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[Continued on nextpage]

(54) **Title:** TREAD PATTERN COMBINATION FOR NON-SLIP SHOES

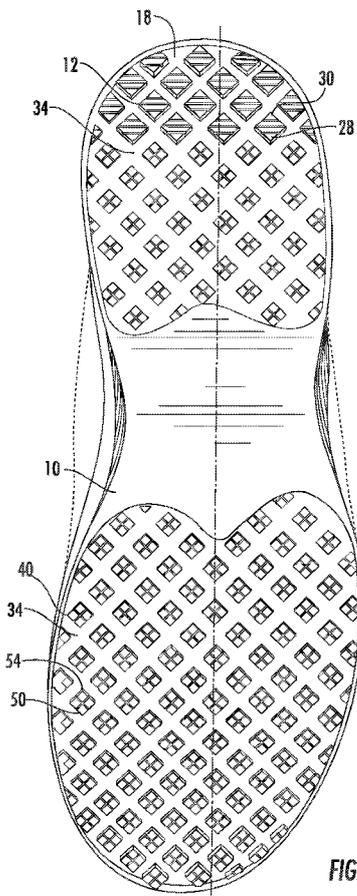


FIG. 2

(57) **Abstract:** The invention involves a tread system for shoes. More specifically, the present invention is a tread combination that is particularly suited to work environments where the workers are required to use a walking gait upon slick floor surfaces, some of which may be partially covered with liquids. The system includes an outsole having a heel strike tread having a pointed leading edge with sipes for squeegeeing and channeling liquid away from the center portion of the tread to prevent forward slippage. The mid and forefoot portions of the outsole are provided with cross siped treads which reduce or prevent sideways slippage of the forefoot.



(84) Designated States (unless otherwise indicated, for every kind of regional protection available):

ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE,

SI, SK, SM, TR), OAPI (BF, BI, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

**Published:**

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## TREAD PATTERN COMBINATION FOR NON-SLIP SHOES

## FIELD OF INVENTION

The present invention generally relates to shoes and, more particularly, to shoes constructed for work environments having water or grease covered flooring.

## BACKGROUND INFORMATION

A shoe is an item of footwear intended to protect and comfort the human foot while doing various activities. The designs of shoes have varied greatly through time and culture, with appearance originally being tied to function. Shoes have traditionally been made from leather, wood or canvas, but are more increasingly being made from rubber, plastics and other petrochemical derived materials. Work environments provide the most difficult area for shoe design. Shoes must be worn for long periods of time and must perform on a daily basis in difficult environments. Traction or grip to a ground surface is beneficial for a work shoe or boot to provide for worker safety. Workers often perform their duties on greasy, wet or damp surfaces. For example, many industries or companies utilize floors which are covered by materials which resist the penetration of fluids or other substances. These materials are utilized so that any substances inadvertently spilled on the floor can be quickly and completely removed from the floor. One of the drawbacks to these types of floor coverings is that, whenever water or other fluids are spilled on these floors, they become very slippery. Examples of this are the floor coverings utilized in restaurants, hotels, hospitals and other institutions. Outdoor workers often encounter snow or ice covered

surfaces during the course of their regular work day. Even employees that commute to the work place encounter ice covered sidewalks and wet floors just getting to the workplace. Thus, what is needed is a shoe outsole that can  
5 be utilized with a wide variety of shoe types which will provide protection from slip and falls whenever wet, icy or grease covered floors are encountered.

In the quest to provide and maintain adequate traction, numerous efforts have been made to enhance the  
10 coefficient friction between a shoe sole and a surface on which the shoe is used. For example, in U.S. Pat. No. 4,555,765, a sport shoe sole is described that possesses a high coefficient of friction along certain portions of the sole, while other portions of the sole are formed of a  
15 compressible and resilient material that is harder than the material of the rest of the sole.

Efforts have also been made to coordinate the design of the sole with the anatomic variations of the foot. Thus, in U.S. Pat. No. 7,101,604, a sole is  
20 described as having a natural grip corresponding to the ergonomic gripping or traction pattern based on the natural foot print of the foot. The sole design, therefore, is provided with major and minor projections that correspond to the various high or low points of the human foot,  
25 presumably corresponding to the points of maximum pressure or compression. However, the sole is formed of an elastic deformable material commonly used for athletic shoes, including rubber, PVC and any suitable synthetic elastic substance. The sole is also described as having a base and  
30 projections, recesses and ridges, as well as possibly including two or more layers in forming the various contours in a sole. Enhanced gripping is based primarily

on the configurations of the various projections, ridges, etc .

Many different shoe soles have been proposed to prevent an individual from slipping. In U.S. Patent No. 5 3,717,943, the sole of a boot or overshoe is made from rubber and includes fins and grooves. The fins cooperate with the grooves to trap air within the grooves. The air facilitates the self-cleaning feature of the boots, which removes mud and other substances from the soles of the 10 boots.

U.S. Patent No. 4,202,116 discloses a tread for a sport shoe which includes a sole having projections extending outwardly from a tread surface. The tread includes a one-piece, thin walled, metal part with at least 15 two separate, dimensionally reinforced surface sections bearing the integrally molded projections. The reinforced surface includes a plurality of embossed, smooth-surfaced and beveled projections. The metal part is fixedly secured to an inner surface of the shoe sole by either a thin wire 20 grid embedded in the synthetic resin sole or uniformly distributed perforations.

U.S. Patent No. 4,274,211 discloses a shoe sole made of flexible rubber material with a non-slip profile. The sole includes a plurality of various sized projections 25 or layered elements. The elements include surfaces which are made from materials that are slip resistant. In addition to being slip resistant, the structure and spacing of the projections prevent the accumulation of mud and other debris on the soles of the shoes.

U.S. Patent No. 7,047,672 discloses a shoe sole 30 which is designed to be used on a sand surface. The sole is made from a compressed material having an upper surface

and a lower surface. A peripheral lip projects downwardly from the lower surface of the sole. A plurality of fins also project downwardly from the lower surface. This type of construction enables efficient propulsion in sandy environments.

U.S. Published Patent Application No. 2009/0188132 discloses a slip resistant shoe sole which includes a plurality of ground contacting projections. The ground contacting projections are V-shaped and are spaced from one another by a predetermined distance in a longitudinal direction of the sole of the shoe. The V-shaped projections also include reinforcements at their base. The projections are made from an elastomeric polymer with a specific JIS-A hardness. This material increases the shoe's ability to resist slipping, and the shape of the projections increases their resistance to avoid bending and deformation .

U.S. Patent No. 7,703,221 discloses a sole assembly for a shoe which includes a flexible base having an underside surface which includes a forward region, a rearward region, and an intermediate region therebetween. The sole includes a plurality of individual sole elements on the underside thereof. Each element includes a body portion and a connecting section which is operatively secured to the underside surface of the flexible base. The sole elements are arranged on the underside surface of the flexible base, such that adjacent sole elements have overlapping sections.

One drawback to the prior art relates to the failure to recognize that different portions of the human gait require different treads along the various portions of the outsole to reduce the possibility of slipping and

falling as a result of debris on a walking surface. This is particularly true with the walking gait where one foot stays in contact with the ground at all times. One variable in gait, that often results in slippage and fall, is foot strike, e.g. how the foot contacts the ground; more specifically, which part of the foot contacts the ground first. While foot strike varies based upon the gait and whether or not the person is wearing shoes, a heel strike is the most common form of foot strike in walking. During a heel strike, only one third or less of the shoe tread is in contact with the ground surface. In addition, the direction and type of force directed at the interphase between the shoe tread and the ground is substantially different than when the mid or forefoot portions of the shoe tread are in contact with the ground surface. The forward motion of the leg and foot are stopped when the tread contacts the ground surface, while weight and motion of the body is transferred to this small contact area. Thus, forward momentum tends to cause the shoe to slip forward, causing the person to lose balance in a vulnerable position. As the gait continues, the weight is shifted to the middle and then the front of the shoe and tread. During this portion of the stride, the forces between the shoe tread and the ground tend to be side forces, which allow the shoe to slip out from under the person. The prior art has been deficient in constructing a shoe that is particularly suited for walking on slick surfaces that have a fluid covering.

Thus, the present invention provides a shoe tread combination which overcomes the disadvantages of prior art shoe tread systems. The shoe tread system of the present invention provides shoe treads in an arrangement that

benefits walkers on slick surfaces, particularly those that may have liquid on the surface.

#### SUMMARY OF THE INVENTION

Briefly, the invention involves a tread system  
5 for shoes. More specifically, the present invention is a  
tread combination that is particularly suited to work  
environments where the workers are required to use a  
walking gait upon slick floor surfaces, some of which may  
be partially covered with liquids. The material from which  
10 the projections are formed increases the shoe sole's  
ability to resist slipping on floor surfaces which are  
covered with oil, water, soap, ice, snow, etc. The shape  
and pattern of the projections or lugs enable them to  
control flexing and engagement to the floor surface. This  
15 increases the footwear sole's ability to resist slipping.  
In particular, the outsole is provided with one type of  
tread that is specifically designed to function similar to  
a squeegee to channel liquids away from the tread so that  
the rubber compound may adhere to the floor surface to  
20 prevent forward slippage, while another tread design  
functions to cover the mid and forefoot portions of the  
outsole and are provided with cross siped treads which  
reduce or prevent sideways slippage of the forefoot.

Accordingly, it is an objective of the present  
25 invention to provide a slip-resistant tread combination for  
shoe outsoles.

It is a further objective of the present  
invention to provide a shoe outsole having a heel strike  
tread that differs in structure and function from the mid  
30 and forefoot portion of the outsole.

It is yet a further objective of the present invention to provide a tread combination that includes a heel strike tread having a pointed front end and sipes for channeling liquid away from the contact surface of the  
5 tread.

It is another objective of the present invention to provide a forefoot tread that includes cross siped treads which channel liquid and provide side directional traction to the shoe outsole.

10 It is yet another objective of the present invention to provide siped treads for a shoe, wherein the siping allows the polymeric material of the tread to function with the surface as a softer durometer material than it actually is by flexing along the sipes.

15 Other objectives and advantages of this invention will become apparent from the following description taken in conjunction with the accompanying drawings wherein are set forth, by way of illustration and example, certain embodiments of this invention. The drawings constitute a  
20 part of this specification and include exemplary embodiments of the present invention and illustrate various objects and features thereof.

#### BRIEF DESCRIPTION OF THE FIGURES

Figure 1 is a bottom perspective view of one  
25 embodiment of the instant invention;

Figure 2 is a bottom view of the embodiment shown in Fig. 1 illustrating the treads of the heel area and the forefoot area;

Figure 3 is a top view of the embodiment shown in  
30 Fig. 1;

Figure 4 is a left side view of the embodiment shown in Fig. 1;

Figure 5 is a right side view of the embodiment shown in Fig. 1;

5 Figure 6 is a front view of the embodiment shown in Fig. 1;

Figure 7 is a rear view of the embodiment shown in Fig. 1;

10 Figure 8 is a side view illustrating the heel strike of a walking gait;

Figure 9 is a perspective view of the heel tread of the present combination; and

Figure 10 is a perspective view of the forefoot tread of the present combination.

15 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

While the present invention is susceptible of embodiment in various forms, there is shown in the drawings and will hereinafter be described a presently preferred embodiment with the understanding that the present disclosure is to be considered an exemplification of the invention and is not intended to limit the invention to the specific embodiments illustrated.

Referring generally to Figs. 1-10, a combination tread pattern 100 for outsoles 10 of non-slip shoes is 25 illustrated. The outsole is provided with two distinct tread member constructions. The combination tread pattern 100 includes a first tread member 12 positioned on the heel area 14 of the shoe outsole 10. The first tread member 12 has a first base portion 16 extending outwardly from a 30 bottom surface 18 of the outsole 10. A plurality of grouser bars 20 are integrally formed to the lowermost

surface 22 of the first base portion 16 of the first tread member 12. The grouser bars 20 are positioned to be substantially parallel and separated from each other by first siping grooves 24. In a most preferred embodiment, the first tread member includes at least two, and more preferably three or four, grouser bars 20, each separated by a siping groove 24. The first siping grooves are oriented to extend orthogonally with respect to a longitudinal axis of the outsole. In this manner, the first working surface 26, e.g. the surface of the first tread that contacts the ground surface, is prevented from hydroplaning during heel strike of the shoe. The first working surface is preferably planar in shape and oriented so that, once the first working surface contacts the ground surface, the siping grooves 24 allow the grouser bars 20 to flex with respect to the base portion, conforming to the ground surface, providing superior grip, and preventing heel strike slippage. The leading edges of the grouser bars include a sharp V-shaped corner to act as a squeegee, separating the liquid and forcing it into the siping grooves 24 and channeling the liquid to the sides of the first tread member 12. The first tread members 12 are square or rectangle in shape when viewed from every side, including the bottom of the outsole 10. A point 28 of the first tread member is oriented toward the front portion of the outsole 10, whereby liquids can be easily routed around the first tread member 12, particularly fluid that has been routed away from the first working surface 26; while a rear point 30 is positioned toward the heel area 14 or rear portion of the outsole 10. In at least one embodiment, the front point 28 and rear point 30 are aligned and parallel with the longitudinal axis of the outsole. In a most

preferred embodiment, the heel strike area 32 (Fig. 8) is about one third to one half of the rear portion of the heel area 14 of the outsole 10. The first tread members 12 are separated by channels 34 that extend to the bottom surface 18 of the outsole 10; the channels being about one eighth of an inch in width, while the first treads are about one eighth of an inch tall. The siping is preferably one sixty-fourth of an inch wide and about half the height of the first and said second treads in depth. In a most preferred embodiment, the first tread member is constructed from the same material as the outsole for ease of manufacturing .

Still referring to Figs. 1-10, a second tread member 40 is positioned in a forefoot portion 42 of said shoe outsole 10; the second tread member 40 having a second base portion 44 integrally formed to said shoe outsole 10. The second base portion 44 includes a plurality of cleat members 46 integrally formed thereto; the cleat members 46 being separated by second siping grooves 48 and having a planar contact surface 56. The second siping grooves 48 form a cross pattern when viewed from the bottom of the outsole 10. In a preferred embodiment, each second tread member 40 includes four substantially equally sized cleats 46 separated by the siping grooves 48. The second tread members 40 are preferably square or rectangle in shape when viewed from any side, as well as the bottom of the outsole 10. A front point 50 of the second tread member 40 is oriented toward the front portion 52 of the outsole 10, whereby liquids can be easily routed to the sides of the second tread member 40. A rear point 54 is positioned toward the heel area 14 or rear portion of the outsole 10. In at least one embodiment, the front point 50 and the rear

point 54 are aligned and parallel with the longitudinal axis of the outsole. In a most preferred embodiment, the second tread members 40 are positioned across the forefoot portion of the outsole 10, and may be positioned on a  
5 portion of the heel so that the angled siping allows the cleat members 46 to provide maximum traction with respect to forefoot sliding, which tends to cause the shoe to slide sideways and forward simultaneously. The second tread members 40 are separated by channels 34 that extend to the  
10 bottom surface 18 of the outsole 10, the channels being about one sixteenth to one half of an inch in width, while the second treads are about one eighth of an inch tall. The siping is preferably one sixty-fourth of an inch wide and about half the height of the second treads in depth. In  
15 a most preferred embodiment, the second tread member 40 is constructed from the same material as the outsole for ease of manufacturing.

The outsole utilizes a polymeric rubber compound that allows the ground contact surface of the outsole to  
20 conform, at least partially, to small ground surface imperfections which causes the rubber compound of the outsole to adhere to the surface. Thus, the teachings of the present outsole utilize both the ability to penetrate softer and gelatinous surface coverings, while the outsole  
25 is constructed from a slip resistant polymeric material having a durometer reading which conforms to surface imperfections for adherence to the working surface. In a preferred embodiment, the present tread members are made from a unique slip resistant polymeric material. The slip  
30 resistant material has a hardness of about .49 Shore, based on tests performed on a Durometer Hardness Tester. The material also has a slip resistance rating of .56 - .65

when tested on a Brungraber Mark 2 Articulated Strut Slip Testing Device. A slip resistant surface is defined as a surface having a rating of .50 or higher when tested on the Brungraber Mark 2 Articulated Strut Slip Testing Device.

5 This provides a unique combination for workers such as those in the restaurant industry who may be required to work in the kitchen area as well as make frequent trips outdoors .

10 Thus, a shoe outsole having a specific tread for heel strike and a secondary tread for forefoot traction on wet or greasy floor surfaces is illustrated. The shoe may be of any type that needs to exhibit extremely high traction with respect to tile or other flooring, and may be provided with hardened or steel toe areas in the shoe for  
15 work environments.

All patents and publications mentioned in this specification are indicative of the levels of those skilled in the art to which the invention pertains. All patents and publications are herein incorporated by reference to  
20 the same extent as if each individual publication was specifically and individually indicated to be incorporated by reference.

It is to be understood that while a certain form of the invention is illustrated, it is not to be limited to  
25 the specific form or arrangement of parts herein described and shown. It will be apparent to those skilled in the art that various changes may be made without departing from the scope of the invention and the invention is not to be considered limited to what is shown and described in the  
30 specification.

One skilled in the art will readily appreciate that the present invention is well adapted to carry out the

objects and obtain the ends and advantages mentioned, as well as those inherent therein. Any compounds, methods, procedures and techniques described herein are presently representative of the preferred embodiments, are intended  
5 to be exemplary and are not intended as limitations on the scope. Changes therein and other uses will occur to those skilled in the art which are encompassed within the spirit of the invention and are defined by the scope of the appended claims. Although the invention has been described  
10 in connection with specific preferred embodiments, it should be understood that the invention as claimed should not be unduly limited to such specific embodiments. Indeed, various modifications of the described modes for carrying out the invention which are obvious to those skilled in the  
15 art are intended to be within the scope of the following claims .

## CLAIMS

What is claimed is:

Claim 1. A slip-resistant tread combination for a shoe outsole comprising:

a first tread member positioned on the heel area of a shoe outsole, said first tread member having a first base portion extending outwardly from a bottom surface of said outsole, a plurality of grouser bars integrally formed to a lowermost surface of said first base portion of said first tread member, said grouser bars being parallel and separated from each other by first siping grooves;

a second tread member positioned in a forefoot portion of said shoe outsole, said second tread member having a second base portion integrally formed to said shoe outsole, a plurality of cleat members integrally formed to said second base portion, said cleat member separated by second siping grooves, said second siping grooves forming a cross pattern when viewed from the bottom of said outsole.

Claim 2. The slip-resistant tread combination of Claim 1 wherein said first siping grooves are oriented to extend orthogonally with respect to a longitudinal axis of said outsole .

Claim 3. The slip-resistant tread combination of Claim 1 wherein said second siping grooves are oriented at about a forty-five degree angle with respect to a longitudinal axis of said outsole.

Claim 4. The slip-resistant tread combination of Claim 2 wherein each said first tread member includes two said first siping grooves.

Claim 5. The slip-resistant tread combination of Claim 2 wherein each said first tread member includes three said first siping grooves.

Claim 6. The slip-resistant tread combination of Claim 2 wherein each said first tread member is a polygon having a front point of said polygon positioned toward a front portion of said outsole and rear point positioned toward a rear portion of said outsole.

Claim 7. The slip-resistant tread combination of Claim 6 wherein said front point and said rear point are aligned and parallel with said longitudinal axis.

Claim 8. The slip-resistant tread combination of Claim 6 wherein said polygon is a square.

Claim 9. The slip-resistant tread combination of Claim 2 wherein each said first tread member is constructed from the same material as said outsole.

Claim 10. The slip-resistant tread combination of Claim 3 wherein each said second tread member is a polygon having a front point of said polygon positioned toward a front portion of said outsole and rear point positioned toward a rear portion of said outsole.

Claim 11. The slip-resistant tread combination of Claim 10 wherein said tread member includes four substantially equally sized cleats.

Claim 12. The slip-resistant tread combination of Claim 1 wherein said first tread member has a larger surface area than said second tread member, but has the same overall height as said second tread member.

Claim 13. The slip-resistant tread combination of Claim 1 wherein said heel area is a heel strike area, said heel strike area being about one third of the rear portion of said heel area of said outsole.

Claim 14. The slip-resistant tread combination of Claim 1 wherein said heel area is a heel strike area, said heel strike area being about one half of the rear portion of said heel area of said outsole.

Claim 15. The slip-resistant tread combination of Claim 12 wherein said first tread members are separated by channels that extend to the lowermost surface of said outsole, said channels being substantially one eighth of an inch in width .

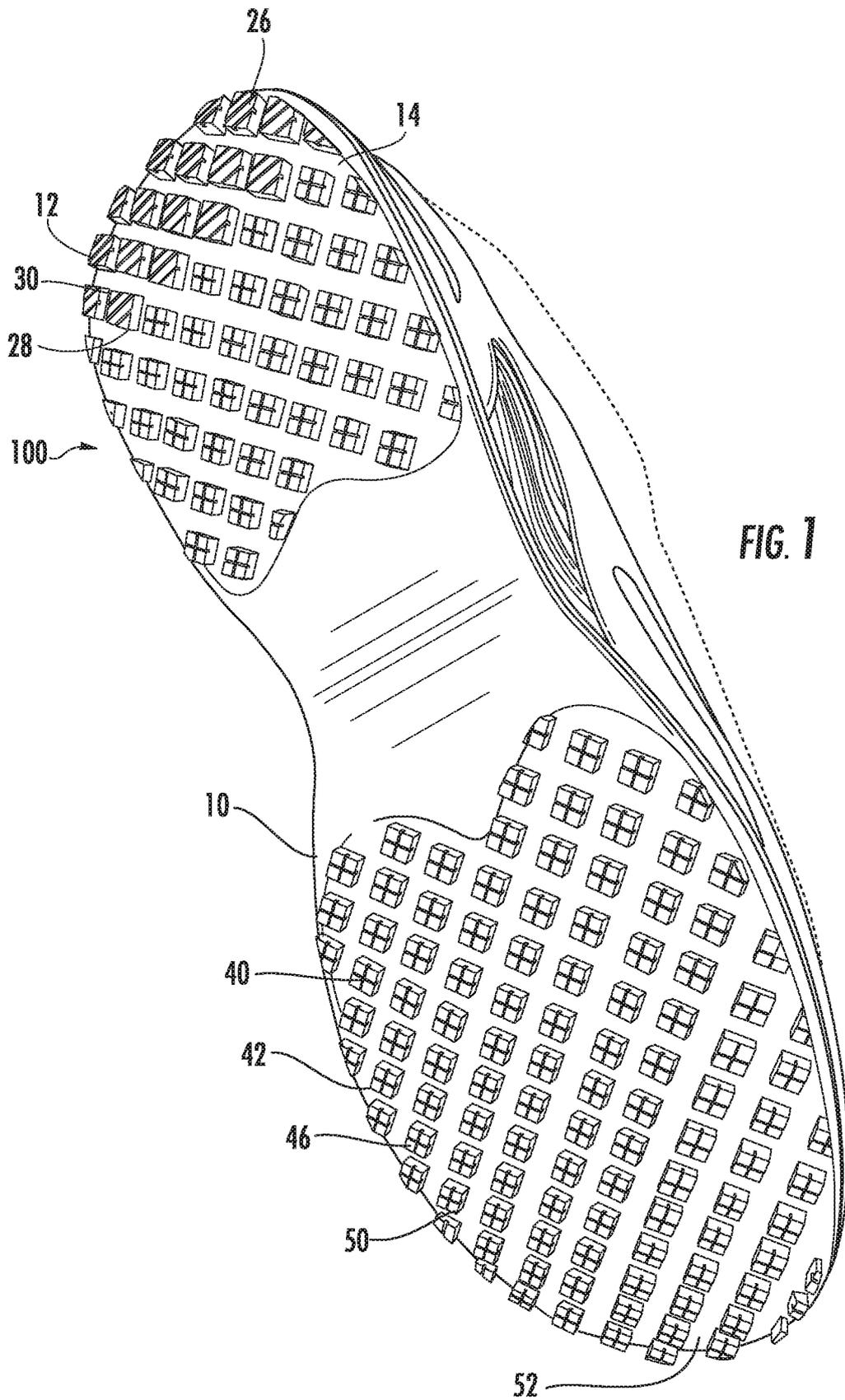
Claim 16. The slip-resistant tread combination of Claim 12 wherein said first tread height is no more than one eighth of an inch tall.

Claim 17. The slip-resistant tread combination of Claim 16 wherein said siping is one sixty-fourth of an inch wide and about half the height of said first and said second treads in depth.

Claim 18. The slip-resistant tread combination of Claim 17 wherein said siping extends completely across said first and said second treads, whereby fluid is channeled away from the contact surface of the tread and the floor surface .

Claim 19. The slip-resistant tread combination of Claim 18 wherein said contact surface is planar.

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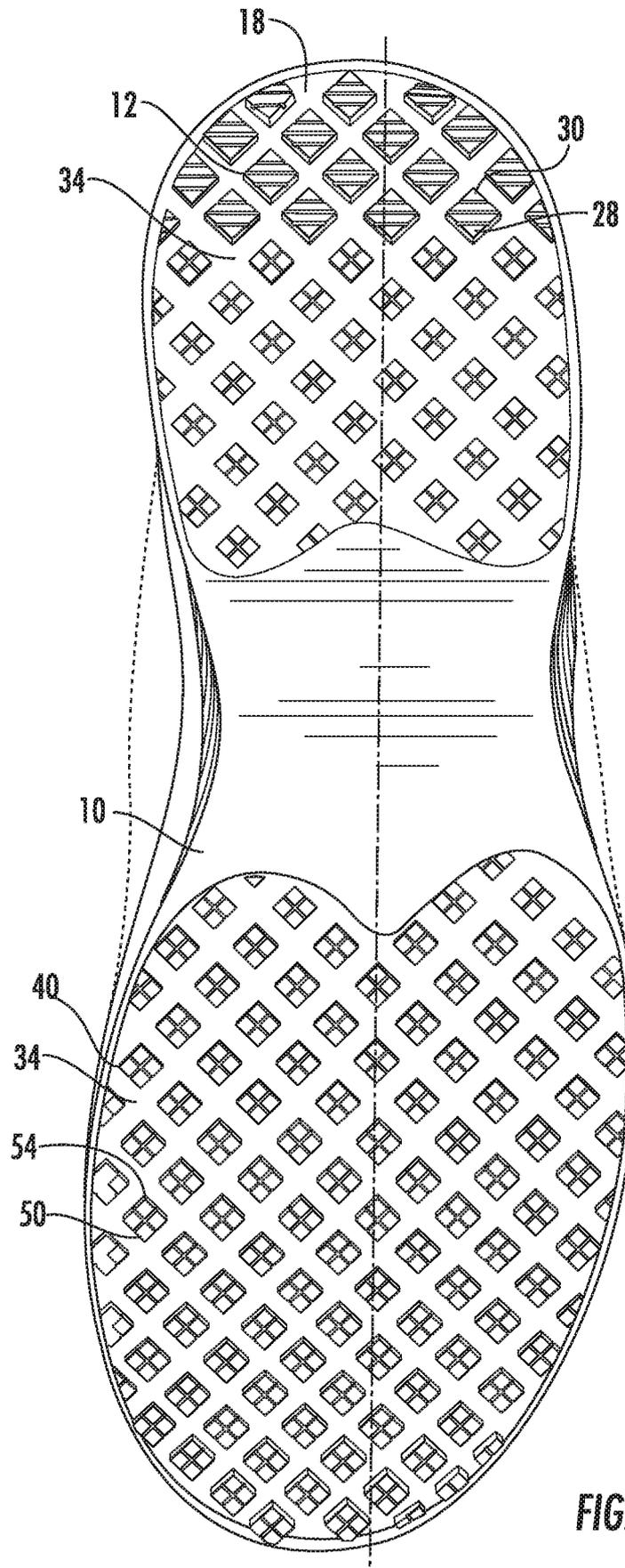
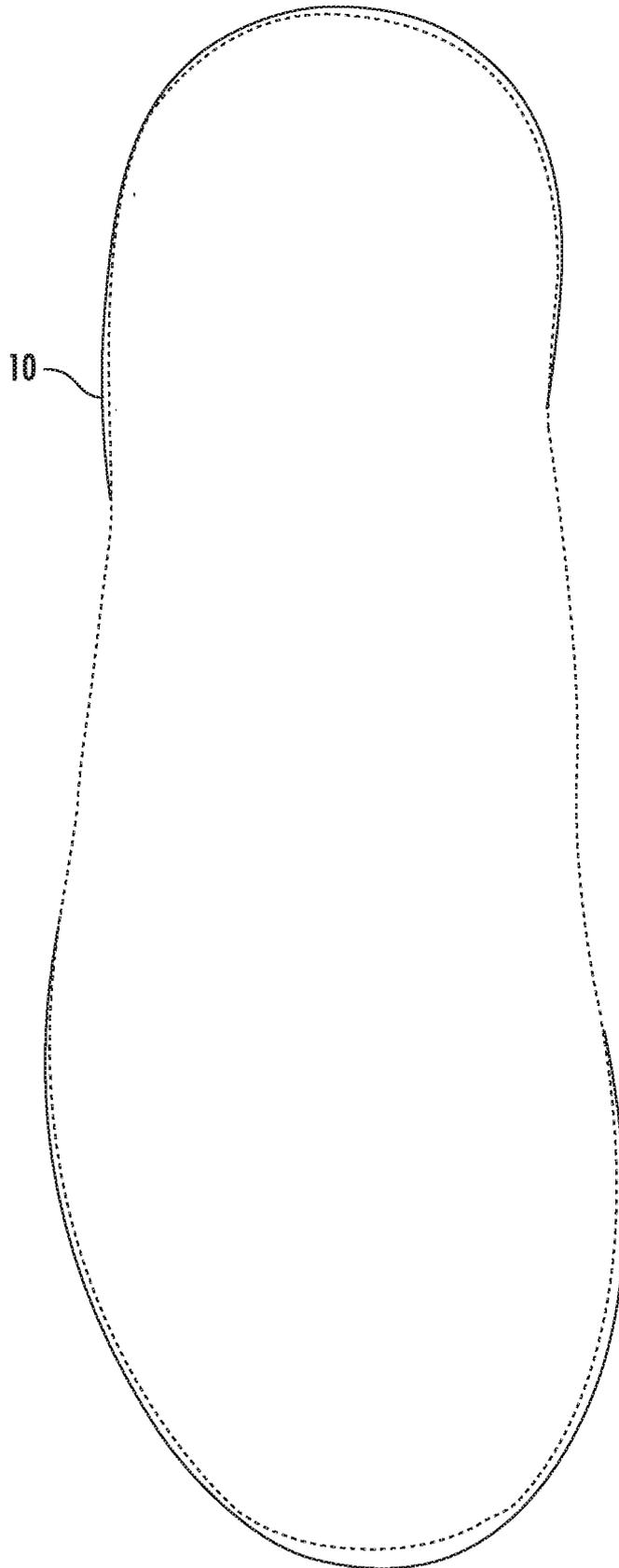


FIG. 2

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**FIG. 3**

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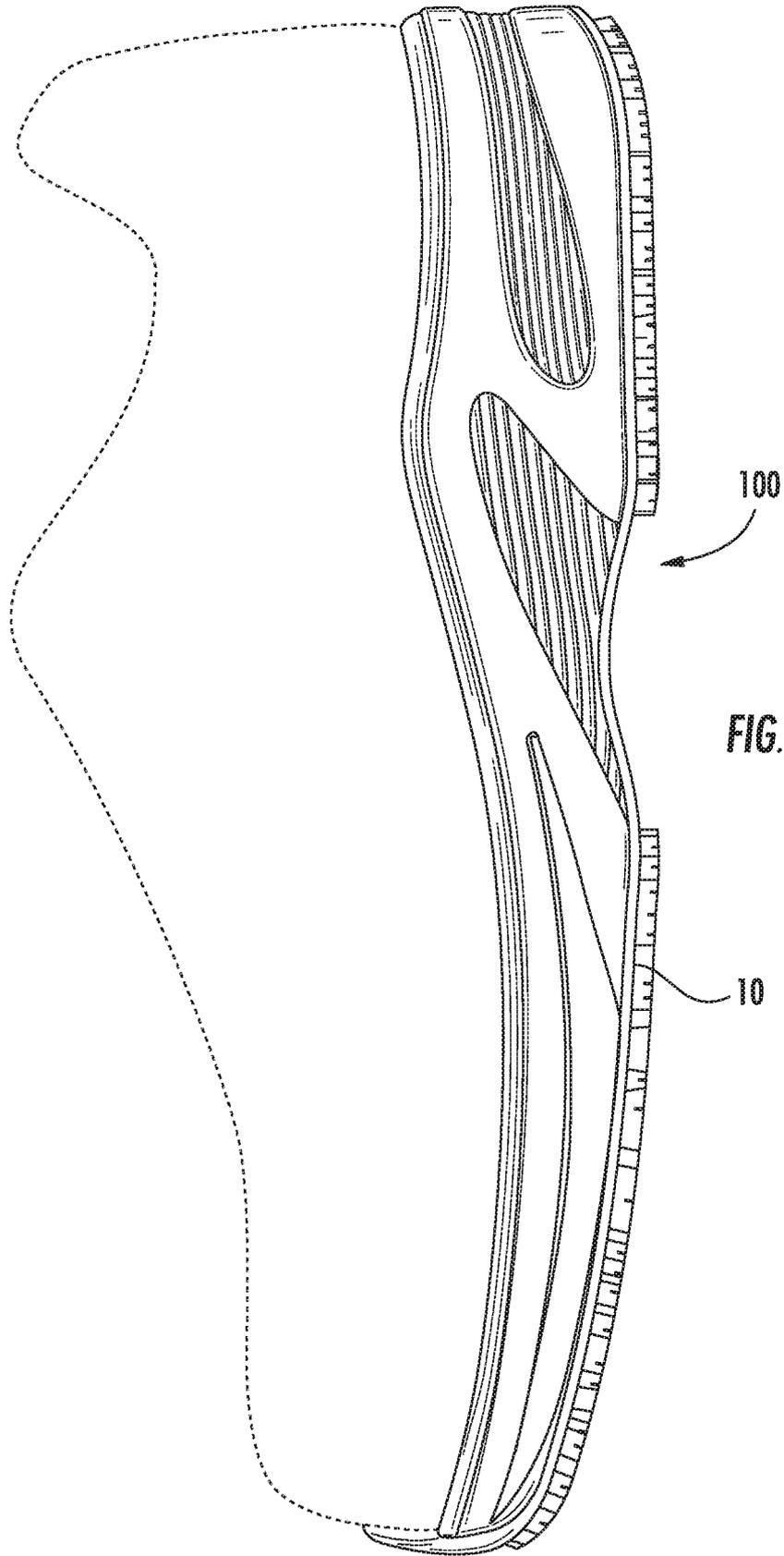
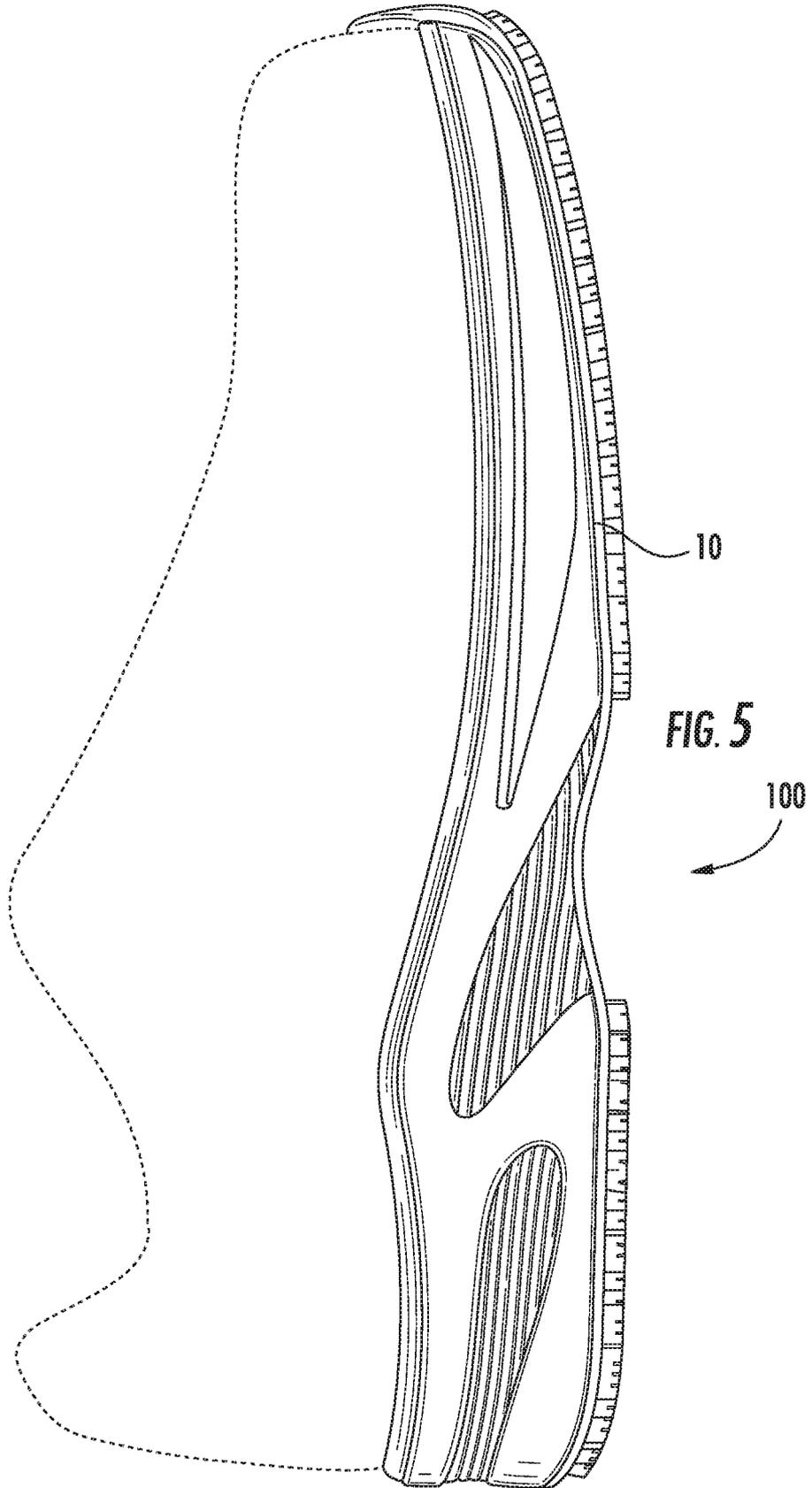


FIG. 4

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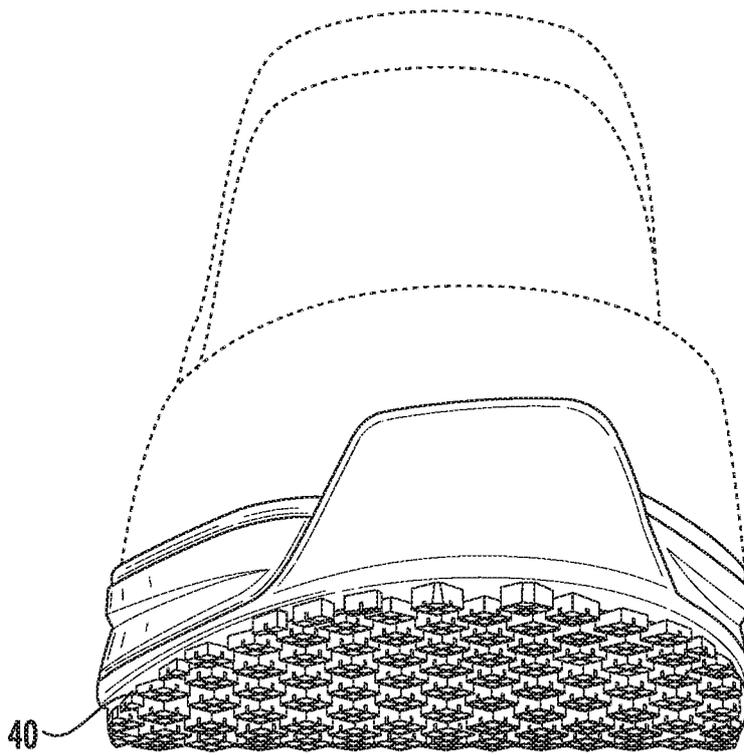


FIG. 6

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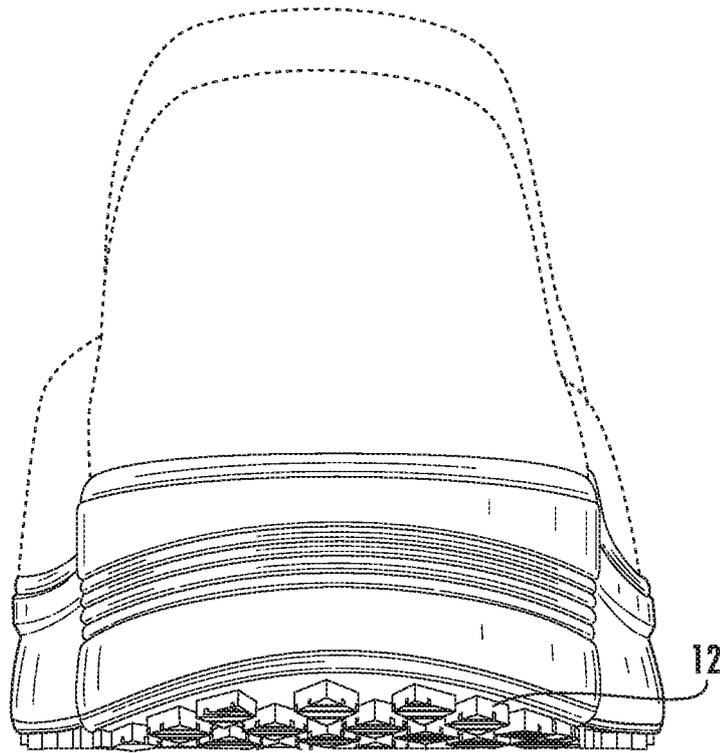


FIG. 7

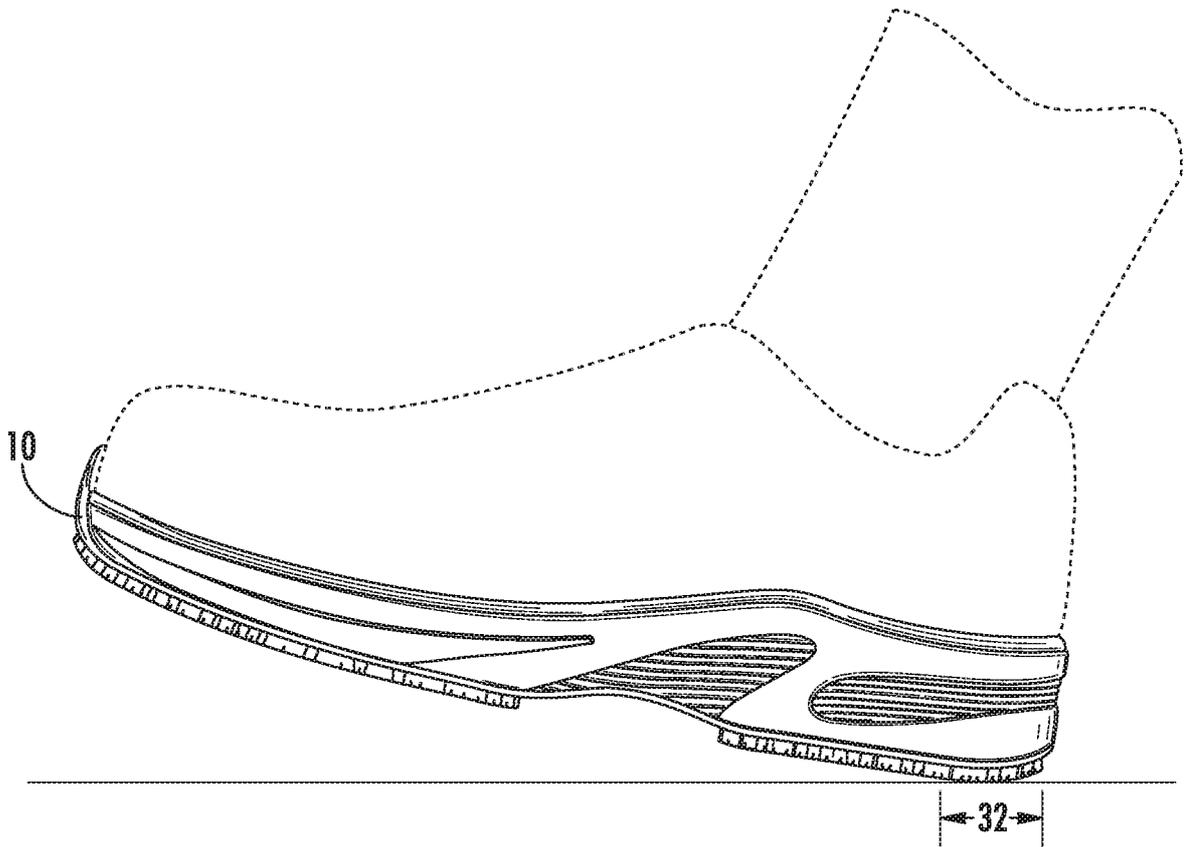
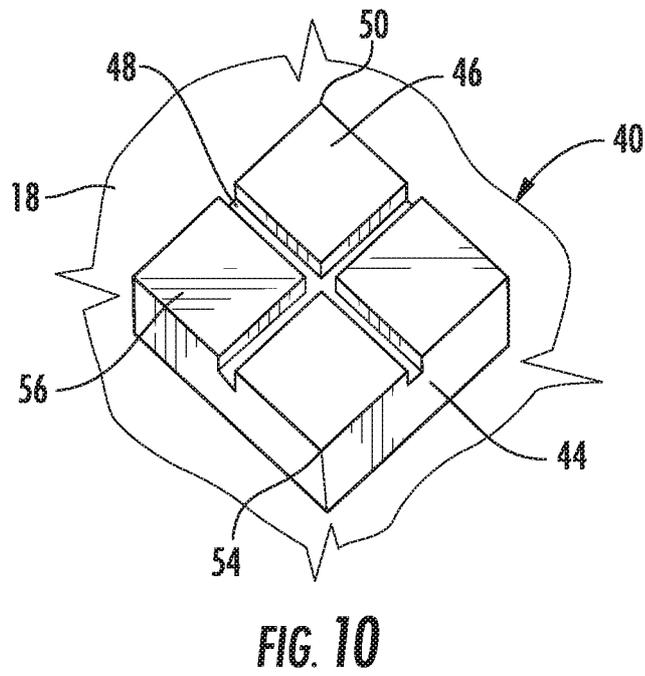
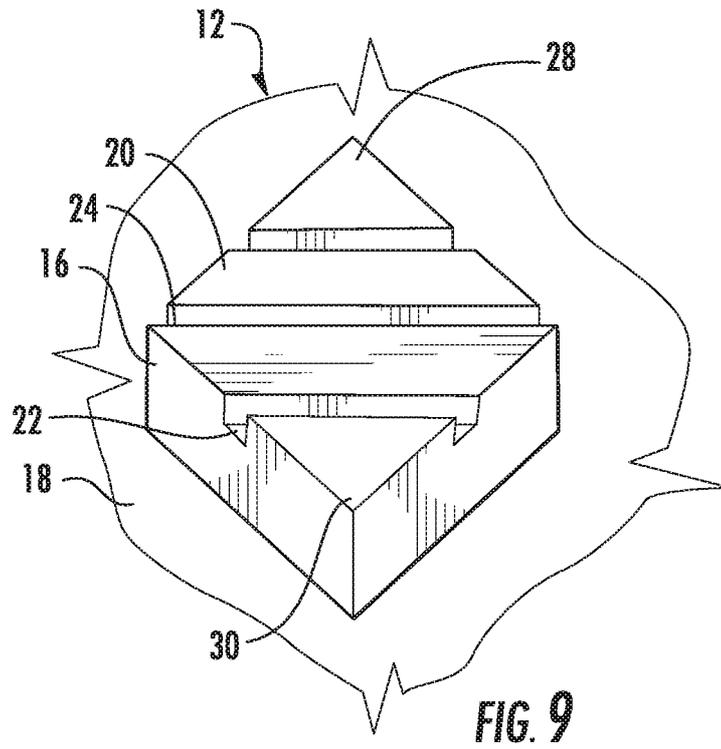


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2017/017297

A. CLASSIFICATION OF SUBJECT MATTER  
INV. A43B13/22 A43B13/26  
ADD.

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)  
A43B

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

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

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2015/128455 AI (LUBART RANDY N [US]) 14 May 2015 (2015-05-14) paragraph [0044] paragraph [0045] figure 1 figure 3	1-19
Y	----- GB 2 068 707 A (BRS INC) 19 August 1981 (1981-08-19) figure 2 figures 4-6	1-19
Y	----- US D 466 912 SI (LEE CHANG HYUN [KR]) 10 December 2002 (2002-12-10) figure 1 ----- -/--	1-19

Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

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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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Date of the actual completion of the international search

10 April 2017

Date of mailing of the international search report

20/04/2017

Name and mailing address of the ISA/

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Fax: (+31-70) 340-3016

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Ari za De Mi guel , Jon

## INTERNATIONAL SEARCH REPORT

International application No  
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2009/307932 A1 (KIRBY GARY E [US] ET AL) 17 December 2009 (2009-12-17) paragraph [0025] -----	15-17
Y	US 2011/017373 A1 (LEE GAP JIN [KR]) 27 January 2011 (2011-01-27) paragraph [0017] -----	15-17
Y	US 2011/247237 A1 (JARA ADAM [FR] ET AL) 13 October 2011 (2011-10-13) paragraph [0014] paragraph [0065] -----	15-17
Y	US 4 538 366 A (NORTON DANIEL E [US]) 3 September 1985 (1985-09-03) column 2, line 58 - line 67 -----	13,14

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No <b>PCT/US2017/017297</b>
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2015128455	AI	14-05-2015	CN 105873464 A 17-08-2016
			EP 3068249 AI 21-09-2016
			KR 20160086866 A 20-07-2016
			US 2015128455 AI 14-05-2015
			Wo 2015073673 AI 21-05-2015
-----			
GB 2068707	A	19-08-1981	CA 1153548 A 13-09-1983
			DE 3103360 AI 28-01-1982
			FR 2475371 AI 14-08-1981
			GB 2068707 A 19-08-1981
			JP S56151001 A 21-11-1981
			US 4378643 A 05-04-1983
-----			
US D466912	SI	10-12 -2002	NONE
-----			
us 2009307932	AI	17-12 -2009	CA 2728485 AI 23- 12 -2009
			US 2009307932 AI 17- 12 -2009
			Wo 2009155302 AI 23- 12 -2009
-----			
us 2011017373	AI	27-01 -2011	NONE
-----			
US 2011247237	AI	13-10-2011	CN 102238883 A 09-11-2011
			EP 2334211 AI 22-06-2011
			JP 5657544 B2 21-01-2015
			JP 2012504480 A 23-02-2012
			US 2011247237 AI 13-10-2011
			wo 2010040755 AI 15-04-2010
-----			
US 4538366	A	03-09-1985	NONE
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