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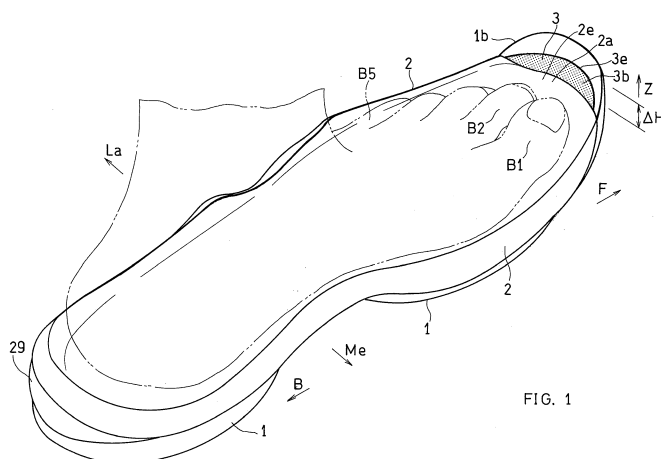
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(54) **SHOE FOR INDOOR SPORTS**

(57) A shoe for indoor sports including: an outer sole having a tread surface; a mid sole arranged over the outer sole; and a resin reinforcement plate which has a Young's modulus greater than a Young's modulus of the outer sole and than a Young's modulus of the mid sole and which is arranged between the outer sole and the mid sole, characterized in that: the reinforcement plate includes a base plate portion and a roll-up portion formed integrally continuous together, with the base plate portion extending from posterior of heads of proximal phalanges of a big toe and a little toe to anterior of a tip of a foot,

and extending continuously from a medial side toward a lateral side in a front portion of the reinforcement plate, and with the roll-up portion being rolled up from the front portion of the base plate portion upwardly Z above an upper surface of a front end portion of the mid sole so as to cover an anterior of the big toe, wherein the reinforcement plate does not cover toes including the big toe and the little toe from directly above; and at least a portion of a front surface of the roll-up portion is covered by an anti-slip member having a greater frictional force against a floor surface than the reinforcement plate.



Description

TECHNICAL FIELD

[0001] The present invention relates to a shoe suitable for indoor sports such as volleyball, for example.

BACKGROUND ART

[0002] In volleyball, most jumps are jumps made with both feet. There are volleyball shoes currently sold, having a structure in which a reinforcement plate is elongated from the midfoot portion to the head of the first metatarsal bone to reduce excessive extension (dorsiflexion) of the metatarsal phalangeal joint (MP joint), thereby effectively transmitting, to the floor surface, the horizontal kicking force of the right foot (a right-footed player) during a jump.

[0003] This conventional example will increase the jump speed. Also, this structure will only be effective for the right foot of a right-footed player during a jump.

[0004] This conventional technique, however, does not focus on the left foot, which has a greater contribution to the jump height (a right-footed player), and cannot so much increase the jump height.

CITATION LIST

PATENT LITERATURE

[0005]

First Patent Document: US4,412,393 B (front page)
 Second Patent Document: US4,453,996 B (front page)
 Third Patent Document: US2010/0005684 A1 (front page)
 Fourth Patent Document: US2010/0307027 A1 (front page)
 Fifth Patent Document: JP57-186509 Y (FIG. 2)
 Sixth Patent Document: JP2002-360305 A (abstract)

SUMMARY OF INVENTION

[0006] It is an object of the present invention to provide a shoe for indoor sports capable of increasing the jump height when jumping with both feet.

[0007] The present invention is directed to a shoe for indoor sports including:

an outer sole having a tread surface;
 a mid sole arranged over the outer sole; and
 a resin reinforcement plate which has a Young's modulus greater than a Young's modulus of the outer sole and than a Young's modulus of the mid sole and which is arranged between the outer sole and the mid sole, characterized in that:

the reinforcement plate includes a base plate portion and a roll-up portion formed integrally continuous together, with the base plate portion extending from heads of proximal phalanges of a big toe and a little toe to anterior of a tip of a foot, and extending continuously in the medial-lateral direction in a front portion of the reinforcement plate, and with the roll-up portion being rolled up from the front portion of the base plate portion upwardly above an upper surface of a front end portion of the mid sole so as to cover an anterior of the big toe, and the reinforcement plate does not cover toes including the big toe and the little toe from directly above; and at least a portion of a front surface of the roll-up portion is covered by an anti-slip member having a greater frictional force against a floor surface than the reinforcement plate.

[0008] In order to increase the jump height in an indoor sport such as volleyball, it is desirable to increase the impulse after the point in time at which the reaction force exerted against the sole from the floor peaks.

[0009] The reinforcement plate of the present invention extends from the heads of the proximal phalanges of the big toe and the little toe to anterior of the tip of the foot, and the reinforcement plate in the roll-up portion is rolled up from the front portion of the base portion upwardly above the upper surface of the front end portion of the midsole. This reduces the extension (dorsiflexion) of the MP joint and the interphalangeal joint of the big toe immediately before the toe takes off the floor surface during a jump, thereby allowing the force of flexion (plantar flexion) of the big toe to be transmitted to the floor surface until the last moment via the reinforcement plate, thus obtaining a large impulse. Therefore, it will be possible to increase the jump height. Moreover, the reinforcement plate having been bent is restored during a jump action, thereby increasing the impulse, and it will be possible to increase the jump height.

[0010] On the other hand, in an indoor sport such as volleyball, there are cases where a ball is received while the tip of the toe is in contact with the floor surface. In such a case, if the front surface of the reinforcement plate is completely exposed, a slip is likely to occur between the reinforcement plate and the floor surface, thereby failing to realize an intended play (action).

[0011] A part or whole of the front surface of the roll-up portion of the reinforcement plate of the present invention is covered by an anti-slip member. This reduces the slip, making it possible to realize an intended play (action).

BRIEF DESCRIPTION OF DRAWINGS

[0012]

FIG. 1 is a schematic perspective view showing a

sole according to Embodiment 1 of the present invention.

FIG. 2 is a perspective view showing a midsole and a reinforcement plate of the sole, as seen from the bottom side.

FIG. 3 is an exploded perspective view of the sole.

FIG. 4 is a perspective view of a reinforcement plate.

FIG. 5 is a plan view showing a relationship between a reinforcement plate and the foot bone structure.

FIG. 6 is a medial side view of a reinforcement plate, showing a midsole and an outsole, partly in a cross-sectional view.

FIG. 7A is a characteristic diagram showing a relationship between the vertical reaction force from the floor surface during a jump and the jump efficiency, and FIG. 7B is a characteristic diagram showing a relationship between the jump efficiency and the jump height.

FIG. 8 is a schematic perspective view showing a sole according to Embodiment 2.

FIG. 9A, FIG. 9B and FIG. 9C are plan views showing reinforcement plates according to other embodiments.

DESCRIPTION OF EMBODIMENTS

[0013] Preferably, at the front end portion of the mid sole, the roll-up portion projects upwardly by 0.3 cm to 3.0 cm with respect to the upper surface of the mid sole.

[0014] If the projection height of the roll-up portion is less than 0.3 cm, the advantageous effect set forth above will be insufficient, whereas if the projection height exceeds 3.0 cm, the rigidity of the toe of the shoe will be excessive.

[0015] For such reasons, the projection height is set more preferably to 0.4 cm to 2.0 cm, and most preferably to 0.4 cm to 1.5 cm.

[0016] Preferably, a position of an upper end of the roll-up portion covering an anterior of a distal phalanx of the big toe is set to be below an upper surface of a base of the distal phalanx of the big toe.

[0017] In such a case, it is possible to prevent the rigidity of the toe from becoming excessive. Note that the roll-up portion covering the distal phalanx may have openings (through holes) or cutouts.

[0018] Preferably, the base plate portion continuously extends to posterior of metatarsal phalangeal joints (MP joints) of the big toe and the little toe.

[0019] In such a case, it is possible to reduce excessive extension of the MP joints, and it can be expected that the impulse increases due to restoration of the reinforcement plate having been bent at the MP joints.

[0020] More preferably, the reinforcement plate further integrally includes a connecting bar connecting together a medial side and a lateral side of the base plate portion, and a medial side end of the connecting bar is arranged posterior to a lateral side end thereof, and the connecting bar extends anterior as the connecting bar extends to-

ward a lateral side.

[0021] In such a case, the connecting bar extends in a direction crossing the array of MP joints of the foot. Therefore, it is possible to further reduce excessive extension of the MP joints.

[0022] Preferably, the base plate portion extends to posterior of a Lisfranc joint on the medial side and the lateral side of the foot.

[0023] In such a case, the extension of the foot at the MP joints is further reduced, and it can be expected that the jump height increases.

[0024] Preferably, the anti-slip member covers the roll-up portion from a lower end to an upper end thereof. In such a case, the resin roll-up portion will not come into contact with the floor surface, and it is therefore possible to reliably reduce the slip.

[0025] Note however that the anti-slip member does not need to cover the entire surface of the roll-up portion, but openings (through holes) may be provided in the anti-slip member so that the reinforcement plate is slightly visible from the front side.

[0026] Preferably, the base plate portion includes a lateral edge portion extending from the front portion in a posterior direction so as to cover a lateral edge of the mid sole, a lateral roll-up portion rolled up upwardly from the lateral edge portion, and a medial side portion spaced apart from a medial edge of the mid sole and extending from the front portion to posterior of a ball of the big toe along the medial edge so as to cover at least a portion of the big toe.

[0027] In such a case, the medial side portion of the base portion extending along the big toe assists the flexion of the MP joint of the big toe having been extended during a jump, thereby increasing the jump height.

[0028] On the other hand, the lateral edge portion and the lateral roll-up portion extending along the lateral edge of the midsole not only assist the flexion on the little toe side, but also reduce the shifting of the foot toward the lateral side during landing or receiving.

[0029] The present invention will be understood more clearly from the following description of preferred embodiments taken in conjunction with the accompanying documents. Note however that the embodiments and the drawings are merely illustrative and should not be taken to define the scope of the present invention. The scope of the present invention shall be defined only by the appended claims. In the accompanying drawings, like reference numerals denote like components throughout the plurality of figures.

DESCRIPTION OF EMBODIMENTS

[0030] Embodiments of the present invention will now be described with reference to the drawings.

[0031] FIG. 1 to FIG. 6 show Embodiment 1. Note that the figures do not show the upper of the shoe.

[0032] The present embodiment is, for example, a shoe for volleyball.

[0033] The sole shown in FIG. 1 includes an outsole 1, a midsole 2 and a reinforcement plate 3 integrally layered together via bonding or welding.

[0034] The outsole 1 shown in FIG. 6 is formed by a foamed material or a non-foamed material of a rubber, and has a greater frictional force on the floor surface than the midsole 2 and the reinforcement plate 3. The outsole 1 includes a tread surface 1s to be in contact with the floor surface, and a roll-up portion at the front end forming an anti-slip member 1b to be described later.

[0035] The midsole 2 is arranged upward Z of the outsole 1, and covers the entire area of the sole of the foot. The midsole 2 is formed mainly by a foamed material having a thermoplastic resin component such as EVA, for example, and absorbs the impact of landing. Note that as shown in FIG. 1, a portion of the midsole 2 may have a rubber-like elastic shock absorber 29, etc.

[0036] An insole (inner sole) (not shown) is bonded on the midsole 2. A sock liner is further attached on the insole in an upper (not shown). Note that an upper is for covering and wrapping the instep of the foot.

[0037] In FIG. 3 and FIG. 6, the reinforcement plate 3 is formed by a non-foamed material containing a thermoplastic resin component, and has a Young's modulus greater than the Young's modulus of the outsole 1. and the Young's modulus of the midsole 2.

[0038] Note that the preferred Young's modulus value of the reinforcement plate 3 is 20 to 500 Mpa, more preferably 40 to 200 Mpa.

[0039] The reinforcement plate 3 is arranged between the outsole 1 and the midsole 2. In the present embodiment, the reinforcement plate 3 is sandwiched between an upper surface 1a of the outsole 1 and a lower surface 2b of the midsole 2. Note that where the midsole 2 includes two, upper and lower, layers layered together, the reinforcement plate 3 may be arranged between the upper and lower layers of the midsole 2. Therefore, there is no particular limitation as long as the reinforcement plate 3 is arranged between the outsole 1 and the midsole 2.

[0040] In FIG. 5, B1 denotes the big toe, B2 the second toe, and B5 the little toe. B11, B21 and B51 denote their respective distal phalanges, B13, B23 and B53 their respective proximal phalanges, and B14, B24 and B54 their respective metatarsal bones.

[0041] The reinforcement plate 3 includes a base portion 3a, a front roll-up portion 3b, a connecting bar 3c, a lateral edge portion 30, a medial side portion 31 and a shank portion 32, which are provided as a loop-shaped integral part. The reinforcement plate 3 does not cover the toes including the big toe B1 and the little toe B5 from directly above.

[0042] The base portion 3a extends from posterior B of the heads of the proximal phalanges B13 and B53 of the big toe B1 and the little toe B5 to anterior F of the tip of the foot. A front portion 3f of the reinforcement plate 3 is curved, and continuously extends from the medial side Me toward the lateral side La.

[0043] Note that a head refers to a portion of each bone that is close to the anterior joint and that is slightly expanding to a greater thickness and it is referred to also as a distal head. On the other hand, a base refers to a portion of each bone that is close to the posterior joint and that is slightly expanding to a greater thickness and it is referred to also as a proximal head.

[0044] As shown in FIG. 6, the front roll-up portion 3b is integrally continuous with the front portion 3f of the base portion 3a, and extends to anterior F of the front end of the midsole 2 while projecting, from the front portion 3f, upward Z of an upper surface 2a of a front end portion 2e of the midsole 2. Moreover, the front roll-up portion 3b is rolled up upward Z, and covers the anterior F of the big toe B1 as shown in FIG. 1. That is, the front roll-up portion 3b extends along the midsole 2 toward an upper-forward diagonal direction past the front end of the midsole 2, and projects from the upper surface 2a at the front end of the midsole 2 in a crescent shape or a half-moon shape.

[0045] Note that a portion of the front roll-up portion 3b that is projecting upward Z from the midsole 2 is dotted.

[0046] In the present embodiment, the front roll-up portion 3b is covered, from the lower end to the upper end of the front roll-up portion 3b, with the anti-slip member 1b of the outsole 1, as shown in FIG. 1 and FIG. 6. Note that the front roll-up portion 3b and the anti-slip member 1b cover the toe portion of the upper (not shown).

[0047] However, there is no particular limitation in the present invention as long as at least a portion of a front surface 3s of the front roll-up portion 3b of FIG. 2 is covered by the anti-slip member 1b of FIG. 1 having a greater frictional force on the floor surface than the reinforcement plate 3. For example, the anti-slip member 1b may be separate from the outsole 1. Small through holes or cut-outs may be provided in the anti-slip member 1b so that the front roll-up portion 3b is partly visible from the front side.

[0048] Preferably, in the front end portion 2e of the midsole 2, the front roll-up portion 3b is projecting upwardly by 0.3 cm to 3.0 cm with respect to the upper surface 2a of the midsole 2 as shown in FIG. 6. More preferably, the amount of projection ΔH is 0.4 cm to 2.0 cm.

[0049] Preferably, the position of the upper end of the front roll-up portion 3b covering the distal phalanx B11 of the big toe B1 is set to be below an upper surface F11 of the base of the distal phalanx B11 of the big toe B1.

[0050] As shown in FIG. 5, in the present embodiment, the base portion 3a continuously extends to posterior B of the metatarsal phalangeal joints MP of the big toe B1 and the little toe B5. Moreover, the base portion 3a extends to posterior B of the Lisfranc joint R on the medial side Me and the lateral side La of the foot.

[0051] The base portion 3a includes the lateral edge portion 30, a lateral roll-up portion 30b, the medial side portion 31 and the shank portion 32 as an integral part.

[0052] The lateral edge portion 30 of FIG. 2 extends toward the posterior B direction from the front portion 3f

so as to cover a lateral edge 21 of the midsole 2. The lateral roll-up portion 30b is rolled up upward Z from the lateral edge portion 30. The medial side portion 31 is spaced apart from a medial edge 2m of the midsole 2, and extends from the front portion 3f along the medial edge 2m to posterior B of the ball BO of the big toe of FIG. 5, covering at least a portion of the big toe B1.

[0053] Thus, the base portion 3a of the reinforcement plate 3 is formed in a continuous loop shape extending from the front portion 3f and the front roll-up portion 3b to the shank portion 32 via the lateral edge portion 30 and the medial side portion 31. Note that the shank portion 32 reinforces the arch, as is well known in the art.

[0054] The reinforcement plate 3 further integrally includes the connecting bar 3c connecting together the medial side Me and the lateral side La of the base portion 3a. A medial end 3m of the connecting bar 3c is arranged posterior B to a lateral end 31 thereof. Thus, the connecting bar 3c extends anterior F as it extends toward the lateral side La.

[0055] The connecting bar 3c defines two through holes H1 and H2 in the loop-shaped reinforcement plate 3.

[0056] The connecting bar 3c will reduce excessive extension of the MP joints MP from the second toe B2 to the little toe B5.

[0057] Next, the mechanism of a jump when spiking in volleyball, etc., will be described.

[0058] For a right-footed player, for example, starting with both feet on the ground, both knees are bent, and then the MP joints are extended while extending the knees, thereby first lifting the right foot in the air, and then lifting the left foot in the air.

[0059] FIG. 7A shows the results of a test on the relationship between the floor reaction force Fz and the jump efficiency ΣFz , and FIG. 7B shows the results of a test on the relationship between the jump efficiency ΣFz and the jump height.

[0060] The jump efficiency ΣFz which is dotted in FIG. 7A, i.e., the impulse ΣFz from when the floor reaction force Fz peaks until the foot comes completely off the floor, is speculated to have a strong correlation with the jump height as shown in FIG. 7B.

[0061] Now, at the moment a foot comes off the ground, the MP joint remains extended while the toes anterior thereto kicks the floor surface. If it is made easier to exert power at the toes and kick the floor surface immediately before the take-off, the impulse ΣFz will be the primary area $\alpha 1$ (dotted) plus the additional area $\alpha 2$ (hatched). This will increase the jump height.

[0062] Moreover, if the extended MP joint is flexed immediately before the take-off, it will further increase the additional area $\alpha 2$, thereby further increasing the jump height.

[0063] FIG. 8 shows Embodiment 2.

[0064] In this example, the upper portion of the front roll-up portion 3b is exposed from the anti-slip member 1b, which is a roll-up portion of the outsole 1. In this ex-

ample, the exposed front roll-up portion 3b is large, and it will further increase the jump height when spiking.

[0065] Note that a test conducted for the increase of the jump height by using Embodiment 2 showed an increase of the jump height of about 2.5 cm.

[0066] FIGS. 9A to 9C show still other examples.

[0067] In the example of FIG. 9A, the connecting bar 3c is absent.

[0068] In the example of FIG. 9B, the front portion 3f of the reinforcement plate 3 is formed in a half-moon shape.

[0069] In the example of FIG. 9C, no opening is provided in the reinforcement plate 3 from the front portion 3f to the shank portion 32.

[0070] While preferred embodiments have been described above with reference to the drawings, various obvious changes and modifications will readily occur to those skilled in the art upon reading the present specification.

[0071] For example, the reinforcement plate 3 of FIG. 5 may be provided extending from the front roll-up portion 3b to posterior B of the heads of the proximal phalanges B13 and B53 of the big toe B1 and the little toe B5, and may be absent posterior B to the heads.

[0072] Alternatively, the reinforcement plate 3 may be provided in a U-letter shape extending from the front roll-up portion 3b to posterior B of the heads of the metatarsal bone B14 and B54 of the big toe B1 and the little toe B5, and may be absent posterior B to the heads.

[0073] In such cases, it is preferably provided with the lateral edge portion 30 and the medial side portion 31 extending toward the anterior F direction from the shank portion 32, with the front end portions of the lateral edge portion 30 and the medial side portion 31 overlapping the rear end portion of the base portion 3a of the reinforcement plate 3 over a portion of the foot in the long axis direction.

[0074] The reinforcement plate 3 may be provided as an integral part of the midsole 2 in the post molding (secondary molding process) of the midsole 2.

[0075] The subject structure may be provided only for the left foot or the right foot, but it may be provided for both of the left foot and the right foot.

[0076] Thus, such changes and modifications are deemed to fall within the scope of the present invention.

INDUSTRIAL APPLICABILITY

[0077] The present invention is applicable to shoes for indoor sports such as volleyball.

REFERENCE SIGNS LIST

[0078]

- 1: Outsole 1a: Upper surface 1b: Anti-slip member
- 1s: Tread surface
- 2: Midsole 2a: Upper surface 2b: Lower surface 2e:

Front end portion 21: Lateral edge 2m: Medial edge 3: Reinforcement plate 30: Lateral edge portion 30b: Lateral roll-up portion 31: Medial side portion 32: Shank portion 3a: Base portion 3b: (Front) roll-up portion 3c: connecting bar 3e: Upper end 3f: Front portion 3s: Front surface 31: Lateral end 3m: Medial end

B1: Big toe B11: Distal phalanx B13: Proximal phalanx B 14: Metatarsal bone

B2: Second toe B21: Distal phalanx B23: Proximal phalanx B24: Metatarsal bone

B5: Little toe B51: Distal phalanx B53: Proximal phalanx B54: Metatarsal bone

BO: Ball of big toe

MP: Metatarsal phalangeal joint R: Lisfranc joint

Me: Medial side La: Lateral side

F: Anterior B: Posterior Z: Upward

ΔH : Amount of projection

Claims

1. A shoe for indoor sports comprising:

an outer sole 1 having a tread surface;
a mid sole 2 arranged over the outer sole 1; and
a resin reinforcement plate 3 which has a Young's modulus greater than a Young's modulus of the outer sole 1 and than a Young's modulus of the mid sole 2 and which is arranged between the outer sole 1 and the mid sole 2,
characterized in that:

the reinforcement plate 3 includes a base plate portion 3a and a roll-up portion 3b formed integrally continuous together, with the base plate portion 3a extending from posterior B of heads of proximal phalanges B53 of a big toe B1 and a little toe B5 to anterior F of a tip of a foot, and extending continuously from a medial side Me toward a lateral side La in a front portion 3f of the reinforcement plate 3, and with the roll-up portion 3b being rolled up from the front portion 3f of the base plate portion 3a upwardly Z above an upper surface 2a of a front end portion 2e of the mid sole 2 so as to cover an anterior F of the big toe B1, and the reinforcement plate 3 does not cover toes including the big toe B1 and the little toe B5 from directly above; and
at least a portion of a front surface 3s of the roll-up portion 3b is covered by an anti-slip member 1b having a greater frictional force against a floor surface than the reinforcement plate 3.

2. A shoe according to claim 1, wherein at a front end

portion 2e of the mid sole 2, the roll-up portion 3b projects upwardly by 0.3 cm to 3.0 cm with respect to the upper surface 2a of the mid sole 2.

3. A shoe according to claim 1, wherein a position of an upper end of the roll-up portion 3b covering an anterior F of a distal phalanx B11 of the big toe B1 is set to be below an upper surface of a base of the distal phalanx B11 of the big toe B1.

4. A shoe according to claim 1, 2 or 3, wherein the base plate portion 3a continuously extends to posterior B of metatarsal phalangeal joints MP of the big toe B1 and the little toe B5.

5. A shoe according to claim 4, wherein the reinforcement plate 3 further integrally includes a connecting bar 3c connecting together a medial side Me and a lateral side La of the base plate portion 3a, and a medial side end 3m of the connecting bar 3c is arranged posterior B to a lateral side end 31 thereof, and the connecting bar 3c extends anterior F as the connecting bar 3c extends toward a lateral side La.

6. A shoe according to any one of claims 1 to 5, wherein the base plate portion 3a extends to posterior B of a Lisfranc joint R on the medial side Me and the lateral side La of the foot.

7. A shoe according to any one of claims 1 to 6, wherein the anti-slip member 1b covers the roll-up portion 3b from a lower end to an upper end thereof.

8. A shoe according to any one of claims 1 to 7, wherein the base plate portion 3a includes a lateral edge portion 30 extending from the front portion 3f in a posterior B direction so as to cover a lateral edge 21 of the mid sole 2, a lateral roll-up portion 30b rolled up upwardly Z from the lateral edge portion 30, and a medial side portion 31 spaced apart from a medial edge 2m of the mid sole 2 and extending from the front portion 3f to posterior B of a ball BO of the big toe along the medial edge 2m so as to cover at least a portion of the big toe B1.

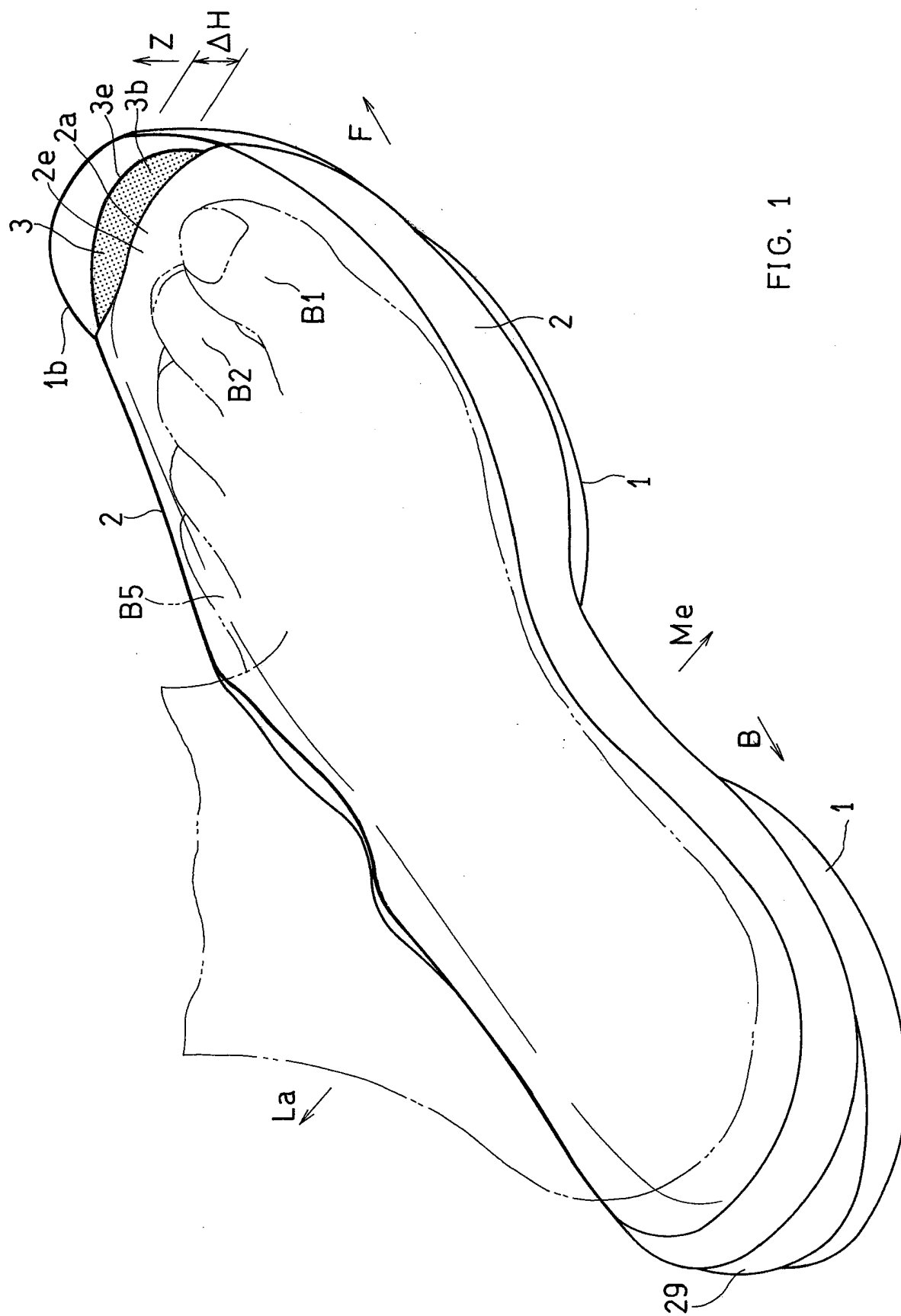


FIG. 1

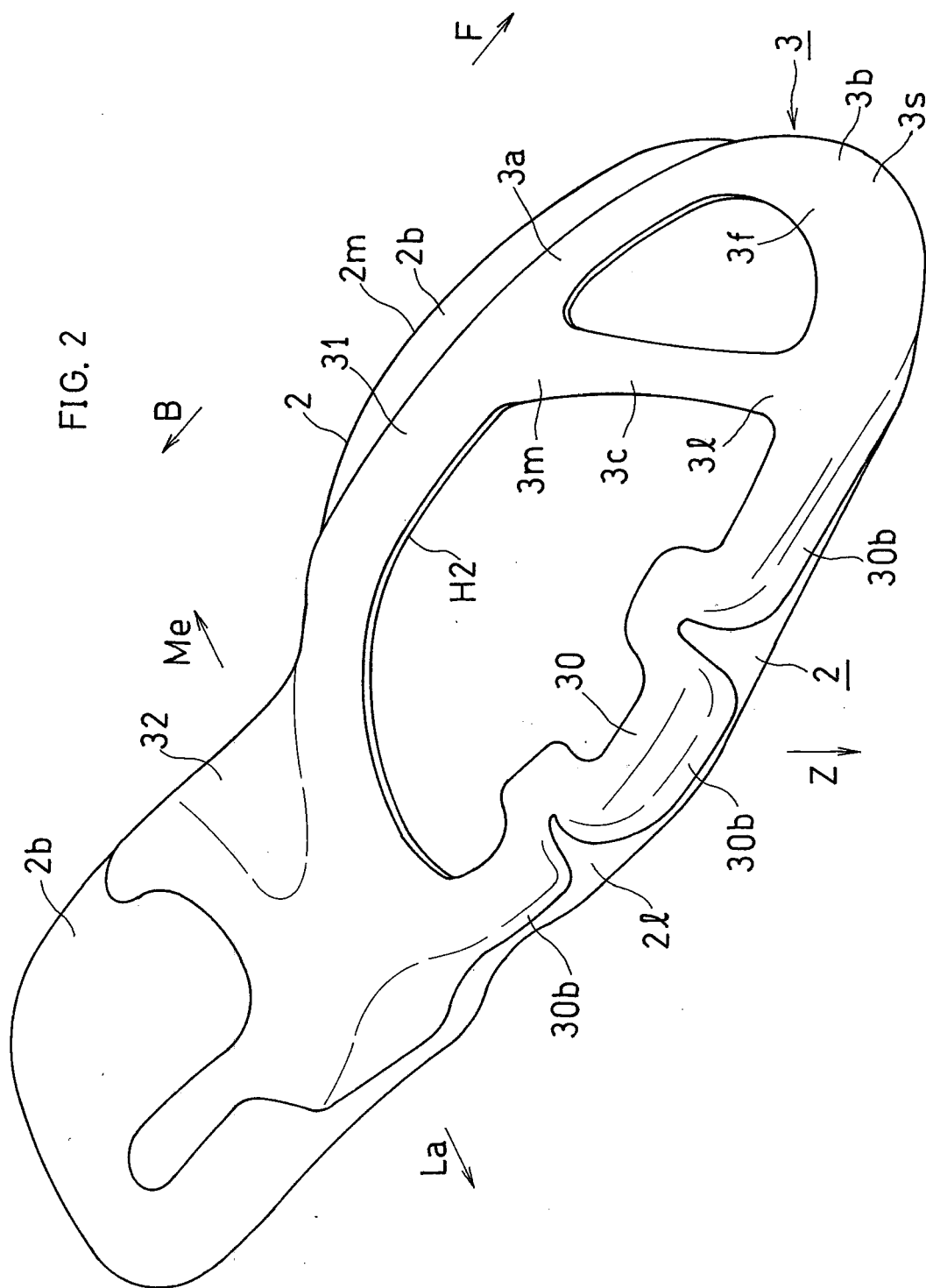
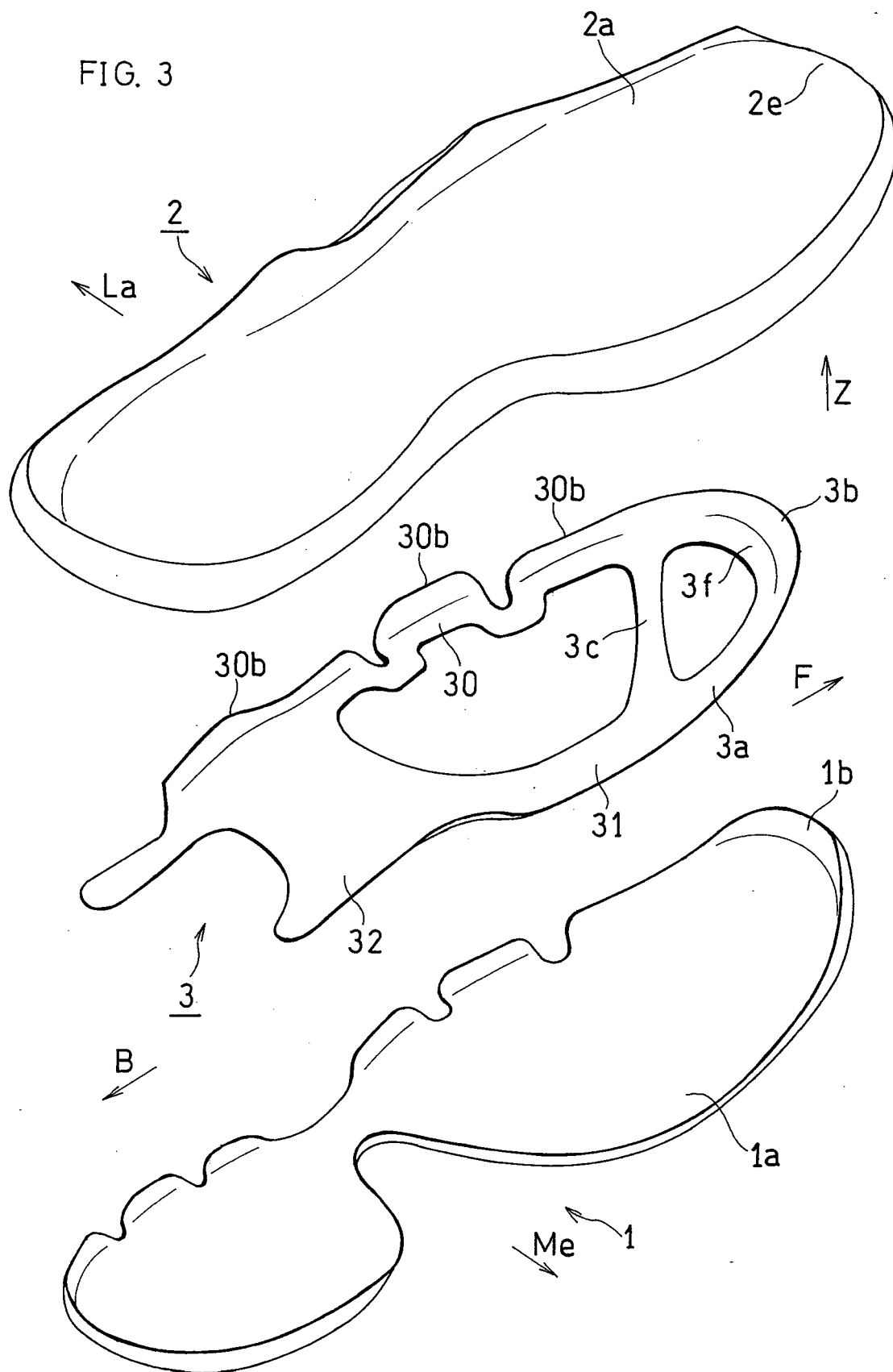


FIG. 3



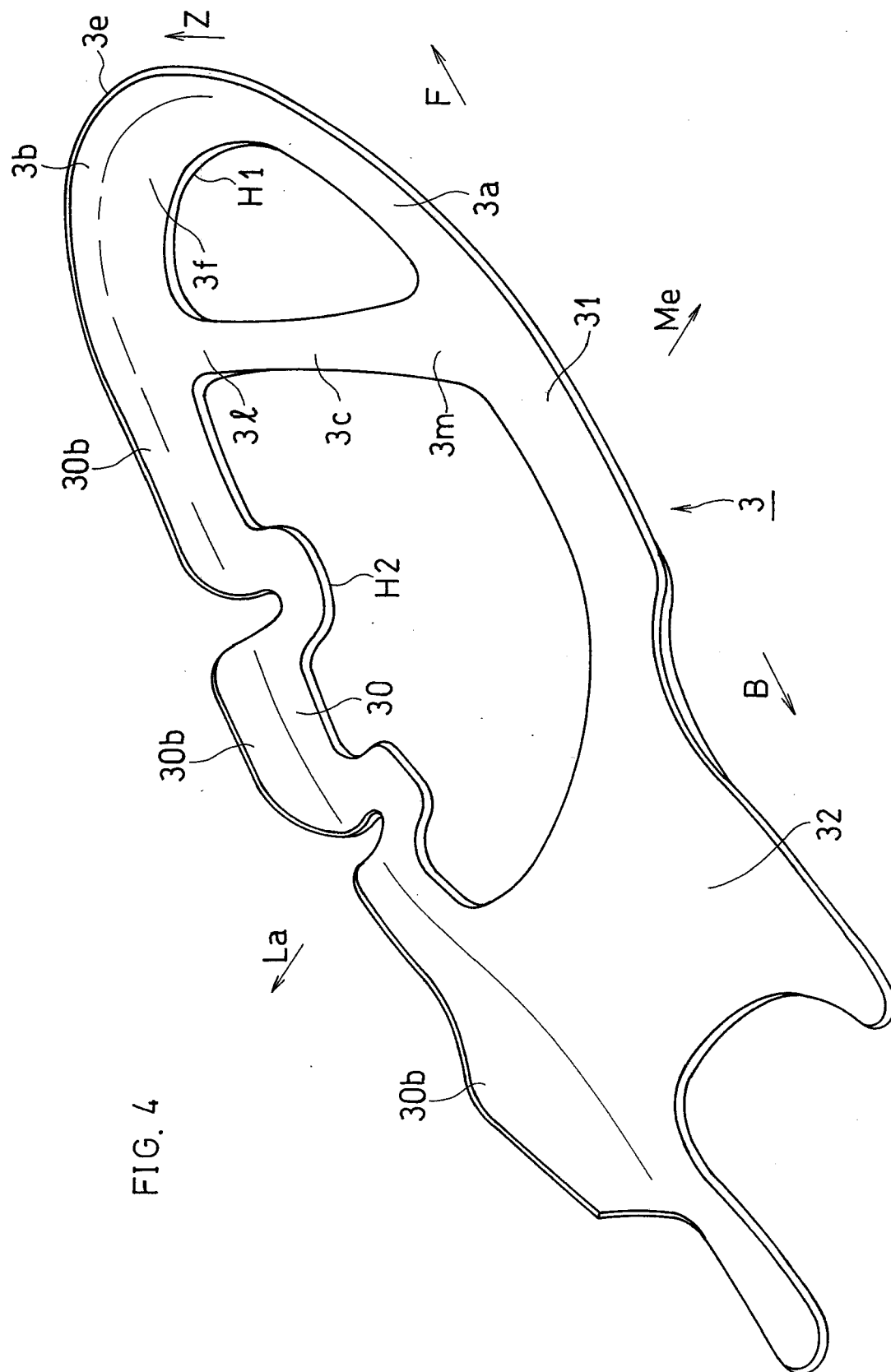


FIG. 4

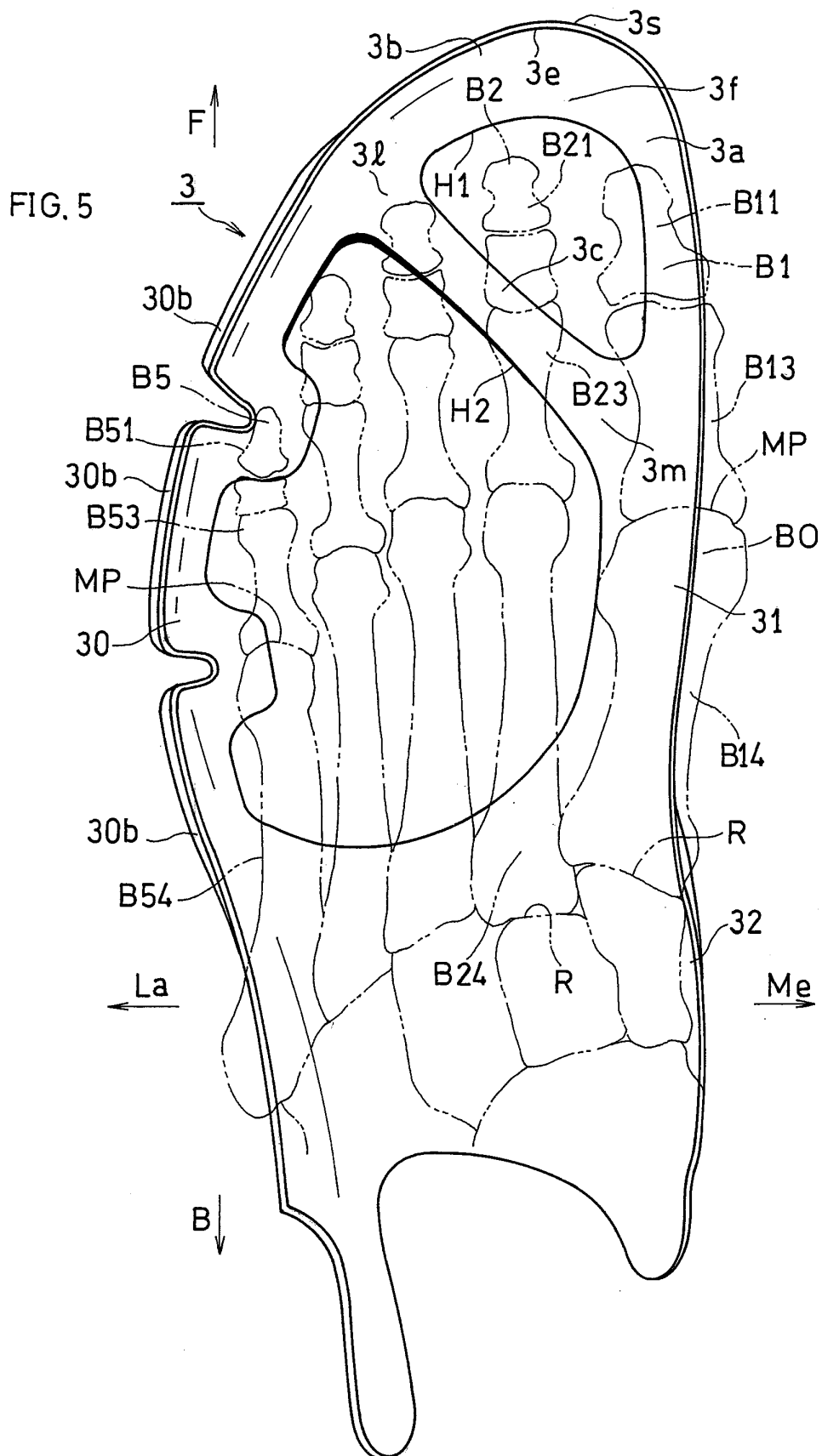


FIG. 6

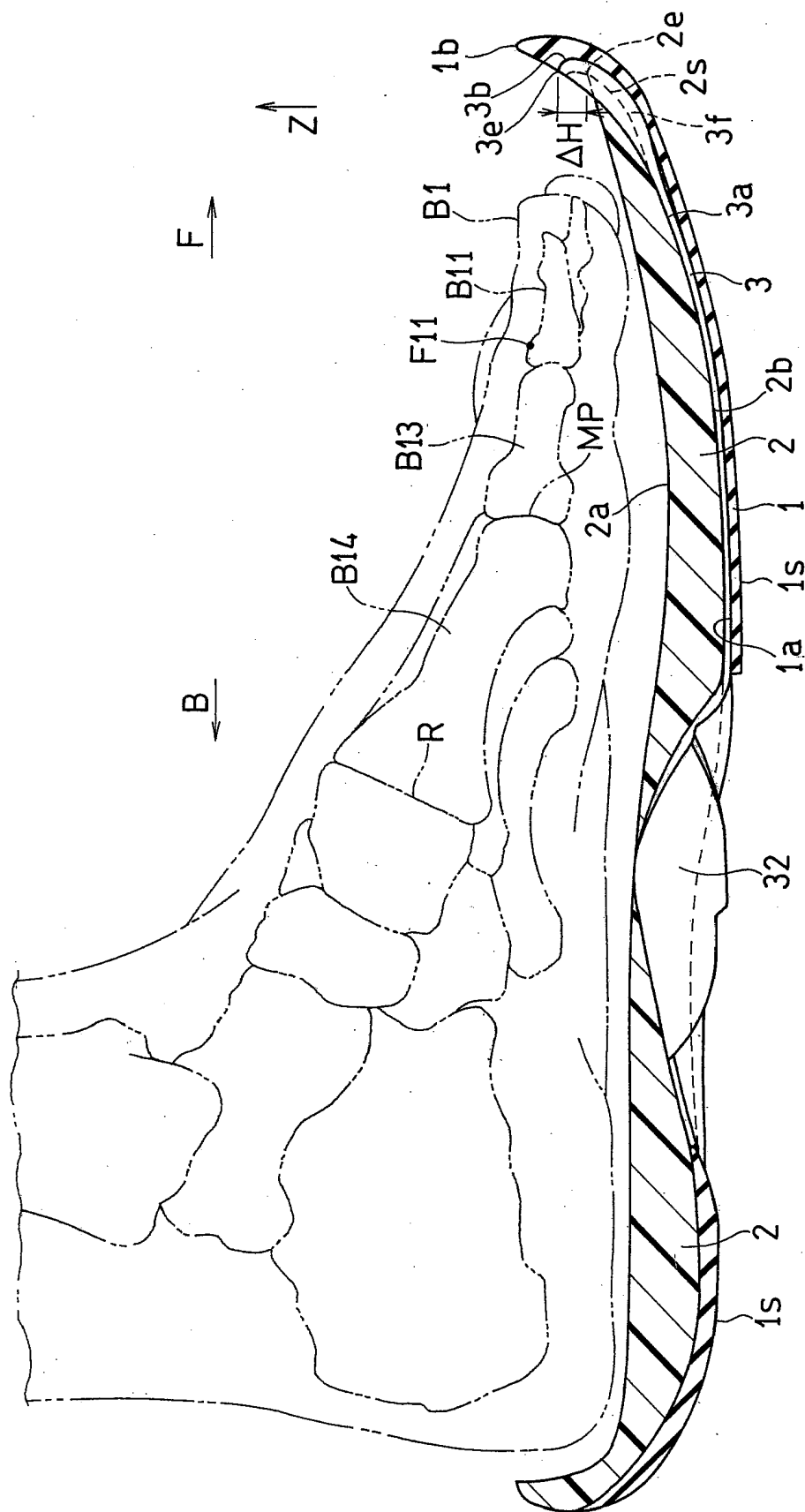


FIG. 7A

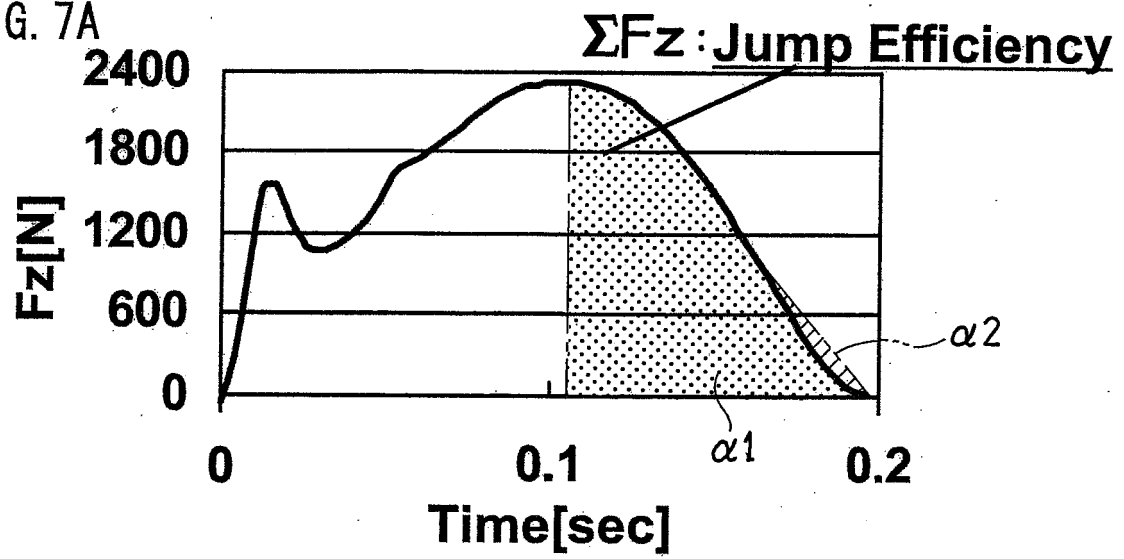
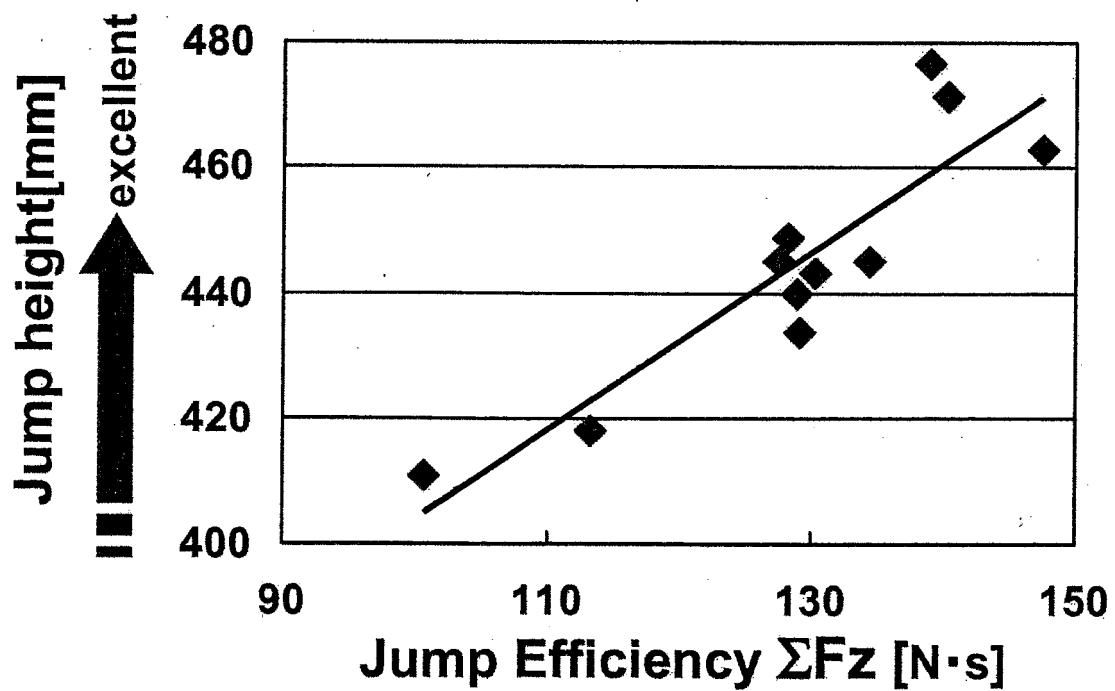


FIG. 7B



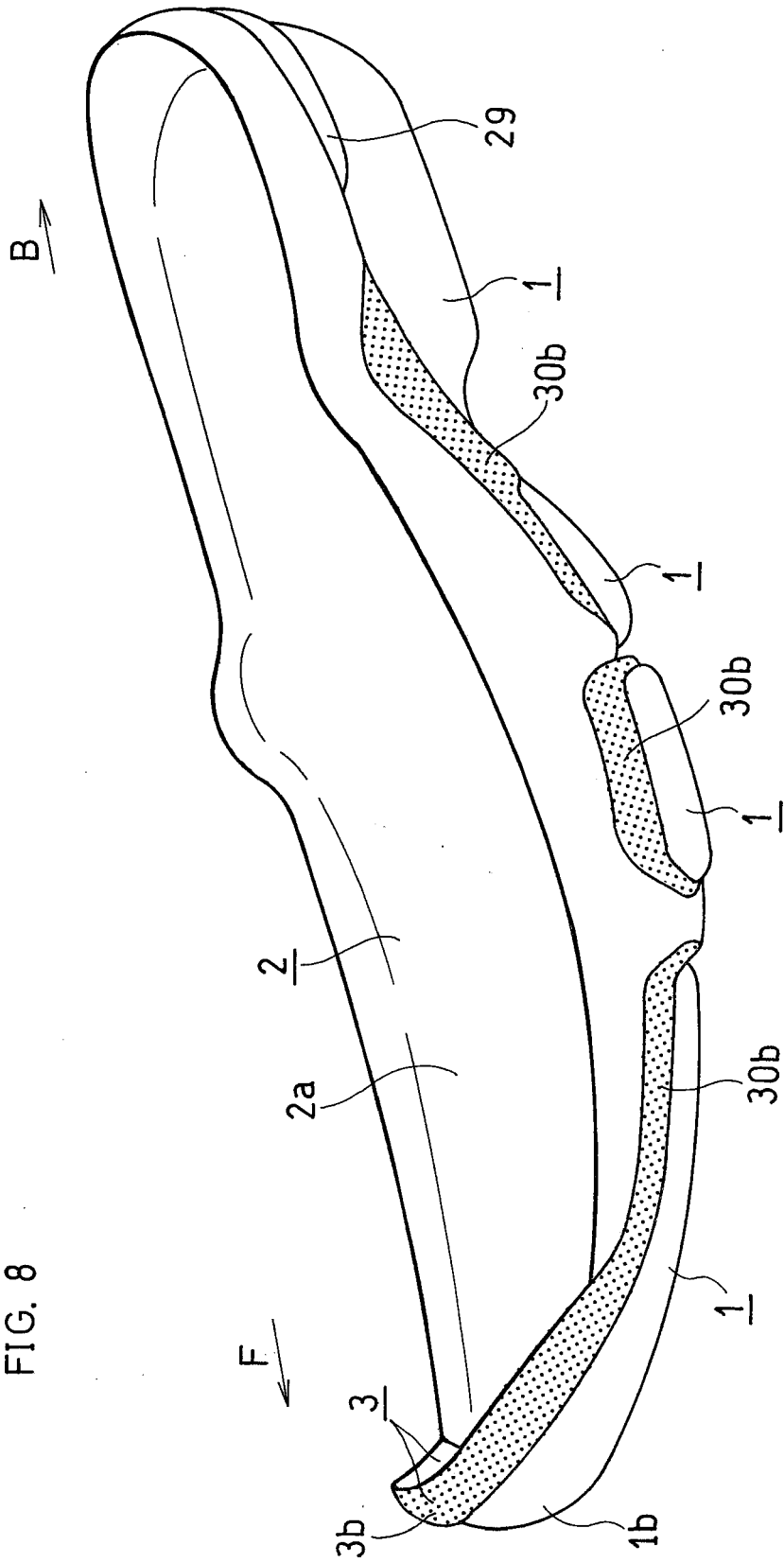


FIG. 9A

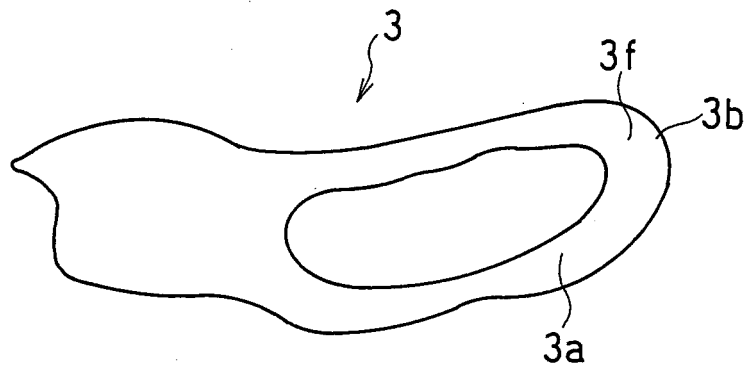


FIG. 9B

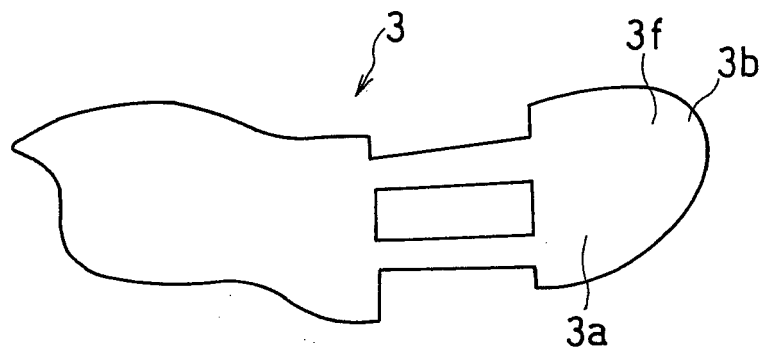
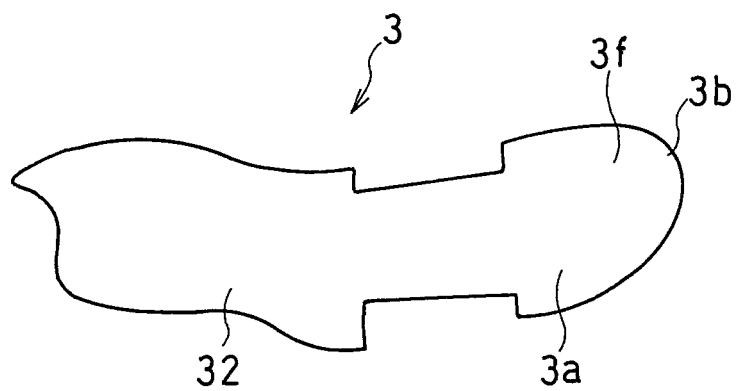


FIG. 9C



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/058730

A. CLASSIFICATION OF SUBJECT MATTER

A43B13/41 (2006.01) i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A43B13/41, A43B5/00, A43B13/12

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2013

Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 197592/1982 (Laid-open No. 103605/1984) (Mizuno Inc.), 12 July 1984 (12.07.1984), entire text; all drawings & US 4561195 A & DE 3329742 A & DE 3329742 A1	1-8
A	US 2002/0152642 A1 (Young CHU), 24 October 2002 (24.10.2002), entire text; all drawings & EP 1381292 A & WO 2002/085146 A1 & DE 60224264 D & DE 60224264 T	1-8

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

* Special categories of cited documents:

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

02 May, 2013 (02.05.13)

Date of mailing of the international search report

14 May, 2013 (14.05.13)

Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 4412393 B [0005]
- US 4453996 B [0005]
- US 20100005684 A1 [0005]
- US 20100307027 A1 [0005]
- JP 57186509 A [0005]
- JP 2002360305 A [0005]