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(54) Benævnelse: **Shoe and method for the contruction thereof**

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DESCRIPTION

Area of the invention

[0001] The present invention relates to shoes or footwear. In more detail the invention relates to shoes that are specially constructed for walking with a balancing influence on the body above the shoes.

Background of the invention and prior art

[0002] It is known that footwear greatly influences the strain on the skeleton and the rest of the body. Poor shoes give an uneven load on joints in the foot and ankle, which spreads out further to the skeleton and the rest of the body above the feet, which can lead to much pain and suffering.

[0003] During walking or running a foot that hits a base will normally hit it at an angle towards the outer side of the heel bone. As the foot rolls forward when the step is carried out, the weight will move in towards the middle of the body. At the end of the step the weight goes over to the ball of the foot and further to the big toe. Thus, the weight is transferred diagonally or across the sole of the foot as the step is carried out. Such transfer or rotation is called pronation. If the rotation is too pronounced, whereby the resultant force comes too near the vertical centreline of the body, as under the big toe, it is called over-pronation. If the rotation inwards about the ankle joint is normal, as described above, it is called normal pronation. If the rotation is too small, so that the force at the end of the step comes nearer the little toe, it is called under-pronation or supination.

[0004] It is known that the wrong pronation leads to an uneven strain that spreads upward in the body from the leg and up to the back and neck. Great pain will occur particularly after prolonged uneven strain.

[0005] It is known that running shoes can be chosen with regard to the right pronation, which can be decided, for example, by visual consideration of the running step.

[0006] The shoes one chooses have an adapted inclined heel position and side support from the heel cap and upper leather with adapted rigidity, so that an over-pronation or under-pronation shall be avoided. The concepts of over pronation and under-pronation appear in connection with running shoes only to be associated to where the pressure comes into the sole of the shoe when setting down the heel and where the pressure comes out in relation to the toes, while the pressure between said positions appears to be able to follow a straight line.

[0007] There are shoes other than running shoes which are adapted to give the correct

pronation. These shoes seem to be constructed with adapted side support and adapted tilted heel to give the right pressure at the heel on setting down, and out to the correct location in relation to the toes, without defining any definite line or path the weight should follow diagonally across the sole. Some examples are found in the publications WO 2009083098, GB 2456766, US 2008276491, US 5323549, US 6341432 and US 2008229624.

[0008] In NO 328090 (corresponds to WO2005067754 and US2008229624), page 1, lines 25-27, it is described that "*The load placed on the sole of the foot moves diagonally across it. From the heel, which is loaded on the outside, the load line moves diagonally inwards over the sole of the foot all the way to the ball of the foot and the big toe".* This relates to healthy people moving naturally without any deformation of the foot. As described in NO 328090, page 2, lines 1-3, the situation is often different in civilised societies: "*This turning of the load exerted on the foot is not found in the population in civilised societies used to shoes and hard surfaces. When one walks on a flat surface the flat sole forces the shoe into a straight heel-to-toe movement*". The invention according to NO 328090 provides a diagonally twisted sole, and a shoe with such sole, to correct the wrong placing of the heel and the wrong heel-to-toe movement so that a diagonal load curve of the sole of the feet is achieved. Anything else about the load curve is not described other than it being diagonal. For the diagonally twisted sole, it is mentioned on page 4, lines 34-36 that *"In special cases it can be imagined that it is not systematically twisted, but instead is adapted to a deformity, a wrong position or a restriction in the foot".* But there are no instructions concerning a given load curve in preference to other load curves. According to the description in the patent NO 328090, it is described in the patent WO 01/15560 (corresponding to US 6782639) how different types of load of the foot can be achieved by hard inserts in the sole. It is given that different types of insert 15 of a different hardness on the middle sole bottom11 are arranged, and the under-sole 12 has a" sand-like elasticity". By these features alone a diagonal or freely definable form of the load line can probably be established.

[0009] But what a person skilled in the arts learns from WO 01/15560 / US 6782639 is that a lack of dynamic, active walking is the underlying problem for many pain related problems, and the invention according to said publication provides a shoe with which active walking is a necessity, as the sole is convex so that the sole rolls against the base when a step is taken. It is pointed out that the shape of the sole parts is incidental (random - US 6782639) or chosen freely (WO 01/15560) and consequently the load curve can not follow any particular line.

[0010] Further related art or background art is found in the patent publications WO 03/002042 A1, EP 2 213 189 A1, WO 2010/136513 A1, KR 2011 0065579 A, US 2006/201028 A1, DE 10 2009 010360, US 5 921 004 A, EP 2 332 432 a, CA 2 597 285 A1 and EP 1 513 038 A.

[0011] Although many are helped by special shoes such as those mentioned or referred to above, it has been shown that many are not being helped, of whom some suffer more damage than benefit from using the shoes. Therefore, there is still a need for an improved shoe so that the suffering associated with wearing wrong shoe and wrong gait can be reduced. The need is met by the present invention, which is the aim of the invention.

Summary of the invention

[0012] In more detail, the invention provides a shoe comprising a sole and at least a part of an upper leather fastened to the sole, distinctive in that the shoe is constructed or adapted so that the resultant force vertically up from the base during walking is displaced along a fixed line, designated SGL (sensory gait line), as the line, for the right foot seen from above starts at the back tilted 40° ±10° from the outside on the setting down of the heel, the line goes forwards and turns outwards so that it goes below the middle of the calcaneus (the heel bone) from where the line further continues forwards to under the middle of the cuboid and has the shape of an extended S that goes out between the first and the second toe along the inside of the second toe bone, the sole as seen from behind of the right foot is turned clockwise in the heel and the intermediate foot area, i.e. higher, possible stiffer, on the inside, medially for the SGL, but, in the main, plane in the front foot area, wherein, if the cross section is taken along the SGL, the displacement along SGL is achieved by having increased height and/or more rigid elasticity along the side of the SGL which the SGL shall turn away from.

[0013] In more detail the shoe is beneficially constructed or adapted so that the resultant force vertically up from the base, or the centre of the pressure from the foot vertically down during a step is, in the main, displaced along a defined line, denoted SGL (sensory gait line), as the line, for the right foot seen from above starts at the back, typically slanting about 40° from the outside at the setting down of the heel, the line turns or swings laterally outwards while it runs forwards so that it runs, in the main, straight forwards under the middle of the heel bone calcaneus (heel bone), from where the line continues up to under the middle of the cuboid from where the line further forwards at first turns or swings medially inwards towards the basis between the second and the third metatarsal and thereafter turns forwards in the longitudinal direction of the foot, so that the line touches the medial side of the corpus second metatarsal and thereafter further forwards along the medial side of the second toe. From the middle under the cuboid and up to the tip of the toe, the SGL will have the form of an extended S that runs out between the first and the second toes. From the middle under the cuboid the SGL runs forwards and medially inwards so that the line goes to under the outer part of the second metatarsal (second intermediate foot bone) under the inner side of the outer end thereof, from where the line runs further forwards between the first and second toe bones, so that the line SGL, from under the middle of the cuboid and forwards has the shape of an extended S. From under the middle of the cuboid the SGL runs further forwards to the area under the basal of the third and the fourth metatarsal, from where the SGL goes forwards and swings medially between the first and the second basal joint and tapers off forwards to the end as the SGL runs out between the first and the second toe. From in front of the rear sharp deflection forwards at the heel set the SGL follows the heel bone and the cuboid so that the SGL goes under the middle of the heel bone and the cuboid before the SGL continues further forwards.

[0014] Surprisingly, it is found that the resultant force or pressure against and along the curved line SGL, with the form as an extended S that swings out at the back by the heel, leads to the

foot getting a natural movement pattern with a balanced muscle activation along and about all axis in the foot and ankle. Thus, the basis is made for an efficient walking movement and natural movement of the joints of the foot, ankle, knee, hip and backbone, with the resulting reduced mechanical loads. Contrary to previous constructions a more anti-pronation heel construction is achieved, as the shape of the shoe guides the step or the placing of the foot through the intermediate foot area, up to and through the forefoot. Thus, over-pronation in the forefoot and resulting negative loads on different joints and elastic structures in the forefoot as well as the intermediate foot, are prevented, whereby the cooperation in the joint mechanics from the foot joints and up through the whole of the body is balanced and thus secure.

[0015] That the resultant force or pressure centre from the foot vertically down against the base, or the pressure or the centre of the pressure from the base against the foot during a step, in the main, moves along or follows a defined line along the sole longitudinally, the line is denoted SGL, means that the resultant or the pressure centre along the cross section of the sole of the foot moves along or follows the SGL. With the expression, at least a part of the upper leather fastened to the sole, is meant that the shoe comprises more than a sole to hold the foot securely to the shoe, such as an upper part, for example, an upper leather and a heel cap. The term shoe encompasses everything from the simplest sandals and slippers to the most complex shoes, essential in this context is that the forces or the pressure is controlled so that the line SGL, in the main, is followed along the whole of the foot, from the heel to the toe. The SGL starts at the back, typically slanting at 40° ±20°, more typically 40° ±10° obliquely, which is the angle in relation to the longitudinal direction of the foot of the sole at the heel set, however, the SGL quickly swings forwards and follows, in the main, the mid-axis or the most pronounced line of the heel bone forwards to the cuboid. From a short distance into the heel bone and up to under the cuboid the line SGL follows the largest bone concentration in the foot or the lower edge of the dominating bone in the foot, while the line from the cuboid and forwards follows another curve which is defined in detail above and below.

[0016] With that the line SGL, in the main, is followed is meant that preferably the construction of the sole of the shoe guides the step so that the line is followed to ±20 mm sidewise, more preferred ±10 mm, possibly ±5 mm sidewise, but most preferred is that the sole construction is such that the shoe is unstable inside the SGL, so that the muscles and nerves are activated in that the foot can flip or tilt about the SGL along the whole length of the foot. Thus, the line can be defined as a band where the resultant force shall lie within the band, the breadth of which is as defined by the permitted deviations from the ideal line, as it is defined above.

[0017] The shoe is constructed or adapted so that the sole, upper part and any insole which when put together provides guidance, as a whole, as assembled, so that the foot during a step flips around the line SGL such that the force goes down through SGL.

[0018] The definitions are given for the right foot seen from above. The corresponding is relevant for the left foot, but everything is the wrong way round about the vertical mid-line of the body, seen in anterior-posterior plane (back to front). Forwards means forwards in the direction of the step and the toes, in the longitudinal direction of the foot, while backwards is

the opposite direction. Outwards or laterally means the direction across the longitudinal direction of the foot, in the direction outwards from the vertical mid-line of the body. Inwards or medially is across in towards the mid-line of the body. The longitudinal axis of the sole of the foot in the direction forwards is typically diverging to a different degree for different people, so that the definitions in relation to joints are more precise.

[0019] It is advantageous for the shoe to have some embodiments with a convex sole in the longitudinal direction against the base. Thus, an instability is generated which gives a dynamic, active gait that leads to a balanced activation and training of muscles, ligaments and tendons.

[0020] In many embodiments the sole of the shoe is preferably concave in the cross direction against the base and the outer longitudinal rims have preferably variable heights that control the weight along the SGL during a step, the sole is as seen from behind for the right foot preferably twisted clockwise in the heel and the intermediate foot area, but, in the main, plane in the forefoot area. Thus, the shoe is lower (possibly softer) on the outside laterally for the SGL in the heel and intermediate foot in relation to the inner side medially for the SGL.

[0021] The upper or inner sole of the shoe lies advantageously against the foot sole on both sides of the SGL to better activate and stimulate the sensory system in the sole of the foot.

[0022] It is advantageous for the shoe to have an instability by flipping about the line SGL so that muscles on both the inside and outside of the foot and ankle are activated and trained, the instability is preferably achieved in that the intermediate sole is softer and more elastic than the upper and lower parts of the sole which provides the correct flipping about the line SGL. It is an advantage if the sole of the shoe has an increased elasticity module or rigidity against being pressed together for harder applications and heavier people, for example, so that running shoes are stiffer than walking shoes which in turn are stiffer than party shoes. Small shoe sizes are advantageously softer than larger shoes. A regulated elasticity module or rigidity against being pressed together can be achieved in known ways, for example, by controlling the amount of material, for example, PU (polyurethane), per volumetric unit injected into a casting mould.

[0023] The sole can advantageously be twisted with regard to the SGL. Similarly, permanent, loose and/or inserts that can be fastened can be adapted to twist around the line SGL so that the resultant force follows the SGL. Similarly, rigidity and elasticity and/or supporting points or zones can be, with greater or smaller rigidity and/or elasticity, arranged alternately at the side of the line SGL so that the resultant force from the foot during a step follows the SGL.

[0024] The line SGL can be regarded to be the natural line for weight, pressure through the foot so that joints, nerves (sensory) and muscles are activated in a balanced way through the step (gait line). In more detail, the joints, nerves, ligaments and connecting tissue structures are actively balanced on each side of the line SGL if the weight follows the SGL, so that any suffering due to an imbalanced gait is reduced or eliminated.

[0025] The invention also provides a method for the manufacture of a shoe according to the invention, characterised by adapting the compressive rigidity and/or height of the sole construction on each side of the line SGL so that the pressure centre from the foot during a step moves along the SGL. The invention also provides an application of a shoe according to the invention, on the foot of a person to adjust the person's gait.

Figures

[0026] The invention is illustrated with the help of figures, where

Fig. 1 illustrates the line SGL seen from above with a foot inside a shoe.

Fig. 2 illustrates the line SGL in relation to the bones of the foot, and the Figures 3a and 3b illustrate a shoe according to the invention.

Detailed description

[0027] Reference is made to Fig. 1 which illustrates a foot, more specifically a foot seen from the underside or a footprint as seen from above, inside a right shoe or on right sole. The purpose is to illustrate how the line 1, or more specifically the curve 1, SGL, runs in relation to the sole of the foot and footprint. The SGL 1 is shown as a thick line or a band, as a certain tolerance for deviations from the ideal line must be included in practice, which is illustrated in that the SGL has a breadth of about 10 mm, which will permit deviations to within ± 5 mm. The tolerance is given as an example only. The illustrated line SGL (sensory gait line) starts at the setting down of the heel at an angle from the outside of the heel bone calcaneus, the line runs forwards and turns laterally outwards so that at about under the middle of the heel bone the direction is approximately directly forwards, while further forwards the SGL has the shape of an extended S that runs from the foot up to along the inside of the second toe. It can be clearly seen that the S-shape goes somewhat out from the mid-line of the body and out and forwards from the heel bone, while further forwards the SGL goes inwards and forwards while it turns, or swings, laterally outwards. At the points for changing the turning direction, the SGL is a straight line and if the SGL was described by a mathematical function the second derivative would be equal to zero at said points while the sign would change according to the turning changes. The curvature of the SGL is open outwards in the rear part of the sole of the foot, it changes to be open inwards in an intermediate area before it is open outwards again at the forward part of the sole of the foot.

[0028] Reference is further made to Fig. 2 which defines the SGL 1 in more detail by relating the SGL to the joints of the foot. The SGL is drawn in and meant to lie correctly in relation to the joints. It is meant that the definitions in the description and claims shall define the SGL as

illustrated in the figures 1 and 2.

[0029] Reference is further made to Figure 3a which illustrates a shoe according to the invention, as seen from the side. The illustrated embodiment has a sole which is convex in the longitudinal direction. Reference is further made to Figure 3b which illustrates the same shoe seen from behind. As can be seen in Fig. 3b, the sole is concave in the cross direction, as the outer rim or edge in the longitudinal direction of the sole guides the foot to correctly flip about the SGL as a step is taken. Something which is difficult to see is that the sole is somewhat twisted and has somewhat varying height at the sides. However, the shoe is built so that if the cross section is taken along the SGL, the edge is higher and/or more rigid along the side of the SGL which the SGL shall turn away from. A more rigid and/or higher outer side ensures that the right foot seen from behind flips anti-clockwise and the resultant force moves inwards along the length of the cross section. The resultant force is controlled in this way to be moved along the SGL.

REFERENCES CITED IN THE DESCRIPTION

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PATENTKRAV

1. Sko som omfatter en sål og i det mindste en del af et overlæder, som er fastgjort til sålen, hvor skoen er konstrueret eller indrettet således, at den resulterende kraft vertikalt opad fra underlaget under vandring forskydes langs en fastlagt linje (1), som betegnes sensorisk ganglinje (sensory gait line – SGL), idet linjen (1), for den højre fod set ovenfra, starter bagtil vippet 40° ± 10° fra ydersiden, når hælen sættes i, linjen (1) går fremad og drejer udad, således at den går under midten af calcaneus (hælbenet), hvorfra linjen (1) yderligere fortsætter fremad til under midten af terningbenet og har form som et langstrakt S, som går ud imellem den første og den anden tå langs indersiden af den anden tåknogle, idet sålen set bagfra på den højre fod drejes med uret i hælen og mellemfodsområdet, dvs. højere, muligvis stivere, på indersiden, medialt for SGL, men hovedsageligt plan i forfodsområdet, hvor forskydningen langs SGL, i tværsnit langs SGL, opnås ved at have øget højde og/eller mere stiv elasticitet langs den side af SGL, som SGL skal dreje væk fra.

2. Sko ifølge krav 1, kendetegnet ved, at skoen er konstrueret eller indrettet således, at den resulterende kraft vertikalt opad fra underlaget under vandring forskydes langs en fastlagt linje, betegnet sensorisk ganglinje (sensory gait line – SGL), idet linjen, for den højre fod set ovenfra, starter bagtil vippet omtrent 40° fra ydersiden, når hælen sættes i, linjen drejer lateralt udad, mens den går fremad, således at den går ligeud fremad under midten af hælbenscalcaneus (hælbenet), hvorfra linjen fortsætter fremad under midten af terningbenet, hvorfra linjen fortsætter fremad, idet den først drejer medialt indad og derefter fremad, således at linjen går til under den ydre del af den anden metatarsal (anden mellemfodsknogle), under indersiden af den ydre ende deraf, hvorfra linjen går yderligere fremad imellem den første og den anden tåknogle, langs indersiden af den anden tåknogle, således at linjen SGL fra midten under terningbenet og yderligere fremad har form som et langstrakt S og med et lateralt sving udad tilbage til hælen.

3. Sko ifølge krav 1 eller 2, kendetegnet ved, at linjen SGL fra under midten af terningbenet forløber yderligere fremad til området imellem udgangspunktet for den tredje og den fjerde metatarsal, hvorfra SGL går fremad og svinger medialt til imellem det første og det andet udgangsled og drejer yderligere fremad til den ender, når SGL løber ud imellem den første og den anden tå.

4. Sko ifølge et af kravene 1-3, kendetegnet ved, at skoen er konstrueret eller indrettet således, at sålen, den øvre del og en eventuel indersål, når de er sat sammen, tilvejebringer støtte, således at foden under vandring vipper rundt om linjen SGL, således at trykcentret går ned igennem SGL.

5. Sko ifølge et af de foregående krav, kendetegnet ved, at skoens sål i den langsgående retning er konveks imod underlaget.

6. Sko ifølge et af de foregående krav, kendetegnet ved, at skoens sål er konkav i den tværgående retning imod underlaget, og at de ydre langsgående forløbende kanter har en variabel højde, som styrer vægten langs SGL under vandring.

7. Sko ifølge et af de foregående krav, kendetegnet ved, at det øvre eller indersålen af skoen ligger imod fodsålen på begge sider af SGL, for dermed bedre at aktivere og stimulere sensorsystemet i fodsålen.

8. Sko ifølge et af de foregående krav, kendetegnet ved, at skoen har en ustabilitet i vipningen omkring linjen SGL, således at muskler på både ydersiden og indersiden af foden aktiveres og motioneres, idet ustabiliteten genereres af, at mellemsålen er blødere og mere elastisk end de nedre dele af sålen, hvilket tilvejebringer den korrekte vipning omkring SGL.

9. Sko ifølge et af de foregående krav, kendetegnet ved, at skoens sål har et øget elasticitetsmodul eller stivhed imod at blive trykket sammen med henblik på hårdere anvendelse.

10. Fremgangsmåde til at fremstille en sko ifølge et af kravene 1-9, kendetegnet ved, at tilpasse stivheden eller elasticiteten af kompression og/eller højde af sålkonstruktionen på begge sider af linjen SGL, således at trykcentret fra foden under vandring forskydes eller bevæges langs linjen SGL.

DRAWINGS

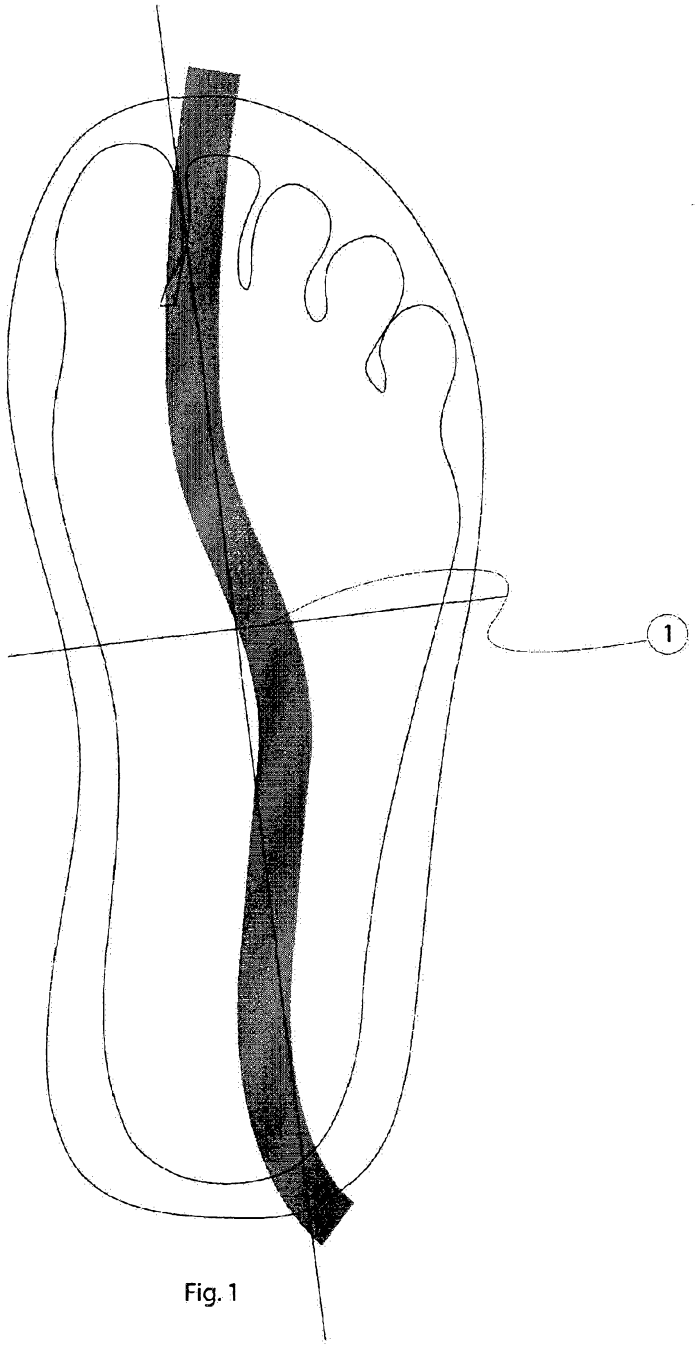

Fig. 1

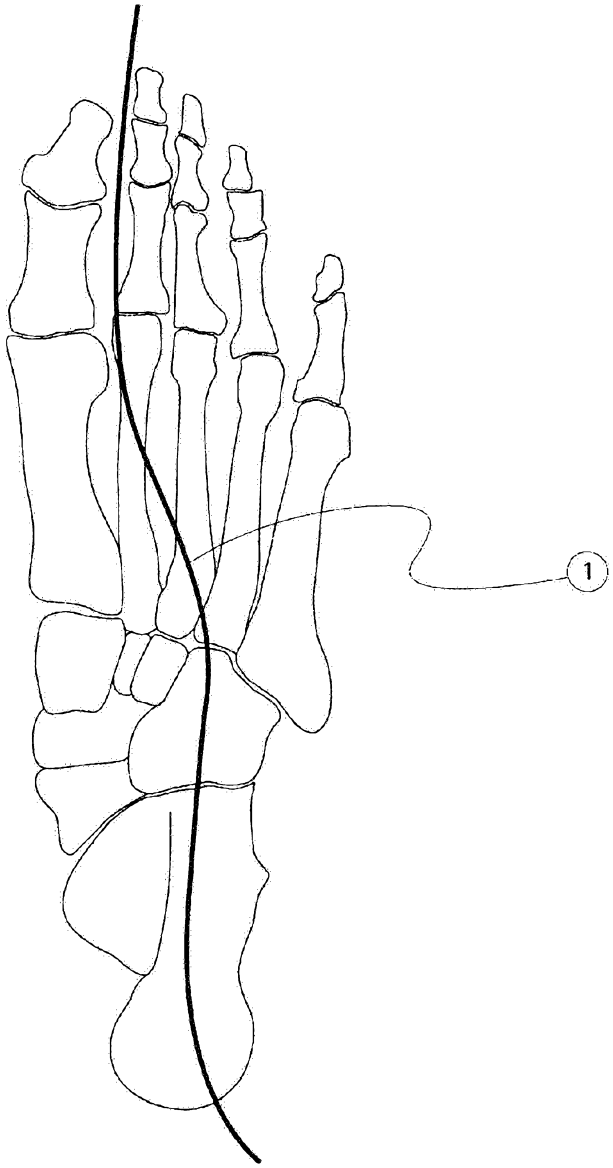

Fig. 2

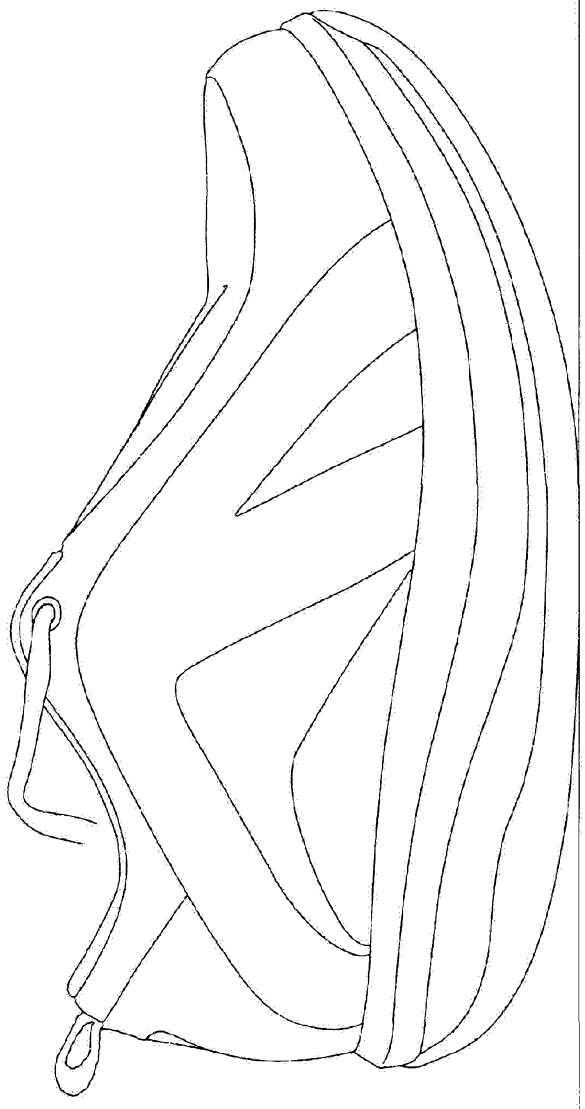

Fig 3a

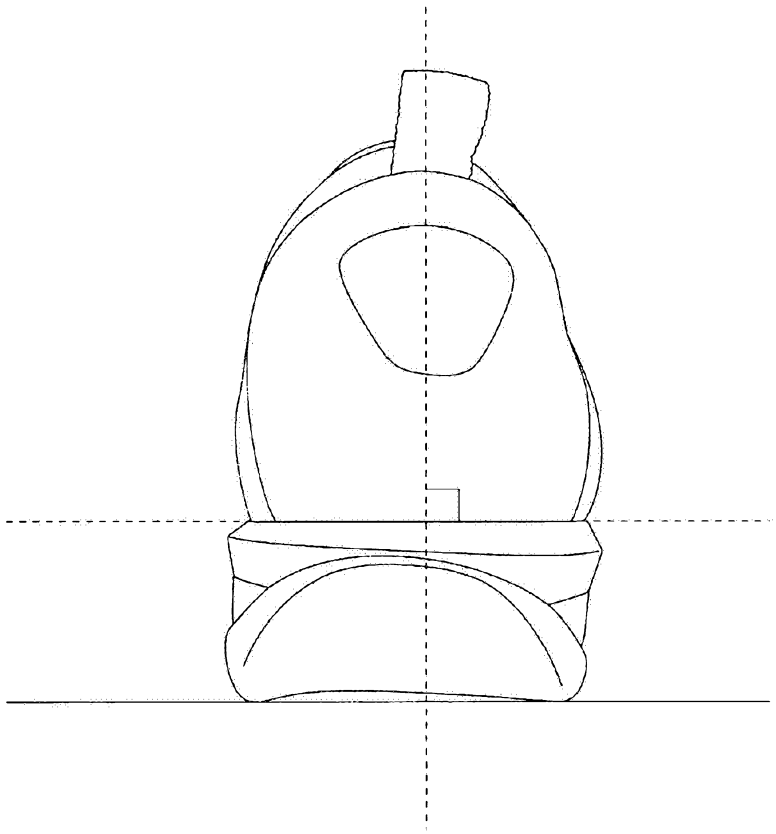

Fig 3b