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(54) **OUTSOLE STRUCTURE FOR SHOES AND CLEATED SHOE USING SAME**

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(57) **ABSTRACT**

A shoe outsole structure includes: a first outsole component made of a deformable soft resin material and configured to entirely support a plantar surface spreading from a forefoot to a hindfoot; and a second outsole component integrally formed on top of the first outsole component, made of a hard resin material which has a higher rigidity than the first outsole component, and configured to support a region, of the plantar surface, which is continuous from a rear portion, of the forefoot, located rearward of metatarsophalangeal joints to the hindfoot.

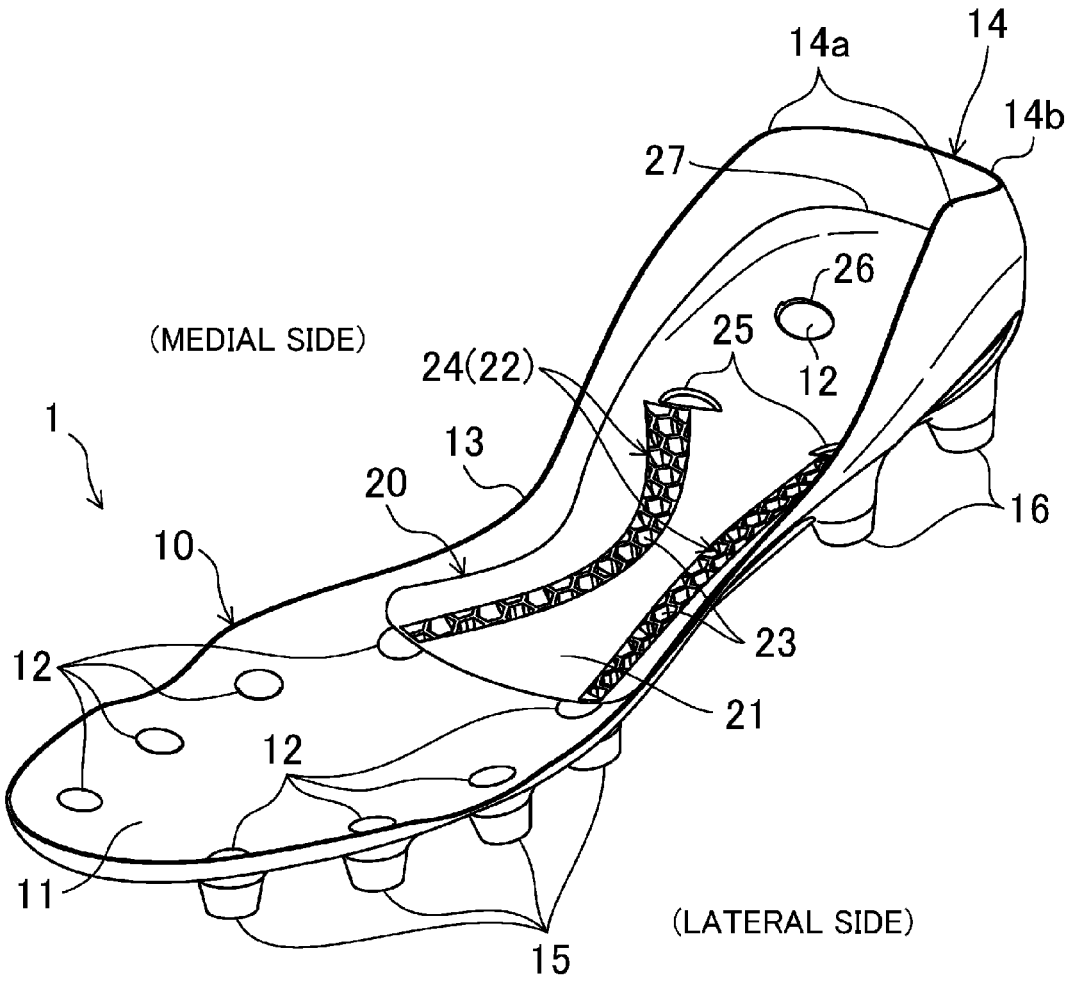
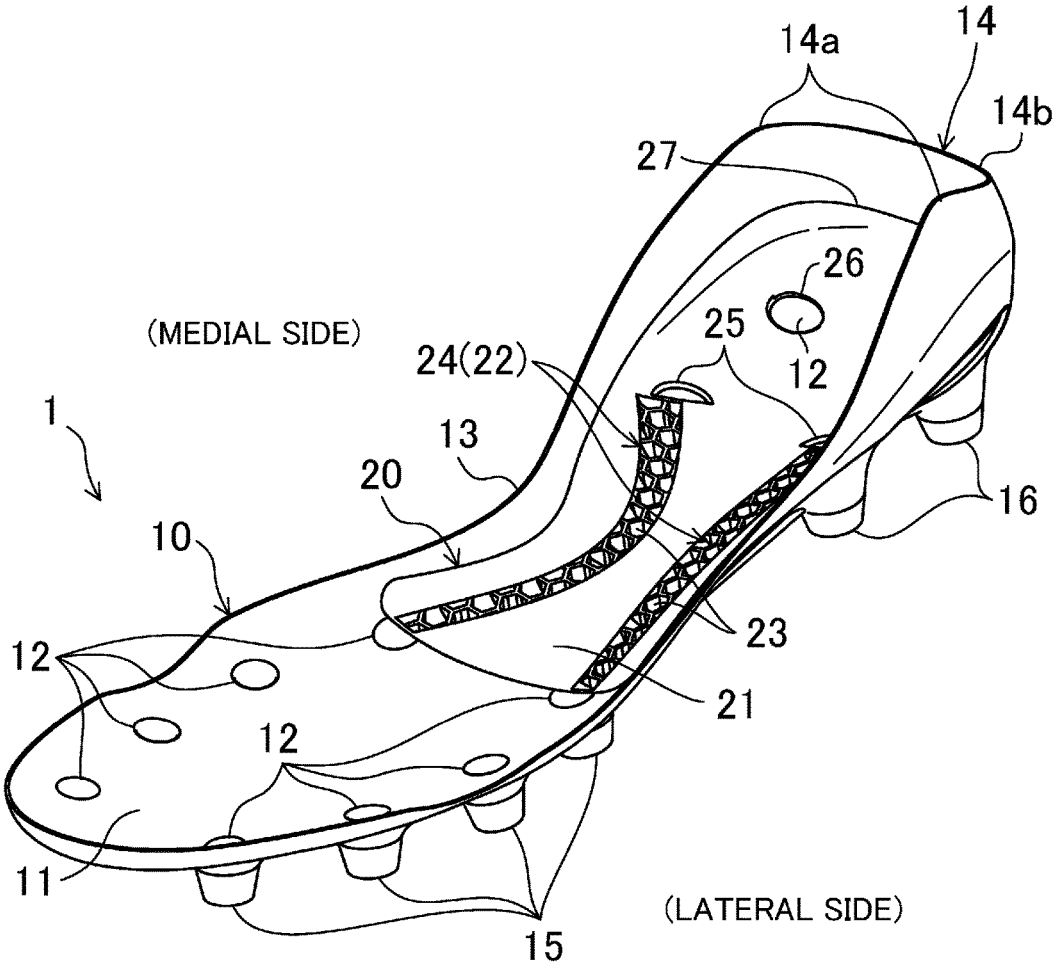


FIG. 1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14
14b
27
26
25
12
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24(22)
1
13
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16
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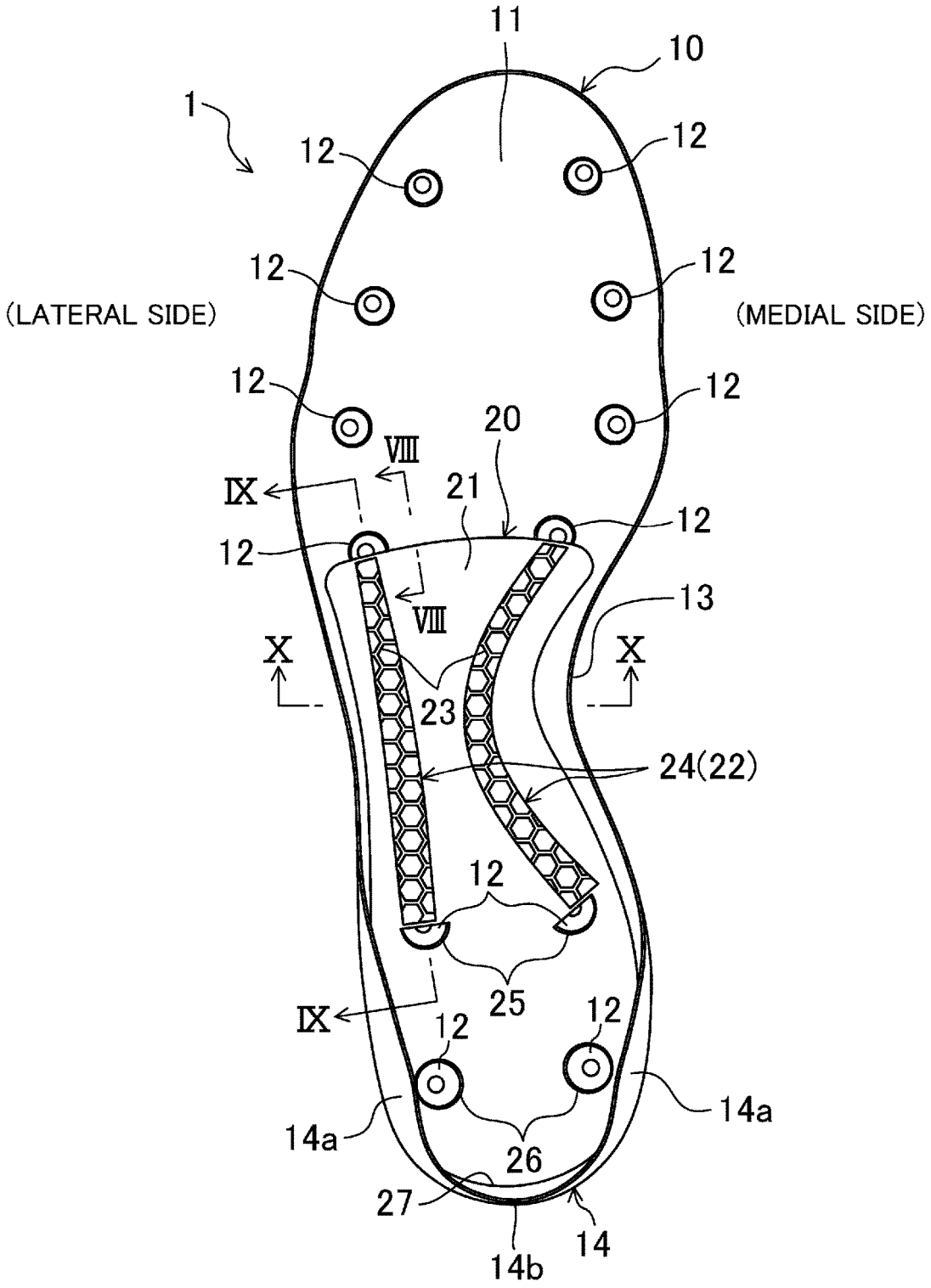
23
12
21
12
11
(LATERAL SIDE)
15

FIG. 2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(LATERAL SIDE)
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VIII
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VIII
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24(22)
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IX
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14a
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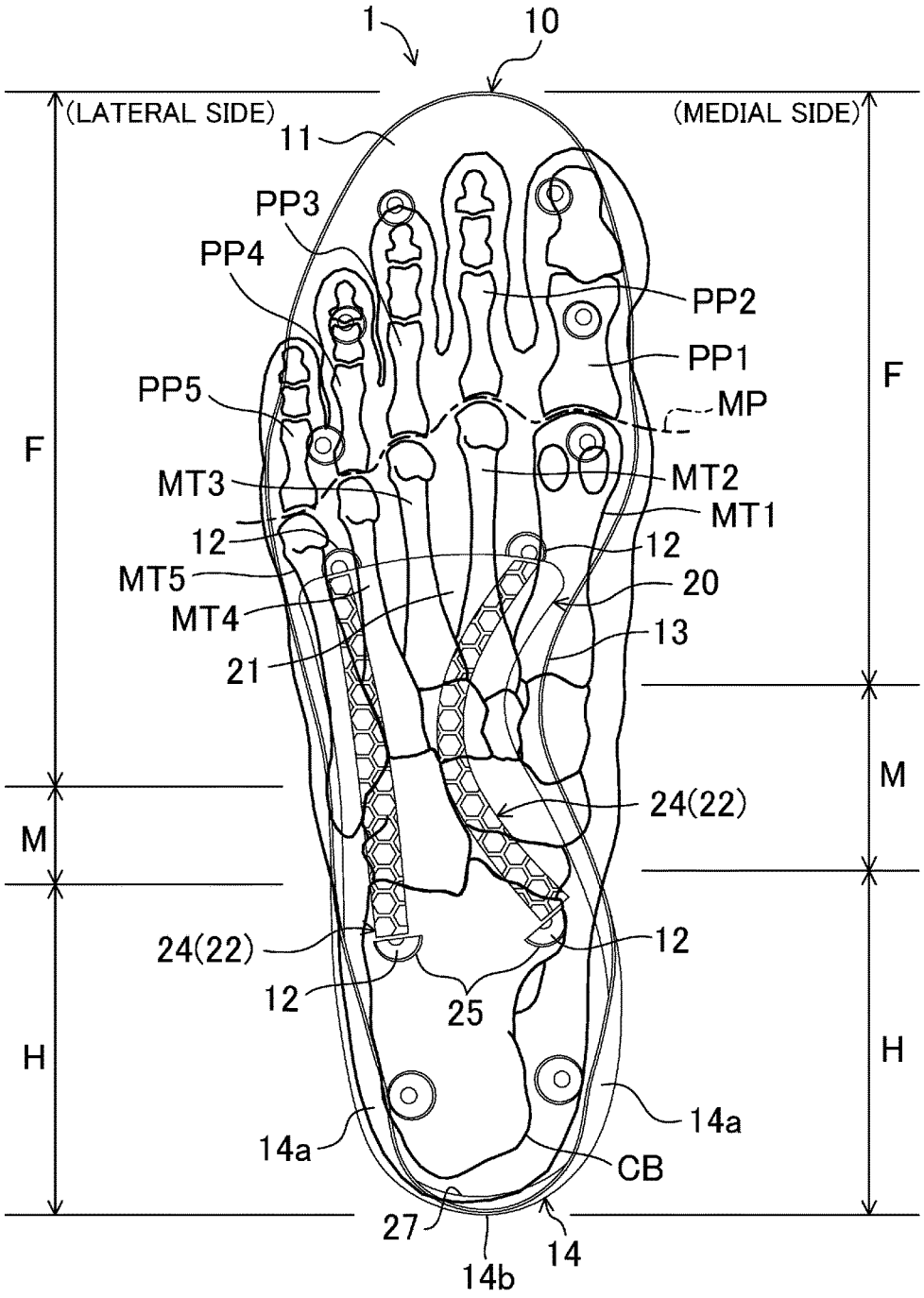
FIG. 3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10
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(MEDIAL SIDE)
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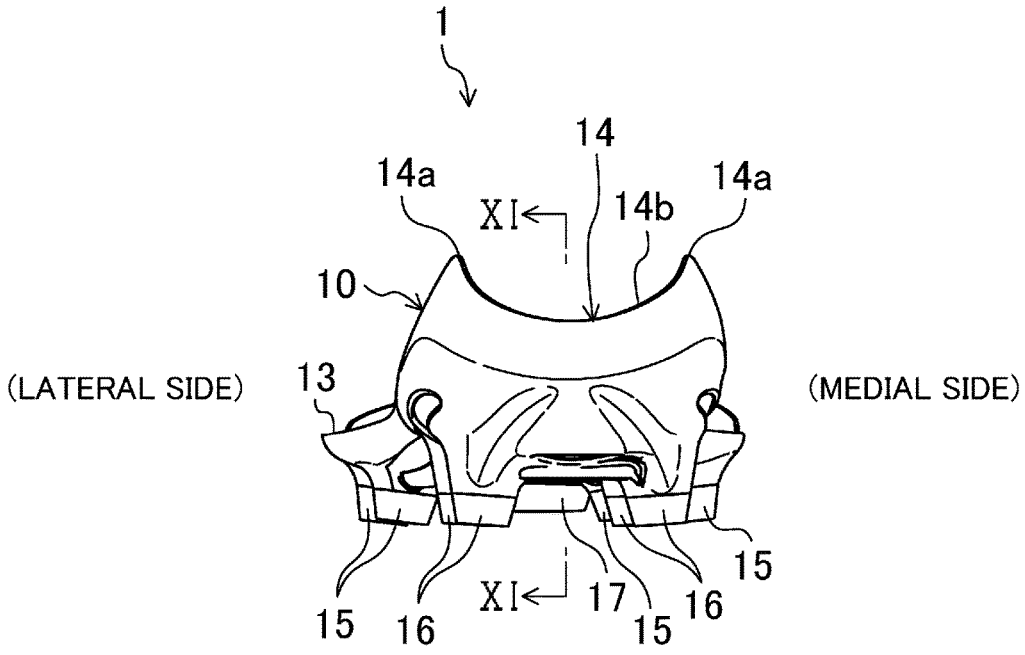
PP3
PP4
PP2
PP1
PP5
MP
F
F
MT3
MT2
MT1
12
12
MT5
20
MT4
13
21
M
M
24(22)
24(22)
12
12
25
H
H
14a
14a
CB
27
14b
14

FIG. 4


1
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14a
14a
XI
14b
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13
(MEDIAL SIDE)
15
XI
17
16
15
15
16

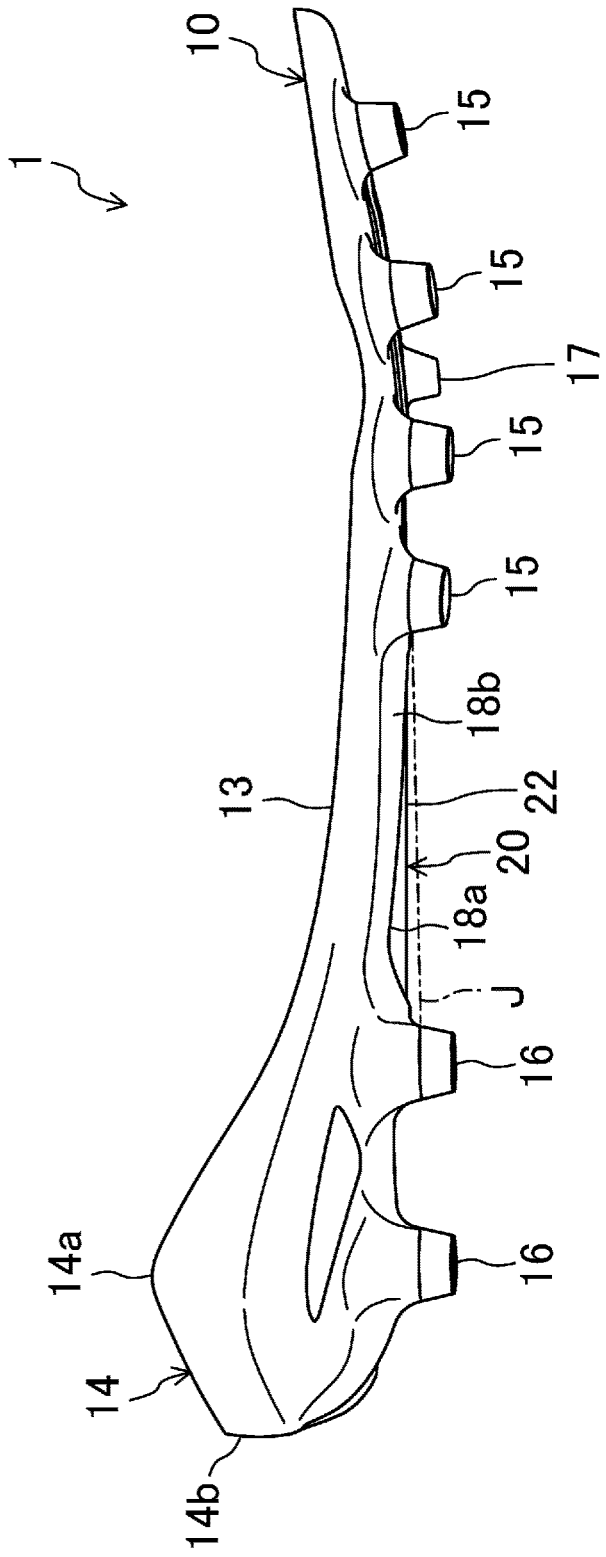
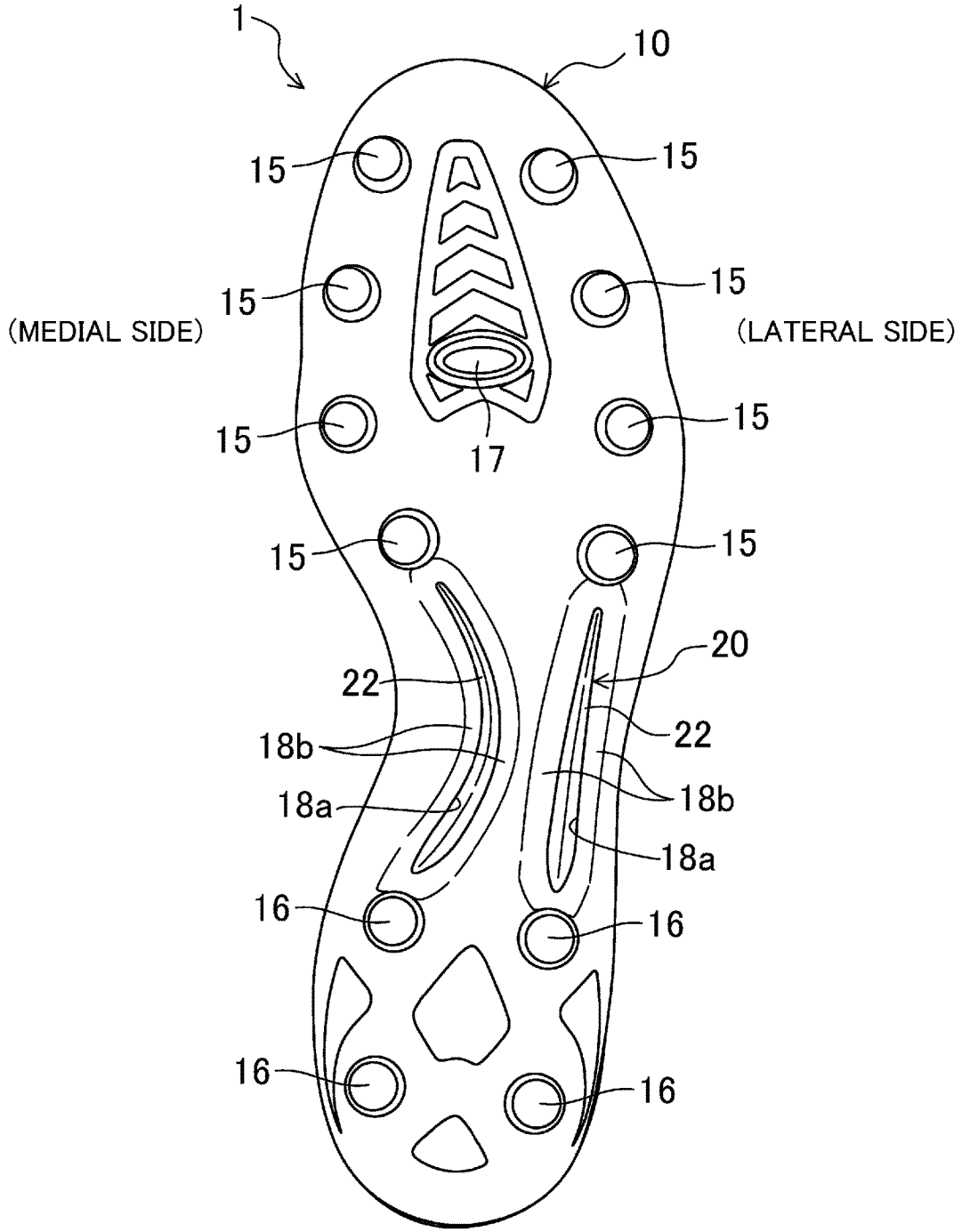


FIG. 5

FIG. 6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(MEDIAL SIDE)
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18a
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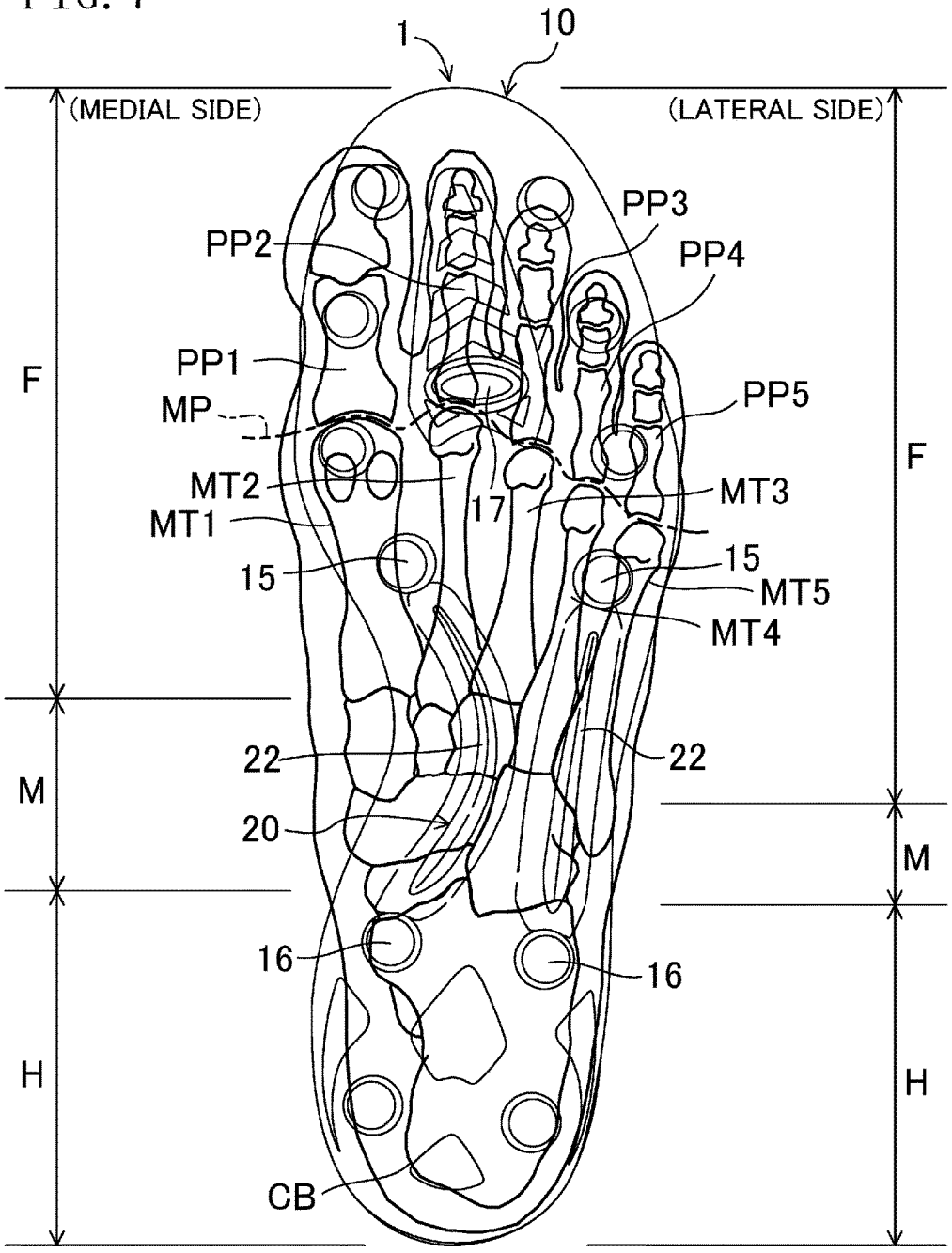
16
16

FIG. 7


1
10
(MEDIAL SIDE)
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PP4
PP1
PP5
MP
MT2
MT3
MT1
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MT5
MT4
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16
16
CB
F
M
H
F
M
H

FIG. 8

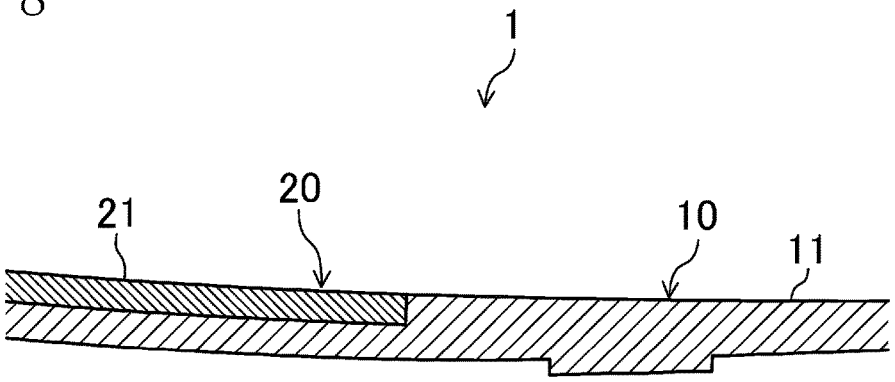


FIG. 9

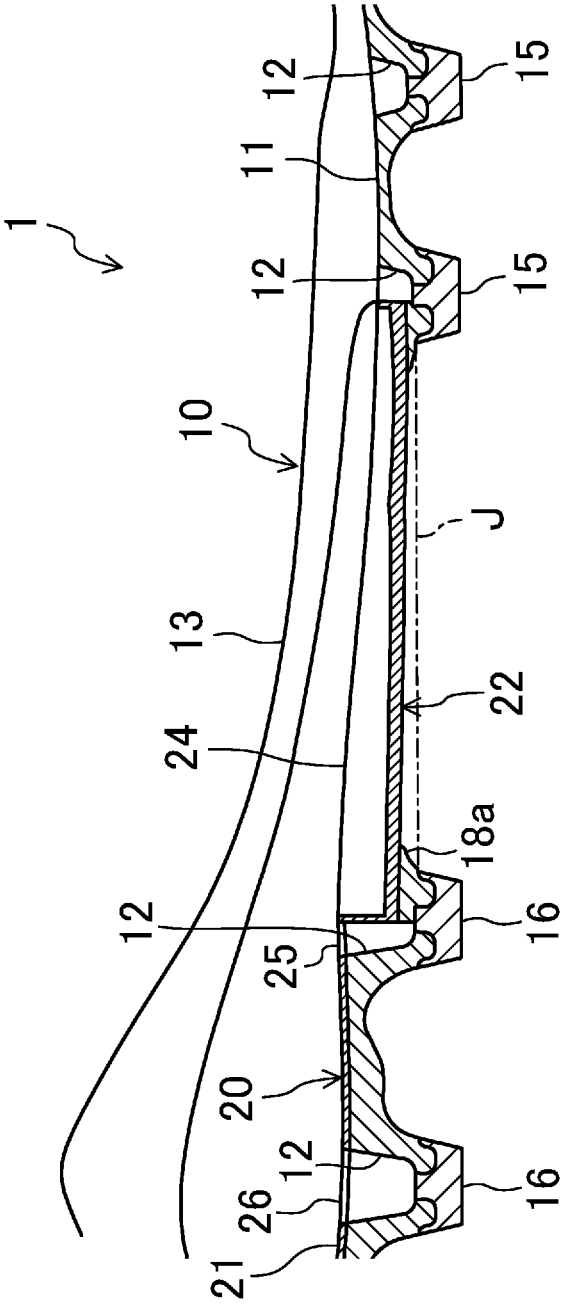
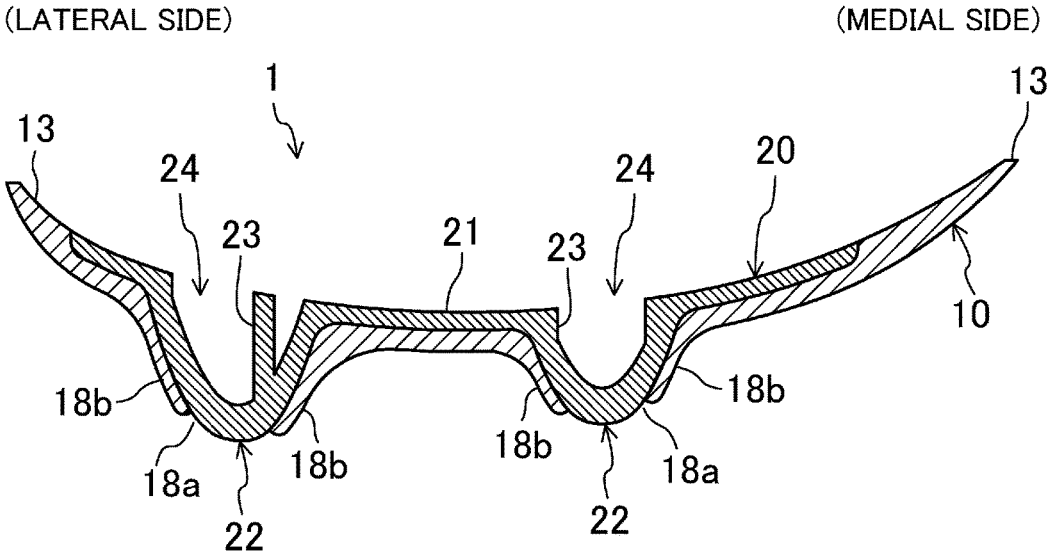


FIG. 10


(LATERAL SIDE)
(MEDIAL SIDE)
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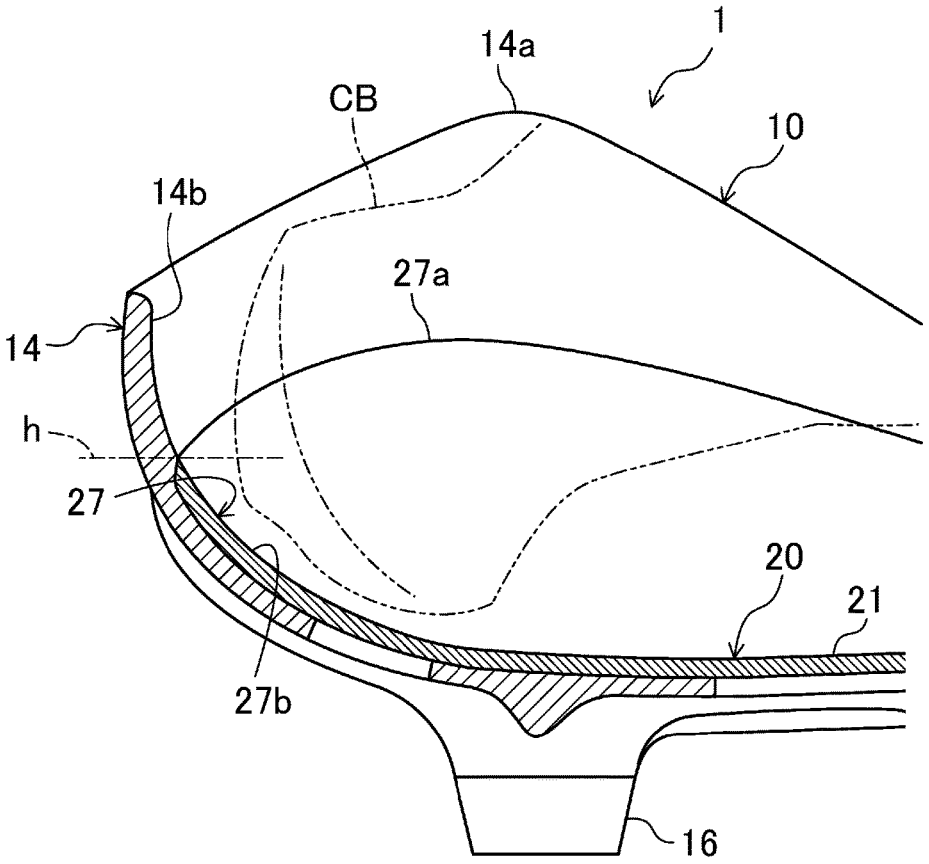
18b
18b
18b
18a
18a
22
22

FIG. 11



OUTSOLE STRUCTURE FOR SHOES AND CLEATED SHOE USING SAME

TECHNICAL FIELD

[0001] The present invention relates to a shoe outsole structure and a cleated shoe using the shoe outsole structure.

BACKGROUND ART

[0002] A shoe outsole structure including two resin materials that have different rigidities and are integral with each other has been known from Patent Document 1, for example.

[0003] Specifically, Patent Document 1 discloses a shoe sole including spikes and formed by integrating a first resin and a second resin which is higher in Young's modulus than the first resin together. The first resin is provided to correspond to a region continuous from the metatarsophalangeal joints (the so-called MP joints) to the tiptoe of a forefoot. The second resin includes a first band portion having the shape of a band and extending along the hallux located at the medial side of a foot, and a second band portion having the shape of a band and extending along the fifth toe located at the lateral side of the foot. The first band portion extends to correspond to a region from a rear end of the forefoot to a site of the proximal condyle of the proximal phalanx of the hallux. On the other hand, the second band portion extends to correspond to a region from the rear end of the forefoot to a site of the proximal condyle of the proximal phalanx of the fifth toe.

CITATION LIST

Patent Documents

[0004] Patent Document 1: Japanese Patent No. 4020879

SUMMARY OF THE INVENTION

Technical Problem

[0005] Meanwhile, it is required for cleated shoes for use in sports in which a player needs to move instantaneously, such as soccer, rugby, American football, and baseball, to have the following characteristics: an area of the shoe corresponding to a region of a wearer's foot which includes the metatarsophalangeal joints and is continuous from a substantial center in the longitudinal direction of the forefoot to the front end of the forefoot, allows the wearer to easily bend his/her joints (in particular, the metatarsophalangeal joints) of the forefoot during exercise; whereas another area of the shoe corresponding to a region of the wear's foot which is continuous from a rear portion, of the forefoot, located rearward of the metatarsophalangeal joints to the hindfoot, reduces an impact applied to the foot at the moment of an instantaneous motion such as a change in direction, and stabilizes, inside the shoe, the region continuous from the rear portion of the forefoot to the hindfoot.

[0006] However, in the shoe sole of Patent Document 1, since each of the first and second band portions extends over the metatarsophalangeal joints and reaches the site of the proximal condyle of the associated proximal phalanx, dorsiflexion occurs mainly in a tiptoe region when the wearer kicks. This limits the bending at the metatarsophalangeal joints of the forefoot, while efficiently generating propulsion for running. That is, it is difficult for cleated shoes including the shoe soles of Patent Document 1 to stabilize a region continuous from a rear portion, of the forefoot, located rearward of the metatarsophalangeal joints to the hindfoot and to allow the metatarsophalangeal joints in the forefoot to be bent flexibly. This creates a risk that repetition of instantaneous motions in a game such as a soccer game may apply physical stresses to a wearer's foot (especially, a vicinity of the metatarsophalangeal joints).

[0007] In view of the foregoing background, it is therefore an object of the present invention to provide a shoe outsole structure which allows the joints, in particular, the metatarsophalangeal joints to be easily bent in a region continuous from a substantial center of the forefoot in a longitudinal direction to a front end of the forefoot, and which stabilizes a region continuous from a rear portion of the forefoot located rearward of the metatarsophalangeal joints to the hindfoot.

Solution to the Problem

[0008] In order to achieve the above object, a first aspect of the present invention is directed to a shoe outsole structure for supporting a plantar surface of a wearer. The shoe sole structure includes: a first outsole component made of a deformable soft resin material and configured to entirely support the plantar surface spreading from a forefoot to a hindfoot; and a second outsole component integrally formed on top of the first outsole component, made of a hard resin material which has a higher rigidity than the first outsole component, and configured to support a region, of the plantar surface, which is continuous from a rear portion, of the forefoot, located rearward of metatarsophalangeal joints to the hindfoot.

[0009] According to the first aspect, in an area corresponding to a region which includes metatarsophalangeal joints and is continuous from a substantial center in the longitudinal direction of the forefoot to a front end of the forefoot, the first outsole component made of a deformable soft resin material allows the joints of the forefoot (especially the metatarsophalangeal joints) to be bent flexibly during exercise. On the other hand, in an area corresponding to a region continuous from a rear portion, of the forefoot, located rearward of the metatarsophalangeal joints to the hindfoot, the second outsole component made of a hard resin material which has a higher rigidity than the first outsole portion can reduce an impact applied to the foot at the time of an instantaneous motion such as a change in direction and stabilize the region from the rear portion of the forefoot to the hindfoot inside the shoe, while maintaining a sufficient flexural rigidity. The configuration in which the second outsole component is integrally formed on top of the first outsole portion makes it possible to obtain both the advantages for the region including metatarsophalangeal joints and continuous from the substantial center in the longitudinal direction to the front end of the forefoot, and the advantages for the region from the rear portion, of the forefoot, located rearward of the metatarsophalangeal joints to the hindfoot.

[0010] A second aspect of the present invention is an embodiment of the first aspect. In the second aspect, a front portion of the second outsole component is located in an area corresponding to a region which is continuous from a substantial center in a longitudinal direction of first to fifth metatarsals to distal condyles of the first to fifth metatarsals, and extends from a left side to a right side of the first outsole component so as to support the first to fifth metatarsals.

[0011] According to the second aspect, while the first outsole component maintains a state where especially the metatarsophalangeal joints are easily bent, the second outsole component made of a hard resin material which has a high rigidity can stabilize the first to fifth metatarsals inside the shoe.

[0012] A third aspect of the present invention is an embodiment of the first or second aspect. In the third aspect, on a bottom surface of the first outsole component, a plurality of first studs are arranged dispersedly in a forefoot area, and in plan view, a front end of the second outsole component overlaps with at least one of the first studs which is located rearward of the metatarsophalangeal joints.

[0013] According to the third aspect, the first studs contribute to enhancement of ground-gripping capability. Further, the front end of the second outsole component overlaps with at least one first stud located rearward of the metatarsophalangeal joints in plan view. Therefore, the boundary between the first and second outsole components is situated above the first stud that is located rearward of the metatarsophalangeal joints. That is, the boundary between the first and second outsole components overlaps with the first stud which can be deformed to very limited extent by bending. This makes it difficult for stresses to concentrate at the boundary between the first and second outsole components having different rigidities. As a result, the second outsole component is less likely to peel off the first outsole component at this boundary.

[0014] A fourth aspect of the present invention is an embodiment of the first or second aspect. In the fourth aspect, a pair of left and right ribs extending in a longitudinal direction is provided in an area of the first outsole component corresponding to a region which is continuous from the portion, of the forefoot, located rearward of the metatarsophalangeal joints to a midfoot, and each rib is constituted by a portion, of the second outsole component, which penetrates the first outsole component so as to project from a bottom surface of the first outsole component.

[0015] According to the fourth aspect, the pair of left and right ribs constituted by portions of the second outsole component having a high rigidity contributes not only to reduction of the weight of the whole outsole structure, but also to enhancement of the flexural rigidity of the area corresponding to the region from the rear portion, of the forefoot, located rearward of the metatarsophalangeal joints to the midfoot. As a result, a physical stress applied to the region of a wearer's foot from a rear portion, of the forefoot, located rearward of the metatarsophalangeal joints to the midfoot can be reduced.

[0016] A fifth aspect of the present invention is an embodiment of the fourth aspect. In the fifth aspect, each of the pair of left and right ribs has a central portion in a longitudinal direction positioned near proximal condyles of first to fifth metatarsals.

[0017] It is generally known that: a player playing soccer or any other sports reduces his/her running speed mainly using his/her forefoot and twist the forefoot to change the running direction; and repetition of this motion causes physical stresses to accumulate in the vicinity of the proximal condyles of the metatarsals (in particular, of the proximal condyle of the fifth metatarsal). According to the fifth aspect, each of the left and right ribs has its central position in the longitudinal direction positioned near the proximal condyles of the first to fifth metatarsals. This contributes to further enhancement of the flexural rigidity in an area corresponding to the vicinity of the proximal condyles of the first to fifth metatarsals. As a result, the physical stresses applied to the vicinity of the proximal condyles of the metatarsals (in particular, of the proximal condyle of the fifth metatarsal) can be reduced.

[0018] A sixth aspect of the present invention is an embodiment of the fourth or fifth aspect. In the sixth aspect, on a bottom surface of the first outsole component, a plurality of first studs are arranged dispersedly in a forefoot area, while a plurality of second studs are arranged dispersedly in a hindfoot area, and in plan view, each of the pair of left and right ribs has a front end overlapping with an associated one of the first studs that is located rearward of the metatarsophalangeal joints and in a rearmost portion of the forefoot area, and a rear end overlapping with an associated one of the second studs that is located in a foremost portion of the hindfoot area.

[0019] According to the sixth aspect, the first and second studs contribute to enhancement of ground-gripping capability. In addition, the left and right ribs are continuous with the first studs that are located rearward of the metatarsophalangeal joints and in the rearmost portion of the forefoot area, and with the second studs that are located in the foremost portion of the hindfoot area. This contributes to further enhancement of the flexural rigidity of the midfoot area in particular.

[0020] A seventh aspect of the present invention is an embodiment of any one of the first to sixth aspects. In the seventh aspect, a counter portion rises from left, right, and rear sides of the first outsole component so as to cover a heel, and from a rear portion of the second outsole component, a heel support portion extends upward to have a top end positioned lower than a top end of the counter portion so as to support a lower portion of the heel.

[0021] According to the seventh aspect, the heel support portion having a high rigidity can stabilize the lower portion of the heel. Furthermore, the counter portion, which has a low rigidity and of which the top end is positioned above the heel support portion, softly holds the periphery of the heel. This reduces a risk of appearance of pain in the wearer's foot during exercise.

[0022] An eighth aspect of the present invention is directed to a cleated shoe including the shoe outsole structure according to any one of the first to seventh aspects.

[0023] The cleated shoe according to the eighth aspect provides the same advantage as in any one of the first to seventh aspects.

Advantages of the Invention

[0024] As can be seen from the foregoing, according to the present invention, an area corresponding to a region which includes the metatarsophalangeal joints and is continuous from a substantial center in the longitudinal direction to the front end of the forefoot allows a wearer to easily bend his/her joints (in particular, the metatarsophalangeal joints) of the forefoot during exercise; whereas another area corresponding to a region from a rear of the forefoot located rearward of the metatarsophalangeal joints to the hindfoot can reduce an impact applied to the foot at the time of an instantaneous motion and stabilize the region from the rear portion of the forefoot to the hindfoot inside the shoe, while maintaining a sufficient flexural rigidity.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] FIG. **1** is a perspective view of a shoe outsole according to an embodiment of the present invention.

[0026] FIG. **2** is a plan view of the shoe outsole according to the embodiment of the present invention.

[0027] FIG. **3** is a plan view schematically showing a positional relationship between the outsole and the skeleton structure of a foot.

[0028] FIG. **4** is a back view of the shoe outsole according to the embodiment of the present invention.

[0029] FIG. **5** is a left side view of the shoe outsole according to the embodiment of the present invention.

[0030] FIG. **6** is a bottom view of the shoe outsole according to the embodiment of the present invention.

[0031] FIG. **7** is a bottom view schematically showing a positional relationship between the outsole and the skeleton structure of a foot.

[0032] FIG. **8** is an enlarged cross-sectional view taken along line VIII-VIII of FIG. **2**.

[0033] FIG. **9** is a cross-sectional view taken along line IX-IX of FIG. **2**.

[0034] FIG. **10** is an enlarged cross-sectional view taken along line X-X of FIG. **2**.

[0035] FIG. **11** is an enlarged cross-sectional view taken along line XI-XI of FIG. **4**.

DESCRIPTION OF EMBODIMENTS

[0036] Embodiments of the present invention will now be described in detail below with reference to the drawings. Note that the following description of the embodiments is merely an example in nature, and is not intended to limit the scope, applications, or use of the present invention.

[0037] FIGS. **1** to **11** show a shoe outsole **1** according to an embodiment of the present invention. Cleated shoes including the outsoles **1** are for sports such as soccer, rugby, American football, and baseball, in which a player needs to move instantaneously. The drawings show the shoe outsole **1** for a left foot only, as an example. Since the shoe outsole for a right foot is symmetrical to that for the left foot, only the outsole for the left foot will be described in the following description, and the description of the outsole for the right foot will be omitted herein. In the following description, the expressions "above," "upward," "on a/the top of," "below," "under," and "downward," represent the vertical positional relationship between respective components of the outsole **1**. The expressions "front," "fore," "forward, "rear," "back," "hind," "behind," and "backward" represent the positional relationship in the longitudinal direction between respective components of the outsole **1**. The expressions "left (side)" "leftward," "right (side)" and "rightward" represent the positional relationship in the width direction between respective components of the outsole **1**. In addition, in the following description, the expression "proximal condyle(s) of metatarsal(s)" of a foot of a human body indicates the condyle(s), of a metatarsal(s), closer to a trunk (i.e., the body apart from the limbs and the head), whereas the expression "a distal condyle(s) of a metatarsal(s)" indicates the condyle (s), of a metatarsal(s), farther from the trunk.

[0038] As shown in FIGS. **1** to **3**, the shoe outsole **1** is configured to support a plantar surface of the wearer. The outsole **1** includes a first outsole component **10** configured to support the entire plantar surface, from a forefoot F to a hindfoot H. For example, the first outsole component **10** is made of a soft resin material such as a nylon-based elastomer, and has the shape of a thin plate. Specifically, the first outsole component **10** has a relatively low flexural rigidity, and is deformable in response to an external force.

[0039] Further, on a surface (top surface) of the first outsole component **10**, a first planta-contact surface **11** is provided which is configured to contact a region, of the plantar surface, which includes the metatarsophalangeal joints MP and is continuous from a substantial center in the longitudinal direction of the forefoot F to the front end of the forefoot F. Note that the metatarsophalangeal joints MP are amphiarthroses which are located between the distal condyles of the metatarsals MT**1**-MT**5** and the proximal condyles of the proximal phalanxes PP**1**-PP**5**, and which connect the metatarsals MT**1**-MT**5** to the proximal phalanxes PP**1**-PP**5**. Furthermore, as shown in FIG. **9**, on the surface of the first outsole component **10**, a plurality of round recesses **12**, **12**, . . . are formed as recesses at positions corresponding to first and second studs **15**, **16** which will be described later.

[0040] As shown in FIGS. **1** to **5**, a rise portion **13** rises and extends along the front, left, and right portions of the periphery of the first outsole component **10**. An upper (not shown) of the shoe is fixed, at the outer surface of its lower portion, to the inner surface of the rise portion **13** and the inner surface of a counter portion **14** which will be described later.

[0041] As shown in FIGS. **1** to **5**, the counter portion **14** is provided to a rear portion of the first outsole component **10**. The counter portion **14** is continuous with, and extends further upward than, the rise portion **13**. The counter portion **14** is shaped to cover left, right, and rear sides of the calcaneus CB (heel). The counter portion **14** is curved such that its inner surface is concave outwardly. As can be seen from FIG. **11**, the counter portion **14** includes, at its left and right parts, side wall portions **14***a*, **14***a* which project upward to have its top end positioned above the calcaneus CB, and are configured to cover the left and right sides of the calcaneus CB. Further, the counter portion **14** includes, at its rear part, a rear wall portion **14***b* which is continuous with the side wall portions **14***a*, **14***a* and configured to cover the rear side of the calcaneus CB. The rear wall portion **14***b* has its top end reaching a vicinity of the top end of the calcaneus CB, and is curved in an arc shape so as to bulge rearward as it goes down. Thus, the counter portion **14** is configured to tightly hold the left and right sides of the heel with the side wall portions **14***a*, **14***a* so as to limit leftward and rightward twisting motions of the calcaneus CB, and to hold the rear side of the heel with the rear wall portion **14***b* to the extent that bending of the ankle is allowed.

[0042] As shown in FIGS. **5** to **7**, in an area of the first outsole component **10** corresponding to a region continuous from a rear portion of the forefoot F to the midfoot M, rib penetration holes **18***a*, **18***a* which are configured to allow ribs **22**, **22** (which will be described later) to project downward extend in the longitudinal direction. Further, rib-holding portions **18***b*, **18***b*, . . . which are downward protrusions are provided adjacent to the rib penetration holes **18***a*, **18***a*. The rib-holding portions **18***b*, **18***b*, . . . sandwich and press the rib **22**, **22** therebetween in the width direction (see FIGS. **9** and **10**).

[0043] In an area, of the bottom surface of the first outsole component **10**, corresponding to the forefoot F, a plurality of (in this embodiment, eight) first studs **15**, **15**, . . . , each of which has the shape of a circular column projecting down-

ward, are arranged dispersedly. Specifically, the first studs **15**, **15**, . . . are arranged in left and right portions (near medial side and lateral side). Pairs each including the left and right first studs **15**, **15**, are arranged at predetermined intervals in the longitudinal direction.

[0044] Moreover, a third stud **17** having a substantially elliptical shape in bottom view is provided at a position corresponding to a substantial center of the forefoot F (i.e., near the second and third proximal phalanx PP**2** and PP**3** in FIG. **7**).

[0045] In another area, of the bottom surface of the first outsole component **10**, corresponding to the hindfoot H, a plurality of (in this embodiment, four) second studs **16**, **16**, . . . , each of which has the shape of a circular column projecting downward, are arranged dispersedly. Specifically, the second studs **16**, **16**, . . . are arranged in left and right portions (near medial side and lateral side). Pairs each including the left and right second studs **16**, **16**, are arranged at predetermined intervals in the longitudinal direction.

[0046] Each of the first to third studs **15**, **16**, and **17** is made of a resin material having high wear resistance, such as thermoplastic polyurethane. Furthermore, as shown in FIG. **9**, the first and second studs **15**, **16** are formed by, for example, injection molding so as to be integral with the bottom surface of the first outsole component **10**, and arranged to correspond to the positions of the round recesses **12**, **12**, . . . of the first outsole component **10**. The thus configured first to third studs **15**, **16**, and **17** enhance ground-gripping capability of the outsole **1**.

[0047] Next, as shown in FIGS. **1** to **3**, the outsole **1** of the present invention includes, as a feature, a second outsole component **20** configured to support a region, of the plantar surface, which excludes the metatarsophalangeal joints MP, i.e., a region which is continuous from a rear portion, of the forefoot F, located rearward of the metatarsophalangeal joints MP to the hindfoot H. The second outsole component **20** is made of a hard resin material which has a higher rigidity than the first outsole component **10**. Examples of the resin material for the second outsole component **20** include nylon containing glass fibers. In other words, the second outsole component **20** has a higher flexural rigidity than the first outsole component **10**, and resists deformation even an external force is applied thereto.

[0048] The second outsole component **20** includes a second planta-contact surface **21** which is configured to contact a region, of the plantar surface, which is continuous from a rear portion, of the forefoot F, located rearward of the metatarsophalangeal joints MP to the hindfoot H. As shown in FIG. **8**, the second outsole component **20** is integrally formed on top of the first outsole component **10** by, for example, injection molding such that the second planta-contact surface **21** is flush with the first planta-contact surface **11** of the first outsole component **10**. Specifically, in the outsole **1** of this embodiment, the first planta-contact surface **11** of the first outsole component **10** that is made of a deformable soft resin material is exposed at an area of the top surface of the outsole **1** corresponding to the region which includes the metatarsophalangeal joints MP and is continuous from the substantial center in the longitudinal direction of the forefoot F to the front end of the forefoot F. On the other hand, the second planta-contact surface **21** of the second outsole component **20** that is made of a hard resin material having a high rigidity is exposed at an area of the top surface of the outsole **1** corresponding to the region which is continuous from the rear portion, of the forefoot F, located rearward of the metatarsophalangeal joints MP to the hindfoot H.

[0049] As shown in FIG. **3**, a front portion of the second outsole component **20** is located, in the longitudinal direction, in an area corresponding to a region which is continuous from substantial centers in the longitudinal direction of the first to fifth metatarsals MT**1**-MT**5** to the distal condyles of the first to fifth metatarsals MT**1**-MT**5**. Moreover, the front portion of the second outsole component **20** extends, in the width direction, from a left side to a right side of the first outsole component **10** so as to support the first to fifth metatarsals MT**1**-MT**5**.

[0050] As shown in FIGS. **5** to **7**, a pair of left and right ribs **22**, **22** projects from the bottom surface of the first outsole component **10**. The pair of ribs **22**, **22** extends in the longitudinal direction in an area corresponding to a region which is continuous from a rear portion, of the forefoot F, located rearward of the metatarsophalangeal joints MP to the midfoot M. As shown in FIGS. **9** and **10**, each of the ribs **22**, **22** is constituted by a portion, of the second outsole component **20**, which protrudes downward and penetrates the first outsole component **10** to project downward with respect to the first outsole component **10**. More specifically, each of the ribs **22**, **22** is configured to protrude downward through an associated one of the rib penetration holes **18***a*, **18***a* of the first outsole component **10** so as to have its lower end located below the first outsole component **10**. The ribs **22**, **22** each constituted by a portion of the second outsole component **20** can have a larger height from the planta support surface (in this embodiment, the second planta-contact surface **21**) of the outsole **1** than typical ribs which could be provided as separate members to the bottom surface of the first outsole component **10**. Thus, the ribs **22**, **22** contribute to reduction of the weight of the whole outsole **1** and improvement of the flexural rigidity of the second outsole component **20**.

[0051] As shown in FIGS. **5** and **9**, each of the ribs **22**, **22** is provided such that its lower end is positioned above a junction position J which connects the junction between the first outsole component **10** and the rearmost first stud **15** to the junction between the first outsole component **10** and the foremost second stud **16** (see the dot-dash line in FIGS. **5** and **9**). This configuration makes it possible to ensure that each of the ribs **22**, **22** has as much a projection height as possible and to prevent the gripping capability of the first and second studs **15**, **16** from being impaired. As shown in FIGS. **6** and **10**, each of the ribs **22**, **22** is firmly held on the first outsole component **10**, by being sandwiched between, and pressed by, the rib-holding portions **18***b*, **18***b* of the first outsole component **10** in the width direction.

[0052] Moreover, as shown in FIGS. **1** to **3**, a honeycomb structure **24** is formed inside (the recess of) each rib **22**. The honeycomb structure **24** is comprised of a plurality of partition walls **23**, **23**, . . . which are in contact with each other and define recesses each having a regular hexagonal shape and recessed downward from the second planta-contact surface **21** of the second outsole component **20** (see FIG. **10**). The honeycomb structure **24** makes the inside of each rib **22** substantially hollow and contributes not only to reduction of the weight of the rib **22**, but also to further enhancement of the flexural rigidity of the area corresponding to a region which is continuous from the rear portion, of the forefoot F, located rearward of the metatarsophalangeal

joints MP to the midfoot M. Note that for the sake of convenience, the partition walls **23**, **23**, . . . are omitted from the honeycomb structures **24**, **24** shown in FIG. **9**.

[0053] As shown in FIGS. **6** and **7**, the rib **22** provided closer to the medial side extends in the longitudinal direction between the first stud **15** that is closer to the medial side and arranged in a rearmost portion, of the forefoot area F, located rearward of the metatarsophalangeal joints MP, and the second stud **16** that is closer to the medial side and arranged in a foremost portion of the hindfoot area H. The rib **22** is curved such that its central portion bulges toward the lateral side from the medial side. The other rib **22** provided closer to the lateral side extends substantially linearly in the longitudinal direction between the first stud **15** that is closer to the lateral side and arranged in the rearmost portion, of the forefoot area F, located rearward of the metatarsophalangeal joints MP, and the second stud **16** that is closer to the lateral side and arranged in the foremost portion of the hindfoot area H. In addition, each of the ribs **22**, **22** is configured such that its central portion is positioned near the proximal condyles of the first to fifth metatarsals MT**1**-MT**5**.

[0054] Here, as shown in FIGS. **1** to **3**, the front end of the second outsole component **20** overlaps with the first studs **15**, **15** that are located rearward of the metatarsophalangeal joints MP, in plan view. More specifically, as shown in FIG. **9**, the front end of each of the honeycomb structures **24**, **24** formed inside the ribs **22**, **22** covers a semicircular portion located rearward of a substantial center of the associated one of the round recesses **12**, **12** of the first outsole component **10** that correspond to the positions of the first studs **15**, **15** arranged in the rearmost portion of the forefoot area F. On the other hand, the rear end of each of the honeycomb structures **24**, **24** covers a semicircular portion located frontward of a substantial center of the associated one of the round recesses **12**, **12** of the first outsole component **10** that correspond to the positions of the second studs **16**, **16** arranged in the foremost portion of the hindfoot area H. In other words, the ribs **22**, **22** are continuous with the first studs **15**, **15** that are located rearward of the metatarsophalangeal joints MP and in the rearmost portion of the forefoot area F, and with the second studs **16**, **16** that are located in the foremost portion of the hindfoot area H.

[0055] The second outsole component **20** has semicircular holes **25**, **25** which correspond to the rear semicircular portions of the round recesses **12** and are adjacent to the rear ends of the honeycomb structures **24**, **24**. The second outsole component **20** further has, at positions corresponding to the second studs **16**, **16** arranged in the rearmost portion of the hindfoot area H, circular holes **26**, **26** each of which has the same size as the round recesses **12**, **12** of the first outsole component **10**.

[0056] As shown in FIGS. **1** to **3**, the second outsole component **20** includes, in its rear portion, a heel support portion **27** which is continuous with the counter portion **14** and configured to support a bottom portion of the calcaneus CB (heel). As shown in FIG. **11**, the heel support portion **27** is integrally formed on top of the counter portion **14** such that the surface of the heel supporter portion **27** is flush with the surface of the counter portion **14**. The heel support portion **27** has, at its left and right parts, side wall portions **27***a*, **27***a* which project upward and are configured to cover the left and right sides of a lower portion of the calcaneus CB. The heel support portion **27** further has, at its rear part, a rear wall portion **27***b* which is continuous with the side wall portions **27***a*, **27***a* and configured to cover a rear side of the lower portion of the calcaneus CB.

[0057] The heel support portion **27** extends upward to have its top end positioned lower than the top end of the counter portion **14**. More specifically, as shown in FIG. **11**, the rear wall portion **27***b* of the heel support portion **27** extends upward such that its top end reaches a rearmost point of a bulge of the calcaneus CB in side view (i.e., the position indicated by the dot-dash line h in FIG. **11**). The top end of each side wall portion **27***a* of the heel support portion **27** is above the top end of the rear wall portion **27***b*.

[0058] As can be seen from the foregoing description, with the shoe outsole **1** according to this embodiment, in the area corresponding to the region that includes the metatarsophalangeal joints MP and is continuous from the substantial center in the longitudinal direction of the forefoot F to the front end of the forefoot F, the first outsole component **10** made of a deformable soft resin material allows the joints in the forefoot F (especially, the metatarsophalangeal joints MP) to be bent flexibly during exercise. On the other hand, in the area corresponding to the region that is continuous from the rear portion, of the forefoot F, located rearward of the metatarsophalangeal joints MP to the hindfoot H, the second outsole component **20** made of a hard resin material which has a higher rigidity than the first outsole component **10** can reduce an impact applied to the foot at the time of an instantaneous motion such as a change in direction and stabilize the region from the rear portion of the forefoot F to the hindfoot H inside the shoe, while maintaining a sufficient flexural rigidity. In the outsole **1** of this embodiment, the configuration in which the second outsole component **20** is integrally formed on top of the first outsole component **10** makes it possible to obtain both the advantages for the region including metatarsophalangeal joints MP and continuous from the substantial center in the longitudinal direction of the forefoot F to the front end of the forefoot F, and the advantages for the region continuous from the rear portion, of the forefoot F, located rearward of the metatarsophalangeal joints MP to the hindfoot H.

[0059] The front portion of the second outsole component **20** is located in an area corresponding to a region which is continuous from a substantial center in the longitudinal direction of the first to fifth metatarsals to the distal condyles of the first to fifth metatarsals, and extends from the left side to the right side of the first outsole component **10** to support the first to fifth metatarsals MT**1**-MT**5**. As a result, the first outsole component **10** can maintain a state where especially the metatarsophalangeal joints MP are easily bent, while the second outsole component **20** having a high rigidity can stabilize the first to fifth metatarsals MT**1**-MT**5** inside the shoe.

[0060] In plan view, the front end of the second outsole component **20** overlaps with the first studs **15**, **15** located rearward of the metatarsophalangeal joints MP. Therefore, the boundary between the first and second outsole components **10** and **20** is situated above the first studs **15**, **15** located rearward of the metatarsophalangeal joints MP. That is, the boundary between the first and second outsole components **10** and **20** overlap with the first studs **15**, **15** which can be deformed to very limited extent by bending. This makes it difficult for stresses to concentrate at the boundary between the first and second outsole components **10** and **20** having different rigidities. As a result, the second outsole

component **20** is less likely to peel off the first outsole component **10** at this boundary.

[0061] According to this embodiment, the pair of left and right ribs **22**, **22** constituted by portions of the second outsole component **20** having a high rigidity contributes not only to reduction of the weight of the whole outsole **1**, but also to enhancement of the flexural rigidity of the area corresponding to the region continuous from the rear portion, of the forefoot F, located rearward of the metatarsophalangeal joints MP to the midfoot M. This makes it possible to reduce a physical stress applied to the region, of a wearer's foot, which is continuous from a rear portion, of the forefoot F, located rearward of the metatarsophalangeal joints MP to the midfoot M.

[0062] In addition, each of the ribs **22**, **22** has its central portion in the longitudinal direction located near the proximal condyles of the first to fifth metatarsals MT**1**-MT**5**, contributing to further enhancement of the flexural rigidity of an area corresponding to a vicinity of the proximal condyles of the first to fifth metatarsals MT**1**-MT**5**. This makes it possible to reduce a physical stress which can be applied to the vicinity of the proximal condyles of the metatarsals MT (especially, the proximal condyle of the fifth metatarsal MT**5**) of a wearer due to repetition of motion of reducing the wearer's running speed using his/her forefoot F and twisting his/her forefoot for change in running direction.

[0063] In plan view, the ribs **22**, **22** have the front ends overlapping with the first studs **15**, **15** that are located rearward of the metatarsophalangeal joints MP and in the rearmost portion of the forefoot area F, and the rear ends overlapping with the second studs **16**, **16** that are located in the foremost portion of the hindfoot area H. In other words, the ribs **22**, **22** are continuous with the first studs **15**, **15** that are located rearward of the metatarsophalangeal joints MP and in the rearmost portion of the forefoot area F, and with the second studs **16**, **16** that are located in the foremost portion of the hindfoot area H. This configuration contributes to further enhancement of the flexural rigidity of the midfoot area M in particular.

[0064] Moreover, according to this embodiment, the heel support portion **27** can stabilize a lower portion of the calcaneus CB (heel). Furthermore, the counter portion **14** having a low rigidity holds the periphery of the heel softly. This can reduce a risk of appearance of pain in the wearer's foot.

OTHER EMBODIMENTS

[0065] In the embodiment described above, the front end of the rib **22** closer to the medial side overlaps with the first stud **15** located in the rearmost portion of the forefoot area F in plan view. However, the present invention is not limited to this embodiment. For example, the front end of the rib **22** closer to the medial side may overlap with the third foremost first stud **15** that is arranged closer to the medial side in the forefoot area F as shown in FIGS. **1** to **3**. In short, it is suitable that the front end of the second outsole component **20** overlaps with any one of the first studs **15** located rearward of the metatarsophalangeal joints MP in plan view.

[0066] The embodiment described above includes the counter portion **14** and the heel support portion **27**. However, the present invention is not limited to this embodiment. Specifically, the outsole **1** (outsole structure) may include a first outsole component **10** having no counter portion **14** and a second outsole component **20** having no heel support portion **27**.

[0067] Note that the present invention is not limited to the embodiments described above, and various changes and modifications may be made without departing from the scope of the present disclosure.

INDUSTRIAL APPLICABILITY

[0068] The present invention is industrially applicable, for example, as a cleated shoe for sports in which a player need to move instantaneously, such as soccer, rugby, America football, and baseball.

DESCRIPTION OF REFERENCE CHARACTERS

[0069] **1**: Outsole (Shoe Outsole Structure)
[0070] **10**: First Outsole Component
[0071] **14**: Counter Portion
[0072] **15**: First Stud
[0073] **16**: Second Stud
[0074] **20**: Second Outsole Component
[0075] **22**: Rib
[0076] **24**: Honeycomb Structure
[0077] **27**: Heel Support Portion
[0078] F: Forefoot
[0079] M: Midfoot
[0080] H: Hindfoot
[0081] MP: Metatarsophalangeal Joints
[0082] PP: Proximal Phalanx
[0083] MT: Metatarsal
[0084] CB: Calcaneus (Heel)

1. A shoe outsole structure for supporting a plantar surface of a wearer, the shoe outsole structure comprising:
a first outsole component made of a deformable soft resin material and configured to entirely support the plantar surface spreading from a forefoot to a hindfoot; and
a second outsole component integrally formed on top of the first outsole component, made of a hard resin material which has a higher rigidity than the first outsole component, and configured to support a region, of the plantar surface, which is continuous from a rear portion, of the forefoot, located rearward of metatarsophalangeal joints to the hindfoot.

2. The shoe outsole structure of claim **1**, wherein
a front portion of the second outsole component is located in an area corresponding to a region which is continuous from a substantial center in a longitudinal direction of first to fifth metatarsals to distal condyles of the first to fifth metatarsals, and extends from a left side to a right side of the first outsole component so as to support the first to fifth metatarsals.

3. The shoe outsole structure of claim **1**, wherein
on a bottom surface of the first outsole component, a plurality of first studs are arranged dispersedly in a forefoot area, and
in plan view, a front end of the second outsole component overlaps with at least one of the first studs which is located rearward of the metatarsophalangeal joints.

4. The shoe outsole structure of claim **1**, wherein
a pair of left and right ribs extending in a longitudinal direction is provided in an area of the first outsole component corresponding to a region which is continuous from the portion, of the forefoot, located rearward

of the metatarsophalangeal joints to a midfoot, and each rib is constituted by a portion, of the second outsole component, which penetrates the first outsole component so as to project from a bottom surface of the first outsole component.

5. The shoe outsole structure of claim **4**, wherein

each of the pair of left and right ribs has a central portion in a longitudinal direction positioned near proximal condyles of first to fifth metatarsals.

6. The shoe outsole structure of claim **5**, wherein

on a bottom surface of the first outsole component, a plurality of first studs are arranged dispersedly in a forefoot area, while a plurality of second studs are arranged dispersedly in a hindfoot area, and

in plan view, each of the pair of left and right ribs has a front end overlapping with an associated one of the first studs that is located rearward of the metatarsophalangeal joints and in a rearmost portion of the forefoot area, and a rear end overlapping with an associated one of the second studs that is located in a foremost portion of the hindfoot area.

7. The shoe outsole structure of claim **1**, wherein

a counter portion rises from left, right, and rear sides of the first outsole component so as to cover a heel, and

from a rear portion of the second outsole component, a heel support portion extends upward to have a top end positioned lower than a top end of the counter portion so as to support a lower portion of the heel.

8. A cleated shoe comprising the shoe outsole structure of claim **1**.

9. A cleated shoe comprising the shoe outsole structure of claim **2**.

10. A cleated shoe comprising the shoe outsole structure of claim **3**.

11. A cleated shoe comprising the shoe outsole structure of claim **4**.

12. A cleated shoe comprising the shoe outsole structure of claim **5**.

13. A cleated shoe comprising the shoe outsole structure of claim **6**.

14. A cleated shoe comprising the shoe outsole structure of claim **7**.

* * * * *