



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/382,214	03/11/2009	Eldad Shemesh	30024X

CONFIRMATION NO. 2324

POWER OF ATTORNEY NOTICE



OC000000100124401

20529
NATH, GOLDBERG & MEYER
Joshua Goldberg
112 South West Street
Alexandria, VA 22314

Date Mailed: 06/11/2018

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/01/2018.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/ngfissha/



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United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/382,214	03/11/2009	Eldad Shemesh	30024X

CONFIRMATION NO. 2324

POA ACCEPTANCE LETTER



OC000000100124421

111739
Dorsey & Whitney / RCPs
Intellectual Property Department - SLC
111 South Main Street
21st Floor
Salt Lake City, UT 84111-2176

Date Mailed: 06/11/2018

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/01/2018.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/ngfissha/

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:



Practitioners associated with the Customer Number:

111739

OR



Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:



The address associated with Customer Number:

111739

OR



Firm or Individual Name

Address

City

State

Zip

Country

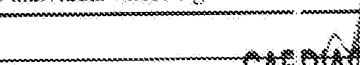
Telephone

Email

Assignee Name and Address:

CardiacSense Ltd.
13 Granit Street, P.O.B. 3129, Business Park
Caesarea, Israel 3088900**A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.****SIGNATURE of Assignee of Record**

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature		Date	5-21-18
Name	Liat Shemesh	Telephone	
Title	COO		

This collection of information is required by 37 CFR 1.31, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Eldad Shemesh et al.

Application No./Patent No.: 7,980,998

Filed/Issue Date: July 19, 2011

Titled: TRAINING AND INSTRUCTING SUPPORT DEVICE

Cardiacsense Ltd., a Limited Liability Corporation

(Name of Assignee)

(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. ☒ the assignee of the entire right, title, and interest in;
2. ☐ an assignee of less than the entire right, title, and interest in
(The extent (by percentage) of its ownership interest is _____ %); or
3. ☐ the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made)

the patent application/patent identified above, by virtue of either:

- A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy therefore is attached.

OR

- B. ☒ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: Eldad Shemesh and Liat Shemesh-Granot To: SPORTTRACKER LTD.

The document was recorded in the United States Patent and Trademark Office at
Reel 042124, Frame 0109, or for which a copy thereof is attached.

2. From: SPORTTRACKER LTD. To: Cardiacsense Ltd.

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

- ☒ As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Marcus S. Simon, Reg.# 50258/

June 1, 2018

Signature

Date

Marcus S. Simon

Attorney for Assignee

Printed or Typed Name

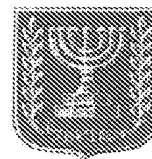
Title

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



מדינת ישראל
משרד המשפטים – רשות התאגידים
רשם החברות והשותפויות



תעודת שינוי שם של חברה

וזאת לתעודה כי החברה

ספורטרקר בע"מ

SPORTTRACKER LTD

שמספרה 514370204

שינתה את שמה ומעתה תקרא בשם

קארדיאקסנס בע"מ

CARDIACSENSE LTD

ניתנה בירושלים ביום:

22/01/2017

כ"ד טבת תשע"ז



אייל גלובוס, עו"ד
רשם החברות והשותפויות
ראש רשות התאגידים

בוצע על ידי אייל גולדרינג

Electronic Acknowledgement Receipt

EFS ID:	32779819
Application Number:	12382214
International Application Number:	
Confirmation Number:	2324
Title of Invention:	TRAINING AND INSTRUCTING SUPPORT DEVICE
First Named Inventor/Applicant Name:	Eldad Shemesh
Customer Number:	20529
Filer:	Marcus S. Simon/Katherine Benton
Filer Authorized By:	Marcus S. Simon
Attorney Docket Number:	30024X
Receipt Date:	01-JUN-2018
Filing Date:	11-MAR-2009
Time Stamp:	12:33:37
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	CardiaSensePreAIAPOA.PDF	1600420	no	2
			7ab79d1f642c1e096d296e1cea4db890d470197b		

Warnings:

IPR2025-00195

Information:					
2	Assignee showing of ownership per 37 CFR 3.73	276264US01_446373_3_Assignee_Statement.pdf	807902	no	2
			1400ad0d9aff6cf1c5106aa987be26c8250dce1		
Warnings:					
Information:					
Total Files Size (in bytes):				2408322	
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					



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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/382,214	07/19/2011	7980998	30024X	2324

20529 7590 06/29/2011
THE NATH LAW GROUP
112 South West Street
Alexandria, VA 22314

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 96 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Eldad Shemesh, Binymina, ISRAEL;
Liat Shemesh-Granot, Binymina, ISRAEL;

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

20529 7590 03/31/2011
THE NATH LAW GROUP
 112 South West Street
 Alexandria, VA 22314

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

12/382,214 03/11/2009 Eldad Shemesh 30024X 2324

TITLE OF INVENTION: TRAINING AND INSTRUCTING SUPPORT DEVICE

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	\$755	\$300	\$0	\$1055	06/30/2011

EXAMINER	ART UNIT	CLASS-SUBCLASS
RICHMAN, GLENN E	3764	482-008000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
 (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 THE NATH LAW GROUP

2 Susanne M. Hopkins

3 William L. Klima

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☒ Issue Fee
☒ Publication Fee (No small entity discount permitted)
☒ Advance Order - # of Copies 10

4b. Payment of Fee(s); (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
☒ Payment by credit card.
☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 14-0112 (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature /Susanne M. Hopkins/ Date June 1, 2011
 Typed or printed name Susanne M. Hopkins Registration No. 33,247

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Electronic Patent Application Fee Transmittal

Application Number:	12382214			
Filing Date:	11-Mar-2009			
Title of Invention:	TRAINING AND INSTRUCTING SUPPORT DEVICE			
First Named Inventor/Applicant Name:	Eldad Shemesh			
Filer:	Susanne M. Hopkins/Michael Turner			
Attorney Docket Number:	30024X			
Filed as Small Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl issue fee	2501	1	755	755
Publ. Fee- early, voluntary, or normal	1504	1	300	300

IPR2025-00195

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Printed copy of patent - no color	8001	10	3	30
Total in USD (\$)				1085

Electronic Acknowledgement Receipt

EFS ID:	10163904
Application Number:	12382214
International Application Number:	
Confirmation Number:	2324
Title of Invention:	TRAINING AND INSTRUCTING SUPPORT DEVICE
First Named Inventor/Applicant Name:	Eldad Shemesh
Customer Number:	20529
Filer:	Susanne M. Hopkins/Michael Turner
Filer Authorized By:	Susanne M. Hopkins
Attorney Docket Number:	30024X
Receipt Date:	01-JUN-2011
Filing Date:	11-MAR-2009
Time Stamp:	10:46:57
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$1085
RAM confirmation Number	9935
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part (if appl.)	Pages (if appl.)
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1	Issue Fee Payment (PTO-85B)	PTOL_SB_85.pdf	948717 52ff0ee86dccb2e812dba955623d9648ab08594e	no	1
Warnings:					
Information:					
2	Fee Worksheet (PTO-875)	fee-info.pdf	33440 38a8feb5d77529327c65495954ba3010581df387	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			982157		
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					



UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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12/382,214

03/11/2009

Eldad Shemesh

30024X

2324

20529

7590

05/05/2011

THE NATH LAW GROUP

112 South West Street

Alexandria, VA 22314

EXAMINER

RICHMAN, GLENN E

ART UNIT

PAPER NUMBER

3764

MAIL DATE

DELIVERY MODE

05/05/2011

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

<i>Response to Rule 312 Communication</i>	Application No.	Applicant(s)
	12/382,214	SHEMESH ET AL.
	Examiner	Art Unit
	/Glenn Richman/	3764

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

1. ☒ The amendment filed on 19 April 2011 under 37 CFR 1.312 has been considered, and has been:

a) ☒ entered.

b) ☐ entered as directed to matters of form not affecting the scope of the invention.

c) ☐ disapproved because the amendment was filed after the payment of the issue fee.

Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue.

d) ☐ disapproved. See explanation below.

e) ☐ entered in part. See explanation below.

/Glenn Richman/
Primary Examiner
Art Unit: 3764

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

SHEMESH, et al.

Conf. No.: 2324

Appl. No.: 12/382,214

Examiner: RICHMAN

Filing Date: March 11, 2009

Art Unit: 3764

Title: **TRAINING AND INSTRUCTING SUPPORT DEVICE**

AMENDMENT AFTER ALLOWANCE UNDER 37 C.F.R. § 1.312

Commissioner for Patents
Attn: Examiner Glenn E. RICHMAN
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Examiner Glenn E. RICHMAN:

Prior to payment of the Issue Fee, please enter the following changes:

Amendments to the Claims begin on page 2 of this paper.

Remarks begin on page 9 of this paper.

A **Conclusion** appears at page 10 of this paper.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A personal device for measuring a training activity of a trainee having a body part which moves and changes its location and orientation, during said training activity, this movement at least partially defining said training activity, said device comprising:

- (a) a sensing unit adapted to repeatedly measure, during said training activity, parameters associated with the movement of said body part and characterizing the location and orientation of said body part relative to its initial location and orientation, and wherein said sensing unit comprising at least accelerometer means, a compass and optionally gyroscope means, said accelerometer means being adapted to measure linear acceleration of said body part along three axis axes, said gyroscope means being adapted to measure angular acceleration of said body part around said three axes, and said parameters being at least linear and angular acceleration values;
- (b) means for attaching the sensing unit to said body part; and
- (c) a processor adapted to receive from the sensing unit said parameters, and to calculate based thereon, data indicative of said training activity, said data including at least the location and orientation of said body part for each of the measurements.

Claims 2 – 3 (Cancelled)

4. (Previously Presented) A person device for measuring a training activity of a trainee having a body part which moves during said training activity, this movement at least partially defining said training activity, said device comprising:

- (a) a sensing unit adapted to repeatedly measure, during said training activity, parameters associated with the movement of said body part, and wherein said sensing unit comprising at least accelerometer means, a compass and optionally gyroscope means;
- (b) means for attaching the sensing unit to said body part;
- (c) a processor adapted to receive from the sensing unit said parameters, and to calculate based thereon, data indicative of said training activity; and
- (d) at least one additional sensing unit and means for its attaching to an additional body part of said trainee, the sensing unit adapted to repeatedly measure, during said activity, parameters characterizing at least the location and orientation of said additional body part relative to its initial position and orientation; and said processor being further adapted to receive from said at least one additional sensing unit said parameters, and to calculate, based thereon, at least the location and orientation of said additional body part for each of the measurements, for use thereof in providing said data.

5. (Original) A device according to claim 1, wherein said activity is a swimming session and said data further includes statistics and summary results for said session.

6. (Previously Presented) A device according to claim 5, wherein said results include one or more of the following: total training time, number of laps, average lap time, average lap velocity, average strokes per lap, fastest and slowest lap, highest and lowest number of hand strokes per lap, instantaneous speed during the laps, hand or leg lifting height for each stroke, distance traveled for each stroke, comparative results to other trainees using similar devices.

7. (Original) A device according to claim 1, further adapted for infrared measurement of the pulse and wherein said data includes the pulse of the trainee.

8. (Previously Presented) A personal device for measuring a training activity of a trainee having a body part which moves during said training activity, this movement at least partially defining said training activity, said device comprising:

- (a) a sensing unit adapted to repeatedly measure, during said training activity, parameters associated with the movement of said body part, and wherein said sensing unit comprising at least accelerometer means, a compass and optionally gyroscope means;
- (b) means for attaching the sensing unit to said body part comprising a flexible platform adapted to amplify at least one of the measurements performed by the sensing unit; and

- (c) a processor adapted to receive from the sensing unit said parameters, and to calculate based thereon, data indicative of said training activity.

9. (Original) A training advisor comprising a device according to claim 1, and further comprising a presentation unit adapted to present to the trainee at least said data or training instructions based on said data.

10. (Original) A training advisor according to claim 9, wherein said presentation unit comprises a screen connected to said processor and adapted for displaying to the trainee readings including at least said data or training instructions to the trainee based on said data.

11. (Previously Presented) A personal device for measuring a training activity of a trainee having a body part which moves during said training activity, this movement at least partially defining said training activity, said device comprising:

- (a) a sensing unit adapted to repeatedly measure, during said training activity, parameters associated with the movement of said body part, and wherein said sensing unit comprising at least accelerometer means, a compass and optionally gyroscope means;
- (b) means for attaching the sensing unit to said body part;
- (c) a processor adapted to receive from the sensing unit said parameters, and to calculate based thereon, data indicative of said training activity; and

- (d) a presentation unit adapted to present to the trainee at least said data or training instructions based on said data, said presentation unit comprising vibrating element adapted to generate vibratory pulses according to a predetermined rule, and to direct said pulses to the skin of said trainee.

12. (Previously Presented) A personal device for measuring a training activity of a trainee having a body part which moves during said training activity, this movement at least partially defining said training activity, said device comprising:

- (a) a sensing unit adapted to repeatedly measure, during said training activity, parameters associated with the movement of said body part, and wherein said sensing unit comprising at least accelerometer means, a compass and optionally gyroscope means;
- (b) means for attaching the sensing unit to said body part;
- (c) a processor adapted to receive from the sensing unit said parameters, and to calculate based thereon, data indicative of said training activity; and
- (d) a presentation unit adapted to present to the trainee at least said data or training instructions based on said data, said presentation unit comprising at least one earphone with a receiving module adapted for wirelessly receiving readings including at least the data from said device or training instructions to the trainee based on said data, and converting said readings into audio signal to be transmitted to the trainee via said at least one earphone.

13. (Original) A training advisor according to claim 9, wherein the processor of said device is further adapted to provide said training instructions according to predetermined rules.

14. (Previously Presented) A personal device for measuring a training activity of a trainee having a body part which moves during said training activity, this movement at least partially defining said training activity, said device comprising:

- (a) a sensing unit adapted to repeatedly measure, during said training activity, parameters associated with the movement of said body part, and wherein said sensing unit comprising at least accelerometer means, a compass and optionally gyroscope means;
- (b) means for attaching the sensing unit to said body part;
- (c) a processor adapted to receive from the sensing unit said parameters, and to calculate based thereon, data indicative of said training activity;
- (d) a presentation unit adapted to present to the trainee at least said data or training instructions based on said data; and
- (e) a computer adapted for being located at a location spaced from said processor and for wirelessly receiving the data from said device, and having a monitor for displaying to a user of said computer said data or information derived therefrom.

15. (Original) A training advisor according to claim 14, wherein said computer further comprises an input unit to receive said training instructions from its user, the computer being adapted to wirelessly transfer said instructions directly or indirectly to said presentation unit.

16. (Original) A training advisor according to claim 14, constituting a part of a training system comprising a plurality of such training advisors for a corresponding plurality of trainees, and wherein said monitor is adapted to display to said user said data or information derived therefrom, relating to said plurality of trainees.

17. (Original) A training advisor according to claim 16, wherein said monitor is adapted to display to said user said data or information derived therefrom, in a real-time activity of said plurality of trainees.

18. (Original) A training advisor according to claim 16, wherein said computer further comprises an input unit to receive from its user the training instructions, the computer being adapted to simultaneously and wirelessly transfer said instructions directly or indirectly to each of said plurality of trainees.

Claims 19 – 35 (Cancelled)

REMARKS

Upon entry of the above amendments, claim 1 is currently amended. Claims 2 – 3 and 19 – 35 remain cancelled, without prejudice or disclaimer. Claims 4, 6, 8, 11, 12, and 14 have been previously presented and claims 5, 7, 9 – 10, 13, 15 – 18 remain as originally filed. The amendment to claim 1 does not introduce new matter within the meaning of 35 U.S.C. §132. The amendment is presented in order to correct a typographical error.

Applicants reserve the right to reintroduce any cancelled subject matter to this application or to any child applications, or to reintroduce the full scope of any claim amended herein.

Accordingly, the Examiner is respectfully requested to enter the above amendment before the payment of the Issue Fee.

Favorable consideration is requested.

CONCLUSION

In view of the foregoing, Applicants respectfully submit that the application is in condition for examination on the merits. The Examiner is invited to contact the undersigned attorney if it is believed that such contact will expedite the prosecution of the application.

Respectfully submitted,

THE NATH LAW GROUP

/Susanne M. Hopkins/

Susanne M. Hopkins
Registration No. 33,247
William L. Klima
Registration No. 32,422
Customer No. 20529

Date: April 19, 2011

THE NATH LAW GROUP

112 S. West Street, Alexandria, VA 22314
Tel: 703-548-6284 / Fax: 703-683-8396
SMH/le

Electronic Acknowledgement Receipt

EFS ID:	9908036
Application Number:	12382214
International Application Number:	
Confirmation Number:	2324
Title of Invention:	TRAINING AND INSTRUCTING SUPPORT DEVICE
First Named Inventor/Applicant Name:	Eldad Shemesh
Customer Number:	20529
Filer:	Susanne M. Hopkins/Lisa Elliott
Filer Authorized By:	Susanne M. Hopkins
Attorney Docket Number:	30024X
Receipt Date:	19-APR-2011
Filing Date:	11-MAR-2009
Time Stamp:	15:12:50
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		AMENDMENT_312.pdf	84834 3f6f1c7a1eff543d0d749a3ad26fd2b3d3f8a453	yes	10

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Amendment after Notice of Allowance (Rule 312)	1	1
	Claims	2	8
	Applicant Arguments/Remarks Made in an Amendment	9	10
Warnings:			
Information:			
Total Files Size (in bytes):		84834	
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>			



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NOTICE OF ALLOWANCE AND FEE(S) DUE

20529 7590 03/31/2011
THE NATH LAW GROUP
112 South West Street
Alexandria, VA 22314

EXAMINER

RICHMAN, GLENN E

ART UNIT

PAPER NUMBER

3764

DATE MAILED: 03/31/2011

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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12/382,214

03/11/2009

Eldad Shemesh

30024X

2324

TITLE OF INVENTION: TRAINING AND INSTRUCTING SUPPORT DEVICE

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
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nonprovisional

YES

\$755

\$300

\$0

\$1055

06/30/2011

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

20529 7590 03/31/2011
THE NATH LAW GROUP
 112 South West Street
 Alexandria, VA 22314

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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12/382,214 03/11/2009 Eldad Shemesh 30024X 2324

TITLE OF INVENTION: TRAINING AND INSTRUCTING SUPPORT DEVICE

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	\$755	\$300	\$0	\$1055	06/30/2011

EXAMINER	ART UNIT	CLASS-SUBCLASS
RICHMAN, GLENN E	3764	482-008000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____
 (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____
 3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s); (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/382,214	03/11/2009	Eldad Shemesh	30024X	2324

20529 7590 03/31/2011
THE NATH LAW GROUP
112 South West Street
Alexandria, VA 22314

EXAMINER

RICHMAN, GLENN E

ART UNIT	PAPER NUMBER
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3764

DATE MAILED: 03/31/2011

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 113 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 113 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No.	Applicant(s)	
	12/382,214	SHEMESH ET AL.	
	Examiner	Art Unit	
	/Glenn Richman/	3764	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 3/21/11.
2. ☒ The allowed claim(s) is/are 1 and 4-18.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|--|
| 1. ☐ Notice of References Cited (PTO-892) | 5. ☐ Notice of Informal Patent Application |
| 2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) | 6. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____. |
| 3. ☐ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____ | 7. ☐ Examiner's Amendment/Comment |
| 4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 8. ☐ Examiner's Statement of Reasons for Allowance |
| | 9. ☐ Other _____. |

/Glenn Richman/
Primary Examiner
Art Unit: 3764

EAST Search History**EAST Search History (Prior Art)**

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	1145	accelerometer near10 (body arm leg) with (axes axis)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2011/03/24 14:56

EAST Search History (I nterference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L3	10	accelerometer same (body arm leg) same (axes axis) same gyroscope.clm.	US-PGPUB	OR	ON	2011/03/24 14:57

3/ 24/ 11 2:58:21 PM**H:\ East\ Workspaces\ 12382214.wsp**

Issue Classification 	Application/Control No. 12/382,214	Applicant(s)/Patent under Reexamination SHEMESH ET AL.
	Examiner /Glenn Richman/	Art Unit 3764

ISSUE CLASSIFICATION											
ORIGINAL					INTERNATIONAL CLASSIFICATION						
CLASS		SUBCLASS			CLAIMED					NON-CLAIMED	
482		8			A	63	B	71	/00		/
CROSS REFERENCES								/		/	
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)							/		/	
482	1	9	901				/		/		
							/		/		
							/		/		
							/		/		
							/		/		
							/		/		
--- (Assistant Examiner) (Date)					/Glenn Richman/ AU 3764 3/24/11			Total Claims Allowed: 16			
(Legal Instruments Examiner) (Date)								O.G. Print Claim(s) 1		O.G. Print Fig. 8	

☐ Claims renumbered in the same order as presented by applicant												☐ CPA		☐ T.D.		☐ R.1.47	
Final	Original		Final	Original		Final	Original		Final	Original		Final	Original		Final	Original	
1	1			31			61			91			121			151	
	2			32			62			92			122			152	
	3			33			63			93			123			153	
8	4			34			64			94			124			154	
2	5			35			65			95			125			155	
3	6			36			66			96			126			156	
4	7			37			67			97			127			157	
9	8			38			68			98			128			158	
5	9			39			69			99			129			159	
6	10			40			70			100			130			160	
10	11			41			71			101			131			161	
11	12			42			72			102			132			162	
7	13			43			73			103			133			163	
12	14			44			74			104			134			164	
13	15			45			75			105			135			165	
14	16			46			76			106			136			166	
15	17			47			77			107			137			167	
16	18			48			78			108			138			168	
	19			49			79			109			139			169	
	20			50			80			110			140			170	
	21			51			81			111			141			171	
	22			52			82			112			142			172	
	23			53			83			113			143			173	
	24			54			84			114			144			174	
	25			55			85			115			145			175	
	26			56			86			116			146			176	
	27			57			87			117			147			177	
	28			58			88			118			148			178	
	29			59			89			119			149			179	
	30			60			90			120			150			180	

Search Notes

Application/Control No.

12/382,214

Examiner

/Glenn Richman/

Applicant(s)/Patent under
Reexamination

SHEMESH ET AL.

Art Unit

3764

SEARCHED

Class	Subclass	Date	Examiner
482	1-9,900-902	3/24/2011	GR
434	247,254	3/24/2011	GR
702	182,183	3/24/2011	GR
705	2,3	3/24/2011	GR

INTERFERENCE SEARCHED

Class	Subclass	Date	Examiner
482	1,8,9,901	3/24/2011	GR

**SEARCH NOTES
(INCLUDING SEARCH STRATEGY)**

	DATE	EXMR
East see attached	3/24/2011	GR
PG Pubs clms see attached	3/24/2011	GR



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BIB DATA SHEET

CONFIRMATION NO. 2324

SERIAL NUMBER 12/382,214	FILING or 371(c) DATE 03/11/2009 RULE	CLASS 482	GROUP ART UNIT 3764	ATTORNEY DOCKET NO. 30024X		
APPLICANTS Eldad Shemesh, Binymina, ISRAEL; Liat Shemesh-Granot, Binymina, ISRAEL; ** CONTINUING DATA ***** This application is a CIP of PCT/IL07/01121 09/11/2007 which claims benefit of 60/843,422 09/11/2006 ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** ** SMALL ENTITY ** 03/27/2009						
Foreign Priority claimed ☐ Yes ☒ No 35 USC 119(a-d) conditions met ☐ Yes ☒ No Verified and Acknowledged <u>/GLENN E. RICHMAN/</u> Examiner's Signature		☐ Met after Allowance Initials	STATE OR COUNTRY ISRAEL	SHEETS DRAWINGS 9	TOTAL CLAIMS 35	INDEPENDENT CLAIMS 6
ADDRESS THE NATH LAW GROUP 112 South West Street Alexandria, VA 22314 UNITED STATES						
TITLE Training and instructing support device						
FILING FEE RECEIVED 1265	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:		☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit			

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of:

Eldad SHEMESH et al.

Conf. No.: 2324

Appl. No.: 12/382,214

Art Unit: 3764

Filed: March 11, 2009

Examiner: RICHMAN, GLENN E.

For: **TRAINING AND INSTRUCTING SUPPORT DEVICE**

AMENDMENT AND RESPONSE

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

This paper is submitted in the above-identified application responsive to the non-final Official Action dated December 20, 2010, making a response due on or before March 21, 2011 (Monday). Accordingly, this paper is timely filed.

Amendments to the Claims begin on page 2 of this paper.

Remarks begin on page 10 of this paper.

A **Conclusion** appears at page 12 of this paper.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (Currently amended) A personal device for measuring a training activity of a trainee having a body part which moves and changes its location and orientation, during said training activity, this movement at least partially defining said training activity, said device comprising:

- (a) a sensing unit adapted to repeatedly measure, during said training activity, parameters associated with the movement of said body part and characterizing the location and orientation of said body part relative to its initial location and orientation, and wherein said sensing unit comprising at least accelerometer means, a compass and optionally gyroscope means, said accelerometer means being adapted to measure linear acceleration of said body part along three axis, said gyroscope means being adapted to measure angular acceleration of said body part around said three axes, and said parameters being at least linear and angular acceleration values;
- (b) means for attaching the sensing unit to said body part; and
- (c) a processor adapted to receive from the sensing unit said parameters, and to calculate based thereon, data indicative of said training activity, said data including at least the location and orientation of said body part for each of the measurements.

Claims 2-3. (Canceled)

4. (Currently amended) A personal device for measuring a training activity of a trainee having a body part which moves during said training activity, this movement at least partially defining said training activity, said device comprising:

- (a) a sensing unit adapted to repeatedly measure, during said training activity, parameters associated with the movement of said body part, and wherein said sensing unit comprising at least accelerometer means, a compass and optionally gyroscope means;
- (b) means for attaching the sensing unit to said body part;
- (c) a processor adapted to receive from the sensing unit said parameters, and to calculate based thereon, data indicative of said training activity; and
- (d) A device according to claim 1, and further comprising at least one additional sensing unit and means for its attaching to an additional body part of said trainee, the sensing unit adapted to repeatedly measure, during said activity, parameters characterizing at least the location and orientation of said additional body part relative to its initial position and orientation; and said processor being further adapted to receive from said at least one additional sensing unit said parameters, and to calculate, based thereon, at least the location and orientation of said additional body part for each of the measurements, for use thereof in providing said data.

5. (Original) A device according to claim 1, wherein said activity is a swimming session and said data further includes statistics and summary results for said session.

6. (Currently amended) A device according to ~~claim 6~~ claim 5, wherein said results include one or more of the following: total training time, number of laps, average lap time, average lap velocity, average strokes per lap, fastest and slowest lap, highest and lowest number of hand strokes per lap, instantaneous speed during the laps, hand or leg lifting height for each stroke, distance traveled for each stroke, comparative results to other trainees using similar devices.

7. (Original) A device according to claim 1, further adapted for infrared measurement of the pulse and wherein said data includes the pulse of the trainee.

8. (Currently amended) A personal device for measuring a training activity of a trainee having a body part which moves during said training activity, this movement at least partially defining said training activity, said device comprising:

(a) a sensing unit adapted to repeatedly measure, during said training activity, parameters associated with the movement of said body part, and wherein said sensing unit comprising at least accelerometer means, a compass and optionally gyroscope means;

- (b) means for attaching the sensing unit to said body part ~~A device according to claim 1, wherein said means for attaching the sensing unit further comprise~~
comprising a flexible platform adapted to amplify at least one of the measurements performed by the sensing unit; and
- (c) a processor adapted to receive from the sensing unit said parameters, and to calculate based thereon, data indicative of said training activity.

9. (Original) A training advisor comprising a device according to claim 1, and further comprising a presentation unit adapted to present to the trainee at least said data or training instructions based on said data.

10. (Original) A training advisor according to claim 9, wherein said presentation unit comprises a screen connected to said processor and adapted for displaying to the trainee readings including at least said data or training instructions to the trainee based on said data.

11. (Currently amended) ~~A training advisor according to claim 9, wherein~~ A personal device for measuring a training activity of a trainee having a body part which moves during said training activity, this movement at least partially defining said training activity, said device comprising:

- (a) a sensing unit adapted to repeatedly measure, during said training activity, parameters associated with the movement of said body part, and wherein said sensing unit comprising at least accelerometer means, a compass and optionally gyroscope means;
- (b) means for attaching the sensing unit to said body part;
- (c) a processor adapted to receive from the sensing unit said parameters, and to calculate based thereon, data indicative of said training activity; and
- (d) a presentation unit adapted to present to the trainee at least said data or training instructions based on said data, said presentation unit comprises comprising vibrating element adapted to generate vibratory pulses according to a predetermined rule, and to direct said pulses to the skin of said trainee.

12. (Currently amended) A personal device for measuring a training activity of a trainee having a body part which moves during said training activity, this movement at least partially defining said training activity, said device comprising:

- (a) a sensing unit adapted to repeatedly measure, during said training activity, parameters associated with the movement of said body part, and wherein said sensing unit comprising at least accelerometer means, a compass and optionally gyroscope means;
- (b) means for attaching the sensing unit to said body part;

- (c) a processor adapted to receive from the sensing unit said parameters, and to calculate based thereon, data indicative of said training activity; and
- (d) a presentation unit adapted to present to the trainee at least said data or training instructions based on said data, A training advisor according to claim 9, wherein said presentation unit comprises comprising at least one earphone with a receiving module adapted for wirelessly receiving readings including at least the data from said device or training instructions to the trainee based on said data, and converting said readings into audio signal to be transmitted to the trainee via said at least one earphone.

13. (Original) A training advisor according to claim 9, wherein the processor of said device is further adapted to provide said training instructions according to predetermined rules.

14. (Currently amended) A personal device for measuring a training activity of a trainee having a body part which moves during said training activity, this movement at least partially defining said training activity, said device comprising:

- (a) a sensing unit adapted to repeatedly measure, during said training activity, parameters associated with the movement of said body part, and wherein said sensing unit comprising at least accelerometer means, a compass and optionally gyroscope means;

- (b) means for attaching the sensing unit to said body part;
- (c) a processor adapted to receive from the sensing unit said parameters, and to calculate based thereon, data indicative of said training activity;
- (d) a presentation unit adapted to present to the trainee at least said data or training instructions based on said data; and
- (e) ~~A training advisor according to claim 9, and further comprising a computer adapted for being located at a location spaced from said processor and for wirelessly receiving the data from said device, and having a monitor for displaying to a user of said computer said data or information derived therefrom.~~

15. (Original) A training advisor according to claim 14, wherein said computer further comprises an input unit to receive said training instructions from its user, the computer being adapted to wirelessly transfer said instructions directly or indirectly to said presentation unit.

16. (Original) A training advisor according to claim 14, constituting a part of a training system comprising a plurality of such training advisors for a corresponding plurality of trainees, and wherein said monitor is adapted to display to said user said data or information derived therefrom, relating to said plurality of trainees.

17. (Original) A training advisor according to claim 16, wherein said monitor is adapted to display to said user said data or information derived therefrom, in a real-time activity of said plurality of trainees.

18. (Original) A training advisor according to claim 16, wherein said computer further comprises an input unit to receive from its user the training instructions, the computer being adapted to simultaneously and wirelessly transfer said instructions directly or indirectly to each of said plurality of trainees.

Claims 19-35. (Canceled)

REMARKS

Claims 1-35 are pending in this application. Claims 19-35 are withdrawn from consideration.

Claims 1, 4, 6, 8, 11, 12, and 14 are amended above. Claims 2, 3, and 19-35 are canceled above without prejudice or disclaimer of the subject matter contained therein.

Claims 3, 4, 8, 11, 12, and 14-18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The claims have been rewritten in independent form to place these claims in condition for allowance.

Applicants, by amending any claims herein, make no admission as to the validity of any rejection made by the Examiner against any claim. Applicants reserve the right to reassert any of the claims canceled or the original claim scope of any claim amended herein, in a continuing application.

It is respectfully submitted that the above amendments to the claims introduce no new matter within the meaning of 35 U.S.C. §132. Accordingly, Applicants respectfully request allowance of the subject application.

- I. Claims 1 and 2 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Case, Jr. et al. (U.S. Patent Publication No. 2006/0136173) as set forth on page 2 of the Official Action.***

The claims have been rewritten in independent form to place these claims in condition for allowance, thus obviating a response to this rejection.

- II. Claims 5 and 6 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Case, Jr. et al. (U.S. Patent Publication No. 2006/0136173) as set forth on page 3 of the Official Action.***

The claims have been rewritten in independent form to place these claims in condition for allowance, thus obviating a response to this rejection.

- III. Claims 3, 4, 8, 11, 12, and 14-18 stand objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.***

The claims have been rewritten in independent form to place these claims in condition for allowance, thus obviating a response to this rejection.

CONCLUSION

Applicants believe that a full and complete response has been made to the pending Office Action and respectfully submit that all of the stated grounds for rejection have been overcome or rendered moot. Should the Examiner feel that there are any issues outstanding after consideration of this response, the Examiner is invited to contact Applicants' undersigned representative at the number below to expedite prosecution.

If an extension of time is necessary to prevent abandonment of this application and is not filed herewith, then such extension of time is hereby petitioned for under 37 C.F.R. §1.136(a). Any fees required for further extensions of time and any fees for the net addition of claims are hereby authorized to be charged to our Deposit Account No. 14-0112. Prompt and favorable consideration of this Reply is respectfully requested.

Respectfully submitted,
THE NATH LAW GROUP

/William L. Klima/
Susanne M. Hopkins
Registration No. 33,247
William L. Klima
Registration No. 32,422
Customer No. 20529

March 21, 2011
THE NATH LAW GROUP
112 South West Street
Alexandria, VA 22314
(703)548-6284

Electronic Acknowledgement Receipt

EFS ID:	9705154
Application Number:	12382214
International Application Number:	
Confirmation Number:	2324
Title of Invention:	Training and instructing support device
First Named Inventor/Applicant Name:	Eldad Shemesh
Customer Number:	20529
Filer:	Susanne M. Hopkins/William Klima
Filer Authorized By:	Susanne M. Hopkins
Attorney Docket Number:	30024X
Receipt Date:	21-MAR-2011
Filing Date:	11-MAR-2009
Time Stamp:	19:32:37
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2011_03_21_ROA.pdf	105540 cce330e41b6161d3b63f70131235da21ac8a04be	yes	12

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	9
	Applicant Arguments/Remarks Made in an Amendment	10	12
Warnings:			
Information:			
Total Files Size (in bytes):		105540	
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>			

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 12/382,214		Filing Date 03/11/2009		☐ To be Mailed	
APPLICATION AS FILED – PART I										
(Column 1)			(Column 2)			SMALL ENTITY ☒ OR		OTHER THAN SMALL ENTITY		
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)	OR	RATE (\$)	FEE (\$)			
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A				
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A				
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A				
TOTAL CLAIMS (37 CFR 1.16(j))	minus 20 =	*	X \$	=	OR	X \$	=			
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X \$	=		X \$	=			
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).									
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
			TOTAL			TOTAL				
* If the difference in column 1 is less than zero, enter "0" in column 2.										
APPLICATION AS AMENDED – PART II										
(Column 1)			(Column 2)			SMALL ENTITY OR		OTHER THAN SMALL ENTITY		
AMENDMENT	03/21/2011	CLAIMS REMAINING AFTER AMENDMENT	MINUS	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)
	Total (37 CFR 1.16(i))	* 16	Minus	** 35	= 0	X \$26 =	0	OR	X \$	=
	Independent (37 CFR 1.16(h))	* 6	Minus	*** 6	= 0	X \$110 =	0	OR	X \$	=
☐ Application Size Fee (37 CFR 1.16(s))										
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								OR		
						TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	
(Column 1)			(Column 2)			SMALL ENTITY OR		OTHER THAN SMALL ENTITY		
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT	MINUS	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X \$	=	OR	X \$	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$	=	OR	X \$	=
☐ Application Size Fee (37 CFR 1.16(s))										
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
<p>* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.</p> <p>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".</p> <p>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".</p> <p>The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.</p>										

Legal Instrument Examiner:
/JERMAINE D. MINOR/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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12/382,214

03/11/2009

Eldad Shemesh

30024X

2324

20529

7590

12/20/2010

THE NATH LAW GROUP

112 South West Street

Alexandria, VA 22314

EXAMINER

RICHMAN, GLENN E

ART UNIT

PAPER NUMBER

3764

MAIL DATE

DELIVERY MODE

12/20/2010

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 12/382,214	Applicant(s) SHEMESH ET AL.	
	Examiner /Glenn Richman/	Art Unit 3764	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04 October 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-35 is/are pending in the application.
- 4a) Of the above claim(s) 19-35 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,5-7,9,10 and 13 is/are rejected.
- 7) ☒ Claim(s) 3,4,8,11,12 and 14-18 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) ☒ Notice of References Cited (PTO-892) | 4) ☐ Interview Summary (PTO-413) |
| 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) ☒ Information Disclosure Statement(s) (PTO/SB/08) | 5) ☐ Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>7/29/09</u> . | 6) ☐ Other: _____ |

DETAILED ACTION

Election/Restrictions

Claims 19-35 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected inventions, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 10/4/10.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 2 are rejected under 35 U.S.C. 102(e) as being anticipated by Case, JR. et al.

Case discloses a sensing unit adapted to repeatedly measure, during said training activity, parameters associated with the movement of said body part abstract, and wherein said sensing unit comprising at least accelerometer means 0039, a compass 0039 and optionally gyroscope means 0039 (though not positively recited); means for attaching the sensing unit to said body part 0042; and a processor adapted to receive from the sensing unit said parameters, and to calculate based thereon, data indicative of said training activity abstract.

As for claims 2, Case further discloses said body part changes its location and orientation during said training activity abstract, said parameters characterizes the location and orientation of said body part relative to its initial location and orientation 0030,0039,0048, said data includes at least the location and orientation of said body part for each of the measurements abstract, 0030,0039,0048.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Case, JR. et al in view of Roncalez et al

Case does not disclose said activity is a swimming session and said data further includes statistics and summary results for said session.

Roncalez discloses said activity is a swimming session and said data further includes statistics and summary results for said session col. 2, lines 54 – et seq.

It would have been obvious to use Roncalez's system with Case, as it is well known as taught by Roncalez, to provide accelerometer's to determine the swimming characteristics of a swimmer.

Roncalez further disclose said results include one or more of the following: total training time, number of laps, average lap time, average lap velocity, average strokes per lap, fastest and slowest lap, highest and lowest number of hand strokes per lap,

Art Unit: 3764

instantaneous speed during the laps, hand or leg lifting height for each stroke, distance traveled for each stroke, comparative results to other trainees using similar devices col. 4, lines 31 - et seq.

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Case, JR. et al in view of Tran

Case does not disclose infrared measurement of the pulse and wherein said data includes the pulse of the trainee.

Tran discloses infrared measurement of the pulse and wherein said data includes the pulse of the trainee 0288.

It would have been obvious to use Tran's system with Cases, as it is well known as taught by Tran, to provide an infrared measurement of the pulse of a trainee, in a monitoring device, for providing feedback to the trainee.

a presentation unit adapted to present to the trainee at least said data or training instructions based on said data.

Claims 9, 10 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Case, JR. et al in view of Townsend et al.

Case does not disclose a presentation unit adapted to present to the trainee at least said data or training instructions based on said data.

Townsend discloses a presentation unit adapted to present to the trainee at least said data or training instructions based on said data col. 2, lines 62 – et seq.

a presentation unit comprising a screen connected to said processor and adapted for displaying to the trainee readings including at least said data or training instructions to the trainee based on said data

It would have been obvious to use Townsend's system with Cases, as it is well known as taught by Townsend, to provide a presentation of instructions to a trainee, based on the training data, for providing a feedback to the trainee.

Allowable Subject Matter

Claims 3, 4, 8, 11, 12, 14-18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to /Glenn Richman/ whose telephone number is 571-272-4981. The examiner can normally be reached on Mon-Thurs.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, LoAn Thanh can be reached on (571)272-4966. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Glenn Richman/
Primary Examiner
Art Unit 3764

Notice of References Cited	Application/Control No. 12/382,214	Applicant(s)/Patent Under Reexamination SHEMESH ET AL.	
	Examiner /Glenn Richman/	Art Unit 3764	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2006/0136173	06-2006	Case et al.	702/182
*	B	US-6,955,542	10-2005	Roncalez et al.	434/254
*	C	US-7,670,263	03-2010	Ellis et al.	482/8
*	D	US-2008/0004904	01-2008	Tran, Bao Q.	705/2
*	E	US-7,698,830	04-2010	Townsend et al.	33/512
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

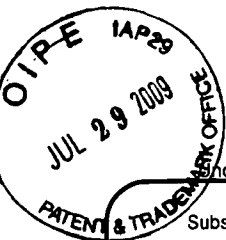
*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes *12382214*	Application/Control No.	Applicant(s)/Patent under Reexamination	
	12/382,214	SHEMESH ET AL.	
	Examiner	Art Unit	
	/Glenn Richman/	3764	

SEARCHED			
Class	Subclass	Date	Examiner

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR



PTO/SB/08A (06-09)

Approved for use through 06/30/2009. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Substitute for form 1449A/PTO

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**

(Use as many sheets as necessary)

Sheet 1

of 1

Complete if Known

Application Number	12/382,214
Filing Date	March 11, 2009
First Named Inventor	Eldad SHEMESH, et al.
Art Unit	3715
Examiner Name	TBD
Attorney Docket Number	30024X

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code ² (if known)			
	1	US- 5,685,722 A	11-11-1997	Serge TABA	
	2	US- 5,600,730 A	02-04-1997	Peggy J. KENNING, et al.	
	3	US- 5,314,389 A	05-24-1994	Simon DOTAN	
	4	US-4,301,808	11-24-1981	Herbert G. TAUS	
	5	US- 6,080,110 A	06-27-2000	Harold THORGERSEN	
	6	US- 6,305,221 B1	10-23-2001	Lawrence J. HUTCHINGS	
		US-			
		US-			
		US-			
		US-			

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. ¹	Foreign Patent Document	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T ⁶
		Country Code ³ Number ⁴ Kind Code ⁵ (if known)				
	1	WO 01/00281 A2	01-04-2001	Trakus, Inc.		
	2	WO 01/10508 A1	02-15-2001	Smith & Nephew PLC		
	3	WO 01/42809 A2	06-14-2001	Esport Incorporated		
	4	WO 2004/038336 A1	05-06-2004	Clothing Plus OY		
	5	WO 00/67858 A1	11-16-2000	Mynhardt		

Examiner
Signature

/Glenn Richman/ (12/15/2010)

Date

Considered

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. ¹ Applicant's unique citation designation number (optional). ² See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. ³ Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶ Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

ALL REFERENCES CONSIDERED EXCEPT WHERE INDICATED OTHERWISE. /G.R./

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

SHEMESH et al.	Conf. No.: 2324
Appl. No.: 12/382,214	Examiner: TBD
Filed: March 11, 2009	Art Unit: 3715
Title: TRAINING AND INSTRUCTING SUPPORT DEVICE	

RESPONSE TO RESTRICTION REQUIREMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

This paper is filed responsive to the Official Action dated September 2, 2010, making a response due on or before October 4, 2010. Accordingly, this Response is timely filed.

Remarks begin on page 2 of this paper.

A **Conclusion** appears at page 3 of this paper.

REMARKS

Claims 1-35 are pending in this application.

In the outstanding Official Action, claims 1-35 are subjected to a restriction requirement.

I. Restriction Requirement

The Examiner has required restriction of claims 1-35 to a single invention under 35 U.S.C. §121. Claims 1-35 were subjected to a restriction requirement as follows:

- Group I - Claims 1-18, drawn to a personal measuring device, classified in class 73, subclass 379.01.
- Group II - Claims 19-24, drawn to a system for instructing a plurality of participants, classified in class 434, subclass 247.
- Group III - Claims 25-30, drawn to a communication device for swimmers, classified in class 482, subclass 55.
- Group IV - Claims 31-35, drawn to drawn to a method of automated training, classified in class 701, subclass 206.

II. Election

Applicants hereby provisionally elect claims 1-18 of Group I, without traverse.

Applicants hereby reserve the right to file a divisional application directed to the non-elected subject matter.

CONCLUSION

Having made the required election, examination on the merits is earnestly solicited. Should the Examiner deem that any further action by Applicants' undersigned representative is desirable and/or necessary, the Examiner is invited to telephone the undersigned at the number set forth below.

In the event this paper is not timely filed, Applicants petition for an appropriate extension of time. Please charge any fee deficiency or credit any overpayment to Deposit Account No. 14-0112.

Respectfully submitted,

THE NATH LAW GROUP

/Ari G. Zytcer/

Date: October 04, 2010
THE NATH LAW GROUP
112 South West Street
Alexandria, Virginia 22314
Tel: (703) 548-6284
Fax: (703) 683-8396

Susanne M. Hopkins
Registration No. 33,247
Ari G. Zytcer
Registration No. 57,474
Customer No. 20529

Electronic Acknowledgement Receipt

EFS ID:	8550647
Application Number:	12382214
International Application Number:	
Confirmation Number:	2324
Title of Invention:	Training and instructing support device
First Named Inventor/Applicant Name:	Eldad Shemesh
Customer Number:	20529
Filer:	Ari G. Zytcer
Filer Authorized By:	
Attorney Docket Number:	30024X
Receipt Date:	04-OCT-2010
Filing Date:	11-MAR-2009
Time Stamp:	13:51:27
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		rrr_30024X.pdf	65556 ee9491cb9f256001ef1ea73dca2425dff56b eb59	yes	3

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Response to Election / Restriction Filed	1	1
	Applicant Arguments/Remarks Made in an Amendment	2	3
Warnings:			
Information:			
Total Files Size (in bytes):		65556	
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>			



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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12/382,214

03/11/2009

Eldad Shemesh

30024X

2324

20529

7590

09/02/2010

THE NATH LAW GROUP

112 South West Street

Alexandria, VA 22314

EXAMINER

RICHMAN, GLENN E

ART UNIT

PAPER NUMBER

3764

MAIL DATE

DELIVERY MODE

09/02/2010

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 12/382,214	Applicant(s) SHEMESH ET AL.	
	Examiner /Glenn Richman/	Art Unit 3764	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 1 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☐ Claim(s) 1-35 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☐ Claim(s) ____ is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☒ Claim(s) 1-35 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) ☐ Notice of References Cited (PTO-892) | 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948) | 5) ☐ Notice of Informal Patent Application |
| 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date ____. | 6) ☐ Other: ____. |

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-18, drawn to a personal measuring device, classified in class 73, subclass 379.01.
- II. Claims 19-24, drawn to a system for instructing a plurality of participants, classified in class 434, subclass 247.
- III. Claims 25-30, drawn to a communication device for swimmers, classified in class 482, subclass 55.
- IV. Claims 31-35, drawn to a method of automated training, classified in class 701, subclass 206.

The inventions are distinct, each from the other because of the following reasons:

Inventions I-III and IV are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another and materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the process as claimed can be practiced by another and materially different apparatus or by hand.

Applicant is advised that the reply to this requirement to be complete must include (i) an election of a invention to be examined even though the requirement may be traversed (37 CFR 1.143) and (ii) identification of the claims encompassing the elected invention.

The election of an invention may be made with or without traverse. To reserve a right to petition, the election must be made with traverse. If the reply does not distinctly

and specifically point out supposed errors in the restriction requirement, the election shall be treated as an election without traverse. Traversal must be presented at the time of election in order to be considered timely. Failure to timely traverse the requirement will result in the loss of right to petition under 37 CFR 1.144. If claims are added after the election, applicant must indicate which of these claims are readable upon the elected invention.

Should applicant traverse on the ground that the inventions are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the inventions to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

A telephone call was made to Gary Nath on 8/30/10 to request an oral election to the above restriction requirement, but did not result in an election being made.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to /Glenn Richman/ whose telephone number is 571-272-4981. The examiner can normally be reached on Mon-Thurs.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, LoAn Thanh can be reached on (571)272-4966. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/Glenn Richman/
Primary Examiner
Art Unit 3764



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/382,214	03/11/2009	Eldad Shemesh	30024X

CONFIRMATION NO. 2324

PUBLICATION NOTICE



OC000000037958912

20529
THE NATH LAW GROUP
112 South West Street
Alexandria, VA 22314

Title: Training and instructing support device

Publication No. US-2009-0239710-A1

Publication Date: 09/24/2009

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

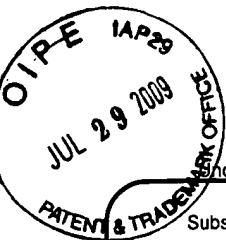
The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <http://pair.uspto.gov/>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



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Substitute for form 1449A/PTO

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**

(Use as many sheets as necessary)

Sheet 1

of 1

Complete if Known

Application Number	12/382,214
Filing Date	March 11, 2009
First Named Inventor	Eldad SHEMESH, et al.
Art Unit	3715
Examiner Name	TBD
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		Number-Kind Code ² (if known)			
	1	US- 5,685,722 A	11-11-1997	Serge TABA	
	2	US- 5,600,730 A	02-04-1997	Peggy J. KENNING, et al.	
	3	US- 5,314,389 A	05-24-1994	Simon DOTAN	
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	1	WO 01/00281 A2	01-04-2001	Trakus, Inc.		
	2	WO 01/10508 A1	02-15-2001	Smith & Nephew PLC		
	3	WO 01/42809 A2	06-14-2001	Esport Incorporated		
	4	WO 2004/038336 A1	05-06-2004	Clothing Plus OY		
	5	WO 00/67858 A1	11-16-2000	Mynhardt		

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(54) Title: **PERFORMANCE MONITORING SYSTEM**

(57) Abstract: The invention, in one embodiment, is directed to a performance measurement system comprising a first player-mounted device and a first field-positioned device. The first player-mounted device includes sensors adapted for automatically collecting sensor information from the first player, and a player transceiver adapted to wirelessly transmit and receive information. The first field-positioned device is adapted to be located in a first stationary position and includes, a field transceiver adapted to receive at least one of the first player sensor data and the performance parameters, and to transmit at least one of the performance parameters and messages to the first player-mounted device. In other embodiments, the system includes display devices and a central processor.

PERFORMANCE MONITORING SYSTEM

Field of the Invention

The invention relates generally to the field of performance monitoring. More specifically, the invention relates to systems and methods for monitoring player
5 performance in sporting events and recreational activities.

Reference to Related Applications

This application claims priority to provisional U.S. patent application 60/141,484, filed on June 29, 1999. This application is a continuation-in-part of U.S. patent application 09/027,430, filed on February 20, 1998, which itself claims priority to
10 provisional U.S. patent application number 60/039,182, filed on February 27, 1997. This application is also a continuation-in-part of U.S. patent application 09/398,157, filed on September 16, 1999, which itself claims priority to provisional U.S. patent application number 60/100,716, filed on September 17, 1998. The entire disclosure of each of the above referenced applications is hereby incorporated by reference.

Background of the Invention

Devices such as timers are used to measure player performance in various sporting events. For example, runners use timers to measure their performance against previous performances, targeted or expected performance, and against other runners. Small digital timers are available which include the functionality of a stopwatch, as well
20 as more advanced functions. Some of these advanced functions included measuring split times as well as elapsed time, displaying the time of day, providing a basic calculator, and providing alarm functions. Generally, these digital timers are embodied in a wristwatch worn by the player. To time an event, the player typically depresses protruding buttons on the watch. For example, to start the timer, the player depresses one

button. To stop the timer or record a split, the player depresses the same or another button. The user typically physically depresses buttons on the watch for the timer to function. This can lead to inaccurate time reporting since the player may depress a button too early or too late. Also, although the timers optionally show split times, the data is of limited usefulness. For example, no data relating to other players is available for display. Furthermore, typically, the functions of the digital timer are performed locally, and there is no remote access to the timer.

Advances in digital electronics have made it possible to design small advanced circuits, such as data storage cameras, phones, MP3 players, and computers that are embedded in digital wrist watches. Data storage circuits have been used, for example to store names, addresses, and telephone numbers. Other technological advances have provided wrist-worn heart rate monitors and global positioning system (GPS) receivers. GPS receivers track and display a player's position. However, that data is typically only available locally to the player. Also, conventional GPS tracking systems fail to track performance data automatically. Limited range two-way radios are available that can be worn on a player's arm. Recently, wireless telephones have been introduced that are also small enough to be worn by a player. These devices also fail to monitor player performance parameters.

Other advances include passive devices that identify runners or marathoners as they pass over active mats located throughout the course. Some of these devices are typically worn on the shoe and are detected by the mat as long as the device passes over the mat. This range is typically about one meter. One such device, also referred to as a tag, is used to time marathoners at different locations along a marathon route. A central computer individually identifies each tag. That identification is cross-referenced to the individual marathoner. Although useful by supporters to track the marathoner's position, this device fails to offer the individual marathoner any feedback regarding his performance, position in the race, or pulse rate, for example. Accordingly an object of the invention is to provide an improved player performance monitoring system that addresses deficiencies in conventional systems.

Summary of the Invention

Briefly, the invention is directed to a performance measuring system. In one embodiment the system of the invention includes player-mounted devices and a plurality of field-positioned devices that feed a central processor and data access or display devices. According to a further embodiment, the performance measuring system monitors the performance of virtually any participant in any type of sporting or recreational activity. Illustratively, according to a preferred embodiment, the system may be used to monitor the performance of people, animals or even vehicles (generally referred to as "players" or "track objects"). By way of example, monitored activities may include, running, skiing, swimming, baseball, hiking, sailing, rowing, basketball, hockey, ice skating, roller skating, skateboarding, soccer, football, tennis, boxing, martial arts, motor sports, horse racing, dog racing, track and field events, racquetball, squash, badminton, volleyball, tug-of-war, weight lifting, bodybuilding, paddleball, handball, and the like. In another example, the system is used to monitor a child's activity or position. Alternatively, the system is used to monitor a child's heart rate or other vital signs.

The player-mounted device contains circuitry that uniquely identifies the instance of the player-mounted device and storage for the user's identification. Circuitry provides for keeping track of time, measuring, storing and processing parameters, and circuitry to transmit and receive data between the device and the outside world. According to one embodiment, the player-mounted device includes sensors, a transceiver, an antenna, a processor, and a display.

A player-mounted device may be mounted in a variety of manners. By way of example, it can be mounted to a player's torso, head, neck, arm or leg. It may also be mounted to player apparel, such as a shirt, pants, glove, helmet, saddle, shoe, or the like. It may also be mounted to equipment, such as a goal, stick, racket, bat, ski, ski board, surf board, ice skate, roller skate, skateboard, puck, ball, or the like. It may also be mounted to a vehicle, such as a bicycle, motorcycle, car, airplane, boat, personal watercraft, snowmobile, or the like.

The sensors can be, for example, pulse rate sensors, blood pressure monitors, glucose monitors and accelerometers. Thus, each player-mounted device can monitor a variety of performance parameters of the player to which it is mounted. Parameters may include for example, heart rate, blood pressure, glucose level, speed, direction, acceleration, rotation, force of impact, elapsed time, split time, hang time in the air, ranking in a competition, position on a course, and the like. The data acquisition sensors collect some of the raw data needed to measure performance parameters. The player-mounted device collects other raw data by interacting with the field-positioned devices to track the time that it takes to travel between various field-positioned devices. In some embodiments, the player processor processes the raw data to determine the performance parameters for the player. In other embodiments, the field-positioned devices perform the processing of the raw data. As a player comes within communication range of a field-positioned device, the player transceiver wirelessly transmits either the raw data, the performance parameters, or some combination of each to the field-positioned device by way of the player antenna. According to one feature, the field-positioned device transmits the processed performance data back to one or more of the player-mounted devices. According to one aspect, the player display displays selected performance parameters of the player to which the device is mounted. According to another aspect, the player display displays selected performance parameters of other players. The displayed parameters may either be received from the field-positioned devices or derived internally. According to another feature, the player-mounted device may include a control/data input mechanism, such as a miniature keypad or one or more pushbuttons. Optionally, the player can enter initial conditions, change the information displayed, and/or request additional performance parameters from the field-positioned devices. Each player-mounted device can be programmed with a unique identification code, which can be transmitted to the field-positioned devices, so that the field-positioned devices can correlate each player-mounted device with a particular player and also identify from which player-mounted device it is receiving data.

Player-mounted device preferences and settings are programmed wirelessly through the data interface. Parameters such as race category (*e.g.*, Masters) are stored in the watch. Also, the users' preferences for the watch alarms, time of day, messaging, etc.

are programmed remotely through this interface. In another embodiment, the users' preferences are programmed locally in the player-mounted device. In yet another embodiment, the programming is done via an optional interface port on the player-mounted device.

5 The field-positioned devices are located proximate to the area of the activity being monitored. These devices are used as fixed position references, to receive data from the player-mounted devices, and to send data including setup information, time of day, messages, and race rank to the player-mounted devices. The field-positioned devices also collect data from the central processor reflecting activity at other field-positioned devices
10 and messages that need to be sent. By way of example, the field-positioned devices may be located, for example, along the perimeter of a playing field, course, track, court, pool, arena, or the like. As skilled artisans will appreciate, the number of field-positioned devices depends at least in part on the size of the area of the activity.

Typically, the field-positioned device will transmit the time and other information
15 to the player-mounted device which will then calculate its split and position in the race. The field-positioned devices operate autonomously and are typically administered remotely and therefore do not require a user interface (keyboard, mouse, and display). According to a further embodiment, the field-positioned devices include a processor, transceiver, antenna, display, keyboard/mouse, and memory. The transceiver enables the
20 field-positioned device to wirelessly communicate with the player-mounted devices. Optionally, the field-positioned devices also wirelessly communicate with the central processor to synchronize timing signals and share player performance information. Communication from the field-positioned device to the central processor can occur with any of a variety of standard techniques used to communicate data among computers:
25 Ethernet, IEEE 802.11 WLAN, fiber optics, IRDA, parallel and serial data, etc.

According to a further feature, the field-positioned devices may also include a global positioning satellite system (GPS) receiver to establish a common timing signal between the field-positioned devices. The GPS receiver may also be used to establish the precise position of the field-positioned devices.

According to another feature, the field-positioned devices include a wired or wireless communication link to the Internet so that the performance measurement system of the invention can post performance information, for either interested or paying parties, at a Web site. With such an Internet connection, the field-positioned devices can also
5 relay communications received from the Internet to one or more of the player-mounted devices. Typically, administrator functions are accomplished remotely via the network connection from a central location.

In one preferred embodiment, a display is available for displaying performance information to event spectators, such as coaches, athletes, scouts, officials, or anyone
10 observing the event, in substantially real-time. According to another feature, the field-positioned devices may include a user keyboard and display to enable fans to interact with the system and data or for a system administrator to configure and monitor the operation of each field-positioned device.

In some embodiments, the player positioning system includes a central processor,
15 which may be used to configure the performance monitoring system, monitor its health, interface with data access and display devices, and to perform some or all of the processing of the data from the player-mounted devices. In one embodiment, the central processor assigns unique identification codes to each of the player-mounted devices. According to another embodiment, the player-mounted devices supply the central
20 processor with their unique identification codes. Either way, the unique identification codes may be used to avoid communication collisions when the field-positioned devices communicate with the player-mounted devices.

According to a further feature, the field-positioned devices are in direct wireless communication with the central processor. Thus, the central processor can provide the
25 field-positioned devices with unique identification codes of the player-mounted devices. Alternatively, the field-positioned devices can assign or collect the player-mounted device unique identification codes, and provide those codes to the central processor. According to another feature, the field-positioned devices use the wireless connection with the central processor to pass the raw data to the central processor. The central

processor processes the raw data and passes processed performance parameters back to the field-positioned devices. In some embodiments, the functionality of the central processor is incorporated into one or more of the field-positioned devices.

5 According to another embodiment, the performance monitoring system of the invention includes an Internet Web server computer, and the central processor includes an Internet connection for communicating with the Web server computer. Such communications may include providing performance parameters to the Web server computer and/or relaying messages between Internet users and the players by way of the field-positioned devices. By connecting to the Web server, interested or paying parties
10 can gain access, download and print the performance parameters. The Web server computer can also make the performance parameters available to the players at the end of the monitored activity. According to another feature, the Web server enables players to register for particular activities by way of an Internet connection.

During setup the central processor or devices connected to it are used to transfer
15 athlete preferences and race-specific setup information into the player-mounted device. According to one preferred embodiment, the data collected by the system from the players can be accessed by a variety of client devices for entertainment, training, or informational purposes. Such devices connect to the central processor to obtain data and present the data, for example, in the form of an Internet Web page, a television graphic,
20 an interactive television feed to the home, a video game, or the like. These clients can also send data back to the central processor for forwarding to the player in the area of the activity. For example, a user at home might locate a friend running a marathon from a Web browser and then send an encouraging message to his/her player-mounted device.

As skilled artisans will appreciate, the invention also provides associated methods
25 for the performing functions of the above briefly described performance monitoring system. Other features of the invention are discussed below in relation to the illustrative drawings.

Brief Description of the Drawings

Figure 1 is a conceptual block diagram depicting exemplary components of an illustrative performance monitoring system according to the invention;

5 Figure 2A is a conceptual diagram of one illustrative application of the performance monitoring system of Figure 1;

Figure 2B is a conceptual diagram of another illustrative application of the performance monitoring system of Figure 1;

Figure 2C is a conceptual diagram of another illustrative application of the performance monitoring system of Figure 1;

10 Figure 3 is a block diagram of an illustrative player-mounted device of the type employed in the performance monitoring system of Figure 1;

Figure 4A depicts an illustrative physical embodiment of the player-mounted device of Figure 3;

15 Figure 4B depicts an illustrative display portion of the player-mounted device of Figure 3;

Figure 4C depicts another illustrative display portion of the player-mounted device of Figure 3;

Figure 5 is a block diagram of an illustrative field-positioned device of the type employed in the performance monitoring system of Figure 1; and

20 Figure 6 is a block diagram of an illustrative central processor of the type optionally employed in the performance monitoring system of Figure 1.

Description of the Illustrative Embodiment

Figure 1 depicts a simplified block diagram of a performance measurement system 100 according to an illustrative embodiment of the invention. The illustrative

performance measurement system 100 includes a player-mounted device 102, and a field-positioned device 104. In an optional embodiment, the system further includes a central processor 106. The central processor 106, in an alternate embodiment, is integrated within the field-positioned device 104. Alternatively, the central processor 106 is further
5 coupled to a network 105. The network 105 may be connected to various network devices including, a Web server 107, a Web client 109, a video game client 111, a wireless client 113, and a TV client 115. As described briefly above, the performance measurement system 100 can monitor the performance of people, animals or even vehicles (generally referred to as “players” or “track objects”) in virtually any type of
10 sporting or recreational activity.

In operation, the player-mounted device 102 mounts in any number of ways to a player, and collects raw data related to the player’s performance and position. In the preferred embodiment, the player-mounted device 102 processes the raw collected data prior to transmission. This processing may include, for example, formatting the data for
15 transmission, error-checking, or compressing the data. The field-positioned devices 104 are located proximate to and around or along the course of the sporting or recreational activity. In the preferred embodiment, the player-mounted device 102 receives time of day messages from field-positioned devices 104 and uses these to calculate splits and position in the race. The player-mounted device 102 receives setup and control messages
20 by the same means. In the preferred embodiment the player-mounted device 102 additionally processes and packages identification code, sensor measurements, and other data and transmits it to a proximate field-positioned device 104. In another embodiment, the field-positioned device 104 acquires data including timing and position data related to a player or players.

25 In another illustrative operation, the player-mounted device 102 transmits raw data to the nearest field-positioned device 104. In alternative operation, the field-positioned device 104 processes the raw data to determine performance parameters and then transmits the performance parameters to the player-mounted device 102, or alternatively, to another field-positioned device 104. In another embodiment, the player-
30 mounted device 102 preprocesses raw data before transmission. The preprocessing can

include, for example, data error correction, data formatting, data compression and the like. For example, the field-positioned device can hold advanced receiver, signal processing capabilities, and the more power hungry circuitry required to multilaterate the player-mounted device 102.

5 In response to receiving performance parameters, the field-positioned device can display select performance parameters for spectator viewing. The field-positioned device 104 can also transmit the performance parameters to the optional central processor 106. The central processor 106 optionally displays the performance parameters. Alternatively, the central processor 106 routes the data to the network 105. In illustrative embodiments,
10 the network 105 is an Ethernet in a local area network or a wide area network. Optional network devices may be coupled to the network 105.

In response to receiving raw or preprocessed data, the field-positioned device 104 processes the data into performance parameters for storage, display, or analysis. Alternatively, the field-positioned device 104 displays selected parameters for spectator
15 viewing and transmits at least some of the performance parameters back to one or more of the player-mounted devices 102. Alternatively, the field-positioned device 104 transmits the raw or preprocessed data to the central processor 106, which processes the data to determine the various performance parameters. The central processor 106 transmits the performance to one or more of the field-positioned devices 104 and/or one
20 or more of the player-mounted devices 102.

In the illustrative embodiment, player-mounted device 102 passes a first field-positioned device 104. The field-positioned device 104 updates or refreshes the internal clock of player-mounted device 102. Additionally, the first field-positioned device 104 records the time the player-mounted device 102 reached it. The first field-positioned
25 device 104 transmits that recorded time to the central processor 106. In one embodiment, the central processor knows the location of the first field-positioned device 104. In another embodiment, the first field-positioned device transmits location data to the central processor 106. The player-mounted device 102 then passes a second field-positioned device 104. The second field-positioned device 104 updates or refreshes the

internal clock of player-mounted device 102. Additionally, the second field-positioned device 104 records the time the player-mounted device 102 reached it. The second field-positioned device 104 transmits that recorded time to the central processor 106. In one embodiment, the central processor 106 knows the location of the second field-positioned device 104. In another embodiment, the second field-positioned device 104 transmits location data to the central processor 106. The central processor 106 then calculates the time elapsed between the player reaching the first field-positioned device 104 and the player reaching the second field-positioned device 104. The central processor 106 transmits the calculated data to the second field-positioned device 104. The second field-positioned device 104 transmits the calculated data to the player-mounted device 102.

In further operation, and as discussed in more detail below, the central processor 106 also provides the performance parameters to the network 105. The network 105 is optionally coupled to network devices. The network devices include, for example, a Web server 107. Another network device includes a Web client 109. A Web client 109 includes a computer with an Internet navigation program. Still another network device includes a video game client 111. The video game client 111 may include, for example, a computer-based client, a video game console, a portable video game, or a handheld video game. Yet another network device includes a wireless client 113. The wireless client 113 may include, for example, a personal digital assistant (PDA), a wireless telephone, a pager, or a two-way pager. Another network device includes a TV client 115. The TV client 115 includes, for example, enhanced TV, Web TV, or interactive TV. Additionally, a television broadcast company, such as a television network, could optionally download and broadcast performance data. Further clients may include, for example, a scoreboard indicator, a scoreboard graphical display, a printer, or the like. Operation of the system 100 is discussed in further detail below.

Figure 2A illustrates a conceptual diagram of the performance monitoring system 200 according to one embodiment of the present invention. The system 200 includes at least one player-mounted device 202. In one embodiment, the player-mounted device 202 is worn on the wrist of the player 216. In another embodiment, a device 202' comprising a transceiver is worn on the shoe or foot of the player 216. The player-

mounted device 202 comprises the transceiver circuitry as well as a visual display for viewing data. In an alternate embodiment, the player-mounted device 202 includes audio circuitry for generating sound. An audio transducer (beeper), earphones or a built-in speaker relay the sound data to the user. The sound data may be in the form of tones,
5 spoken language or music, for example.

Figure 2A-2C also depicts various media 201 in which the event or activity is taking place. In alternative embodiments, the media 201, for example, is a field, a road, a track, a body of water, a ski slope, a desert, a forest, a wilderness, a beach, or the like. The performance monitoring system 200 further includes field-positioned devices 206
10 placed at various locations around or along the medium 201. In another embodiment, the field-positioned devices 206 are known as tower transceivers (TTs). The field-positioned devices 206 include transceiver circuitry as well as a processor and memory for data storage, manipulation and forwarding. In another embodiment, the field-positioned devices 206 include a display 212 adapted for viewing by the player 216. The display
15 212, in one embodiment, is a large screen display as is commonly used for scoring at events. In another embodiment, supporters can send messages to the player via the network 105 (e.g., from the Internet). The player 216 views the messages, along with her performance data, as she passes the display 212 or on the player-mounted device 202.

In one embodiment, the field-positioned devices 206 are located at regular
20 intervals along the medium 201. In another embodiment, the field-positioned devices 206 are located at uneven intervals along the medium 201. In yet another embodiment, the field-positioned device 206 includes a sensor strip 204 located on the medium 201. The players 216 pass over the sensor strip 204 during the event. When the players 216 with a player-mounted device 202 come within range of a field-positioned device 206,
25 data is transmitted between the player-mounted device 202 and the field-positioned device 206. In another embodiment, the field-positioned device 206 includes an antenna 208 for transmitting and receiving data. In yet another embodiment, the field-positioned device 206 is a fixed transceiver 214. The tower transceiver 214 is substantially a permanent fixture including a transceiver, an antenna 208, and a connection to the
30 network 105 of Figure 1.

The signal transmitted by the player-mounted device 202 to the field-positioned device 206 includes a unique identifier of the player-mounted device 202, identification of the player 216 and his race category, splits, and measured parameters such as x, y, z location, heart rate, blood pressure, ambient temperature, arm speed, or bat speed, for example. The data transmitted by the field-positioned device 206 to the player-mounted device 202 includes time of day, elapsed time, runners that have passed already, interval or split time, pace, distance traveled, distance left in event, calories burned, distance to next refreshment, and position in race, for example.

In another embodiment, the field-positioned device 206 is mounted in a moving vehicle 210. The moving vehicle 210 is a car, truck, van, motorcycle or any vehicle for mounting the field-positioned device 206. In one embodiment, the moving vehicle follows the player 216 and the location of the vehicle 210 is found by GPS or similar system. This embodiment wirelessly provides a virtually continuous update of player position over large geographical areas. In another embodiment, several vehicles 210 are stationed along the route. After the last player 216 passes the stationary vehicle 210, it moves to another location in the route. By utilizing several vehicles 210, fewer field-positioned devices 206 are required to monitor a race, for example.

In one embodiment, the player-mounted device 202 includes a GPS circuit which receives signals from the GPS satellites 218. The GPS circuit along with the field-positioned devices 206, generate precise position information of each player 216. Processing can take place in the player-mounted device 202 or the signal can be transmitted to a field-positioned device 206 for more powerful processing with the benefit of not loading the player-mounted battery 202.

An optional embodiment of the system 200 includes a central processor 203. The central processor 203 comprises an antenna 211, a transceiver, a processor, and a database, for example. In one embodiment, the central processor 203 programs each of the player-mounted devices 202 with a unique identifier. In another embodiment, the central processor 203 initializes and synchronizes the field-positioned devices 206. In yet another embodiment, the central processor 203 comprises a database which includes all

of the data relating to the players 216 and the event. The central processor 203 further includes a processor 207 for processing and retrieving data from the database 213. In another embodiment, the central processor 203 receives data from the field-positioned devices 206 through an antenna 211. The antenna 211 is coupled to a transceiver. The transceiver is adapted to receive and route data to the processor 207. In another embodiment, the transceiver 209 transmits data from the processor 207 to the field-positioned devices 206. In alternate embodiments, the processor is a PC-based computer, a workstation, or a server, for example. In another embodiment, the processor includes a graphical user interface (GUI).

10 In one embodiment, the central processor 203 transmits data wirelessly to the network 105. In another embodiment, the central processor 203 transmits data to the network 105 via a hardwire link. In still another embodiment, the central processor 203 processes raw data received from the field-positioned devices 206 and generates statistics based on that raw data. The central processor 203 transmits the statistics to the field-positioned devices 206. The central processor 203 further transmits voice or data messages to the field-positioned devices 206. The field-positioned devices 206 relay the messages to the specific player-mounted device 202. In another embodiment, the system 200 may send some or all of the player-mounted devices 202 the same message, such as "Race Over."

20 Figure 2B illustrates another embodiment of the system 200' of the present invention. In this embodiment, medium 201' is water. The water may be a lake, river, ocean, channel, or any suitable body of water. In one embodiment, the player-mounted device 202 is waterproof. In another embodiment, the player-mounted device 202 is waterproof to 300 meters below the surface of the water. In yet another embodiment, the player-mounted device 202 is adapted for use on the wrist of the player 216. In still another embodiment, the player-mounted device 202''' is adapted for use in the goggles of the player 216. In this embodiment the player-mounted device 202''' is adapted to display the data on the lens of the goggle while also allowing the player 216 to view the surrounding environment 201'.

At least one buoy 220 including a transceiver and an antenna 208 is located along the course. The buoy 220 functions as a field-positioned device 206 for the water. The buoy 220 is anchored to remain substantially stationary. In another embodiment, the buoy 220 is free to float with the tide. In yet another embodiment, a boat tows the buoy 220. In this embodiment, the player 216 swims past the buoy 220. As the player 216 reaches the buoy 220, data is both transmitted and received between the player-mounted device 220 and the transceiver within the buoy 220. In one embodiment, the data includes a distress signal sent by the player 216. The distress signal alerts nearby rescue boats that the player 216 is in trouble. In another embodiment, the player-mounted device 202 transmits data including water temperature to the buoy 220. In an alternate embodiment, the boat 218 is adapted to transmit and receive data in conjunction with the player-mounted device 202. Alternatively, a plurality of boats 218 is anchored along the course. Each boat 218 includes a field-positioned device 206. In another embodiment, boat 218 follows player 216 along the course.

Figure 2C illustrates an alternative embodiment of the system 200'' of the present invention. In this embodiment, the medium 201'' is snow. The player 216 is wearing skis 224. In one embodiment, the player 216 wears the player-mounted device 202 on her arm. In another embodiment, the player-mounted device 202'' is mounted to one of the skis 224. In yet another embodiment, the player-mounted device 202''' is incorporated into goggles worn by the player 216. The performance data is displayed on at least one of the lenses of the goggles while allowing the user to simultaneously view the surrounding environment 201''. The embodiment further includes field-positioned devices 222 located along the course. The field-positioned devices 222 include the transceivers as well as antennas 208. In another embodiment, snowmobiles (not shown) including field-positioned devices are located along the course.

In one embodiment, the position and performance information is transmitted to a central processor 203 which downloads the data to a database. In another embodiment, the information is adapted for viewing over the Internet.

Figure 3 is a block diagram of an illustrative player-mounted device 102 of the type employed in the performance monitoring system 100 of Figure 1. The player-mounted device 102 illustratively includes a processor 308, a transceiver 306, an antenna 302, a display 314, a digital memory 310, a data acquisition subsystem 312, a
5 beeper/speaker subsystem 316, and a power source 320. Optionally, the illustrative player-mounted device 102 also includes control inputs and a voice actuated control/data input.

As mentioned above, the player-mounted device 102 monitors performance parameters in virtually any sport or recreational activity, including for example, running,
10 skiing, swimming, baseball, hiking, sailing, rowing, basketball, hockey, ice skating, roller skating, skateboarding, soccer, football, tennis, boxing, martial arts, motor sports, horse racing, dog racing, track and field events, racquetball, squash, badminton, volleyball, tug-of-war, weight lifting, bodybuilding, paddleball, handball, and the like. In further embodiments, the player mounted device 102 can monitor military maneuvers. As also
15 mentioned above, according to the illustrative embodiment, the player-mounted device 102 may be mounted in a variety of manners. By way of example, it can be mounted to a player's torso, head, neck, arm or leg. It may also be mounted to player apparel, such as a shirt, pants, padding, glove, helmet, saddle, shoe, skate, or the like. It may also be mounted to equipment, such as a goal, stick, racket, bat, ski, ski board, surf board,
20 skateboard, or the like. It may also be mounted to a vehicle, such as a bicycle, motorcycle, car, airplane, boat, personal watercraft, snowmobile, or the like. In some embodiments, the player-mounted device 102 is referred to as a "player patch."

According to the illustrative embodiment, the antenna 302 is a 902-928 MHz antenna. The antenna 302 may be, for example, a patch antenna, a stub, or a dipole
25 antenna. Other frequencies can, of course, be used depending on requirements. In a preferred embodiment, the player antenna 302 couples to a diplexer or switch. This coupling serves to isolate the transmit signals from the receive signals. In one mode of operation, the illustrative player-mounted device 102 transmits and receives information in half-duplex mode. In that embodiment, the transmit and receive modes are mutually
30 exclusive and are individually software-controlled. In another mode of operation, the

player-mounted device 102 transmits and receives information in full-duplex mode. In this embodiment, the transmit and receive modes operate simultaneously.

The transceiver 306 down converts incoming radio frequency (RF) signals from the antenna 302 from 916 MHz to a baseband or intermediate frequency (IF) of 10.7
5 MHz. The signal is then demodulated into a corresponding bit stream by a demodulator. The transceiver 306 sends the bit stream to the processor 308. In one embodiment, the demodulator is included in a single-chip transceiver. One such player transceiver is the TRF6900 RF transceiver, available from Texas Instruments, Inc., Dallas, Texas. The illustrative player transceiver 306 further includes a direct digital synthesizer (DDS). The
10 DDS acts as the local oscillator for both up- and down-conversion of the data signals

The processor 308 is adapted to perform a plurality of functions. For example, the processor 308 controls the operation of the transceiver 306. The processor 308 also interfaces to stored memory 310 to access stored information. The processor 308 is further adapted to receive data from the sensors and data acquisition block 312, and to
15 format that data for transmission to the field-positioned device 104 according to a protocol or for the purposes of compression and/or error detection and correction. The processor 308 also interfaces to the display 314 and the beeper/speaker 316 subsystems. The display 314 and the beeper 316 subsystems are adapted to relay data to the user 216. The processor 308 further controls system timing, including a power saving sleep mode.
20 In an alternative embodiment, the processor 308 also synchronizes received bit streams. The processor 308 also decodes and routes data. In another embodiment, the processor 308 performs compression, error detection and error correction. The processor 308 also organizes upstream data words into proper packet formats for modulation and transmission. Additionally, the processor 308 changes transmit and receive frequency by
25 setting the DDS. In the illustrative embodiment, the processor 308 is an MSP430 micro-controller, manufactured by Texas Instruments, Inc., Dallas, Texas.

Illustratively, the digital memory subsystem 310 includes an electrically erasable programmable read only memory (EEPROM). By way of example, the EEPROM may store non-volatile information such as instructions to be executed by processor 308,

device, user, and/or event information. The memory 310 may also include random access memory (RAM) for the temporary storage of raw data, monitored parameters and other volatile data. In some embodiments, the memory subsystem 310 is integrated into the processor 308.

5 The sensor and data acquisition block 312 comprises sensors or modules for making measurements of interesting parameters. By way of example, the sensors may include a multi-axis accelerometer to measure and calculate acceleration, stride length, velocity, the force of an impact, such as boxer's punch; a gyro can be used to measure the rotation of a figure skater; the radial and axial forces to which a player, such as a race car
10 or driver, are subjected; the bat speed of a baseball player, or the arm speed of a player, such as a pitcher or a quarterback. A heart sensor enables cardiac parameters such as heart rate to be measured. A temperature sensor can measure ambient air temperature or body temperature. A glucose sensor could be used to monitor blood glucose levels. A pressure sensor can be used to monitor, for example, the depth of the diver in diving or
15 scuba events. An altimeter may be included to measure, the players altitude, for example, in mountain climbing events. As discussed briefly above, and as skilled practitioners will appreciate, many other sensing and monitoring devices can be employed in the data acquisition subsystem 312 to enable calculation of a variety of performance parameters. For example, the system 100 can measure and calculate blood pressure, speed, direction,
20 rotation, strength, elapsed time, split time, hang time, heart waveforms, brain waveforms, ranking in a competition, and the like.

 In one embodiment, the processor 308 receives data from the sensor and data acquisition block 312. The processor 308 processes the data. The player transceiver 306 transmits the processed data to the field-positioned device 104. In another embodiment,
25 the player-mounted device 102 transmits raw data from the sensors to the field-positioned device 104. The field-positioned device 104 then processes the raw data. In another embodiment, the data acquisition sensors collect a portion of the raw data needed to measure performance parameters. In another embodiment, the player-mounted device 102 collects other data by interacting with the field-positioned devices 104. In other
30 embodiments, the processor 308 processes the raw data to determine the performance

parameters for the player. In other embodiments, the field-positioned devices 104 perform the processing of some or all of the raw data. As the player 216 comes within communication range of a field-positioned device 104, the player transceiver 306 wirelessly transmits either the raw data, the performance parameters, or some combination of each to the field-positioned device 104 by way of the player antenna 302. According to one feature, the field-positioned device 104 transmits processed performance data back to one or more of the player-mounted devices 300. According to one feature the field-positioned device 104 can measure or calculate player position and transmit it back to the player-mounted device or to the system for display. According to one feature the player-mounted device 102 can transmit signals it receives to the field-positioned device 104 in raw format for additional processing to determine its precise position without large demands on the battery.

The player display 314 and the beeper/speaker 316 are optionally used to convey information to the player 216. For example, the player display 214 may display real time, along with split times and elapsed time; present rank in event, heart rate, force of impact, temperature, identification information, or other performance parameter or raw data. In another embodiment, the player display 314 displays performance parameters of either the player to which the device 102 is mounted or of other players as specified during setup of the system 100, and either received from the field-positioned devices 104 or derived internally. The display 314 may also display messages from officials, coaches, team doctors, administrators, spectators, and the like. In one embodiment, the player display 314 is an LCD dot-matrix addressable module. In the illustrative embodiment, the Varitronix COG-12264I²C chip-on-glass LCD display module is used. Varitronix, of Hong Kong manufactures the illustrative player display 314. In another embodiment, the player display 314 is adapted to display both graphics and text. In alternate embodiments, the player display 314 is a monochrome or color display.

In the illustrative embodiment, the beeper/speaker 316 sounds an audible alarm at, for example, predefined checkpoints, at user settable times, or in response to the occurrence of user settable or predefined events. In one embodiment, the beeper is a piezoelectric buzzer. In another embodiment, the beeper is an audio transducer. In the

illustrative embodiment, the Star Micronics CUT or MZT series audio transducer is used. Star Micronics America, Incorporated of Edison, New Jersey manufactures the illustrative audio transducer 316.

In alternative embodiments, the beeper/speaker 316 is an audio speaker 316
5 enabling the processor 308 to generate synthesized voice, music, or other audible sounds. In yet another embodiment, the speaker 316 is integrated into a wireless headphone worn by the player 216. In a further embodiment, the headphone is hardwired to the player-mounted device 102. In a further embodiment, the headphone is used together with a
10 microphone to allow the player to send and receive short voice messages. According to another embodiment, by sending a voice message through the speaker 316, an animal trainer can command an animal player to which the player-mounted device 102 is fastened.

The control/data input interface 320 enables a player 216 to input data into the processor 308. In one embodiment, the input interface 320 includes a microphone, the
15 input data is audio in nature, and the processor 308 recognizes a limited set of audio commands. According to an alternative embodiment, the interface 320 includes an infrared port, adapted for communicating with a device having infrared transmission capabilities, such as a keyboard, laptop computer, personal digital assistant (PDA), electronic organizer, digital watch, or the like. In another embodiment, the infrared port
20 communicates with the field-positioned devices 104.

The control input 318 illustratively is a pushbutton interface that enables the player 216 to perform certain functions such as, for example, activating the backlight, responding to questions, and selecting the information to be displayed on the display 314. In the preferred embodiment a single control is used to control functionality. This makes
25 the player-mounted device 102 easy to use while the player is running, etc. More complex control and setup functions are then accomplished using the wireless link to a computer 104 or 106. In other embodiments, the player-mounted device 102 includes a plurality of control inputs 318. According to that embodiment, other advanced features such as back-lit illumination, and local time setting are available. Alternatively, the

control input 318 functions as a stopwatch control. In another embodiment, the control input 318 includes a miniature keypad. Optionally, the player can enter initial conditions, change the information displayed, send messages or respond to messages, and/or request additional performance parameters from the field-positioned devices 104.

5 The power source 320 supplies power to the various player-mounted device components. In one embodiment, the power source 320 employs a 3-volt lithium cell. In another embodiment, it employs one or more 1.5-volt alkaline cells. In one embodiment, the power source 320 includes a battery conditioning circuit to monitor, step-up, and regulate the output of a battery. Alternatively, the power source 320 includes a battery
10 supervisory circuit. The battery supervisory circuit includes "low battery" and "fault" indicators. This signal is supplied to processor 308 to control its modes and the player can be notified of battery level or condition through either the display 314 or the beeper/speaker subsystem 316

 As mentioned above, in some embodiments the player-mounted device 102
15 processes the raw data locally within processor 308 and displays processed data on player display 314, while in other embodiments the device 102 transmits the processed data to a field-positioned device 104. In yet another embodiment, the player-mounted device 102 includes a wireless communication link to a network. The wireless network link enables the player-mounted device 102 to transmit to and receive data from network devices 107-
20 115 for viewing.

 Figure 4A depicts a wrist-worn embodiment 400 of the player-mounted device 102. The wrist-worn embodiment 400 includes a display 314. The wrist-worn device 400 also includes a case 424 that houses the display 314, as well as some or all of the internal circuitry discussed above with respect to Figure 3. The case 424 is typically
25 manufactured from metal or plastic. In alternate embodiments, the case 424 is sweat proof, waterproof, and shock resistant. In another embodiment, the case 424 includes a scratchproof transparent window through which the display 314 can be viewed. In yet another embodiment, the window is tinted and/or polarized to minimize glare. The case and band also provide mounting for the antenna used to send and receive signals.

The illustrative case 424 also includes pushbuttons 426a-426c. In one embodiment, each of the pushbuttons 426a-426c activates different modes of the wrist-worn device 400. In another embodiment, one of the pushbuttons 426a-426c illuminates the player display 425. As described above with respect to the control input 318, the
5 pushbuttons 428a-426c individually and in combination can provide a plethora of functionality.

In another embodiment, the case 424 also includes at least one interface port 434. In exemplary embodiments, the interface port 434 provides at least one of an infrared port, a serial port, a keyboard/mouse port, a universal serial port (USB), or a printer port.
10 Because of size constraints, wireless interfaces to the device are preferable (e.g., IEEE802.11, Bluetooth, BodyLAN, IRDA, etc.).

The wrist-worn device 400 further includes a strap 428 and a buckle 430 for attaching the device 400 to the arm of a player 216. In alternate embodiments, the strap 428 is manufactured from plastic, metal, leather, or any suitable synthetic or natural
15 material. In alternative embodiments, the metal is titanium, steel, aluminum, gold, silver, platinum, or any suitable metal. In another embodiment, the strap 428 is a metal bracelet with a clasp. In another embodiment, the strap 428 is closed with Velcro.

Referring now to Figure 4B, therein is shown an alternative embodiment 314' of the player display 314. Data shown in Figure 4B is related to the current date and time of
20 day. The current date 402 is Friday the 18th. The current hour 404 is twelve o'clock. The current minute 406 is zero minutes. The current seconds 408 is eighteen seconds. The player display 314' further indicates the morning or afternoon 410. In another embodiment, the player display 314' can be displayed in 24 hour or military time format. In that case AM/PM indicator 410 is not displayed. In the preferred embodiment, the
25 player display 400 includes a field for displaying text or graphical messages 412. The text or graphical messages 412 may be received, by way of example, from a field-positioned device 104, the central processor 106, other wireless device. In alternative embodiments, the player 216 optionally displays messages 412 to himself or herself on the player display 314'.

Figure 4C depicts another alternative embodiment 314'' of the player display 314. Data shown in the display 314'' is related to sample performance parameters. For example, the current position 414 of this player is 153rd place. The current elapsed hours 416 is two hours. The current elapsed minutes 418 is twenty-six minutes. The current
5 elapsed seconds 420 is twenty seconds. Additionally, as shown at 422, the player 216 is averaging just over an eight-minute mile. As described above, virtually any parameter that can be monitored relating to an activity can be displayed in the player display 314.

Figure 5 illustrates a block diagram of an illustrative field-positioned device 104 of the type employed by the system 100 Figure 1. The field-positioned device 104
10 includes a transceiver 506, an antenna 502, a processor 508, and a power source 520. Alternate embodiments of the field-positioned device 104 include memory 510, a public display 514, a keyboard/mouse interface 512, a user display 526, a network connection 522, and a GPS receiver 524. In one embodiment, the antenna 502 is a dipole antenna. In another embodiment, the antenna 502 is flexible. In another embodiment, the antenna
15 502 is located remotely from the field-positioned device 104.

The field-positioned device 104 includes a transceiver 506. The transceiver 506 is coupled to antenna 502. In one embodiment, the field transceiver 506 includes a receiver section for receiving signals from the player-mounted device 102. The receiver section of the field transceiver 506 downconverts an incoming RF signal. A demodulator
20 included in the receiver section demodulates the RF signal into a data bit stream corresponding to the originally transmitted signal. The field transceiver 506 routes the data bit stream to the processor 508.

In one embodiment, the processor 508 processes the data received from the player-mounted device 102. In other embodiments, the processor 508 prepares new
25 requests for the player-mounted device 102, logs all player-mounted device 102 transactions, performs system housekeeping functions, processes data from the player-mounted device 102, and sends appropriate input to the public display 514 and the user display 526. In another embodiment, the processor 508 interprets raw data received from the data acquisition subsystem 312 of the player-mounted device 102. In yet another

embodiment, the processor 508 routes processed data to the field transceiver 506 for transmission to the player-mounted device 102. In other embodiments, the processor 508 is a PC-based computer system, a workstation, or a server. The field-positioned device 104 further includes a memory 510. The memory 510 is interfaced to the processor 508.

- 5 In an alternate embodiment, the memory 510 is integrated into the processor 508. In alternate embodiments, the memory 510 comprises random access memory RAM, read only memory ROM, or a disk or tape drive.

- The transceiver 506 includes a transmitter section. In one embodiment, the transmitter section includes a DDS. The DDS provides the carrier and determines the frequency of transmission to and reception from the player-mounted device 102. The transmitter section is coupled to the antenna 502. The antenna 502 sends the transmitted signal to the player-mounted device 102.

- In another embodiment, the network further interfaces to a public display 514. The public display 514 is adapted to display statistical information, player position, player identification, messages, and the like. In one embodiment, the public display 514 is a computer monitor. In another embodiment, the public display 514 is a large scoreboard display interfaced to the processor 508. The system can recognize the player, update statistics, and display messages and statistics on the scoreboard for the player as he passes. For example, the players' name might be displayed so the crowd could cheer for the Marathon runner by name. In another embodiment, the field-positioned device 104 further comprises a user display 526. The user display 526 is adapted to display statistical information, player position, player identification, messages, and the like. In one embodiment, the user display 526 is a computer monitor.

- The field-positioned device 104 further comprises a keyboard/mouse interface 512. The keyboard/mouse interface 512 is coupled to the processor 508. The interface 512 allows a user to input various parameters into the processor 508 or control its setup. For example, a user inputs parameters relating to configuring the system for specific events. In another embodiment, the interface 512 is integrated into the processor 508.

The field-positioned device 104 further comprises a power source 520. In one embodiment, the power source 520 is a battery. In another embodiment, the power source 520 is an alternating current (AC) source. In yet another embodiment, the power source 520 is a direct current (DC) source. In still another embodiment, the power source 520 comprises a solar cell. The power source is adapted to provide power to all active system components in the field-positioned device 104.

The field-positioned device 104 further includes an network link 522. The network link 522 is coupled to the processor 508. In one embodiment, the network link is adapted to allow users on the Internet to send messages to the player 216. The player 216 receives the message on the player-mounted device 102. The field-positioned device 104 transmits the message to the player-mounted device 102. In an alternate embodiment, the Internet link is adapted to allow system 100 to transmit data relating to an event to the Internet. Users logged onto the Internet can then view the data. In another embodiment, the network link allows data to be uploaded from the processor 508 to a local or remote server 107. In that embodiment, the server stores and processes the data. In an alternate embodiment, the remote server creates and serves dynamic web pages to Internet clients.

In one embodiment, the field-positioned device 104 further includes a GPS receiver 524. The GPS receiver 524 is coupled to the processor 508. Using orbiting satellites, the GPS receiver 524 can calculate its own position. The GPS receiver 524 is adapted to locate the field-positioned device 104, synchronize its clock to other field-positioned devices and send location data to the player-mounted device 102 or send location data to the central processor 106. In another embodiment, the GPS sends location data to the Internet via the Internet link 522.

Figure 6 is a block diagram of an illustrative central processor 106 of the type optionally employed in the performance monitoring system of Figure 1. The central processor 106 includes a transceiver 606, an antenna 211, a processor 608, and a database 610. Alternate embodiments of the central processor 106 include a user display 614, a keyboard/mouse interface 620, and an Internet link 622. In one embodiment, the antenna 602 is a monopole, patch or other largely omnidirectional antenna. In another

embodiment, the antenna 211 is flexible. In another embodiment, the antenna 211 is located remotely from the central processor 106.

5 The central processor 106 also includes a transceiver 606. The transceiver 606 is coupled to the antenna 602. In one embodiment, the transceiver 606 includes a receiver section for receiving signals from the field-positioned device 104. The receiver section of the transceiver 606 downconverts an incoming RF signal and a demodulator in the receiver section demodulates the RF signal into a data bit stream corresponding to the originally bit stream transmitted by the field-positioned device 104. This bit stream is routed to the processor 608.

10 In one embodiment, the processor 608 processes the data received from the field-positioned device 104. In other embodiments, the processor logs all player-mounted device 102 transactions, logs all field-positioned device 104 transactions, performs system housekeeping functions, processes data from the player-mounted device 102, processes data from the field-positioned devices 104, and sends appropriate input to the user display 614 or other networked display devices 107-115. In another embodiment, 15 the processor 608 interprets raw data received from the data acquisition subsystem 312 of the player-mounted device 102. In yet another embodiment, the processor 608 routes processed data to the field-positioned device 104 for transmission to the player-mounted device 102. In other embodiments, the processor 608 is a PC-based computer system, a workstation, or a server. The central processor 106 further includes a database 610. The database 610 is interfaced to the processor 608. In an alternate embodiment, the database 610 is integrated into the processor 608. In alternate embodiments, the database 610 comprises random access memory RAM, read only memory ROM, or a disk or tape drive. Alternatively, the database 610 is a database server. 20

25 The transceiver 606 includes a transmitter section. In one embodiment, the transmitter section includes a DDS. The DDS acts as the local oscillator onto which is modulated baseband data from the processor 608 at the carrier frequency for transmission to the field-position device 104. The transmitter section is coupled to the antenna 602. The antenna 602 sends the transmitted signal to the field-positioned device 104.

In another embodiment, the processor 608 further connects to a user display 614. The user display 614 is adapted to display statistical information, player position, player identification, messages, and the like. In one embodiment, the user display 614 is a computer monitor running software that presents the data interactively. In another
5 embodiment, the user display 614 is a flat screen display.

The central processor 106 further comprises a keyboard/mouse interface 620. The keyboard/mouse interface 620 is coupled to the processor 608. The interface 620 allows a user to input various parameters into the processor 608. For example, a user inputs parameters relating to configuring the system for specific events or queries the system for
10 status and health data. In another embodiment, the interface 620 is integrated into the processor 608.

The central processor 106 further includes an LAN or WAN (Internet) link 622. The Internet link 622 is coupled to the processor 608. In one embodiment, the network link is adapted to allow users on the network to send messages to the player 216. The
15 player 216 receives the message on the player-mounted device 102. The central processor 106 transmits the message to the field-positioned device 104, which transmits the message to the player-mounted device 102. In an alternate embodiment, the network link is adapted to allow the central processor 106 to transmit data relating to an event to the Internet. Users logged onto the Internet can then view the data. In another
20 embodiment, the network link allows data to be uploaded from the processor 608 to a local or remote server 107. In that embodiment, the remote server stores, processes, and serves the data. In an alternate embodiment, the remote server hosts the Internet site containing the processed data.

One embodiment of the operation of the system 100 is as follows. An event
25 includes a sporting event, such as baseball, football, soccer, hockey, track and field, a marathon, a triathlon, boxing, karate, swimming, skating, cycling, racing, and wrestling, for example. At event also includes recreational events, such as hiking, climbing, hunting, bungee jumping, and walking, for example.

In the initial stage of an event, a database 610, located in the field-positioned device 104 or, alternatively, in the central processor 106, relates each specific player-mounted device 102 to the user 216 wearing it. The player-mounted devices 102 are linked in the database 610 to pertinent user information (e.g., athlete's name, vital
5 statistics, historical performance information, etc.). The user information is either soft- or hard-coded into the player-mounted device 102 or it may be looked up in a database using the player's ID.

The central database 610 links all field-positioned device transactions from every field-positioned device 104. In one embodiment, the linking is done in real-time. In
10 another embodiment, the database 610 continuously monitors traffic to insure that only a single field-positioned device 104 interacts with a particular player-mounted device 102 at any given time. In another embodiment, the database 610 acts as a dispatcher. In that embodiment, the database 610 assigns the player-mounted device 102 to a particular field-positioned device 104, based on its proximity to that field-positioned device 104.
15 The proximity is derived from triangulation or other means known to those skilled in the art. In another embodiment, positional information of the player-mounted device 102 is derived using the triangulation or multilateration method. In one embodiment, the triangulation method entails positioning a suitable number of field-positioned devices 104 at various locations around the course. The location of the player-mounted device 102 is
20 calculated based on its position relative to the field-positioned devices 104. In another embodiment, positional information is derived through GPS circuitry integrated into the player-mounted device 102.

In one embodiment of the system 100, a player 216 wears the player-mounted device 102. The player 216 passes near field-positioned devices 104. As the player 216
25 nears a field-positioned device 104, data is exchanged wirelessly between the player-mounted device 102 and the field-positioned device 104. The field-positioned devices 104 can be located at mile splits, kilometer splits, or at other intervals convenient to the user or event. In another embodiment, the field-positioned devices 104 are water stations.

In one embodiment, the player-mounted device 102, appears to be a watch or tag. The device 102 has standard runner's watch features like split or lap time, time of day, date, year, elapsed time, countdown timer, date, day of week, alarm, target split, back light, intervals, and 12/24 hour mode, for example. For sports such as triathlons, data can
5 be tagged. By tagging data, events with multiple sub-events can be effectively monitored. For example, one group of data applies to running, a second group applies to swimming, and a third group applies to the bicycling portions of the event. The device 102 watch can optionally display graphical data, such as simple bitmaps, or graphs showing data trends that indicate whether a user is gaining in the race or falling back. In
10 alternate embodiments, the graphical data or graphs are displayed either on the device 102, by means of a separate display, as audio signals, or via a virtual reality headset, for example.

The player-mounted device 102 can optionally include heart rate monitoring circuitry for receiving, processing, and display of heart rate data. Such circuitry includes
15 heart rate, time spent above, below and within target heart rate, average and maximum heart rate, and recovery time. Additionally, the player-mounted device 102 can include altitude monitoring circuitry or barometric pressure reading circuitry. Furthermore, the player-mounted device 102 can include temperature or compass circuitry. In addition, the player-mounted device 102 can include pedometer monitoring circuitry, *i.e.* stride
20 length, strides/second and accelerometers and/or gyros for measuring the smoothness of stride. Also, the player-mounted device 102 can include inputs for bicycle sensors, such as wheel rotations. One skilled in the art will appreciate that other sensors and monitors not mentioned could be integrated into the player-mounted device 102.

In another embodiment, memory 310 is provided to store data gathered by the
25 player-mounted device 102. The data can be downloaded to the field-positioned devices 104 or viewed on the display 314. For example, the player-mounted device 102 stores lap times for n laps. In one embodiment, the player-mounted device 102 switches between two or more time zones. In another embodiment, the player-mounted device 102 is adapted to download alphanumeric messages, graphical, or audio messages to the

runner. For example, the player-mounted device 102 scrolls the message "Good Job" from supporters following along on the Internet.

In one embodiment, the player-mounted device 102 has a non-volatile memory that stores the player's identification, such as number, name, age, and weight. The display 314 optionally shows the player's place within a specified category (*i.e.* wheelchair or age group), and/or her overall place. The player-mounted device 102 also has a wireless link for uploading all the settings and all the information to be displayed and for downloading information from the player-mounted device 102. The wireless link includes the ability to set the local time in the player-mounted device 102. The transmitted data is formatted in such a way so as to avoid collisions with other player-mounted devices 102. Data from many player-mounted devices 102 is transmitted simultaneously and decoded properly at a specific field-positioned device 104.

In another embodiment, the player-mounted device 102 contains a wireless link which transmits the player's position information. In one embodiment, this is achieved via multilateration. The player-mounted device 102 also contains a wireless link which may be interfaced to a vehicle mounted unit (not shown) for longer distance signal transmissions. Alternatively, the player-mounted device 102 displays the position of other players in the event. This feature is useful to determine what position each player is currently in or to locate friends or competitors.

In alternate embodiments, the locations, shapes, and sizes of buttons, and the size and shape of the display and display graphics are ergonomically designed for ease of use. In one embodiment, the player-mounted device 102 is adapted to send data by selecting from a list of pre-entered messages, in a manner similar to 2-way pagers. For example, the player may send an Internet a message to supporters, such as "I'm doing well." The player-mounted device 102 also provides feedback to the user via sound, vibration, or visual indicators.

In one embodiment, the system 100 of the present invention also comprises display software included in the processor 608 and a database 610. The database 610 provides storage for all data. The processor 608 provides a display of the positions of all

the players in the event. This processor 608 can provide a snapshot, an animated recreation, or can display data in real-time. The software also provides a graphical output to the Internet or broadcast television. The software can also output statistics and/or graphics to data feeds such as SportsTicker™, or to pagers, for example. In another
5 embodiment, the software provides output data to a satellite or cable television system.

The software contains analysis algorithms that can be applied to the data, as well as means for calculating and transmitting data to the field-positioned device 104. The field-positioned device 104 then transmits the data to the player-mounted devices 102. The software allows Internet users to send data to players and to receive data from
10 players. Reports are provided to players at the end of the race in hardcopy or electronic format.

Having described and shown the preferred embodiments of the invention, it will now become apparent to one of skill in the art that other embodiments incorporating the concepts may be used and that many variations are possible which will still be within the
15 scope and spirit of the claimed invention. It is felt, therefore, that these embodiments should not be limited to disclosed embodiments but rather should be limited only by the spirit and scope of the following claims.

What is claimed is:

- 1 1. A performance monitoring system comprising,
2 a first player-mounted device including,
3 a sensor adapted to automatically collect first player sensor data from said
4 first player, and
5 a player transceiver adapted to wirelessly transmit and receive
6 information, and
7 a first field-positioned device adapted to be located in a first stationary position
8 and including,
9 a field transceiver adapted to receive at least one of said first player sensor
10 data and said performance parameters, and to transmit at least one of said
11 performance parameters and a message to at least said first player-mounted
12 device.
- 1 2. A performance monitoring system according to claim 1, wherein said first player-
2 mounted device further includes a display adapted to display said performance
3 parameters to said first player.
- 1 3. A performance monitoring system according to claim 1, wherein said first field-
2 positioned device further includes a field processor adapted to process said first player
3 sensor data to generate said performance parameters.
- 1 4. A performance monitoring system according to claim 3, wherein said field
2 processor is further adapted to process time information with said first player sensor data
3 to generate said performance parameters.
- 1 5. A performance monitoring system according to claim 1, wherein said first field-
2 positioned device is further adapted to detect a time at which said first player passes a
3 predefined landmark.

- 1 6. A performance monitoring system according to claim 1, wherein said first player-
2 mounted device is further adapted to detect a time at which said first player passes a
3 predefined landmark.
- 1 7. A performance monitoring system according to claim 3 further comprising,
2 a central processor having a database and adapted to perform at least one of
3 collecting, storing and distributing at least one of said first player sensor data and said
4 performance parameters, and wherein said field transceiver is further adapted to transmit
5 said performance parameters to said central processor.
- 1 8. A performance monitoring system according to claim 7 further comprising,
2 at least one of a Web server, a Web client, a video game client, a wireless client, a
3 scoreboard indicator, a printer, a scoreboard display, and a television client, coupled to a
4 network and adapted to provide said performance parameters to a network user, and
5 wherein said central processor is further adapted to upload said performance parameters
6 to said network.
- 1 9. A performance monitoring system according to claim 1, wherein said first field-
2 positioned device connects via a communication network with a display adapted to
3 display said performance parameters to spectators.
- 1 10. A performance monitoring system according to claim 1 further comprising,
2 a central processor adapted to process said first player sensor data to generate said
3 performance parameters and including a database adapted to aggregate at least one of
4 said performance parameters and said first player sensor data, and
5 said field transceiver is further adapted to transfer said first player sensor data to
6 said central processor.
- 1 11. A performance monitoring system according to claim 10 wherein said central
2 processor facility is further adapted to provide said field-positioned device with said
3 performance parameters.

- 1 12. A performance monitoring system according to claim 10 wherein said first field-
2 positioned device connects via a communication network with a display adapted to
3 display said performance parameters to spectators.
- 1 13. A performance monitoring system according to claim 10 further comprising,
2 at least one of a Web server, a Web client, a video game client, a wireless client, a
3 scoreboard indicator, a printer, a scoreboard display, and a television client, coupled to a
4 network and adapted to provide said performance parameters to a network user, and
5 wherein said central processor is further adapted to upload said performance parameters
6 to said network.
- 1 14. A performance monitoring system according to claim 1, wherein said first player-
2 mounted device further includes a display device adapted for displaying a selected
3 portion of said performance data to said first player.
- 1 15. A performance monitoring system according to claim 1, wherein said sensor is
2 adapted to sense at least one of a heart characteristics of said first player, brainwave
3 characteristics of said first player, body temperature of said first player, blood pressure of
4 said first player, blood sugar level of said player, an air temperature, and an atmospheric
5 pressure.
- 1 16. A performance monitoring system according to claim 1, wherein
2 said first player-mounted device further includes at least one accelerometer
3 adapted to measure at least one of an acceleration of said first player, a stride length of
4 said first player, stride rate of said first player, a velocity of said player, and an impact of
5 with said player, and to generate first player sensor data indicative thereof.
- 1 17. A performance monitoring system according to claim 1, wherein
2 said first player-mounted device further includes at least one gyroscope adapted to
3 measure a rotational acceleration of said first player-mounted device, and to generate first
4 player sensor data indicative thereof.

- 1 18. A performance monitoring system according to claim 1, wherein
2 said first player-worn device further includes at least one accelerometer adapted
3 to measure an acceleration resulting from an impact, and said system is further adapted to
4 calculate a force of said impact.
- 1 19. A performance monitoring system according to claim 1 further comprising,
2 a second player-mounted device including,
3 a sensor adapted to automatically collect second player sensor data from
4 said second player, and
5 a player transceiver adapted to wirelessly transmit and receive
6 information, and
7 a second field-positioned device adapted to be located in a second stationary
8 position and including,
9 a field transceiver adapted to receive at least one of said first player sensor
10 data, said second player sensor data, and said performance parameters, and to
11 transmit at least one of said performance parameters and a message to at least one
12 of said first and said second player-mounted devices, and wherein
13 said performance parameters include performance parameters associated with at
14 least one of said first player and said second player.
- 1 20. A performance monitoring system according to claim 19 further comprising,
2 a central processor adapted to process at least one of said first player sensor data,
3 said second player sensor data, said performance parameters, and time information to
4 determine a first time for said first player to traverse a distance between two predefined
5 landmarks.
- 1 21. A performance monitoring system according to claim 20, wherein said central
2 processor is further adapted to process at least one of said first player sensor data, said

3 second player sensor data, said performance parameters, and time information to
4 determine a second time for said second player to traverse a distance between two
5 predefined landmarks.

1 22. A performance monitoring system according to claim 21, wherein said central
2 processor is further adapted to process said first time and said second time to determine a
3 relative time ranking between said first and said second players.

1 23. A performance monitoring system comprising,

2 a first player-mounted device including,

3 a data sensor adapted to automatically collect first player performance
4 from said first player,

5 a player processor adapted for processing said first player performance
6 data, and

7 a player transceiver adapted to wirelessly transmit and receive
8 information, and

9 a first field-positioned device adapted to be located in a first stationary position
10 and including,

11 a field transceiver adapted to receive said processed first player
12 performance data transmitted from said first player-worn device, and to provide
13 messages to said player transceiver.

1 24. A performance monitoring system according to claim 23 further comprising,

2 a second player-mounted device including,

3 a sensor adapted to automatically collect second player performance data
4 from said second player,

5 a player processor adapted to process said second player performance
6 data, and
7 a player transceiver adapted to wirelessly transmit and receive
8 information, and
9 a second field-positioned device adapted to be located in a second stationary
10 position and including,
11 a field transceiver adapted to receive said first and said second player
12 processed performance data, and to transmit at least one of a portion of said first
13 and said second player processed performance data, and messages to at least one
14 of said first and said second player-mounted devices, and
15 wherein, said transceiver of said first field-positioned device is further adapted to
16 transmit at least one of a portion of said first and second player processed performance
17 data, and messages to at least one of said first and second player-mounted devices.

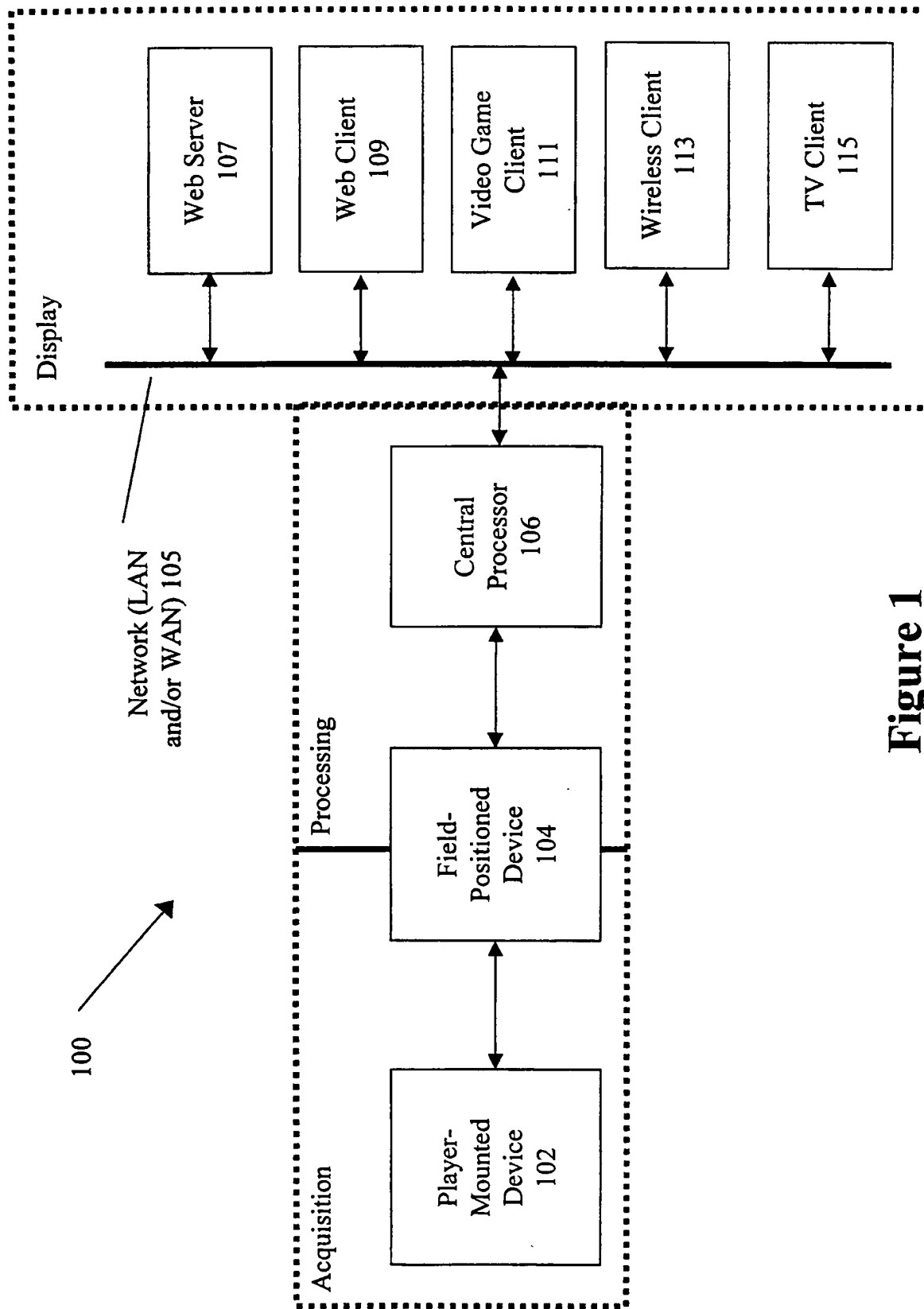


Figure 1

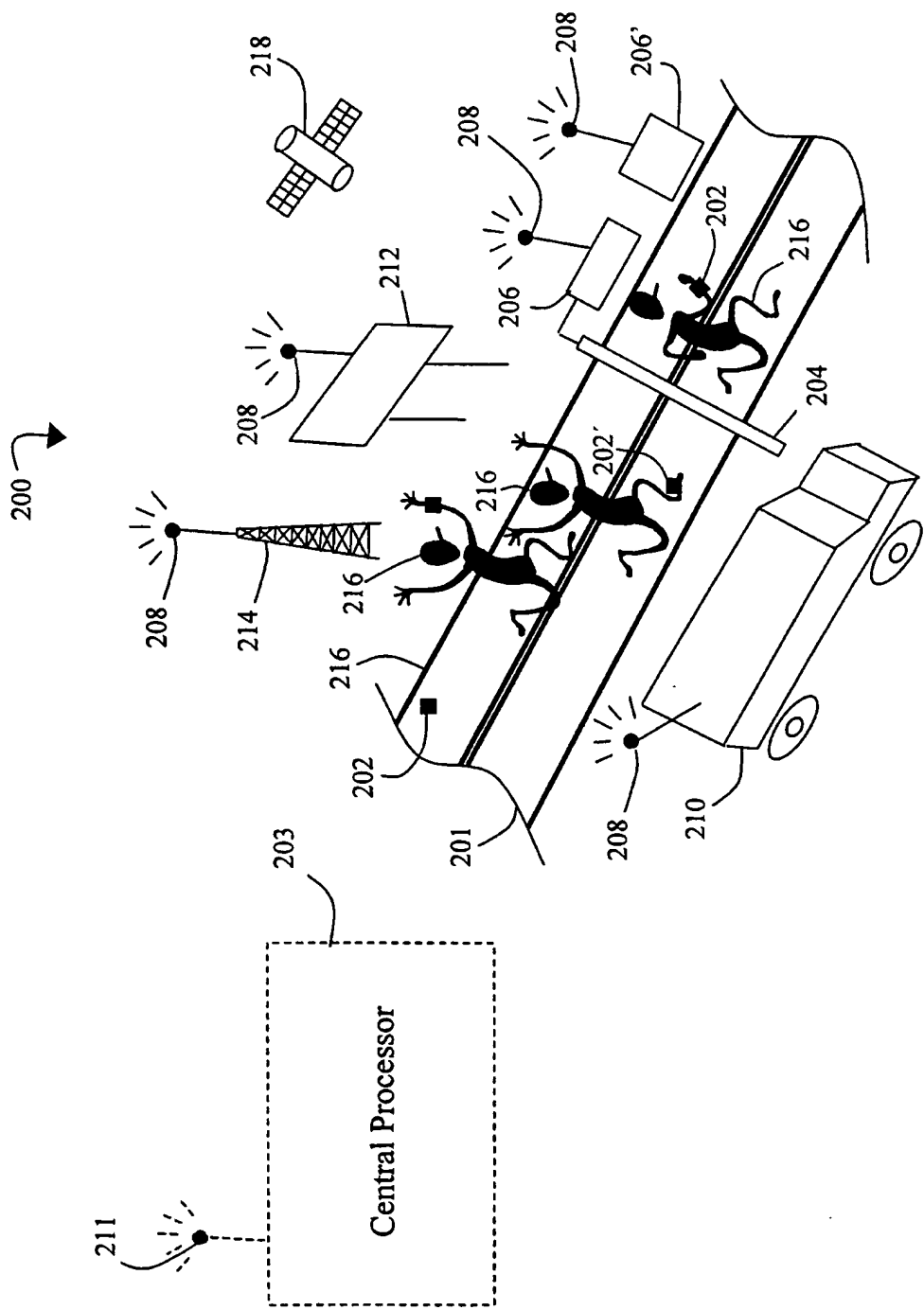


Figure 2A

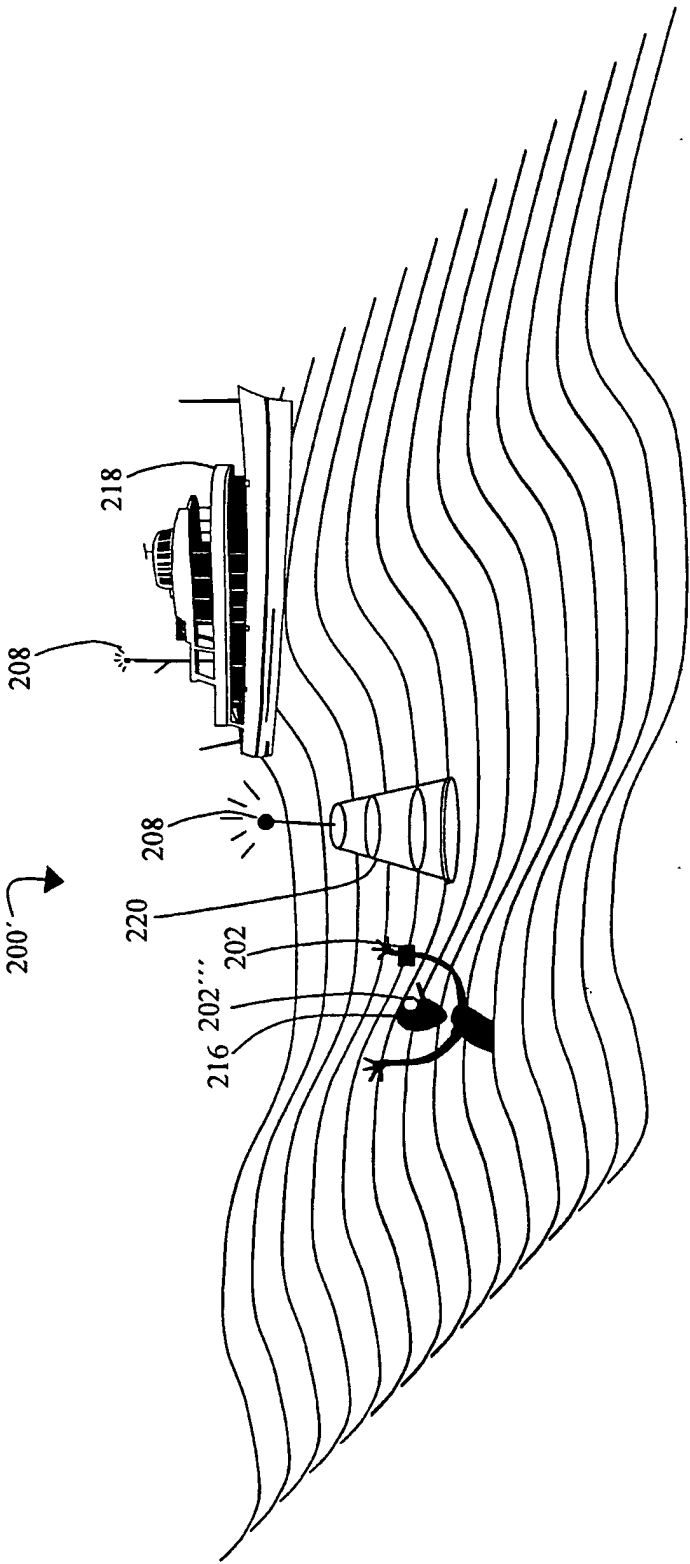


Figure 2B

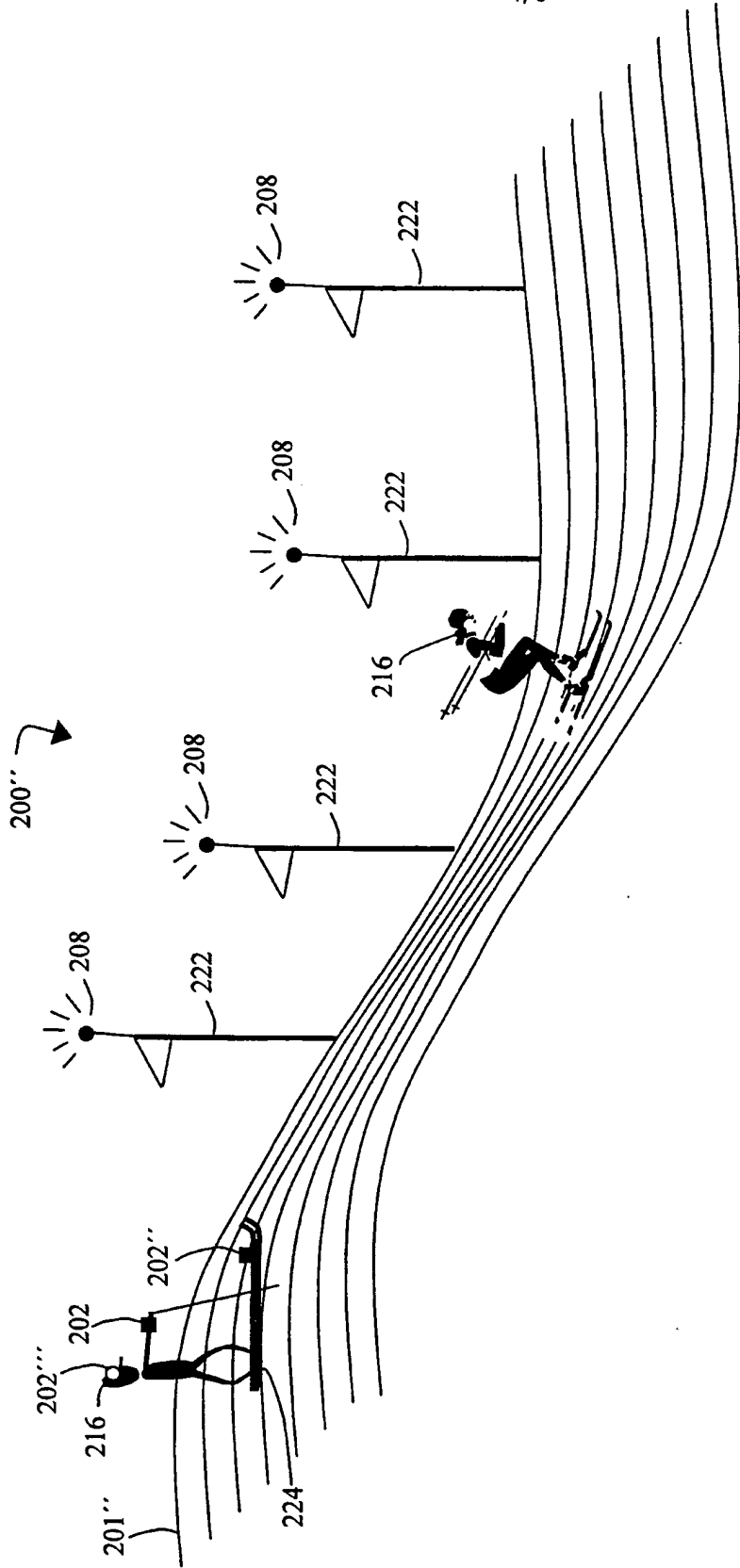


Figure 2C

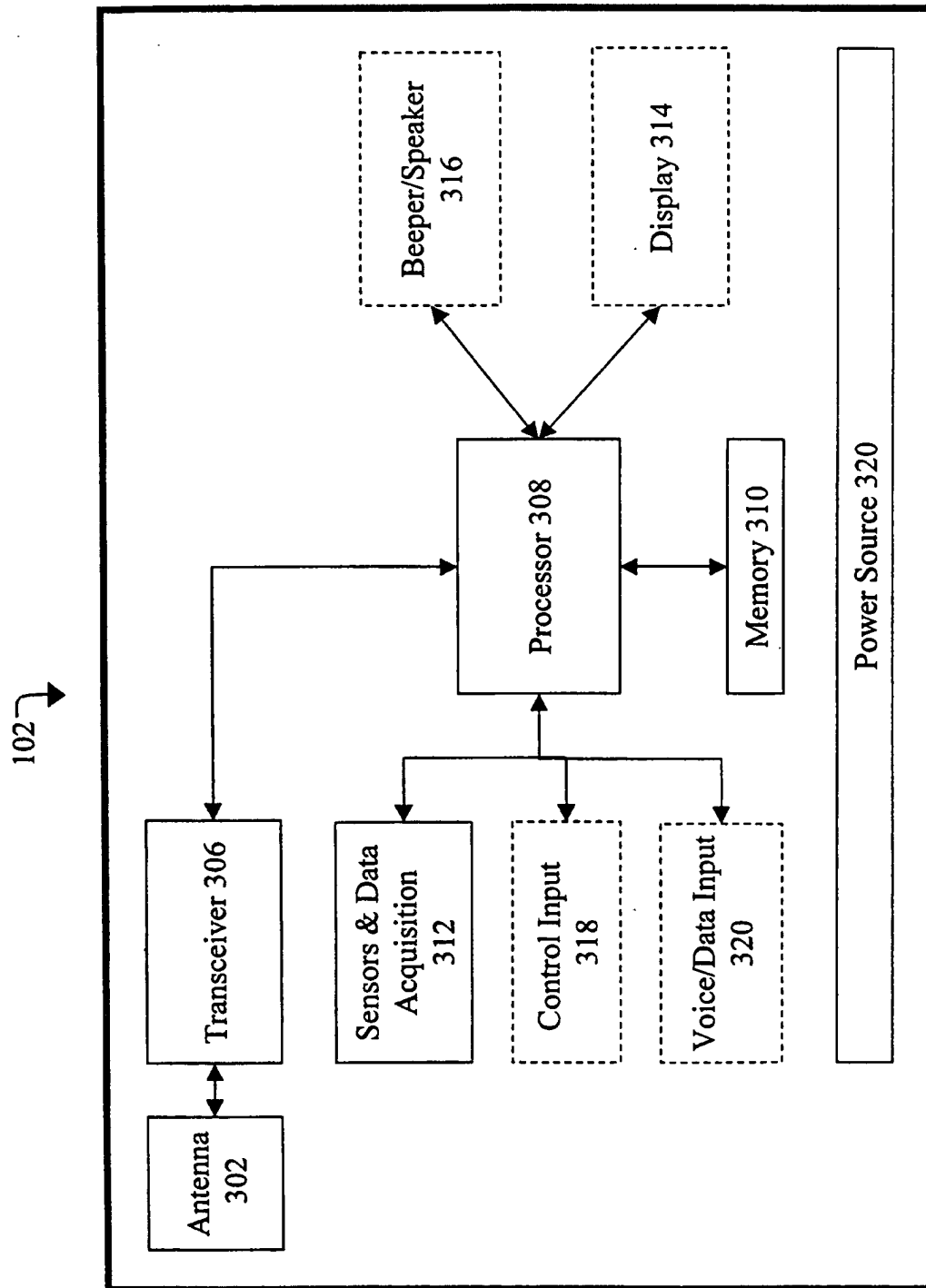


Figure 3

6/9

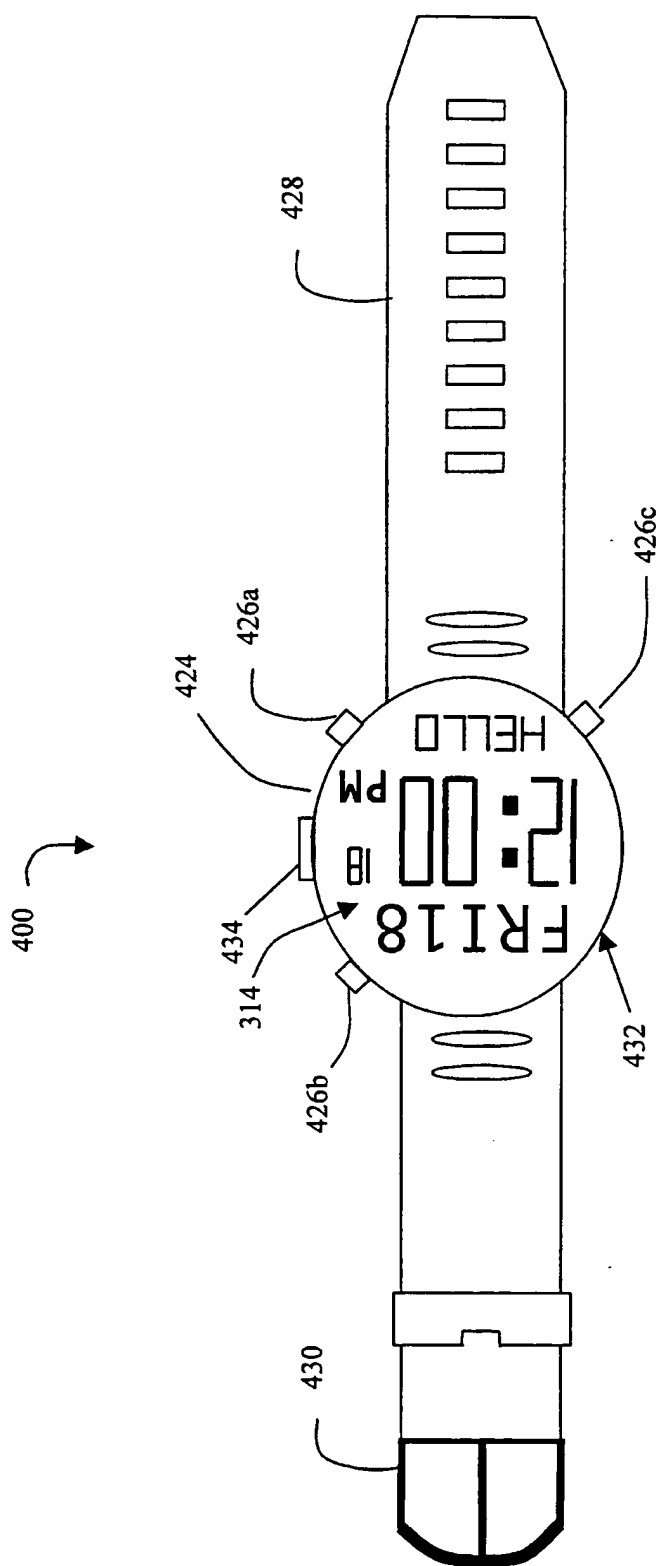


Figure 4A

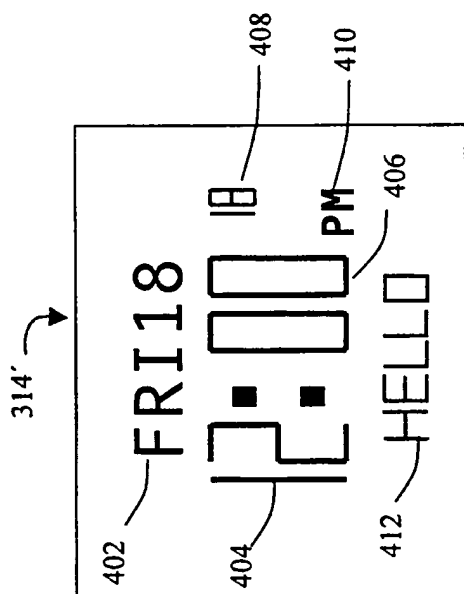


Figure 4B

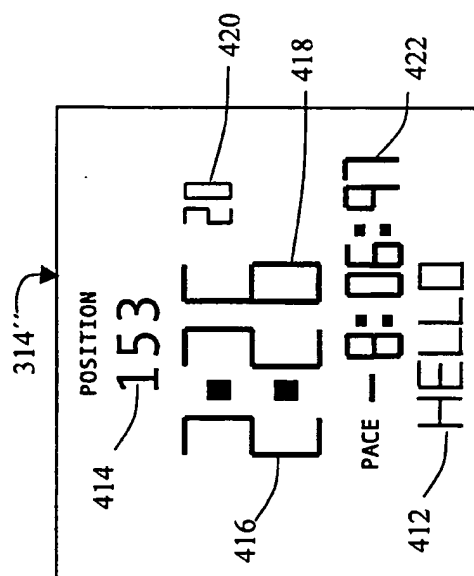


Figure 4C

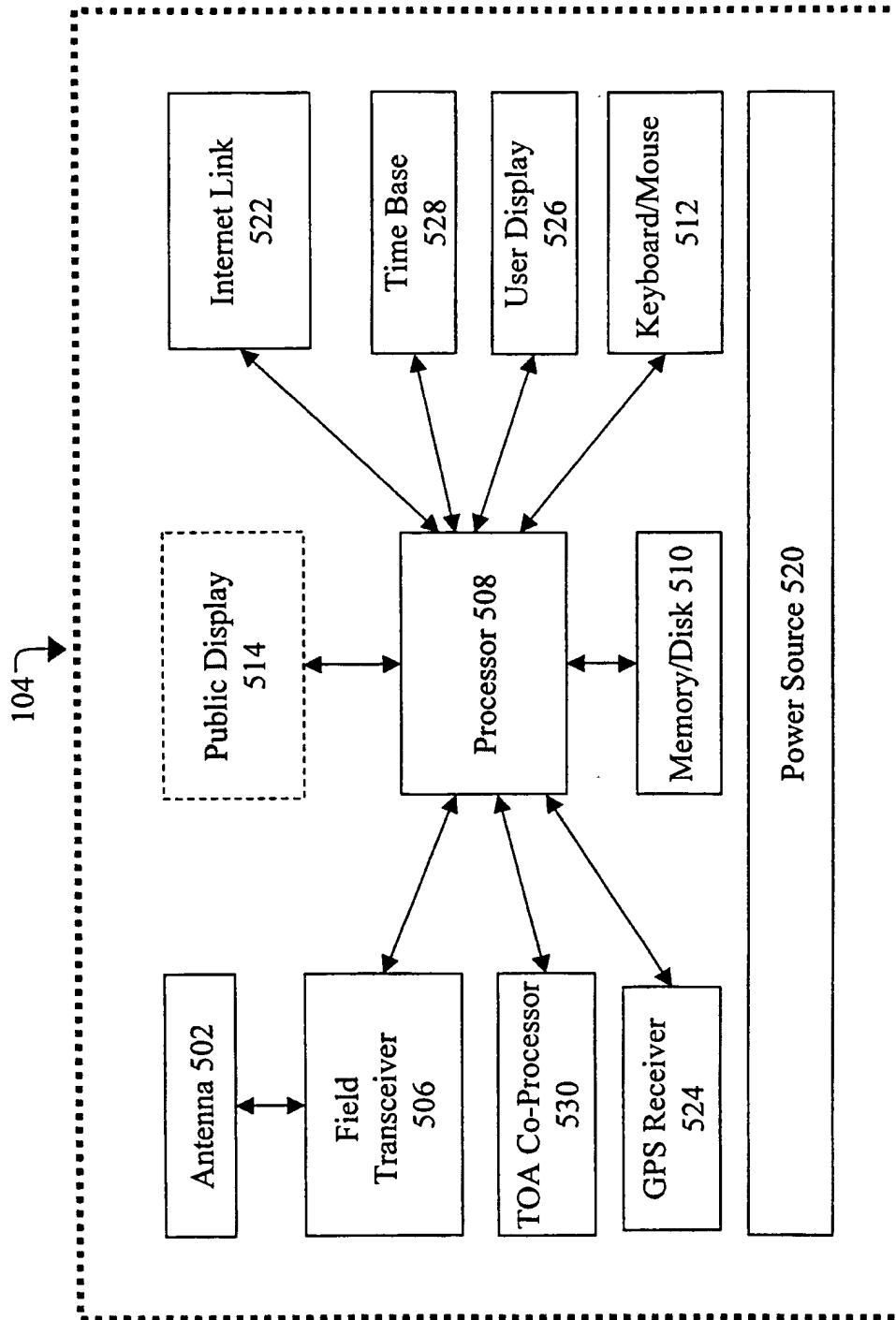


Figure 5

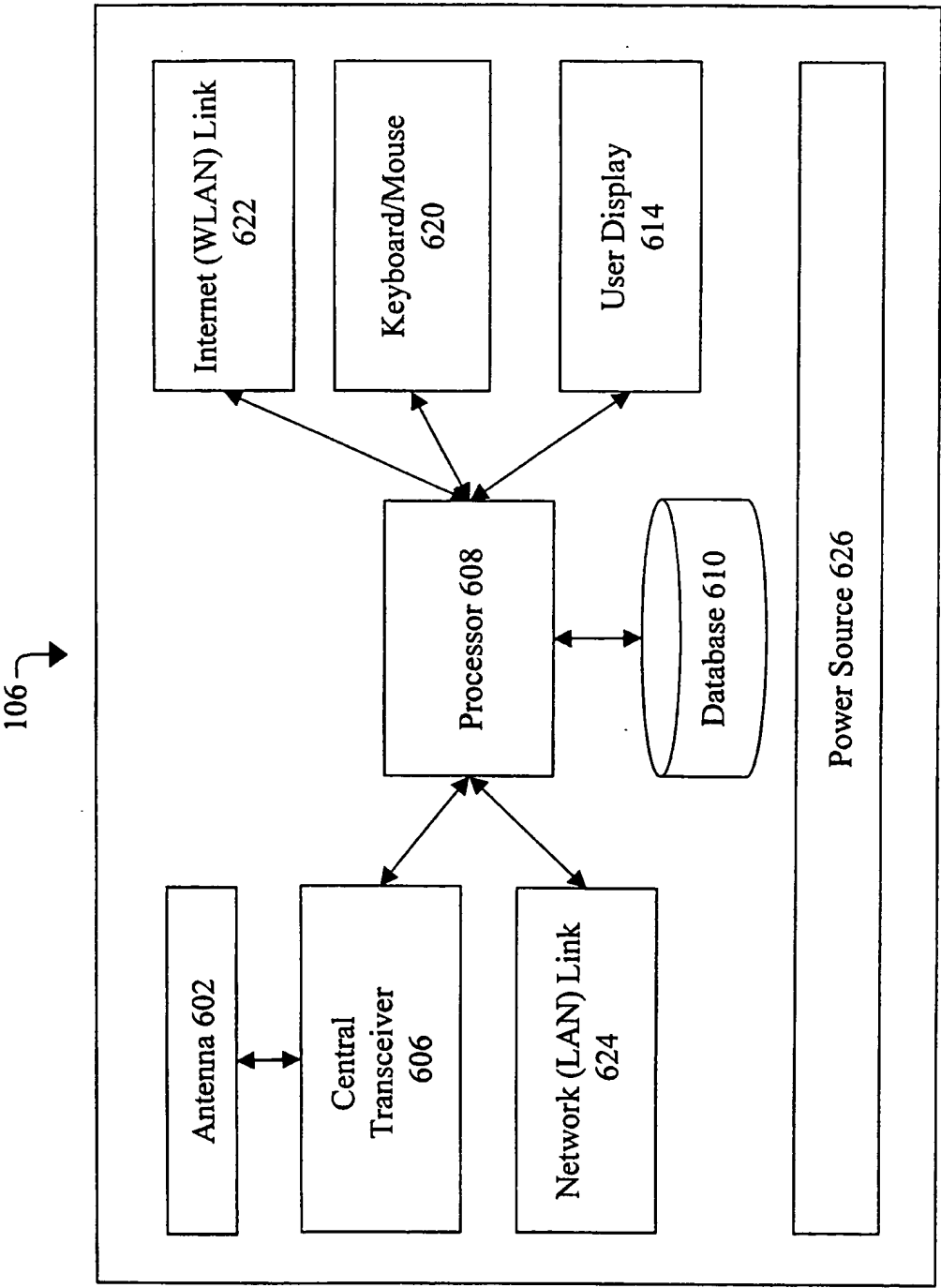


Figure 6

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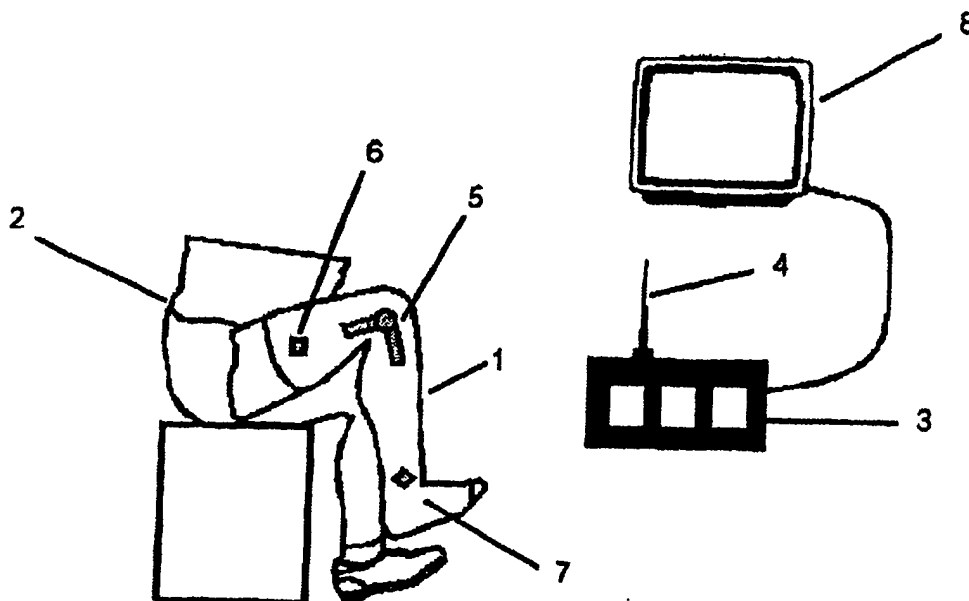
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(54) Title: REHABILITATION DEVICE



(57) Abstract: The invention relates to a position sensor device, which is attachable to a user and is able to indicate the position and/or motion of a body part of the user.

WO 01/10508 A1



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

REHABILITATION DEVICE

The invention relates to exercise devices used for the rehabilitation of patients following traumatic joint injury but also for sports physiotherapy and general exercise. The device may also be suitable for care of patients following wound injury, especially when patient compliance is required. More specifically, the invention relates to an intelligent device that allows a selection of exercise programs to be monitored.

It is well known that muscle, bones and joints should be exercised to maintain strength. It is also known that fractures exposed to permissible weight bearing stress often heal more predictably and more rapidly than fractures, which are not stressed at all. This is also believed true for connective tissue, such as ligaments and certain cartilage. Similarly the exercising of injured limbs has beneficial effects to the healing of the joint or muscle injury.

Currently the neuromuscular stage of rehabilitation is only addressed by one -to -one physiotherapy treatment, which can be costly and is time consuming. Current treatment systems and devices are concerned with enhancing proprioception via skin receptors or by training balance alone in the therapist's clinic, this could include the wobble board and KAT system.

Previously proprioception was thought of as just balance however surprisingly the devices of this invention show that the position and angle of the user's limbs, and / or the kinesthesia of the user's limbs may allow the therapists a better understanding of condition of the limb of the user. With regard to proprioceptive / neuromuscular rehabilitation this may allow the therapist a better understanding of the progression of a patient's rehabilitation, whether the patient is progressing at the desired rate and whether the exercise programme is suitable to the patient, or if it is not, to

2

change the exercise program. Similarly this can offer benefits to the therapist working with sports men and women.

Previous physiotherapy equipment and treatment systems needed
5 close supervision by the therapist to ensure that the exercises were being
carried out correctly and indeed to ensure that the user was doing the
exercises. The therapist, for the prior art rehabilitation systems had to be
present when the user was being assessed. Usually the person using the
physiotherapy equipment or treatment system, whether a patient or sports
10 person would have to travel to the therapist at a clinic to use the
equipment and to perform the exercises. Due to the time wasted between
seeing one patient or client and the next this current system has the
disadvantage of being a very ineffective use of the therapist's time.

15 It was previously thought that the current system, of the patient or
client always travelling to the therapist for their rehabilitation treatment
could not be improved upon as the treatment system required large,
sometimes heavy, expensive equipment which was not easily
transportable and that the therapist would have to be present to monitor
20 the exercise programme.

It is an object of the present invention to address some of these
before mentioned problems.

25 It is an object of the present invention to provide a device, which
indicates the position and/or movement of a user's limb.

It is an object of the present invention to provide a proprioceptive
and/ or neuromuscular device that may monitor and record the user's
30 performance.

3

It is an object of the present invention to provide a proprioceptive and/ or neuromuscular device, which is portable.

According to the present invention there is provided an exercise
5 device comprising at least one position sensor that is attachable to a user and which can then indicate the position and/ or motion of a body part.

Also according to the present invention there is provided an exercise
device comprising at least one position and/ or motion sensor that is
10 attachable to a user and which indicates the position of the body part of the user to which the position and/ or motion sensor is attached.

Preferably the, or all, position sensors are in communication with a
processor for processing data generated from the position sensor.
15

In preferred embodiments, the exercise device of the present
invention will have a memory to store data generated from the position
sensor, in order to download the data generated at a later time. However
the exercise device of the present invention may also have a data
20 transmitter that automatically transmits the data generated as it is generated. Whether the data generated by the sensor is downloaded as it is generated or at a later time, this information may be transmitted to the user or the therapist. If the data generated is stored by the exercise
device of the present invention or by a separate memory database to
25 which the exercise device has sent the data to, then the therapist, or user, can examine the data at a later, perhaps more convenient time, than when the actual exercise was performed.

Optionally the exercise device of the present invention may have a
30 message conveyor, in order to instruct the user to perform a predetermined exercise programme. In simple embodiments of the present invention the instructions to the user may be written on a sheet of

4

paper given to the user by the therapist. In more sophisticated embodiments of the present invention the instructions may be displayed on a separate monitor.

5 The device however may simply be worn by a user to indicate when a limb, or body part, of the user is moving too fast, or too far in a particular direction. This may therefore be used to help prevent, for example, over-reaching by the user.

10 According to the present invention there is provided an exercise device having;

 a position sensing means that is attachable to a user whereby the position sensing means senses the position of the body part of the user where the position sensing means is attached;

15 and a control means in communication with the position sensing means for receiving outputs from the position sensing means,

 the control means further including programmed processing means, for processing outputs from the position sensing means, and memory means for retaining the processed data outputs from the position sensing means, and

20 the control means further having means to instruct a user to perform a predetermined exercise programme.

 It is envisaged that the present invention can be small enough to be easily transportable and therefore the exercise routine need not necessarily be performed at the therapists clinic.

 Even if the device is used in the therapist's clinic there are many advantages for using the present invention over the prior art devices. The therapist would be able to deal for users of the device more quickly than in the past and may have a reliable means of comparison to how the user is performing the exercises and how the improvement is progressing.

There is an increasing demand for numerical records of patients' rehabilitation to be available for the following purposes.

To make therapists accountable for their actions, for instance, for
5 performance reviews or litigation cases.

For feedback to the surgeon/physician, for example for justification for or against further intervention.

For feedback for reimburer, for example to please insurance companies requiring proof that patients are complying with treatment.

10 For greater understanding of therapy and clinical research i.e. optimisation, of treatments and presentation of results.

For standardisation of treatment and common practices.

For overcoming prejudiced views in the art, by therapists, relating to rehabilitation.

15

Likewise, as the device may have means to convey instructions of the exercise programme to the user and has means to monitor and record the user's performance, it is again not necessary to use the device in the therapist's clinic only.

20

Not being restricted to performing the exercises at the therapist's clinic has many benefits to both the user and the therapist.

The user can save considerable time by not having to visit the
25 therapist as often and can more easily fit the required exercise program into his or her daily routine. Being able to do the required exercises in private may also be a favourable consideration to some users and thus the user's compliance for doing the exercises may in fact increase when not in the presence of the therapist. This may be especially true when the
30 device is for rehabilitation of elderly patients.

6

The therapist also saves considerable time as data from the device can be collated some time after the exercises have been done and can be sent to the therapists for analysing or can be down loaded to a data collecting station at a mutually convenient time. The therapists will
5 however still be able to closely monitor the user's compliance of carrying out the exercise and to determine if the exercises are having the desired effect. The therapist can alter the predetermined exercise programme of the device in order to ensure that the user does have an exercise programme suitable to their particular needs.

10

As individuals will perform the same exercise programme in very different ways with differing degrees of abilities, especially regarding speed, force and accuracy, it is hard for the therapist to compare the progress of one user with another. For example a young sports person
15 may well be able to perform a programme of exercises faster than an elderly person that has been on the same programme of exercises for a longer period of time than the sports person. Consequently for the therapist to measure the progress of the user it is not only how well the user performs the exercise on the particular occasion but how much of an
20 improvement there is in performing the exercises from before. The present invention provides an easy means to store and analyse the user's current and past exercise data to aid the therapist to monitor the progress of the user and therefore to be able to change the exercise programme accordingly. There is therefore an opportunity for the user to have a
25 speedier recovery, saving time and money for the user and the therapist.

30

We hereby define the term position sensor to mean any sensor that can detect or compare its position, angle or motion and/ or its rate of change of position, angle or motion.

7

Such position sensors are known in the art and include variable capacitance sensors, rotatory potentiometers, accelerometers, and angle sensors e.g. gyroscope and potentiometers.

5 Accelerometers are well known in the car industry for triggering car airbags. Accelerometers on the market that may be used with the present invention include accelerometers sold under the Trade Name IC sensors and those marketed by Analog Device Inc., for example the ADXL202 accelerometer. These are two-axis $\pm 2g$ micromachined sensors.

10

Typical gyroscopes suitable for use with the present invention are MG 100 supplied from Gyration Inc. This is a dual-axis gyroscope, originally designed for integration into pointers and remote controls, and computers and home entertainments systems.

15

The position sensor can be attached to the user by any suitable means. This could be simply by having a stick-on patch with the sensor or alternatively the sensor could be held on the user by a bandage or dressing. Likewise a strap with suitable hook and loop fastenings, for instance like those sold under the trade name of Velcro (Trade Mark),
20 could be used to hold the position sensor in place.

Preferably the position sensor will be incorporated into a sleeve whereby the sleeve can be easily attached to the user at the desired
25 position.

The sleeve may be any size or shape suitable to be attached to the user. Typically the sleeve will be in the shape of a glove, sock, armband, ring or bracelet, legband or anklet.

30

Likewise the sleeve may be made of any suitable material that would enable it to be safely attached to the user. The sleeve may be rigid like a

8

conventional brace or may be of soft material. Preferably the sleeve will be substantially of soft material. When the sleeve is of substantially soft material, any soft material may be used to construct the sleeve for instance, textile fabrics. More preferably the sleeve will be small, soft and
5 light in weight in order to be as comfortable to the user as possible.

The communication means by which the data from the position sensor means is conveyed to the control unit, in embodiments where there is a control unit, can be by any means suitable for such a purpose.
10 Preferably the communication means will be by radio signalling or the like, so that the user is not hindered physically when doing the exercises. The communication means however could be by wire to the control unit provided that the exercises could be performed within the limited range of the wire.

15

The control unit could be attached to the user, for instance to a belt held around the user's waist, to allow freedom of movement of the device when the user is performing the exercises. This may be an important feature when the means of communicating the data from the position
20 sensor to the control unit is by wire. This type of embodiment of the present invention may be especially important when the user is jogging and the control unit must be able to move with the user.

Alternatively the control unit and position sensor could be contained
25 together within one unit provided the one unit could be small enough and sufficiently light in weight to be carried by the user.

The device of the present invention can be used by itself or with other exercise aids. Other exercise aids could be a mat that has markings
30 on it to indicate positions on the mat that the user may be requested to move to or to move a particular body part or limb to.

- Preferably it is envisaged that the user will have an exercise programme that requires that the user to move either a hand or foot, or any other suitable part of the body, to a desired position on the mat. These programmes may specify whether it is the left or right, hand or foot
- 5 or other body limb that is to be moved. For exercises requiring the user to move his foot or feet, to desired positions on the mat, the mat may preferably be positioned on the floor. Likewise for exercises designed to exercise mainly the lower body of the user the mat may preferably be positioned on the floor. Where the exercises require the user to move
- 10 their hand, the mat may suitably be placed on a table or on a wall or other vertical surface to allow easy positioning of the user's hand on the mat. Likewise for exercises designed mainly for the upper body of the user the mat may be suitably placed on a table or held vertically. Suitable means of attaching the mat to a wall or vertical surface could be used to position
- 15 the mat. The mat need not be restricted to substantially flat surfaces for it is envisaged that the mat could be used on uneven surfaces in order to test a users balance and/ or movement on an uneven surface. Typically the mat could be used on stairs or on a wobble board. This is especially important for rehabilitation exercises where a patient may feel quite stable
- 20 when on surfaces that are substantially even but not when on stairs or when on surfaces that are uneven. Suitable attachment means to attach the mat securely to the stairs would be preferably used in conjunction with the mat in order to ensure safe usage of the mat by the user.
- 25 Likewise the mat may also be used on soft surfaces. For example the mat may be used on an exercise bouncer.

- The mat may be of any size or shape however it is envisaged that a mat of approximately 1 m to 2 m by 1 m to 2 m would be preferable to
- 30 allow for easy transportation of the device. It is envisaged that a smaller mat could be used for upper body exercises, for instance 1 m by 1 m, and a larger mat, for instance 2 m by 2 m, for exercises directed at lower body

10

exercises. Typically the mat may be 1 m by 2 m for exercises directed solely for the upper body, and typically 2.5 m by 1.5 m for exercises directed solely for the lower body. The particular mat need not be limited for any particular program of exercise and it is envisaged that the one mat
5 could be used for exercises directed at both the upper and lower body of the user. When not being used, the mat in some embodiments of the present invention may be easily rolled or folded to facilitate storage.

The mat can be made of any suitable material. Typically the mat will
10 contain elastic material.

Preferably the mat will have markings to act as specific targets for the user to make contact with the mat when directed to do so for the particular exercise programme. This could be simply a series of labelled
15 or indexed grids on the mat. The grids on the mat could be of different sizes and therefore suitable for a wider range of exercise programs. Typically when different size grids are used on the one mat the grids will be colour coded in order to allow easy visual differentiation between the grids. Typically the grid spacing will enable desired targets to be large
20 enough for the user's hand or foot to be placed substantially over the target area.

Other markings could simply be shapes, numbers, letters or pictures on the surface of the mat.
25

Typically the grid spacing will enable desired target areas to be large enough for the user's hand or foot, or other body limb, to be placed substantially over the target area.

30 The mat may even contain lights on the surface of the mat in embodiments of the present invention where the lights themselves are the target for which the user should place their hand or foot, or other body

11

limb, on to when that particular light lights up. The lights would suitably be protected from the physical contact of the user putting pressure on the surface of the mat. It would also be preferable with this embodiment of the present invention if the lights could be contained within the

5 substantially flat surface of the mat or cover target so that the surface is still substantially flat. Having the surface substantially flat is important where the user is walking on the mat and may be tripped by the lights if the lights projected from the surface.

10 A common exercise programme presently used by therapists to monitor rehabilitation of a patient, which may be performed by a user with the present invention is the step up step down exercise.

This exercise can be used to address ankle, knee and even hip

15 mobility and strength of the patient. Sensors may be attached to the user at various positions on the leg, e.g. front and/or back, to detect sideways and vertical accelerations, and sideways and vertical rotations. Typically the sensors may be positioned above or below the ankle or knee depending on the joint of interest. When the exercise is done correctly,

20 the device will show that the sections of the limb above and below the joint are aligned throughout. When the exercise is done incorrectly there will be evidence of the joint being twisted and the angle achieved by the joint will be less than when the exercise is carried out correctly.

Preferably both accelerometers and gyroscopes would be used with an

25 embodiment of this invention to perform this type of exercise.

A particularly suitable exercise for performing with the present invention is the simple active/passive range of motion exercises. For these, during rehabilitation, the patient is asked to move their joint through

30 certain angles. Either passively (moved by the therapist or a machine) or actively using the muscles. The range of motion should increase during rehabilitation.

Typically the control means will be able to collect and store the data from the position sensor or any other sensors being used with the invention, in order to be able to later download the collected data. The
5 downloading of the collected data, may be done by the therapist either at the clinic, or elsewhere, or the data could be downloaded by the user and sent to the therapist for analysing. It is possible, using suitable means that the collected data could be sent to the therapist by telephone, e.g. e-mail, or radio. It is even possible that the collected data could be sent to
10 a collecting station near to the therapist or at the clinic to enable the therapist to analyse the data when required.

The predetermined exercise programme of the device may be pre-programmed into the device by the therapist. There is no limitation to
15 what exercise programmes could be programmed into the device, in order for the user to carry out the exercise programme. The therapist would preferably choose an exercise programme that would be challenging to the user but still within their capabilities. The exercise programmes may consist entirely of simple commands, for instance to move the left foot to
20 grid H or to move the right hand to square 5 when the present invention is used with such a particular target. The commands may be any number of different command including commands to ask the user to jump, hop, hit, kick, run or push.

25 The instructions or commands of what movement the user is required to do can be conveyed to the user by any suitable means. The means to convey instructions or commands to the user need not necessarily be attached to the control unit, or the device of the present invention, as the means to convey instructions or commands to the user
30 as the means to convey instructions or commands to the user may be in wireless communication with it. This may be by instructions on a TV or LCD screen that the user can look at whilst performing the exercise

13

programme. The display on the screen may be by any suitable means but would typically be written instructions or a graphic display of what the instructions are. The instructions may also be conveyed to the user by other visual means for example when lights are used within the mat to move to the light, which is switched on or off as the case may be. Additionally the device may incorporate a light projecting means on to a mat where the user must move to where the light projection falls onto the mat. The instructions however could be by simple audio means, i.e. audiotape, or digitised voice. In the simplest of embodiments of the present invention the instructions to the user in order to perform the exercise programme may be written on a sheet of paper. Once the device has indicated to the user to start the exercises, for instance, this may be to show that the control means is ready to monitor and record the exercises, the user may perform the exercises as written on the sheet of paper.

Where the sleeve of the present invention covers the sole of the foot of the user the sleeve may contain a pressure sensor on the sole of the foot which is in communication with the control unit and is able to detect when the user places that particular foot on the ground. The pressure sensor may be able to distinguish when the user places the foot onto the ground and when the user actually puts weight on the foot. This information can be monitored and stored by the control unit to be later downloaded to a central data collecting unit at the therapist's clinic to be analysed.

This embodiment of the present invention may be easily adapted that the device may have pressure sensors positioned to monitor the pressure for hand, shoulder, arm exercises or the like. For instance, the amount of pressure by a user's hand may be monitor against a wall when performing a predetermined exercise.

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Devices of the present may be of various weights but preferably the device will be of a weight that can easily be portable and carried by the user with ease.

5 For small devices having few sensors the total weight of the device, being attached to the user may be less than 200 g. Preferably a device with few sensors would weigh less than 100 g, more preferably it would weigh less than 75 g.

10 Typical weights for a device with a single sensor may be 35 g, 38 g, 42 g and 45 g.

 When more sensors are used this may increase the weight of the device used and therefore when a number of sensors are used the total weight of the device may be less than 2 kg. Preferably less than 1.5 kg
15 and more preferably less than 1 kg, when low weight devices are required. The weight of the device attached to any one position on a user is unlikely to exceed 750 g, preferably it is unlikely to exceed 500 g when attached to any one position on a user, when low weight devices are
20 required.

 It may however be required that the device is of a substantial weight and therefore the device of the present invention may be any suitable weight which enables the user to perform the exercise programme.
25 Typically the device will be less than 15 kg in weight.

 According to the present invention there is also provided a method of manufacturing an exercise device comprising the steps of combining one or more position sensors, that are attachable to a user in which the
30 position sensor, or sensors, indicate the position of the body part of the user where one or more of the position sensors are attached, to be in

15

communication with a processor for processing data generated from one or more of the position sensors.

5 The invention further provides a method of manufacturing an exercise device comprising the step of connecting,
a position sensitive means that is attachable to a user in which the position sensing means is for sensing the position of the body part of the user where the position sensing means is attached,
and a control means in communication with the position sensor
10 means for receiving outputs from the position sensor means,
the control means further including programmed processing means for processing outputs from the position sensing means and memory means for retaining the processed data outputs from the position sensing means,
15 the control means further having means to instruct a user to perform a predetermined exercise program.

The invention will now be further described by way of example only with reference to the drawings which are:-

20

Fig. 1 shows a device according to a first embodiment of the invention.

25 Fig. 2 shows a mat for use with an embodiment of the present invention.

Fig. 3 shows a Capacitance One Dimensional Angle sensor suitable for use with the present invention, the sensor having a position of low capacitance.

30

Fig. 4 shows a Capacitance sensor of Fig. 3, the sensor having a position of high capacitance.

Fig. 5 shows a circuit diagram typical of an electrical circuit for use with the Capacitance sensor shown in Fig. 3.

5 Fig. 6 shows inductive Angle Sensors for use with the present invention.

Fig. 7 is a view of a user's leg with two positioned gyroscopes, positioned ready for a knee bend exercise programme.

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Fig. 8 is a view of a user performing an embodiment of an active range of motion exercises.

Fig. 9 shows one embodiment of a sensor and attachment means of
15 the present invention.

Fig. 10 is a flow diagram explaining a weight shift exercise.

Fig. 11 shows a typical neural network suitable for use with the
20 present invention.

Fig. 1 shows a first embodiment of the invention in which a sleeve (1) is positioned on the right leg of a user (2), covering the knee and ankle joints of the right leg of the user (2). On the sleeve near to the knee
25 position is attached an angle sensor (5), in order to measure the angle between the thigh and lower leg. Attached to the sleeve there are also two accelerometers (6,7) for measuring movement of the right leg of the user (2). One accelerometer (6) is attached to the thigh position of the sleeve, the other accelerometer (7) is positioned near to the ankle
30 position of the sleeve. The accelerometers (6,7) and the angle sensor (5) are in wireless communication with a control unit (3). An aerial (4) attached to the control unit (3) aids reception of signals from the

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accelerometers (6,7) and the angle sensor (5). Attached to the control unit is a small television screen (8) whereby instructions from the control unit are conveyed to the user (2), to perform an exercise programme. The exercise programme is predetermined by a therapist. After performing the exercise programme the user (2) downloads the data via radio from the control unit to a central data-collecting unit at the therapists clinic for analysing. The therapist can also change the exercise programme by radio, without the need for seeing the user.

Fig 2 depicts a mat (21) for use in accordance with a second embodiment of the present invention. The mat (21) has a target grid on its upper surface.

Figures 3 and 4 show an example of a capacitance One Dimensional Angle Sensor suitable for use with the present invention. The angle sensor is based on the capacitance of a pair of parallel plates. The area of the plates overlapping is directly proportional to the capacitance. As the angle changes, the overlap of the plates change, as seen in Fig. 3 and Fig. 4, resulting in a change in capacitance.

The sensor may be attached to a hinged device and therefore would be capable of detecting angles in one plane (i.e. elbow motion). The sensor can be produced for a low cost and using a simple circuit, for instance as shown in figure 5. In order to remove the need for every sensor requiring calibration, incorporation of an absolute angle marker (e.g. at 0°, 45° or 90°) is necessary, such as an L.E.D. or a photocell. The capacitance varies non-linearly with angle, hence the output voltage requires linearising by use of a look-up table, curve fit or spline.

As can be seen from the circuit diagram (figure 5), U1a is used to produce a free-running oscillator. The output from this circuit triggers U1b, which is configured as a monostable multivibrator. The pulse period

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of this monostable is determined by the capacitance connected across terminals CN1 and CN2, which in this instance is a rotary vane capacitor whose capacitance is dependent on angular position. The output from IC 1b is a pulse train of fixed frequency with a mark/space ratio, which varies according to the position of the variable capacitor. The DC component of the pulse train will vary with the mark/space of the pulse train. IC U2b is configured as a filter, which extracts the DC component from the pulse train. The DC component is level shifted and buffered by IC U2a and presented at connector CN4 for processing as required.

10

Inductive 3D angle sensors may also be used with the present invention in order to detect the angle of the body limb, which the present invention is attached to. These sensors may be suitable for sensing the angle of joints capable of moving in more than one dimension (i.e. shoulder, hip, ankle, wrist).

The device may be wireless and may be based on mutual inductance (as used to transmit heart rate data in sports heart monitor products). The sensor consists of a coil driven at a given frequency. The detector is a set of three coils, with iron cores, set orthogonally to each other (figure 6). As the sensor moves through the field, voltages are induced in the three coils, which can be detected and interpreted in response to the sensor position. When the coils are parallel the coupling is at a maximum and at a minimum when the coils are orthogonal. The coupling is dependent on the angle between the coils' axes, but also the distance between the coils.

To detect shoulder angle, it is anticipated that the transmitting coil would be on the patient's arm, whilst the three perpendicular receiving coils would be mounted on the chest.

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An exercise programme suitable for use with the present invention is the Knee Bend Exercise (figure 7). This exercise programme involves measuring the angle of the patient's limbs and is particularly suitable for movement in one plane. This exercise programme can work equally well
5 for the elbow and other joints where the movement required is in one plane. Suitably therefore the One-dimensional Angle sensors such as the Capacitance Angle Sensor shown in Figure 3 may be used.

Typically the patient or user does the exercise sitting on a chair or
10 on the edge of the bed. Two sensors e.g. gyroscopes are used, the first sensor (71) positioned above the knee and the second sensor (72) positioned below the knee. A larger number of sensors could be used, however for simplicity two is adequate.

15 The angle between the two parts of the limb, e.g. leg, is calculated from the orientation of the sensors.

Figures 8a, 8b and 8c show an embodiment of an active range motion exercise that can be performed with the present invention.
20 Sensors of the present invention may be positioned on the user's arm so that the vertical motion of the arm (Fig. 8a), the horizontal motion of the arm (Fig. 8b) or the rotation of the arm (Fig. 8c) may be monitored. By using the present invention to monitor this type of exercise enables accurate results to be collected quickly and efficiently. By using the
25 present invention to monitor this type of invention also enables complex movement of the arm to be performed and still accurate results can be collected which may be analysed to give useful data that can indicate how well the user can perform the exercises.

30 For this exercise the sensors of the present invention may be, suitably positioned on the user's arms by means of a bracelet, as shown in Figure 9. These are typically made of an elongated plastic material

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coiled to form an expanding bracelet shape (91) having one or more sensors (92) and optionally having a detachable cover (93). This bracelet may be positioned anywhere on the arms, the coiled mechanism acting to hold the bracelet without causing discomfort to the user and also not
5 restricting movement by the user. The bracelet may be suitable for use on other limbs of the body, for instance on the leg.

The bracelets may be attached by any suitable means. A possible means to attach the bracelet around a user's limb is by VELCRO (Trade
10 Mark) material.

The bracelets of Figure 9 may have a hard wire connection to a data processor for processing the data generated, however preferably the data generated would be conveyed to the processor by radio. This has the
15 advantage that the user has good freedom of movement.

Examples of the manufacture and use of the invention are described below:-

20 Example 1

An exercise device having four accelerometers, each accelerometer incorporated into a bracelet of soft material. The bracelet being substantially made of a woven cotton that provides some stretch in order
25 to be easily attachable to a user's leg. The user wears the bracelets with the accelerometer/ position sensing means at each ankle and just below each knee such that the accelerometers are placed on the outside position of the user's leg.

30 The accelerometers detect limb motion and detect when the user is on one leg and how high the leg is held off the ground etc. The accelerometers are in wireless communication to a central unit which

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records information regarding the user's movements. The central unit has memory and processing means. The central unit was held by a belt to the user's waist. The central control unit has built into it a small audio microprocessor that conveys instructions to the user of what exercises to do. The exercise programme having been predetermined, and pre-programmed into the central control unit.

The user is instructed to hop on the left leg and then the right leg at various times throughout the exercise programme. After completion of the exercise programme the central unit was removed from the user and downloaded by telephone via a modem to a data collecting station at the therapist's clinic to be examined by the physiologist at a later time.

Example 2

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An exercise device having four accelerometers as described in Example 1, additionally also having a mat. The accelerometers are in wireless communication with a central control unit, which is placed on the floor near to the mat. The position of the accelerometers is monitored, thus indicating joint position and speed of joint response following instruction. The mat is positioned on the floor and the user is instructed audibly from a microprocessor that is attached to the central control unit, to perform particular exercises by placing the left foot or right foot on various positions on the mat.

25

The time that the microprocessor instructs the user to perform particular exercises is recorded in order to measure the response time to perform the exercise. The grid measures approximately from 1.5 m by 1.5 m and has two colour-coded grids. A solid line blue coloured grid whereby the grid forms squares with sides of 15 cm in length and these squares are evenly divided into four by a red coloured broken line grid. The blue coloured grid is labelled in the centre of the squares by blue

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numbering one to one hundred. The control device is pre-programmed to instruct the user to move his left foot or right foot to various positions by the audio microprocessor.

- 5 This information is collected and stored in the control means. After performance of the exercise programme the data collected is sent by telephone via a modem to a central data collecting station at the therapist's clinic for the therapist to analyse the data at a later time. The therapist can therefore monitor compliance by the user and the accuracy
10 and speed of carrying out the programmed exercises. In this way the therapist saves considerable time in monitoring the user but can still monitor the benefits of performing the exercises.

Example 3

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- An exercise device having four accelerometers as described in Example 1 having also a rubber mat hanging from a door. The accelerometers are in wireless communication with a central control unit. The mat is hung from the door by a light plastic clip that attaches to the
20 mat and hangs over the top of the door. The door is closed to firmly hold the mat in a stable position. The central control unit is able to collect data from the accelerometers of where the users ankles and knees are at a given time. The mat is approximately 1 m by 1 m with different coloured circles measuring 15 cm in diameter on the outer facing surface of the
25 mat. The control unit is connected to a TV via the aerial socket of the TV. The TV is placed in view of the user when the user is positioned next to the mat. The control unit conveys instructions to the user via the TV screen as the TV screen displays the particular colour of circle which the user is instructed to move his hands to in accordance with the
30 predetermined exercise programme, programmed by the therapist beforehand. The compliance of the user and the accuracy and speed at which the user completed the exercise program is monitored. This data is

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collected and stored by the control unit until downloaded by the therapist to a central data collecting station by telephone via a modem.

Example 4

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An exercise device consisting of a sock with two accelerometers incorporated into the material in such a way that when the sock is positioned on the foot, one of the accelerometers is positioned at the ankle at the back of the ankle joint and the other accelerometer is positioned at the top of the toes of the foot. The user wears the sock on the right foot and is required to perform the exercise programme. The accelerometers are in wireless communication with a central control unit, which is placed in the same room where the exercises are to be performed. A mat is placed on the floor in front of the user and instructions from an audio microprocessor that is attached to the central control unit conveys instructions to the user of what exercises to do. These instructions will be to move the right foot to various positions on the mat while keeping the left foot still. The mat has a numbered grid on its upper surface, the different grid numbers being target positions for the user to move the right foot to. After the exercise programme has been completed the information that has been processed and stored in the central control unit is downloaded to a central data collecting at the therapist's clinic.

25 Example 5

An exercise device as described in Example 4 where the accelerometers are replaced by angle sensors. The angle sensors used were gyroscopes, MG 100, supplied from Gyration Inc.

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Example 6

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An exercise device as described in Example 4 where the sleeve also contains a pressure sensor on the sole of the foot region of the sleeve in order to measure additionally when the user places the right foot onto the ground and when the user places weight onto the right foot.

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Example 7

An exercise device as described in Example 5 where the sleeve also contains a pressure sensor on the sole of the foot region of the sleeve in order to measure pressure on the sleeve when the user places the right foot onto the ground and when the user places weight onto the right foot.

10

Example 8

An exercise device having two accelerometers contained within a sleeve such that when the sleeve is placed on the arm of the user one accelerometer is positioned near to the wrist and the other near to the elbow. The accelerometers are in wireless communication with a central control unit. The central control unit has attached to it an audio microprocessor for conveying instructions to the user regarding the exercise programme, which the user is requested to do. Before starting the exercise programme the user is sitting down. The exercise programme starts with the microprocessor delivering an ascending audio note and the user moves the arm with the device attached in time to the audio note. The movements of the arm are processed and recorded by the central control unit to be downloaded later to a data collecting station at the therapist's clinic by telephone via a modem. The therapist can therefore examine the data at a later time in order to assess how the user is progressing with the exercise programme.

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Example 9

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An exercise device as described in Example 8 where the accelerometers are replaced by angle sensors, which are positioned adjacent to the elbow joint. The angle sensors used were gyroscopes, MG 100, supplied from Gyration Inc.

5

Example 10

For this example the patient was asked to perform a weight shift exercise. The patient was asked to rock from side to side putting their full weight on each leg in turn. A common occurrence is for a patient to rock their shoulders or hips. When this occurs the patient may believe their weight is being fully transferred to each limb, but this is not the case. Sensors, e.g. accelerometers in this example, are placed on the sternum and the waist for detecting abnormal shoulder or hip movement.

15

The data collected was analysed rather like what the therapist would do in practice. When the exercise was done correctly the upper body moves from side to side while remaining in a vertical plane. When the exercise is done correctly sensors at the waist and chest will indicate approximately equal movements. However, when the exercise is done incorrectly the shoulders (upper body) or hips are likely to move significantly more than the other or there will simply be insufficient movement. Commonly when the exercise is done incorrectly there will be shoulder wobble (when the shoulders move significantly more than the hips) or hips wobble (when the hips move significantly more than the shoulders) or insufficient movement (when the patient does not move his body enough due to, for example, tiredness or injury).

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The ranges of the horizontal axis of each of the two accelerometers are compared and advice is given to the patient. The flow chart of Figure 10 explains the analysis, with range-waist representing the range of

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acceleration at the waist and range-chest representing the range of acceleration at the chest.

Example 11

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Weight shift exercises similar to the exercise explained in Example 10 apart from that the user also has accelerometers to detect sideways movement of their waist and shoulders.

10 The data collected was analysed using neural network. The neural networks are very good at identifying non-linear relationships between a set of inputs and one or more outputs. The advantage of using neural networks is that they find the best relationship without the user having to specify a choice of possible relationships. Neural networks find a
15 relationship but do not determine if this relationship is a good or bad one, meaningful or meaningless, it is up to the user or therapist to determine this.

Neural networks train using a set of data (the training set). Users
20 assess the quality of the network output using another set of data (the validation set). Because the networks train on one set and are assessed using another, it is possible, if the two data sets are too similar, for the network to be of low quality even though the validation set suggests otherwise. Therefore, cautious users have another set of data (the test
25 set) to reduce the chance of this happening.

Figure 11 shows a typical neural network. There is one input node (111) for each feature; there is one output node (112) for each class of movement. The number of hidden nodes (113) can vary. The lines (114)
30 represent weights between pairs of nodes. Hidden nodes, e.g. h1, will be the sum of input nodes i1 to i5 multiplied by their respective weights w1 to w5. The other hidden nodes (113) are the sum of the same input nodes

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(111) but multiplied by a different set of weights. Similarly, each of the output nodes (112) are the sum of the hidden node multiplied by a set of weights. Ideally. In a classifying network like this one, the output will be close to unity while all the other outputs will be close to zero. This is because the volunteer's movement can only be put into one class at a time. In order to help the network find the optimum set of weights, each sum of inputs to a node can also be scaled to fall within a desired range of values.

10 The movement of the user performing the exercises is classified into one of four classes:

1. Correct movement
2. Move hips less
- 15 3. Move hips and shoulders more
4. Move hips and shoulders less

Accelerometers were placed in front of the user at the waist and at the chest. The outputs from the accelerometers in the horizontal and vertical planes were used (please note that in Example 10 only side-to-side movement was considered).

The following features were extracted from each of the four accelerometers:

- 25 1. The standard deviation of the accelerometer output over the 30 readings (about 1.8 seconds)
2. The range of accelerometer output over the last 30 readings (i.e. accelmax- accelmin)
3. The absolute sum of the accelerometer change over the last 30 readings (i.e. the sum of abs (reading n – reading n-1)
- 30

Twelve features (the above three from each of four accelerometers) are input to the network. The network used Bayesian regularisation to limit the magnitude of each network weight.

- 5 Matlab version 5.3.1 with the neural network toolbox 3.0.1 was used to do the analysis.

Other training regimes could be used. Not all features need be input into the network, thus simplifying its use but probably reducing its
10 accuracy. The number of hidden nodes could be varied. Finally, the output classification could be altered, but only if the assessors are watching the patient, changes the classification of the exercises.

The therapist can examine the data at a later time in order to assess
15 the user's performance.

Example 12

In this example the patient was asked to perform a knee bend
20 exercise.

One gyroscope is placed on each part of the leg, above and below the knee. The gyroscopes are oriented to detect a forwards/backwards and up/down change in position, i.e. it would detect a change in knee
25 angle, but not a side-to-side movement of the leg. Typically 100 or more readings are taken without the sensors moving to determine the mean stationary output of each gyroscope. Typically, these might be, as in this example, 1125 for the upper leg and 1767 for the lower leg (arbitrary units). Previous experiments have indicated that each sensor changes
30 output by 10.7 for a 1 degree change in orientation. Thus for the upper leg, the angle is:

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$$\text{Angle Upper Leg} = (\text{sensor output} - 1125) / 10.7$$

The angle for the lower leg is:

5 $\text{Angle Lower Leg} = (\text{sensor output} - 1767) / 10.7$

The knee angle is:

$$\text{Knee angle} = \text{Angle upper leg} - \text{Angle lower leg}$$

10

Interpretation of the quality of the exercise can be made using any of the terms in the final equation.

Again the therapist or user can examine the data generated at a
15 later time to assess the results of the exercise programme.

Example 13

Forward Step-up/down

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A device of the invention having one accelerometer above the knee and one accelerometer below the knee was positioned on a user. The user was asked to stand facing a single step. The step was 17 cm high and wide enough for the user to stand on comfortably. The user would
25 step up, onto the step, ending with both feet on the step. Then the patient steps down onto the floor, ending with both feet on the floor.

The exercise was repeated several times. The results i.e. data from the accelerometers was collected, downloaded via a modem to a
30 computer at the therapist's clinic to be analysed later.

Example 14

Lateral Step-up/down

Using a similar step as described in Example 13, the user initially
5 stands to the side of the step. The device of the invention, which the user
is wearing, is similar to the one described in Example 13, except that, the
accelerometers are replaced by gyroscopes, MG 100.

10 Standing feet together to the side of the step, the user steps up onto
the step, leading with the leg nearer the step, ending with both feet on the
step. Then the user steps down onto the floor, ending with both feet on
the floor. (The step down can be done on either side of the step,
depending which leg the exercise is aimed at. The user leads with the
foot closer to the direction of travel.)

15 The exercise was repeated several times. The results from the
accelerometers were collected, downloaded via a modem to a computer at
the therapist's clinic to be analysed later.

20 Example 15

An exercise device as described in Example 4 in which at the
accelerometer positions there is also an angle sensor. The angle sensors
used were gyroscopes, MG 100, supplied from Gyration Inc.

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CLAIMS

1. An exercise device comprising at least one position sensor that is attachable to a user and which can then indicate the position and/or motion of a body part of the user.
2. An exercise device as claimed in claim 1 in which the position sensor is in communication with a processor for processing data generated by the position sensor.
3. An exercise device as claimed in claim 2 in which the processor and sensor are attached.
4. An exercise device as claimed in claim 2 in which the sensor communicates with the processor by radio signals.
5. An exercise device as claimed in any preceding claim in which the processor can store data.
6. An exercise device as claimed in any preceding claim in which the device has means to convey information to the user.
7. An exercise device as claimed in claim 6 in which the device is able to convey information the user of the position data.
8. An exercise device as claimed in claim 6 in which the device is able to convey information of an exercise programme.
9. An exercise device as claimed in any preceding claim in which one or more of the sensors are selected from the group; capacitance sensor, accelerometer, rotary potentiometer, angle sensors, potentiometers, or mixtures thereof.

10. An exercise device as claimed in any one claim 1 to 9 in which one or more of the sensors are gyroscope.
- 5 11. An exercise device as claimed in any preceding claim in which one or more of the sensors are attached to an arm of the user.
12. An exercise device as claimed in any one of claims 1 to 10 in which one or more of the sensors are attached to a leg of the user.
- 10 13. An exercise device as claimed in any preceding claim in which one or more of the sensors are attached to a user by a soft sleeve.
14. An exercise device as claimed in any one of claims 1 to 13 in which
- 15 the processor communicates with a computer.
15. A rehabilitation device comprising an exercise device as described in any one of the preceding claims.

1/8

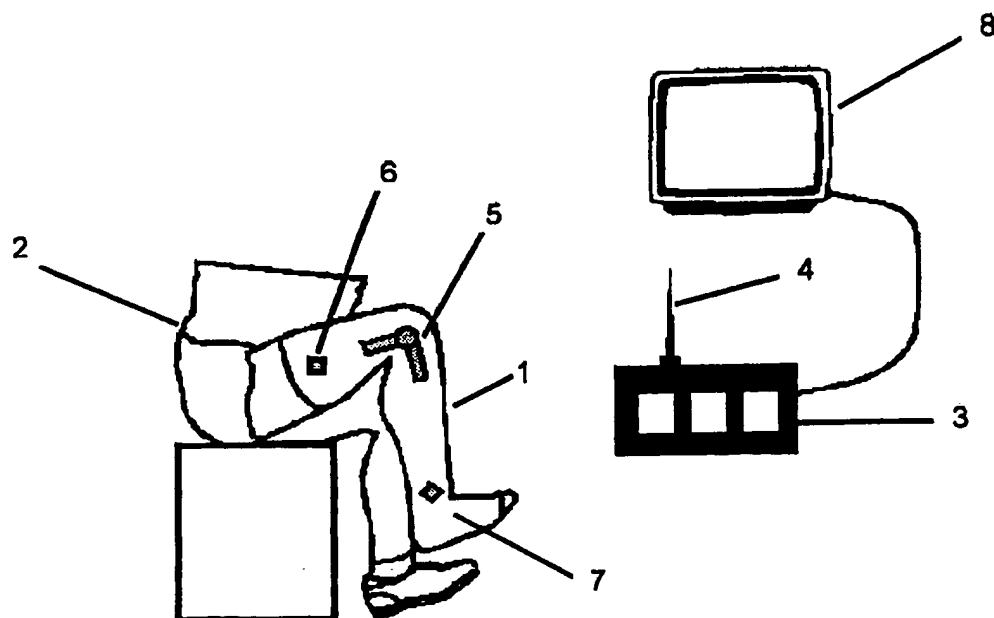


Fig. 1

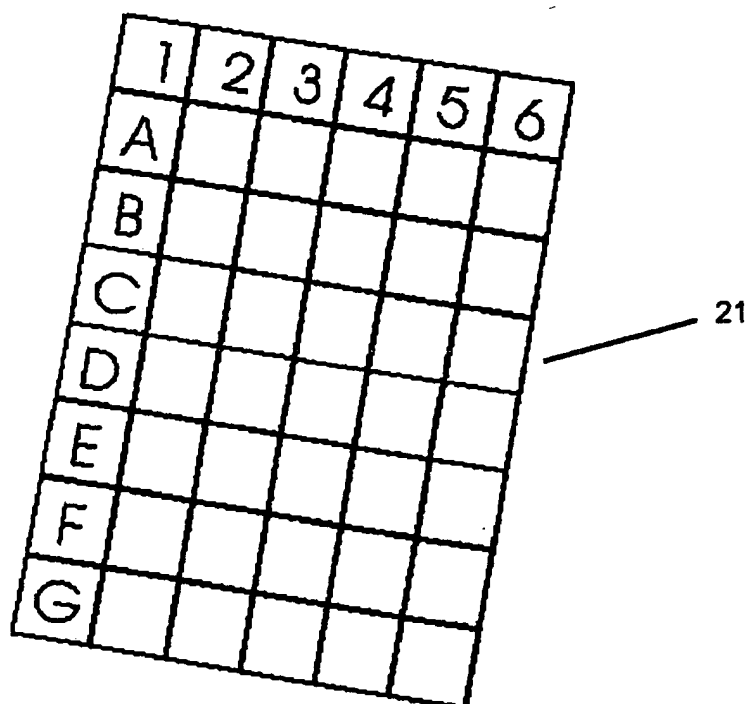


Fig. 2

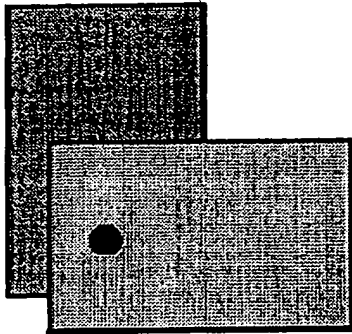


Fig. 3

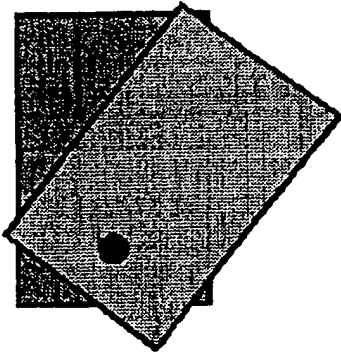


Fig. 4

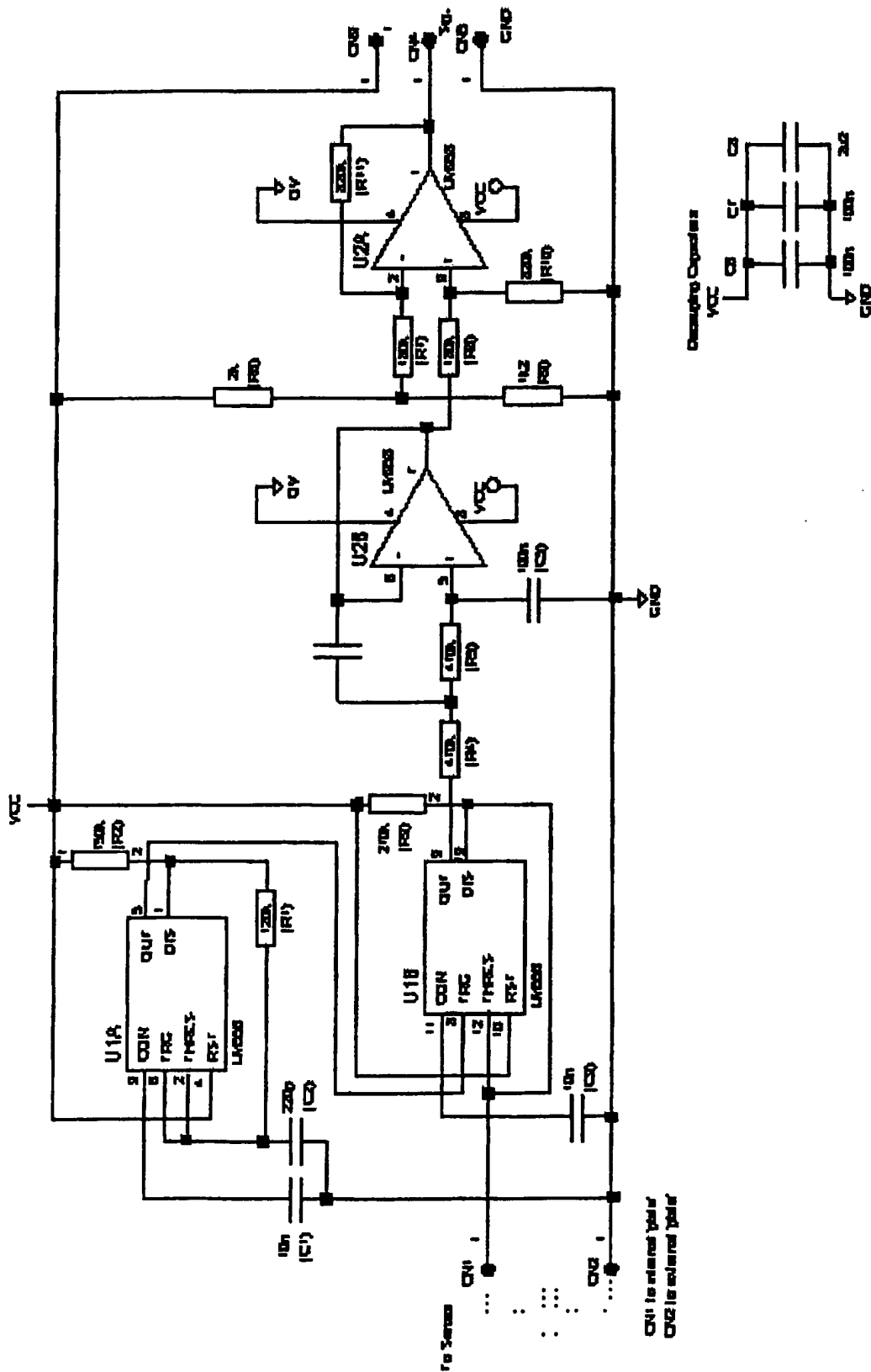


Fig. 5

4/8

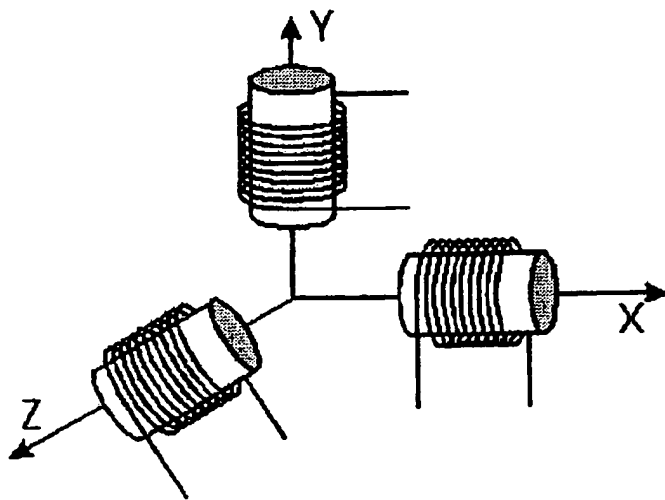


Fig. 6

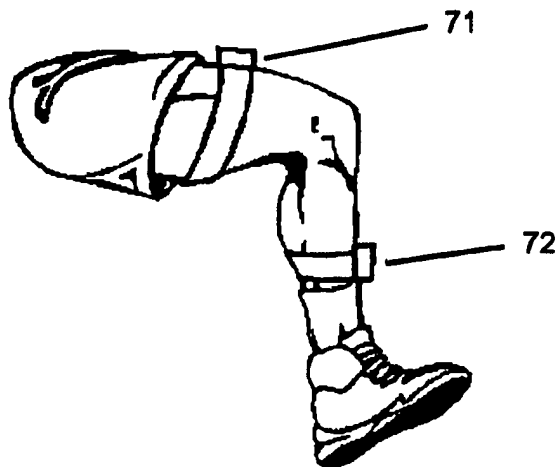


Fig. 7

5/8

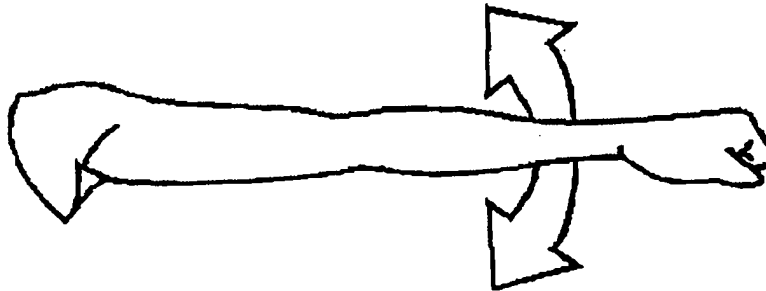


Fig. 8a

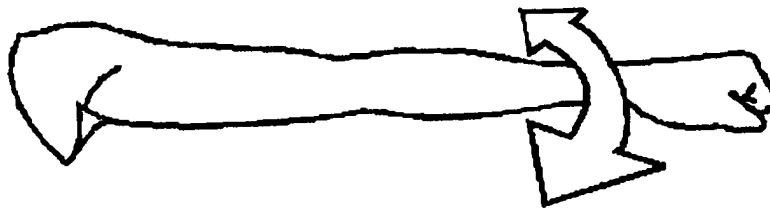


Fig. 8b

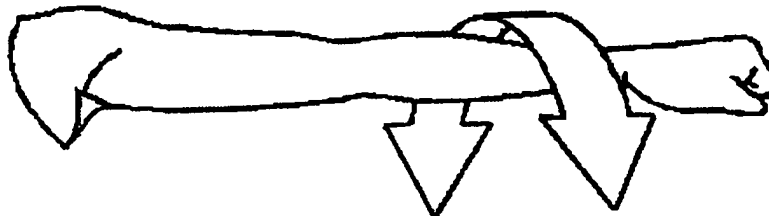


Fig. 8c

6/8

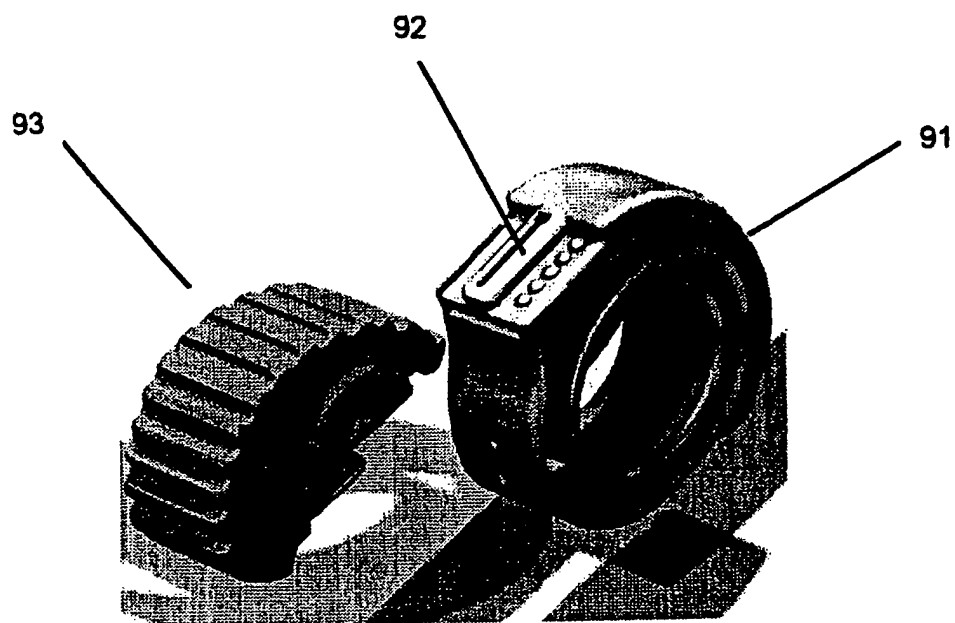


Fig. 9

7/8

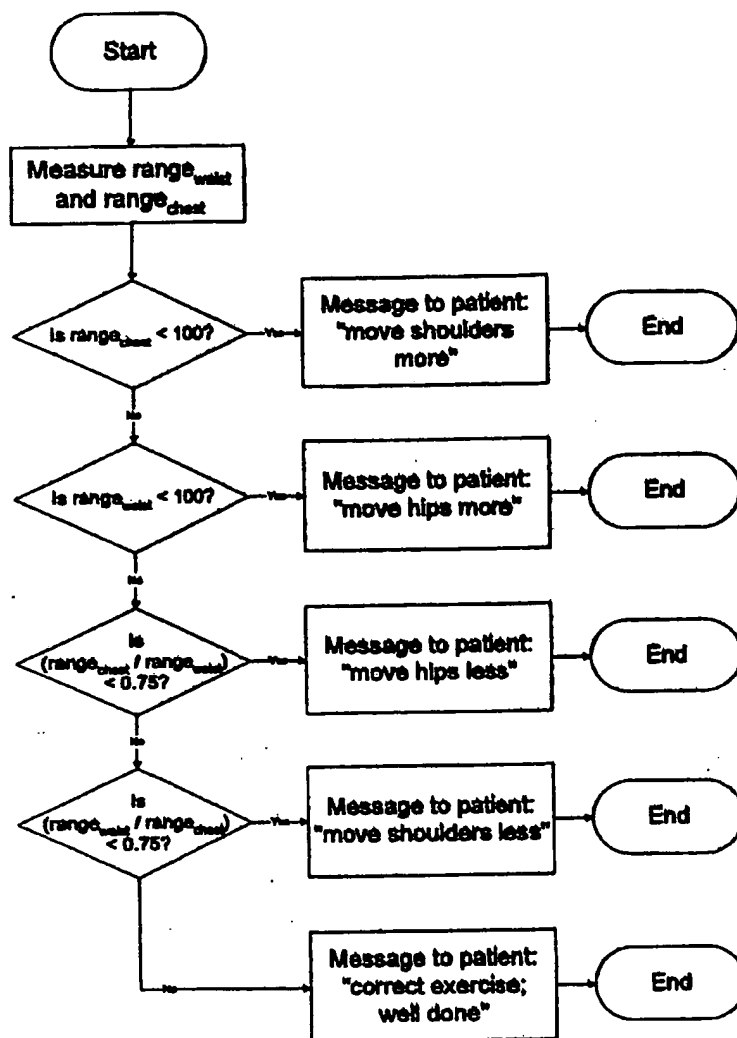


Fig. 10

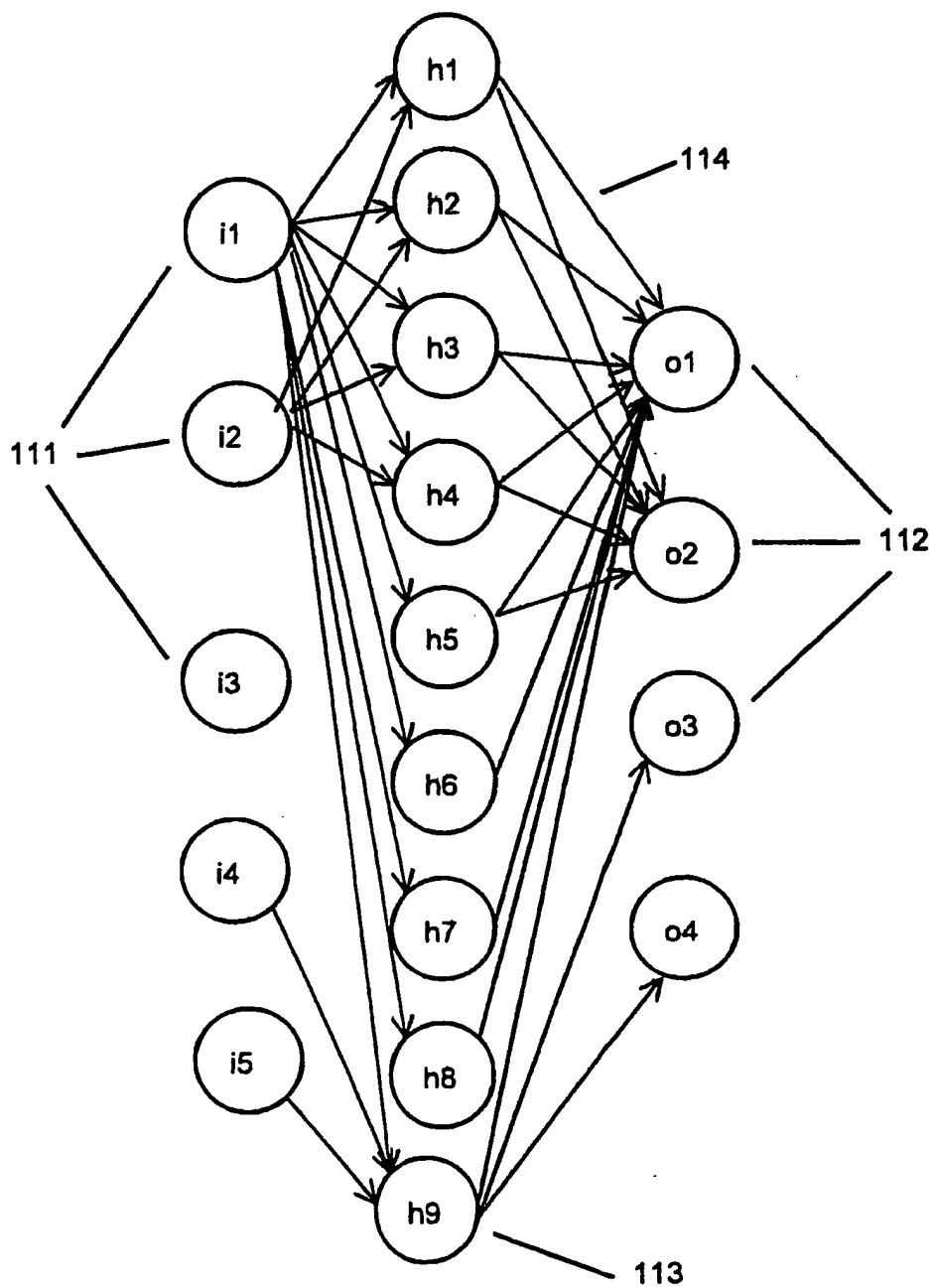


Fig.11

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/02065

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A63B24/00 A61B5/103 A61B5/11

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 A63B A61B

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.
X	US 5 524 637 A (ERICKSON JON W) 11 June 1996 (1996-06-11) column 2, line 51 - line 60 column 7, line 53 - line 57 column 8, line 4 - line 9 column 8, line 46 - line 66 column 9, line 3 - line 9 claim 21; figures	1-6,8,9, 11-15
Y	---	7
Y	US 5 484 389 A (LUND RICHARD G ET AL) 16 January 1996 (1996-01-16) column 20, line 52 -column 21, line 34 column 21, line 43 -column 22, line 26 figures 1,11,15 --- -/-	7

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>EP 0 494 749 A (ORTHOPEDIC SYSTEMS INC) 15 July 1992 (1992-07-15) abstract; claim 17 -----</p>	10

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5524637 A	11-06-1996	NONE	
US 5484389 A	16-01-1996	US 5368546 A	29-11-1994
		US 5052375 A	01-10-1991
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		WO 9112786 A	05-09-1991
EP 0494749 A	15-07-1992	US 5337758 A	16-08-1994
		JP 5207992 A	20-08-1993

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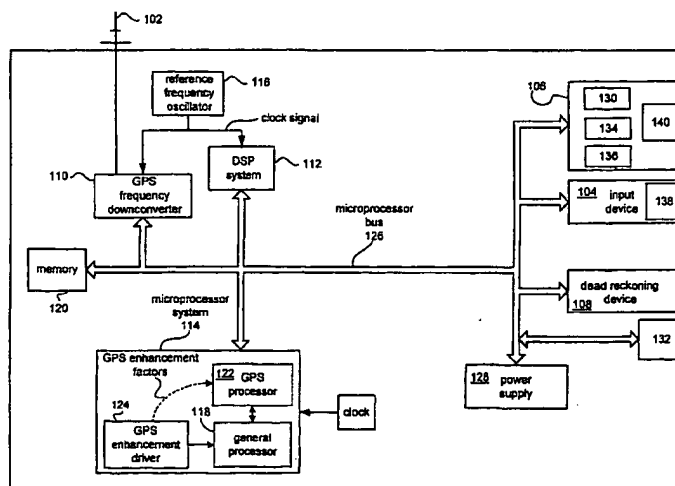
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(54) Title: **GPS ATHLETIC PERFORMANCE MONITOR METHODS AND APPARATUS THEREOF**



(57) Abstract: A system for automatic monitoring real-time athletic performance of a user is described. A portable unit (100) having a GPS receiver capable of providing GPS velocity data to a processor unit (122) includes a processor unit (122) coupled to a database (120) having information such as physical characteristics, weight, age, and gender, is able to provide a updated readout to a display unit (106) of the user's ongoing athletic performance statistics. Such statistics include elevation gain, current speed, current heading, current elevation, calories burned, anticipated calories burned (based upon a pre-selected course), and others. By using Doppler shift based GPS velocity measurements, the athletic performance monitor is able to provide an accurate accounting of a user's athletic performance in real time. In some cases, a virtual competition can be held whereby users at different locations and/or at different times can conduct a virtual competition using the athletic performance monitor coupled to a server computer.

WO 01/42809 A2

GPS ATHLETIC PERFORMANCE MONITOR METHODS AND APPARATUS THEREOF

5

BACKGROUND OF THE INVENTION

1. Field of Invention

The invention relates generally to performance monitoring. More particularly, methods and apparatus for monitoring an athlete's real time performance using a
10 global positioning satellite system (GPS) are disclosed.

2. Description of Relevant Art

Outdoor endurance activities have become very popular not only because they are enjoyable and healthy, but also because they provide opportunities for
15 competition, camaraderie, and a structured regimen. It would be highly beneficial for an individual participating in an outdoor endurance activity such as running, cross-country skiing, in-line skating, or outdoor swimming to be able to monitor his or her performance in metrics such as speed, distance, slope, elevation, and calories on a real-time basis. Additionally, as part of a particular training program, an athlete will
20 want to be able to keep track of his or her performance for a particular event as well as be able to store for later comparison with subsequent athletic events. For example, if a runner desires to track his or her performance over a period of time, various physical characteristics of the runner, such as age, weight, and gender, for example, could be used to evaluate the runner's performance against both his or her individual
25 performances, either as an average or against trend data over a designated period of time. In addition to being able to gauge their own particular athletic performances

against their own historical record, an athlete would also like to be able to compare his or her own performance against a reference performance typical of, for example, a person having similar physical characteristics. In this way, an athlete could gauge his or her own athletic prowess and abilities against an accepted reference and be able to
5 determine, for example, what percentile he or she falls in relation to his or her particular cohort of runners.

In addition to being able to ascertain one's own performance against a hypothetical norm, an athlete would also like to be able to compete against other athletes. Such competitions historically have been held in meets, or other local
10 physical competitions where athletes meet in person and compete. It would also be desirable to be able to compete against an opponent even in those situations where both opponents can not be physically in the same location, by the use of a network such as the Internet. However, being able to track each individual, until recently, has been impractical to say the least.

15 Further, structured real-time coaching is presently available to very few athletes, and the need to train on measured courses in order to undergo traditional highly structured workouts severely limits an athlete's options in pursuing advanced training regimens. This situation is worsened when the athlete wishes to train in an area in which he or she is unfamiliar with local training routes. A means to provide
20 real-time performance coaching, pre-planned structured workouts, and access to a compilation of local training routes would be highly beneficial to athletes.

With the advent of the global positioning system (GPS), the ability to track a particular object, be it a car, boat, or person, on the surface of the Earth in real time has greatly improved. GPS technology enables the possibility of compact portable
25 devices that monitor and store a user's location, speed, and elevation in real time.

However, there remain several impediments to the widespread adoption of GPS-based portable athletic monitors: (1) GPS signals are easily blocked when the athlete passes under heavy foliage or by high buildings; (2) GPS slope and elevation measurements are highly inaccurate, compromising a GPS performance monitor's ability to log the elevation profile and thus accurately assess athletic performance; and (3) GPS speed measurements based on analysis of time-stamped location waypoints are not accurate enough for performance analysis.

There have been several attempts in the past to incorporate a GPS device into a portable athletic monitor, but none has been particularly successful. One such attempt is represented by U.S. Patent 6,002,982. This invention uses GPS only to log user location as a function of time, in parallel with another sensor that monitors a performance metric such as speed. It does not utilize the GPS to measure performance and thereby is limited to activities such as bicycling in which speed measurement can be performed using other technology. It also does not provide for on-line racing, workout databases, or route databases, nor does it address the above-mentioned impediments to GPS use.

U.S. patent 6,013,007 utilizes a GPS receiver to record a series of time-stamped location waypoints, from which it deduces a user's athletic performance. This approach to GPS velocity measurement is significantly less accurate than GPS carrier-wave Doppler velocity measurement, leading in typical situations to objectionably high velocity error. Further, this patent also fails to address any of the above impediments to GPS use.

U.S. patent 6,032,108 details a GPS athletic performance monitor that minimizes the effects of errors due to navigational reference systems and the intentional slight dithering of civilian GPS. This dithering, referred to as Selective

Availability, has since been terminated by the U.S. government. Errors due to reference system are also not a concern as long as the same system is used consistently. Similarly to the other patents named above, this patent does not address any of the above impediments to GPS use.

5 Therefore, what is needed is a portable GPS based athletic performance monitor and system capable of providing consistently available, accurate, real time athletic performance specific to a particular user. In addition, the portable GPS monitor should be able to interface with a distributed network of computers, such as the Internet, in order to provide a link to a virtual community of athletes.

10

SUMMARY OF THE INVENTION

The invention relates to an apparatus and method for monitoring an athlete's real-time performance using the Global Positioning System (GPS). In one implementation, a portable athletic performance monitoring and training system
5 arranged to provide athletic performance data associated with an athletic performance is described. The system includes a GPS receiver and a memory device storing selected data such as measured user performance metrics and a digital elevation model (DEM) database that describes the local elevation profile. The DEM data serve to improve the accuracy of the GPS elevation and speed measurements as well
10 as to improve the tolerance of the system to satellite blockage.

The system also includes a processor arranged to calculate carrier-wave Doppler-shift based user velocity based upon data received from the GPS receiver and the DEM, and to calculate selected athletic performance feedback data using the calculated user velocity and other data such as the elevation profile and the user
15 physical characteristics. The use of Doppler based velocity measurements gives accuracies in the range of 0.1 mph in typical GPS receivers, which is the highest accuracy typically required for useful assessment of athletic activities.

The system further includes a data I/O port arranged to provide a data interface between the system and an external computing device, whereby the data can
20 be transmitted to and from a computer network such as the Internet. This enables a host of competitive, community, and experience-enhancing functions including virtual races, favorite-routes databases, regimen databases, performance benchmarking, and route mapping and planning. Further, the Internet connection enhances the performance of GPS by enabling the seamless downloading of DEM
25 data for the area in which an athlete is training and by enabling the downloading of

precise satellite location ("ephemeris") data, which greatly speeds up the system's initial start-up time.

These and other advantages of the present invention will become apparent upon reading the following detailed descriptions and studying the various figures of

5 the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention, together with further advantages thereof, may best be understood by reference to the following description taken in conjunction with the accompanying drawings in which:

5 Fig. 1 represents a particular implementation a GPS personal trainer 100 in accordance with an embodiment of the invention that is typically carried on or by a user during a particular training session.

Fig. 2 illustrates a block diagram of a GPS frequency down-converter in accordance with an embodiment of the invention.

10 Fig. 3 illustrates a block diagram of a DSP system in accordance with an embodiment of the invention.

Fig. 4 illustrates a flowchart describing a process for initializing the trainer in accordance with an embodiment of the invention.

15 Fig. 5 illustrates a flowchart detailing the process whereby the trainer is set to act in the passive mode in accordance with an embodiment of the invention.

Fig. 6 shows a flowchart detailing the active mode in accordance with an embodiment of the invention.

20 Fig. 7 is a flowchart describing a particular implementation of the mode selection operation as a training mode in accordance with an embodiment of the invention.

Fig. 8 shows a flowchart detailing one implementation of the course mode in accordance with an embodiment of the invention.

Fig. 9 is a flowchart detailing an implementation of the workout mode in accordance with an embodiment of the invention.

Fig. 10 shows a flowchart detailing an implementation of a cross country mode in accordance with an embodiment of the invention.

5 Fig. 11 illustrates a number of trainers coupled to form a virtual competition in accordance with an embodiment of the invention.

Fig. 12 illustrates a computer system that can be employed to implement the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

The following description is provided to enable any person skilled in the art to make and use the invention and sets forth the best modes contemplated by the inventor for carrying out the invention. Various modifications, however, will remain readily apparent to those skilled in the art, since the basic principles of the present invention have been defined herein specifically to provide a novel GPS based personal trainer and methods of use thereof.

Reference will now be made in detail to a preferred embodiment of the invention. An example of the preferred embodiment is illustrated in the accompanying drawings. While the invention will be described in conjunction with a preferred embodiment, it will be understood that it is not intended to limit the invention to one preferred embodiment. To the contrary, it is intended to cover alternatives, modifications, and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

Broadly speaking, the invention relates to an improved method, apparatus and system for automatic monitoring in real-time athletic performance of a user. In one implementation, the invention provides a portable unit having a GPS receiver capable of providing GPS velocity data to a processor unit. The processor unit, being coupled to a database having information such as physical characteristic data such as weight, age, and gender, stored therein, is able to provide a updated readout to a display unit of the user's ongoing athletic performance statistics. Such statistics include elevation gain, current speed, current heading, current elevation, calories burned, anticipated calories burned (based upon a preselected course), and others. By using Doppler shift based GPS velocity measurements, the inventive athletic performance monitor is able to provide an accurate accounting of a user's athletic performance.

In a preferred embodiment, the inventive monitor can be coupled to a distributed network of computers, such as the Internet, by way of an I/O port coupled to external circuitry, such as a personal computer, personal digital assistant (PDA), modem, etc. In this way, the user can download selected data related to, for example, other athlete's performance data, selected courses, training programs, etc. so as to be a part of a virtual community of athletes each of whom interact with each other in either a real time basis or in some cases, during what is referred to as a virtual competition, such as a race.

Fig. 1 represents a particular implementation a GPS personal trainer 100 in accordance with an embodiment of the invention that is typically carried on or by a user during a particular training session. The GPS personal trainer 100 is arranged to receive GPS satellite signals from one or more GPS satellites having a line of sight to a GPS antenna 102 and to determine a location of the GPS antenna 102 and a time of observation. The GPS personal trainer 100 also includes one or more input devices 104 to receive requests from a user, one or more output devices 106 to display information to a user as well as communicate with external circuitry by way of, for example, a data port (not shown but described below). It should be noted that the user input devices 104 have associated labels to enable a user to know how to request an operation of the GPS personal trainer 100. In one embodiment, the labels are hard or permanent. Alternatively, the labels are soft or can be changed by the user according to a menu of operations. In some embodiments, the GPS personal trainer 100 can optionally include one or more dead reckoning devices 108 to provide direction information or change of location information. Such dead reckoning devices include altimeters, accelerometers, cadence measurements sensors and the like.

In the described embodiment, the GPS antenna 102 receives the GPS satellite signals and provides a GPS antenna signal having a frequency of approximately 1.575 GHz. A GPS frequency down converter 110 receives and down converts the GPS antenna signal to a GPS intermediate frequency (IF) signal suitable for digital processing. A digital signal processor (DSP) system 112 receives the GPS IF signal from the GPS frequency down converter 110 and provides digital signals representing correlation information, for example, to a microprocessor system 114. It should be noted that in some embodiments the DSP system 112 can be physically integrated into the microprocessor system 114. A reference frequency oscillator 116 provides a system clock signal to the frequency down converter 110 and the DSP system 112. Optionally, the system clock signal is provided by an external source.

More particularly, Fig. 2 illustrates a block diagram of a GPS frequency down-converter 200 in accordance with an embodiment of the invention. It should be noted that the down-converter 200 in one possible implementation of the down-converter 110 and should therefore not be construed as limiting either the scope or intent of the invention. As configured, the GPS frequency down-converter 200 provides the GPS IF signal to the DSP system 112. The GPS frequency down-converter 200 uses radio frequency RF analog integrated circuit design techniques and fabrication processes well known to those skilled in the arts. A preamplifier 202 receives the GPS antenna signal at a frequency of approximately 1.575 GHz and issues an amplified signal to an RF to IF channel 204. In an alternative embodiment, a preamplifier in the GPS antenna 102 eliminates the requirement for the preamplifier 202. Typically, a preamplifier in the GPS antenna 102 and/or the preamplifier 202 is required in order to provide good signal to noise ratio for the GPS IF signal. A local oscillator system 206 receives the system clock signal at one frequency from the

reference frequency oscillator 116 (or external clock source) and provides one or more local oscillator signals at one or more other frequencies to the RF to IF channel 204. The RF to IF channel 204 uses the local oscillator signals to down-convert the frequency of the amplified GPS antenna signal to the GPS IF signal and passes the IF signal to an optional first sampler 208. The first sampler 208 synchronizes the GPS IF signal to the clock signal, quantizes the amplitude of the GPS IF signal and issues a digital GPS IF signal to the DSP system 112.

Fig. 3 illustrates a block diagram of a DSP system 300 in accordance with an embodiment of the invention. It should be noted that the DSP system 300 is one possible implementation of the DSP 112 and should therefore not be construed as limiting either the scope or intent of the invention. The DSP system 300 has any number of operational modes, the most commonly used one is where the GPS IF signal is acquired and tracked. In the described embodiment, the DSP system 300 uses digital integrated circuit design techniques and fabrication processes well known to those skilled in the arts. A second sampler 302 synchronizes the GPS IF signal to the system clock signal and quantizes the amplitude of the GPS IF signal to provide a digital GPS IF signal to one or more DSP channels 304. The second sampler 302 can be included in each of the DSP channels 304, however since the input and the output of the second sampler 302 is common for all the DSP channels, a cost savings is achieved by using a single second sampler 302.

The microprocessor system 114 assigns each DSP channel 304 to process the GPS satellite signals as represented by the GPS IF signal from one or more individual GPS satellites. The DSP channel 304 is assigned only one GPS satellite signal in parallel operation and is assigned more than one GPS satellite signal in serial operation. More particularly, in serial operation, the DSP channel 304 time sequences

through the assigned GPS satellite signals. Each of the DSP channels 304 includes at least one carrier correlator 306 and at least one code correlator 308 to receive the GPS IF signal, to receive the system clock signal and to correlate the carrier and the code, respectively, in the GPS satellite signal as assigned by the microprocessor system

5 114.

The carrier correlator 306 correlates the carrier of the GPS satellite signal to a carrier Numerically Controlled Oscillator (NCO) included in the carrier correlator 306. The microprocessor system 114 receives and processes correlation information from the carrier correlator 306 and provides digital signals to adjust the carrier NCO frequency. The code correlator 308 correlates the C/A code PRN modulation to a code NCO included in the code correlator 308 and a PRN sequence that is specified by the microprocessor system 114 in order to assign a GPS satellite signal to the DSP channel 304. The times of start of the GPS satellite signals are processed to determine relative distances and speeds (pseudoranges and pseudorange rates) for the GPS satellites.

Referring back to Fig. 1, the microprocessor system 114 includes a general processor unit 118 capable of executing a pre-determined set of instructions stored in a memory 120 as pre-coded software instructions and data. The general processor unit 118 is coupled to both a GPS processor 122 and a GPS enhancement driver 124. The GPS processor 122 serves to convert the measurements from the DSP system 112 into actual location/velocity solutions for the user. The GPS enhancement driver 124 serves to integrate data from GPS enhancements such as a DEM database and the dead reckoning device 108 into the GPS and the performance calculations. It should be noted that commonly the GPS processor 122 and the GPS enhancement driver 124 may be physically integrated into the general processor unit 118. It should also be

noted that the general processor unit 118 is capable of receiving tracking data provided by the GPS processor 122 and provide any number and kind of positional data. Such positional data can be used in any number of training modes and includes, instantaneous speed, instantaneous bearing (i.e., compass direction), average speed,
5 distance covered, various location coordinates, absolute elevation as well as rate of elevation change (or slope).

The microprocessor system 114 operates in a conventional manner to receive digital signals from the DSP system 112, to process the digital signals by executing pre-coded software stored in the memory 120 and to issue digital signals to control
10 the various elements of the GPS personal trainer 100. In one implementation, the microprocessor system 114 receives digital signals representing, for example, correlation information from the DSP system 112 and issues digital signals representing location, rate of change of location, direction, and/or time to the output devices 106. A bus 126 carries digital signals between the microprocessor system
15 114 and the various elements of the GPS personal trainer 100. A power supply unit 128 can take the form of a rechargeable battery such as a NiCd, LiH, and the like. By using such long life batteries, the trainer 100 can used for extensive training sessions typical of long term athletic endeavors such as, but not limited to, marathon training, triathlon training, ultra-marathon training, orienteering, etc.

20 Accordingly, the processor 114 is capable of generating any number and kind of training data useful in providing the trainer 100 with the capability of operating in any number of user specific training modes. Such training modes include a pre-planned workout mode where the trainer 100, in real time, updates the user's current speed and based upon data stored in the memory 120, provides real time feedback
25 whether to speed up or slow down. Other modes include a pre-planned route mode

where the trainer 100 uses a pre-selected route stored in the memory 120 to provide real time directions to the user in order to stay on course. In a preferred embodiment, the output devices 106 includes a display unit 130 that is used to provide the user with the aforementioned feedback data as well as providing the display of other

5 information and data useful to the user. Such data includes a workout summary that can be used to review and critique a particular workout session. In addition, the data can include any appropriate information that the user deems appropriate.

In the described embodiment, the system includes an I/O data port 132 coupled to the memory 120 by way of the bus 126 that is capable of downloading or

10 uploading data to or from external circuitry, such as a computer system, either local or remote.

In a preferred embodiment of the invention, a Digital Elevation Model (DEM) database is stored into the memory 120. The function of the DEM is to improve the system's performance in periods of partial satellite blockage and to improve the

15 elevation and velocity accuracy of the system. In some cases, the data in the DEM can be provided by an external source such as the Internet by way of the I/O port 132 from a master database on a remote server. Furthermore, using the display 130 or the display on an external computing device, the data in the DEM can be used to create visual images of the terrain for use by the user of the trainer 100. Basically any

20 application in which the trainer 100 is located at the level of the surface of the earth as mapped in DEM's, and where the trainer 100 moves in areas of unknown or changing elevation, can be appropriately enhanced.

In the described embodiment, the DEM gives the elevation, Z, as a function of the horizontal position X and Y. A preferred embodiment would include a DEM

25 based upon the USGS's National Elevation Database (NED), which provides

seamless elevation data across the entire United States. It should be noted that there are similar DEM's available for the other parts of the world. DEM's are generally data files showing the elevation in meters on a grid throughout the mapped area, typically with points spaced every arc-second (about 30 meters). Such elevation data

5 are accurate to typically about 5 meters. It should be noted that DEM's are commonly produced using other coordinate systems than that of GPS, and that therefore the DEM data should preferably be converted to the GPS coordinate system in order to maximize accuracy. Even though a typical 7.5-minute map in an uncompressed format would occupy about 400 kilobytes of memory on board the

10 device, this amount of memory is small and inexpensive and a typical application would typically require only one or perhaps a small number of such maps to be loaded. Using well-understood data compression techniques, even less memory would be necessary, or conversely, more data could be stored if so desired.

The use of the DEM would enhance the GPS position functions as follows.

15 For normal 3-dimensional GPS, the device must track four satellites, from which it can calculate the three position quantities X, Y, Z, plus time simultaneously. Using a DEM, the device needs only track three satellites, because it knows Z as a function of X and Y. The device would use its three satellites to solve for X, Y, Z(X,Y) and time simultaneously. Thus in challenging environments where fewer than four satellites

20 are visible, the device can still maintain a high quality position fix. Moreover, the accuracy of the elevation readings Z is greatly enhanced.

Similarly, for velocity readings, the GPS receiver may either simply take differences in the position readings, in which case the above benefit in position accuracy translates into velocity accuracy; or it may calculate speed using the Doppler

25 effect. In the latter case, the device uses the measured Doppler shifts of the signals

from several satellites to calculate the velocity components dX/dt , dY/dt , and dZ/dt .

Using a DEM, the processor can impose the constraint given by the total derivative of $Z(X,Y)$ onto the Doppler speed calculation: $dZ/dt = \partial Z/\partial X dX/dt + \partial Z/\partial Y dY/dt$.

Doing so again reduces the number of satellites required by one and improves

5 accuracy.

The overall accuracy of position and velocity determination is enhanced by the use of the DEM even when four or more satellites are visible. Basically, the DEM serves as a surrogate for one satellite (and is actually more accurate than a satellite would be). If for example four satellites are visible, then without the DEM these

10 satellites would determine one position fix point uniquely, with some significant error. Having the DEM means that there is now effectively one satellite more than is needed for a unique fix, and so the GPS can do a best-fit using all (or as many as are helpful) of the visible satellites. A best-fit using more satellites will in general be more accurate than a unique fix using the minimum number of satellites. Moreover

15 the DEM is oriented in such a direction as to greatly enhance the elevation data accuracy in particular, which is ordinarily the least accurate of the measured coordinates.

Typical GPS receivers have a "2-D" navigation mode in the elevation is treated as fixed, and the satellites are then used to find the X-Y position and velocity

20 under the assumption that the elevation is whatever value at which it is fixed. This mode may give an easy way to implement the DEM-assisted GPS in current receivers, if the local terrain slope is not too extreme. Basically, the trainer 100 would iteratively find the combination of X, Y and $Z(X,Y)$ that is consistent between the GPS and the DEM. The simplest implementation would be to assume that the

25 elevation has not changed significantly since the last fix point. Thus this previous

elevation is input to the GPS as the present elevation; the GPS finds the corresponding X, Y position; then the DEM is used to find the corresponding new elevation (which is presumably not much different from the previous one). This method, though simple to implement, will not be accurate in difficult terrain. It also
5 does not offer any way to calculate the velocity correctly using the vertical component of velocity, dZ/dt . The velocity calculated by a receiver in 2-D mode will be incorrect if the elevation is changing, regardless of whether the receiver is given the correct instantaneous value of the elevation Z.

The more rigorously accurate solution is to incorporate the DEM data directly
10 into the GPS position and velocity equations, essentially imposing additional constraints on the permissible position and velocity solutions. Ideally the solution will use a Kalman filter, a filtering algorithm that integrates all the available data, along with estimates of its potential error (the elevation data will have some error, though less than the GPS measurements), to provide the best possible estimate of the
15 position and velocity at all times. Doing so will more accurately find the location even in highly sloped or variable environments, and it will calculate the velocity correctly.

An additional benefit of the DEM is that the trainer 100, or a user's PC, could generate and display 2-D representations or images of the 3-D terrain, so that the user
20 could examine the terrain visually either before or after traveling in it using the device. Thus a "virtual reality" display showing how the terrain appears would be generated. Desired or completed routes through the terrain could be shown. Moreover, athletes preparing for a race with a particular elevation profile might benefit from software that uses the DEM database to engineer a local training route
25 that has a similar elevation profile to that of the race, and the GPS device could then

guide them along that route. Finally, the DEM might be overlaid with a road map or map of other features of interest to aid in route planning.

The amount of DEM data that a user could ultimately want is very large. The USGS's NED of the entire US would occupy about 20 gigabytes of storage in 16-bit integer format. Therefore at present memory sizes in computers and portable devices, the user is unlikely to wish to carry an entire database of all places where he or she may travel. With its rapidly increasing bandwidth, the Internet provides an ideal solution. An Internet-based server holding the entire country-wide or world-wide database would enable users of the hardware device to download relevant areas of the database to their own PC's and/or GPS devices as needed. Some of the computational functions such as route design or imaging might also beneficially reside on the server rather than in client software.

In some embodiments, the dead reckoning devices 108 includes a barometric-pressure altimeter, which is used instead of a DEM, or in addition to it, to enhance GPS in many of the same ways. The altimeter can have a sensitivity around 10m, thus comparable to that of the DEM. It would have the benefits that it could be used anywhere without requiring the user to pre-load DEM data relating to that area, and that it would work accurately even when the DEM is inappropriate, e.g. when the user is crossing a high bridge, climbing a tower, running up and down stadium stairs, or traveling on terrain that has been altered by land-moving equipment. The altimeter would let the trainer 100 function even if the user was unable to pre-load local DEM data, and it would improve/augment the DEM's accuracy in general, especially in places such as mentioned above where the DEM would be inaccurate or inappropriate. Further, used in conjunction with the DEM, it would provide improved measurement accuracy of barometric pressure for assessment of weather conditions.

In a preferred embodiment, the dead reckoning devices 108 includes an accelerometer or other inertial sensor that is adapted to sense the rhythmic motion associated with a user's athletic performance, e.g. strides, rhythmic arm motion, or slight side-to-side motion of a bicycle in synchronization with the pedaling motion.

5 The purpose of this sensor is further to enhance the performance of the system during periods of partial or complete satellite blockage, as well as to enable smoothing and enhanced accuracy of GPS velocity results. During the periods when the GPS system is generating accurate velocity measurements, these measurements are used to calibrate the inertial sensor, e.g. to establish a relationship between user's speed and

10 the frequency of the rhythmic motion. During these periods, the inertial measurements may also be used to smooth and enhance the GPS results. During periods when the GPS measurements are compromised by satellite blockage, the inertial sensor readings are used in conjunction with the calibration results to extrapolate the user's speed and distance traveled, until contact with GPS is

15 reestablished. It should be noted that the inertial sensor used in this mode does not monitor the user's direction of travel, and that therefore the actual route taken by the user during the satellite blockage may not be accurately recorded. This situation could be remedied by the use of an additional sensor to monitor direction, e.g. a magnetic compass or a gyroscope.

20 The use of an inertial sensor provides significant additional utility to the user beyond the improved system performance. It enables, for example, a runner's stride length to be monitored and analyzed, and suitable coaching to be offered to optimize performance. Further, in an embodiment in which the trainer also contains a digital-audio player 134 and headphones 136, it enables an audio signal such as music to be

synchronized with the user's stride cadence, providing a substantial motivational enhancement.

In the described embodiment, the GPS enhancement driver 124 provides selected ones of the GPS enhancement factors, including DEM data and inertial
5 sensor data, to the GPS processor 122. In some cases, the selected GPS enhancement factors are determined by the user (based upon manually supplied input by way of the inputs 104) or as directed by a particular training program downloaded by way of the I/O interface 132 to the memory 120 and subsequently executed by the general
10 processor 118. It should be noted that the I/O interface 132 could be any interface suitably arranged to transfer digital data in either a serial or parallel manner. Such interfaces can include an IR type interface, a Universal Serial Bus (USB) port, or any other serial port capable of transferring any particular program.

In the described embodiment, the use of the I/O port allows the trainer 100 to be connected to a computer network, whereby precise satellite location data
15 (ephemeris) can be continually downloaded to the device. If the user commences a training session during the period in which these data remain valid (approximately 3-4 hours following disconnection from the network) then instead of the normal GPS start-up time of 1-3 minutes, the trainer 100 will establish satellite contact in a time of typically several seconds in a procedure known as "hot" starting. This represents a
20 substantial added convenience for the user.

In the described embodiment, the system includes a digital filter such as a Kalman filter, preferentially implemented in software, adapted to provide an optimal estimate of the user's location, speed, and performance by combining all available information from all sensors. This filter may advantageously offer the ability to be
25 tuned for the characteristic movements involved in specific sports; for example, in a

running mode it would be adapted for slower speeds and sharper turns than in a bicycling mode. It may also automatically tune itself for optimum performance with a given user in a given activity, based on prior experience with that user.

In another embodiment, the system may also include a sensor to monitor the user's heart rate. Such a sensor may either be embedded in the device or disposed in a chest-strap type sensor with a wireless connection. Given that chest-strap sensors are in common use today, it may be preferable simply to include a wireless receiver inside the system to receive heart-rate signals from an external chest-strap sensor.

During a typical training session, a user will select whether to use the trainer 100 in a passive mode or in an active mode. In the passive mode, the trainer 100 will use calculate the particular performance parameters (such as instantaneous speed, average speed, distance traveled, elevation gained, etc.). In this way, the user is able to store a particular training session performance parameters in the memory 120 and, if so desired, subsequently download the data by way of the I/O interface 132 to external devices, such as a personal computer, any number of digital appliances (such as a Palm Pilot™), or even directly to a distributed network, such as the Internet where it can be viewed and/or downloaded by any interested party. In this way, a user, as a member of an online group, for example, can post particular training session parameters for others of the group to view and compare.

By allowing the trainer 100 to download software from any appropriate external device, the trainer 100 is capable of being selected to operate in what is referred to as the active mode. In the active mode, selected software, in the form of pre-determined training routines, courses, comparative performance data, and the like, can be downloaded by way of the I/O interface 132 into the memory 120 (if necessary) or, if enough memory is available, directly into the general processor 118

for subsequent execution. By operating in the active mode, the general processor 118 uses real time GPS data provided by the GPS processor 122 to provide real time feedback to the user during any particular training session. One such training mode, referred to as a course mode, is initiated by first downloading particular course parameters (such as location markers and associated speed markers) associated with a desired training course by way of for example, the data interface 118, or by any other appropriate input device, such as a compact disk, flash memory, and the like.

Specifically, a user can select a course on which to train, the parameters are then fed into the trainer 100 either manually during an initialization process, or downloaded from a course database stored in for example a computer that can take any appropriate form such as a desktop, laptop, digital appliance, or one of any number of interconnected computers typical of the Internet. Once the particular course data is available, the trainer 100 provides real time feedback to the user indicating that the user is following the appropriate course and his/her physical performance (such as heart rate based upon input data from a heart rate sensor 138 included in the input devices 104, if the trainer 100 is so equipped) is within an acceptable range.

In another training mode, referred to as a workout mode, the trainer 100 is used to track, in real time, the speed performance of the user based upon a downloaded speed profile. During a training session in the workout mode, the trainer 100 periodically ascertains the instantaneous speed of the user and compares it to the stored speed profile. If the instantaneous speed (or average speed in some cases) falls out of a pre-determined range of speed values based upon the speed profile, a feedback signal is directed at the user. If the user is going too fast, a slow down signal is provided, and conversely, if the user is going too slow then the trainer 100

provides a speed up signal by way of, for example, and headset 140, or other such sound producing device included in the output devices 104. In this way, the trainer 100 provides the user with the capability of accurately following a particular training regimen without the need to have a second party constantly coach or otherwise keep track of the user's performance.

In yet another training mode referred to as a cross-country mode, the trainer 100 provides both spatial and temporal feedback based upon a course profile and an associated speed profile. In the cross-country mode, the trainer 100 provides real time feedback for both location and speed parameters thereby assuring that the user is able to constantly gauge his or her performance against a selected standard. Additionally, by providing real time positional feedback, the possibility of a user becoming lost or otherwise disoriented is greatly reduced.

Fig. 4 illustrates a flowchart describing a process 400 for initializing the trainer 100 in accordance with an embodiment of the invention. At 402, the user turns on the trainer by either connecting it directly to a power source (such as a USB cable, for example) or by simply turning the trainer on. Once power is supplied to the trainer, the GPS processor and the general processor are initialized at 404. In some cases, the initialization of the GPS processor may take some time in order for the GPS processor to locate the position of the various GPS satellites. Once the GPS processor and the general processor have been initialized, external data is pre-loaded into the on-board memory at 406. In some cases, the external data is pre-loaded from a computer coupled to the trainer by way of the I/O interface, and in others, the external data can be data stored in a secondary memory cache included in the trainer 100. Such secondary cache memory can be found in, for example, the general processor or the GPU processor. Once the external data has been loaded, the user selects a

particular operation mode at 408. In the described embodiment, such modes include a passive mode at 410 and an active mode at 412.

Fig. 5 illustrates a flowchart detailing the process 410 whereby the trainer is set to act in the passive mode in accordance with an embodiment of the invention.

5 Once set to operate in the passive mode, the general processor receives instantaneous positional data from the GPS processor at 502. At 504, a determination is made whether or not an enhanced GPS operating mode is desired. If the enhanced GPS mode is desired, then the appropriate GPS enhancements are provided by the GPS enhancement driver to the GPS processor and the general processor at 506. In either
10 case, the general processor calculates various training parameters such as speed, elevation, distance traveled, average speed, and average rate of elevation gain (grade) at 508. At 510, a particular display mode is selected after which the appropriate training results are displayed on the display unit at 512 based upon the selected display mode.

15 When not selected to operate in the passive mode, the trainer can be selected to operate in the active mode as illustrated by Fig. 6 showing a flowchart detailing the active mode 412 in accordance with an embodiment of the invention. At 601, a user selects a particular training mode after which, at 602, external data based upon the selected training mode is pre-loaded into the on-board memory in the same or similar
20 way in which the external data is downloaded for the passive mode described above. At 604, a determination is made whether or not an enhanced GPS operating mode is desired. If the enhanced GPS mode is desired, then the appropriate GPS enhancements are provided by the GPS enhancement driver to the GPS processor and the general processor at 606. In either case, the general processor calculates various
25 training parameters such as speed, elevation, distance traveled, average speed, and

average rate of elevation gain (grade) at 608 based upon GPS data provided by the GPS processor. At 610, the general processor compares the calculated parameters to those corresponding parameters in the stored data based upon a user selected training mode. At 612, a particular display mode is selected after which the appropriate
5 training results are displayed on the display unit at 614 based upon the selected display mode.

Fig. 7 is a flowchart describing a particular implementation of the mode selection operation 601 as a training mode in accordance with an embodiment of the invention. As shown, in one embodiment, at 702 a user can select a course mode, a
10 workout mode at 704, or a cross-country mode at 706. In the case where the particular selected mode is the course mode, Fig. 8 shows a flowchart detailing one implementation of the course mode 702 in accordance with an embodiment of the invention. At 802, the current position as calculated by the general processor based upon received GPS data is compared to a corresponding position determined by the
15 pre-loaded course. At 804, a determination is made whether or not the current position is consistent with being on course. If the current position is not on course, then a course correction flag is thrown at 806 and control is passed back to 802, otherwise, a determination is made at 808 whether or not the course is complete. If the course is not complete, then control is passed back to 802.

20 Fig. 9 is a flowchart detailing an implementation of the workout mode 704 in accordance with an embodiment of the invention. At 902, the general processor compares the current elapsed time to a pre-loaded elapsed time marker. A determination is then made at 904 whether or not the user is going too fast, in which case, a slow down flag is thrown at 906 after which control is passed back to 902. If,
25 however, it is determined that the user is not going too fast, then a determination is

made to 908 whether or not the user is going too slow based upon the pre-determined elapsed time marker. If the user is determined to be going too slow, then a speed up flag is thrown at 910 and control is passed back to 902. If, however, it is determined that the user is not going too slow, then a determination is made at 912 if the course is
5 complete in which case control is passed back to 902.

Fig. 10 shows a flowchart detailing an implementation of the cross-country mode 706 in accordance with an embodiment of the invention. At 1001, a comparison is made between the calculated current position and that of an associated pre-loaded course. Based upon the comparison, at 1002, a determination is made
10 whether or not the current position is consistent with being on course. If the current position is not on course, then a course correction flag is thrown at 1004 and control is passed back to 1001, otherwise, the general processor compares the current elapsed time to a pre-loaded elapsed time marker at 1006. A determination is then made at 1008 whether or not the user is going too fast, in which case, a slow down flag is
15 thrown at 1010 after which control is passed back to 1006. If, however, it is determined that the user is not going too fast, then a determination is made at 1012 whether or not the user is going too slow based upon the pre-determined elapsed time marker. If the user is determined to be going too slow, then a speed up flag is thrown at 1014 and control is passed back to 1006. If, however, it is determined that the user
20 is not going too slow, then a determination is made at 1016 if the course is complete in which case control is passed back to 1001.

Fig. 11 illustrates a number of trainers 100 coupled to form a virtual competition 1100 in accordance with an embodiment of the invention. By coupling a number of trainers 100-1 through 100-3 to a server 1102, what is referred to as a
25 virtual competition can be held. By virtual competition it is meant that any number of

competitors 1104, 1106, and 1108, for example, can “virtually” compete with each other without the need for being either spatially and/or temporally juxtaposed. For example, the competitor 1104 is wearing the trainer 100-1 at a location “X₁”, whereas the competitor 1106 is wearing the trainer 100-2 at a location “X₂” and the competitor 1108 is wearing the trainer 100-3 at a location “X₃”. At a time t₁, the competitor 1102 downloads course data 1112 from the server computer 1102. As described above, the course data 1112 can include maps, elevation gains, training protocols, etc. consistent with the virtual competition. Once the competitor 1102 has completed the prescribed course, results 1114 are sent back to the server computer 1102 and stored in a buffer 1116 (or its equivalent). In a similar manner, at times t₂ and t₃ (each of which can be different from each other as well as time t₁) competitors 1104 and 1106 download their respective course data, upload their respective results which are stored in the data buffer 1116 (or its equivalent) or in any other appropriate memory location or device. Once all the competitor’s results have been stored in the data buffer 1116, the server computer 1102 then determines a “winner” taking any number of different approaches. For example, in one scenario, each competitor provides an individual profile that includes such characteristics as age, weight, etc. The server computer 1102 can then process the course data from each competitor and based upon certain weighting factors determine a winner which is then downloaded to each competitor as, for example, a winner’s flag 118.

Fig. 12 illustrates a computer system 1200 that can be employed to implement the present invention. The computer system 1200 or, more specifically, CPUs 1202, may be arranged to support a virtual machine, as will be appreciated by those skilled in the art. As is well known in the art, ROM acts to transfer data and instructions unidirectionally to the CPUs 1202, while RAM is used typically to transfer data and

instructions in a bi-directional manner. CPUs 1202 may generally include any number of processors. Both primary storage devices 1204, 1206 may include any suitable computer-readable media. A secondary storage medium 1208, which is typically a mass memory device, is also coupled bi-directionally to CPUs 1202 and provides additional data storage capacity. The mass memory device 1208 is a computer-readable medium that may be used to store programs including computer code, data, and the like. Typically, mass memory device 1208 is a storage medium such as a hard disk or a tape which generally slower than primary storage devices 1204, 1206. Mass memory storage device 1208 may take the form of a magnetic or paper tape reader or some other well-known device. It will be appreciated that the information retained within the mass memory device 1208, may, in appropriate cases, be incorporated in standard fashion as part of RAM 1206 as virtual memory. A specific primary storage device 1204 such as a CD-ROM may also pass data uni-directionally to the CPUs 1202.

CPUs 1202 are also coupled to one or more input/output devices 510 that may include, but are not limited to, devices such as video monitors, track balls, mice, keyboards, microphones, touch-sensitive displays, transducer card readers, magnetic or paper tape readers, tablets, styluses, voice or handwriting recognizers, or other well-known input devices such as, of course, other computers. Finally, CPUs 1202 optionally may be coupled to a computer or telecommunications network, *e.g.*, an Internet network or an intranet network, using a network connection as shown generally at 512. With such a network connection, it is contemplated that the CPUs 1202 might receive information from the network, or might output information to the network in the course of performing the above-described method steps. Such information, which is often represented as a sequence of instructions to be executed

using CPUs 1202, may be received from and outputted to the network, for example, in the form of a computer data signal embodied in a carrier wave. The above-described devices and materials will be familiar to those of skill in the computer hardware and software arts.

5 Although only a few embodiments of the present invention have been described, it should be understood that the present invention may be embodied in many other specific forms without departing from the spirit or the scope of the present invention.

 Although the methods of providing efficient techniques for providing real time
10 athletic performance data in accordance with the present invention are suitable for implementation with personal computers, digital assistants, and the like, the methods may generally be applied in any suitable low bandwidth or high bandwidth distributed data network. In particular, the methods are suitable for use in digital appliances and other low bandwidth networks. Such low bandwidth systems include, but are not
15 limited to: virtual private networks direct serial connections across telephone lines ("BBS systems"), and LANs and WANs regardless of network protocol.

 While the present invention has been described as being used with a computer system coupled to the Internet, it should be appreciated that the present invention may generally be implemented on any suitable computer system. Therefore, the present
20 examples are to be considered as illustrative and not restrictive, and the invention is not to be limited to the details given herein, but may be modified within the scope of the appended claims along with their full scope of equivalents.

What is claimed is:

In the claims:

1. A portable athletic performance monitoring and training system
5 arranged to provide athletic performance data associated with an athletic performance, comprising:
 - a GPS receiver having an antenna;
 - a memory device arranged to store,
 - a digital elevation model (DEM) database that includes local
10 DEM data used to describe a local elevation profile, and
 - an athletic performance database that includes velocity data;
 - a processor coupled to the GPS receiver and the memory device arranged to,
 - calculate a carrier-wave-Doppler based user velocity using data
15 received from the GPS receiver,
 - calculate selected athletic performance feedback data using the calculated user velocity and the local elevation profile,
 - calculate user elevation based upon the DEM database; and
 - a data I/O port arranged to provide a data interface between the system
20 and an external device; and
 - a visual display device coupled to the processor arranged to selectively display the performance feedback data
2. A system as recited in claim 1, wherein the system further comprises
25 an inertial sensor adapted to sense rhythmic motion associated with the athletic performance, and wherein the processor includes algorithms selected from the group comprising: the use of inertial-based measurements to provide speed data when GPS data is unavailable, the use of GPS data, when available, to calibrate inertial-based speed measurements, and the use of inertial data to smooth out GPS speed
30 measurements.
3. A system as recited in claim 2, wherein the inertial sensor is selected from a group comprising: an accelerometer and a gyroscope.

4. A system as recited in claim 1, wherein the data transferred through the data I/O port is selected from a group comprising: an athletic training program capable of being executed by the processor, a training route, the local DEM data, digital cartographic data, ephemeris data, a digital-audio file, and user athletic performance data, and wherein the external device is selected from a group comprising: a personal computer (PC), a personal digital assistant (PDA), and a remote server computer and wherein the external device communicates with an Internet server computer via the Internet.

10

5. A system as recited in claim 4, wherein the Internet server computer provides data selected from the group comprising: DEM data, digital cartographic data, ephemeris data, a database of training routes, a database of athletic training programs, and a selection of digital-audio files chosen to provide motivational enhancement for athletic training.

15

6. A system as recited in claim 1, wherein the visual display device selectively displays the performance feedback data as a function of the local elevation profile or as a function of the local cartographic profile or as a function of the local cartographic profile and the local elevation profile.

20

7. A system as recited in claim 1, wherein the visual display device is selected from a group comprising: an LCD, a CRT display, and a plasma discharge display.

25

8. A system as recited in claim 1, wherein in a workout mode, the processor directs the user through a pre-programmed workout routine based upon a workout mode performance feedback data using a continually updated interface displayed by the visual display device.

30

9. A system as recited in claim 1, wherein the data received from the GPS receiver is filtered by a sport-specific digital filter in order to maximize accuracy for a particular sport.

5 10. A system as recited in claim 1 further comprising:
a sensor adapted to monitor the user's heart rate.

11. A system as recited in claim 1, wherein if local DEM data are not present in the memory device at the time of an athletic performance, the user
10 performance data are post-processed using local DEM data on an external computing device.

12. A system as recited in claim 11, wherein the computing device is selected from a group comprising: a GPS device, a PDA, a personal computer, an
15 Internet server computer.

13. A system as recited in claim 1, wherein the other selected athletic performance feedback data are selected from a group comprising: time elapsed, total distance traveled, elevation, elevation change rate, net elevation change, total
20 elevation gain or loss, calorie expenditure rate, total calories expended, watt expenditure rate, total watts expended, number of strides, stride cadence, stride length, relative performance compared to a previous performance or goals, sport-specific performance scale, and generalized sports overall performance scale.

25 14. A system as recited in claim 1, wherein the data I/O port is selected from a group comprising: a serial port, a parallel port, a USB port, an IR port, a Bluetooth interface, and a wireless modem.

30

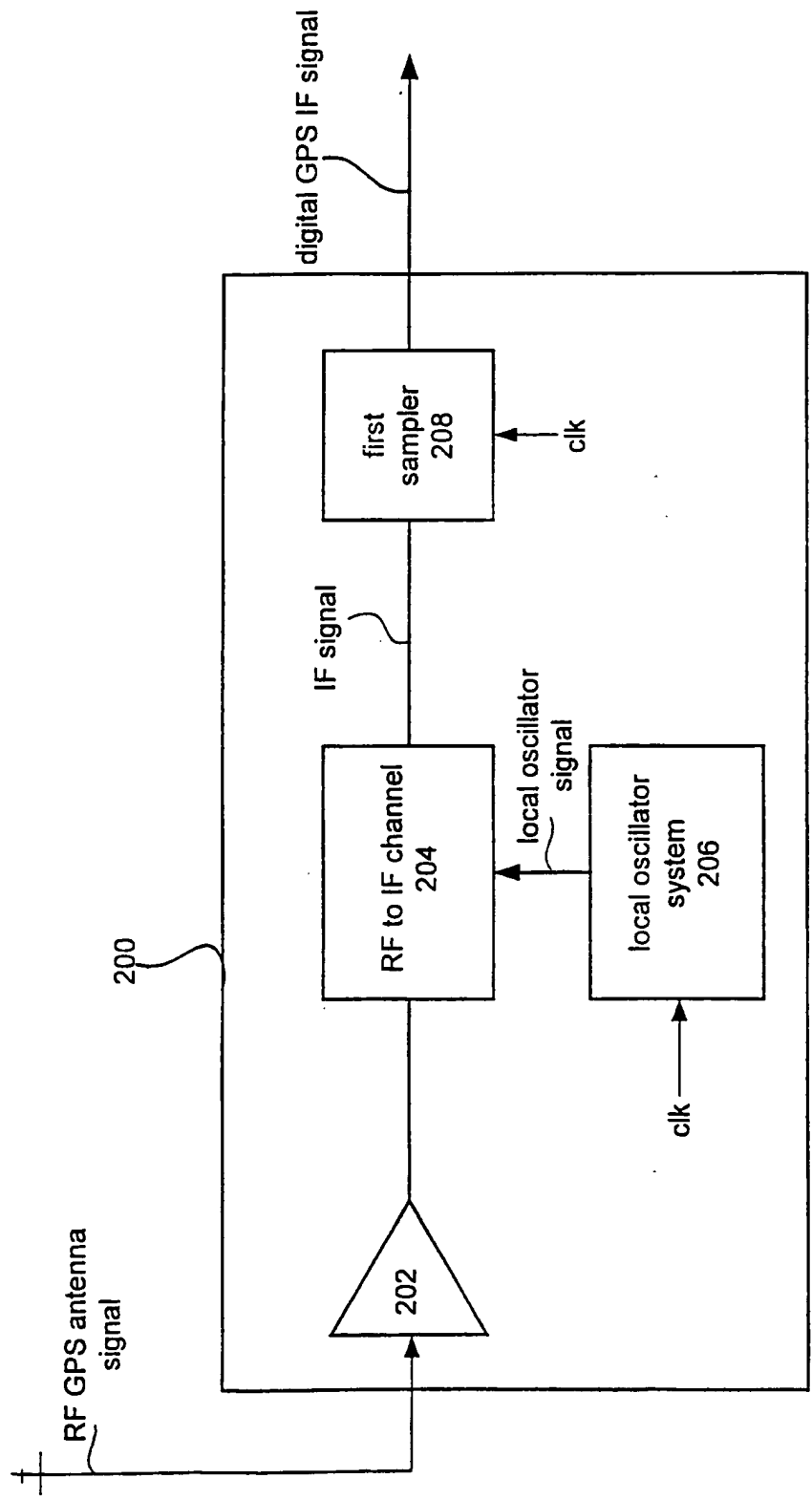


Fig. 2

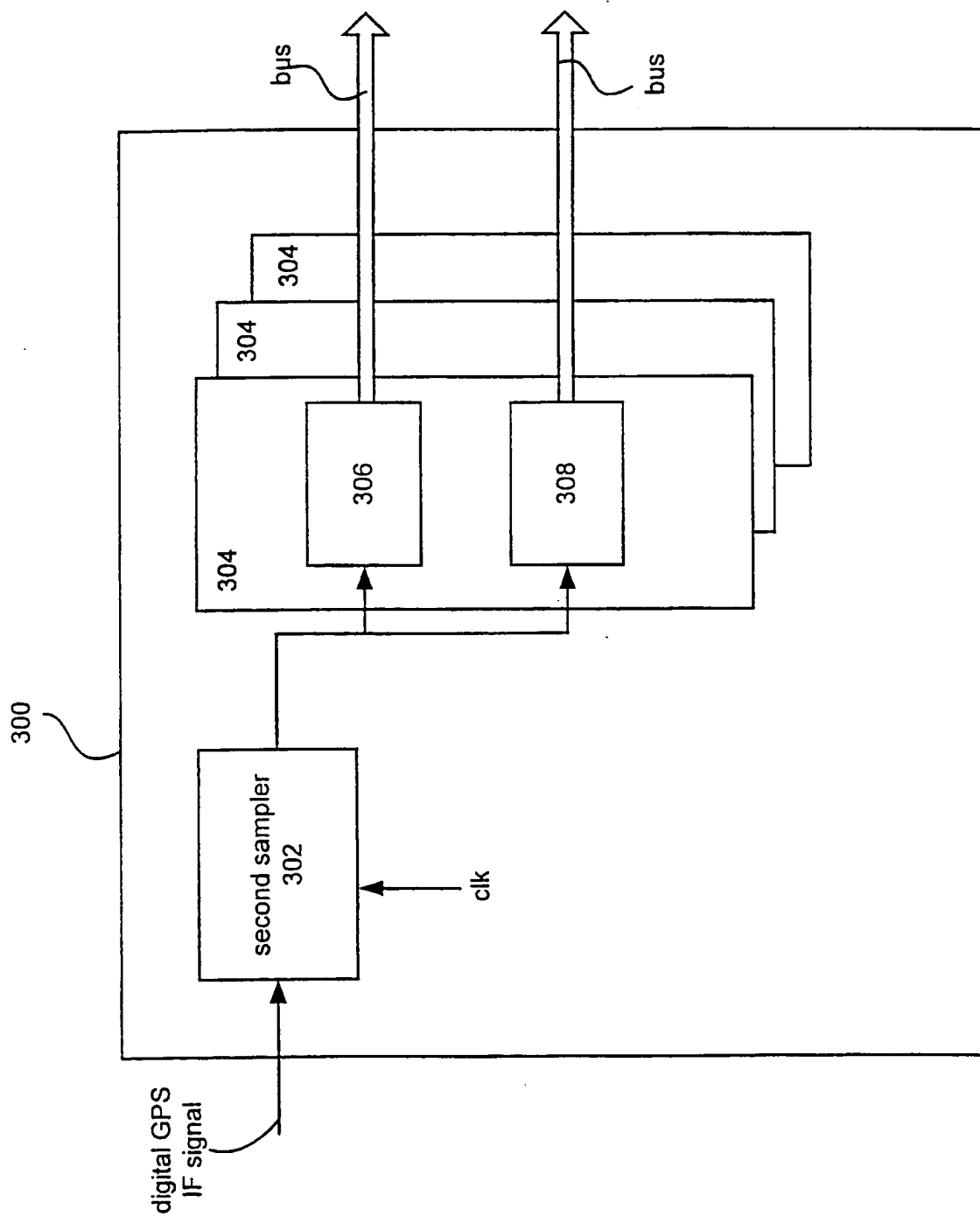
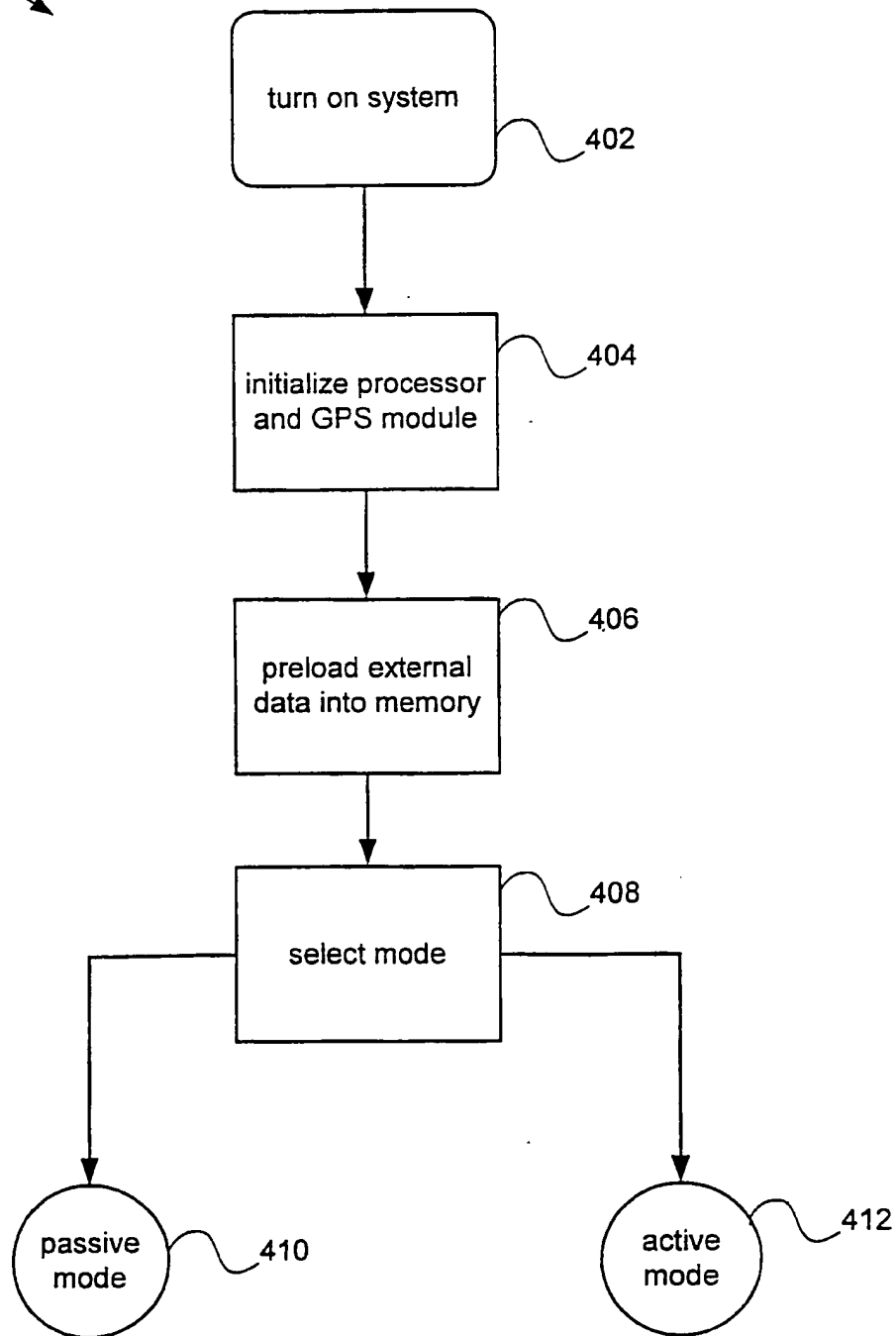


Fig. 3

Fig. 4

400



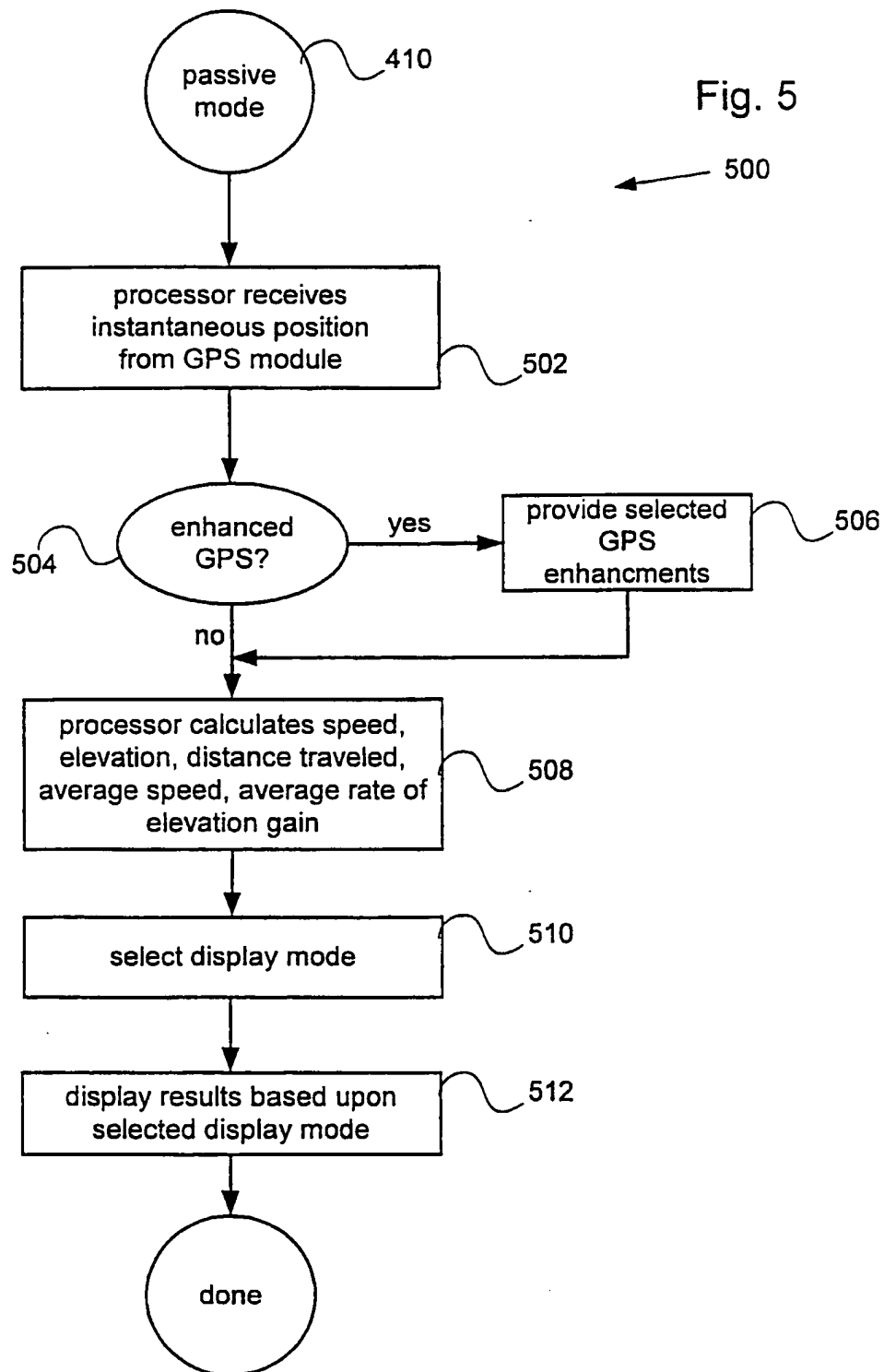
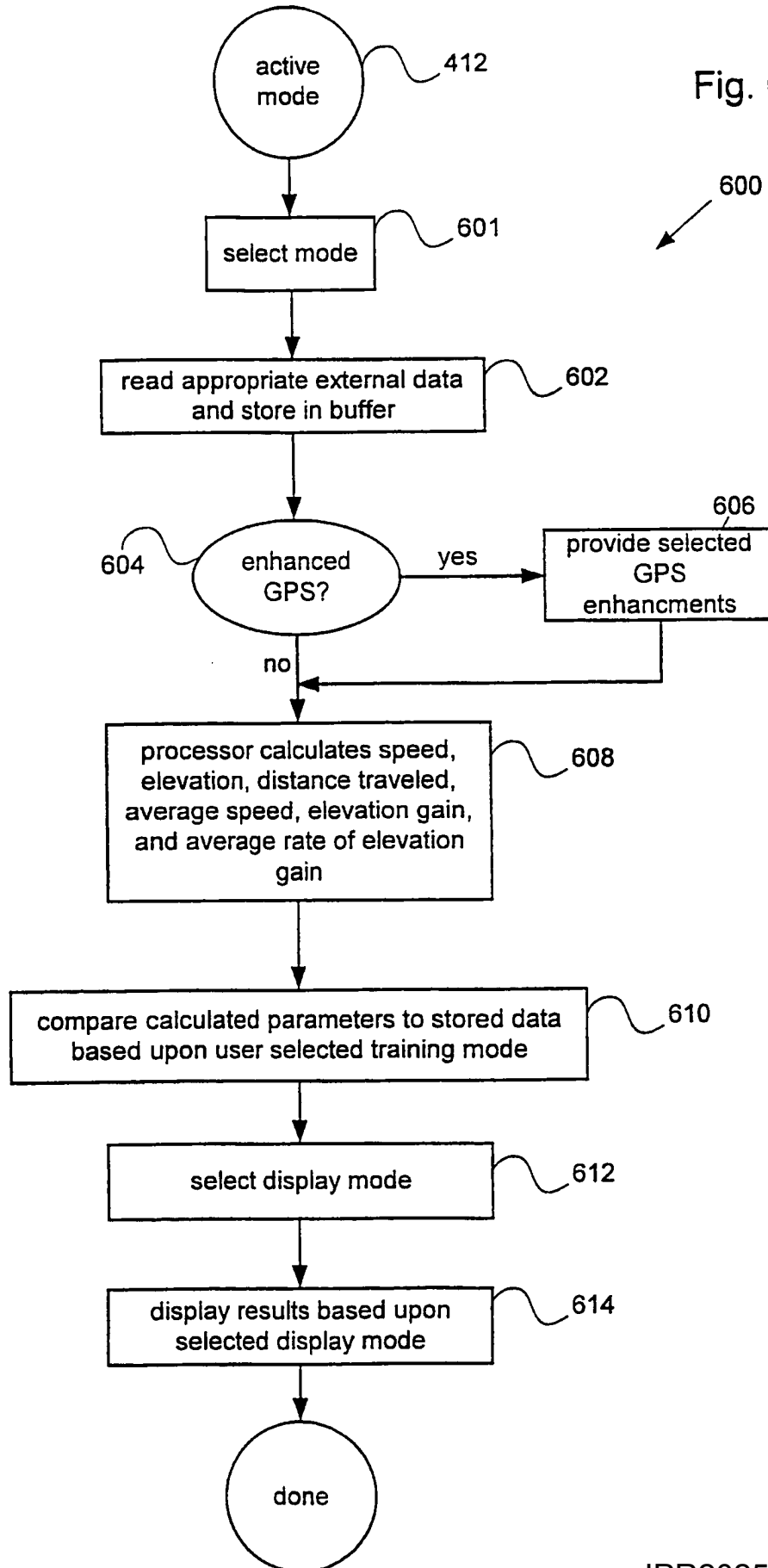


Fig. 6



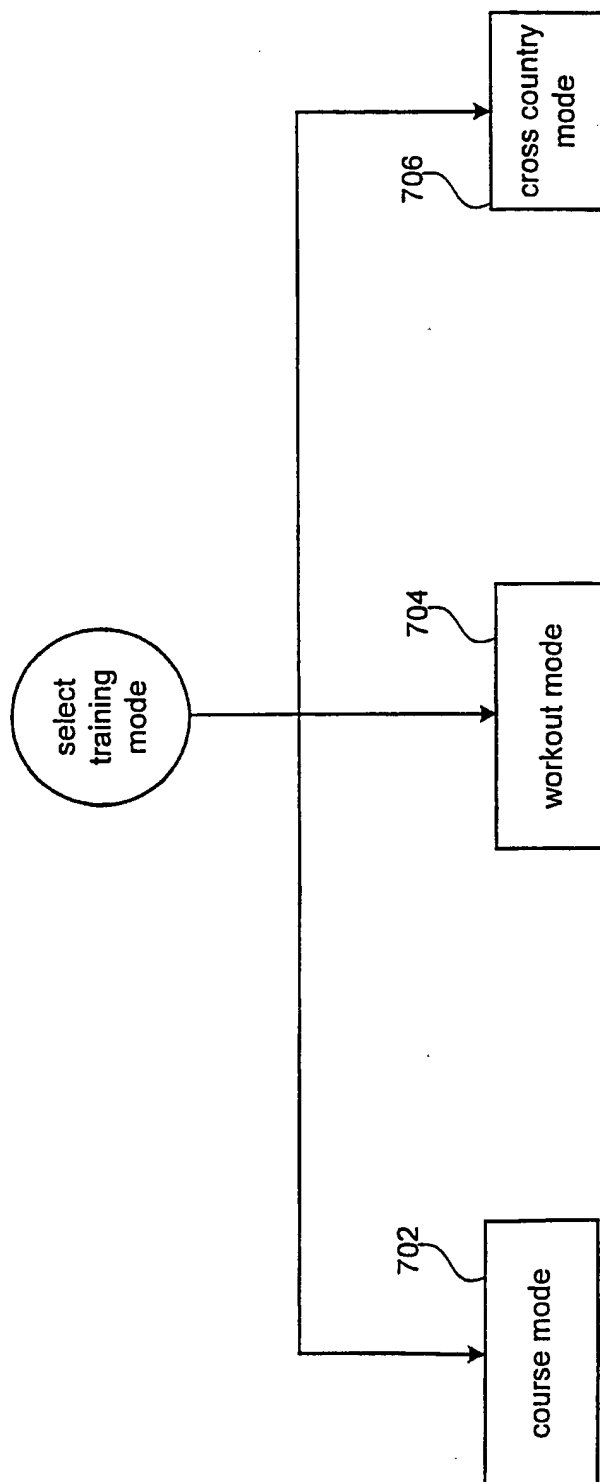
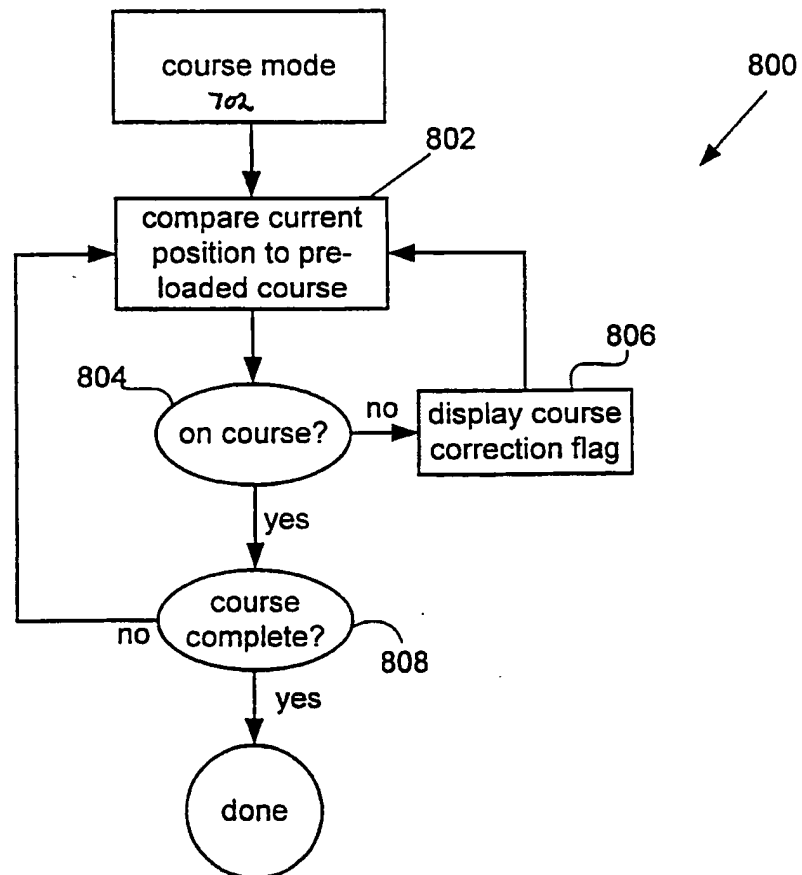


Fig. 7

Fig. 8



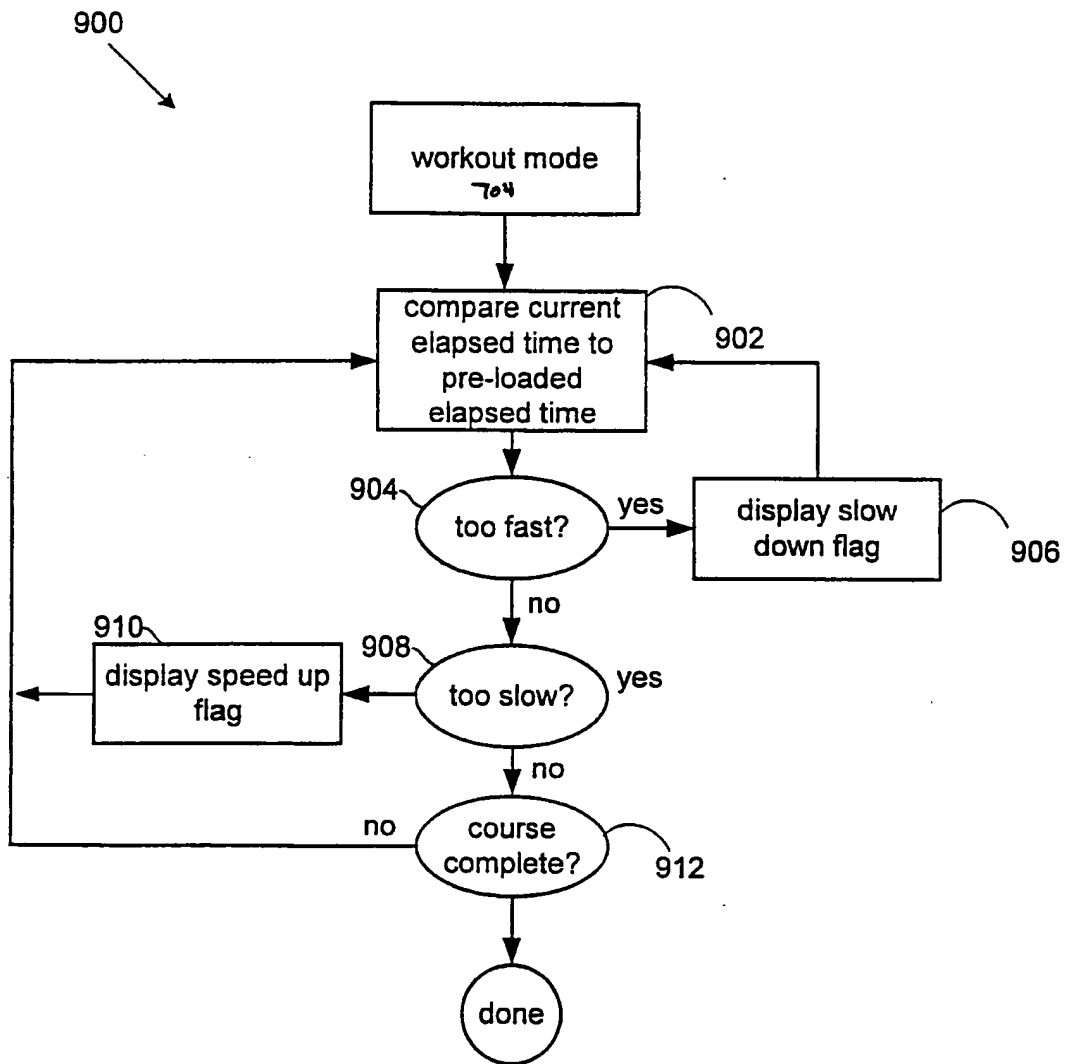


Fig. 9

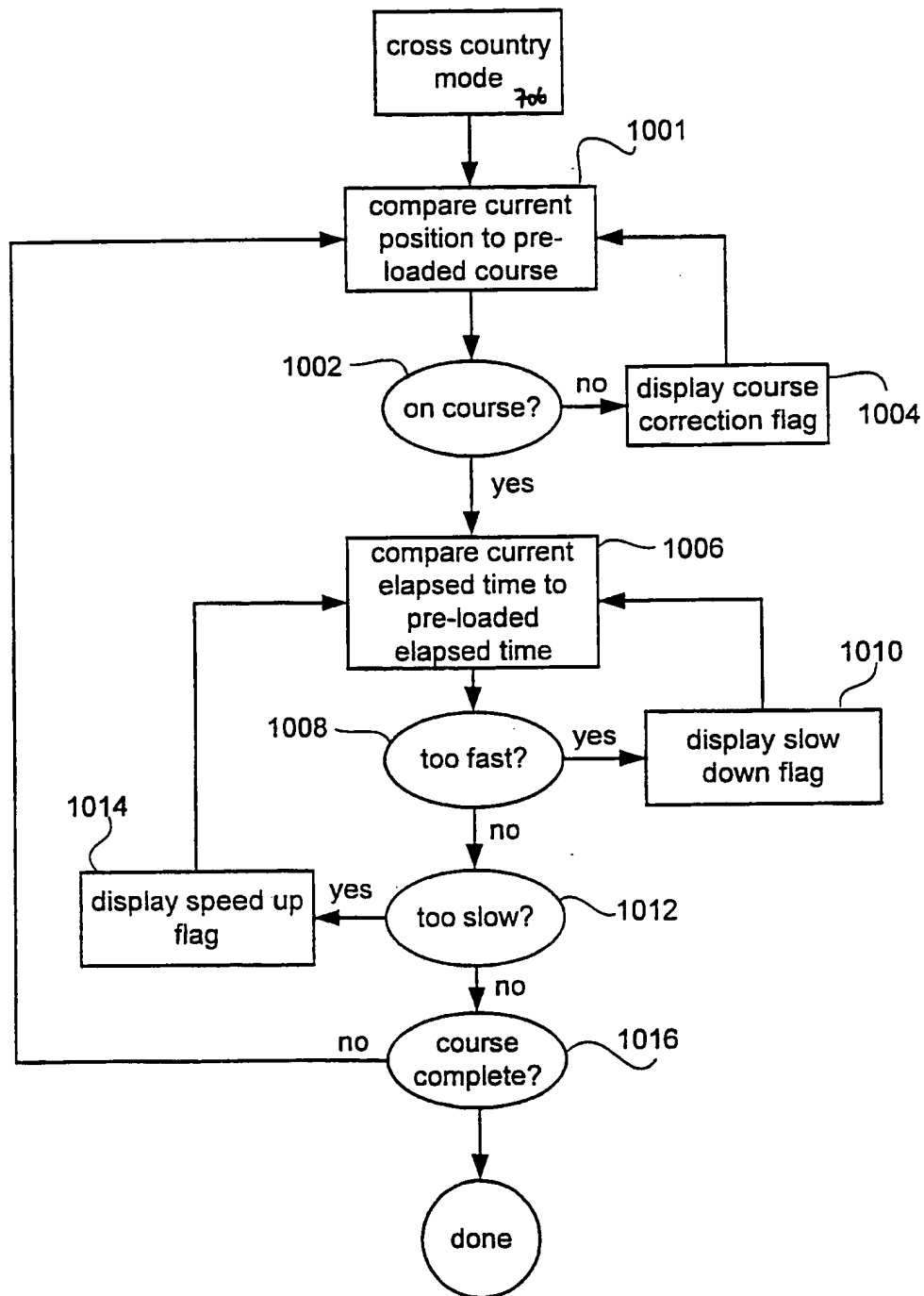


Fig. 10

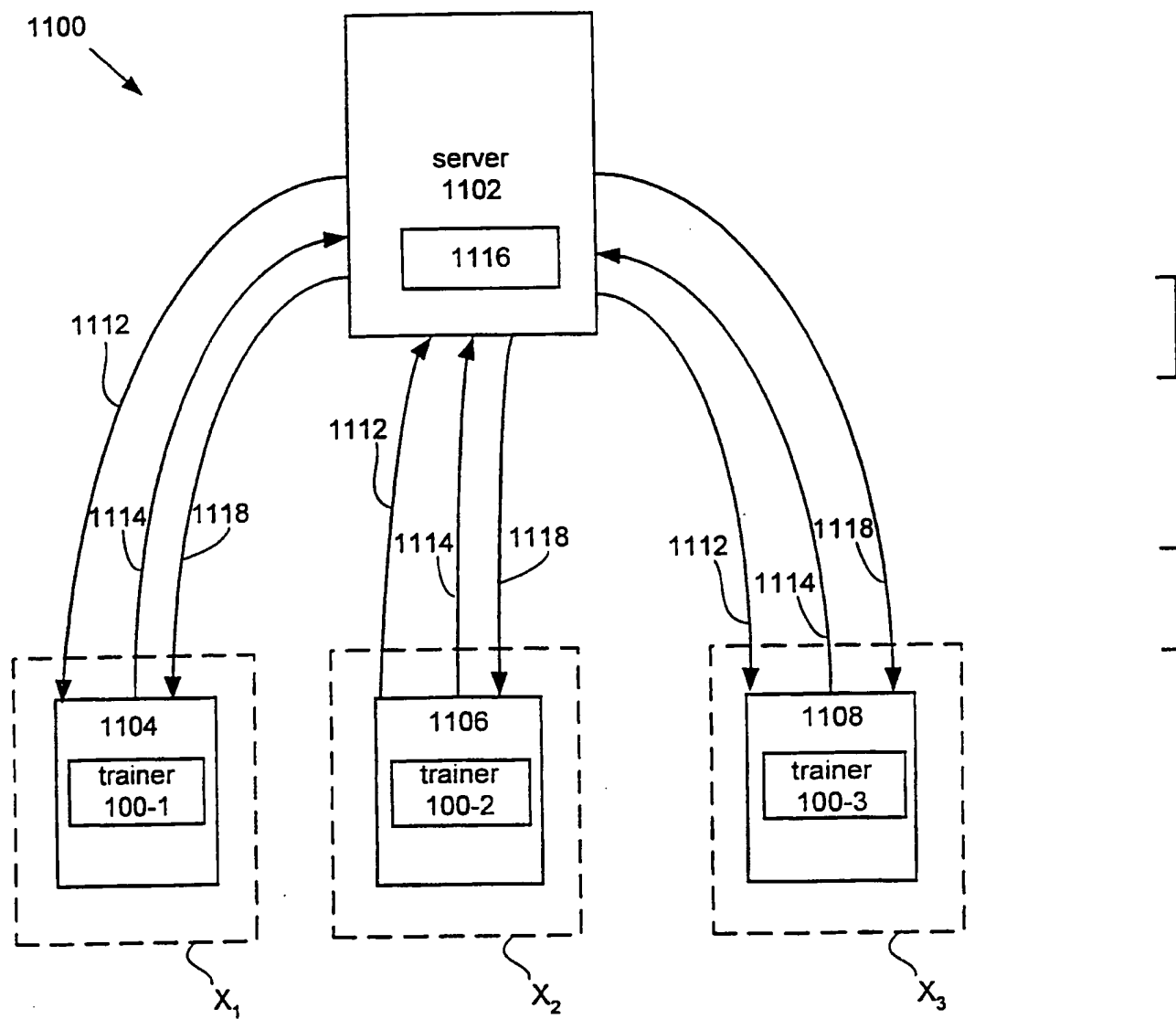


Fig. 11

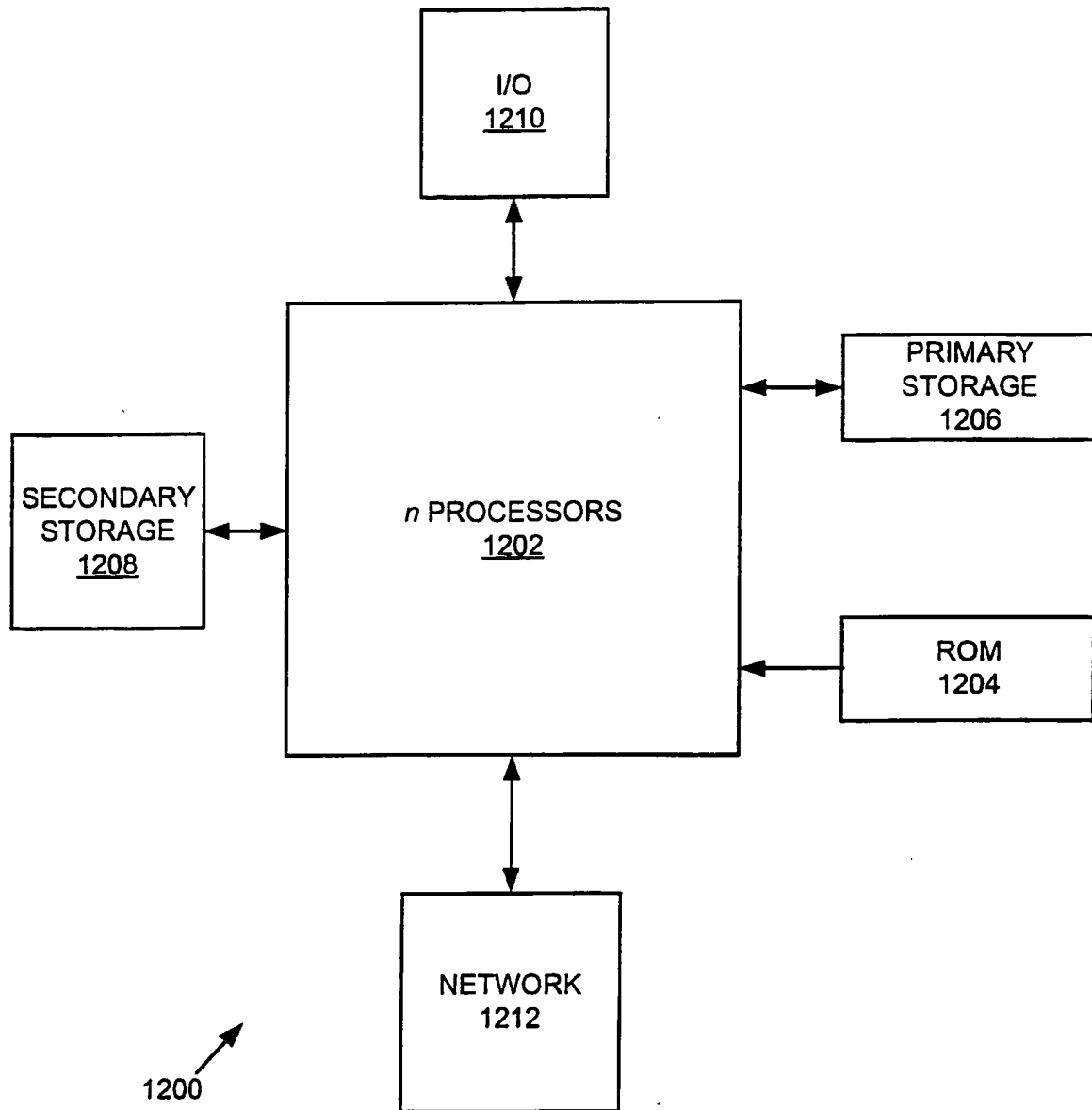


Fig. 12

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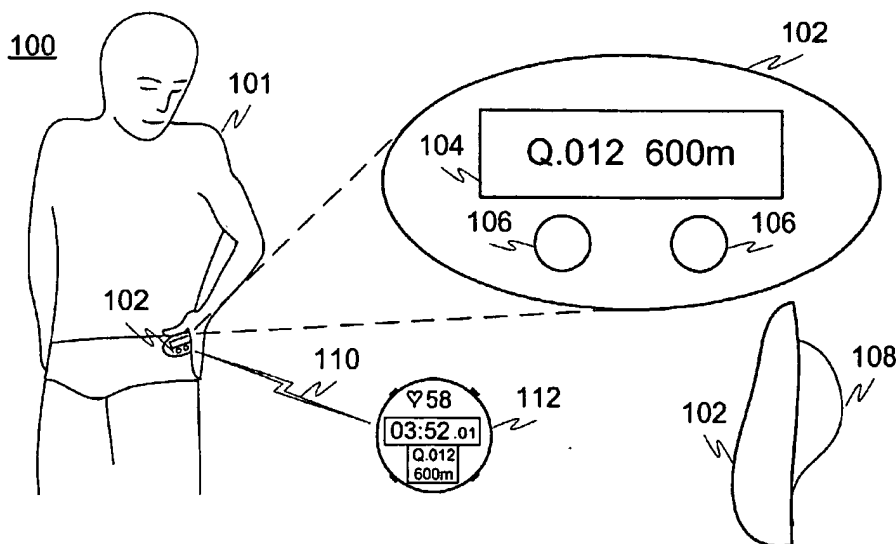
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(54) Title: DISTANCE METER



(57) Abstract: The invention relates to a method (800), a system (100) and a device (102) for measuring the number of laps and/or the distance covered by a person during his/her performance. The invention relates particularly to a distance meter (102) to be worn by the user, which measures the distance covered by the object and comprises a magnetic sensor (212) for determining the direction of a magnetic field (304) external to the sensor relative to the sensor (212). The distance meter (102) to be worn by the user in accordance with the invention also comprises a counter (207), whose value is increased when the measured deviation of the magnetic field exceeds a preset limit, i.e. in the situation where a fitness trainer following a given track turns and starts moving into another direction on the track.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Distance meter

5 The invention relates to a distance meter. The invention relates specifically to a lap and distance counter for fitness trainers such as swimmers.

10 During their exercise, fitness trainers often move back and forth along a given path, with the exercise target typically set as a covered distance or number of laps. Fitness swimmers, for instance, typically carry out complete, successively repeated laps on a 25 or 50 m track in a swimming bath, sprinters run over a predetermined distance of a given stretch and skaters or runners carry out several laps along an oval track. Typical training comprises counting the covered distance or number of laps.

15 One manner of evaluating the performance and metering the distance is counting the number of laps and multiplying the obtained number with the length of the lap. Under exercising conditions, for instance, a fitness trainer will have to count the number of laps personally. This involves the problem that, while covering long distances or carrying out several laps, the trainer has difficulties in finally remembering the number of laps performed, especially if he/she has to concentrate on improving e.g. a special technique at the same time, or if the performance has lasted a long time and the trainer is getting tired. In addition, especially in public swimming baths, there are many other persons exercising and other disturbing factors, which tend to affect the trainer's concentration and counting of laps.

25 One solution to the problems mentioned above is provided by an abacus, for instance, in which the trainer shifts one bead for each performed lap. There are also known solutions, in which the fitness trainer carries a transceiver means, such as the ultrasonic solution disclosed by US patent specification 5, 136, 621, in which the performance of one lap is registered as the fitness trainer carrying the device passes by a certain control station. There are also various prior art solutions based on GPS means and acceleration sensors, which monitor the trainer's movements in order to conclude the speed and the covered distance. US patent specification 5,767,417 discloses a solution specially conceived for swimmers with a view to measuring the covered distance and speed, comprising means attached to the swimmer's body for measuring the water current. In addition, there is a prior art solution especially for swimmers, in which the swimmer hits a detector provided at the end of the pool,

with his hand, for instance, in order to mark a lap and thus to determine the covered distance.

However, solutions of the kind above involve problems. Using an abacus, for instance, or touching a detector provided at the end of the track, such as a pool, requires free access for the swimmer all the way to the abacus or the detector, and his/her paying special attention to marking the performed lap. What is more, for fitness swimmers, who make an orthodox U-turn at the end of the pool, it is even impossible to use an abacus or a detector to be touched. A further reason is that, on public premises, there may be mischief, involving intentional changes of the counted number of laps during the use of an abacus or a detector to be touched. In addition, special transceiver means should be fitted in position during the exercise, and this may be an impossible task in a public skating rink or swimming bath, which is full of people exercising. Also, solutions based on GPS means and acceleration sensors are costly and often inaccurate as well. Thus, for instance, with a fitness trainer exercising at an indoor gym, there may be problems in communicating between a GPS means and the satellite. Furthermore, the solution based on measurement of the water current as disclosed by US patent specification 5,767,417 is suitable only for swimmers, and it should also be noted that such a device, when used on public premises, might be anaesthetic and even interfere with many a fitness trainer's performances.

The purpose of the present invention is to provide an economical system for measuring the distance covered by a fitness trainer, which is easy to use and does not disturb him/her, allowing the prior art shortcomings mentioned above to be reduced. The invention aims at bringing a solution to the special issue of how to count the number of laps repeatedly carried out by an object moving around a given track and how to measure the distance covered without the trainer having to concentrate on counting the number of laps or on using a device. Another purpose of the invention is to conceive a solution allowing the number of performed laps or the covered distance to be readily displayed to the training person during and/or after the performance.

The goals of the invention are achieved as follows: the distance meter of the invention, which comprises means for measuring the direction of an external magnetic field, is worn by the person, and one lap or track side is marked as covered when a deviation of the magnetic sensor of the distance meter relative to

the direction of the external magnetic field measured by the sensor exceeds a set limit value, i.e. a situation where the person turns into another direction of movement on the track. The distance meter determines the covered distance with the aid of the number of laps/length of sides it has counted and the fed length of one
5 single lap/side. In addition, the goals of the invention are achieved by bringing the distance meter in data transmission communication with at least one other data processing device, such as, for instance, a device for measuring pulse data, and by storing the number of performed laps as a function of time.

10 The method of the invention for measuring the distance covered by a person is characterised by

- fastening on the person a magnetic sensor having substantially stationary direction relative to the person,

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- monitoring any deviation of the magnetic sensor from a magnetic field external to the sensor, and

- counting the times the deviation of the magnetic sensor from the external magnetic
20 field exceeds a set limit value.

The distance meter of the invention for measuring the distance covered by an object is characterised by the distance meter being worn by the person and comprising a magnetic sensor for determining the direction of the magnetic sensor relative to a
25 magnetic field external to the sensor, and also a counter and the distance meter to be worn by the user being arranged to increase the meter value when the deviation of the magnetic sensor from the external magnetic field exceeds a set limit value.

A number of preferred embodiments of the invention are defined in the dependent
30 claims.

This patent application uses the following concepts, among other things:

- In this application "a lap" denotes typically either a complete lap, which is
35 completed when the training person returns to his/her starting point after having performed a complete lap or half a lap around the track, such as, for instance, the length of one stretch of a swimming pool. It should be noted that a complete lap

may be e.g. triangular, and then a lap may imply the entire lap or one third of the entire lap, i.e. one side length, or in the case of a square or oval track, a lap may stand for the entire lap or one fourth of the lap, i.e. one side length. It is obvious to those skilled in the art that various combinations expressing the type of track can be
5 implemented.

- "A person" or object may be a fitness trainer, for instance, such as a swimmer, a sprinter, a runner, a skater, a ski jumper, a downhill racer, a canoeist or any other object, human or other animal being, who moves along a track with his/her
10 direction of movement regularly reversed, such as e.g. a runner running along an oval running track, or a swimmer swimming back and forth along a swimming track in a swimming pool.

- "Type of sport" or mode of use is the data describing the sport to be performed
15 which is fed into the distance meter to be worn by the user, such as swimming, running or skating. With e.g. swimming fed as type of sport into the distance meter, the distance meter will be in "the swimming mode", being especially arranged to evaluate the results it has measured compared to the determined type of sport.

- "Magnetic field" is a magnetic field that is generated by a source external to the
20 distance meter and that can be measured by the magnetic sensor of the distance meter, such as the magnetic field of the earth. The magnetic field can also be artificially generated by means of an electromagnet, for instance.

25 The invention achieves considerable advantages over prior art solutions. The distance meter to be worn by the user in accordance with the invention can be used without an external counter-means for accurate counting of laps. The invention also allows for a lightweight and very small-sized meter, having a size even smaller than that of a matchbox, so that the meter does not interfere with the fitness trainer's
30 performances and also is acceptable from a social point of view. The distance meter of the invention can also be made such that it can be fastened to the person's garments by means of a simple fastening mechanism, allowing the distance meter to be used with several garments and in different sports, and it is also easy to detach for laundry, change of garment or purchase of a new garment, for instance.

35 The fastening mechanism may be carried out by means of e.g. a press-stud, a Velcro tape or a suspender, allowing the distance meter to be fastened directly to the

garment, such as a belt, a pair of trousers, a pair of trunks or a headgear. The meter can also be equipped with a separate belt or strap for fastening the meter. The fitness trainer's garment, such as a pair of trunks, may also have a pocket specifically designed for the distance meter, and the pocket can be transparent, allowing the fitness trainer to check his/her performance on the screen of a distance meter equipped with a display, directly through the garment, without detaching the meter. With the pocket on the garment designed for the meter, it is ensured that the meter is maintained in position during the performance. The most reliable point for fastening in terms of measurement techniques and the most advantageous point is fastening to the carrier's trousers, especially in the hip area, because the person's pelvic area remains stable compared to his hands or feet, for instance, during running, skating and swimming.

The invention has the special advantage of the magnetic sensor provided in the distance meter, allowing measurements of the direction of a magnetic field external to the meter, such as the magnetic field of the earth, relative to the meter. The magnetic sensor is preferably a biaxial magnetic sensor, but it can optionally be a triaxial magnetic sensor. In addition, the distance meter can be equipped with control means, such as press-studs, by means of which the meter can be switched on and which can be used for feeding in advance the length of a lap or a side into the meter.

In one embodiment, the type of the track to be performed can also be fed into the meter, such as e.g. an oval shape or a straight back and forth track, such as the track of a swimming pool, and the type of sport, such as e.g. swimming, running or skating. The type of the track to be performed can also be triangular, circular or have any other distinct geometric pattern that can be illustrated in a plane. According to a further embodiment of the invention, a limit value for a deviation of the magnetic sensor relative to the external magnetic field can be fed and set in the distance meter. Optionally, the user can conclude the limit value by means of the fed track geometry without requiring actions.

In one embodiment, the distance meter of the invention can be arranged in data transmission communication with another device, such as, for instance, a pulse meter, and then the distance meter can deliver data it has measured, such as the number of laps or the distance covered, to the pulse meter in the course of the sports performance. This allows the fitness trainer to check the number of laps and/or the

distance covered on a pulse meter at his/her wrist. In addition, decoding of the pulse meter data may provide the pulse as a function of time and also as a function of the covered distance. Optionally, the data collected by the distance meter can be delivered also to other data processing devices, such as a display panel or a computer, for subsequent analysis, among other purposes. The distance meter preferably comprises also a memory unit, allowing delivery of data only after the sports performance has ended.

The data transmission communication can be performed e.g. with a short-range radio link, such as Bluetooth technology, or by optical means, such as e.g. by means of an IR transceiver. The data transmission communication can be performed also by means of any other data transmission method known by those skilled in the art, such as e.g. wire data transmission technology.

The distance meter of the invention can also be equipped with a screen for displaying e.g. the number of counted laps and/or the covered distance and also for displaying fed data, instructions and other data, such as user interface data. The display is preferably an LCD display, but it may also be any other display known by those skilled in the art.

In one embodiment, the distance meter can be equipped also with means for detecting the meter mode, so that the meter detects when it is being carried by a user, the meter passing accordingly into standby state, for instance, without requiring the user to take actions when fastening the meter to his/her garments. The means for detecting standby may be e.g. a capacitive sensor for measuring the permittivity of the environment, or a sensor measuring the temperature, the electric conductivity or the moisture. While the user is fastening the meter to his/her garment, any of these variables may change under the effect of the user's presence, so that the meter may conclude that it is being carried and pass into standby, and then measurements can be activated for example by pressing the meter or any press button on the meter. In addition, a distance meter especially devised for swimmers can be equipped with a moisture sensor allowing detection of the swimmer being in the water, and then the measurement unit is activated.

In a further embodiment, the distance meter of the invention can be equipped with a sensor detecting the fitness trainer's position. The sensor detecting the position may be a separate sensor detecting the position, or optionally a magnetic sensor with

several axes. A distance meter especially intended for swimmers or a distance meter in swimming mode may detect when the swimmer is in swimming position and when he/she is in vertical position. This allows erroneous counting of the laps due to vertical rotation at the pool end to be avoided. Also, a sensor detecting the position may detect whether the swimmer is doing backstroke or swimming on his/her stomach, thus preventing registering of false information in situations where the swimmer switches from butterfly to backstroke in the course of a lap.

The distance meter can also be equipped with a controller "learning" the lap cycle, comprising several modes for each sport and also allowing for the geometric type and length of the fed lap and capable of evaluating the reliability of the performance compared to any fed sport and track data. Thus, for instance, if the user has fed swimming as the type of sport and 100 metres as the length of a track lap, it is unlikely that one lap would be performed in less than 20 seconds; yet this is feasible in skating on a 100 m. track. In one embodiment, the controller can monitor the lap times performed by the trainer in different sports and infer the reliability of the marked lap from this. The controller may thus reject the marking of a lap, or at least give the trainer a warning of this, in case the lap time seems impracticable. One of the reasons for this may be a wrong definition of the sport, of the length of the lap/side or the geometric pattern of the lap, or optionally it may be due to the fact that the distance meter has been kept switched on at other times than during the sports performance, tending to cause "unnecessary" rotation.

In one embodiment, the controller may "average" the direction of the measured magnetic field, and then any momentary deviation caused e.g. by a rotation or the detour of an obstacle in the course of the lap can be ignored in the counting of the laps. In another embodiment of the invention, the sampling frequency can also be changed depending on the distance, the sport and/or the track. In long-distance swimming mode, for instance, and on a long track side, the direction of the magnetic field can be measured by using a longer interval (a smaller sampling frequency) than in the case of a fast sport and/or a short track.

Also, the distance meter to be worn by the user in accordance with the invention can be programmed before the sports performance starts to give an alarm when the preset number of laps or distance is covered. If, for instance, a swimmer wishes to swim 1,000 metres in a 25 m pool, he can program the distance meter to give an alarm when 1,000 metres, 20 laps or 40 side lengths are covered. The distance metre

of the invention may give an alarm by means of an acoustic signal, a light signal or a vibration, for instance. Optionally the programming and/or alarm can be performed together with another data processing device compatible with the distance meter to be worn by the user in accordance with the invention, such as a pulse meter, for instance.

The distance meter can be programmed with an electric identifier (ID) identifying the distance meter or the fitness trainer, and in that case, if a plurality of distance meters are at a close mutual distance, it can be avoided that the data of different distance meters get mixed with each other as data are transferred by means of other data processing devices, for instance.

In its most straightforward embodiment, the distance meter of the invention is set into measuring mode at the beginning of the performance, and the measurement is terminated at the end of the performance using a control button on the meter.

Preferred embodiments of the invention are explained in further detail below with reference to the accompanying drawings, in which

- Figure 1 shows an exemplified distance meter to be worn by the user and a system for providing data transmission communication between the distance meter to be worn by the user and a data processing device in accordance with one embodiment of the invention,
- Figure 2 shows a block diagram of an exemplified distance meter to be worn by the user in accordance with one embodiment of the present invention,
- Figure 3 shows the operating mode of an exemplified distance meter to be worn by the user in accordance with one embodiment of the invention,
- Figure 4 shows the direction of a magnetic field measured by the distance meter of the invention as a function of time in a swimming pool of figure 3, with movement in accordance with one embodiment of the present invention,
- Figure 5 shows the direction of a magnetic field measured by the distance meter of the invention as a function of time, while a fitness trailer equipped

with the distance meter is moving along a square track in accordance with one embodiment of the present invention,

5 Figure 6 shows the direction of a magnetic field measured by the distance meter of the invention as a function of time, while a fitness trailer equipped with the distance meter is moving along a triangular track in accordance with one embodiment of the present invention,

10 Figure 7 shows the direction of a magnetic field measured by the distance meter of the invention as a function of time, while a fitness trailer equipped with the distance meter is moving along an oval track in accordance with one embodiment of the present invention,

15 Figure 8 shows an exemplified method for enabling the operation of the distance meter in accordance with one embodiment of the present invention.

Figure 1 illustrates an exemplified distance meter 102 of the present invention to be worn by a person 101 and also a system 100 for providing data transmission communication 110 between the distance meter 102 and a data processing device 20 112 in accordance with one embodiment of the present invention. The distance meter is typically equipped with a screen 104 for displaying the counted laps and the covered distance and control data and other interface data to the user. The distance meter 102 may also comprise one or more control buttons 106 for controlling the operation of the distance meter and for feeding data. In addition, the 25 distance meter 102 can be equipped with fastening means, such as a suspender 108, for fastening the distance meter to the exercising person or to his/her garment.

In one example, during or optionally after the performance, the distance meter 102 of the invention can be in data transmission communication 110 with another data 30 transmission device, such as e.g. a computer or a data processing device carried at the user's wrist. The data transmission connection 110 is most preferably carried out by means of a short-range radio link. In accordance with the invention, the distance meter 102 may be in data transmission communication with e.g. a wristwatch 112 collecting pulse data, allowing the fitness trainer to monitor the data 35 collected by the distance meter directly on the screen of his watch, during the performance, for instance. Typically, the distance meter stores the data it has collected also in its memory means, allowing data to be checked later and perhaps

transferred to some other data processing device, such as a computer, for instance. In an exemplified embodiment, the data of the distance meter and the means collecting pulse data can be monitored in combination, allowing e.g. the pulse to be observed as a function of the distance, the number of laps and/or time.

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Figure 2 shows a block diagram of an exemplified distance meter 102 to be worn by the user in accordance with the invention and also connections between any components of the distance meter. The components of the distance meter 102 are preferably interconnected by a mother board 202 or a similar connecting element. In one embodiment, the mother board may comprise a previously integrated unit performing e.g. arithmetic operations, such as a processor 204, a memory unit 206, a counter 207 and a clock 208. In addition, the distance meter typically comprises a power supply 210, preferably a battery.

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A crucial component in the distance meter of the invention is a magnetic sensor 210 for measuring the direction of an external magnetic field, the sensor being carried out e.g. by means of a biaxial magnetic sensor of HMC1022 type. The magnetic sensor may also have several axes. The distance meter also has control means 214, preferably press buttons, for controlling the operation of the distance meter and for feeding data into the meter. The distance meter can also be equipped with a display unit 216, such as an LCD display for displaying data. The distance meter also typically comprises means 218 for data transmission, such as an IR transmitter, an IR transceiver or a short-range radio link. A short-range radio link can be carried out by means of Bluetooth techniques, for instance. Data transmission between a pulse meter carried at the wrist and the distance meter is most preferably carried out by means of a short-range radio link, however, data transmission e.g. between a computer and the distance meter can also be carried out with wire data transmission techniques.

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In a preferred embodiment of the invention, the distance meter to be worn by the user may comprise also a controller 220. The controller may control the lap cycles relative to deviations in the measured magnetic field, relative to the time and relative to the length of a fed lap or side, and possibly to a fed sport type, and infer from this whether the deviation has occurred within the limits of normal conditions, or whether it is an erroneous interpretation, and then it either changes or does not change the value of the counter 207. The controller may also learn the fitness trainer's lap cycle by means of a special teaching mode, in which the fitness trainer

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programs the distance meter in teaching mode and performs the normal training performance around a track, the controller storing data relating especially to the turning points, and in one embodiment, the controller may even suggest a geometric pattern as the track. After the teaching mode, the controller may compare data of the consecutive laps with data of the lap performed during the teaching mode, such as deviations from the magnetic field as a function of time. In one embodiment, the controller may also change the sampling frequency to make it more consistent with the particular measuring situation.

10 The distance meter 102 of the invention may further comprise a sensor 222 detecting the fitness trainer's position, such as e.g. a sensor based on micro mechanic Bonded Silicon On Insulator (BSOI) techniques, or any other position-detecting sensor known by those skilled in the art. The fitness trainer's position can be observed also by a magnetic sensor 212, especially a triaxial magnetic sensor. A position-detecting sensor 222, or optionally 212, may detect when the fitness trainer is in swimming position and when he/she is in vertical position, so that, in case of the swimming mode or of a distance meter especially intended for swimmers, erroneous lap counting due to vertical rotation at the pool end can be avoided. The sensor 22 or 212 may also detect whether the swimmer is swimming on his stomach or on his back. In one embodiment, the distance meter 102 may comprise also means 224 for identifying the operating mode of the meter, allowing detection of whether the meter is carried or not carried by the user. In one embodiment, the distance meter 102 may also comprise alarm means 226 for giving an alarm e.g. when a preset number of laps or distance is covered.

25 However, it should be noted that the distance meter 102 to be worn by the user in accordance with the invention is exemplified, and that at least part of the components are optional. In other words, the distance meter to be carried by the user in accordance with the invention can be implemented with a notably smaller number of components than those shown in figure 2.

Figure 3 shows the operating situation 300 of an exemplified distance meter carried by the user in one embodiment of the invention, where the fitness trainer 101 is a swimmer swimming back and forth in a swimming pool 302. At a) the swimmer is swimming into a direction, where the south is on the rear left side and the north is on the front right side relative to the swimmer's direction of movement. The magnetic sensor included in the distance meter 102 to be carried by the user in

accordance with the invention may thus infer the swimmer's direction of movement from the direction of the magnetic field 304 it has measured, in this case approx. 293 °. At b), where the swimmer is returning in the same pool, the determined swimming direction is approx. 113 °.

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In the case of figure 3, the measurement is most definite and accurate, given the reversed signs of the measured components indicating the direction of the magnetic field at the turning point, where the swimmer resumes his incoming direction. Should the pool be positioned exactly in the north-south direction or in the east-west direction, the sign of only one of the measured components would be reversed, and this would yet be a sufficient indicator of the swimmer having turned back in the pool. In fact, the reversal detection is most straightforward when the sign of at least one of the measured components describing the direction of the magnetic field is reversed.

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Figure 4 shows the direction of a magnetic field measured by the distance meter of the invention as a function of time in the pool shown in figure 3, with the user swimming back and forth along a straight track. In the case shown in figure 3, the swimmer first swims along the track in a direction of about 290 ° for about 45 seconds, and then he resumes his incoming direction of 113 °, and continues swimming for about 45 seconds. The cycle is extremely distinct and the measurement accuracy is good. Especially if the distance meter averages the values describing the direction of the magnetic field it has determined, any anomalies caused by slight meandering can be ignored. If the fitness trainer has fed the geometric pattern of the track and the length of the side or lap into the distance meter, the speed of said side or lap can be calculated after the side or lap has been counted. The average speed of longer intervals or optionally the fastest laps can also be determined.

30 However, it should be noted that, even if the sport shown in figures 3 and 4 is swimming, the operation of the distance meter of the invention is by no means restricted to swimming alone, the meter being equally well applicable to other sports as well, such as e.g. cycling, skating, running or paddling, involving regular repeated movement along a track or lap.

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Figure 5 shows a square track and the direction of a magnetic field measured by the distance meter of the invention as a function of time, the fitness trainer equipped

with the distance meter following a square track, whose sides 1) and 3) extend in the south to north direction. In the exemplified case of figure 5, the fitness trainer starts the performance at the intersection of sides 1) and 4), following first side 1) to the north (either 0 ° or 360 °, in this case 0 °) for about 28 seconds, and then turns to the west, into direction 270 °, proceeding along side 2). Then the fitness trainer turns to the south on the track, into the direction 180 °, following side 3), and finally towards starting point, i.e. towards the intersection between side 4) and side 1), proceeding along side 4) towards the east in the direction 90 °. In this case as well, the characteristic of the direction of the magnetic field as a function of time is distinct, i.e. the characteristic clearly shows the turning points, allowing easy and accurate counting of the covered number of laps or sides.

Figure 6 shows a triangular track and the direction of a magnetic field measured by the distance meter of the invention as a function of time, the fitness trainer equipped with the distance meter following the triangular track, where the fitness trainer starts from the intersection of sides 3) (east-west direction) and 1) and proceeds along side 1) towards the direction of about 330 ° for about 28 seconds, and then turns along side 2) to a direction of about 210 ° for about 28 seconds, and finally turns to proceed along side 3) into a direction of about 90 ° for about 28 seconds. It should be noted that having reached the starting point (intersection between sides 1) and 3)), the fitness trainer turns via the north to side 1), and then the characteristic describing the direction of the magnetic field may make a momentary stop at 0 °, however, owing to the controller, this will be ignored in the counting of laps. The fact whether the characteristic describing the direction of the magnetic field stops at 0 ° depends among other things on the fitness trainer's turning speed and the sampling frequency of the distance meter of the invention.

In one embodiment of the invention, the sampling frequency of the distance meter can be changed. Especially on a long side or lap length, the sampling frequency can be set to a lower value, so that the direction of the magnetic field can be detected only every other second, for instance. The sampling frequency can be changed without requiring actions by the user.

In the case illustrated by figure 6 as well, where the fitness trainer follows a triangular track regularly, the characteristic of the direction of the magnetic field measured by the distance meter of the invention as a function of time is distinct, in

other words, the characteristic distinctly shows the turning points, and hence the number of covered laps or sides can be readily and accurately counted.

Figure 7 illustrates an oval track and the direction of a magnetic field measured by the distance meter of the invention as a function of time, the fitness trainer equipped with the distance meter following an oval track, where sides 1) and 3) are in the south-north direction and sides 2) and 4) in the east-west direction. In the exemplified case, the fitness trainer starts from point A, proceeding first in parallel with side 1) towards the north into an approx. 0° direction for about 20 seconds, and then he turns to proceed in parallel with side 2) into the direction of about 270° for about 30 seconds. As the fitness trainer has covered the stretch parallel with side 2), he/she further turns to proceed in parallel with side 3) to the south about 180° for about 20 seconds, and eventually, before one complete lap is covered, along side 4) to the east direction of about 90° for about 30 seconds.

It can be further noted that, when an oval track is regularly followed, the characteristic of the direction of the magnetic field measured by the distance meter of the invention as a function of time is distinct, i.e. the characteristic distinctly shows the turning points, and consequently, the covered number of laps or sides can be readily and accurately counted.

Figure 8 illustrates an exemplified method 800 for implementing the operation of the distance meter carried by the user in one embodiment of the present invention, in which a magnetic sensor is initially fastened to a person with substantially stationary direction relative to the person. The operating mode of the distance meter can be identified in step 802 with the aid of a means for identifying the operating mode included in the distance meter, the value of the output signal of the means being determined by the operating mode of the distance meter, i.e. by the fact whether the distance meter is being or not carried by the user. In step 802a, the distance meter can be switched in standby mode (ON), provided that the distance meter is worn by the user, or in step 802b it can be switched off from the standby mode (OFF), provided that the distance meter has been taken off, on the basis of the output of the means for identifying the operating mode of the distance meter. However, steps 802, 802a and 802b are optional, and it should be noted that the standby mode could also be switched on with a switch such as an ON/OFF switch.

In the method of the invention, in step 804, track settings can be fed into the distance meter, such as e.g. the geometric pattern of the track to be followed (i.a. a straight, circular, triangular, square, rectangular, oval shape), the length of the lap and the length of the side. In step 804, a limit value for the deviation of the magnetic sensor relative to an external magnetic field can be fed, or optionally, the limit value can be inferred from the fed geometric track pattern. The operating mode of the distance meter can be fed in step 806, but this is not compulsory. The operating mode may describe e.g. the type of sport to be performed, and it may be e.g. a running mode, a skating mode or a swimming mode. In one embodiment, a swimming mode, for instance, can be identified without requiring the user's actions, with the aid of a sensor detecting the fitness trainer's position. The actual training area can be detected in step 808 as the direction of the magnetic field as a function of time at a specific sampling frequency. The sampling frequency may be fixed, or in one embodiment, it can be adjusted to the fed operating mode, the geometric track pattern and the length of the lap or the side, among other variables.

When there is a deviation of the direction of the measured magnetic field, step 810 can evaluate the reliability and permanence of the deviation and also conclude whether the deviation was due to the fitness trainer's turning to another side on the track, for instance, or whether the deviation was a sudden deviation caused by an evasive movement, for instance. If step 810 evaluated the deviation as an acceptable one, the value of the counter counting the number of laps or sides is increased in step 812. This step may also calculate the covered distance with the aid of the fed track data and the counted laps. In one embodiment, step 812 may deliver the number of counted laps and distance data over a data transmission communication to another data processing device, such as a device collecting pulse data, which the fitness trainer carries at his/her wrist. However, it should be noted that data can be transferred between an external data processing device and the distance meter carried by the user in accordance with the invention also during other steps, and that the external data processing device may also be some other means collecting pulse data, such as a computer, for instance.

After step 812 or optionally after step 810, the method proceeds to step 814 in order to decide whether the measurement should be continued. If the user interrupts the measurement, for instance, the collecting of measurement data can be ended in step 816, and the collected data can be filed in a file. If the measurement is continued, the process may return to step 806, for instance. In one embodiment, and especially

in the case of a distance meter intended for the swimming mode or swimmers, the swimmer's position can be concluded in step 806, i.e. the fact whether the swimmer is in swimming position or in vertical position. If the swimmer is in swimming position, the measurement can be carried on normally, but if the swimmer has remained resting in vertical position at the end of the pool, the measurement will be carried on only when the swimmer has resumed his swimming position. The swimming position can be monitored also during the other steps.

Only a number of embodiments of the invention have been described above. The principle of the invention can naturally be varied within the scope of protection defined by the claims, regarding details of the embodiment and fields of application, for instance. In particular, it should be noted that the distance meter of the invention can be manufactured in a simplified version for a specific sport or track, such as a straight track for swimmers, and then it is not necessary to feed or set the type of sport or track in the operating situation, but the entire measurement can be carried out by activating the meter at the outset of the performance and by stopping the meter at the end of the performance.

It should be further noted that, depending on the embodiment, the data transmission between the distance meter of the invention and the data processing device may be bi-directional, allowing the operation of the distance meter to be controlled by means of said data processing device. The fitness trainer may feed data into the distance meter of the invention in the course of the performance by means of a data processing device, such as a pulse meter carried at the fitness trainer's wrist.

25

Claims

1. A method (800) for measuring the distance covered by a person, **characterised in**
- 5 - fastening to the person (101) a magnetic sensor (212) with substantially stationary direction relative to the person,
- monitoring (808) any deviation of the magnetic sensor relative to the magnetic field (304) external to the sensor, and
- 10 - counting the times (812) the deviation of the magnetic sensor relative to the external magnetic field exceeds a set limit value.
2. A method as defined in claim 1, **characterised in that**, before the performance starts, at least on of the following data is fed into the distance meter (102) reading the output of the magnetic sensor: type of sport, length of one lap or one side, data about the geometric pattern of the track and set value for the deviation of the magnetic sensor relative to an external magnetic field.
- 15 3. A method as defined in claim 1, **characterised in that** the fitness trainer's position is also detected and a decision about continuing the measurement is made on the basis of the detected position and the fed type of sport.
- 20 4. A method as defined in claim 1, **characterised in that** the distance covered is determined by the counted times and the fed length of a lap or a side.
- 25 5. A method as defined in claim 1, **characterised in that** data are delivered from the distance meter (102) to at least one other data processing device (112).
- 30 6. A distance meter (102) for measuring the distance covered by an object, **characterised in that** the distance meter (102) is a wearable distance meter, and that it comprises a magnetic sensor (212) for determining the direction of the magnetic sensor (212) relative to a magnetic field (304) external to the sensor (102), and also a counter (207), and that the wearable distance meter (102) is arranged to decrease
- 35 the value of the counter (207) when the deviation of the magnetic sensor (212) relative to an external magnetic field (304) exceeds the set limit value.

7. A distance meter as defined in claim 6, **characterised** in that the distance meter (102) comprises fastening means (108) for fastening the sensor with substantially stationary direction relative to the object and in that the fastening means is a press stud, a strap, a belt, a suspender (108) or a garment equipped with a pocket
5 substantially adapted to the size and shape of the meter, such as a pair of trunks.

8. A distance meter as defined in claim 6, **characterised** in that the distance meter (102) comprises control means (214, 216), such as a press button and a display for feeding at least one of the following data into the distance meter: type of sport,
10 length of one lap or side, information about the geometric pattern of the track and a set value for the deviation of the magnetic sensor relative to an external magnetic field.

9. A distance meter as defined in claim 6, **characterised** in that the distance meter (102) includes a sensor (222) for detecting the swimmer's swimming position and vertical position, respectively.
15

10. A distance meter as defined in claim 6, **characterised** in that the distance meter (102) comprises a controller (220), which is arranged to evaluate the consistency of the measured lap cycle with at least one of the following: fed type of sport, length of
20 lap, length of side, geometric pattern of the track, deviation of the magnetic sensor from the limit value of an external magnetic field and spent time.

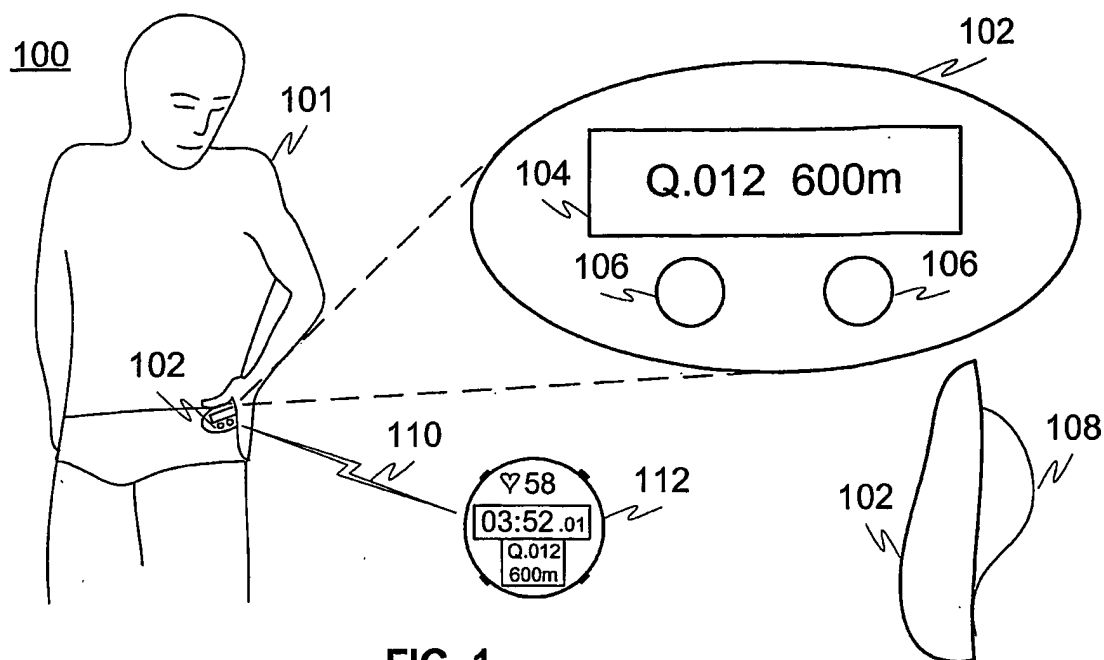
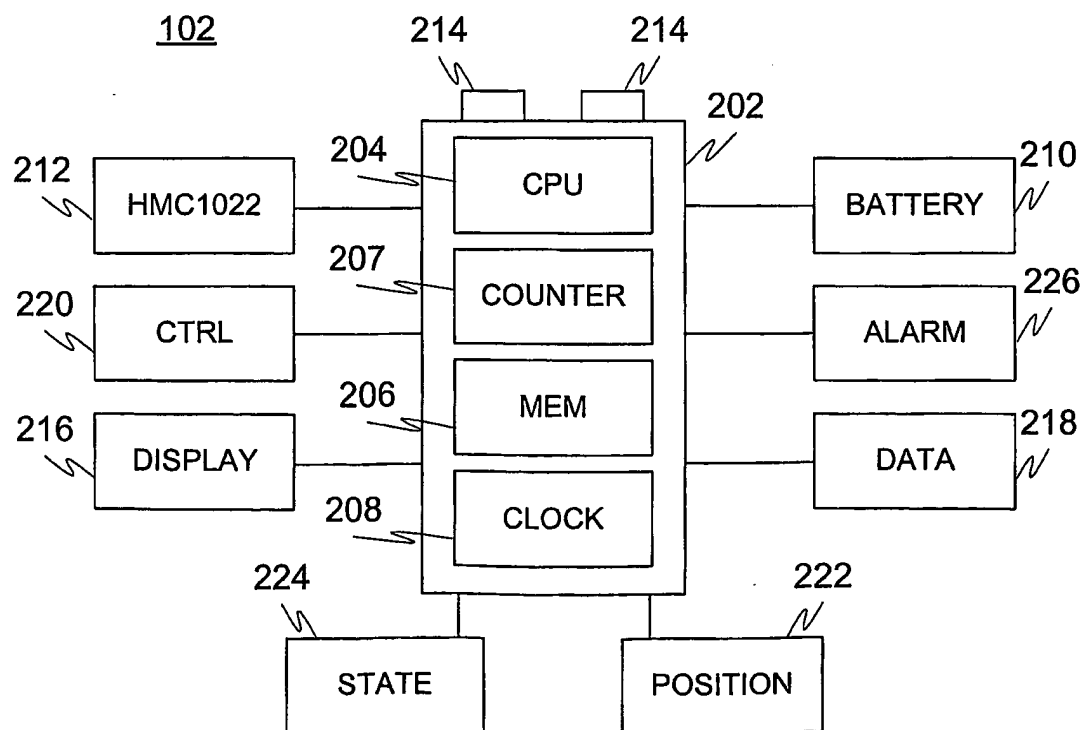
11. A distance meter as defined in claim 6, **characterised** in that the distance meter (102) is arranged in data transmission communication (110) with at least one other data processing device (112).
25

12. A distance meter as defined in claim 11, **characterised** in that the data processing device is a computer, a display screen or a device measuring pulse data
30 (112).

13. A distance meter as defined in claim 6, **characterised** in that the distance meter (102) comprises a means (224) for detecting the operating mode of the wearable distance meter, the means allowing the conclusion whether the meter is being worn
35 or not worn by the user.

14. A distance meter as defined in claim 6, **characterised** in that the distance meter (102) is arranged to give an alarm when a preset distance or number of laps is covered.

1/3



2/3

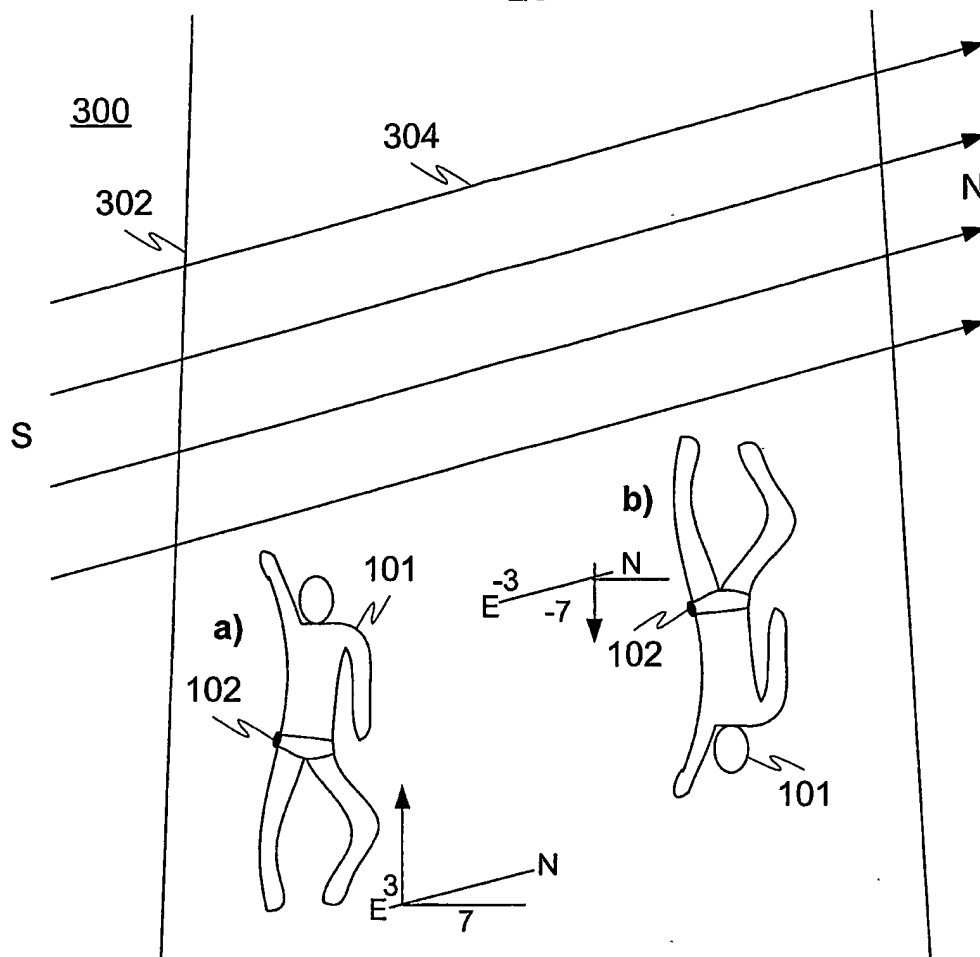


FIG. 3

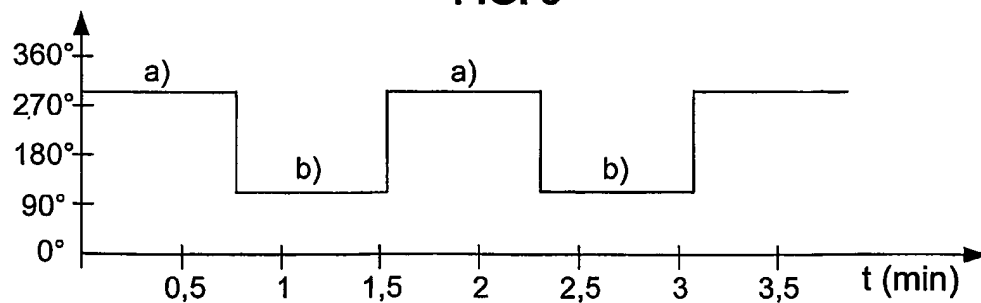


FIG. 4

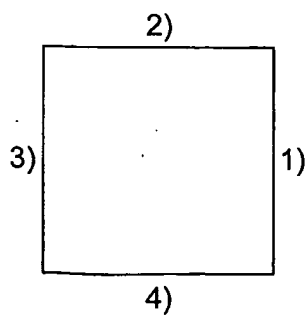
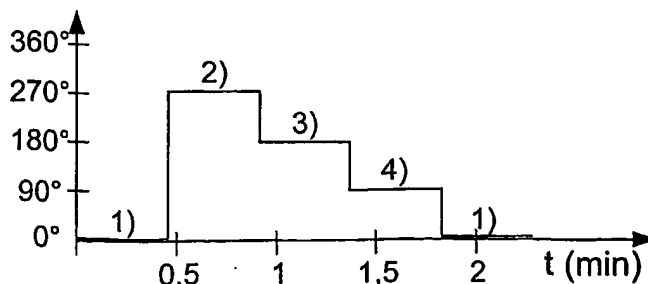


FIG. 5

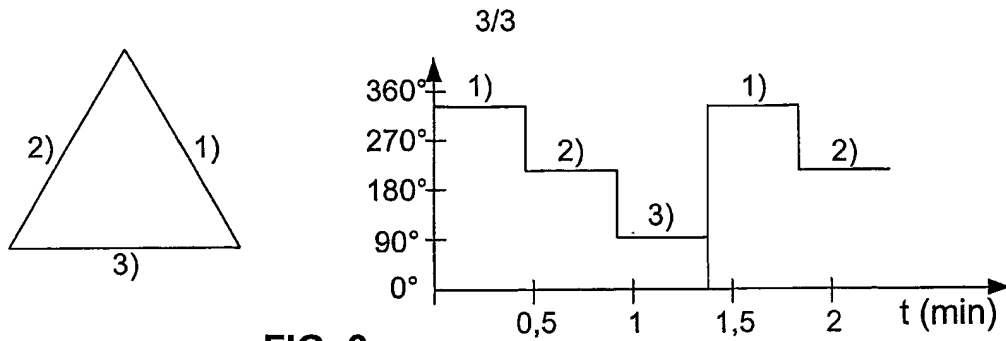


FIG. 6

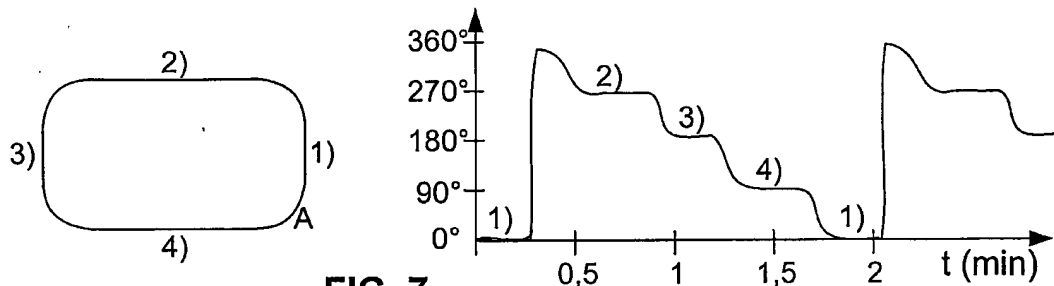


FIG. 7

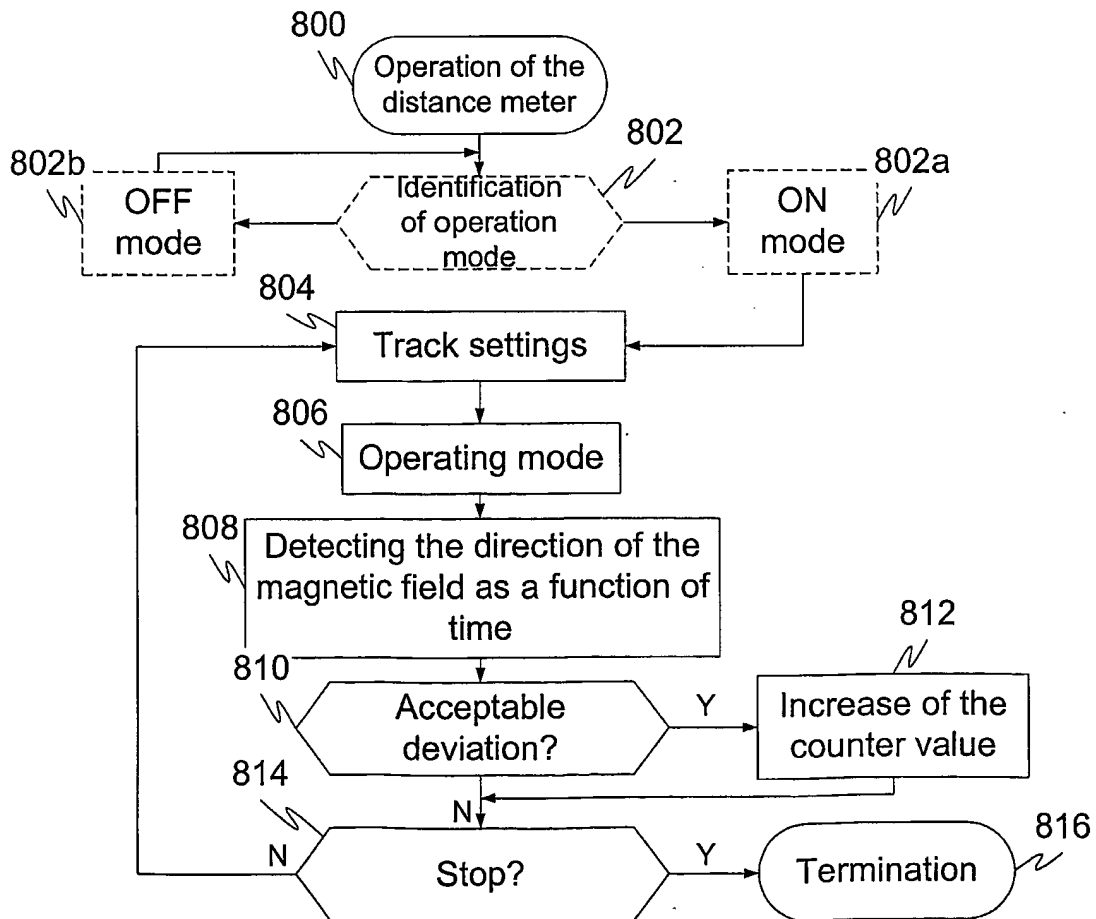


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 2003/000798

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G01C 22/00, A63B 69/00

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)

IPC7: G01C, A63B, G01R

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

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 0067858 A1 (MYNHARDT, GERHARD), 16 November 2000 (16.11.2000), whole document --	1-14
X	US 5661398 A (KA YIU SHAM ET AL), 26 August 1997 (26.08.1997), column 5, line 48 - column 6, line 17 --	1,2,4,6-8
X	EP 1250887 A2 (ACUMEN MANUFACTURING LTD.), 23 October 2002 (23.10.2002), whole document --	1,5-7,11,12, 14
X	US 4530105 A (J.RABINOWITZ), 16 July 1985 (16.07.1985), whole document --	1,2,6-8

☒ Further documents are listed in the continuation of Box C.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4703445 A (A.A.DASSLER), 27 October 1987 (27.10.1987), abstract --	1-14
A	US 4991126 A (L.REITER), 5 March 1991 (05.03.1991), abstract -- -----	1-14

INTERNATIONAL SEARCH REPORT

Information on patent family members

01/12/2003

International application No.

PCT/FI 2003/000798

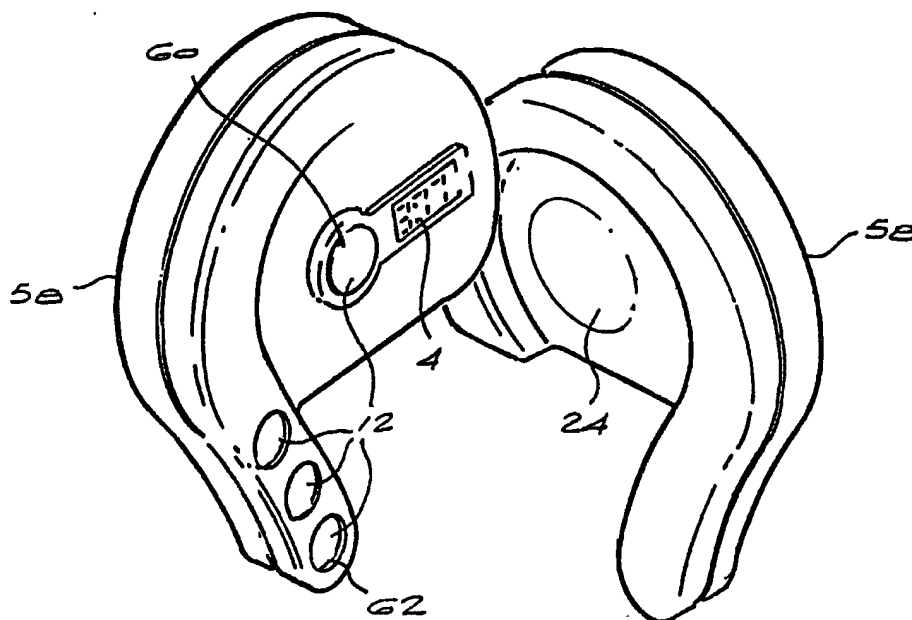
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				EP	0152057 A	21/08/1985
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				WO	8707012 A	19/11/1987
				AT	128986 A	15/02/1988
				AT	386683 B	26/09/1988



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/IB00/00579 (22) International Filing Date: 5 May 2000 (05.05.00) (30) Priority Data: 99/3142 6 May 1999 (06.05.99) ZA (71)(72) Applicant and Inventor: MYNHARDT, Gerhard, Stephanus [ZA/ZA]; 9 Hydewoods, Townsend Avenue, 2196 Hyde Park (ZA). (74) Agents: GILSON, David, Grant et al.; Spoor and Fisher, P.O. Box 41312, 2024 Craighall (ZA).		(81) Designated States: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, 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). Published <i>With international search report.</i>

(54) Title: APPARATUS FOR DETERMINING WHEN A SWIMMER TURNS



(57) Abstract

The apparatus comprises a portable housing which can be worn by a swimmer, for example in or on the swimmer's ear. A magnetic sensor in the housing detects a change of orientation of the swimmer relative to the earth's magnetic field when the swimmer turns and generates a turn signal which is sent to a processor. Alternatively, a shock sensor arranged to be strapped to the swimmer's ankle, for example, can be used to transmit a signal to a processor in the housing. The processor generates an output signal in the form of selected stored speech components to indicate to the swimmer parameters such as total elapsed time, number of laps or lap time.

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APPARATUS FOR DETERMINING WHEN A SWIMMER TURNSBACKGROUND OF THE INVENTION

THIS invention relates to apparatus for determining when a swimmer turns, typically at the completion of a length of a pool.

When training, swimmers need to keep count of the number of laps swum, as well as the time per lap, and the elapsed time. Knowing the number of strokes per lap is also useful for the swimmer.

In prior art systems, a swimmer is required to press a button at every turn to keep count of the number of laps, and to look at a display in order to obtain relevant information.

It is an object of the invention to provide apparatus for determining when a swimmer turns at the completion of a lap without requiring the swimmer to press any buttons at the time of turning. It is also an object of the present invention to provide information to a swimmer without requiring the swimmer to look at a display.

CONFIRMATION COPY

SUMMARY OF THE INVENTION

According to the invention there is provided apparatus for determining when a swimmer turns comprising:

a portable housing;

a sensor in the housing for detecting turning of the swimmer and for generating a turn signal in response thereto;

processor means in the housing and responsive to the turn signal to generate an output signal; and

output means responsive to the output signal to generate an output perceptible to the swimmer and indicative of at least one of the number of laps swum by the swimmer, the time elapsed since a predetermined time, and the time per lap.

The sensor may comprise at least one magnetic field sensor.

Preferably the sensor comprises three magneto-inductive field sensors which are arranged orthogonally.

Alternatively the sensor may comprise an acceleration sensor or a shock sensor.

The acceleration sensor or shock sensor may be located with the processor means in the housing.

Alternatively, the acceleration sensor or shock sensor may be arranged to be worn on a limb of the swimmer, the apparatus then including transmitting means for transmitting the turn signal from the sensor to the processor means.

The output means may comprise a storage device for storing data corresponding to predetermined words, and an audio output device, so that an audio signal comprising one or more words is output to the swimmer when turning of the swimmer is detected.

The storage device and the audio output device are preferably arranged to be controlled by the processor means, which accesses the storage device to retrieve data corresponding to selected words to be output to the speech output device.

The housing is preferably waterproof and sized and shaped to be placed in proximity to the swimmer's ear, so that the audio output device will output speech signals audible to the swimmer while the apparatus is in use.

The apparatus may include a display for displaying selected parameters to the swimmer, the selected parameters including at least one of the number of laps swum by the swimmer, the time elapsed since a predetermined time, and the time per lap.

The processor means is preferably a microprocessor having associated input means arranged to allow a user to input commands to the microprocessor.

The apparatus preferably includes a memory device for storing data relating to predetermined user defined parameters and a communication device for

downloading the stored data to an external device.

BRIEF DESCRIPTION OF THE DRAWINGS

- Figure 1** is a schematic block diagram of the electronic circuit of a first embodiment of apparatus according to the invention;
- Figure 2** is a schematic block diagram illustrating an arm movement sensor to be used in conjunction with the circuit illustrated in Figure 1;
- Figure 3** is a schematic block diagram of the electronic circuit of a second embodiment of the invention; and
- Figure 4** shows a housing in which the circuit of Figures 1 and 3 is placed.

DESCRIPTION OF EMBODIMENTS

The main purpose of the present invention is to determine automatically when a swimmer turns at the completion of a lap, usually at the side of a pool. This event can then be used to determine a variety of useful data, such as the number of laps swum, split time for last completed lap, elapsed time since start and distance swum since start. Another purpose of the present invention is to communicate this information to the swimmer audibly while swimming.

Figure 1 illustrates a first embodiment of the invention. The main

components used for this embodiment are:

- a processor 2;
- an LCD display 4;
- an audio transducer 6;
- sensors 8;
- a serial electrically erasable programmable read only memory (EEPROM) 10;
- input switches 12;
- a battery 14; and
- a PC interface 16.

The three sensors are magneto-inductive sensors such as the SEN-M magneto-inductive sensor supplied by Precision Navigation. This sensor operates by the inductance of the sensor varying depending on the applied magnetic field strength. These sensors are used in a magnetometer arrangement to accurately measure orientation changes as a result of changes sensed in the orientation of the earth's magnetic field relative to the sensor.

An operational amplifier 18 is arranged as a Schmitt trigger, with one of the three magneto-inductive sensors connected in its feedback path, thereby forming a relaxation oscillator circuit. This causes the operational amplifier 18 to oscillate depending on the inductance of the particular sensor. Three CMOS type CD4066 transmission gates, TG1, TG2 and TG3 allow the processor 2 to select which of the sensors are to be used at any time. The three sensors are arranged orthogonally so that two of them are in the same plane but offset 90 degrees to one another and the third is mounted vertically relative to this plane. The three sensors are therefore continuously and

sequentially enabled to provide a frequency output from the oscillator indicating the magnetic field strength in the relevant plane.

A highly integrated Motorola MC68HC05L25 microprocessor is used as the processor 2. The microprocessor 2 contains its own internal program memory, read/write data memory, LCD display interface, clock, frequency counter, analog to digital converter and external interfaces. A sequence of program instructions (the program) is loaded into the microprocessor's program memory which executes the tasks allowing it to function.

The magneto-inductive sensor frequencies are measured by an event counter function. The frequency changes sensed as the device is rotated in the horizontal plane indicate heading. This heading is calculated as arctangent (Y frequency/X frequency). Tilt variations also affect the sensors and the vertical magnetic component is therefore measured and used to correct the sensed direction via a simple cosine rotation function. Since only a change of direction which is close to 180 degrees needs to be sensed, exact heading information is not required, and a 180 degree change in direction will be detected as a turn. The calculated heading is also averaged over a period of 1 second to avoid short-term changes resulting from tilt.

Alternatively, a tilt sensor (not shown) may be added to provide additional tilt correction information to the microprocessor 2. This tilt sensor will also provide a means of sensing the swimmer's strokes. Typically, a dual axis tilt sensor, such as the ADXL202 from Analog Devices, is used to detect head sideways movement, which indicates breathing and strokes when swimming freestyle and backstroke, as well head up and down movement, which indicates strokes when swimming breaststroke and butterfly. The tilt sensor must be mounted to be as close as possible to the horizontal with

respect to the water surface when the swimmer is wearing the device placed over his/her ear while swimming, and without the head being tilted in either a sideways or up and down direction. The ADXL202 sensor is sensitive to both static acceleration, such as gravity, and dynamic acceleration, due for example to the head being turned. It provides two digital signals with pulse width modulated outputs in a range of $\pm 2G$, indicating acceleration on the particular axis. This pulse width is then measured against the pulse period by the microprocessor 2, which will produce an 8 bit value indicating both static and dynamic acceleration.

The microprocessor 2 is also able to output speech signals to the swimmer. Data corresponding to the speech is stored in the attached EEPROM 10 in the widely used and well known Advanced Delta Pulse Code Modulation (ADPCM) form at 9.6 k samples/second. Each word of speech is stored as one of up to 256 phrases, each phrase containing as a first byte its 8 bit address, and a 16 bit length stored in 2 bytes. A fast SDI interface bus is used between the EEPROM 10 and the microprocessor 2.

The program will cause the phrase location in the EEPROM to be located using a table listing the actual addresses for each phrase. The microprocessor 2 fetches data sequentially from this address, starting with the phrase address for checking purposes, and then the phrase length word. The microprocessor 2 fetches phrase data sequentially up to the end of the stored data according to the length of each word. Each speech byte fetched is handled in 4 bit nibbles. The program calculates the 8 bit value reflecting the speech analog value at that point from the 4 bit delta data. The 8 bit data is continuously output as a pulse width modulation signal on the PA7 pin of the microprocessor 2. This is achieved by sequentially shifting out from the least significant bit each of the 8 data bits.

An external integrator consisting of a resistor and a capacitor converts this to an analog value, which is then amplified by a TLC3702 operational amplifier 20. This operational amplifier 20 has an NPN transistor 22 buffered output driving the speech output to a small moving coil loudspeaker 24.

The stored phrases typically contain numerics, such as 'nought', 'one', 'two', up to 'ten', and words such as 'lap', 'laps', 'total', 'time', 'split', 'rep', 'go', 'last', 'distance', 'yards', 'meters', 'on', 'off', 'started' and 'stopped'. Other words which may be found useful for a particular variation of this embodiment may also be included.

The microprocessor 2 has four associated control buttons 12 which are identified as follows:

- | | |
|------------|---|
| On/Off | to switch the device on/off; |
| Start/Stop | to start and stop a measurement cycle; |
| Mode | to change the operating modes; |
| Set | to select a particular option or setting. |

The microprocessor 2 contains an internal timer, which is used to clock time in 0.1 second steps. This timer is cleared by the swimmer, and started by activating the start/stop button.

The microprocessor 2 functions by denoting every change in direction as an event "Turn". In the normal mode this event will result in various parameters, such as number of laps, time of last lap, total elapsed time and distance since start being calculated and stored. The calculated data

required by the swimmer after each lap is then used to retrieve the correct phrases from the EEPROM for conversion to speech, for example, 'total' 'laps' 'two' 'four' to indicate 24 laps completed.

The personal computer (PC) interface 16 is a simplex 125kHz transmitter and receiver operating at a low bit rate of 2400 bits per second. Data is transmitted by outputting 125kHz amplitude modulated data via a buffer 26 and a transmission gate 28 to a capacitor/coil combination 30, which is tuned to 125kHz. When receiving data, the transmission gate 28 is disabled. The 125kHz data is demodulated using a peak detector consisting of an operational amplifier 32, a diode 34 and a capacitor 36.

This same 125kHz receiver is also used to receive pulses from an arm movement sensor illustrated in Figure 2. The arm movement sensor is used to detect and monitor arm strokes, and is also used to automatically detect when a swimmer starts or stop swimming. The sensor is thin and compact and is attached to an elastic wrist strap. It is battery operated and contains a miniature shock sensor 40, which may be, for example, a PKGS-25LA device supplied by Willow Technologies Ltd. This particular shock sensor is selected for the sensitivity required to reliably detect arm forward extension, such as when the arm moves forward before entry when swimming freestyle, backstroke and butterfly, and when it is extended forward when swimming breaststroke.

A TLC3702 operational amplifier 42 amplifies the signal from the shock sensor 40. The negative going output from this operational amplifier firstly removes the reset signal from a counter 44, and is secondly inverted by a dual input NAND gate 46 in order to enable a resonator controlled oscillator, denoted generally by reference numeral 48. This oscillator uses a

500kHz ceramic resonator 50, and is based on a linearly biased Schmitt trigger NAND gate 52.

The counter 44 is an octal counter which divides the signal down. The output at Q1 of the counter 44 is the required 125kHz carrier frequency. This signal is gated with either output Q5 or Q6 of the counter 44 in order to send bursts of either 8 or 16 cycles of the 125kHz signal. This will allow two shock sensors to be used with the device and the device will simply detect in software whether the 125kHz burst is either 8 or 16 cycles long in order to differentiate between sensors. The arm movement sensor is set for 8 cycles of 125kHz carrier per burst. An inductor 54 and a capacitor 56 are tuned to 125kHz in order to transmit bursts of carrier to the main device described above.

A second embodiment of the invention is illustrated in Figure 3. The part of the apparatus illustrated in Figure 3 is similar to the apparatus of Figure 1 described above and like parts are denoted by like reference numerals. In this embodiment, the magnetometer is removed from the circuit and a leg shock sensor or accelerometer is used to determine when a swimmer turns at the side of a pool by measuring when the swimmer kicks off from the side of the pool. The shock sensor can be based on piezo shock sensing devices, such as the PKGS range supplied by Willow Technologies Ltd., and manufactured by Murata. These sensors sense acceleration, which means that other types of accelerometers, such as the dual axis ADXL202 from Analog Device can also be used.

The shock sensor or accelerometer can be mounted in the main unit illustrated in Figure 3 where it will interface directly to the microprocessor 2 after being amplified and buffered. In this case it is mounted so that it is sensitive to

acceleration in the forward direction. Alternatively, the sensor can be attached to a leg for additional sensitivity to the kicking motion when turning. In this case the sensor will contain the same circuitry as that used in the arm movement sensor described above with reference to Figure 2. However, it will be set to transmit 16 cycles at 125kHz each time a kick is detected. The sensor is mounted in a waterproof enclosure on an elastic strap and placed around one of the swimmer's ankles. In this variation, the sensitivity of the shock sensor is such that it does not detect and signal kicks from any of the swimming strokes. and a reception of bursts of pulses from the sensor therefore results in the Turn event as described above.

The circuitry of the apparatus described with reference to Figures 1 and 3 above is mounted in a waterproof housing 58 as illustrated in Figure 4. The housing 58 is typically made from a soft silicone rubber and fits over an ear of the swimmer. The housing 58 is made waterproof using O rings and rubber seals. In use, all or part of a swimming cap may cover the housing 58. The sound transducer 24 sits against the swimmer's ear, and the buttons 12 are somewhat recessed to avoid them being accidentally activated. The start/stop button 60 as well as the on/off button 62 can be easily reached while wearing the device, as these buttons may be needed while the apparatus is in use.

The liquid crystal display 4 is situated at the rear of the housing 58, and has 6 digits for time display and 4 digits for lap display. The liquid crystal display 4 also has the following icons:

Yards symbol;

Meters symbol;

Modes icons:

Normal;

Set interval training:

Set repeat time;

Set laps per repeat;

Set number of repeats;

Set rest period;

Set pool length.

One important function that the invention is able to implement is the ability to control interval training by communicating with the swimmer. This is done by counting and communicating the number of repeats, indicating when a repeat has to start via a count down, communicating the swim time per repeat, and indicating when the particular interval exercise set has finished.

Thus it can be seen that the apparatus determines when a swimmer turns at the end of a lap without requiring the swimmer to press any buttons at the time of turning. It also provides information to a swimmer without requiring the swimmer to look at the display.

CLAIMS:

1. Apparatus for determining when a swimmer turns comprising:

a portable housing;

a sensor in the housing for detecting turning of the swimmer
and for generating a turn signal in response thereto;

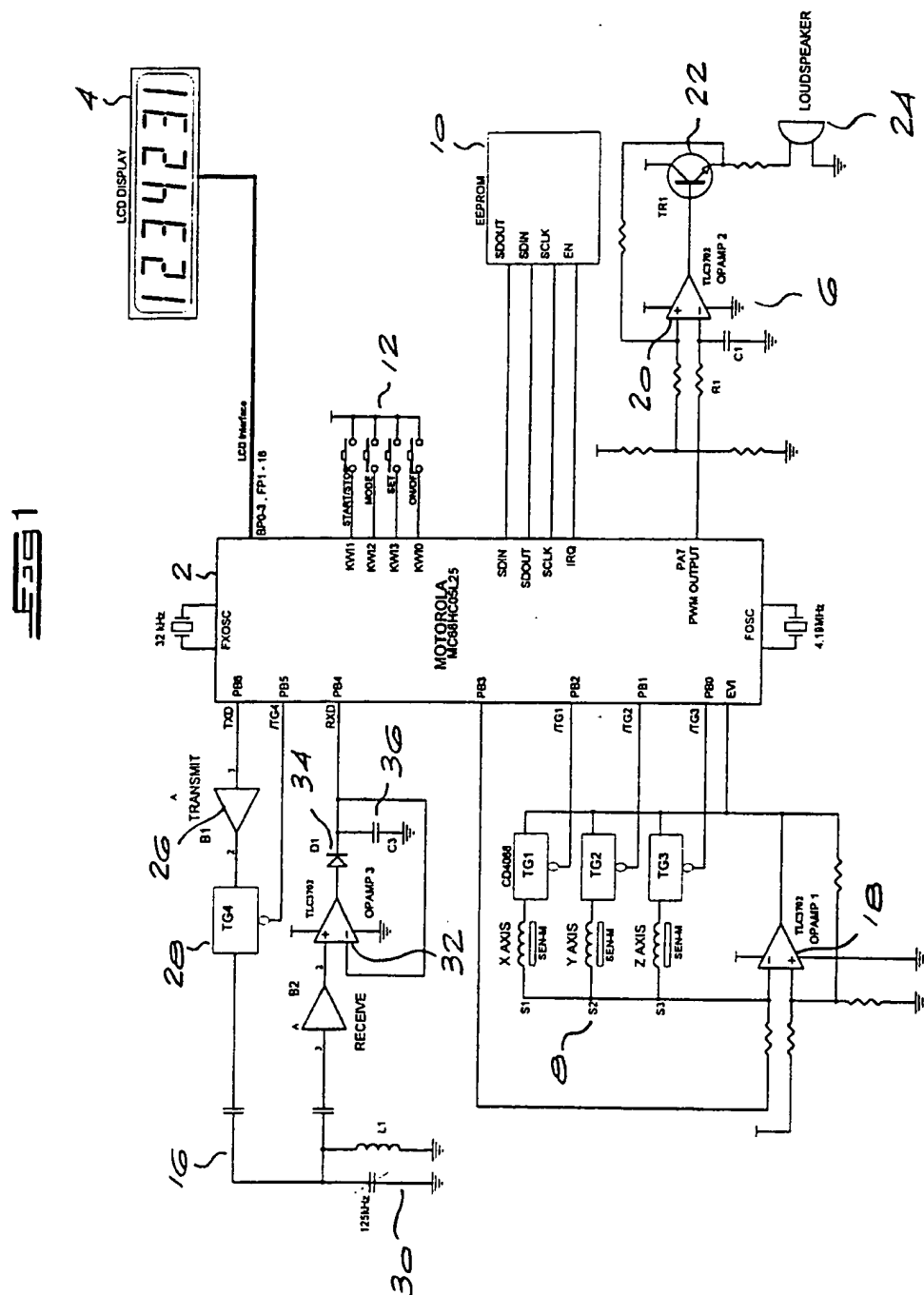
processor means in the housing and responsive to the turn
signal to generate an output signal; and

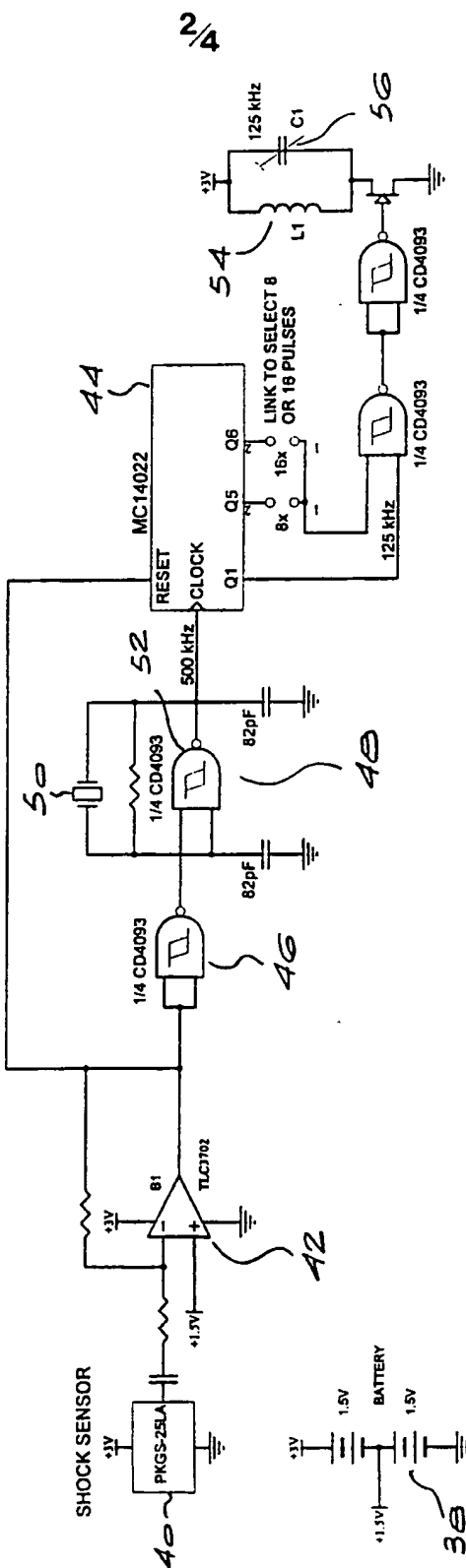
output means responsive to the output signal to generate an
output perceptible to the swimmer and indicative of at least
one of the number of laps swum by the swimmer, the time
elapsed since a predetermined time, and the time per lap.
2. Apparatus according to claim 1 wherein the sensor comprises at least
one magnetic field sensor.
3. Apparatus according to claim 2 wherein the sensor comprises three
magneto-inductive field sensors which are arranged orthogonally.
4. Apparatus according to claim 1 wherein the sensor comprises an
acceleration sensor or a shock sensor.
5. Apparatus according to claim 4 wherein the acceleration sensor or
shock sensor is located with the processor means in the housing.

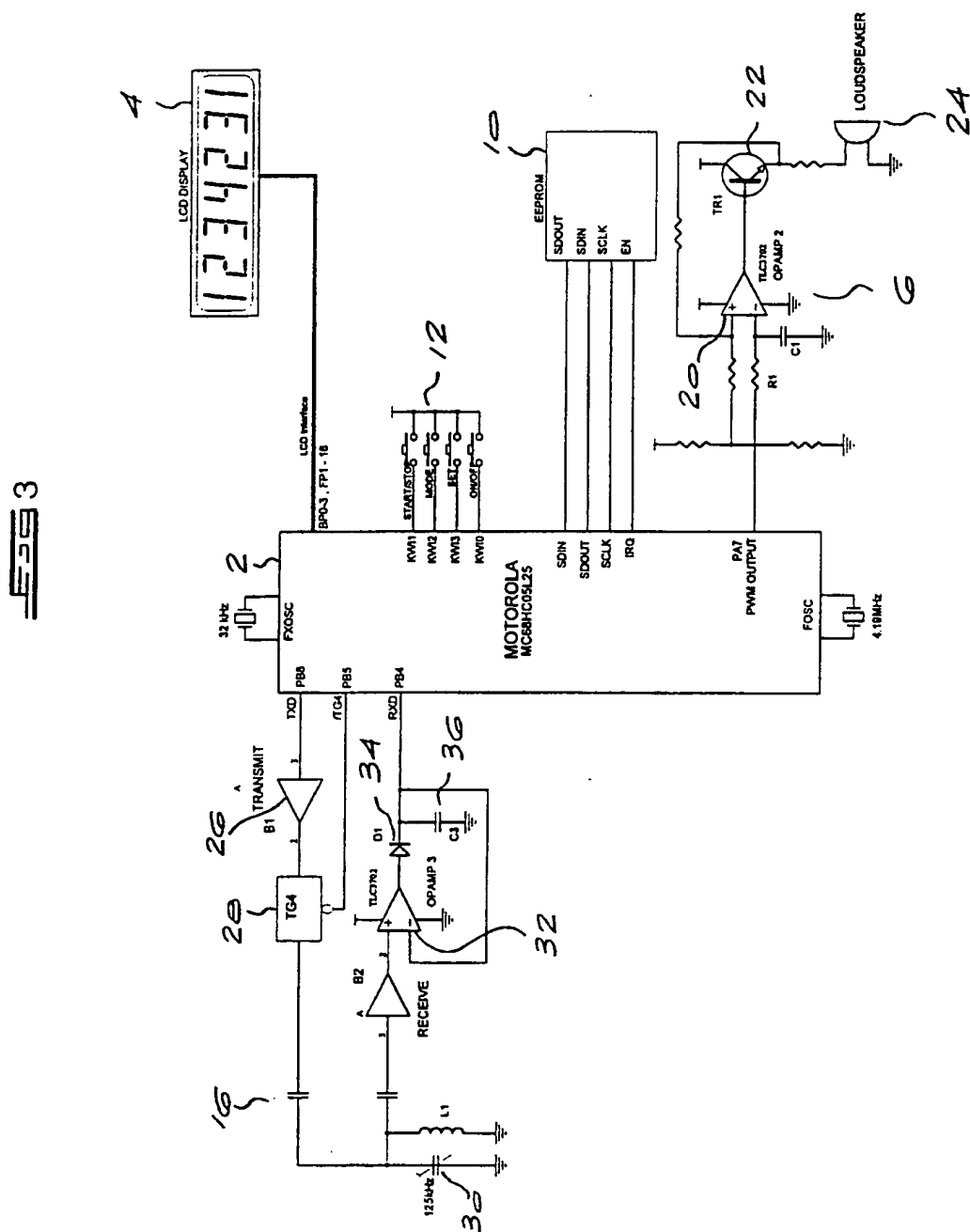
6. Apparatus according to claim 4 wherein the acceleration sensor or shock sensor is arranged to be worn on a limb of the swimmer, the apparatus including transmitting means for transmitting the turn signal from the sensor to the processor means.
7. Apparatus according to any one of the claims 1 to 6 wherein the output means comprises a storage device for storing data corresponding to predetermined words, and an audio output device, so that an audio signal comprising one or more words is output to the swimmer when turning of the swimmer is detected.
8. Apparatus according to claim 7 wherein the storage device and the audio output device are arranged to be controlled by the processor means, which accesses the storage device to retrieve data corresponding to selected words to be output to the speech output device.
9. Apparatus according to claim 7 or claim 8 wherein the housing is waterproof and is sized and shaped to be placed in proximity to the swimmer's ear, so that the audio output device will output speech signals audible to the swimmer while the apparatus is in use.
10. Apparatus according to any one of claims 1 to 9 including a display for displaying selected parameters to the swimmer, the selected parameters including at least one of the number of laps swum by the swimmer, the time elapsed since a predetermined time, and the time per lap.
11. Apparatus according to any one of claims 1 to 10 wherein the

processor means is a microprocessor having associated input means arranged to allow a user to input commands to the microprocessor.

12. Apparatus according to claim 11 including a memory device for storing data relating to predetermined user defined parameters and a communication device for downloading the stored data to an external device.

$\frac{1}{4}$ 





4/4

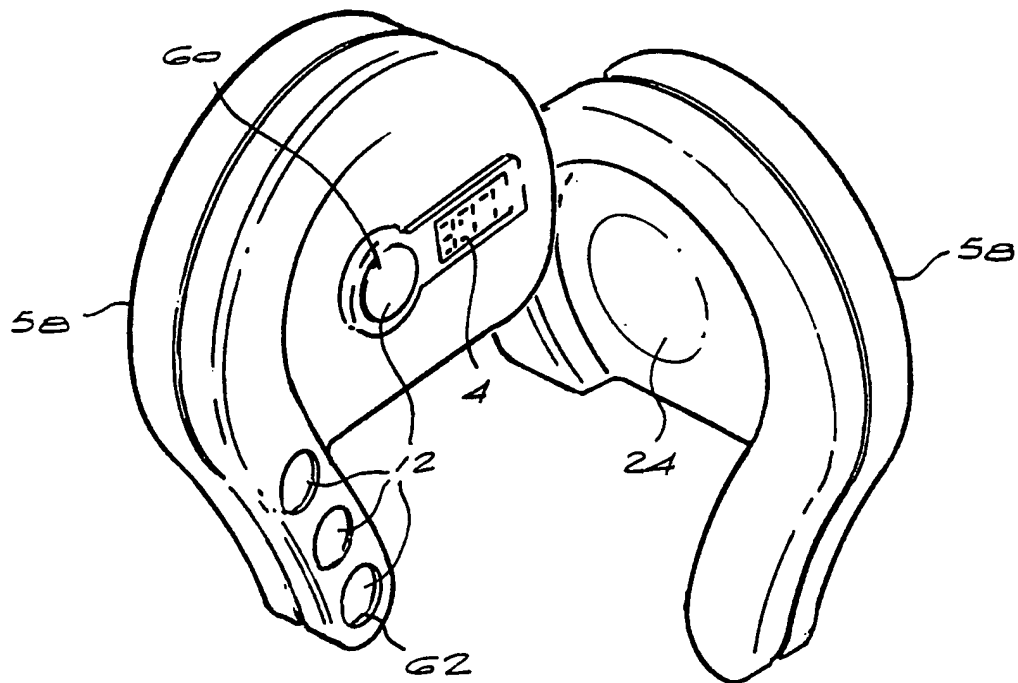


FIG 4

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 00/00579

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A63B69/00 A63B71/06

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 A63B G01R

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, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 530 105 A (RABINOWITZ JONATHAN) 16 July 1985 (1985-07-16) column 2, line 19 -column 4, line 3; figures 1,4	1,2,7,8, 10
Y	—	3
Y	WO 98 44358 A (PRECISION NAVIGATION INC) 8 October 1998 (1998-10-08) page 4, line 7 - line 22	3
X	US 5 685 722 A (TABA SERGE) 11 November 1997 (1997-11-11) column 2, line 63 -column 3, line 27 column 4, line 19 - line 63 column 5, line 3 - line 57 column 6, line 17 - line 26 column 8, line 41 - line 60	1,2,4-6
Y	—	7-12
	—/--	

☒ Further documents are listed in the continuation of box C.

☒ 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

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"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

2 August 2000

Date of mailing of the international search report

09/08/2000

Name and mailing address of the ISA

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Authorized officer

Millward, R

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB 00/00579

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	W0 96 36404 A (MILEY PATRICK GERARD) 21 November 1996 (1996-11-21) page 5, line 9 -page 6, line 12 page 7, line 11 -page 8, line 14 page 10, line 20 -page 11, line 17 page 19, line 12 - line 17	7-12
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INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 00/00579

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US 5685722 A	11-11-1997	AU 693331 B AU 5064096 A CA 2173920 A DE 19614347 A JP 8285967 A	25-06-1998 24-10-1996 14-10-1996 17-10-1996 01-11-1996
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US 5585871 A	17-12-1996	NONE	

INTERNATIONAL SEARCH REPORT

International application No

PCT/IL2007/001121

A. CLASSIFICATION OF SUBJECT MATTER

INV. A63B69/00 A63B69/12 A63B71/02 A63B71/06 A63B24/00

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)

A63B G07C

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, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication where appropriate of the relevant passages	Relevant to claim No.
X	WO 01/00281 A (TRAKUS INC [US]) 4 January 2001 (2001-01-04) page 3, lines 1-28 - page 7, lines 1-27 page 11, lines 27-30 - page 12, lines 1-30 page 15, lines 15-29 - page 16, lines 1-14 page 18, lines 5-20; figures page 22, lines 7-11 - page 29, lines 20,21; figures	1-29, 31-39
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	----- -/-	

☒ Further documents are listed in the continuation of Box C.☒ See patent family 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
- *Z* document member of the same patent family

Date of the actual completion of the international search

28 January 2008

Date of mailing of the international search report

06/02/2008

Name and mailing address of the ISA/

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Authorized officer

Teissier, Sara

INTERNATIONAL SEARCH REPORT

International application No
PCT/IL2007/001121

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document with indication where appropriate of the relevant passages	Relevant to claim No
X A	US 6 305 221 B1 (HUTCHINGS LAWRENCE J [US]) 23 October 2001 (2001-10-23) column 2, lines 65-67 - column 3, lines 1-3 column 5, lines 66,67 - column 6, lines 1-5 column 7, lines 47-67 - column 8, lines 1,2 column 9, lines 63-67 - column 10, lines 1-34 column 20, lines 26-48; figures	1-10, 12-14 30
X	WO 01/42809 A (ESPORT INC [US]) 14 June 2001 (2001-06-14) page 5, lines 1-25 - page 6, lines 1-5 page 20, lines 5-24; claims 2,3; figures	25-39
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IL2007/001121

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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US 5600730	A	04-02-1997	NONE	



Mail Stop AMENDMENT
Attorney Docket No. 30024X

JPW

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Eldad SHEMESH, et al. Conf. No.: 2324
Appl. No.: 12/382,214 Examiner: TBD
Filed: March 11, 2009 Art Unit: 3715
Title: **TRAINING AND INSTRUCTING SUPPORT DEVICE**

TRANSMITTAL LETTER

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

Submitted herewith for filing in the U.S. Patent and Trademark Office is the following:

- (1) Transmittal Letter, one (1) page;
- (2) Information Disclosure Statement, four (4) pages;
- (3) PTO/SB/08a, with 11 references cited, one (1) page;
- (4) 5 references attached;
- (5) International Search Report, dated January 28, 2008.

Respectfully submitted,

THE NATH LAW GROUP

Gary M. Nath
Registration No. 26,965
Susanne M. Hopkins
Registration No. 33,247
Derek Richmond
Registration No. 45,771
Customer No. 20529

Date: July 29, 2009
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GMN/SMH/DR/hk



Mail Stop AMENDMENT
Attorney Docket No. 30024X

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Eldad SHEMESH, et al.	Conf. No.: 2324
Appl. No.: 12/382,214	Examiner: TBD
Filed: March 11, 2009	Art Unit: 3715
Title: TRAINING AND INSTRUCTING SUPPORT DEVICE	

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

Pursuant to 37 CFR §§ 1.97 and 1.98, the documents listed on the enclosed Form PTO/SB/08 are submitted for consideration by the Examiner in the examination of the above-identified patent application.

This submission is not a representation that a search has been made, or that better art does or does not exist. In addition, this submission does not constitute an admission that each or all of the listed documents are material or constitute "prior art." If the Examiner applies any of the documents as "prior art" against any claim in this application and Applicant(s) determine that the cited documents do not constitute "prior art" under United States law, Applicant(s) expressly reserve the right to present, to the United States Patent and Trademark Office, the relevant facts and law regarding the appropriate status of such documents. Likewise, Applicant(s) expressly reserve the right to establish an earlier date of invention of any or all of the subject matter disclosed in this application, or any application claiming priority from this application, in order to remove any reference submitted herewith as prior art.

Applicant(s) further reserve the right to take appropriate action to establish the patentability of the disclosed subject matter over the listed documents, should one or more of the documents be applied against the claims of the present application. This submission of documents is not to be taken as a concession that any document represents art that is relevant or analogous to the subject matter claimed at any time throughout the prosecution of this or any application claiming priority from this

application. Accordingly, the right to argue that any document is not properly within the scope of prior art relevant to an examination of the present claims is also expressly reserved.

The Information Disclosure Statement (hereinafter "IDS") is being filed as follows:

- a. ☒ The IDS is being filed within three months of the filing date of a national application, or within three months of the date of entry into the national stage as set forth in 37 C.F.R. 1.491 in an international application, or before the mailing date of a first Official Action on the merits, whichever event occurs last.
- b. ☐ The IDS is being filed after a first action on the merits but before the mailing date of a final Official Action under 37 C.F.R. 1.113, or a Notice of Allowance under 37 C.F.R. 1.311.

The IDS is accompanied by:

- i. ☐ a certification in part (e) below as specified in 37 C.F.R. 1.97(e),

or
- ii. ☐ a check in the amount required by 37 C.F.R. 1.17(p).
- c. ☐ The IDS is being filed after the mailing date of a final Official Action under 37 CFR 1.113, or a Notice of Allowance under 37 CFR 1.311, but before payment of the issue fee.

The IDS is accompanied by:

- i. ☐ Certification report(e) below;

and
- ii. ☐ A check in the amount as required by 1.17(p).
- d. ☐ The IDS is being filed pursuant to 37 C.F.R. 1.97(i), for placement in the file.

e. Certification:

☐ I hereby certify that each item of information contained in the Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application or in a counterpart United States patent application not more than three months prior to the filing of this statement,

or

☐ I hereby certify that no item of information cited in the Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application, or, to my knowledge after making reasonable inquiry, was known to any individual designated in 37 C.F.R. 1.56(c) more than three months prior to the filing of this Information Disclosure Statement.

or

☐ Appropriate certification is attached.

f. ☒ If no check is enclosed and a fee is due in connection with this communication or if the check enclosed is insufficient, the Commissioner is authorized to charge any fee or additional fee due in connection with this communication to Deposit Account No. 14-0112.

g. ☒ Copies of the documents are attached herewith with a completed PTO/SB/08

or

☐ Copies of the documents are not attached, with a completed Form PTO/SB/08 as allowed under CFR 1.98(d)(1)(2). The earlier application is identified as:

and / or

☒ Copies of US Patents/Publications are not attached, with a completed Form PTO/SB/08 as allowed in Official Gazette Aug. 5, 2003/ Vol. 1273, no. 1.

h. ☒ A copy of the International Search Report is enclosed herewith.

- i. [] A copy of the European Search Report or Supplementary European Search Report is enclosed herewith.

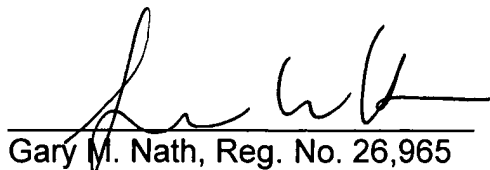
The Examiner is respectfully requested to cite the documents listed on the attached Form PTO/SB/08 in the next Official Action. In so doing, the Examiner is respectfully requested to initial in the space adjacent to the listing of each document on the Form PTO/SB/08, and return a copy of the initialed Form PTO/SB/08 with the next communication to Applicant(s), to confirm that these documents have been considered by the Examiner and made of record in this application.

Should any additional fees be owed in connection with this Information Disclosure Statement, please charge any such fee deficiency to Deposit Account No. 14-0112. Likewise, please credit any overpayment to Deposit Account No. 14-0112.

The Examiner is invited to contact the undersigned attorney at the below-listed telephone number, with regard to any questions that may arise.

Respectfully submitted,

THE NATH LAW GROUP



Gary M. Nath, Reg. No. 26,965
Susanne M. Hopkins, Reg. No. 33,247
Derek Richmond, Reg. No. 45,771
Customer No. 20529

Date: July 29, 2009

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GMN/SMH/DR/hk



UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
12/382,214	03/11/2009	3715	1265	30024X	35	6

CONFIRMATION NO. 2324

UPDATED FILING RECEIPT



20529
THE NATH LAW GROUP
112 South West Street
Alexandria, VA 22314

Date Mailed: 06/15/2009

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Eldad Shemesh, Binymina, ISRAEL;
Liat Shemesh-Granot, Binymina, ISRAEL;

Power of Attorney: The patent practitioners associated with Customer Number 20529

Domestic Priority data as claimed by applicant

This application is a CIP of PCT/IL07/01121 09/11/2007
which claims benefit of 60/843,422 09/11/2006

Foreign Applications

If Required, Foreign Filing License Granted: 03/27/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/382,214**

Projected Publication Date: 09/24/2009

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

Training and instructing support device

Preliminary Class

434

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

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Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

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set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Eldad SHEMESH, et al.

Conf. No.: 2324

Appl. No.: 12/382,214

Examiner: TBD

Filed: March 11, 2009

Group Art Unit: 3715

For: **TRAINING AND INSTRUCTING SUPPORT DEVICE**

RESPONSE TO THE NOTICE TO FILE CORRECTED APPLICATION PAPERS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

In response to the Notice to File Corrected Application Papers mailed on **May 27, 2009**, submitted herewith are the following documents:

- (1) One (1) Replacement Sheet of Formal Drawings.

In the event this paper is not timely filed, Applicants hereby petition for an appropriate extension of time. Please charge any fee deficiency or credit any overpayment to Deposit Account No. 14-0112.

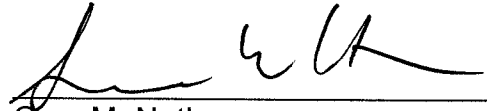
It is submitted that this replacement sheet of formal drawings obviates all of the objections to the drawings in said Notice. No new matter has been added.

The Examiner is welcomed to telephone the undersigned attorney if he has any questions or comments.

The Commissioner is hereby authorized to charge any deficiency or credit any excess to Deposit Account Number 14-0112.

Respectfully submitted,

THE NATH LAW GROUP

A handwritten signature in black ink, appearing to read 'Gary M. Nath', is written over a horizontal line.

Gary M. Nath

Registration No. 26,965

Susanne M. Hopkins

Registration No. 33,247

Derek Richmond

Registration No. 45,771

Customer No. 20529

Date: June 2, 2009

THE NATH LAW GROUP

112 S. West Street

Alexandria, Virginia 22314

Tel: (703) 548-6284

Fax: (703) 683-8396

GMN/SMH/DR/bd

Electronic Acknowledgement Receipt

EFS ID:	5444482
Application Number:	12382214
International Application Number:	
Confirmation Number:	2324
Title of Invention:	Training and instructing support device
First Named Inventor/Applicant Name:	Eldad Shemesh
Customer Number:	20529
Filer:	Susanne M. Hopkins/Brian Davis
Filer Authorized By:	Susanne M. Hopkins
Attorney Docket Number:	30024X
Receipt Date:	03-JUN-2009
Filing Date:	11-MAR-2009
Time Stamp:	14:10:36
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
------------------------	----

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	2222_001.pdf	166059 cce64f3c7ac43c52f65edfe9fc7ddac26950d86e	no	1

Warnings:

Information:

IPR2025-00195

2	Drawings-only black and white line drawings	2221_001.pdf	106227	no	1
			fe8b64c130476a059cbf1beb91c6b9fde45e358a		
Warnings:					
Information:					
3	Applicant Response to Pre-Exam Formalities Notice	2223_001.pdf	102297	no	2
			bf9da64fa53673079857ec1488683b1884e010c7		
Warnings:					
Information:					
Total Files Size (in bytes):			374583		
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TRANSMITTAL FORM <i>(to be used for all correspondence after initial filing)</i>	Application Number	12/382,214	
	Filing Date	March 11, 2009	
	First Named Inventor	Eldad SHEMESH, et al.	
	Art Unit	3715	
	Examiner Name	TBD	
Total Number of Pages in This Submission	4	Attorney Docket Number	30024X

ENCLOSURES (Check all that apply)		
☐ Fee Transmittal Form ☐ Fee Attached ☐ Amendment/Reply ☐ After Final ☐ Affidavits/declaration(s) ☐ Extension of Time Request ☐ Express Abandonment Request ☐ Information Disclosure Statement ☐ Certified Copy of Priority Document(s) ☒ Reply to Missing Parts/ Incomplete Application ☐ Reply to Missing Parts under 37 CFR 1.52 or 1.53	☒ Drawing(s) ☐ Licensing-related Papers ☐ Petition ☐ Petition to Convert to a Provisional Application ☐ Power of Attorney, Revocation Change of Correspondence Address ☐ Terminal Disclaimer ☐ Request for Refund ☐ CD, Number of CD(s) _____ ☐ Landscape Table on CD	☐ After Allowance Communication to TC ☐ Appeal Communication to Board of Appeals and Interferences ☐ Appeal Communication to TC (Appeal Notice, Brief, Reply Brief) ☐ Proprietary Information ☐ Status Letter ☐ Other Enclosure(s) (please identify below):
Remarks Enclosures Include: Response to Notice to File Corrected Application Papers; One (1) Replacement Sheet of Formal Drawings		

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT			
Firm Name	THE NATH LAW GROUP		
Signature	/Susanne M. Hopkins/		
Printed name	Susanne M. Hopkins		
Date	June 3, 2009	Reg. No.	33,247

CERTIFICATE OF TRANSMISSION/MAILING			
I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:			
Signature			
Typed or printed name		Date	

This collection of information is required by 37 CFR 1.5. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

5/9

FIG. 4B

Time	P		D	
	Measurements (Linear/Rotational)	Location S (x,y,z)	Orientation O (yaw,pitch,roll)	
	T1	Ax1,Ay1,Az1 / Ayaw1,Apitch1,Aroll1	Sx1,Sy1,Sz1	Oyaw1,Opitch1,Oroll1
	T2	Ax2,Ay2,Az2 / Ayaw2,Apitch2,Aroll2	Sx2,Sy2,Sz2	Oyaw2,Opitch2,Oroll2
T3	Ax1,Ay1,Az1 / Ayaw1,Apitch1,Aroll1	Sx3,Sy3,Sz3	Oyaw3,Opitch3,Oroll3	

Name	Number of completed finished laps	Elapsed time	Last lap time	Number of hand strokes per lap	Number of lag strokes per lap	Average distance per hand stroke	Heart bit rate	Average height of right hand stroke	Average height of left led stroke
Liat	12	00:05:45	45	12	54	2.08	134	1.3	0.2
Mulan	32	00:20:45	35	14	65	1.79	142	1.2	0.15
Yaeer	11	00:06:12	54	15	88	1.67	145	1.1	0.1

FIG. 5



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/382,214	03/11/2009	Eldad Shemesh	30024X

CONFIRMATION NO. 2324

WITHDRAWAL NOTICE



OC000000036120112

20529
THE NATH LAW GROUP
112 South West Street
Alexandria, VA 22314

Date Mailed: 05/27/2009

Letter Regarding a New Notice and/or the Status of the Application

If a new notice or Filing Receipt is enclosed, applicant may disregard the previous notice mailed on 03/31/2009. The time period for reply runs from the mail date of the new notice. Within the time period for reply, applicant is required to file a reply in compliance with the requirements set forth in the new notice to avoid abandonment of the application.

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
<https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at
1-866-217-9197 or visit our website at <http://www.uspto.gov/ebc>.

If the reply is not filed electronically via EFS-Web, the reply must be accompanied by a copy of the new notice.

If the Office previously granted a petition to withdraw the holding of abandonment or a petition to revive under 37 CFR 1.137, the status of the application has been returned to pending status.

/ctuazon/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or
1-888-786-0101



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
12/382,214	03/11/2009	3715	1265	30024X	35	6

CONFIRMATION NO. 2324

20529
THE NATH LAW GROUP
112 South West Street
Alexandria, VA 22314

FILING RECEIPT



OC000000036120130

Date Mailed: 05/27/2009

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Eldad Shemesh, Binymina, ISRAEL;
Liat Shemesh-Granot, Binymina, ISRAEL;

Power of Attorney: The patent practitioners associated with Customer Number 20529

Domestic Priority data as claimed by applicant

This application is a CIP of PCT/IL07/01121 09/11/2007
which claims benefit of 60/843,422 09/11/2006

Foreign Applications

If Required, Foreign Filing License Granted: 03/27/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/382,214**

Projected Publication Date: To Be Determined - pending completion of Corrected Papers

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

Training and instructing support device

Preliminary Class

434

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER**Title 35, United States Code, Section 184****Title 37, Code of Federal Regulations, 5.11 & 5.15****GRANTED**

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as

set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/382,214	03/11/2009	Eldad Shemesh	30024X

CONFIRMATION NO. 2324

FORMALITIES LETTER



OC000000036120131

20529
THE NATH LAW GROUP
112 South West Street
Alexandria, VA 22314

Date Mailed: 05/27/2009

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Filing Date Granted

An application number and filing date have been accorded to this application. The application is informal since it does not comply with the regulations for the reason(s) indicated below. Applicant is given TWO MONTHS from the date of this Notice within which to correct the informalities indicated below. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

The required item(s) identified below must be timely submitted to avoid abandonment:

- Replacement drawings in compliance with 37 CFR 1.84 and 37 CFR 1.121(d) are required. The drawings submitted are not acceptable because:
 - The drawings must be reasonably free from erasures and must be free from alterations, overwriting, interlineations, folds, and copy marks. See Figure(s) 4B.

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
<https://portal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/ctuazon/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



1PW
Mail Stop MISSING PARTS
Attorney Docket No. 30024X

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Eldad SHEMESH, et al.

Conf. No.: 2324

Appl. No.: 12/382,214

Examiner: TBD

Filed: March 11, 2009

Group Art Unit: 3715

For: **TRAINING AND INSTRUCTING SUPPORT DEVICE**

TRANSMITTAL LETTER

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

Submitted herewith for filing in the U.S. Patent and Trademark Office is the following:

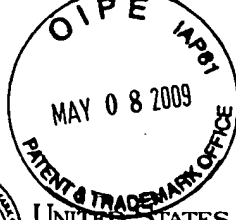
- (1) Copy of Notice to File Corrected Application Papers, two (2) pages;
- (2) Response to Notice to File Corrected Application Papers, two (2) pages; and
- (3) One (1) Replacement Sheet of Formal Drawings.

In the event this paper is not timely filed, Applicants petition for an appropriate extension of time. Please charge any fee deficiency or credit any overpayment to Deposit Account No. 14-0112.

Respectfully submitted,
THE NATH LAW GROUP

Gary M. Nath
Registration No. 26,965
Susanne M. Hopkins
Registration No. 33,247
Derek Richmond
Registration No. 45,771
Customer No. 20529

Date: May 8, 2009
THE NATH LAW GROUP
112 S. West Street
Alexandria, Virginia 22314
Tel: (703) 548-6284
Fax: (703) 683-8396
GMN/SMH/DR/bd



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/382,214	03/11/2009	Eldad Shemesh	30024X

CONFIRMATION NO. 2324

FORMALITIES LETTER



Date Mailed: 03/31/2009

20529
THE NATH LAW GROUP
112 South West Street
Alexandria, VA 22314

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Filing Date Granted

An application number and filing date have been accorded to this application. The application is informal since it does not comply with the regulations for the reason(s) indicated below. Applicant is given TWO MONTHS from the date of this Notice within which to correct the informalities indicated below. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

The required item(s) identified below must be timely submitted to avoid abandonment:

- Replacement drawings in compliance with 37 CFR 1.84 and 37 CFR 1.121(d) are required. The drawings submitted are not acceptable because:
 - The drawings submitted to the Office are not electronically reproducible because portions of figures 4B are missing and/or blurry.

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.

<https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/mkibret/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



Mail Stop MISSING PARTS
Attorney Docket No. 30024X

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Eldad SHEMESH, et al.

Conf. No.: 2324

Appl. No.: 12/382,214

Examiner: TBD

Filed: March 11, 2009

Group Art Unit: 3715

For: **TRAINING AND INSTRUCTING SUPPORT DEVICE**

RESPONSE TO THE NOTICE TO FILE CORRECTED APPLICATION PAPERS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

In response to the Notice to File Corrected Application Papers mailed on **March 31, 2009**, submitted herewith are the following documents:

- (1) One (1) Replacement Sheet of Formal Drawings.

In the event this paper is not timely filed, Applicant hereby petitions for an appropriate extension of time. Please charge any fee deficiency or credit any overpayment to Deposit Account No. 14-0112.

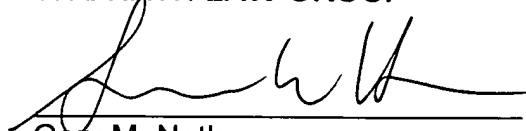
It is submitted that this replacement sheet of formal drawings obviates all of the objections to the drawings in said Notice. No new matter has been added.

The Examiner is welcomed to telephone the undersigned attorney if he has any questions or comments.

The Commissioner is hereby authorized to charge any deficiency or credit any excess to Deposit Account Number 14-0112.

Respectfully submitted,

THE NATH LAW GROUP

A handwritten signature in black ink, appearing to read 'Gary M. Nath', is written over a horizontal line.

Gary M. Nath
Registration No. 26,965
Susanne M. Hopkins
Registration No. 33,247
Derek Richmond
Registration No. 45,771
Customer No. 20529

Date: May 8, 2009
THE NATH LAW GROUP
112 S. West Street
Alexandria, Virginia 22314
Tel: (703) 548-6284
Fax: (703) 683-8396
GMN/SMH/DR/bd

REPLACEMENT SHEET

Attorney Docket No. 30024X – Application No. 12/382,214

5 / 9

5/9

FIG. 4B

Time	P		D	
	Measurements (Linear/Rotational)	Location S (x,y,z)	Orientation O (yaw,pitch,roll)	
T1	Ax1,Ay1,Az1 / Ayaw1,Apitch1,Aroll1	Sx1,Sy1,Sz1	Oyaw1,Opitch1,Oroll1	
T2	Ax2,Ay2,Az2 / Ayaw2,Apitch2,Aroll2	Sx2,Sy2,Sz2	Oyaw2,Opitch2,Oroll2	
T3	Ax1,Ay1,Az1 / Ayaw1,Apitch1,Aroll1	Sx3,Sy3,Sz3	Oyaw3,Opitch3,Oroll3	

Name	Number of completed laps	Elapsed time	Last lap time	Number of hand strokes per lap	Number of lag strokes per lap	Average distance per hand stroke	Heart bit rate	Average height of right hand stroke	Average height of left led stroke
Liat	12	00:05:45	45	12	54	2.08	134	1.3	0.2
Mulan	32	00:20:45	35	14	65	1.79	142	1.2	0.15
Yaeer	11	00:06:12	54	15	88	1.67	145	1.1	0.1

FIG. 5



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
12/382,214	03/11/2009	3715	1265	30024X	35	6

CONFIRMATION NO. 2324

20529
THE NATH LAW GROUP
112 South West Street
Alexandria, VA 22314

FILING RECEIPT



OC000000035209666

Date Mailed: 03/31/2009

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Eldad Shemesh, Binymina, ISRAEL;
Liat Shemesh-Granot, Binymina, ISRAEL;

Power of Attorney: The patent practitioners associated with Customer Number 20529

Domestic Priority data as claimed by applicant

This application is a CIP of PCT/IL07/01121 09/11/2007
which claims benefit of 60/843,422 09/11/2006

Foreign Applications

If Required, Foreign Filing License Granted: 03/27/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/382,214**

Projected Publication Date: To Be Determined - pending completion of Corrected Papers

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

Training and instructing support device

Preliminary Class

434

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/382,214	03/11/2009	Eldad Shemesh	30024X

CONFIRMATION NO. 2324

FORMALITIES LETTER



OC000000035209667

20529
THE NATH LAW GROUP
112 South West Street
Alexandria, VA 22314

Date Mailed: 03/31/2009

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Filing Date Granted

An application number and filing date have been accorded to this application. The application is informal since it does not comply with the regulations for the reason(s) indicated below. Applicant is given TWO MONTHS from the date of this Notice within which to correct the informalities indicated below. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

The required item(s) identified below must be timely submitted to avoid abandonment:

- Replacement drawings in compliance with 37 CFR 1.84 and 37 CFR 1.121(d) are required. The drawings submitted are not acceptable because:
 - The drawings submitted to the Office are not electronically reproducible because portions of figures 4B are missing and/or blurry.

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

Replies should be mailed to:

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Alexandria VA 22313-1450

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/mkibret/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

03/11/2009

PTO/SB/05 (08-08)

Approved for use through 06/30/2010. OMB 0651-0032

U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

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UTILITY
PATENT APPLICATION
TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	30024X
First Inventor	Eldad SHEMESH, et al.
Title	TRAINING AND INSTRUCTING SUPPORT DEVICE
Express Mail Label No.	

APPLICATION ELEMENTS See MPEP chapter 600 concerning utility patent application contents.	ADDRESS TO: Commissioner for Patents P.O. Box 1450 Alexandria VA 22313-1450
<p>1. ☒ Fee Transmittal Form (e.g., PTO/SB/17) (Submit an original and a duplicate for fee processing)</p> <p>2. ☒ Applicant claims small entity status. See 37 CFR 1.27.</p> <p>3. ☒ Specification [Total Pages <u>34</u>] Both the claims and abstract must start on a new page (For information on the preferred arrangement, see MPEP 608.01(a))</p> <p>4. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets <u>9</u>]</p> <p>5. Oath or Declaration [Total Sheets <u>2</u>] a. ☒ Newly executed (original or copy) b. ☐ A copy from a prior application (37 CFR 1.63(d)) (for continuation/divisional with Box 18 completed) i. ☐ DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) name in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).</p> <p>6. ☒ Application Data Sheet. See 37 CFR 1.76</p> <p>7. ☐ CD-ROM or CD-R in duplicate, large table or Computer Program (Appendix) ☐ Landscape Table on CD</p> <p>8. Nucleotide and/or Amino Acid Sequence Submission (if applicable, items a. - c. are required) a. ☐ Computer Readable Form (CRF) b. Specification Sequence Listing on: i. ☐ CD-ROM or CD-R (2 copies); or ii. ☐ Paper c. ☐ Statements verifying identity of above copies</p>	ACCOMPANYING APPLICATION PARTS <p>9. ☐ Assignment Papers (cover sheet & document(s)) Name of Assignee _____</p> <p>10. ☐ 37 CFR 3.73(b) Statement ☒ Power of Attorney (when there is an assignee)</p> <p>11. ☐ English Translation Document (if applicable)</p> <p>12. ☐ Information Disclosure Statement (PTO/SB/08 or PTO-1449) ☐ Copies of foreign patent documents, publications, & other information</p> <p>13. ☐ Preliminary Amendment</p> <p>14. ☒ Return Receipt Postcard (MPEP 503) (Should be specifically itemized)</p> <p>15. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed)</p> <p>16. ☐ Nonpublication Request under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.</p> <p>17. ☒ Other: <u>Transmittal Letter, Cover Page of WO</u> <u>2008/032315 A1, PCT/ISA/220, PCT/ISA/210, PCT/ISA/237,</u> <u>Check</u></p>
<p>18. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in the first sentence of the specification following the title, or in an Application Data Sheet under 37 CFR 1.76:</p> <p>☐ Continuation ☐ Divisional ☒ Continuation-in-part (CIP) of prior application No.: <u>PCT/IL2007/001121</u></p> <p>Prior application information: _____ Examiner: _____ Art Unit: _____</p>	
19. CORRESPONDENCE ADDRESS	
☒ The address associated with Customer Number: <u>20529</u> OR ☐ Correspondence address below	
Name _____	
Address _____	
City _____	State _____ Zip Code _____
Country _____	Telephone _____ Email _____
Signature _____ Date <u>March 11, 2009</u>	
Name (Print/Type) <u>Susanne M. Hopkins</u> Registration No. <u>33,247</u> (Attorney/Agent)	

This collection of information is required by 37 CFR 1.53(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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Effective on 12/08/2004.

Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL

For FY 2009

☒ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT (\$1,265.00)

Complete if Known

Application Number	Not Yet Assigned
Filing Date	March 11, 2009
First Named Inventor	Eldad SHEMESH, et al.
Examiner Name	TBD
Art Unit	TBD
Attorney Docket Number	30024X

METHOD OF PAYMENT (check all that apply)

☒ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

☒ Deposit Account Deposit Account Number: 14-0112 Deposit Account Name: Gary M. Nath

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☐ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, except for the filing fee

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FEE CALCULATION**1. BASIC FILING, SEARCH, AND EXAMINATION FEES**

Application Type	FILING FEES		SEARCH FEES		EXAMINATION FEES		Fees Paid (\$)
	Fee (\$)	Small Entity Fee (\$)	Fee (\$)	Small Entity Fee (\$)	Fee (\$)	Small Entity Fee (\$)	
Utility	330	165	540	270	220	110	\$545.00
Design	220	110	100	50	140	70	
Plant	220	110	330	165	170	85	
Reissue	330	165	540	270	650	325	
Provisional	220	110	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Small Entity Fee (\$)	Fee (\$)
Each claim over 20 (including Reissues)	52	26
Each independent claim over 3 (including Reissues)	220	110
Multiple dependent claims	390	195
Total Claims	35	20 or HP = 15
Extra Claims	15	Fee (\$)
Fee Paid (\$)	\$390.00	
HP = highest number of total claims paid for, if greater than 20.		
Indep. Claims	6	3 or HP = 3
Extra Claims	3	Fee (\$)
Fee Paid (\$)	\$330.00	
HP = highest number of independent claims paid for, if greater than 3.		

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is \$260 (\$130 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

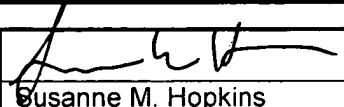
Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof	Fee (\$)	Fees Paid (\$)
43	0	0	130	\$0.00

4. OTHER FEE(S)

Non-English Specification, \$130 fee (no small entity discount)

Other (e.g., late filing surcharge):

SUBMITTED BY

Signature		Registration No. 33,247 (Attorney/Agent)	Telephone (703) 548-6284
Name (Print/Type)	Susanne M. Hopkins		Date March 11, 2009

This collection of information is required by 37 CFR 1.136. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Eldad SHEMESH, et al.	Conf. No.:	TBD
Appl. No.: Not Yet Assigned	Examiner:	TBD
Filed: March 11, 2009	Art Unit:	TBD
For: TRAINING AND INSTRUCTING SUPPORT DEVICE		

TRANSMITTAL LETTER

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

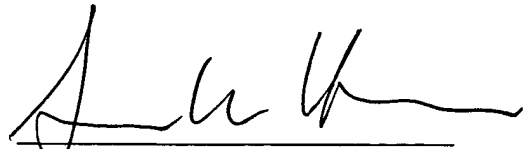
Submitted herewith for filing in the U.S. Patent and Trademark Office is the following:

- (1) PTO/SB/05, Utility Patent Application Transmittal, one (1) page;
- (2) PTO/SB/17, Fee Transmittal for FY 2009, one (1) page;
- (3) Application Data Sheet, four (4) pages;
- (4) Continuation-in-Part Application, forty-three (43) pages, consisting of:
 - 26 pages of Textual Specification,
 - 7 pages of 35 Claims,
 - 1 page of the Abstract, and
 - 9 sheets of Drawings;
- (5) One (1) Executed Declaration & Power of Attorney, two (2) pages;
- (6) Cover Page of International Publication No.: WO 2008/032315 A1, one (1) page;
- (7) PCT/ISA/220, two (2) pages;
- (8) PCT/ISA/210, four (4) pages;
- (9) PCT/ISA/237, nine (9) pages;
- (10) Our check no.: 7974 in the amount of \$1,265.00 for the filing fees (\$545), excess claims fee (\$390), and extra independent claims fee (\$330) as a Small Entity; and
- (11) Serial Number Postcard.

Please charge any fee deficiency or credit any overpayment to Deposit Account No. 14-0112.

Respectfully submitted,

THE NATH LAW GROUP

A handwritten signature in black ink, appearing to read 'Gary M. Nath', written over a horizontal line.

Gary M. Nath
Registration No. 26,965
Susanne M. Hopkins
Registration No. 33,247
Customer No. 20529

Date: March 11, 2009
THE NATH LAW GROUP
112 S. West Street
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GMN/SMH/bd

TRAINING AND INSTRUCTING SUPPORT DEVICE

This is a Continuation-In-Part of International PCT Application No. PCT/IL2007/001121 filed September 11, 2007 and claims priority from US Provisional Patent Application no. 60/843,422 filed September 11, 2006, the contents of which are
5 hereby incorporated by reference in their entirety.

FIELD OF THE INVENTION

10 The present invention relates to methods, systems and devices for monitoring activities performed by a person, and for allowing communication with respect thereto, in particular where such activities includes sports, e.g. swimming.

BACKGROUND OF THE INVENTION

15 Devices of the kind to which the present invention refers are disclosed for example in US 5,685,722 and US 5,600,730.

US 5,685,722 is directed to goggles incorporating an electronic timer and display for displaying the times of a swimmer with a display accessible to a swimmer connected to the goggles. An accelerometer is used to determine a swimmer's
20 movements with an electronic circuit for processing the information from the accelerometer to determine a swimmer's movements and time between movements.

US 5,600,730 is directed to a swimming training device that may be part of an overall training system. The device is deployable releasably in a swimming cap and can receive electromagnetic wave signals. The device can then convert the signals into
25 electrical charges which are then translated into audible sound. The system includes the cap with the receiving device and a transmitting source. The transmitting source allows the broadcasting of verbal instructions, as well as music and timing signals.

SUMMARY OF THE INVENTION

30 The present invention is directed to measuring movement parameters of a person who may be in individual or a member of a group, and who participates in an activity involving movement of at least one body part of the person, wherein the movement parameters may optionally be associated with the movement of said body part. For example, the measured movement parameters may be associated with the location and
35 orientation of said body part of the person.

In at least some embodiments of the invention real-time communication is provided during said activity between an instructor and the person, in particular, a plurality of persons participating in such activity, and in case the activity is swimming, such communication may be of a swimming instructor with swimmers. When the activity is swimming, such instructor may be a trainer or a coach, and the participants may be trainees, for example. In general, the activity involving a group of participants and the instructor may be any suitable physical activity including a sport activity, in which participants are required to perform measurable body movements.

According to one aspect of the present invention, there is provided a system for use by an instructor in instructing of a plurality of participants engaged in an activity. The system comprises a plurality of personal measuring devices each adapted for being worn by one of the participants and for enabling repeated measurement, during the activity, of parameters relating to the participant's movements. The system includes a computer adapted for use by the instructor for wirelessly receiving from each of the personal measuring devices, data, which may be derived or calculated from the measured parameters, a monitor or other presentation means for presenting to the instructor the data or information derived therefrom, and optionally an input unit adapted to receive instructions from the instructor. In some embodiments, the instructor may only monitor the participants, and in other embodiments may also provide instructions to the participants using the input unit. The system may also include a plurality of presentation units, each for presenting to a participant at least the instructions of the instructor, and communication means connected to the computer and adapted to wirelessly transfer the instructions directly or indirectly to each of the presentation units.

Features of at least some embodiments of the system include that it allows the instructor to communicate with a plurality of participants during the activity, and to provide them with real-time instructions that are based upon measurements of their movement during the activity. Such instructions can be the same instructions for any group of the participants, or alternatively, the instructor can direct different instructions to different participants.

The system may also include any one of a plurality of different types of presentation units for enabling the participant to receive the instructions. One type of such a unit may be a screen adapted to be worn by each of the participants, e.g. on

his/her wrist, or a screen that is visible elsewhere to the participants. Another type of the presentation unit may be earphones to be worn by each participant. The earphones may be connected to a receiving module adapted for wirelessly receiving the instructions, or any other communications, in digital format, and converting them into audio signals to
5 be transmitted to the participant via the earphones.

The computer that is operated by the instructor, can also process and analyze the data received from the participants' personal measuring devices in order to provide various information and statistics to the instructor. For example, such information may include comparative data regarding various participants that are engaged in the activity.
10 As for the personal measurement devices, such devices may each include a sensing unit adapted to repeatedly measure, during the activity, parameters characterizing movement of a specific body part of a single participant, for example, the location and orientation of this body part relative to its initial position and orientation, or to any other predefined position and orientation, and means adapted for the attachment of the measuring device
15 to this specific body part. In this embodiment, the measuring device may further include a processor adapted to receive from the sensing unit the measured parameters, and to calculate, based thereon, information indicative of the participant's activity, which includes the location and orientation of the body part for each of the measurements.

According to another aspect of the present invention, there is provided a
20 communication system particularly suitable for the communication with one or more swimmers. The system comprises a transmitting module adapted to communicate in accordance with a wireless communication protocol with at least one receiving module associated with at least one swimmer. The transmitting module is adapted to obtain data designated to at least one swimmer, to accommodate the data and/or derivatives thereof
25 thus giving rise to accommodated data, to process the accommodated data in order to fit it to the wireless communication protocol, and to transmit the processed data to the at least one receiving module upon a predefined condition. The receiving module which is associated with at least one swimmer is adapted to receive the data transmitted from the transmitting module and process it in order to facilitate presenting it to the swimmer.
30 The predefined condition may be communication availability of the at least one receiving module and the wireless communication protocol may be configured to recognize the communication availability of the at least one receiving module.

The data may be originated from an audio signal and the transmitting module may further be adapted to convert the audio signal into the data. The audio signal and/or the data, may be associated with instructions from an instructor.

The process of accommodating the data in the transmitting module may include
5 compressing the data, and the process in the at least one receiving module may include decompressing the data. The communication protocol may be a Bluetooth protocol.

In case the communication system is designed for communication with a swimmer, the receiving module may constitute a part of a device attachable to the wrist of the swimmer and/or a part of a device attachable to the head of the swimmer.
10 In the latter case, the receiving module may additionally comprise at least one earphone and may be adapted for converting the data into audio signal to be transmitted to the swimmer via the at least one earphone. The receiving module may also include digital media means adapted to display music to the swimmer via the at least one earphone. Alternatively or additionally, the receiving module may include a
15 screen that is adapted to facilitate presenting of data to the swimmer. Moreover, the receiving module may be adapted to further transmit the data to an additional receiving module which may constitute a part of an additional device which may be attached to the head of the swimmer. The additional device may thus comprise at least one earphone and may be adapted for converting the data into audio signal to be
20 transmitted to the swimmer via the at least one earphone.

According to yet another aspect of the present invention a method for automated training one or more swimmers is provided. The method comprises:

- (a) obtaining data related to one or more training instructions designated to at least one swimmer among the swimmers;
- 25 (b) automated processing the obtained data in order to fit a wireless communication protocol; and
- (c) transmitting the processed data to at least one receiving module associated with the at least one swimmer upon a predefined condition; wherein the predefined condition is communication availability of the at least one
30 receiving module, and the wireless communication protocol is configured to recognize the communication availability of the at least one receiving module.

The method may also include receiving the transmitted data and further processing thereof in order to facilitate presenting the data related to training instructions to the at least one swimmer.

5 The automated processing of the obtained data may additionally comprise a compression operation and processing the received data may further comprise a decompression operation.

Among advantages of the communication system and method of training in accordance with certain embodiments of the present invention is facilitating successful communication of certain data (e.g. training instructions, music, etc.) to a designated swimmer, or a group of such swimmers, during swimming, despite the inherent physical communication barriers that exist when the swimmers are submerged during swimming and other underwater activities.

According to yet another aspect the present invention, a personal device for measuring a training activity of a trainee, is provided. Such a device is adapted to measure parameters associated with the movement of a body part of the trainee during the training activity, and comprises a sensing unit which includes accelerometer means, a compass, and optional gyroscope means, means for attaching the sensing unit to the body part, and a processor adapted to receive from the sensing unit said parameters, and to calculate, based thereon, data indicative of the training activity.

20 As the body part may change its location and orientation during the training activity, the parameters may characterize the location and orientation of the body part relative to its initial position and orientation, or to any predefined location and orientation, and the data may accordingly include at least the location and orientation of the body part for each of the measurements.

25 The personal device allows to determine, and later present, the exact location and orientation of the body part of a trainee, based on which the trainee or the instructor may reach conclusions regarding various characteristics of the trainee's movement, and by this, may help the trainee to improve his/her movements and subsequently his/her abilities.

30 The accelerometer means may be adapted to measure linear acceleration of the body part along three axes and the gyroscope means may be adapted to measure angular acceleration of said body part around said three axes, by virtue of which the parameters may be at least linear and angular acceleration values.

The device is particularly useful for automatic measuring repetitive activity, in which case said processor may be adapted to calculate the periodicity of said activity based on parameters received from the sensing unit. .

5 In at least some embodiments of the invention, the means for attaching the sensing unit further comprise a flexible platform adapted to amplify at least one of the measurements obtained from the sensing unit(s).

Optionally, the device may comprise more than a single sensing unit, wherein each sensing unit will be attached to a different body part of the trainee, such as for example, to any of his/her limbs, his/her head, or his/her waist. This may allow
10 simultaneous measurement of parameters characterizing the location and orientation of the additional body part of the trainee relative to its initial location and orientation. In this case, the processor may be further adapted to receive the measured parameters from all the sensing units and, based thereon, to calculate, for each measurement, at least the location and orientation of all the body parts whose movements are measured.

15 The data which is calculated by means of the device, may be further processed, and/or stored for later usage, and/or presented to the trainee and/or to others in various ways, and/or transmitted to an external computer for different purposes in real-time. It will be appreciated that many different options of such usage are possible. A memory unit may further be included in the device for storing the data, optionally for later
20 usage, and the processor may be configured for exporting the stored data to a computer to be displayed or further analyzed. Further optionally, the data may be exported to and internet/intranet network, where it may be shared with other users of similar devices.

Optionally, the data may further include statistics and summary results for any
25 specific activity, and wherein the activity is swimming, the data may relate, for example, to statistics and summary results for swimming sessions or laps. For example, the results may include one or more of the following: total training time, number of laps, average lap time, average lap velocity, average strokes per lap, fastest and slowest lap, highest and lowest number of hand strokes per lap, instantaneous
30 speed during the laps, hand or leg lifting height for each stroke, distance traveled for each stroke, comparative results to other trainees using similar devices.

Further, optionally, the device may comprise a pulse measuring unit adapted for being held in contact with the trainee during said activity, in which case the data

provided by the measuring device may also include the pulse rate of the trainee. Said pulse measuring unit may be of an IR type, and include an infrared emitter and a corresponding infrared sensor. In the present invention, the pulse measuring unit may be adapted to both measure the pulse and audibly present the results simultaneously in
5 at least one ear canal and with a single earphone. Optionally, the unit may measure the pulse and play the results together with any other audio information (i.e. music, instruction) simultaneously in both ears.

Moreover, the device may be designed to eliminate the adverse effect on the pulse measurement of sudden movements of the trainee (or any part of his/her body)
10 during the activity. This goal is achieved by using sensing devices such as accelerometers. The sensors may have a waterproof design or the device may including sealing means for their sealing to allow the use of these sensors even when the trainee is submerged in water, .

Another type of data which may be produced by the processor of the measuring
15 device and displayed, is a graphic illustration of the trainee or of any of his/her body parts whose movement is measured in various moving positions, or as a video simulation that is displaying such movement in real-time. It will be appreciated by a person skilled in the art that the processor may calculate further types of data that may be derived from any of the measurements and from any combination thereof. It will
20 also be appreciated by a person skilled in the art that any additional information which is known in the art may be included in that data, for use in further calculations, displaying, or otherwise.

The personal measuring device may be part of a training advisor system that may involve providing the trainee with instructions which are based, objectively or
25 subjectively, upon the measurements, and the measuring device may include a presentation unit for the trainee. One possible option for such a unit is a viewing screen which is connected to the processor. This option may be applicable, for example, when the device is attached to a body part that is visible to the trainee, for example, to his/her wrist. Another option of presenting the data to the trainee is using earphones. The
30 earphones may be connected to a receiving module adapted for wirelessly receiving the data, or any other communication, in digital format, and converting it into audio signal to be transmitted to the trainee. Alternatively, a single earphone may be used. It will be appreciated that the data can be presented to the trainee in real-time, i.e. in the course of

the activity and during the corresponding measurements. Yet another option is to use a mechanism for providing signals that are configured to be felt by the trainee, and such a mechanism may comprise, for example, a vibrating element designed to generate vibratory pulses and direct these to the skin of the trainee.

5 The source of the instructions presented to the trainee may also vary. One option is for the processor itself to be adapted to automatically provide instructions according to predetermined rules and based upon the data that it calculates from the measured parameters. Such an option may be implied also on a remote computer that wirelessly receives the data from the device, and provides instructions in a similar manner to be
10 transmitted back to the trainee. Alternatively, a user of the computer, which for example can be a trainer, may observe the data on a monitor, and may provide instructions using an input device, for example a keyboard or a microphone, to be transmitted back to the trainee. The last two options are for the computer to be adapted to wirelessly transfer the instructions directly or indirectly to the presentation unit.

15 The training advisor may constitute a part of a training system comprising a plurality of such training advisors for a corresponding plurality of trainees, wherein the presentation unit that is used by the trainer is adapted to present to him/her data or information derived therefrom and relating to those plurality of trainees. Such a system may also be adapted to present to the user the data or information, in a real-time activity
20 of the plurality of trainees, and may also allow the computer to simultaneously and wirelessly transfer the instructions of its user directly or indirectly to each of the plurality of trainees, or a group thereof, upon the user's choice. Optionally, when the activity is swimming, the communication with the trainees, i.e. swimmers, may be preformed with the devices and/or methods which described below.

25

BRIEF DESCRIPTION OF THE DRAWINGS

In order to understand the invention and to see how it may be carried out in practice, embodiments will now be described, by way of non-limiting examples only, with reference to the accompanying drawings, in which:

30 **Fig. 1** is a block diagram of a training advising system according to one embodiment of the present invention;

Fig. 2A is an illustration of a personal measuring device according to another embodiment of the invention;

Fig. 2B is a schematic illustration of a sensing unit in a personal measuring device of Fig. 2A;

5 **Fig. 3** is an illustration of a swimmer wearing sensors on his/her limbs according to an embodiment of the invention;

Fig. 4A illustrates one example of a swimmer in three different states, using the sensing unit as illustrated in Fig. 2;

10 **Fig. 4B** is a table which includes examples of parameters and calculated data for each measurement taken by the sensing unit in the example in Fig. 4A;

Figs. 5-7 illustrate examples of various possible screen shots that a trainer may choose to observe during a swimming activity when using an advising system according one embodiment of the present invention;

15 **Fig. 8** is a flow chart diagram illustrating an example of operation of an advising system illustrated in Fig. 1 and using a sensing unit illustrated in Fig. 2;

Fig. 9 is an illustration of a communication system according to still further embodiment of the present invention; and

Fig. 10 is a flow chart diagram that describes a method of automated training in accordance with certain embodiments of the present invention.

20 **DETAILED DESCRIPTION OF EMBODIMENTS**

In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the invention. However, it will be understood by those skilled in the art that the present invention may be practiced without these specific details. In other instances, well-known methods, procedures, 25 components and circuits have not been described in detail so as not to obscure the present invention.

Unless specifically stated otherwise, as apparent from the following discussions, it is appreciated that throughout the specification discussions, utilizing terms such as , "processing", "computing", "calculating", or the like, refer to the action and/or processes 30 of a computer or computing system, or processor or similar electronic computing device, that manipulate and/or transform data represented as physical, such as

electronic, quantities within the computing system's registers and/or memories into other data, similarly represented as physical quantities within the computing system's memories, registers or other such information storage, transmission or display devices.

Embodiments of the present invention may use terms such as, processor,
5 computer, apparatus, system, sub-system, module, unit, device (in single or plural form) for performing the operations herein. This may be specially constructed for the desired purposes, or it may comprise a general purpose computer selectively activated or reconfigured by a computer program stored in the computer. Such a computer program may be stored in a computer readable storage medium, such as, but not limited to, any
10 type of disk including optical disks, CD-ROMs, magnetic-optical disks, read-only memories (ROMs), random access memories (RAMs), electrically programmable read-only memories (EPROMs), electrically erasable and programmable read only memories (EEPROMs), magnetic or optical cards, any other type of media suitable for storing electronic instructions that are capable of being conveyed via a computer system bus.

15 The processes/devices (or counterpart terms specified above) and displays presented herein are not inherently related to any particular computer or other apparatus, unless specifically stated otherwise. Various general purpose systems may be used with programs in accordance with the teachings herein, or it may prove convenient to construct a more specialized apparatus to perform the desired method. The desired
20 structure for a variety of these systems will appear from the description below. In addition, embodiments of the present invention are not described with reference to any particular programming language. It will be appreciated that a variety of programming languages may be used to implement the teachings of the inventions as described herein.

25 Referring to **Fig. 1**, a block diagram of a training advising system according to a first embodiment of the invention, generally designated with numerals **101** is adapted for use by an instructor **20** in instructing a plurality of participants **2** engaged in an activity according to one example of the present invention. The activity may be, for example, any sport activity, for example swimming, as well as other activities which
30 involve physical activity of plurality of participant and an instructor, particularly such an activity in which the instructor **20** may monitor and, optionally instruct, the participants **2** in real time. According to aspects of the invention, the participants **2** may

include sportsmen, trainees and so on, for example, and/or the instructor **20** may include a teacher, coach, trainer, and so on.

The system **101** comprises a plurality of personal measuring devices **10a**, **10b**, ...**10x**, which may be substantially identical, and which for ease of reference may each be referred to as device **10**. Each device **10** is adapted for being attached to a corresponding one of the participants **2a**, **2b**, ...**2x**, which for ease of reference may each be referred to as participant **2**. Each device **10** is also adapted for enabling any parameter(s) **P** related to the participant's movement to be measured repeatedly for a time period during the activity, and comprises a sensing unit **11** that is adapted to measure any such parameter(s) **P**, as will be further detailed below. Each device **10** may further comprise an amplifier (not shown) adapted to amplify at least one of the measurements obtained from the sending unit. Each device **10** may further comprise measuring units for measuring health condition parameters of participant **2**, such as pulse rate or ECG measuring units (not shown) Each device **10** also comprises a processor **12** that is operatively connected to the corresponding sensing unit **11** and can derive, calculate or otherwise determine various data **D** from the measured parameters **P**. Each personal device **10** also comprises a presentation unit **14** that is adapted to present information, including these various data **D**, and also instructions **I** (if exist) sent from the instructor **20** to the participant(s) **2**. Presentation unit **14** may include, for example, an audio generation system, and/or a video generation system and/or any other presentation means that enable the desired information to be presented to the corresponding participant **2**, as will be further detailed below. The presentation may be done in real-time, and during the activity, as well as after the activity as post-activity briefing which is useful for self training for example. In such embodiment (not shown) a memory component is desired in order to accommodate the parameters **P** and/or data **D** and a wireless communication module is not necessary.

In addition, each of the personal devices **10** comprises a communication module **16** adapted to wirelessly transmit the data **D**, which can also include the original parameters **P**, to enable the same to be presented to instructor **20**. Communication module **16** may apply any wireless communication technology. Such technology may include, for example, a Blue Tooth protocol, ZigBee protocol and Wi-Fi technology.

The personal measuring device **10** according to one example of the invention, may be adapted for being worn by the corresponding participant **2**, directly on the body,

for example on the wrist, in a similar manner to a watch, for example, or on the upper arm in a likewise similar manner, or, in other examples, can be adapted to be attached to a headband, goggles, shoes, wet socks or any other clothing or accessories or other means which are inherently attached to or worn by the participant. For example, and referring to **Fig. 2A**, each device **10** may be encapsulated in a suitable housing **60**, which according to the particular activity may be water proof, dust proof, weather proof, heat proof, and so on, and may optionally include an interface **62** for direct or indirect attachment to the participant **2**, in particular with respect to a desired particular body part thereof. For example, the interface **62** may comprise an elastic and/or adjustable band, for wrapping around the wrist, upper arm, forearm, waist, ankle, head, thigh, calf, and so on; alternatively, the interface **62**, may comprise a clamp or the like, or a Velcro patch, adhesive patch or any other suitable means for clamping or otherwise attaching the device **10** onto an armband, waistband, belt, pocket, goggles, cap, and so on. Alternatively, a pocket, strap or other restraining enclosure on a suitable item of clothing or accessory, for example worn by or attached to the particular body part of the participant, at least during the activity, may be provided for accommodating the device **10**.

The means for attaching the measuring device or its sensing unit may incorporate therein the amplifier mentioned above, adapted to amplify at least one of the measurements obtained from the sending unit. For example, the amplifier may be in the form of a flexible platform which, when located on a moving part of the user's body, such as for example, the wrist of a swimmer, amplifies the reading from the sensing unit in each movement of said part, e.g. on each hand stroke of the swimmer.

Alternatively, the various components of the device **10**, for example sensing unit **11**, presentation unit **14**, communication module **16** and so on may each be comprised in a separate housing and attached to a different body part of the participant **2**, the various components being operatively interconnected for example via wires, optic cable, wireless communication, and so on.

The system **101** further comprises a computer **22**, for example a pocket PC, laptop, palm device, Desktop computer, and so on, adapted for use by the instructor **20** during the activity of the participants **2**. The computer **22** comprises another communication module **28** which adapted to communicate with the communication module **16**, e.g. for wirelessly receiving from each of the personal measuring devices

10, the data **D** generated by each device **10**. The computer **22**, having a processor **23**, can be adapted for suitable manipulating the data **D** from each device, and for example perform suitable calculations to provide further information based on the data **D**. The computer **22** is operatively connected to a monitor **26**, or alternatively to a printer or
5 other display to display to the instructor **20** any part of the data **D** or the information derived therefrom which the instructor **2** chooses to view. It will be noted the instructor may choose to view data concerning either one of the participants **2**, or any group of participants **2** at any one time, and may selectively switch viewing between participants or groups thereof as desired. The computer **22** also has a user interface including input
10 unit **24**, which can be, for example a keyboard, a microphone, tablet, touch screen or any other device capable of enabling instructions **I** from the instructor **20** to be received into computer **22**. The instructions **I** can be re-directed to any one of the participants **2**, and/or to any group of participants **2**, and accordingly, the computer **22** is configured to wirelessly transmit via its communication module **28** the instructions **I** to one or more
15 of the corresponding participants **2** as designated by the instructor **20**. The instructions **I** received by each of the corresponding participants **2** are presented thereto via the corresponding presentation units. An example of the operation of the system **101** is provided below.

The source of the instructions **I** and the manner in which such instructions may
20 be generated may vary according to the particular application of system **101**. In some embodiments, the instructor **20** manually inputs instructions to be sent to one or more participants via computer **22**, or may choose instructions from a menu provided in the computer. Alternatively, and, for example, in other embodiments of the invention, any of the processors **12** and/or **23** may be adapted to automatically provide instructions **I**
25 according to predetermined rules and based upon the data **D** provided by the device(s) **10**, i.e., without the need of an actual trainer or instructor **20** to actively provide such instructions, and hence in this example the system may be referred to as a "Virtual Training" system. In yet other applications of the system **101**, the instructions **I** are generated only by the processor **12**, and for such variations of the first embodiment of
30 the invention there is then also no need for an additional computer **22** or for communicating the data **D** externally with respect to the device **10**.

An example of a predetermined rule may correspond to: "if the height of the right hand stroke is greater than X mm– display to the swimmer instruction to lower

his/her right hand strokes". In such an example, the device **10** monitors parameters **P** such as to be able to determine or to directly provide at least the height of the right hand stroke of the participant – if during such monitoring, which may include sampling and/or determining this height as often as is desired or predetermined according to
5 preset rules, the height of the right hand stroke is greater than X mm, the processor **12** (or the computer **22**) will thus generate a signal or command that will cause the display unit to transmit a message meaning "lower right hand stroke" to the user. The message may be a visual text message, a corresponding image, a suitable audio verbal message or signal, and so, in a manner that will be understood by the particular participant, who
10 is nominally previously trained to understand such messages when the message is not a verbal or textual message, and as will be further detailed below.

Those skilled in the art will readily appreciate that the invention is not bound by the configuration of **Fig. 1**; equivalent and/or modified functionality may be consolidated or divided in another manner and may be implemented in any combination
15 of software, firmware and hardware.

The sensing unit

A more detailed description will be given now to the sensing unit **11**. As discussed above, the measuring device **10**, which comprises sensing unit **11**, is adapted
20 to be attached **10** to each of the participants **2**, and the sensing unit **11** is configured to measure, during the activity, one or more parameters **P** that characterize the movement of the corresponding participant **2** relative to his/her initial location and orientation or any other datum location and orientation for that matter.

Additional reference is made now to **Fig. 2B** which is a schematic illustration of
25 a sensing unit according to one example of the invention. In this example, sensing unit **11** is adapted to be attached (integrally with the personal measuring device **10**) to a specific body part of the participant **2**, and it is designated to measure, during the activity, parameters **P** that characterize the movement of the corresponding body part relative to its initial location and orientation.

30 The sensing unit **11** may comprise accelerometers, gyroscopes, compasses or any combination thereof. When the measuring device **10** is designed for swimming activity, the device may comprise sealing the sensing unit, or at least each device used

therein and requiring such sealing, in a way that will allow its use even when the participant 2 is submerged in water.

In the shown example, the sensing unit 11 comprises an arrangement to determine the movement of the body part along six degrees of freedom, and includes an
5 accelerometer module 70 adapted to measure linear acceleration of the measured body part along three orthogonal axes, and a gyroscope module 80 adapted to measure angular acceleration of the body part around the three orthogonal axes, i.e, with respect to yaw, pitch and roll. Thus, the parameters **P** which are provided to the processor 12, in this example, include at least linear and angular acceleration values with respect to the
10 three orthogonal axes, X, Y and Z.

In repetitive activity, the sensing unit may be adapted to measure the periodicity of such activity. For example, in a swimming activity, accelerometers periodicity is easy to find outside of water due to the high readings obtained when the user hitting the ground.

15 In some embodiments, the sensing unit 11 may be placed at approximately the center of gravity of the participant 2, and may be used to monitor the movement of the participant 2, rather than of a body part thereof.

In other example, a compass (not shown) may be used whose advantage is in that its measurements are provided relative to the earth electromagnetic field as an external
20 reference point (outside the sensor). For applications of the kind described above, the compass may be three dimensional and it may be, for example, located on the head of the user, and be able, for example, to reveal if the user stands or lays down on the ground, as well as the changes in the direction of movement of the user (or any part of his body) such as a turn in a swimming pool (at the end of each lap, for example).

25

In variations of the first embodiment, each device 10 may comprise more than a single sensing unit 11 wherein each sensing unit may be attached to a different body part of the participant 2, such as for example, on any part of the limbs, head, or waist. For example, as can be seen in Fig. 3, a swimmer participant 2, may be equipped with
30 five sensing units 11 on his limbs and torso, in particular one sensing unit 11 being worn on each of the two wrists, the two ankles and the waist, according to one embodiment of the invention. This embodiment may allow simultaneously measurement of parameters characterizing the location and orientation of a plurality of body parts of

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the participant relative to their respective initial locations and orientations. In this embodiment each sensing unit 11 may be interconnected for example via wires, optic cable, wireless communication to a single measuring device, or alternatively, each sensing unit may constitute a part of a separate device 10, as a single participant 2 may, in an alternative embodiment of the invention, concurrently use more than a single device.

As for the operation of the illustrated sensing unit 11 as part of a system according to one embodiment of the present invention, reference is also made now to Figs. 2A and 2B as well as to Fig. 4A which illustrates an example including a participant 2 while performing a swimming activity (freestyle) and using a personal measuring device 10 attached to his left wrist and having a sensing unit 11 comprised therein.

While swimming, the sensing unit 11, in this example, repeatedly samples linear and angular acceleration values of the left wrist. According to those values, the processor 12 calculates for each reading the location and orientation of the left wrist of the swimmer. The frequency of the sampling of the sensing unit is predefined and can be adapted, for example, to different types of activities. In Fig. 4A, three different consecutive positions of the swimmer participant 2 are illustrated and referred to as t-1, t-2 and t-3. In each of said positions, the wrist of swimmer participant 2 changes its location and orientation, and for each position sensing unit 11 samples linear and angular acceleration values (which constitute parameters P) and the processor 12 calculates the location and orientation of the wrist (which constitute data D). Reference is made now to Fig. 4B that includes a table which details the parameters P and the calculated data D for each of the measurements in t-1, t-2 and t-3 of the present example.

The data D provided by the processor 12, which in this example constitutes the location and orientation of the body part being monitored for any given period of time, may be further processed (as will be described below in detail when discussing the operation of the computer 22) and/or stored within device 10 within a memory unit (not shown) for later use. In such a use, for example, the participant 2 can transfer such stored data to a computer after he finishes his activity for an ex-post study and analyzing his/her activity, for this function, while the processor 12 may have the

capability to export the stored data **D** (many export alternatives are available in the art). In such embodiment wireless communication means are not necessary.

The data **D** can be also be presented to the participant **2** by the presentation unit **14** in real-time. Optionally, the data **D** may be transmitted via wireless communication module **16**, in real-time, to an external computer **22**. Further optionally, the data may be exported to and internet/intranet network, where it may be shared with other users of similar devices. It will be appreciated that more than a single option of such usage is possible for a single device.

10 **Pulse rate measuring unit**

Pulse rate measuring unit (not shown) may be provided for measuring the pulse rate of the participant 2. The pulse measuring unit (PMU) may be adapted for being held in contact with the participant during his activity with or without connection to a measuring device **10**.

15 The PMU may be in the form of an external non-invasive detector adapted to measure the pulse rate in the participant's ear or other thin appendage of his body. One type of such detector is disclosed, for example, in U.S 5,314,389, where it is used in an electrocardiograph (ECG). Another type is a technique using IR technology, comprised of an infrared emitter and a corresponding infrared sensor, as disclosed for example in
20 U.S 4,301,808 and US 6,080,110, whose description from these references and the manner of operation are incorporated herein by reference. According to this technology, the emitter and the sensor are attached to the one user's ear so as measure the pulse inside that ear and play the results together with music via a headset to the other ear.

In the measuring device **10**, the PMU may be adapted to measure the pulse and
25 audibly play the results simultaneously in at least one ear canal and with a single earphone. Optionally, the device may measure the pulse and play the results together with any other audio information (i.e. music, instruction) simultaneously in both ears.

Moreover, in some embodiments of the present invention, the device may be designed to eliminate the adverse effect on the pulse measurement of sudden
30 movements of the participant (or any part of his body) during the activity. This goal is achieved by using sensing devices such as accelerometers.

When the measuring device 10 is designed for swimming activity, the device may comprise sealing the above PMU, or at least its emitter and sensor, in a way that will allow its use even when user is submerged in water.

5

The computer

A more detailed description will be given now regarding the computer 22. The computer 22, can additionally process the data **D** received from each of the participants 2 in order to provide information including statistical information regarding one or more participants, which the instructor 20 may choose and display via monitor 26. For example, such information may include comparative data regarding various participants 2 (or any group therefrom) that are engaged in the activity, their summary results and various statistics.

15 Wherein the activity is swimming, the data may relate to statistics and summary results for swimming sessions or laps. More particularly, the results may include one or more of the following: total training time, number of laps, average lap time, average lap velocity, average strokes per lap, fastest and slowest lap, highest and lowest number of hand strokes per lap, instantaneous speed during the laps, hand or leg lifting height for each stroke, distance traveled for each stroke, comparative results to other participants using similar devices.

20 Another type of data which may be generated by the computer 22 and displayed is a graphic illustration of the participant or of any of the measured body parts thereof in various moving positions, or as a video simulation that is displaying such movements in real-time. It will be appreciated by a person skilled in the art that the processor may calculate further types of data that may be derived from any of the measurements and from any combination thereof. It will also be appreciated by a person skilled in the art that any additional information which is known in the art may be included in that data which is either used for further calculations, displaying, or otherwise.

25 Although that in the example which is illustrated in **Fig. 1** a plurality of participants 2 and an instructor 20 having a computer 22 are presented, it would be appreciated, that the additional processing and analyzing described herein may be

performed in other embodiments by the processor 12 of the device 10 instead of, or in addition to, the processor 23. In particular, such processing and analysis may be performed in yet other embodiments, by the participant himself after finishing the activity as was described above, and retrieving the data from the memory.

5 **Figs. 5 to 7** are schematic examples of various possible screen visual displays that a trainer instructor may choose to view during a swimming activity of three swimmer participants, who are referred to therein as: Liat, Mulan and Yaeer. As can be appreciated, there are various alternative viewing configurations for the data relating to the swimmer participants. For example, comparative information regarding several
10 swimmers may be presented and viewed simultaneously (**Fig. 5**); detailed information may be viewed regarding an activity in real time of a single swimmer (**Fig. 6**) or even during a single lap (**Fig. 7**).

The presentation unit

15 A more detailed description will be given now to the presentation unit 14 with reference to **Fig. 1**. The system 101 may include different types of presentation units 14 for enabling any of the participants 2 to receive instructions **I** and/or data **D**.

For example, in one personal measuring device 10b, the presentation unit may be visually based, and includes a screen 14b which constitutes a part of the device 10b
20 being worn by participant 2b. In such embodiment, the screen (with the device) should be located at a position which will enable the participant to see it during the activity and according to it. In another example (not shown) which is relevant for swimming or any other activity which involves wearing goggles or a helmet (i.e. American football, ski), a screen may be a part of goggles that may present data as well as enable the wearer, at
25 the same time, to look ahead.

Another example of a presentation unit is used by participant 2x having a personal measuring device 10x is illustrated in Fig. 1, and includes an audio-based presentation unit comprising earphones 14x. The earphones worn by participant 2x and may be connected to a receiving module (not shown) adapted for wirelessly receiving
30 instructions 34 from the computer 22, or any other suitable communication for that matter (for example, processed data 32 transmitted from the device's communication means 16) in digital format, and converting it into audio signal to be transmitted to participant 2a. In this example, the personal device 10x may be attached to the

01778711\33-01

earphones **14x** as well, or alternatively may be attached to another body part of the participant **2x**, for example the participant's wrist. In the latter example, the communication module **16** may have the ability to wireless transmit data **D** to the receiving module (not shown) that are connected to the earphones **14x**. In another example, a presentation unit may be a single earphone that will operate in a similar manner to the earphones **14a** described above.

It will be appreciated that the data **D** and/or instructions **I** may be presented to the participant in real-time, i.e. in the course of the activity and during the time the corresponding measurements are being taken.

It will also be appreciated, that a single participant may have more than a single presentation unit **14** as well as more than a single measuring device **10**.

Alternatively, in yet another example, the presentation unit **14** may comprise a mechanism for providing signals that are configured to be felt by a body part including the skin, though optionally having no noticeable corresponding audio or visual effect.

Such a mechanism may comprise, for example, a vibrating element that generates vibratory pulses and directs these to the skin of the participant **2** to enable the participant to feel the vibrations. Optionally, the frequency and/or amplitude of the vibrations may provide a measure of the data **D** and/or instructions **I**, according to a preset convention. For example, the more a particular parameter **P** of the particular body part to which the device **10** is attached deviates from a particular optimum, the higher the vibration frequency that is generated, enabling the participant to adjust his/her movements in a manner such that the vibrations subside. This particular form of presentation unit **14** enables the same to provide direct feedback information to the same part of the body as the device **10** which comprises the presentation unit **14** is fitted, and allows multiple units **10**, fitted onto different body parts of the same participant **2**, to simultaneously provide such information as required in a manner that is easily and readily understandable by the participant **2**.

The operation of the system – example

Fig. 8 illustrates a flow chart diagram that describes an example operation of an advising system according to the embodiment of **Fig. 1**, and in which the activity is a swimming activity with two participants **2**, **swimmer A** and **swimmer B**, and the instructor is a human instructor (i.e. not a virtual trainer). In this example, each

swimmer A and B has a personal measuring device 10 which is attached to his wrist. The presentation unit 14 for each swimmer comprises earphones, and the sensing unit within each measuring device 10 is sensing unit 11 which is described above in accordance with Figs. 2 and 4.

5 As swimmers A and B commence the swimming activity, each sensing unit 11 begins to take readings of the corresponding parameters P_A and P_B of the swimmers (40_A and 40_B respectively), the obtained parameters including linear and angular acceleration values in this example and as described above. The measurement is performed repeatedly, the parameters being obtained by sampling measurements at
10 every successive predetermined time interval. For each sampling, the measured values of parameter P_A are transferred to processor 12 for further processing to enable calculation of the location and orientation of the wrist of the swimmer (42_A), which constitutes the data D_A , which is wireless transmitted to the instructor's computer 22 via the communication module 16 (44_A). In this example, the measured values relating to
15 parameters P_B are not processed in processor 12 and the unprocessed parameters P_B constitute the data D_B that is wireless transmitted to computer 22 via the communication module 16 (44_B).

Computer 22 receives both data D_A and data D_B (46), and further processes these data in order to generate the information as decided by the instructor 20 (48). This
20 information can be any data which may be derived from the measuring devices of the swimmers as detailed above and exemplified with reference to Figs. 5-7. The computer 22, via its monitor 26, displays to the instructor 20 the generated information (50). The instructor 20, based on the displayed information, can then decide what instruction he/she would like to transmit to any of the swimmers A and B, and accordingly inserts
25 this input, using input means 24, to the processor 23 of the computer 22 (52), to be subsequently transmitted to the swimmers (54). In this example, two streams of instructions I are transmitted: instruction I_A is transmitted to swimmer A, and instruction I_{AB} is transmitted to swimmer A and to swimmer B.

Each of the personal measuring devices 10 of the swimmers A and B receiving
30 the instructions which are designated to them only, swimmer A receives instructions I_A and I_{AB} (56_A) and swimmer B receives instruction I_{AB} (56_B). In this example, since both swimmers have earphones as presentation units 14, the instructions are received in the earphones' associated communication module as described above with reference to
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earphones **14x** in **Fig. 1** and converted to audio format (**58_A** and **58_B**) to be played to each of the swimmers A and B, respectively (**60_A** and **60_B**).

The Communication system

5 A closer look will be dedicated now to the communication with a participant in case the participant is a swimmer. The term "swimmer" used with reference to **Figs. 9** and **10** include any person engaged in water-related activities comprising one or more submerging periods characterized by natural communication barriers caused by submerging.

10 Reference is made now to **Fig. 9** which illustrates a block diagram of a communication system for communicating with a certain swimmer or a group thereof. The communication system comprises a transmitting module **250** and one or more receiving modules **150**, each associated with certain swimmer **100**. The transmitting module **250** comprises an input unit adapted to obtain data designated to one or more
15 certain swimmers or groups thereof (e.g. pre-recorded or obtained in real time training instructions **I** from an instructor **200**, instructions generated by a "virtual trainer" in accordance with certain rules, messages designated to the swimmer, personalized music, etc.), a processor **254** connected to the input unit **252**, storage/ accommodating unit **256** connected to the processor **254** and communication module **258** connected to the
20 processor and adapted to wirelessly transmit respective data **D** to one or more appropriate receiving modules **150**. The input unit **252** may be, for example, a microphone, and in such a case, the transmitting module **150** will also include means (e.g. a vocoder, not shown) to convert the audio signal to digital format for processing. The transmitting module is adapted to obtain data designated to one or more swimmers
25 or groups thereof, to accommodate said data and/or derivatives thereof (e.g. data in a digitalized and/or compressed form), to process (by the processor **254** and/or by the communication module **258**) the accommodated data **D** or in order to fit it to certain wireless communication protocol, and to transmit the processed data to respective receiving module(s) upon a predefined condition. The predefined condition is
30 communication availability of the respective receiving module(s); and the wireless communication protocol is configured to recognize communication availability of the respective receiving module(s). The wireless communication protocol may be, for example, a Bluetooth protocol or other appropriate protocol.

The computer **22** detailed with reference to **Fig. 1** may comprise the transmitting module or parts thereof.

The receiving module **150** comprises a communication module **152** adapted to receive the data **D** transmitted by the transmitting module **250**, a processor **154** adapted to process the data **D** received, and earphones **156** to present the data **D** in an audio format to the corresponding swimmer **100**. The receiving module **150** may be attached to any of the swimmer's **100** ears, as well as to the headband of the swimmer's goggles (not shown). Earphones **156** can further present music or other types of audio data as well. In such a case, a digital media means adapted to present music, like an MP3 player, may be connected to receiving module **150** and/or to earphones **156**. The receiving module **150** may also include a screen (not shown) to display the instructor's input to the swimmer **100**.

Alternatively or additionally, receiving module **150** may be attached to the swimmer's wrist and may constitute part of another device (not shown), that can be a measuring device as described hereinabove, or a watch. It will be appreciated that a single system may include more than a single receiving module for one swimmer, as, for example, one receiving module will be attached to the swimmer's wrist, while the other one will be attached to the swimmer's head and be connected to earphones. In such example, both receiving modules may receive the transmitted data from the transmitting module **250** to be presented to the swimmer in various ways (e.g. using a screen and earphones, respectively), or in another example, only one of the receiving module can be adapted to receive the transmitted data from the transmitting module **250** and transmit it to the second receiving module.

In certain embodiments of the invention, the processor **254** may be adapted to compress the data **D** in order to enable transmission during a short period of time which is often shorter than the actual time in which the data **D** is received from the input unit **252** and/or displayed via the earphones **156** to the swimmer. For example, it may be desired to compress such data before the transmission when a duration of instructions designated to be heard by certain swimmer **100** is above a period of communication availability of the respective receiving device. In such embodiment, processor **154** at the receiving module may be adapted to decompress the received data in order to enable presenting the original data **D** to the swimmer **100** in an appropriate manner.

In certain embodiments of the invention, the transmission unit may be also configured to send the same or different data to several swimmers concurrently, in accordance with personal or group designation.

Those skilled in the art will readily appreciate that the invention is not bound by the configuration of **Fig. 9**; equivalent and/or modified functionality may be consolidated or divided in another manner and may be implemented in any combination of software, firmware and hardware.

Reference is made now to **Fig. 10** which is a flow chart diagram that describes a method of automated training in accordance with certain embodiments of the present invention. The method may be implemented with a help of the communication system detailed with reference to **Fig. 9**, or otherwise.

The training starts with obtaining data (270) related to one or more training instructions designated to at least one swimmer among the swimmers.

In certain embodiments of the present invention, the transmitting module obtains that data from instructor **200**, and the designated swimmer is swimmer A while there is plurality of other swimmers in the swimming pool, some of them having a receiving module **150**. The obtained data may be recorded. The instructions may be based on input which the instructor receives concerning the swimmer's A movement. Such input may be based upon sensing devices which are attached to swimmer A. Alternatively, the data may be related to any other message or other information which the instructor wishes to transmit to one or more designated swimmers or groups thereof. Also, an instructor may be a virtual trainer which is activated upon a pre-defined set of rules. In certain embodiments of the present invention the instructor **200** records his message by signaling the beginning and end thereof. The instructor also identifies to whom the message is designated. The identification may be made in various methods. One of which is stating out loud the name or number of the designated swimmer. In such a case means for converting audio (voice) into digital format (e.g. a vocoder, not shown) are required. Another method is pressing a key designating the identity of the swimmer. In any such method, the identification may be done before, during or after recording of the message. Accordingly, the message will be accommodated in the transmitting unit together with a digital mark, or other identifier, that indicates to whom the message is designated.

The obtained data is further processed (272) (e.g. by the transmitting module) in order to fit a wireless communication protocol (e.g. Bluetooth). The processing also may include other steps, which may occur in different order. In certain embodiments of the invention, the processing of the obtained data may include, for example, accommodating the data, converting an audio format to digital format data, exporting the data, manipulating the data according to predetermined rules, compressing the data and adding identification means (e.g. information bytes) to the data according to the designation of the recipient swimmer. The designated data may be accommodated in plurality of data blocks as to enable efficient transition thereof.

The wireless communication protocol is configured to facilitate recognition of communication availability of said at least one receiving module.

The transmission of the processed data to at least one receiving module associated with the swimmer A will start upon meeting (**decision 273**) a pre-defined condition. If such condition is not met, the transmission does not begin; optionally, additional data may be further obtained and added to the accommodated data awaiting transmission.

It will be appreciated that obtaining and processing the additional data may be provided regardless of the transmission process.

In this example, such a condition is the communication availability of at least one receiving device associated with the designated swimmer A. Communication availability means physical ability of communication between the transmitting module and the receiving module, this ability depends, for example, on a current submerging depth of the swimmer A. It should be noted that different availability criteria may be applied in different embodiments of the invention.

It will be appreciated that if receiving module 150 of swimmer A is either attached to his wrist or to his head, there will be frequent periods of times in which the receiving module will be out of the water, as swimmer A will have to strike his/her hand in order to swim and to raise his/her head above water in order to breathe. When the pre-defined condition, i.e. communication availability of swimmer A, is met, the data package is transmitted (274) to the receiving module 150 of swimmer A.

If all the designated data have been transmitted (**decision 277, yes**) or if the designated receiving device is no longer available to communicate (**decision 275, no**), for example, when the swimmer is underwater, then the transmission is stopped (280).

Alternatively, if not all of the designated data have been transmitted yet (**decision 277, no**) and if the designated receiving module is available for communication (**decision 275, yes**) than the transmission is continued (**278**).

5 The transmitted data are receiving by one or more designated receiving units for further processing facilitating presentation of training instructions (or other information) to the respective swimmer.

In a certain embodiment of the present invention, the processing of the obtained data includes compression of the data before the transmission. For example, the compression rate may be adapted to enable a match between duration of the compressed
10 instructions designated to certain swimmer and a period of communication availability of the respective receiving device. After receiving module **150**, via communication module **152**, receives the compressed data, the processor **154** decompresses the data which then may be presented to the swimmer A via earphones **156**.

It should be noted that in certain embodiments of the invention, the transmission
15 of the same or different data may be provided to several swimmers concurrently, in accordance with personal or group designation.

Those skilled in the art will readily appreciate that various modifications and changes can be applied to the embodiments of the invention as hereinbefore described without departing from its scope, defined in and by the appended claims.

20

CLAIMS:

1. A personal device for measuring a training activity of a trainee having a body part which moves during said training activity, this movement at least partially defining said training activity, said device comprising:
 - 5 (a) a sensing unit adapted to repeatedly measure, during said training activity, parameters associated with the movement of said body part, and wherein said sensing unit comprising at least accelerometer means, a compass and optionally gyroscope means;
 - (b) means for attaching the sensing unit to said body part; and
 - 10 (c) a processor adapted to receive from the sensing unit said parameters, and to calculate based thereon, data indicative of said training activity.
2. A personal device according to claim 1, wherein said body part changes its location and orientation during said training activity, said parameters characterizes the location and orientation of said body part relative to its initial location and orientation,
15 and said data includes at least the location and orientation of said body part for each of the measurements.
3. A device according to claim 2, wherein said accelerometer means adapted to measure linear acceleration of said body part along three axes, said gyroscope means adapted to measure angular acceleration of said body part around said three axes, and
20 wherein said parameters are at least linear and angular acceleration values.
4. A device according to claim 1, and further comprising at least one additional sensing unit and means for its attaching to an additional body part of said trainee, the sensing unit adapted to repeatedly measure, during said activity, parameters characterizing at least the location and orientation of said additional body part relative
25 to its initial position and orientation; and said processor being further adapted to receive from said at least one additional sensing unit said parameters, and to calculate, based thereon, at least the location and orientation of said additional body part for each of the measurements, for use thereof in providing said data.
- 30 5. A device according to claim 1, wherein said activity is a swimming session and said data further includes statistics and summary results for said session.

6. A device according to claim 6, wherein said results include one or more of the following: total training time, number of laps, average lap time, average lap velocity, average strokes per lap, fastest and slowest lap, highest and lowest number of hand strokes per lap, instantaneous speed during the laps, hand or leg lifting height for each stroke, distance traveled for each stroke, comparative results to other trainees using similar devices.

7. A device according to claim 1, further adapted for infrared measurement of the pulse and wherein said data includes the pulse of the trainee.

8. A device according to claim 1, wherein said means for attaching the sensing unit further comprise a flexible platform adapted to amplify at least one of the measurements performed by the sensing unit.

9. A training advisor comprising a device according to claim 1, and further comprising a presentation unit adapted to present to the trainee at least said data or training instructions based on said data.

10. A training advisor according to claim 9, wherein said presentation unit comprises a screen connected to said processor and adapted for displaying to the trainee readings including at least said data or training instructions to the trainee based on said data.

11. A training advisor according to claim 9, wherein said presentation unit comprises vibrating element adapted to generate vibratory pulses according to a predetermined rule, and to direct said pulses to the skin of said trainee.

12. A training advisor according to claim 9, wherein said presentation unit comprises at least one earphone with a receiving module adapted for wirelessly receiving readings including at least the data from said device or training instructions to the trainee based on said data, and converting said readings into audio signal to be transmitted to the trainee via said at least one earphone.

13. A training advisor according to claim 9, wherein the processor of said device is further adapted to provide said training instructions according to predetermined rules.

14. A training advisor according to claim 9, and further comprising a computer adapted for being located at a location spaced from said processor and for wirelessly receiving the data from said device, and having a monitor for displaying to a user of said computer said data or information derived therefrom.

15. A training advisor according to claim 14, wherein said computer further comprises an input unit to receive said training instructions from its user, the computer being adapted to wirelessly transfer said instructions directly or indirectly to said presentation unit.

5 16. A training advisor according to claim 14, constituting a part of a training system comprising a plurality of such training advisors for a corresponding plurality of trainees, and wherein said monitor is adapted to display to said user said data or information derived therefrom, relating to said plurality of trainees.

17. A training advisor according to claim 16, wherein said monitor is adapted to
10 display to said user said data or information derived therefrom, in a real-time activity of said plurality of trainees.

18. A training advisor according to claim 16, wherein said computer further comprises an input unit to receive from its user the training instructions, the computer being adapted to simultaneously and wirelessly transfer said instructions directly or
15 indirectly to each of said plurality of trainees.

19. A system for use by an instructor in instructing of a plurality of participants engaged in an activity, comprising:

(a) a plurality of personal measuring devices each adapted for being worn by one of said participants and for repeatedly measuring, during said activity,
20 parameters of the participant's movement;

(b) a computer adapted for being used by said instructor for wirelessly receiving from each of said personal measuring devices, data, calculated based on said parameters, and having a monitor for displaying said data or information derived therefrom, and an input unit adapted to receive instructions from the
25 instructor;

(c) a plurality of presentation units, each for presenting to said participant at least said instructions; and

(d) communication means connected to said computer adapted to wirelessly transfer said instructions directly or indirectly to each of said presentation
30 units.

20. A system according to claim 19, wherein at least one of said plurality of personal measuring devices for at least one participant from said plurality of participants, includes:

- (a) a sensing unit adapted to repeatedly measure, during said activity parameters associated with said movement, and wherein said sensing unit comprising at least accelerometer means and gyroscope means;
- (b) means for attaching the sensing unit to said participant; and
- 5 (c) a processor adapted to receive from the sensing unit said parameters, and to calculate based thereon, data indicative of said activity.

21. A system according to claim 19, wherein at least one of said plurality of presentation units is a screen adapted for being worn by said participant.

22. A system according to claim 19, wherein at least one of said presentation units
10 comprises at least one earphone with a receiving module adapted for wirelessly receiving at least said instructions in digital format, and converting it into audio signal to be transmitted to said participant via said at least one earphone.

23. A system according to claim 19, wherein said activity is swimming.

24. A system according to claim 19, wherein said information displayed to said
15 instructor includes comparative data about the activity of two or more of said plurality of participants.

25. A communication system for communicating with one or more swimmers, the system comprising a transmitting module adapted to communicate in accordance with a wireless communication protocol with at least one receiving module associated with
20 at least one swimmer, wherein:

- (a) the transmitting module is adapted to obtain data designated to said at least one swimmer, to accommodate said data and/or derivatives thereof thus giving rise to accommodated data, to process the accommodated data in order to fit it to the wireless communication protocol, and to transmit the
25 processed data to said at least one receiving module upon a predefined condition;
- (b) said at least one receiving module associated with said at least one swimmer is adapted to receive the data transmitted from the transmitting module and to process the received data in order to facilitate presenting the data to the
30 swimmer;
- (c) the predefined condition is communication availability of said at least one receiving module; and

- (d) the wireless communication protocol is configured to facilitate recognition of communication availability of said at least one receiving module.

5 **26.** A communication system according to claim 25, wherein said process of accommodated data in the transmitting module includes compressing said data and said process in said at least one receiving module including decompressing the data.

10 **27.** A communication system according to claim 25, wherein said receiving module constitutes a part of a device attached to the head of said swimmer, comprises at least one earphone and is adapted for converting said data into audio signal to be transmitted to the swimmer via said at least one earphone.

15 **28.** A communication system according to claim 27, wherein said receiving module includes digital media means adapted to display music to said swimmer via said at least one earphone.

29. A communication system according to claim 25, wherein said receiving module includes a screen that is adapted to facilitate said presenting of data to the swimmer.

20 **30.** A communication system according to claim 25, wherein said receiving module is adapted to further transmit said data to an additional receiving module which constitutes a part of an additional device attached to the head of said swimmer, said additional device comprises at least one earphone and is adapted for converting said data into audio signal to be transmitted to the swimmer via said at least one
25 earphone.

31. A method for automated training one or more swimmers, the method comprising:

- 30 **(a)** obtaining data related to one or more training instructions designated to at least one swimmer among said swimmers;
- (b)** automated processing the obtained data in order to fit a wireless communication protocol; and
- (c)** transmitting the processed data to at least one receiving module associated with said at least one swimmer upon a predefined condition; wherein the

predefined condition is communication availability of said at least one receiving module, and the wireless communication protocol is configured to facilitate recognition of communication availability of said at least one receiving module.

5 **32.** The method of Claim 31 further comprising receiving the transmitted data and further processing thereof in order to facilitate presenting said data related to training instructions to said at least one swimmer.

33. The method of Claim 32 wherein processing data to be transmitted further comprises a compression operation and processing the received data further comprises
10 a decompression operation.

34. A program storage device readable by machine, tangibly embodying a program of instructions executable by the machine to perform method steps for automated training one or more swimmers, the method comprising:

(a) obtaining data related to one or more training instructions designated to at
15 least one swimmer among said swimmers;

(b) automated processing the obtained data in order to fit a wireless communication protocol; and

(c) transmitting the processed data to at least one receiving module associated with said at least one swimmer upon a predefined condition; wherein the
20 predefined condition is communication availability of said at least one receiving module, and the wireless communication protocol is configured to facilitate recognition of communication availability of said at least one receiving module.

35. A computer program product comprising a computer useable medium having
25 computer readable program code embodied therein for automated training one or more swimmers, the computer program product comprising:

(a) computer readable program code for causing the computer to obtain data related to one or more training instructions designated to at least one swimmer among said swimmers;

30 **(b)** computer readable program code for causing the computer to automated processing the obtained data in order to fit a wireless communication protocol; and

- (c) computer readable program code for causing the computer to transmit the processed data to at least one receiving module associated with said at least one swimmer upon a predefined condition; wherein the predefined condition is communication availability of said at least one receiving module, and the wireless communication protocol is configured to facilitate recognition of communication availability of said at least one receiving module.

10

ABSTRACT

A personal device is provided for measuring a training activity of a trainee having a body part which moves during this training activity, this movement at least partially
5 defining said training activity. The device comprises a sensing unit adapted to repeatedly measure, during the training activity, parameters associated with the movement of the body part, and wherein the sensing unit comprising at least accelerometer means, a compass and, optimally, gyroscope means. The device further
10 comprises means for attaching the sensing unit to the body part and a processor adapted to receive from the sensing unit the parameters and to calculate based thereon, data indicative of the training activity. In addition, there are provided a system for use by an instructor in instructing of a plurality of participants engaged in an activity, a communication system for communicating with one or more swimmers, the system comprising a transmitting module adapted to communicate in accordance with a
15 wireless communication protocol with at least one receiving module associated with at least one swimmer, and a method for automated training one or more swimmers accordingly.

20

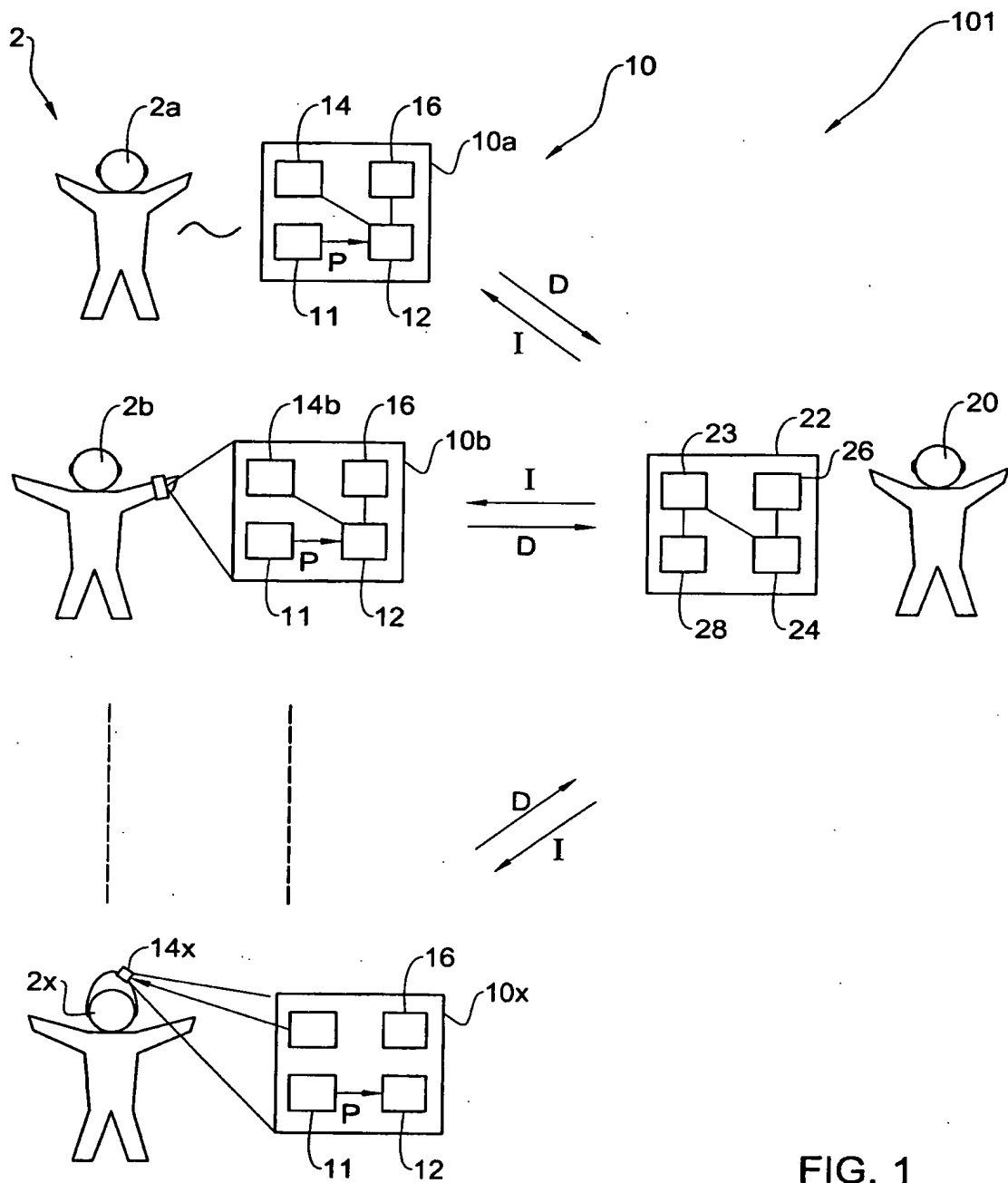


FIG. 1

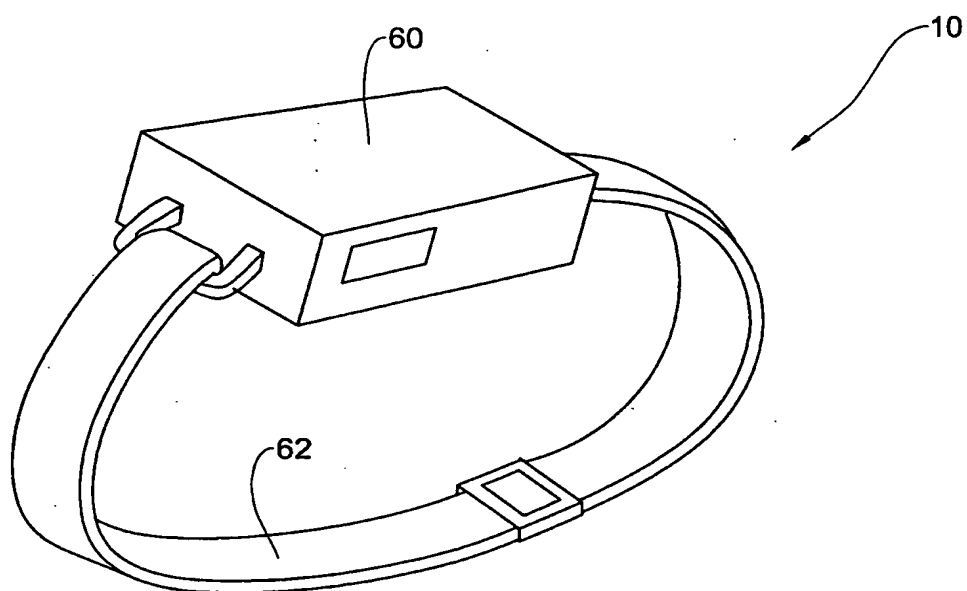


FIG. 2A

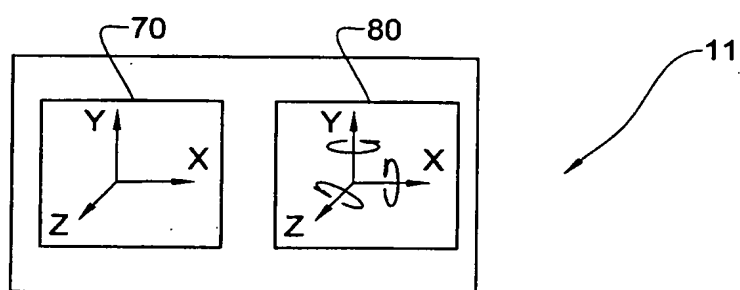


FIG. 2B

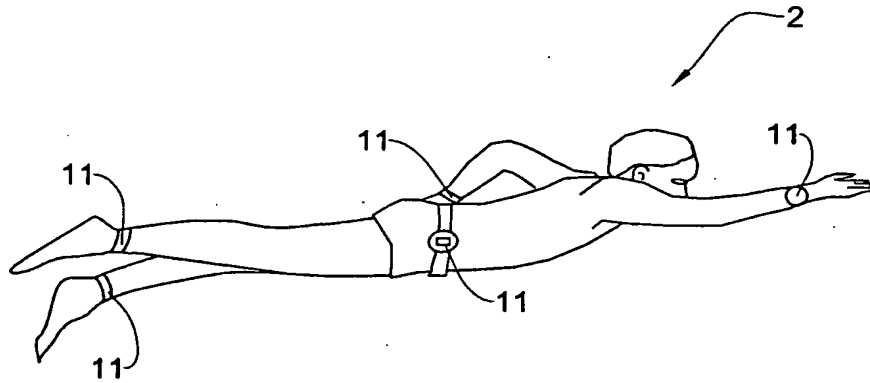


FIG. 3

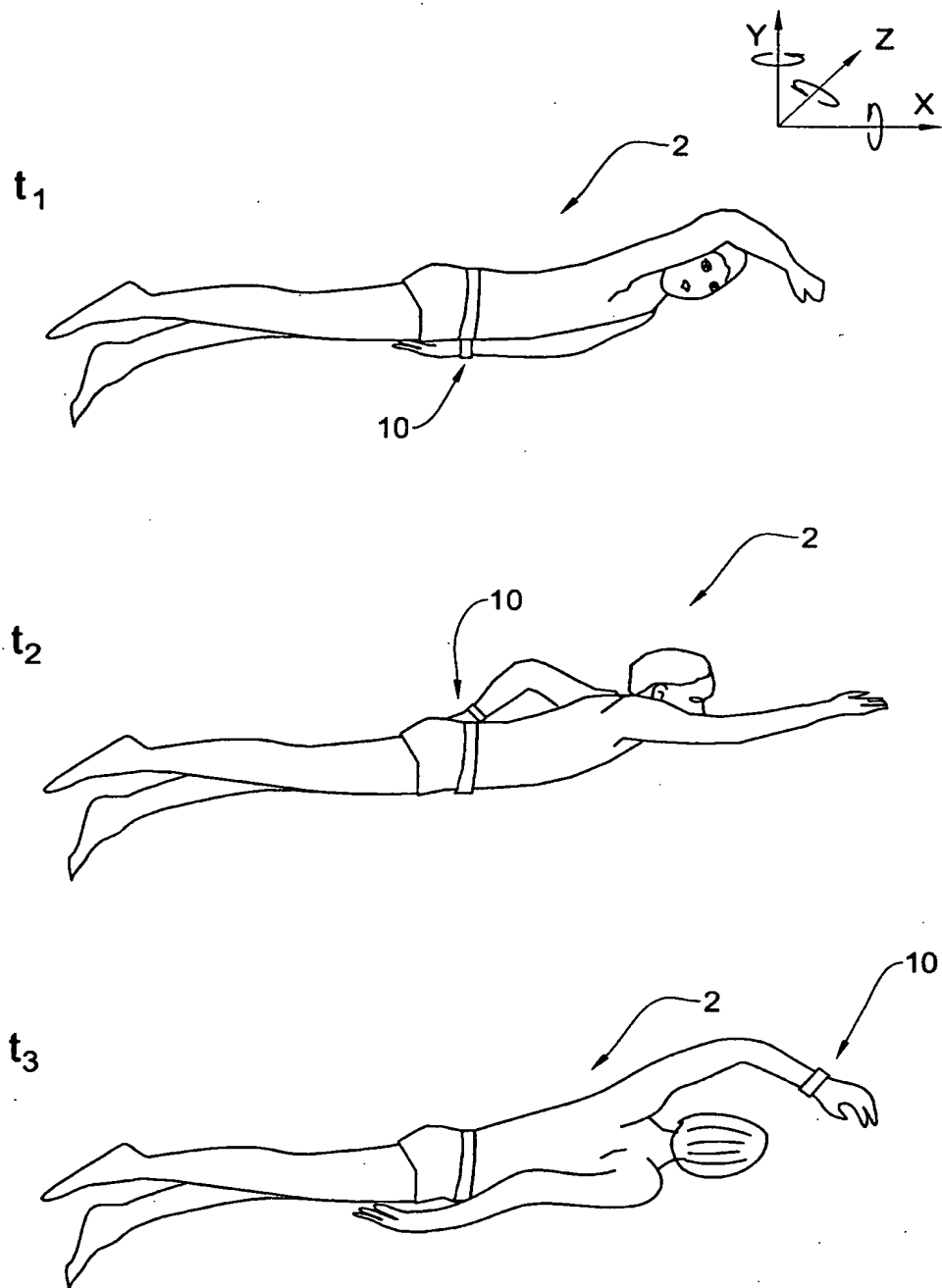


FIG. 4A

FIG. 4B

Time	P		D	
	Measurements (Linear/Rotational)	Location S (x,y,z)	Orientation O (yaw,pitch,roll)	
T1	Ax1,Ay1,Az1 / Ayaw1,Apitch1,Aroll1	Sx1,Sy1,Sz1	Oyaw1,Opitch1,Oroll1	
T2	Ax2,Ay2,Az2 / Ayaw2,Apitch2,Aroll2	Sx2,Sy2,Sz2	Oyaw2,Opitch2,Oroll2	
T3	Ax3,Ay3,Az3 / Ayaw3,Apitch3,Aroll3	Sx3,Sy3,Sz3	Oyaw3,Opitch3,Oroll3	

Name	Number of completed finished laps	Elapsed time	Last lap time	Number of hand strokes per lap	Number of lag strokes per lap	Average distance per hand stroke	Heart bit rate	Average height of right hand stroke	Average height of left led stroke
Liat	12	00:05:45	45	12	54	2.08	134	1.3	0.2
Mulan	32	00:20:45	35	14	65	1.79	142	1.2	0.15
Yaeer	11	00:06:12	54	15	88	1.67	145	1.1	0.1

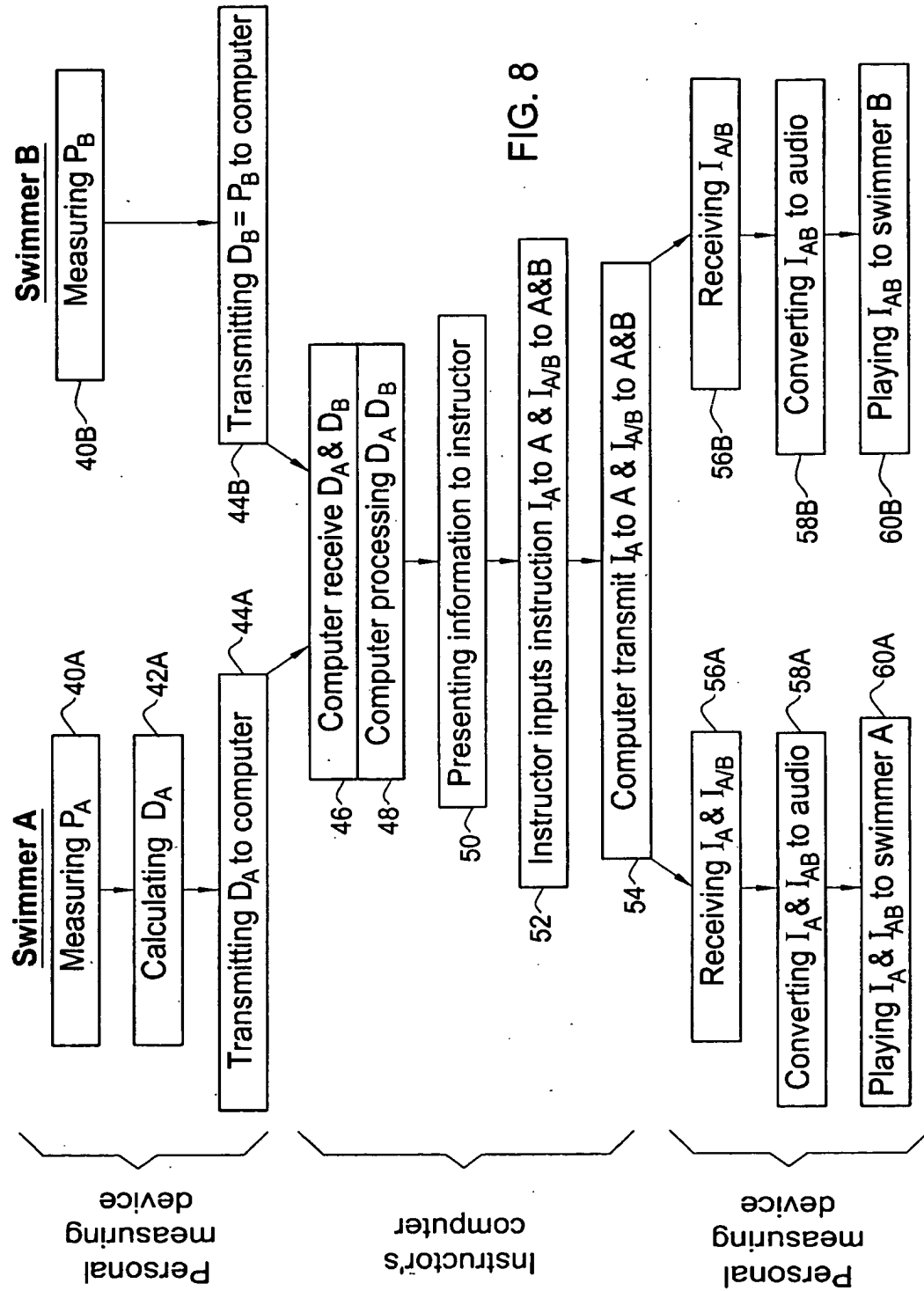
FIG. 5

Swimmer name: Liat									
Lap number	Time per lap	Number of hand strokes	Number of lag strokes	Average distance per hand stroke	Heart bit rate	Height of right hand stroke	Height of left hand stroke	Number of right leg strokes	Number of left leg strokes
1	45	12	45	1	120	2	2	45	45
2	32	13	46	2	121	2.2	2.2	46	46
3	28	14	47	3	122	1.9	1.9	47	47

FIG. 6

Swimmer Liat, Lap number: 35							
Time in the lap	Right hand height	Left hand height	Right leg height	Left leg height	Right hand orientation	Left hand orientation	Body orientation
0.1	0.11	-0.14	0.05	-0.05	120	85	20
0.2	0.12	-0.15	0.06	-0.06	121	86	21
0.3	0.14	-0.16	0.07	-0.07	122	87	22

FIG. 7



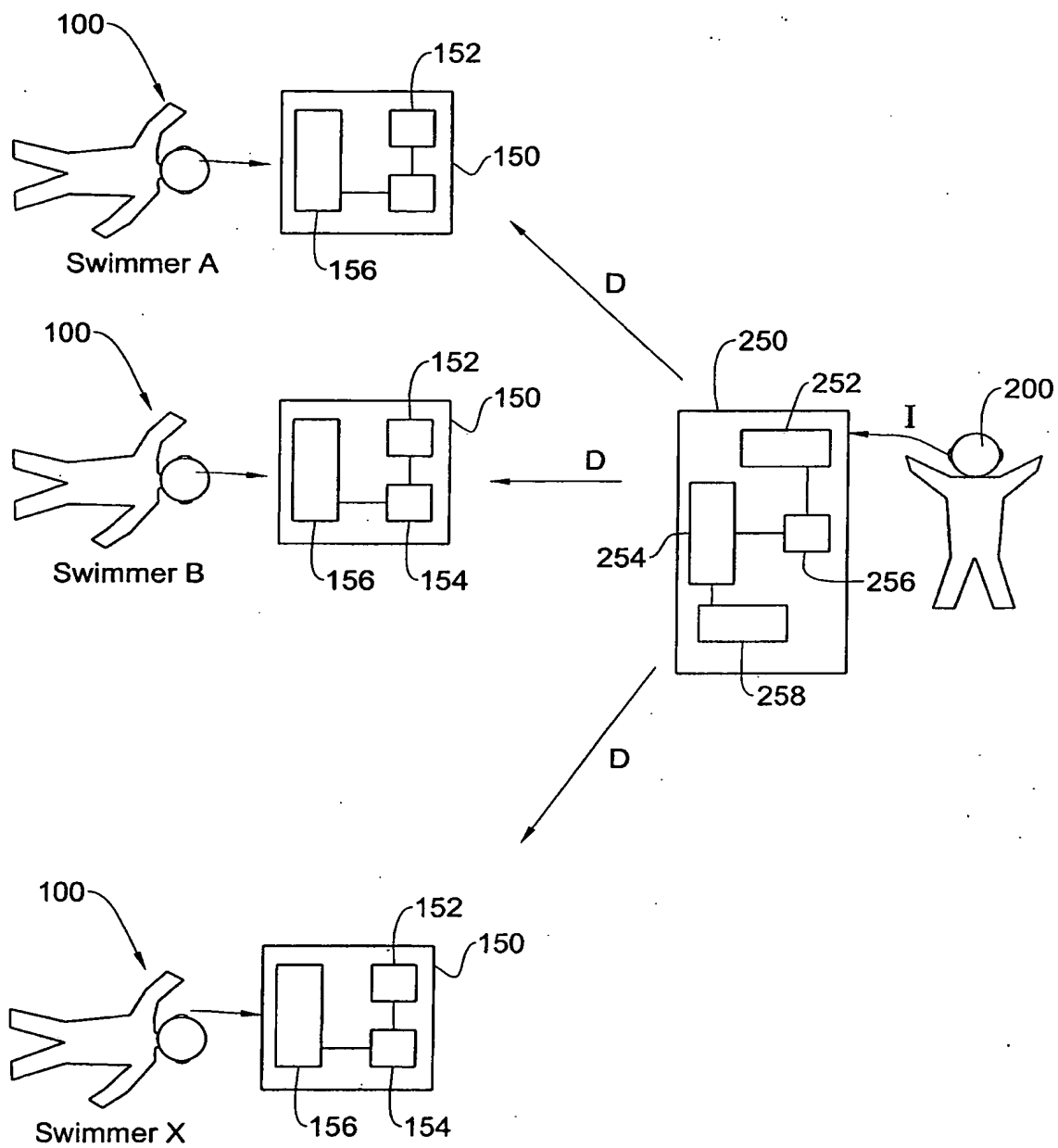


FIG. 9

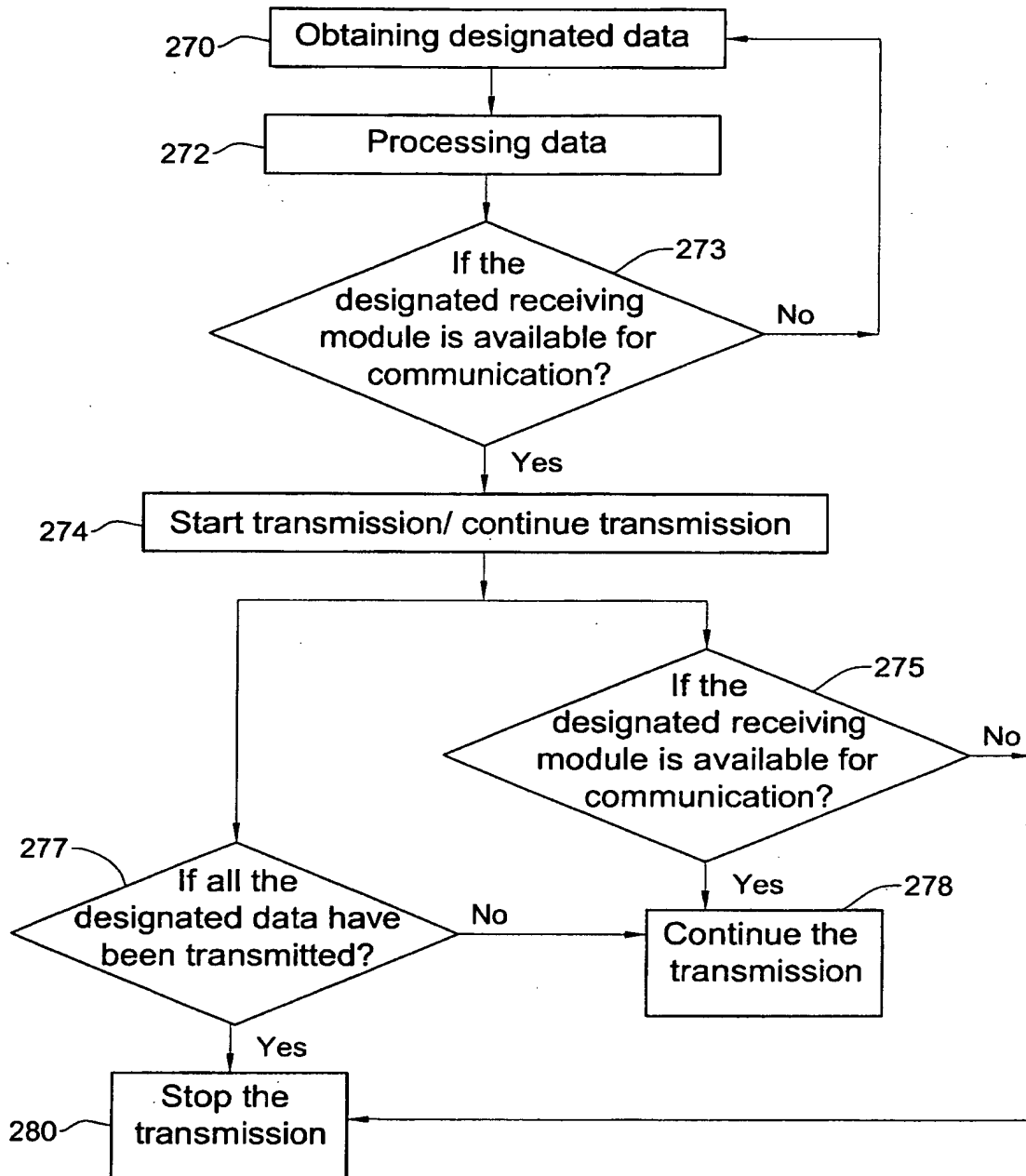


FIG. 10

COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled TRAINING AND INSTRUCTING SUPPORT DEVICE, the specification of which:

- ☐ is attached hereto.
☐ was filed on _____ as Application Serial No. _____ and was amended on _____.
☒ was described and claimed in PCI International Application No. PCI/IL07/001121 filed on September 11, 2007 and as amended under PCI Article _____ on _____

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCI international filing date of the continuation-in-part application.

I hereby claim the benefit under Title 35, United States Code, §119(e)(1) of any United States provisional application(s) listed below:

U.S. Serial No.	Filing Date	Status
60/843,422	September 11, 2006	

I hereby claim the benefit under 35 U.S.C. §120 of any prior U.S. non-provisional application(s) or under §365(c) of any prior PCI international application(s) designating the U.S., listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in such U.S. or PCI international application in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose to the PTO all information which is material to patentability as defined in 37 C.F.R. §1.56 which became available between the filing date of the prior application and the national or PCI international filing date of this application:

Application Serial No.	Filing Date	Status

I hereby claim foreign priority benefits under 35 U.S.C. §§ 119 (a)-(d) and 365 (b) of any prior foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or under §365(a) of any PCI international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application for patent or inventor's certificate or any PCI international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

Country	Application No.	Filing Date	Priority Claimed
			☐

Attorney's Docket No : Please Provide

Combined Declaration and Power of Attorney

Page 2 of 2 Pages

I/We hereby appoint the Practitioners associated with the following Customer Number:

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Send Correspondence to:

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The undersigned hereby authorizes the U.S. Attorneys or Agents appointed herein to accept and follow instructions from Reinhold Cohn and Partners as to any action to be taken in the U.S. Patent and Trademark Office regarding this application without direct communication between the U.S. Attorneys or Agents and the undersigned. In the event of a change of the persons from whom instructions may be taken, the U.S. Attorneys or Agents appointed herein will be so notified by the undersigned.

I hereby further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Application Data Sheet

Application Information

Application Number::	Not Yet Assigned
Filing Date::	March 11, 2009
Application Type::	Continuation-In-Part
Subject Matter::	Utility
Suggested Classification::	
Suggested Group Art Unit::	
CD-ROM or CD-R?::	None
Number of CD disks::	0
Number of copies of CDs::	0
Sequence submission?::	No
Computer Readable Form (CRF)::	No
Number of copies of CRF::	0
Title::	TRAINING AND INSTRUCTING SUPPORT DEVICE
Attorney Docket Number::	30024X
Request for Early Publication?::	No
Request for Non-Publication?::	No
Suggested Drawing Figure::	
Total Drawing Sheets::	9
Small Entity?::	Yes
Latin name::	

Variety denomination name::

Petition included?:: No

Petition Type:: N/a

Licensed U.S. Govt. Agency:: N/a

Contract or Grant Numbers:: N/a

Secrecy Order in Parent Appl.?:: No

Applicant Information (1)

Applicant Authority type:: Inventor

Primary Citizenship Country:: IL

Status:: Full Capacity

Given Name:: Eldad

Middle Name::

Family Name:: SHEMESH

Name Suffix::

City of Residence:: Binymina

State or Province of Residence::

Country of Residence:: IL

Street of Mailing address:: 3 Hakatzir Street

City of mailing address:: Binymina

State/Province of mailing address::

Country of mailing address:: IL

Postal Code of mailing address:: 30500

Applicant Information (2)

Applicant Authority type:: Inventor
Primary Citizenship Country:: IL
Status:: Full Capacity
Given Name:: Liat
Middle Name::
Family Name:: SHEMESH-GRANOT
Name Suffix::
City of Residence:: Binymina
State or Province of Residence::
Country of Residence:: IL
Street of Mailing address:: 3 Hakatzir Street
City of mailing address:: Binymina
State/Province of mailing address::
Country of mailing address:: IL
Postal Code of mailing address:: 30500

Correspondence Information

Correspondence Customer Number:: 20529
Name:: THE NATH LAW GROUP
Street of mailing address:: 112 S. West Street
City of mailing address:: Alexandria
State or Province of mailing address:: Virginia

Country of mailing address:: United States of America

Postal or Zip Code of mailing address:: 22314

Phone number:: (703) 548-6284

Fax number:: (703) 683-8396

E-Mail address:: ip@nathlaw.com

Representative Information

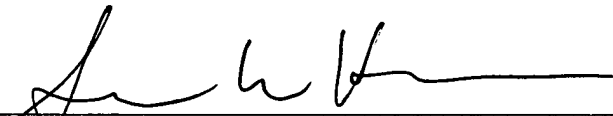
Representative Customer Number:: 20529

Domestic Priority Information

Application::	Continuity Type::	Parent Application::	Parent Filing Date (MM/DD/YY) ::
This Application	Continuation-in- Part of	PCT/IL2007/001121	09/11/07
PCT/IL2007/001121	An application claiming the benefit under 35 USC 119(e)	60/843,422	09/11/06

Signature

Signature::



First Name:: Susanne M. Last Name:: Hopkins

Registration No.: 33,247 Date (MM/DD/YY): 03/11/09

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
20 March 2008 (20.03.2008)

PCT

(10) International Publication Number
WO 2008/032315 A1

(51) International Patent Classification:

A63B 69/00 (2006.01) A63B 71/06 (2006.01)
A63B 69/12 (2006.01) A63B 24/00 (2006.01)
A63B 71/02 (2006.01)

(21) International Application Number:

PCT/IL2007/001121

(22) International Filing Date:

11 September 2007 (11.09.2007)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

60/843,422 11 September 2006 (11.09.2006) US

(71) Applicants and

(72) Inventors: SHEMESH, Eldad [IL/IL]; 3 Hakatzir Street,
30500 Binyamina (IL). SHEMESH-GRANOT, Liat
[IL/IL]; 3 Hakatzir Street, 30500 Binyamina (IL).

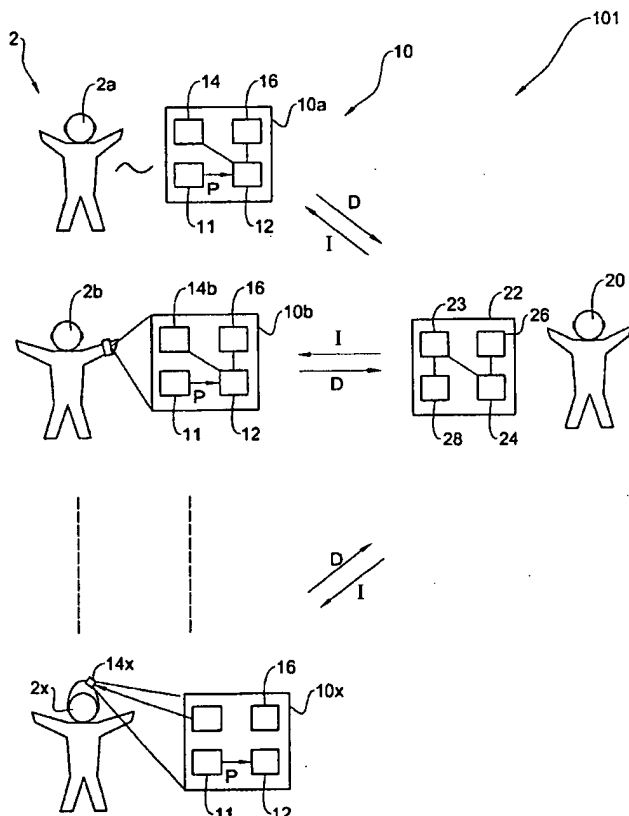
(74) Agent: REINHOLD COHN AND PARTNERS; P.O.
Box 4060, 61040 Tel Aviv (IL).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH,
CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG,
ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL,
IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK,
LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW,
MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL,
PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY,
TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA,
ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,
FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL,

[Continued on next page]

(54) Title: TRAINING AND INSTRUCTING SUPPORT DEVICE



(57) Abstract: A personal device is provided for measuring a training activity of a trainee having a body part which moves during this training activity, this movement at least partially defining said training activity. The device comprises a sensing unit adapted to repeatedly measure, during the training activity, parameters associated with the movement of the body part, and wherein the sensing unit comprising at least accelerometer means and gyroscope means. The device further comprises means for attaching the sensing unit to the body part and a processor adapted to receive from the sensing unit the parameters and to calculate based thereon, data indicative of the training activity. In addition, there are provided a system for use by an instructor in instructing of a plurality of participants engaged in an activity, a communication system for communicating with one or more swimmers, the system comprising a transmitting module adapted to communicate in accordance with a wireless communication protocol with at least one receiving module associated with at least one swimmer, and a method for automated training one or more swimmers accordingly.

WO 2008/032315 A1

PATENT COOPERATION TREATY

E

1

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

To:

REINHOLD COHN AND PARTNERS
P.O. Box. 4060
61040 Tel-Aviv
ISRAEL

RECEIVED

12-02-2008

REINHOLD COHN AND PARTNERS

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT AND
THE WRITTEN OPINION OF THE INTERNATIONAL
SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Date of mailing
(day/month/year)

06/02/2008

Applicant's or agent's file reference

177871.1 IL

FOR FURTHER ACTION

See paragraphs 1 and 4 below

International application No.

PCT/IL2007/001121

International filing date
(day/month/year)

11/09/2007

Applicant

SHEMESH, Eldad

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

When? The time limit for filing such amendments is normally two months from the date of transmittal of the International Search Report.

Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes
1211 Geneva 20, Switzerland, Facsimile No.: (41-22) 338.82.70

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.
3. ☐ **With regard to the protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

- ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.
- ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. Reminders

Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. These comments would also be made available to the public but not before the expiration of 30 months from the priority date.

Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until **30 months** from the priority date (in some Offices even later); otherwise, the applicant must, within **20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.

See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicant's Guide*, Volume II, National Chapters and the WIPO Internet site.

Name and mailing address of the International Searching Authority



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

Authorized officer

Laure Acquaviva

NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the *PCT Applicant's Guide*, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions, respectively.

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report and the written opinion of the International Searching Authority, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only (see *PCT Applicant's Guide*, Volume I/A, Annexes B1 and B2).

The attention of the applicant is drawn to the fact that amendments to the claims under Article 19 are not allowed where the International Searching Authority has declared, under Article 17(2), that no international search report would be established (see *PCT Applicant's Guide*, Volume I/A, paragraph 296).

What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

When?

Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

How?

Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/may accompany the amendments?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 177871.1 IL	FOR FURTHER ACTION see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/IL2007/001121	International filing date (day/month/year) 11/09/2007	(Earliest) Priority Date (day/month/year) 11/09/2006
Applicant SHEMESH, Eldad		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 4 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of:

- ☒ the international application in the language in which it was filed
☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (See Box No. II)

3. ☐ **Unity of invention is lacking** (see Box No. III)

4. With regard to the **title**,

- ☒ the text is approved as submitted by the applicant
☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

- ☒ the text is approved as submitted by the applicant
☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority

6. With regard to the **drawings**,

- a. the figure of the **drawings** to be published with the abstract is Figure No. 1
☒ as suggested by the applicant
☐ as selected by this Authority, because the applicant failed to suggest a figure
☐ as selected by this Authority, because this figure better characterizes the invention
b. ☐ none of the figures is to be published with the abstract

INTERNATIONAL SEARCH REPORT

International application No

PCT/IL2007/001121

A. CLASSIFICATION OF SUBJECT MATTER

INV. A63B69/00 A63B69/12 A63B71/02 A63B71/06 A63B24/00

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)

A63B G07C

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, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01/00281 A (TRAKUS INC [US]) 4 January 2001 (2001-01-04) page 3, lines 1-28 - page 7, lines 1-27 page 11, lines 27-30 - page 12, lines 1-30 page 15, lines 15-29 - page 16, lines 1-14 page 18, lines 5-20; figures page 22, lines 7-11 - page 29, lines 20,21; figures	1-29, 31-39
X	WO 01/10508 A (SMITH & NEPHEW [GB]; GRANVILLE NICHOLAS WILLIAM [GB]; POUNDER NEILL MA) 15 February 2001 (2001-02-15) page 3, lines 4-27 - page 4, lines 10-26 page 6, lines 27-29 - page 7, lines 1-21 page 16, lines 8-32 - page 17, lines 1-8 page 19, lines 9-13; figures	1-7, 9-15,22, 25-28
	----- -/--	

☒ Further documents are listed in the continuation of Box C.☒ See patent family 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.
- *Z* document member of the same patent family

Date of the actual completion of the international search

28 January 2008

Date of mailing of the international search report

06/02/2008

Name and mailing address of the ISA/

European Patent Office, P.B. 5816 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Teissier, Sara

INTERNATIONAL SEARCH REPORT

International application No

PCT/IL2007/001121

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 6 305 221 B1 (HUTCHINGS LAWRENCE J [US]) 23 October 2001 (2001-10-23) column 2, lines 65-67 - column 3, lines 1-3 column 5, lines 66,67 - column 6, lines 1-5 column 7, lines 47-67 - column 8, lines 1,2 column 9, lines 63-67 - column 10, lines 1-34 column 20, lines 26-48; figures -----	1-10, 12-14 30
X	WO 01/42809 A (ESPORT INC [US]) 14 June 2001 (2001-06-14) page 5, lines 1-25 - page 6, lines 1-5 page 20, lines 5-24; claims 2,3; figures -----	25-39
X A	WO 2004/038336 A (CLOTHING PLUS OY [FI]; REHO AKSELI [FI]; KARINSALO TAPIO [FI]) 6 May 2004 (2004-05-06) the whole document -----	19,25 1-18, 20-24, 26-39
X A	WO 00/67858 A (MYNHARDT GERHARD STEPHANUS [ZA]) 16 November 2000 (2000-11-16) page 2, lines 1-28 - page 3, lines 1-28; figures -----	19,25 1-18, 20-24, 26-39
A	US 5 600 730 A (KENNING PEGGY J [US] ET AL) 4 February 1997 (1997-02-04) cited in the application the whole document -----	1-39

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IL2007/001121

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 0100281	A	04-01-2001	AU 6202800 A	31-01-2001
WO 0110508	A	15-02-2001	AU 5089900 A	05-03-2001
			CA 2375335 A1	15-02-2001
			EP 1187662 A1	20-03-2002
			JP 2003506165 T	18-02-2003
US 6305221	B1	23-10-2001	NONE	
WO 0142809	A	14-06-2001	NONE	
WO 2004038336	A	06-05-2004	AU 2003275528 A1	13-05-2004
			EP 1561086 A1	10-08-2005
			US 2006098772 A1	11-05-2006
WO 0067858	A	16-11-2000	AU 4308500 A	21-11-2000
US 5600730	A	04-02-1997	NONE	

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY
(PCT Rule 43bis.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/IL2007/001121

International filing date (day/month/year)
11.09.2007

Priority date (day/month/year)
11.09.2006

International Patent Classification (IPC) or both national classification and IPC
INV. A63B69/00 A63B69/12 A63B71/02 A63B71/06 A63B24/00

Applicant
SHEMESH, Eldad

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:



European Patent Office
D-80298 Munich
Tel. +49 89 2399 - 0 Tx: 523656 epmu d
Fax: +49 89 2399 - 4465

Date of completion of
this opinion

see form
PCT/ISA/210

Authorized Officer

Teissier, Sara

Telephone No. +49 89 2399-2543



WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/IL2007/001121

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:
 - ☒ the international application in the language in which it was filed
 - ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material:
 - ☐ on paper
 - ☐ in electronic form
 - c. time of filing/furnishing:
 - ☐ contained in the international application as filed.
 - ☐ filed together with the international application in electronic form.
 - ☐ furnished subsequently to this Authority for the purposes of search.
4. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/IL2007/001121

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	
	No: Claims	<u>1-39</u>
Inventive step (IS)	Yes: Claims	
	No: Claims	<u>1-39</u>
Industrial applicability (IA)	Yes: Claims	<u>1-39</u>
	No: Claims	

2. Citations and explanations

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V.

1 Reference is made to the following documents:

- D1 : WO 01/00281 A (TRAKUS INC [US]) 4 January 2001 (2001-01-04)
- D2 : WO 01/10508 A (SMITH & NEPHEW [GB]; GRANVILLE NICHOLAS WILLIAM [GB]; POUNDER NEILL MA) 15 February 2001 (2001-02-15)
- D3 : US 6 305 221 B1 (HUTCHINGS LAWRENCE J [US]) 23 October 2001 (2001-10-23)
- D4 : WO 2004/038336 A (CLOTHING PLUS OY [FI]; REHO AKSELI [FI]; KARINSALO TAPIO [FI]) 6 May 2004 (2004-05-06)
- D5 : WO 00/67858 A (MYNHARDT GERHARD STEPHANUS [ZA]) 16 November 2000 (2000-11-16)
- D6 : WO 01/42809 A (ESPORT INC [US]) 14 June 2001 (2001-06-14)

2 INDEPENDENT CLAIM 1,19,25,35,38,39

2.1 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of **independent claims 1,19,25,35,38,39** are not new in the sense of Article 33(2) PCT.

Document D1 discloses (the references in parentheses applying to this document):

A personal device for measuring a training activity of a trainee having a body part which moves during said training activity (page 3 line , fig. 4a), this movement at least partially defining said training activity, said device comprising:

- a sensing unit adapted to repeatedly measure, during said training activity, parameters associated with the movement of said body part, and wherein said sensing unit comprising at least accelerometer means and gyroscope means (page 18, lines 5-20, page 29 lines 20,21);
- means for attaching the sensing unit to said body part (page 3 lines 23,24 figure 4a, figure 2a); and
- a processor adapted to receive from the sensing unit said parameters, and to calculate based thereon, data indicative of said training activity (figure 3).

Furthermore D1 discloses:

A system for use by an instructor in instructing of a plurality of participants engaged in an activity (page 6 lines 8-13 figure 2a,2c), comprising:

- a plurality of personal measuring devices each adapted for being worn by one of said participants and for repeatedly measuring, during said activity, parameters of the participant's movement;
- a computer adapted for being used by said instructor for wirelessly receiving from each of said personal measuring devices (page 7 lines 4-13), data, calculated based on said parameters, and having a monitor for displaying said data or information derived there from, and an input unit adapted to receive instructions from the instructor;
- a plurality of presentation units (page 6 lines 8-13 figure 2a,2c), each for presenting to said participant at least said instructions; and
- communication means connected to said computer adapted to wirelessly transfer said instructions directly or indirectly to each of said presentation units (page 7 lines 4-13).

And D1 discloses:

A communication system for communicating with one or more swimmers (page 3 lines 1-10), the system comprising a transmitting module adapted to communicate in accordance with a wireless communication protocol with at least one receiving module associated with at least one swimmer, wherein (page 4 lines 1-15):

- the transmitting module is adapted to obtain data designated to said at least one swimmer, to accommodate said data and/or derivatives thereof thus giving rise to accommodated data, to process the accommodated data in order to fit it to the wireless communication protocol, and to transmit the processed data to said at least one receiving module upon a predefined condition (figure 1);
- said at least one receiving module associated with said at least one swimmer is adapted to receive the data transmitted from the transmitting module and to process the received data in order to facilitate presenting the data to the swimmer (figure 1);
- the predefined condition is communication availability of said at least one receiving module; and

- the wireless communication protocol is configured to facilitate recognition of communication availability of said at least one receiving module (figures).

Therefore Independent claims 1,19,25 are not new with respect to document D1 in the sense of Article 33(2) PCT.

- 2.2 Moreover the subject-matter of the **independent claims 1** is not new with respect to document D2 or D3 (see search report).
- 2.3 Moreover the subject-matter of the **independent claims 19** is not new with respect to document D5 or D6 (see search report)
- 2.4 Moreover the subject-matter of the **independent claims 25** is not new with respect to documents D2 or D4 or D5 or D6 (see search report).
- 2.5 **Independent method claim 35** is directed to a method for an automated training method of independent claim 25, all steps of the method being inevitably carried out by the normal, intended use of the device according to any of documents D1, D2, D4-D6.
Therefore the subject-matter of Independent method claim 35 is not new in the sense of Article 33(2) PCT.
- 2.7 Since the device known from any of the documents D1-D6 would not work without a program element as defined in **independent claim 38** and a computer-readable medium as defined in **independent claim 39**, the subject-matter of these claims likewise lacks novelty (Article 54(1),(2) EPC).

Therefore the subject-matter of **independent claims 1,19,25,35,38,39** is not new in the sense of Article 54(1),(2) EPC.

4 DEPENDENT CLAIMS 2-18, 20-24, 26-34, 36,37

Dependent claims 2-18, 20-24, 26-34, 36,37 do not contain any features which, in

combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty (Article 33(2) and (3) PCT).

- 4.1 The subject-matter of **dependent claims 2-7,9,10,12-14** is not new as the features thereof are disclosed in D1 or D2 or D3 (see search report).
- 4.2 The subject-matter of **dependent claim 8** is not new as the features thereof are disclosed in D3 (see search report).
- 4.3 The subject-matter of **dependent claims 11,22,26-28** is not new as the features thereof are disclosed in D1 or D2 (see search report).
- 4.4 The subject-matter of **dependent claim 15** is not new as the features thereof are disclosed in D2 (search report).
- 4.5 The subject-matter of **dependent claims 16-18,20,21,23,24** is not new as the features thereof are disclosed in D1 (see search report).
- 4.6 The subject-matter of **dependent claims 29,31-34** is not new as the features thereof are disclosed in D1 or D4 (see search report).
- 4.7 The subject-matter of **dependent claim 30** is not new as the features thereof are disclosed in D4 (see search report).
- 4.8 The subject-matter of **dependent method claims 36,37** likewise is not new and not involves an inventive step in the sense of Article 33(2),(3) PCT following mutatis mutandis, the same reasons as above for independent method claim 35 (see point 2.5).

Re Item VII.

1. **Independents claims 1,19,25,35,38,39** are not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those fea-

tures known in combination from the prior art being placed in the preamble (Rule 6.3(b)(I) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).

2. The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

Re Item VIII.

1. Although claims 19,25 have been drafted as separate independent claims, they appear to comprise all the features of claim 1 and is therefore not appropriately formulated as claims dependent on the latter (Rule 6.4 PCT).
The aforementioned claims therefore lack conciseness and as such do not meet the requirements of Article 6 PCT.

Possible steps after receipt of the international search report (ISR) and written opinion of the International Searching Authority (WO-ISA)

General information	For all international applications filed on or after 01/01/2004 the competent ISA will establish an ISR. It is accompanied by the WO-ISA. Unlike the former written opinion of the IPEA (Rule 66.2 PCT), the WO-ISA is not meant to be responded to, but to be taken into consideration for further procedural steps. This document explains about the possibilities.
Amending claims under Art. 19 PCT	Within 2 months after the date of mailing of the ISR and the WO-ISA the applicant may file amended claims under Art. 19 PCT directly with the International Bureau of WIPO. The PCT reform of 2004 did not change this procedure. For further information please see Rule 46 PCT as well as form PCT/ISA/220 and the corresponding Notes to form PCT/ISA/220.
Filing a demand for international preliminary examination	<p>In principle, the WO-ISA will be considered as the written opinion of the IPEA. This should, in many cases, make it unnecessary to file a demand for international preliminary examination. If the applicant nevertheless wishes to file a demand this must be done before expiry of 3 months after the date of mailing of the ISR/ WO-ISA or 22 months after priority date, whichever expires later (Rule 54bis PCT). Amendments under Art. 34 PCT can be filed with the IPEA as before, normally at the same time as filing the demand (Rule 66.1 (b) PCT).</p> <p>If a demand for international preliminary examination is filed and no comments/amendments have been received the WO-ISA will be transformed by the IPEA into an IPRP (International Preliminary Report on Patentability) which would merely reflect the content of the WO-ISA. The demand can still be withdrawn (Art. 37 PCT).</p>
Filing informal comments	After receipt of the ISR/WO-ISA the applicant may file informal comments on the WO-ISA directly with the International Bureau of WIPO. These will be communicated to the designated Offices together with the IPRP (International Preliminary Report on Patentability) at 30 months from the priority date. Please also refer to the next box.
End of the international phase	At the end of the international phase the International Bureau of WIPO will transform the WO-ISA or, if a demand was filed, the written opinion of the IPEA into the IPRP, which will then be transmitted together with possible informal comments to the designated Offices. The IPRP replaces the former IPER (international preliminary examination report).
Relevant PCT Rules and more information	Rule 43 PCT, Rule 43bis PCT, Rule 44 PCT, Rule 44bis PCT, PCT Newsletter 12/2003, OJ 11/2003, OJ 12/2003

PATENT APPLICATION SERIAL NO. _____

**U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET**

03/12/2009 SHOHAMNE 00000005 12382214

01 FC:2011	165.00 OP
02 FC:2111	270.00 OP
03 FC:2311	110.00 OP
04 FC:2202	390.00 OP
05 FC:2201	330.00 OP

**PTO-1556
(5/87)**

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number

12382214

APPLICATION AS FILED – PART I

(Column 1)

(Column 2)

SMALL ENTITY

OR

**OTHER THAN
SMALL ENTITY**

FOR	NUMBER FILED	NUMBER EXTRA
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A
TOTAL CLAIMS (37 CFR 1.16(i))	35 minus 20 =	15
INDEPENDENT CLAIMS (37 CFR 1.16(h))	6 minus 3 =	3
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$260 (\$130 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).	
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))		

RATE (\$)	FEE (\$)
N/A	\$165
N/A	\$270
N/A	\$110
X \$26 =	390
X \$110 =	330
\$135	
\$195	
TOTAL	1265

OR

RATE (\$)	FEE (\$)
N/A	\$330
N/A	\$540
N/A	\$220
X \$52 =	
X \$220 =	
\$270	
\$390	
TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED – PART II

(Column 1)

(Column 2)

(Column 3)

SMALL ENTITY

OR

**OTHER THAN
SMALL ENTITY**

	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
Total (37 CFR 1.16(i))	*	Minus	**	=
Independent (37 CFR 1.16(h))	*	Minus	***	=
Application Size Fee (37 CFR 1.16(s))				
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))				

RATE (\$)	ADDI- TIONAL FEE (\$)
X \$26 =	
X \$110 =	
\$195	
TOTAL ADD'L FEE	

OR

RATE (\$)	ADDI- TIONAL FEE (\$)
X \$52 =	
X \$220 =	
\$390	
TOTAL ADD'L FEE	

	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
Total (37 CFR 1.16(i))	*	Minus	**	=
Independent (37 CFR 1.16(h))	*	Minus	***	=
Application Size Fee (37 CFR 1.16(s))				
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))				

RATE (\$)	ADDI- TIONAL FEE (\$)
X \$26 =	
X \$110 =	
\$195	
TOTAL ADD'L FEE	

OR

RATE (\$)	ADDI- TIONAL FEE (\$)
X \$52 =	
X \$220 =	
\$390	
TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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