



(11) **EP 3 542 659 A1**

(12) **EUROPEAN PATENT APPLICATION**  
 published in accordance with Art. 153(4) EPC

(43) Date of publication:  
**25.09.2019 Bulletin 2019/39**

(51) Int Cl.:  
**A43B 13/12** <sup>(2006.01)</sup> **A43B 5/00** <sup>(2006.01)</sup>  
**A43B 5/06** <sup>(2006.01)</sup> **A43B 13/14** <sup>(2006.01)</sup>  
**A43B 13/18** <sup>(2006.01)</sup>

(21) Application number: **17883088.1**

(22) Date of filing: **08.12.2017**

(86) International application number:  
**PCT/JP2017/044228**

(87) International publication number:  
**WO 2018/116874 (28.06.2018 Gazette 2018/26)**

(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:  
**MA MD TN**

(71) Applicant: **Nakatsuka, Tatsuya**  
**Nagano 399-3303 (JP)**

(72) Inventor: **Nakatsuka, Tatsuya**  
**Nagano 399-3303 (JP)**

(74) Representative: **Mewburn Ellis LLP**  
**City Tower**  
**40 Basinghall Street**  
**London EC2V 5DE (GB)**

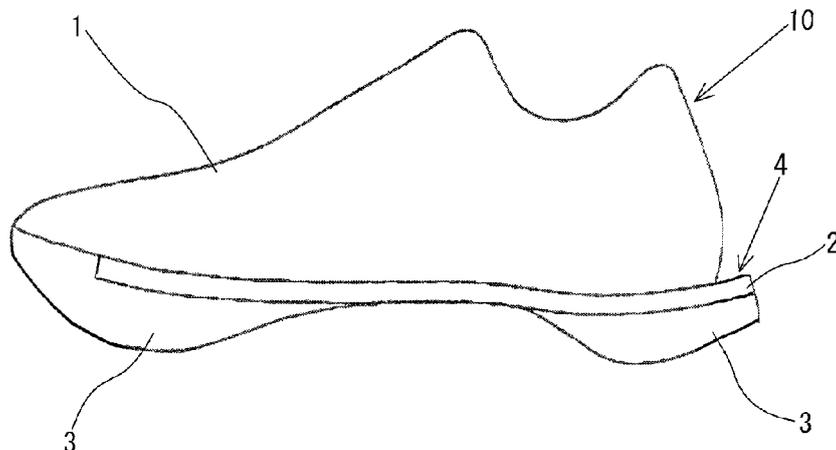
(30) Priority: **23.12.2016 JP 2016257968**

(54) **SHOE**

(57) The present invention addresses the problem of providing a shoe, which is light and capable of improving cushioning properties and a thrust force occurring upon push off without sacrificing comfort to wear, has a simple structure and can be mass-produced. This problem is solved by a shoe (10) characterized by being provided with: a shoe body (1) into which a foot (F) is inserted; a

hard plate (2) which covers a necessary area on a bottom side of the shoe body (1) in a length direction and is fixed to the bottom side of the shoe body (1) only at a necessary location including a position of a front foot part; and cushion materials (3) which are attached to both end parts of a ground contact side of the hard plate (2) in the length direction.

**FIG.5**



**EP 3 542 659 A1**

## Description

### Technical Field

**[0001]** The present invention relates to a shoe, which has comfort to wear and which is capable of efficiently converting grounding impact into a thrust force occurring upon push off and is suitable for running or walking.

### Background Art

**[0002]** In a conventional running shoe or a conventional walking shoe (hereinafter referred to as "shoe"), as shown in Fig. 6, a cushion material 24 is provided to an entire sole member 22 of a shoe 20 so as to reduce grounding impact applied to a sole of foot and obtain flexibility and a thrust force occurring upon push off. The shoe having such structure is disclosed in, for example, Patent Literature 1 (Japanese Laid-open Patent Publication No. 2002-85104).

**[0003]** The inventor of the present invention has invented a shoe, which is capable of storing grounding impact as energy and radiating the stored energy as a repulsion force when pushing off by a front foot part and is capable of reducing fatigue and burden of the foot and running or walking efficiently, and the shoe is disclosed in Patent Literature 2 (Japanese Laid-open Patent Publication No. 2010-162318). Concretely, as shown in Fig. 7, a hard stepping plate 31 and a hard grounding plate 34 are connected, by a connecting section 34 of a heel part (a rear foot part), with a suitable clearance 33, so that a plate spring 35, which returns the clearance 33 to an original state when an external force for narrowing the clearance 33 is applied, is formed, and the plate spring 35 is attached to a bottom part of the shoe at a front foot part of the hard stepping plate 31.

### Citation List

#### Patent Literature

#### [0004]

Patent Literature 1: Japanese Laid-open Patent Publication No. 2002-85104

Patent Literature 2: Japanese Laid-open Patent Publication No. 2010-162318

### Summary of Invention

#### Technical Problem

**[0005]** In the conventional shoe disclosed in Patent Literature 1, if the cushion materials are partially provided on a ground contact surface so as to improve cushioning properties and obtain an effective thrust force for push off while running or walking, pressure is partially applied to the sole of foot and comfortableness will be worse.

Therefore, providing the cushion materials on the grounding surface is restricted. Further, in the conventional shoe disclosed in Patent Literature 2, a structure of the plate spring, which is capable of receiving grounding impact and which has suitable mechanical strength for obtaining the repulsion force for push off, is complex, and it is difficult to mass-produce the plate spring. Even if the plate spring is composed of a light material, an entire weight of the shoe must be heavier.

#### Solution to Problem

**[0006]** Thus, an object of the present invention is to provide a shoe, which is light and capable of improving cushioning properties and a thrust force occurring upon push off without sacrificing comfort to wear and which has a simple structure and can be mass-produced.

**[0007]** Namely, the shoe of the present invention comprises: a shoe body into which a foot is inserted; a hard plate covering a necessary area on a bottom side of the shoe body in a length direction and being fixed to the bottom side of the shoe body only at a necessary location including a position of a front foot part; and cushion materials being attached to at least both end parts of a ground contact side of the hard plate in the length direction.

**[0008]** Preferably, the necessary area is the entire shoe body in the length direction. With this structure, options of attachment positions of the cushion materials can be increased.

**[0009]** Preferably, the necessary area is an area from the front foot part to a heel part except a toe part. With this structure, flexibility of the shoe body for pushing off and following capability of the hard plate to the shoe body can be improved.

**[0010]** Preferably, the cushion material is attached to a position on the bottom side of the shoe body which corresponds to the toe part. With this structure, comfort to wear when pushing off can be improved, and a repulsion force can be increased.

**[0011]** Preferably, the hard plate is curved and projected, at a position corresponding to the front foot part, toward a ground. With this structure, the hard plate can easily follow the shoe body when pushing off, and a separation (a distance) between the hard plate and the heel part of the shoe body is shortened, so that inertia moment of the shoe can be made smaller, and fatigue and burden of the foot can be reduced.

**[0012]** Preferably, a sectional shape of the hard plate in a width direction is formed into a corrugated shape. With this structure, a weight of the hard plate can be reduced, and a strength of the hard plate in the length direction can be increased, so that performance of the hard plate can be kept for a long period.

**[0013]** Preferably, a bending resistance of a part of the hard plate corresponding to the area of the front foot part is smaller than that of another part corresponding to an area from an intermediate foot part to the heel part. With

this structure, flexibility of the shoe while running can be secured, and a repulsion force occurring upon push off can be increased.

**[0014]** Preferably, the hard plate and the cushion material are backwardly projected from the shoe body. With this structure, dispersion and reduction of grounding impact can be accelerated. Further, an area of a ground contact side of the hard plate, in which the cushion materials can be provided, can be broadened, so that options of attachment positions of the cushion materials can be increased, and the cushion materials can be optionally provided.

#### Advantageous Effects of Invention

**[0015]** As described above, the hard plate is provided on the bottom side of the shoe body, so that the cushion materials can be partially provided on the ground contact side of the hard plate without sacrificing comfort to wear. The hard plate is fixed to the bottom side of the shoe body only at the necessary location of the front foot part, so that the heel part of the shoe body (a rear foot part) separates from the hard plate when pushing off and flexibility of the shoe body can be maintained. The cushion materials are attached to the both end parts (the heel part and the toe part or the front foot part) of the ground contact side of the hard plate in the length direction, so that the cushion material need not be provided to the intermediate foot part and the weight of the shoe can be reduced.

**[0016]** By partially providing the cushion materials on the ground contact side of the shoe, an amount of deformation of the cushion materials can be increased, and cushioning properties and the repulsion force can be improved. Namely, grounding impact while running can be absorbed by the cushion materials of the heel part and the front foot part, and the cushion material of the heel part restores by weight shift, so that the cushion material upwardly lifts a user wearing the shoes and the cushion material of the front foot part is further compressed. Therefore, the hard plate and the shoe body are inclined forward, and restoring the shoe can be accelerated. Further, the cushion material of the front foot part, which has been compressed when pushing off, restores, so that the user wearing the shoes is upwardly lifted and the thrust force is generated. Therefore, the cushion materials are deformed when grounding, so that the stored energy can be efficiently converted into the thrust force occurring upon push off. Further, the structure of the shoe can be simplified, so that the light shoe can be mass-produced.

#### Brief Description of Drawings

##### **[0017]**

Fig. 1 is a side view of a shoe of Embodiment 1.

Fig. 2 is a perspective view of a hard plate.

Fig. 3 is a side view of the shoe shown in Fig. 1, in

which the shoe is pushed off.

Fig. 4 is a side view of a shoe of Embodiment 2.

Fig. 5 is a side view of a shoe of Embodiment 3.

Fig. 6 is a side view of the conventional shoe (Prior Art).

Fig. 7 is a side view of another conventional shoe (Prior Art).

#### Description of Embodiments

**[0018]** Embodiments of the shoe of the present invention will be described.

##### (Embodiment 1)

**[0019]** As shown in Fig. 1, a shoe 10 of the present embodiment comprises: a shoe body 1 into which a foot F is inserted; a hard plate 2 covering a necessary area on a bottom side of the shoe body in a length direction; and cushion materials 3 being attached on a ground contact side of the hard plate 2.

**[0020]** The hard plates 2 entirely covers a bottom side of the shoe body 1 in a length direction. A suitable material of the hard plate 2 is a light and has high mechanical strength. In the present embodiment, the hard plate 2 is composed of carbon fiber resin, but the material of the hard plate 2 is not limited to the carbon fiber resin. As shown in Fig. 1, the hard plate 2 is curved and projected, at a position of a front foot part, toward a ground when seen from a side. The hard plate 2 is fixed to a bottom side of the shoe body 1 only in a necessary length area including a border part between a phalange and a metatarsal (a necessary location of the front foot part). Namely, the hard plate 2 is not fixed to the bottom side of the shoe body 1 in an area from an intermediate foot part to a heel part (a rear foot part), and the hard plate 2 is capable of moving to and away from a bottom surface of the shoe body 1.

**[0021]** Fig. 2 is a perspective view of the hard plate 2 seen from a lower side. In the hard plate 2, a plurality of projecting stripes 2a are arranged, in a width direction of the hard plate 2, with prescribed separations. Recessed stripes 2b are respectively formed between the projecting stripes 2a. Namely, in an upper surface of the hard plate 2, the projecting stripes 2a shown in Fig. 2 form the recessed stripes 2b, and the recessed stripes 2b in a bottom surface of the hard plate 2 form the projecting stripes 2a, so that a sectional shape of the hard plate 2 in the width direction is formed into a corrugated shape. By forming the sectional shape in the width direction into the corrugated shape, a weight of the hard plate 2 can be reduced, and a strength (a bending strength) of the hard plate 2 in the length direction can be improved.

**[0022]** As to a height of each projecting stripe 2a (a depth of each recessed stripe 2b), a depth of the intermediate foot part and the heel part is deeper than that of the front foot part. With this structure, a bending resistance (a bending strength) of the hard plate 2 in an area

of the front foot part can be smaller than a bending resistance (a bending strength) thereof in an area from the intermediate foot part to the heel part. The upper and the bottom surfaces of the hard plate 2 may be formed flat. By changing the shape of the hard plate 2, the shoe 10 having a suitable repulsion force and comfortableness according to user's object and preference can be provided.

**[0023]** Cushion materials 3 are respectively attached to both end parts, i.e., the front foot part and the heel part, of a ground contact side (the bottom side) of the hard plate 2 in the length direction. Namely, as clearly shown in Fig. 1, no cushion material 3 is attached to a part of the hard plate 2 corresponding to the intermediate foot part, so that the parts of the cushion materials 3 contact the ground but the part of the hard plate 2 corresponding to the intermediate foot part is separated from the ground in a state where the shoe 10 is merely put on the ground.

**[0024]** When the user wearing the shoes 10 begins to run as shown in Fig. 3, only the front foot part of the shoe 10 contacts the ground, so that an area of the hard plate 2, which corresponds to the area from the intermediate foot part to the heel part, is separated from the ground and the heel part of the shoe body 1. Therefore, bending properties of the shoe 10 is not sacrificed, so that the user can smoothly push off the ground. When contacting the ground, a pressure applied to the front foot part and the heel part can be dispersed to an entire sole of user's foot by the hard plate 2, so that comfortableness of the shoe 10 can be improved.

**[0025]** The cushion materials 3 are respectively attached to the locations of the ground contact side of the hard plate 2 corresponding to the front foot part and the heel part (at least the both end parts of the ground contact side of the hard plate 2 in the length direction). The cushion materials 3 are composed of a material having superior softness and elasticity, e.g., EVA (Ethylene-Vinyl Acetate). By partially providing the cushion materials 3 on the ground contact side of the hard plate 2, the shoe 10 can be suitably lightened.

**[0026]** In the shoe 10 having the above described structure, grounding impact can be efficiently stored in the cushion materials 3 as elastic energy (repulsion energy). Therefore, when the user pushes off the ground by a ground contact surface of the shoe 10, the repulsion energy generated by restoring the cushion materials 3 can be applied in a direction of push off as a thrust force, so that high power push off can be obtained.

(Embodiment 2)

**[0027]** In the shoe 10 of the present embodiment, an area of attaching the hard plate 2 to the shoe body 1 and locations of attaching the cushion materials 3 are different from those of the shoe 10 of Embodiment 1. Concretely, as shown in Fig. 4, the hard plate 2 is provided to the bottom side of the shoe body 1 and in an area in

the length direction from the front foot part to the heel part except a toe part. Namely, the hard plate 2 does not cover the toe part of the shoe 10. The hard plate 2 is attached to the bottom side of the shoe body 1 only in the necessary length area including the border part between the phalange and the metatarsal (the necessary location of the front foot part).

**[0028]** As described above, the part not covered with the hard plate 2 is formed on the bottom side of the shoe body 1, a bending angle of a bending part of the shoe 10, which is a border part between the part covered with the hard plate 2 and the part not covered therewith, can be made wider. With this structure, following capability of the hard plate 2 to the shoe body 1 can be improved when pushing off, so that comfort to wear can be further improved.

**[0029]** In the shoe 10 of the present embodiment, the cushion material 3 is additionally provided to the bottom side of the shoe body 1 in the toe part which is not covered with the hard plate 2. The cushion material 3 provided to the toe part is separated from the cushion materials 3 which are attached to the both end parts of the ground contact side of the hard plate 2 in the length direction, and it is formed into a triangular shape when seen from a side.

**[0030]** A maximum thickness of the cushion material 3 covering the toe part is approximately equal to that of the cushion materials 3 attached to the bottom side of the hard plate 2. By employing such cushion materials 3, stumbling which is caused when the cushion material 3 of the toe part unexpectedly contacts the ground while running or walking can be prevented. By wearing the shoes 10, the thrust force occurring upon push off and comfort to wear can be further improved. Elastic coefficients of the cushion materials 3 of the toe part, the front foot part and the heel part may be different from each other.

(Embodiment 3)

**[0031]** In Fig. 5, the part of the shoe 10 not covered with the hard plate 2 is covered with the cushion material 3 of the front foot part. Namely, the cushion material 3 of the front foot part and the cushion material 3 of the toe part described in Embodiment 2 are integrated in the present embodiment. With this structure, in comparison with Embodiment 2, producing and attaching the cushion material 3 can be simplified, and durability can be improved.

**[0032]** In the present embodiment, as shown in Fig. 5, the hard plate 2 and the cushion material 3 attached to the heel part of the hard plate 2 are backwardly projected from a rear end of the shoe body 1 and form a projecting part 4. By forming the projecting part 4, impact absorbability when grounding can be improved, so that burden of the foot can be suitably reduced.

**[0033]** The present invention has been explained in detail with reference to the embodiments, but the present

invention is not limited to the embodiments. For example, the shoe 10 of the above described embodiments is but the shoe may be suitably applied to a walking shoe.

**[0034]** In the above described embodiments, the cushion materials 3 act as ground contact members of the shoe 10, but outer sole members may be attached to the bottom surfaces of the cushion materials 3 as ground contact members. In Embodiment 1, the bending resistance of the hard plate 2 in the length direction may be partially differed. Concretely, by employing the hard plate 2 in which the bending resistance in the area of the front foot part is smaller than that in the area from the intermediate foot part to the heel part, flexibility of the shoe 10 can be suitably secured even if the hard plate 2 is attached to the entire shoe body 1 in the length direction. Further, by attaching the hard plate 2 to the entire shoe body 1 in the length direction, the shoe 10 having stable comfort to wear can be produced.

**[0035]** In Embodiment 2, the cushion material 3 is attached to the toe part of the shoe body 1 (the part not covered with the hard plate 2), but the cushion material 3 attached to the toe part of the shoe body 1 may be omitted. With this structure, the weight of the shoe 10 can be further reduced. On the other hand, the cushion material 3 may be attached to cover the entire ground contact side of the hard plate 2. With this structure, stability of the shoe 10 can be improved and the hard plate 2 can be protected when running or walking on an uneven ground.

**[0036]** Further, the structures of Embodiments 1-3 may be selectively combined or applied to other examples.

## Claims

### 1. A shoe comprising:

a shoe body into which a foot is inserted;  
 a hard plate covering a necessary area on a bottom side of the shoe body in a length direction and being fixed to the bottom side of the shoe body only at a necessary location including a position of a front foot part; and  
 cushion materials being attached to at least both end parts of a ground contact side of the hard plate in the length direction.

2. The shoe according to claim 1, wherein the necessary area is the entire shoe body in the length direction.

3. The shoe according to claim 1, wherein the necessary area is an area from the front foot part to a heel part except a toe part.

4. The shoe according to claim 3, wherein the cushion material is attached to a position on the bottom side of the shoe body which corresponds to the toe part.

5. The shoe according to any one of claims 1-4, wherein the hard plate is curved and projected, at a position corresponding to the front foot part, toward a ground.

6. The shoe according to any one of claims 1-5, wherein a sectional shape of the hard plate in a width direction is formed into a corrugated shape.

7. The shoe according to any one of claims 1-6, wherein a bending resistance of a part of the hard plate corresponding to the area of the front foot part is smaller than that of another part corresponding to an area from an intermediate foot part to the heel part.

8. The shoe according to any one of claims 1-7, wherein the hard plate and the cushion material are backwardly projected from the shoe body.

FIG.1

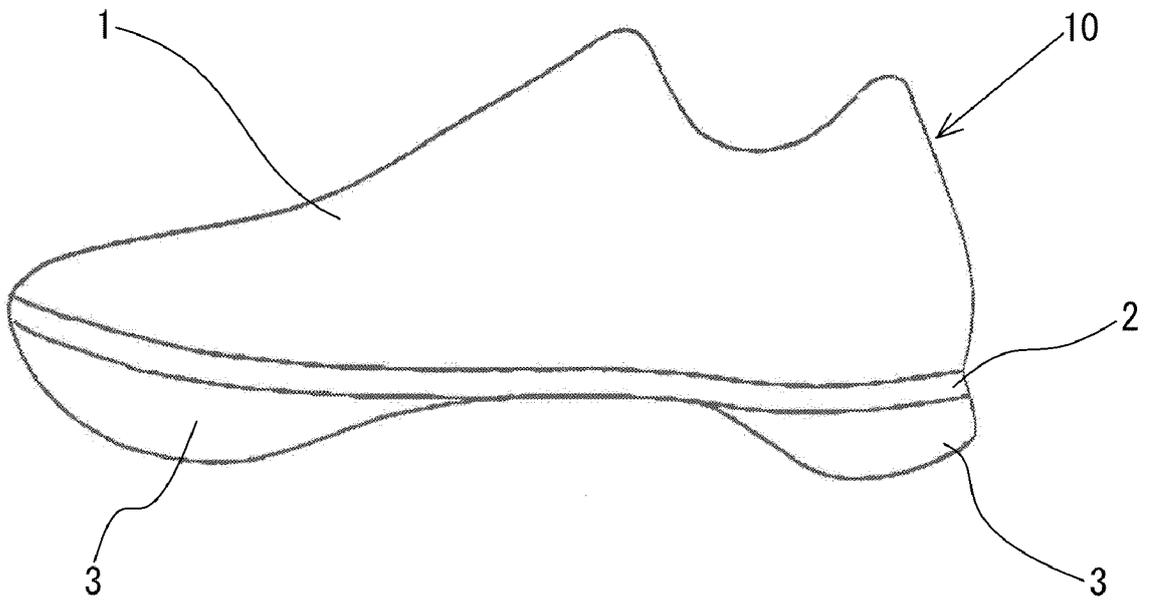


FIG.2

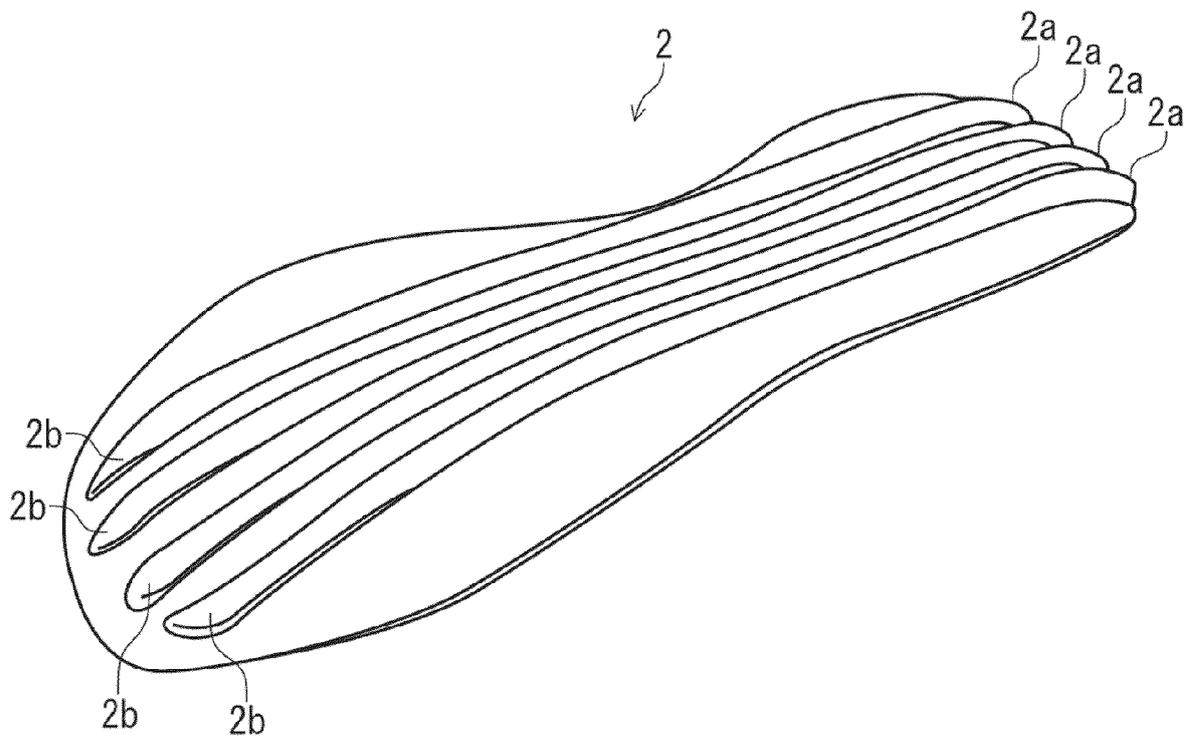


FIG.3

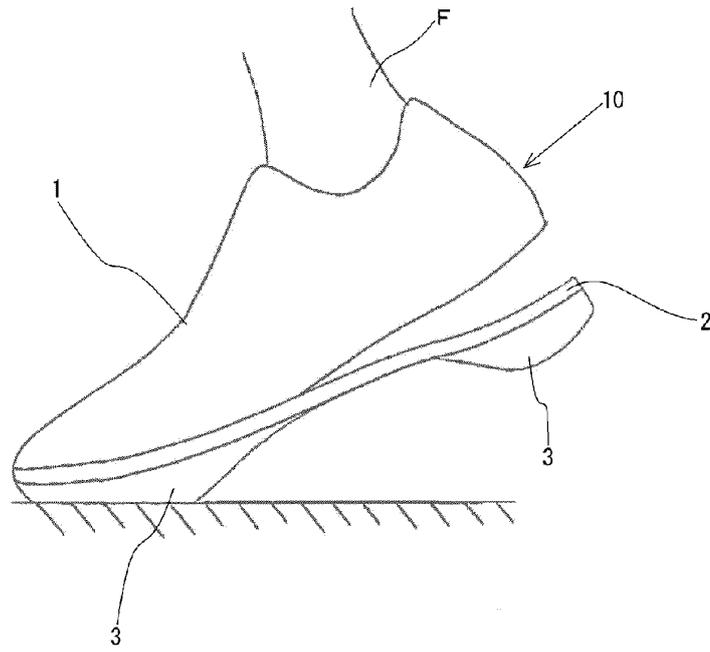


FIG.4

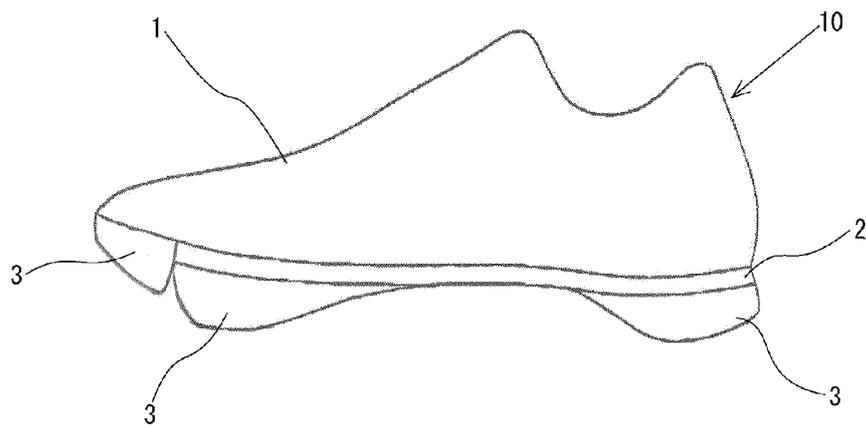


FIG.5

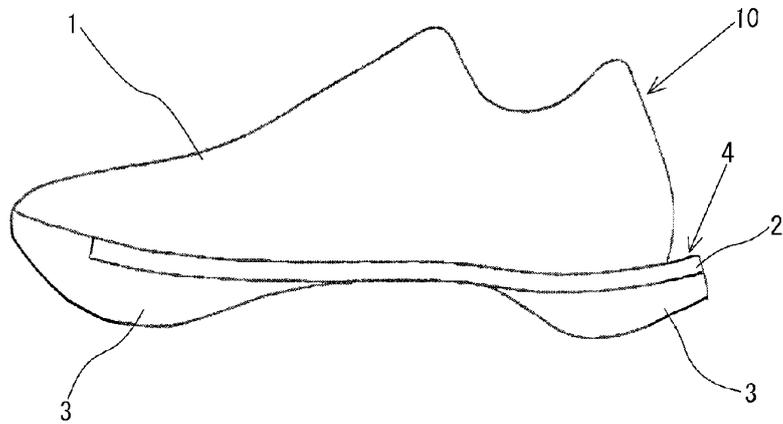


FIG.6  
PRIOR ART

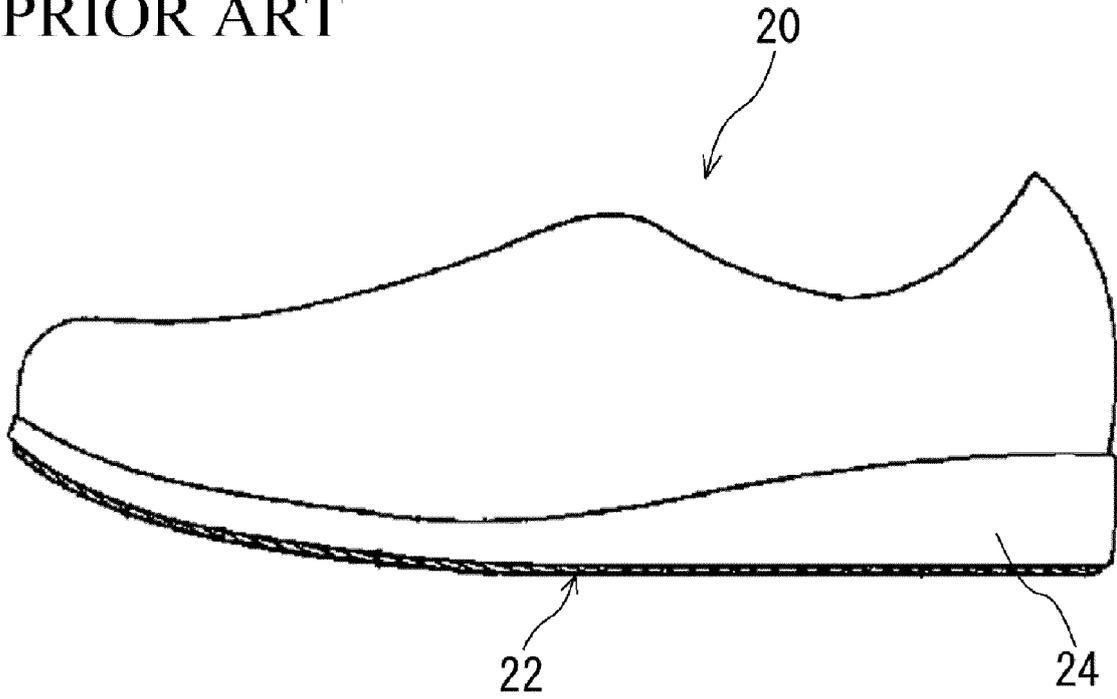
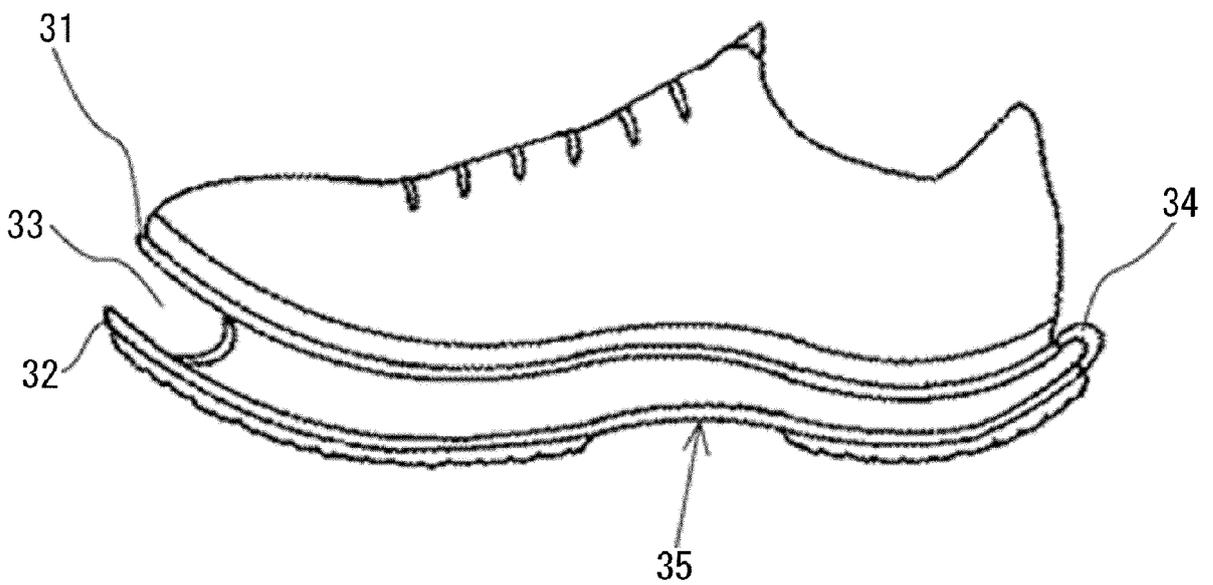


FIG.7  
PRIOR ART



INTERNATIONAL SEARCH REPORT

International application No.  
PCT/JP2017/044228

5

**A. CLASSIFICATION OF SUBJECT MATTER**  
Int.Cl. A43B13/12 (2006.01) i, A43B5/00 (2006.01) i, A43B5/06 (2006.01) i, A43B13/14 (2006.01) i, A43B13/18 (2006.01) i  
According to International Patent Classification (IPC) or to both national classification and IPC

10

**B. FIELDS SEARCHED**  
Minimum documentation searched (classification system followed by classification symbols)  
Int.Cl. A43B13/12, A43B5/00, A43B5/06, A43B13/14, A43B13/18

15

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
Published examined utility model applications of Japan 1922-1996  
Published unexamined utility model applications of Japan 1971-2018  
Registered utility model specifications of Japan 1996-2018  
Published registered utility model applications of Japan 1994-2018

20

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

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

25

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 9-285304 A (ASICS CORP.) 04 November 1997, paragraphs [0026]-[0028] (Family: none)	1-2
Y		3-8
X	JP 2008-543526 A (PSB SHOE GROUP, LLC) 04 December 2008, paragraphs [0045]-[0057], fig. 1-6 & US 2006/0288611 A1, paragraphs [0047]-[0059], fig. 1-7 & US 2008/0127521 A1 & WO 2007/002440 A2 & CA 2620384 A & CN 101257815 A & AU 2006262000 A & MX 2008000050 A	1-2
Y		5-8

30

35

40

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

45

\* Special categories of cited documents:  
 "A" document defining the general state of the art which is not considered to be of particular relevance  
 "E" earlier application or patent but published on or after the international filing date  
 "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)  
 "O" document referring to an oral disclosure, use, exhibition or other means  
 "P" document published prior to the international filing date but later than the priority date claimed  
 "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  
 "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone  
 "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

50

Date of the actual completion of the international search \_\_\_\_\_ Date of mailing of the international search report \_\_\_\_\_

55

Name and mailing address of the ISA/  
Japan Patent Office  
3-4-3, Kasumigaseki, Chiyoda-ku,  
Tokyo 100-8915, Japan  
Authorized officer \_\_\_\_\_  
Telephone No. \_\_\_\_\_

INTERNATIONAL SEARCH REPORT

International application No.  
PCT/JP2017/044228

5  
10  
15  
20  
25  
30  
35  
40  
45  
50  
55

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2001-309801 A (SATO, Yoshihiro) 06 November 2001, paragraphs [0075]-[0086], [0120]-[0121], fig. 1-5, 10, 12 (Family: none)	3-8
Y	JP 2003-38207 A (MIZUNO INC.) 12 February 2003, paragraphs [0005], [0009]-[0012], fig. 1-3, 14 (Family: none)	5-8
Y	JP 2010-162318 A (NAKATSUKA, Tatsuya) 29 July 2010, fig. 1-4 & US 2010/0269368 A1, fig. 1-5	8

**REFERENCES CITED IN THE DESCRIPTION**

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

**Patent documents cited in the description**

- JP 2002085104 A [0002] [0004]
- JP 2010162318 A [0003] [0004]