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

(11) **EP 4 140 344 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
01.03.2023 Bulletin 2023/09

(21) Application number: **22184503.5**

(22) Date of filing: **12.07.2022**

(51) International Patent Classification (IPC):
A43B 5/06 *(2006.01)* ***A43B 7/32*** *(2006.01)*
A43B 13/02 *(2006.01)* ***A43B 13/18*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
A43B 13/187; A43B 5/06; A43B 7/32; A43B 13/026

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

(30) Priority: **24.08.2021 JP 2021136625**

(71) Applicant: **ASICS Corporation**
Kobe-shi Hyogo 650-8555 (JP)

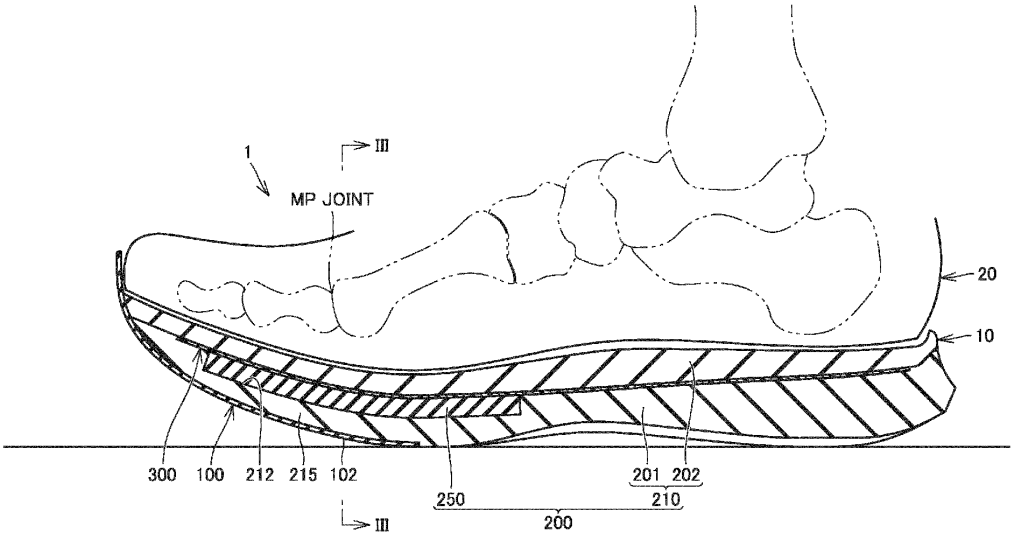
(72) Inventors:
- **Taniguchi, Norihiko**
  Hyogo, 650-8555 (JP)
- **Takashima, Shingo**
  Hyogo, 650-8555 (JP)
- **Kozuka, Yuya**
  Hyogo, 650-8555 (JP)
- **Sakaguchi, Masanori**
  Hyogo, 650-8555 (JP)
- **Takemura, Shuhei**
  Hyogo, 650-8555 (JP)
- **Kogure, Takayuki**
  Hyogo, 650-8555 (JP)

(74) Representative: **Marks & Clerk LLP**
15 Fetter Lane
London EC4A 1BW (GB)

(54) SOLE AND SHOE

(57) A sole (10) includes: a midsole main body (210); an elastic portion (250); and a pressing member (300). The midsole main body (210) includes a containing portion (212). The elastic portion (250) is contained in the containing portion (212) in a compressed state. The pressing member (300) has an elastic modulus higher than an elastic modulus of the elastic portion (250) in the compressed state, and presses the elastic portion (250) so that the elastic portion (250) is maintained in the compressed state. The elastic modulus of the elastic portion (250) in the compressed state is larger than an elastic modulus of the midsole main body (210).

FIG.1



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Description

[0001] This nonprovisional application is based on Japanese Patent Application No. 2021-136625 filed on August 24, 2021 with the Japan Patent Office, the entire contents of which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present disclosure relates to a sole and a shoe.

Description of the Background Art

[0003] Conventionally, a shoe having a plate provided in a midsole is known. For example, US 9833038 discloses a sole structure including an upper midsole member, a lower midsole member, and a plate. The upper midsole member has an upper surface, a lower surface, and a through hole. The lower midsole member has an upper surface in contact with the lower surface of the upper midsole member, and a raised portion raised from this upper surface and positioned in the through hole of the upper midsole member. The raised portion has an upper surface flush with the upper surface of the upper midsole member. The plate is in contact with the upper surface of the upper midsole member and the upper surface of the raised portion. The plate is bonded to the upper surface of the raised portion, but not bonded to the upper surface of the upper midsole member.

SUMMARY OF THE INVENTION

[0004] Shoes used for exercise involving a motion such as running is required to reduce impact at the time of landing and to suppress excessive deformation of a midsole at the time of taking off.

[0005] An object of the present disclosure is to provide a sole and a shoe capable of achieving both reduction of impact at the time of landing and suppression of excessive deformation of a midsole main body at the time of taking off.

[0006] A sole according to one aspect of the present disclosure includes: a midsole main body; an elastic portion made of an elastic body and disposed in the midsole main body; and a pressing member that presses the elastic portion, wherein the midsole main body includes a containing portion that contains the elastic portion, the elastic portion is contained in the containing portion in a compressed state in which a volume of the elastic portion is compressed to be smaller than a volume of the elastic portion in an unloaded state in which no external force acts on the elastic portion, the pressing member has an elastic modulus higher than an elastic modulus of the elastic portion in the compressed state, and presses the elastic portion so that the elastic portion is maintained in the compressed state, and the elastic modulus of the elastic portion in the compressed state is larger than an elastic modulus of the midsole main body.

[0007] Further, a shoe according to one aspect of the present disclosure includes: the sole as described above; and an upper that is directly or indirectly connected to the sole and located above the sole.

[0008] The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

Fig. 1 is a cross-sectional view of a shoe according to a first embodiment of the present disclosure.

Fig. 2 is a plan view showing a relationship between a part of a sole and a bone of a foot of a wearer of a shoe.

Fig. 3 is a cross-sectional view taken along line III-III in Fig. 1.

Fig. 4 is a cross-sectional view of a part of the sole in a plane orthogonal to the foot length direction, schematically illustrating a modified example of a pressing member.

Fig. 5 is a cross-sectional view of a part of the sole in a plane orthogonal to the foot length direction, schematically illustrating a modified example of a pressing member.

Fig. 6 is a cross-sectional view of a part of the sole in a plane orthogonal to the foot length direction, schematically illustrating a modified example of a midsole.

Fig. 7 is a cross-sectional view of a part of the sole in a plane orthogonal to the foot length direction, schematically illustrating a modified example of an elastic portion.

Fig. 8 is a plan view schematically illustrating a modified example of the elastic portion.

Fig. 9 is a plan view schematically illustrating a modified example of the elastic portion.

Fig. 10 is a plan view schematically illustrating a modified example of the elastic portion.

Fig. 11 is a plan view schematically illustrating a modified example of the elastic portion.

Fig. 12 is a cross-sectional view of a sole of a shoe according to a second embodiment of the present disclosure.

Fig. 13 is a cross-sectional view illustrating the sole illustrated in Fig. 12 in a state before an elastic portion is pressed by a pressing member.

Fig. 14 is a cross-sectional view of a part of the sole in a plane orthogonal to the foot length direction, illustrating a modified example of a midsole.

Fig. 15 is a cross-sectional view of a part of the sole

in a plane orthogonal to the foot length direction, illustrating a modified example the midsole.

Fig. 16 is a cross-sectional view of a sole of a shoe according to a third embodiment of the present disclosure.

Fig. 17 is a cross-sectional view taken along line XVII-XVII illustrated in Fig. 16.

Fig. 18 is a cross-sectional view illustrating a state in which an inner sole is removed from a state in Fig. 17.

Fig. 19 is a cross-sectional view of a part of the sole in a plane orthogonal to the foot length direction, illustrating a modified example of the midsole.

Fig. 20 is a cross-sectional view of a part of the sole in a plane orthogonal to the foot length direction, illustrating a modified example of the midsole.

Fig. 21 is a cross-sectional view of a part of the sole in a plane orthogonal to the foot length direction, illustrating a modified example of the midsole.

Fig. 22 is a cross-sectional view illustrating the state in which the pressing member is removed from Fig. 20.

Fig. 23 is a cross-sectional view showing a modified example of the sole.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] Embodiments of the present disclosure will be described with reference to the drawings. In the drawings hereinafter referred to, the same or corresponding members are denoted by the same reference numerals. In the following description, terms such as a foot length direction, a foot width direction, a front side, and a rear side are used. These terms indicating directions indicate directions as viewed from the viewpoint of a wearer wearing a shoe 1 placed on a flat surface such as the ground. For example, anterior refers to a toe side and posterior refers to a heel side. In addition, inside refers to the inside of the foot (first toe side of the foot) in the foot width direction, and outside refers to the outside of the foot in the foot width direction.

(First embodiment)

[0011] Fig. 1 is a cross-sectional view of a shoe according to a first embodiment of the present disclosure. Shoe 1 of the present embodiment can be applied as, for example, sports shoes or walking shoes, and the use of shoe 1 is not limited.

[0012] As illustrated in Fig. 1, shoe 1 includes a sole 10 and an upper 20.

[0013] Upper 20 is directly or indirectly connected to sole 10, and provides a space for containing the foot of the wearer together with sole 10.

[0014] As illustrated in Figs. 1 and 3, sole 10 includes an outer sole 100, a midsole 200, and a pressing member 300.

[0015] Outer sole 100 constitutes a landing portion. Outer sole 100 is made of rubber or the like.

[0016] Midsole 200 is provided on outer sole 100. Upper 20 is disposed on midsole 200. That is, midsole 200 is provided between upper 20 and outer sole 100. As illustrated in Fig. 2, midsole 200 includes a forefoot region R1, a midfoot region R2, and a hindfoot region R3. Fig. 2 shows a part of sole 10 for the right foot, but the sole for the left foot has a shape symmetrical, or substantially symmetrical, with the shape of sole 10 for the right foot.

[0017] Forefoot region R1 is a region overlapping a forefoot portion of the wearer of shoe 1 in the thickness direction of sole 10. The forefoot portion is a portion of the foot of the wearer located at the front portion in the longitudinal direction, that is, the foot length direction (vertical direction in Fig. 2) of shoe 1. Forefoot region R1 is a region located in a range of about 0% to 30% with respect to an entire length of shoe 1, from a front end portion toward a rear end portion of shoe 1.

[0018] The foot length direction is a direction parallel to a shoe center SC (see Fig. 2). Shoe center SC is not limited to the center line of shoe 1, and may be a line corresponding to a straight line connecting the center of the calcaneus of a standard wearer of shoe 1 and the middle of the first toe and the second toe.

[0019] Midfoot region R2 is a region overlapping a midfoot portion of the wearer of shoe 1 in the thickness direction of sole 10. The midfoot portion is a portion located at a central portion of the foot of the wearer in the longitudinal direction. Midfoot region R2 is a region located in a range of about 30% to 80% with respect to the entire length of shoe 1 from a distal end portion toward the rear end portion of shoe 1.

[0020] Hindfoot region R3 is a region overlapping a rear foot portion of the wearer of shoe 1 in the thickness direction of sole 10. The rear foot portion is a portion located at a rear portion of the foot of the wearer in the longitudinal direction. Hindfoot region R3 is a region located in a range of about 80% to 100% with respect to the entire length of shoe 1 from the front end portion toward the rear end portion of shoe 1.

[0021] As illustrated in Figs. 1 and 3, midsole 200 includes a midsole main body 210 and an elastic portion 250.

[0022] Midsole main body 210 is formed of a resin foam material or the like. Midsole main body 210 includes a lower midsole 201 and an upper midsole 202.

[0023] Lower midsole 201 is provided on outer sole 100. That is, a lower surface of lower midsole 201 is covered with outer sole 100. Only a part of the lower surface of lower midsole 201 may be covered with outer sole 100, or an entire area thereof may be covered with outer sole 100.

[0024] Upper midsole 202 is connected onto lower midsole 201. Upper midsole 202 may have rigidity higher than rigidity of lower midsole 201, or may have the same rigidity as that of lower midsole 201.

[0025] Midsole main body 210 has a containing portion 212 that contains elastic portion 250. In the present em-

bodiment, as illustrated in Fig. 1, containing portion 212 is provided in lower midsole 201. Lower midsole 201 has an upper surface 201S facing upper midsole 202, and containing portion 212 has a shape opening toward upper surface 201S of lower midsole 201. Containing portion 212 has a shape recessed downward from upper surface 201S of lower midsole 201. Containing portion 212 may be provided in a shape extending over lower midsole 201 and upper midsole 202.

[0026] Elastic portion 250 is disposed in midsole main body 210. Specifically, elastic portion 250 is contained in containing portion 212. Elastic portion 250 is made of an elastic body. Elastic portion 250 may be formed of the same material as that of lower midsole 201 or upper midsole 202, or of a material different from these materials.

[0027] Elastic portion 250 is contained in containing portion 212 in a compressed state in which a volume of elastic portion 250 is compressed to be smaller than a volume of the elastic portion in an unloaded state in which no external force acts on elastic portion 250. The elastic modulus of elastic portion 250 in the compressed state is larger than an elastic modulus of midsole main body 210.

[0028] Here, the unloaded state means a state in which the wearer does not wear shoe 1 (a state in which a load from the foot of the wearer does not act on elastic portion 250) and a state in which elastic portion 250 is not pressed by pressing member 300 described later.

[0029] As illustrated in Figs. 1 and 2, elastic portion 250 is disposed at a position across an MP joint in the foot length direction. Specifically, midsole main body 210 includes an MP joint supporting region 215 that supports the MP joint of the foot of the wearer of shoe 1, and elastic portion 250 is provided in MP joint supporting region 215. MP joint supporting region 215 is provided in a range across forefoot region R1 and midfoot region R2. A length L1 of elastic portion 250 in the foot length direction is set to about 10% to 70% with respect to the entire length of shoe 1. A distance from the front end portion of midsole main body 210 to the front end portion of elastic portion 250 is set to about 10% to 30% with respect to the entire length of shoe 1.

[0030] Elastic portion 250 has a supporting surface 250S. Supporting surface 250S is configured by an upper surface of elastic portion 250. Supporting surface 250S indirectly supports the foot of the wearer via upper midsole 202, an insole (not illustrated), and the like. Supporting surface 250S is exposed from containing portion 212.

[0031] Pressing member 300 is a member that presses elastic portion 250. In the present embodiment, pressing member 300 is provided in a plate shape. However, as long as elastic portion 250 can be pressed, pressing member 300 may be formed of a wire or the like.

[0032] Pressing member 300 is provided on midsole main body 210. As illustrated in Fig. 1, in the present embodiment, pressing member 300 is disposed in midsole main body 210. More specifically, pressing member 300 is disposed between lower midsole 201 and upper midsole 202. Midsole main body 210 has a space for containing pressing member 300. This space has a shape corresponding to a shape of pressing member 300. Pressing member 300 is bonded to at least one of lower midsole 201 and upper midsole 202.

[0033] As illustrated in Fig. 2, pressing member 300 has an outer shape larger than an outer shape of supporting surface 250S in plan view. Pressing member 300 is disposed so as to cover an entire area of supporting surface 250S. Pressing member 300 presses elastic portion 250 from above. When pressing member 300 is formed of a wire, a fixing position of the wire to containing portion 212 may be located outside elastic portion 250 in plan view.

[0034] As illustrated in Fig. 1, outer sole 100 is disposed on a side (a lower side) opposite to a side on which pressing member 300 is disposed with respect to elastic portion 250. Outer sole 100 includes a support portion 102 that supports elastic portion 250 from the side opposite to the side on which pressing member 300 is disposed with respect to elastic portion 250. Support portion 102 may be provided in a shape overlapping an entire area of elastic portion 250 in the foot length direction in the thickness direction, or may be provided in a shape overlapping a part of elastic portion 250 in the foot length direction in the thickness direction. Outer sole 100 has an elastic modulus higher than an elastic modulus of elastic portion 250 in the compressed state.

[0035] Pressing member 300 has an elastic modulus higher than the elastic modulus of elastic portion 250 in the compressed state. Pressing member 300 presses elastic portion 250 so that elastic portion 250 is maintained in the compressed state. Pressing member 300 has a function of suppressing excessive deformation of midsole main body 210 particularly at the time of taking off.

[0036] Pressing member 300 is made of a fiber-reinforced resin or a non-fiber-reinforced resin. Examples of the fiber used for the fiber-reinforced resin include carbon fiber, glass fiber, aramid fiber, Dyneema fiber, Zylon fiber, and boron fiber. Examples of the non-fiber-reinforced resin include polymer resins such as a polyurethane-based thermoplastic elastomer (TPU) and an amide-based thermoplastic elastomer (TPA). Pressing member 300 is preferably made of a fiber-reinforced plastic containing a synthetic resin and the above-mentioned fibers, and more preferably made of a carbon-fiber-reinforced plastic containing a synthetic resin and carbon fibers.

[0037] As described above, in sole 10 of the present embodiment, elastic portion 250 is contained in containing portion 212 of midsole main body 210 in the compressed state, and the elastic modulus of elastic portion 250 in the compressed state is larger than the elastic modulus of midsole main body 210, so that elastic portion 250 suppresses excessive deformation of midsole main body 210 at the time of taking off. Further, midsole main body 210 mainly exerts impact buffering at the time of landing.

[0038] Hereinafter, modified examples of the above embodiment will be described.

(First modified example)

[0039] As illustrated in Fig. 4, pressing member 300 may include a base portion 310 and at least one protruding portion 312.

[0040] Base portion 310 has a pressing surface 310S that presses elastic portion 250 downward. Pressing surface 310S has a shape corresponding to supporting surface 250S and upper surface 201S of lower midsole 201.

[0041] Protruding portion 312 protrudes from pressing surface 310S toward elastic portion 250. Protruding portion 312 has a shape extending in the foot length direction. More specifically, at least one protruding portion 312 is preferably provided in a rib shape having the same shape in the foot length direction. A length of protruding portion 312 in the foot width direction (left-right direction in Fig. 3) may be provided so as to gradually decrease as being separated from pressing surface 310S.

[0042] In the example shown in Fig. 3, the at least one protruding portion 312 includes a plurality of protruding portions 312. Protruding portions 312 are arranged side by side at intervals in the foot width direction. Although not illustrated, protruding portions 312 may also preferred to be formed as a rib shape extending in the foot width direction.

[0043] In this aspect, since protruding portion 312 prevents elastic portion 250 from expanding outward in the foot width direction, elastic portion 250 is effectively maintained in the compressed state.

(Second modified example)

[0044] As illustrated in Fig. 5, pressing member 300 may include base portion 310 and a pair of restraint walls 330. A shape of base portion 310 is the same as that in the first modified example. Pressing surface 310S of base portion 310 is bonded to supporting surface 250S.

[0045] The pair of restraint walls 330 extends downward from both ends of pressing surface 310S in the foot width direction (left-right direction in Fig. 5). The pair of restraint walls 330 restrain elastic portion 250 from both sides in the foot width direction. An inner side surface of each of restraint walls 330 is not bonded to elastic portion 250. Restraint wall 330 preferably extends in a rib shape in the foot length direction, for example. Further, restraint wall 330 is more preferably provided as an annular shape (a polygon such as a quadrangle, a circle, an ellipse, and a closed figure surrounded by a straight line or a curve, in a plan view) that surrounds elastic portion 250.

[0046] In this aspect, since elastic portion 250 is restrained from both sides in the foot width direction, elastic portion 250 is effectively maintained in the compressed state. In addition, since the inner side surface of restraint wall 330 and a side surface of elastic portion 250 do not adhere to each other, elastic portion 250 can be deformed smoothly and enter restraint wall 330 when a load is applied.

(Third modified example)

[0047] As illustrated in Fig. 6, sole 10 may further include a support member 350. Support member 350 is disposed on the side (lower side in the example of Fig. 6) opposite to the side on which pressing member 300 is disposed with respect to elastic portion 250, and supports elastic portion 250. Support member 350 sandwiches elastic portion 250 together with pressing member 300. Support member 350 may be formed of the same material as that of pressing member 300. Support member 350 has an elastic modulus higher than the elastic modulus of elastic portion 250 in the compressed state. Although not illustrated, under support member 350, midsole main body 210 may not be provided. In this case, outer sole 100 functions as a support member.

(Fourth modified example)

[0048] As illustrated in Fig. 7, elastic portion 250 may have a plurality of elastic elements 251. Elastic elements 251 are in contact with each other. Elastic elements 251 can independently and elastically deform in the thickness direction of sole 10. Elastic elements 251 may be formed of the same material or of different materials.

[0049] In this aspect, by adjusting an elastic modulus of each of elastic elements 251, an elastic modulus for each region in elastic portion 250 can be adjusted. In addition, each elastic element 251 can be deformed independently, and a portion to which the load is applied can be appropriately deformed.

(Fifth modified example)

[0050] As illustrated in Fig. 8, elastic portion 250 may have a shape extending longer in the foot length direction in the foot width direction on the outer foot side (right side in Fig. 8) than on the inner foot side. A length L2 of elastic portion 250 in the foot length direction is set to, for example, about 10% to 70% with respect to the entire length of shoe 1. In this way, it is possible to suppress excessive deformation of the midsole main body at the time of taking off for the type of wearers who lands with the forefoot.

(Sixth modified example)

[0051] As illustrated in Fig. 9, elastic portion 250 may be disposed at a position overlapping a region extending over hindfoot region R3 and midfoot region R2 in the thickness direction. Elastic portion 250 has a shape which gradually extends toward the outer foot side toward the front in the foot length direction, and in which the length in the foot width direction decreases. A length L3 of elastic portion 250 in the foot length direction is set to, for example, about 10% to 70% with respect to the entire

length of shoe 1. In this way, it is possible to suppress excessive deformation of the midsole main body at the time of taking off for the type of wearers who lands with the heel.

(Seventh modified example)

[0052] As illustrated in Fig. 10, elastic portion 250 may be disposed at a position biased to the inner foot side in MP joint supporting region 215. A length L4 of elastic portion 250 in the foot length direction is set to, for example, about 10% to 70% with respect to the entire length of shoe 1. In this way, it is possible to suppress excessive deformation of the midsole main body at the time of taking off for the type of wearer who lands with the portion near inner side of the forefoot. In addition, since a range for forming elastic portion 250 is small, which facilitates manufacturing.

(Eighth modified example)

[0053] As illustrated in Fig. 11, elastic portion 250 may be disposed in the central portion of MP joint supporting region 215 in the foot width direction. A length L5 of elastic portion 250 in the foot length direction is set to, for example, about 10% to 70% with respect to the entire length of shoe 1. In this way, it is possible to achieve suppress excessive deformation of the midsole main body at the time of taking off for the type of wearers who lands with the portion near the center of the forefoot. In addition, since a range for forming elastic portion 250 is small, which facilitates manufacturing.

(Second embodiment)

[0054] Next, sole 10 of a second embodiment of the present disclosure will be described with reference to Figs. 12 and 13. In the second embodiment, only portions different from those of the first embodiment will be described, and descriptions of the same structures, operations, and effects as those of the first embodiment will not be repeated. To the second embodiment, modified examples of the first embodiment may also be applied.

[0055] In the present embodiment, elastic portion 250 is made of the same material as that of midsole main body 210, and is formed integrally with midsole main body 210 so as to be connected to midsole main body 210. Specifically, elastic portion 250 is made of the same material as that of lower midsole 201, and is formed integrally with lower midsole 201 so as to be connected to lower midsole 201. In Figs. 12 and 13, a boundary portion between elastic portion 250 and lower midsole 201 in the thickness direction is indicated by a chain double-dashed line. In Fig. 12, the chain double-dashed line representing the boundary portion extends linearly, but actually, the chain double-dashed line has a shape curved so as to slightly protrude downward. More strictly speaking, as elastic portion 250 is compressed, a portion of lower midsole 201 interposed between outer sole 100 and elastic portion 250 is also compressed, and the boundary line may be deformed into a shape different from the shape described above.

[0056] Fig. 13 illustrates elastic portion 250 in a state before elastic portion 250 is pressed by pressing member 300, that is, in the unloaded state, and Fig. 12 illustrates elastic portion 250 in the compressed state. As illustrated in Fig. 13, supporting surface 250S of elastic portion 250 in the unloaded state protrudes upward from upper surface 201S of lower midsole 201. Supporting surface 250S of elastic portion 250 in the compressed state is flush with upper surface 201S of lower midsole 201.

[0057] A cut S may be provided at the boundary between lower midsole 201 and elastic portion 250. In this way, elastic portion 250 is easily contained in containing portion 212 in the compressed state.

[0058] In this embodiment, a region surrounded by cut S, a surface passing through an upper end portion of cut S, and a surface passing through a lower end portion of cut S (boundary portion between elastic portion 250 and lower midsole 201 in the thickness direction) corresponds to containing portion 212.

[0059] Next, a modified example of the second embodiment will be described.

(Ninth modified example)

[0060] As illustrated in Fig. 14, a groove portion 214 may be provided at the boundary between lower midsole 201 and elastic portion 250. Preferably, a width of groove portion 214 gradually decreases downward from upper surface 201S of lower midsole 201. The width of groove portion 214 means a distance between an outer peripheral surface of elastic portion 250 in the unloaded state and lower midsole 201. Also in this aspect, elastic portion 250 is easily contained in containing portion 212 in the compressed state.

[0061] Also in Fig. 14, the boundary portion between elastic portion 250 and lower midsole 201 in the thickness direction is indicated by a chain double-dashed line.

(Tenth modified example)

[0062] As illustrated in Fig. 15, elastic portion 250 may have end surfaces 252 connected to both ends of supporting surface 250S in the foot width direction. Each of end surfaces 252 has a shape gradually extending downward from supporting surface 250S toward outside in the foot width direction in the unloaded state.

[0063] Also in Fig. 15, the boundary portion between elastic portion 250 and lower midsole 201 in the thickness direction is indicated by a chain double-dashed line.

(Third embodiment)

[0064] Next, sole 10 of a third embodiment of the present disclosure will be described with reference to

Figs. 16 to 18. In the third embodiment, only portions different from those of the first embodiment will be described, and descriptions of the same structures, operations, and effects as those of the first embodiment will not be repeated. To the third embodiment, modified examples of the first embodiment may also be applied.

[0065] In the present embodiment, sole 10 includes midsole 200, pressing member 300, and an inner sole 400.

[0066] Midsole 200 includes midsole main body 210 and elastic portion 250. In the present embodiment, midsole main body 210 includes a first main body 203 and a second main body 204.

[0067] First main body 203 has a shape extending from the front end to the rear end in the foot length direction. A thickness of first main body 203 is smaller than a thickness of midsole main body 210 in the first embodiment. First main body 203 is provided with containing portion 212. As illustrated in Figs. 16 and 17, containing portion 212 opens toward an upper surface and a lower surface of first main body 203. That is, containing portion 212 penetrates first main body 203 in the thickness direction thereof.

[0068] Second main body 204 is connected to a lower surface of a rear portion of first main body 203 in the foot length direction. Second main body 204 is disposed at a position overlapping a heel portion of the foot of the wearer in the thickness direction.

[0069] Elastic portion 250 is contained in containing portion 212 in the compressed state. Elastic portion 250 may be formed of the same material as that of first main body 203 or second main body 204, or of a material different from these materials. Elastic portion 250 is configured separately from first main body 203.

[0070] Fig. 17 illustrates a cross-sectional view taken along line XVII-XVII in Fig. 16, and Fig. 18 illustrates a state in which inner sole 400 is removed from Fig. 17. Fig. 18 illustrates elastic portion 250 in the unloaded state. As illustrated in Fig. 18, supporting surface 250S of elastic portion 250 in the unloaded state is located above an upper surface 203 S of first main body 203.

[0071] Pressing member 300 is connected to the lower surface of first main body 203. In the present embodiment, pressing member 300 constitutes an outer sole. Pressing member 300 is made of a resin. Pressing member 300 presses elastic portion 250 from below. As illustrated in Fig. 16, a rear portion of pressing member 300 is disposed between first main body 203 and second main body 204.

[0072] Inner sole 400 is connected onto midsole 200. Inner sole 400 is connected to an upper surface of first main body 203 and covers supporting surface 250S. Inner sole 400 is preferably bonded to supporting surface 250S. Inner sole 400 includes a support portion 402 that supports elastic portion 250 from the side (upper side) opposite to the side on which pressing member 300 is disposed with respect to elastic portion 250.

[0073] Hereinafter, modified examples of the third embodiment will be described.

(Eleventh modified example)

[0074] As illustrated in Fig. 19, first main body 203 may have a lower interposed portion 217 interposed between elastic portion 250 and pressing member 300.

(Twelfth modified example)

[0075] As illustrated in Fig. 20, first main body 203 may have an upper interposed portion 218 interposed between elastic portion 250 and inner sole 400.

(Thirteenth modified example)

[0076] As illustrated in Fig. 21, first main body 203 may have an upper interposed portion 218 interposed between elastic portion 250 and inner sole 400, and elastic portion 250 may be made of the same material as that of first main body 203 and formed integrally with first main body 203 so as to be connected to upper interposed portion 218. In Fig. 21, in the outer shape of containing portion 212, a boundary portion between elastic portion 250 and upper interposed portion 218 is indicated by a chain double-dashed line. The definition of containing portion 212 is the same as that in the second embodiment.

[0077] Fig. 22 illustrates a state in which pressing member 300 is removed from Fig. 21. Fig. 22 illustrates elastic portion 250 in the unloaded state. As illustrated in Fig. 22, a lower surface 250S2 of elastic portion 250 in the unloaded state is positioned below a lower surface 203S2 of first main body 203. A cut S may be provided at a boundary between first main body 203 and elastic portion 250.

(Fourteenth modified example)

[0078] As illustrated in Fig. 23, midsole main body 210 may be formed of a single member. The thickness of midsole main body 210 in this example is smaller than the thickness of midsole main body 210 in the third embodiment.

[0079] Pressing member 300 is connected to a lower surface of midsole main body 210. In this example, an entire area of pressing member 300 in the foot length direction constitutes a landing portion.

[0080] The embodiments disclosed herein should be considered to be illustrative in all respects and not restrictive. The scope of the present invention is defined by the claims, instead of the descriptions of the embodiments stated above, and meanings equivalent to the claims and all modifications within the scope are included.

[Embodiments]

[0081] It is understood by those skilled in the art that

the plurality of exemplary embodiments described above are specific examples of the following aspects.

[0082] A sole according to an aspect of the present disclosure includes: a midsole main body; an elastic portion made of an elastic body and disposed in the midsole main body; and a pressing member that presses the elastic portion, wherein the midsole main body includes a containing portion that contains the elastic portion, the elastic portion is contained in the containing portion in a compressed state in which a volume of the elastic portion is compressed to be smaller than a volume of the elastic portion in an unloaded state in which no external force acts on the elastic portion, the pressing member has an elastic modulus higher than an elastic modulus of the elastic portion in the compressed state, and presses the elastic portion so that the elastic portion is maintained in the compressed state, and the elastic modulus of the elastic portion in the compressed state is larger than an elastic modulus of the midsole main body.

[0083] In this sole, the elastic portion is contained in the containing portion of the midsole main body in the compressed state, and the elastic modulus of the elastic portion in the compressed state is larger than the elastic modulus of the midsole main body, so that the elastic portion suppresses excessive deformation of the midsole main body at the time of taking off. In addition, the midsole main body mainly exerts impact buffering at the time of landing.

[0084] Further, the midsole main body may include an upper surface, the containing portion has a shape opening toward the upper surface of the midsole main body. In this case, the elastic portion may include a supporting surface that is exposed from the containing portion and indirectly supports a foot of a wearer, and the pressing member may press the supporting surface in a state in which the pressing member is fixed to the upper surface of the midsole main body.

[0085] In this aspect, since the pressing member presses the supporting surface of the elastic portion, the elastic portion is contained in the containing portion in the compressed state.

[0086] Moreover, the elastic portion may be made of a material identical with a material of the midsole main body and may be formed integrally with the midsole main body so as to be connected to the midsole main body. In this case, the elastic portion includes a supporting surface that indirectly supports a foot of a wearer, and the supporting surface in the unloaded state protrudes upward from the upper surface of the midsole main body.

[0087] In this aspect, by fixing the pressing member to the upper surface of the midsole main body, the elastic portion is contained in the containing portion in the compressed state.

[0088] In this case, the elastic portion may have end surfaces connected to both ends of the supporting surface in a foot width direction. Each of the end surfaces preferably has a shape gradually extending downward from the supporting surface toward outside in the foot width direction in the unloaded state.

[0089] In this aspect, the elastic portion easily fits in the containing portion in the compressed state.

[0090] Further, it is preferable that a cut is provided at a boundary between the midsole main body and the elastic portion.

[0091] Also in this aspect, the elastic portion easily fits in the containing portion in the compressed state.

[0092] Preferably, the pressing member has an outer shape larger than an outer shape of the supporting surface in plan view, and is disposed so as to cover an entire area of the supporting surface.

[0093] In this aspect, the elastic portion is uniformly compressed.

[0094] Moreover, the pressing member may include a pressing surface that presses the supporting surface downward.

[0095] In this case, the pressing member may further include a protruding portion protruding from the pressing surface toward the elastic portion. The protruding portion preferably has a shape extending in the foot length direction.

[0096] In this aspect, since the protruding portion prevents the elastic portion from expanding outward in the foot width direction, the elastic portion is effectively maintained in the compressed state.

[0097] Moreover, the pressing member may further include a pair of restraint walls extending downward from both ends of the pressing surface in a foot width direction. The pair of restraint walls preferably restrain the elastic portion from both sides in the foot width direction.

[0098] In this aspect, since the elastic portion is restrained from both sides in the foot width direction, the elastic portion is effectively maintained in the compressed state.

[0099] Further, the elastic portion may include a plurality of elastic elements, each of which is independently and elastically deformable in a thickness direction of the sole.

[0100] In this aspect, by adjusting an elastic modulus of each of the elastic elements, an elastic modulus for each region in the elastic portion can be adjusted. In addition, each elastic element can be deformed independently, and the portion to which the load is applied can be appropriately deformed.

[0101] Moreover, the midsole main body may include an MP joint supporting region that supports an MP joint of a foot of a wearer of a shoe. In this case, it is preferable that the elastic portion is provided in the MP joint supporting region.

[0102] In addition, the pressing member is preferably made of fiber-reinforced plastic.

[0103] Further, a shoe according to one aspect of the present disclosure includes: the sole as described above; and an upper that is directly or indirectly connected to the sole and located above the sole.

[0104] Although the present invention has been described and illustrated in detail, it is clearly understood

that the same is by way of illustration and example only and is not to be taken by way of limitation. The scope of the present invention is interpreted by the terms of the appended claims, and it is intended that meanings equivalent to the claims and all modifications within the scope are included.

Claims

1. A sole (10) comprising:

a midsole main body (210);
an elastic portion (250) made of an elastic body and disposed in the midsole main body; and
a pressing member (300) that presses the elastic portion, wherein
the midsole main body includes a containing portion (212) that contains the elastic portion,
the elastic portion (250) is contained in the containing portion in a compressed state in which a volume of the elastic portion is compressed to be smaller than a volume of the elastic portion in an unloaded state in which no external force acts on the elastic portion,
the pressing member (300) has an elastic modulus higher than an elastic modulus of the elastic portion in the compressed state, and presses the elastic portion so that the elastic portion is maintained in the compressed state, and
the elastic modulus of the elastic portion in the compressed state is larger than an elastic modulus of the midsole main body.

2. The sole according to claim 1, wherein

the midsole main body includes an upper surface (201S),
the containing portion (212) has a shape opening toward the upper surface of the midsole main body,
the elastic portion (250) includes a supporting surface (250S) that is exposed from the containing portion and indirectly supports a foot of a wearer, and
the pressing member (300) presses the supporting surface in a state in which the pressing member is fixed to the upper surface of the midsole main body.

3. The sole according to claim 1, wherein

the midsole main body has an upper surface (201S),
the elastic portion (250) is made of a material identical with a material of the midsole main body and is formed integrally with the midsole main body so as to be connected to the midsole main body,
the elastic portion includes a supporting surface (250S) that indirectly supports a foot of a wearer, and
the supporting surface in the unloaded state protrudes upward from the upper surface of the midsole main body.

4. The sole according to claim 3, wherein

the elastic portion (250) includes end surfaces (252) connected to both ends of the supporting surface in a foot width direction, and
each of the end surfaces (252) has a shape gradually extending downward from the supporting surface toward outside in the foot width direction in the unloaded state.

5. The sole according to claim 3 or 4, wherein a cut (S) is provided at a boundary between the midsole main body and the elastic portion.

6. The sole according to any one of claims 2 to 5, wherein the pressing member (300) has an outer shape larger than an outer shape of the supporting surface in plan view, and is disposed so as to cover an entire area of the supporting surface.

7. The sole according to any one of claims 2 to 6, wherein the pressing member (300) includes a pressing surface (310S) that presses the supporting surface downward.

8. The sole according to claim 7, wherein

the pressing member (300) further includes a protruding portion (312) protruding from the pressing surface toward the elastic portion, and the protruding portion has a shape extending in a foot length direction.

9. The sole according to claim 7 or 8, wherein

the pressing member (300) further includes a pair of restraining walls (330) extending downward from both ends of the pressing surface in a foot width direction, and
the pair of restraint walls restrain the elastic portion from both sides in the foot width direction.

10. The sole according to any of claims 1 to 9, wherein the elastic portion (250) includes a plurality of elastic elements (251), each of which is independently and elastically deformable in a thickness direction of the sole.

11. The sole according to any one of claims 1 to 10, wherein

the midsole main body (210) includes an MP joint supporting region (215) that supports an MP joint of a foot of a wearer of a shoe, and
the elastic portion is provided in the MP joint supporting region.

12. The sole according to any one of claims 1 to 11, wherein the pressing member (300) is made of fiber-reinforced plastic.

13. A shoe (1) comprising:

the sole (10) according to any one of claims 1 to 12; and
an upper (20) that is directly or indirectly connected to the sole and located above the sole.

FIG.1

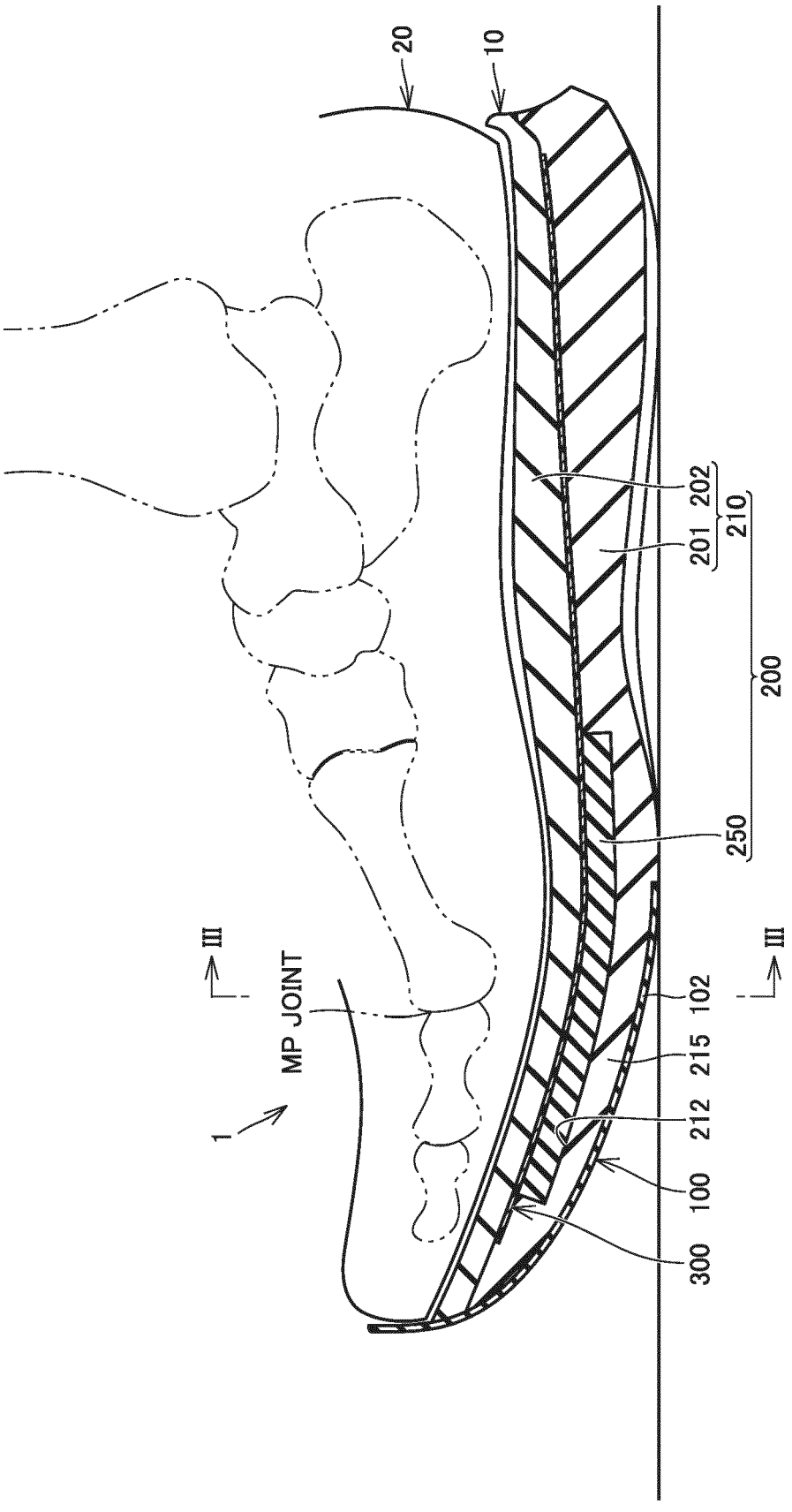


FIG.2

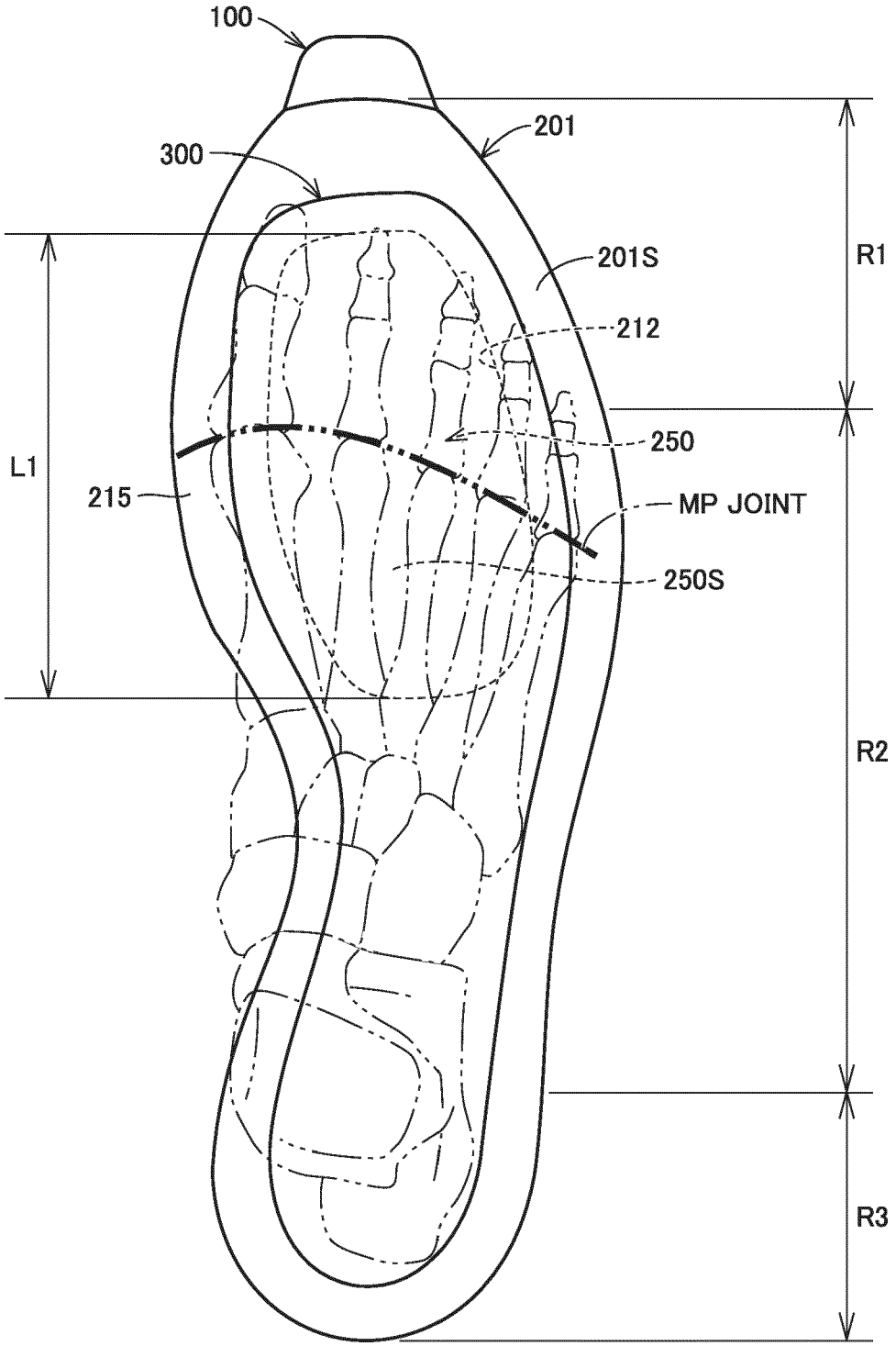


FIG.3

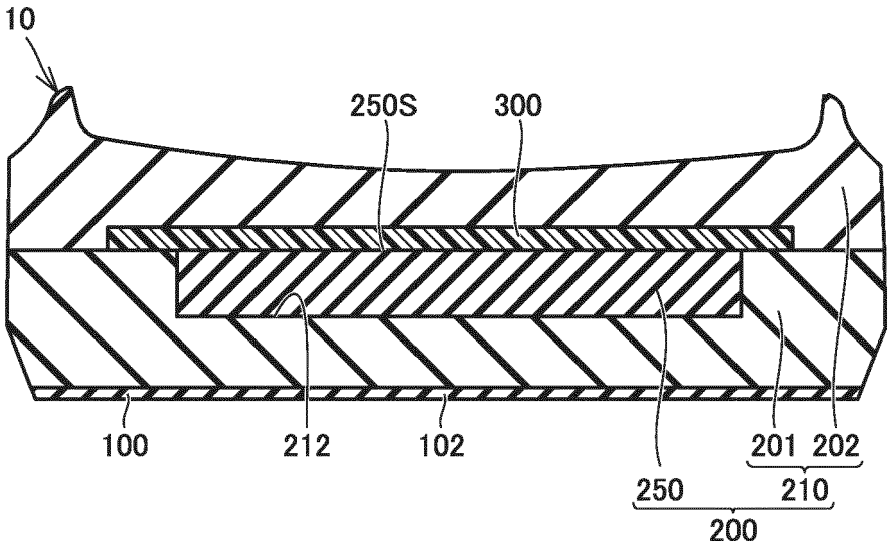


FIG.4

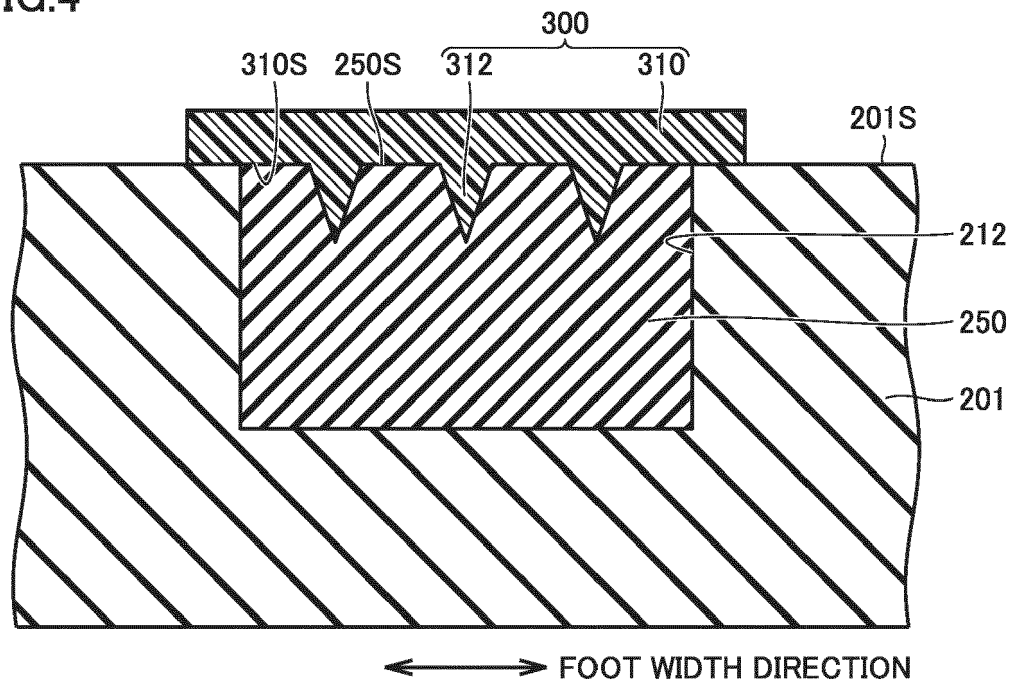


FIG.5

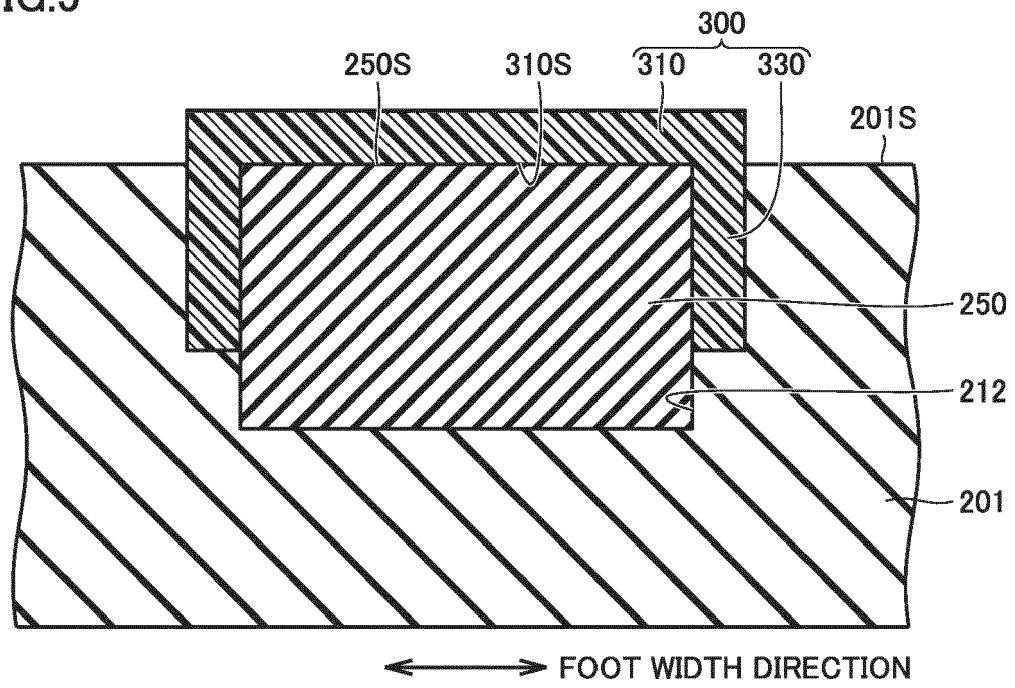


FIG.6

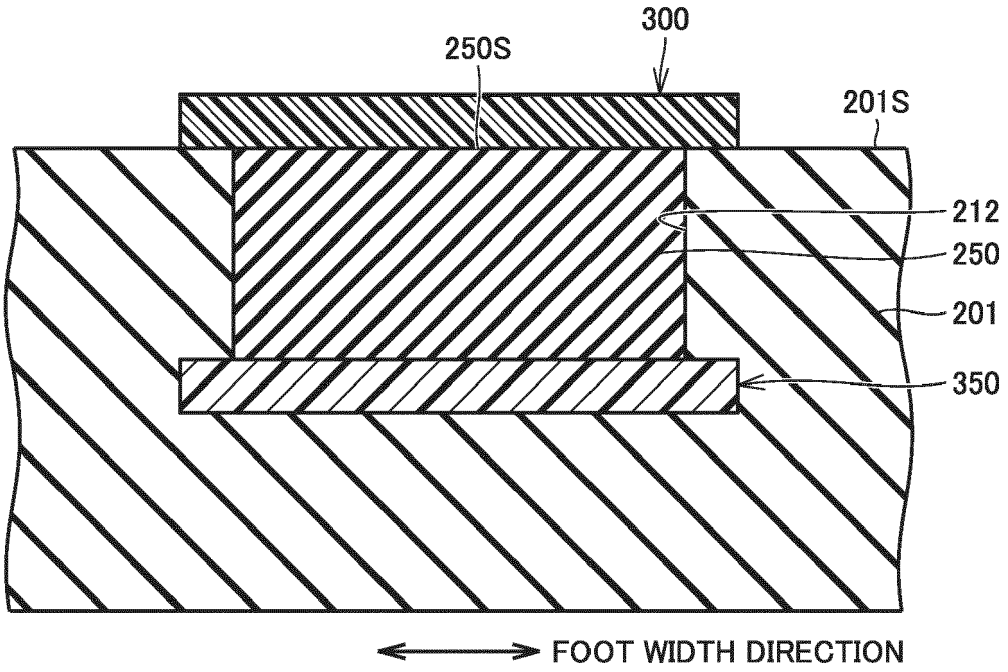


FIG.7

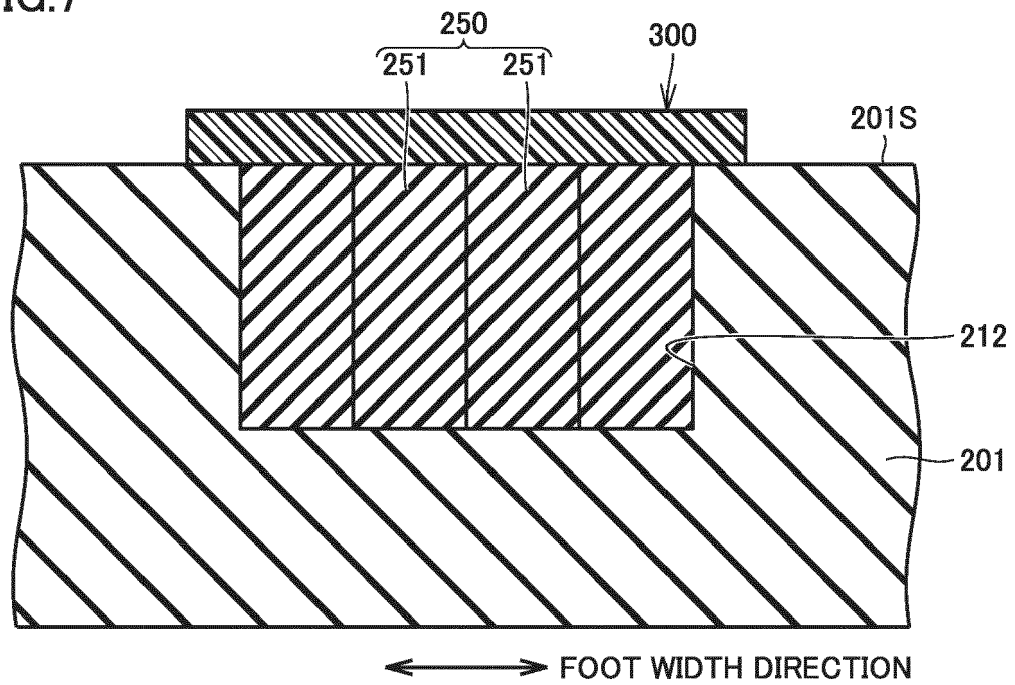


FIG.8

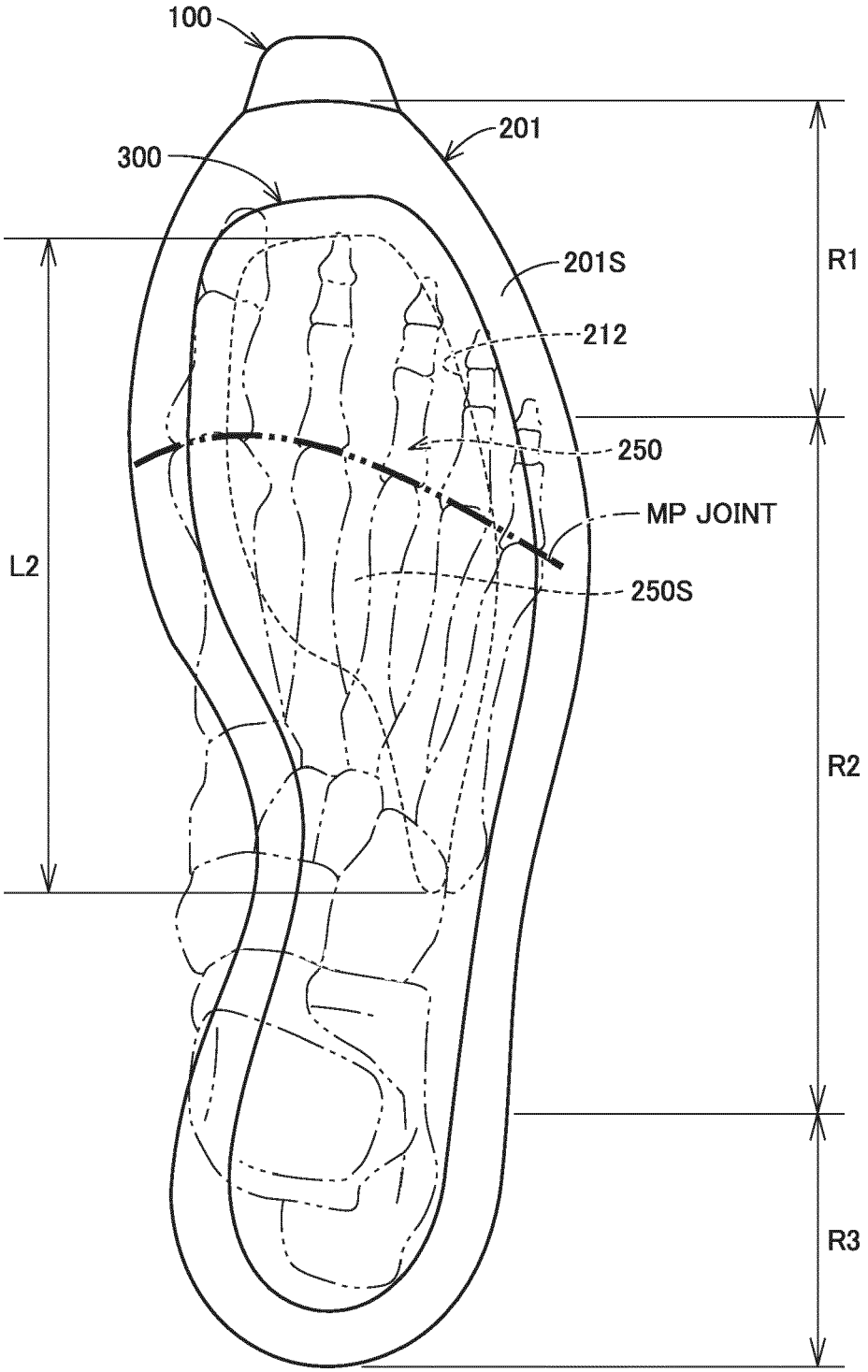


FIG.9

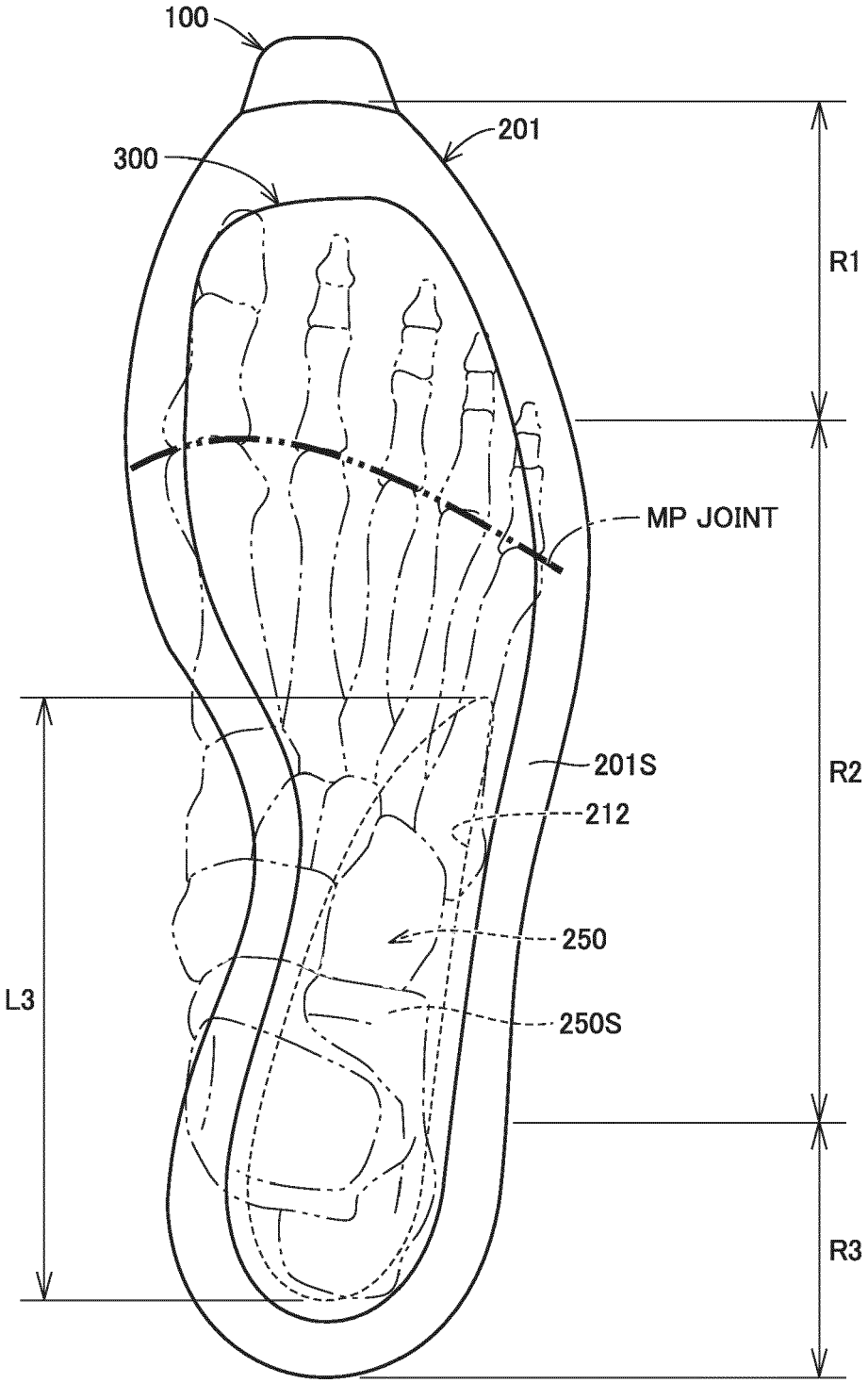


FIG.10

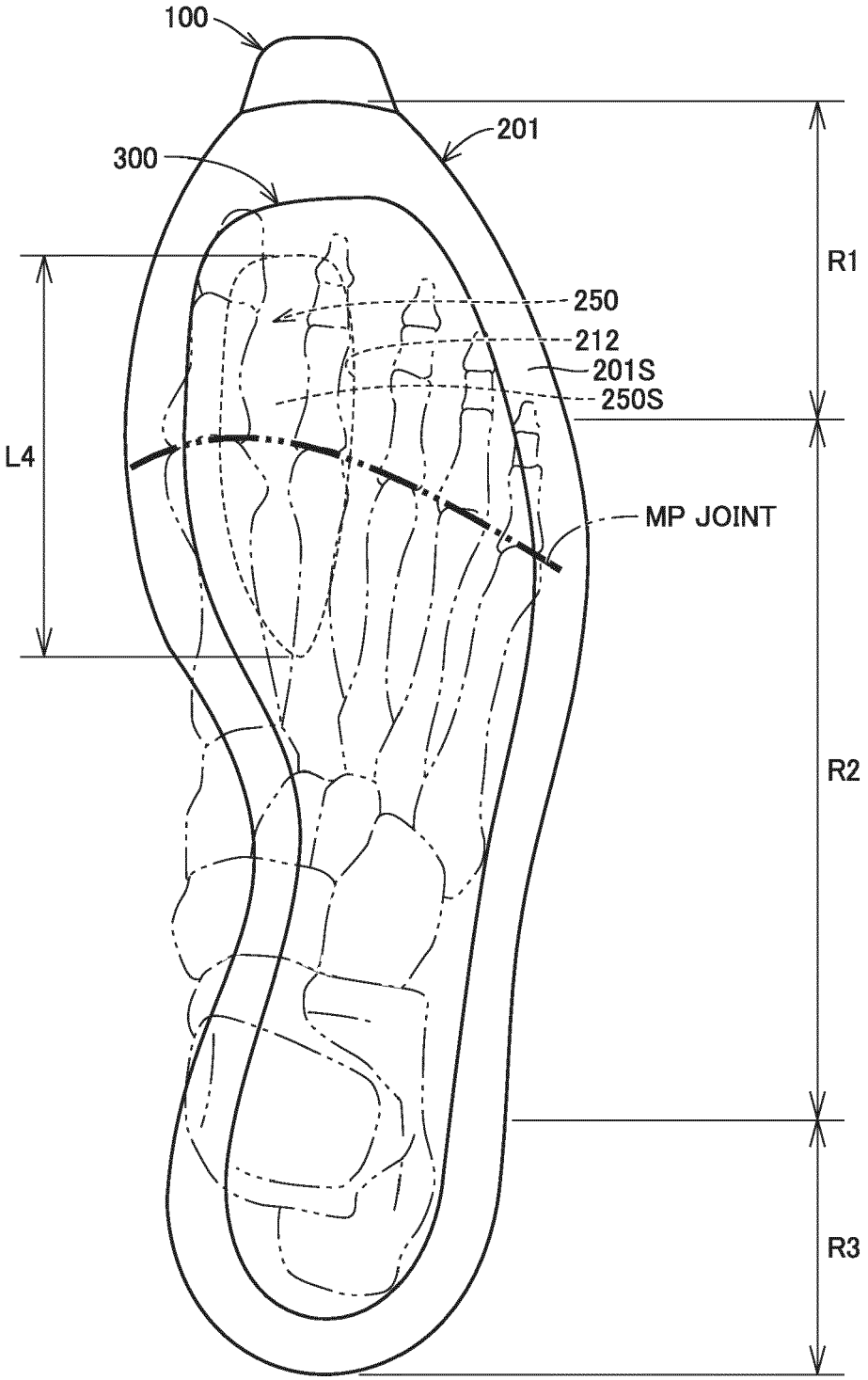


FIG.11

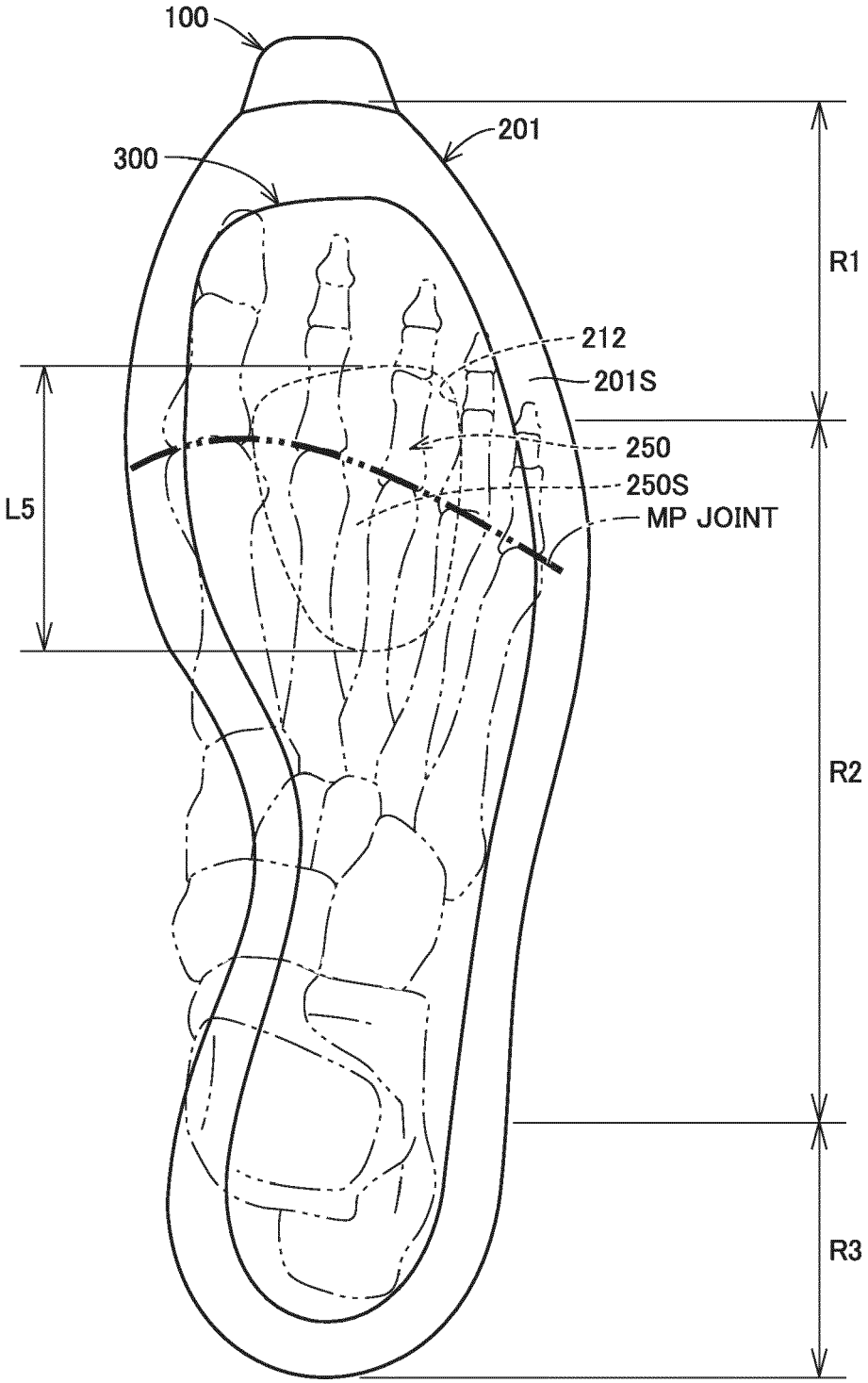


FIG.12

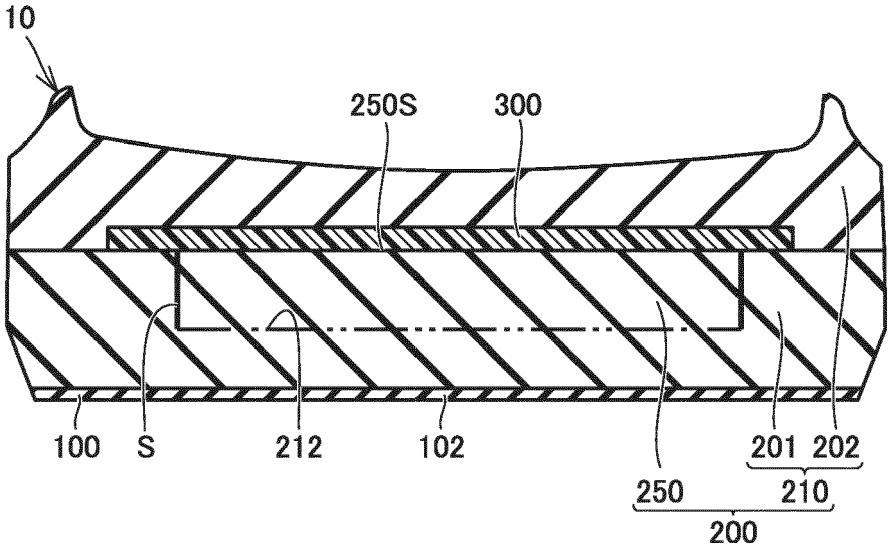


FIG.13

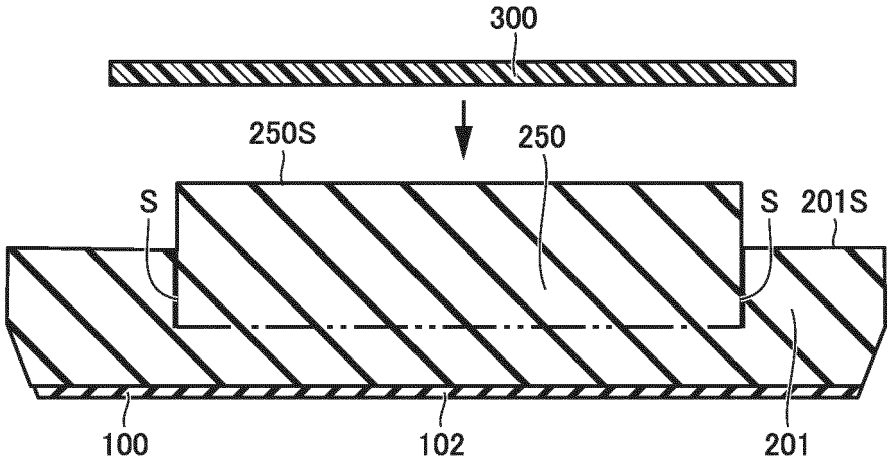


FIG.14

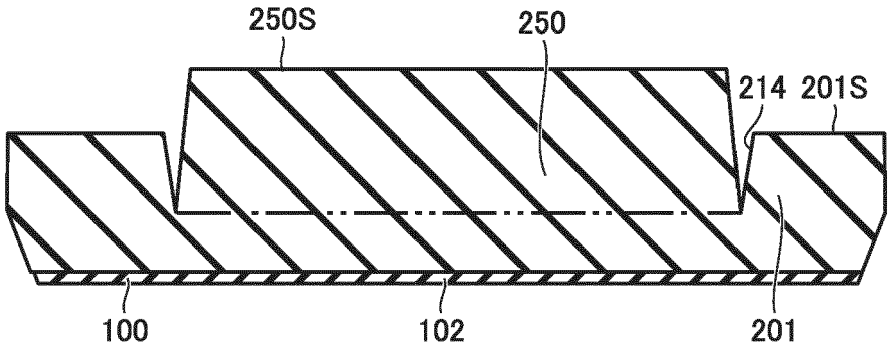


FIG.15

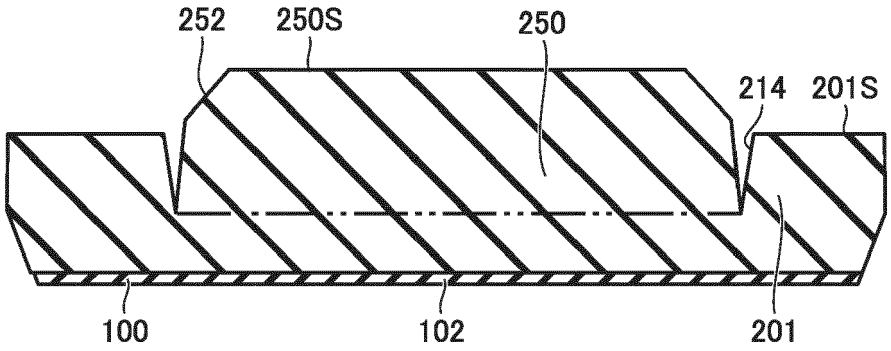


FIG.16

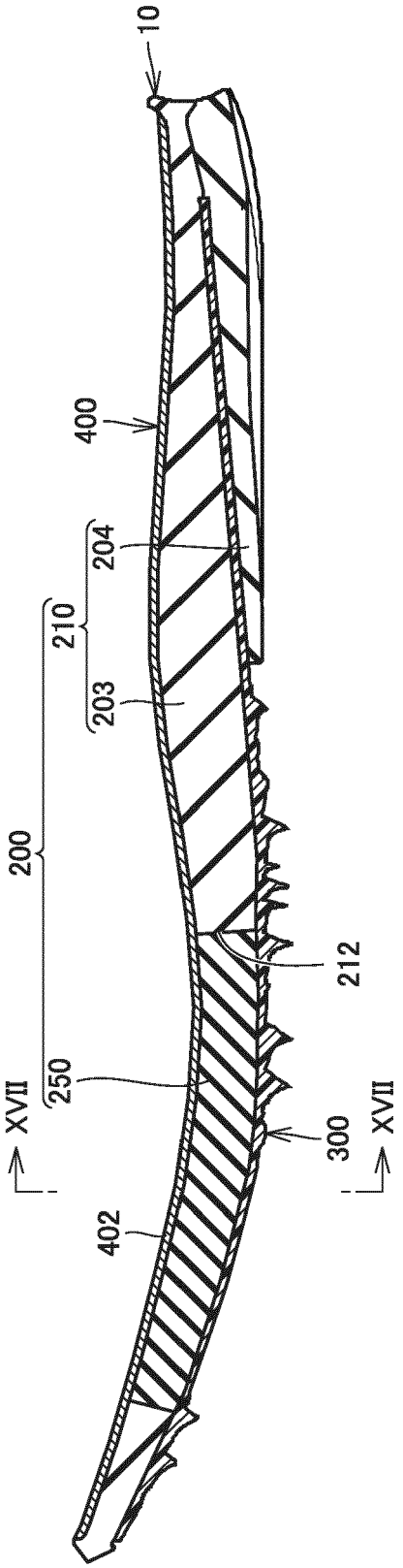


FIG.17

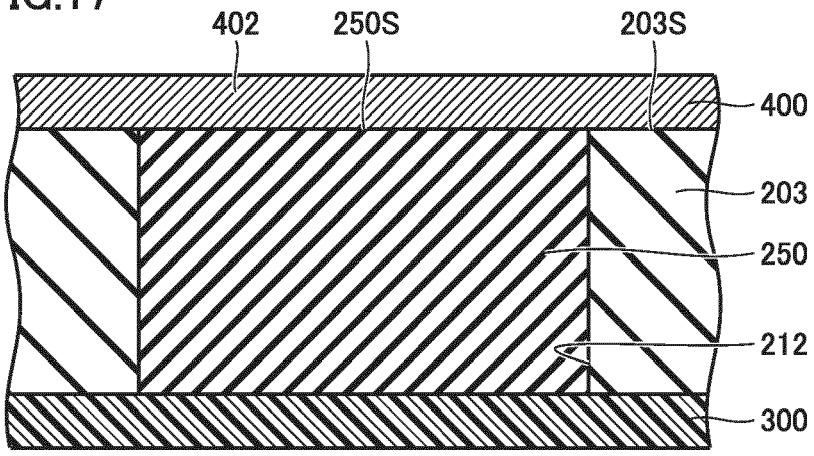


FIG.18

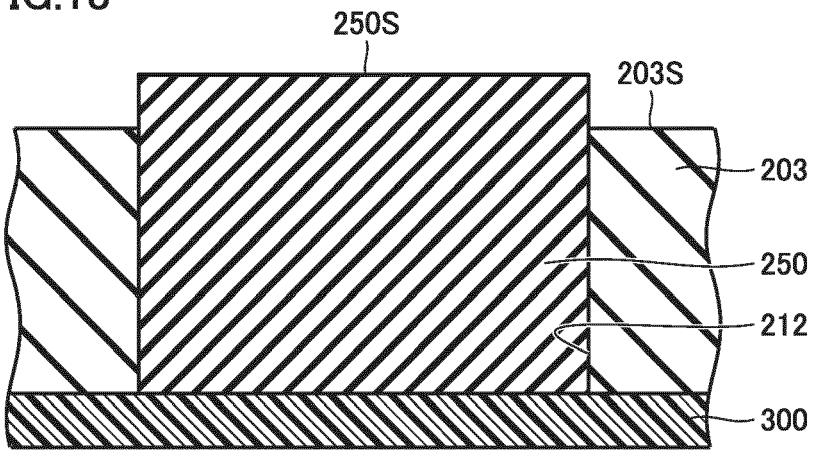


FIG.19

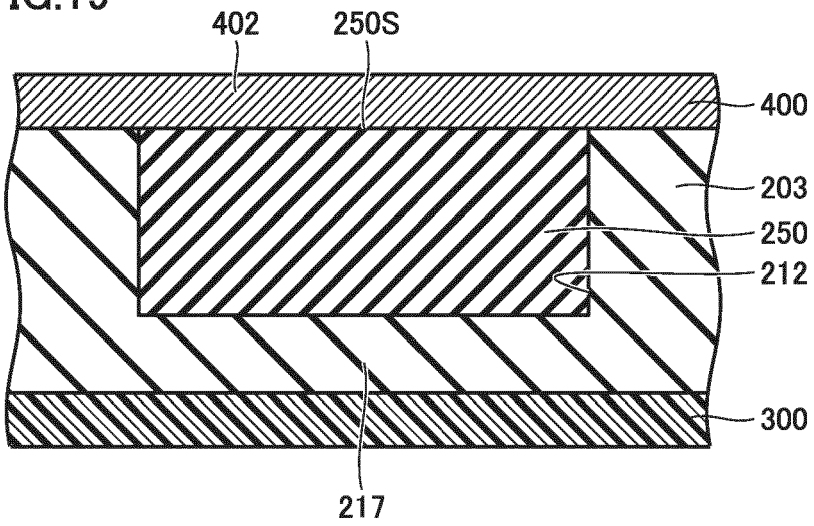


FIG.20

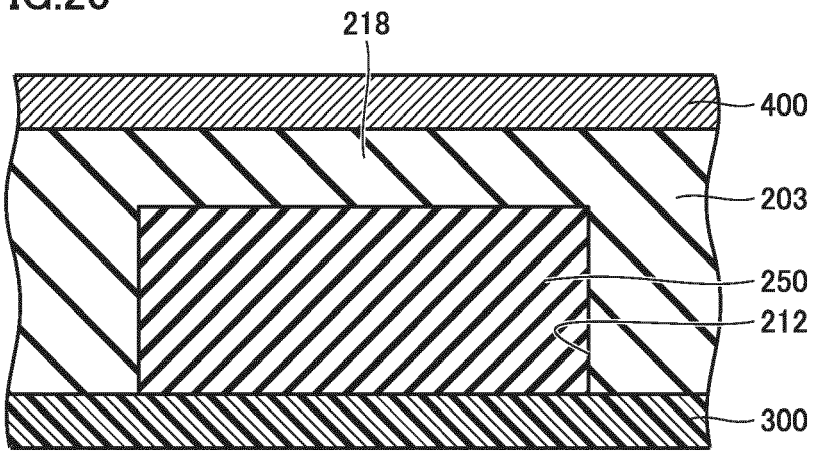


FIG.21

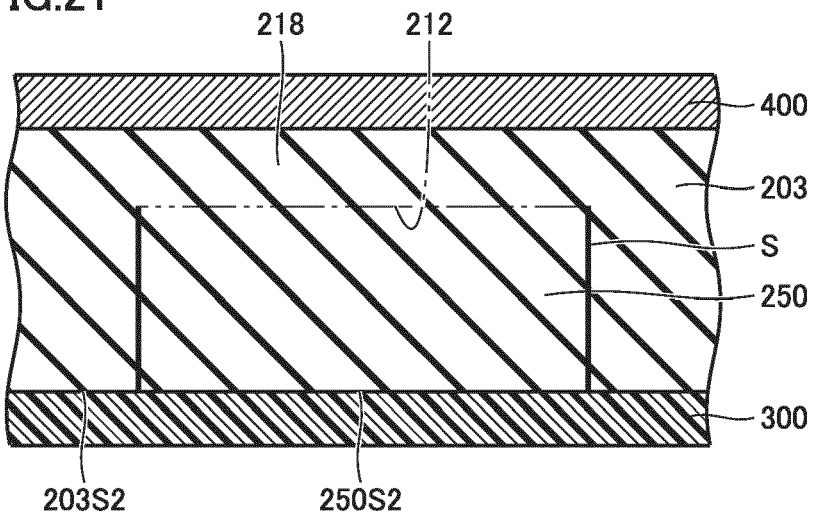
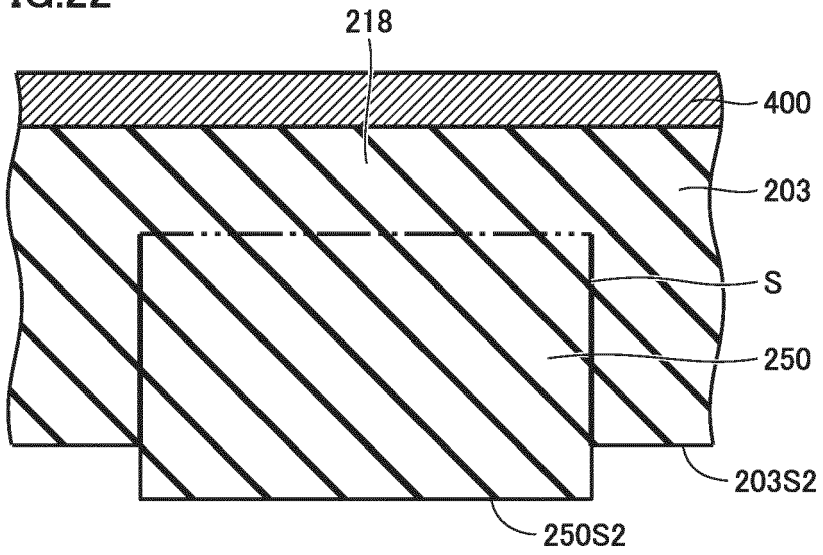


FIG.22



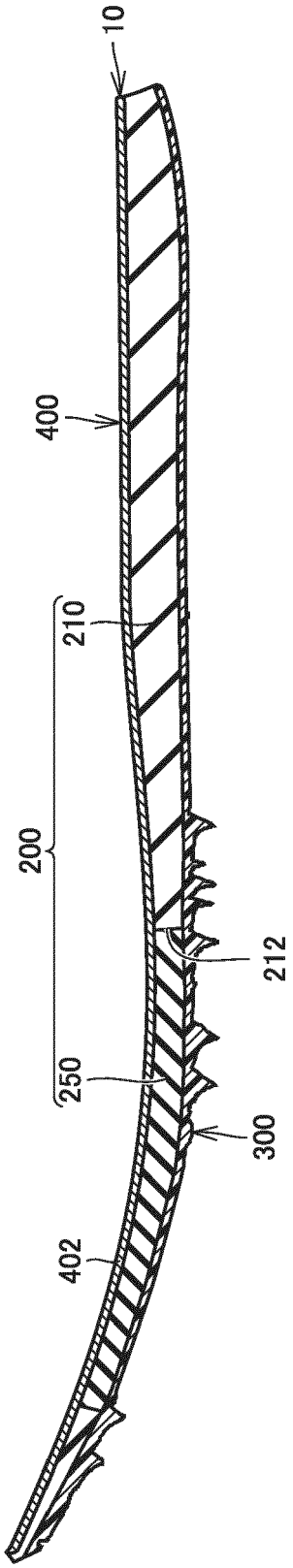


FIG.23

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EUROPEAN SEARCH REPORT

Application Number
EP 22 18 4503

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	GB 2 155 759 A (COLGATE PALMOLIVE CO) 2 October 1985 (1985-10-02) * abstract * * page 1, lines 114-126 * * page 2, lines 47-51 * * page 8, line 11 - page 9, line 18 * * figures 29-35 * * claims 1-5,7 * -----	1-3,5-7, 10-13 4,8,9	INV. A43B5/06 A43B7/32 A43B13/02 A43B13/18
			TECHNICAL FIELDS SEARCHED (IPC)
			A43B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 December 2022	Espeel, Els

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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P : intermediate document

T : theory or principle underlying the invention
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L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 18 4503

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14-12-2022

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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- US 9833038 B **[0003]**