(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 888 483 A1

(12) EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:
06.10.2021 Bulletin 2021/40

(21) Application number: **19890276.9**

(22) Date of filing: **12.11.2019**

(51) Int Cl.:
A43B 7/22 *(2006.01)* ***A43B 7/14*** *(2006.01)*
A43B 7/16 *(2006.01)*

(86) International application number:
PCT/KR2019/015367

(87) International publication number:
WO 2020/111587 (04.06.2020 Gazette 2020/23)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **29.11.2018 KR 20180150456**
01.11.2019 KR 20190138492

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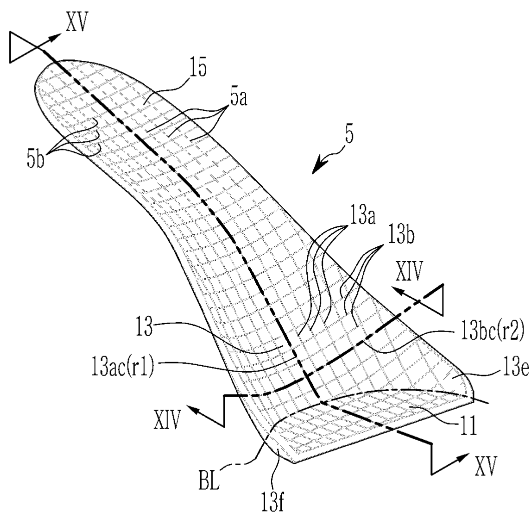
(54) HIGH-HEELED SHOE SOLE STRUCTURE AND HIGH-HEELED SHOE INCLUDING SAME

(57) The present invention discloses a sole structure of a high-heeled shoe that may have a walking mechanism similar to movement of human walking when a pedestrian wears and walks in high-heeled shoes.

A sole structure of a high-heeled shoe of the present invention includes: a front portion supported on the ground; a bending portion that extends from the front portion to be positioned at a rear side of a metatarsophalangeal joint and is bent in an opposite direction to the ground; and a rear portion extending from the bending portion.

FIG. 12



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Printed by Jouve, 75001 PARIS (FR)

Description

[Technical Field]

[0001] The present invention relates to a high-heeled shoe sole structure and a high-heeled shoe including the same that may have a walking mechanism similar to movement of human walking when a pedestrian wears and walks in high-heeled shoes.

[Background Art]

[0002] During a human gait cycle, at the heel off and toe off period after the midstance, extension of the metatarsophalangeal joints occurs, and simultaneously, inversion and adduction of the heel of the foot occur.

[0003] A pedestrian wearing conventional high-heeled shoes suffers from an ankle sprain due to instability of a rearfoot depending on a high heel, when a body's weight is loaded on the ground while standing or walking. Therefore, a sole structure of the conventional high-heeled shoes is made of a very hard material in which a metal shank is inserted from a rear boundary of a front portion that is a portion where the shoe contacts the ground and is supported on the ground to an end of the rearfoot.

[0004] In addition, in the state of wearing conventional high-heeled shoes, since a plantar fascia is tightly pulled, passive movement occurs in which toes are bent toward the sole. Therefore, in the foot in the state of wearing the conventional high-heeled shoe, force to be bent to a ground direction is applied to a front portion thereof, which is a portion of the high-heeled shoe supported by the ground. Therefore, the front portion of the high-heeled shoe is substantially made to maintain a shape of the shoe in a swing phase in which the body weight is not loaded on the ground. Particularly, when a platform is attached to a sole of the front portion of the high-heeled shoe supported by the ground, movement of the forefoot and rearfoot is not allowed at all.

[0005] In addition, the extension occurs in a direction of the instep at the metatarsophalangeal joints at the heel off and toe off after the midstance. However, since the conventional high heel sole structure is not flexible, it cannot cope with this, and thus there is a problem in that the heel comes out of the shoe, so that it is difficult to normally walk.

[0006] FIG. 24 illustrates a side cross-sectional view of a foot skeleton and a main structure of a shoe in a state of wearing conventional high-heeled shoes, and FIG. 25 illustrates a last and a general sole structure used to manufacture conventional high-heeled shoes.

[0007] General high-heeled shoes are manufactured through the following process.

[0008] First, a high-heeled shoe is manufactured by combining a general sole structure (S) and a last (L), putting an upper (U) thereon and then firmly combining the upper (U) to the general sole structure (S). In addition, the high-heeled shoe is manufactured by combining a heel (H) and an outsole (O) to the general sole structure (S). In the general sole structure (S), a metal shank (MS) is inserted from a rear boundary (BL) of a portion (portion A in FIG. 24) supported on the ground to an end (portion B indicated by dots in FIG. 25) of a rearfoot, for standing or walking stability. That is, a very hard metal shank (MS) extending to the rearfoot from the rear boundary BL of the portion supported on the ground is combined to the general sole structure (S).

[0009] Meanwhile, the body weight-bearing area in the foot is the heel, the head of the first metatarsal bone, and the head of the fifth metatarsal bone. The above-mentioned three portions are connected to each other in an arch form, enabling efficient body weight-bearing and walking.

[0010] In the high-heeled shoe, a posterior part of the foot behind the heads of metatarsal bones (MTBH) is artificially raised. Therefore, a portion (B) of the conventional sole structure (S) that is not supported by the ground but is in the air is made of a very solid material. In addition, the heel (H) of the high-heeled shoe is coupled to the posterior part of the conventional sole structure (S) to maintain the shape of the shoe.

[0011] FIG. 26 illustrates a state of an extension of metatarsophalangeal joints in a state of wearing conventional high-heeled shoes.

[0012] Generally, when high-heeled shoes are worn, the metatarsophalangeal joints (MTP) are always maintained in an extended state due to the shape of the shoe, so that the plantar fascia (PF) is tightly pulled (which is indicated by an arrow of an imaginary line in FIG. 26). When the plantar fascia (PF) is pulled as described above, passive movement that flexes the metatarsophalangeal joint (MTP) occurs, so that force in which the toes are bent toward the sole of the foot occurs (which is indicated by a solid arrow in FIG. 26). Therefore, the portion that supports the ground in the high-heeled shoe is solidly manufactured to some extent to maintain the shape of the shoe.

[0013] FIG. 27 (a) to (c) illustrate drawings for explaining a problem of the conventional high-heeled shoe. FIG. 27 (a) illustrates the standing in a state of wearing the high-heeled shoe, or the midstance during walking, FIG. 27 (b) illustrates the heel off during walking, and FIG 27 (c) illustrates the toe off during walking.

[0014] The conventional sole structure (S) is not bent during the heel off even if the portion supported on the ground is made to be flexible to some extent. Since the body weight is loaded onto the ground through the heads of metatarsal bones (MTBH) during the heel off, even if the heel is separated from the ground, the front portion of the foot including the heads of metatarsal bones (MTBH) contacts to the ground. Accordingly, in the conventional sole structure (S), even if the portion supported on the ground is somewhat flexible, the sole structure (S) is not bent during the heel off, so that the heel comes out of the shoe.

[0015] During the toe off, the heads of metatarsal bones (MTBH) is separated from the ground and the body weight is loaded only on the toes. Accordingly, when the portion supported on the ground in the conventional sole structure (S) is flexibly manufactured to some extent, it may be bent to some extent in a lower portion of the metatarsophalangeal joint. However, even in this case, since it is not bent enough to follow the movement of the foot, and the heel comes out from the shoe as shown in FIG. 27 (c).

[0016] Therefore, since the high-heeled shoe to which the conventional sole structure S is applied is not suitable for the movement of the foot according to the walking, it is not possible to effectively support the foot.

[Disclosure]

[Technical Problem]

[0017] Therefore, the present invention has been made in an effort to provide a high-heeled shoe sole structure and a high-heeled shoe including the same that may maintain a shape of a shoe by limiting flexion of a metatarsophalangeal joint during a swing phase, and may improve stability of walking by supporting a body weight during a stance phase or standing when the body weight is loaded on the ground.

[0018] In addition, the present invention has been made in an effort to provide a high-heeled shoe sole structure and a high-heeled shoe including the same that may be optimized for foot movement by allowing extension of a metatarsophalangeal joint during heel off and toe-off while walking.

[Technical Solution]

[0019] An embodiment of the present invention provides a sole structure of a high-heeled shoe, including: a front portion supported on the ground; a bending portion that extends from the front portion to be positioned at a rear side of a metatarsophalangeal joint and is bent in an opposite direction to the ground; and a rear portion extending from the bending portion.

[0020] The bending portion may include a bending curved portion that forms a concave curve in an opposite direction to the ground.

[0021] In the bending curved portion, a curvature of a transverse center line of the bending portion that is parallel to a transverse axis of a foot and formed along a line crossing a longitudinal center line of the bending portion may be larger than that of the longitudinal center line of the bending portion formed along a longitudinal axis of the foot.

[0022] The bending portion may be concavely bent in a direction opposite to the ground during heel off and toe off in a gait cycle, and may be limited to be bent in a ground direction during a swing phase in the gait cycle.

[0023] The bending portion may be bent during heel off and toe off in a gait cycle such that the rear portion may correspond to foot movement in inversion and adduction directions of a foot.

[0024] In the transverse center line of the bending portion, a curvature of a lateral side portion may be larger than that of a medial side portion.

[0025] In the bending portion, a thickness of a lateral side portion may be thicker than that of a medial side portion.

[0026] The bending portion may include at least one or more bending adjustment holes or bending adjustment grooves that make degrees of bending of a medial side portion and a lateral side portion different.

[0027] Another embodiment of the present invention provides a high-heeled shoe provided with a sole structure, wherein the sole structure includes: a front portion supported on the ground; a bending portion that extends from the front portion to be positioned at a rear side of a metatarsophalangeal joint and is bent in an opposite direction to the ground; and a rear portion extending from the bending portion.

[Advantageous Effects]

[0028] According to the embodiment of the present invention, by forming a one-way bending portion that is bent only in an opposite direction to the ground or a bending curved portion that is concave in the opposite direction to the ground in a sole structure behind a ground support boundary line of a front portion or behind a metatarsophalangeal joint, it is possible to improve stability of walking when walking in high-heeled shoes by limiting flexion of the metatarsophalangeal joint during a swing phase and maintaining stability of a foot during a stance phase or standing.

[0029] In addition, according to the embodiment of the present invention, movement of a sole structure coincides with extension movement of a metatarsophalangeal joint and adduction movement and inversion movement of a heel, by a bending portion formed in the sole structure at a rear side of a metatarsophalangeal joint or a ground support boundary line during heel off and toe-off while walking, thereby stably and comfortably walking.

[Description of the Drawings]

[0030]

FIG. 1 illustrates a skeleton of a foot for explaining the terms used in an embodiment of the present invention.

FIG. 2 illustrates a side view of a skeleton of a foot and high-heeled shoes in a state of wearing high-heeled shoes for explaining the terms used in an embodiment of the present invention.

FIG. 3 illustrates inversion and eversion in foot movement.

FIG. 4 illustrates adduction and abduction in foot movement.

FIG. 5 illustrates plantarflexion and dorsiflexion in the foot movement.
FIG. 6 illustrates a stance phase classified into five stages for explaining a general human gait cycle.
FIG. 7 illustrates a state of heel off while walking barefoot.
FIG. 8 illustrates a state of toe off while walking barefoot.
FIG. 9A (a) to (c) illustrate directionalities of bending in a flexible plate structure.
FIG. 9A (d) to (f) illustrate directionalities of bending in a flexible plate structure.
FIG. 10 illustrates a high-heeled shoe for explaining a first embodiment of the present invention.
FIG. 11 illustrates an exploded view of main portions of the high-heeled shoe of FIG. 10.
FIG. 12 illustrates a perspective view of a sole structure of the first embodiment of the present invention.
FIG. 13 illustrates a side view of FIG. 12.
FIG. 14 illustrates a cross-sectional view taken along line XIV-XIV of FIG. 12.
FIG. 15 illustrates a cross-sectional view taken along line XV-XV of FIG. 12.
FIG. 16 illustrates processes in which a bending portion acts in a state of wearing high-heeled shoes to which the first embodiment of the present invention is applied.
FIG. 17 illustrates movement of a sole structure corresponding to movement of a heel when a foot is viewed from a rear thereof as compared with that of the prior art, when wearing high-heeled shoes to which the first embodiment of the present invention is applied.
FIG. 18 illustrates a perspective view of a sole structure of a second embodiment of the present invention.
FIG. 19 illustrates a cross-sectional view taken along line XIX-XIX of FIG. 18.
FIG. 20 illustrates a cross-sectional view taken along line XX-XX of FIG. 18.
FIG. 21 illustrates a case in which an auxiliary member (Sb) is attached in the second embodiment of the present invention.
FIG. 22 illustrates a sole structure for explaining a third embodiment of the present invention.
FIG. 23 illustrates a sole structure for explaining a fourth embodiment of the present invention.
FIG. 24 illustrates a side cross-sectional view of a foot skeleton and a main structure of a shoe in a state of wearing conventional high-heeled shoes.
FIG. 25 illustrates a last and a sole structure used to manufacture conventional high-heeled shoes.
FIG. 26 illustrates a state of an extension of metatarsophalangeal joints in a state of wearing conventional high-heeled shoes.
FIG. 27 illustrates a drawing for explaining a problem in conventional high-heeled shoes.

[Mode for Invention]

[0031] The present invention will be described more fully hereinafter with reference to the accompanying drawings, in which embodiments of the invention are shown. As those skilled in the art would realize, the described embodiments may be modified in various different ways, all without departing from the spirit or scope of the present invention. In order to clearly describe the present invention, portions that are irrelevant to the description are omitted, and identical or similar constituent elements throughout the specification are denoted by the same reference numerals.

[0032] FIG. 1 illustrates a top plan view of a skeleton structure of a foot for explaining an embodiment of the present invention, and FIG. 2 illustrates a side view of a skeleton of a foot in a state of wearing high-heeled shoes.

[0033] The terms used in the description of an embodiment of the present invention will be defined as follows.

[0034] Anterior (A) (or distal) means a direction of a toe, and posterior (P) (or proximal) means an opposite direction of the toe, that is, a direction of a heel of a foot. Medial (M) means a direction toward a center of a body, and lateral (L) means an opposite direction of the center of the body. Superior (S) (or dorsal) means a direction of an instep, and inferior (I) (or plantar) means an opposite direction of the instep, that is, a direction toward the ground.

[0035] In addition, a longitudinal axis (LA) of a foot means a length direction of the foot. A transverse axis (TA) means a line connecting the first metatarsophalangeal joint (MTP1) and the fifth metatarsophalangeal joint (MTP5) while intersecting with the longitudinal axis (LA).

[0036] A metatarsophalangeal joint (MTP) means a joint between metatarsal bones (MTB) and proximal phalanx (PP).

[0037] A forefoot FF means an anterior portion based on a tarsometatarsal joint (TMT). A midfoot MF means between a tarsometatarsal joint (TMT) and a transverse tarsal joint (TT). A rearfoot (RF) means a posterior portion of the transverse tarsal joint (TT).

[0038] Heads of metatarsal bones (MTBH) mean head portions of the metatarsal bones (MTB). The head of the first metatarsal bone (MTBH1), the head of the fifth metatarsal bone (MTBH5), and the heel are areas in which a body weight is loaded on the ground while standing or walking.

[0039] FIG. 3 illustrates movement of inversion and eversion of heel movement for explaining an embodiment of the present invention. The inversion of the heel of the foot means twisting movement of the foot inward based on a midline of the body (which is indicated by a left arrow of an imaginary line in FIG. 3 (a)). The eversion of the heel of the foot means twisting movement of the foot outward based on the midline of the body (which is indicated by a right arrow of an imaginary line in FIG. 3 (c)). In FIG. 3, reference symbol AH denotes an axis of a heel.

[0040] FIG. 4 illustrates movement of adduction and abduction of a foot for explaining an embodiment of the present invention. Among the movement of the foot, the adduction means movement in which the foot approaches inwardly based on the midline of the human body (which is indicated by a right arrow of an imaginary line in FIG. 4). Among the movement of the foot, the abduction means movement in which the foot moves outwardly based on the midline of the human body (which is indicated by a left arrow of an imaginary line in FIG. 4). The inversion and eversion are rotational movements, whereas the adduction and abduction are linear movements.

[0041] FIG. 5 illustrates movement occurring in the metatarsophalangeal joint (MTP) of the foot for explaining an embodiment of the present invention. The extension of the metatarsophalangeal joint (MTP) means movement in which the toe is bent upward (which is indicated by an upward arrow of an imaginary line in FIG. 5). When wearing high-heeled shoes, the metatarsophalangeal joint (MTP) is always in an extended state due to the shape of the shoe. The flexion of the metatarsophalangeal joint (MTP) means movement in which the toe is bent downward (which is indicated by a downward arrow of an imaginary line in FIG. 5).

[0042] The movement of the foot according to the gait cycle of the human based on the bare foot will be described with reference to FIG. 6.

[0043] In FIG. 6, (a) to (e) are schematic views for explaining the human gait cycle.

[0044] The human gait cycle is divided into a stance phase and a swing phase based on one foot (hatched portions in the drawing).

[0045] The stance phase is a state in which a portion of the foot contacts the ground while walking. The stance phase may be divided into five stages: heel strike, loading response, midstance, heel off, and toe off.

[0046] The heel strike refers to the moment when the heel comes into contact with the ground. The loading response is a stage in which the entire sole of the foot comes into contact with the ground after the heel strike.

[0047] The heel strike and loading response are processes of absorbing impact from the ground and distributing the body weight (shown in FIG. 6 (a) and (b)). The midstance is a stage in which the body weight is maximally loaded on the foot while the leg is vertical on the ground (shown in FIG. 6 (c)). The heel off is a stage in which the heel of the foot leaves the ground (shown in FIG. 6 (d)). The toe off is a stage in which the toes leave the ground (shown in FIG. 6 (e)).

[0048] On the other hand, the swing phase refers to a state in which the foot is away from the ground. During the swing phase, there should be sufficient toe clearance. That is, when the toe is not dragged or caught on the ground, the risk of a fall is reduced and stable walking is achieved. The gait is realized by repeatedly performing the stance phase and the swing phase.

[0049] FIG. 7 (a) illustrates a side view of a heel off state during walking barefoot, and FIG. 7 (b) illustrates a rear view of a heel off state viewed in a rear side (heel side) during walking barefoot.

[0050] Since the heel leaves the ground after the midstance, movement of the heel occurs based on the front foot in contact with the ground. In the stage of the heel off, the body weight is loaded on the ground by contacting the ground from the heads of metatarsal bones (MTBH) to toes.

[0051] In the heel off state of the barefoot, the extension (movement in a direction of an imaginary arrow line in FIG. 7 (a)) of the metatarsophalangeal joints (MTP) occurs as the heel leaves the ground.

[0052] In addition, at the same time, the inversion (movement in a direction of an imaginary curved arrow line (i) in FIG. 7 (b)) that is movement in which the heel rotates inward, and the adduction (movement in a direction of an imaginary straight arrow line (a) in FIG. 7 (b)) that is movement inwardly closer, occur.

[0053] FIG. 8 (a) illustrates a side view of a toe off state during walking barefoot, and FIG. 8 (b) illustrates a rear view of a toe off state viewed in a rear side (heel side) during walking barefoot.

[0054] In the stage of the toe off, as the heads of metatarsal bones (MTBH) leaves the ground, the body weight is loaded on the ground only through the toes.

[0055] As shown in FIG. 8, during the toe off, as the metatarsophalangeal joint (MTP) is further extended, the inversion and adduction of the heel are maximized.

[0056] FIG. 9A (a) to (f) and FIG. 9B (a) to (f) illustrate directionalities of bending in a flexible plate structure.

[0057] As shown in FIG. 9A (a), since the flexible flat plate without a curve has no direction for bending, it is easily bent both upward and downward along the longitudinal plane LP and the transverse plane TP.

[0058] FIG. 9A (b) is a drawing for explaining that when a curve is given along one axis (zero Gaussian curvature), bending is restricted along an axis that intersects it. As shown in FIG. 9A (b), when a concave curve is given upward along the transverse plane TP, bending at the longitudinal plane LP intersecting with it is limited, and particularly downward bending is the most limited.

[0059] FIG. 9A (c) and 9B (d) are drawings for explaining the direction of bending when curves are given along two intersecting axes.

[0060] As shown in FIG. 9A (c), when the curve direction (concave upward) along the transverse plane TP and the curve direction (concave downward) along the longitudinal plane LP are opposite (negative Gaussian curvature), both the upward and downward bending with respect to the longitudinal and transverse planes are limited. In contrast, as shown in FIG. 9B (d), when the curve directions with respect to two axes are the same (positive Gaussian curvature), and for example, when both the longitudinal plane LP and the transverse plane TP are concave upward, downward bending is limited in both the longitudinal plane LP and the transverse plane TP.

[0061] FIG. 9B (e) is a drawing for explaining that the sharper the curved shape, the more restrictive the bending in the opposite direction to the curved direction at the axis intersecting the curve axis. As shown in FIG. 9B (e), the sharper the curve concave upward along the transverse plane TP, that is, the larger the curvature, the downward bending in the longitudinal plane LP intersecting it is more limited.

[0062] FIG. 9B (f) is a drawing viewed by, as in FIG. 9b (e), making the curvature of the transverse plane TP larger than that of the longitudinal plane LP, and in the curvature of the transverse plane TP, making a curvature rL of the outer portion thereof larger than a curvature rM of an inner portion thereof, then cutting it into the transverse plane TP. Since the curve of the outer portion is sharper than the inner portion, the downward bending in the longitudinal plane LP is more limited at the outer portion compared with the inner portion.

[0063] The curvature of the curved line is expressed as a curvature at a point on the curved line. Therefore, a curvature value of a two-dimensional plane curve may be compared with a curvature value of a point having a maximum curvature value in each plane curve. Alternatively, it may also be compared with an average of the curvature values at all points on the curve.

[0064] FIG. 10 illustrates a high-heeled shoe for explaining a first embodiment of the present invention, and FIG. 11 illustrates an exploded view of main portions of the high-heeled shoe of FIG. 10.

[0065] The high-heeled shoe of the first embodiment of the present invention includes a foot fixing portion 1, an insole 3, a sole structure 5, an outsole 7, and a heel 9.

[0066] The foot fixing portion 1 is a portion that may wrap the foot, forms a shape of the shoe, and is made of leather, etc. In addition, the insole 3 is a portion that is in direct contact with the sole of the foot. The sole structure 5 may support a load of a pedestrian, and simultaneously, maintain a shape of the shoe. In addition, the insole 3 may be coupled to an upper side of the sole structure 5. The outsole 7 is coupled to a lower portion of the sole structure 5, and a front side thereof directly contacts the ground. The heel 9 is coupled to the sole structure 5 to support a load of the heel of the foot.

[0067] The sole structure 5 of the embodiment of the present invention is a sole that supports a body weight in the high-heeled shoe and serves as a frame of the shoe, and it may be referred to by a term such as a midsole or inner sole.

[0068] FIG. 12 illustrates a perspective view of the sole structure 5 of the first embodiment of the present invention, and FIG. 13 illustrates a side view of FIG. 12. Longitudinal lines 5a and transverse lines 5b indicated by imaginary lines in FIG. 12 are projections of grid lines on the sole structure 5 to represent a curvature of the sole structure 5. The longitudinal lines 5a shown in FIG. 12 are lines projected on the sole structure 5 in a vertical direction toward the ground, and are lines parallel to a longitudinal axis LA of the foot. The transverse lines 5b shown in FIG. 12 are lines projected on the sole structure 5 in a direction perpendicular to a straight line AB (shown in FIG. 13), and are lines parallel to a transverse axis TA of the foot. The straight line AB shown in FIG. 13 is a line connecting a rear end point PA of the sole structure 5 and a rear end point PB of a front portion 11 supported on the ground, and is a straight line parallel to the longitudinal axis of the foot. These longitudinal lines 5a and transverse lines 5b form a grid line, and they are projections of the grid line.

[0069] The sole structure 5 of the first embodiment of the present invention includes, as shown in FIG. 12 and FIG. 13, the front portion 11, a bending portion 13, and a rear portion 15.

[0070] The front portion 11 is a portion in which the front side of the high-heeled shoe is supported on the ground during the loading response.

[0071] The first embodiment of the present invention will be described by illustrating an example in which the front portion 11 has a size that covers only some of the portion supported on the ground. In the sole structure 5 of the first embodiment of the present invention, when the front portion 11 is formed to have a size that covers only some of the portion supported on the ground, as shown in FIG. 11, separate auxiliary members Sb1 and Sb2 may be attached to the front portion 11.

[0072] The front portion 11 may include a ground support boundary line BL having a round-shaped boundary concave toward the front when a rear portion of the front portion 11 extending to the bending portion 13 is viewed in a plan view.

[0073] The ground support boundary line BL of the front portion 11 allows the front portion 11 to be firmly supported on the ground, thereby improving the stability of walking during the stance phase. In addition, the front portion 11 is limited in bending due to the shape of the ground support boundary line BL, so that the shape of the shoe may be maintained.

[0074] The bending portion 13 may include a one-directional bending portion that is bent only in a direction opposite to the ground, or a bending curved portion that forms a concave curve in an opposite direction to the ground.

[0075] The bending portion 13 preferably extends from the ground support boundary line BL of the front portion 11 to be positioned at the rear side of the metatarsophalangeal joint (MTP). In other words, the bending portion 13 is preferably positioned at the heel side based on the ground support boundary line BL of the front portion 11. That is, the bending portion 13 may be positioned between the ground support boundary line BL of the front portion 11 and a boundary line (indicated by dotted lines in FIG. 13 and FIG. 15) formed by the midfoot MF and the forefoot FF.

[0076] The bending portion 13 may be formed of the bending curved portion, so that the bending may be limited in the direction toward the ground, and may be flexibly bent in the direction opposite to the ground. That is, the bending portion 13 may be bent in one direction toward the direction opposite to the ground.

[0077] It is preferable that the bending portion 13 is formed of the bending curved portion that forms a concave curve in the direction opposite to the ground. Accordingly, in the bending portion 13, longitudinal lines 13a (imaginary lines indicated in the longitudinal direction in FIG. 12) parallel to a longitudinal center line 13ac of the bending portion, and transverse lines 13b (imaginary lines indicated in the width direction in FIG. 12) parallel to a transverse center line 13bc of the bending portion, have a curvature concave in the direction opposite to the ground. In the description of the first embodiment of the present invention, the longitudinal center line 13ac of the bending portion is a center line passing through the longitudinal axis (LA) of the foot in the bending portion 13, and the transverse center line 13bc of the bending portion is a center line that passes through a central portion of the bending portion 13 in the width direction thereof while being parallel to the transverse axis (TA) of the foot.

[0078] It is preferable that a curvature r2 of the transverse center line 13bc of the bending portion is larger than a curvature r1 of the longitudinal center line 13ac of the bending portion. Since the curvature refers to an instantaneous change rate of a slope of a tangent line of a point that moves along a curved line at a constant speed, a curvature of a plane curve is expressed as a curvature at a point on the curve. Therefore, in the description of the present invention, "the curvature r2 of the transverse center line 13bc of the bending portion is larger than the curvature r1 of the longitudinal center line 13ac of the bending portion" means that a curvature value of a point having a maximum curvature value at the transverse center line 13bc of the bending portion is larger than a curvature value of a point having a maximum curvature value at the longitudinal center line 13ac of the bending portion. Alternatively, it means that an average of the curvature value of the transverse center line 13bc of the bending portion is larger than an average of the curvature value of the longitudinal center line 13ac of the bending portion. In addition, in comparing the curvature values, a boundary portion of the bending portion 13, particularly a boundary portion with the front portion 11 or curvature values at both ends, are substantially excluded.

[0079] As described above, when the curvature r2 of the transverse center line 13bc of the bending portion is larger than the curvature r1 of the longitudinal center line 13ac of the bending portion, as described in FIG. 9B (e), the bending downward along the longitudinal axis is further limited. The bending portion 13 is bent concave in the opposite direction to the ground during the heel off and toe off after the midstance, and the bending in the ground direction is limited. In other words, the bending portion 13 is bent in the same direction as the movement of the extension of the metatarsophalangeal joint (MTP), while the bending portion 13 is limited to be bent in the same direction as the movement of the flexion of the metatarsophalangeal joint (MTP).

[0080] The bending portion 13 has the flexibility to be bent in the same direction as the movement of the extension of the metatarsophalangeal joint (MTP) during the heel off and toe off after the midstance while walking. Therefore, like walking with bare feet, even when wearing high-heeled shoes, a pedestrian may naturally walk during the heel off and toe off.

[0081] In addition, as the bending portion 13 is bent in the same direction as the bare foot movement during the heel off and toe off while walking, since the rear portion 15 also moves upward, so that the heel rises, and the bending portion 13 serves to prevent the heel from coming out of the foot fixing portion 1.

[0082] When a wearer wears the high-heeled shoes, the plantar fascia (PF) is tautly pulled, so that force to flex the metatarsophalangeal joint (MTP) is generated (shown in FIG. 26). Particularly, during the swing phase, since the sole of the shoe is off the ground, the front end of the shoe may be bent toward the ground by the flexion of the metatarsophalangeal joint (MTP).

[0083] Since the bending portion 13 of the present invention is limited to be bent in the ground direction during the swing phase, the flexion of the metatarsophalangeal joint (MTP) is also limited. Therefore, sufficient toe clearance is provided during the swing phase, so that the tip of the shoe is not dragged or caught on the ground, resulting in stable walking.

[0084] Meanwhile, inner and outer edge portions of the bending portion 13 may form support reinforcing portions 13e and 13f further extending to the front portion 11 and both sides of the ground support boundary line BL. Since the support reinforcing portions 13e and 13f of the bending portion 13 extend upward from both sides of the round-shaped ground support boundary line BL, they may allow concave bending in the opposite direction to the ground, but may further limit bending in the ground direction.

[0085] Therefore, the sole structure 5 of the present invention allows more easily the extension of the metatarsophalangeal joint (MTP) during the heel off and toe off. In addition, the sole structure 5 of the present invention may further limit the flexion of the metatarsophalangeal joint (MTP) during the swing phase. Therefore, a pedestrian wearing the high-heeled shoes may walk with more stability.

[0086] As described above, since the sole structure 5 of the present invention has a simple structure, it is possible to reduce production cost. That is, the sole structure 5 of the present invention may secure the movement of the extension of the metatarsophalangeal joint (MTP) during the heel off and toe off after the midstance, as much as possible. At the same time, the sole structure 5 of the present invention has a structure that limits the movement of the flexion of the metatarsophalangeal joint (MTP) during the swing phase, and has a simple structure, so that it may be easily applied to high-heeled shoes, and it is possible to reduce the manufacturing cost.

[0087] FIG. 14 is a drawing viewed from the front of a transverse cross-section of the bending portion 13 in the first embodiment, wherein the curvature r2 of the transverse center line 13bc of the bending portion is divided into a curvature r3 of an outer portion 13c and a curvature r4 of an inner portion 13d. FIG. 15 is a drawing taken along the longitudinal axis of the sole structure 5 in the first embodiment.

[0088] In the bending portion 13 of the first embodiment of the present invention, it is preferable that the curvature r3 of the outer portion 13c is larger than the curvature r4 of the inner portion 13d. The bending portion 13 means that the inner portion 13d is more flexible than the outer portion 13c.

[0089] After the midstance, the heel 9 of the shoe leaves the ground, so that only the front portion 11 of the sole structure 5 contacts the ground, and the weight is loaded on the ground through the front portion 11 of the sole structure 5. Therefore, during the heel off and toe off, movement occurs in the remaining rear portion of the sole structure 5 while the front portion 11 is fixed to the ground. That is, a direction of movement of the rear portion 15 is determined by a difference in flexibility between the inner portion 13d and the outer portion 13c in the bending portion 13.

[0090] Therefore, in the sole structure 5 of the present invention, during the heel off and toe off in the gait cycle, the rear portion 15 extending rearward from the bending portion 13 rises upward (in a direction of an imaginary arrow line in FIG. 15) based on the front portion 11, and simultaneously, it is twisted (an imaginary curved arrow line in FIG. 14) and moved in the inward (M) direction (an imaginary straight arrow line in FIG. 14). Accordingly, during the heel off and toe off of the gait cycle, the rear portion 15 moves in the same direction as the inversion and adduction direction of the heel. In other words, in the bending portion 13 having the structure in which the curvature r3 of the outer portion 13c is larger than the curvature r4 of the inner portion 13d, even when a pedestrian wears the high-heeled shoes, the rear portion 15 of the sole structure 5 may move in the same direction as the movement of the heel. Therefore, the pedestrian wearing the high-heeled shoes to which the sole structure 5 of the present invention is applied may walk with more stability.

[0091] The rear portion 15 is a portion that may extend from the bending portion 13 to the rear to support the heel. As shown in FIG. 15, it is preferable that the rear portion 15 is formed to have a concave curve in the ground direction along the longitudinal axis and a concave curve in the opposite direction to the ground along the transverse axis. The rear portion 15 of the present invention is limited in bending in all directions by reversing the curved directions in the transverse axis and the longitudinal axis. In addition, the bending of the rear portion 16 may be limited by increasing its thickness or inserting or attaching a shank made of a solid material.

[0092] When walking in a state of wearing the high-heeled shoes, the front portion 11, the bending portion 13, and the rear portion 15 allow the sole structure 5 to be bent corresponding to the three-dimensional movement of the sole, so that stable walking may be realized. In addition, the sole structure of the present invention may be processed with a synthetic resin material of the same material, thereby reducing manufacturing cost.

[0093] FIG. 16 is a drawing for explaining a process in which the bending portion 13 acts when walking while wearing the high-heeled shoes to illustrate the first embodiment of the present invention.

[0094] FIG. 16 (a) illustrates a state of the heel strike in the gait cycle. FIG 16 (a) shows a state in which the bending portion 13 at the rear side of the metatarsophalangeal joint (MTP) or at the rear side of the front portion 11 is not bent in the direction of the ground. In addition, the bending portion 13 is not bent in the direction of the ground even in the swing phase. In other words, since the curvature r2 of the transverse center line 13bc of the bending portion is larger than the curvature r1 of the longitudinal center line 13ac of the bending portion, the sole structure 5 of the present invention is not bent toward the ground during the heel strike and swing phase. In addition, in the sole structure 5 of the present invention, the bending portion 13 and the front portion 11 are more limited to be bent in the direction of the ground in the heel strike and swing phase by the support reinforcing portions 13e and 13f of the bending portion 13. In other words, when walking in the high-heeled shoes to which the sole structure 5 of the present invention is applied, as the plantar fascia is pulled, force is generated that causes the toes to flex toward the ground, but due to the action of the bending portion 13, the bending portion 13 and the front portion 11 are prevented from being bent in the direction of the ground.

[0095] Therefore, the sole structure 5 of the first embodiment of the present invention enables stable walking by maintaining the extension of the metatarsophalangeal joint during the swing phase and the heel strike.

[0096] In addition, in the bending portion 13, the front portion 11 supports the ground during the loading response immediately after the heel strike, and in this case, bending is limited as well.

[0097] FIG. 16 (b) illustrates a state of the midstance in the gait cycle. FIG. 16 (b) illustrates a state in which the front portion 11 supports the ground. The bending portion 13 is not bent in the midstance period as in the swing phase and the heel strike.

[0098] FIG. 16 (c) illustrates a state of the heel off in the gait cycle. FIG 16 (c) shows a state in which the bending portion 13 at the rear of the metatarsophalangeal joint (MTP) or at the rear of the front portion 11 supported on the ground is bent in the opposite direction to the ground. During the heel off, the heel leaves the ground, but the body weight is continuously loaded onto the ground through the heads of metatarsal bones (MTBH). Accordingly, the front portion 11 positioned in front of the ground support boundary line BL contacts the ground to not be bent, but the bending portion 13 positioned in the rear of the ground support boundary line BL is bent.

[0099] The bending portion 13 of the present invention is bent while forming a concave curve upward during the heel off because the curved directions with respect to the longitudinal axis and the transverse axis are the same. In addition, the bending portion 13 is further limited in bending toward the ground along the longitudinal axis crossing the transverse axis, by the structure in which the curvature r2 of the transverse center line 13bc of the bending portion is larger than the curvature r1 of the longitudinal center line 13ac of the bending portion during the heel off.

[0100] In addition, the rear portion 15 moves corresponding to the movement of inversion and adduction of the heel, by the structure in which in the transverse center line 13bc of the bending portion, the curvature r3 of the outer portion 13c is larger than the curvature r4 of the inner portion 13d. Accordingly, the sole structure 5 of the first embodiment of the present invention is bent in the same direction as the movement of the extension of the metatarsophalangeal joint (MTP) similar to walking in bare feet, and at the same time, is bent in the same direction as the movement of the inversion and adduction of the foot. Therefore, according to the first embodiment of the present invention, walking with stability is realized even when walking with the high-heeled shoes.

[0101] In addition, according to the sole structure 5 of the first embodiment of the present invention, as the bending portion 13 is easily bent in the direction opposite to the ground, the rear portion 15 moves in the same direction as the movement of the heel, thereby preventing the shoe from being separated from the heel.

[0102] FIG. 17 is a drawing comparing the movements of the sole structure 5 corresponding to the movements of the heels viewed from the rear of the foot when the conventional high-heeled shoe and the high-heeled shoe of the first embodiment of the present invention are worn.

[0103] FIG. 17 (a) shows a state in which the sole structure of the shoe and the heel leave each other, when the movement of the inversion and adduction of the heel occurs during the heel off in the state of wearing the conventional high-heeled shoes. During the heel off, the heel 9 leaves the ground, so that the heel and the rear portion 15 of the sole structure differently move based on the ground (G). The conventional sole structure lacks flexibility, and it is only upwardly bent even if it is bent, so that the heel movement and the sole structure movement do not coincide. That is, as shown in FIG. 17 (a), an axis AH of the heel does not coincide with an axis AHS of the heel 9.

[0104] On the other hand, FIG. 17 (b) shows that the rear portion 15 of the sole structure 5 moves in the same direction as the heel movement during the heel off in the state of wearing the high-heeled shoes of the first embodiment of the present invention. The rear portion 15 of the first embodiment of the present invention easily upwardly moves by the action of the bending portion 13 of the first embodiment described above, and at the same time, it rotates and moves in the inward direction corresponding to the movements of the inversion (an imaginary curved arrow line (i) in FIG. 17 (b)) and the adduction (an imaginary straight arrow line (a) in FIG. 17 (b)) of the heel. Therefore, the axis AH of the heel and the axis AHS of the heel 9 coincide with each other, thereby improving the stability of walking.

[0105] FIG. 18 is a drawing for explaining a second embodiment of the present invention. FIG. 19 is a cross-sectional view of the bending portion 13 of the sole structure 5 of FIG. 18 taken along the transverse center line. FIG. 20 is a cross-sectional view of the sole structure 5 of FIG. 18 taken along the longitudinal center line. FIG. 21 is a drawing of an example in which an auxiliary member Sb is attached in the second embodiment. Compared with the first embodiment of the present invention, a feature of the second embodiment of the present invention that is different from the first embodiment will be mainly described, and a description of the same feature as that of the first embodiment follows that of the first embodiment.

[0106] In the sole structure 5 of the second embodiment of the present invention, in order to further enhance the one-way flexibility of the bending portion 13 and in order that bending degrees of an inner portion 13h (medial side portion) and an outer portion 13i (lateral side portion) are different, at least one bending adjustment groove 13g may be provided in the bending portion 13.

[0107] In the second embodiment of the present invention, an example provided with one bending adjustment groove 13g will be illustrated and described.

[0108] The sole structure 5 of the second embodiment of the present invention may further enhance the one-way flexibility of the bending portion 13 by providing the bending adjustment groove 13g in a center of the bending portion 13 to reduce a thickness thereof. In other words, the bending portion 13 may be configured so that a thickness T1 of a center portion thereof is thinner than thicknesses T2 and T3 of edges thereof. In addition, the bending portion 13 may be configured so that, by making the thickness T2 of the inner edge thinner than the thickness T3 of the outer edge, it more smoothly corresponds to the inversion and adduction movements of the heel during the heel off and the toe off. In the first embodiment of the present invention described above, the example in which the boundary portion BL between the front portion 11 and the bending portion 13 is formed of the round-shaped line has been described, but in the boundary portion between the front portion 11 and the bending portion 13 of the second embodiment of the present invention, the front portion 11 and the bending portion 13 may be connected by a smooth curved surface.

[0109] In addition, as shown in FIG. 20, the front portion 11 may be configured to have a thickness that is gradually thinner toward the front side. In this case, as shown in FIG. 21, even if the auxiliary member Sb is attached to the lower side of the front portion 11, a step difference occurring at a boundary portion between the front portion 11 and the auxiliary member Sb may be minimized. Therefore, it is possible to reduce manufacturing processes of high-heeled shoes by omitting a separate auxiliary member. In addition, the auxiliary member Sb may be made of a material used for the portion of the conventional sole structure supported on the ground, and may be implemented in various designs according to a size or shape of a pedestrian's foot.

[0110] FIG. 22 illustrates the sole structure 5 for explaining a third embodiment of the present invention. Compared with the sole structure 5 of the first embodiment, a feature of the third embodiment of the present invention that is different from the first embodiment will be described, and a description of the same feature as that of the first embodiment follows that of the first embodiment.

[0111] In the third embodiment of the present invention, when the front portion 11 extends in the toe direction, that is, forward, it may cover the entire support portion. That is, in the third embodiment of the present invention, the front portion 11 and the auxiliary member Sb are integrally configured, compared with the first embodiment. That is, according to the third embodiment of the present invention, the number of parts may be reduced by manufacturing the sole structure 5 in one process by omitting the auxiliary member Sb.

[0112] FIG. 23 is a drawing for explaining a fourth embodiment of the present invention, showing the sole structure 5. Compared with the above-described embodiments, a feature of the fourth embodiment of the present invention that is different from the above-described embodiments will be mainly described, and a description of the same feature as those of the above-described embodiments follows that of the above-described embodiments.

[0113] In the sole structure 5 of the fourth embodiment of the present invention, in order to further enhance the one-way flexibility of the bending portion 13 and in order that bending degrees of an inner portion (medial side portion) and an outer portion (lateral side portion) are different, at least one or more bending adjustment holes 13j and 13k may be provided in the bending portion 13.

[0114] As in the case of having the bending adjustment holes 13j and 13k of the fourth embodiment of the present invention and the bending adjustment groove 13g of the second embodiment, a very large curvature value may occur at a boundary portion between the bending adjustment holes 13j and 13k or the bending adjustment groove 13g. Therefore, in comparing the curvature of the transverse center line 13bc of the bending portion and the curvature of the longitudinal center line 13ac of the bending portion, it is natural that the curvature value at this boundary portion is excluded.

[0115] According to the fourth embodiment of the present invention, it is possible to more easily bend the bending portion 13 in one direction, by forming the bending adjustment holes 13j and 13k in the bending portion 13.

[0116] In addition, in the fourth embodiment of the present invention, the size of the bending adjustment hole 13j formed in the medial side portion may be larger than the size of the bending adjustment hole 13k formed in the lateral side portion. The fourth embodiment of the present invention may allow the rear portion 15 to move corresponding to the inversion and adduction movements of the heel during the heel off and the toe off. In addition, the bending adjustment holes 13j and 13k may be formed as a plurality of small holes, and a degree of bending may be varied by forming different sizes or intervals of holes and the number of holes. The fifth embodiment of the present invention also shows that it may be configured in various ways to achieve the purpose of the present invention.

[0117] While this invention has been described in connection with what is presently considered to be practical embodiments, it is to be understood that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

Claims

1. A sole structure of a high-heeled shoe, comprising:

   a front portion supported on the ground;
   a bending portion that extends from the front portion to be positioned at a rear side of a metatarsophalangeal joint and is bent in an opposite direction to the ground; and
   a rear portion extending from the bending portion.

2. The sole structure of the high-heeled shoe of claim 1, wherein
   the bending portion includes a bending curved portion that forms a concave curve in an opposite direction to the ground.

3. The sole structure of the high-heeled shoe of claim 2, wherein
   in the bending curved portion,
   a curvature of a transverse center line of the bending portion that is parallel to a transverse axis of a foot and formed along a line crossing a longitudinal center line of the bending portion is larger than that of the longitudinal center line of the bending portion formed along a longitudinal axis of the foot.

4. The sole structure of the high-heeled shoe of claim 1, wherein
   the bending portion is concavely bent in a direction opposite to the ground during heel off and toe off in a gait cycle, and is limited to be bent in a ground direction during a swing phase in the gait cycle.

5. The sole structure of the high-heeled shoe of claim

1, wherein
the bending portion is bent during heel off and toe off in a gait cycle such that the rear portion corresponds to foot movement in inversion and adduction directions of a foot.

6. The sole structure of the high-heeled shoe of claim 3, wherein
in the transverse center line of the bending portion, a curvature of a lateral side portion is larger than that of a medial side portion.

7. The sole structure of the high-heeled shoe of claim 1, wherein
in the bending portion,
a thickness of a lateral side portion is thicker than that of a medial side portion.

8. The sole structure of the high-heeled shoe of claim 1, wherein
the bending portion includes at least one or more bending adjustment holes or bending adjustment grooves that make degrees of bending of a medial side portion and a lateral side portion different.

9. A high-heeled shoe provided with a sole structure, wherein the sole structure includes:

a front portion supported on the ground;
a bending portion that extends from the front portion to be positioned at a rear side of a metatarsophalangeal joint and is bent in an opposite direction to the ground; and
a rear portion extending from the bending portion.

10. The high-heeled shoe of claim 9, wherein
the bending portion includes a bending curved portion that forms a concave curve in an opposite direction to the ground.

11. The high-heeled shoe of claim 10, wherein
in the bending curved portion,
a curvature of a transverse center line of the bending portion that is parallel to a transverse axis of a foot and formed along a line crossing a longitudinal center line of the bending portion is larger than that of the longitudinal center line of the bending portion formed along a longitudinal axis of the foot.

12. The high-heeled shoe of claim 9, wherein
the bending portion is concavely bent in a direction opposite to the ground during heel off and toe off in a gait cycle, and is limited to be bent in a ground direction during a swing phase in the gait cycle.

13. The high-heeled shoe of claim 9, wherein
the bending portion is bent during heel off and toe off in a gait cycle such that the rear portion corresponds to foot movement in inversion and adduction directions of a foot.

14. The high-heeled shoe of claim 11, wherein
in the transverse center line of the bending portion, a curvature of a lateral side portion is larger than that of a medial side portion.

15. The high-heeled shoe of claim 9, wherein
in the bending portion,
a thickness of a lateral side portion is thicker than that of a medial side portion.

16. The high-heeled shoe of claim 9, wherein
the bending portion includes at least one or more bending adjustment hole or bending adjustment groove that makes degrees of bending of a medial side portion and a lateral side portion different.

FIG. 1

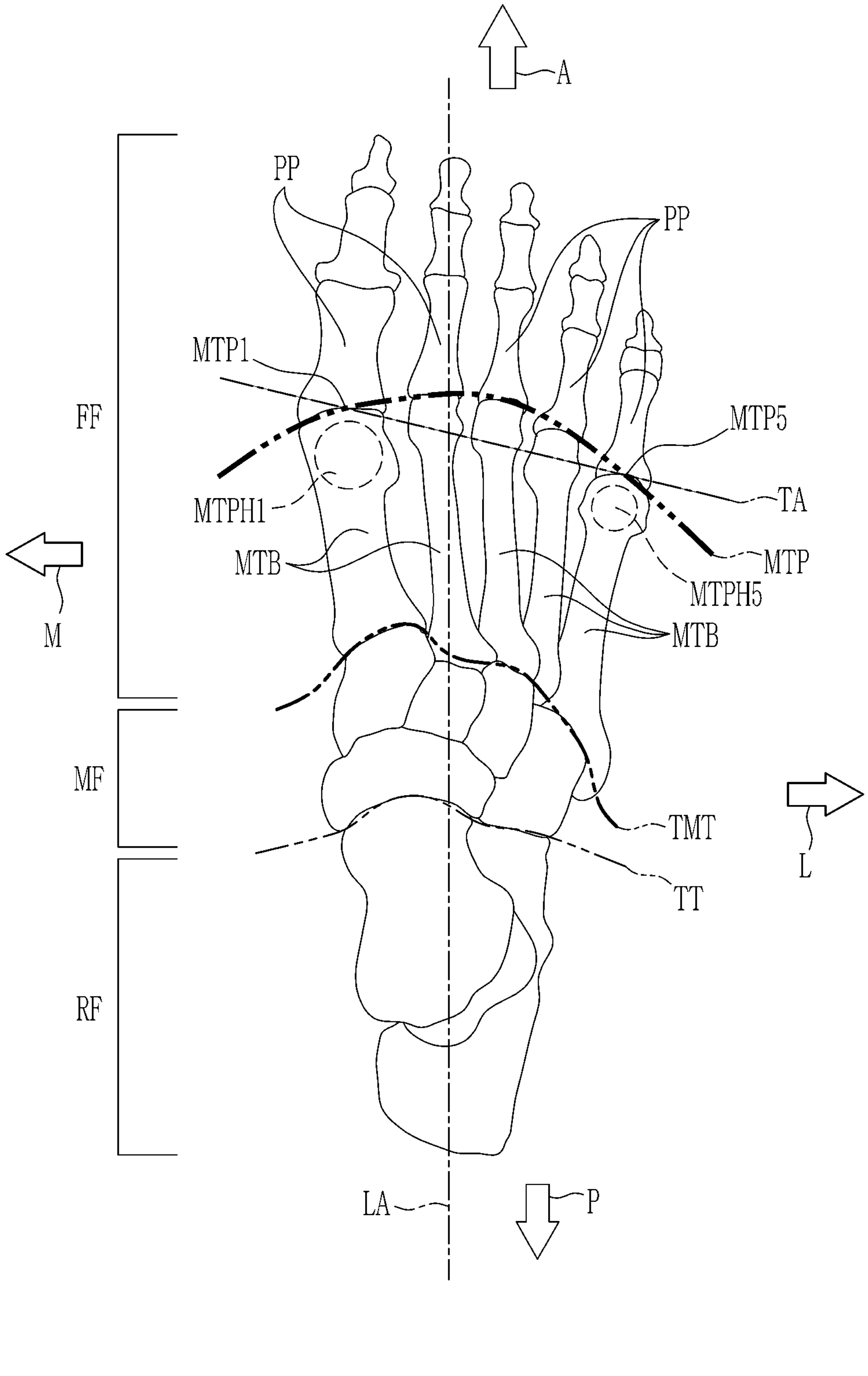

A
PP
PP
MTP1
FF
MTP5
TA
MTPH1
MTB
MTP
M
MTPH5
MTB
MF
TMT
L
TT
RF
LA
P

FIG. 2

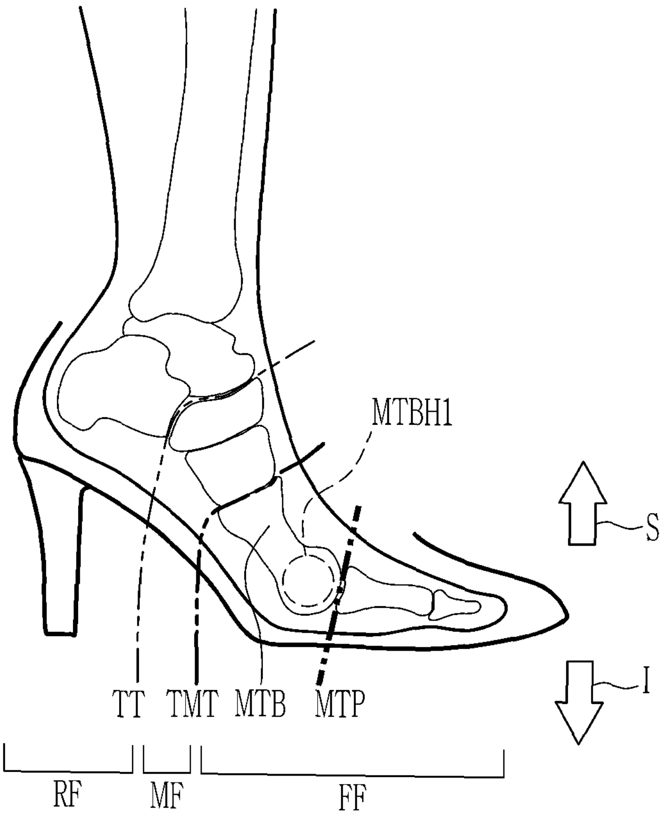


FIG. 3

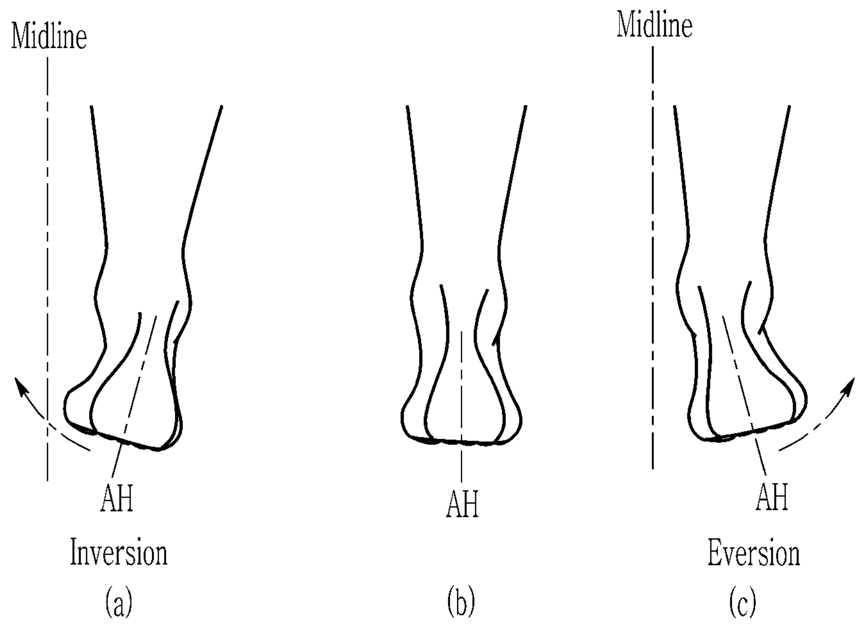


FIG. 4

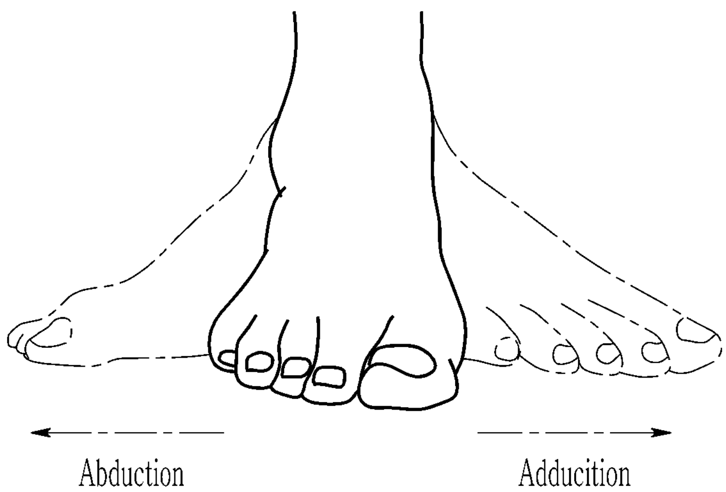


FIG. 5

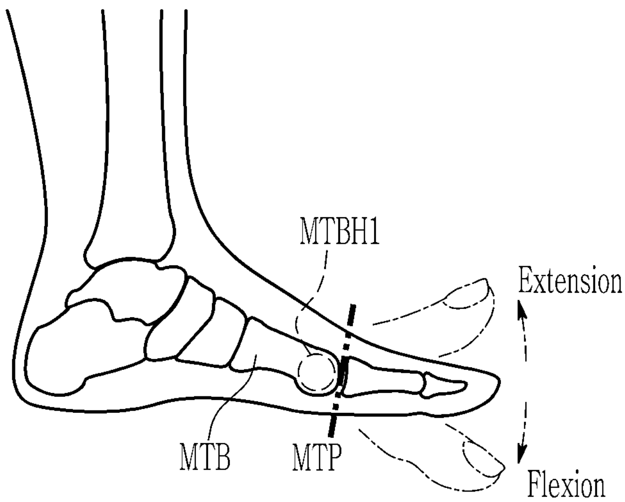


FIG. 6

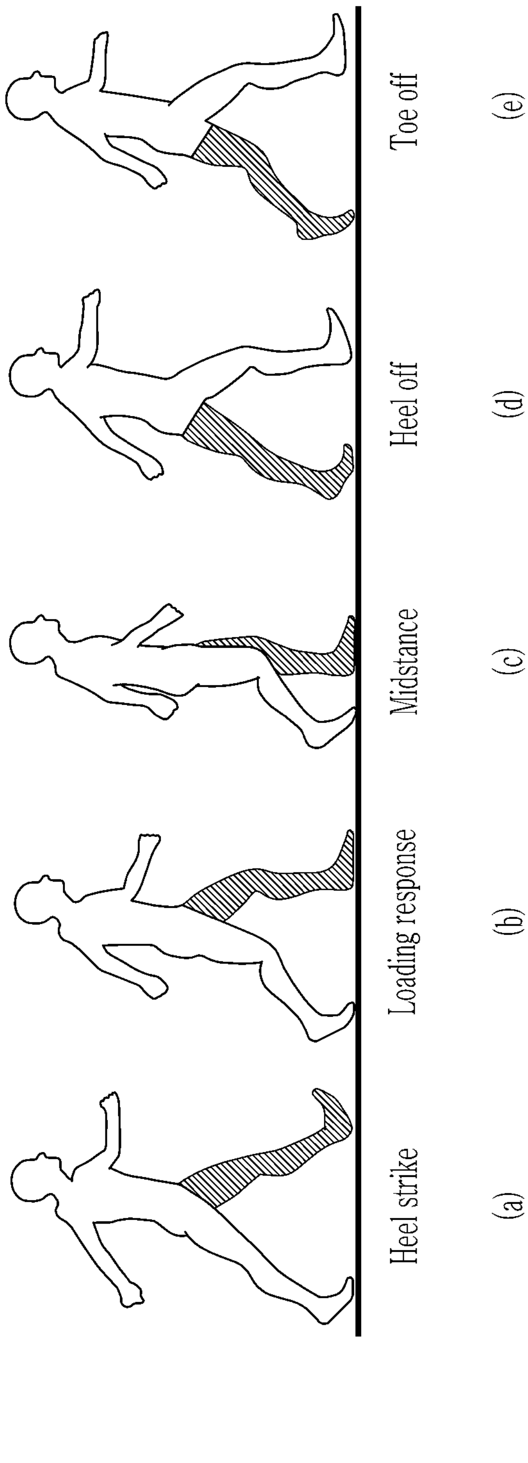

Heel strike
(a)
Loading response
(b)
Midstance
(c)
Heel off
(d)
Toe off
(e)

FIG. 7

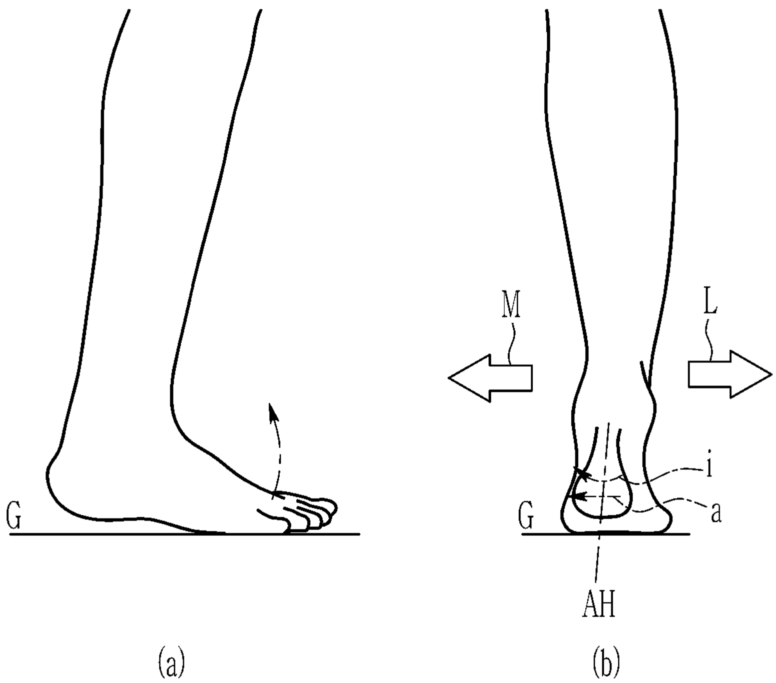


FIG. 8

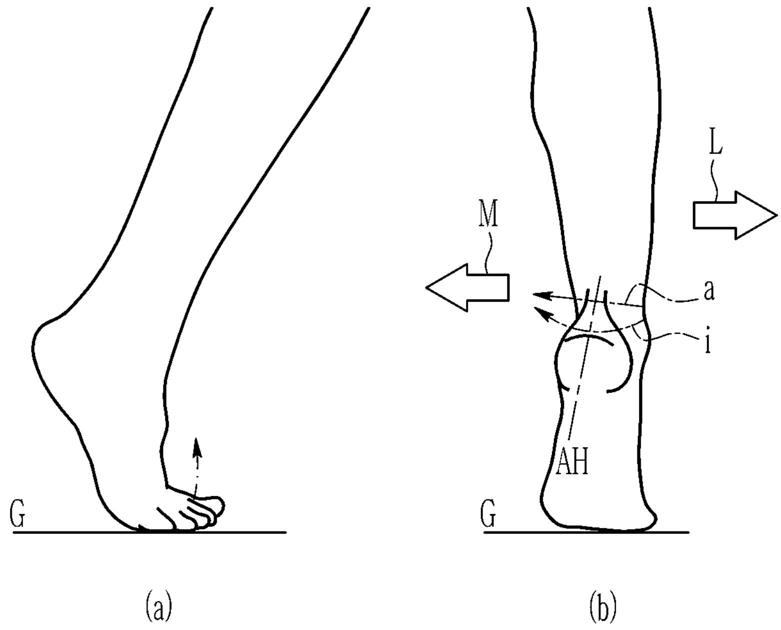


FIG. 9A

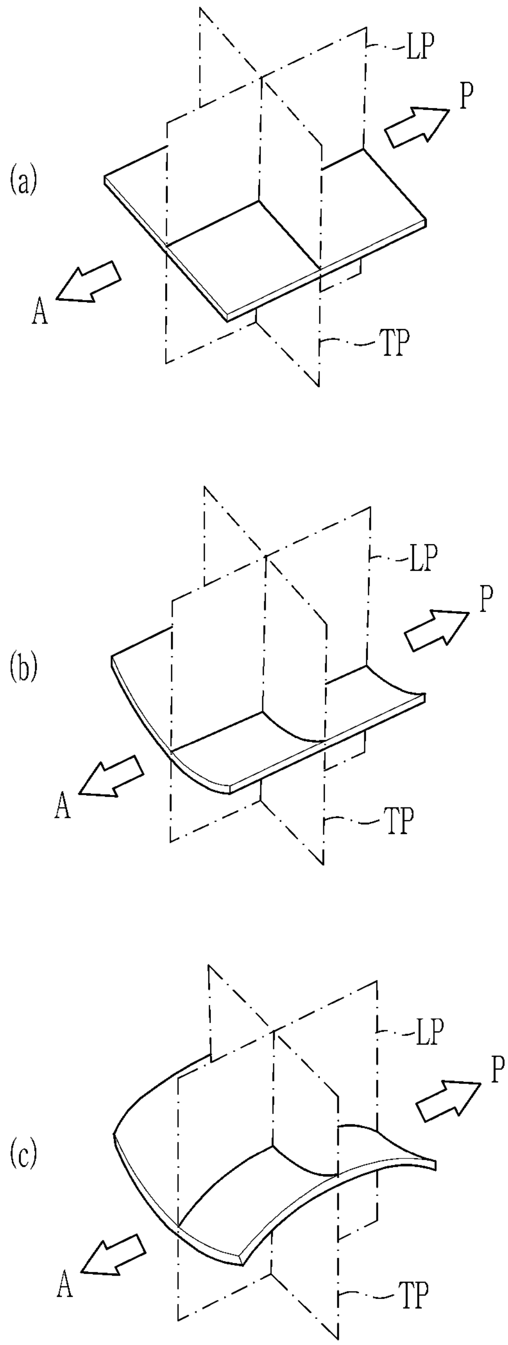


FIG. 9B

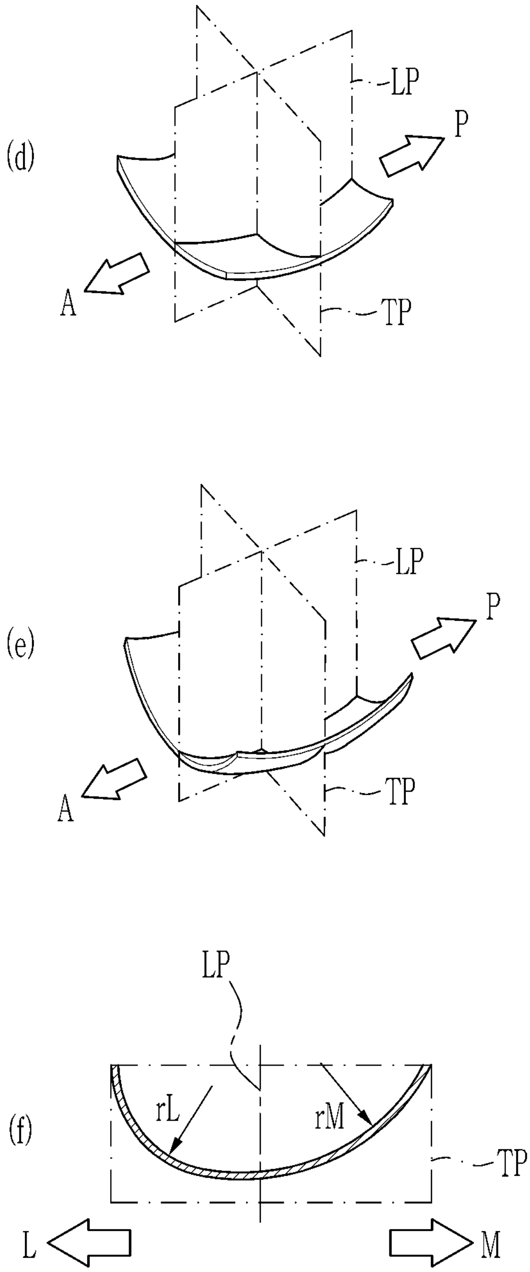


FIG. 10

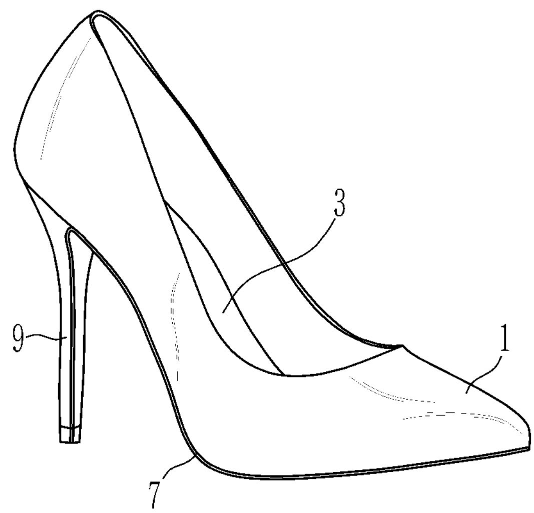


FIG. 11

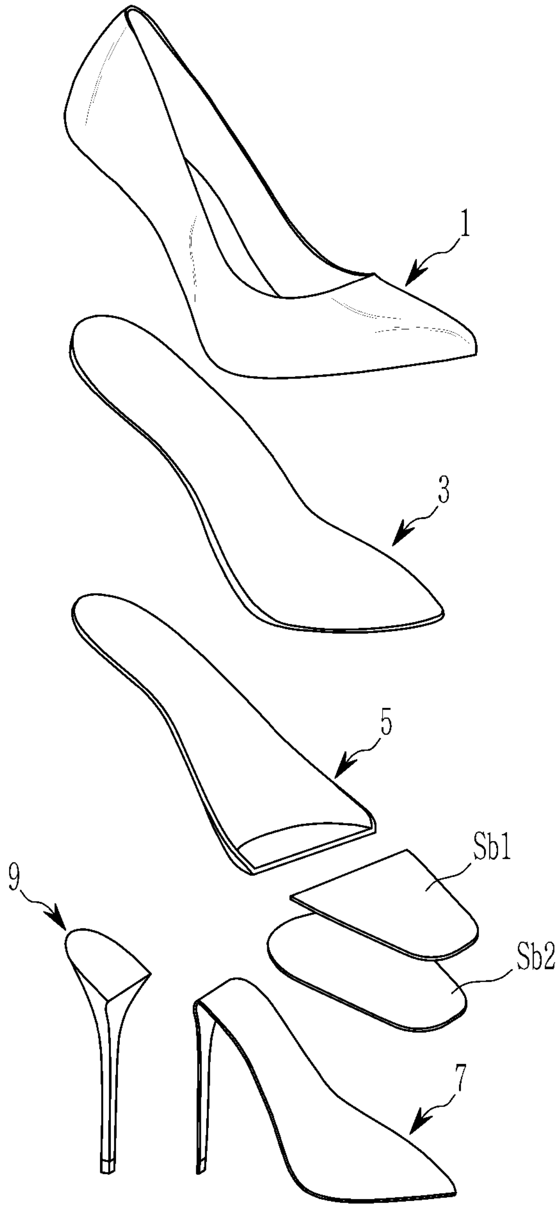


FIG. 12

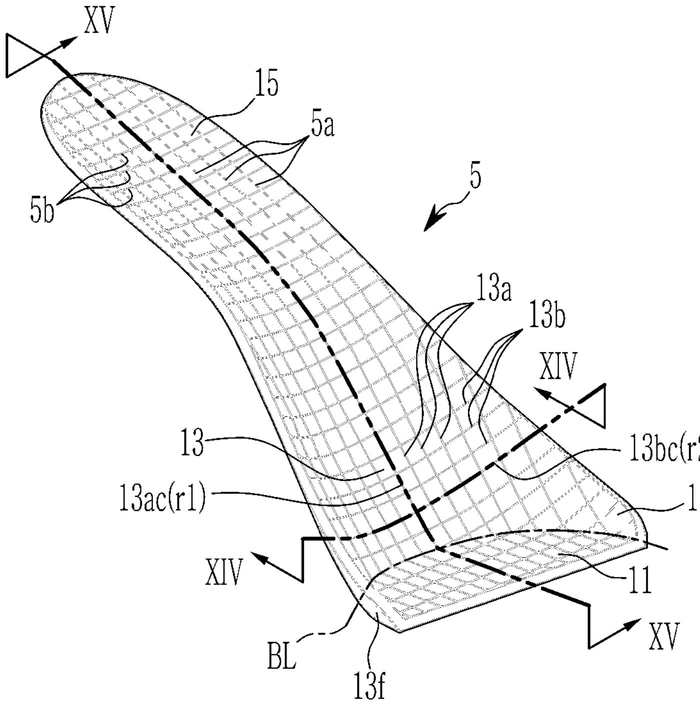


FIG. 13

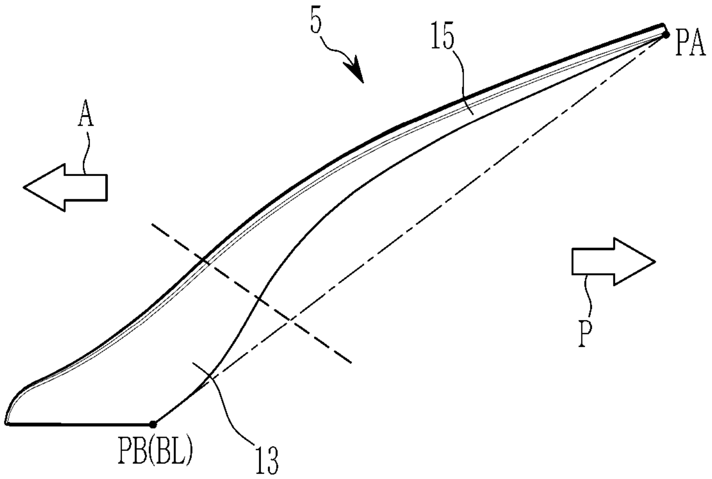


FIG. 14

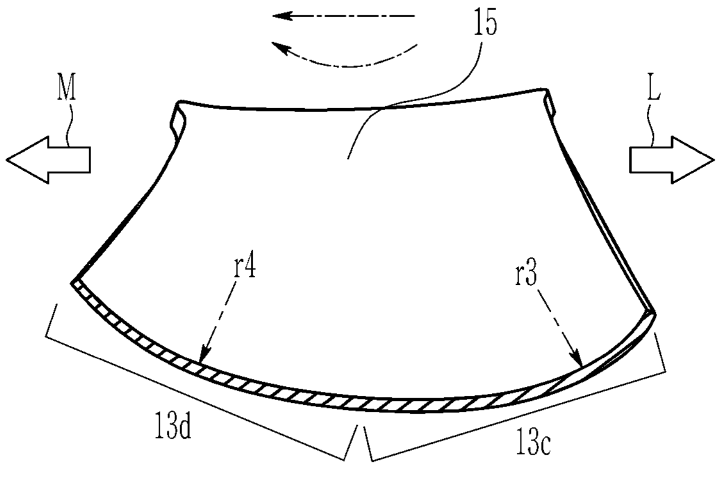


FIG. 15

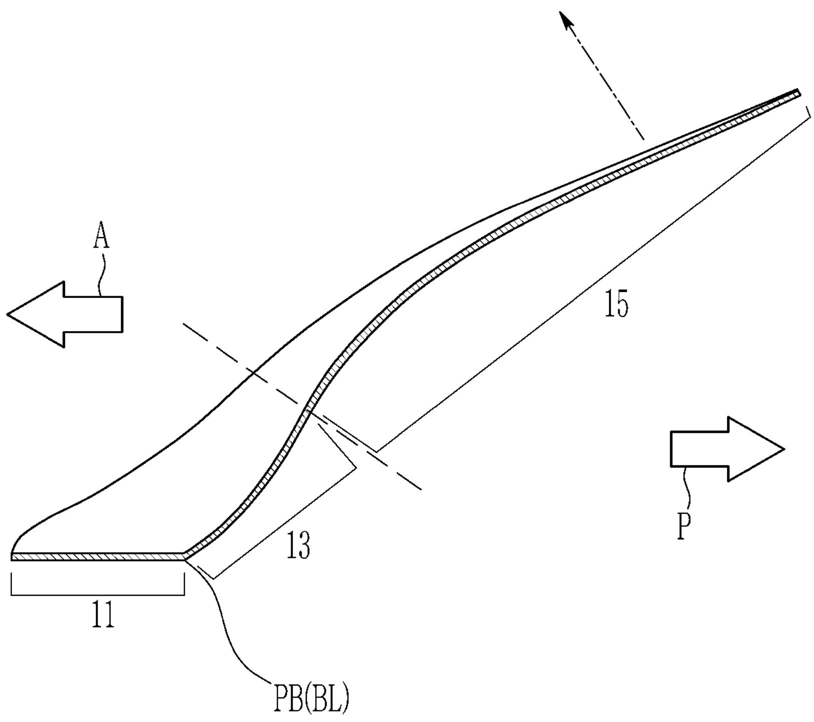
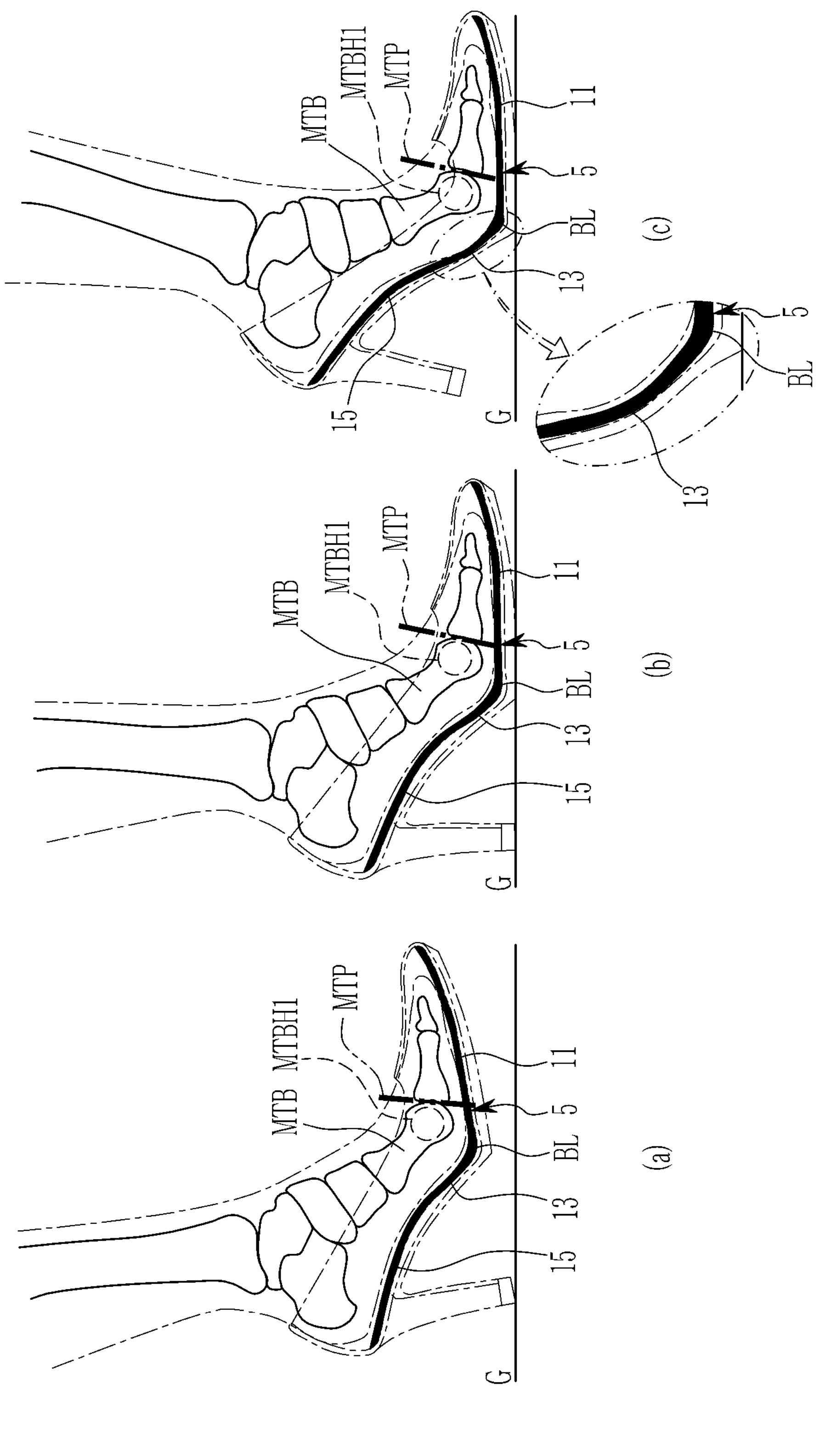


FIG. 16



MTB
MTBH1
MTP
11
5
BL
13
15
G
(a)
MTB
MTBH1
MTP
11
5
BL
13
15
G
(b)
MTB
MTBH1
MTP
11
5
BL
13
15
G
(c)
5
BL
13

FIG. 17

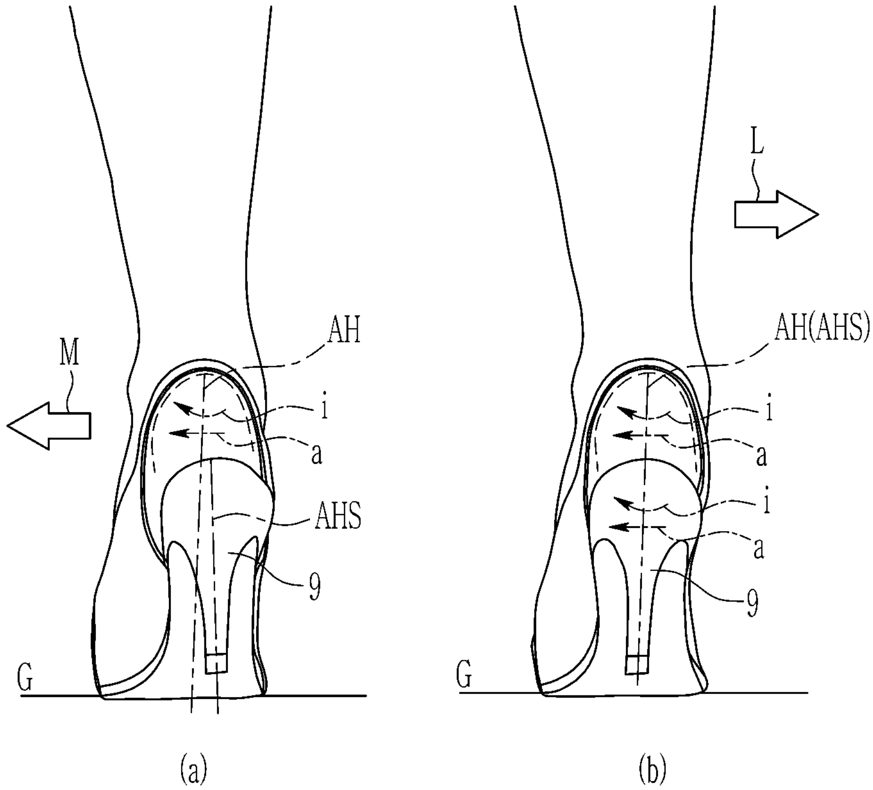


FIG. 18

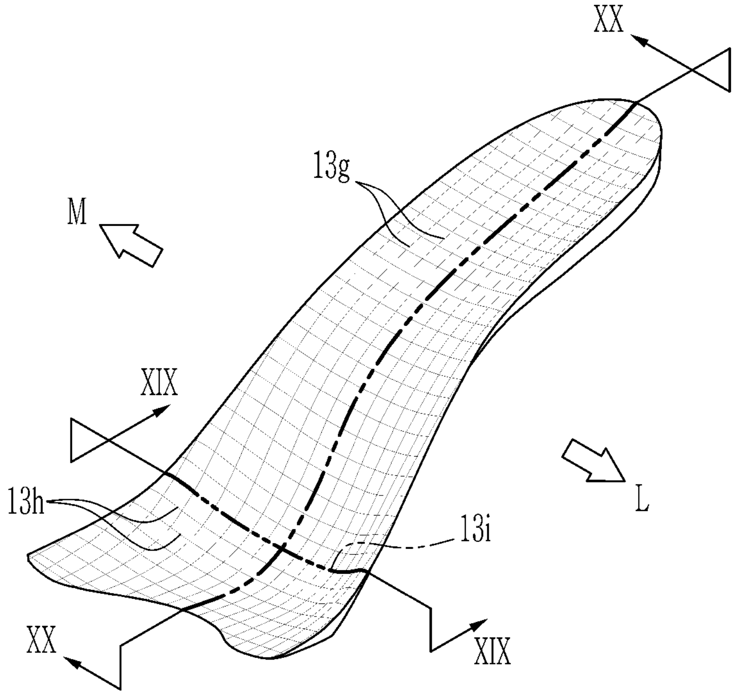


FIG. 19

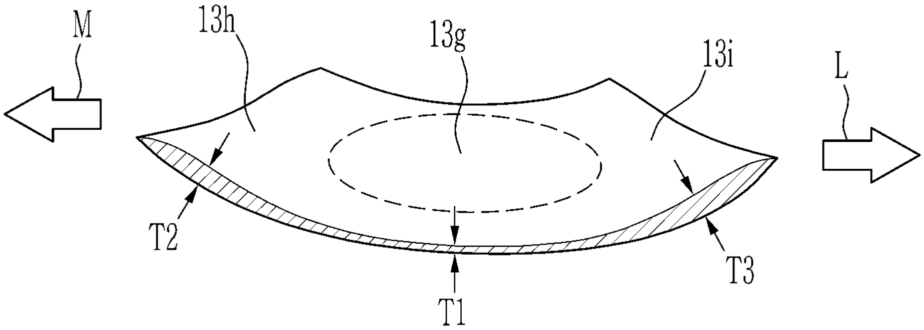


FIG. 20

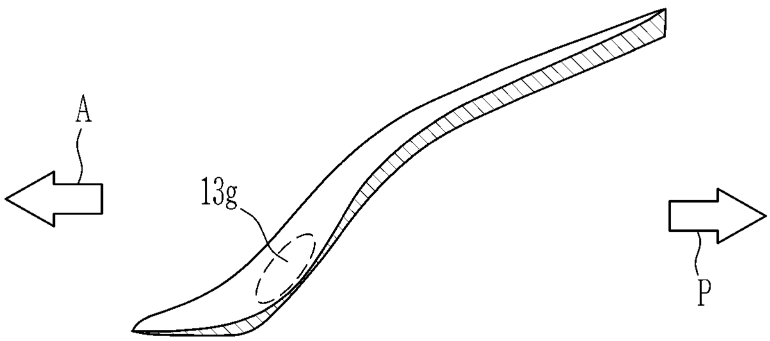


FIG. 21

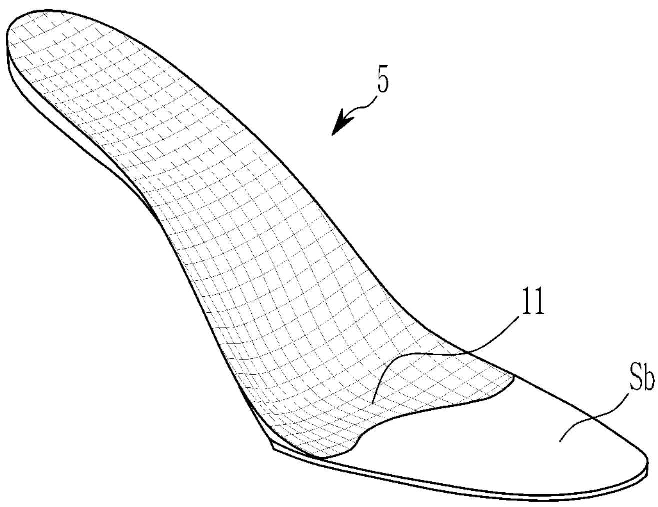


FIG. 22

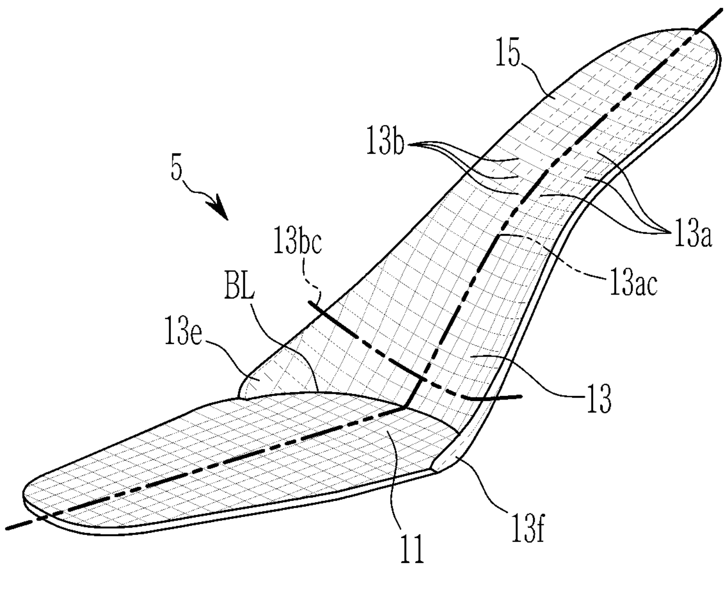


FIG. 23

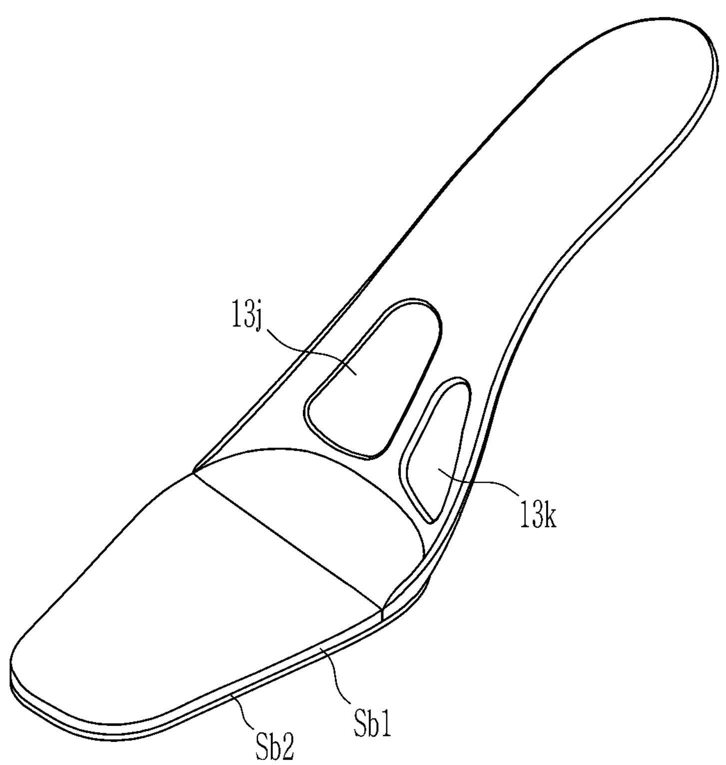


FIG. 24

Prior

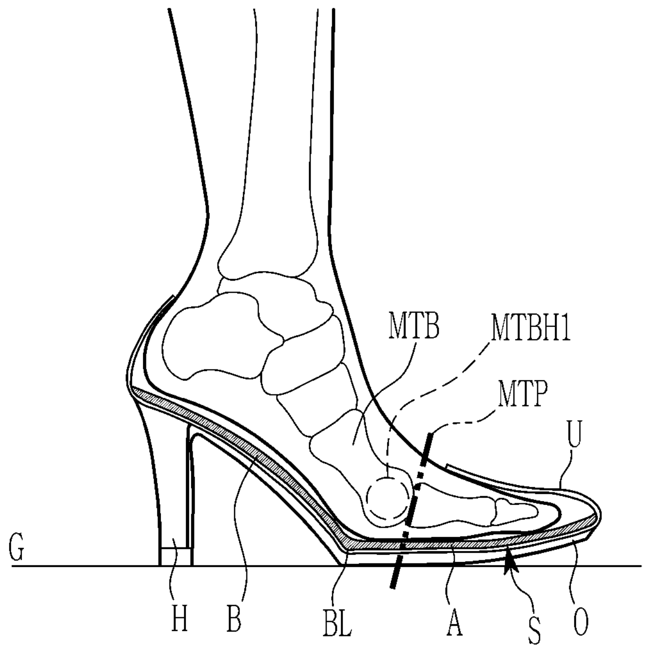


FIG. 25

Prior

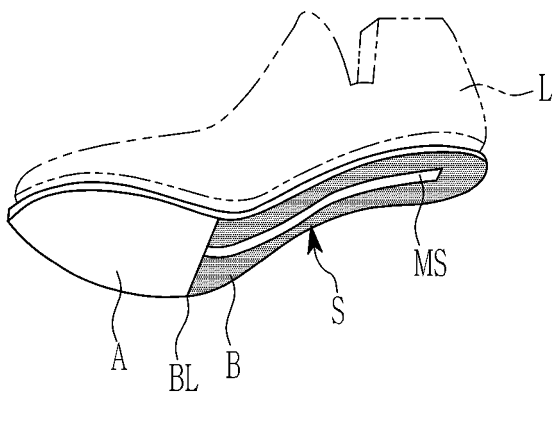


FIG. 26

Prior

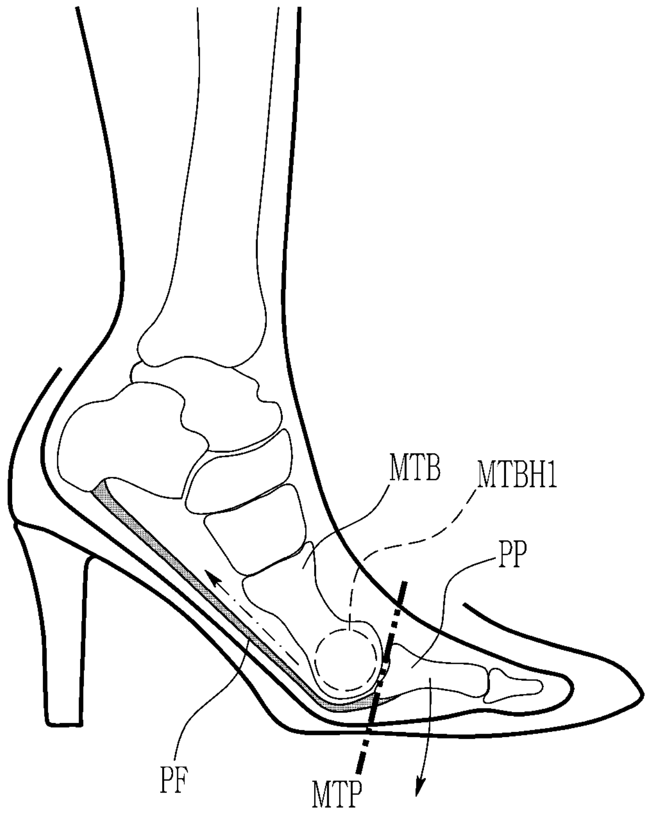
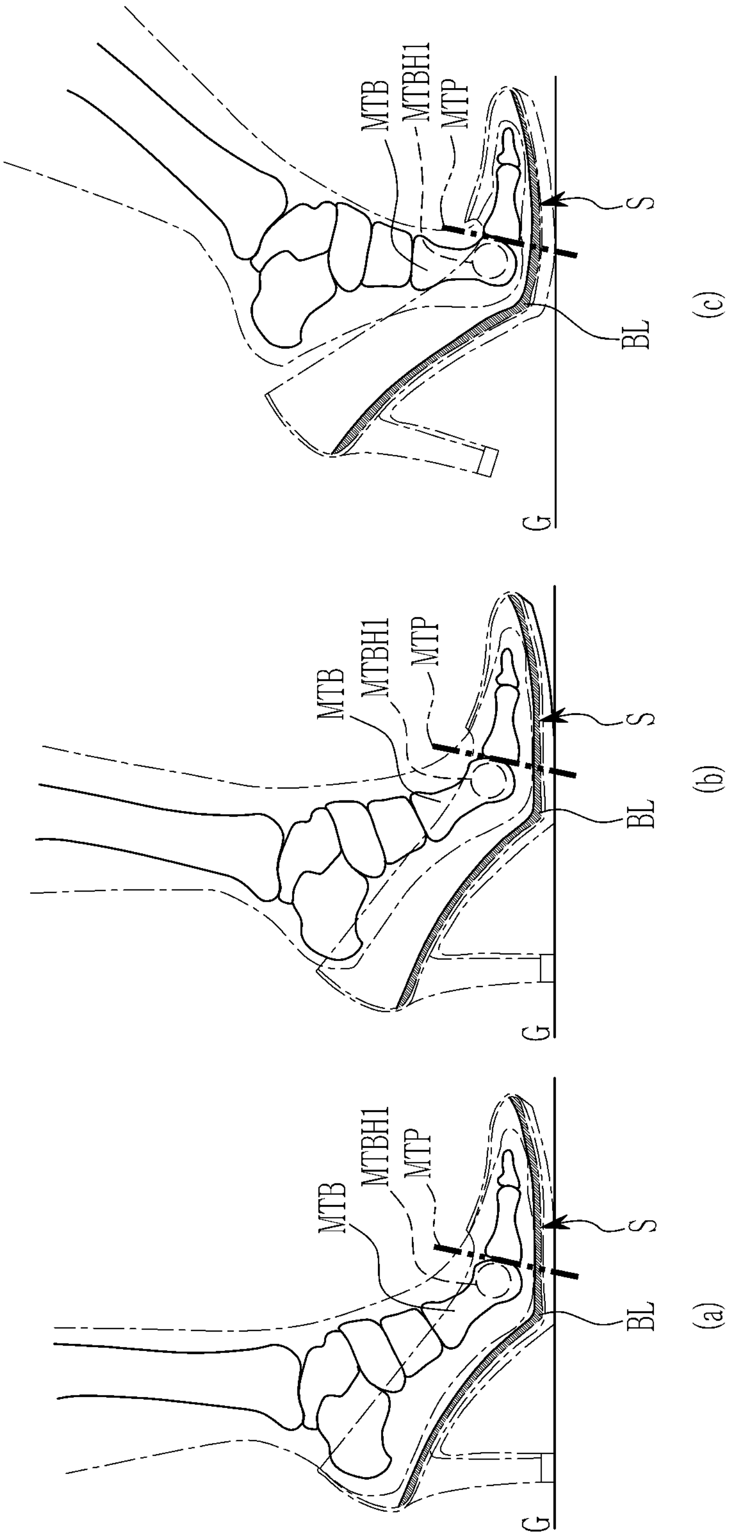


FIG. 27
Prior



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2019/015367

A. CLASSIFICATION OF SUBJECT MATTER

A43B 7/22(2006.01)i, A43B 7/14(2006.01)i, A43B 7/16(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A43B 7/22; A43B 13/20; A43B 3/00; A43B 7/14; A43B 7/16; A43B 7/26; A43B 7/30; A43B 7/32

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models: IPC as above
Japanese utility models and applications for utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS (KIPO internal) & Keywords: shoes, walk, interphalangeal joint, bending and high-heel

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009-0193683 A1 (IGDARI, Sashanaz Hashempour) 06 August 2009 See paragraphs [0038], [0046] and figures 1A-2.	1-3,6,7,9-11,14,15
A		4,5,8,12,13,16
A	US 2009-0007455 A1 (MONTGOMERY, Scott) 08 January 2009 See claim 1 and figures 1-5.	1-16
A	KR 10-2009-0068455 A (BIOMECHANICS CO., LTD.) 29 June 2009 See claim 1 and figures 3-6b.	1-16
A	US 2016-0021971 A1 (CARVER, Andrew Lewis) 28 January 2016 See claim 1 and figures 1-6.	1-16
A	US 2014-0182166 A1 (ELLIS, Frampton E., III) 03 July 2014 See claim 11 and figure 11D.	1-16

☐ Further documents are listed in the continuation of Box C.   ☒ See patent family annex.

* Special categories of cited documents:
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 FEBRUARY 2020 (25.02.2020)	**26 FEBRUARY 2020 (26.02.2020)**

Name and mailing address of the ISA/KR	Authorized officer
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2019/015367

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