

(21) Application No: **1416725.8**
 (22) Date of Filing: **22.09.2014**
 (30) Priority Data:
 (31) **1316918** (32) **24.09.2013** (33) **GB**

(51) INT CL:
A43B 13/12 (2006.01) **A43B 13/00** (2006.01)

(56) Documents Cited:
GB 2411336 A **EP 2526803 A**
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(58) Field of Search:
 INT CL **A43B**
 Other: **WPI & EPODOC**

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(54) Title of the Invention: **Improvements in and relating to footwear and foot wear analysis**
 Abstract Title: **Sole with wear depth indicators**

(57) A shoe (100) comprising an insole and an outsole (1) that includes a plurality of discrete wear depth indicator datums (3) indicative of outsole wear. The datums are arranged at positions below the foot prone to wear to provide a visual indication of wear over time. Each wear depth indicator (3) can have two wear indicators (3a) at different depths that can be formed in localized regions or extend across the surface of the sole. The indicators can lie flush with the sole surface or be part of projections from the sole base and may be a different colour to the sole. A method of analysing the wear pattern of the indicators includes providing a reference 3D geometry of the sole of the unworn shoe on a computer and comparing it to that of the shoe since being worn. A personalized shoe can be made according to a person's wear pattern.

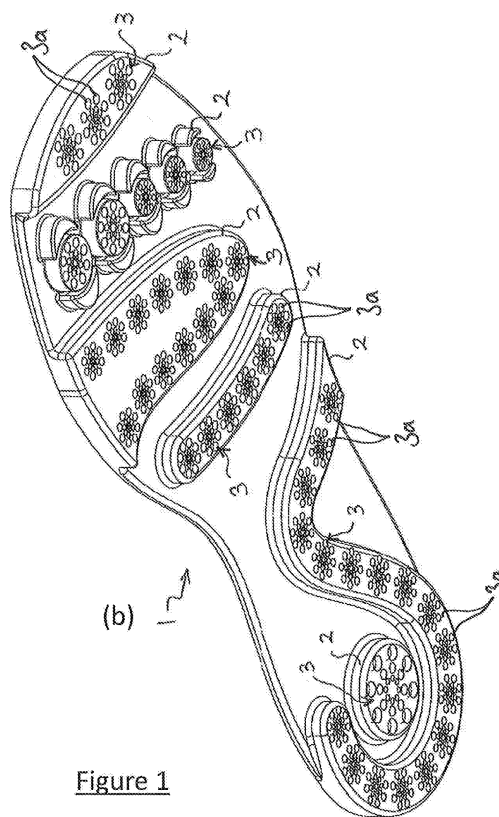


Figure 1

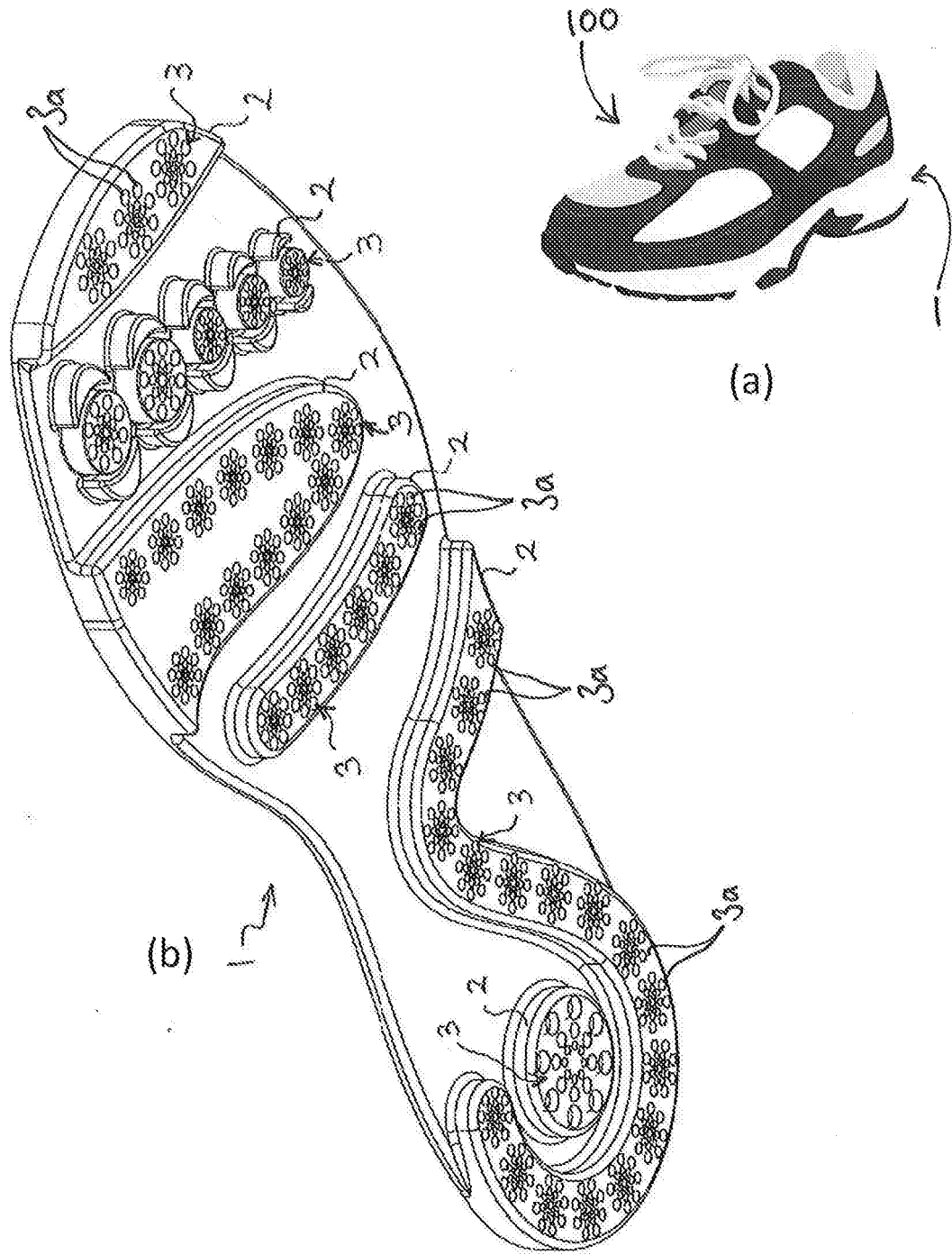


Figure 1

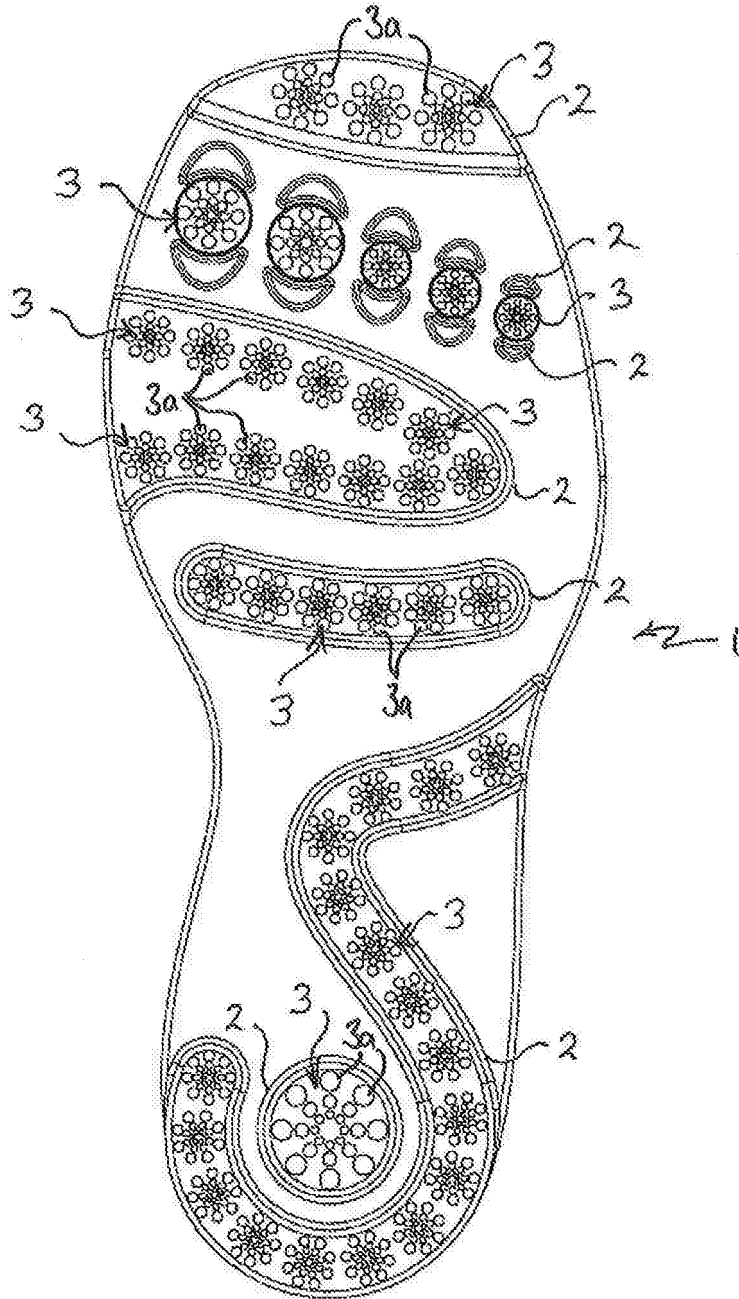


Figure 2

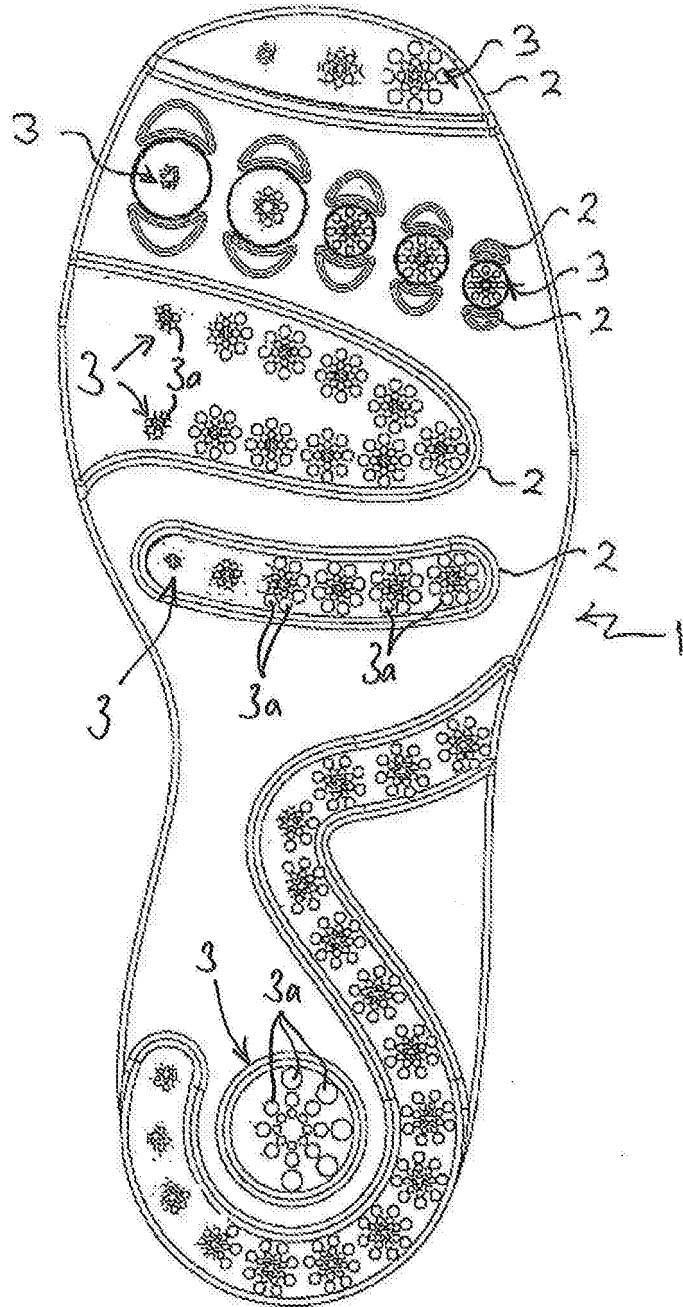


Figure 3

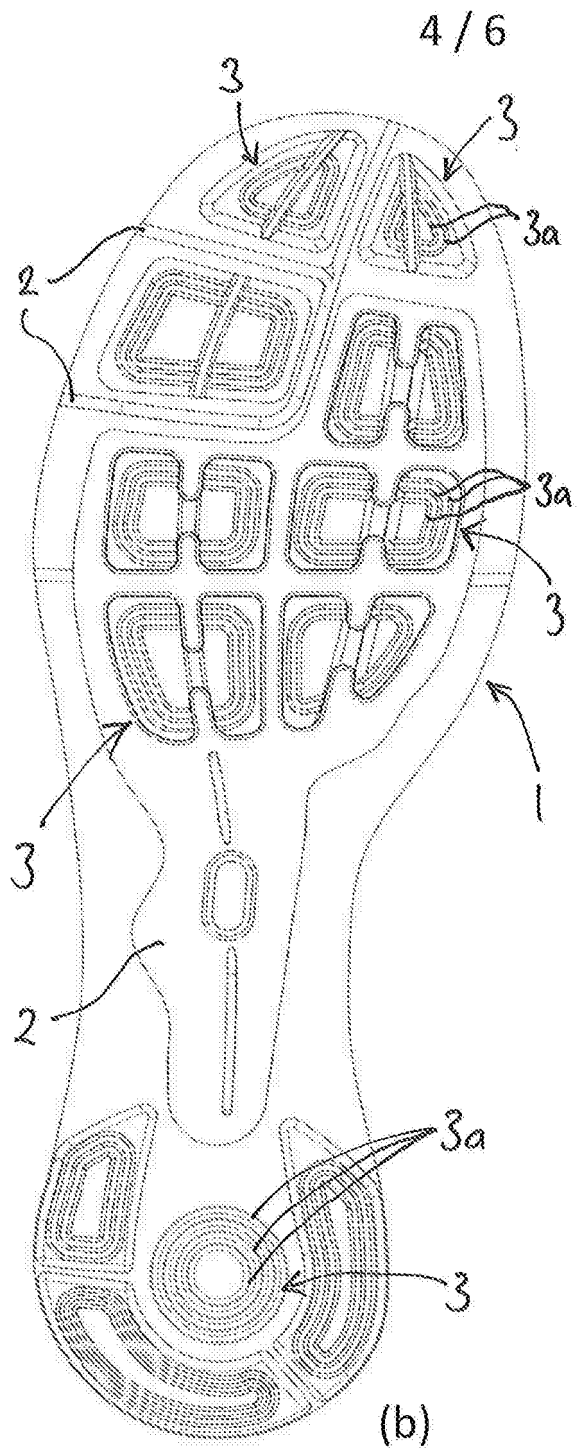


Figure 4

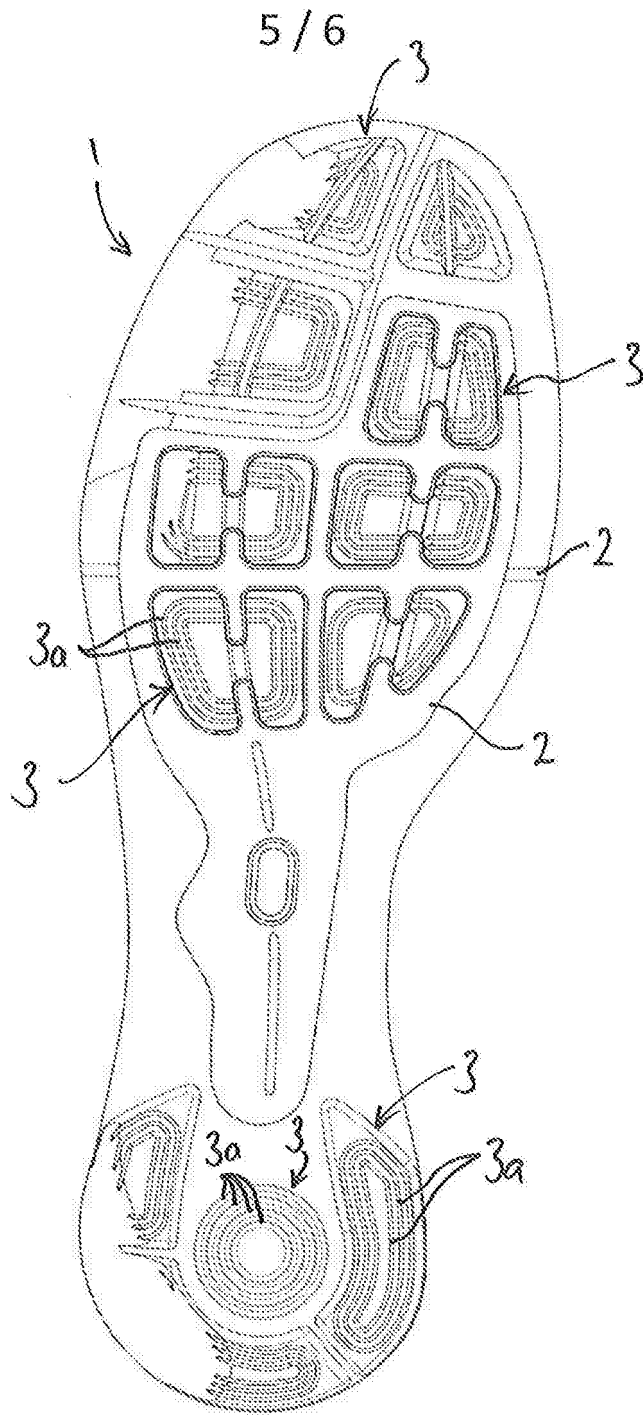


Figure 5

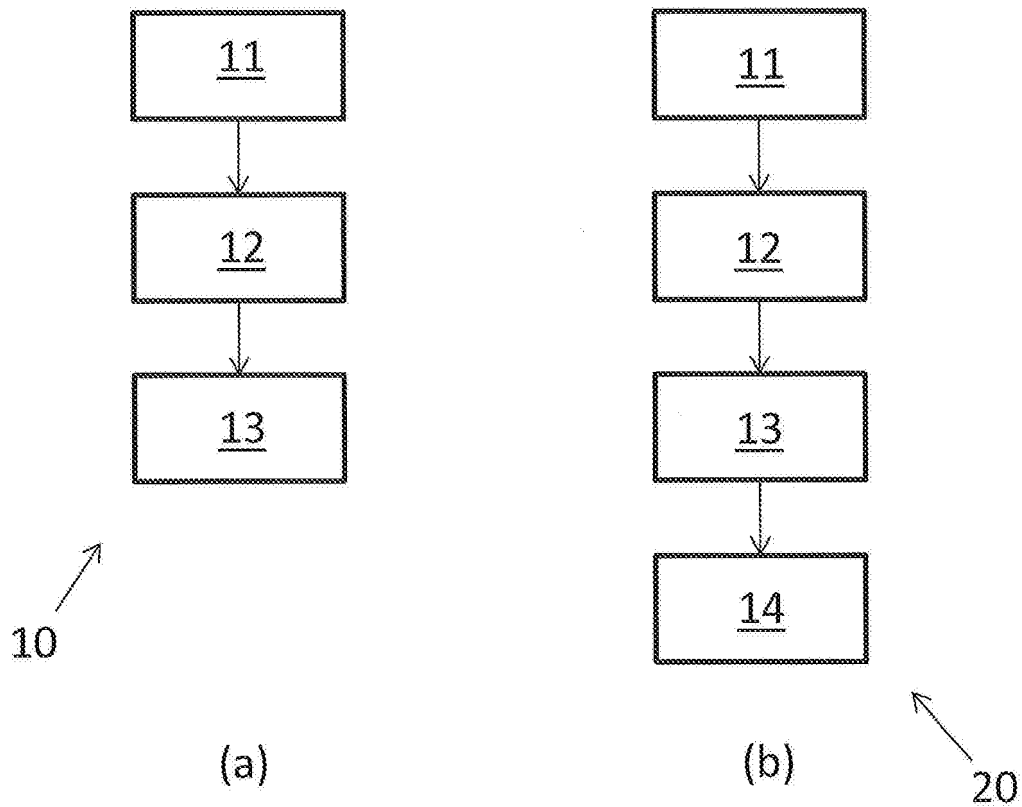


Figure 6

Improvements in and relating to footwear and foot wear analysis

This invention relates to footwear, and in particular to problems relating to uneven wear patterns on e.g. running shoes, due to the individual foot characteristics of the user of the shoe, leading to uneven wear across parts of the sole. In this patent specification the term 'shoe' is intended to include all kinds of footwear of the type having a sole, typically an elastomeric sole, in which noticeable wear can be expected over time until a point is reached when the shoe is no longer serviceable and has to be replaced.

The human foot is a complex structure required to not just bear the weight of the human body, but additional forces imposed on the foot during e.g. running, and these forces tend to concentrate on specific areas of the foot corresponding to, typically, the end of some of the bones in the foot such as the 5th metatarsal or 'foot bone' representing the outer arch of the foot, tarsal bones such as the talus and the calcaneus in the case of the heel of the foot and the junctions between the metatarsal bones and phalanges or toes. These collectively transmit force through the human body to the sole and hence, when the foot is in a shoe having a deformable sole, such as a running shoe, the area of the shoe which contacts the ground first wears away more quickly than other parts of the sole of the shoe. Where the wear is relatively even over the whole area of the sole of the shoe, this indicates that the shape of the insole of the shoe closely matches the shape of the sole of the user of the shoe, but where it doesn't the sole of the shoe will experience uneven wear and, similarly if the foot strike or gait of the user is uneven, it will also induce uneven wear in the sole.

It is known to incorporate wear indicators in, for example, vehicle tyres whereby to warn the vehicle driver when the tyre itself is too worn for continued safe use and this general principle has also been applied to shoes, such as running shoes, as described in WO98/44819 where wear indicators are incorporated into the outsole of a shoe to thereby give a qualitative indication of wear and therefore the loss of the ability to cushion and absorb shock, thereby indicating a need for shoe replacement. However, the causes of wear in the sole of a shoe can be complex and include inward rolling of the foot during normal motion (pronation) as the outer edge of the heel strikes the ground and the foot rolls inward and flattens out, and the opposite condition, supination, where the foot rolls outwardly, especially during the push-off phase of running. In the case of the latter the muscles and tendons of the foot and ankle act to stabilise the foot and hence experience a large amount of strain in the process. As a consequence, especially as concerns running shoes, careful selection of the correct or best shoe for each foot is often necessary, where the choice may be made on the recommendation of a third party if the particular shoe under consideration has not been used before by the customer.

The present invention is derived from the realisation that there is a need for a simple means whereby the wear of a sole of a shoe may be easily determined by the user of a shoe such that e.g. remedial action can be taken to change the gait of the user to neutralise problems associated with the foot strike where this is possible, although if it is not, to instead compensate for such uneven wear by the use of shoe insole inserts to correct the balance of wear across the whole of the shoe sole, or by making a shoe with an insole or midsole

that compensates for such uneven wear with an outer sole having points of varying thickness and/or hardness whereby to prolong the life of the shoe and, in the case of sports shoes at least, increase the performance of the shoe relative to conventional shoes.

5 According to a first aspect of the invention there is provided a shoe comprising a shoe insole for receiving a foot and shoe outsole for ground engagement by the wearer of the shoe, the outsole comprising a tread and a plurality of discrete wear depth indicator datums indicative of outsole wear at each such datum, the datums being arranged at positions below the foot prone
10 to wear, such as under the heel, to thereby provide a visual indication of wear over time at each such datum.

The datums may be of a different colour to the rest of the outsole so that the amount of wear of the outsole in that region can be easily seen.

Conveniently, each datum is comprised of at least two wear indicators,
15 which may separately comprise a localised region of the outsole, an extended elongate region, such as a ridge of the outsole, or an extended surface region, such as a plateau region of the outsole, each of different depth to the other relative to the thickness of the sole, and advantageously they are arranged generally concentrically with the deepest or thickest wear indicators at the centre
20 of the datum and the shallowest or thinnest wear indicators at the outside. With this arrangement wear of the shoe sole over time is easily visible, as is also uneven wear as between various of the datum across the sole.

The datums themselves may be arranged to lie flush with the surface of the shoe sole, which may be made of a different, softer, material or the datums

may protrude above the major plane of the sole, although it will be understood that any convenient combination may be used.

The datums are conveniently of different colour to the rest of the shoe sole so that wear can be easily seen and analysed, which analysis may be done
5 by eye or electronically. Accordingly, according to a second aspect of the invention there is provided a method of analysing the wear pattern of the plurality of discrete wear depth indicator datums described in the first aspect of the invention, including the steps of providing a reference 3D geometry of the sole of the unworn shoe on a computer, thereafter uploading subsequent 3D
10 geometry of the sole of the shoe at intervals during the life of the shoe and comparing such geometry with the reference to thereafter ascertain the wear pattern across the sole for the wearer of the shoe.

With this arrangement, a computer application may be, for example, downloaded onto a smart phone having a camera whereafter progressively worn
15 images of the sole of the shoe may be uploaded to a computer having details of the sole of the shoe in its unworn condition to thereby provide means to compare the rate and position of wear of the shoe sole over time for the particular user of the shoe. This permits, by way of example, personalised correction insoles to be inserted in a worn shoe for the wearer or a tailored new
20 shoe may be made for that person to thereby prevent or inhibit uneven wear across the sole.

According to a third aspect of the invention there is provided a method of making a shoe tailored to the foot strike (gait) of an individual, the method including the steps, in any suitable order, of obtaining reference data according

to the method described in the second aspect of the invention and thereafter adjusting the thickness and/or hardness of areas of the sole of the shoe to compensate for the gait of the user of the shoe to thereby prolong the life of the shoe for that wearer or increase the performance of the user of the shoe.

5 According to a fourth aspect of the invention there is provided a shoe made in accordance with the method of the third aspect of the invention.

The invention will now be described, by way of example only, with reference to the accompanying drawings in which:

10 Figure 1a is a perspective view of a shoe according to an embodiment of the present invention;

 Figure 1b is a perspective under-view of an outer sole of the shoe illustrated in figure 1b;

 Figure 2 is a plan view of the outer sole of Figure 1b in its unworn condition;

15 Figure 3 is a plan view of the outer sole of Figure 1b in its worn condition;

 Figure 4a is a perspective view of a shoe according to an alternative embodiment of the present invention;

 Figure 4b is a plan view of the underside of an unworn outsole of the shoe illustrated in figure 4a;

20 Figure 5 is a plan view of the underside of the outsole illustrated in Figure 4b, in a worn condition;

 Figure 6a is a schematic illustration of the steps associated with a method of analysing the wear pattern of the plurality of wear depth indicator datums of a shoe; and,

Figure 6b is a schematic illustration of the steps associated with a method for making a shoe tailored to the foot strike (gait) of an individual.

Referring firstly to Figure 1a and 1b of the drawings, there is shown the outer sole or outsole 1 of part of the shoe 100, the outsole 1 being generally planar and having protruding therefrom and integral therewith a series of raised portions or treads 2 with which to grip the ground, each positioned to lie over or around areas of the outsole 1 corresponding to pressure points transmitted through the shoe 100 from the foot of the wearer (not shown) of the shoe 100. Between or within each of the tread portions 2 are one or more datums 3, each comprising concentrically arranged wear indicators 3a, preferably of a different colour to the treads 2. In the embodiment illustrated in figure 1, the datums comprise a plurality of rows of indicators, the rows being concentrically arranged around a centre of the respective datum 3. The indicators 3a of each row separately comprise a circular formation formed on the outsole 1. The indicators 3a associated with each row extend progressively deeper or longer within the sole 1, radially toward a centre of the respective datum 3, to provide an indication of progressive areas of wear as shown with reference to Figures 2 and 3. In Figure 2, which represents an unworn outer sole 1, it will be seen that the various wear depth indicators 3a are of varying sizes according to the position they occupy within the datum 3, being longest/deepest at the centre and shortest/shallower at the periphery, Nevertheless, all provide a visual indication that the treads 2 of the sole 1 are unworn. In contrast, it will be seen from Figure 3 that the treads 2 and hence the datums 3 have worn unevenly to the left of the sole 1 such that a portion of some of the indicators 3a have entirely

disappeared, whereas in others their radial size has diminished, thereby indicating the level of wear on that part of the sole 1.

Referring to Figures 4 and 5 of the drawings, there is illustrated a plan view of the underside of an outsole 1 of a shoe 200 according to an alternative embodiment of the present invention in an unworn and worn condition, respectively. The outsole illustrated in figures 4 and 5 comprises the same features as the outsole illustrated in figures 2 and 3, and so like features have been reference with like numerals. However, indicators 3a illustrated in figures 4 and 5 comprise extended elongate regions, namely ridges which are concentrically arranged around a centre of the respective datum 3. It is envisaged that the indicators 3a illustrated in Figure 4 and 5 provide for a more continuous indication of wear across the sole, compared with the localised circular indicators 3a illustrated in figure 2 and 3.

In yet a further embodiment which is not illustrated, the indicators 3a may instead or additionally comprise extended areas of the outsole 1 to provide for a further refined, continuous indication of wear across the outsole 1. However, it is to be appreciated that the sole 1 may comprise a combination of localised and extended indicators 3a.

With the foregoing arrangements illustrated in figure 2 to 5, it therefore follows that uneven wear across the sole 1 is easily seen such that corrective insoles may be used to prolong the life of the shoe, which may be a sports' shoe, in which case it is to be anticipated that the performance of the user of the shoe would be improved by the use of such a corrective insole, or the corrective

insole could be used instead by those who suffer from podiatry-related pain, in each case by effectively correcting the natural gait of the user of the shoe.

Referring to figure 6a of the drawings, there is illustrated a schematic illustration of the steps associated with a method 10 of analysing the wear pattern of the plurality of wear depth indicator datums of a shoe 100, 200, according to an embodiment of the present invention. In accordance with the method 10, a computer application may be used to compare a reference 3D geometry of the sole 1 of an unworn shoe, acquired at step 11, with a worn shoe at intervals during the life of the shoe, at step 12, to thereafter ascertain the wear pattern across the sole 1 for the wearer of the shoe 100, 200, at step 13. This naturally leads on to a further embodiment of a method 20 for making a shoe 100, 200 tailored to the foot strike (gait) of an individual, as illustrated in figure 6b of the drawings. The method 20 comprises the use of the method 10 of the above described embodiment. In addition, through the use of a suitable computer program, or by physical measurement of the wear associated with each datum point across the sole 1, the method 20 further comprises analysing the data to predict when e.g., a replacement shoe will be required, and in the case of sports' shoes to accurately measure the strike angle of the shoe 100, 200 relative to the ground during e.g. running, to calculate the strike area for that shoe and with all such data thereafter produce either a gait-neutralising insole or a shoe itself made to wear evenly relative to the gait of the user of the worn shoe at step 14.

Thus, the invention in all its aspects provides a more scientific approach to tackling the problem of wear to outer soles due to the particular gait of the

user such that corrective action can be easily taken by the use of corrective inserts for existing shoes. Corrected shoes may also be made for future use which already have in-built compensation in the sole of the shoe for that person, in each instance thereby increasing the performance of the shoe, reducing the risk of injury to e.g., the wearer of a running shoe, and providing more comfortable footwear for those suffering from podiatry-related pain.

Claims

1. A shoe comprising a shoe insole for receiving a foot and shoe outsole for ground engagement by the wearer of the shoe, the outsole comprising a tread and a plurality of discrete wear depth indicator datums indicative of outsole wear
5 at each such datum, the datums being arranged at positions below the foot prone to wear, to thereby provide a visual indication of wear over time at each such datum.
2. A shoe according to Claim 1 wherein each datum is comprised of at least two wear indicators, each of different depth to the other relative to the thickness
10 of the sole.
3. A shoe according to claim 2, wherein one or more of the at least two wear indicators comprise a localised region of the outsole.
4. A shoe according to claim 2 or 3, wherein one or more of the at least two wear indicators comprise an extended elongate region of the outsole.
- 15 5. A shoe according to claim 2, 3 or 4, wherein one or more of the at least two wear indicators comprise an extended surface region.
6. A shoe according to any preceding Claim, wherein the datums are arranged generally concentrically with the deepest or thickest wear indicator areas at the centre of the datum and the shallowest or thinnest wear indicator
20 areas at the outside.
7. A shoe according to any preceding Claim wherein the datums are arranged to lie flush with the surface of the shoe sole.
8. A shoe according to any of Claims 1 to 6 wherein the datums protrude above a major plane of the sole.

9. A shoe according to any preceding Claim wherein the datums are of different colour to the rest of the shoe sole so that wear can be easily seen and analysed.

5 10. A method of analysing the wear pattern of the plurality of wear depth indicator datums of a shoe according to Claim 1, including the steps of providing a reference 3D geometry of the sole of the unworn shoe on a computer, thereafter uploading subsequent 3D geometry of the sole of the shoe at intervals during the life of the shoe and comparing such geometry with the reference to thereafter ascertain the wear pattern across the sole for the wearer of the shoe.

10 11. A method of making a shoe tailored to the foot strike (gait) of an individual, the method including the steps, in any suitable order, of obtaining reference data according to the method described in the second aspect of the invention and thereafter adjusting the thickness and/or hardness of areas of the sole of the shoe to compensate for the gait of the user of the shoe to thereby
15 prolong the life of the shoe for that wearer or increase the performance of the user of the shoe.

12. A shoe made in accordance with the method of the third aspect of the invention.

20 13. A shoe having a sole substantially as hereinbefore described with reference to the drawings.



Application No: GB1416725.8

Examiner: Ms Becky Lander

Claims searched: 1-9 & 13

Date of search: 20 March 2015

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-6, 8 & 9	EP2526803 A (ROYAL COLLEGE OF ART) See figures 1 & 6-8 and paragraph [0020] & [0021]
X	1-5 & 7-9	WO98/44819 A (BROZ) See figures and pages 14 to 20
X	1-5, 7 & 9	FR2795924 A (OXYPAS) See figures and abstract
X	1-5, 8 & 9	US2006/101671 A (BEREND et al.) See figures 3 & 4 and paragraph [0055]
X	1-5, 8 & 9	WO2004/047578 A (LUPOS et al.) See figures and abstract
X	1-5, 7 & 9	GB2411336 A (BUCHANAN ORTHOTICS LTD) See figures and page 5
X	1-5, 7 & 9	US6922916 B (POTTER) See figures and paragraphs [0010] & [0011]

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Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^X :

Worldwide search of patent documents classified in the following areas of the IPC

A43B

The following online and other databases have been used in the preparation of this search report



WPI & EPODOC

International Classification:

Subclass	Subgroup	Valid From
A43B	0013/12	01/01/2006
A43B	0013/00	01/01/2006