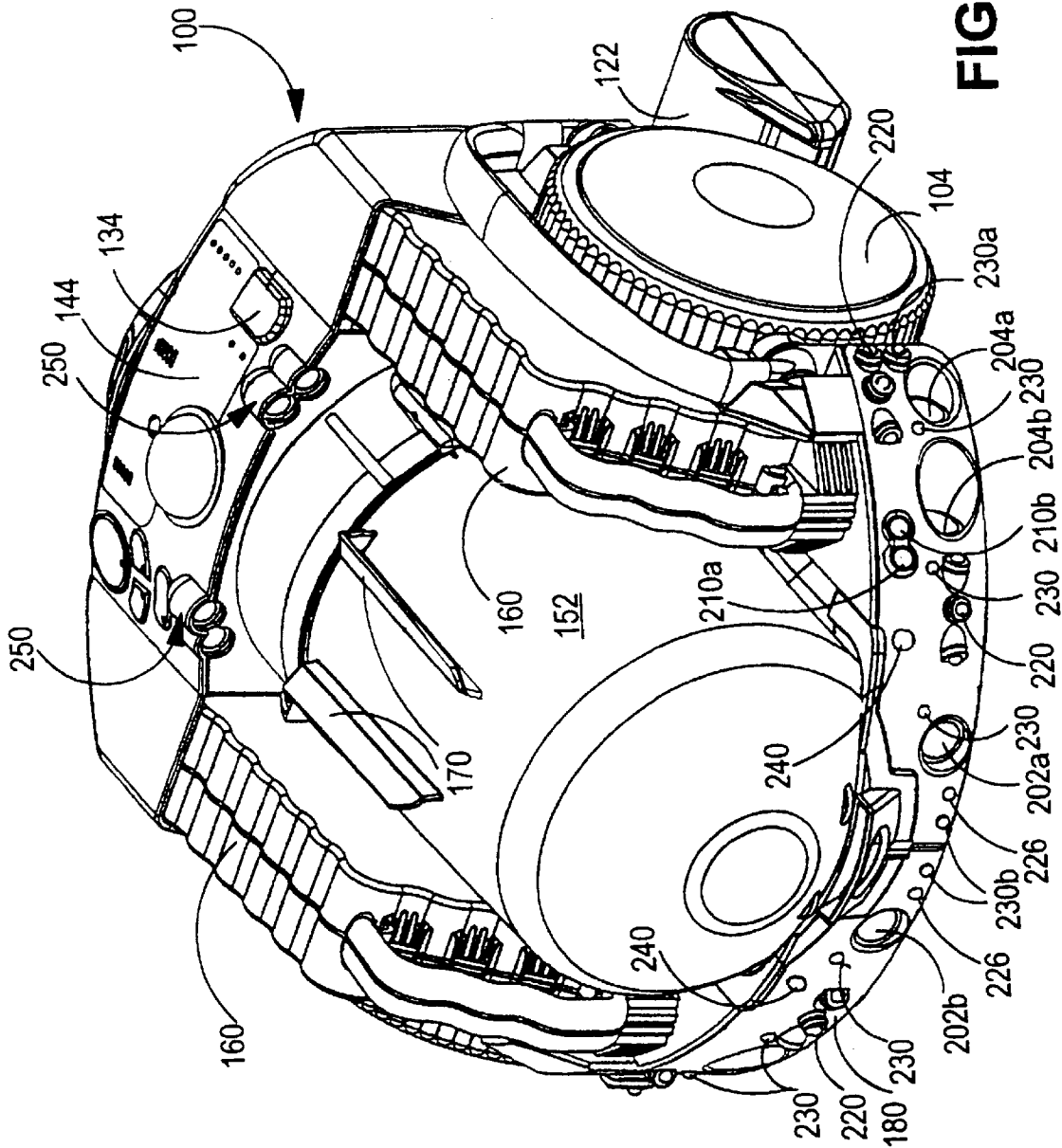


FIG. 1.

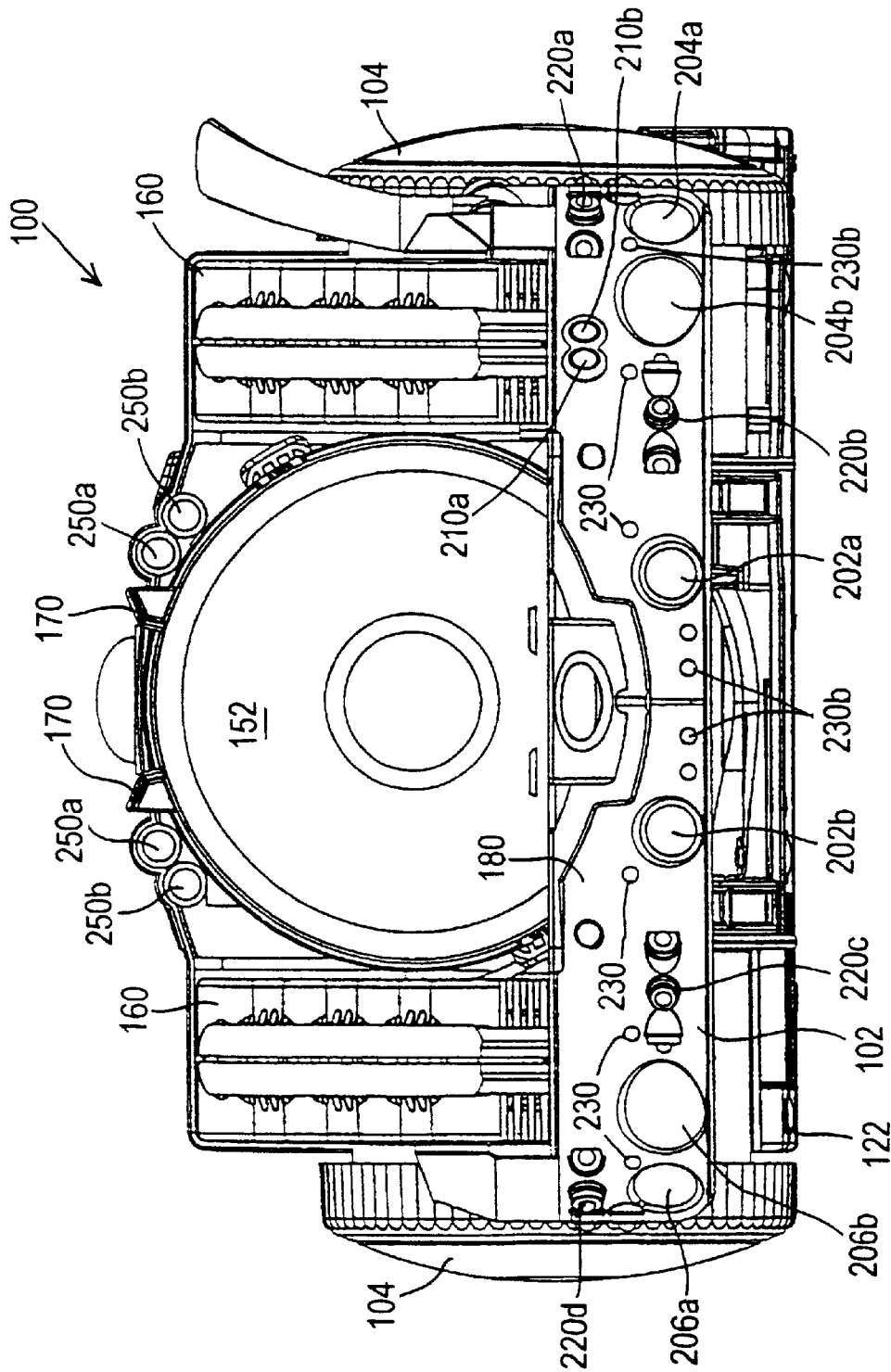


FIG. 2.

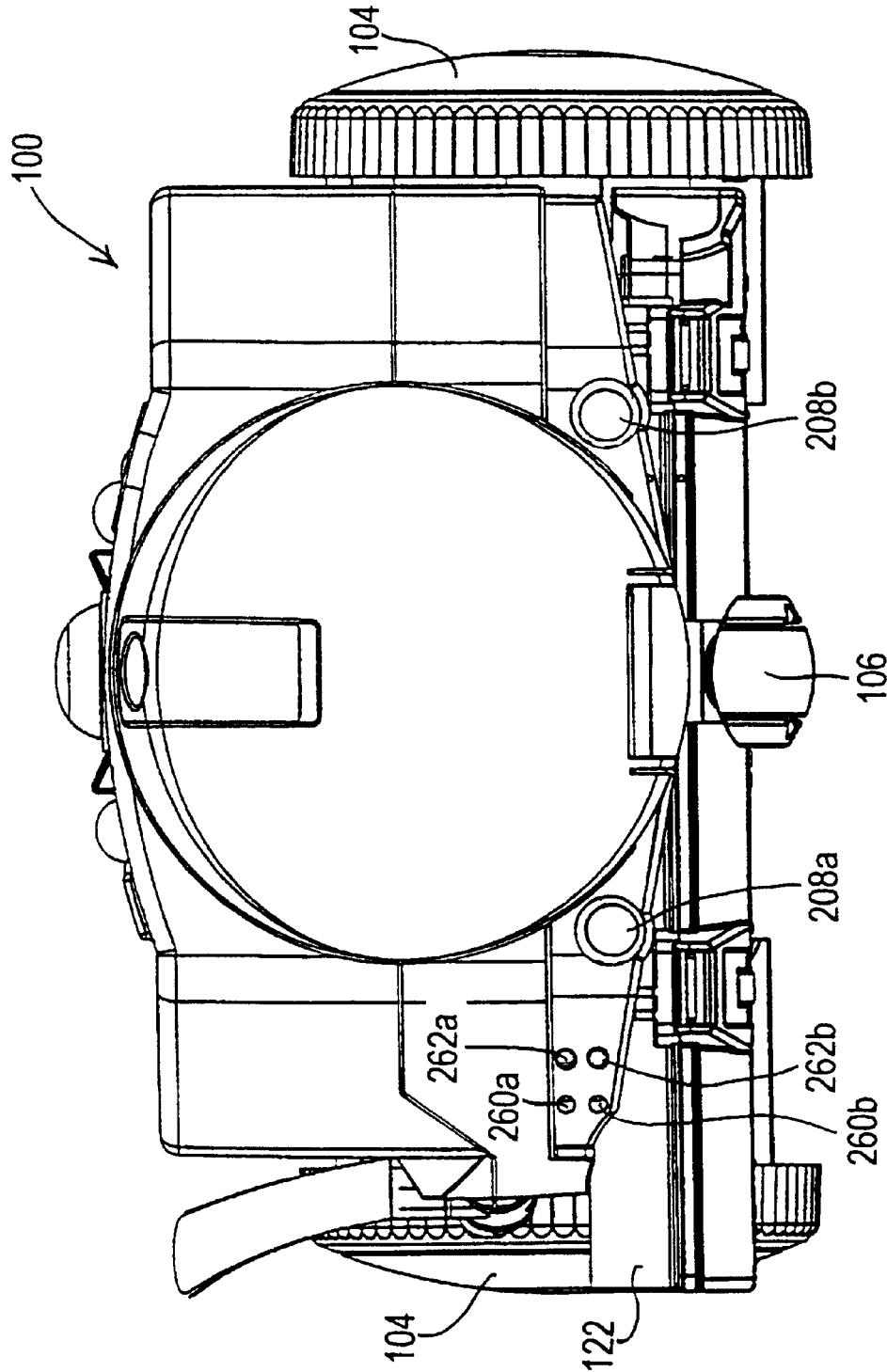


FIG. 3.

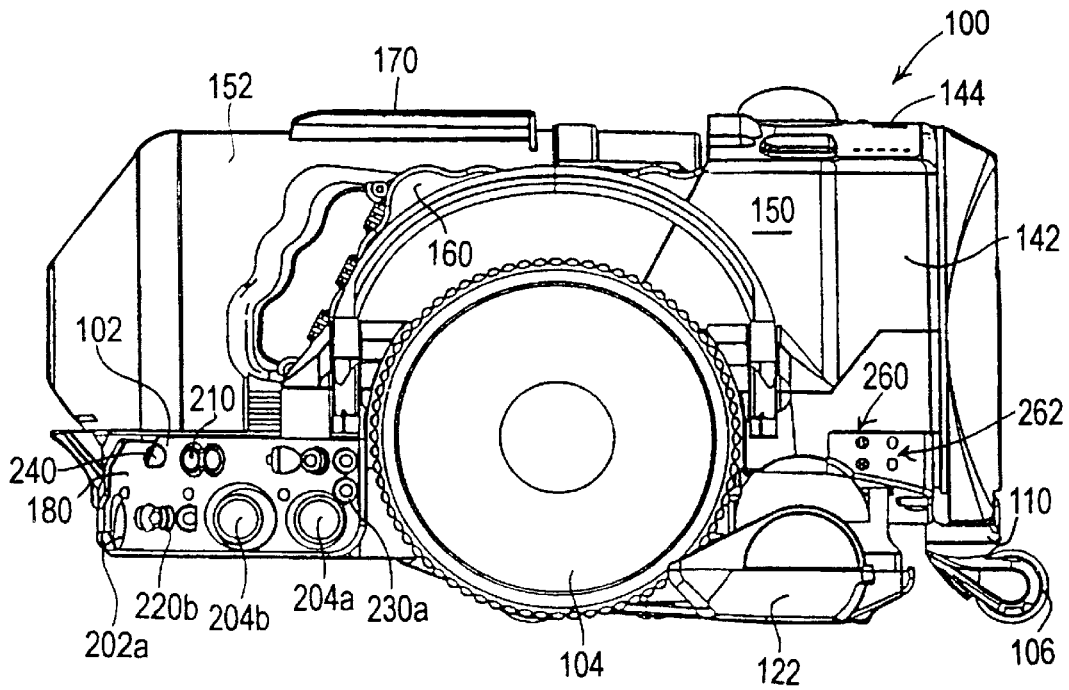


FIG. 4a.

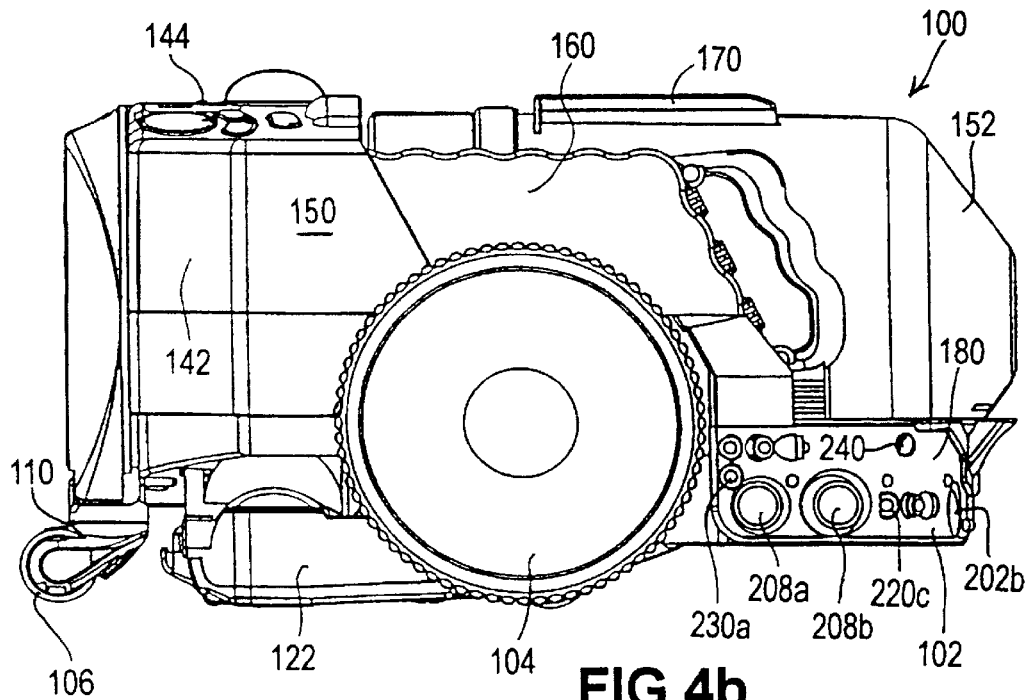


FIG. 4b.

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.