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(71) Applicant: **DEKA PRODUCTS LIMITED PARTNERSHIP** [US/US]; 340 Commercial Street, Manchester, NH 03101 (US).

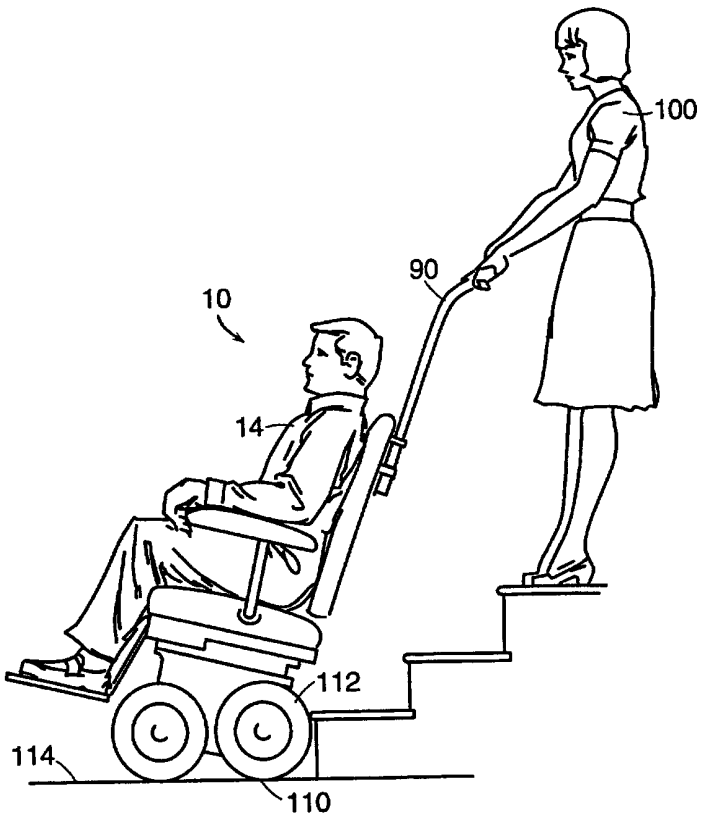
(72) Inventors: **KAMEN, Dean, L.**; 15 Westwind Drive, Bedford, NH 03110 (US). **AMBROGI, Robert, R.**; 141 Arah Street, Manchester, NH 03104 (US). **HEINZMANN, John, David**; 585 Belmont Street, Manchester, NH 03104 (US). **HEINZMANN, Richard, Kurt**; P.O. Box 272, Francestown, NH 03043 (US). **HERR, David**; R.R.2 1548, Compton, NH 03223 (US). **MORRELL, John, B.**; 1365 Belmont Street, Manchester, NH 03104 (US).

(74) Agents: **SUNSTEIN, Bruce, D.** et al.; Bromberg & Sunstein LLP, 125 Summer Street, Boston, MA 02110-1618 (US).

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[Continued on next page]

(54) Title: CONTROL OF A BALANCING PERSONAL VEHICLE



(57) Abstract: A vehicle for transporting a payload over a surface that may be irregular and may include stairs. The vehicle has a support for supporting the payload and a ground contacting element movable with respect to a local axis, where the local axis can be moved with respect to some second axis that has a defined relation with respect to the support. The vehicle also has a motorized drive arrangement for permitting controllable motion of the ground contacting element so as to operate in an operating condition that is unstable with respect to tipping in at least a fore-aft plane when the motorized drive arrangement is not powered. The vehicle also has an input device for receiving an indication from an assistant who is not disposed on the vehicle of a direction of desired motion of the vehicle.

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(84) **Designated States** *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

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INTERNATIONAL SEARCH REPORT

Inte ional Application No
PCT/US 00/06636

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61G5/06 G05G9/047

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61G G05G G05D B60L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 701 965 A (HEINZMANN RICHARD K ET AL) 30 December 1997 (1997-12-30) cited in the application column 5, line 45 - line 67 column 7, line 3 - line 45	1-3,7
X	column 13, line 13 -column 14, line 43; figures 9-21	4-6,8,9
A	US 4 312 417 A (DALTON TODD E ET AL) 26 January 1982 (1982-01-26) the whole document	1-3,7,9
P,X	US 5 975 225 A (KAMEN DEAN L ET AL) 2 November 1999 (1999-11-02) the whole document	4-6,8,9

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
7 September 2000	14. 09. 2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Godot, T

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Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Inte .ional Application No
PCT/US 00/06636

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 3 814 199 A (JONES W) 4 June 1974 (1974-06-04) abstract; figures ---	10 11-16
Y	US 5 831 596 A (ASHRAF MUFTI M ET AL) 3 November 1998 (1998-11-03) abstract column 7, line 34 - line 59; figures ---	11-16
A	US 5 630 756 A (THURSTON KEITH E ET AL) 20 May 1997 (1997-05-20) abstract -----	15,16

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Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 00/06636

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-9

   Vehicle with motorized ground contacting element which is inherently unstable, having an input device for an assistant to indicate the desired direction of motion of the vehicle.

2. Claims: 10-16

   User input device for controlling acceleration of a vehicle

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte ional Application No
PCT/US 00/06636

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5701965 A	30-12-1997	US 5971091 A	26-10-1999
		US 5975225 A	02-11-1999
		US 5791425 A	11-08-1998
		US 5794730 A	18-08-1998
US 4312417 A	26-01-1982	NONE	
US 5975225 A	02-11-1999	US 5971091 A	26-10-1999
		US 5701965 A	30-12-1997
		US 5791425 A	11-08-1998
		US 5794730 A	18-08-1998
US 3814199 A	04-06-1974	NONE	
US 5831596 A	03-11-1998	DE 69306941 D	06-02-1997
		DE 69306941 T	28-05-1997
		EP 0634037 A	18-01-1995
		ES 2098729 T	01-05-1997
		WO 9320535 A	14-10-1993
US 5630756 A	20-05-1997	CA 2196721 A	06-08-1997