US009709971B2

(12) **United States Patent**
Ellis

(10) **Patent No.: US 9,709,971 B2**
(45) **Date of Patent: *Jul. 18, 2017**

(54) **BLADDERS, COMPARTMENTS, CHAMBERS OR INTERNAL SIPES CONTROLLED BY A WEB-BASED CLOUD COMPUTER SYSTEM USING A SMARTPHONE DEVICE**

(71) Applicant: **Frampton E. Ellis**, Jasper, FL (US)

(72) Inventor: **Frampton E. Ellis**, Jasper, FL (US)

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

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **15/298,441**

(22) Filed: **Oct. 20, 2016**

(65) **Prior Publication Data**

US 2017/0038747 A1 Feb. 9, 2017

Related U.S. Application Data

(63) Continuation of application No. 15/164,650, filed on May 25, 2016, now Pat. No. 9,504,291, which is a (Continued)

(51) **Int. Cl.**
G05B 15/02 (2006.01)
A43B 13/38 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***G05B 15/02*** (2013.01); ***A41D 1/002*** (2013.01); ***A43B 1/0054*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC G05B 15/02; A43B 13/38
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,649,552 A 3/1987 Yukawa
4,989,349 A 2/1991 Ellis, III
(Continued)

FOREIGN PATENT DOCUMENTS

KR 1020090049572 A 5/2009
KR 1020110071727 A 6/2011
(Continued)

OTHER PUBLICATIONS

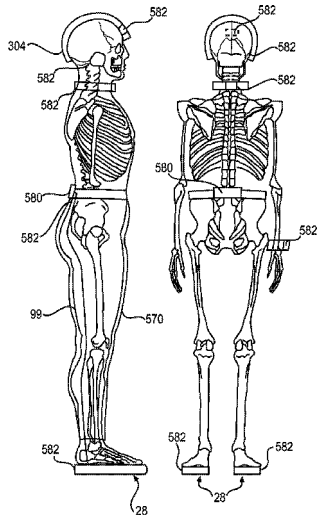
Morris, S. J., et al., "Shoe-Integrated Sensor system for Wireless Gait Analysis and Real-Time Feedback," Proceedings of the Second Joint EMBS/BMES Conference, Houston, TX, USA, Oct. 23-26, 2002, pp. 2468-2469.
(Continued)

Primary Examiner — Joseph Feild
Assistant Examiner — Omar Casillashernandez
(74) *Attorney, Agent, or Firm* — Mendelsohn Dunleavy, P.C.

(57) **ABSTRACT**

A computer system including a Web site and/or a cloud array of computers configured to have a connection to a smartphone or other mobile computer device and use the device and connection to control a configuration of one or more bladders, compartments, chambers and internal sipes located in a sole or removable inner sole insert of footwear. The computer system can also use the device and connection to transmit data to the computer system for storage and/or shared or independent processing and/or analysis, process data from sensors located in either one or both of the sole or the removable inner sole insert of the device user, and in, on, or near a center of gravity of the device user, and use the processed data to alter a configuration of the bladders, compartments, chambers and internal sipes.

30 Claims, 40 Drawing Sheets



Related U.S. Application Data

continuation of application No. 14/922,408, filed on Oct. 26, 2015, now Pat. No. 9,375,047, which is a continuation of application No. 14/722,547, filed on May 27, 2015, now Pat. No. 9,207,660, which is a continuation of application No. 14/615,749, filed on Feb. 6, 2015, now Pat. No. 9,100,495, which is a continuation of application No. 14/605,192, filed on Jan. 26, 2015, now Pat. No. 9,063,529, and a continuation of application No. 14/605,177, filed on Jan. 26, 2015, now Pat. No. 9,160,836, said application No. 14/605,192 is a continuation of application No. 13/859,859, filed on Apr. 10, 2013, now Pat. No. 9,030,335, said application No. 14/605,177 is a continuation of application No. 13/859,859, filed on Apr. 10, 2013, now Pat. No. 9,030,335.

(60) Provisional application No. 61/852,038, filed on Mar. 15, 2013, provisional application No. 61/851,869, filed on Mar. 14, 2013, provisional application No. 61/851,598, filed on Mar. 11, 2013, provisional application No. 61/687,127, filed on Apr. 19, 2012, provisional application No. 61/687,072, filed on Apr. 18, 2012.

(51) **Int. Cl.**

A43B 13/18	(2006.01)
A43B 13/40	(2006.01)
A43B 1/00	(2006.01)
A43B 3/00	(2006.01)
A43B 7/14	(2006.01)
H04L 29/08	(2006.01)
H04M 1/725	(2006.01)
H04W 24/04	(2009.01)
G08C 17/02	(2006.01)
G05B 19/406	(2006.01)
A41D 1/00	(2006.01)
A43B 17/02	(2006.01)
A61B 5/00	(2006.01)
A61B 5/103	(2006.01)
A61F 5/14	(2006.01)
A43B 13/20	(2006.01)
H04W 84/18	(2009.01)

(52) **U.S. Cl.**

CPC ***A43B 3/0005*** (2013.01); ***A43B 3/0015*** (2013.01); ***A43B 7/14*** (2013.01); ***A43B 13/18*** (2013.01); ***A43B 13/181*** (2013.01); ***A43B 13/186*** (2013.01); ***A43B 13/189*** (2013.01); ***A43B 13/203*** (2013.01); ***A43B 13/38*** (2013.01); ***A43B 13/40*** (2013.01); ***A43B 17/026*** (2013.01); ***A61B 5/0022*** (2013.01); ***A61B 5/1036*** (2013.01); ***A61B 5/6807*** (2013.01); ***A61F 5/14*** (2013.01); ***G05B 19/406*** (2013.01); ***G08C 17/02*** (2013.01); ***H04L 67/125*** (2013.01); ***H04M 1/7253*** (2013.01); ***H04W 24/04*** (2013.01); *A43B 1/00* (2013.01); *A43B 3/00* (2013.01); *A43B 13/20* (2013.01); *G05B 2219/40568* (2013.01); *G05B 2219/45243* (2013.01); *H04W 84/18* (2013.01)

(58) **Field of Classification Search**

USPC 340/870.07; 36/29

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,317,819	A	6/1994	Ellis, III	
5,544,429	A	8/1996	Ellis, III	
5,813,142	A	9/1998	Demon	
5,909,948	A	6/1999	Ellis, III	
6,115,941	A	9/2000	Ellis, III	
6,115,945	A	9/2000	Ellis, III	
6,163,982	A	12/2000	Ellis, III	
6,295,744	B1	10/2001	Ellis, III	
6,308,439	B1	10/2001	Ellis, III	
6,314,662	B1	11/2001	Ellis, III	
6,360,453	B1	3/2002	Ellis, III	
6,487,795	B1	12/2002	Ellis, III	
6,584,706	B1	7/2003	Ellis, III	
6,591,519	B1	7/2003	Ellis, III	
6,609,312	B1	8/2003	Ellis, III	
6,629,376	B1	10/2003	Ellis, III	
6,662,470	B2	12/2003	Ellis, III	
6,675,498	B1	1/2004	Ellis, III	
6,675,499	B2	1/2004	Ellis, III	
6,708,424	B1	3/2004	Ellis, III	
6,729,046	B2	5/2004	Ellis, III	
6,748,674	B2	6/2004	Ellis, III	
6,763,616	B2	7/2004	Ellis, III	
6,782,641	B2	8/2004	Turner et al.	
6,789,331	B1	9/2004	Ellis, III	
6,810,606	B1	11/2004	Ellis, III	
6,877,254	B2	4/2005	Ellis, III	
6,918,197	B2	7/2005	Ellis, III	
7,010,869	B1	3/2006	Ellis, III	
7,082,697	B2	8/2006	Ellis, III	
7,093,379	B2	8/2006	Ellis, III	
7,119,510	B2	10/2006	Kawai	
7,127,834	B2	10/2006	Ellis, III	
7,168,185	B2	1/2007	Ellis, III	
7,174,658	B2	2/2007	Ellis, III	
7,191,644	B2	3/2007	Haselhurst et al.	
7,334,350	B2	2/2008	Ellis, III	
7,676,960	B2	3/2010	DiBenedetto et al.	
7,713,173	B2	5/2010	Shin et al.	
7,822,391	B1	10/2010	Delker et al.	
8,209,882	B2	7/2012	Leimer et al.	
8,291,614	B2	10/2012	Ellis	
9,030,335	B2	5/2015	Ellis	
9,063,529	B2	6/2015	Ellis	
9,100,495	B2	8/2015	Ellis	
9,160,836	B2	10/2015	Ellis	
9,207,660	B2	12/2015	Ellis	
9,375,047	B2	6/2016	Ellis	
2002/0000051	A1	1/2002	Ellis	
2002/0007571	A1	1/2002	Ellis	
2002/0007572	A1	1/2002	Ellis	
2002/0014020	A1	2/2002	Ellis	
2002/0014021	A1	2/2002	Ellis	
2002/0023373	A1	2/2002	Ellis	
2002/0073578	A1	6/2002	Ellis	
2002/0116841	A1	8/2002	Ellis	
2003/0009308	A1	1/2003	Kirtley	
2003/0046830	A1	3/2003	Ellis	
2003/0070320	A1	4/2003	Ellis	
2003/0079375	A1	5/2003	Ellis	
2003/0131497	A1	7/2003	Ellis	
2003/0208926	A1	11/2003	Ellis	
2003/0217482	A1	11/2003	Ellis	
2004/0025375	A1	2/2004	Turner et al.	
2004/0134096	A1	7/2004	Ellis	
2004/0250447	A1	12/2004	Ellis	
2005/0016020	A1	1/2005	Ellis	
2005/0086837	A1	4/2005	Ellis	
2005/0217142	A1	10/2005	Ellis, III	
2005/0217143	A1	10/2005	Ellis	
2006/0032086	A1	2/2006	Ellis	
2006/0248749	A1	11/2006	Ellis	
2007/0006489	A1 *	1/2007	Case, Jr.	A43B 3/0005 36/132
2007/0123391	A1	5/2007	Shin et al.	

(56) **References Cited**

U.S. PATENT DOCUMENTS

2007/0163147	A1	7/2007	Cavanagh et al.
2007/0175066	A1	8/2007	Hann
2007/0180736	A1	8/2007	DiBenedetto et al.
2008/0086916	A1	4/2008	Ellis
2009/0107009	A1	4/2009	Bishop et al.
2009/0183387	A1	7/2009	Ellis
2009/0200661	A1	8/2009	Ellis
2011/0056093	A1	3/2011	Ellis, III
2011/0153261	A1	6/2011	Jang et al.
2011/0197157	A1	8/2011	Hoffman et al.
2011/0305357	A1	12/2011	Wells
2012/0054137	A1	3/2012	Alush
2012/0186101	A1	7/2012	Sanchez
2012/0265434	A1	10/2012	Woodard et al.
2013/0047461	A1	2/2013	Tzeng
2015/0257479	A1	9/2015	Ellis

FOREIGN PATENT DOCUMENTS

WO	WO2007126510	A2	11/2007
WO	WO2007126518	A1	11/2007

OTHER PUBLICATIONS

Salpavaara, T., et al., "Wireless Insole Sensor System for Plantar Force Measurements During Sport Events," XIX IMEKO World Congress, Fundamental and Applied Metrology, Sep. 6-11, 2009, Lisbon, Portugal, pp. 2118-2123.

Ran, L. Y. "Development of Instrumented Insole Using Force Sensing Resistors," Faculty of Engineering and Science, Universiti Tanku Abdul Rahman, Apr. 2011, pp. i-319.

Murphy, N., et al., "Foot Pressure Measurement in a Clinical Setting," Tekscan, Inc. 2012, Retrieved from www.tekscan.com/medical., pp. 1-17.

Chumanov, E.S., et al., "Tracking the position of insole pressure sensors during walking and running". In: Proceedings from the 30th annual meeting of the american society of biomechanics, Stanford University, CA, 2007, pp. 1-2.

Carr, K., et al. "Biomechanics Gait Analysis Lab: Final Report," UCONN Biomedical Engineering, Team 3, 2006, pp. i-140.

"The Pedar System," Retrieved on Apr. 11, 2013 from http://novel.de/novelcontent/pedar, pp. 1-2.

Petei, D.L., et al., "Time dependent behaviour of a force-sensitive resistor plantar pressure measurement insole." Proc Instn Mech Engrs 1996, vol. 210, No. 2, pp. 121-125.

International Search Report and Written Opinion; Mailed Jul. 30, 2013 for corresponding PCT Application No. PCT/US2013/037045.

Complete file history for U.S. Appl. No. 13/859,859 on Feb. 5, 2015.

Complete file history for U.S. Appl. No. 14/605,192 on Jul. 13, 2015.

Complete file history for U.S. Appl. No. 14/605,177 on Jul. 16, 2015.

Complete file history for U.S. Appl. No. 14/615,749 on Jul. 16, 2015.

Partial file history for U.S. Appl. No. 13/859,859 from Mar. 4, 2015 to Apr. 22, 2015.

Partial file history for U.S. Appl. No. 14/605,192 from Sep. 4, 2015 to present.

Partial file history for U.S. Appl. No. 14/605,177 from Sep. 2, 2015 to present.

Partial file history for U.S. Appl. No. 14/615,749 from Jul. 29, 2015 to present.

European Search Report; Mailed Dec. 14, 2015 for EP Application No. 13778247.0.

Complete file history for U.S. Appl. No. 15/164,650 on Oct. 18, 2016.

* cited by examiner

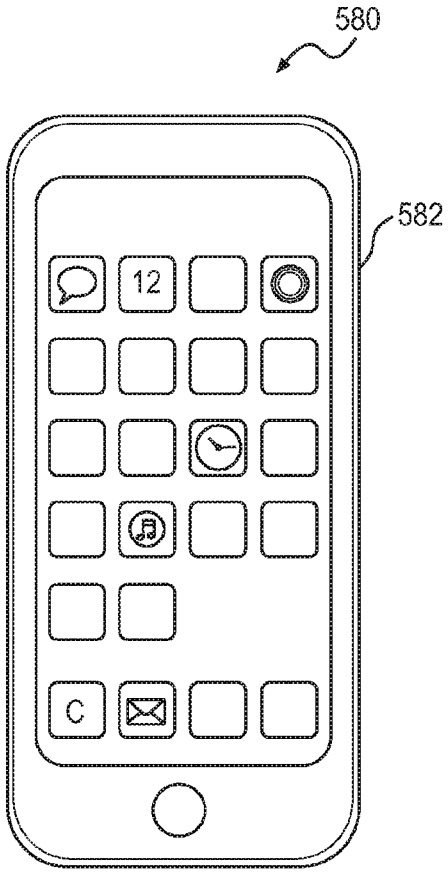


FIG. 1A

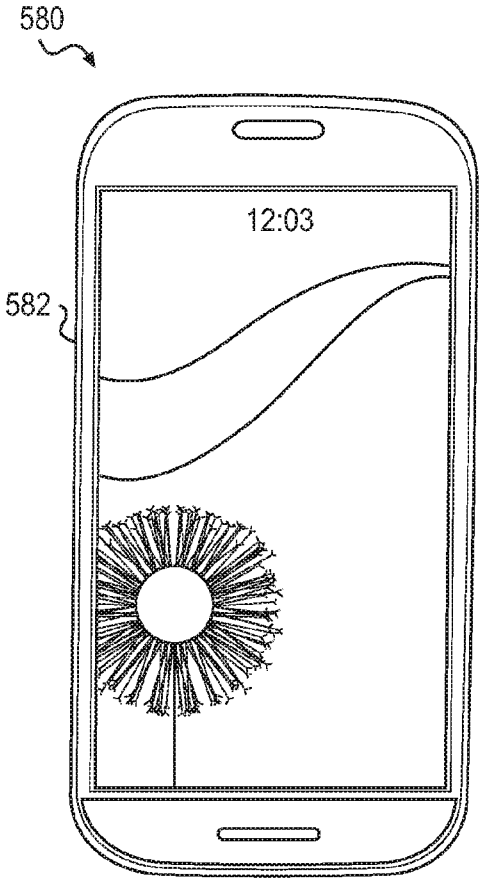


FIG. 1B

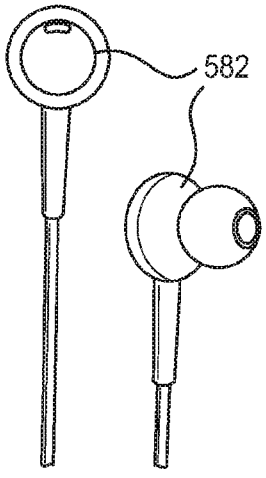


FIG. 2A

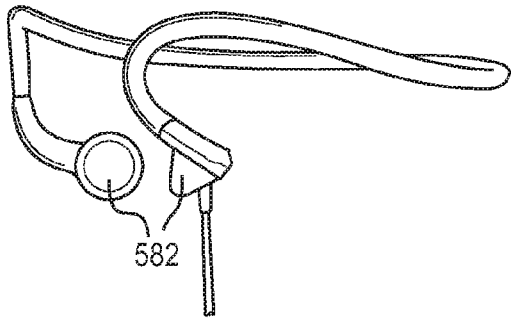


FIG. 2B

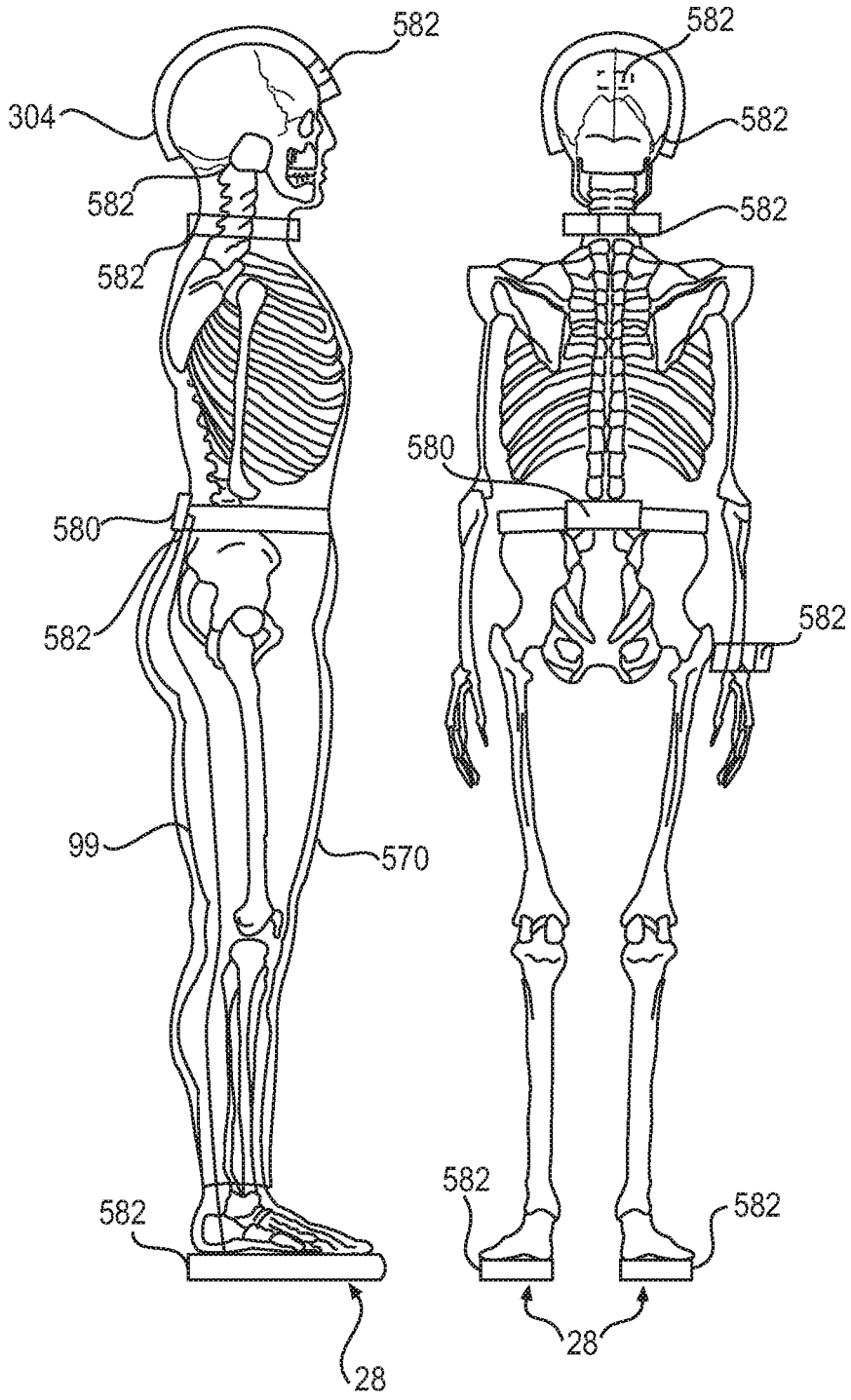

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FIG. 3

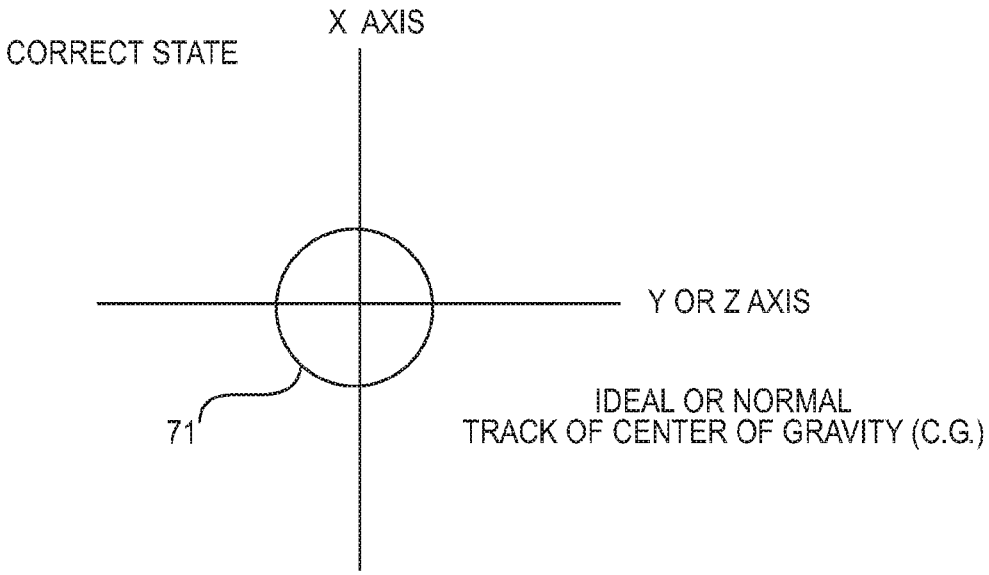

CORRECT STATE
X AXIS
Y OR Z AXIS
71
IDEAL OR NORMAL
TRACK OF CENTER OF GRAVITY (C.G.)

FIG. 4A

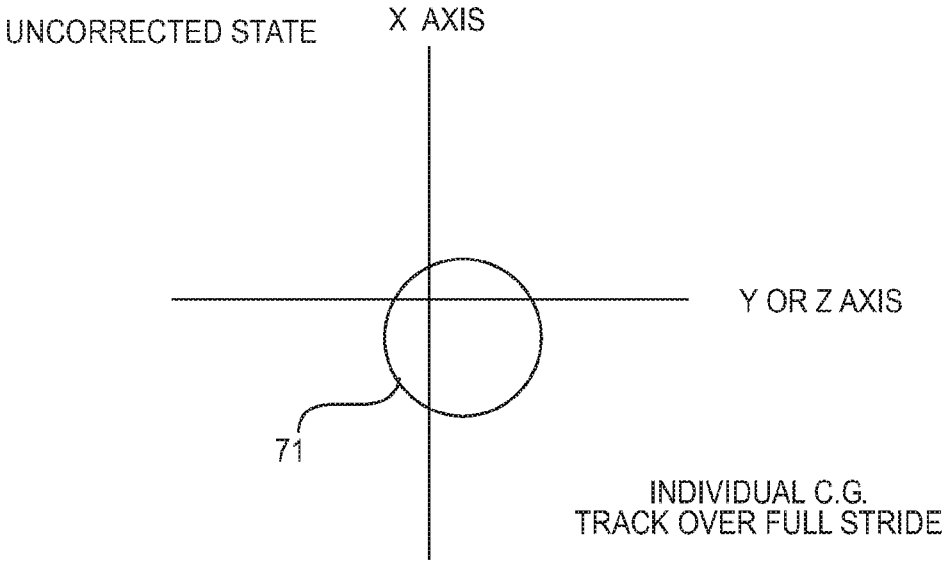

UNCORRECTED STATE
X AXIS
Y OR Z AXIS
71
INDIVIDUAL C.G.
TRACK OVER FULL STRIDE

FIG. 4B

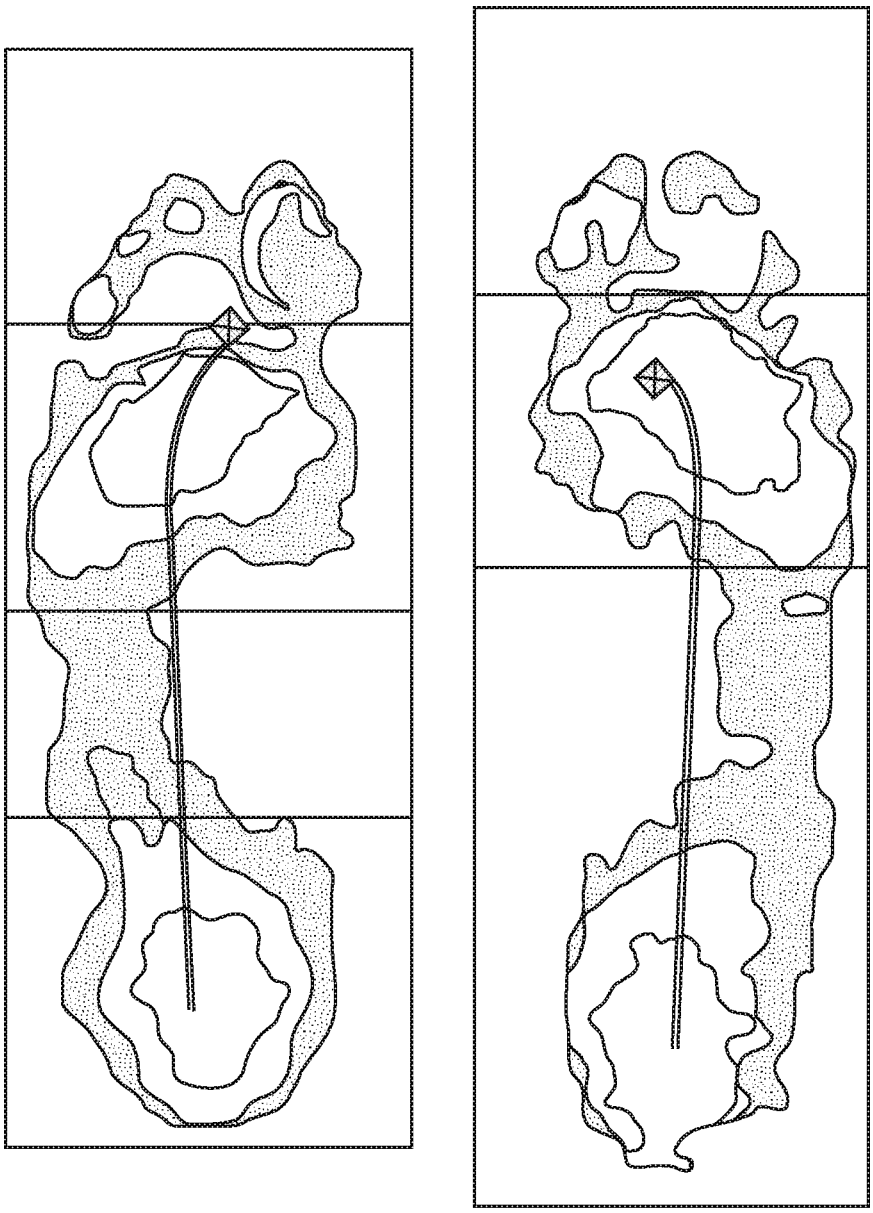


FIG. 5
PRIOR ART

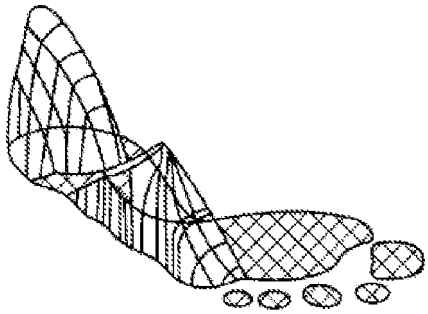


FIG. 6A
PRIOR ART

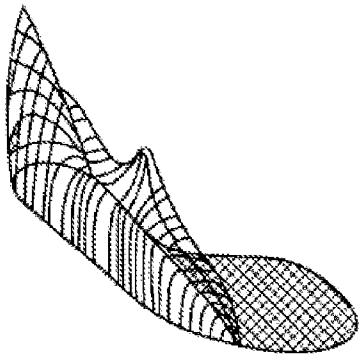


FIG. 6B
PRIOR ART

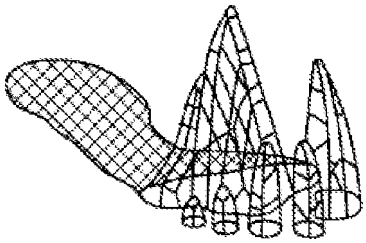


FIG. 6C
PRIOR ART

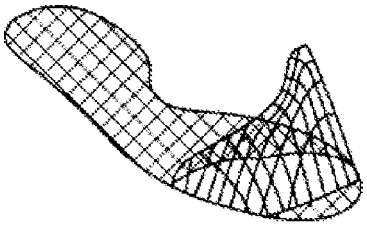


FIG. 6D
PRIOR ART

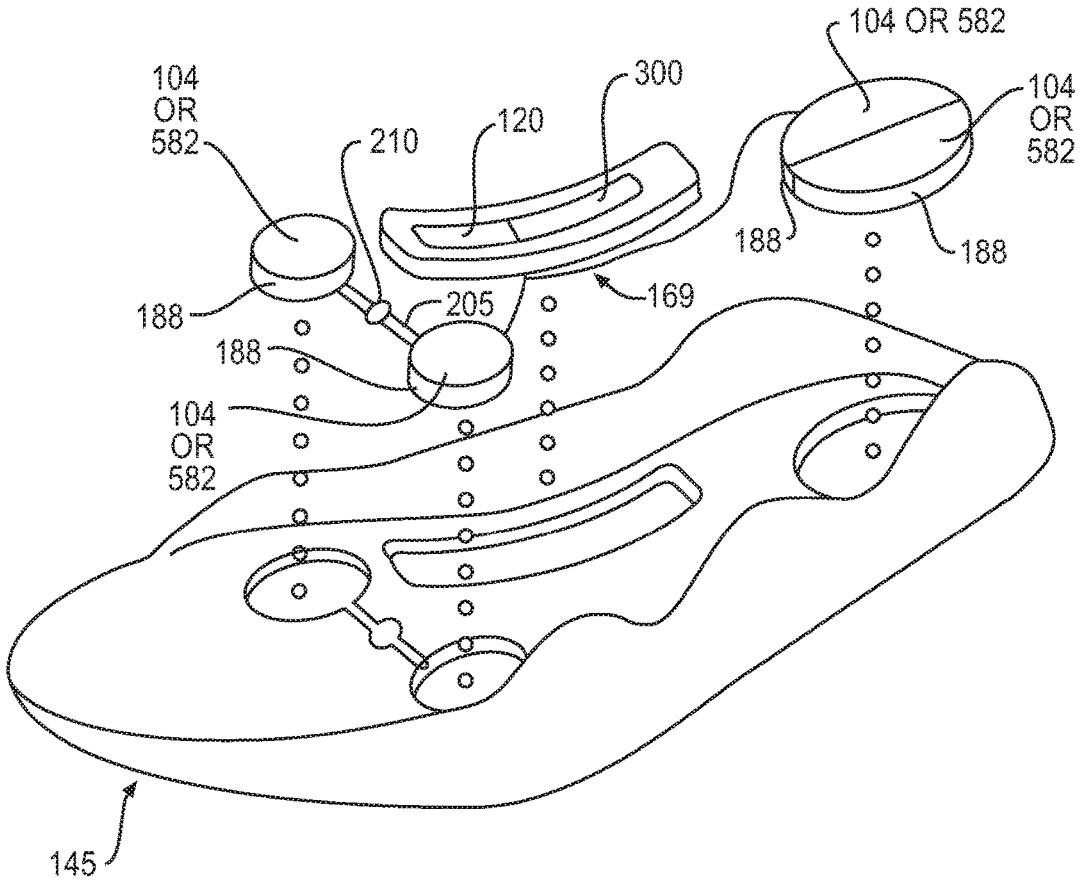


FIG. 7
PRIOR ART

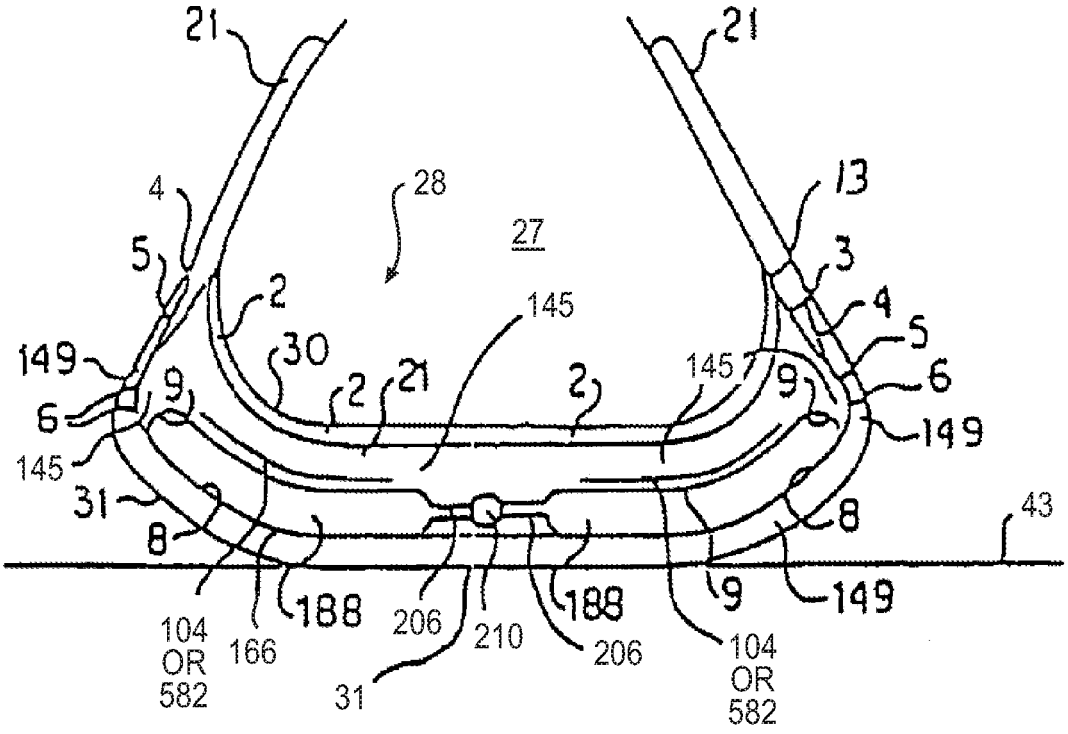


FIG. 8
PRIOR ART

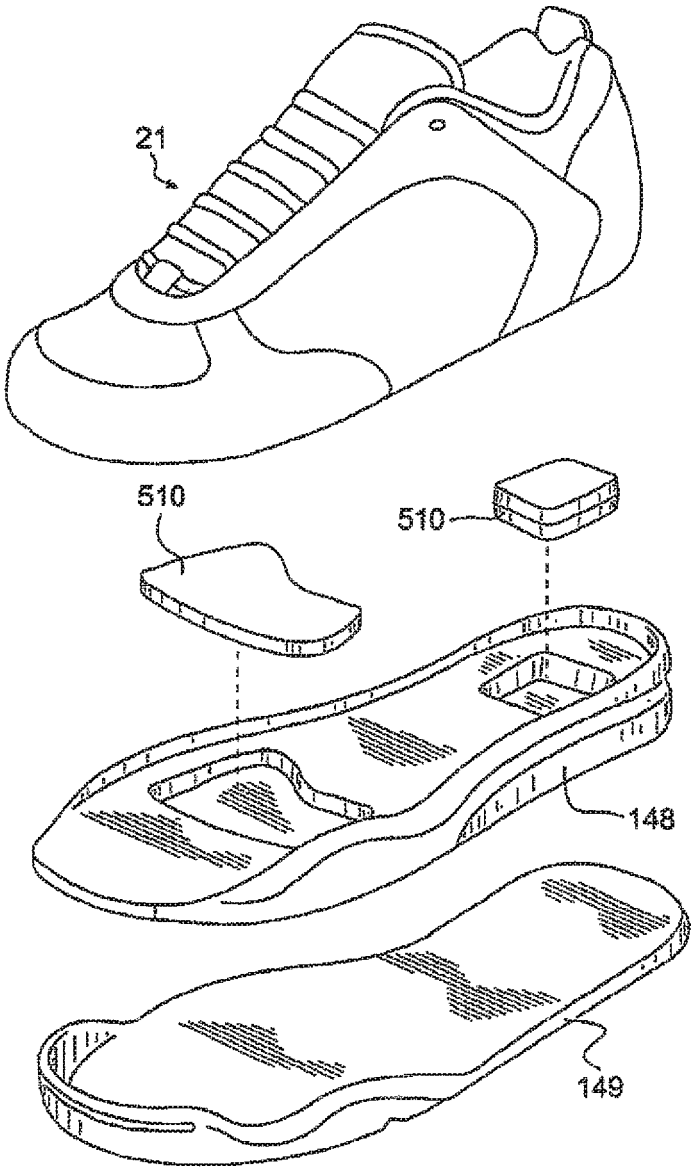


FIG. 9
PRIOR ART

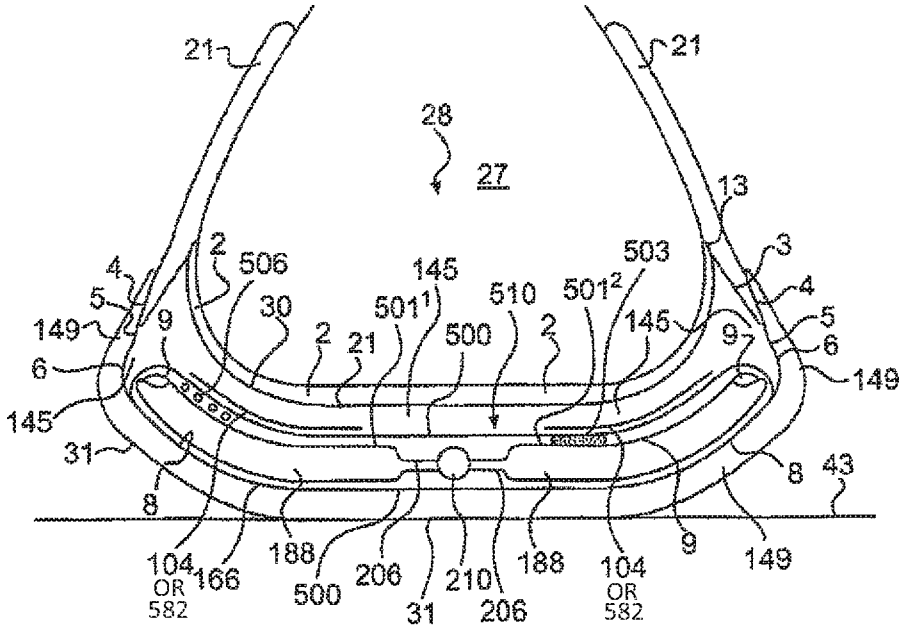


FIG. 10A
PRIOR ART

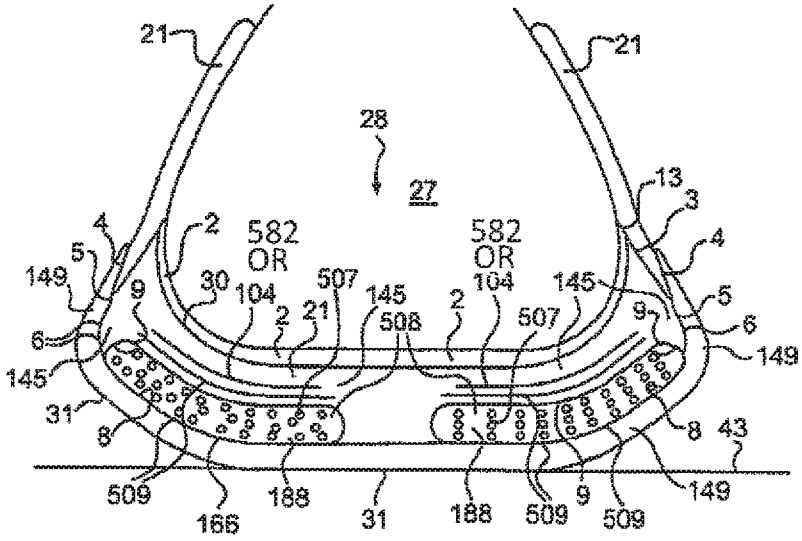
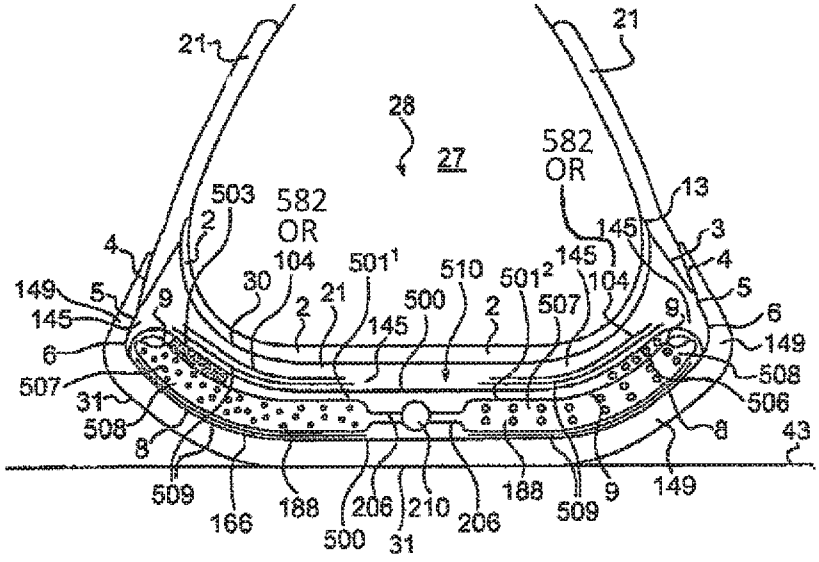


FIG. 10B
PRIOR ART



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PRIOR ART

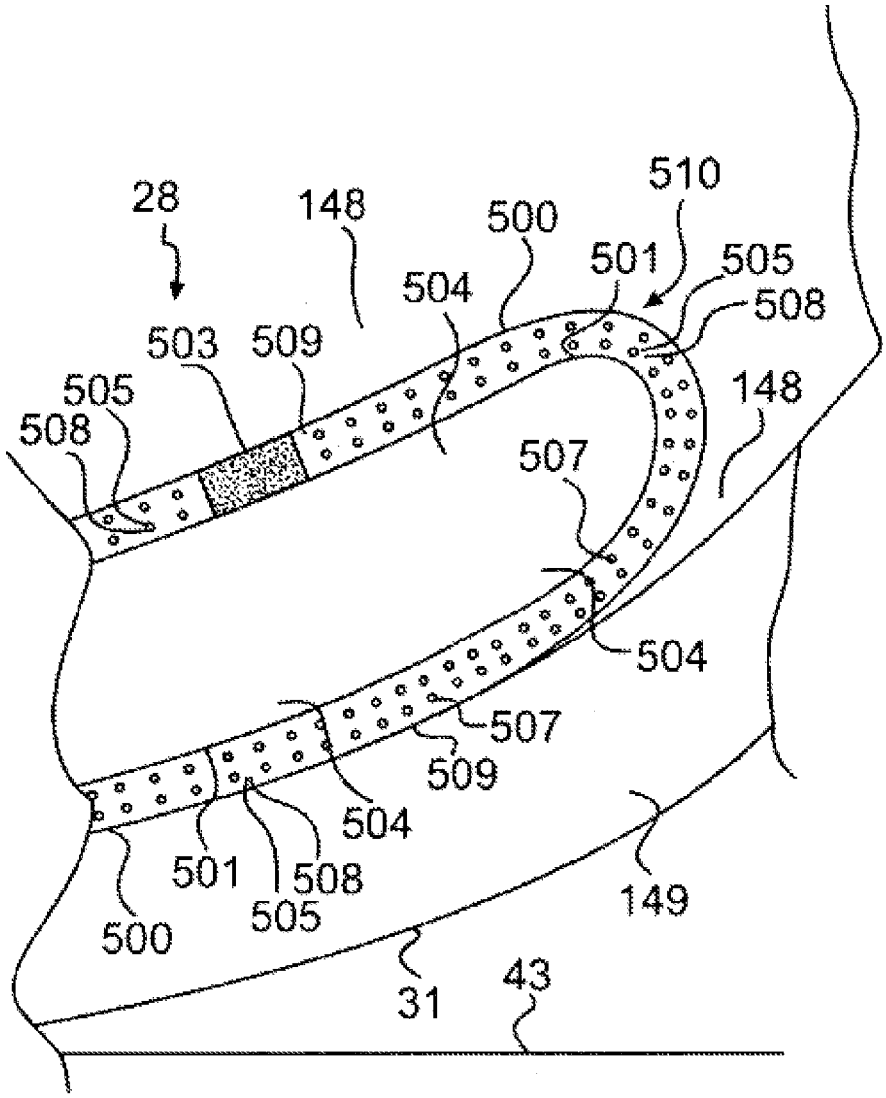


FIG. 10D
PRIOR ART

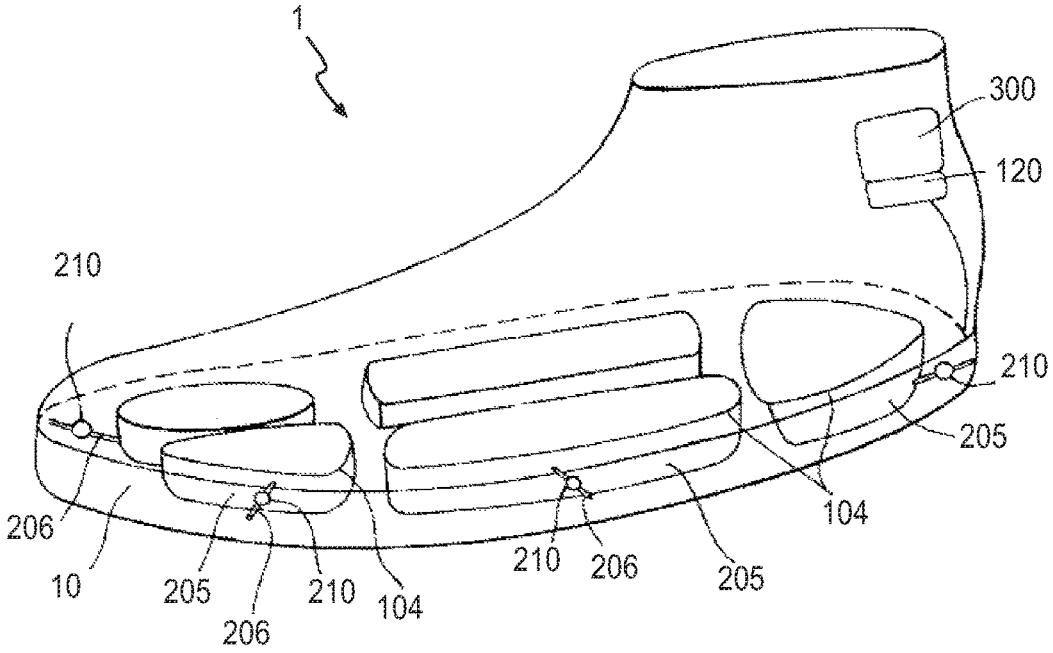
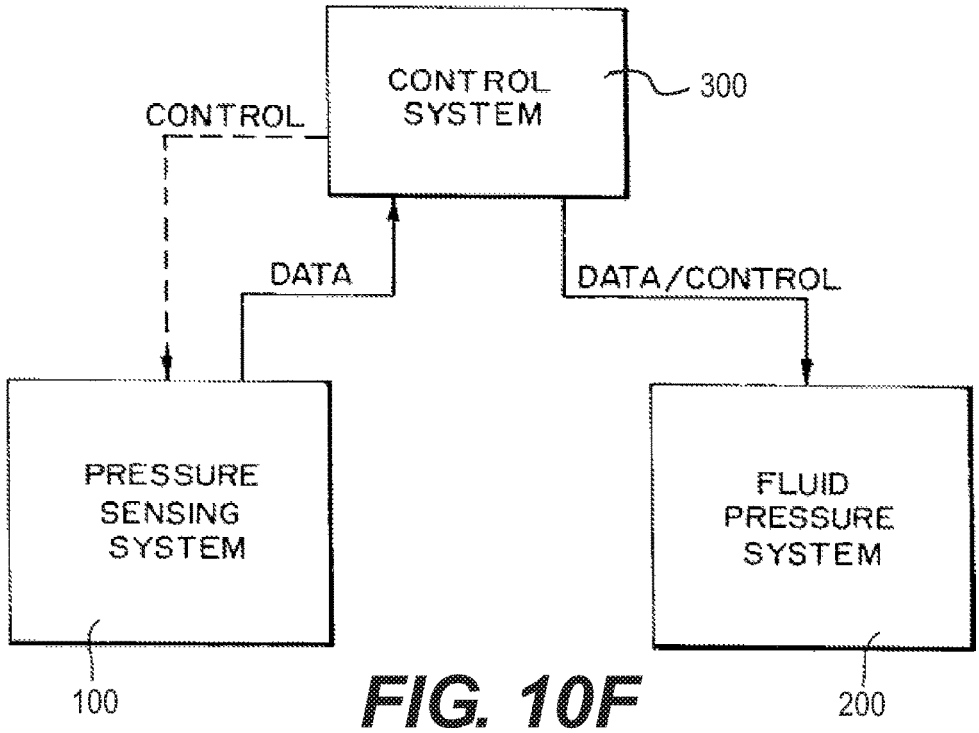


FIG. 10E
PRIOR ART



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PRIOR ART

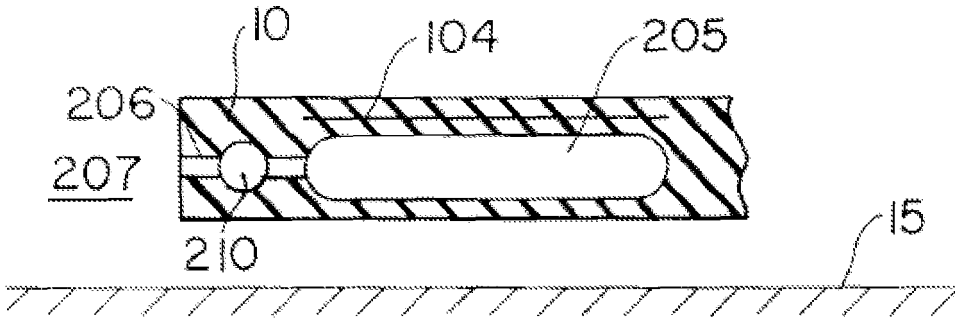


FIG. 10G
PRIOR ART

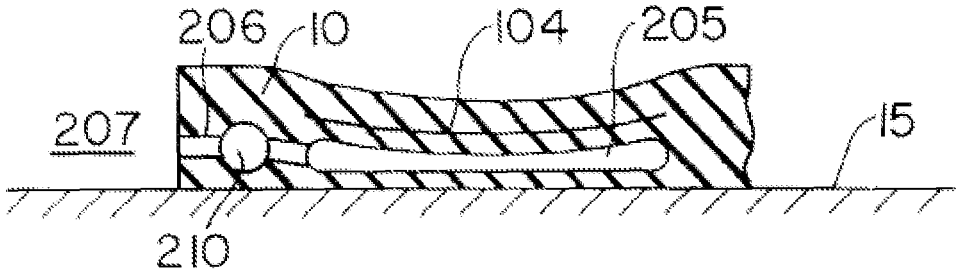


FIG. 10H
PRIOR ART

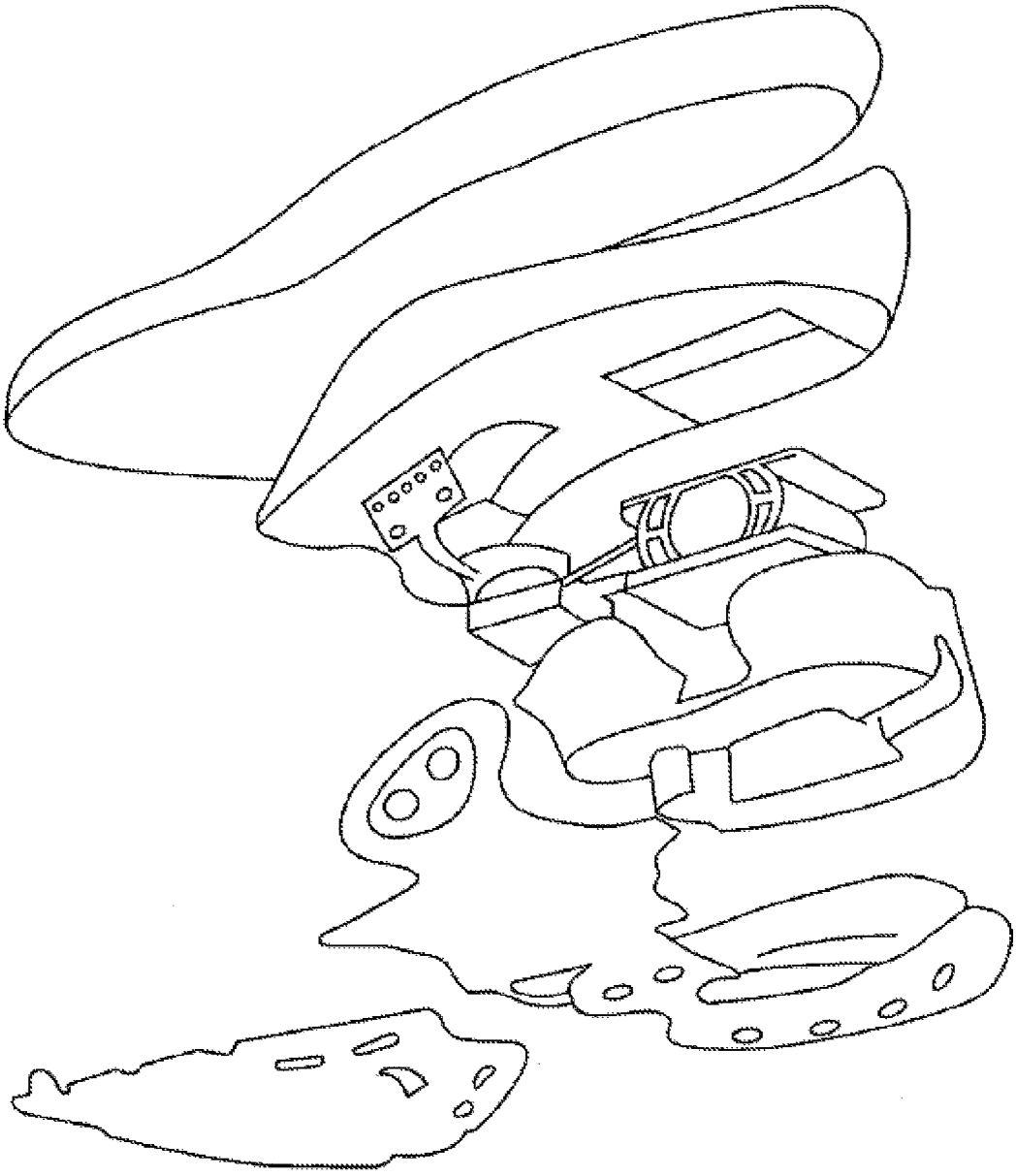
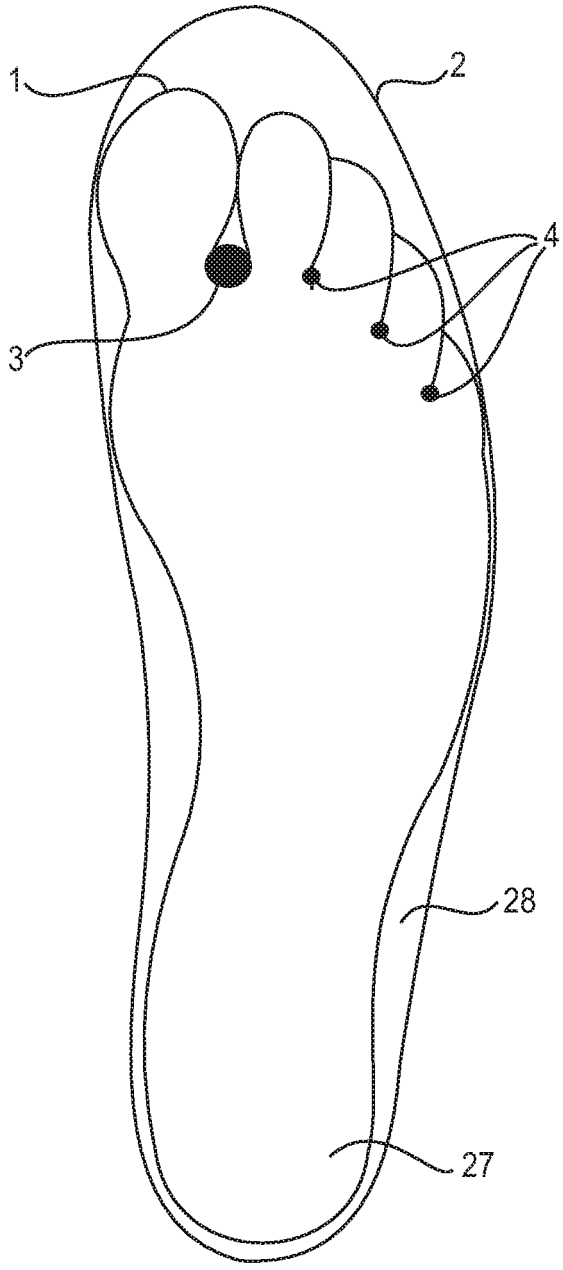


FIG. 10I
PRIOR ART



HORIZONTAL VIEW

FIG. 11A

FIG. 11E

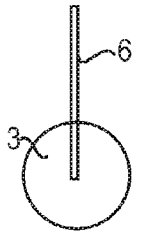
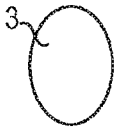


FIG. 11C



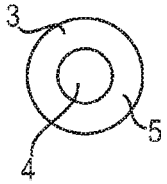


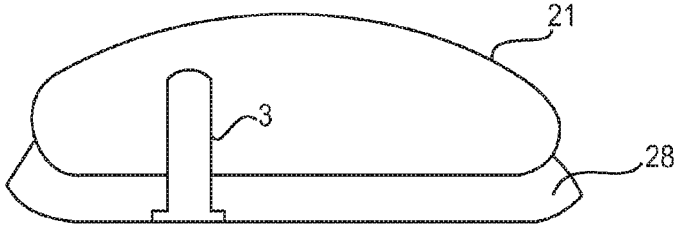
FIG. 11B

ANTERIOR

FIG. 11D

HORIZONTAL CROSS SECTION

FIG. 11F



FRONTAL PLANE
CROSS SECTION

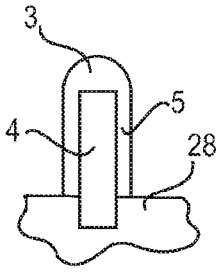


FIG. 11G

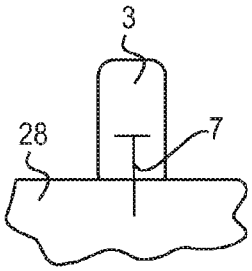


FIG. 11H

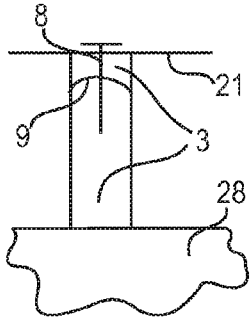


FIG. 11I

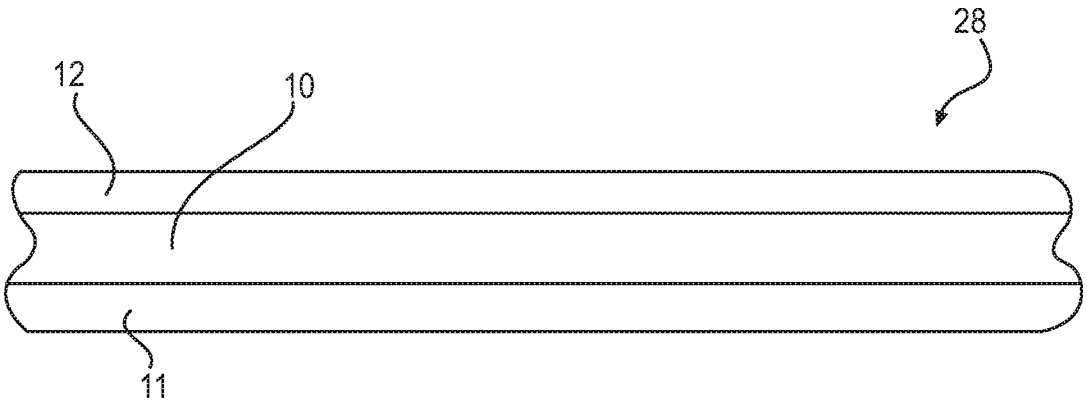
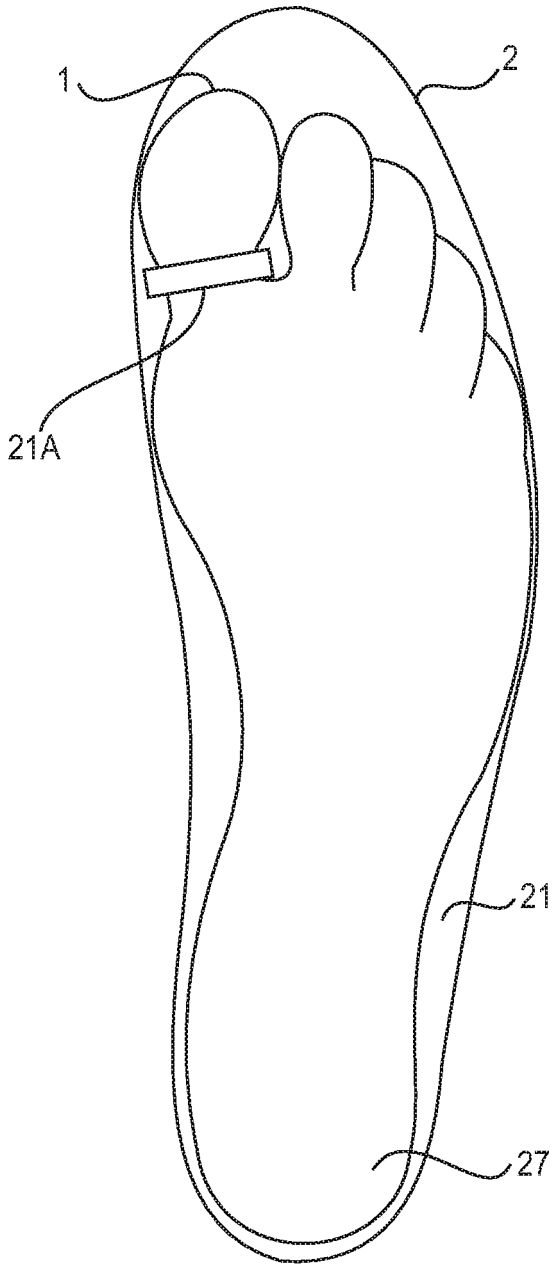


FIG. 12A



HORIZONTAL VIEW FROM BOTTOM UPWARD

FIG. 12B

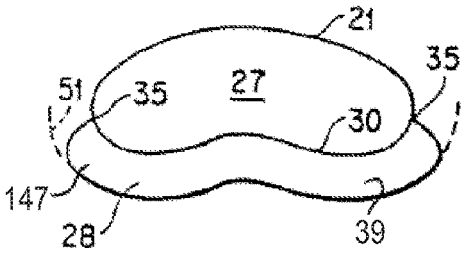


FIG. 13A
PRIOR ART

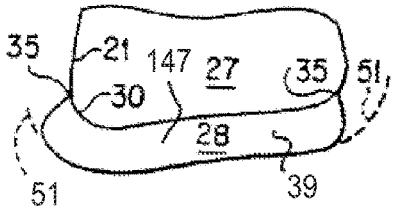


FIG. 13B
PRIOR ART

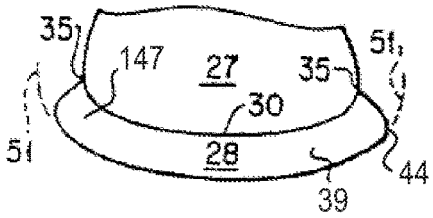


FIG. 13C
PRIOR ART

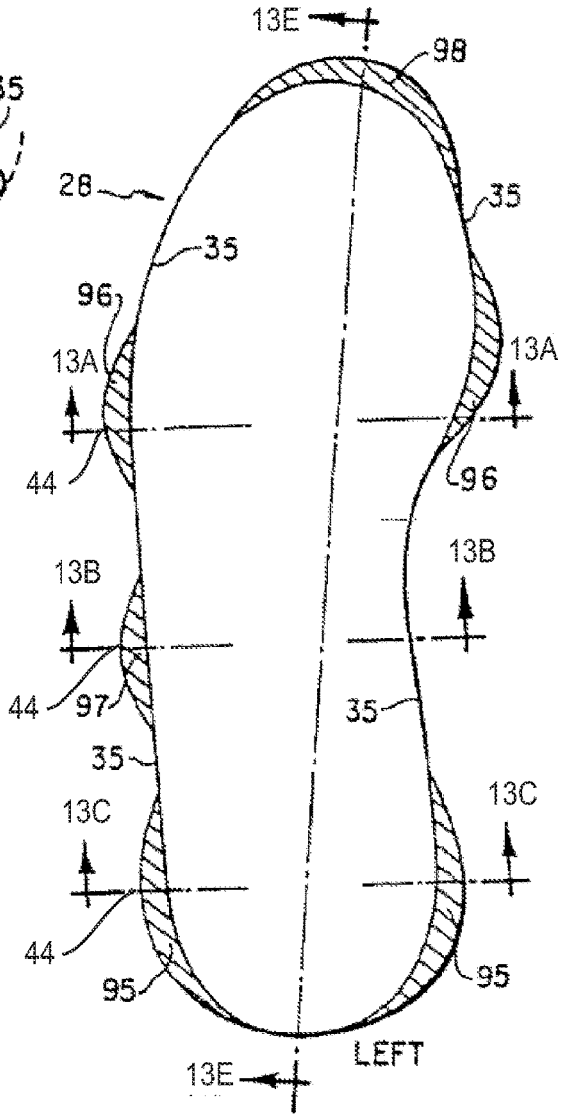


FIG. 13D
PRIOR ART

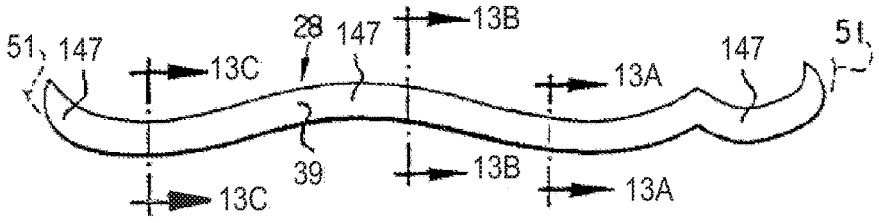


FIG. 13E
PRIOR ART

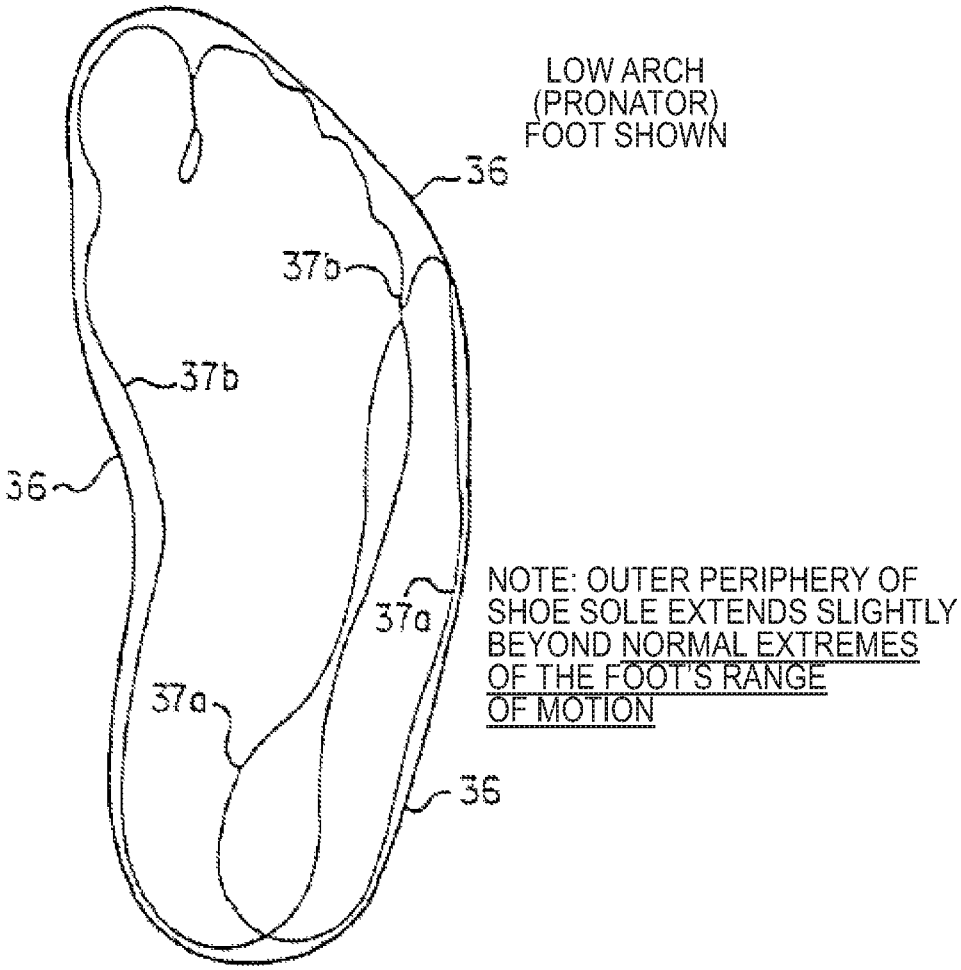


FIG. 14A
PRIOR ART

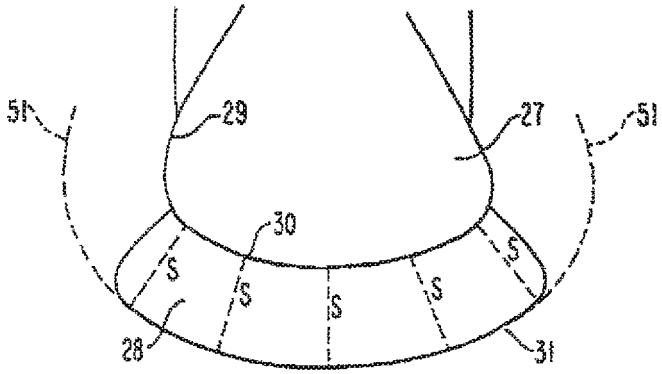


FIG. 14B
PRIOR ART

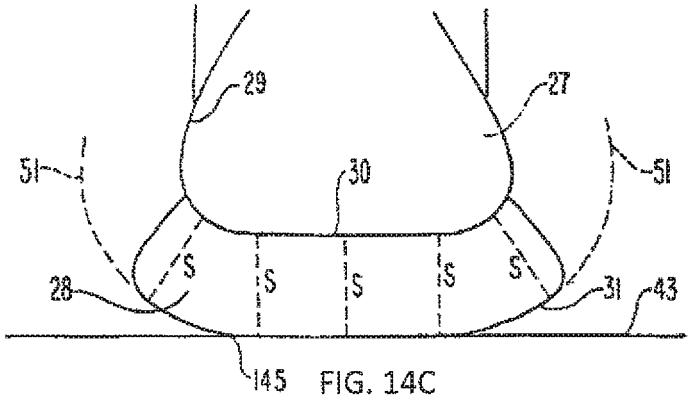


FIG. 14C
PRIOR ART

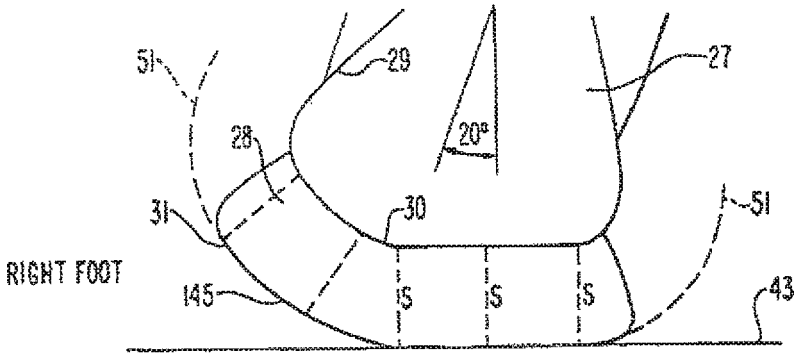


FIG. 14D
PRIOR ART

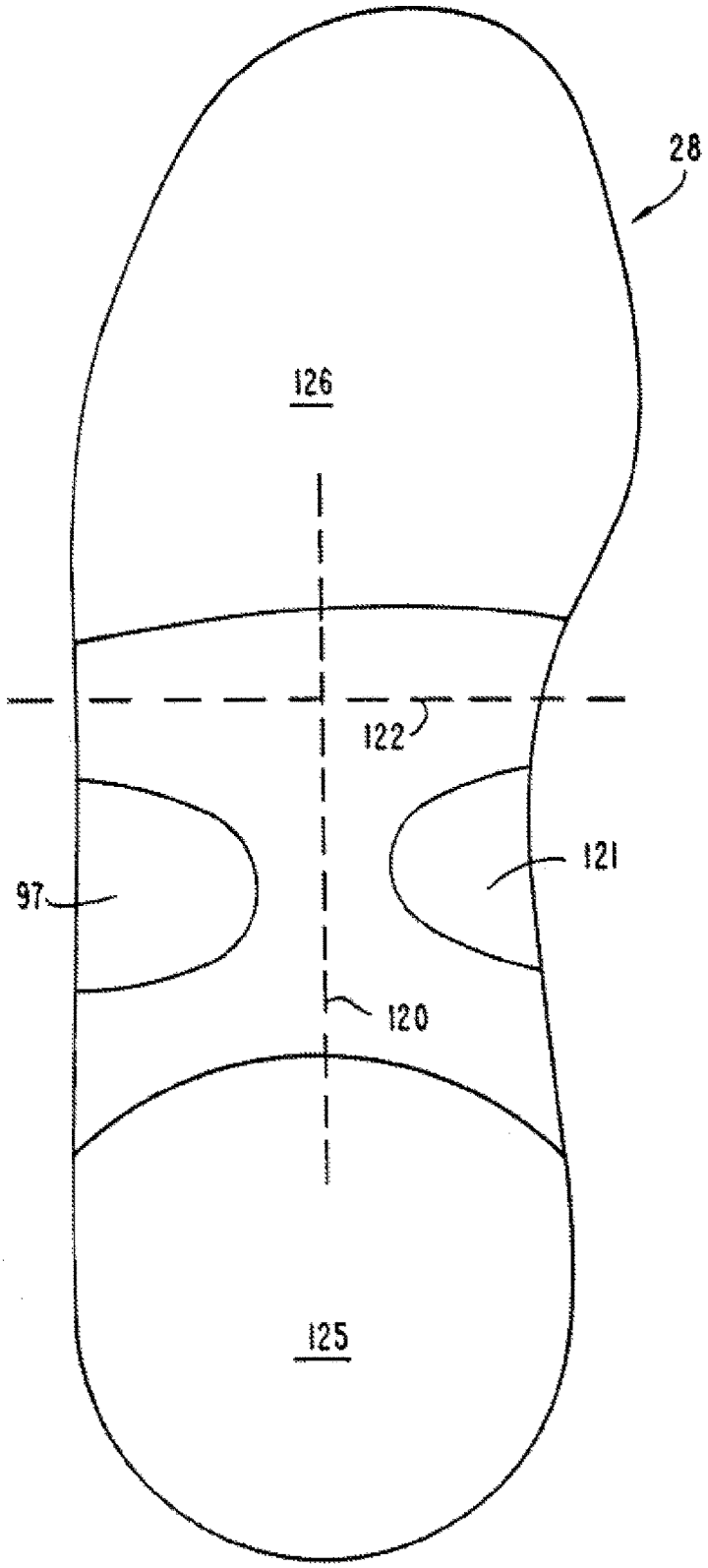


FIG. 14E
PRIOR ART

FIG. 15A

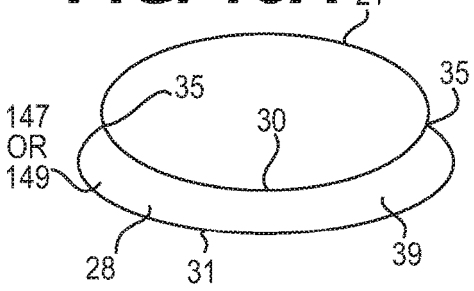


FIG. 15B

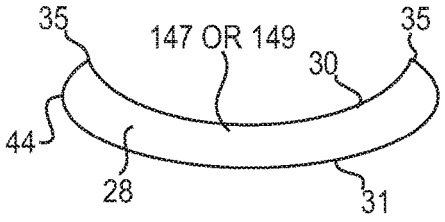
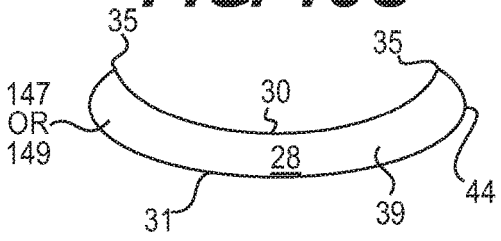


FIG. 15C



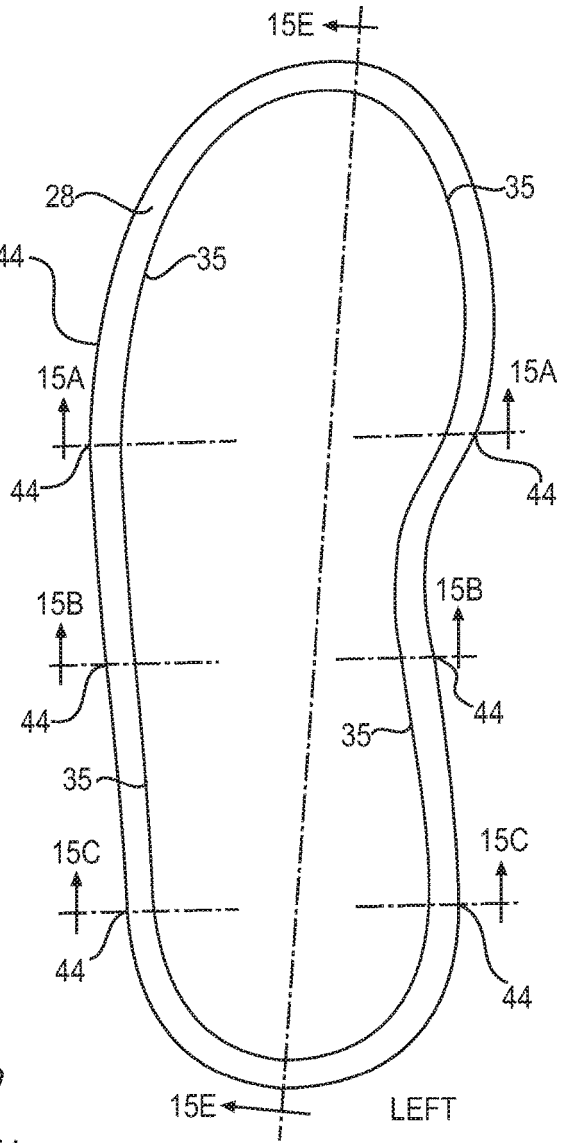


FIG. 15D

FIG. 15E

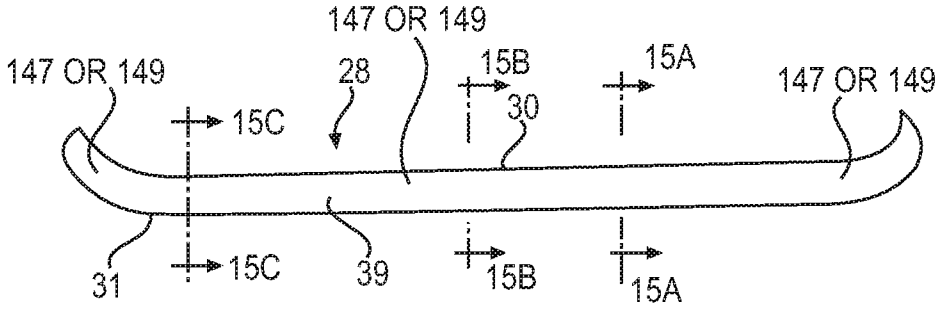


FIG. 15F

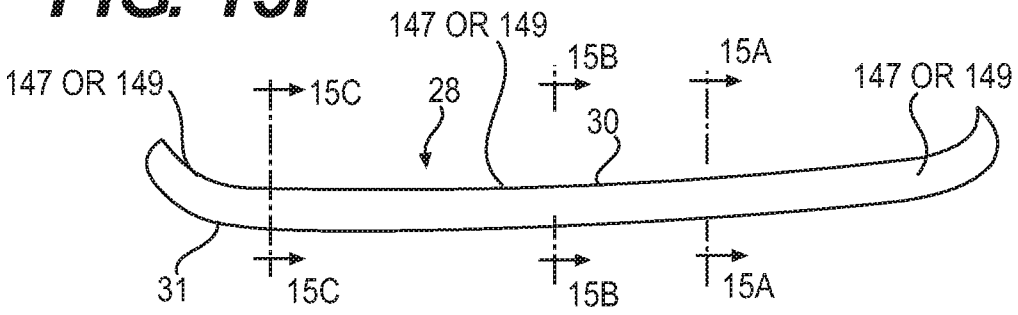


FIG. 15G

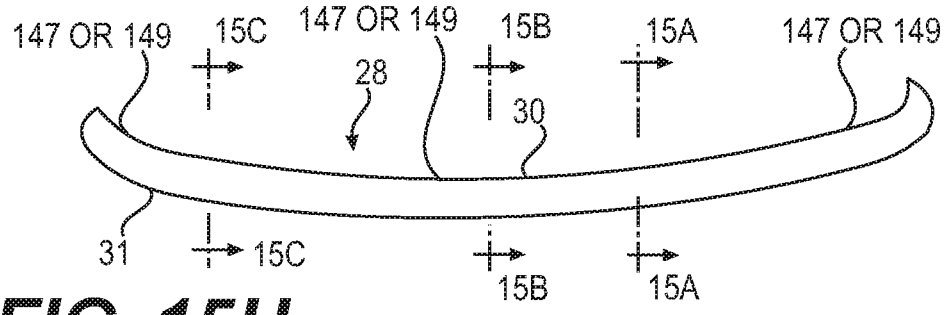


FIG. 15H

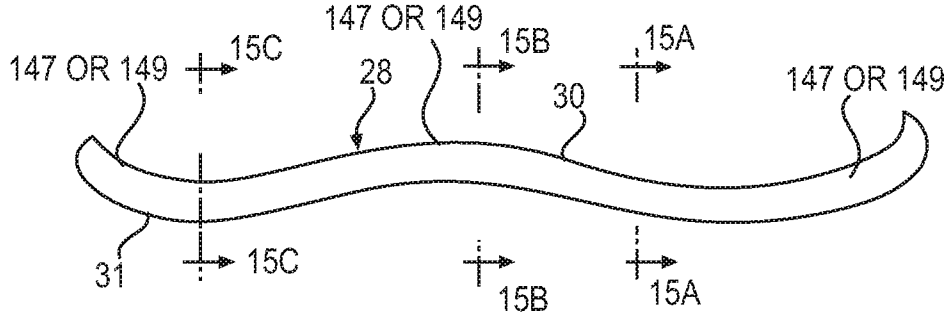


FIG. 16A

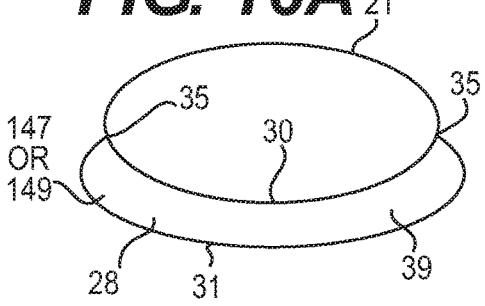


FIG. 16B

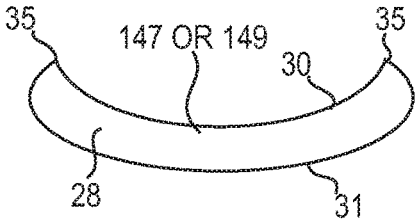
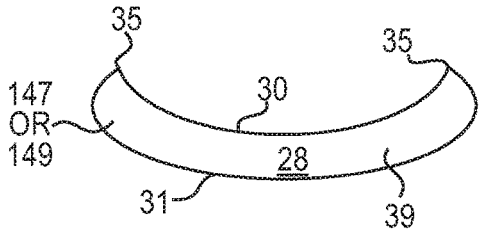


FIG. 16C



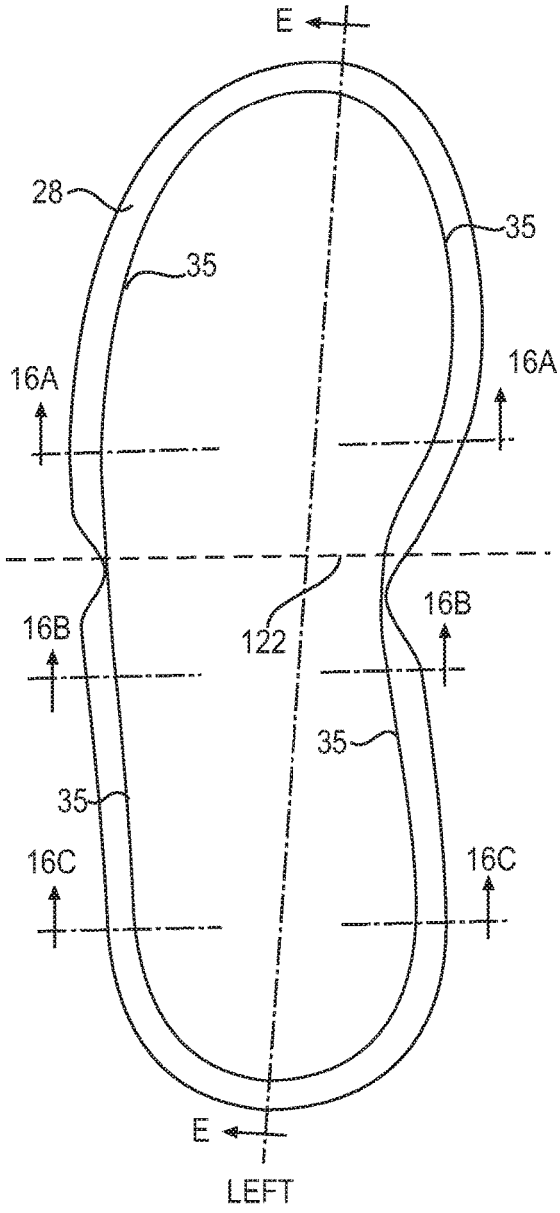


FIG. 16D

FIG. 16E

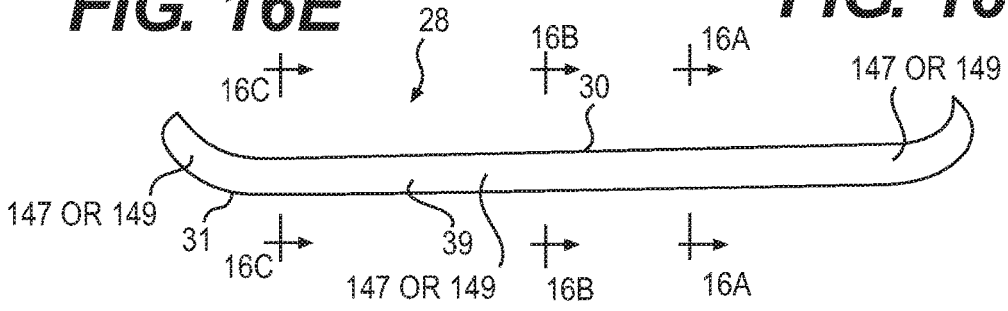


FIG. 17A

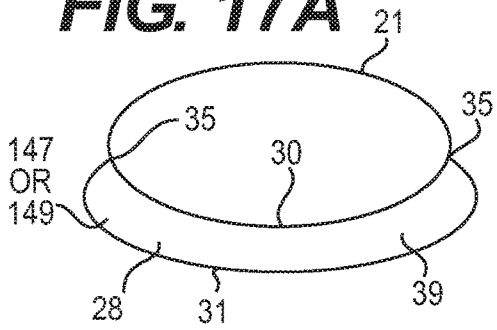


FIG. 17B

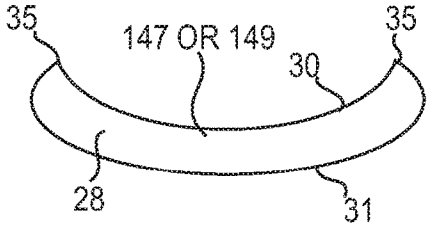
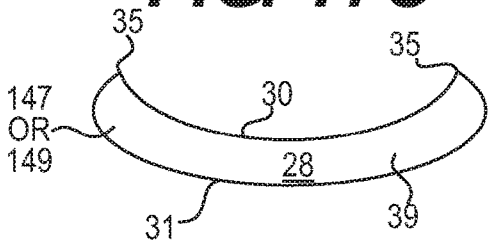


FIG. 17C



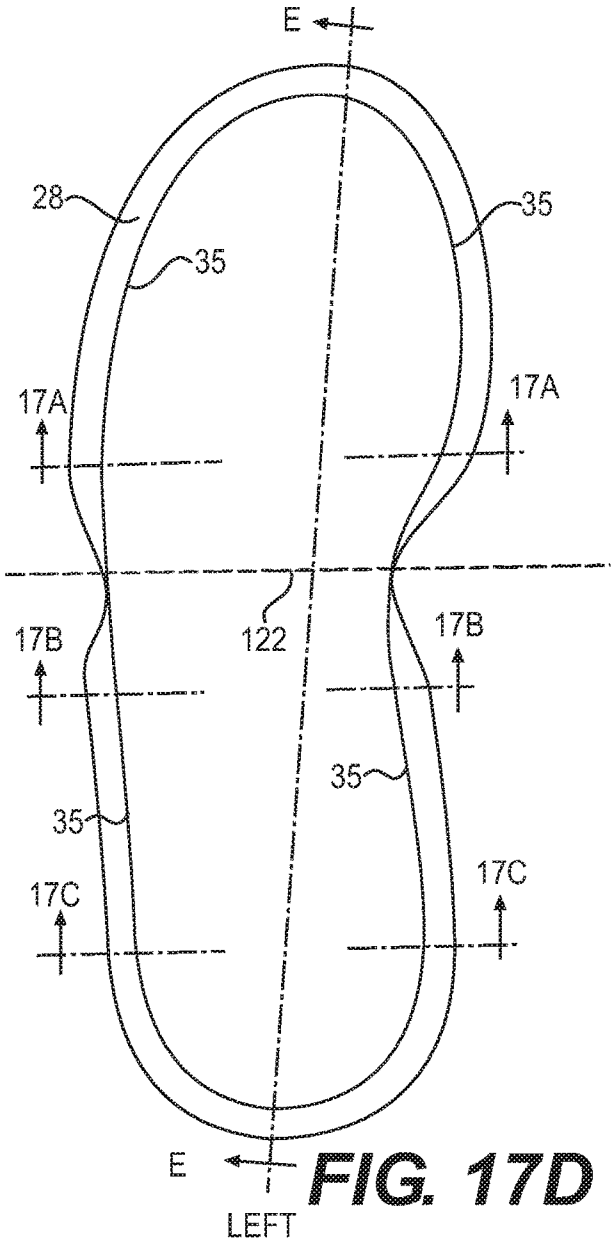


FIG. 17D

FIG. 17E

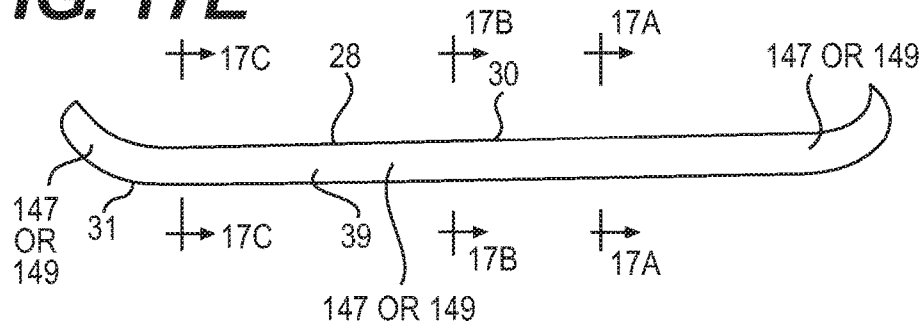


FIG. 18A

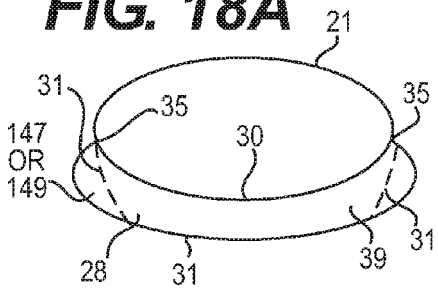


FIG. 18B

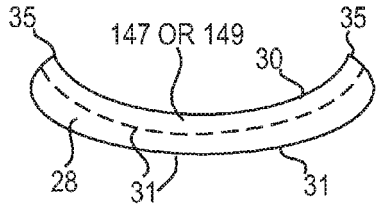
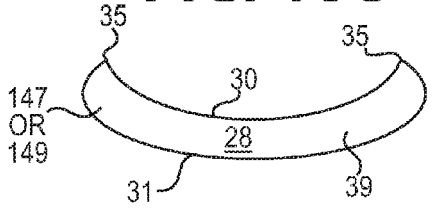


FIG. 18C



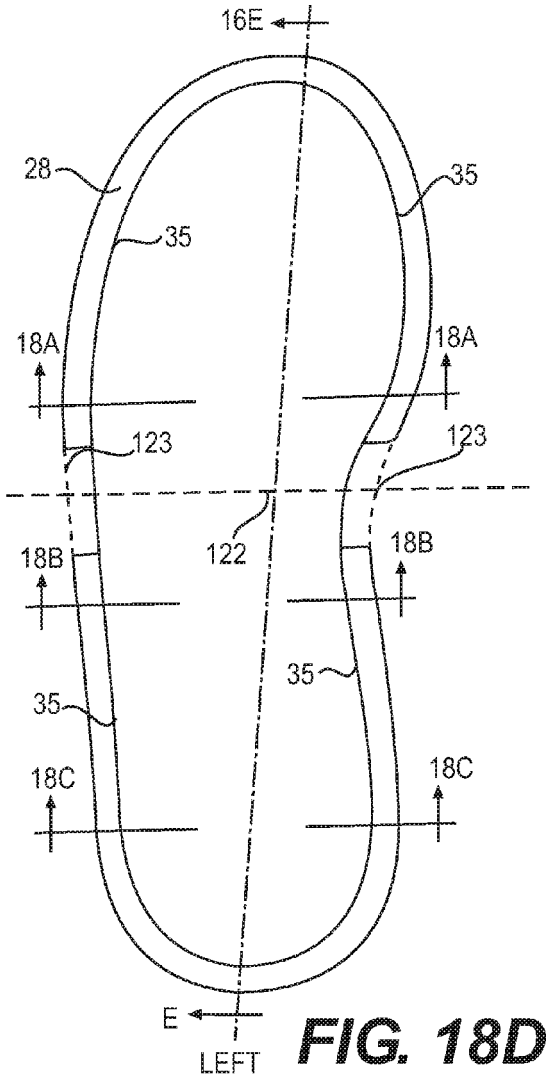


FIG. 18D

FIG. 18E

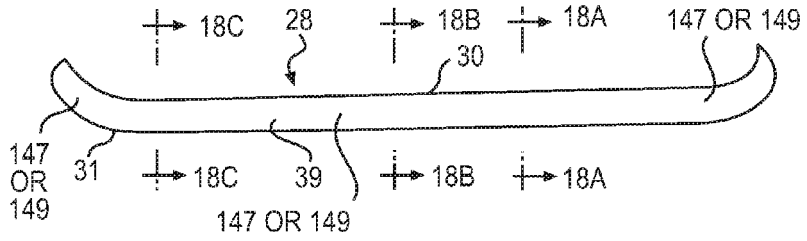


FIG. 19A

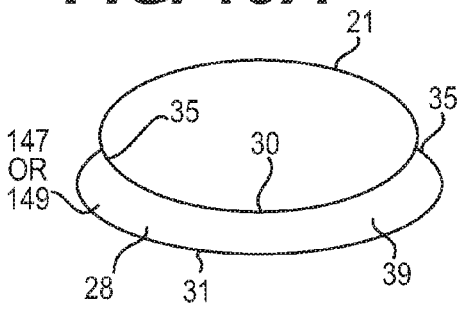


FIG. 19B

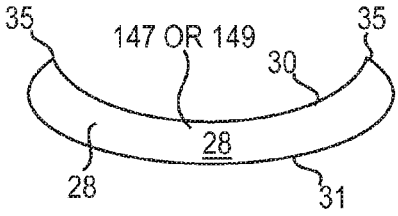
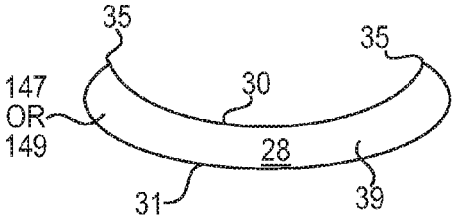


FIG. 19C



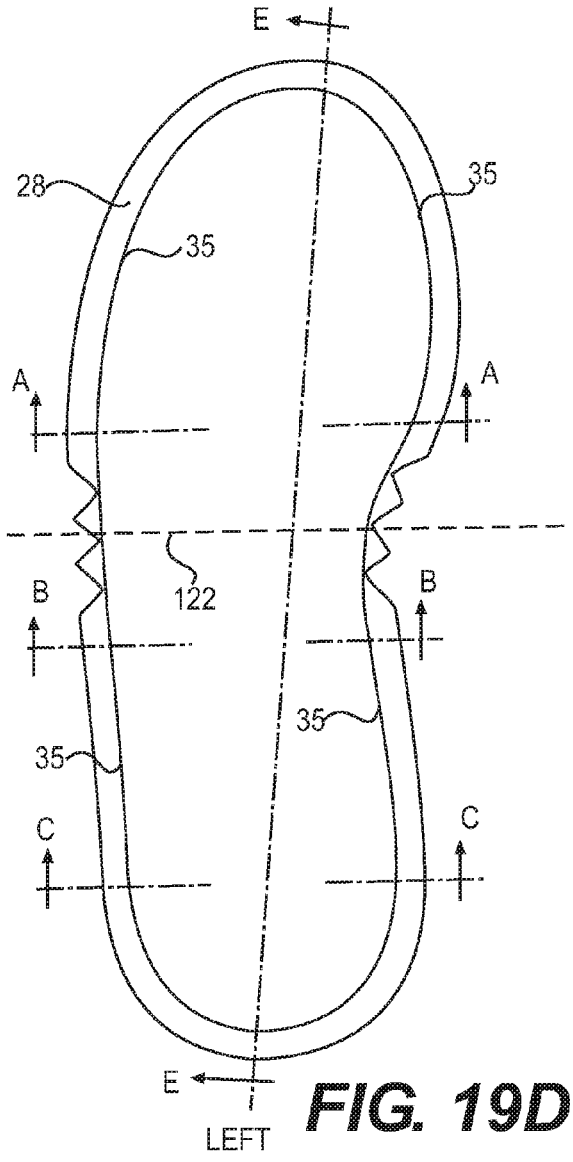


FIG. 19D

FIG. 19E

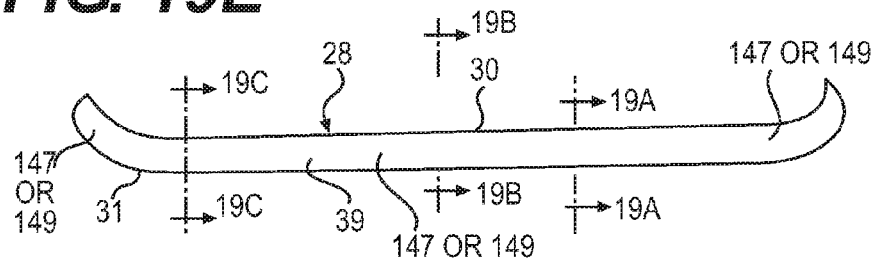


FIG. 20A

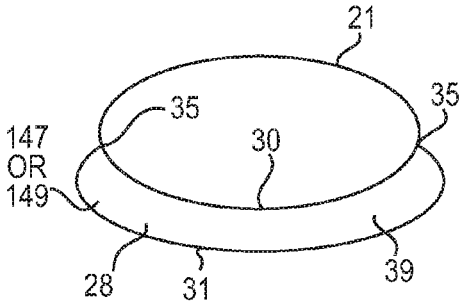


FIG. 20B

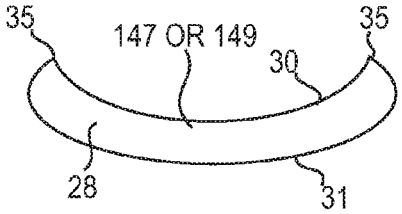
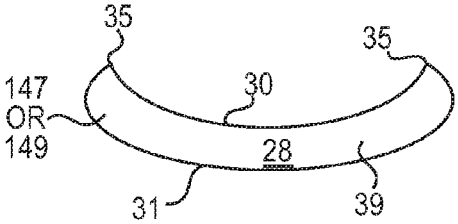


FIG. 20C



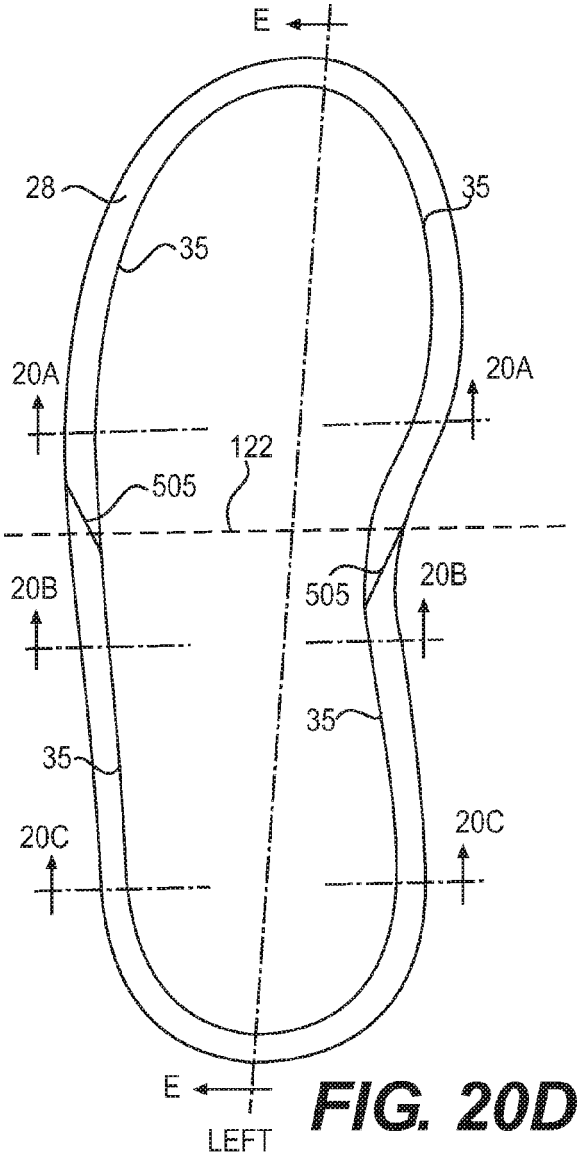


FIG. 20D

FIG. 20E

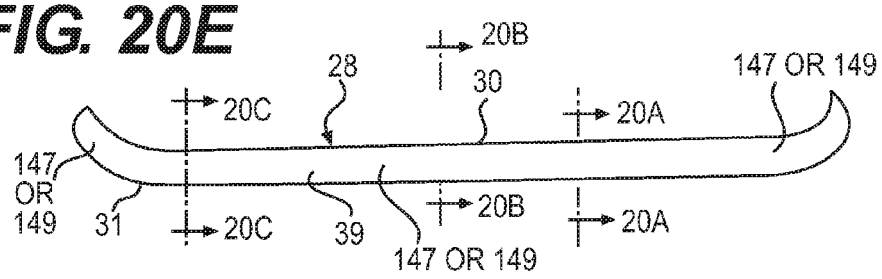


FIG. 21A

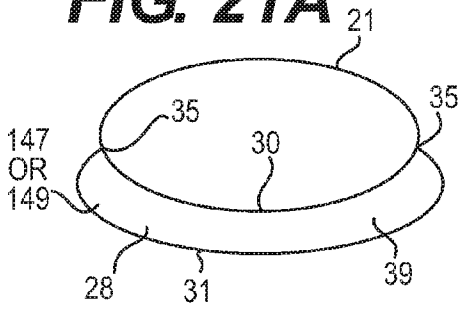


FIG. 21B

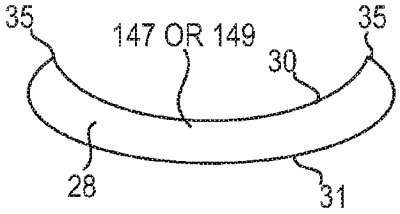
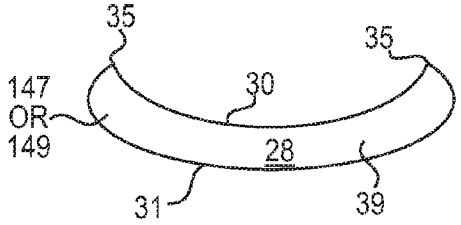


FIG. 21C



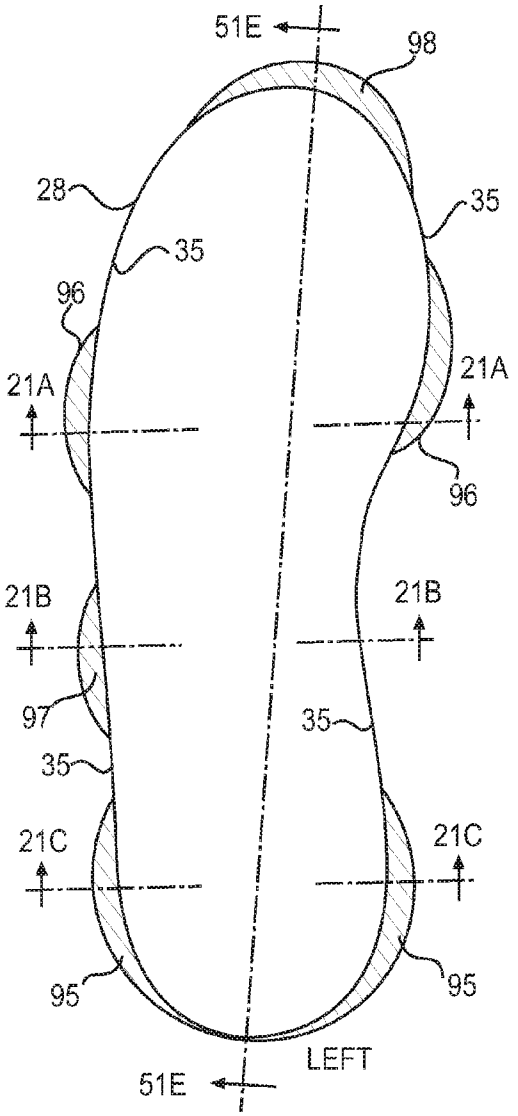


FIG. 21D

FIG. 21E

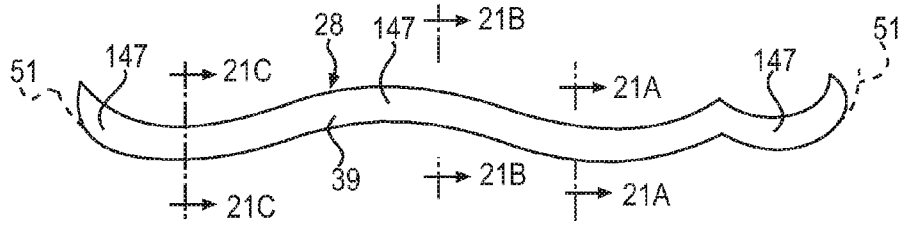


FIG. 22A

FRONT VIEW

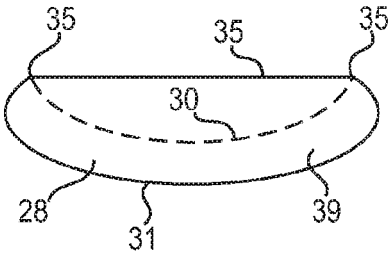


FIG. 22B

REAR VIEW

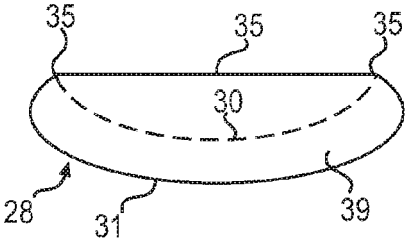
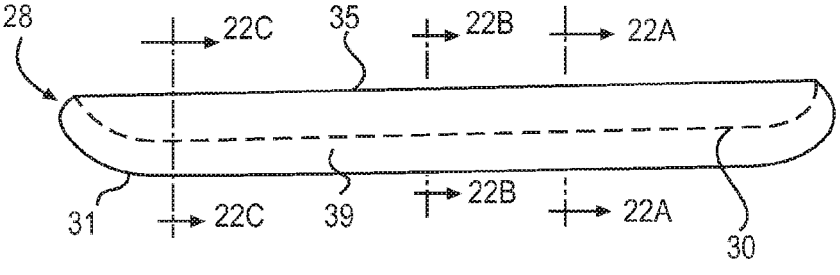


FIG. 22C



SIDE VIEW

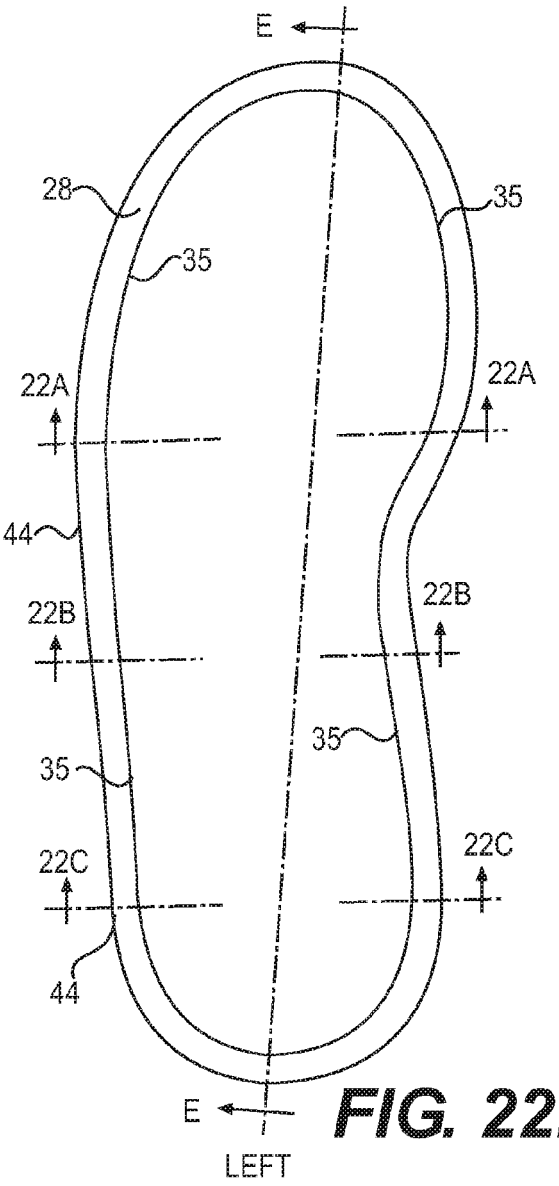


FIG. 22D

FIG. 23A

FRONT VIEW

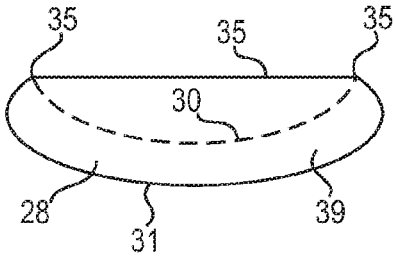
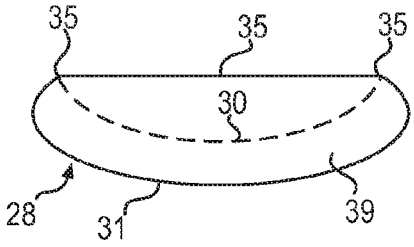


FIG. 23B

BACK VIEW



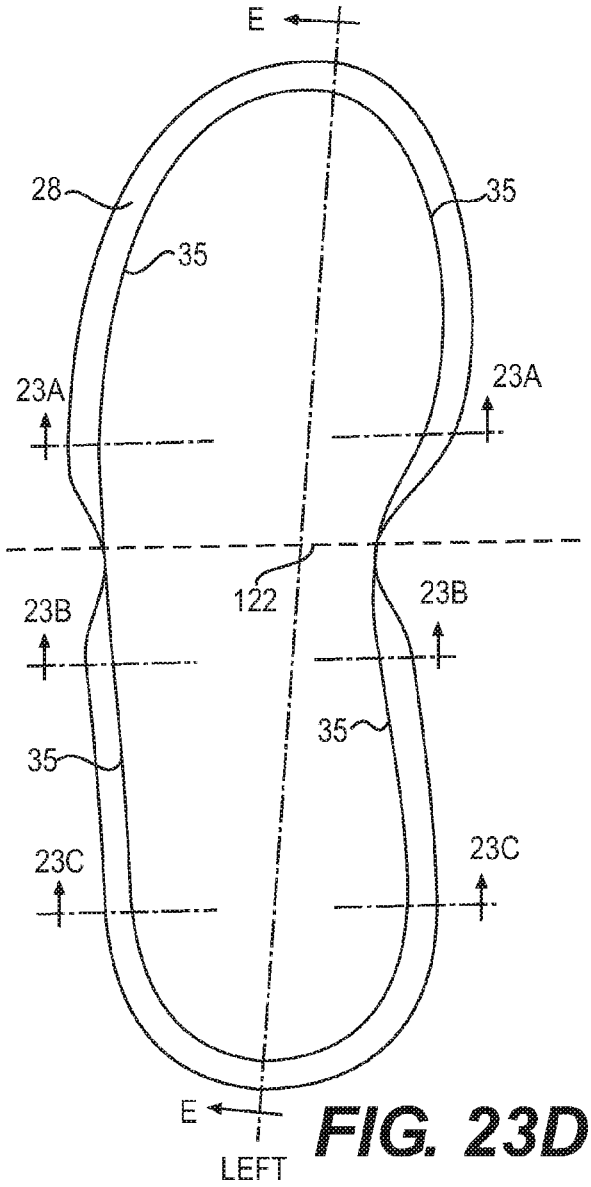
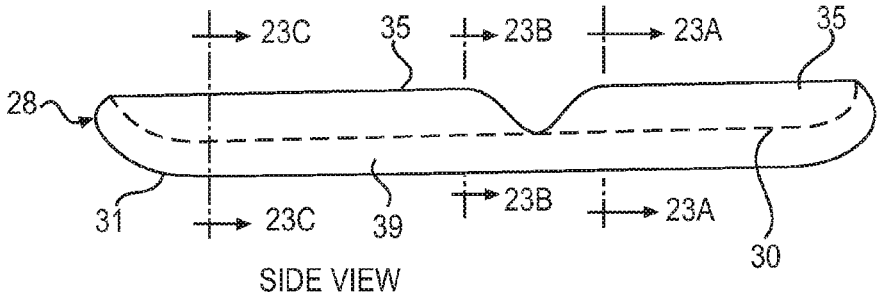


FIG. 23D

FIG. 23C



SIDE VIEW

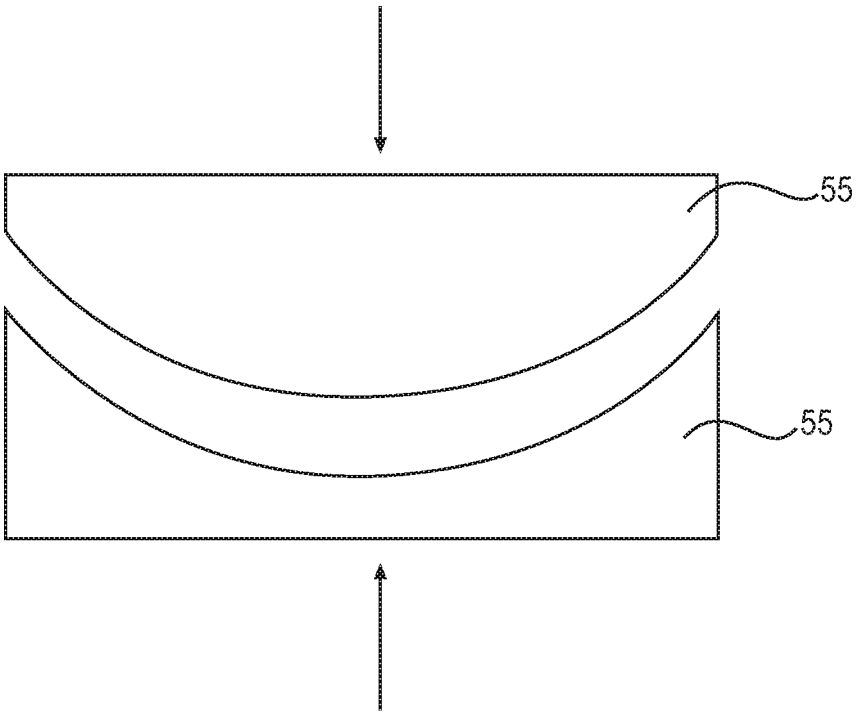


FIG. 24

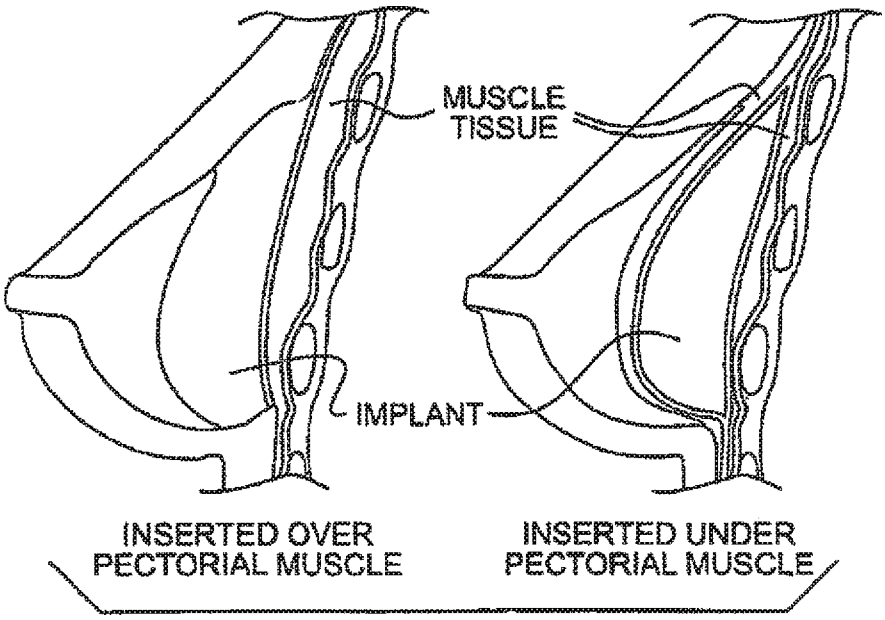


FIG. 25A
PRIOR ART

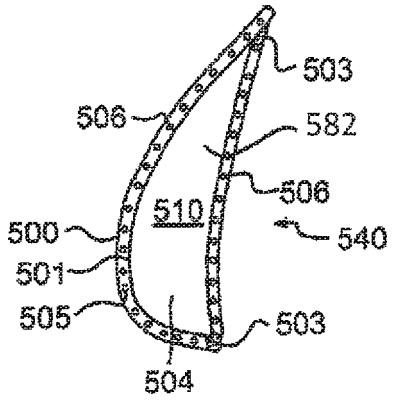


FIG. 25B
PRIOR ART

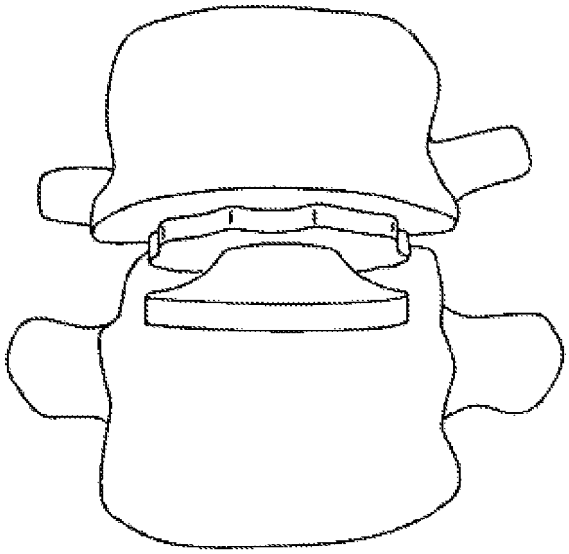


FIG. 26A
PRIOR ART

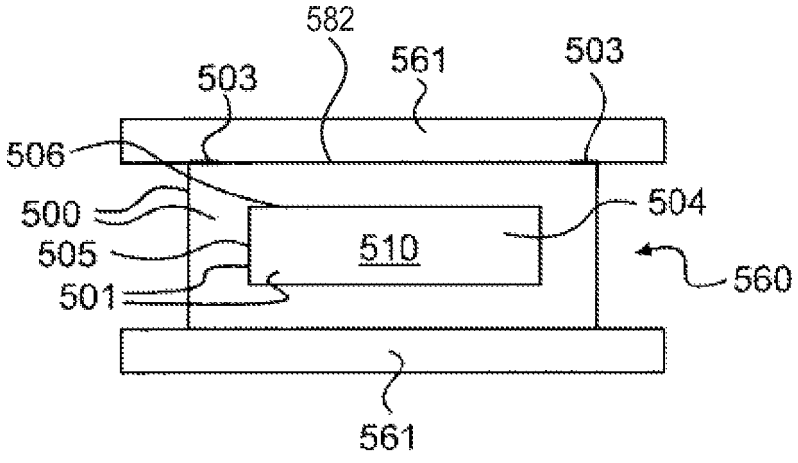


FIG. 26B
PRIOR ART

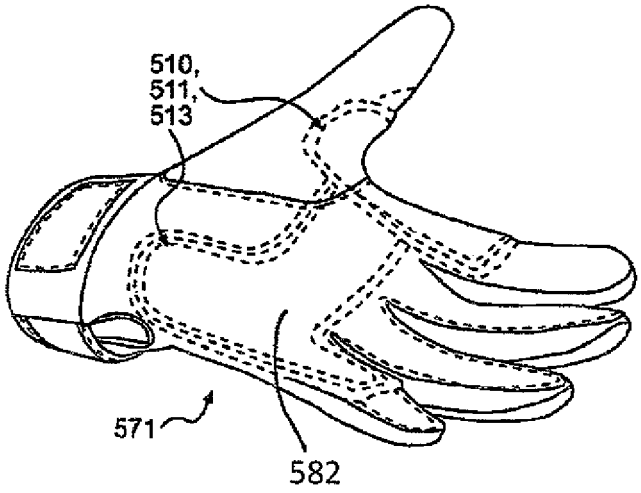


FIG. 27A

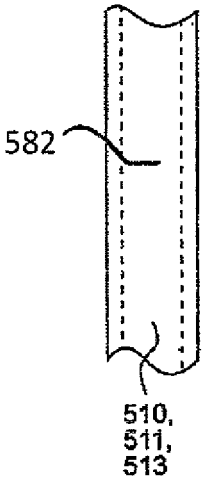


FIG. 27C

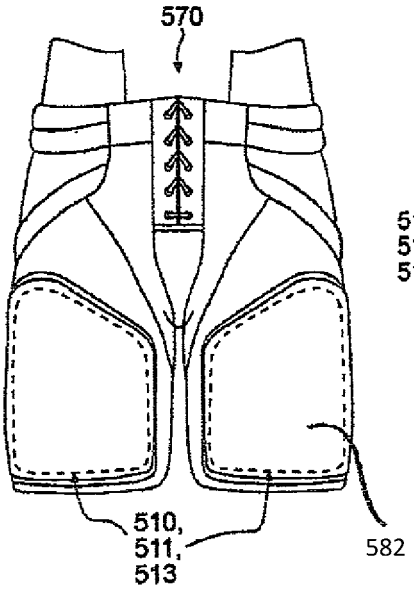


FIG. 27D

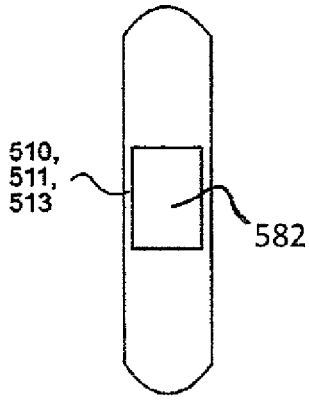


FIG. 27B

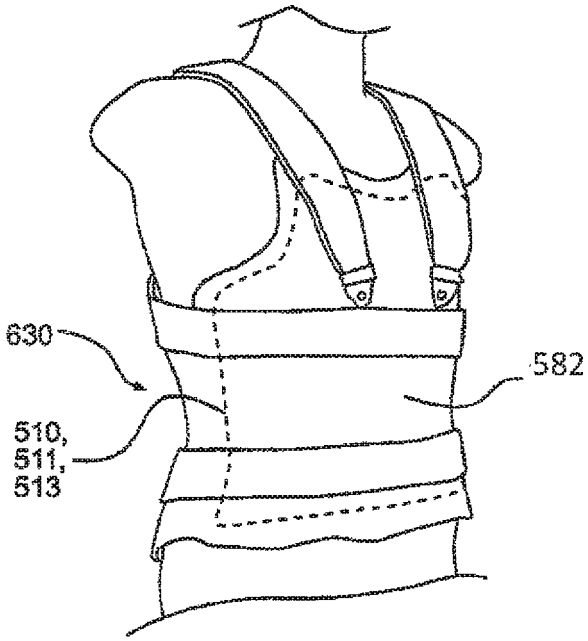


FIG. 28A

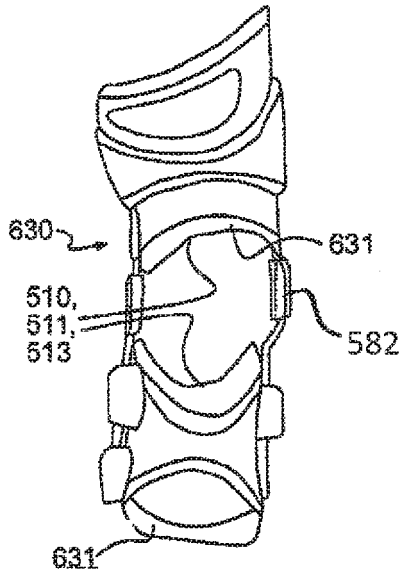


FIG. 28B

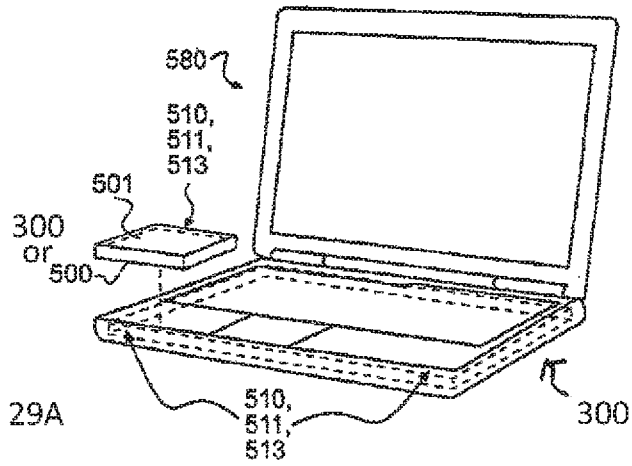


FIG. 29A

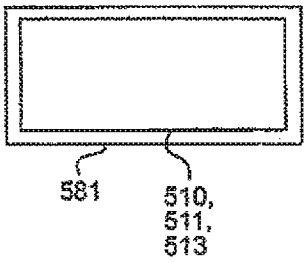


FIG. 29B

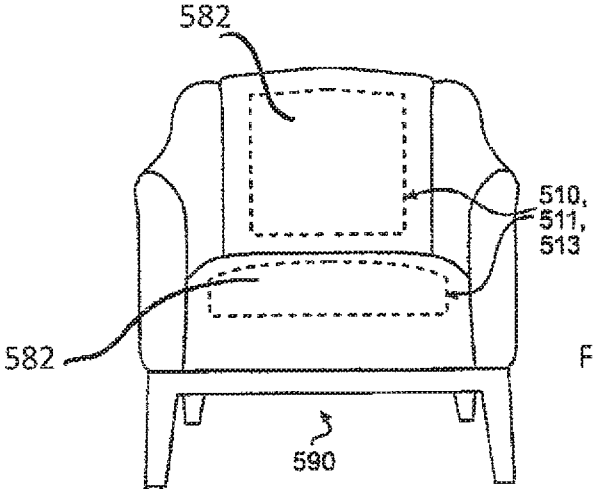


FIG. 30

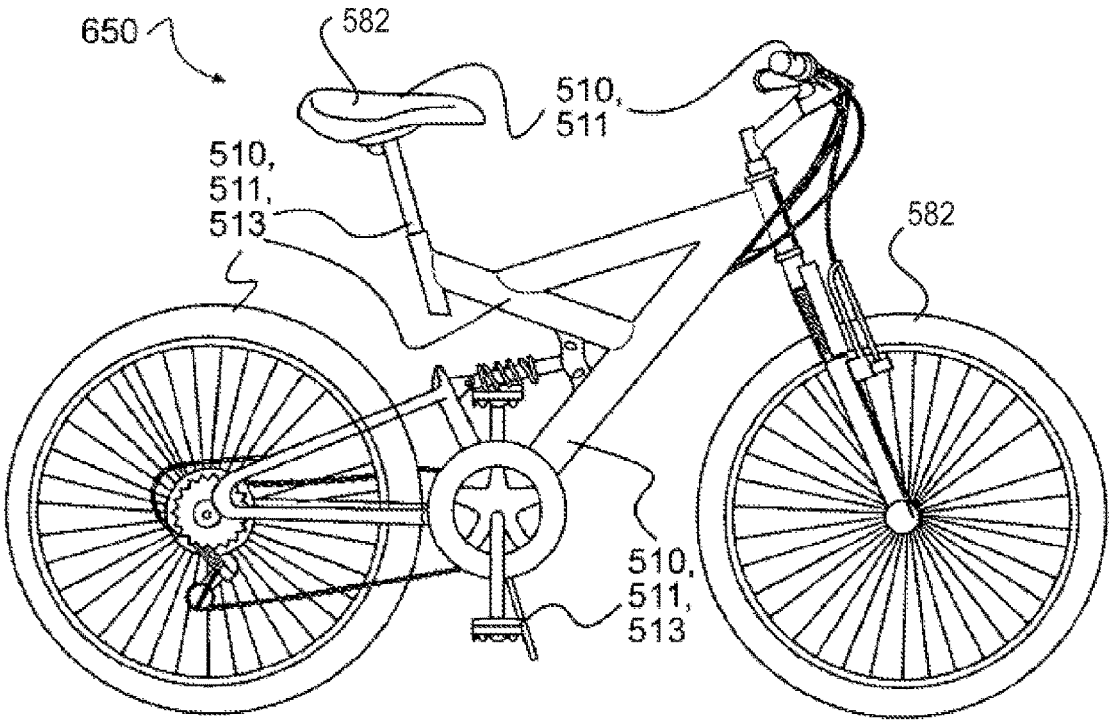

650
582
510,
511
510,
511,
513
582
510,
511,
513

FIG. 31

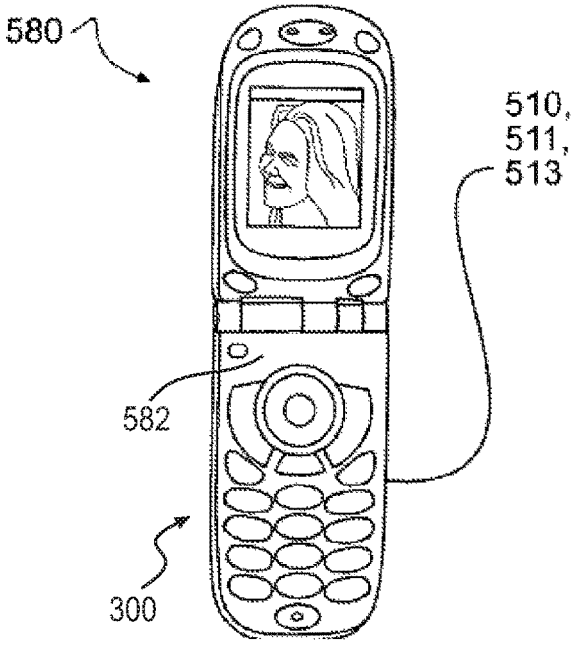

580
510,
511,
513
582
300

FIG. 32

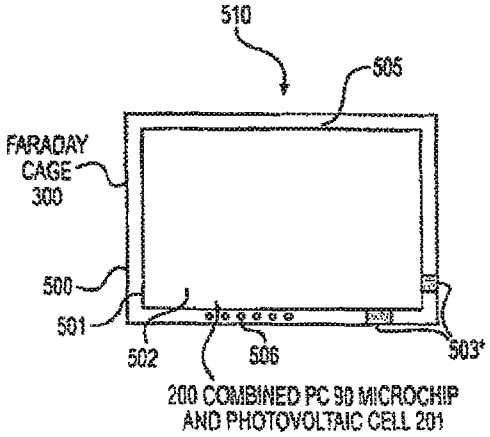


FIG. 33A
PRIOR ART

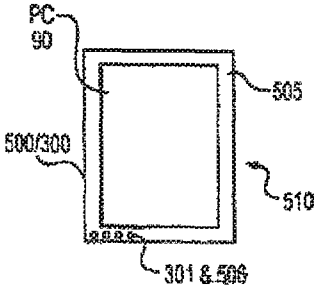


FIG. 33D
PRIOR ART

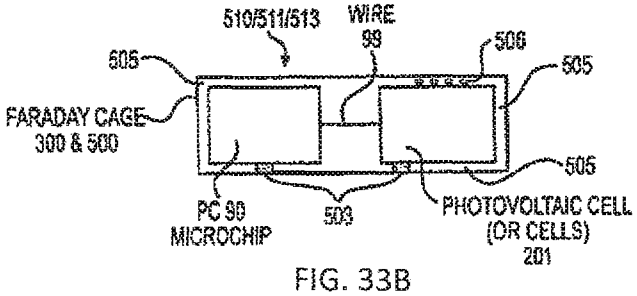


FIG. 33B
PRIOR ART

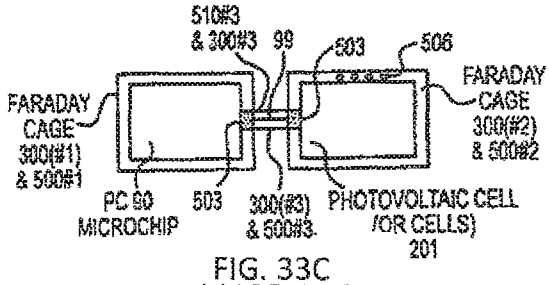


FIG. 33C
PRIOR ART
*CAN INCLUDE EXTERNAL CONNECTION FROM MICROCHIP/CELL 200

BLADDERS, COMPARTMENTS, CHAMBERS OR INTERNAL SIPES CONTROLLED BY A WEB-BASED CLOUD COMPUTER SYSTEM USING A SMARTPHONE DEVICE

This application is a continuation of U.S. patent application Ser. No. 15/164,650, filed May 25, 2016, which is a continuation of U.S. patent application Ser. No. 14/922,408, filed Oct. 26, 2015, now U.S. Pat. No. 9,375,047, issued Jun. 28, 2016, which is a continuation of U.S. patent application Ser. No. 14/722,547, filed May 27, 2015, now U.S. Pat. No. 9,207,660, issued Dec. 8, 2015, which is a continuation of U.S. patent application Ser. No. 14/615,749, filed Feb. 6, 2015, now U.S. Pat. No. 9,100,495, issued Aug. 4, 2015, which is a continuation of U.S. patent application Ser. Nos. 14/605,177 and 14/605,192, both filed Jan. 26, 2015, now U.S. Pat. No. 9,160,836, issued Oct. 13, 2015 and U.S. Pat. No. 9,063,529, issued Jun. 23, 2015, respectively, and U.S. patent application Ser. Nos. 14/605,177 and 14/605,192, both filed Jan. 26, 2015, are continuations of U.S. patent application Ser. No. 13/859,859, filed Apr. 10, 2013, now U.S. Pat. No. 9,030,335, issued May 12, 2015, which claims the benefit of the following U.S. Provisional Application Nos. 61/687,072, filed on Apr. 18, 2012; No. 61/687,127, filed Apr. 19, 2012; No. 61/851,598, filed Mar. 11, 2013; No. 61/851,869, filed Mar. 14, 2013; and No. 61/852,038, filed Mar. 15, 2013.

BACKGROUND

In many prior U.S. Patents, including for example both the '819 and '982 patents, the applicant has shown in detail the inherent stability defects in most modern footwear, which are structurally flat instead of wrapping around the anatomically rounded shape of an intended wearer's foot sole, as required in order to preserve the naturally superior biomechanical stability of the intended wearer's bare foot sole.

However, there is also high degree of complexity inherent in correctly designing and manufacturing anatomically neutral footwear due to the extremely complex structure of the human foot. The result is that nearly all commercially available footwear available currently significantly degrade the natural stability of the barefoot, resulting in needless chronic and acute injuries.

But the alternative of bare feet alone is not the answer, since bare feet are often unsuited for the modern environment, since they fail to provide insulation against extreme heat or cold, protection against sharp objects or dangerous chemicals, and traction on artificial sports or other surfaces.

With no practical alternatives, a wearer of modern footwear is forced into a lifetime of defective footwear use that all too frequently results in anatomical structure and gait problems that cause severe chronic injury to joints and other health issues. Unfortunately, with existing technology, only the symptoms of the injury are ever treated, because there is currently no way to easily evaluate and identify the underlying specific footwear causes of the injury or to eliminate those causes or reduce their severity.

Nor is there a way to provide immediate and effective testing and evaluation to find the most optimal footwear solution as quickly as possible. Nor is there a way then to immediately implement that most optimal footwear solution, while afterwards continuing indefinitely the ongoing testing and evaluation to prevent future problems. Nor is there as way to share these individual optimal solutions among larger population groups to achieve potentially many other tangible health benefits among similar subgroups.

SUMMARY

The applicant's new footwear sole inventions emphasize an extraordinarily simple approach, which is simply bending the sides of footwear sole up in the direction of the foot, instead of leaving the sole structure conventionally flat. The result is a new footwear sole that is simply concavely rounded underneath the intended wearer's foot sole, particularly as viewed in frontal plane cross-sections.

The new footwear soles are not complex to design and manufacture, since they avoid dealing with the enormous complexity of trying to conform to the irregularly shaped human foot structure. They still, however, preserve most if not all of the essential biomechanical superiority of the barefoot in natural pronation and supination motion, even when shod with any of the variations of the new sole inventions described in this application—as long as the footwear sole's concave rounding is configured to deform under a body weight load to flatten against the flat ground, as does a barefoot sole.

The applicant's inventions also include using a smartphone device with motion sensors and/or in-shoe force and/or pressure sensors to easily evaluate and identify the underlying specific footwear causes of a footwear injury or to eliminate those causes or reduce their severity. The applicant's inventions also include footwear with bladders, compartments, chambers and/or sipes configured to be controlled by the smartphone in real time and can also include the concavely rounded sole structure invention described above and elsewhere in this application.

With the applicant's smartphone and configurable footwear, there a way to provide immediate and effective testing and evaluation to find the most optimal footwear solution as quickly as possible. In addition, with them there a way then to immediately implement that most optimal footwear solution, while afterwards continuing indefinitely the ongoing testing and evaluation to prevent future problems. Furthermore, with them there as way to share these individual optimal solutions among larger population groups to achieve potentially many other tangible health benefits among similar subgroups.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1**A and **1**B are examples of smartphones, the iPhone 5™ and the Samsung Galaxy S III™, respectively, which can be used to actively configure footwear and other apparatus.

FIGS. **2**A and **2**B are example ear phones and headphones, respectively, which can include motion, proximity, and other sensors **582**.

FIG. **3** shows side and back views of a human skeleton to illustrate the potential positions for the smartphone and for sensors on the body or apparel or equipment, including footwear, pants, belt, collar, wristband, earphones, and helmet.

FIGS. **4**A and **4**B show two axis graphs showing examples of tracks of center of gravity (C.G.) motion over at least a full locomotion stride, FIG. **4**A showing a model or correct or preferred state and FIG. **4**B showing uncorrected or misaligned state.

FIG. **5** shows a prior art example of the left and right foot force and relative pressure measurements provided by an existing in-shoe system by F-Scan™.

FIGS. **6**A-**6**D are other prior art examples showing insole pressure measurements of the running stride and are FIGS. **9**-**12** of the applicant's '948 U.S patent.

FIG. **7** shows a perspective view of a prior art example of footwear with computer controlled bladders, compartments, or chambers located in a removable midsole section and was FIG. **11**P of the applicant's '749 U.S. application publication.

FIG. **8** shows a frontal plane view of a similar embodiment and was FIG. 11N of the same '749 publication.

FIG. **9** shows a perspective view of a prior art example of footwear with inner bladders, compartments, or chambers of FIGS. **7** & **8** with internal flexibility sipes and outer, bladders, compartments, or chambers and was FIG. 1C of the applicant's '916 U.S. Publication.

FIG. **10**A-**10**D are FIGS. 15, 16, and 17A-17B of the applicant's '916 publication and show footwear prior art computer controlled inner bladders, compartments, or chambers surrounded by internal flexibility sipes and outer bladders, compartments, or chambers. FIGS. **10**E-**10**H show prior art examples FIGS. 1, 2, 4A and 4B from Demon's U.S. Pat. No. 5,813,142 of computer controlled valves venting from bladders to outside the shoe sole. FIG. **10**I is FIG. 44 of the same publication and shows a footwear prior art computer controlled mechanical cushioning system.

FIG. **11**A-**11**I are examples of the applicant's semi-thong inventions. FIG. **11**A shows a horizontal view of the upper surface of a footwear sole with an intended wearer's footprint superimposed in its normal position with the semi-thong **3** located between the big and second toes; and optional other semi-thong locations indicated between the other toes. FIGS. **11**B-**11**E show horizontal cross-sections of the semi-thong; FIG. **11**F shows a frontal plane cross-section showing the location of an example semi-thong. FIGS. **11**G-**11**I show examples of different semi-thong structures in cross-section.

FIG. **12**A is a blown up cross-section of an example part of the applicant's inventions of an extremely minimalist footwear sole or a traction sock or an individual thread. FIG. **12**B shows an example of the most minimalist of footwear, which is without any sole and only a big toe strap **21***a* (and/or other toe straps), elastic or other, to hold down the forefoot of the soleless footwear upper.

FIGS. **13**A-**13**E is a prior art series showing the applicant's prior inventions of footwear soles conforming to the shape of an intended wearer's unloaded foot sole and was FIG. 51A-51E of the applicant's '350 U.S patent.

FIG. **14**A is prior art FIG. 62 from the applicant's '350 U.S. Patent showing the extra sole width required to accommodate the dynamic footprint and FIGS. **14**B-**14**D are prior art FIGS. 1A-1C from the applicant's '982 U.S. Patent showing the footwear sole's capability to deform to flatten under the body weight of a wearer, including during 20 degrees of supination or pronation. FIG. **14**E is the prior art FIG. 28c of the applicant's '819 U.S. Patent showing the flexibility axis **122**.

FIGS. **15**A-**15**H is a series similar to FIGS. **13**A-**13**E showing frontal plane and sagittal plane cross-sections and horizontal plan overview of the applicant's new inventions of a footwear sole that is concavely rounded relative to the intended wearer's foot sole in frontal plane cross-sections in the forefoot, midfoot, and heel areas of the footwear sole; FIGS. **15**E-**15**H show different potential variations that can be incorporated into the long axis structure shown in FIGS. **15**A-**15**D.

FIG. **16**A-**16**E is like FIG. **15**A-E, but with a flexibility groove just aft of the forefoot of the footwear sole on both sides, between the cross-sections of FIGS. **16**A and **16**B.

FIGS. **17**A-**17**E, FIGS. **18**A-**18**E, FIGS. **19**A-**19**E, and FIGS. **20**A-**20**E show variations of the flexibility groove located proximate to flexibility axis **122**, with FIG. **18**D also showing a fabric cover over the groove, the fabric cover optionally forming a portion of a strap for the upper and FIG. **20**D showing flexibility sipes **505** instead of grooves and FIGS. **18**A and **18**B showing with dashed line the position of the inset outersole **31** established by the groove.

FIG. **21**A-**21**E is the applicant's concavely rounded footwear sole inventions applied to prior art FIGS. **13**A-**13**E, which is an example embodiment with bulges and abbreviated sides for flexibility.

FIGS. **22**A-**22**D are a front view, a back view, a side view, and an overhead view of the applicant's concavely rounded footwear sole shown in FIGS. **15**A-**15**E, with inner dashed lines showing the inner surface **30** of the sole.

FIG. **23**A-**23**D are a front view, a back view, a side view, and an overhead view of the applicant's concavely rounded footwear sole shown in FIGS. **17**A-**17**E, with inner dashed lines showing the inner surface **30** of the sole.

FIG. **24** is a frontal plane cross-section of a press and/or press forms **55** configured structurally to form a concavely rounded footwear sole such as shown in FIGS. **15**-**23**.

FIGS. **25**B, **26**B, **27**A-**27**D, **28**A-**28**B, **29**A-**29**B & **30**, **31**-**32** and **33**A-**33**D are examples of apparatus with sensors **582** based on FIGS. 29B, 32B, 59 & 60A-60C, 69 & 70, 61A-61B & 62, 78 and 79 from the applicant's –916 U.S. application and FIG. 23A-C & G of the '661 application; FIGS. **25**A and **26**A are prior art examples based on FIGS. 29A and 32A of the '916 application.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS

Among the inventions included in this application are the method, apparatus, and software of using a general or special purpose computer device **580**, including a smartphone **580** such as an Apple iPhone 5™ and a Samsung Galaxy S III™, as shown in FIGS. **1**A and **1**B, as well as a Motorola Droid™, a Nokia Lumia™ and a BlackBerry™ 10, as other examples, to measure the relative motion of a body and/or a body part during the locomotion of a user of the smartphone (or any other portable or mobile microcomputer device, general purpose or specialized, including for example the Apple iPod™).

The smartphone device **580** can also be used to measure the force or relative pressure distribution of the wearer's foot sole in footwear; or to do both, including simultaneously, while also performing the other standard functions of a smartphone, like performing phone, email, browsing, and audio and/or video functions.

Smartphones can be configured with existing hardware motion sensing components, like a three-axis gyroscope and three-axis accelerometer in the iPhone 5™ and Samsung Galaxy S III™, for example, and/or additional and/or new hardware or software components to perform similar or other motion data measurement. The above smartphone or other microcomputing devices **580** can be mobile and/or wearable.

The smartphone or other devices **580** can also be configured to be capable of recording and/or streaming (in real time or later) wired or wirelessly any such measurement data to another computer, either local to the user (using a tablet, laptop or desktop, for example) or to a cloud array of

computers such as the example of the Apple iCloud or to any other computer. The smartphone or other device **580** can be configured to process the measurement data itself and/or in conjunction with a local and/or remote server, including the examples of an Apple iPhone™, a MacBook Pro™ laptop computer and/or the Apple iCloud™.

The smartphone or other device **580** can be configured to include the necessary sensor or sensors **582**, in the device **580** itself and/or connected to it by wire or wirelessly, as well as associated electronic, software, and other components, to provide the capability to capture various kinds of motion and/or other data measurements; and/or the smartphone device can be used with one or more peripheral devices with sensors **582** and associated components, which can be located with or near the smartphone or located remotely from it, so that the motion of the body and/or one or more body parts of the user can be measured separately and/or simultaneously in whatever manner desired. For example, an iPhone 5™ with EarPods™ or other headphones, as shown in FIGS. **2**A and **2**B, that include motion sensors can be paired with an iPod™ with additional sensors and be connected to each other wirelessly or wired (even potentially in the future including the example of using a wearer's body as a conductive wire).

The smartphone **580** and/or associated peripheral device with remote sensor or sensors **582** and/or other devices can be especially useful in measuring the relative motion of the body or one or more body parts of a user and/or wearer when the wearer is in any form of locomotion or gait, including walking and running. For example, an iPhone™ can be attached to a user's belt and located proximate to the small of the back of the wearer, as shown in FIG. **3**, at which location the iPhone™ is positioned close to the wearer's center of gravity (C.G.) and therefore data measurements of the wearer at that location during walking or running, for example, approximate fairly well the wearer's center of gravity (C.G.) motion during that locomotion, such as lateral or side-to-side C.G. motion in a frontal plane.

Besides the smartphone **580** being carried by the user/wearer, it can be maintained in a relative position close enough to the user/wearer that the smartphone can communicate wirelessly with one or more peripheral devices with sensors **582** on a test subject not carrying the smartphone during a test; alternatively, another computer like a tablet or laptop or desktop can be configured to perform the same functions as a smartphone device **580**, although with less or little mobility; such a peripheral device with sensors **582** can itself also simply record data measurements for later transfer to the smartphone **580** or other computer in a wired or wireless or a memory card like a USB drive or SD card, for examples.

In addition, the smartphone device **580** can be configured so that when it is paired with another motion sensor besides that in the smartphone or other device **580** itself, such as a separate sensor or sensors **582** in a peripheral device like an EarPod™ set or headphones; for example, that second sensor or sensors **582** can be configured to measure 1D, 2D, or 3D data of the relative motion of the wearer's head during locomotion (assuming earplug-like fixation by the ear canal) and that data can be recorded by and/or streamed to the smartphone device **580**. The smartphone **580** such as an Apple iPhone™ can be configured to receive the data set of the head motion and compare that head motion data set with its own CG motion data set and/or send that head motion data set and/or its CG motion data set to the Apple iCloud for such comparison and/or both iPhone™ and iCloud™ can share the data set comparison and perform other functions in a shared operation and/or with either performing any given operation or part thereof independently.

The results of that motion data comparison and any other operation can be recorded and/or stored and/or transmitted or otherwise made accessible to the user/wearer and/or to an approved third party such as a doctor or podiatrist or biomechanics specialist or other professional or semi-professional technician, including licensed or not, who is treating, consulting, or evaluating the user/wearer for overuse injury or acute injury (including accidents of any type) or to prevent injury and/or optimize performance for locomotion including for work, sports, leisure, or activities of daily living. There can be any practical number of additional and/or separate motion or other sensors **582** of any useful configuration that can be located at any practical number of body parts of a user/wearer. The sensors **582** can be attached, fastened, or worn in any practical manner, including implanting in a human body (or in an animal body or in a plant). The smartphone or other device **580** can also be configured to receive shared data from other smartphones or other devices **580** and/or other shared peripheral devices with sensors **582** located with other user wearers.

The smartphone or other device **580** can also measure absolute or geographic position of the wearer, such as by the global positioning system (GPS), compass, or other system, method or component, and can record and/or correlate in real time the absolute position (CG or other approximate point) of the user/wearer with the relative position motion of one or many body parts of the user/wear (or the same information shared from other smartphone **580** user wearers), and/or stream in real time or transmit the data sets to a cloud like the iCloud™ example above.

The position measurement, either relative or absolute, can be in one plane (1D) or in two planes (2D) or in three planes (3D), with correlated time measurement for example as well; sagittal, horizontal, and/or transverse (or frontal) planes are examples. Other data sets can potentially be captured, recorded, processed and/or transmitted by the smartphone or other device **580** or connected sensor or sensors **582**, such as blood pressure, heart rate, respiration rate, blood sugar level, weight, body temperature (core or a body part), ambient temperature, or any other body or body part measurement, medical or other.

The sensor or sensors **582** can be of any type, including the examples of relative and absolute motion, pressure, force, time, heat, moisture, chemical, electrical or electromagnetic, including visible light. The sensors **582** can be located in any practical location on any article of apparel or personal equipment, including the examples of earphones or earplugs, headphones, hat, helmet, protective padding or armor, braces, prosthetics, glasses, watch, belt, waistband, armband, attached with tape or bandage or glue, necklace or lanyard, cervical collar, ring, headband, in any manner attached or embedded in conventional or specialized clothing. The sensors **582** can also be worn or attached onto or implanted in the wearer's body, temporarily in a body piercing or permanently in a body implant.

The sensors **582** can also be located in the user's footwear of any form or type, including in orthotics or prosthetics. The sensors **582** can be entirely diagnostic, such as the example of dynamic footsole force and/or pressure sensors **104** like F-Scan™ and similar in-shoe products like insoles. The footwear sensors **582** can also work with active foot motion control devices, like the example of computer controlled compartments located in or on footwear soles and/or removable in-shoe inserts like the examples shown in FIGS. 11A-11C, 11M, 11N, 11O, and 11P in the '350 patent and

FIGS. 11A-11C, 11M, 11N, 11O, 11P, 11T, 11U, 97, 98, and 99A & B in the '665 patent application; the U.S. Pat. No. 5,813,142 to Demon is another example of the prior art. The example embodiments shown in these figures can be used to proactively and/or reactively alter shoe or orthotic (or prosthetic) soles to control the relative foot position between the right and left feet of the user/wearer's feet, such as to alter the neutral position of either or both feet separately toward a more generally supinated or pronated position, or for another example to alter the relative height of any specific portion of the right and/or left shoe or orthotic or prothetic sole, such as the forefoot, heel, or midsection or under any one or more bones of a user/wearer's right and/or left feet, or under the full right or left foot. These sole configuration alterations can be set potentially by smartphone device control for any time period, including dynamically for each step during locomotion of each foot of the user/wearer and/or dynamically many times during each step, and a data record of the alterations can be recorded and/or streamed from within each sole or in the sensor **582** or in the smartphone **580**.

These footwear or orthotic sole alterations can be controlled by the smartphone device **580** based its 1D or 2D or 3D motion measurements, for example, of the user/wearer's body part or parts, including center of gravity motion (CG) during some form of locomotion. One example would be to correct for excessive lateral movement of the user/wearer's center of gravity to one side more than another, as measured in the frontal plane, compared to an established norm less prone to injury. Another example, which can be related, is to reduce the crossover of right and/or left extremities (legs and/or feet) across the centerline of the user/wearer's body, as measured in the wearer's frontal plane during locomotion. Pre-programmed solutions can be applied using the user/wearer's smartphone and/or a cloud, and real time or subsequent testing can be conducted, including by the third parties like a doctor or other professional or technician referenced earlier, by using the smartphone, including to connect directly to the third party or parties or to a cloud for shared or independent operations.

The operating systems of the above described smartphone or other device **580** can be an iOS™ or Android™ or Windows Phone OS or BlackBerry 10 for an Apple™ or Android™ or Windows™ or Linux™ smartphone or tablet, for example; other operating systems, existing or future can be used to perform those operations. Such an app can be downloaded from Apple™ or Google™, for example, or for a Kindle™ downloaded from Amazon™ or downloaded from Microsoft™ for the Nokia Lumia™ for other examples. The operations described above for one or more sensors **582** can also be controlled by the same app as for the smartphones or other device **580** above. The app can be software alone or include one or more special or new sensors **582** and/or other hardware and/or firmware.

At least the footwear specific portions of the app can be developed by a footwear vendor like Nike™, Adidas™, or Under Armor™, for example, and/or an independent or university biomechanics laboratory, and the overall app can be co-developed with the smartphone **580** and sensor **582** hardware makers, as well as the smartphone operation system developers, of which examples have been cited above. Data sets from the smartphone or other devices **580** can be transmitted to a World Wide Web site for processing, evaluation (especially comparison with other wearers or users), storage, sharing, and other functions for the user wearer of the smartphone **580** (and may include the use of cloud resources) run by any of the entities referenced above.

The smartphone or other device **580** can also be configured to control compartments implanted within (or attached to) the human body (or an animal body or plant), including examples such as FIGS. **29**A & B or FIGS. **32**A & B with multiple compartments like those previously shown for footwear, such as in FIGS. 11M-P, 11T-U, and 97-99A & B of the '665 patent application. Such implants or attachments can be configured to include one or more sensors **582** discussed previously. Similarly, the smartphone or other device **580** can be used to control compartments in the same way in body braces, padding, and armor, including in the examples shown in FIGS. 60A, 69, and 70 of the '930 patent application.

The computer or other device **580** including the example of a smartphone **580** can also be configured to include a microprocessor alone, including a system-on-a-chip (SoC), including a personal computer on a chip, and can also include a Faraday Cage **300**, which can coincide with an outer compartment **500**, such as the example shown in FIG. 23G of the '769 patent application. Especially because of privacy of data concerns, the smartphone or other device **580** or any Web site storing data therefrom can be configured to include any combination of security features indicated in the applicant's U.S. patent application Ser. No. 398,403 filed Feb. 16, 2012, and published as Publication No. 20120311690 on Dec. 6, 2012 and in application Ser. No. 10/684,657 filed Oct. 15, 2003 and published as Publication No. 2005/0180095 on Aug. 18, 2005, both of which applications are hereby incorporated by reference in their entirety in this application.

A smartphone or other mobile computer device, either general purpose or specialized, can comprise the following: the smartphone device can be configured to actively control the configuration of one or more bladders, compartments, chambers or internal sipes and one or more sensors located in either one or both of a sole or a removable inner sole insert of the footwear of the user and/or located in an apparatus worn or carried by the user, glued unto the user, or implanted in the user; and the one or more bladders, compartments, chambers, or sipes, and one or more sensors can be configured for computer control. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device can be configured to record a first test data set consisting of measurements by a sensor of the force and/or the relative pressure distribution of a wearer's foot sole on or near an upper surface of the wearer's footwear during the wearer's locomotion or other physical activity; the first test data set as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device can be configured to record a first test data set consisting of measurements by a sensor of the relative motion during the user's locomotion or other physical activity of a position at or near to a part of the body of the user of the smartphone device; the first test data set as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other mea-

surements. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device can be configured to record a first test data set consisting of measurements of the relative motion during the user's locomotion or other physical activity of a position that is at or near the center of gravity of the body of the user of the smartphone device, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device can be configured to establish a first configuration setting for the bladders, compartments, chambers, sipes or other portions of the apparatus or of either or both of the footwear soles. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The first configuration setting of the smartphone device can be a neutral or baseline condition, including the condition wherein the smartphone device has not activated control of the apparatus or the footwear soles. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device can be configured to activate a second configuration setting for the bladders, compartments, chambers, sipes, or other portions of the apparatus or of either or both of the soles, the second configuration being different from the first configuration setting. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

Using the second configuration setting, the smartphone device can be configured to record a second test data set consisting of measurements of the relative motion during locomotion or other physical activity of the position at or near to the part of the user, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

Using the second configuration setting, the smartphone device can be configured to record a second test data set consisting of measurements of the relative motion during locomotion or other physical activity of the position at or near to the center of gravity of the user, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device can be configured to compare the first test data set and the second test data set with a preferred data set for the measurements of relative motion during locomotion or other physical activity of the part of a model user or users, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device can be configured to compare the first test data set and the second test data set with a preferred data set for the measurements of relative motion during locomotion or other physical activity of the position at or near to the part of a model user or users, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device can be configured to compare the first test data set and the second test data set with a preferred data set for the measurements of relative motion during locomotion or other physical activity of the position at or near to the center of gravity of a model user or users, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device can be configured to select the configuration setting of the footwear soles that produced the test data set that is the closest to the preferred data set and to reject the other configuration setting, thereby completing at least one full cycle of an operation to optimize the configuration for the wearer. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The full cycle of the configuration optimizing operation can be repeated as frequently as necessary until the most recent test data set either closely matches the preferred data set or cannot be made to match the test data more closely. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example

invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The full cycle of the configuration optimizing operation can be repeated hundreds or thousands or millions or billions of times. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The model user or users can be chosen from a group of shod or barefoot users who have a history of low levels of overuse and/or acute injuries, the barefoot users including users that are distinguished by level of previous or current conventional footwear use, such as barefoot users that have been formerly shod and/or occasionally shod or seldom shod or never shod with conventional footwear. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device can be configured to include a gyroscope and an accelerometer. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device can be configured to include one or more wired connections and/or one or more wireless connections, the wireless connections including WiFi, Bluetooth, near field communications (NFC) and/or cellular. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The relative motion can include geographic motion tracking between one or more geographic positions and said device is configured to include a global positioning system (GPS) components and/or another geographic location tracking capability. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device can be configured for wired and/or wireless connection to at least one peripheral device with at least one remote sensor located at or near to a body part of the user. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The remote sensor can be of any known type, including motion, pressure, time, heat moisture, chemical, electrical, or electromagnetic sensor. At least one peripheral device can be a headphone set or a audio earplugs set or an earplugs set with at least one or two remote motion sensors. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

At least one peripheral device with at least one remote sensor can be configured to record and/or transmit a first and/or second test data set consisting of the measurements of the relative motion during locomotion or other physical activity of a position at or near to the body part of the user of the smartphone device, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The body part can be one or more of the smartphone device user's head, neck, shoulder, chest, cervical, thoracic or lumbar back, rib, elbow, wrist, hand, waist, sacrum, pubic bone, illiac crest, thigh, hip, knee, patella, shin bone or tibia, ankle, toe, forefoot, midfoot or heel of foot; or wherein the body part is part of the body of an animal or a portion of a plant. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The remote sensor can be located in any practical location on any article of clothing or personal equipment, including earphones or earplugs, helmet, glasses, watch, belt, waistband, elastic underwear, armband, attached with tape or bandage, necklace or lanyard, cervical collar, ring, headband, in any manner attached or embedded in conventional or specialized clothing, or glued on the skin of the wearer. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The at least one peripheral device with at least one remote sensor can transmit, in real time and/or later, the first and/or second data sets to the smartphone device and/or to another computer. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The apparatus or either or both of the footwear soles can include one or more or a multitude or 20 or 50 or 100 or 500 or 1000 or 4000 or 16,000 individual sensors. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The locomotion can include walking and/or running. The test data sets can include at least a full stride or many strides of the walking and/or running locomotion or at least one full cycle or many cycles of any other repetitive motion of the user. The first and/or second test data sets can be collected when the locomotion occurs on a flat level surface, a flat

uphill or upward inclining surface, or a flat downhill or downward inclining surface. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The apparatus or either or both of the footwear soles can be configured to include at least a magnetorheological fluid located in the one or more bladders, compartments, chambers, sipes or other portions, the magnetorheological fluid being controlled at least in part or completely by the smartphone device. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The apparatus or either or both of the footwear soles can be configured to include at least one valve located between the two or more bladders, compartments, chambers, sipes, or other portions, the at least one valve being controlled at least in part or completely by the smartphone device. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The apparatus or either or both of the footwear soles can be configured to include at least one electric and/or electronic and/or electromechanical device that is controlled at least in part or completely by the smartphone device Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The apparatus and/or footwear sole or soles can include at least one battery and/or at least one device wherein the body weight and/or muscular energy of a wearer of the smartphone device is used to generate electrical power in the apparatus or either or both of the footwear soles. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The apparatus or either or both of the footwear soles can be configured to include a wired and/or wireless connection to the smartphone device. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

An article of apparel or equipment can be configured to include wiring to connect the smartphone device to the apparatus and/or either or both of the footwear soles and/or one or more peripheral devices with at least one remote sensor; and/or wherein the smartphone device is configured to provide power to the apparatus and/or footwear soles and/or peripheral devices. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device can be configured to actively control the configuration of one or more footwear soles of the user by altering the relative longitudinal height, including positive or negative heel lift (or drop), or negative or positive forefoot lift, and/or the relative side-to-side height between lateral and medial sides, and/or the relative height between the right and the left footwear, or a combination of these relative height alterations. These alterations are structurally and functionally like those performed typically by podiatrists and orthopedic specialists, for example. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device can be configured to actively control the configuration of one or more footwear soles of the user by altering the relative longitudinal firmness between heel area and forefoot area and/or side-to-side firmness between lateral and medial side areas, and/or the relative firmness between the right and the left footwear, or a combination of these relative firmness alterations. These alterations are structurally and functionally like those performed typically by podiatrists and orthopedic specialists, for example. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device can be configured to actively control the configuration of one or more footwear soles of the user by altering the relative height or firmness under one or more of the foot bones of the wearer, including under the calcaneus, the lateral calcaneal tuberosity, the base of the fifth metatarsal, the longitudinal arch, the metatarsal arch, each of the heads of the metatarsals, and each of the distal phalanges, including the hallux or big toe. These alterations are structurally and functionally like those performed typically by podiatrists and orthopedic specialists, for example. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device can be configured to actively control of the apparatus or footwear configuration at least once per full operation cycle or locomotion stride, many times per full operation cycle or locomotion stride, once per many full operation cycles or locomotion strides, or based on a set time period of any duration or based on another test condition. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The device can be configured to record a first test data set consisting of measurements of the force and/or the relative pressure distribution of the wearer's foot sole on an upper surface of the footwear during the wearer's locomotion or other physical activity, as measured in at least one plane

(1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements, the footwear upper surface including at least a multitude or 20 or 50 or 100 or 500 or 1,000 or 4,000, or 16,000 individual pressure sensors. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

Using the second configuration setting, the smartphone device can be configured to record a second test data set consisting of measurements of the force and/or the relative pressure distribution of the wearer's footsole on an upper surface of the footwear during the wearer's locomotion or other physical activity, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device can be configured to compare the first test data set and the second test data set with a preferred data set for the measurements of force and/or relative pressure distribution of the foot sole of a model user or users on an upper surface of the footwear during the locomotion or other physical activity, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device can be configured to select the configuration setting of the soles that produced the test data set for the force or relative pressure distribution that is the closest to the preferred data set for relative pressure distribution and to reject the other configuration setting, thereby completing at least one full cycle of an operation to optimize the wearer's configuration. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The optimizing operation can be used to reduce a range of pronation and/or supination of the wearer's foot and ankle during the landing phase of locomotion through active configuration by the smartphone device of the either or both of the footwear soles. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The optimizing operation can be used by the smartphone device to actively configure either or both of the footwear soles or the apparatus in one or more or many areas of high and/or low pressure as measured on the upper surface of the footwear soles during the landing phase of locomotion or as measured on the outer surface of the apparatus during operation. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The optimizing operation can be used by the smartphone device to actively configure either or both of the footwear soles or the apparatus to produce a forefoot strike, a midfoot strike, or a heel strike at the beginning of the landing phase during locomotion for either or both of the wearer's feet. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The optimizing operation can be used by the smartphone device to actively configure either or both of the footwear soles or the apparatus to change the motion of the center of force on the surface of footwear for either or both of the wearer's feet during locomotion. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

Other test data sets can potentially be monitored, recorded, processed and/or transmitted by the smartphone device or remote sensor or sensors, such as blood pressure, heart rate, respiration rate, blood sugar level, weight, body temperature (core or a body part), ambient temperature, or any other body or body part measurement, medical or other, or audio or video. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

One or more of the test data sets can be transmitted to a cloud system for storage and/or shared or independent processing and/or analysis of groups or categories of users and/or shared access by permitted third parties and by the user. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

One or more of the test data sets can be transmitted to a web site for storage and/or processing and/or analysis of groups or categories of users and/or shared access by the user and by third parties permitted by the user. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device can be used to measure the relative positions to each other of a user's right and left feet during the stance phase of locomotion so as to determine the degree of crossover of right and/or left feet across the centerline of the user's body, as measured in the frontal plane during the stance phase of locomotion; and then to test a series of configuration settings in order to reduce or eliminate the crossover. Any of the components or methods of the example invention embodiments described in this

paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device and/or the apparatus and/or the footwear and/or the peripheral devices with sensors can be used as a medical system or a medical tool for diagnostic, therapeutic, and/or rehabilitative functions before and/or during and/or after surgical or other medical treatment. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device and/or the apparatus and/or the footwear and/or the peripheral devices with sensors can be used as a medical system or a medical tool for medical treatment functions through non-surgical means. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device and/or the apparatus and/or the footwear and/or the peripheral devices with sensors can be used as a podiatric system or a podiatric tool for diagnostic, therapeutic, and/or rehabilitative functions before and/or during and/or after surgical or other podiatric treatment. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device and/or the apparatus and/or the footwear and/or the peripheral devices with sensors can be used as a medical system or a medical tool to stimulate or retard structural bone growth and/or joint development in a child wearer prior to adulthood through non-surgical means. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device and/or the apparatus and/or the footwear and/or the peripheral devices with sensors can be used as a medical system or a medical tool to prevent or reduce the gradual deterioration of bone and/or joint structure in an adult wearer through non-surgical means. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device and/or the apparatus and/or the footwear and/or the peripheral devices with sensors can be used as a medical system or a medical tool to treat the deterioration of bone and/or joint structure in an elderly wearer through non-surgical means. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device can be worn at the centerline of the rearmost portion of the wearer's belt or otherwise attached at or near the small of the wearer's lumbar back, centered between and at about the level of the illiac crests. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The apparatus can be a helmet and/or helmet padding and/or other padding or protective gear, including braces, with one or more bladders, compartments, chambers, sipes, or other portions that are actively configured by the smartphone device. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The footwear can be configured so that any part of or all of the configurable components of the footwear are located in a removable or fixed insert or a removable or fixed orthotic. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

One or both of a wearer's footwear can be configured to include a sole which has concavely rounded upper and lower surfaces relative to the intended wearer's foot sole, as measured in at least in a frontal plane cross-section taken in the heel area, the forefoot, and in the midfoot area; and/or wherein the upper and lower surfaces are substantially parallel; and/or wherein the concavely rounded lower surface extends to the lateral extent **44** of one or both sides of the sole. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

One or both of a wearer's concavely rounded footwear can be configured to deform under the pressure of the wearer's body weight so as to flatten the rounding against the flat surface of the ground, in just the same way that rounded portions of the wearer's foot sole flatten against the flat surface of the ground. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

One or both of a wearer's footwear can be configured to include a sole which has a toe end portion and a heel end portion that have concavely rounded upper and lower surfaces relative to the position of the intended wearer's foot sole, as measured in at least in a sagittal plane cross-section taken along the long axis of the footwear; and/or wherein the upper and lower surfaces can be substantially parallel; and/or wherein the concavely rounded lower surface can extend to the most anterior extent and/or posterior extent of the sole; and/or one or both of a wearer's footwear can be

configured to include a flat portion between the toe end portion and heel end portion, as measured in at least in a sagittal plane cross-section taken along the long axis of the footwear. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

One or both sides of the sole can have at least one flexibility groove located in the midfoot of the footwear sole proximate to a flexibility axis **122** located at about the posterior of the forefoot of the footwear sole and anterior to a position proximate to the base of the fifth metatarsal of the intended wearer's foot sole; and/or the flexibility grove can extend through part or all of the underneath portion between the sides of the footwear sides; and/or the footwear sole has other flexibility grooves. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

One or both of a wearer's concavely rounded footwear soles can be formed from a flat sheet of heat and/or pressure-sensitive plastic and/or rubber, including foamed or blown, the flat sheet being put under heat and/or pressure by a press **55** with upper and lower surfaces configured to produce the concavely rounded footwear sole; and/or the footwear sole can be configured to include at least two layers that are laminated together with heat and/or pressure sensitive glue; and/or at least a part or all of the footwear sole can be formed using a mold. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

One or both of a wearer's footwear sole can be configured to have at least a semi-thong **3** positioned to be located between the big toe and second toe of the intended wearer's foot; the semi-thong can be fixed, fastened, or embedded in only to the upper surface and/or other portions of the footwear sole and can be not fixed to and/or contacting a portion of the footwear upper or straps; and/or optional semi-thongs positioned can be to be located between one or more or all of the other toes of the wearer's foot sole; and/or the semi-thong can have a round, an oval, or an anthropomorphically-determined shape, as viewed in a horizontal cross-section; and/or the semi-thong can be constructed of plastic and/or rubber, including foamed or blown; and/or the semi-thong can be configured to have at least one softer material on the outer surface and a core of at least one firmer material inside; and/or the semi-thong can be configured to form a portion of the bottom surface the footwear sole; and/or the semi-thong can be configured to be temporarily fastened to at least a portion of the footwear upper or strap; and/or wherein the semi-thong can have a strut extending forward between the toes that serves as a protective partition between the toes. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

One or both of a wearer's most minimalist footwear can be a footwear sole and/or a sock that is configured to include only a fabric layer, a traction coating layer on the outer surface of the fabric, and a traction coating layer on the inner surface of the fabric; and/or wherein the coating layers can be rubber and/or plastic, including foamed and/or blown; and/or wherein one or both of the coating layers can be continuous or formed in a geometric or other pattern or randomly oriented and/or irregularly shaped; and/or the minimalist footwear can be configured to include a midsole insert and/or orthotic; and/or wherein one or both of a wearer's most minimalist footwear can be a footwear sole and/or a sock that is configured to include only the fabric, which is fabricated with a thread coated with a traction coating layer. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

One or both of a wearer's most minimalist footwear can be a footwear sole and/or a sock that can be configured to include at least one fabric layer, at least one traction coating layer on the outer surface of the fabric, and at least one traction coating layer on the inner surface of the fabric; and/or wherein the coating layers can be rubber and/or plastic, including foamed and/or blown; and/or wherein one or both of the coating layers can be continuous or formed in a geometric or other pattern or randomly can be oriented and/or irregularly shaped; and/or the minimalist footwear can be configured to include a midsole insert and/or orthotic; and/or wherein the fabric can be fabricated with a thread coated with a traction coating layer. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

The smartphone device or apparatus can be configured to include an outer coating of Teflon™. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

A software app can configure at least a portion of a part or all of the configuration of a smartphone device and/or one or more sensors and/or one or both footwear and/or one or more apparatus. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

A sole and/or a removable inner sole insert for footwear can comprise the following: one or more bladders, compartments, chambers, internal sipes or other portions located in the sole and/or in a removable insert; one or more sensors located in or on the sole and/or in the removable sole insert and/or located in or on an insole; the one or more bladders, compartments, chambers, sipes or other portions and the one or more sensors can be configured for control by a smartphone or other mobile computer device, general purpose or specialized; and/or the control can be conducted through a wired or a wireless connection. In addition, one or both of a wearer's footwear and/or the removable inner sole insert for footwear can be configured to include a sole which has

concavely rounded upper and lower surfaces relative to the intended wearer's foot sole, as measured in at least in a frontal plane cross-section taken in the heel area, the forefoot, and in the midfoot area; and/or the upper and lower surfaces can be substantially parallel; and/or the concavely rounded lower surface can extend to the lateral extent **44** of one or both sides of the sole; and/or the lateral extent **44** can extend above the lowest point of the inner footwear surface. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

A sole and/or a removable inner sole insert for footwear for footwear can comprise the following: one or both of a wearer's footwear can be configured to include a sole and/or the removable inner sole insert which has concavely rounded upper and lower surfaces relative to the intended wearer's foot sole, as measured in at least in a frontal plane cross-section taken in the heel area, the forefoot, and in the midfoot area; and/or the upper and lower surfaces can be substantially parallel; and/or the concavely rounded lower surface can extend to the lateral extent **44** of one or both sides of the sole; and/or the lateral extent **44** can extend above the lowest point of the inner footwear surface. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

A sole and/or a removable sole insert for footwear can comprise the following: one or both of a wearer's footwear sole and/or the removable sole insert can be configured to have at least a semi-thong **3** positioned to be located between the big toe and second toe of the intended wearer's foot; the semi-thong can be fixed, fastened, or embedded in only to the upper surface and/or other portions of the footwear sole and can be not fixed to and/or contacting a portion of the footwear upper or straps; and/or optional semi-thongs can be positioned to be located between one or more or all of the other toes of the wearer's foot sole; and/or the semi-thong can have a round, an oval, or an anthropomorphically-determined shape, as viewed in a horizontal cross-section; and/or the semi-thong can be constructed of plastic and/or rubber, including foamed or blown; and/or the semi-thong can be configured to have at least one softer material on the outer surface and a core of at least one firmer material inside; and/or the semi-thong can be configured to form a portion of the bottom surface the footwear sole; and/or the semi-thong can be configured to be temporarily fastened to at least a portion of the footwear upper or strap; and/or wherein the semi-thong can have a strut extending forward between the toes that serves as a protective partition between the toes. One or both of a wearer's footwear can be configured to include a sole which has concavely rounded upper and lower surfaces relative to the intended wearer's foot sole, as measured in at least in a frontal plane cross-section taken in the heel area, the forefoot, and in the midfoot area; and/or wherein the upper and lower surfaces can be substantially parallel; and/or wherein the concavely rounded lower surface can extend to the lateral extent **44** of one or both sides of the sole. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

A sole can comprise the following: one or both of a wearer's most minimalist footwear can be a footwear sole and/or a sock that can be configured to include only a fabric layer, a traction coating layer on the outer surface of the fabric, and a traction coating layer on the inner surface of the fabric; and/or wherein the coating layers can be a rubber and/or plastic, including foamed and/or blown; and/or wherein one or both of the coating layers can be continuous or formed in a geometric or other pattern or randomly oriented and/or irregularly shaped; and/or the minimalist footwear can be configured to include a midsole insert and/or orthotic; and/or wherein one or both of a wearer's most minimalist footwear can be a footwear sole and/or a sock that is configured to include only the fabric, which can be fabricated with a thread coated with a traction coating layer; and/or the sole is configure to allow for a removable sole insert as discussed at least in the several preceding three paragraphs. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

A sole can comprise the following: one or both of a wearer's most minimalist footwear can be a footwear sole and/or a sock that can be configured to include at least one fabric layer, at least one traction coating layer on the outer surface of the fabric, and at least one traction coating layer on the inner surface of the fabric; and/or wherein the coating layers can be rubber and/or plastic, including foamed and/or blown; and/or wherein one or both of the coating layers can be continuous or formed in a geometric or other pattern or randomly oriented and/or irregularly shaped; and/or the minimalist footwear can be configured to include a midsole insert and/or orthotic; and/or wherein the fabric can be fabricated with a thread coated with a traction coating layer; and/or the sole can be configured to allow for a removable sole insert as discussed above. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

An apparatus can comprise the following: one or more bladders, compartments, chambers, sipes or other portions can be located in the apparatus; one or more sensors can be located in or on the apparatus; the one or bladders, compartments, chambers, sipes or other portions and the one or more sensors being configured for control by a smartphone or other mobile computer device, general purpose or specialized; and/or the control can be conducted through a wired or a wireless connection. The apparatus can be configured to operate with and/or be controlled by the smartphone device as described in detail above. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

An article of apparel or equipment can comprise the following: the article of apparel or equipment can be configured to include wiring to connect the smartphone device to the apparatus and/or either or both of the footwear soles and/or one or more peripheral devices with at least one

remote sensor; and/or wherein the smartphone device can be configured to provide power to the apparatus and/or footwear soles and/or peripheral devices. Any of the components or methods of the example invention embodiments described in this paragraph can be combined with any other components or methods of the example invention embodiments described in previous paragraphs above or in the patents or applications incorporated by reference in this application.

A helmet, including faceguard and/or chinguard, or other protective equipment including braces and body armor can be configured to comprise an outer coating of Teflon™ 304 to reduce rotational forces such as on the head. Even a smartphone device or an apparatus can usefully be configured to comprise an outer coating of Teflon™ 304 to reduce forces when positioned inside a protective case; alternatively, a case or other protective device for a smartphone device or tablet or other electronic device can be configured to comprise an outer coating of Teflon™ to reduce tangential impact forces.

This application incorporates by reference in their entirety the following published U.S. Patent and patent applications: U.S. Pat. No. 5,317,819 issued Jun. 7, 1994; U.S. Pat. No. 5,813,142 issued Sep. 29, 2998 to Ronald S. Demon; U.S. Pat. No. 5,909,948 issued Jun. 8, 1999; U.S. Pat. No. 6,163,982 issued Dec. 26, 2000; application Ser. No. 11/282,665 published Nov. 9, 2006 as Pub. No. 2006/0248749 A1; application Ser. No. 11/802,930 published Apr. 17, 2008 as Pub. No. US 2008/0086916 A1; application Ser. No. 11/190,087 published Feb. 26, 2008 as U.S. Pat. No. 7,334,350 B2; and application Ser. No. 12/292,769 published on Aug. 13, 2009 as Pub. No. US 2009/0200661 A1. The publication cover pages of the '948, '350 patent and the '665, '930, and '769 patent applications are also included with this application at the end to confirm the specific and explicit incorporation by reference of these four documents.

More specifically incorporated by reference are at least the following figures and the textual specification associated with the figures: FIGS. 9-12 of the '948 patent; FIGS. 1C, 15, 16, 17A & B, 29A & B, 32A & B, 44, 59, 60, 61A & B, 69, 70, and 79 of the '930 U.S. patent application; FIGS. 11M, 11N, 11O, and 11P of the '350 U.S. patent; FIGS. 11M, 11N, 11O, 11P, 11T, 11U, 63, 97, 98, and 99A & B of the '665 U.S. patent application; and FIG. 23G of the '769 U.S. patent application. Copies of these figures are also included in this application.

The applicant claims the right to priority based on U. S. Provisional Patent Applications previously filed.

The applicant's other footwear U.S. Pat. Nos. 4,989,349; 5,317,819; 5,544,429; 5,909,948; 6,115,941; 6,115,945; 6,163,982; 6,308,439; 6,314,662; 6,295,744; 6,360,453; 6,487,795; 6,584,706; 6,591,519; 6,609,312; 6,629,376; 6,662,470; 6,675,498; 6,675,499; 6,708,424; 6,729,046; 6,748,674; 6,763,616; 6,789,331; 6,810,606; 6,877,254; 6,918,197; 7,010,869; 7,082,697; 7,093,379; 7,127,834; 7,168,185; and 7,174,658 are hereby incorporated by reference herein in their entirety into this application for completeness of disclosure of the applicant's novel and useful combination of one or more of any of the features or components of any of the figures of this application with one or more of any of the features of any one or more of the preceding applicant's patents listed above in this paragraph.

The applicant's other footwear published U.S. Application Numbers 20020000051; 20020007571; 20020007572; 20020014020; 20020014021; 20020023373; 20020073578; 20020116841; 20030046830; 20030070320; 20030079375; 20030131497; 20030208926; 20030217482; 20040134096; 20040250447; 20050016020; 20050086837; 20050217143; and 20060032086 are hereby incorporated by reference herein in their entirety into this application for completeness of disclosure of the applicant's novel and useful combination of one or more of any of the features or components of any of the figures of this application with one or more of any of the features of any one or more of the preceding applicant's published U.S. Applications listed above in this paragraph.

The preceding novel methods, apparatus and software for computers including for a computer including a smartphone and other related devices and for peripheral devices with sensors to be used with said computers.

A. A smartphone or other mobile computer device, general purpose or specialized, comprising: the smartphone device is configured to actively control the configuration of one or more bladders, compartments, chambers or internal sipes and one or more sensors located in either one or both of a sole or a removable inner sole insert of the footwear of the user and/or located in an apparatus worn or carried by the user, glued unto the user, or implanted in the user; and the one or more bladders, compartments, chambers, or sipes, and one or more sensors being configured for computer control.

B. The smartphone device of paragraph A, wherein the device is configured to record a first test data set consisting of measurements by a sensor of the force and/or relative pressure distribution of a wearer's footsole on or near an upper surface of the wearer's footwear during the wearer's locomotion or other physical activity; the first test data set as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements.

C. The smartphone device of any one of paragraphs A-B, wherein the device is configured to record a first test data set consisting of measurements by a sensor of the relative motion during the user's locomotion or other physical activity of a position at or near to a part of the body of the user of the smartphone device; the first test data set as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements.

D. The smartphone device of any one of paragraphs A-C, wherein the device is configured to record a first test data set consisting of measurements of the relative motion during the user's locomotion or other physical activity of a position that is at or near the center of gravity of the body of the user of the smartphone device, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements.

E. The smartphone device of any one of paragraphs A-D, wherein the smartphone device is configured to establish a first configuration setting for the bladders, compartments, chambers, sipes or other portions of the apparatus or of either or both of the footwear soles.

F. The smartphone device of any one of paragraphs A-E, wherein the first configuration setting is a neutral or baseline condition, including the condition wherein the smartphone device has not activated control of the apparatus or the footwear soles.

G. The smartphone device of any one of paragraphs A-F, wherein the smartphone device is configured to activate a second configuration setting for the bladders, compartments, chambers, sipes, or other portions of the apparatus or of either or both of the soles, the second configuration being different from the first configuration setting.

H. The smartphone device of any one of paragraphs A-G, wherein using the second configuration setting, the smartphone device is configured to record a second test data set consisting of measurements of the relative motion during locomotion or other physical activity of the position at or near to the part of the user, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements.

I. The smartphone device of any one of paragraphs A-H, wherein using the second configuration setting, the smartphone device is configured to record a second test data set consisting of measurements of the relative motion during locomotion or other physical activity of the position at or near to the center of gravity of the user, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements.

J. The smartphone device of any one of paragraphs A-I, wherein the smartphone device is configured to compare the first test data set and the second test data set with a preferred data set for the measurements of relative motion during locomotion or other physical activity of the part of a model user or users, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements.

K. The smartphone device of any one of paragraphs A-J, wherein the smartphone device is configured to compare the first test data set and the second test data set with a preferred data set for the measurements of relative motion during locomotion or other physical activity of the position at or near to the part of a model user or users, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements.

L. The smartphone device of any one of paragraphs A-K, wherein the smartphone device is configured to compare the first test data set and the second test data set with a preferred data set for the measurements of relative motion during locomotion or other physical activity of the position at or near to the center of gravity of a model user or users, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements.

M. The smartphone device of any one of paragraphs A-L, wherein the smartphone device is configured to select the configuration setting of the footwear soles that produced the test data set that is the closest to the preferred data set and to reject the other configuration setting, thereby completing at least one full cycle of an operation to optimize the configuration for the wearer.

N. The smartphone device of any one of paragraphs A-M, wherein the full cycle of the configuration optimizing operation is repeated as frequently as necessary until the most recent test data set either closely matches the preferred data set or cannot be made to match the test data more closely.

O. The smartphone device of any one of paragraphs A-N, wherein the full cycle of the configuration optimizing operation is repeated hundreds or thousands or millions or billions of times.

P. The smartphone device of any one of paragraphs A-O, wherein the model user or users are chosen from a group of shod or barefoot users who have a history of low levels of overuse and/or acute injuries, the barefoot users including users that are distinguished by level of previous or current conventional footwear use, such as barefoot users that have been formerly shod and/or occasionally shod or seldom shod or never shod with conventional footwear.

Q. The smartphone device of any one of paragraphs A-P, wherein the smartphone device is configured to include a gyroscope and an accelerometer.

R. The smartphone device of any one of paragraphs A-Q, wherein the smartphone device is configured to include one or more wired connections and/or one or more wireless connections, the wireless connections including WiFi, Bluetooth, near field communications (NFC) and/or cellular.

S. The smartphone device of any one of paragraphs A-R, wherein the relative motion includes geographic motion tracking between one or more geographic positions and said device is configured to include a global positioning system (GPS) components and/or another geographic location tracking capability.

T. The smartphone device of any one of paragraphs A-S, wherein the smartphone device is configured for wired and/or wireless connection to at least one peripheral device with at least one remote sensor located at or near to a body part of the user.

U. The smartphone device of any one of paragraphs A-T, wherein the remote sensor is of any known type, including motion, pressure, time, heat moisture, chemical, electrical, or electromagnetic sensor.

V. The smartphone device of any one of paragraphs A-U, wherein the at least one peripheral device is a headphone set or a audio earplugs set or an earplugs set with at least one or two remote motion sensors.

W. The smartphone device of any one of paragraphs A-V, wherein the at least one peripheral device with at least one remote sensor is configured to record and/or transmit a first and/or second test data set consisting of the measurements of the relative motion during locomotion or other physical activity of a position at or near to the body part of the user of the smartphone device, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements.

X. The smartphone device of any one of paragraphs A-W, wherein the body part is one or more of the smartphone device user's head, neck, shoulder, chest, cervical, thoracic or lumbar back, rib, elbow, wrist, hand, waist, sacrum, pubic bone, illiac crest, thigh, hip, knee, patella, shin bone or tibia, ankle, toe, forefoot, midfoot or heel of foot; or wherein the body part is part of the body of an animal or a portion of a plant.

Y. The smartphone device of any one of paragraphs A-X, wherein the remote sensor is located in any practical location on any article of clothing or personal equipment, including earphones or earplugs, helmet, glasses, watch, belt, waistband, elastic underwear, armband, attached with tape or bandage, necklace or lanyard, cervical collar, ring, headband, in any manner attached or embedded in conventional or specialized clothing, or glued on the skin of the wearer.

Z. The smartphone device of any one of paragraphs A-Y, wherein the at least one peripheral device with at least one remote sensor transmits, in realtime and/or later, the first and/or second data sets to the smartphone device and/or to another computer.

AA. The smartphone device of any one of paragraphs A-Z, wherein the apparatus or either or both of the footwear soles include one or more or a multitude or 20 or 50 or 100 or 500 or 1000 or 4000 or 16,000 individual sensors.

BB. The smartphone device of any one of paragraphs A-Z and AA, wherein the locomotion includes walking and/or running.

CC. The smartphone device of any one of paragraphs A-Z and AA-BB, wherein the test data sets include at least a full

stride or many strides of the walking and/or running locomotion or at least one full cycle or many cycles of any other repetitive motion of the user.

DD. The smartphone device of any one of paragraphs A-Z and AA-CC, wherein the first and/or second test data sets are collected when the locomotion occurs on a flat level surface, a flat uphill or upward inclining surface, or a flat downhill or downward inclining surface.

EE. The smartphone device of any one of paragraphs A-Z and AA-DD, wherein the apparatus or either or both of the footwear soles are configured to include at least a magnetorheological fluid located in the one or more bladders, compartments, chambers, sipes or other portions, the magnetorheological fluid being controlled at least in part or completely by the smartphone device.

FF. The smartphone device of any one of paragraphs A-Z and AA-EE, wherein the apparatus or either or both of the footwear soles are configured to include at least one valve located between the two or more bladders, compartments, chambers, sipes, or other portions, the at least one valve being controlled at least in part or completely by the smartphone device.

GG. The smartphone device of any one of paragraphs A-Z and AA-FF, wherein the apparatus or either or both of the footwear soles are configured to include at least one electric and/or electronic and/or electromechanical device that is controlled at least in part or completely by the smartphone device.

HH. The smartphone device of any one of paragraphs A-Z and AA-GG, wherein at least one battery and/or at least one device wherein the body weight and/or muscular energy of a wearer of the smartphone device is used to generate electrical power in the apparatus or either or both of the footwear soles.

II. The smartphone device of any one of paragraphs A-Z and AA-HH, wherein the apparatus or either or both of the footwear soles are configured to include a wired and/or wireless connection to the smartphone device.

JJ. The smartphone device of any one of paragraphs A-Z and AA-II, wherein an article of apparel or equipment is configured to include wiring to connect the smartphone device to the apparatus and/or either or both of the footwear soles and/or one or more peripheral devices with at least one remote sensor; and/or wherein the smartphone device is configured to provide power to the apparatus and/or footwear soles and/or peripheral devices.

KK. The smartphone device of any one of paragraphs A-Z and AA-JJ, wherein the smartphone device is configured to actively control the configuration of one or more footwear soles of the user by altering the relative longitudinal height, including positive or negative heel lift, or negative or positive forefoot lift, and/or the relative side-to-side height between lateral and medial sides, and/or the relative height between the right and the left footwear soles, or a combination of these relative height alterations.

LL. The smartphone device of any one of paragraphs A-Z and AA-KK, wherein the smartphone device is configured to actively control the configuration of one or more footwear soles of the user by altering the relative longitudinal firmness between heel area and forefoot area and/or side-to-side firmness between lateral and medial side areas, and/or the relative firmness between the right and the left footwear soles, or a combination of these relative firmness alterations.

MM. The smartphone device of any one of paragraphs A-Z and AA-LL, wherein the smartphone device is configured to actively control the configuration of one or more footwear soles of the user by altering the relative height or firmness under one or more of the foot bones of the wearer, including under the calcaneus, the lateral calcaneal tuberosity, the base of the fifth metatarsal, the longitudinal arch, the metatarsal arch, each of the heads of the metatarsals, and each of the distal phalanges, including the hallux or big toe.

NN. The smartphone device of any one of paragraphs A-Z and AA-MM, wherein the smartphone device is configured to actively control of the apparatus or footwear configuration at least once per full operation cycle or locomotion stride, many times per full operation cycle or locomotion stride, once per many full operation cycles or locomotion strides, or based on a set time period of any duration or based on another test condition.

OO. The smartphone device of any one of paragraphs A-Z and AA-NN, wherein the device is configured to record a first test data set consisting of measurements of the force and/or the relative pressure distribution of the wearer's footsole on an upper surface of the footwear during the wearer's locomotion or other physical activity, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements, the footwear upper surface including at least a multitude or 20 or 50 or 100 or 500 or 1,000 or 4,000, or 16,000 individual pressure sensors.

PP. The smartphone device of any one of paragraphs A-Z and AA-OO, wherein using the second configuration setting, the smartphone device is configured to record a second test data set consisting of measurements of the force and/or the relative pressure distribution of the wearer's footsole on an upper surface of the footwear during the wearer's locomotion or other physical activity, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements.

QQ. The smartphone device of any one of paragraphs A-Z and AA-PP, wherein the smartphone device is configured to compare the first test data set and the second test data set with a preferred data set for the measurements of force and/or relative pressure distribution of the foot sole of a model user or users on an upper surface of the footwear during the locomotion or other physical activity, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements.

RR. The smartphone device of any one of paragraphs A-Z and AA-QQ, wherein the smartphone device is configured to select the configuration setting of the soles that produced the test data set for the force or relative pressure distribution that is the closest to the preferred data set for relative pressure distribution and to reject the other configuration setting, thereby completing at least one full cycle of an operation to optimize the wearer's configuration.

SS. The smartphone device of any one of paragraphs A-Z and AA-RR, wherein the optimizing operation is used to reduce a range of pronation and/or supination of the wearer's foot and ankle during the landing phase of locomotion through active configuration by the smartphone device of the either or both of the footwear soles.

TT. The smartphone device of any one of paragraphs A-Z and AA-SS, wherein the optimizing operation is used by the smartphone device to actively configure either or both of the footwear soles or the apparatus in one or more or many areas of high and/or low pressure as measured on the upper surface of the footwear soles during the landing phase of locomotion or as measured on the outer surface of the apparatus during operation.

UU. The smartphone device of any one of paragraphs A-Z and AA-TT, wherein the optimizing operation is used by the

smartphone device to actively configure either or both of the footwear soles or the apparatus to produce a forefoot strike, a midfoot strike, or a heel strike at the beginning of the landing phase during locomotion for either or both of the wearer's feet.

VV. The smartphone device of any one of paragraphs A-Z and AA-UU, wherein the optimizing operation is used by the smartphone device to actively configure either or both of the footwear soles or the apparatus to change the motion of the center of force on the surface of footwear for either or both of the wearer's feet during locomotion.

WW. The smartphone device of any one of paragraphs A-Z and AA-VV, wherein other test data sets can potentially be monitored, recorded, processed and/or transmitted by the smartphone device or remote sensor or sensors, such as blood pressure, heart rate, respiration rate, blood sugar level, weight, body temperature (core or a body part), ambient temperature, or any other body or body part measurement, medical or other, or audio or video.

XX. The smartphone device of any one of paragraphs A-Z and AA-WW, wherein one or more of the test data sets are transmitted to a cloud system for storage and/or shared or independent processing and/or analysis of groups or categories of users and/or shared access by permitted third parties and by the user.

YY. The smartphone device of any one of paragraphs A-Z and AA-XX, wherein one or more of the test data sets are transmitted to a web site for storage and/or processing and/or analysis of groups or categories of users and/or shared access by the user and by third parties permitted by the user.

ZZ. The smartphone device of any one of paragraphs A-Z and AA-YY, wherein the smartphone device is used to measure the relative positions to each other of a user's right and left feet during the stance phase of locomotion so as to determine the degree of crossover of right and/or left feet across the centerline of the user's body, as measured in the frontal plane during the stance phase of locomotion; and then to test a series of configuration settings in order to reduce or eliminate the crossover.

AAA. The smartphone device of any one of paragraphs A-Z and AA-ZZ, wherein the smartphone device and/or the apparatus and/or the footwear and/or the peripheral devices with sensors are used as a medical system or a medical tool for diagnostic, therapeutic, and/or rehabilitative functions before and/or during and/or after surgical or other medical treatment.

BBB. The smartphone device of any one of paragraphs A-Z and AA-ZZ and AAA, wherein the smartphone device and/or the apparatus and/or the footwear and/or the peripheral devices with sensors are used as a medical system or a medical tool for medical treatment functions through non-surgical means.

CCC. The smartphone device of any one of paragraphs A-Z and AA-ZZ and AAA-BBB, wherein the smartphone device and/or the apparatus and/or the footwear and/or the peripheral devices with sensors are used as a podiatric system or a podiatric tool for diagnostic, therapeutic, and/or rehabilitative functions before and/or during and/or after surgical or other podiatric treatment.

DDD. The smartphone device of any one of paragraphs A-Z and AA-ZZ and AAA-CCC, wherein the smartphone device and/or the apparatus and/or the footwear and/or the peripheral devices with sensors are used as a medical system or a medical tool to stimulate or retard structural bone growth and/or joint development in a child wearer prior to adulthood through non-surgical means.

EEE. The smartphone device of any one of paragraphs A-Z and AA-ZZ and AAA-DDD, wherein the smartphone device and/or the apparatus and/or the footwear and/or the peripheral devices with sensors are used as a medical system or a medical tool to prevent or reduce the gradual deterioration of bone and/or joint structure in an adult wearer through non-surgical means.

FFF. The smartphone device of any one of paragraphs A-Z and AA-ZZ and AAA-EEE, wherein the smartphone device and/or the apparatus and/or the footwear and/or the peripheral devices with sensors are used as a medical system or a medical tool to treat the deterioration of bone and/or joint structure in an elderly wearer through non-surgical means.

GGG. The smartphone device of any one of paragraphs A-Z and AA-ZZ and AAA-FFF, wherein the smartphone device is worn at the centerline of the rearmost portion of the wearer's belt or otherwise attached at or near the small of the wearer's lumbar back, centered between and at about the level of the illiac crests.

HHH. The smartphone device of any one of paragraphs A-Z and AA-ZZ and AAA-GGG, wherein the apparatus is a helmet and/or helmet padding and/or other padding or protective gear, including braces, with one or more bladders, compartments, chambers, sipes, or other portions that are actively configured by the smartphone device.

III. The smartphone device of any one of paragraphs A-Z and AA-ZZ and AAA-HHH, wherein the footwear is configured so that any part of or all of the configurable components of the footwear are located in a removable or fixed insert or a removable or fixed orthotic.

JJJ. The smartphone device of any one of paragraphs A-Z and AA-ZZ and AAA-III, wherein one or both of a wearer's footwear is configured to include a sole which has concavely rounded upper and lower surfaces relative to the intended wearer's foot sole, as measured in at least in a frontal plane cross-section taken in the heel area, the forefoot, and in the midfoot area; and/or wherein the upper and lower surfaces are substantially parallel; and/or wherein the concavely rounded lower surface extends to the lateral extent of one or both sides of the sole.

KKK. The smartphone device of any one of paragraphs A-Z and AA-ZZ and AAA-JJJ, wherein one or both of a wearer's concavely rounded footwear is configured to deform under the pressure of the wearer's body weight so as to flatten the rounding against the flat surface of the ground, in the same way that rounded portions of the wearer's foot sole flatten against the flat surface of the ground.

LLL. The smartphone device of any one of paragraphs A-Z and AA-ZZ and AAA-KKK, wherein one or both of a wearer's footwear is configured to include a sole which has a toe end portion and a heel end portion that have concavely rounded upper and lower surfaces relative to the position of the intended wearer's foot sole, as measured in at least in a sagittal plane cross-section taken along the long axis of the footwear; and/or wherein the upper and lower surfaces are substantially parallel; and/or wherein the concavely rounded lower surface extends to the most anterior extent and/or posterior extent of the sole; and/or one or both of a wearer's footwear is configured to include a flat portion between the toe end portion and heel end portion, as measured in at least in a sagittal plane cross-section taken along the long axis of the footwear.

MMM. The smartphone device of any one of paragraphs A-Z and AA-ZZ and AAA-LLL, wherein one or both sides of the sole has at least one flexibility groove located in the midfoot of the footwear sole proximate to a flexibility axis **122** located at about the posterior portion of the forefoot of

the footwear sole and anterior to a position proximate to the base of the fifth metatarsal of the intended wearer's foot sole; and/or wherein the flexibility grove extends through part or all of the underneath portion between the sides of the footwear sides; and/or the footwear sole has other flexibility grooves.

NNN. The smartphone device of any one of paragraphs A-Z and AA-ZZ and AAA-MMM, wherein one or both of a wearer's concavely rounded footwear sole is formed from a flat sheet of heat and/or pressure-sensitive plastic and/or rubber, including foamed or blown, the flat sheet being put under heat and/or pressure by a press with upper and lower surfaces configured to produce the concavely rounded footwear sole; and/or the footwear sole is configured to include at least two layers that are laminated together with heat and/or pressure sensitive glue; and/or at least a part or all of the footwear sole is formed using a mold.

OOO. The smartphone device of any one of paragraphs A-Z and AA-ZZ and AAA-NNN, wherein one or both of a wearer's footwear sole is configured to have at least a semi-thong positioned to be located between the big toe and second toe of the intended wearer's foot; the semi-thong is fixed, fastened, or embedded in only to the upper surface and/or other portions of the footwear sole and is not fixed to and/or contacting a portion of the footwear upper or straps; and/or optional semi-thongs positioned to be located between one or more or all of the other toes of the wearer's foot sole; and/or the semi-thong has a round, an oval, or an anthropomorphically-determined shape, as viewed in a horizontal cross-section; and/or the semi-thong is constructed of plastic and/or rubber, including foamed or blown; and/or the semi-thong is configured to have at least one softer material on the outer surface and a core of at least one firmer material inside; and/or the semi-thong is configured to form a portion of the bottom surface the footwear sole; and/or the semi-thong is configured to be temporarily fastened to at least a portion of the footwear upper or strap; and/or wherein the semi-thong has a strut extending forward between the toes that serves as a protective partition between the toes.

PPP. The smartphone device of any one of paragraphs A-Z and AA-ZZ and AAA-OOO, wherein one or both of a wearer's most minimalist footwear is a footwear sole and/or a sock that is configured to include only a fabric layer, a traction coating layer on the outer surface of the fabric, and a traction coating layer on the inner surface of the fabric; and/or wherein the coating layers are rubber and/or plastic, including foamed and/or blown; and/or wherein one or both of the coating layers are continuous or formed in a geometric or other pattern or randomly oriented and/or irregularly shaped; and/or the minimalist footwear is configured to include a midsole insert and/or orthotic; and/or wherein one or both of a wearer's most minimalist footwear is a footwear sole and/or a sock that is configured to include only the fabric, which is fabricated with a thread coated with a traction coating layer.

QQQ. The smartphone device of any one of paragraphs A-Z and AA-ZZ and AAA-PPP, wherein one or both of a wearer's most minimalist footwear is a footwear sole and/or a sock that is configured to include at least one fabric layer, at least one traction coating layer on the outer surface of the fabric, and at least one traction coating layer on the inner surface of the fabric; and/or wherein the coating layers are rubber and/or plastic, including foamed and/or blown; and/or wherein one or both of the coating layers are continuous or formed in a geometric or other pattern or randomly oriented and/or irregularly shaped; and/or the minimalist footwear is configured to include a midsole insert and/or orthotic; and/or wherein the fabric is fabricated with a thread coated with a traction coating layer.

RRR. The smartphone device of any one of paragraphs A-Z and AA-ZZ and AAA-QQQ, wherein a software app configures at least a portion of a part or all of the smartphone device and/or sensors and/or footwear and/or apparatus.

SSS. A sole and/or a removable inner sole insert for footwear, comprising: one or more bladders, compartments, chambers, internal sipes or other portions located in the sole and/or in a removable insert; one or more sensors located in or on the sole and/or in the removable sole insert and/or located in or on an insole; the one or more bladders, compartments, chambers, sipes or other portions and the one or more sensors being configured for control by a smartphone or other mobile computer device, general purpose or specialized; and/or the control is conducted through a wired or a wireless connection.

TTT. The sole and/or the removable sole insert of paragraph SSS, wherein one or both of a wearer's footwear and/or the removable inner sole insert for footwear is configured to include a sole which has concavely rounded upper and lower surfaces relative to the intended wearer's foot sole, as measured in at least in a frontal plane cross-section taken in the heel area, the forefoot, and in the midfoot area; and/or wherein the upper and lower surfaces are substantially parallel; and/or wherein the concavely rounded lower surface extends to the lateral extent of one or both sides of the sole; and/or wherein the lateral extent extends above the lowest point of the inner footwear surface.

UUU. The sole and/or the removable sole insert of paragraph SSS, wherein one or both of a wearer's footwear is configured to operate with and/or be controlled by the smartphone device of any one of paragraphs A-Z and AA-ZZ and AAA-RRR.

VVV. A sole and/or a removable inner sole insert for footwear for footwear, comprising: one or both of a wearer's footwear is configured to include a sole and/or the removable inner sole insert which has concavely rounded upper and lower surfaces relative to the intended wearer's foot sole, as measured in at least in a frontal plane cross-section taken in the heel area, the forefoot, and in the midfoot area; and/or wherein the upper and lower surfaces are substantially parallel; and/or wherein the concavely rounded lower surface extends to the lateral extent of one or both sides of the sole; and/or wherein the lateral extent extends above the lowest point of the inner footwear surface.

WWW. A sole and/or a removable sole insert for footwear, comprising:

one or both of a wearer's footwear sole and/or the removable sole insert is configured to have at least a semi-thong positioned to be located between the big toe and second toe of the intended wearer's foot; the semi-thong is fixed, fastened, or embedded in only to the upper surface and/or other portions of the footwear sole and is not fixed to and/or contacting a portion of the footwear upper or straps; and/or optional semi-thongs positioned to be located between one or more or all of the other toes of the wearer's foot sole; and/or the semi-thong has a round, an oval, or an anthropomorphic-ally-determined shape, as viewed in a horizontal cross-section; and/or the semi-thong is constructed of plastic and/or rubber, including foamed or blown; and/or the semi-thong is configured to have at least one softer material on the outer surface and a core of at least one firmer material inside; and/or the semi-thong is configured to form a portion of the bottom surface the footwear sole; and/or the semi-thong is configured to be temporarily fastened to at least a portion of the footwear upper or strap;

and/or wherein the semi-thong has a strut extending forward between the toes that serves as a protective partition between the toes.

XXX. The sole and/or the removable sole insert of paragraph SSS, wherein one or both of a wearer's footwear is configured to include a sole which has concavely rounded upper and lower surfaces relative to the intended wearer's foot sole, as measured in at least in a frontal plane cross-section taken in the heel area, the forefoot, and in the midfoot area; and/or wherein the upper and lower surfaces are substantially parallel; and/or wherein the concavely rounded lower surface extends to the lateral extent of one or both sides of the sole.

YYY. A sole, comprising: one or both of a wearer's most minimalist footwear is a footwear sole and/or a sock that is configured to include only a fabric layer, a traction coating layer on the outer surface of the fabric, and a traction coating layer on the inner surface of the fabric; and/or wherein the coating layers are rubber and/or plastic, including foamed and/or blown; and/or wherein one or both of the coating layers are continuous or formed in a geometric or other pattern or randomly oriented and/or irregularly shaped; and/or the minimalist footwear is configured to include a midsole insert and/or orthotic; and/or wherein one or both of a wearer's most minimalist footwear is a footwear sole and/or a sock that is configured to include only the fabric, which is fabricated with a thread coated with a traction coating layer; and/or the sole is configure to allow for a removable sole insert of any one of paragraphs SSS-UUU.

ZZZ. A sole, comprising: one or both of a wearer's most minimalist footwear is a footwear sole and/or a sock that is configured to include at least one fabric layer, at least one traction coating layer on the outer surface of the fabric, and at least one traction coating layer on the inner surface of the fabric; and/or wherein the coating layers are rubber and/or plastic, including foamed and/or blown; and/or wherein one or both of the coating layers are continuous or formed in a geometric or other pattern or randomly oriented and/or irregularly shaped; and/or the minimalist footwear is configured to include a midsole insert and/or orthotic; and/or wherein the fabric is fabricated with a thread coated with a traction coating layer; and/or the sole is configure to allow for a removable sole insert of any one of paragraphs SSS-UUU.

AAAA. An apparatus, comprising: one or more bladders, compartments, chambers, sipes or other portions located in the apparatus; one or more sensors located in or on the apparatus; the one or bladders, compartments, chambers, sipes or other portions and the one or more sensors being configured for control by a smartphone or other mobile computer device, general purpose or specialized; and/or the control is conducted through a wired or a wireless connection.

BBBB. The apparatus of paragraph AAAA, wherein the apparatus is configured to operate with and/or be controlled by the smartphone device of any one of paragraphs A-Z and AA-ZZ and AAA-RRR.

CCCC. An article of apparel or equipment, comprising: the article of apparel or equipment can be configured to include wiring to connect the smartphone device to the apparatus and/or either or both of the footwear soles and/or one or more peripheral devices with at least one remote sensor; and/or wherein the smartphone device is configured to provide power to the apparatus and/or footwear soles and/or peripheral devices.

DDDD. A helmet or other protective equipment including braces and body armor, comprising: an outer coating of Teflon™.

EEEE. The smartphone device of any one of paragraphs A-Z and AA-ZZ and AAA-QQQ, wherein the smartphone device or apparatus is configured to include an outer coating of Teflon™.

The invention claimed is:

1. A computer system, comprising:

a Web site and/or a cloud array of computers;

wherein the computer system is configured to have a connection to a smartphone device or other mobile computer device and the computer system is configured to use the device and the connection to control a configuration of:

one or more computer-controlled bladders, compartments, chambers and internal sipes located in a footwear sole or a removable inner sole insert of both shoes or other footwear of a user of the device; and

wherein the computer system is further configured to use the device and the connection to:

transmit data to the computer system for storage and/or shared or independent processing and/or analysis,

process data received from one or more sensors located in either one or both of the sole or the removable inner sole insert of the device user, and from at least one sensor located in, on, or near a center of gravity of the device user, and

use at least the processed data to alter the configuration of the one or more bladders, compartments, chambers and internal sipes of the device user.

2. The computer system as claimed in claim **1**, further comprising at least one sensor located in, on, or near the head of the device user; and

wherein the computer system is further configured to control the configuration of the one or more bladders, compartments, chambers and internal sipes by using the device and the connection to:

process data received from the at least one sensor located in, on, or near the head of the device user, and

use at least the processed data from the sensor located in, on, or near the head of the device user to alter the configuration of the one or more bladders, compartments, chambers and internal sipes of the device user.

3. The computer system as claimed in claim **1**, further comprising at least one sensor located in the device; and

wherein the computer system is further configured to control the configuration of the one or more bladders, compartments, chambers and internal sipes by using the device and the connection to:

process data received from the at least one sensor located in the device, and

use at least the processed data from the sensor located in, on, or near the head of the device user to alter the configuration of the one or more bladders, compartments, chambers and internal sipes of the device user.

4. The computer system as claimed in claim **2**, wherein the at least one sensor located in, on, or near the head of the device user includes a gyroscope and is located and used so as to measure at least the motion of the head of the device user.

5. The computer system as claimed in claim **1**, wherein the at least one sensor located in, on, or near the center of gravity of the device user is located on any article of apparel or personal equipment, including protective padding or armor, braces, prosthetics, or in any manner is attached or embedded in clothing, or attached with tape or a bandage or

glue, or worn or attached onto or implanted in the wearer's body, temporarily in a body piercing or permanently in a body implant.

6. The computer system as claimed in claim **1**, wherein the sensor located in, on, or near the center of gravity of the device user is in the device.

7. The computer system as claimed in claim **1**, wherein the computer system is configured to cause the device to control the configuration of:

the one or more computer-controlled bladders, compartments, chambers and internal sipes located in the footwear sole or the removable inner sole insert of both the shoes or other footwear of the device user, and

wherein the computer system is further configured to cause the device to:

transmit data to the computer system for storage and/or shared or independent processing and/or analysis,

process data received from the one or more sensors located in either one or both of the sole or the removable inner sole insert of the device user and from the at least one sensor located in, on, or near a center of gravity of the device user, and

use the processed data to alter the configuration of the one or more bladders, compartments, chambers and internal sipes of the device user.

8. The computer system of claim **1**, wherein the computer system is further configured to share access to the computer system among one or more authorized third parties and/or the device user.

9. The computer system of claim **8**, wherein the computer system is further configured for conducting real time or subsequent testing involving the one or more authorized third parties.

10. The computer system of claim **9**, wherein the computer system is further configured for conducting real time or subsequent testing involving an authorized third party who is a licensed doctor or a licensed podiatrist.

11. The computer system of claim **9**, wherein the computer system is further configured for conducting real time or subsequent testing involving an authorized third party who is a biomechanics specialist or other professional or semi-professional technician.

12. The computer system of claim **9**, wherein the computer system is further configured to analyze test data sets of groups or categories of device users.

13. The computer system of claim **1**, wherein the computer system is configured to use the device to alter either or both of the footwear soles including at least a magnetorheological fluid located in at least one of the one or more bladders, compartments, chambers and internal sipes, the magnetorheological fluid being controlled at least in part or completely by the device; and/or

wherein the computer system is configured to use the device to alter either or both of the footwear soles including at least one valve located between two or more of said bladders, compartments, chambers and internal sipes, the at least one valve being controlled at least in part or completely by the device; and/or

wherein the computer system is configured to use the device to alter either or both of the footwear soles including at least one electric and/or electronic and/or electromechanical component that is controlled at least in part or completely by the device.

14. The computer system of claim **1**, wherein the computer system is configured to use the device to control the configuration of one or more footwear soles of the device user by altering a relative longitudinal height, including positive or negative heel lift, or negative or positive forefoot lift, and/or a relative side-to-side height between lateral and medial sides, and/or a relative height between right and left footwear soles, or a combination of these relative height alterations; and/or

wherein the computer system is configured to use the device to control the configuration of one or more footwear soles of the device user by altering relative longitudinal firmness between heel area and forefoot area and/or side-to-side firmness between lateral and medial side areas, and/or relative firmness between right and left footwear soles, or a combination of these relative firmness alterations; and/or

wherein the computer system is configured to use the device to control the configuration of one or more footwear soles of the device user by altering relative height or firmness under one or more of the foot bones of the device user, including under a calcaneus, a lateral calcaneal tuberosity, a base of a fifth metatarsal, a longitudinal arch, a metatarsal arch, each head of a metatarsal, and each distal phalange, including a hallux or big toe; and/or

wherein the computer system is configured to use the device to control the footwear configuration at least once per full operation cycle or locomotion stride, many times per full operation cycle or locomotion stride, once per many full operation cycles or locomotion strides, or based on a set time period of any duration or based on another test condition.

15. The computer system of claim **1**, wherein the computer system is configured to use the device to:

record a first data set for a first configuration of the footwear and a second test data set for a second configuration of the footwear, each said data set consisting of measurements of force and/or relative pressure distribution of the device user's footsole on an upper surface of the footwear during the device user's locomotion or other physical activity, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements, the footwear upper surface including at least a multitude or 20 or 50 or 100 or 500 or 1,000 or 4,000, or 16,000 individual pressure sensors;

compare the first test data set and the second test data set with a preferred data set for measurements of the force and/or the relative pressure distribution of the foot sole of a model wearer or wearers on an upper surface of the footwear during the locomotion or other physical activity, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements; and

select the configuration of the footwear that produced the test data set for the force or relative pressure distribution that is closest to the preferred data set for the force or relative pressure distribution and to reject the other configuration, thereby completing at least one full cycle of an operation to optimize the configuration of the footwear; and

wherein the optimizing operation is used to reduce a range of pronation and/or supination of the device user's foot and ankle during a landing phase of locomotion through active configuration of either or both of the footwear soles.

16. The computer system of claim **1**, wherein the computer system is configured to use the device to perform an optimizing operation whereby the device actively configures either or both of the footwear soles to change a motion of a

center of force on a surface of the footwear for either or both of the device user's feet during locomotion.

17. The computer system of claim **1**, wherein the computer system is configured to use the device to measure relative positions to each other of the device user's right and left feet during a stance phase of locomotion so as to determine a degree of crossover of right and/or left feet across a centerline of the device user's body, as measured in a frontal plane during a stance phase of locomotion; and then to test a series of configuration settings in order to reduce or eliminate crossover.

18. The computer system of claim **1**, wherein the computer system uses a barefoot model to configure the device and the footwear with sensors and/or with other sensors to be a medical or podiatric system or a medical or podiatric tool for diagnostic, therapeutic, and/or rehabilitative functions before and/or during and/or after surgical or other medical or podiatric treatment through non-surgical means; and/or to stimulate or retard structural bone growth and/or joint development in a child wearer prior to adulthood through non-surgical means or to reduce gradual deterioration of bone and/or joint structure of an adult wearer or an elderly wearer through non-surgical means.

19. The computer system of claim **1**, wherein the computer system is configured to use the device to carry out the following steps:

first, control the one or more bladders, compartments, chambers and internal sipes by establishing a first configuration setting of said one or more bladders, compartments, chambers and internal sipes for at least a first test during locomotion or other physical activity of the device user;

second, control the one or more bladders, compartments, chambers and internal sipes by establishing a second configuration setting of said one or more bladders, compartments, chambers and internal sipes that is different from the first configuration setting for at least a second test during locomotion or other physical activity of the device user;

third, process measurement data from the first and second tests received from the sensors located in both footwear soles or inserts and from the at least one sensor in the device and/or in another device and/or located in an apparatus;

fourth, compare the data from the first and second tests with a preferred data set;

fifth, select one said configuration setting of the one or more bladders, compartments, chambers and internal sipes from the first or second test that produced data that is closest to matching the preferred data set.

20. The computer system of claim **1**, wherein the computer system is configured to use the device to record and compare multiple test data sets consisting of measurements of relative motion during the device user's locomotion or other physical activity of a position at or near to a part of the body of the device user; as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements.

21. The computer system of claim **1**, wherein the computer system is configured to use the device to record and compare multiple test data sets including data from at least the one sensor located in, on, or near a center of gravity of the device user and consisting of measurements of relative motion during the device user's locomotion or other physical activity of a position that is at or near a center of gravity (C.G.) of a body of the device user, as measured in at least one plane (1D) or in two planes (2D) or in three planes (3D) and/or including time or other measurements.

22. The computer system of claim **1**, wherein the computer system is configured to use at least measurements in two planes or dimensions (2D) or in three planes or dimensions (3D) from at least the one sensor located in, on, or near a center of gravity of the device user.

23. The computer system of claim **1**, wherein the at least one sensor includes at least one of a gyroscope and an accelerometer.

24. The computer system of claim **1**, wherein computer system is configured to utilize computer control located in the footwear to control the one or more bladders, compartments, chambers and internal sipes.

25. The computer system of claim **1**, wherein the computer system is configured to use the device to receive input from at least one sensor including a gyroscope and/or an accelerometer located in another device and/or located in an apparatus worn or carried by the device user, attached to the device user, or implanted in the device user, the apparatus or the other device being separate from the footwear of the device user.

26. The computer system of claim **1**, wherein the computer system is configured to use the device to receive input from an apparatus with at least one gyroscope and/or accelerometer and/or other relative and/or absolute motion sensor and/or pressure sensor and/or force sensor, the apparatus comprising any article of clothing or personal equipment, including earphones or earplugs, helmet, eyeglasses, watch, belt, waistband, elastic underwear, armband, a taped or bandaged attachment, necklace, lanyard, cervical collar, ring, headband, body piercing, or that are in any manner attached or embedded in conventional or specialized clothing worn or attached to the skin of a wearer, or padding or braces, armor, or seating or furniture, or worn or attached onto or implanted in the wearer's body, temporarily in a body piercing or permanently in a body implant.

27. The computer system of claim **1**, wherein the computer system is configured to use the device to control an apparatus worn or carried by the device user, attached to the device user, or implanted in the device user, the apparatus or the other device being separate from the footwear of the device user or the computer system is configured to control the apparatus, the apparatus including one or more bladders, compartments, chambers and internal sipes that are configured for computer control so that the device or the computer system alters the configuration of the one or more bladders, compartments, chambers and internal sipes of the apparatus.

28. The computer system of claim **2**, wherein the computer system is configured to use the device to:

measure and receive 1D or 2D or 3D data of the relative motion of the device user's head during locomotion using earplug sensor fixation by the ear canals of the device user's head and compare the device user's head motion data with the device user's center of gravity (C.G.) data during locomotion or other physical activity; and/or

send either or both sets of data to the computer system and/or a third party for comparison and/or to conduct other functions in a shared operation, including a partially shared operation.

29. A computer system comprising:

a Web site and/or a cloud array of computers;

wherein the computer system is configured to have a connection to a smartphone device or other mobile

computer device and the computer system is configured to use the device and the connection to control a configuration of:

one or more computer-controlled footwear structural elements located in a footwear sole or a removable inner sole insert of both shoes or other footwear of a user of the device; and

wherein the computer system is further configured to use the device and the connection to:

transmit data to the computer system for storage and/or shared or independent processing and/or analysis,

process data received from the one or more sensors located in either one or both of the sole or the removable inner sole insert of the device user, and from the at least one sensor located in, on, or near the center of gravity of the device user, and

use at least the processed data to alter the configuration of the one or more footwear structural elements of the device user.

30. The computer system as claimed in claim **1**, wherein the sensor located in, on, or near the center of gravity of the device user is an accelerometer.

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