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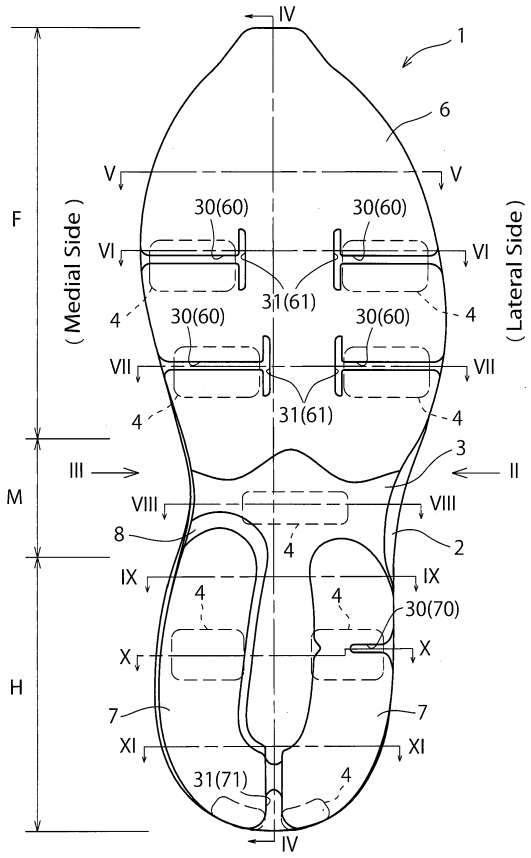
(54) SOLE STRUCTURE FOR SHOE

(57) The invention is directed to improving a sole deformability of a forefoot portion and a heel portion. The sole structure 1 includes an upper plate 2 disposed on an upper side of the sole assembly 1, a lower plate 3 that is disposed under the upper plate 2 and that forms a gap S with the upper plate 2, and a pillar-shaped connecting member 4 that is provided in the gap S and that vertically interconnects the upper plate 2 with the lower plate 3. At least a portion of the lower plate 3 is divided in the longitudinal direction by a lateral indentation 30 at a position that the connecting member 4 is in contact with.

FIG. 1



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Description

TECHNICAL FIELD

[0001] The present invention relates generally to a sole structure for a shoe, and more particularly, to an improved sole structure that can enhance a sole deformability of a forefoot region and a heel region.

BACKGROUND ART

[0002] As a sole structure for a shoe that can improve sole bendability, the applicant of the present invention has proposed such sole structures as shown in Japanese Patent Nos. 4087882 and 4020953.

[0003] Japanese Patent No. 4087882 describes a sole structure in which an upper plate is provided on an upper side of a forefoot region of the sole structure, a lower plate having a plurality of projections is provided under the upper plate via a gap, and the upper and lower plates are interconnected to each other through a cushion bar (see Figures 1A and 1B). Japanese Patent No. 4020953 describes a sole structure in which an upper plate is provided on an upper side of a heel region of the sole structure, a wavy lower plate having at least two downwardly convexly bulging parts to form a gap with the upper plate is provided under the upper plate, the upper and lower plates are interconnected to each other through an elastic block, and an outsole is provided and longitudinally separated on a lower surface of each of the downwardly convexly bulging parts of the lower plate (see Figures 1A and 1B).

[0004] According to the sole structure shown in Japanese Patent No. 4087882, when the forefoot region of the sole structure begins to bend during running, the lower plate extends longitudinally in such a way that each of the projections of the lower plate deforms to extend longitudinally. Thereby, bending deformation of the forefoot region is not hindered by the lower plate and bendability of the forefoot region is thus improved.

[0005] According to the sole structure shown in Japanese Patent No. 4020953, at the time of a heel strike onto the ground, the lower surface of each of the downwardly convexly bulging parts of the lower plate comes into contact with the ground via the longitudinally separated outsoles. Thereby, deformation of each of the downwardly convexly bulging parts of the lower plate is not restricted and bendability of the heel region is thus improved.

[0006] With regard to the bendability of the sole structure, a certain effect can be achieved in each of the sole structures described in the above-mentioned Japanese Patent Nos. 4087882 and 4020953. However, there is a strong demand in the shoes industry that especially in sports shoes not only bendabilty of the sole forefoot region but also bendability and flexibility of the sole heel region should be further improved.

[0007] The present invention has been made in view of these circumstances and its object is to provide a sole structure for a shoe that can improve sole deformability of a forefoot region and a heel region. Specifically, the present invention is directed to enhancing bendability of the forefoot region of the sole structure having an upper and lower plate disposed via a gap formed therebetween. Also, the present invention is directed to enhancing bendability and flexibility of the heel region of the sole structure having an upper and lower plate disposed via a gap formed therebetween.

DISCLOSURE OF INVENTION

[0008] A sole structure for a shoe according to the invention claimed in claim 1 includes an upper plate disposed on an upper side of the sole structure, a lower plate that is disposed on a lower side of the sole structure and that form a gap with the upper plate, and an elastic member that is provided in the gap and that vertically interconnects the upper plate with the lower plate. At least a portion of the lower plate is divided in a longitudinal direction by a lateral indentation provided at a position where the lower plate is in contact with the elastic member.

[0009] According to the invention claimed in claim 1, since the lower plate is divided in the longitudinal direction via the lateral indentation and is in contact with the elastic member at the position where the indentation is formed, when a load is applied to the sole structure during wearing the shoe, one of the longitudinally extending regions in front of and in the rear of the indentation of the lower plate is easy to deform independently of the other of the longitudinally extending regions of the lower plate. Along with that, since a portion of the lower plate where the indentation is formed is supported by the elastic member, the lateral indentation is easy to deform so as to expand in the longitudinal direction. Thereby, sole deformability of the forefoot region and the heel region of the sole structure can be improved. Also, at the time of ground contact of the sole structure, since the gap formed between the upper plate and the lower plate acts as a cushioning hole, cushioning properties can be improved. Moreover, the elastic member contributes to deformability of the sole structure, thereby enhancing durability of the lower plate and thus the entire sole structure.

[0010] In the invention claimed in claim 2, the upper plate and the lower plate are disposed at a forefoot region of the sole structure, the elastic member is disposed at a medial side end portion and a lateral side end portion of the sole structure, and the lower plate extends continuously without being divided in the longitudinal direction at a laterally central region of the sole structure.

[0011] In this case, when a load is applied to the sole structure, one of the longitudinally extending regions in front and in the rear of the indentation of the lower plate is easy to deform independently of the other of the longitudinally extending regions of the lower plate. At the same time, a longitudinally continuously extending part

at the laterally central region of the lower plate is easy to bending-deform without being restrained by the elastic member. Thereby, bendability of the forefoot region of the sole structure can be improved.

[0012] In the invention claimed in claim 3, the lower plate not only has a laterally extending first indentation formed therein that divides the lower plate in the longitudinal direction at the medial side end portion and the lateral side end portion of the sole structure but also has a longitudinally extending second indentation that is formed therein at the laterally central region of the sole structure and that is integrated with the first indentation.

[0013] In this case, a longitudinally continuously extending part at the laterally central region of the lower plate becomes easier to bending-deform, thus further enhancing bendability of the forefoot region of the sole structure. Also, provision of the second indentation in addition to the first indentation makes the lower plate lighter in weight.

[0014] In the invention claimed in claim 4, the first indentation and the second indentation form a generally T-shaped indentation in the lower plate.

[0015] A longitudinally continuously extending portion of the lower plate may have an upwardly convex shape at the laterally central region of the sole structure (see the invention claimed in claim 5).

[0016] In this case, since the longitudinally continuously extending portion at the laterally central region of the lower plate has a longitudinal extension margin, it is easy to extend in the longitudinal direction, thus further improving bendability of the forefoot region of the sole structure.

[0017] The elastic member may have a recess formed on a lower surface thereof that is disposed at a position corresponding to the indentation of the lower plate and that extends along the indentation (see the invention claimed in claim 6).

[0018] In this case, at the time of deformation of the lower plate, the elastic member deforms elastically in such a way that a width of the recess expands. As a result of this, the longitudinally extending regions in front and in the rear of the indentation of the lower plate are much easier to deform, thus further improving sole deformability of the forefoot region and the heel region of the sole structure.

[0019] The elastic member may extend along an entire width of the sole structure (see the invention claimed in claim 7) .

[0020] In the invention claimed in claim 8, the upper plate and the lower plate may be provided at a forefoot region of the sole structure, the elastic member may be disposed inside a medial side end portion and inside a lateral side end portion of the sole structure, and the lower plate may extend continuously without being divided in the longitudinal direction at a laterally central region, the medial side end portion and the lateral side endportion of the sole structure.

[0021] In this case, when a load is applied to the sole structure, one of the longitudinally extending regions in front of and in the rear of the indentation of the lower plate is easily deformable independently of the other of the longitudinally extending regions of the lower plate. Along with that, longitudinally continuously extending parts at the laterally central region, the medial side end portion, and the lateral side end portion of the lower plate are easy to bending-deform without being restrained by the elastic member. Thereby, bendability of the forefoot region of the sole structure can be improved.

[0022] In the invention claimed in claim 9, the lower plate not only has a laterally extending third indentation that divides the lower plate in the longitudinal direction inside at the medial side end portion and inside at the lateral side end portion of the sole structure but also has a longitudinally extending fourth indentation at the laterally central region of the sole structure that is integrated with the third indentation and a longitudinally extending fifth indentation inside at the medial side end portion and inside at the lateral side end portion of the sole structure that is integrated with the third indentation.

[0023] In this case, longitudinally continuously extending parts at the laterally central region, the medial side end portion and the lateral side end portion of the lower plate become much easier to bending-deform due to the provision of the fourth and fifth indentations, thus further enhancing bendability of the forefoot region of the sole structure.

[0024] The third to fifth indentations formagenerally H-shaped indentation in the lower plate (see the invention claimed in claim 10).

[0025] In the invention claimed in claim 11, the upper plate and the lower plate are disposed at a heel region of the sole structure, the elastic member is disposed on a heel lateral side and a heel rear end side, at least a portion of the lower plate is divided in the longitudinal direction by a lateral indentation provided at a position where the lower plate is in contact with the elastic member on the heel lateral side, and at least a portion of the lower plate is divided in the lateral direction by a longitudinal indentation provided at a position where the lower plate is in contact with the elastic member on the heel rear end side.

[0026] In this case, since the lower plate is divided in the longitudinal direction by the lateral indentation and the lower plate is in contact with the elastic member at the position where the indentation is formed, when a load is applied to the sole structure, one of the longitudinally extending regions in front of and in the rear of the indentation of the lower plate is easily deformable independently of the other of the longitudinally extending regions of the lower plate. Thereby, bendability of the heel region of the sole structure can be improved. Moreover, in this case, the lower plate is divided in the lateral direction as well by the longitudinal indentation. The longitudinally and laterally regions of the lower plate divided by the lateral and longitudinal indentations are easily deflectable in the vertical direction at the time of impacts of the

heel region of the sole structure onto the ground, thus further improving cushioning properties of the heel region of the sole structure and achieving a smooth impact feeling.

[0027] The lower plate may have a downwardly convex shape at a longitudinally region extending in front of and in the rear of the lateral indentation (see the invention claimed in claim 12).

[0028] In this case, since each of the downwardly convex portions of the lower plate has an extension margin in the longitudinal and vertical directions, the lower plate is easily deflectable in the longitudinal and vertical directions, thus further improving sole deformability of the forefoot region and the heel region of the sole structure and also further enhancing cushioning properties.

[0029] The lower plate may have a plurality of bulges that respectively bulge downwardly convexly and the elastic member may be disposed at a position where the respective bulges are longitudinally adjacent to each other (see the invention claimed in claim 13).

[0030] In this case as well, since each of the downwardly convex-shaped bulges of the lower plate has an extension margin in the longitudinal and vertical directions, the lower plate is easily deflectable in the longitudinal and vertical directions, thus further improving sole deformability of the forefoot region and the heel region of the sole structure and also further enhancing cushioning properties.

[0031] The lower plate may have an outsole fixedly attached on a lower surface thereof and the outsole may be divided in the longitudinal direction by an indentation that corresponds to the indentation of the lower plate (see the invention claimed in claim 14).

[0032] In this case, deformation of the lower plate is not hindered by the outsole, thus allowing the forefoot region and the heel region of the lower plate to deform smoothly.

BRIEF DESCRIPTION OF DRAWINGS

[0033]

FIG. 1 is a bottom view of a sole structure for a shoe according to an embodiment of the present invention;

FIG. 2 is a lateral side view viewed from the arrow mark II of FIG. 1;

FIG. 3 is a medial side view viewed from the arrow mark III of FIG. 1;

FIG. 4 is a longitudinal sectional view of FIG. 1 taken along line IV-IV;

FIG. 5 is a cross sectional view of FIGS. 1 to 4 taken along line V-V;

FIG. 6 is a cross sectional view of FIGS. 1 to 4 taken along line VI-VI;

FIG. 7 is a cross sectional view of FIGS. 1 to 4 taken along line VII-VII;

FIG. 8 is a cross sectional view of FIGS. 1 to 4 taken along line VIII-VIII;

FIG. 9 is a cross sectional view of FIGS. 1 to 4 taken along line IX-IX;

FIG. 10 is a cross sectional view of FIGS. 1 to 4 taken along line X-X;

FIG. 11 is a cross sectional view of FIGS. 1 to 4 taken along line XI-XI;

FIG. 12 is a rear elevational view of a heel of the sole structure of FIG. 1;

FIG. 13 is an enlarged view of a region including a connecting member of the sole structure of FIG. 1, corresponding to a partially enlarged view of FIG. 2; and

FIG. 14 is a bottom view of a sole structure for a shoe according to another embodiment of the present invention, corresponding to FIG. 1.

BEST MODE FOR CARRYING OUT THE INVENTION

[0034] Embodiments of the present invention will be hereinafter described in accordance with the appended drawings.

[0035] FIGS. 1 to 13 show a sole structure for a shoe according to an embodiment of the present invention. In the illustrated example, a running shoe is taken as an example.

[0036] In the following explanations, upward direction (upper side), downward direction (lower side), forward direction (front side), and rearward direction (rear side) of a sole structure designate upward direction (upper side), downward direction (lower side), forward direction (front side), and rearward direction (rear side) of a shoe, respectively. That is, taking FIG. 2 as an example, an upward direction and a downward direction of the sole structure indicate a right side and a left side of FIG. 2 respectively, and a forward direction and a rearward direction of the sole structure indicate an upward direction and a downward direction of FIG. 2 respectively. Also, in FIGS. 1 to 4, H indicates a heel region of the sole structure, M for a midfoot region, and F for a forefoot region respectively.

[0037] As shown in FIGS. 1 to 4, Sole structure 1 for a shoe includes an upper plate 2 that is disposed on an upper side of the sole structure 1 and that extends to curve gently from the heel region H through the midfoot region M to the forefoot region F, a lower plate 3 that is located downwardly away from the upper plate 2 with a gap S formed between the upper plate 2 and the lower plate 3, that extends from the heel region H through the midfoot region M to the forefoot region F and that includes a plurality of downwardly convex parts (bulging parts) 3A, and pillar-shaped connecting members (elastic members) 4 that are disposed in the gap S and that interconnect the upper plate 2 with the lower plate 3 vertically.

[0038] An upper midsole 5 is fixedly attached to an upper surface of the upper plate 2, extending from the heel region H through the midfoot region M to the forefoot

region F. An outsole 6 with a ground contact surface to contact the ground is fixedly attached to a lower surface of a forefoot region of the lower plate 3. A lateral side portion of a U-shaped outsole 7 with a ground contact surface to contact the ground is fixedly attached to a lower surface on a lateral side of a heel region of the lower plate 3 and a medial side portion of the U-shaped outsole 7 is fixedly attached to a lower surface on a medial side of a heel region of the lower plate 3 through a lower midsole 8.

[0039] Both of the upper plate 2 and the lower plate 3 are plate-like members, extending in a width direction (the left to right direction in FIG. 1). An upper end edge portion of the upper plate 2 is wavy-shaped in a longitudinal direction because an upraised portion 2b is formed that extends upwardly on opposite sides of the upper plate 2 (see FIGS. 5 to 11). The upper plate 2 and the lower plate 3 are preferably formed of a hard elastic member, andmorespecifically, thermoplastic resin such as thermo plastic polyurethane (TPU), polyamide elastomer (PAE), acrylonitrile-butadiene-styrene (ABS) resin and the like, or thermosetting resin such as epoxy resin, unsaturated polyester resin and the like. In addition, the upper plate 2 and the lower plate 3 may be formed of fiber reinforced prastics (FRP) formed of reinforcing fibers such as carbon fibers, aramid fibers, glass fibers or the like and matrix resin such as thermosetting resin or thermoplastic resin.

[0040] In the forefoot region F of the sole structure 1, the connecting members 4 are formed of a pair of members disposed at a medial side end and a lateral side end respectively (here, two pairs of members 4 are provided). In the midfoot region M, the connecting member 4 is formed of a single member disposed at a laterally central portion. In the heel region H, the connecting members 4 are formed of a pair of members disposed at a medial side end and a lateral side end respectively and a single member disposed at a heel rear end. The connecting members 4 are preferably formed of an elastic member such as a hard rubber and the like.

[0041] The upper midsole 5 includes a foot sole contact surface 50a that extends along a foot sole shape of a shoe wearer and an upraised portion 50b that extends upwardly from opposite side ends and a heel rear end of the foot sole contact surface 50a (see FIGS. 5 to 12) . The upper midsole 5 and the lower midsole 8 are preferably formed of soft elastic materials, more specifically, thermoplastic resin such as ethylene-vinyl acetate copolymer (EVA) and the like, foamed thermoplastic resin, thermosetting resin such as polyurethane (PU) and the like, foamed thermosetting resin, rubber materials such as butadiene rubber, chloroprene rubber and the like, or foamed rubber materials.

[0042] A laterally extending first indentation 30 is formed at a position where a bottom surface of each of the connecting members 4 contacts the lower plate 3 on a medial side end and a lateral side end respectively in the forefoot region F of the lower plate 3. Each of the indentations 30 is disposed at an upwardly convex portion 3B between longitudinally adjacent downwardly convex portions 3A in the lower plate 3 (see FIGS. 2 and 13) . The lower plate 3 is fixedly attached to each of the connecting members 4 at portions where the lower plate 3 overlaps with each of the connecting members 4 vertically in front of and in the rear of each of the indentations 30. Here, an example is shown in which the indentation 30 is provided both at a longitudinally central position of the forefoot region F and at a rear side position near the midfoot region M. That is, in this example, two pairs of laterally extending indentations 30 are provided at opposite side ends in the forefoot region F. The lower plate 3 is thus longitudinally divided by each of the indentations 30 into a front region extending in front of the indentation 30 and a rear region extending in the rear of the indentation 30. Also, each of the indentations 30 opens at a medial side end and a lateral side end of the lower plate 3.

[0043] A longitudinally extending second indentation 31 is formed at a laterally central portion in the forefoot region of the lower plate 3 in connection with the laterally first extending indentation 30. These first and second indentations 30, 31 form a generally T-shaped indentation in the lower plate 3. Here, an example is shown in which each of the indentations 31 is formed at a slightly inward position from each of the connecting members 40. A longitudinal region disposed between the laterally adjacent indentations 31 at a laterally central portion of the lower plate 3 extends longitudinally without being divided. Also, in this example, the longitudinally extending region at the laterally central portion of the lower plate 3 has an upwardly convex bulging shape at a region between the laterally adjacent indentations 31 (see FIG. 4).

[0044] The outsole 6 has a laterally extending indentation 60 and a longitudinally extending indentation 61 at positions that correspond to (i.e. that are disposed opposite) the laterally extending indentation 30 and the longitudinally extending indentation 31 respectively in the forefoot region of the lower plate 3. Namely, the outsole 6 also has a generally T-shaped indentation formed of these indentations 60, 61. Thereby, a longitudinal region of the outsole 6 extending in front of and in the rear of each of the indentations 60 is longitudinally divided by each of the indentations 60. Along with that, a longitudinal region at a laterally central portion disposed between the laterally adjacent indentations 61 of the outsole 6 extends longitudinally without being divided. Also, in this example, the longitudinally extending region at the laterally central portion of the outsole 6 has an upwardly convex bulging shape at a region between the laterally adjacent indentations 61 (see FIG. 4).

[0045] On a lateral side in a heel region of the lower plate 3, a laterally extending indentation 30 is formed at a portion of a position where the lower plate 3 contacts a bottom surface of the connecting member 4. The indentation 30 is disposed at an upwardly convex part 3B between the downwardly convex parts 3A adjacent to each other in the longitudinal direction of the lower plate

3 (see FIG. 2). At a position where the lower plate 3 vertically overlaps with the connecting member 4 in front of and in the rear of the indentation 30, the lower plate 3 is fixedly attached to the connecting member 4. Here, an example is shown in which the laterally extending indentation 30 is located at a longitudinally generally central position of the heel region H. A longitudinal region of the lower plate 3 extending in front of and in the rear of the indentation 30 is thus divided longitudinally by the indentation 30. The indentation 30 opens to the lateral side end of the lower plate 3.

[0046] The outsole 7 has a lateral indentation 70 at a position that corresponds to (i.e. that is disposed opposite) the lateral indentation 30 of the lower plate 3. A longitudinal region of the outsole 7 extending in front of and in the rear of the indentation 70 is thus divided longitudinally by the indentation 70. At the same time, a longitudinal region at a laterally central portion and a medial side end portion of the outsole 7 extends longitudinally without being divided.

[0047] At a heel rear end in the heel region of the lower plate 3, a longitudinally extending indentation 31 is formed at a position where a bottom surface of the connecting member 4 contacts (see FIG. 12). In this example, the indentation 31 extends beyond a longitudinal length of the connecting member 4 (see FIG. 1) . The lower plate 3 is fixedly attached to the connecting member 4 at opposite positions of the indentation 31 where the lower plate 3 overlaps with the connecting member 4. A lateral region of the lower plate 3 extending opposite the indentation 31 is thus divided in the lateral direction by the indentation 31. The indentation 31 opens to the rear end of the lower plate 3.

[0048] The outsole 7 has a longitudinal indentation 71 at a position that corresponds to (i.e. that is disposed opposite) the longitudinal indentation 31 of the lower plate 3. A lateral region of the outsole 7 that extends opposite the indentation 71 is thus divided in the lateral direction by the indentation 71.

[0049] On a bottom surface of each of the connecting members 4, a laterally extending recess 40 is formed at a position corresponding to the lateral indentation 30 of the lower plate 3 and the lateral indentation 60, 70 of the outsoles 6, 7 (see FIG. 13).

[0050] Effects of the above-mentioned sole structure 1 are given as follows:

a) Since the lower plate 3 is longitudinally divided by the lateral indentation 30, when a load is applied to the sole structure 1 during wearing a shoe, one of the longitudinal regions in front of and in the rear of the indentation 30 of the lower plate 3 is easily deformable independent of the other of the longitudinal regions of the lower plate 3. At the same time, since the lower plate 3 contacts the connecting member 4 at a part where the indentation 30 is formed and such apart is supported by the connecting member 4, the lateral indentation 30 is easy to deform in such a way to extend in the longitudinal direction. Thereby, a sole deformability of the forefoot region F and the heel region H of the sole structure 1, that is, bendability and vertical flexibility can be improved.

b) Since the gap S formed between the upper plate 2 and the lower plate 3 acts as a cushion hole at the time of an impact of the sole structure 1 onto the ground, thus improving cushioning properties. Also, since the connecting member 4 contributes to deformability of the sole structure 1, durability of the lower plate 3 and thus the entire sole structure can be improved compared to such a case that deformability of only the lower plate 3 is dependent on. Especially when a rubber-made connecting member 4 is used, since a rubber-made connecting member is in superior in durability at low temperature, durability of the lower plate 3 and thus the entire sole structure at low temperature can be improved compared to such a case that deformability of only the lower plate 3 at low temperature is dependent on.

c) Since the connecting member 4 is disposed at the medial end portion and the lateral end portion of the sole structure 1 and the lower plate 3 extends continuously in the longitudinal direction without being divided at the laterally central portion of the sole structure 1, when a load is applied to the sole structure 1, not only one of the longitudinal regions extending in front of and in the rear of the indentation 30 of the lower plate 3 is easily deformable independent of the other of the longitudinal regions of the lower plate 3 but also the longitudinally extending portion at the laterally central portion of the lower plate 3 is easily bending-deformable without being restricted by the connecting member 4. Thereby, bendability of the sole structure 1 can be further enhanced.

d) Since the longitudinal indentation 31 is formed at the forefoot region of the lower plate 3, the longitudinally extending region at the laterally central portion of the lower plate 3 is much easier to bending-deform, thus further improving bendability of the forefoot region F of the sole structure 1. Moreover, the longitudinal indentation 31 is formed in addition to the lateral indentation 30, thus making the lower plate 3 lighter in weight.

e) Since the longitudinally extending region at the laterally central portion in the forefoot region of the lower plate 3 has an upwardly convex bulging shape, the longitudinally extending region has a longitudinal extension allowance and is thus easily extensible in the longitudinal direction. Thereby, bendability of the forefoot region F of the sole structure 1 can be further improved.

f) Since the recess 40 that extends along the indentation 30 is formed on the bottom surface of the connecting member 4 at the position that corresponds to the indentation 30 of the lower plate 3, the connecting member 4 can elastically deform in such a

way to expand the width of the recess 40 at the time of deformation of the lower plate 3. Thus, each of the longitudinal regions in front of and in the rear of the indentation 30 of the lower plate 3 is more easily deformable. As a result, sole deformability of the forefoot region F and the heel region H of the sole structure 1 can be further improved.

g) Since the lateral indentation 30 is formed on the lateral side in the heel region of the lower plate 3 and the longitudinal indentation 31 is formed at the rear end of the heel region, when the sole structure 1 impacts the ground on the heel lateral side, the heel lateral side region of the lower plate 3 divided by the lateral and longitudinal indentations 30, 31 is easy to deform in the vertical direction. Cushioning properties of the heel region H of the sole structure 1 can thus be further improved to achieve a smooth ride feeling.

h) Since the lowerplate 3 has a downwardly convex bulging shape in the longitudinal region extending in front of and in the rear of the lateral indentation 30 of the lower plate 3 and thus each of the downwardly convex portions 3A of the lower plate 3 has a deformation allowance in the longitudinal and vertical directions, the lower plate 3 is easily deformable in the longitudinal and vertical directions. Thereby, sole deformative performance of the forefoot region and the heel region of the sole structure 1 can be further improved and cushioning properties can be further improved.

i) Since the outsoles 6, 7 are fixedly attached to the bottom surface of the lower plate 3 and each of the outsoles 6, 7 is divided in the longitudinal direction by each of the indentations 60, 70 corresponding to the indentations 30 of the lower plate 3, the forefoot region and the heel region of the lower plate 3 can smoothly deform in such a manner that deformation of the lower plate 3 is not hindered by the outsoles 6, 7.

[Alternative Embodiment 1]

[0051] In the above-mentioned embodiment, an example was explained in which the lower plate 3 has a plurality of downwardly convex portions 3A, but in the sole structure of the present invention, the lower plate 3 may extend slightly curvedly from the heel region H through the midfoot region M to the forefoot region F without having such a plurality of downwardly convex portions 3A.

[Alternative Embodiment 2]

[0052] In the above-mentioned embodiment, an example was shown where the longitudinally extending region at the laterally central portion of the lower plate 3, which extends between the laterally adjacent connecting members 4 in the forefoot region and the heel region of the lower plate 3, has an upwardly convex bulging shape, but the longitudinally extending region may be formed in a planar shape or slightly curved shape.

[Alternative Embodiment 3]

[0053] In the above-mentioned embodiment, an example was shown where the lateral indentations 30, 60 in the forefoot region of the lower plate 3 and the outsole 6 are formed along the entire lateral length of the connecting member 4, but the application of the present invention is not limited to such an example. The lateral length of the indentations 30, 60 may be a portion of the lateral length of the connecting member 4. In this case, a region in which the indentation 30 is not formed at a position where the lower plate 3 contacts the connecting member 4 is preferably not fixedly attached to the connecting member 4. That is intended to facilitate bending-deformation of the longitudinally extending region with no indentations 30 in the lower plate 3 without restraint by the connecting member 4.

[Alternative Embodiment 4]

[0054] In the above-mentioned embodiment, an example was shown where the lateral length of the lateral indentations 30, 70 in the heel region of the lower plate 3 and the outsole 7 is a portion of the lateral length of the connecting member 4, but the lateral length of each of the indentations 30, 70 may extend along the entire lateral length of the connecting member 4. Also, in this example, a region having no indentations 30 formed at a position where the lower plate 3 contacts the connecting member 4 is fixedly attached to the connecting member 4. That is because bendability in the heel region is less required than that in the forefoot region, but the region is not necessarily fixedly attached to the connecting member 4.

[Alternative Embodiment 5]

[0055] In the above-mentioned embodiment, an example was shown where the longitudinal length of the longitudinal indentations 31, 71 in the heel rear end of the lower plate 3 and the outsole 7 exceeds the longitudinal length of the connecting member 4, but the application of the present invention is not limited to such an example. The longitudinal length of the longitudinal indentations 31, 71 may be almost the same as the longitudinal length of the connecting member 4.

[Alternative Embodiment 6]

[0056] In the above-mentioned embodiment, an example was shown where two pairs of lateral indentations 30, 60 are provided in the forefoot region of the lower plate 3 and the outsole 6, that is, the lateral indentations 30, 60 are provided at the two medial sides and the two lateral sides respectively, but the application of the

present invention is not limited to such an example. Only a pair of indentations 30, 60 may be provided in the forefoot region of the lower plate 3 and the outsole 6. For example, in FIG. 1, only a pair of indentations 30, 60 disposed at a longitudinally generally central position in the forefoot region of the lower plate 3 and the outsole 6 may be retained and a pair of indentations 30, 60 disposed at a position near the midfoot region may be omitted.

[Alternative Embodiment 7]

[0057] In the above-mentioned embodiment, an example was shown where the upper plate 2 and the lower plate 3 constituting the sole structure of the present invention are provided not only at the forefoot region but also at the heel region of the sole structure 1, but the present invention also has application to an example in which the upper plate 2 and the lower plate 3 are provided either at the forefoot region or at the heel region.

[Alternative Embodiment 8]

[0058] In the above-mentioned embodiment, an example was shown where the connecting member 4 is disposed at the medial side end portion and the lateral side end portion in the forefoot region of the sole structure 1, but the connecting member 4 may be disposed inside the medial side end portion (i.e. on the laterally central side) and inside the lateral side end portion (i.e. on the laterally central side) of the sole structure 1.

[0059] FIG. 14 is abottomview of such a sole structure, corresponding to FIG. 1 of the above-mentioned embodiment. In FIG. 14, the same reference numbers as those in FIG. 1 indicate identical or functionally similar elements. As shown in FIG. 14, in the forefoot region F of the sole structure 1, each of the connecting members 4 is disposed at a position inside the medial side endportion (i.e. at a laterally nearly central position) and also disposed at a position inside the lateral side end portion (i. e. at a laterally nearly central position) . Also, as depicted in FIG. 14, a laterally extending third indentation 30 of the lower plate 3 and the corresponding laterally extending indentation 60 of the outsole 6 are disposed inside the medial side end portion and inside the lateral side end portion without opening to the medial side end and the lateral side end of the lower plate 3 and the outsole 6. The indentations 30, 60 are formed integrally with a longitudinally extending fourth indentation 31 in the laterally central portion of the lower plate 3, the corresponding longitudinal indentation 61 of the outsole 6, a longitudinally extending fifth indentation 32 inside the medial and lateral side end portions of the lower plate 3, and the corresponding longitudinal indentation 62 of the outsole 6. The indentations 30, 31 and 32 form a generally H-shaped indentation in the lower plate 3. Similarly, the indentations 60, 61 and 62 form a generally H-shaped indentation in the outsole 6.

[0060] In this case, the lower plate 3 extends in the longitudinal direction without being divided not only at the laterally central portion of the sole structure 1 but also at the medial side end portion and the lateral side end-portion. According to such a structure, when a load is applied to the sole structure 1, one of the longitudinally extending regions in front of and in the rear of the lateral indentation 30 of the lower plate 3 is easily deformable independent of the other of the longitudinally extending regions of the lower plate 3. Along with that, the longitudinally extending region at the laterally central portion of the lower plate 3 and the longitudinally extending regions at the medial side end portion and the lateral side end portion of the lower plate 3 are easily bending-deformable without being restricted by the connecting member 4. Bendability of the forefoot region F of the sole structure 1 can thus be enhanced. Moreover, since the longitudinally extending regions at the laterally central portion and the medial and lateral side end portions of the lower plate 3 are more easily bending-deformable by the longitudinal indentations 30, 31, thus further improving bendability of the forefoot region F of the sole structure 1.

[Alternative Embodiment 9]

[0061] The connecting member 4 may extend along the entire lateral length of the sole structure 1. In this case, the lateral indentation 30 formed in the lower plate 3 may be provided along the entire length in the width direction, alternatively, at a portion in the width direction (e.g. at the medial/lateral side end portion, or at the laterally central portion). Also, at this juncture, at a position where a lateral indentation 30 is not formed in the lower plate 3, the lower plate 3 is preferably not fixedly attached to the connecting member 4. That is intended to facilitate bending-deformation of the longitudinally extending region of the lower plate 3 without restraint by the connecting member 4.

[Alternative Embodiment 10]

[0062] In the above-mentioned embodiment, an example was shown where the lateral indentation 60 and the longitudinal indentation 61 are respectively formed at positions of the outsole 6 corresponding respectively to the lateral indentation 30 and the longitudinal indentation 31 of the lower plate 3, but the application of the present invention is not limitedto such an example. Without disposing the outsole 6 at the entire forefoot region of the lower plate 3 as with the above-mentioned embodiment, a plurality of outsole plate pieces may be provided and bonded to a region other than the indentations 30, 31 on the bottom surface of the lower plate 3.

[Other Applicable Examples]

[0063] In the above examples, the sole structure of the present invention was applied to a running shoe, but the

application of the present invention is not limited to such an example. The present invention also has application to other various sports shoes including walking shoes.

INDUSTRIAL APPLICABILITY

[0064] As mentioned above, the present invention is of use to a sole structure for a shoe, and it is especially suitable for a sole structure for a sports shoe that requires a superb sole deformability .

Claims

1. A sole structure for a shoe comprising:

an upper plate disposed on an upper side of said sole structure;
a lower plate that is disposed on a lower side of said sole structure and that forms a gap with said upper plate; and
an elastic member that is provided in said gap and that vertically interconnects said upper plate with said lower plate,
wherein at least a portion of said lower plate is divided in a longitudinal direction by a lateral indentation provided at a position where said lower plate is in contact with said elastic member.

2. The sole structure according to claim 1, wherein said upper plate and said lower plate are provided at a forefoot region of said sole structure, said elastic member being disposed at a medial side end portion and a lateral side end portion of said sole structure, said lower plate extending continuously in the longitudinal direction at a laterally central region of said sole structure.

3. The sole structure according to claim 2, wherein said lower plate has a laterally extending first indentation that divides said lower plate in the longitudinal direction at the medial side end portion and the lateral side end portion of said sole structure, said lower plate further having a longitudinally extending second indentation at the laterally central region of said sole structure, said second indentation being integrated with said first indentation.

4. The sole structure according to claim 3, wherein said first indentation and said second indentation form a generally T-shaped indentation in said lower plate.

5. The sole structure according to claim 2, wherein a longitudinally continuously extending portion of said lower plate has an upwardly convexly bulging shape at the laterally central region of said sole structure.

6. The sole structure according to claim 1, wherein said elastic member has a recess formed on a lower surface thereof, said recess being disposed at a position corresponding to said indentation of said lower plate and extending along said indentation.

7. The sole structure according to claim 1, wherein said elastic member extends along an entire width of said sole structure.

8. The sole structure according to claim 1, wherein said upper plate and said lower plate are provided at a forefoot region of said sole structure, said elastic member being disposed inside a medial side end portion and inside a lateral side end portion of said sole structure, said lower plate extending continuously in the longitudinal direction at a laterally central region, the medial side end portion and the lateral side end portion of said sole structure.

9. The sole structure according to claim 8, wherein said lower plate has a laterally extending third indentation that divides said lower plate in the longitudinal direction inside at the medial side end portion and inside at the lateral side end portion of said sole structure, said lower plate further having a longitudinally extending fourth indentation at the laterally central region of said sole structure, said fourth indent at ion being integrated with said third indentation, said lower plate still further having a longitudinally extending fifth indentation inside the medial side end portion and inside the lateral side end portion of said sole structure, said fifth indentation being integrated with said third indentation.

10. The sole structure according to claim 9, wherein said third to fifth indentations form a generally H-shaped indentation in said lower plate.

11. The sole structure according to claim 1, wherein said upper plate and said lower plate are disposed at a heel region of said sole structure, said elastic member is disposed on a heel lateral side and a heel rear end side, at least a portion of said lower plate is divided in the longitudinal direction by a lateral indentation provided at a position where said lower plate is in contact with said elastic member on the heel lateral side, and at least a portion of said lower plate is divided in a lateral direction by a longitudinal indentation provided at a position where said lower plate is in contact with said elastic member on the heel rear end side.

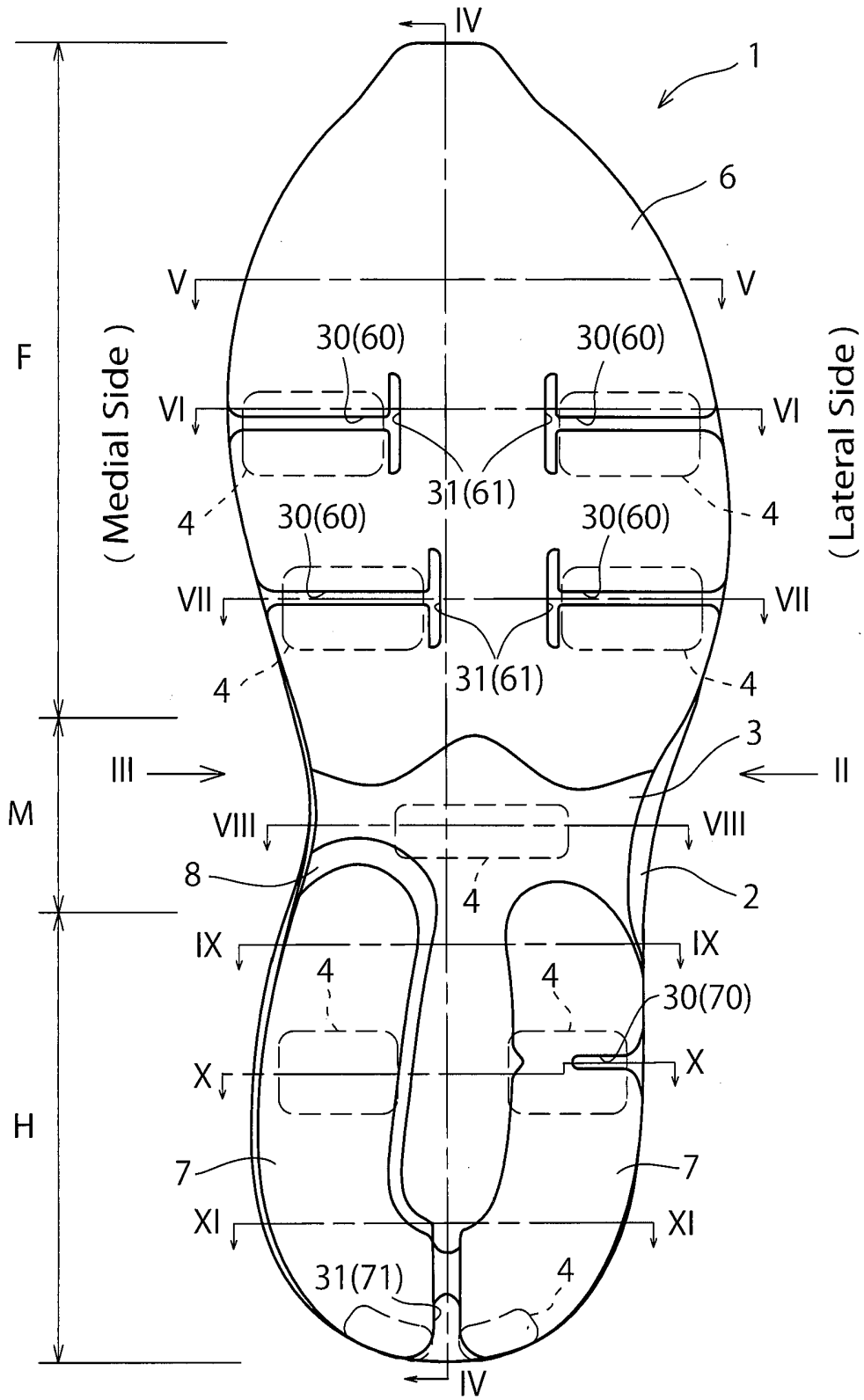
12. The sole structure according to claim 1, wherein said lower plate has a downwardly convex shape at a longitudinally region extending in front of and in the rear of said lateral indentation.

13. The sole structure according to claim 1, wherein said

lower plate has a plurality of bulges that respectively bulge downwardly convexly, said elastic member being disposed at a position where said respective bulges are longitudinally adjacent to each other.

14. The sole structure according to claim 1, wherein said lower plate has an outsole fixedly attached on a lower surface of said lower plate, said outsole being divided in the longitudinal direction by an indentation that corresponds to said indentation of said lower plate.

FIG. 1


IV
1
6
V
V
F
(Medial Side)
30(60)
30(60)
VI
VI
(Lateral Side)
31(61)
4
4
30(60)
30(60)
VII
VII
31(61)
4
4
3
III
II
M
VIII
VIII
8
4
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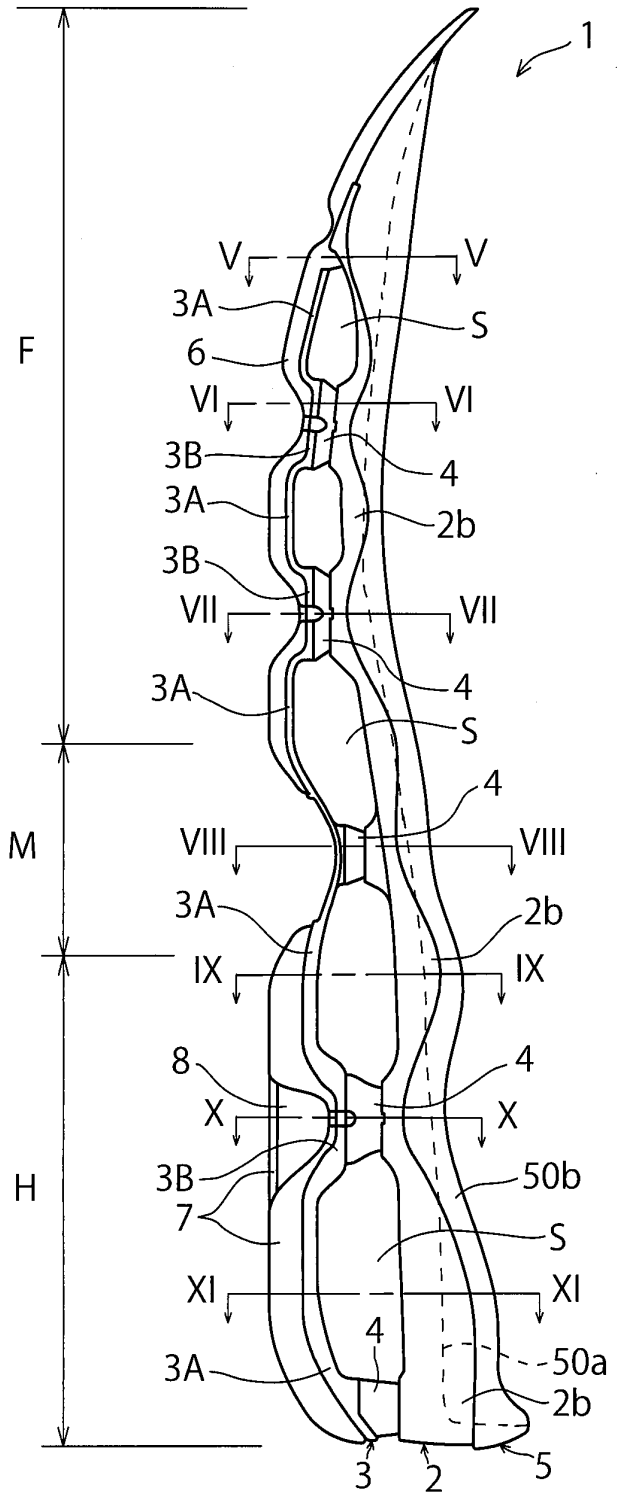
4
4
30(70)
X
X
H
7
7
XI
XI
31(71)
4
IV

FIG. 2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4
M
VIII
VIII
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2b
IX
IX
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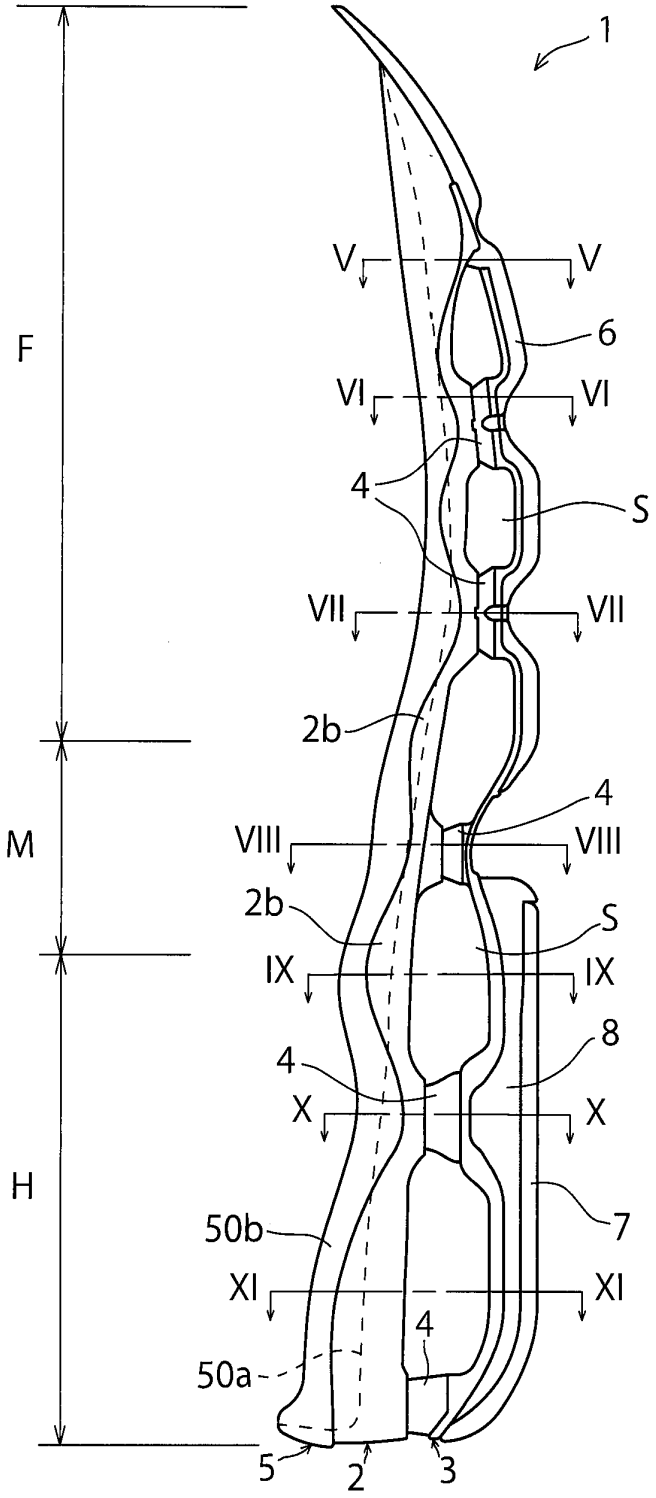
FIG. 3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50a
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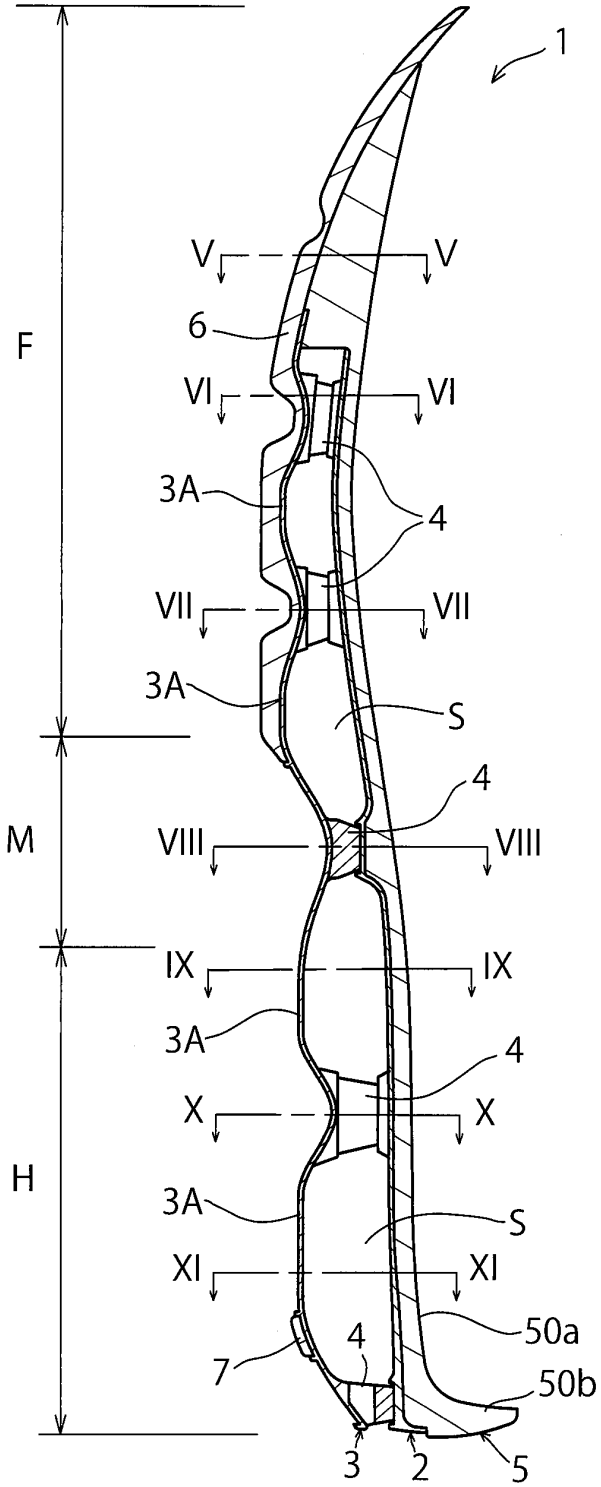
FIG. 4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VII
VII
3A
S
4
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VIII
VIII
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4
50a
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50b
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5

FIG. 5

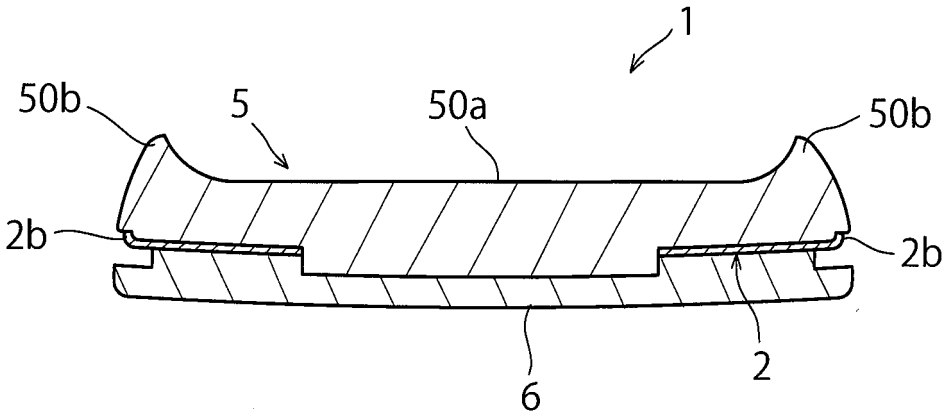


FIG. 6

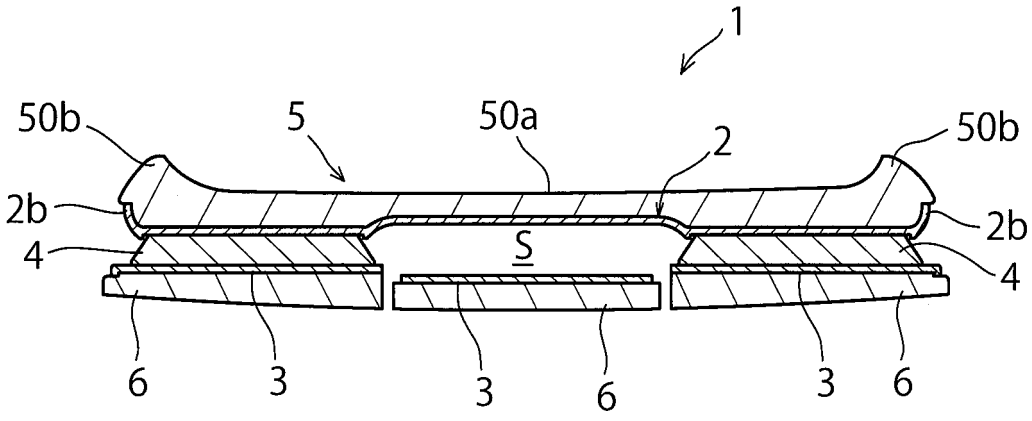


FIG. 7

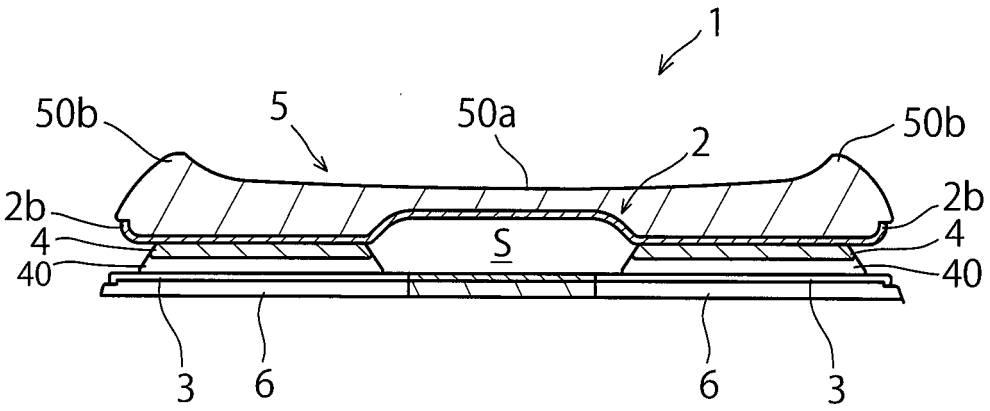


FIG. 8

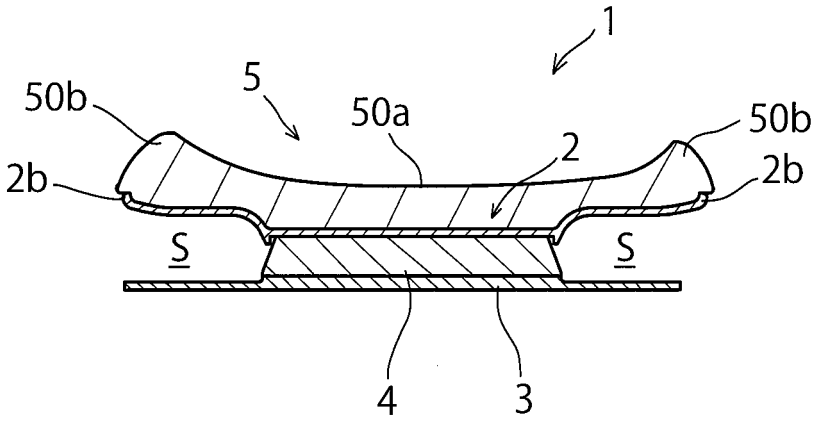


FIG. 9

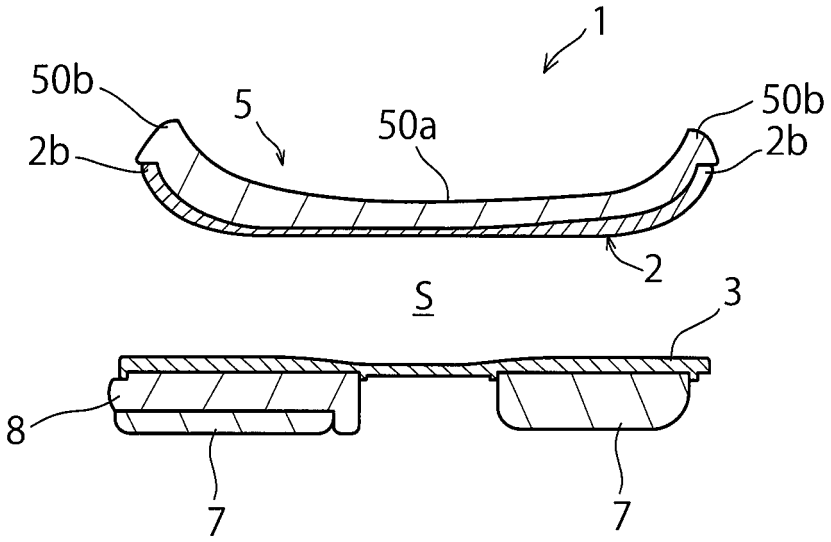


FIG. 10

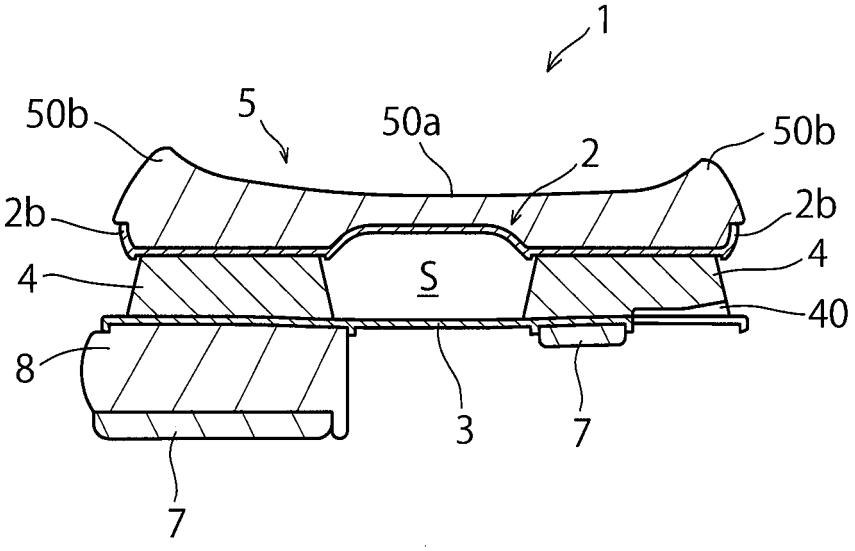


FIG. 11

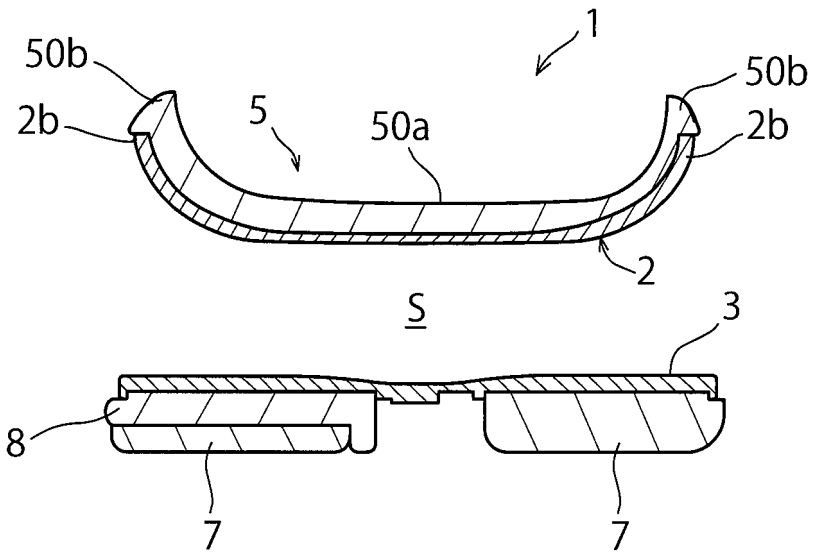


FIG. 12

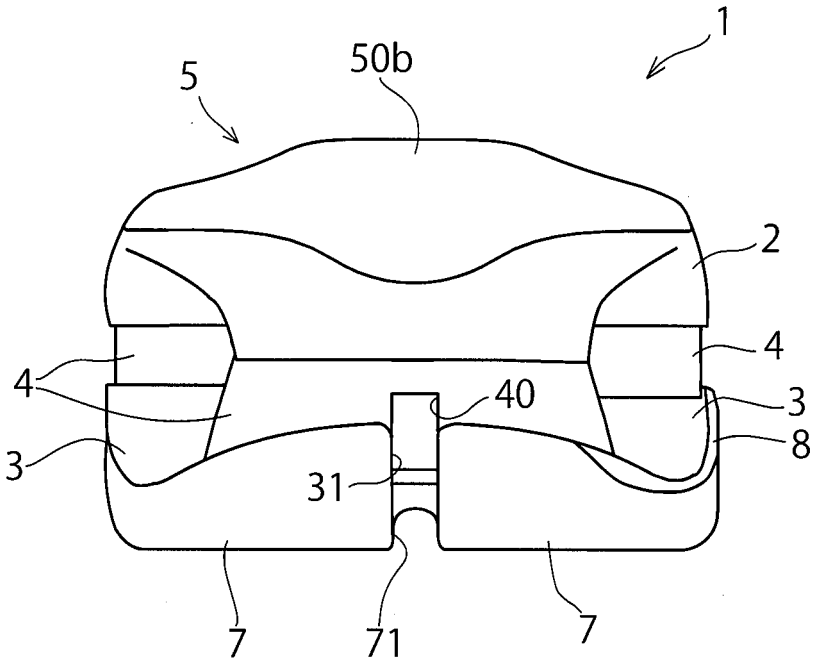


FIG. 13

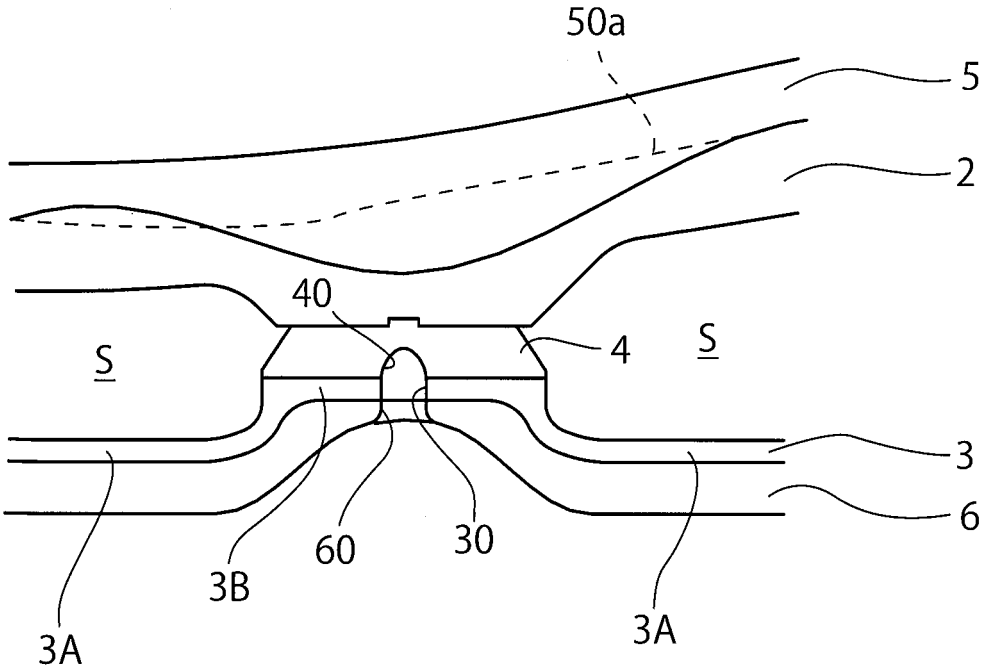
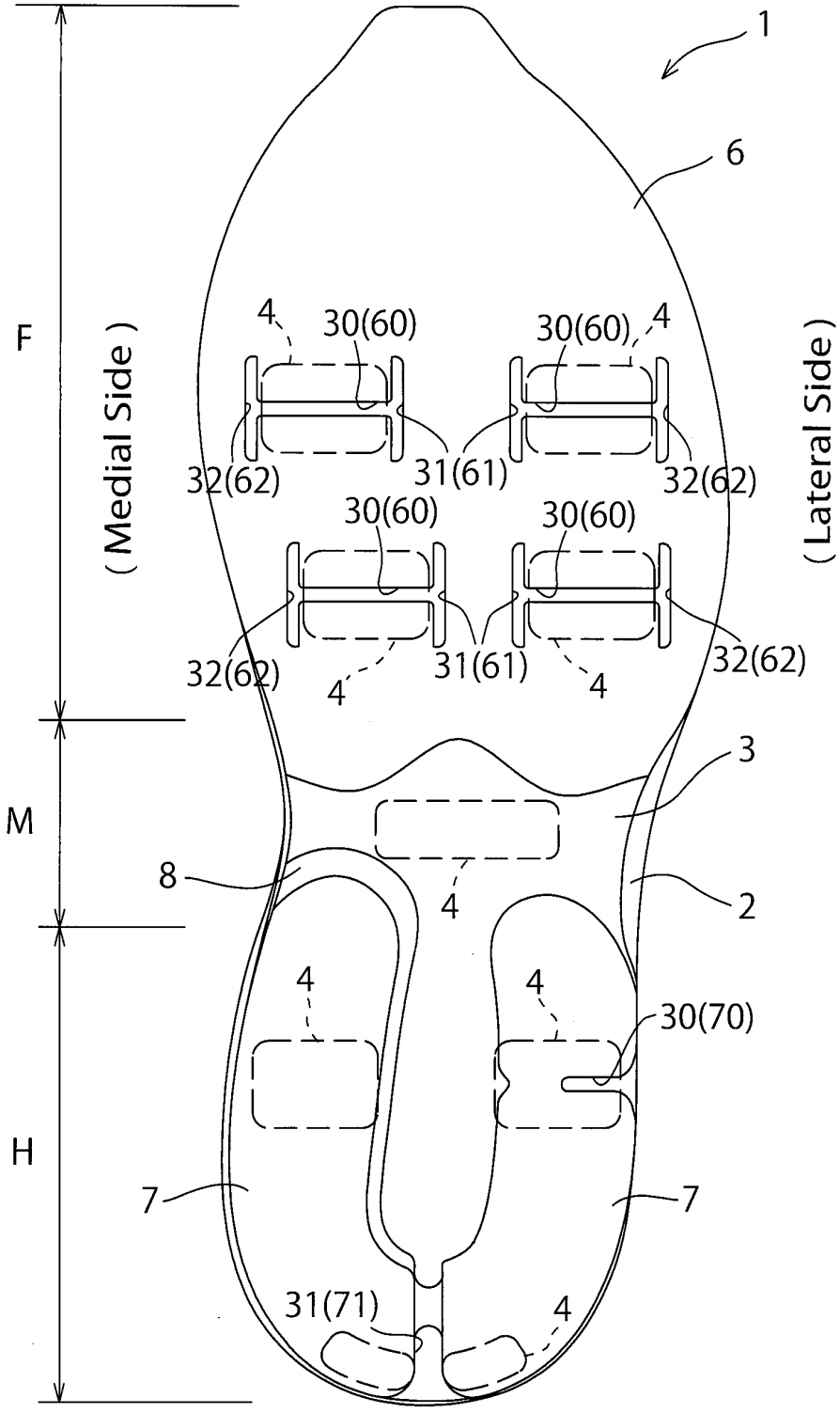


FIG. 14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(Lateral Side)
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32(62)
30(60)
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3
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30(70)
7
7
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4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/060044

A. CLASSIFICATION OF SUBJECT MATTER
A43B13/14(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)
A43B13/14

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2014
Kokai Jitsuyo Shinan Koho 1971-2014 Toroku Jitsuyo Shinan Koho 1994-2014

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 4087882 B2 (Mizuno Inc.), 21 May 2008 (21.05.2008), entire text; all drawings (Family: none)	1-14
A	JP 2011-10946 A (Mizuno Inc.), 20 January 2011 (20.01.2011), entire text; all drawings & EP 2269478 A1	1-14
A	JP 2004-65978 A (Adidas International Marketing B.V.), 04 March 2004 (04.03.2004), entire text; all drawings & US 2004/0049946 A1 & EP 1386553 A1 & DE 10234913 A1	1-14

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

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"O" document referring to an oral disclosure, use, exhibition or other means
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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
17 July, 2014 (17.07.14)	05 August, 2014 (05.08.14)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/060044

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2008/0052960 A1 (Manon BELLEY), 06 March 2008 (06.03.2008), entire text; all drawings & JP 2007-307378 A & EP 1857004 A1 & CA 2587810 A1	1-14

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 4087882 B **[0002] [0003] [0004] [0006]**
- JP 4020953 B **[0002] [0003] [0005] [0006]**