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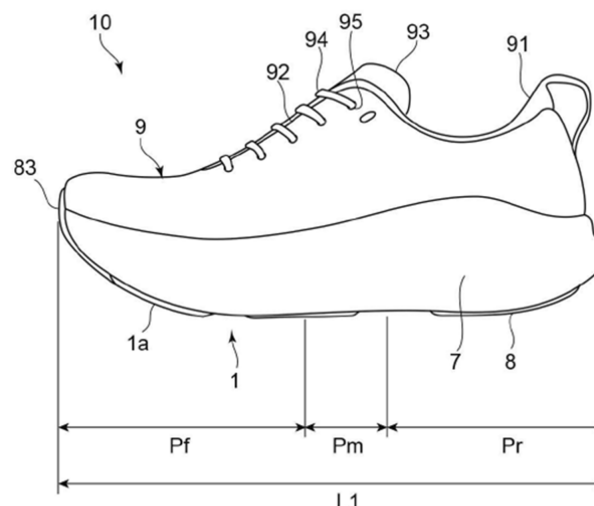
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(54) **SOLE**

(57) Provided is a sole (1) capable of promoting, while improving the flexibility of MP joints of a foot, a smooth weight transfer in a foot length direction from a heel to a toe, and a smooth weight transfer in a foot width direction from a lateral side of the foot to a medial side of the foot. A lower surface 1a of a sole (1) in-

cludes a central groove (2) located at a central part of the sole (1) in the foot width direction and extending in the foot length direction, and a lateral-side groove (3) located on the lateral side of the foot relative to the central groove (2) and extending in the foot length direction.

FIG. 1



EP 4 825 242 A1

Description**CROSS-REFERENCE TO RELATED APPLICATION**

[0001] This application claims priority to Japanese Patent Application No. 2025-068695, the disclosures of which are incorporated herein by reference in their entirety.

BACKGROUND**Technical field**

[0002] The present disclosure relates to a sole.

Background Information

[0003] Non Patent Document (Masahiro Takahashi, Masato Maeda, Haruo Nomura, and Yasuyoshi Yanagida, "Plantar Pressure Distribution During Running of Long-distance Runner", Journal of Japan Society of Sports Industry, VOL. 10, No. 1 (2000), 75-88) describes in a publication a pattern of foot pressure distribution indicating that while a body weight is transferred in a foot length direction from a rearfoot portion to a forefoot portion via a midfoot portion by a running motion, the body weight is also transferred in a foot width direction from a lateral side of the foot to a medial side of the foot mainly in the forefoot portion. As can be seen, on the bottom of a runner's foot during running, in a period from when the runner's foot contacts the ground to when it is off the ground, the body weight of the runner is transferred not only in the foot length direction from the heel to the toe but also in the foot width direction. In order to improve the running performance, it is effective to allow the weight transfer to proceed smoothly.

[0004] In conventional running shoes, on the basis of an idea that a smooth weight transfer in a foot length direction from a heel to a toe is realized by conforming to the bending of MP joints of the foot, a structure in which a groove extending along the foot width direction is provided on a lower surface of the forefoot portion of a sole (in the vicinity of the MP joints, in particular) has generally been adopted. Running shoes having such a structure are described in, for example, Japanese Unexamined Patent Application Publication No. 2000-083705 and Japanese Unexamined Patent Application Publication No. 2019-051231.

[0005] Chinese Patent No. 104095349 describes a sports shoe provided with four longitudinal grooves extending in a foot length direction on a bottom surface of a shoe sole, which is made of rubber, having excellent abrasion resistance. The bottom surface of the shoe sole is divided into five sections by the four longitudinal grooves such that the divided sections correspond to the positions of the wearer's plantar fascia in a one-to-one relationship.

SUMMARY

[0006] The present disclosure has been conceived in view of the above-described circumstances, and provides a sole capable of promoting, while improving the flexibility of MP joints of a foot, a smooth weight transfer in a foot length direction from a heel to a toe, and a smooth weight transfer from a lateral side of the foot to a medial side of the foot along a foot width direction.

[0007] A sole of the present disclosure pertains to a sole which constitutes a part of footwear, in which a lower surface of the sole includes a central groove located at a central part of the sole in a foot width direction and extending in a foot length direction, and a lateral-side groove located on a foot's lateral side relative to the central groove and extending in the foot length direction. Each of the central groove and the lateral-side groove includes a deepest portion extending at a substantially constant depth from rear to front of the sole, a front portion extending at a depth smaller than the depth of the deepest portion in front of the deepest portion, and a rear portion extending at a depth smaller than the depth of the deepest portion in rear of the deepest portion. When an area between a first virtual straight line, which passes through a position at an outer edge of the lower surface on the foot's lateral side at a point corresponding to 30% of a sole length with reference to a front end of the sole and a position at an outer edge of the lower surface on a foot's medial side at a point corresponding to 20% of the sole length with reference to the front end of the sole, and a second virtual straight line, which passes through a position at the outer edge of the lower surface on the foot's lateral side at a point corresponding to 45% of the sole length with reference to the front end of the sole and a position at the outer edge of the lower surface on the foot's medial side at a point corresponding to 35% of the sole length with reference to the front end of the sole is referred to as a tread area, each of at least a part of the deepest portion of the central groove and at least a part of the deepest portion of the lateral-side groove overlaps the tread area in a top view.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

FIG. 1 is a side view showing an example of footwear in which a sole of the present disclosure is used;

FIG. 2 is a bottom view of the sole;

FIG. 3 is a view of a central groove in which (A) is a bottom view, (B) is a cross-sectional view taken along line X1-X1, and (C) is a cross-sectional view taken along line X2-X2;

FIG. 4 is a view of a lateral-side groove in which (A) is a bottom view, (B) is a cross-sectional view taken along line Y1-Y1, and (C) is a cross-sectional view taken along line Y2-Y2;

FIG. 5 is a top view of a sole in which wearer's foot bones are superimposed on a bottom surface of the sole;

FIG. 6 is a schematic view illustrating a change in the posture of the sole during running;

FIG. 7 is a bottom view of a forefoot portion;

FIG. 8 is a view of a medial-side groove in which (A) is a bottom view, (B) is a cross-sectional view taken along line Z1-Z1, and (C) is a cross-sectional view taken along line Z2-Z2;

FIG. 9 is a front sectional view of the sole in a tread area TA; and

FIG. 10 is a front perspective view showing a toe of a shoe.

DETAILED DESCRIPTION

[Footwear]

[0009] FIG. 1 is a side view showing an example of footwear in which a sole of the present disclosure is used. In the present embodiment, a shoe as footwear will be described as an example. A shoe 10 illustrated in FIG. 1 is a running shoe as a sports shoe. However, the use of a shoe in which the sole of the present disclosure is used is not particularly limited, and the shoe may be a jogging shoe, a walking shoe, a casual shoe, or the like. The wearer is assumed to be a person of a standard body type who has the feet conforming to the size of the footwear (the shoe 10 in the present embodiment).

[0010] With respect to terms indicating directions, a foot length direction corresponds to a front-rear direction of the shoe 10. The foot length direction is an extending direction of a shoe center SC (see FIG. 2), which is a center line of the shoe 10 in a top view. The front refers to the direction from a heel to a toe of a foot, and the rear refers to the opposite direction. A foot width direction corresponds to a left-right direction of the shoe 10. The foot width direction is the direction which is orthogonal to the foot length direction in a top view. A foot's medial side refers to the first toe side of a foot in the foot width direction, and a foot's lateral side refers to the fifth toe side of the foot in the foot width direction. Below refers to the direction in which gravity is directed in a state in which the shoe 10 is placed on the horizontal ground, and above refers to the opposite direction.

[0011] The shoe 10 includes a sole 1 and an upper 9 which is disposed above the sole 1. The shoe 10 is configured such that the wearer's foot is supported by the sole 1 from below and covered by the upper 9 from above. The upper 9 is connected to the sole 1 by adhesive bonding, sewing, or the like. The upper 9 may be configured to cover the sole of the wearer's foot with an insole (not shown). A shoe insert (not shown) may be fitted above the insole.

[0012] In the present embodiment, the sole 1 includes: a forefoot portion Pf which supports a toe portion and a tread portion of the wearer's foot; a rearfoot portion Pr which supports a heel portion of the wearer's foot; and a midfoot portion Pm located between the forefoot portion Pf and the rearfoot portion Pr. The forefoot portion Pf is, for example, a region in the range of 0% or more and less than 45% of a sole length L1 with reference to a front end of the sole 1. The midfoot portion Pm is, for example, a region in the range of 45% or more and less than 60% of the sole length L1 with reference to the front end of the sole 1. The rearfoot portion Pr is, for example, a region in the range of 60% or more and less than or equal to 100% of the sole length L1 with reference to the front end of the sole 1.

[0013] The upper 9 includes: a shoe opening portion 91 into which the wearer's foot can be inserted; an instep opening portion 92 extending toward the front from the shoe opening portion 91; a tongue 93 closing the instep opening portion 92; and a shoelace 94 disposed above the tongue 93. The tongue 93 covers a range from a front portion of the wearer's ankle to the instep, and is fitted to the wearer's instep by a downward pressing force generated by the tightening the shoelace 94. The shoelace 94 is inserted into eyelets 95 formed on the left and right sides of the instep opening portion 92. The upper 9 is not limited to such a configuration, and a conventionally known structure and material may be applied with no particular limitation.

[0014] In the present embodiment, while the sole 1 and the shoe 10 for a left foot will be described as an example, the description can be similarly applied to a sole and a shoe for a right foot. The sole and the shoe for the right foot have a shape bilaterally symmetrical to the sole 1 and the shoe 10 for the left foot, or a shape substantially similar thereto.

[Sole]

[0015] FIG. 2 is a bottom view of the sole 1. The sole 1 constitutes a part of the shoe 10 which is footwear. A lower surface 1a of the sole 1 includes a central groove 2 located at a central part of the sole 1 in the foot width direction and extending in the foot length direction, and a lateral-side groove 3 located on the foot's lateral side relative to the central groove 2 and extending in the foot length direction. In the present embodiment, the lower surface 1a of the sole 1 further includes a medial-side groove 4 located on the foot's medial side relative to

the central groove 2 and extending in the foot length direction. However, the configuration is not limited to the above, and the setting of the medial-side groove 4 is arbitrary. In the following description, the central groove 2, the lateral-side groove 3, and the medial-side groove 4 (when the medial-side groove 4 is not provided, the central groove 2 and the lateral-side groove 3) may be collectively referred to as "longitudinal grooves 5".

[0016] The central groove 2 and the lateral-side groove 3 include deepest portions 2d and 3d extending at a substantially constant depth from the rear to the front of the sole 1, front portions 2f and 3f extending at a depth smaller than the depth of the deepest portions 2d and 3d in front of the deepest portions 2d and 3d, and rear portions 2r and 3r extending at a depth smaller than the depth of the deepest portions 2d and 3d in rear of the deepest portions 2d and 3d, respectively. Further, only one deepest portion may be provided in the central groove 2 or a plurality of deepest portions may be provided in the central groove 2. Only one deepest portion may be provided in the lateral-side groove 3 or a plurality of deepest portions may be provided in the lateral-side groove 3. Here, the "depth" of the groove is intended as the length from a ground-contacting surface of the sole 1 to a bottom surface of the groove in an up-down direction. The phrase "extending at a substantially constant depth" is intended as not including a change in the depth that has been provided intentionally as design, and minute unevenness caused by a surface quality of the sole 1 or the like may be included. In FIGS. 2 and 5, the deepest portions 2d and 3d, and a deepest portion 4d, which will be described later, are colored.

[0017] Illustration (A) of FIG. 3 is a bottom view of the central groove 2. Illustration (B) of FIG. 3 is a cross-sectional view taken along line X1-X1 conforming to a groove width center line of the central groove 2. In illustration (B) of FIG. 3, in order to make it easy to understand a change in the depth of the central groove 2, the lower surface 1a is depicted as being flat. Illustration (C) of FIG. 3 is a cross-sectional view taken along line X2-X2 conforming to a groove width direction of the central groove 2. The central groove 2 has a continuous groove shape extending from the rear portion 2r to the front portion 2f via the deepest portion 2d. A depth D2 of the central groove 2 is relatively large at the deepest portion 2d and is relatively small at each of the front portion 2f and the rear portion 2r. The depth D2 of the central groove 2 is maximum at the deepest portion 2d.

[0018] Illustration (A) of FIG. 4 is a bottom view of the lateral-side groove 3. Illustration (B) of FIG. 4 is a cross-sectional view taken along line Y1-Y1 conforming to a groove width center line of the lateral-side groove 3. In illustration (B) of FIG. 4, in order to make it easy to understand a change in the depth of the lateral-side groove 3, the lower surface 1a is depicted as being flat.

Illustration (C) of FIG. 4 is a cross-sectional view taken along line Y2-Y2 conforming to a groove width direction of the lateral-side groove 3. The lateral-side groove 3 has a continuous groove shape extending from the rear portion 3r to the front portion 3f via the deepest portion 3d. A depth D3 of the lateral-side groove 3 is relatively large at the deepest portion 3d and is relatively small at each of the front portion 3f and the rear portion 3r. The depth D3 of the lateral-side groove 3 is maximum at the deepest portion 3d.

[0019] FIG. 5 is a top view of the sole 1 in which the wearer's foot bones are superimposed on the lower surface 1a of the sole 1. Position P1 is a position at an outer edge of the lower surface 1a on the foot's lateral side at a point corresponding to 30% of the sole length L1 with reference to the front end of the sole 1. In other words, a length La from the front end of the sole 1 to position P1 in the foot length direction is 30% of the sole length L1. Position P2 is a position at an outer edge of the lower surface 1a on the foot's medial side at a point corresponding to 20% of the sole length L1 with reference to the front end of the sole 1. In other words, a length Lb from the front end of the sole 1 to position P2 in the foot length direction is 20% of the sole length L1. Position P3 is a position at the outer edge of the lower surface 1a on the foot's lateral side at a point corresponding to 45% of the sole length L1 with reference to the front end of the sole 1. In other words, a length Lc from the front end of the sole 1 to position P3 in the foot length direction is 45% of the sole length L1. Position P4 is a position at the outer edge of the lower surface 1a on the foot's medial side at a point corresponding to 35% of the sole length L1 with reference to the front end of the sole 1. In other words, a length Ld from the front end of the sole 1 to position P4 in the foot length direction is 35% of the sole length L1.

[0020] When an area between a first virtual straight line SL1 passing through position P1 and position P2 and a second virtual straight line SL2 passing through position P3 and position P4 is referred to as a tread area TA, each of at least a part of the deepest portion 2d of the central groove 2 and at least a part of the deepest portion 3d of the lateral-side groove 3 overlaps the tread area TA in a top view (see also FIG. 2). In FIG. 7, the tread area TA is hatched. As illustrated in FIG. 5, the tread area TA is an area that overlaps with MP joints of the wearer's foot in a top view.

[0021] FIG. 6 is a schematic view illustrating a change in the posture of the sole 1 during running. The wearer lifts the heel to move forward, and shifts the center of gravity toward the front and kicks the ground. In doing so, the sole 1 is bent in such a way that the rearfoot portion Pr is raised while the forefoot portion Pf is made to be in contact with the ground, as illustrated in FIG. 6, with the MP joints of the wearer's foot being the bending position. In this process, at the bottom of the wearer's foot, the body weight is transferred not

only toward the front in the foot length direction but also in the foot width direction from the foot's lateral side to the foot's medial side in the forefoot portion Pf. That is, in the present embodiment, the body weight is transferred along the MP joints of the foot, which correspond to the bending position, as indicated by arrows A1, A2, and A3 shown in FIG. 7.

[0022] In the sole 1, the central groove 2 and the lateral-side groove 3 are formed, whereby the sole 1 is easily deformed when receiving a load, and flexible deformation according to a change in the distribution of foot pressure is enabled. In accordance with the weight transfer from the rear to the front along the foot length direction, the central groove 2 is deformed relatively small at the rear portion 2r, then deformed relatively large at the deepest portion 2d, and then deformed relatively small at the front portion 2f. Similarly, the lateral-side groove 3 is deformed relatively small at the rear portion 3r, then deformed relatively large at the deepest portion 3d, and then deformed relatively small at the front portion 3f. Consequently, in the central groove 2 and the lateral-side groove 3, the amount of deformation gradually changes from the rear in order, i.e., in the order of the rear portion, the deepest portion, and the front portion. Thus, an effect of promoting a smooth weight transfer along the foot length direction is achieved.

[0023] Further, in the sole 1, each of at least a part of the deepest portion 2d and at least a part of the deepest portion 3d overlaps the tread area TA. Thus, deformation caused by the bending of the MP joints of the foot as indicated in FIG. 6 is facilitated, and an effect of promoting the weight transfer along the foot length direction is achieved. Moreover, a plurality of grooves (at least two grooves which are the central groove 2 and the lateral-side groove 3) are arranged side by side in the foot width direction, and deformation in the foot width direction is facilitated. Thus, an effect of promoting a smooth weight transfer from the foot's lateral side to the foot's medial side along the foot width direction is achieved, and it is possible to flexibly adapt to a change in the distribution of foot pressure at the time of kicking the ground as illustrated in FIG. 7. As can be seen, not only the weight transfer along the foot length direction but also the weight transfer along the foot width direction can be supported. In particular, the sole 1 is suitable for improving the running performance.

[0024] As illustrated in FIG. 5, each of the deepest portion 2d of the central groove 2 and the deepest portion 3d of the lateral-side groove 3 overlaps a virtual line VL passing through a big toe ball portion B1 and a little toe ball portion B5 of the wearer's foot in a top view (see also FIG. 2). The virtual line VL is formed of a curved line extending smoothly. The virtual line VL can be set at an arbitrary position in a range passing through the big toe ball portion B1 and the little toe ball portion B5. Therefore, for example, the virtual line VL may be set at a position passing through a front end, a

rear end, or the center of each of the big toe ball portion B1 and the little toe ball portion B5. Since the virtual line VL indicated in FIG. 5 extends along the MP joint of each toe of the wearer, there may be a case where the virtual line VL is a virtual line corresponding to the MP joints of the wearer's foot.

[0025] As illustrated in FIGS. 3 and 4, the depth of each of the front portions 2f and 3f of the central groove 2 and the lateral-side groove 3 may be continuously decreased toward the front of the sole 1, and the depth of each of the rear portions 2r and 3r of the central groove 2 and the lateral-side groove 3 may be continuously increased toward the front of the sole 1. Therefore, the amount of deformation is gradually increased toward the front in the rear portion 2r, so that relatively large deformation is possible at the deepest portion 2d, and the amount of deformation is gradually decreased toward the front in the front portion 2f. Similarly, the amount of deformation is gradually increased toward the front in the rear portion 3r, so that relatively large deformation is possible at the deepest portion 3d, and the amount of deformation is gradually decreased toward the front in the front portion 3f. As a consequence, a smooth weight transfer along the foot length direction can be effectively promoted.

[0026] The central groove 2 is formed as a single groove that is not branched in the middle or does not intersect with another groove. No step is formed on a groove bottom surface 21 of the central groove 2, and the depth D2 of the central groove 2 may be changed smoothly. At the deepest portion 2d, the groove bottom surface 21 may extend parallel to the lower surface 1a. The lateral-side groove 3 is formed as a single groove that is not branched in the middle or does not intersect with another groove. No step is formed on a groove bottom surface 31 of the lateral-side groove 3 and the depth D3 of the lateral-side groove 3 may be changed smoothly. At the deepest portion 3d, the groove bottom surface 31 may extend parallel to the lower surface 1a. Each of the groove bottom surface 21 and the groove bottom surface 31 is formed to be flat in a cross-sectional view taken along the groove width direction, but is not limited thereto, and may be arc-shaped, V-shaped, or the like.

[0027] It is sufficient if the central groove 2 is located substantially at the center in the foot width direction, and the central groove 2 need not be strictly located at the center in the foot width direction. From the standpoint of forming the central groove 2 at a more suitable position, at least a part of the deepest portion 2d of the central groove 2 may overlap a second metatarsal bone MB2 or a third metatarsal bone MB3 of the wearer's foot in a top view. In the present embodiment, as illustrated in FIG. 5, an example in which a part of the deepest portion 2d overlaps the third metatarsal bone MB3 in a top view is shown.

[0028] The lateral-side groove 3 is disposed between the outer edge of the lower surface 1a on the foot's

lateral side and the central groove 2. From the standpoint of forming the lateral-side groove 3 at a more suitable position, at least a part of the deepest portion 3d of the lateral-side groove 3 may overlap a fourth metatarsal bone MB4 or a fifth metatarsal bone MB5 of the wearer's foot in a top view. In the present embodiment, as illustrated in FIG. 5, an example in which a part of the deepest portion 3d overlaps the fifth metatarsal bone MB5 in a top view is shown.

[0029] From the standpoint of forming the central groove 2 at a more suitable position, at least a part of the deepest portion 2d of the central groove 2 may be located on the foot's lateral side relative to the MP joint of the first toe of the wearer's foot and on the foot's medial side relative to the MP joint of the fourth toe of the wearer's foot. In the present embodiment, as illustrated in FIG. 5, an example in which the entire deepest portion 2d is located on the foot's lateral side relative to the MP joint of the first toe and on the foot's medial side relative to the MP joint of the fourth toe is shown.

[0030] From the standpoint of forming the lateral-side groove 3 at a more suitable position, at least a part of the deepest portion 3d of the lateral-side groove 3 may be located on the foot's lateral side relative to the MP joint of the third toe of the wearer's foot. In the present embodiment, as illustrated in FIG. 5, an example in which the entire deepest portion 3d is located on the foot's lateral side relative to the MP joint of the third toe is shown.

[0031] From the standpoint of forming the central groove 2 at a more suitable position, at least a part of the deepest portion 2d of the central groove 2 may overlap a second proximal phalanx PP2 or a third proximal phalanx PP3 of the wearer's foot in a top view. In the present embodiment, as illustrated in FIG. 5, an example in which a part of the deepest portion 2d overlaps the second proximal phalanx PP2 in a top view is shown.

[0032] From the standpoint of forming the lateral-side groove 3 at a more suitable position, at least a part of the deepest portion 3d of the lateral-side groove 3 may overlap a fourth proximal phalanx PP4 or a fifth proximal phalanx PP5 of the wearer's foot in a top view. In the present embodiment, as illustrated in FIG. 5, an example in which a part of the deepest portion 3d overlaps the fourth proximal phalanx PP4 in a top view is shown.

[0033] From the standpoint of forming the lateral-side groove 3 at a more suitable position, at least a part of the deepest portion 3d of the lateral-side groove 3 may overlap the little toe ball portion B5 of the wearer's foot in a top view.

[0034] From the standpoint of forming the central groove 2 and the lateral-side groove 3 at more suitable positions, as illustrated in FIG. 2, the deepest portion 2d of the central groove 2 may be located on the foot's medial side relative to a heel center HC, which is a

straight line connecting the center of a heel bone of the wearer's foot and between the third toe and the fourth toe, and the deepest portion 3d of the lateral-side groove 3 may be located on the foot's lateral side relative to the heel center HC. However, the configuration is not limited to the above and a part of the deepest portion 2d or a part of the deepest portion 3d may overlap the heel center HC.

[0035] In the present embodiment, an example in which each of the central groove 2 and the lateral-side groove 3 is a curved line including a convex portion protruding toward the foot's lateral side is shown. Alternatively, at least one of the central groove 2 and the lateral-side groove 3 may be a curved line including a convex portion protruding toward the foot's lateral side. The groove width center line of the central groove 2 is a curved line including a convex portion 20a protruding in an arc shape toward the foot's lateral side (see FIG. 3), and the groove width center line of the lateral-side groove 3 is a curved line including a convex portion 30 protruding in an arc shape toward the foot's lateral side (see FIG. 4). With such a structure, since the central groove 2 and the lateral-side groove 3 resemble those on the sole 1 in shape in a top view, a width of each of a region 61 (see FIG. 7) extending in the foot length direction between the central groove 2 and the lateral-side groove 3 and a region 62 (see FIG. 7) extending in the foot length direction between the outer edge of the lower surface 1a on the foot's lateral side and the lateral-side groove 3 can be brought close to a constant width. Thus, an effect of promoting deformation when a load is received can be exhibited stably along the foot length direction.

[0036] Further, in the present embodiment, an example in which the central groove 2 is a curved line including a convex portion protruding toward the foot's medial side in front of the virtual line VL is shown. The groove width center line of the central groove 2 is a curved line including a convex portion 20b protruding in an arc shape toward the foot's medial side (see FIG. 3). With such a structure, since the central groove 2 can be extended along a movement locus of the center of gravity of the body, a shift of the center of gravity of the body along a central part in the foot width direction can be promoted, whereby the running stability can be enhanced. In the present embodiment, the groove width center line of the central groove 2 is an S-shaped curved line including the convex portion 20a and the convex portion 20b.

[0037] It is preferable that at least a part of the width in the foot width direction between the deepest portion 3d of the lateral-side groove 3 and the outer edge of the lower surface 1a on the foot's lateral side (i.e., the width of the region 62 described above) should be substantially constant. By this feature, the effect of promoting deformation when a load is received can be exhibited stably along the foot length direction. From this point of view, it is preferable that the width of the region 62 in

the foot width direction should be substantially constant over the entire area in a range in the foot length direction in which the deepest portion 3d is formed.

[0038] As illustrated in FIGS. 2 to 4, each of the deepest portion 2d and the deepest portion 3d intersects with the virtual line VL. In the present embodiment, a length L2dr of a portion extending to the rear from the virtual line VL, at the deepest portion 2d of the central groove 2, is greater than a length L2df of a portion extending to the front from the virtual line VL ($L2df < L2dr$). Further, a length L3dr of a portion extending to the rear from the virtual line VL, at the deepest portion 3d of the lateral-side groove 3, is smaller than a length L3df of a portion extending to the front from the virtual line VL ($L3df > L3dr$). By this feature, it is possible to effectively promote deformation in the process in which the body weight is transferred from the rear to the front in the vicinity of the virtual line VL at which the foot pressure is increased. However, the configuration is not limited to the above and the magnitude relationship of the above-described lengths may be reversed.

[0039] In the present embodiment, the length L2df is greater than the length L3df ($L2df > L3df$).

[0040] With such a structure, it is easy to maintain the effect of promoting deformation until the end of a kicking motion. From this point of view, it is suitable that a front end of the deepest portion 2d of the central groove 2 is located more to the front than a front end of the deepest portion 3d of the lateral-side groove 3. Similarly, it is suitable that the front end of the deepest portion 2d of the central groove 2 is located more to the front than a front end of the deepest portion 4d of the medial-side groove 4 to be described later. Further, in the present embodiment, the length L2dr is greater than the length L3dr ($L2dr > L3dr$). A rear end of the deepest portion 2d of the central groove 2 is located more to the rear than a rear end of the deepest portion 3d of the lateral-side groove 3, and is located more to the rear than a rear end of the deepest portion 4d of the medial-side groove 4 to be described later.

[0041] As illustrated in FIGS. 2 to 4, in the present embodiment, a length L2b of a portion extending to the rear from the virtual line VL at the central groove 2 is greater than a length L2a of a portion extending to the front from the virtual line VL ($L2a < L2b$). By this feature, it is possible to improve the flexibility of the MP joints in the process in which the body weight is transferred from the rear to the front with respect to the virtual line VL at which the foot pressure is increased at the time of kicking the ground. In the present embodiment, the length L2a is greater than a length L3a of a portion extending to the front from the virtual line VL at the lateral-side groove 3 ($L2a > L3a$). Further, the length L2b is greater than a length L3b of a portion extending to the rear from the virtual line VL at the lateral-side groove 3 ($L2b > L3b$). However, the configuration is not limited to the above and the magnitude relationship of the above-described lengths may be re-

versed.

[0042] As described above, the lower surface 1a includes the medial-side groove 4 located on the foot's medial side relative to the central groove 2 and extending in the foot length direction. In the present embodiment, three grooves constituted of the central groove 2, the lateral-side groove 3, and the medial-side groove 4 are formed in the forefoot portion Pf, and these grooves extend in the foot length direction so as to intersect with the virtual line VL. The medial-side groove 4 includes the deepest portion 4d extending at a substantially constant depth from the rear to the front of the sole 1, a front portion 4f extending at a depth smaller than the depth of the deepest portion 4d in front of the deepest portion 4d, and a rear portion 4r extending at a depth smaller than the depth of the deepest portion 4d in rear of the deepest portion 4d. Further, only one deepest portion may be provided in the medial-side groove 4 or a plurality of deepest portions may be provided in the medial-side groove 4. At least a part of the deepest portion 4d of the medial-side groove 4 overlaps the tread area TA in a top view. In the present embodiment, an example in which the entire deepest portion 4d of the medial-side groove 4 overlaps the tread area TA in a top view is shown.

[0043] Illustration (A) of FIG. 8 is a bottom view of the medial-side groove 4. Illustration (B) of FIG. 8 is a cross-sectional view taken along line Z1-Z1 conforming to a groove width center line of the medial-side groove 4. In illustration (B) of FIG. 8, in order to make it easy to understand a change in the depth of the medial-side groove 4, the lower surface 1a is depicted as being flat. Illustration (C) of FIG. 8 is a cross-sectional view taken along line Z2-Z2 conforming to a groove width direction of the medial-side groove 4. The medial-side groove 4 has a continuous groove shape extending from the rear portion 4r to the front portion 4f via the deepest portion 4d. A depth D4 of the medial-side groove 4 is relatively large at the deepest portion 4d and is relatively small at each of the front portion 4f and the rear portion 4r. The depth D4 of the medial-side groove 4 is maximum at the deepest portion 4d.

[0044] In the sole 1 of the present embodiment, the medial-side groove 4 is formed in addition to the central groove 2 and the lateral-side groove 3, whereby the sole 1 is further easily deformed when receiving a load, and more flexible deformation according to a change in the distribution of foot pressure is enabled. In accordance with the weight transfer from the rear to the front along the foot length direction, the medial-side groove 4 is deformed relatively small at the rear portion 4r, then deformed relatively large at the deepest portion 4d, and then deformed relatively small at the front portion 4f. Therefore, an effect of promoting a smooth weight transfer along the foot length direction is achieved.

[0045] Since at least a part of the deepest portion 4d overlaps the tread area TA, deformation caused by the bending of the MP joints of the foot as indicated in FIG.

6 is further facilitated. Further, as illustrated in FIG. 9, at the stage in which the foot pressure is high in an area on the foot's lateral side (arrow A1 in FIG. 7), deformation can be promoted by the lateral-side groove 3 as indicated by illustration (A) of FIG. 9, at the stage in which the foot pressure is high in a central area (arrow A2 in FIG. 7), deformation can be promoted by the central groove 2 as indicated by illustration (B) of FIG. 9, and at the stage in which the foot pressure is high in an area on the foot's medial side (arrow A3 in FIG. 7), deformation can be promoted by the medial-side groove 4 as indicated by illustration (C) of FIG. 9. Consequently, a smooth weight transfer from the foot's lateral side to the foot's medial side along the foot width direction can be effectively promoted.

[0046] From the standpoint of further facilitating the deformation caused by the bending of the MP joints of the foot and also more effectively promoting a smooth weight transfer from the foot's lateral side to the foot's medial side along the foot width direction, the deepest portion 4d of the medial-side groove 4 may overlap the virtual line VL in a top view.

[0047] As illustrated in FIG. 8, the depth of the front portion 4f of the medial-side groove 4 may be continuously decreased toward the front of the sole 1, and the depth of the rear portion 4r of the medial-side groove 4 may be continuously increased toward the front of the sole 1. Accordingly, as with the central groove 2 and the lateral-side groove 3, the amount of deformation is gradually increased toward the front in the rear portion 4r, so that relatively large deformation is possible at the deepest portion 4d, and the amount of deformation is gradually decreased toward the front in the front portion 4f. Therefore, a smooth weight transfer along the foot length direction can be effectively promoted.

[0048] The medial-side groove 4 is formed as a single groove that is not branched in the middle or does not intersect with another groove. No step is formed on a groove bottom surface 41 of the medial-side groove 4 and the depth D4 of the medial-side groove 4 may be changed smoothly. At the deepest portion 4d, the groove bottom surface 41 of the medial-side groove 4 may extend parallel to the lower surface 1a. The groove bottom surface 41 is formed to be flat in a cross-sectional view taken along the groove width direction, but is not limited thereto, and may be arc-shaped, V-shaped, or the like.

[0049] The medial-side groove 4 is disposed between the outer edge of the lower surface 1a on the foot's medial side and the central groove 2. From the standpoint of forming the medial-side groove 4 at a more suitable position, at least a part of the deepest portion 4d of the medial-side groove 4 may overlap a first metatarsal bone MB1 of the wearer's foot in a top view. In the present embodiment, as illustrated in FIG. 5, an example in which a part of the deepest portion 4d overlaps the first metatarsal bone MB1 in a top view is shown.

[0050] From the standpoint of forming the medial-side groove 4 at a more suitable position, at least a part of the deepest portion 4d of the medial-side groove 4 may be located on the foot's medial side relative to the MP joint of the second toe of the wearer's foot. In the present embodiment, as illustrated in FIG. 5, an example in which the entire deepest portion 4d is located on the foot's medial side relative to the MP joint of the second toe is shown.

[0051] From the standpoint of forming the medial-side groove 4 at a more suitable position, at least a part of the deepest portion 4d of the medial-side groove 4 may overlap a first proximal phalanx PP1 of the wearer's foot in a top view. In the present embodiment, as illustrated in FIG. 5, an example in which a part of the deepest portion 4d overlaps the first proximal phalanx PP1 in a top view is shown.

[0052] At least a part of the deepest portion 4d of the medial-side groove 4 may overlap the big toe ball portion B1 of the wearer's foot in a top view. As the deepest portion 4d overlaps the big toe ball portion B1 where the foot pressure tends to increase, it is possible to appropriately promote a smooth weight transfer.

[0053] From the standpoint of forming the medial-side groove 4 at a more suitable position, as illustrated in FIG. 2, the deepest portion 4d of the medial-side groove 4 may be located on the foot's medial side relative to the shoe center SC. From the standpoint of forming the lateral-side groove 3 at a more suitable position, the deepest portion 3d of the lateral-side groove 3 may be located on the foot's lateral side relative to the shoe center SC. The present embodiment shows an example in which the lateral-side groove 3 is located on the foot's lateral side relative to the shoe center SC, the medial-side groove 4 is located on the foot's medial side relative to the shoe center SC, and the central groove 2 is located between the lateral-side groove 3 and the medial-side groove 4.

[0054] In the present embodiment, an example in which the medial-side groove 4 is a curved line including a convex portion protruding in an arc shape toward the foot's medial side is shown. The groove width center line of the medial-side groove 4 is a curved line including a convex portion 40 protruding in an arc shape toward the foot's medial side (see FIG. 8). With such a structure, since the central groove 2 and the medial-side groove 4 resemble those on the sole 1 in shape in a top view, a width of a region 63 (see FIG. 7) extending in the foot length direction between the outer edge of the lower surface 1a on the foot's medial side and the medial-side groove 4 can be brought close to a constant width. Thus, an effect of promoting deformation when a load is received can be exhibited stably along the foot length direction.

[0055] In the present embodiment, a depth D3d of the deepest portion 3d of the lateral-side groove 3 is smaller than a depth D2d of the deepest portion 2d of the central groove 2 ($D2d > D3d$). By this feature, it is

possible to obtain an effect of promoting a shift of the center of gravity of the body along the central part in the foot width direction, thereby enhancing the running stability. Further, a depth D4d of the deepest portion 4d of the medial-side groove 4 is smaller than the depth D2d ($D2d > D4d$). By this feature, it is possible to obtain an effect of suppressing overpronation (excessive pronation), in which the wearer's foot excessively falls toward the foot's medial side at the time of landing. From the standpoint of promoting the deformation along the movement locus of the center of gravity of the body, thereby enhancing the running stability, it is preferable that the deepest portion 2d of the central groove 2 should be the deepest among the longitudinal grooves 5.

[0056] In the present embodiment, the depth D3d is the same size as the depth D4d ($D2d > D3d = D4d$). The size is not limited to the above and the depth D3d may be greater than the depth D4d ($D2d > D3d > D4d$). With such a structure, it is possible to promote the deformation along the movement locus of the center of gravity of the body as described above while suppressing overpronation. Meanwhile, in addition to making the depth D4d smaller than the depth D2d, the depth D3d may be made the same size as the depth D2d ($D2d = D3d > D4d$). In that case, an effect of suppressing overpronation while increasing the amount of deformation of the forefoot portion Pf is achieved. It is also possible to make the depths of the deepest portions of the longitudinal grooves 5 the same size ($D2d = D3d = D4d$) with the intention of causing the deformation uniformly in the foot width direction.

[0057] In the present embodiment, a length L3d of the deepest portion 3d of the lateral-side groove 3 is smaller than a length L2d of the deepest portion 2d of the central groove 2 ($L2d > L3d$). By this feature, it is possible to obtain an effect of promoting a shift of the center of gravity of the body along the central part in the foot width direction, thereby enhancing the running stability. Further, a length L4d of the deepest portion 4d of the medial-side groove 4 is smaller than the length L2d ($L2d > L4d$). By this feature, it is possible to obtain an effect of suppressing overpronation. From the standpoint of promoting the deformation along the movement locus of the center of gravity of the body, thereby enhancing the running stability, it is preferable that the deepest portion 2d of the central groove 2 should be the longest among the longitudinal grooves 5.

[0058] In the present embodiment, the length L3d is greater than the length L4d ($L2d > L3d > L4d$). With such a structure, it is possible to promote the deformation along the movement locus of the center of gravity of the body as described above while suppressing overpronation. Alternatively, in addition to making the length L4d smaller than the length L2d, the length L3d may be made the same size as the length L2d ($L2d = L3d > L4d$). By this feature, the effect of suppressing overpronation while increasing the amount of deforma-

tion of the forefoot portion Pf is achieved. Meanwhile, the length L3d may be made the same size as the length L4d ($L2d > L3d = L4d$). The amount of deformation can be well balanced between the foot's lateral foot side and the foot's medial side while promoting deformation along the movement locus of the center of gravity of the body.

[0059] The length L2d is set to, for example, 15% or more of the length L1 of the sole 1, and is preferably set to 20% or more. The length L2d is set to, for example, 40% or less of the length L1 of the sole 1, preferably set to 35% or less, and is more preferably set to 30% or less. The length L3d is set to, for example, 6% or more of the length L1 of the sole 1, and is preferably set to 10% or more. The length L3d is set to, for example, 20% or less of the length L1 of the sole 1, and is preferably set to 15% or less. The length L4d is set to, for example, 3% or more of the length L1 of the sole 1, and is preferably set to 5% or more. The length L4d is set to, for example, 20% or less of the length L1 of the sole 1, and is preferably set to 15% or less. All of the length L2d, the length L3d, the length L4d, and the length L1 are dimensions measured along the foot length direction.

[0060] In the present embodiment, a width W4d of the deepest portion 4d of the medial-side groove 4 is the same size as a width W2d of the deepest portion 2d of the central groove 2 and a width W3d of the deepest portion 3d of the lateral-side groove 3 ($W2d = W3d = W4d$). As illustrated in FIG. 3, the width W2d is obtained as a distance between a pair of groove edges 22 and 22 in the groove width direction. In a case where the groove edge 22 is provided with a chamfered portion as in the present embodiment, the groove edge 22 is specified by an intersection of a virtual line obtained by extending a groove wall 23 downward and a virtual line obtained by extending the lower surface 1a to the groove width center line side. The width W3d and the width W4d can be obtained in a similar manner.

[0061] The width W3d may be smaller than the width W2d ($W2d > W3d$). By this feature, it is possible to promote a shift of the center of gravity of the body along the central part in the foot width direction, thereby enhancing the running stability. Further, the width W4d may be smaller than the width W2d ($W2d > W4d$). By this feature, it is possible to obtain an effect of suppressing overpronation. When the width W3d and the width W4d are of the same size ($W2d > W3d = W4d$), the amount of deformation can be well balanced between the foot's lateral side and the foot's medial side while promoting deformation along the movement locus of the center of gravity of the body. When the width W3d is greater than the width W4d ($W2d > W3d > W4d$), it is possible to promote deformation along the movement locus of the center of gravity of the body while suppressing overpronation. Meanwhile, the width W3d may be the same size as the width W2d ($W2d = W3d > W4d$), in which case the overpronation can be suppressed

while increasing the amount of deformation of the forefoot portion Pf.

[0062] As illustrated in FIGS. 1 and 2, the sole 1 includes a midsole 7 and an outsole 8 covering at least a part of the midsole 7 from below. The midsole 7 continuously extends in the foot length direction from the forefoot portion Pf to the rearfoot portion Pr via the midfoot portion Pm. The outsole 8 is firmly fixed to the midsole 7 by adhesive bonding or the like. The outsole 8 protrudes downward relative to the midsole 7 and forms the ground-contacting surface of the shoe 10. Each of the midsole 7 and the outsole 8 may be constituted by combining a plurality of members, or may be constituted of a single member.

[0063] It is preferable that the midsole 7 should have excellent shock-absorbing properties while having appropriate strength. From the above point of view, a resin foam material containing a resin material, as a main ingredient, and a foaming agent and a crosslinking agent, as accessory ingredients, may be used for the midsole 7. For example, ethylene-vinyl acetate copolymer (EVA), polyolefin resin, thermoplastic polyurethane, thermoplastic polyamide-based elastomer (TPA, TPAE), or thermoplastic polyester-based elastomer is used as the resin material. Further, a rubber foam material containing a rubber material, as a main ingredient, and a plasticizer, a foaming agent, a reinforcing agent, and a crosslinking agent, as accessory ingredients, may be used for the midsole 7. As the rubber material, butadiene rubber, for example, is used.

[0064] The outsole 8 should preferably be excellent in abrasion resistance and grip performance. From the above point of view, a member made of a material containing a rubber material, as a main ingredient, and a plasticizer, a reinforcing agent, and a crosslinking agent, as accessory ingredients, may be used for the outsole 8. As the rubber material, butadiene rubber, for example, is used. The outsole 8 is constituted of a member which has a higher elastic modulus and is harder than the midsole 7. Therefore, the midsole 7 is more easily deformed than the outsole 8 when a load is applied to the sole 1.

[0065] As illustrated in FIG. 2, each of the central groove 2 and the lateral-side groove 3 is formed in the midsole 7 and is exposed downward without being covered by the outsole 8. With such a structure, since the outsole 8 does not hinder the deformation of the central groove 2 and the lateral-side groove 3, deformation of the midsole 7 occurs relatively easily in the foot width direction by the application of the load. For this reason, flexible deformation of the midsole 7 in the foot width direction according to a change in the distribution of foot pressure is enabled. In the present embodiment, the medial-side groove 4 is also formed in the midsole 7 and is exposed downward without being covered by the outsole 8. The outsole 8 is disposed at a position avoiding the longitudinal grooves 5. The longitudinal grooves 5 are formed by causing the midsole 7 to be

recessed upward, and are open facing downward. The longitudinal grooves 5 may be formed in a region of the lower surface 1a which is not in contact with the ground.

[0066] The outsole 8 includes a lateral-side outsole 81 disposed on the foot's lateral side relative to the lateral-side groove 3. The lateral-side outsole 81 is disposed in the region 62 (see FIG. 7) between the outer edge of the lower surface 1a on the foot's lateral side and the lateral-side groove 3. The lateral-side outsole 81 is formed of a part separate from another outsole 82 that is disposed on the foot's medial side relative to the lateral-side groove 3. With such a structure, since the lateral-side outsole 81 does not hinder the deformation of the lateral-side groove 3, deformation is easily promoted in the lateral-side groove 3. As illustrated in FIG. 2, the lateral-side outsole 81 is divided in the front-rear direction (into two sections in the present embodiment). This facilitates deformation caused by the bending of the foot, and thus, is convenient in promoting a smooth weight transfer along the foot length direction.

[0067] The outsole 82 is disposed in each of the region 61 (see FIG. 7) between the central groove 2 and the lateral-side groove 3, the region 63 (see FIG. 7) between the outer edge of the lower surface 1a on the foot's medial side and the medial-side groove 4, and a region 64 (see FIG. 7) between the central groove 2 and the medial-side groove 4. As illustrated in FIG. 2, the outsole 82 is formed of a single part that extends rearward from the toe to be branched into three segments. By this feature, the outsole 8 does not hinder the deformation of the central groove 2 and the medial-side groove 4, so that deformation is easily promoted in the central groove 2 and the medial-side groove 4. Further, the outsole 82 has a notch 83 recessed in the foot width direction. This facilitates deformation caused by the bending of the foot, and thus, is convenient in promoting a smooth weight transfer along the foot length direction.

[0068] FIG. 10 is a front perspective view showing a toe of the shoe 10. As illustrated in FIG. 10, the outsole 8 includes a rolled-up portion 84 which is rolled upward on the toe side. The rolled-up portion 84 has an asymmetric shape deviated to the foot's medial side in a front view. By this feature, it is possible to realize weight reduction by reducing the outsole in the lateral-side portion while ensuring durability of the medial-side portion where a large load is applied at the time of kicking the ground. The lateral-side outsole 81 is not rolled upward, and the rolled-up portion 84 is formed by the outsole 82. The rolled-up portion 84 is adhesively bonded to the upper 9.

[0069] Unless otherwise specified, the shapes, dimensions, angles, and the like described in the present specification are based on the sole and the footwear in an unloaded state in which no foot pressure or the like is applied.

[0070] It will be appreciated by those skilled in the art

that the embodiments described above are specific examples of the following aspects.

[1] A sole of the present disclosure pertains to a sole which constitutes a part of footwear, in which a lower surface of the sole includes a central groove located at a central part of the sole in a foot width direction and extending in a foot length direction, and a lateral-side groove located on a foot's lateral side relative to the central groove and extending in the foot length direction. Each of the central groove and the lateral-side groove includes a deepest portion extending at a substantially constant depth from rear to front of the sole, a front portion extending at a depth smaller than the depth of the deepest portion in front of the deepest portion, and a rear portion extending at a depth smaller than the depth of the deepest portion in rear of the deepest portion. When an area between a first virtual straight line, which passes through a position at an outer edge of the lower surface on the foot's lateral side at a point corresponding to 30% of a sole length with reference to a front end of the sole and a position at an outer edge of the lower surface on a foot's medial side at a point corresponding to 20% of the sole length with reference to the front end of the sole, and a second virtual straight line, which passes through a position at the outer edge of the lower surface on the foot's lateral side at a point corresponding to 45% of the sole length with reference to the front end of the sole and a position at the outer edge of the lower surface on the foot's medial side at a point corresponding to 35% of the sole length with reference to the front end of the sole is referred to as a tread area, each of at least a part of the deepest portion of the central groove and at least a part of the deepest portion of the lateral-side groove overlaps the tread area in a top view. With such a structure, it is possible to promote, while improving the flexibility of MP joints of a foot, a smooth weight transfer in the foot length direction from a heel to a toe, and a smooth weight transfer from the foot's lateral side to the foot's medial side along the foot width direction.

[2] In the sole according to [1] described above, each of the deepest portion of the central groove and the deepest portion of the lateral-side groove may overlap a virtual line passing through a big toe ball portion and a little toe ball portion of a foot of a wearer in a top view. With such a structure, it is possible to effectively promote a smooth weight transfer in the foot length direction from the heel to the toe, and a smooth weight transfer from the foot's lateral side to the foot's medial side along the foot width direction.

[3] In the sole according to [1] or [2] described above, a configuration in which a depth of the front portion of each of the central groove and the lateral-side groove is continuously decreased toward the front of the sole, and a depth of the rear portion of each of the central groove and the lateral-side groove is continuously increased toward the front of the sole may be employed. As a consequence, a smooth weight transfer along the foot length direction can be effectively promoted.

[4] In the sole according to [1] to [3] described above, at least a part of the deepest portion of the central groove may overlap a second metatarsal bone or a third metatarsal bone of a foot of a wearer in a top view. With such a structure, the deepest portion of the central groove is formed at a more suitable position.

[5] In the sole according to any one of [1] to [4] described above, at least a part of the deepest portion of the lateral-side groove may overlap a fourth metatarsal bone or a fifth metatarsal bone of a foot of a wearer in a top view. With such a structure, the deepest portion of the lateral-side groove is formed at a more suitable position.

[6] In the sole according to any one of [1] to [5] described above, at least a part of the deepest portion of the central groove may be located on the foot's lateral side relative to an MP joint of a first toe of a foot of a wearer and on the foot's medial side relative to an MP joint of a fourth toe of the foot of the wearer. With such a structure, the deepest portion of the central groove is formed at a more suitable position.

[7] In the sole according to any one of [1] to [6] described above, at least a part of the deepest portion of the lateral-side groove may be located on the foot's lateral side relative to an MP joint of a third toe of a foot of a wearer. With such a structure, the deepest portion of the lateral-side groove is formed at a more suitable position.

[8] In the sole according to any one of [1] to [7] described above, a configuration in which: the deepest portion of the central groove is located on the foot's medial side relative to a heel center, which is a straight line connecting a center of a heel bone of a foot of a wearer and between a third toe and a fourth toe; and the deepest portion of the lateral-side groove is located on the foot's lateral side relative to the heel center may be employed. With such a structure, the deepest portion of each of the central groove and the lateral-side groove is formed at a more suitable position.

[9] In the sole according to any one of [1] to [8] described above, each of the central groove and the lateral-side groove may be a curved line including a convex portion protruding toward the foot's lateral side. With such a structure, a width of each of a region extending in the foot length direction between the central groove and the lateral-side groove and a region extending in the foot length direction between the outer edge of the lower surface on the foot's lateral side and the lateral-side groove can be brought close to a constant width. Thus, an effect of promoting deformation when a load is received can be exhibited stably along the foot length direction.

[10] In the sole according to any one of [1] to [9] described above, a configuration in which: a length of a portion extending to the rear from the virtual line, at the deepest portion of the central groove, is greater than a length of a portion extending to the front from the virtual line; and a length of a portion extending to the rear from the virtual line, at the deepest portion of the lateral-side groove, is smaller than a length of a portion extending to the front from the virtual line may be employed.

With such a structure, it is possible to effectively promote deformation in the process in which the body weight is transferred from the rear to the front in the vicinity of the virtual line at which the foot pressure is increased.

[11] In the sole according to any one of [1] to [10] described above, at least a part of a width in the foot width direction between the deepest portion of the lateral-side groove and the outer edge of the lower surface on the foot's lateral side may be substantially constant. By this feature, the effect of promoting deformation when a load is received can be exhibited stably along the foot length direction.

[12] In the sole according to any one of [1] to [11] described above, a configuration in which: the lower surface includes a medial-side groove located on the foot's medial side relative to the central groove and extending in the foot length direction; the medial-side groove includes a deepest portion extending at a substantially constant depth from the rear to the front of the sole, a front portion extending at a depth smaller than the depth of the deepest portion in front of the deepest portion, and a rear portion extending at a depth smaller than the depth of the deepest portion in rear of the deepest portion; and at least a part of the deepest portion of the medial-side groove overlaps the tread area in a top view may be employed. With such a structure, a smooth weight transfer from the foot's lateral side to the foot's medial side along the foot width direction can be effectively promoted.

[13] In the sole according to [12] described above, at least a part of the deepest portion of the medial-side groove may overlap a first metatarsal bone of a foot of a wearer in a top view. With such a structure, the deepest portion of the medial-side groove is formed at a more suitable position.

[14] In the sole according to [12] or [13] described above, at least a part of the deepest portion of the medial-side groove may be located on the foot's medial side relative to an MP joint of a second toe of a foot of a wearer. With such a structure, the deepest portion of the medial-side groove is formed at a more suitable position.

[15] In the sole according to any one of [12] to [14] described above, at least a part of the deepest portion of the medial-side groove may overlap a big toe ball portion of a foot of a wearer in a top view. With such a structure, the deepest portion of the medial-side groove is formed at a more suitable position.

[16] In the sole according to any one of [12] to [15] described above, the medial-side groove may be a curved line including a convex portion protruding toward the foot's medial side. With such a structure, a width of a region extending in the foot length direction between the outer edge of the lower surface on the foot's medial side and the medial-side groove can be brought close to a constant width. Thus, an effect of promoting deformation when a load is received can be exhibited stably along the foot length direction.

[17] In the sole according to any one of [1] to [16] described above, a depth of the deepest portion of the lateral-side groove may be smaller than a depth of the deepest portion of the central groove. By this feature, it is possible to obtain an effect of promoting a shift of the center of gravity of the body along the central part in the foot width direction, thereby enhancing the running stability.

[18] In the sole according to any one of [1] to [17] described above, a length of the deepest portion of the lateral-side groove may be smaller than a length of the deepest portion of the central groove. By this feature, it is possible to obtain an effect of promoting a shift of the center of gravity of the body along the central part in the foot width direction, thereby enhancing the running stability.

[19] In the sole according to any one of [1] to [18] described above, a width of the deepest portion of the lateral-side groove may be smaller than a width of the deepest portion of the central groove. By this feature, it is possible to obtain an effect of promot-

ing a shift of the center of gravity of the body along the central part in the foot width direction, thereby enhancing the running stability.

[20] In the sole according to any one of [1] to [19] described above, a configuration in which: the sole includes a midsole and an outsole covering at least a part of the midsole from below; and each of the central groove and the lateral-side groove is formed in the midsole and is exposed downward without being covered by the outsole may be employed. With such a structure, since deformation occurs relatively easily by the application of a load, flexible deformation according to a change in the distribution of foot pressure is enabled.

[21] Footwear of the present disclosure may be footwear including the sole according to any one of [1] to [20] described above, and an upper disposed above the sole. With such footwear, it is possible to promote, while improving the flexibility of the MP joints of a foot, a smooth weight transfer in the foot length direction from a heel to a toe, and a smooth weight transfer from the foot's lateral side to the foot's medial side along the foot width direction.

[0071] In the above-described embodiment, the case where the sole of the present disclosure is applied to a shoe as footwear has been described, but the present disclosure is not limited thereto. For example, the sole of the present disclosure may be applied to other types of footwear such as sandals, boots, and slippers.

[0072] Although an embodiment of the sole according to the present disclosure has been described with reference to the accompanying drawings, it should be considered that the specific configuration is not limited to this embodiment. The scope of the present invention is defined not only by the above description of the embodiment but also by the appended claims, and includes all modifications within the meaning and scope equivalent to the scope of the claims.

[0073] The sole according to the present disclosure is in no way limited to the above-described embodiment, and the advantageous effects are not limited to those described above. Various improvements and modifications can be made to the sole according to the present disclosure without departing from the spirit of the present disclosure. Further, the configurations adopted in the above-described embodiment may be arbitrarily combined and adopted.

Claims

1. A sole which constitutes a part of footwear in which:

a lower surface of the sole includes a central groove located at a central part of the sole in a foot width direction and extending in a foot length direction, and a lateral-side groove located on a foot's lateral side relative to the central groove and extending in the foot length direction;

each of the central groove and the lateral-side groove includes a deepest portion extending at a substantially constant depth from rear to front of the sole, a front portion extending at a depth smaller than the depth of the deepest portion in front of the deepest portion, and a rear portion extending at a depth smaller than the depth of the deepest portion in rear of the deepest portion; and

when an area between a first virtual straight line, which passes through a position at an outer edge of the lower surface on the foot's lateral side at a point corresponding to 30% of a sole length with reference to a front end of the sole and a position at an outer edge of the lower surface on a foot's medial side at a point corresponding to 20% of the sole length with reference to the front end of the sole, and a second virtual straight line, which passes through a position at the outer edge of the lower surface on the foot's lateral side at a point corresponding to 45% of the sole length with reference to the front end of the sole and a position at the outer edge of the lower surface on the foot's medial side at a point corresponding to 35% of the sole length with reference to the front end of the sole is referred to as a tread area,

each of at least a part of the deepest portion of the central groove and at least a part of the deepest portion of the lateral-side groove overlaps the tread area in a top view.

2. The sole according to claim 1, wherein each of the deepest portion of the central groove and the deepest portion of the lateral-side groove overlaps a virtual line passing through a big toe ball portion and a little toe ball portion of a foot of a wearer in a top view.

3. The sole according to claim 1, wherein:

a depth of the front portion of each of the central groove and the lateral-side groove is continuously decreased toward the front of the sole; and

a depth of the rear portion of each of the central groove and the lateral-side groove is continuously increased toward the front of the sole.

4. The sole according to claim 1, wherein at least a part of the deepest portion of the central groove overlaps a second metatarsal bone or a third metatarsal bone of a foot of a wearer in a top view. 5
5. The sole according to claim 1, wherein at least a part of the deepest portion of the lateral-side groove overlaps a fourth metatarsal bone or a fifth metatarsal bone of a foot of a wearer in a top view. 10
6. The sole according to claim 1, wherein at least a part of the deepest portion of the central groove is located on the foot's lateral side relative to an MP joint of a first toe of a foot of a wearer and on the foot's medial side relative to an MP joint of a fourth toe of the foot of the wearer. 15
7. The sole according to claim 1, wherein at least a part of the deepest portion of the lateral-side groove is located on the foot's lateral side relative to an MP joint of a third toe of a foot of a wearer. 20
8. The sole according to claim 1, wherein:

the deepest portion of the central groove is located on the foot's medial side relative to a heel center, which is a straight line connecting a center of a heel bone of a foot of a wearer and between a third toe and a fourth toe; and the deepest portion of the lateral-side groove is located on the foot's lateral side relative to the heel center. 25 30
9. The sole according to claim 2, wherein:

a length of a portion extending to the rear from the virtual line, at the deepest portion of the central groove, is greater than a length of a portion extending to the front from the virtual line; and 35 40

a length of a portion extending to the rear from the virtual line, at the deepest portion of the lateral-side groove, is smaller than a length of a portion extending to the front from the virtual line. 45
10. The sole according to claim 1, wherein at least a part of a width in the foot width direction between the deepest portion of the lateral-side groove and the outer edge of the lower surface on the foot's lateral side is substantially constant. 50
11. The sole according to claim 1, wherein:

the lower surface includes a medial-side groove located on the foot's medial side relative to the central groove and extending in the foot length direction; 55
- the medial-side groove includes a deepest portion extending at a substantially constant depth from the rear to the front of the sole, a front portion extending at a depth smaller than the depth of the deepest portion in front of the deepest portion, and a rear portion extending at a depth smaller than the depth of the deepest portion in rear of the deepest portion; and at least a part of the deepest portion of the medial-side groove overlaps the tread area in a top view.
12. The sole according to claim 11, wherein at least a part of the deepest portion of the medial-side groove overlaps a first metatarsal bone of a foot of a wearer in a top view.
13. The sole according to claim 11, wherein at least a part of the deepest portion of the medial-side groove is located on the foot's medial side relative to an MP joint of a second toe of a foot of a wearer.
14. The sole according to claim 11, wherein at least a part of the deepest portion of the medial-side groove overlaps a big toe ball portion of a foot of a wearer in a top view.
15. The sole according to any one of claims 1 to 14, wherein:

the sole includes a midsole and an outsole covering at least a part of the midsole from below; and each of the central groove and the lateral-side groove is formed in the midsole and is exposed downward without being covered by the outsole.

FIG. 1

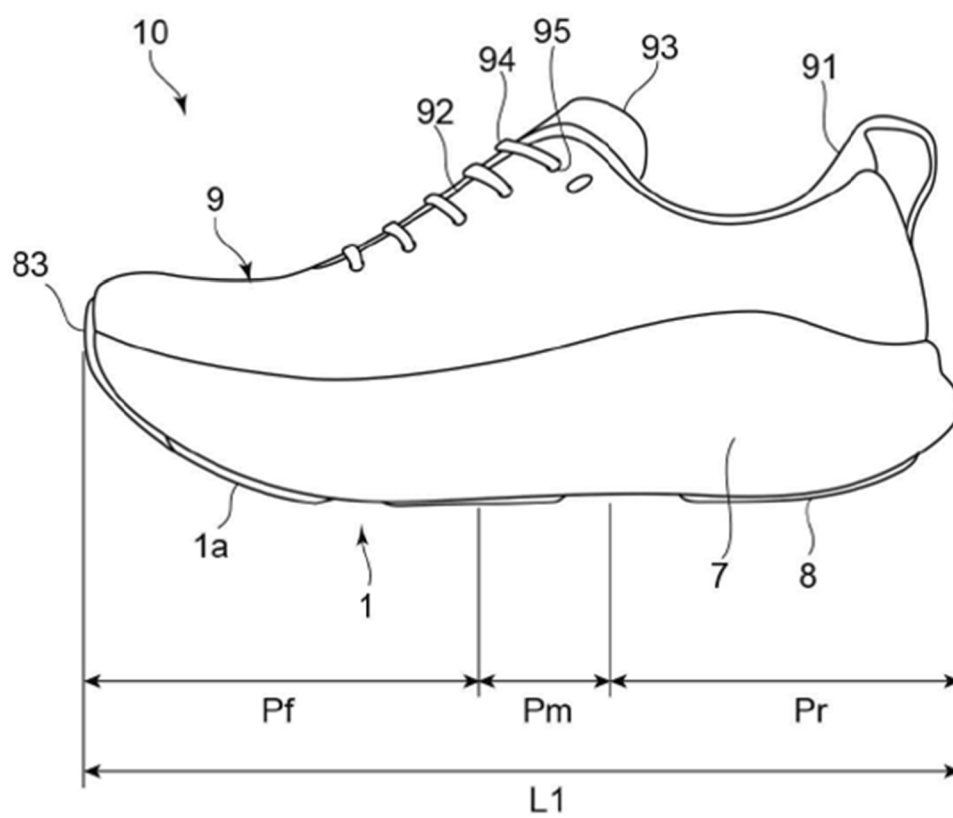


FIG. 2

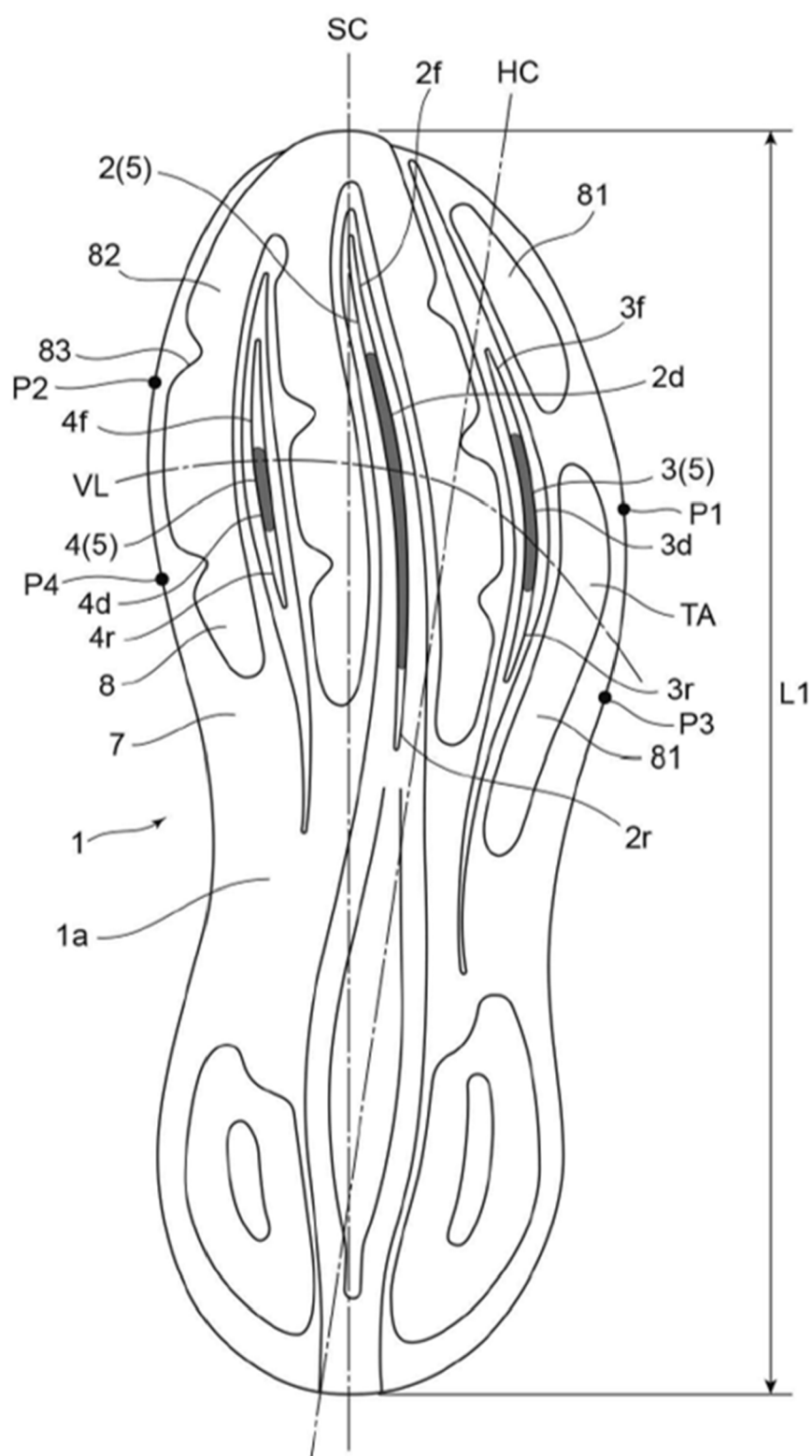


FIG. 3

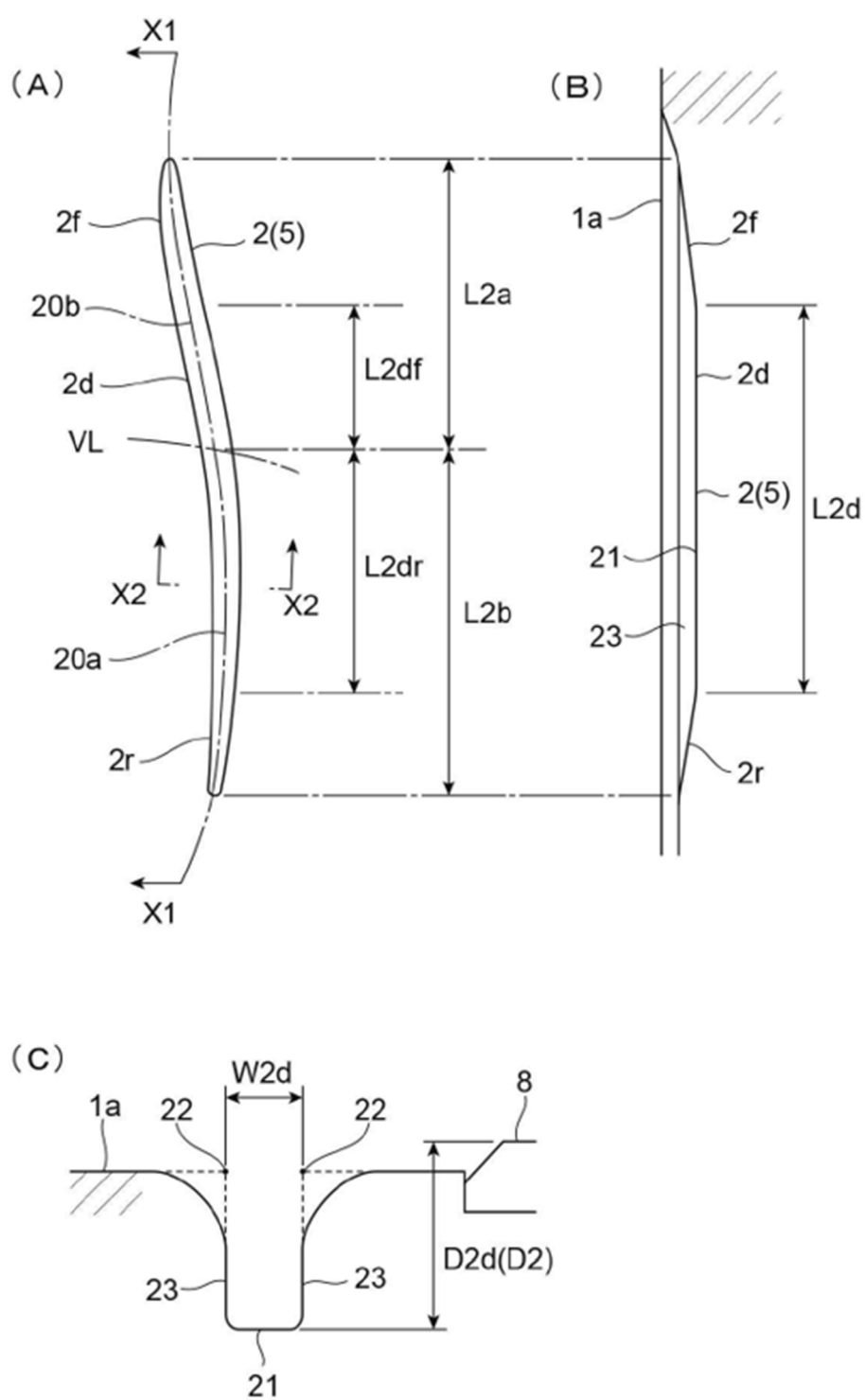
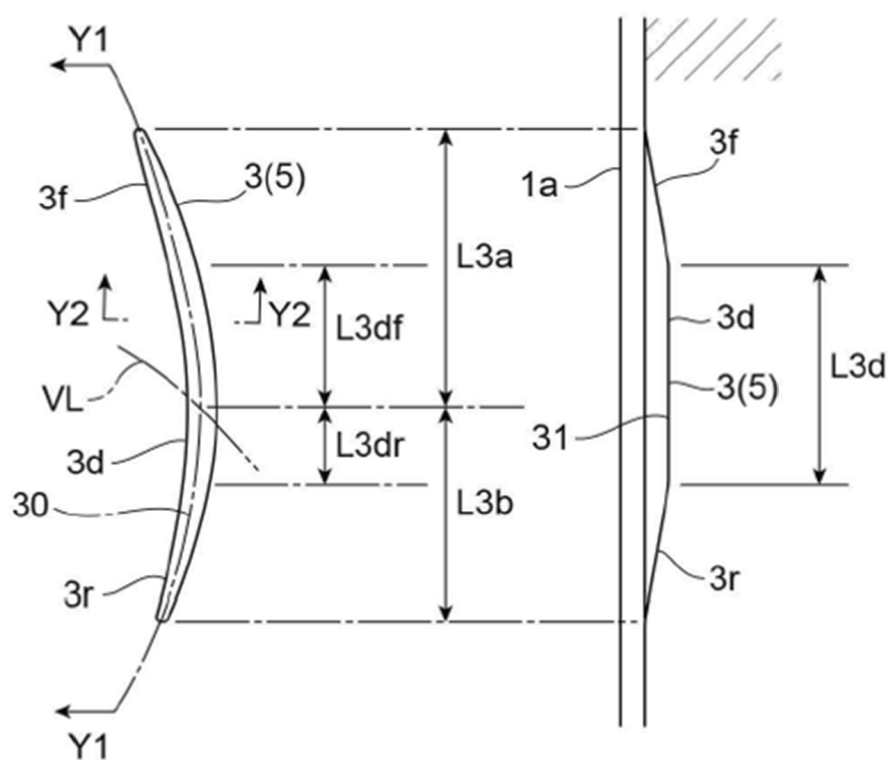


FIG. 4

(A)

(B)



(C)

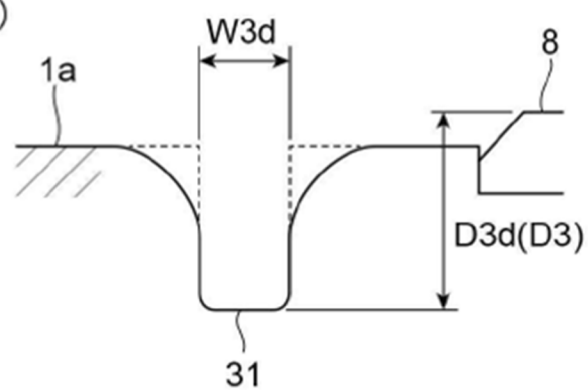


FIG. 5

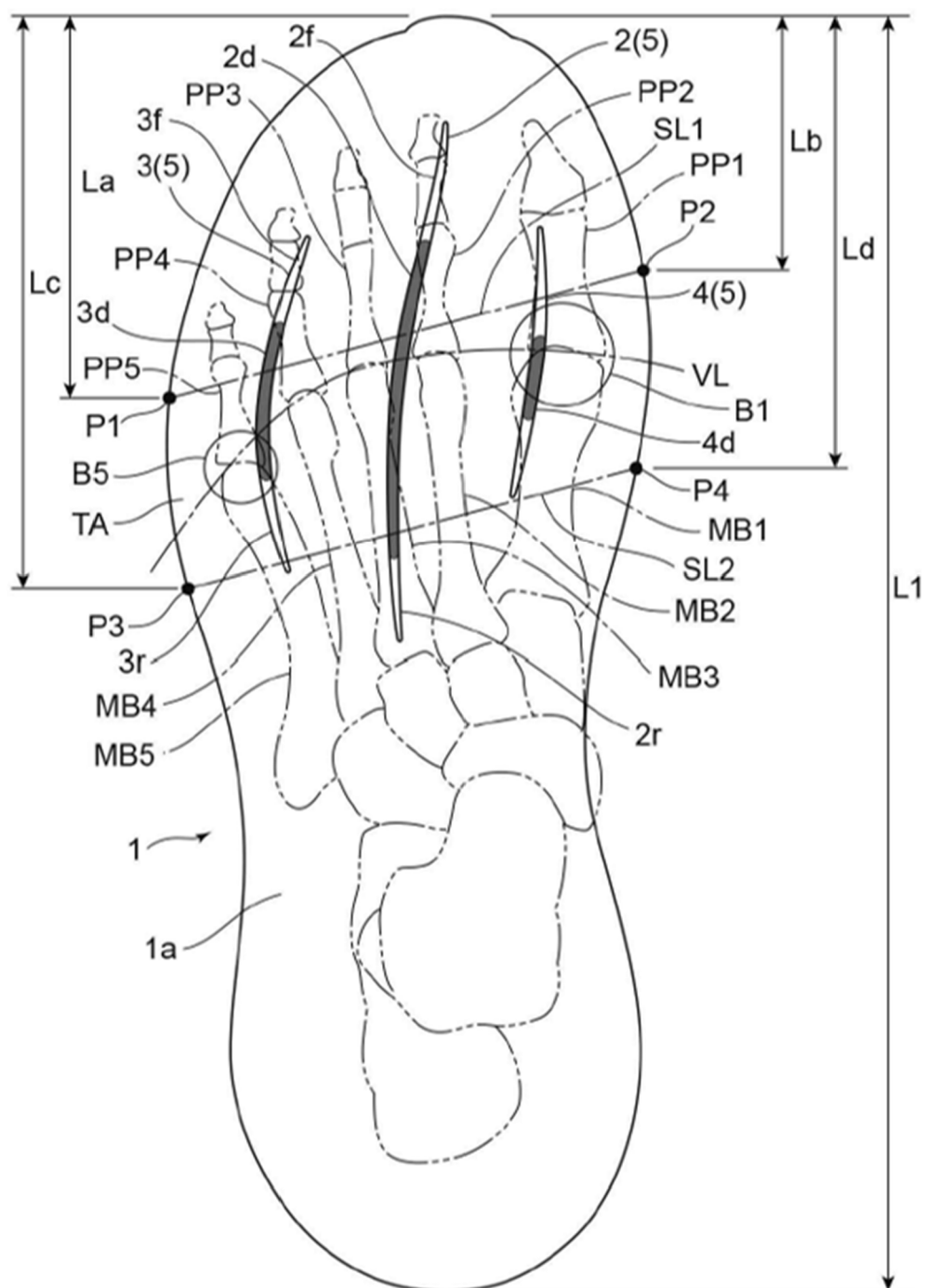


FIG. 6

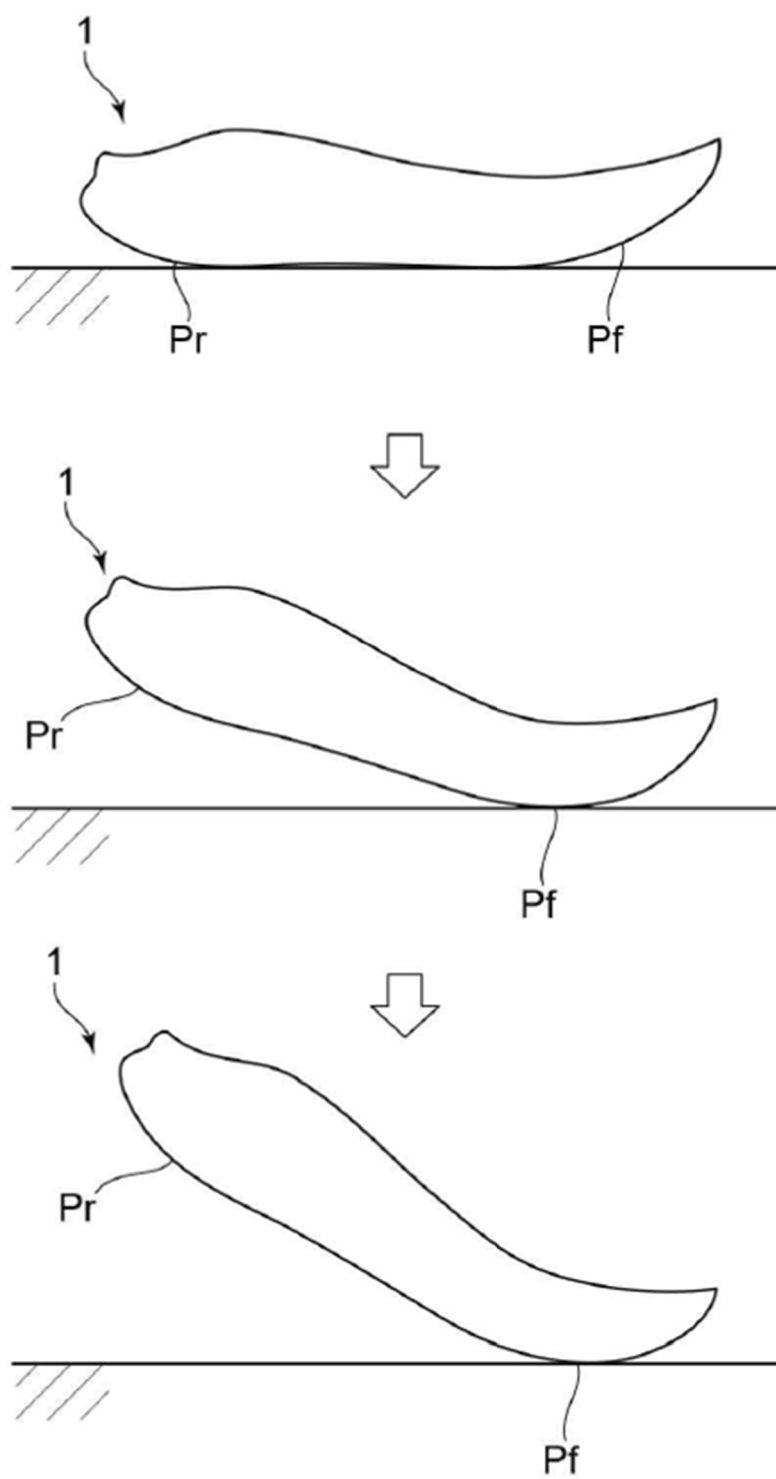


FIG. 7

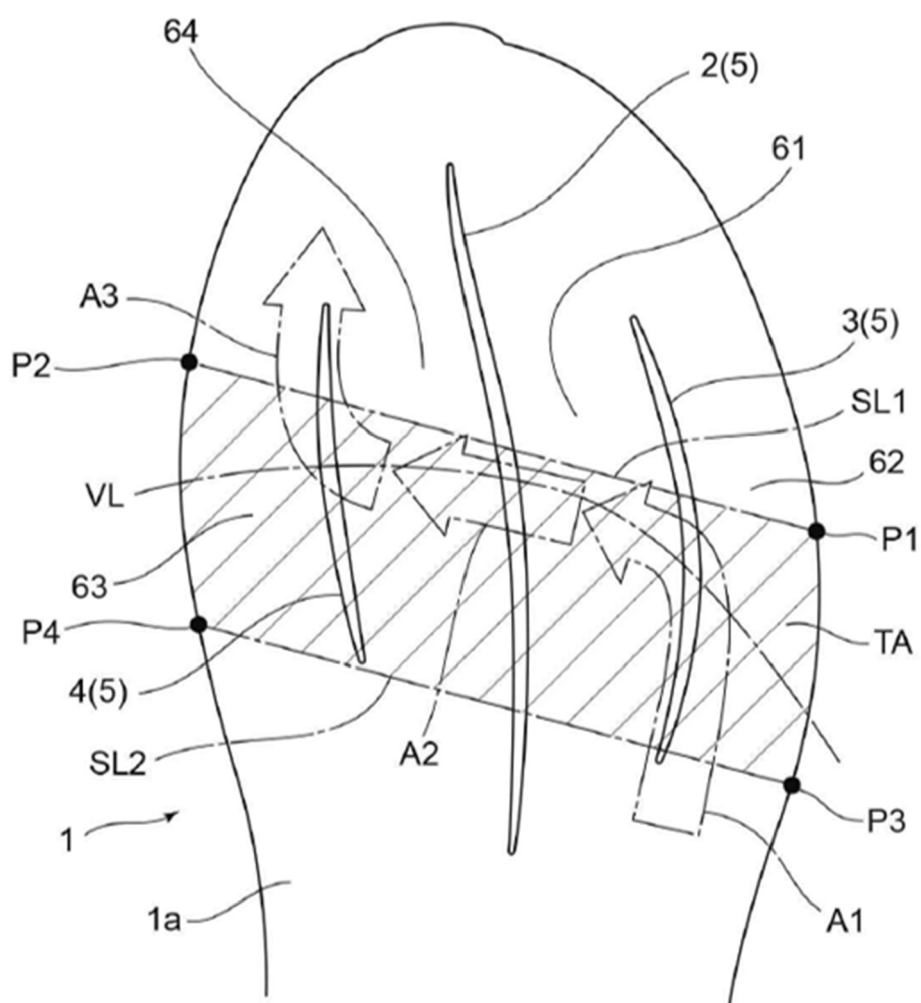


FIG. 8

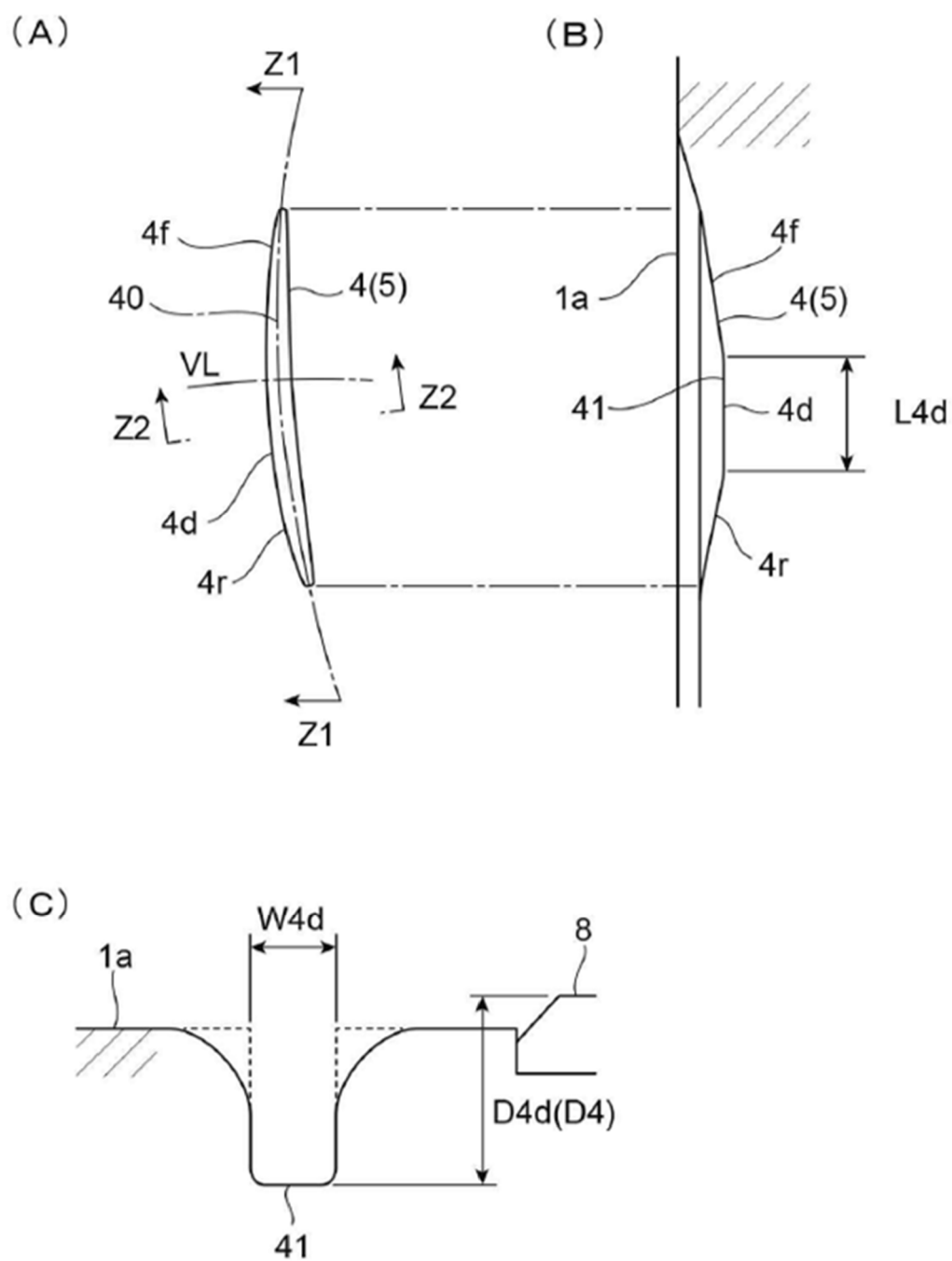


FIG. 9

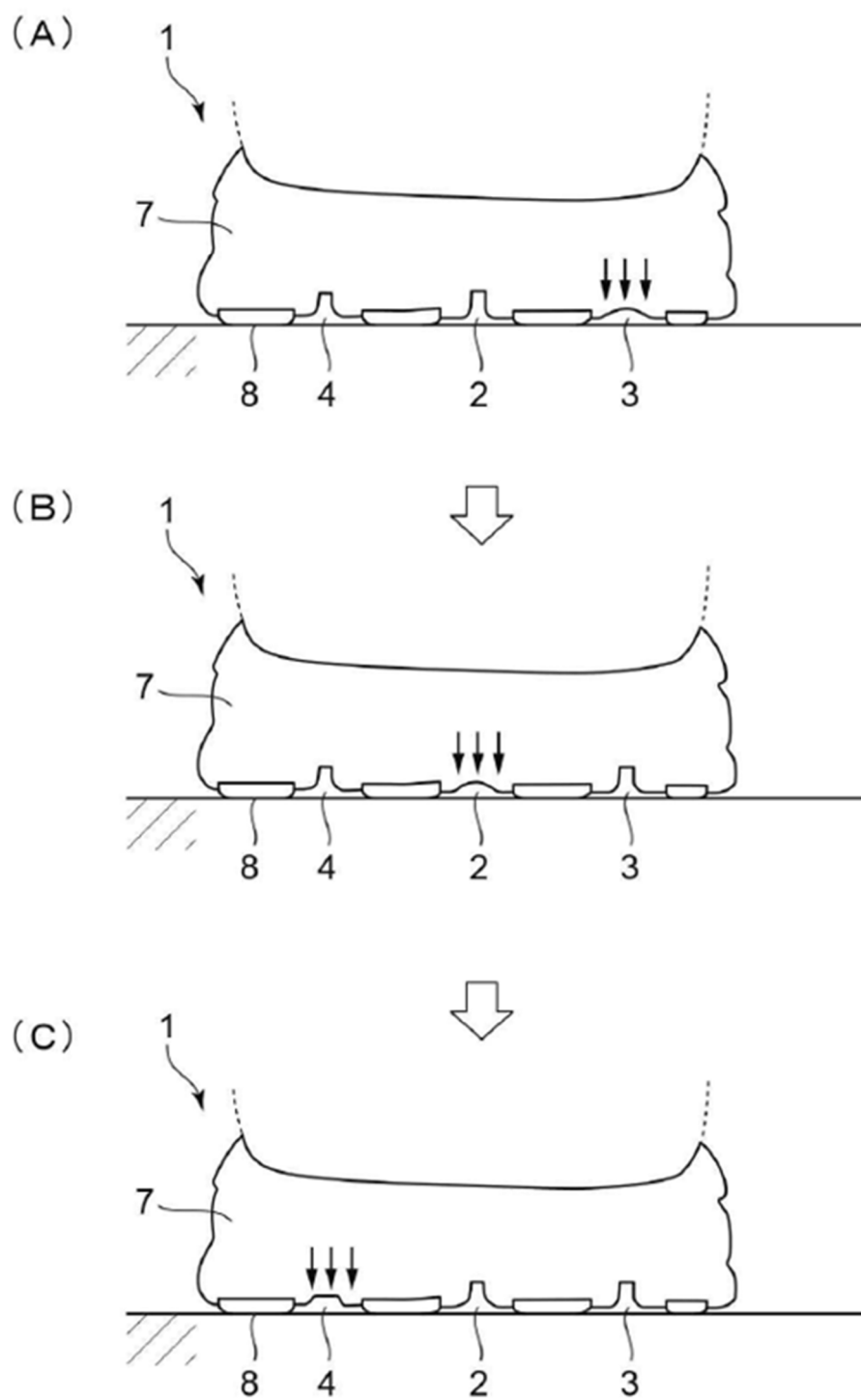
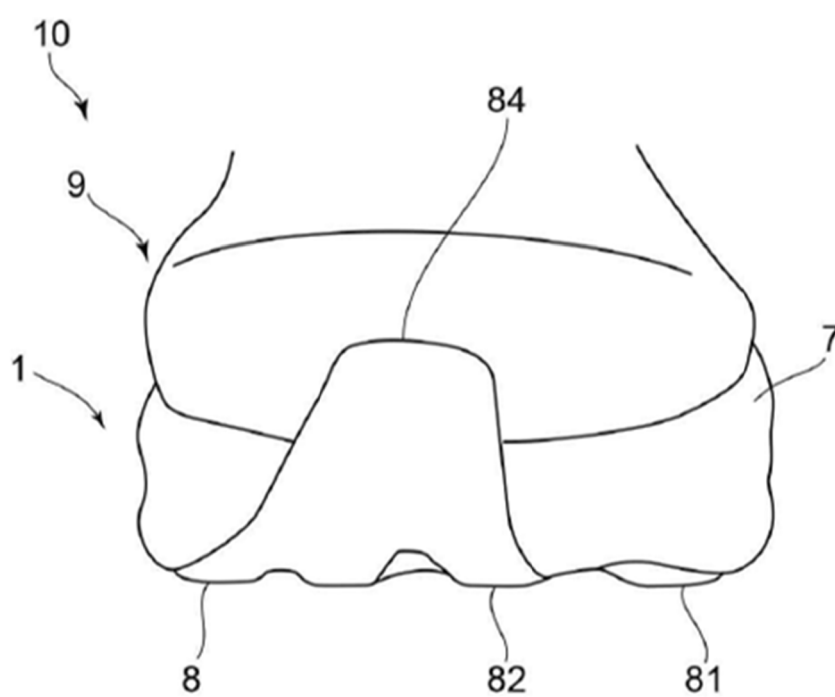


FIG. 10





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