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FOOTBALANCE SYSTEM INC. AND FOOTBALANCE SYSTEM OY

**IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF CALIFORNIA**

FOOTBALANCE SYSTEM INC. AND
FOOTBALANCE SYSTEM OY,

Plaintiffs,

v.

ZERO GRAVITY INSIDE, INC.; ROAD
RUNNER SPORTS, INC.; ZENA
IOVINA/IOVINO; PATRIK LOUKO;
SASHA HANNON and EERO
KAAKKOLA,

Defendants.

Case No. 15-CV-1058-JLS-DHB

**THIRD AMENDED COMPLAINT
AND DEMAND FOR JURY TRIAL**

1 **COMPLAINT**

2 Plaintiffs FootBalance System Inc. and FootBalance System Oy (collectively,
3 **“FootBalance”** or **“Plaintiffs”**), by and through their attorneys, make and file this
4 Third Amended Complaint against Defendant Zero Gravity Inside, Inc. (**“ZGI”**),
5 Patrik Louko, and Eero Kaakkola (collectively **“Defendants”**). In support of this
6 Complaint, Plaintiffs allege as follows:

7 **PARTIES**

8 1. Plaintiff FootBalance System Inc. (**“FSI”**) is a California corporation,
9 with a principal place of business at 4999 Pearl East Circle #302, Boulder, CO 80301.

10 2. Plaintiff FootBalance System Oy (**“FSO”**) is a Finnish corporation
11 located at Valimotie 5 00151 Vantaa, Finland.

12 3. Upon information and belief, Defendant ZGI is a Delaware corporation
13 with a principal place of business at 2525 Southport Way, Suite G, National City, CA
14 91950 and/or 4660 La Jolla Village Dr, Suite 500, San Diego, California 92122.

15 4. Patrik Louko is the founder of ZGI. Mr. Louko is an individual that has
16 and/or currently does live in this judicial district. Mr. Louko is a former executive of
17 FootBalance.

18 5. Upon information and belief, Zero Gravity Inside Oy is a related entity
19 of ZGI. Its former deputy board member is Eero Kaakkola.

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21 **JURISDICTION AND VENUE**

22 6. This is a claim for patent infringement that arises under the Patent Laws
23 of the United States, 35 U.S.C. § 1, *et seq.*, including 35 U.S.C. § 271. This Court has
24 jurisdiction over the subject matter of this action pursuant to 28 U.S.C. §§ 1331 and
25 1338.

26 7. Each Defendant is subject to personal jurisdiction in the State of
27 California and this District consistent with the principles of due process.

1 8. Upon information and belief, ZGI continuously, systematically, and
2 purposefully conducts business within this District, including but not limited to
3 offering for sale and selling the accused products. ZGI has purposefully availed itself
4 to the privileges and benefits of the laws of California and is therefore subject to the
5 jurisdiction of this Court.

6 9. Mr. Louko is a former executive of FootBalance and holds himself out
7 as the CEO, President and Founder of ZGI. He worked on behalf of FootBalance
8 with Road Runner Sports, Inc. (RRS) concerning the sale of FootBalance products to
9 RRS that are very similar to the products sold by ZGI. On information and belief, he
10 is directly responsible for ZGI's establishment and infringement. On information and
11 belief, he helped or directed his wife, Ms. Iovina/Iovino,¹ to found ZGI. His liability
12 in this action stems, at least in part, from acts taken by him in and/or directed to this
13 judicial district.

14 10. On information and belief, Mr. Kaakkola is employed by, an officer of,
15 or a consultant to ZGI and directly involved in the infringement at issue in this case.
16 Mr. Kaakkola lived with in this judicial district. His liability in this action stems, at
17 least in part, from acts taken by him in and/or directed to this judicial district.

18 11. Venue is proper in this District pursuant to 28 U.S.C. §§ 1391 and 1400
19 because ZGI is subject to personal jurisdiction in this court and have done business,
20 have infringed, and continue to infringe U.S. Patent Nos. 7,793,433 ("the `433
21 Patent") and 8,171,589 ("the `589 Patent") within this District, and this action arises
22 from transactions of that business and that infringement. For example, ZGI has
23 imported, offered for sale, sold and used infringing products to be delivered to its
24 offices within this District.

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27 ¹ Both spellings have been found in public information.

12. Venue is proper as to the individual defendants in this District pursuant to 28 USC §§1391 and 1400 because at least ZGI resides in this district, a substantial part of the events or omissions giving rise to the claim occurred, or a substantial part of property that is the subject of the action is situated in this District and the individual defendants have committed acts of infringement and have a regular and established place of business in this District.

13. Joinder of all Defendants in this action is appropriate under 35 USC §299. Each Defendant is jointly and/or severally and/or alternatively liable for infringement stemming from the same individual and/or series of transactions or occurrences related to the making, using, importing into the United States, offering for sale, or selling of the same accused product or process. Moreover, common questions of fact will arise in the action. As explained herein, the individual defendants formed and/or operated ZGI for the purpose of providing infringing goods to RRS and other customers and/or inducing/contributing to RRS' and other customers' infringement. Similarly, the individuals induced and contributed to ZGI's infringing actions.

FACTUAL BACKGROUND

A. FootBalance and U.S. Patent Nos. 7,793,433 & 8,171,589

14. FootBalance is an innovative health and fitness company that focuses on providing individually formed footwear to customers.

15. On September 14, 2010 the United States Patent and Trademark Office duly and lawfully issued the `433 Patent, entitled "Individually Formed Footwear and a Related Method." A true and correct copy of the `433 Patent is attached hereto as **Exhibit A**.

16. The `433 Patent matured from Patent Application Serial Number 11/486,080, filed on July 14, 2006 ("the '080 Application").

1 17. On May 8, 2012 the United States Patent and Trademark Office duly and
2 lawfully issued the `589 Patent, entitled “Individually Formed Footwear and a
3 Related Method.” A true and correct copy of the `589 Patent is attached hereto as
4 **Exhibit B**. The `589 Patent is a divisional of the `433 Patent.

5 18. FSO is the owner, by assignment, of the entire right, title and interest in
6 and to the `433 and `589 Patents. FSI is a wholly owned subsidiary of FSO and is the
7 exclusive licensee of the `433 and `589 Patents.

8 19. Generally, the claims of the `433 and `589 Patents are directed to
9 individually formed footwear, such as shoes and insoles, and a method for providing
10 such footwear.

11 20. The technology embodied in the `433 and `589 Patents present a
12 breakthrough in custom orthotic insoles. Prior to FootBalance’s innovations
13 practicing the `433 and `589 Patents, custom orthotic insoles were heavy, expensive,
14 and cumbersome to manufacture. Prior solutions for custom orthotic insoles required
15 multiple, time consuming, and expensive visits to a medical center for measuring and
16 fitting the insoles.

17 21. The technology embodied in the `433 and `589 Patents is quite
18 extraordinary. In brief, Mr. Erkki Hakkala—inventor of the `433 and `589 Patents
19 and founder of FSO—invented shoe insoles containing thermoplastic materials that
20 can be heated and then molded directly to a customer’s foot. FootBalance has
21 developed a full line of custom insoles to fit multiple body types, shoes, and
22 activities. The FootBalance custom insoles utilize specially-designed “blanks,” which
23 consist of layers of materials, including at least one layer of thermoplastic material.
24 To mold the custom insole, the insoles are heated in an oven that was developed by
25 FootBalance. The customer is positioned on a molding station, which includes
26 specially designed flexible pillows, also developed by FootBalance. The heated
27 insoles are placed between the customer’s foot and the pillows. The customer’s foot
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1 and the insole are then manipulated in different ways by the store employee to
2 achieve a custom fit.

3 22. The technology embodied in the '433 and '589 Patents allow a customer
4 to create custom-molded insoles in less than ten minutes at a price point that is far
5 less than any other 100% custom orthotic on the market.

6 23. Because FootBalance's custom orthotic insoles could be used with in-
7 store customization and FootBalance did not have physical stores in the United
8 States, FootBalance chose to engage a business in the United States that could
9 provide in-store customization.

10 24. On or about December 8, 2008, FSO entered into a distribution
11 agreement with RRS, a specialty running goods store in the United States. The terms
12 of the distribution agreement included terms whereby FootBalance would provide
13 RRS with customizable shoe insoles and the equipment needed for customizing those
14 insoles. RRS, in turn, would exclusively market FootBalance insoles to customers in
15 its retail shoe stores throughout the United States. RRS and FootBalance cooperated
16 for nearly five years, with RRS selling hundreds of thousands of FootBalance-
17 branded insoles in its stores. The FootBalance insoles sold in the RRS stores
18 practiced the '433 Patent and were marked with the '433 Patent number. The method
19 of making the FootBalance insoles sold in the RRS stores practiced the '589 Patent.

20 25. Eventually, the distribution agreement was purported terminated by
21 RRS. At the time of termination, RRS had already engaged another vendor to provide
22 custom insoles. Upon information and belief, RRS' new vendor, ZGI, was created by
23 former FootBalance employees Louko and Kaakkola, utilizing their knowledge of
24 FootBalance's patent products and methods to create ZGI's custom insole products.
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B. Defendants ZGI, Louko and Kaakkola Created Its Infringing Zero Gravity Insoles Using FootBalance's Patented Products and Methods

26. On or about 2007, Louko was hired by FootBalance Oy as a consultant. He was later elevated to CEO of FootBalance System, Inc. and CEO of FootBalance Group.

27. During Louko's employment at FootBalance, Louko had complete access to FootBalance's custom shoe insole technology, including the inventions disclosed in the '433 and '589 Patents. Mr. Louko had direct responsibility for the RRS account in the U.S. and continual contact with RRS personnel.

28. On or about 2010, Louko left FootBalance System, Inc. and FootBalance Group.

29. Upon information and belief, after Louko left FootBalance, Louko and Kaakkola developed custom insoles based on FootBalance's patented products and the patented method of making FootBalance's patented products. The custom insoles developed by Louko and Kaakkola eventually became the ZGI insoles.

30. Upon information and belief, prior to RRS' termination of its distribution agreement with FootBalance, Louko and Kaakkola provided infringing custom insoles to RRS and provided instructions and training to RRS employees to make custom insoles that violated the '433 and '589 Patents. Upon information and belief, the insoles provided by Louko and Kaakkola to RRS infringe the '433 patent. Upon information and belief, the method of making the custom insoles as instructed by Louko and Kaakkola to RRS infringe the '589 Patent.

31. Upon information and belief, Louko and Kaakkola continued to specifically and intentionally direct RRS employees to make, use, sell, and offer to sell the Zero Gravity custom insoles as RRS switched its supplier of custom insoles from FootBalance to ZGI.

32. ZGI was incorporated on January 3, 2014. Upon information and belief, Louko and Kaakkola began making, using, selling, and offering for sale custom insoles to RRS before ZGI was incorporated.

33. Upon information and belief, ZGI's only business is making and selling of custom insoles that infringe the '433 and '589 Patents. That is, all of ZGI custom insole products infringe the '433 and '589 patents. Upon information and belief, ZGI sells the custom insoles under a "store brand" label (e.g. custom insoles sold by RRS were branded to the consumer as "RoadRunner Sports" insoles).

34. ZGI's system of creating custom insoles is identical to FootBalance's system of creating custom insoles. ZGI utilizes specially-designed "blanks," which consist of layers of materials, including at least one layer of thermoplastic material. To create ZGI's insoles, the ZGI insoles are first heated in a ZGI-branded oven while the customer is positioned on a stand on top of molding station with flexible pillows. The heated ZGI insoles are placed between the customer's foot and the pillows. The customer's foot and the ZGI insole are then manipulated in different ways by the store employee to achieve a custom fit.

35. Upon information and belief, ZGI has sold substantial numbers of its infringing insoles to customers other than RRS, as ZGI's posted sales figures greatly exceed the number of custom insoles likely purchased by RRS. A press release on ZGI's website dated November 3, 2015, states that ZGI has sold more than 650,000 units in the prior 18 months. Based on FootBalance's sales of custom insoles to RRS, as well as RRS' footprint and FootBalance's knowledge of the US market, the 650,000 units purported sold by ZGI vastly outnumbers the sales RRS could generate during an 18-month window.²

² Upon information and belief, discovery in this case will further demonstrate the pre-suit knowledge and infringement of the '433 and '589 Patents by ZGI, Louko and Kaakkola. For example, basic documents that were produced pursuant to a protective

1 36. FootBalance has significant experience in developing its custom insoles
2 and associated equipment. Based on that experience, it takes many months –
3 including working with customers – to finalize the design and production of the
4 equipment to make the insoles, quality test the insoles themselves, make the ovens,
5 balancing stations and associated fitting pillows, quality test those items, work with
6 customers to train personnel to perform the custom fit process. This can be an
7 iterative process of working with customers, making modifications, and retesting.

8 37. On information and belief, to meet the mass production of infringing
9 products of over 650,000 units, including creation of the entire molding system used
10 at retailers, Louko and Kaakkola began making, using, selling, and/or offering to sell
11 infringing insoles long before the four months between ZGI's date of incorporation in
12 January 2014 and the start of its alleged sales in May 2014.

13 38. On information and belief, while ZGI was incorporated in January 2014,
14 individual Defendants Louko and Kaakkola would have needed to begin and did
15 begin their infringement of the '433 and '589 Patents long prior to that date.

16 39. Furthermore, each of Mr. Louko and Mr. Kaakkola made and used
17 insoles for themselves and colleagues that infringed each of the '433 and '589
18 Patents. They did this both before and after the incorporation of ZGI in 2014.

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23 order during arbitration between FootBalance and RRS will further support the
24 allegations against ZGI, Louko and Kaakkola. Despite the producing party (RRS) in
25 the arbitration not objecting to these documents being utilized in this action under
26 seal, ZGI has objected under the arbitration's protective order to the inclusion or
27 reference of these documents with the complaint, despite not being a party to that
28 protective order. ZGI also refused to permit early discovery on these same issues, and
also refused to conduct a meet-and-confer to address its objection (or basis thereof).

C. The Defendants' Pre-Litigation Knowledge of FootBalance's Footwear and the '433 and '589 Patents

40. ZGI, Louko and Kaakkola each has had actual knowledge of FootBalance's patented inventions, the '433 and '589 Patents and their infringement thereof, since before the filing of this complaint and prior to ZGI's formation. Louko knew of this information from his work at FootBalance and he formed and guided the operations of ZGI. In 2010, FootBalance and Eero Kaakkola entered into a research and development project to develop a new heater for FootBalance's custom insoles. Mr. Kaakkola was introduced to FootBalance through Louko. On information and belief, Mr. Louko is an interested party, with actual or constructive ownership and control of ZGI.

41. On November 30, 2010, Eero Kaakkola published Patent Application No. 12/956,511 ("the '511 Application") entitled "Custom-fit Insole for Footwear and Related Method of Manufacture." A true and correct copy of the '511 Application is attached hereto as **Exhibit C.**

42. On September 28, 2011 FootBalance and Eero Kaakkola entered into an agreement whereby Eero Kaakkola assigned the '511 Application and certain additional rights to FootBalance. A copy of the valid and enforceable patent sale and assignment document between FootBalance and Eero Kaakkola (the "Assignment") is attached as **Exhibit D.**

43. The Assignment provides, in Clause 4, that FootBalance shall have the right to all future modifications, changes, and improvements to the invention or to the customized insoles for a duration of 5 years. Exh. D, Clause 4. Mr. Kaakkola holds several patents and has significant experience with U.S. Patents. As part of his dealings and agreements with FootBalance, Mr. Kaakkola was aware of and had actual knowledge of the '433 Patent. He thus also had knowledge of the divisional application that led to the related '589 Patent.

D. ZGI Is the Alter Ego of Patrik Louko As Louko Undercapitalized ZGI, Louko and ZGI Have Unity of Interest, ZGI Disregards Its Corporate Form, and ZGI Could Not Adequately Compensate FootBalance

52. ZGI operates as the alter ego of Louko. ZGI and Louko have a unity of interest and ownership such that ZGI is not a separate entity from Louko. FootBalance would face an inequitable result if the actions taken by Louko would be treated as ZGI's alone.

53. ZGI has identical equitable ownership as Louko, as ZGI is controlled and dominated by Louko. Louko holds himself out as the CEO, President and Founder of ZGI.

54. ZGI disregards corporate formalities. Upon information and belief, ZGI does not conduct regular board meetings, does not conduct regular shareholder meetings, and does not issue stock. Upon information and belief, Louko uses ZGI corporate accounts and assets for personal purposes. On information and belief, Louko helped or directed his wife, Ms. Iovina/Iovino, to found ZGI. For example, while Ms. Iovina/Iovino is listed in state filings as the CEO of ZGI, she has no such role and Louko is the CEO. On information and belief, ZGI and Louko engaged in this misrepresentation in an attempt to hide Louko's involvement from FootBalance.

55. ZGI has been and continues to be undercapitalized. Upon information and belief, ZGI lacks sufficient capital to cover debts, including liability from its infringement of the '433 and '589 Patents. Upon information and belief, Louko lacked sufficient capital to start ZGI. Upon information and belief, ZGI continues to lack minimal capitalization.

1 56. Louko uses ZGI as a mere shell for his personal business. Finland has
2 relatively open disclosure of financial information, and corporate financial
3 information can be found from the Finnish Patent and Registration Office. Publicly
4 available financial information indicates that Louko withdrew approximately 1.2
5 million EUR from ZGI within a year of ZGI's incorporation. Publicly available
6 financial information also indicates that Kaakkola withdrew approximately 700,000
7 EUR from ZGI within a year of ZGI's incorporation. Upon information and belief,
8 1.9 million EUR represents a substantial portion of ZGI's operational revenue from
9 2014 and exceeds ZGI's profits for 2014.

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11 **FIRST CLAIM FOR RELIEF**
12 **(Infringement of U.S. Patent No. 7,793,433)**

13 57. Plaintiffs reallege and incorporate by reference the allegations contained
14 in the previous paragraphs of this Complaint as though fully set forth herein.

15 58. Upon information and belief, the Defendants, and/or those acting in
16 concert with them, with actual knowledge of the '433 Patent before the filing of this
17 action (and/or Amended Complaint), have intentionally infringed and continue to
18 infringe, contribute to infringement, and/or induce infringement of the '433 Patent,
19 either literally or under the doctrine of equivalents. The Defendants' infringing
20 activities in the United States and this District include, among other things, making,
21 using, selling and/or offering to sell products, methods and/or systems all of ZGI's
22 custom insoles, including, but not limited to "The Flash" and "The Force" product
23 names (the "Accused Products"), which infringes at least one claim of the '433
24 Patent. On information and belief, ZGI has a very limited product line and does not
25 make, use, offer for sale, sell or import non-infringing custom insoles.

26 59. The Accused Products infringe at least claim 1 of the '433 Patent, as the
27 Accused Products are insoles for footwear, which contain: (1) at least one layer made
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1 of thermoplastic material; (2) a lower layer configured to be placed against the
2 footwear; (3) the thermoplastic material in the ZGI insole is amorphous polyethylene
3 terephthalate (A-PET); (4) the thermoplastic material becomes plastic substantially
4 between 45°C and 95°C; (5) the thermoplastic material is configured to reach out
5 from under a heel of a foot only to the metatarsophalangeal joint of the foot; and (6)
6 the lower layer of the insole is configured to reach from under the heel to the
7 metatarsophalangeal joint and extend further to a toe of the foot. Further details will
8 be provided in infringement contentions to be provided under the court's local rules.

9 60. Louko has directly infringed by offering for sale, making and using
10 infringing Accused Products. He has – outside of or prior to the formation of ZGI –
11 offered for sale Accused Products. He has also personally made and used Accused
12 Product.

13 61. Kaakkola has directly infringed the '433 Patent by making and using
14 infringing Accused Products. On information and belief, prior to the formation of
15 ZGI, he has made and used Accused Products. Upon information and belief, he
16 personally designed the infringing manufacturing systems and use systems used in
17 the infringement.

18 62. Upon information and belief, the Defendants, and/or those acting in
19 concert with them, with actual knowledge of the '433 Patent before the filing of this
20 action, contributed to the infringement of the '433 Patent, by having its direct and
21 indirect customers sell, offer for sale, use, and/or import into the United States and
22 this Judicial District, and placing into the stream of commerce, the Accused Products.

23 63. Upon information and belief, the Accused Products are especially made
24 or adapted such that they infringe the '433 Patent, and have no substantially non-
25 infringing uses.

26 64. Upon information and belief, the Defendants, and/or those acting in
27 concert with them, with actual knowledge of the '433 Patent before the filing of this

1 action (and the application maturing to the `433 Patent), have intentionally induced
2 infringement of the `433 Patent, by having its direct and indirect customers sell, offer
3 for sale, use, and/or import into the United States and this Judicial District, and
4 placing into the stream of commerce, the Accused Products, with knowledge that
5 such products infringe the `433 Patent, and using the same in a manner that infringes
6 the `433 Patent. The individual Defendants induced ZGI's infringement. For
7 example, on information and belief, each of ZGI, Louko and Kaakkola have worked
8 with individual customers to instruct them how to make and use the Accused
9 Products. They have taught them to use the molding stations and ovens and how to
10 use the custom insole inserts.

11 65. Upon information and belief, ZGI sells the Accused Products to its
12 customers, including RRS, with knowledge and intent of all Defendants that its
13 customers would infringe the `433 Patent.

14 66. Each Defendant had actual notice of the `433 Patent since before the
15 filing of this action (or amended Complaint), and acted despite an objectively high
16 likelihood that their actions constituted infringement.

17 67. Despite knowledge of the `433 Patent, the Defendants continue to
18 recklessly, willfully, and/or deliberately infringe the `433 Patent.

19 68. Upon information and belief, Defendants have generated significant
20 sales of products incorporating FootBalance's patented technology, exposing
21 Defendants to significant liability for its infringement of the `433 Patent.

22 69. Upon information and belief, unless enjoined, Defendants, and/or others
23 acting on behalf of Defendants, will continue their infringing acts, thereby causing
24 irreparable harm to FootBalance for which there is no adequate remedy at law.

25 70. As a result of Defendant's infringement of the `433 Patent, FootBalance
26 has suffered and will continue to suffer harm and injury, including monetary damages
27 in an amount to be determined at trial, and is entitled to recovery of all said damages.

SECOND CLAIM FOR RELIEF
(Infringement of U.S. Patent No. 8,171,589)

71. Plaintiffs reallege and incorporate by reference the allegations contained in the previous paragraphs of this Complaint as though fully set forth herein.

72. Upon information and belief, the Defendants, and/or those acting in concert with them, with actual knowledge of the '589 Patent before the filing of this action (and/or Amended Complaint), have intentionally infringed and continue to infringe, contribute to infringement, and/or induce infringement of the '589 Patent, either literally or under the doctrine of equivalents. The Defendants' infringing activities in the United States and this District include, among other things, making, using, selling and/or offering to sell products, methods and/or systems, all of ZGI's custom insoles, including, but not limited to "The Flash" and "The Force" product names (the "Accused Products"), which infringes at least one claim of the '589 Patent. On information and belief, ZGI has a very limited product line, only selling custom insoles, and does not make, use, offer for sale, sell or import non-infringing custom insoles.

73. The Accused Products infringe at least claim 1 of the '589 Patent, as the Accused Products are individually formed insoles, produced using the following steps: (1) an in-store sales representative provides an insole preform that comprises at least one layer made of A-PET thermoplastic material; (2) the thermoplastic material becomes plastic above its glass transition temperature, which is substantially between 45°C and 95°C, the thermoplastic material is configured to reach out from under a heel of a foot only to the metatarsophalangeal joint of the foot, and a lower layer configured to be placed against the footwear; and the lower layer is configured to reach from under the heel to the metatarsophalangeal joint and extend further to a toe of the foot; (3) the insole preform is heated above the glass transition temperature of the thermoplastic layer using the ZGI ovens; (4) the customer is guided to step on the

1 heated preform utilizing the ZGI molding pillows; (5) the customer's foot is adjusted
2 so that the plantar arch settles to a normal high position; (6) the angle of the ankle is
3 adjusted to the right position; and (7) waiting for the temperature of the heated insole
4 preform to drop under the glass transition temperature of the thermoplastic. Further
5 details will be provided in infringement contentions to be provided under the court's
6 local rules.

7 74. Louko has directly infringed by offering for sale, making and using
8 infringing Accused Products. He has – outside of or prior to the formation of ZGI –
9 offered for sale Accused Products. He has also personally made and used Accused
10 Product.

11 75. Kaakkola has directly infringed the '433 Patent by making and using
12 infringing Accused Products. On information and belief, prior to the formation of
13 ZGI, he has made and used Accused Products. Upon information and belief, he
14 personally designed the infringing manufacturing systems and use systems used in
15 the infringement.

16 76. Upon information and belief, the Defendants, and/or those acting in
17 concert with them, with actual knowledge of the '589 Patent before the filing of this
18 action, contributed to the infringement of the '589 Patent, by having its direct and
19 indirect customers sell, offer for sale, use, and/or import into the United States and
20 this Judicial District, and placing into the stream of commerce, the Accused Products.

21 77. Upon information and belief, the Accused Products are especially made
22 or adapted such that they infringe the '589 Patent, and have no substantially non-
23 infringing uses.

24 78. Upon information and belief, the Defendants, and/or those acting in
25 concert with them, with actual knowledge of the '589 Patent before the filing of this
26 action (and the application maturing to the '589 Patent), have intentionally induced
27 infringement of the '589 Patent, by having its direct and indirect customers sell, offer
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1 for sale, use, and/or import into the United States and this Judicial District, and
2 placing into the stream of commerce, the Accused Products, with knowledge that
3 such products infringe the `589 Patent, and using the same in a manner that infringes
4 the `589 Patent. The individual Defendant induced ZGI's and/or RRS' infringement.
5 For example, on information and belief, each of ZGI, Louko and Kaakkola have
6 worked with individual customers to instruct them how to make and use the Accused
7 Products. They have taught them to use the molding stations and ovens and how to
8 use the custom insole inserts.

9 79. Upon information and belief, ZGI sells the Accused Products to its
10 customers, including RRS, with knowledge and intent of all Defendants that its
11 customers would infringe the `589 Patent.

12 80. Each Defendant had actual notice of the `589 Patent since before the
13 filing of this action (or Amended Complaint), and acted despite an objectively high
14 likelihood that their actions constituted infringement.

15 81. Despite knowledge of the `589 Patent, the Defendants continue to
16 recklessly, willfully, and/or deliberately infringe the `589 Patent.

17 82. Upon information and belief, the Defendants have generated significant
18 sales of products incorporating FootBalance's patented technology, exposing
19 Defendants to significant liability for its infringement of the `589 Patent.

20 83. Upon information and belief, unless enjoined, Defendants, and/or others
21 acting on behalf of Defendants, will continue their infringing acts, thereby causing
22 irreparable harm to FootBalance for which there is no adequate remedy at law.

23 84. As a result of Defendants' infringement of the `589 Patent, FootBalance
24 has suffered and will continue to suffer harm and injury, including monetary damages
25 in an amount to be determined at trial, and is entitled to recovery of all said damages.

PRAYER FOR RELIEF

WHEREFORE, FootBalance prays for entry of judgment that:

1. Each Defendant is individually, jointly and severally or alternatively liable for infringement, contributory infringement, and inducing infringement of the `433 Patent and `589 Patent under 35 U.S.C. § 271;

2. Each Defendant, and each of its affiliates, subsidiaries, officers, agents, servants, employees, representatives, successors and assigns, and all other persons in active concert or participation with ZGI, shall be preliminarily and permanently enjoined from further infringing, contributing to others' infringement, and inducing others to infringe the `433 Patent and `589 Patent under 35 U.S.C. § 283;

3. Each Defendant shall pay damages to FootBalance resulting from the infringement of the `433 Patent and the `589 Patent pursuant to *inter alia* 35 U.S.C. § 284 and including its lost profits, price erosion damages and/or at least a reasonable royalty;

4. Each Defendants' infringement and continuing infringement of the `433 Patent and the `589 Patent was and is willful, justifying trebling the award of damages under 35 U.S.C. § 284, or such other enhancement of the award of damages that the Court deems appropriate;

5. This action be determined to be an exceptional case and FootBalance be awarded its attorney's fees, costs, and expenses under *inter alia* 35 U.S.C. § 285;

6. FootBalance be entitled to pre-judgment and post-judgment interest and costs against ZGI, in accordance with *inter alia* 35 U.S.C. § 284; and

7. FootBalance be awarded such other and further relief as the Court may deem just and proper.

DEMAND FOR JURY TRIAL

FootBalance hereby demands a trial by jury of all issues so triable.

Dated: October 21, 2016

By: /s/ Howard Wisnia

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EXHIBIT A

(12) **United States Patent**
Hakkala

(10) **Patent No.:** **US 7,793,433 B2**
(45) **Date of Patent:** **Sep. 14, 2010**

(54) **INDIVIDUALLY FORMED FOOTWEAR AND
A RELATED METHOD**

(75) Inventor: **Erkki Hakkala**, Helsinki (FI)

(73) Assignee: **Footbalance System Oy**, Helsinki (FI)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 883 days.

(21) Appl. No.: **11/486,080**

(22) Filed: **Jul. 14, 2006**

(65) **Prior Publication Data**

US 2008/0010856 A1 Jan. 17, 2008

(51) **Int. Cl.**

A43B 13/38 (2006.01)
A43B 7/14 (2006.01)

(52) **U.S. Cl.** **36/44; 36/93; 36/154**

(58) **Field of Classification Search** 36/44,
36/93, 154, 43, 29, 2.6
See application file for complete search history.

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Primary Examiner—Ted Kavanaugh

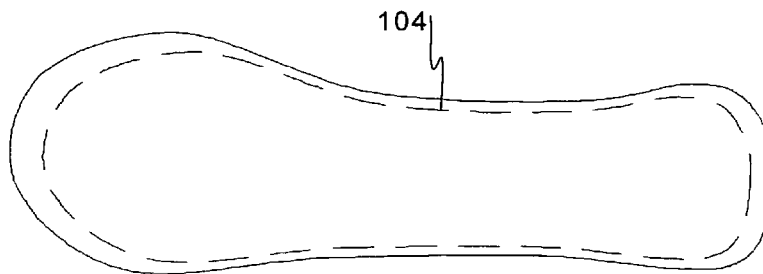
(74) *Attorney, Agent, or Firm*—Young & Thompson

(57) **ABSTRACT**

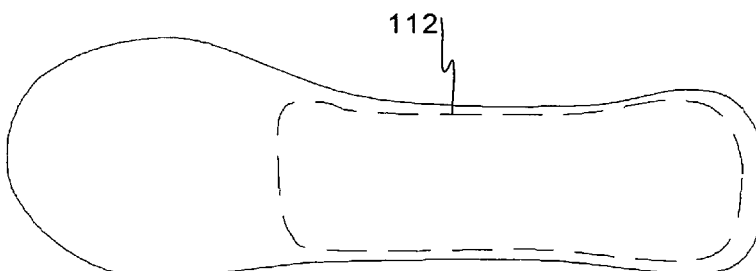
Individually formed footwear such as shoes and insoles for
correcting the feet position and alleviate related problems.
The shoe or insole comprises at least one layer made of
thermoplastic material, which material is advantageously
chosen from a group of ABS, PVC, A-PET and PETG. A
method for providing such footwear to a client at a retail store
is likewise presented.

13 Claims, 5 Drawing Sheets

102



110



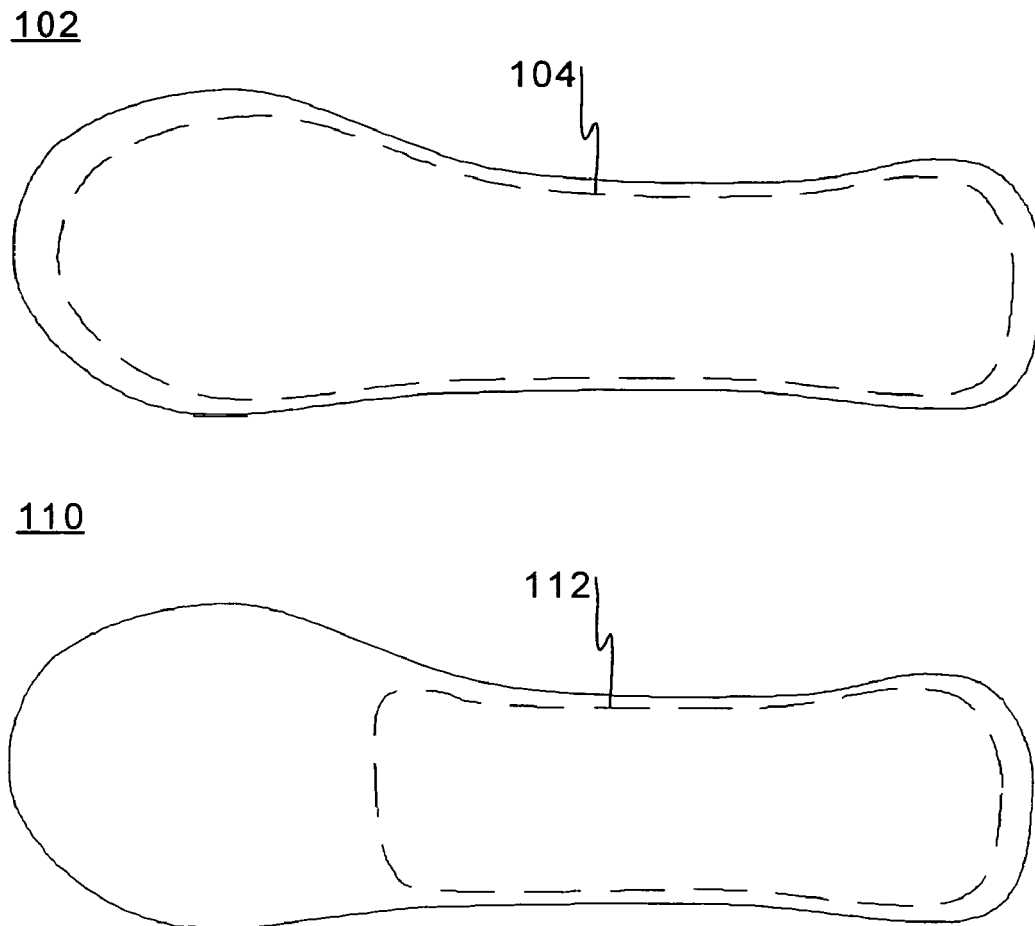


Figure 1

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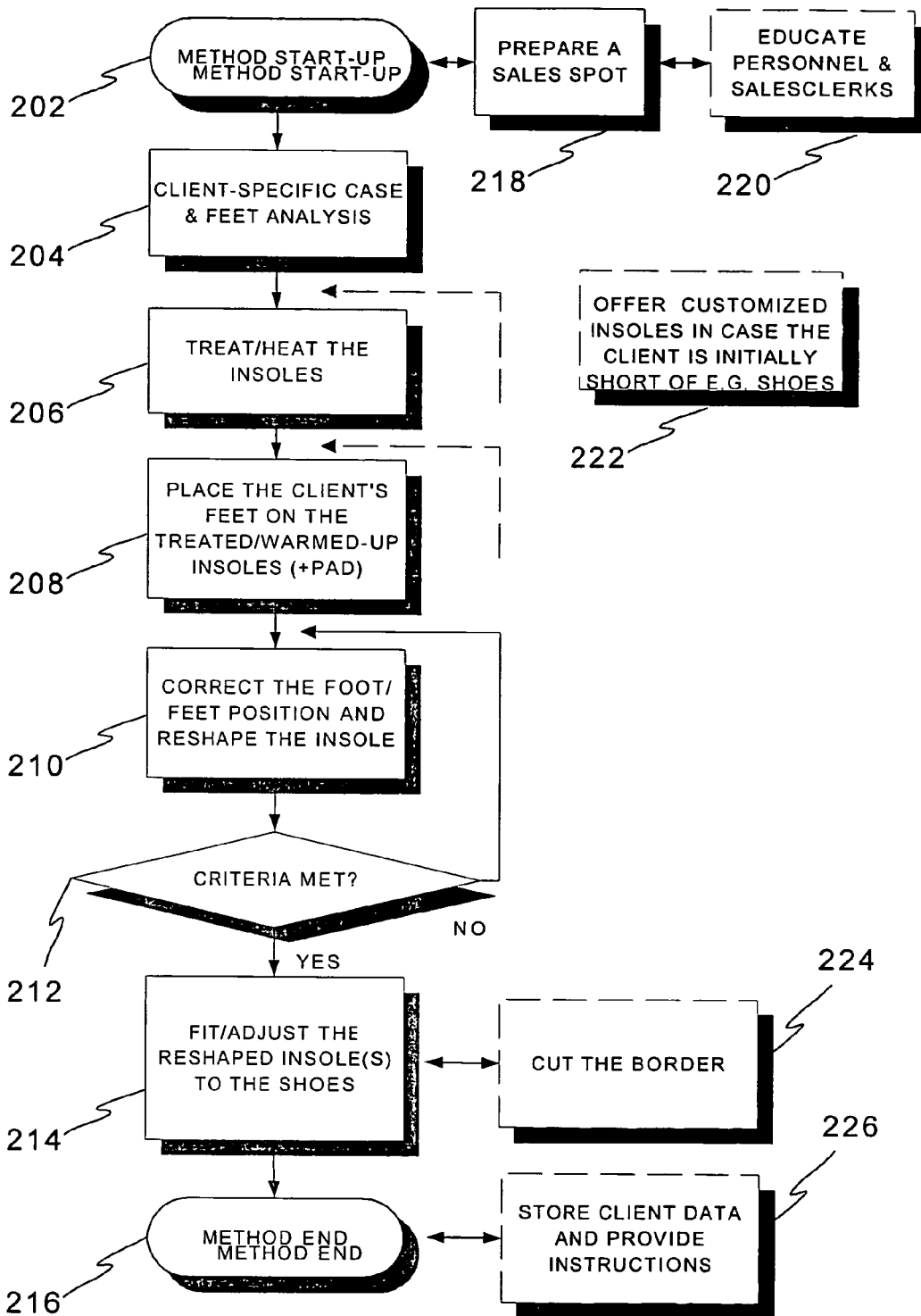


Figure 2

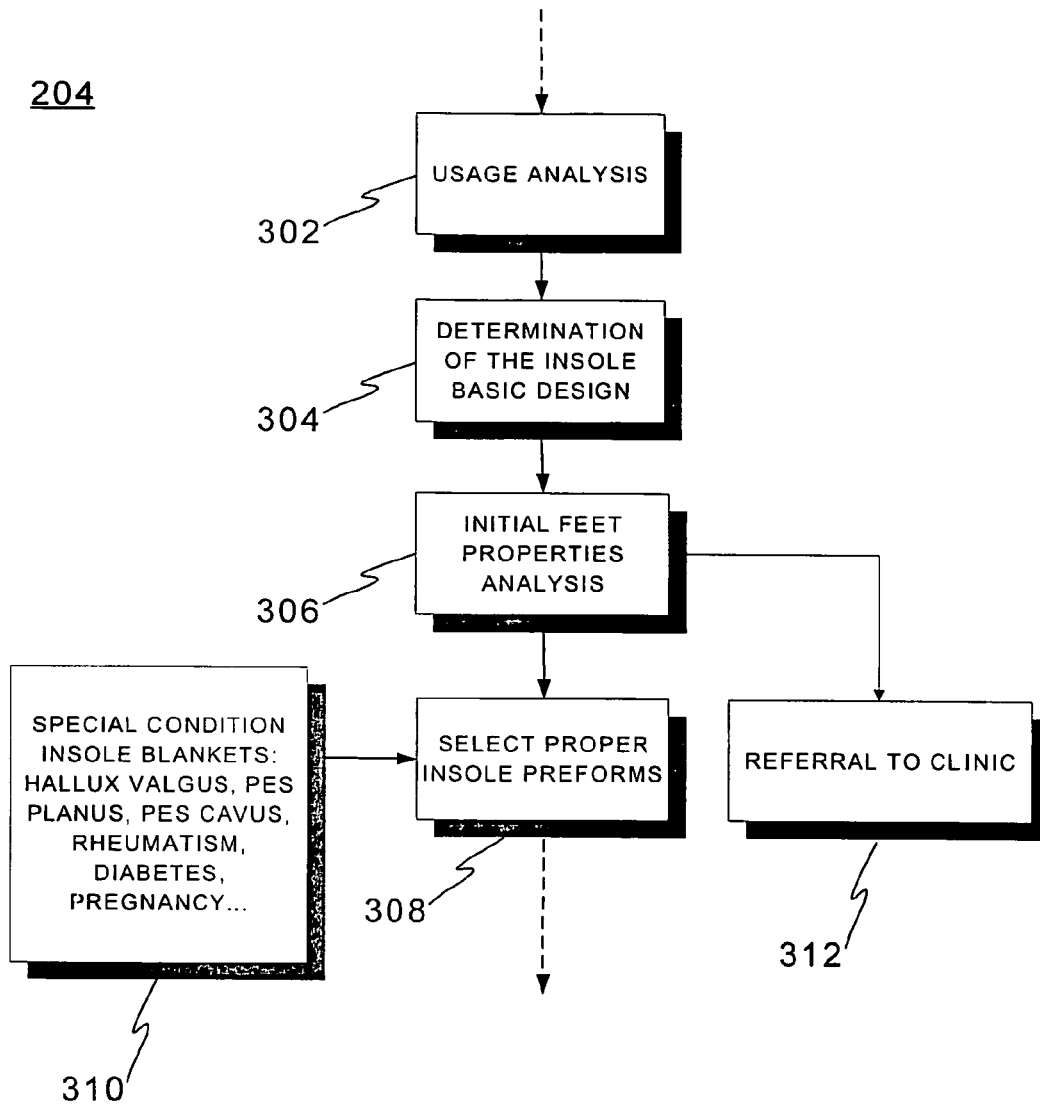


Figure 3

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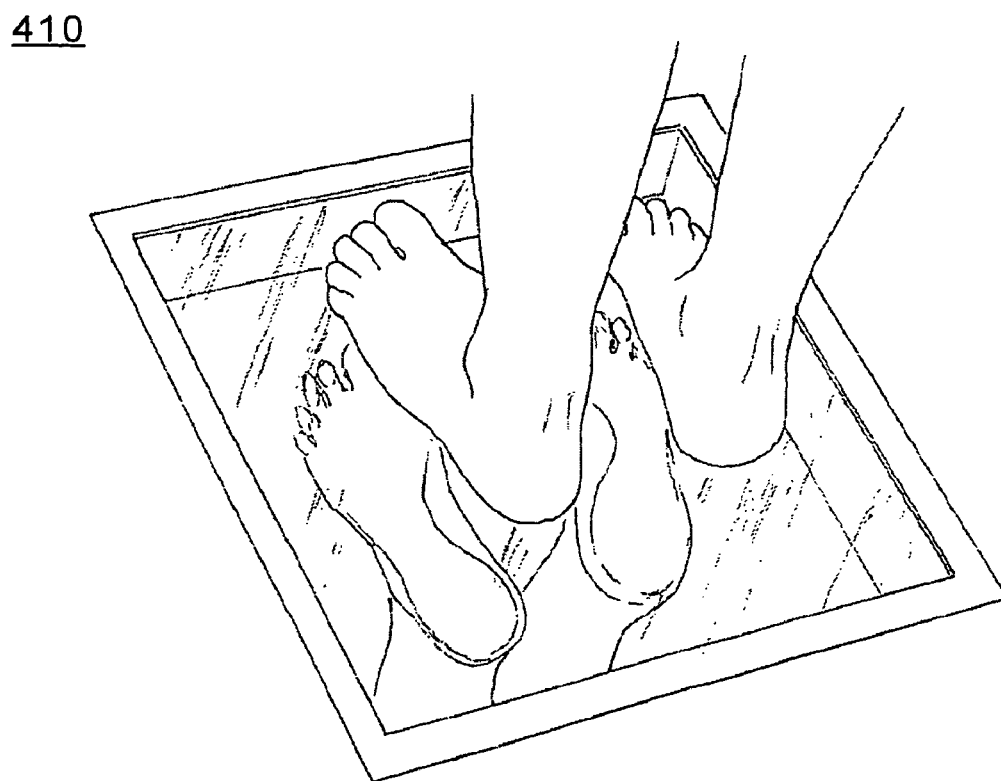
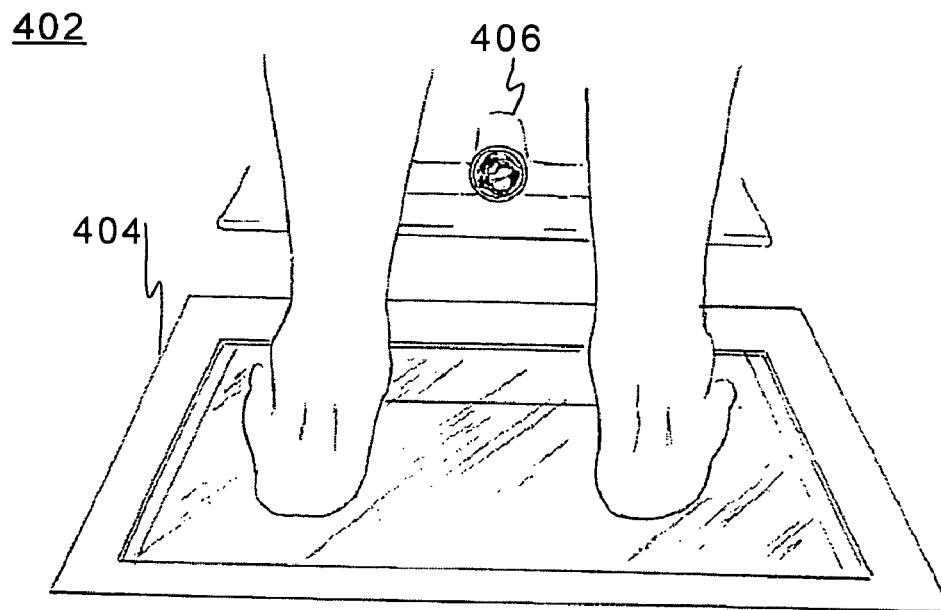


Figure 4

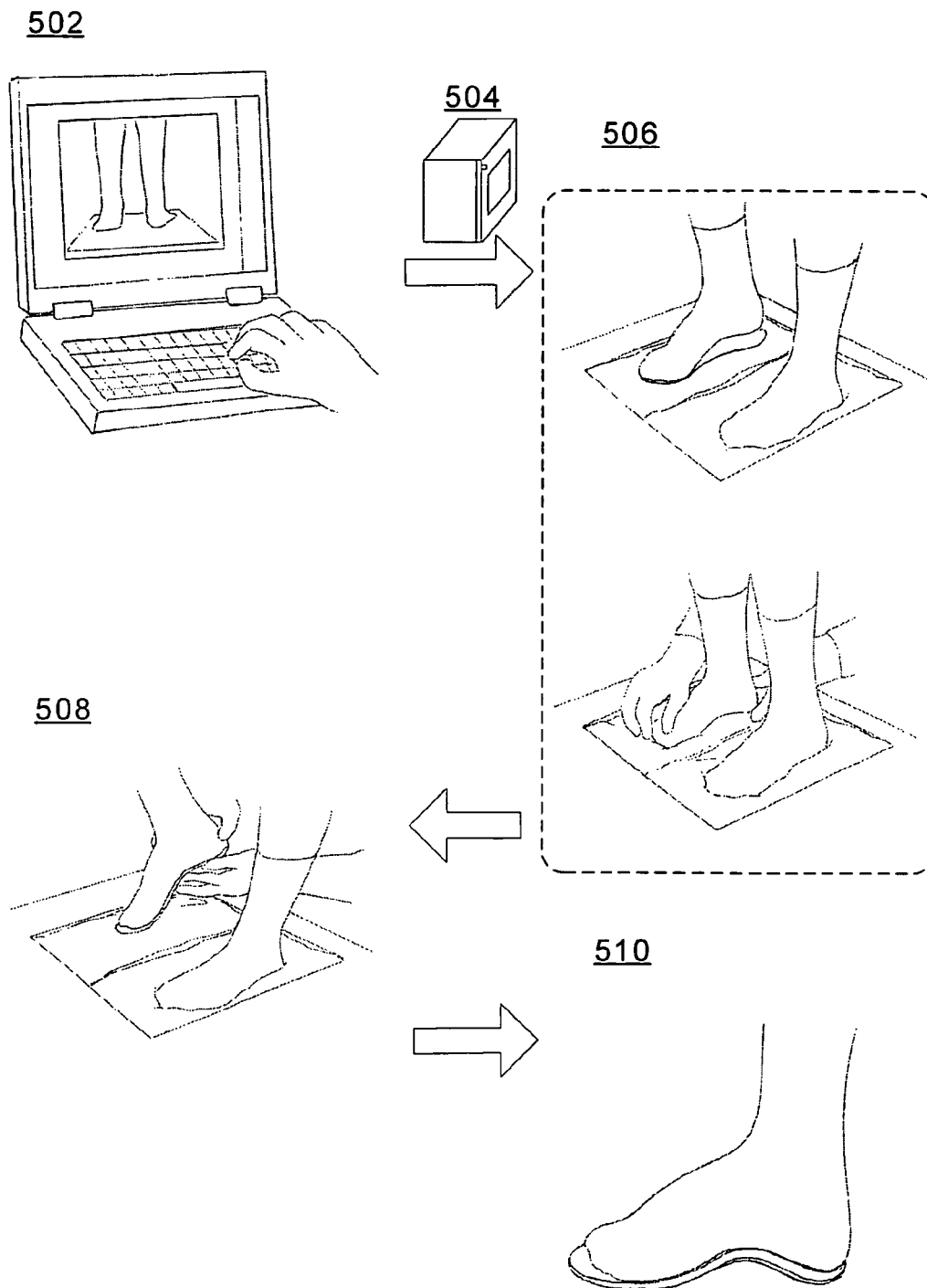


Figure 5

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**INDIVIDUALLY FORMED FOOTWEAR AND
A RELATED METHOD****FIELD OF THE INVENTION**

The current invention generally relates to footwear. In particular the invention concerns personalized shoes, insoles and a method for obtaining those.

BACKGROUND OF THE INVENTION

Approximately 70% of the world population suffer from some sort of foot problems. Only few of the total number have had a chance to purchase insoles that alleviate at least part of the problems. Traditionally, custom-made shoes and insoles have been manufactured by professional shoemakers, physiotherapists, or podiatrists. So far the associated purchase process has been rather time-consuming and costly; a person willing to spend 120-250 EUR on custom made insoles or more than 300 EUR in bespoke shoes has to visit one of aforesaid professionals or their remote partner to get their feet characteristics measured including e.g. a foot size and other properties, advantageously also problem-causing features, after which the order is placed in a waiting list for initiating the actual manufacturing process by the professional. Often the delay between placing the order and receiving the customized shoes/insoles thus extends to few days or even few weeks, which makes the overall process rather awkward especially from a standpoint of a casual client.

Foot motion/gait problems reflect to soles, ankles, knees, hips, back, etc; that is why their treatment and prevention is particularly beneficial to the whole human well-being. An individual takes around 15 000-16 000 steps every day. The load on feet in sports is many times the weight of the body. For example, the ground force is about three times one's body weight while running and 7.5 times while playing basketball due to jumps and other irregular moves. Provided that the foot position is correct, the load divides evenly between the upper joints.

A common condition called pronation refers to inward (i.e. medial) roll of the foot (especially heel and arch), which turns into overpronation when the foot rolls too much. In contrast, oversupination is caused by too small inward roll. Both conditions easily cause pain, wear and even stress injuries in the feet and various body joints.

Different (arch) support insoles are available for correcting the foot position. They have been designed to support longitudinal medial and lateral arch but without separately glued wedges they do not actually correct foot position. Wedging is a time-consuming and expensive process. The obtained result depends on the person doing the task and still tends to be rather inaccurate. As another drawback, after gluing the wedges to the soles one cannot take a new mold without first removing the wedges.

Ready-made supports in the insoles do not provide a perfect match to anyone's feet, as people do not generally bear identical feet shape. Accordingly, many support insoles are ultimately deemed inconvenient due to their lousy fit.

SUMMARY OF THE INVENTION

In order to alleviate aforesaid problems the current invention provides, as its one aspect, an insole for a shoe, which insole comprises at least one layer made of thermoplastic material, which material is chosen from a group consisting of: ABS, PVC, A-PET, and PETG so that the selected material

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becomes plastic substantially under 95° C. and above 45° C., i.e. somewhere within the range.

In another aspect a shoe comprises a sole having at least two layers one of which being made of thermoplastic material.

An insole or a shoe that is to be subjected to a shaping (or actually reshaping as it inherently has some kind of basic form after manufacturing) procedure of the invention for correcting the foot position is hereinafter called a preform.

In a further aspect a method of producing an individually formed insole includes:

choosing one or more, e.g. a pair of, insole preforms from a selection of preforms having a thermoplastic layer, heating the chosen preform above the glass transition temperature (T_g) temperature of the thermoplastic layer in case the preform lacks preheating,

guiding a client to step on the heated preform,

adjusting the angle of the ankle to the right position with help and guidance of an orthopedic or other trained person,

adjusting the client's foot so that the plantar arch settles to a normal high position, and

waiting for the temperature of the heated insole preform to drop under the glass transition temperature of the thermoplastic.

Yet in a further aspect a method of producing an individually formed shoe includes the following steps:

choosing one or more, e.g. a pair of, shoe preforms from a selection of shoe preforms,

heating the chosen shoe preform above the glass transition temperature of the thermoplastic layer of the shoe preform in case the preform lacks preheating,

guiding the client to step into the heated shoe preform,

adjusting the client's foot so that the plantar arch settles to a normal high position,

adjusting the angle of the ankle to the right position with help and guidance of an orthopedic or other trained person,

taking the shoe preform off from the foot, and

waiting for the temperature of the shoe preform to drop under the glass transition temperature of the thermoplastic.

Still in a further aspect a method for providing individually formed footwear to a client comprises:

arranging a sales spot including a plurality of alternative articles selected from the group consisting of: an insole, a liner for a shoe, and a shoe; said sales spot further including means for customizing an article belonging to said plurality of articles to the client's foot,

studying a foot of the client so as to enable choosing an article belonging to said plurality of articles,

treating, preferably heating by said means for customizing, at least part of the chosen article to render its form responsive to an external force introduced thereon,

placing the client's foot in contact with the treated article in accordance with the predetermined use thereof, and manually shaping the treated article so as to correct the foot position by conforming thereto.

The utility of the invention arises from a number of issues. First, the individually formed shoe or insole provides natural arch support and divides the ground force more evenly through the foot, knee, hip, and the back. Secondly, it reduces overpronation or oversupination and realigns the gait. This affects positively to the body posture and alleviates fatigue, sprained ankles, rubbing and pain. The invention further stabilizes the foot, adds lateral support of the foot and strength-

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ens it to reduce loss in muscle power. Yet, the transverse arch is supported when the thermoplastic layer extends under it.

Further, when considering the issue from a retail perspective, the shoes/insoles can be offered through common retail stores, e.g. sport or shoe stores, and the required customization process by a trained sales clerk takes only minutes. The sales spot consumes only a minor space (few square meters) and compulsory investments in equipment can be kept low. Provision of customized insoles cultivates the pro image emanating from the retailer and offers a promotional value in relation to other products as well; it attracts people to visit the store and raises the sales figures of related products (shoes/insoles, socks, etc) respectively. The profit margin can be kept high while the retail price is still considerably lower than with its prior art antecessors.

In an embodiment of the invention an insole or a shoe has a thermoplastic layer that extends substantially over the major area of the insole, optionally still leaving at least the border areas intact for facilitating easy adjustment and cutting thereof.

In another embodiment of the invention an insole or a shoe has a thermoplastic layer that covers laterally only part of the insole/shoe. Advantageously the thermoplastic still reaches out lengthwise at least from under the heel to under the plantar arch and in lateral direction almost to the whole width of the insole.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following, the invention is described in more detail by reference to the attached drawings, wherein

FIG. 1 is a sketch of two insole embodiments according to the invention.

FIG. 2 is a flow diagram representing one example of a method of the invention wherein individually formed footwear is provided to a client.

FIG. 3 is a more specific flow diagram about relevant analysis steps for determining the client's needs.

FIG. 4 depicts a podoscope including a transparent glass plate on which the client is standing during the feet analysis.

FIG. 5 further visualizes selected method steps of FIG. 2.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

A preform (~blanket) insole has at least one layer, which is made of thermoplastic and reaches out at least from under the heel to under the plantar arch of the target person's, herein-after client, foot. Advantageously two or three material layers that are connected together are used in the preform insole for the comfort of the client. The upper layer (if used) of the preform insole is placed against the foot and the lower layer is placed against the shoe. Materials of these two layers can be selected among any prior art materials used in insoles. For example, the lower layer may be constructed from a known material such as Rheluflex (trademark of Rhenoflex GmbH Ltd) comprising non-woven polyester as a carrier, ionomer-resin-ethylvinylacetate blend as an extruded core, and EVA-Hotmelt as an adhesive.

The middle layer of the insole (in case of three layers) is made of thermoplastic. The used thermoplastic can be selected from a large group of known thermoplastics. The critical value is the temperature, so-called glass transition temperature, where the thermoplastic becomes plastic and on the other hand turns back to solid form when the temperature is decreasing after shaping the insole. This temperature should not generally be so high that the insole feels uncom-

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fortable against the client's foot. Notwithstanding a high glass transition temperature, a thermoplastic is still applicable if it can be cooled down enough prior to placing in contact with the foot provided that the thermoplastic remains plastic, i.e. mouldable. Adequate temperature for the thermoplastic to become plastic is preferably somewhere under 95° C. and above 45° C. Advantageously the range is from 50° C. to 85° C. Suitable materials that become or are plastic within the preferred ranges are for example thermoplastic polyesters A-PET (Amorphous polyester terephthalate) and PETG (glycol-modified polyethylene terephthalate, which is a copolyester), or such with essentially similar characteristics. Also e.g. ABS (acrylonitrile butadiene styrene), PVC (polyvinyl chloride) can be used.

Thickness of the thermoplastic layer shall be preferably selected so as to provide reasonable support to the client's foot when the layer is in a rigid state. The thickness may also vary throughout the layer, if e.g. more flexibility is desired under the toe area (thinner) than the plantar arch area (thicker).

Other characteristic required for the thermoplastic dictates that it should be rigid under the melting temperature.

With reference to an embodiment shown in the upper sketch 102 of FIG. 1, the middle layer 104 (or the only layer) made of thermoplastic can cover laterally the whole area of the insole. In alternative embodiment, see sketch 110, the layer 112 covers laterally only a part of the insole. In that option it is necessary that the thermoplastic reaches out lengthwise at least under the heel to under the plantar arch and in lateral direction advantageously almost to the whole width of the insole. As one feasible implementation, the thermoplastic layer is designed so as to reach out from under the heel to the metatarsophalangeal joint of the foot so that transverse arch can be supported. Also, a precut pad can be placed under the transverse arch when the insole is shaped to lift the transverse arch into the optimum position. However, it is advantageous to keep some range at the edge of the insole without the hard thermoplastic in case there is need for little adjustment when the insole is placed in the shoe. Also, the toe area of the insole should remain without the hard thermoplastic to enable natural movement of the foot during walking or running.

One major aspect of the invention relates to producing a preform of an insole that is ready in one piece (thus possibly having separate layers that are connected together with adhesive or such) and easy to heat over the glass transition temperature of the included thermoplastic. After cooling the insole is preferably rigid one-piece structure that corrects the foot position and supports the foot, especially the plantar arch and transverse arch thereof. The plantar arch can be adjusted to a proper high position by pulling the client's toe up and/or by lifting his/her heel up while keeping the toes against a support surface (Windlass effect). The adjustments can be carried out on a soft pad with or without further manual guiding. Alternatively, a trained person may reach a decent result just by hands without a supporting surface.

Alternatively, in accordance with the current invention a shoe can be provided, said shoe having a sole, which can be shaped according to client's foot for correcting the incorrect position thereof. The shoe in this case shall have at least one material layer of thermoplastic. The shoe is advantageously manufactured to include all necessary layers and is just personalized upon purchase. Suitable shoes include, for example, various types of walking shoes, sport shoes, boots, sandals and soft gym shoes.

The sole is advantageously at least a two-piece structure including a thermoplastic layer either situated on top of the

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sole material or being integrated, for example embedded, within it. The one or more sole layers excluding the thermoplastic layer may comprise e.g. EVA (ethylvinylacetate) or other prior art materials; e.g. aforesaid EVA is even available in different hardnesses. If there is more than one layer the thermoplastic layer can be smaller in lateral direction than the whole sole. It is essential that the thermoplastic layer reaches out at least from under the heel to under the plantar arch of the foot the same way as with the insole. The thermoplastic materials can be selected the same way as with the insole. It may be advantageous to make at least the outer surface of the sole of some wear resistant and good friction characteristics-having material. Optionally, e.g. viscoelastic foam or other material, which may also be thermosensitive, can be used within the shoe, whereby the shoe internals also reshape in addition to mere insole and provide additional comfort/support. With this embodiment can be assured very comfortable personalised shoe that supports tightly the bone structure of the feet and ankle. This is very important if the client has a for example diabetes or rheumatism and the shoe shouldn't cause any friction or abnormal pressure to the foot.

In a further alternative, footwear such as shoes (walking, sports, discipline-specific, etc), skates, ski boots, etc can be offered with preinstalled insoles in accordance with the invention, which insoles shall be then personalized before use. The layers inside the shoe that receive the insole of the invention shall advantageously conform to the insole shapes. Optionally, e.g. viscoelastic foam or other material that is optionally thermosensitive can be used within the shoe, whereby the shoe internals also reshape in addition to mere insole.

FIG. 2 discloses a flow diagram, by way of example only, of the method for providing individually formed insoles to a client by a retailer. The insoles may be provided as such or with shoes that may even include the insoles of the invention by default. Likewise, shoes including a mouldable sole of the invention can be offered via the method presented hereinafter. Some of the method steps and associated devices are further visualized in FIGS. 3-5 for clarification.

The inventive concept makes it possible to finalize customized insoles only a few minutes after receiving the assignment. The insoles of the invention can be provided to the retailers as a part of a complete service package including a sales spot, equipment for feet study, and equipment for making customized insoles. The service package may also include training the sales personnel via an educational program that may be an (intensive) course or lection-based.

In step 202, a method start-up, a sales spot is prepared 218 for use at retailer premises. The sales spot may be advantageously delivered as a predetermined ensemble comprising a number of separate elements having a recommended location within the spot so that the spot aggregate can be just conveniently positioned in a preferred location, or alternatively, the retailer may at least partially build it up according to his personal preferences from separate elements if seen useful. The spot includes the necessary means to rapidly provide a customer with properly shaped insoles. Such means may include a stand or a rack with a number of insole preforms (preferably packaged in lightweight, space-saving and at least partially transparent cases, made of e.g. cardboard) with varying properties (size, thickness, basic design, etc), a molding stand with one or more casting pads, a heating system, see numeral 504 of FIG. 5, such as an oven for heating the insole preforms, and basically optional study means for analyzing the client's feet and problems/properties thereof in addition to the mere ocular inspection that is anyhow to be performed by the trained staff.

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The study means may include, for example, a podoscope, a camera system, and a computer. The podoscope is, by definition, a device for analyzing the interaction of the foot and a supporting surface. A client stands on a transparent glass plate of the podoscope, see reference numeral 404 of sketch 402 in FIG. 4, whereupon an image of his feet is shown through a mirror to the person doing the measurements, see lower sketch 410. The study means, e.g. aforesaid podoscope, can also include data acquisition means such as an optical scanner, a camera, or some other suitable apparatus for optically and/or electrically imaging the client's feet and their position (errors), see numeral 406. Such imaging technology enables storing client-dependent data at the retailer for future use and archiving purposes.

The imaging technology may be hooked up to a printer and/or a computer, see numeral 502 of FIG. 5, which is configured to visualize different views, e.g. foot images with optional zooming, silhouettes, etc, on a display based on the gathered data. The trained sales clerk may then point out to the client, via the visualized image, the problems found in his feet position and explain how the situation can actually be improved by the custom-made insoles in accordance with the invention. The computer may also be configured to store the data, preferably client-specifically. Respectively, printed images can be stored. Further, either the computer may include a data transfer interface of its own, e.g. a network interface, or a separate data transfer interface may be coupled thereto or directly to the data acquisition means to transfer the acquired data to external destinations such as the retailer chain's central server or third parties' databases, if allowed by the client.

Yet, the start-up phase includes educating 220 the sales clerks and other personnel about the sales and customization processes of the insoles of the invention. Preferably, professionals authorized by the insole manufacture shall take care of the training. It is beneficial to the result that the personnel know how to utilize the different insole designs, the oven, the study means, and the molding stand. Certainly, a responsibility for different devices can also be divided between several persons, i.e. one person may take care of the feet analysis whereas the other actually molds the insole to a proper form. Only qualified in-store professionals may be entitled to wear a brand label associated with the insoles. The educational program may include regular follow-ups that can be correspondingly made mandatory for continued qualification and right to wear the brand label.

Reverting to the execution-time flow of the invention, step 204 refers to a client-specific analysis phase during which a trained sales clerk initially studies the client's needs either by manual/ocular investigation of the feet or by listening to the client, preferably by doing both.

The analysis step 204 has been further illustrated in FIG. 3 to set forth different aspects included therein; first of all, a proper basic design or "style" of the insole may be determined 304, via usage analysis 302, from multiple options such as men's/women's, sport (general and optionally discipline-resolution such as tennis, running, soccer, football, basketball, hockey, skating, skiing, trekking, etc), health, military, medical and basic design, the design then affecting e.g. shape, material, thickness, elasticity, etc of the preform. The information for the analysis and decision-making (e.g. desired use/purpose of the insoles 302) may be gathered directly from the client by inquiring and monitoring his or her needs. The client may have brought along a pair of shoes to be used with the insoles, for example, which facilitates selecting a proper preform design and size.

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In addition to mere basic design selection that heavily depends on the desired use, more refined data about the client's feet and their position (overpronation, oversupination, etc) may be collected **306** and reviewed via e.g. visual inspection and the study means such as the podoscope explained hereinbefore. A foot size is naturally a typical parameter/criterion required for determining a proper insole preform **308**, although an oversized preform may in some applications be decently cut to a smaller size. The client may directly tell the size to the clerk, but the size may also be verified on the spot by utilizing available measurement equipment. Moreover, special conditions **310** such as hallux valgus, pes planus, pes cavus, rheumatism, diabetes, or pregnancy may imply a need for special preforms that are advantageously in the retailer stock as well. Rare situations may still occur wherein a responsible sales clerk notices that the client's feet and/or indicated use of the insoles require deeper investigation and a proper insole cannot be reliably addressed on the basis of the acquired information, or that the needed preforms are simply not available. The sales clerk may then refer the client to a specialized clinic employing foot specialists, e.g. physiotherapists or podiatrists, with more profound knowledge **312**. Alternatively, the clerk may himself contact the clinic specialists for consultation and optionally order special preforms to the client, if possible. In the clinic more detailed examination shall be conducted; for example, neuromuscular, circulation joints, and soft tissues palpation and motion tests can be performed. The biomechanics of the lower extremities and the spine can be evaluated by videotaping the client's standing position, walking and running. Radiographs, bone scans, CT, MR, or sonography may also be available. Thus, by co-operation between the clinic and retail stores providing the insoles the client may receive fully guaranteed service, whereupon basic cases can be solved on the spot at retailer premises whereas more comprehensive study shall be carried out at the clinic.

Instead of verbally communicating with the client from the scratch, e.g. a computer with tailored software may be provided to interview the client about feet properties and intended use of the insoles, which then at least semi-automatically forms a client profile based on a predetermined set of profiling rules. Alternatively, the client may have his preferences already stored at the retailer due to an existing customer history, in which case the analysis step may be basically omitted provided his or her personal data and future use of the new insoles will substantially remain unchanged.

Anyway, the software or the sales clerk optionally assisted by the software may recommend a proper insole design to the client based on the available information, and a corresponding insole preform will be then picked up, preferably from the nearby rack where the preforms (or packages, each comprising one or two preforms) reside on view as conveniently grouped based on the sizes/designs thereof. As human feet are practically never of equal size or shape, the preforms may have been packed separately instead of traditional pair-packs. Alternatively, if the client already knows his needs without motivation for re-analysing the case, he may pick up proper preforms by himself after which he consults the clerk for the rest of the customization procedure.

In step **206** a proper pair of preforms has already been determined and they are heated up to a temperature that enables reformation of at least predefined portions thereof as a response to a physical force introduced on them. The material selections for the preforms as explained hereinbefore guarantee a softening temperature for the predetermined portions that is still tolerable by the client, e.g. 85° C. After heating the perform to a reasonably high temperature as

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aforesaid 85° C., it is preferable to wait until the temperature drops to a more convenient reading like 70-75° C. from the standpoint of the client. Alternatively, the client may wear a sock or corresponding protection to insulate the foot from extensive heat. The heating device is advantageously selected and configured so that the heating up time is preferably only a few minutes or less in order to provide the client with swift service.

In step **208** the heated preforms are preferably placed on a flexible material like a casting pad (e.g. a pillow/cushion) of a molding stand, for example, and the client is instructed to introduce force via his soles to the preform surfaces meanwhile the clerk guides the client's feet to a proper position and manually, shapes, by physical interaction, e.g. through fingertips, the insoles to conform to the feet and achieve an improved mold according to the principles of the invention, see step **210** in FIG. 2 and numeral **506** in FIG. 5. Shaping may refer to introducing protrusions to a desired direction from the original insole form/plane, for example. Furthermore, the client may stand on the preforms to introduce the necessary pressure corresponding to the real weight bearing posture. Advantageously the molding stand includes a lower portion to receive one or more casting pads and the client's feet on top of those, and an upper portion such as a crossbar from which the client can seek support during the casting process.

In step **212** the clerk checks whether each insole conforms to the respective foot (sole) of the client and provides improved foot position and body posture, refer to numerals **508** and **510** of FIG. 5. In case there is still some tweaking to do, the method may be redirected to a proper antecedent step such as step **206**, **208**, or **210**. Otherwise, the individually formed insoles are fit to the client's shoes, which may require slight further adjustments like cutting the border areas, etc **224**.

The method execution is ended in step **216**. It is waited until the temperature of the insoles drops under the glass transition temperature of the thermoplastic after which the insoles can be taken into use. In case the retailer in question is willing to maintain a customer register or forward such information to a centralized register possibly maintained by the retail chain, the insole manufacturer or some other third party, the customer data may be stored **226** to facilitate future business with the same client. This preferably happens only after receiving an explicit acceptance for storing personal information by the client. Step **226** may also include providing insole maintenance instructions to the client.

As an additional service, the clerks may be advised to channel the client's interest into the insoles of the invention even in the case the client is initially short of new shoes **222** only. This may happen either unconditionally or not until noticing a foot problem that the custom insole could alleviate.

The retail store may also offer a product guarantee that enables the client to get the preforms reshaped again by the retailer without any additional cost or with just a basic service fee, if a need arises.

Although the above method was described from the standpoint of a pair of insoles that are individually shaped to the client, which still is the preferred scenario, it is feasible for providing a single insole (or a single shoe) alike.

In the current invention also a liner or other element/layer to be placed in a shoe and possibly provided with a shoe or other footwear can be considered as the insole of the invention provided that it features similar effects and overall applicability.

Likewise, a shoe of the invention may be offered in the spirit of the above method. Especially a shoe sole or a part

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thereof may be constructed by following the ideas presented hereinbefore with reference to an insole. E.g. the sole of a soft gym shoe, a ballet shoe, a sandal or other type of shoe with soft enough portions suitable for manual molding after heating can be reformed accordingly.

It's clear to a skilled person that certain method steps can be also executed in reverse order, e.g. feet properties analysis 306 and an aggregate of usage analysis 302 and insole basic design selection 304; both aspects contribute to selecting a proper insole blanket 308.

Instead of heating, the preforms may be reshaped by utilizing some other feature than an embedded thermoplastic material. For example, certain resins can be hardened by utilizing predetermined chemical substances. However, in applying those it's important to select materials that enable trouble-free but still real-time reshaping of the preform on the client's foot, i.e. they must not introduce health hazards, e.g. burns, to the client upon or after the reshaping procedure.

In addition to humans, the invention may also be applied in manufacturing customized footwear for animals.

The invention claimed is:

1. An insole for footwear, comprising:
at least one layer made of thermoplastic material; and
a lower layer configured to be placed against the footwear, wherein said thermoplastic material is selected from the group consisting of: ABS, PVC, A-PET and PETG, wherein said thermoplastic material of said at least one layer becomes plastic substantially under 95° C. and above 45° C., and
wherein the at least one layer of thermoplastic material is configured to reach out from under a heel of a foot only to the metatarsophalangeal joint of the foot, and
wherein the lower layer is configured to reach from under the heel to the metatarsophalangeal joint and extend further to a toe of the foot.
2. The insole of claim 1, further comprising:
an upper layer configured to be placed against the foot.
3. The insole of claim 1, wherein the at least one layer of thermoplastic material reaches out at least from under the heel of the foot to under a plantar arch of the foot.

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4. The insole of claim 1, wherein said lower layer includes at least one material selected from the group consisting of: non-woven polyester, and ionomerresin-ethylvinylacetate blend.

5. Footwear, comprising:
the insole of claim 1.

6. The footwear of claim 5, wherein said footwear is selected from a group consisting of: a shoe, a skate, and a ski boot.

7. The footwear of claim 5, further comprising:
a thermosensitive internal layer.

8. A shoe, comprising:
a sole having at least two layers, a first of said two layers being a thermoplastic layer made of thermoplastic material,

wherein said thermoplastic material of said thermoplastic layer is selected from the group consisting of: ABS, PVC, A-PET and PETG,

wherein said thermoplastic material becomes plastic substantially under 95° C. and above 45° C.,

wherein the thermoplastic layer is configured to reach out from under a heel of a foot only to the metatarsophalangeal joint of the foot, and

wherein a second of the two layers is configured to reach from under the heel to the metatarsophalangeal joint and extend further to a toe of the foot.

9. The shoe of claim 8, wherein the sole further comprises at least one of an upper layer configured to be placed against any of a foot, and a lower layer configured to be placed against a walking surface.

10. The shoe of claim 8,
wherein the thermoplastic layer reaches out at least from under the heel of the foot to under a plantar arch of the foot, and

wherein the shoe further comprises a lower layer against a walking surface.

11. The shoe of claim 8, wherein the thermoplastic layer is integrated in a sole material.

12. The shoe of claim 8, further comprising:
an internal layer made of viscoelastic foam.

13. The shoe of claim 8, wherein the thermoplastic layer is on top of a sole material.

* * * * *

EXHIBIT B

(12) **United States Patent**
Hakkala

(10) **Patent No.:** **US 8,171,589 B2**
(45) **Date of Patent:** **May 8, 2012**

(54) **INDIVIDUALLY FORMED FOOTWEAR AND A RELATED METHOD**

(75) Inventor: **Erkki Hakkala**, Helsinki (FI)

(73) Assignee: **Footbalance System Oy**, Helsinki (FI)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 127 days.

(21) Appl. No.: **12/849,953**

(22) Filed: **Aug. 4, 2010**

(65) **Prior Publication Data**

US 2010/0293727 A1 Nov. 25, 2010

Related U.S. Application Data

(62) Division of application No. 11/486,080, filed on Jul. 14, 2006, now Pat. No. 7,793,433.

(51) **Int. Cl.**
A43D 1/00 (2006.01)

(52) **U.S. Cl.** **12/146 B**; 12/146 M

(58) **Field of Classification Search** 12/146 B,
12/146 M, 142 N; 36/93, 44, 43, 154, 153,
36/88

See application file for complete search history.

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Primary Examiner — Ted Kavanaugh

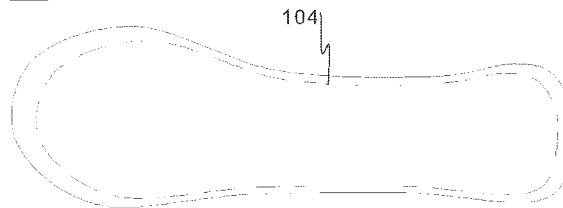
(74) *Attorney, Agent, or Firm* — Young & Thompson

(57) **ABSTRACT**

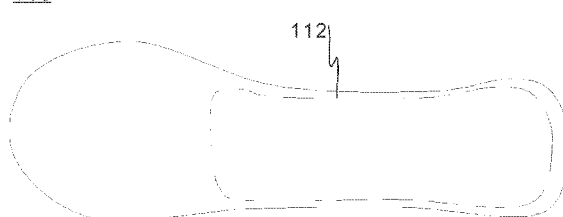
Individually formed footwear such as shoes and insoles for correcting the feet position and alleviate related problems. The shoe or insole includes at least one layer made of thermoplastic material, which material is advantageously chosen from a group of ABS, PVC, A-PET and PETG. A method for providing such footwear to a client at a retail store is likewise presented.

6 Claims, 5 Drawing Sheets

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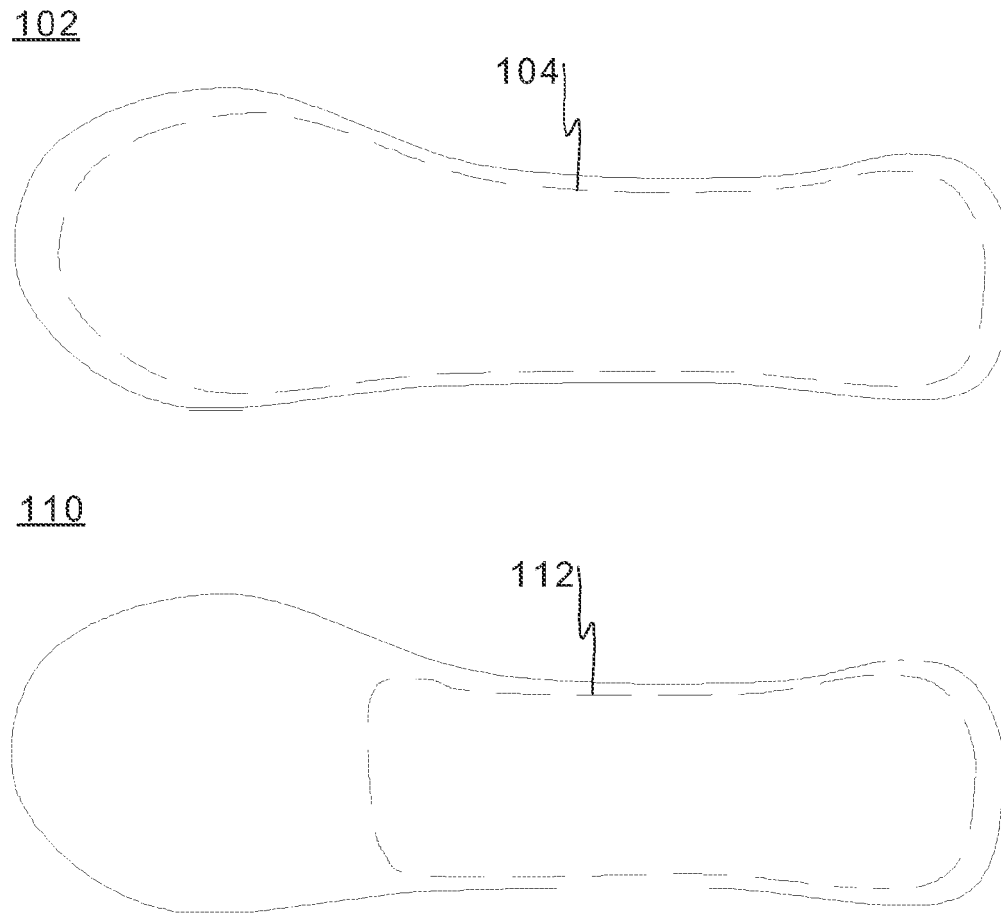


Figure 1

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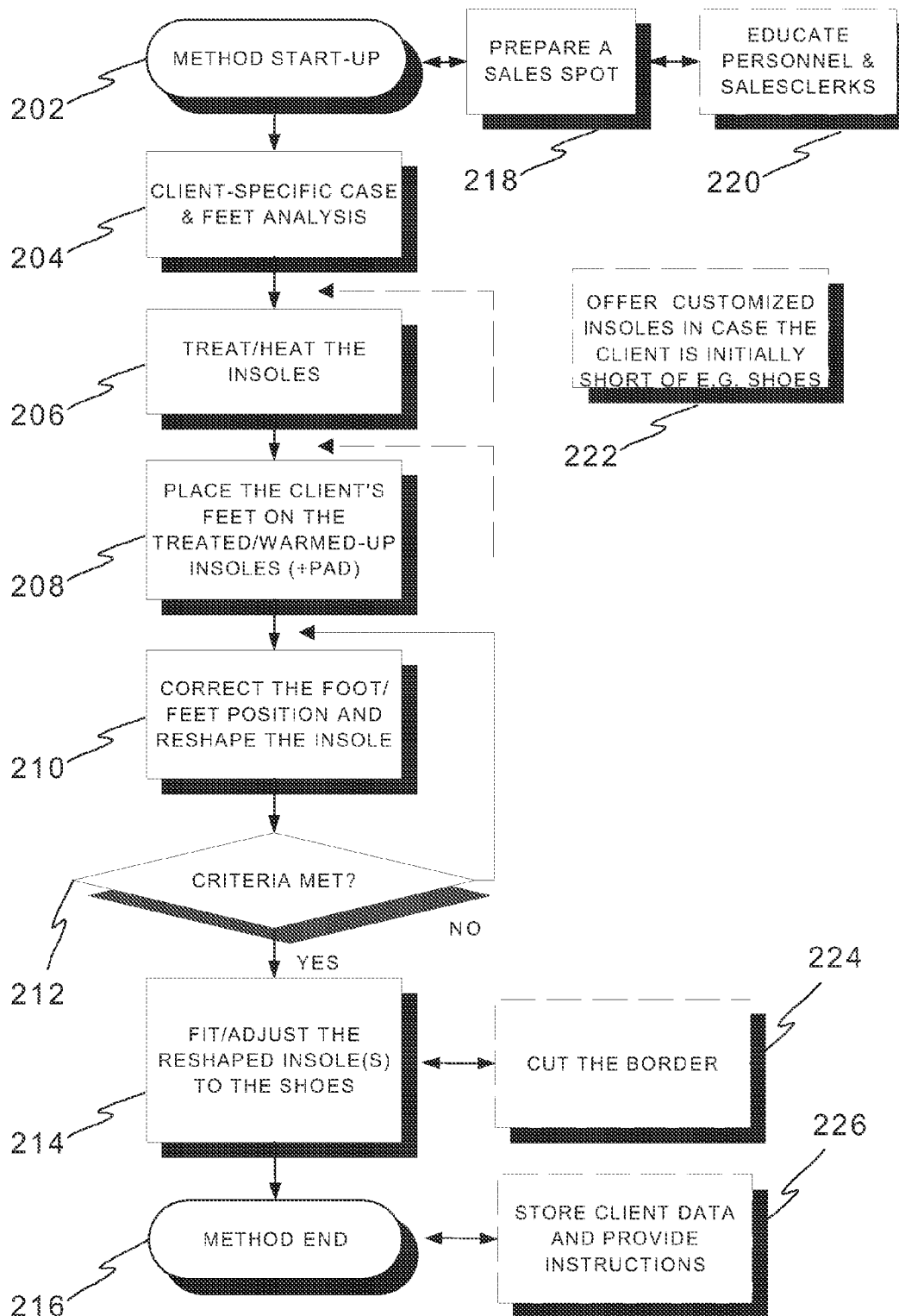


Figure 2

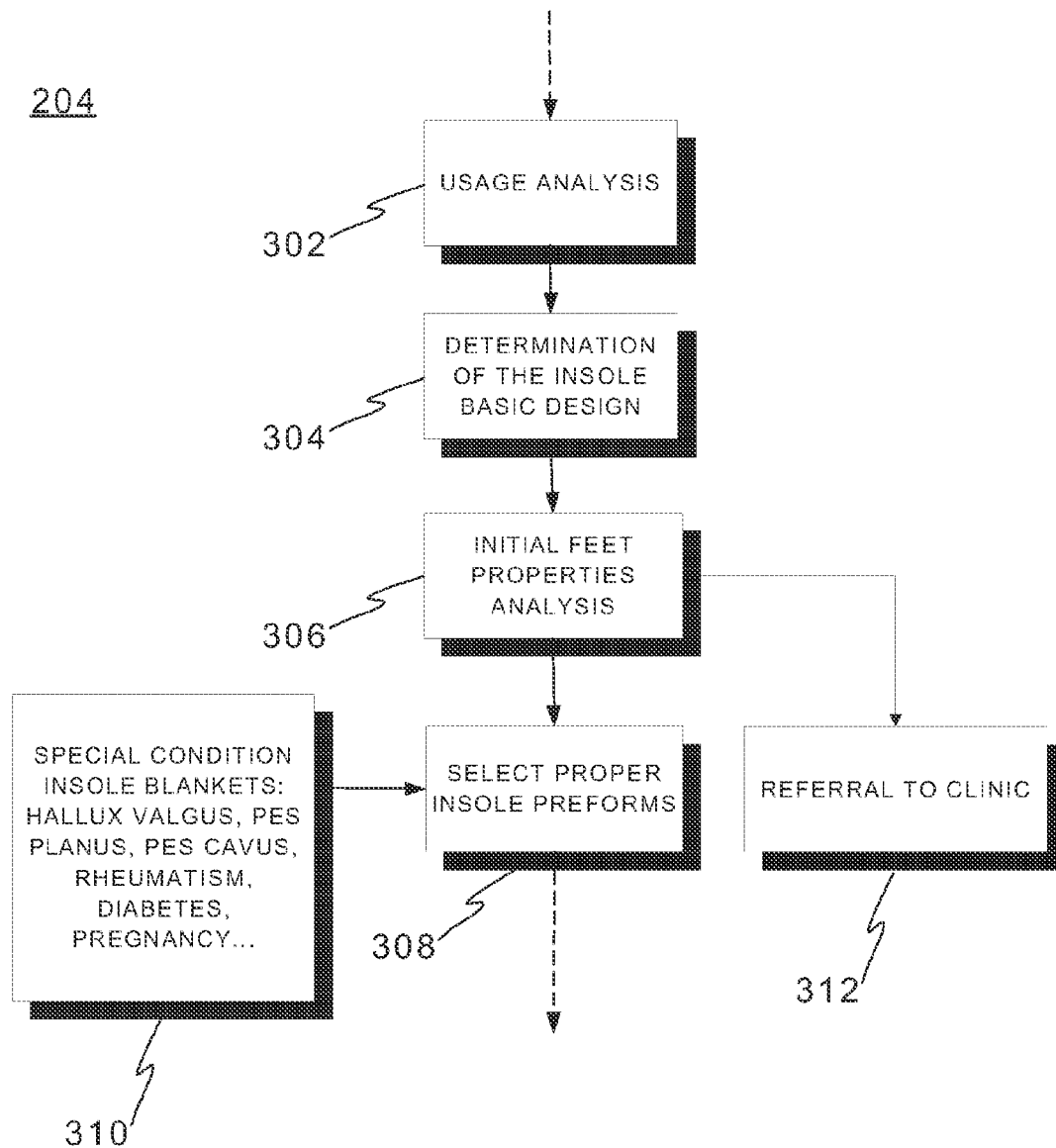


Figure 3

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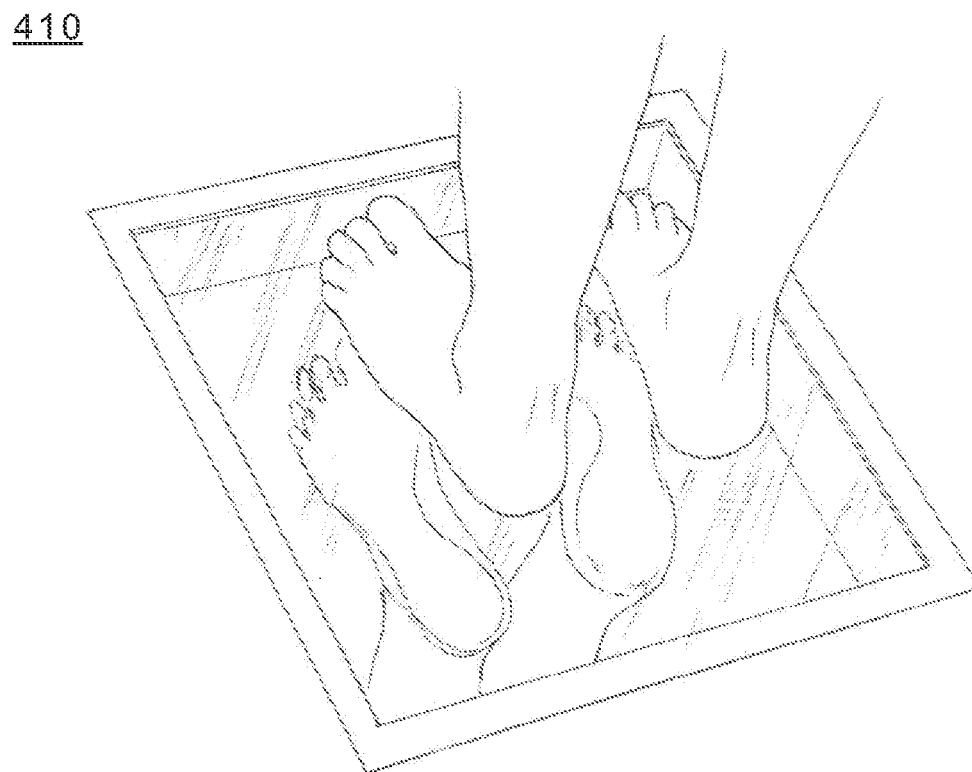
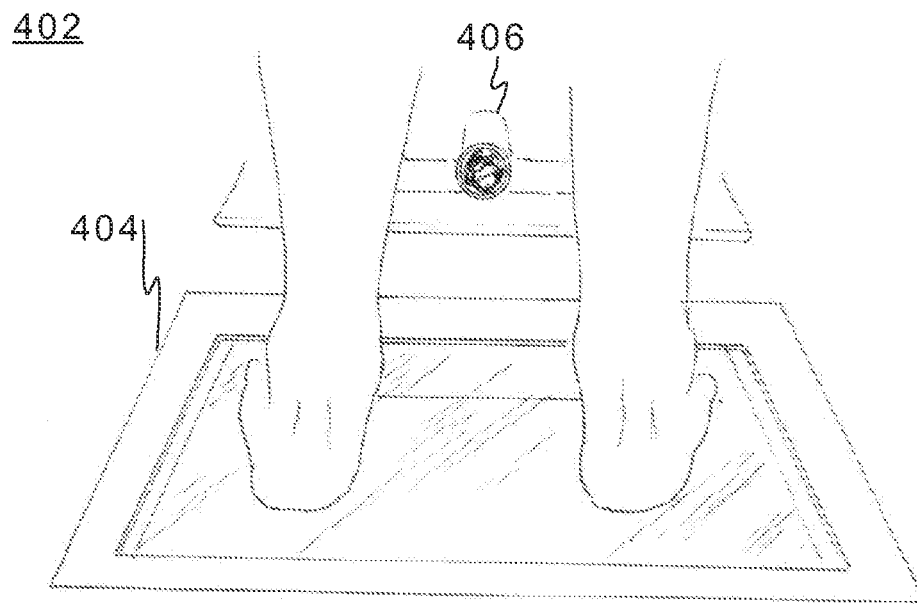


Figure 4

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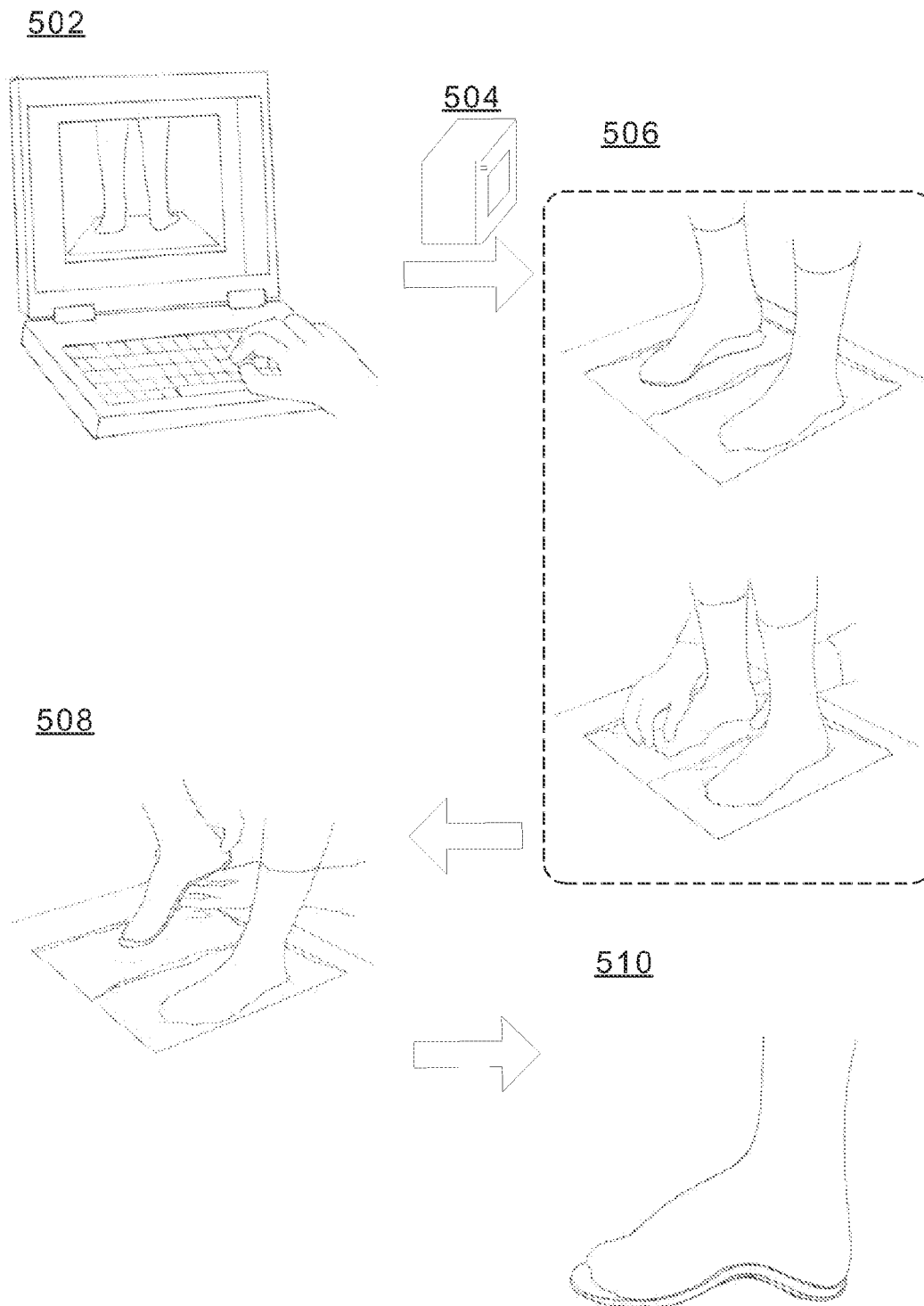


Figure 5

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**INDIVIDUALLY FORMED FOOTWEAR AND
A RELATED METHOD****CROSS REFERENCE TO RELATED
APPLICATIONS**

This application is a divisional of application Ser. No. 11/486,080 filed on Jul. 14, 2006. The entire contents of each of the above-identified applications are hereby incorporated by reference.

FIELD OF THE INVENTION

The current invention generally relates to footwear. In particular the invention concerns personalized shoes, insoles and a method for obtaining those.

BACKGROUND OF THE INVENTION

Approximately 70% of the world population suffer from some sort of foot problems. Only few of the total number have had a chance to purchase insoles that alleviate at least part of the problems. Traditionally, custom-made shoes and insoles have been manufactured by professional shoemakers, physiotherapists, or podiatrists. So far the associated purchase process has been rather time-consuming and costly; a person willing to spend 120-250 EUR on custom made insoles or more than 300 EUR in bespoke shoes has to visit one of aforesaid professionals or their remote partner to get their feet characteristics measured including e.g. a foot size and other properties, advantageously also problem-causing features, after which the order is placed in a waiting list for initiating the actual manufacturing process by the professional. Often the delay between placing the order and receiving the customized shoes/insoles thus extends to few days or even few weeks, which makes the overall process rather awkward especially from a standpoint of a casual client.

Foot motion/gait problems reflect to soles, ankles, knees, hips, back, etc; that is why their treatment and prevention is particularly beneficial to the whole human well-being. An individual takes around 15 000-16 000 steps every day. The load on feet in sports is many times the weight of the body. For example, the ground force is about three times one's body weight while running and 7.5 times while playing basketball due to jumps and other irregular moves. Provided that the foot position is correct, the load divides evenly between the upper joints.

A common condition called pronation refers to inward (i.e. medial) roll of the foot (especially heel and arch), which turns into overpronation when the foot rolls too much. In contrast, oversupination is caused by too small inward roll. Both conditions easily cause pain, wear and even stress injuries in the feet and various body joints.

Different (arch) support insoles are available for correcting the foot position. They have been designed to support longitudinal medial and lateral arch but without separately glued wedges they do not actually correct foot position. Wedging is a time-consuming and expensive process. The obtained result depends on the person doing the task and still tends to be rather inaccurate. As another drawback, after gluing the wedges to the soles one cannot take a new mold without first removing the wedges.

Ready-made supports in the insoles do not provide a perfect match to anyone's feet, as people do not generally bear identical feet shape. Accordingly, many support insoles are ultimately deemed inconvenient due to their lousy fit.

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SUMMARY OF THE INVENTION

In order to alleviate aforesaid problems the current invention provides, as its one aspect, an insole for a shoe, which insole comprises at least one layer made of thermoplastic material, which material is chosen from a group consisting of: ABS, PVC, A-PET, and PETG so that the selected material becomes plastic substantially under 95° C. and above 45° C., i.e. somewhere within the range.

In another aspect a shoe comprises a sole having at least two layers one of which being made of thermoplastic material.

An insole or a shoe that is to be subjected to a shaping (or actually reshaping as it inherently has some kind of basic form after manufacturing) procedure of the invention for correcting the foot position is hereinafter called a preform.

In a further aspect a method of producing an individually formed insole includes:

choosing one or more, e.g. a pair of, insole preforms from a selection of preforms having a thermoplastic layer, heating the chosen preform above the glass transition temperature (T_g) temperature of the thermoplastic layer in case the preform lacks preheating, guiding a client to step on the heated preform, adjusting the angle of the ankle to the right position with help and guidance of an orthopedic or other trained person, adjusting the client's foot so that the plantar arch settles to a normal high position, and waiting for the temperature of the heated insole preform to drop under the glass transition temperature of the thermoplastic.

Yet in a further aspect a method of producing an individually formed shoe includes the following steps:

choosing one or more, e.g. a pair of, shoe preforms from a selection of shoe preforms, heating the chosen shoe preform above the glass transition temperature of the thermoplastic layer of the shoe preform in case the preform lacks preheating, guiding the client to step into the heated shoe preform, adjusting the client's foot so that the plantar arch settles to a normal high position, adjusting the angle of the ankle to the right position with help and guidance of an orthopedic or other trained person, taking the shoe preform off from the foot, and waiting for the temperature of the shoe preform to drop under the glass transition temperature of the thermoplastic.

Still in a further aspect a method for providing individually formed footwear to a client comprises:

arranging a sales spot including a plurality of alternative articles selected from the group consisting of: an insole, a liner for a shoe, and a shoe; said sales spot further including means for customising an article belonging to said plurality of articles to the client's foot, studying a foot of the client so as to enable choosing an article belonging to said plurality of articles, treating, preferably heating by said means for customizing, at least part of the chosen article to render its form responsive to an external force introduced thereon, placing the client's foot in contact with the treated article in accordance with the predetermined use thereof, and manually shaping the treated article so as to correct the foot position by conforming thereto.

The utility of the invention arises from a number of issues. First, the individually formed shoe or insole provides natural

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arch support and divides the ground force more evenly through the foot, knee, hip, and the back. Secondly, it reduces overpronation or oversupination and realigns the gait. This affects positively to the body posture and alleviates fatigue, sprained ankles, rubbing and pain. The invention further stabilizes the foot, adds lateral support of the foot and strengthens it to reduce loss in muscle power. Yet, the transverse arch is supported when the thermoplastic layer extends under it.

Further, when considering the issue from a retail perspective, the shoes/insoles can be offered through common retail stores, e.g. sport or shoe stores, and the required customisation process by a trained sales clerk takes only minutes. The sales spot consumes only a minor space (few square meters) and compulsory investments in equipment can be kept low. Provision of customized insoles cultivates the pro image emanating from the retailer and offers a promotional value in relation to other products as well; it attracts people to visit the store and raises the sales figures of related products (shoes/insoles, socks, etc) respectively. The profit margin can be kept high while the retail price is still considerably lower than with its prior art antecessors.

In an embodiment of the invention an insole or a shoe has a thermoplastic layer that extends substantially over the major area of the insole, optionally still leaving at least the border areas intact for facilitating easy adjustment and cutting thereof.

In another embodiment of the invention an insole or a shoe has a thermoplastic layer that covers laterally only part of the insole/shoe. Advantageously the thermoplastic still reaches out lengthwise at least from under the heel to under the plantar arch and in lateral direction almost to the whole width of the insole.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following, the invention is described in more detail by reference to the attached drawings, wherein

FIG. 1 is a sketch of two insole embodiments according to the invention.

FIG. 2 is a flow diagram representing one example of a method of the invention wherein individually formed footwear is provided to a client.

FIG. 3 is a more specific flow diagram about relevant analysis steps for determining the client's needs.

FIG. 4 depicts a podoscope including a transparent glass plate on which the client is standing during the feet analysis.

FIG. 5 further visualizes selected method steps of FIG. 2.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

A preform (~blanket) insole has at least one layer, which is made of thermoplastic and reaches out at least from under the heel to under the plantar arch of the target person's, herein-after client, foot. Advantageously two or three material layers that are connected together are used in the preform insole for the comfort of the client. The upper layer (if used) of the preform insole is placed against the foot and the lower layer is placed against the shoe. Materials of these two layers can be selected among any prior art materials used in insoles. For example, the lower layer may be constructed from a known material such as Rhexuflex (trademark of Rhenoflex GmbH Ltd) comprising non-woven polyester as a carrier, ionomer-resin-ethylvinylacetate blend as an extruded core, and EVA-Hotmelt as an adhesive.

The middle layer of the insole (in case of three layers) is made of thermoplastic. The used thermoplastic can be

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selected from a large group of known thermoplastics. The critical value is the temperature, so-called glass transition temperature, where the thermoplastic becomes plastic and on the other hand turns back to solid form when the temperature is decreasing after shaping the insole. This temperature should not generally be so high that the insole feels uncomfortable against the client's foot. Notwithstanding a high glass transition temperature, a thermoplastic is still applicable if it can be cooled down enough prior to placing in contact with the foot provided that the thermoplastic remains plastic, i.e. mouldable. Adequate temperature for the thermoplastic to become plastic is preferably somewhere under 95° C. and above 45° C. Advantageously the range is from 50° C. to 85° C. Suitable materials that become or are plastic within the preferred ranges are for example thermoplastic polyesters A-PET (Amorphous polyester terephthalate) and PETG (glycol-modified polyethylene terephthalate, which is a copolyester), or such with essentially similar characteristics. Also e.g. ABS (acrylonitrile butadiene styrene), PVC (polyvinyl chloride) can be used.

Thickness of the thermoplastic layer shall be preferably selected so as to provide reasonable support to the client's foot when the layer is in a rigid state. The thickness may also vary throughout the layer, if e.g. more flexibility is desired under the toe area (thinner) than the plantar arch area (thicker).

Other characteristic required for the thermoplastic dictates that it should be rigid under the melting temperature.

With reference to an embodiment shown in the upper sketch 102 of FIG. 1, the middle layer 104 (or the only layer) made of thermoplastic can cover laterally the whole area of the insole. In alternative embodiment, see sketch 110, the layer 112 covers laterally only a part of the insole. In that option it is necessary that the thermoplastic reaches out lengthwise at least under the heel to under the plantar arch and in lateral direction advantageously almost to the whole width of the insole. As one feasible implementation, the thermoplastic layer is designed so as to reach out from under the heel to the metatarsophalangeal joint of the foot so that transverse arch can be supported. Also, a precut pad can be placed under the transverse arch when the insole is shaped to lift the transverse arch into the optimum position. However, it is advantageous to keep some range at the edge of the insole without the hard thermoplastic in case there is need for little adjustment when the insole is placed in the shoe. Also, the toe area of the insole should remain without the hard thermoplastic to enable natural movement of the foot during walking or running.

One major aspect of the invention relates to producing a preform of an insole that is ready in one piece (thus possibly having separate layers that are connected together with adhesive or such) and easy to heat over the glass transition temperature of the included thermoplastic. After cooling the insole is preferably rigid one-piece structure that corrects the foot position and supports the foot, especially the plantar arch and transverse arch thereof. The plantar arch can be adjusted to a proper high position by pulling the client's toe up and/or by lifting his/her heel up while keeping the toes against a support surface (Windlass effect). The adjustments can be carried out on a soft pad with or without further manual guiding. Alternatively, a trained person may reach a decent result just by hands without a supporting surface.

Alternatively, in accordance with the current invention a shoe can be provided, said shoe having a sole, which can be shaped according to client's foot for correcting the incorrect position thereof. The shoe in this case shall have at least one material layer of thermoplastic. The shoe is advantageously

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manufactured to include all necessary layers and is just personalized upon purchase. Suitable shoes include, for example, various types of walking shoes, sport shoes, boots, sandals and soft gym shoes.

The sole is advantageously at least a two-piece structure including a thermoplastic layer either situated on top of the sole material or being integrated, for example embedded, within it. The one or more sole layers excluding the thermoplastic layer may comprise e.g. EVA (ethylvinylacetate) or other prior art materials; e.g. aforesaid EVA is even available in different hardnesses. If there is more than one layer the thermoplastic layer can be smaller in lateral direction than the whole sole. It is essential that the thermoplastic layer reaches out at least from under the heel to under the plantar arch of the foot the same way as with the insole. The thermoplastic materials can be selected the same way as with the insole. It may be advantageous to make at least the outer surface of the sole of some wear resistant and good friction characteristics-having material. Optionally, e.g. viscoelastic foam or other material, which may also be thermosensitive, can be used within the shoe, whereby the shoe internals also reshape in addition to mere insole and provide additional comfort/support. With this embodiment can be assured very comfortable personalised shoe that supports tightly the bone structure of the feet and ankle. This is very important if the client has a for example diabetes or rheumatism and the shoe shouldn't cause any friction or abnormal pressure to the foot.

In a further alternative, footwear such as shoes (walking, sports, discipline-specific, etc), skates, ski boots, etc can be offered with preinstalled insoles in accordance with the invention, which insoles shall be then personalized before use. The layers inside the shoe that receive the insole of the invention shall advantageously conform to the insole shapes. Optionally, e.g. viscoelastic foam or other material that is optionally thermosensitive can be used within the shoe, whereby the shoe internals also reshape in addition to mere insole.

FIG. 2 discloses a flow diagram, by way of example only, of the method for providing individually formed insoles to a client by a retailer. The insoles may be provided as such or with shoes that may even include the insoles of the invention by default. Likewise, shoes including a mouldable sole of the invention can be offered via the method presented hereinafter. Some of the method steps and associated devices are further visualized in FIGS. 3-5 for clarification.

The inventive concept makes it possible to finalize customised insoles only a few minutes after receiving the assignment. The insoles of the invention can be provided to the retailers as a part of a complete service package including a sales spot, equipment for feet study, and equipment for making customized insoles. The service package may also include training the sales personnel via an educational program that may be an (intensive) course or lecture-based.

In step 202, a method start-up, a sales spot is prepared 218 for use at retailer premises. The sales spot may be advantageously delivered as a predetermined ensemble comprising a number of separate elements having a recommended location within the spot so that the spot aggregate can be just conveniently positioned in a preferred location, or alternatively, the retailer may at least partially build it up according to his personal preferences from separate elements if seen useful. The spot includes the necessary means to rapidly provide a customer with properly shaped insoles. Such means may include a stand or a rack with a number of insole preforms (preferably packaged in lightweight, space-saving and at least partially transparent cases, made of e.g. cardboard) with varying properties (size, thickness, basic design, etc), a molding

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stand with one or more casting pads, a heating system, see numeral 504 of FIG. 5, such as an oven for heating the insole preforms, and basically optional study means for analysing the client's feet and problems/properties thereof in addition to the mere ocular inspection that is anyhow to be performed by the trained staff.

The study means may include, for example, a podoscope, a camera system, and a computer. The podoscope is, by definition, a device for analysing the interaction of the foot and a supporting surface. A client stands on a transparent glass plate of the podoscope, see reference numeral 404 of sketch 402 in FIG. 4, whereupon an image of his feet is shown through a mirror to the person doing the measurements, see lower sketch 410. The study means, e.g. aforesaid podoscope, can also include data acquisition means such as an optical scanner, a camera, or some other suitable apparatus for optically and/or electrically imaging the client's feet and their position (errors), see numeral 406. Such imaging technology enables storing client-dependent data at the retailer for future use and archiving purposes.

The imaging technology may be hooked up to a printer and/or a computer, see numeral 502 of FIG. 5, which is configured to visualize different views, e.g. foot images with optional zooming, silhouettes, etc, on a display based on the gathered data. The trained sales clerk may then point out to the client, via the visualized image, the problems found in his feet position and explain how the situation can actually be improved by the custom-made insoles in accordance with the invention. The computer may also be configured to store the data, preferably client-specifically. Respectively, printed images can be stored. Further, either the computer may include a data transfer interface of its own, e.g. a network interface, or a separate data transfer interface may be coupled thereto or directly to the data acquisition means to transfer the acquired data to external destinations such as the retailer chain's central server or third parties' databases, if allowed by the client.

Yet, the start-up phase includes educating 220 the sales clerks and other personnel about the sales and customisation processes of the insoles of the invention. Preferably, professionals authorized by the insole manufacture shall take care of the training. It is beneficial to the result that the personnel know how to utilize the different insole designs, the oven, the study means, and the molding stand. Certainly, a responsibility for different devices can also be divided between several persons, i.e. one person may take care of the feet analysis whereas the other actually molds the insole to a proper form. Only qualified in-store professionals may be entitled to wear a brand label associated with the insoles. The educational program may include regular follow-ups that can be correspondingly made mandatory for continued qualification and right to wear the brand label.

Reverting to the execution-time flow of the invention, step 204 refers to a client-specific analysis phase during which a trained sales clerk initially studies the client's needs either by manual/ocular investigation of the feet or by listening to the client, preferably by doing both.

The analysis step 204 has been further illustrated in FIG. 3 to set forth different aspects included therein; first of all, a proper basic design or "style" of the insole may be determined 304, via usage analysis 302, from multiple options such as men's/women's, sport (general and optionally discipline-resolution such as tennis, running, soccer, football, basketball, hockey, skating, skiing, trekking, etc), health, military, medical and basic design, the design then affecting e.g. shape, material, thickness, elasticity, etc of the preform. The information for the analysis and decision-making (e.g. desired

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use/purpose of the insoles **302**) may be gathered directly from the client by inquiring and monitoring his or her needs. The client may have brought along a pair of shoes to be used with the insoles, for example, which facilitates selecting a proper preform design and size.

In addition to mere basic design selection that heavily depends on the desired use, more refined data about the client's feet and their position (overpronation, oversupination, etc) may be collected **306** and reviewed via e.g. visual inspection and the study means such as the podoscope explained hereinbefore. A foot size is naturally a typical parameter/criterion required for determining a proper insole preform **308**, although an oversized preform may in some applications be decently cut to a smaller size. The client may directly tell the size to the clerk, but the size may also be verified on the spot by utilizing available measurement equipment. Moreover, special conditions **310** such as hallux valgus, pes planus, pes cavus, rheumatism, diabetes, or pregnancy may imply a need for special preforms that are advantageously in the retailer stock as well. Rare situations may still occur wherein a responsible sales clerk notices that the client's feet and/or indicated use of the insoles require deeper investigation and a proper insole cannot be reliably addressed on the basis of the acquired information, or that the needed preforms are simply not available. The sales clerk may then refer the client to a specialized clinic employing foot specialists, e.g. physiotherapists or podiatrists, with more profound knowledge **312**. Alternatively, the clerk may himself contact the clinic specialists for consultation and optionally order special preforms to the client, if possible. In the clinic more detailed examination shall be conducted; for example, neuromuscular, circulation joints, and soft tissues palpation and motion tests can be performed. The biomechanics of the lower extremities and the spine can be evaluated by videotaping the client's standing position, walking and running. Radiographs, bone scans, CT, MR, or sonography may also be available. Thus, by co-operation between the clinic and retail stores providing the insoles the client may receive fully guaranteed service, whereupon basic cases can be solved on the spot at retailer premises whereas more comprehensive study shall be carried out at the clinic.

Instead of verbally communicating with the client from the scratch, e.g. a computer with tailored software may be provided to interview the client about feet properties and intended use of the insoles, which then at least semi-automatically forms a client profile based on a predetermined set of profiling rules. Alternatively, the client may have his preferences already stored at the retailer due to an existing customer history, in which case the analysis step may be basically omitted provided his or her personal data and future use of the new insoles will substantially remain unchanged.

Anyway, the software or the sales clerk optionally assisted by the software may recommend a proper insole design to the client based on the available information, and a corresponding insole preform will be then picked up, preferably from the nearby rack where the preforms (or packages, each comprising one or two preforms) reside on view as conveniently grouped based on the sizes/designs thereof. As human feet are practically never of equal size or shape, the preforms may have been packed separately instead of traditional pair-packs. Alternatively, if the client already knows his needs without motivation for re-analysing the case, he may pick up proper preforms by himself after which he consults the clerk for the rest of the customisation procedure.

In step **206** a proper pair of preforms has already been determined and they are heated up to a temperature that enables reformation of at least predefined portions thereof as

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a response to a physical force introduced on them. The material selections for the preforms as explained hereinbefore guarantee a softening temperature for the predetermined portions that is still tolerable by the client, e.g. 85° C. After heating the preform to a reasonably high temperature as aforesaid 85° C., it is preferable to wait until the temperature drops to a more convenient reading like 70-75° C. from the standpoint of the client. Alternatively, the client may wear a sock or corresponding protection to insulate the foot from extensive heat. The heating device is advantageously selected and configured so that the heating up time is preferably only a few minutes or less in order to provide the client with swift service.

In step **208** the heated preforms are preferably placed on a flexible material like a casting pad (e.g. a pillow/cushion) of a molding stand, for example, and the client is instructed to introduce force via his soles to the preform surfaces meanwhile the clerk guides the client's feet to a proper position and manually, shapes, by physical interaction, e.g. through fingertips, the insoles to conform to the feet and achieve an improved mold according to the principles of the invention, see step **210** in FIG. 2 and numeral **506** in FIG. 5. Shaping may refer to introducing protrusions to a desired direction from the original insole form/plane, for example. Furthermore, the client may stand on the preforms to introduce the necessary pressure corresponding to the real weight bearing posture. Advantageously the molding stand includes a lower portion to receive one or more casting pads and the client's feet on top of those, and an upper portion such as a crossbar from which the client can seek support during the casting process.

In step **212** the clerk checks whether each insole conforms to the respective foot (sole) of the client and provides improved foot position and body posture, refer to numerals **508** and **510** of FIG. 5. In case there is still some tweaking to do, the method may be redirected to a proper antecedent step such as step **206**, **208**, or **210**. Otherwise, the individually formed insoles are fit to the client's shoes, which may require slight further adjustments like cutting the border areas, etc **224**.

The method execution is ended in step **216**. It is waited until the temperature of the insoles drops under the glass transition temperature of the thermoplastic after which the insoles can be taken into use. In case the retailer in question is willing to maintain a customer register or forward such information to a centralized register possibly maintained by the retail chain, the insole manufacturer or some other third party, the customer data may be stored **226** to facilitate future business with the same client. This preferably happens only after receiving an explicit acceptance for storing personal information by the client. Step **226** may also include providing insole maintenance instructions to the client.

As an additional service, the clerks may be advised to channel the client's interest into the insoles of the invention even in the case the client is initially short of new shoes **222** only. This may happen either unconditionally or not until noticing a foot problem that the custom insole could alleviate. The retail store may also offer a product guarantee that enables the client to get the preforms reshaped again by the retailer without any additional cost or with just a basic service fee, if a need arises.

Although the above method was described from the standpoint of a pair of insoles that are individually shaped to the client, which still is the preferred scenario, it is feasible for providing a single insole (or a single shoe) alike.

In the current invention also a liner or other element/layer to be placed in a shoe and possibly provided with a shoe or

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other footwear can be considered as the insole of the invention provided that it features similar effects and overall applicability.

Likewise, a shoe of the invention may be offered in the spirit of the above method. Especially a shoe sole or a part thereof may be constructed by following the ideas presented hereinbefore with reference to an insole. E.g. the sole of a soft gym shoe, a ballet shoe, a sandal or other type of shoe with soft enough portions suitable for manual molding after heating can be reformed accordingly.

It's clear to a skilled person that certain method steps can be also executed in reverse order, e.g. feet properties analysis 306 and an aggregate of usage analysis 302 and insole basic design selection 304; both aspects contribute to selecting a proper insole blanket 308.

Instead of heating, the preforms may be reshaped by utilizing some other feature than an embedded thermoplastic material. For example, certain resins can be hardened by utilizing predetermined chemical substances. However, in applying those it's important to select materials that enable trouble-free but still real-time reshaping of the preform on the client's foot, i.e. they must not introduce health hazards, e.g. burns, to the client upon or after the reshaping procedure.

In addition to humans, the invention may also be applied in manufacturing customized footwear for animals.

What is claimed is:

1. A method of producing an individually formed insole, comprising the steps of:

providing an insole preform that comprises

at least one layer made of thermoplastic material of one of the following: ABS, PVC, A-PET and PETG, said thermoplastic material becoming plastic above its glass transition temperature, which is substantially under 95° C. and above 45° C., wherein the at least one layer of thermoplastic material is configured to reach out from under a heel of a foot only to the metatarsophalangeal joint of the foot, and

a lower layer configured to be placed against the footwear, wherein the lower layer is configured to reach from under the heel to the metatarsophalangeal joint and extend further to a toe of the foot;

heating the preform above the glass transition temperature of the thermoplastic layer in case the preform lacks preheating;

guiding the client to step on the heated preform;

adjusting the client's foot so that the plantar arch settles to a normal high position;

adjusting the angle of the ankle to the right position; and waiting for the temperature of the heated insole preform to drop under the glass transition temperature of the thermoplastic.

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2. The method of claim 1 further comprising one or more of following steps:

placing the insole preform on a soft pad;

ensuring that the insole preform is following tightly the plantar arch and the foot is in correct position; and/or finish the shape of the insole to fit the inside dimensions of the shoe.

3. The method of claim 1, wherein the foot adjusting step comprises at least one of the following:

pulling the client's toe up so that the plantar arch settles to a normal high position, and/or

lifting the client's heel up while keeping the toes against a support surface.

4. A method of producing an individually formed shoe, comprising the steps of:

providing a shoe preform that comprises

a sole having at least two layers, a first of said two layers being made of thermoplastic material of one of the following: ABS, PVC, A-PET and PETG, said thermoplastic material becoming plastic above its glass transition temperature, which is substantially under 95° C. and above 45° C., wherein the first layer is configured to reach out from under a heel of a foot only to the metatarsophalangeal joint of the foot, and a second layer is configured to reach from under the heel to the metatarsophalangeal joint and extend further to a toe of the foot;

heating the shoe preform above the glass transition temperature of the thermoplastic layer of the shoe preform in case the preforms lack preheating;

guiding the client to step into the heated shoe preform;

adjusting the client's foot so that the plantar arch settles to a normal high position;

adjusting the angle of the ankle to the right position;

taking the shoe preform off from the foot; and

waiting for the temperature of the heated shoe preform to drop under the glass transition temperature of the thermoplastic.

5. The method of claim 4 wherein the method further comprises one or more of following steps:

placing the shoe preform on a soft pad; and

ensuring that the shoe preform is following tightly the plantar arch and the foot is in correct position.

6. The method of claim 4, wherein the foot adjusting step comprises at least one of the following:

pulling the client's toe up so that the plantar arch settles to a normal high position; and/or

lifting the client's heel up while keeping the toes against a support surface.

* * * * *

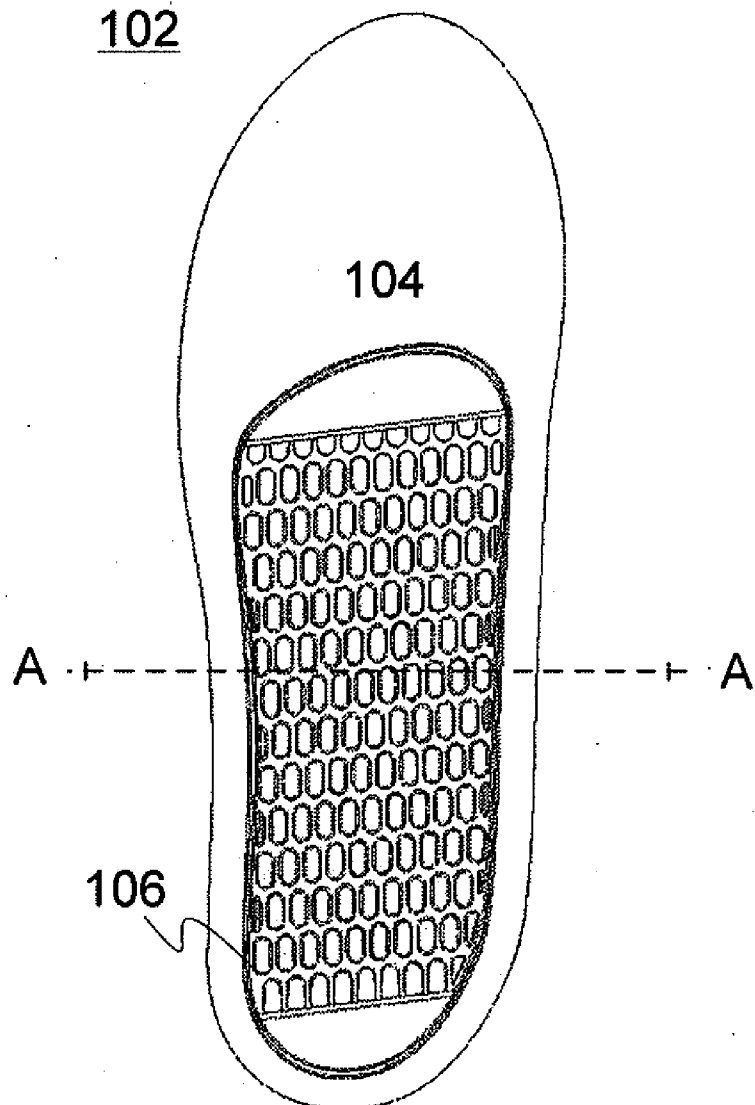
EXHIBIT C

(19) **United States**(12) **Patent Application Publication**
KAAKKOLA(10) **Pub. No.: US 2012/0131817 A1**(43) **Pub. Date: May 31, 2012**(54) **CUSTOM-FIT INSOLE FOR FOOTWEAR AND
RELATED METHOD OF MANUFACTURE**(52) **U.S. Cl. 36/44; 428/156; 156/93**(76) **Inventor: Eero KAAKKOLA, Helsinki (FI)**

(57)

ABSTRACT(21) **Appl. No.: 12/956,511**

An insole suitable for use with footwear. A body has at least one material layer and includes at least one heat-sensitive support element including thermoplastic material. The heat-sensitive support element is embedded in or joined with body to enable shaping at least part of the insole when heated and hardening by cooling. The heat-sensitive support element includes a plurality of hollows facing a direction substantially opposite a predetermined top side of the insole intended to receive a foot of a user. A corresponding method.

(22) **Filed: Nov. 30, 2010****Publication Classification**(51) **Int. Cl.****A43B 13/38** (2006.01)**B32B 7/08** (2006.01)**B32B 3/30** (2006.01)

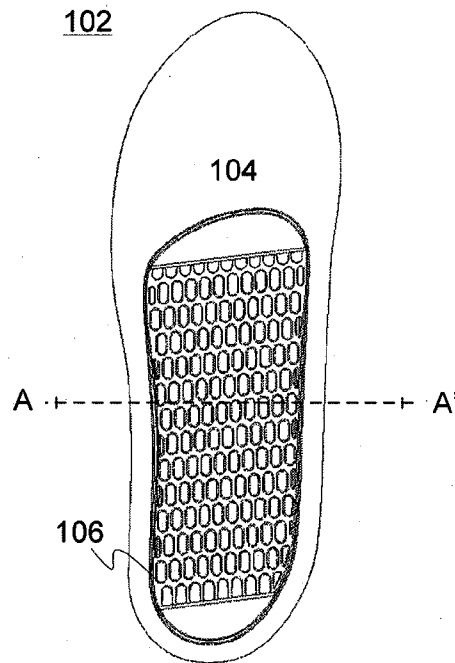


Figure 1a

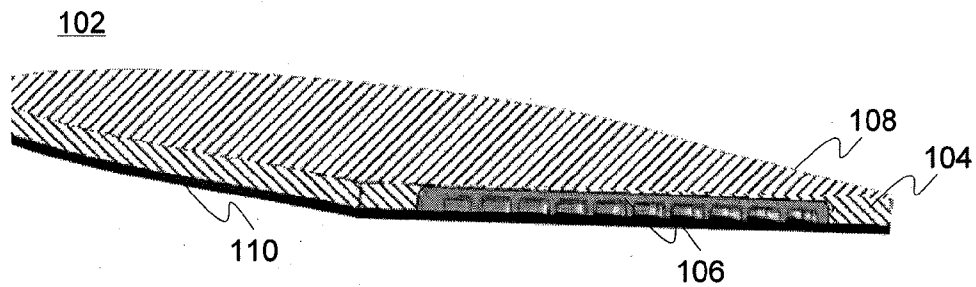


Figure 1b

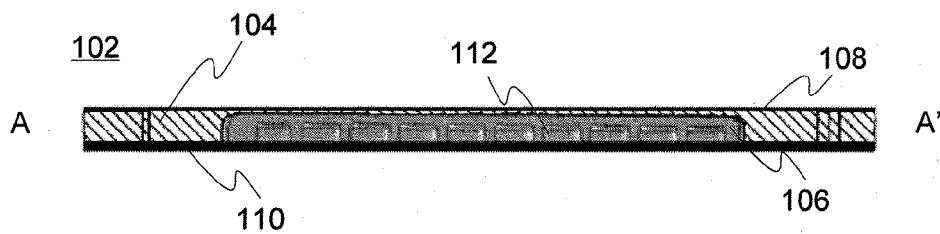


Figure 1c

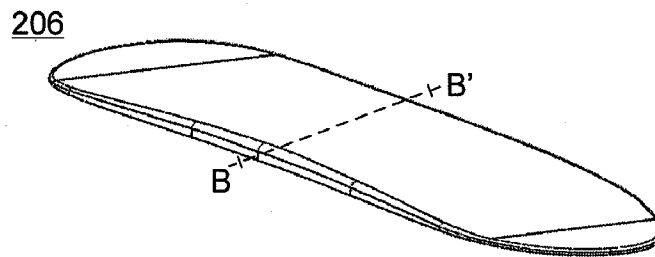


Figure 2a

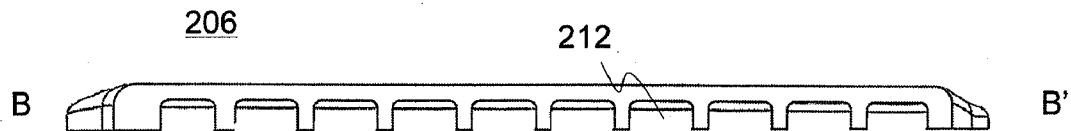


Figure 2b



Figure 2c

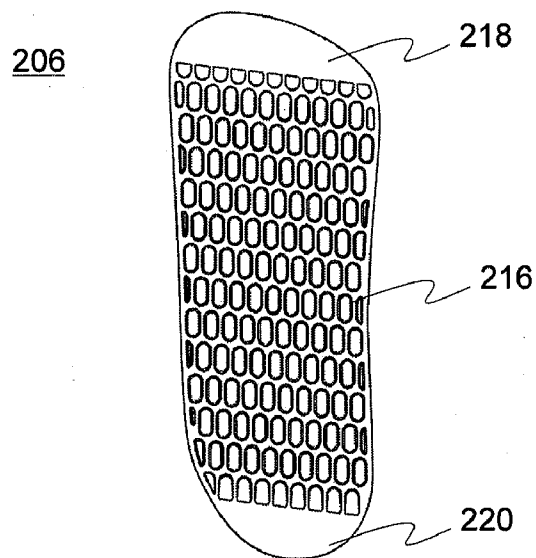


Figure 2d

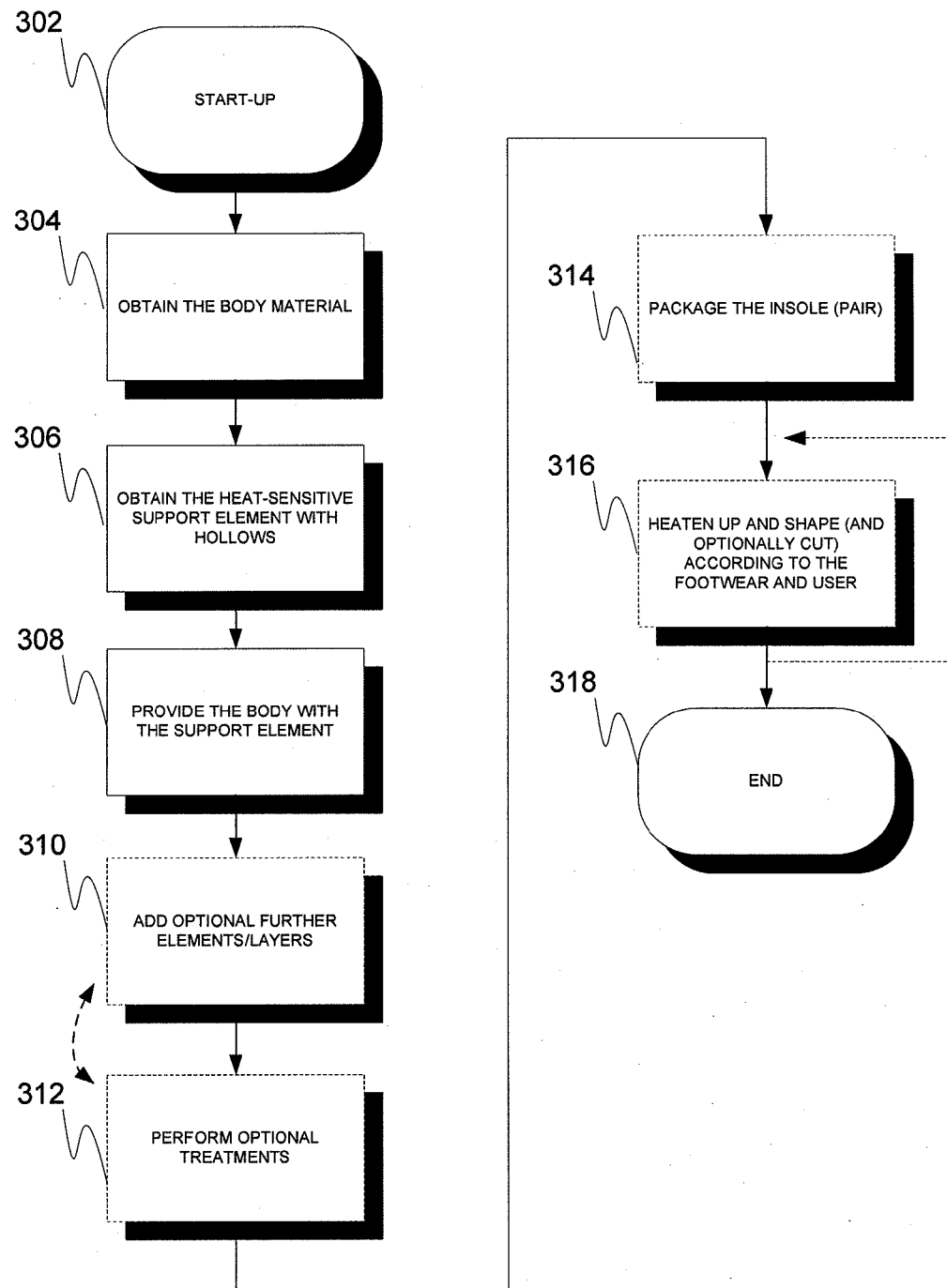


Figure 3

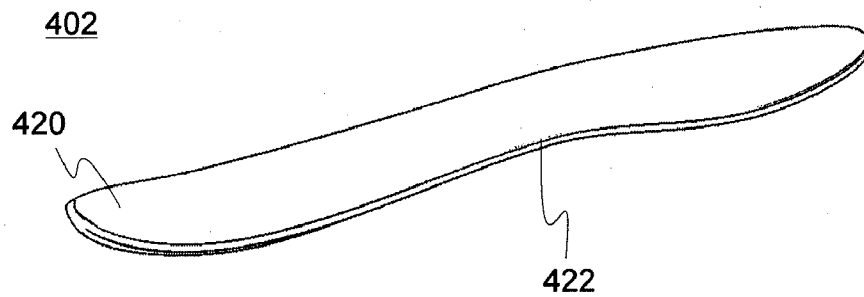


Figure 4a

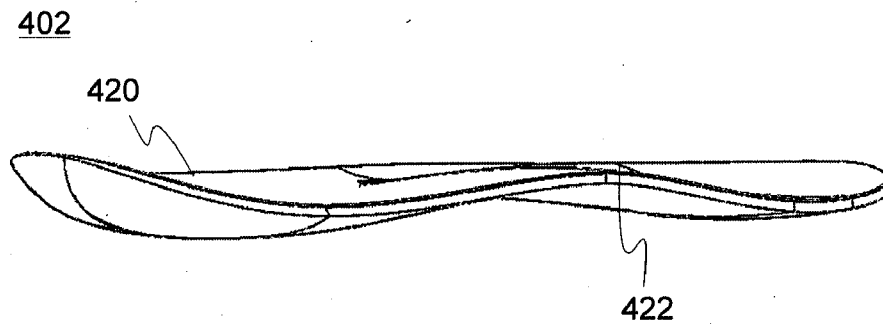


Figure 4b

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CUSTOM-FIT INSOLE FOR FOOTWEAR AND RELATED METHOD OF MANUFACTURE

FIELD OF THE INVENTION

[0001] Generally the present invention pertains to footwear. In particular the invention concerns custom-fit insoles.

BACKGROUND OF THE INVENTION

[0002] Classically insoles placed on the midsole of footwear such as shoes have been applied to capture dirt and moisture from the foot, provide cushioning (shock absorption) thereto and/or achieve optimal fit of the foot relative to the footwear amongst potential other purposes. Different use scenarios, e.g. various sport disciplines, have required scenario-specific customization of the insole and footwear design and related materials in view of desired support, comfort, water resistance, size, weight, and durability, for example. In addition, as human feet considerably vary in size and other features between a plurality of subjects, and even between left and right foot of the same subject, custom-made, personalized insoles and shoes have been around for some time already.

[0003] Traditionally, custom-fit shoes or insoles have been manufactured by specialists such as shoemakers or podiatrists, respectively. Measuring a subject person's feet, designing the associated molds and manufacturing the personalized insoles therewith has been a lengthy process taking several days or even weeks, not to mention processes leading to fully custom-made shoes. Obviously the resulting price of these kinds of top-end products has been relatively high due to e.g. the variety of different process steps and the amount of hand-work required.

[0004] More recently, easier and quicker tailoring options for footwear have been developed utilizing a standard-shaped, typically substantially flat insole preforms as a starting point for in situ instant or low-delay customization via shaping and optionally cutting.

[0005] For example, in certain solutions different chemically or thermally curable chemicals have been included in an unshaped, still plastic, insole preform followed by placing a subject person's foot in contact with the preform to make an impression thereon while initiating the curing process. As a result, a custom-made insole has been ultimately obtained, having a shape following the contour of the subject person's sole.

[0006] Some other solutions have particularly utilized thermoplastic material as an ingredient of an insole. Upon heating an insole preform provided with thermoplastic material over a predetermined temperature, a so-called glass transition temperature, the thermoplastic material turns formable and plastic thus enabling manual shaping of the then flexible and elastic insole according to the subject person's foot such that potential foot problems like overpronation or oversupination are advantageously also addressed by the supporting and correcting effect of the modified insole shapes. Letting the shaped insole to cool down below the aforesaid temperature hardens the material back to solid yet preserving the newly-gained custom shape.

[0007] US2008010856 discloses one example of the latter-type custom-fit insoles, wherein thermoplastics are utilized. Insole preforms comprising a layer of thermoplastic material are provided to retail stores for real-time customization by a clerk in view of the personal properties of each client. For

example, the client's foot and the customized insole may be adjusted such that the plantar arch settles to a normal high position. The supply chain from an insole manufacturer to the end client is thus shortened and the insoles kept affordable.

[0008] Even the admittedly, in many ways splendid contemporary formable individualized insoles, such as the aforementioned insoles comprising a layer of thermoplastic material, still bear a number of flaws or at least practical imperfections in terms of the properties of the shaped and user-specifically tailored end product not forgetting the manufacturing and shaping phases thereof. Namely, it has been noticed that in connection with heavy users and/or hard use, a shaped but thin thermoplastic layer included in an insole does not necessarily provide sufficient support to the user's foot. However, increasing the thickness of the thermoplastic layer for enhanced support makes shaping thereof trickier, if not impossible, and possibly causes continuous discomfort as the user may then feel the presence of the boosted layer beneath the insole top portion and consider it annoyingly hard. The weight of the insole and thus the associated footwear evidently increases and more production material is required for manufacturing it, which fights against one evident basic principle of insole and generally footwear design, i.e. lightness, and causes additional pressure on the price of the insole.

SUMMARY OF THE INVENTION

[0009] It shall be noted that this summary is generally provided to introduce a selection of concepts that are further described below in the detailed description. However, this summary is not intended to specifically identify most important or, in particular, essential features of the claimed subject matter and thus limit the claimed subject matter's scope.

[0010] Accordingly, it is an object to alleviate one or more defects associated with prior solutions. This and other objects may be achieved with embodiments of the invention which may take the form of an insole, a heat-sensitive support element for use with an insole, or a related method of manufacture.

[0011] In one aspect, an insole suitable for use with footwear, includes a body having one or more material layers and provided with at least one heat-sensitive support element, such as a layer or piece, comprising thermoplastic material, the heat-sensitive support element being embedded in or joined with body to enable shaping at least part of the insole when heated and hardening by cooling, the heat-sensitive support element comprising a plurality of hollows facing a direction substantially opposite the predetermined top side of the insole intended to receive a user's foot.

[0012] Shaping may be performed to correct the foot posture with proper support, for example, and/or to generally match the shape of the insole better with the target user's foot's shapes to provide additional comfort and/or support.

[0013] In some embodiments, the hollows may include a plurality of at least piece-wise parallel elements such as grooves. A number of substantially longitudinal and/or transverse hollows may be arranged relative to the insole, for example. The hollows may be arranged in row, matrix (rows and transverse columns), and/or some other configuration. Through-holes and similar may be at least mostly omitted to avoid the possible annoyance by the user arising from feeling the resulting indented surface structure through the insole top surface. Instead, e.g. blind-holes may be preferred. The hollows may be independent and separate from each other and/or

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they may be connected with reference to e.g. the aforesaid matrix form wherein the rows and columns may obviously have joints, i.e. common portions. A hollow or a plurality of hollows may define different patterns and forms, which may include straight, curved and/or various geometric shapes in the thermoplastic substrate material of the heat-sensitive support element.

[0014] In another aspect, a method for manufacturing an insole includes obtaining at least one heat-sensitive support element comprising thermoplastic material and being configured with a plurality of hollows on a predetermined bottom side of the element, and providing a body of one or more material layers with the heat-sensitive support element to enable shaping at least part of the insole when heated and hardening by cooling.

[0015] In a further aspect, a heat-sensitive support element for an insole of footwear includes thermoplastic material to enable shaping at least part of the insole when heated and hardening by cooling, the heat-sensitive support element further including a number of hollows on a predetermined bottom side of the element configured to substantially face, when in use, the insole bottom.

[0016] The utility of embodiments of the present invention and especially of the described use of hollows in the integrated support element follows from a plurality of issues depending on each particular embodiment thereof. The obtained insole may be light and thin, yet stiff enough in relevant portions. Even the insoles with raised maximum thickness due to a heavy user and/or heavy use inducing heavy load, may remain relatively light, thin (on average) and thus comfortable. Also re-shaping the insole may remain somewhat effortless when heated due to added flexibility, thanks to the hollows. It may further heat up and cool down rapidly. The shaped insole may effectively support the user's foot, correct the foot posture and reduce unnecessary shock load to the foot, knees, and back, and further minimize the related wear and pain e.g. in joints. The insole may be made affordably and affordable. For instance, thermoplastic material may be saved due to the presence of hollows therein.

[0017] The expression "a number of" refers herein to any positive integer starting from one (1), e.g. to one, two, or three.

[0018] The expression "a plurality of" refers herein to any positive integer starting from two (2), e.g. to two, three, or four.

[0019] The expression "to comprise" is applied herein as an open limitation that neither requires nor excludes the existence of also unrecited features.

[0020] The terms "a" and "an" do not denote a limitation of quantity, but denote the presence of at least one of the referenced item.

[0021] The term "thermoplastic material" refers herein to material that softens on being heated above a predetermined temperature and hardens again when cooled back. Thus the softening is substantially reversible with thermoplastic materials in contrast to e.g. thermosets that harden basically permanently when heated enough.

[0022] The term "hollow" refers herein to a hole, notch, dent, cavity, excavation, recession, depression, groove, or any similar form. The dimensions or the shape of the hollow is not restricted to any particular embodiment, if not stated otherwise.

[0023] Different embodiments of the present invention are disclosed in the dependent claims.

BRIEF DESCRIPTION OF THE RELATED DRAWINGS

[0024] Next the invention is described in more detail with reference to the appended drawings in which

[0025] FIG. 1*a* illustrates, via a cutaway view, an embodiment of an insole according to the present invention.

[0026] FIG. 1*b* is a perspective cutaway representation of the embodiment of FIG. 1*a*.

[0027] FIG. 1*c* is another cutaway and substantially also cross-sectional view of the insole internals along the transverse line A-A'.

[0028] FIG. 2*a* illustrates an embodiment of a heat-sensitive support element according to the present invention.

[0029] FIG. 2*b* is a cutaway and substantially also cross-sectional view of the heat-sensitive support element along the transverse line B-B' of FIG. 2*a*.

[0030] FIG. 2*c* is a longitudinal side view of an embodiment of the support element.

[0031] FIG. 2*d* illustrates the bottom surface of an embodiment of the heat-sensitive support element.

[0032] FIG. 3 is a flow diagram disclosing an embodiment of a method in accordance with the present invention.

[0033] FIG. 4*a* illustrates an embodiment of an insole in accordance with the present invention after customization.

[0034] FIG. 4*b* illustrates the embodiment of FIG. 4*a* from another angle.

DETAILED DESCRIPTION

[0035] FIG. 1 illustrates a planar, top view of an embodiment of an elongated insole **102** according to the present invention. It comprises a body **104** of one or more material layers, such as (soft) foam layers and/or other layers, and at least one heat-sensitive support element **106**, such as a layer or piece incorporating thermoplastic material, comprising a number of hollows facing a direction substantially opposite the predetermined top side of the insole receiving a user's foot, i.e. the number of hollows substantially facing the ground and away from the user's sole when the insole is in use. In some embodiments the insole **102** may be particularly configured in view of e.g. dimensions so as to receive the user's foot (there may be e.g. a sock thereon) including both the toes and the sole. In alternative embodiments, insoles designed to receive only a portion of the foot such as the sole or a part thereof may be constructed.

[0036] In the figure, a piece has been cut out from the insole surface to illustrate the underlying support element **106** provided with the hollows. The hollows, although preferably facing the insole bottom, have been also shown in the figure for illustrative purposes. In some embodiments, the support element **106** may be optically substantially transparent or translucent in which case the contours of the hollow structures may also in reality be viewable from above the element **106**.

[0037] In some embodiments, a plurality of heat-sensitive support elements **106** may be utilized in the same insole. The elements **106** may differ in properties such as material, thickness, shape, the configuration of hollows, etc. depending on the location and thus desired characteristics of the elements, for instance.

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[0038] When properly shaped according to the user's foot, the insole **102** may nicely conform to the underside of at least portion thereof. The insole **102** may be located underneath the foot in a shoe or other footwear such as a (ski) boot.

[0039] FIG. **1b** represents one possible perspective cut-away illustration of the embodiment of FIG. **1a**. The visualized insole **102** is obviously a preform, i.e. it still bears a substantially default, i.e. flat and/or non-customized basic shape, which may be preferred for storing the insole **102** with minimum space requirement prior to sale or use instant upon which it is then subjected to heat-enabled user-specific shaping and optional further tailoring potentially including cutting of the excessive (edge) material in view of different footwear and feet, for example.

[0040] The body **104** defines, in the illustrated embodiment, a middle layer of the insole **102** and extends substantially over the insole length. In addition to the support element **106**, further material layers and functional and/or physical elements (pieces) such as a bottom layer **110**, optionally comprising fabric or rubber, configured to contact the footwear, and/or at least one top layer **108** defined by e.g. predetermined fabric, may be included in the insole **106**, however being not compulsory. Yet, these further layers and elements may be considered to belong to the body **104** or, due to having e.g. some specific other function like the support element **106**, be thus at least logically seen to remain as separate therefrom and/or be really physically still separable.

[0041] The body **104** may be substantially planar or contain a number of protrusions, recessions, and/or other forms. The top side thereof may be made at least partly complementary to an estimated shape of a user's sole. It may include a contoured surface and e.g. concave form(s) for the purpose. The body **104** may be substantially solid or contain e.g. a number of holes. The body **104** and the remaining other physical elements such as the support element **106** connected thereto thus advantageously form an aggregate, composite entity, although in some embodiments one or more physical elements thereof may be removably connected to enable subsequent cleaning, replacement or other procedure requiring removal.

[0042] Two or more material layers or elements may be generally joined together utilizing gluing, laminating, stitching, and/or moulding, for example. Among other options hot glue (hot melt adhesive) may be applied. Also mechanical coupling via e.g. friction-based fastening arrangements such as a projection and a recess, the two optionally being complementary in shape and configured to engage each other, and/or hook-and-loop (e.g. Velcro™) or other type of fasteners may be applied. These latter options facilitate connecting elements together removably. Fastening elements may itself be attached to the corresponding substrate materials by gluing, for example.

[0043] One or more functional and/or physical elements may be provided to the insole including at least one element selected from the group consisting of a cushioning element, moisture-permeable element, moisture-repellent element, moisture absorbing element, moisture-controlling element, anti-bacteria element, anti-corn element (e.g. cushion, recess and/or partition (or other guiding element) for the purpose), anti-fungus element, gel element, barrier element, odor-free element, arch support element, heel cup, stitching, washable element, anti-slippery element, and the aforesaid heat-sensitive (thermoplastic) element. The barrier element may prevent contact and/or material flow between two material layers

such as a gel layer and adjacent layer, for example. A number of predetermined shapes, materials and/or treatments thereof (heat, chemical, etc.) may be generally applied to implement various preferred functionalities. An element may be typically formed from a number of material layers and/or physical elements provided to the insole structure **102**.

[0044] Regarding the applicable materials in general, the insole **102**, such as the body **104** thereof, may include at least one material, such as synthetic foam material, selected from the group consisting of EVA (Ethylene Vinyl Acetate), PU (Polyurethane), PE (Polyethylene), and polyester. Other suitable materials may be utilized as well. As mentioned hereinbefore, the body **104** may be a composite of a plurality of materials. The insole **102** is a composite of at least the basic body material and the optionally removably integrated support element **106** by default.

[0045] The support element **106** may include at least one thermoplastic material selected from the group consisting of ABS (acrylonitrile butadiene styrene), PVC (polyvinyl chloride), A-PET (Amorphous polyester terephthalate) and PETG (polyethylene terephthalate Glycol). Other suitable materials may be applied. The support element **106** may also be a composite of a plurality of materials.

[0046] FIG. **1c** is another cutaway, substantially also cross-sectional, view of the insole internals along the transverse line A-A'. In this figure, the hollows **112** defined by the support element **106** are clearly visible. The hollows **112** have substantially rectangular, slightly rounded cross-section, which may imply e.g. substantially rectangular cuboid as the 3D shape of each hollow as defined by the element **106**, but in other embodiments a number of other shapes may be additionally or alternatively exploited. For example, substantially half-ellipsoidal shape could be applied.

[0047] In various embodiments, preferably the shape, dimensions, densities and/or patterns of the hollows are selected such that desired savings in the use of the thermoplastic material(s), increase in the plastic state shapeability in contrast to conventional flat face support element, and sufficient structural strength and/or rigidity are achieved. Various existing structural engineering design rules and applications may be utilized for determining suitable hollow shapes etc. so that the predetermined design parameters such as tensile, compressive, and/or torsional (shear) strengths are fulfilled regarding related insole portions and locations. In many cases, round, regular, and/or symmetrical shapes may provide the desired results.

[0048] In some embodiments, the hollows **112** may form a cellular or matrix pattern structure on the support element **106**. This may be done to achieve the desired design objectives such as lightness, strength, rigidity and/or thickness (average or max). The hollows may remain unfilled. Alternatively, one or more hollows could be at least partially filled with predetermined material, which might be different in properties in contrast to the thermoplastic material of the support element **106**, such as softer and more flexible foam material and/or material having specific other characteristics. The filling material may be provided to the hollows separately and/or via an underlying layer comprising e.g. protrusions reaching out to the hollows.

[0049] FIG. **2a** illustrates the general outline of an embodiment of a heat-sensitive support element **206** according to the present invention. Such support element **206** shown in a pre-form condition (i.e. substantially flat and/or non-customized), could be applied in connection with the insole of FIG.

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1a, for example. The shape of the heat-sensitive support element 206 may vary depending on the embodiment. For example, it may generally follow the shapes of the overall insole or the body thereof, optionally with smaller dimensions such as length and/or width. Alternatively, the element 206 may bear different shape, e.g. substantially elliptical or circular shape. The support element 206 may be dimensioned and positioned so as to extend across the length of the insole or just a number of portions thereof, from the heel area till the toe area, for example. In some embodiments, a plurality of thermoplastic support elements may be applied in a single insole as mentioned hereinbefore. Each support element may be configured to provide dedicated foot support in its predetermined location.

[0050] FIG. 2b is a cutaway and substantially also cross-sectional view of the heat-sensitive support element along the transverse line B-B' of FIG. 2a. Cross-sections of the hollows 212 are visible in this figure. Some predetermined areas such as border areas (front/toe area, side area(s) and/or back/heel area) may at least partially lack the hollows, or their density, size, and/or depth may be smaller in contrast to other areas. In other words, some portions of the element 206 may be configured to contain a number of predetermined hollows and the rest be left without.

[0051] FIG. 2c is a longitudinal side view of an embodiment of the support element.

[0052] As shown in the figure, the thickness of the element 206 may vary and be thus uneven. Accordingly, the target insole including the element 206 may also vary in thickness in case the variance in the thickness of the element 206 is not compensated by complementary design of a number of other elements of the insole such as the body. The thickness may be varied in longitudinal and/or transverse direction of the insole. For instance, a number of predetermined portions such as the central portion 214 of the element 206 may be made thicker than remaining areas such as the border areas, e.g. toe and/or heel areas, to provide additional rigidity and foot support in desired locations only, such as the estimated location of a predetermined arch of a user's sole, e.g. the plantar arch. Also the longitudinal side edges may be made thinner. Yet, the shaped element 206 may be better able to correct wrong plantar arch and/or transverse arch postures as the more rigid and stronger thicker portions can be disposed at least in the associated more critical areas of the insole. Alternatively, the element 206 may be, in preform state, substantially planar and of substantially equal thickness.

[0053] In some embodiments, the maximum thickness of the support element 206 and/or the overall insole may preferably be about 5 mm or less, more preferably about 3 mm or less, and most preferably about 1.5 mm or less. The use of hollows lightens the insole in contrast to solid counterpart and makes the element 206 more flexible and shapeable even in the case of embodiments with elevated maximum thickness.

[0054] Preferably the edge thickness of the support element 206 and/or the overall insole may be about 1.5 mm or less, more preferably about 1 mm or less, and most preferably about 0.5 mm or less.

[0055] Generally thinner structures reduce the total weight while adding to the shapeability and wearing comfort. By various embodiments of the present invention, certain areas of the insole may be thus made thicker for the purposes of increased rigidity and support, for example, while substantially maintaining the above advantageous characteristics due to e.g. clever configuration of hollows (shaping, dimension-

ing, patterning) based on the applied structural engineering design guidelines. The use of hollows allows more flexible location-dependent adjustment of the insole properties.

[0056] In some embodiments, the depth of a number of hollows may be about 20%, 30%, 40%, 50%, 60%, 70%, 80%, or 90% of the average or maximum thickness of the element 206. The above figures may alternatively indicate lower or higher limits of the corresponding ranges for preferred hollow depth. The depth of the hollows may vary and be location-dependent relative to the element 206. For example, on areas with reduced need for maximal stiffness and/or rigidity, the hollows may be at least relatively deeper than on the other areas. Alternatively or additionally, on areas with higher maximum thickness (to provide maximum foot support, for example) the hollows may be made deeper to reduce the corresponding average thickness and balance out the weight and comfort aspects otherwise easily weakened by the elevated maximum thickness.

[0057] FIG. 2d illustrates the bottom surface of an embodiment of the heat-sensitive support element. A cellular pattern structure 216 as defined by the hollows and walls between them is extending from the heel area to the toe area such that the both ends 218, 220 of the element 206 remain hollow-free. Such portions may also be thinner than the rest of the element 206. In some embodiments, at least a part of the heel portion and/or the toe portion may be substantially hollow-free and optionally of thinner construction than the central portion with increased thickness for additional foot support.

[0058] FIG. 3 is a flow diagram disclosing an embodiment of a method in accordance with the present invention. Optional items are indicated with broken lines in the figure.

[0059] At start-up 302, the necessary gear such as machining gear, a molding machine and/or a hot glue provision apparatus, e.g. a hot glue gun, may be obtained and configured.

[0060] At 304, the body material(s) such as predetermined foam is obtained. Ready-made material pieces may be acquired from a supplier or the material may be in-house manufactured. Suitable moulding process may be applied. The body material may be arranged such as cut to a predetermined preform shape and size at this point or later during the process depending on the embodiment.

[0061] At 306, at least one heat-sensitive support element comprising thermoplastic material is obtained for each insole to be manufactured. Again, ready-made pieces may be acquired from a supplier or they may be in-house manufactured. The support element may be manufactured by injection moulding, for instance.

[0062] The general shape and the hollows may be formed by the mold. Alternatively or additionally, suitable machining technique(s) such as milling, carving, drilling, boring, planing and shaping may be applied for either or both the purposes. Chemical method(s) such as etching may be utilized.

[0063] At 308, the body is provided with the at least one heat-sensitive support element. The body may contain a number of material layers some of which may cover the at least one support element and/or remain under it. For example, the body may include a foam layer covered by a fabric layer with desired properties such as moisture-repellency or permeability.

[0064] In some embodiments, the at least one support element optionally provided with further element(s) such as the insole bottom layer-forming element may be utilized as an insert in a moulding process, such as injection moulding

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process, during which additional material such as body material(s) is provided thereon during a number of moulding rounds. Thus, the body may be substantially simultaneously formed and joined with the at least one support element. For example, the at least one support element may be overmoulded with the body material(s). The body may at least partially embed the at least one support element. In some embodiments, the body may at least partially cover the at least one support element.

[0065] As an alternative to moulding, a potentially ready-formed body, optionally comprising a recess for accommodating at least part of the at least one support element, may be attached to the at least one support element or an aggregate of the at least one support element and further element(s) such as cushioning element(s) and/or material layer(s) by gluing or laminating, for example.

[0066] At 310, optionally further material layers and/or elements, such as the bottom layer of the insole, such as a fabric layer with desired properties such as friction, may be provided to the insole by gluing or laminating, for example. The bottom layer and the body may be configured to jointly encapsulate the at least one support element.

[0067] At 312, optional treatments such as anti-odor or anti-fungus treatments may be executed to desired portions of the insole by spraying, for example.

[0068] At 314, the insole may be packaged optionally pairwise for shipping and storing. In some alternative embodiments, the insole may be inserted in a shoe for shipping, storing and/or retail purposes.

[0069] At 316, the insole may be heated and shaped according to a user's foot to provide support and correct foot posture. The insole hardens upon cooling back but retains its modified shape. The insole may be cut to better fit the target footwear and provide comfort. The preform turns into an actual customized insole.

[0070] Generally, various embodiments of the insole according to the present invention may be sold separately or together with a matching shoe, for example. Even in the latter case the insole is preferably removable.

[0071] The method execution is ended at 318. Item 316 may be re-executed for correcting the shape, for example, which is indicated by the broken loop-back arrow in the figure. The mutual ordering of method items described above may be altered as being obvious to a skilled person. For example, the execution order of items 310 and 312 may be reversed depending on each particular embodiment, which is emphasized by a bi-directional arrow in the figure. Accordingly, some method items may be divided into further sub-items or be aggregated. A number of new items may be included in the method.

[0072] FIGS. 4a and 4b illustrate an embodiment of an insole 402 generally discussed herein after heating and shaping, i.e. customization in view of a user's foot, from two different angles. It is clearly visible in the figures how e.g. the heel 420 and plantar arch 422 areas have been elevated to support the foot and maintain correct posture by shaping the underlying heat-sensitive support element accordingly.

[0073] The previously presented considerations concerning the various embodiments of the insole and the heat-sensitive support element thereof may be applied to the embodiments of the method mutatis mutandis, and vice versa, as being appreciated by a skilled person.

[0074] The scope of the present invention is determined by the attached claims together with the equivalents thereof. A

person skilled in the art will appreciate the fact that the explicitly disclosed embodiments were constructed for illustrative purposes only, and the scope will cover further embodiments and equivalents that best suit each particular use case of the invention. For example, in some occasions the insole could include thermoset material instead of or in addition to thermoplastic material. The insole portion comprising thermoset material could be shaped prior to heating so that it is maintained in the modified shape while reaching a predetermined hardening temperature and then retains the newly shaped form afterwards. Further, some embodiments of the present invention could be tailored as to the materials, shapes, dimensions, etc. for use with animal feet instead of human users.

1. An insole for use with footwear, comprising:
a body having one or more material layers and comprising at least one heat-sensitive support element comprising thermoplastic material, the heat-sensitive support element is embedded in or joined with the body to enable shaping at least part of the insole when heated and hardening by cooling, wherein the heat-sensitive support element comprises a plurality of hollows facing a direction substantially opposite a predetermined top side of the insole intended to receive a foot of a user.
2. The insole according to claim 1, further comprising:
a top layer including fabric material intended to receive the foot of the user.
3. The insole according to claim 1, further comprising:
a bottom layer beneath the heat-sensitive support element intended to contact the footwear.
4. The insole according to claim 1, wherein the body further comprises at least one material selected from the group consisting of: foam, silicon-based foam, EVA (Ethylene Vinyl Acetate), PU (Polyurethane), PE (Polyethylene), and polyester.
5. The insole according to claim 1, wherein the heat-sensitive support element comprises at least one material selected from the group consisting of: ABS (acrylonitrile butadiene styrene), PVC (polyvinyl chloride), A-PET (Amorphous polyester terephthalate), and PETG (polyethylene terephthalate Glycol).
6. The insole according to claim 1, wherein the plurality of hollows is located, at least in relation to the longitudinal axis and optionally to the transverse axis, in the central portion of the heat-sensitive support element.
7. The insole according to claim 1, wherein the insole comprises gel material.
8. The insole according to claim 1, wherein the plurality of hollows is substantially configured in a cellular or matrix pattern.
9. The insole according to claim 1, further comprising:
at least one functional element selected from the group consisting of: a cushioning element, moisture-permeable element, moisture-repellent element, moisture absorbing element, moisture-controlling element, anti-bacteria element, anti-corn element, anti-fungus element, barrier element, odor-free element, arch support element, heel cup, stitching, washable element, and anti-slippery element.
10. The insole according to claim 1, wherein the heat-sensitive support element has an uneven thickness, and wherein the plurality of hollows is optionally located in one or more areas of greater thickness.
11. The insole according to claim 1, wherein the heat-sensitive support element has an uneven thickness and a por-

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tion thereof configured to support a plantar arch area of the foot of the user substantially belongs to the portion with the greatest thickness.

12. The insole according to claim 1, wherein a maximum or average thickness of the heat-sensitive support element is substantially equal to or less than 1.5 mm.

13. The insole according to claim 1, wherein a maximum or average thickness of the heat-sensitive support element is substantially equal to or less than 1.0 mm.

14. The insole according to claim 1, wherein a maximum or average thickness of the heat-sensitive support element is substantially equal to or less than 0.5 mm.

15. The insole according to claim 1, wherein a depth of the plurality of hollows is substantially equal to or greater than 20% of a maximum or average thickness of the heat-sensitive support element.

16. The insole according to claim 1, wherein a depth of the plurality of hollows is substantially equal to or greater than 40% of a maximum or average thickness of the heat-sensitive support element.

17. The insole according to claim 1, wherein a depth of the plurality of hollows is substantially equal to or greater than 50% of the maximum or average thickness of the heat-sensitive support element.

18. A method for manufacturing an insole, the method comprising:

obtaining at least one heat-sensitive support element comprising thermoplastic material and being configured with a plurality of hollows on a predetermined bottom side of the element; and

providing an insole body comprising one or more material layers with the heat-sensitive support element to enable shaping at least part of the insole when heated and hardening by cooling.

19. The method according to claim 18, wherein a plurality of elements have been integrated by applying at least one technique selected from the group consisting of:

molding, laminating, gluing, stitching, and the use of a number of fastening elements.

20. The method according to claim 19, wherein the plurality of elements includes the body and the heat-sensitive support element.

21. The method according to claim 18, wherein the heat-sensitive support element and at least a portion of the plurality of hollows are formed utilizing molding, optionally injection molding.

22. The method according to claim 14, wherein at least a portion of the plurality of hollows are formed by machining the support material.

23. A heat-sensitive support element for an insole of footwear, said support element comprising:

thermoplastic material to enable shaping at least part of the insole when heated and hardening by cooling; and

a plurality of hollows on a predetermined bottom side of the element configured to substantially face, when in use, the insole bottom.

* * * * *

EXHIBIT D

PATENT SALE AND ASSIGNMENT

This Agreement is by and between ("Assignor") and ("Assignee"), hereinafter referred as "Parties".

WHEREAS, Assignor Eero Kaakkola, has invented a certain invention (the "Invention"), described below, and holds a Patent application (no. 12/956,511 in USA) related thereto; and

WHEREAS, Assignee Footbalance System Oy, wishes to acquire the entire rights, title, and interest in the Invention and in to the Patent application;

NOW, the Parties agree as follows:

1. Assignment

Assignor does hereby irrevocably assign to Assignee entire rights, title, and interest worldwide (including but not limited to the patent claims, all rights to prepare derivative works, all goodwill, knowhow and all other intellectual property rights), in and to the Patent application number 12/956,511 in USA and the Invention described as "An insole for use with footwear comprising at least one heat-sensitive support element comprising thermoplastic material, wherein the heat-sensitive support element comprises a plurality of hollows facing a direction substantially opposite a predetermined top side of the insole intended to receive a foot of a user".

2. Payment

In consideration for the assignment set forth in Section 1, Assignor shall pay Assignee the total sum of thirty-thousand (30.000,00) Euros, as a non-refundable payment, payable as a whole on the latest date of signature by the Parties.

The ownership will be transferred when the total sum of thirty-thousand (30.000,00) Euros is paid in full.

3. Representations and Warranties

Assignor represents and warrants to Assignee:

- (a) Assignor has the right, power and authority to enter into this Agreement;

EK 30.8.11

EH 28.9.11

(b) Assignor is the exclusive owner of all right, title and interest, including all intellectual property rights, in the Invention and the Patent application;

(c) The Invention and Patent application are free of any liens, security interests, encumbrances or licenses;

(d) That according to its best actual knowledge the Invention and Patent application do not infringe the rights of any person or entity;

(e) There are no claims, pending or threatened, with respect to Assignor's rights in the Invention and Patent application;

(f) This Agreement is valid, binding and enforceable in accordance with its terms; and

(g) Assignor is not subject to any agreement, judgment or order inconsistent with the terms of this Agreement.

4. Development co-operation

The Parties agree that the Assignor will continue to develop the invention in co-operation with Assignee and agrees to use all reasonable efforts to further the development of the Invention. The Parties will agree upon the terms of such co-operation separately.

The ownership to any and all intellectual property rights obtained by the Assignor directly or indirectly and which are a result of a co-operation between the Assignee and Assignor or which exist in any changes, modifications, adaptations or improvements made to the Invention or to the customized insoles shall remain with the Assignee for the period of five (5) years from the latest date of signature by the Parties.

5. Limitation of liability

Notwithstanding any other provision of this Agreement, neither Party shall under any circumstances be liable for any indirect, consequential, special or incidental damages or for lost profits, lost opportunities, lost revenues, loss of business or goodwill howsoever arising under or in connection with this Agreement.

6. Entire Agreement

This Agreement, contains the entire understanding and agreement between the parties hereto with respect to its subject matter and supersedes any prior or contemporaneous written or oral agreements, representations or warranties between them respecting the subject matter hereof.

7. Amendment

This Agreement may be amended only by a writing signed by both parties.

Ek 30.8.11

EV 28.9.11

8. Severability

If any term, provision, covenant or condition of this Agreement, or the application thereof to any person, place or circumstance, shall be held by a court of competent jurisdiction to be invalid, unenforceable or void, the remainder of this Agreement and such term, provision, covenant or condition as applied to other persons, places and circumstances shall remain in full force and effect.

9. Agreement to Perform Necessary Acts

Assignee and Assigner agree to perform any further acts and execute and deliver any documents that may be reasonably necessary to carry out the provisions of this Agreement.

10. Governing Law and Settlement of disputes

This Agreement shall be construed in accordance with the Laws of Finland and any dispute under this Agreement shall be finally settled under the Rules of the Board of Arbitration of the Central Chamber of Commerce of Finland by one arbitrator appointed by the said Board.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement in duplicate originals by their duly authorized officers or representatives.

Signature 

Name: Eero Kaakkola, Helsinki, Finland

Title: _____

Date: 30th August 2011

Footbalance System Oy

Signature 

Name: MIKKO HAICALA

Title: CEO

Date: 28.09.11

PATENT SALE AND ASSIGNMENT

This Agreement is by and between ("Assignor") and ("Assignee"), hereinafter referred as "Parties".

WHEREAS, Assignor Eero Kaakkola, has invented a certain invention (the "Invention"), described below, and holds a Patent application (no. 12/956,511 in USA) related thereto; and

WHEREAS, Assignee Footbalance System Oy, wishes to acquire the entire rights, title, and interest in the Invention and in to the Patent application;

NOW, the Parties agree as follows:

1. Assignment

Assignor does hereby irrevocably assign to Assignee entire rights, title, and interest worldwide (including but not limited to the patent claims, all rights to prepare derivative works, all goodwill, knowhow and all other intellectual property rights), in and to the Patent application number 12/956,511 in USA and the Invention described as "An insole for use with footwear comprising at least one heat-sensitive support element comprising thermoplastic material, wherein the heat-sensitive support element comprises a plurality of hollows facing a direction substantially opposite a predetermined top side of the insole intended to receive a foot of a user".

2. Payment

In consideration for the assignment set forth in Section 1, Assignor shall pay Assignee the total sum of thirty-thousand (30.000,00) Euros, as a non-refundable payment, payable as a whole on the latest date of signature by the Parties.

The ownership will be transferred when the total sum of thirty-thousand (30.000,00) Euros is paid in full.

3. Representations and Warranties

Assignor represents and warrants to Assignee:

- (a) Assignor has the right, power and authority to enter into this Agreement;

EK 30.8.16

EH 28.9.11

ASSIGNMENT

WHEREAS, I, **Eero Kaakkola**, a citizen of Finland and residing at Vannetie 47 A, 00430 Helsinki, Finland, am the sole and exclusive owner of U.S. Patent Application Serial Number 12/956,511, filed on 11/30/2010;

AND WHEREAS, Footbalance System Oy (reg.no 1839211-0), of Helsinki, Finland, a corporation of Finland, whose post office address is Hämeentie 135 A, 00560 Helsinki, Finland, has been desirous of acquiring in and for the United States, the entire right, title and interest in, to and under the patent rights;

NOW, THEREFORE, TO ALL WHOM IT MAY CONCERN, be it known that Eero Kaakkola has sold, assigned and transferred, and does hereby assign and transfer unto the said Footbalance System Oy the entire right, title and interest in and to the said invention in and for the United States, and Letters Patent of the United States which may be granted therefore, the same to be held and enjoyed by the said Footbalance System Oy, its successors, assigns, and legal representatives, to the full end of the term for which the Letters Patent may be granted as fully and entirely as the same would have been held and enjoyed by Eero Kaakkola if this assignment had not been made; and Eero Kaakkola hereby requests the Commissioner of Patents to issue the Letters Patent to Footbalance System Oy in accordance with this assignment.

EXECUTED, this 30 day of August, 2011

Signature: 

Name: Eero Kaakkola

Address: Vannetie 47 A, 00430 Helsinki, Finland

EXHIBIT E

MINTZ LEVIN

Howard Wisnia | 858 314 1592 | hwisnia@mintz.com

3580 Carmel Mountain Road, Suite 300
San Diego, CA 92130
858-314-1500
858-314-1501 fax
www.mintz.com

May 11, 2015

VIA FEDEX

Ms. Zena Iobina (or Iovina)
CEO
Zero Gravity Inside, Inc.
2525 Southport Way, Suite G
National City, CA 91950

--and--

4660 La Jolla Village Dr, Suite 500
San Diego, California 92122

Re: Notice of U.S. Patent Nos. 7,793,433 and 8,171,589

Dear Ms. Iobina/Iovina¹:

We represent FootBalance System Oy and FootBalance System Inc. (collectively "FootBalance") with regard to various intellectual property matters. This letter is to notify Zero Gravity Inside Inc. ("ZGI") of its infringement of FootBalance's patent rights by certain custom shoe insoles being sold by ZGI.

FootBalance System Oy owns U.S. Patent Nos. 7,793,433 ("the '433 Patent") and 8,171,589 ("the '589 Patent") both entitled "Individually Formed Footwear and a Related Method." FootBalance System Inc. holds an exclusive license to the '433 and '589 Patents. Copies of the '433 and '589 Patents are attached as well as a courtesy copy of a complaint that we filed in U.S. District Court, Southern District of California today concerning the custom insoles that are being sold and offered for sale by ZGI that infringe upon one or more claims of the '433 and '589 Patents.

ZGI is familiar with FootBalance's patented invention as FootBalance entered into a research and development project with Mr. Eero Kaakkola, in 2010 to develop a heater for manufacturing custom insoles. We understand Mr. Kaakkola to be a former deputy board member of the related Finnish entity, Zero Gravity Inside Oy. Moreover, on September 28, 2011, FootBalance entered into an agreement whereby Mr. Eero Kaakkola assigned to FootBalance all rights to U.S. Patent Application No. 12/956,511, directed to custom insoles. Moreover, as you (ZGI's president) are the wife of former FootBalance executive Patrik Louko, and Ms. Hannon (COO) is also a former FootBalance employee, ZGI acted with actual knowledge of its wrongdoing. We are currently exploring additional business torts, non-competition and employment law violations by each of

¹ Public sources have both spellings of this name listed.

Mintz, Levin, Cohn, Ferris, Glovsky and Popeo, P.C.

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the above named individual, and will likely file an additional complaint and/or amend this complaint to add these individuals to the action and demand compensation from them.

Despite being aware of the '433 and '589 Patents and FootBalance's custom insoles, ZGI began making, using, offering for sale, selling and marketing its own custom insoles - which infringe at least one claim of the '433 and '589 Patents - resulting in significant lost sales and damage to FootBalance.

Please confirm that ZGI shall immediately cease and desist its wrongful conduct, including without limitation its sale and delivery of infringing goods to Road Runner Sports. Please also provide us, within 3 business days, a complete accounting of all infringing goods sold, to whom, the price charged and the amounts collected.

Please be aware that spoliation of evidence is a serious matter in California and Federal Courts; no one should delete or alter potentially relevant evidence, including word documents, power points, emails, voicemails, and/or texts from any computer, phone or other device. You are under an affirmative duty to preserve all evidence, including the duty to inform and supervise all potentially involved ZGI employees, agents and consultants of these duties. This includes all ZGI employees and individuals associated therewith including without limitation the individuals identified by name in the Complaint and herein.

Nothing contained in this letter should be construed as a waiver of any of FootBalance's rights or claims, all of which are expressly reserved.

We have also arranged to have copies of these materials delivered to your Finnish address, as well as all individuals mentioned by name in this document.

We look forward to your prompt response.

Sincerely,

A handwritten signature in black ink, appearing to read 'H. N. Wisnia', written over a horizontal line.

Howard N. Wisnia

Enclosures

CC: As stated

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